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June 2005

Readers, please note:

This document, Raymark – OU6 – Additional Properties, Final Remedial Investigation Report dated June 2005 is an update to a report with the same title dated April 2004.

The April 2004 report was updated because additional sampling was performed at three properties: DPW Lot, 35 Third Ave, and 251 East Main Street. This additional sampling was done in an effort to further delineate areas at these properties that had been found to contain waste from Raymark.

This June 2005 update contains all of the original findings contained in the original April 2004 report. The only changes that have been made are the updated data and related text, figures, and tables. Pages in this update that have been revised are denoted with a "-R" suffix in the file name at the very bottom left of each revised page.

The above information is provided in an attempt to address any confusion over the two versions of this report. The April 2004 report should be considered obsolete. It has not been referenced in any way in this update.

This updated report, Raymark – OU6 – Additional Properties, Final Remedial Investigation Report dated June 2005 is a complete summary of all available information and is the final report for this operable unit.

RI02967F

FINAL
REMEDIAL INVESTIGATION

VOLUME I OF II

RAYMARK - OU6 – ADDITIONAL PROPERTIES
STRATFORD, CONNECTICUT

Note: This Report includes revisions to EPA's previous April 2004 Remedial Investigation Report

RESPONSE ACTION CONTRACT (RAC), REGION I

For
U.S. Environmental Protection Agency

By
Tetra Tech NUS, Inc.

EPA Contract No. 68-W6-0045
EPA Work Assignment No. 112-RICO-01H3
TtNUS Project No. N4106

June 2005

TETRA TECH NUS, INC.

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FINAL
REMEDIAL INVESTIGATION

VOLUME I OF II

RAYMARK - OU6 – ADDITIONAL PROPERTIES
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June 2005

Heather M. Ford
Project Manager

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ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
AVS/SEM	acid volatile sulphide/simultaneously extractable metals
bgs	below ground surface
CDD	chlorinated dibenzo-p-dioxins
CDF	chlorinated dibenzofurans
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	contract laboratory program
cm	centimeter
COPC	chemicals of potential concern
CSI	comprehensive site investigation
CSF	cancer slope factor
CT DEC	Connecticut Direct Exposure Criteria
CT DEP	Connecticut Department of Environmental Protection
CT DPHAS	Connecticut Department of Public Health and Addiction Services
CT PMC	Connecticut Pollutant Mobility Criteria
CT RSR	Connecticut Remediation Standard Regulation
DABS	Dermal Absorption Factors
DHHS	Department of Health and Human Services
dL	Deciliter
DNAPL	dense non-aqueous phase liquid
DOT	Department of Transportation
DPW	Department of Public Works
ECG	electrocardiograph
ELI	Environmental Laboratories, Inc.
EPA	United States Environmental Protection Agency
EPC	exposure point concentrations
ERA	ecological risk assessment
ESI	expanded site inspection
FEMA	Federal Emergency Management Agency
FID	flame ionization detector
FRW	fraction of property estimated to contain Raymark waste
FS	Feasibility Study
GA/GAA	State of Connecticut Classification for Drinking Water source
GB	State of Connecticut Classification for Non-drinking Water source
GC/ECD	gas chromatograph with electron capture detection
GPR	ground penetrating radar
GPS	Global Positioning System
HEAST	Health Effects Assessment Summary Tables
HHEM	Human Health Evaluation Manual
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic model
ILCR	incremental lifetime cancer risk
IRIS	Integrated Risk Information System
kg	kilogram
LOAEL	lowest observed adverse effect level
μg	microgram

ACRONYMS (cont.)

MEP	multiple extraction procedure
mg	milligram
mph	miles per hour
NAPL	non-aqueous phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NERL	New England Regional Laboratory
NESHAP	National Emission Standard for Hazardous Air Pollutants
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no observed adverse effect level
NTCRA	Non-time critical response action
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
ppb	parts per billion
ppm	parts per million
PRG	preliminary remediation goal
RAF	relative adsorption factor
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SAS	special analytical services
SPLP	synthetic precipitation leaching procedure
SRI	Strategic Redevelopment Initiative
SSL	soil screening level
SVOC	semi-volatile organic compound
TAL	target analyte list
TCDD	2,3,7,8-tetrachloro-dibenzo-p-dioxin
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TEF	toxicity equivalence factor
TERC	Total Environmental Restoration Contract
TEQ	toxicity equivalent
TOC	total organic carbon
TtNUS	TetraTech NUS
UCL	upper confidence limit
USGS	United States Geological Society
VOC	volatile organic compound
VSP	vertical sampling program
XRF	x-ray fluorescence
yr	year

ES EXECUTIVE SUMMARY

This Remedial Investigation (RI) report for the Raymark Industries, Inc. Superfund Site – Operable Unit (OU) 6 - Additional Properties Study Area has been prepared by Tetra Tech NUS, Inc. (TtNUS), as authorized by the U. S. Environmental Protection Agency (EPA) under Work Assignment No. 112-RICO-01H3, Contract No. 68-W8-0045. This RI report presents the findings of field investigations undertaken over a 10-year period (1993-2003) to locate additional properties in Stratford, CT that may or may not contain Raymark waste. The results of these field investigations have identified 24 properties that have been impacted by waste from the former Raymark Facility. A comprehensive Feasibility Study (FS) identifying the cleanup options being considered for these 24 properties and other areas within the Raymark site will be issued as a separate document.

This RI report is structured as follows: Section 1 provides background information regarding the overall Raymark Industries, Inc. Superfund Site; Section 2 discusses the establishment of the OU6 study area, including an explanation of the Raymark waste definition; Section 3 is a property-by-property presentation of the sampling information and location of Raymark waste on each of the 24 properties; and Section 4 is a summary of the RI report. This RI report was developed for soils contamination and does not include assessment of other media, such as sediments, surface water, and groundwater.

The interpretation of the data and information compiled for each of the 24 properties included in this RI report indicates that:

- In addition to the Raymark waste indicator contaminants (chysotile asbestos, lead, and either copper or polychlorinatedbiphenyls (PCBs) - Aroclor 1268 only), fill throughout the OU6 study area is also contaminated with volatile organic contaminants (VOCs), semi-volatile organic contaminants (SVOCs), pesticides, other PCBs, dioxins, furans, and metals.

- Although contamination is ubiquitous across the OU6 study area, the contaminants and concentrations are not uniformly distributed, due, primarily, to irregular dumping practices. The sample location maps in Section 3 identify the estimated Raymark waste areas on each of the 24 properties.

- Asbestos is present at concentrations greater than 1% at all 24 properties. This fact alone may be sufficient to justify remedial actions. The presence of pavement and vegetative

cover at most of the OU6 properties reduces the potential inhalation exposures to asbestos; however, disturbances of asbestos-containing soil through digging will increase the potential for airborne asbestos exposures and associated inhalation risks. This underscores the importance of avoiding disturbances of asbestos-containing soils prior to remediation and using health protective measures during remediation. Asbestos was not quantified as part of the estimated potential risks to human health.

- Potential risks to human health from estimated areas of Raymark waste are in excess of EPA acceptable limits or levels of concern based on estimates of hazard indices, cancer risk, and/or modeled blood lead levels at 14 of the 24 properties. Cancer risks at 6 additional properties fall within EPA's target risk range of 10^{-4} to 10^{-6}.

- Although no quantitative ecological risk assessment was performed as part of this RI, based on available data, minimal ecological risk is assumed for the properties within the OU6 study area, assuming erosion and migration of wastes are controlled.

A small number of additional properties still need to be investigated as the result of access issues at specific properties that were previously included in the over 200 properties evaluated initially as part of OU6. These properties will be evaluated in the future by EPA to determine the potential presence of Raymark waste.

1.0 INTRODUCTION

This Remedial Investigation (RI) Report (report) evaluates the nature and extent of contamination in the soils from 24 properties that resulted from past disposal practices of the Raymark Industries, Inc. Facility (former Raymark Facility or Facility), located in Stratford, Fairfield County, Connecticut (Table 1-1 and Figure 1-1). Tetra Tech NUS, Inc. (TtNUS) prepared this report for the U.S. Environmental Protection Agency (EPA) under a Response Action Contract (RAC) Work Assignment No. 112-RICO-01H3, Contract No. 68-W6-0045, to partially fulfill the requirements for Raymark Operable Unit No. 6 (OU6) – Additional Properties. This RI report was developed based on the approved Draft Work Plan Option Period, June 2001, and approved Draft Work Plan, Amendment No. 2, July 2002, and subsequent amendments.

As requested by EPA, this RI incorporates information compiled in the *Final Area I Remedial Investigation, Raymark – Ferry Creek OU3* (TtNUS, October 1999b), the *Draft Final Area II Remedial Investigation, Raymark – Ferry Creek OU3* (TtNUS, November 2000a) and the *Draft Final Area III Remedial Investigation, Raymark – Ferry Creek OU3* (TtNUS, November 2000b). Additional efforts to evaluate groundwater contamination beneath and downgradient of the former Raymark Facility are being conducted by TtNUS under Raymark - Operable Unit No. 2 (OU2-Groundwater), Work Assignment No. 126-RICO-01H3. This RI was prepared in accordance with the *Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA, 1988), and is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA); and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

1.1 Purpose of Report

This report documents the investigations performed, and evaluates the nature and extent of soil contamination, and associated public health and environmental risks, within 24 properties where waste from the former Raymark Facility has come to be located. Figure 1-2 identifies the location of each of these 24 properties, and Table 1-1 lists the 24 properties.

The purpose of this report is to provide the documentation necessary to support a Feasibility Study (FS) and the selection of a source control remedy in a Record of Decision (ROD).

The overall objectives of this RI report are to:

- Compile and evaluate applicable soil data needed to characterize the conditions at each property and to determine the nature and extent of contamination in the soil impacted by waste from the Raymark Facility;

- Evaluate the risks to human health and the environment at each property;

- Use existing information to summarize ecological conditions at the properties, where available; and

- Serve as the data resource for developing, screening, and evaluating a range of potential alternative remedial actions that address the contamination within the OU6 study area and support a comprehensive Feasibility Study.

1.2 Report Organization

This report contains a discussion of investigation activities, results, and interpretations, references, tables, and figures for each property, and appendices. Appendix A contains the boring logs, Appendix B contains supplemental and backup data for the Human Health Risk Evaluation, and Appendix C contains the analytical data used to produce this report. Appendix D contains a discussion of the field investigations associated with this OU6 RI.

This report is organized as follows:

- Section 1, Introduction, discusses the purpose and scope of the report, summarizes the background and history of the Raymark Industries, Inc. Superfund Site, and presents the physical characteristics of the overall Raymark Superfund site.

- Section 2, Establishment of the OU6 Study Area, presents the identification of properties evaluated, the development of the definition of Raymark waste, the description of the Raymark waste area used for each property, a physical description of the general setting of the area around the properties, and the general approach for identifying the nature and

extent of contamination, determining the fate and transport mode of contaminants, and assessing the human health and ecological risks within the study area.

- Section 3, Property Evaluations, presents a discussion of the physical characteristics of each of the 24 properties included in the OU6 study area, the known nature and extent of contamination on each property, the fate and transport of that contamination, and the estimated potential risks to human health and the environment.

- Section 4, Summary and Conclusions, summarizes Section 3 and states conclusions reached about the contaminated areas for each property.

1.3 Background

This section summarizes the history of the former Raymark Facility, describes the Raymark Superfund Site, and identifies other activities associated with the former Raymark Facility. Refer to the *OU1 Final Remedial Investigation Report* (HNUS, 1995) for further details on Facility operating history, environmental activities, permits, and compliance history.

1.3.1 History of Raymark Facility and Environs

The Raymark Facility, formerly named Raybestos - Manhattan Company, was located at 75 East Main Street in Stratford, Fairfield County, Connecticut, at latitude 41°_12'_02.5"_N and longitude 73°_07'_14.0"_W (see Figure 1-1). The Raymark Facility operated from 1919 until 1989, when the manufacturing plant was shut down and permanently closed; however, the property was not cleaned up until 1997. A remedial investigation and feasibility study (RI/FS) for the Raymark Facility was completed in 1995 (HNUS, 1995). Subsequent to the completion of the RI/FS, EPA designated the facility as Operable Unit No. 1 (OU1). In 1996 and 1997, as part of the property cleanup activities, the Facility buildings were demolished and a permanent cap was placed over the contaminated areas on the property. Based on Stratford tax map information, the Facility occupied 33.4 acres. Raymark manufactured friction materials containing asbestos and non-asbestos components, metals, phenol-formaldehyde resins, and various adhesives. Primary products were gasket material, sheet packing, and friction materials including clutch facings, transmission plates, and brake linings. As a result of these activities, soils at the Facility were contaminated primarily with asbestos, lead, copper, and polychlorinated biphenyl compounds (PCBs).

During the facility's 70 years of operation, it was common practice to dispose of manufacturing waste as "fill" material both at the Raymark Facility, as well as at various locations in Stratford. The manufacturing wastes from various plant operations were used to fill low-lying areas on-site to create additional space for facility expansion. Based on aerial photographs and reported knowledge of site activities, on-site disposal occurred between 1919 and 1984, and progressed essentially from north to south, across the Raymark Facility. As a result of disposal of these manufacturing wastes on the property, soils at the facility became contaminated primarily with asbestos, lead, copper, and PCBs. New buildings and parking areas were constructed over these filled areas as the manufacturing facility expanded. Raymark also offered manufacturing wastes as "free fill" to employees, residents, and the town.

The Raymark Facility was underlain by an extensive manmade drainage network. Water and wastes from the manufacturing operations were collected and diverted into the facility drainage system, which also collected stormwater runoff. These liquids were transported through the drainage system network, mixed with lagoon wastewaters, and then discharged to Ferry Creek.

Solids were allowed to settle in Lagoon Nos. 1, 2, and 3 prior to discharge of clarified wastewater and unsettled solids to Lagoon No. 4. Lagoon No. 4 discharged directly into Ferry Creek. Discharge of wastewater to Lagoon Nos. 1, 2, and 3 ceased in 1984. These lagoons were closed in December 1992 and January 1993. During the fall of 1994, stormwater drainage that had exited the Raymark Facility through Lagoon No. 4 was diverted around this lagoon and connected directly to the storm sewer. The storm sewer ultimately discharged to Ferry Creek. Lagoon No. 4 was closed in early 1995, prior to the placement of the permanent cap over the property.

During the operation of the lagoons, the settled material in the lagoons was periodically removed by dredging. During the facility's 70 years of operation, it was common practice to dispose of both this dredged lagoon waste and other manufacturing waste as fill material (referred to as waste in this report) both at the Raymark Facility and at various locations in Stratford. Several of the locations that received waste are included within the area designated as the OU6 study area for this RI report (Figure 1-2).

A number of these off-the-facility locations, where Raymark waste was disposed, were contaminated with asbestos, lead, PCBs, and/or other contaminants at levels that posed a potential threat to public

health. To abate the potential health threat to residential properties, residential locations were remediated under EPA CERCLA time-critical removal actions during 1993 to 1996. The excavated material from these residential locations was placed under a permanent cap at the Raymark Facility. Raymark waste identified at one municipal property, Wooster Middle School, was also excavated, stored, and ultimately placed under a permanent cap at the former Raymark Facility. Additional properties have been identified as locations where Raymark waste was disposed; these 24 properties are the subject of this RI report.

Based on this information, EPA listed the former Raymark Facility and properties that contain waste from the Raymark Facility, on the National Priorities List (NPL) on January 18, 1994. Listing on the NPL authorizes the expenditure of CERCLA funds. The property was granted a final listing status on April 25, 1995.

1.3.2 Raymark Superfund Site Description and Setting

Contaminated areas associated with Raymark Superfund Site have been divided into nine operable units. EPA created these nine operable units (OUs) to help manage the cleanup process. The nine operable units are as follows:

OU1 Raymark Facility
OU2 Groundwater
OU3 Upper Ferry Creek and Surrounding Wetlands
OU4 Raybestos Memorial Field
OU5 Shore Road Area
OU6 Additional Properties Study Area
OU7 Lower Ferry Creek, Selby Pond, and Housatonic River wetlands
OU8 Beacon Point Area and Elm Street Wetlands
OU9 Short Beach Park and Stratford Landfill

The area identified as the OU6 study area includes 24 properties impacted by waste from the former Raymark Facility (see Section 2.1 for a discussion on the establishment of the OU6 study area). These properties are not all contiguous to each other and are scattered, mainly along the eastern edge of Stratford, running north to south (see Figure 1-2). The OU6 study area encompasses a total of 157.1 acres (see Table 1-1). Fourteen of the 24 properties identified in this RI report were

previously evaluated within the areas described in the Raymark – Ferry Creek (OU3) investigations. The OU3 evaluations did not evaluate properties individually, rather the 14 properties were included in the larger areas identified as A-1, A-2, and A-3 in the *Final Area I Remedial Investigation, Raymark – Ferry Creek (OU3)* (TtNUS, 1999b); Area B in the *Ferry Creek OU3 Draft Final RI, Area II* (TtNUS, 2000a); and Area D in the *Ferry Creek OU3 Draft Final RI, Area III* (TtNUS, 2000b). These OU3 investigations evaluated these 14 properties as part of a larger investigation of soil and sediments around them. EPA subsequently decided to divide its efforts into soil-only properties and sediment-only areas. This meant that the 14 properties included as part of OU3 were re-evaluated individually as part of the soil-only evaluation under this OU6 RI report. The remaining 8 properties included in this OU6 RI report are outside of the Ferry Creek OU3 study area and are located throughout the town.

Three water bodies in the OU6 study area abut some of the 24 properties: the Housatonic River, Ferry Creek, and Bruce Brook. Each is located on Figure 1-2 and on the appropriate Section 3 figures.

1.3.3 Other Raymark Related Activities

On-going activities in the vicinity of the Raymark Superfund Site that are related to the investigations conducted to support this RI include:

- Raymark Facility Closure (OU1) – Raymark waste from residential properties was brought back to the former Raymark Facility and placed under a permanent cap by EPA under the U.S. Army Corps of Engineer's Total Environmental Restoration Contract (TERC) in 1997. A soil vapor extraction system is in place to capture the bulk of the volatile organic contaminants (VOCs), especially toluene, remaining under the cap. A dense non-aqueous phase liquid (DNAPL) extraction system is removing separate phase NAPL (predominately 1,1,1-trichloroethane), which is collected in the sump portion of several extraction wells. This property is now privately owned, and has been redeveloped as a shopping center. Operation and maintenance activities are being conducted by the Connecticut Department of Environmental Protection (CT DEP).

- Groundwater RI Activities (OU2) – An RI is being prepared for Raymark - OU2 to evaluate groundwater contamination under and downgradient of the former Raymark Facility. The

OU2 RI is being conducted concurrently with this OU6 RI. A Draft RI for the OU2 RI was submitted to EPA in November 2000 (TtNUS, 2000c). Additional groundwater investigations were completed in the spring and summer of 2003. A revised RI report will be issued during the winter/spring 2004 with a separate FS for OU2 to follow shortly thereafter.

- Raymark Ferry Creek RI Activities (OU3) – This operable unit encompasses the areas also known as OU7 and OU8. Three RIs (OU3 (Final), OU7 (Draft Final), and OU8 (Draft Final)) were completed in 1999, 2000, and 2000, respectively (TtNUS, 1999b, 2000a, and 2000b). This OU will be included in a comprehensive FS for OU3 (including OU7 and OU8), OU4, OU5, and OU6.

- Raybestos Memorial Ballfield Activities (OU4) – EPA issued the Final RI report, (TtNUS, 1999a). This OU will be included in a comprehensive FS for OU3 (including OU7 and OU8), OU4, OU5, and OU6.

- Raymark Shore Road Activities (OU5) – An Engineering Evaluation and Cost Analysis was released in 1999 (TtNUS, 1999c). A cap was completed in 2001. A Draft RI was released in 2002. This OU will be included in a comprehensive FS for OU3 (including OU7 and OU8), OU4, OU5, and OU6.

- Raymark Short Beach Park and Stratford Landfill Activities (OU9) – A field investigation of these areas will culminate in an RI and FS that is expected to be released in 2005.

- A substantial number of field investigations relating to soil, sediment, surface water, biota, groundwater, soil gas, and indoor air have been conducted at the former Raymark Facility and its environs. A discussion of those investigations that are pertinent to this OU6 RI study area is included in Appendix D, on Table D-1.

2.0 ESTABLISHMENT OF THE OU6 STUDY AREA

As stated in Section 1.3, Raymark Industries, Inc. (Raymark), a manufacturer of automotive friction components, was located at 75 East Main Street, in Stratford, Connecticut. During its 70 years of operation, it was Raymark's common practice to dispose of manufacturing wastes both at the Raymark Facility and at various locations in the Town of Stratford. Beginning around 1993, the EPA's Removal Program sampled soil at many commercial, recreational, and residential properties throughout Stratford for the potential presence of Raymark wastes. From 1993 through 1995, EPA conducted removal actions, consisting primarily of soil excavation, at a number of residential properties presenting the greatest health threats. Properties where sampling did not find immediate health threats were designated for EPA's Remedial Program to address. After 1995, EPA's Remedial Program focused on other health threats in Stratford resulting from wastes from the former Raymark Facility.

From 2002 to 2004, EPA's Remedial Program continued the investigation of soil at commercial, recreational, and residential properties and began to evaluate the potential for risks from long-term contaminant exposures. Procedures were developed by EPA, in consultation with the CT DEP, and reviewed by the Raymark Advisory Committee's consultant, to determine whether soils at a property had been adequately characterized, if additional sampling was needed, and the overall status of each property after characterization was complete. These procedures dictated the process of evaluating a property and determining whether Raymark waste was present.

Based on sampling results, once a property was determined to have Raymark waste contamination, the property was divided into those areas with Raymark waste and those without Raymark waste. While the entire property was sampled and evaluated for the nature and extent of contamination, the estimated area of Raymark waste on a property is the only portion of that property evaluated in the Human Health Risk Assessment (see Section 2.7 and Section 3 property write ups). Section 2.1, Identification of Properties, below, together with the figure for each property in Section 3, detail the procedures used in the evaluations.

The discussions in the following sections describe: the procedures used for identification of the 24 properties that comprise the OU6 Study area; how the definition of Raymark waste was

developed and applied to these 24 properties; the development of the estimated area of Raymark waste; the physical characteristics of the setting of the OU6 study area; the nature and extent of the contamination within the 24 properties of the OU6 study area; the principles of contaminant movement on the 24 properties; and a discussion of the risks associated with the Raymark waste and other contaminants on the 24 properties within the study area.

2.1 Identification of Properties*

The Universe of Properties[1] evaluated as part of this RI included all properties that had been identified over a 10-year period where there was a potential for Raymark waste to be present (see Figure 2-1). These locations were identified by a number of sources including, but not limited to, officials of the Town of Stratford, Raymark records and/or former employees, historical records, analytical data, and neighbors/citizens. Reasons for identification included, without limitation, knowledge of past filling/disposal activities and locations, property conditions and topography, proximity to the former Raymark Facility, and proximity to areas subject to excavation actions by EPA's Removal Program. Each property was evaluated to determine whether adequate sampling had been previously conducted to evaluate the potential presence of Raymark waste. Both EPA and the CT DEP (the Agencies) participated in these evaluations.

Specifically, if adequate shallow (0-2 feet) and depth (>2 feet) samples had been collected, then an assessment for the presence of Raymark waste was made based on a comparison of the sampling results to the definition of Raymark waste described in Section 2.2. If Raymark waste was identified on the property (that is, if the sampling results met the definition of Raymark waste), then the property was included in the Raymark Operable Unit No. 6 Remedial Investigation Report (OU6 RI[2]). If Raymark waste was not identified, then the property was "out"[3] of the evaluation process and no further action would be needed under Superfund.

If only shallow samples were collected or if no shallow or depth samples had been collected, the Agencies, with input from the town, reviewed the property to determine the potential for Raymark waste to be present in soil on the property. The Agencies'[4] determination of whether or not there was a potential for Raymark waste to be present on a property was based upon a

* Footnotes in Sections 2.1 and 2.2 reflect points of decisions as shown on Figures 2-1 and 2-2 for identifying Raymark waste.

number of factors. These factors included, without limitation, input from town officials (Town of Stratford, 2002/2003), evidence of past filling/disposal activities and locations, property conditions and topography, analytical data, aerial photography, proximity to the former Raymark Facility, proximity to areas subject to excavation by EPA's Removal Program, and evaluations and recommendations made by the federal Agency for Toxic Substances and Disease Registry (ATSDR) and/or the Connecticut Department of Public Health (CT DPH). Further, if a property abutted another property that had either been subject to an EPA removal action or was determined to contain Raymark waste, then that property usually was recommended for shallow and depth sampling, particularly if the Raymark waste portion of the removal property abutted it.

If the Agencies determined that there was not a potential for Raymark waste to be present on a property, then the property was considered "out" of the evaluation process and not part of the OU6 RI. If the Agencies determined there was a potential for Raymark waste to be present or if the evidence was inconclusive, then additional sampling was recommended[5]. At the conclusion of such sampling, analytical results were compared to the definition of Raymark waste. If Raymark waste was identified on a property, then the property was included in the OU6 RI. If Raymark waste was not identified on a property, the property was considered "out" of the evaluation process and no further action would be performed under Superfund.

2.2 Definition of Raymark Waste

All determinations of the presence or absence of Raymark waste (Raymark Waste Identified[6]) were based on the following definition of Raymark waste: Raymark waste in soil is defined as a single soil sample at the same depth interval containing lead above 400 parts per million (ppm) (milligrams per kilogram (mg/kg)) **and** asbestos (chrysotile only) greater than 1 percent **and either** copper above 288 ppm (mg/kg) **or** polychlorinated biphenyls (PCBs)(Aroclor 1268 only) above 1 ppm (mg/kg). This definition was developed by EPA, in consultation with the CTDEP, and reviewed by the Raymark Advisory Committee's consultant, prior to an evaluation of sampling data from the properties.

Properties that have soil samples with analytical results meeting the Raymark waste definition, and that have not undergone a removal action, or are not included under other operable units

as discussed in Section 1.3.3, are presented in this RI Report. A list of these properties is shown on Table 1-1. A Human Health Risk Assessment (HHRA) was performed to estimate potential current and/or future risks to the public from the contaminants detected in soils at each property containing Raymark waste. The results of these evaluations are presented for each property in Section 3.

As shown on Figure 2-2, details of the development of the Raymark waste definition are as follows:

1. **Lead** - Lead was selected as an identifying contaminant of Raymark waste as it was used in the fabrication of various brake and friction materials in the Raymark manufacturing process. Raymark acknowledged in its RCRA "Part A application" that up to 2.5 billion gallons of lead-contaminated waste liquid flowed through its on-site lagoons on an annual basis. The on-site lagoons were routinely dredged and the spoils were disposed of on the facility property and at other locations throughout the town. The soils and sediments on the former Raymark Facility, in particular the on-site lagoons, contained high levels of lead.

   Lead was identified as a contaminant of concern because it appeared in most samples collected during the 1992 – 1994 sampling on the former Raymark Facility (elevated lead concentrations were found in process waste, imported fill, and native fill – the latter two assumed to be the result of leachate or cross contamination).

   In addition, based on the samples collected on the former Raymark Facility and during the 1993 to 1995 removal actions, 400 mg/kg lead was selected by EPA and approved by ATSDR as a conservative permanently protective cleanup level for residential properties. This value was consistent with EPA's 1992 draft *Soil Screening Level Guidance and Revised Interim Soil Lead Guidance* document (EPA, 1992c). This document was later published in July 1994 as *Revised Interim Guidance on Establishing Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (EPA, 1994b). This value was also consistent with the sample data obtained from the former Raymark Facility itself.

Currently, the 400 mg/kg lead standard remains because it meets the new proposed Connecticut Remediation Standard Regulations (CT RSRs) for residential properties. In an effort to differentiate this contaminant from lead paint from a home or business, the presence of lead and asbestos in the same sample will further identify it as Raymark waste.

2. **Asbestos** - Asbestos was selected as an identifying contaminant of Raymark waste by EPA in 1993 because of its dominance in the waste materials from the 1993 to 1995 removal actions and from samples collected at the former Raymark Facility. The one percent definition was set because it meets the National Emission Standards for Hazardous Air Pollutants (NESHAP) definition for an asbestos-containing material (EPA, 1990a). Currently, the Raymark waste definition remains at one percent, identifying the asbestos as chrysotile asbestos. Chrysotile asbestos was selected as the specific asbestos of concern due to its dominance in the samples collected at the former Raymark Facility. From the hundreds of samples collected at the former Raymark Facility, chrysotile asbestos was the only form of asbestos identified.

3. **PCBs** – PCBs were selected as an identifying contaminant of Raymark waste because of their predominance in samples collected at the former Raymark Facility and given that PCBs do not occur naturally in the environment. A concentration of 1 mg/kg total PCB was adopted by EPA for use in previous removal actions since unrestricted exposure to 1 mg/kg or less of total PCBs has been deemed safe by EPA (OSWER Directive: *Remedial Actions for Superfund Sites with PCB Contamination*) (EPA, 1990b). Based on historical sampling, EPA further believes that the majority of PCBs at the former Raymark Facility resemble Aroclor 1268 rather than the other PCB Aroclors (including Aroclor 1262 which was also found consistently at the Raymark Facility). As such, EPA has refined the definition of Raymark waste from the general term “total PCBs” to the more descriptive term “Aroclor 1268” as noted below. Samples collected at the former Raymark Facility, and during the 1993 to 1995 removal actions, indicated that PCBs were contained in the waste materials. Using this information, PCBs were selected as an identifying contaminant of Raymark waste. In 1993, the 1 mg/kg total PCB standard was

selected based on the OSWER directive from August 1990, *Remedial Actions for Superfund Sites with PCB Contamination* (EPA, 1990b). Pursuant to this guidance, samples from properties collected from 1993 to 1995 with PCBs greater than 1 mg/kg were considered above the action level that is protective of human health in a residential exposure scenario without institutional controls.

Currently, the definition of Raymark waste has been refined to state that the PCBs action level is greater than 1 mg/kg Aroclor 1268, for the reasons described below. Aroclor 1262 was dismissed because it was not considered exclusively unique to the former Raymark Facility samples.

- Wipe samples, taken within the former Raymark Facility buildings that contained processes that most likely used PCBs, had Aroclor 1268.

- Samples collected by former Raymark Facility consultants, from the sediments and soils on the facility property where off-specification process waste was dumped to fill in low spots on the property, contained Aroclor 1268.

- Knowledge that PCB usage was probable in manufacturing processes such as Raymark's (plasticizers in phenolic resins and as wax extenders).

- No other known users of 1268 Aroclors have been identified in the area (either to jointly dump materials on the properties throughout Stratford and/or to provide disposal materials to Raymark as imported fill material. EPA assumes that any fill materials brought onto the Raymark property would have been from local sources as a cost savings to the company).

- Samples taken from known Raymark waste disposal areas around Stratford over the past 10 years contained Aroclor 1268.

4. **Copper** - Copper was selected as an identifying contaminant because of its predominance in the Raymark waste from samples collected from the 1993 to 1995 removal actions, and the former Raymark Facility. The 288 mg/kg standard was selected by EPA as the identifying benchmark as it is ten times greater than average background concentrations (see Table 2-2).

2.3 Raymark Waste Area

Based on the Raymark waste definition identified above, EPA, in consultation with the CT DEP and review by the Raymark Advisory Committee consultant, calculated the area of Raymark waste at each property. These areas are shown on the respective Section 3 figures for each property (Figures 3-1 through 3-24) as the "Estimated Area of Raymark Waste" and are presented in both square feet and acres for all properties on Table 1-1. The area of Raymark waste defines the portion of each property for which risks to human health have been estimated. Exposures are prorated based on the proportion of the property containing the Raymark waste (see Section 2.7). Areas of each property that are outside of the defined Raymark waste area may also contain contamination (see discussion provided for each property in Section 3). Some of the contamination outside the defined Raymark waste area may even exceed safe levels established by the state or federal governments. However, because these areas do not meet the definition of Raymark waste, they are not evaluated for risk effects within this document. Information on all contaminants both within and outside the estimated area of Raymark waste are described in both Section 2.7 and for individual properties in Section 3.

The following steps were used to determine the estimated lateral extent of Raymark waste for each property, shown as the gray areas on the figures in Section 3.

- All of the soil sample analytical data available from the property were assembled in a database.

- The database was queried to display soil sampling data for Raymark waste constituents (lead, asbestos, Aroclor 1268, and copper).

- The analytical data for each soil sample were evaluated to determine which sample locations met the Raymark waste definition.

- Every sample location for which data were available was shown on a map of the property.

- Sample locations where Raymark waste was present were noted.

- At each sample location containing Raymark waste, the halfway point between the location and any adjacent sample locations that did not contain Raymark waste was measured and noted.

- After all of the halfway points had been noted, the midpoints were connected and an assumed limit to Raymark waste for the property was developed.

- Raymark waste limits, without regard to on-site buildings, were drawn.

- After preliminary lines were drawn, the building footprints were subtracted and the Raymark waste lines were redrawn around the perimeter of each building so as to exclude the areas beneath buildings.

Some of the limitations of the method used to determine the Raymark waste areas are noted below; however, this is not a comprehensive list of limitations:

1. Assuming that all data were valid and complete, the accuracy of lateral extent lines was partially a function of the density of sample points on a particular property. The existence of a sparse or irregular distribution of sample points tended to assign greater significance to those sample points over other points that were located within an area that was densely populated with sample points.

2. Soil samples were evaluated without regard to the depth from which the soil sample was collected.

3. If a soil sample did not meet the Raymark waste definition as described under Section 2.2, then it was not considered Raymark waste. This limitation has ramifications for future estimates of Raymark waste or actual measurements of Raymark waste during implementation of a remedial action. Two examples of the limitations of the data are as follows. First, if a soil sample satisfies two of the four Raymark waste criteria (i.e. lead and asbestos), but no data exists to determine whether it satisfies the third or fourth criteria (i.e. PCB and copper), the soil sample was not considered to be Raymark waste. Second, if a soil sample did not satisfy the criteria for Raymark waste, but came close (i.e. lead=390 ppm), it was not considered Raymark waste. Please note that areas not comprehensively sampled for identification of Raymark waste may be re-sampled and characterized during the pre-design and design stages of the Superfund remedial action.

4. The analytical data that were used to perform this evaluation were collected as much as 10 years ago. It is possible that contaminant migration has impacted the characteristics of the soil at these locations, and that a sample collected today from the same location may have different contaminant characteristics.

5. The analytical results were compared to the Raymark waste criteria definition without consideration of the accuracy and precision of the analytical method used. For most of the soil samples, x-ray fluorescence (XRF) screening was performed for lead and copper and gas chromatograph with electron capture detection (GC/ECD) screening was performed for PCBs as Aroclors. Confirmatory samples were sent for laboratory analysis of lead, copper, and PCBs using EPA-approved methods. When screening and confirmatory results were available for one sample, the confirmatory results were used.

Once the assumed lateral extent line was drawn onto a map of the property, AutoCAD was used to measure the area of Raymark waste. The area of Raymark waste for each property is presented on Table 1-1. Only Raymark waste that was located within the property boundary was included in the total surface area for a particular property; Raymark waste located off the property may be indicated on the figure, but is not included in the surface area totals for that property. Where relevant, it is included in the evaluation for the abutting property where

Raymark waste was found within its borders. The buildings were deleted from calculations of the estimated area of Raymark waste (as shown on Table 1-1).

2.4 Physical Characteristics of the OU6 Study Area

This section describes the physical characteristics of the OU6 study area and the region in which the study area is situated. The surface features and land uses are described in Section 2.4.1; surface geology and fill materials are presented in Section 2.4.2; and discussions of climate are presented in Section 2.4.3. Throughout this report, all elevations are stated in feet with respect to the National Geodetic Vertical Datum (NGVD), 1929.

2.4.1 Surface Features and Land Use

Most of the 24 properties are part of the Housatonic River Basin, a tidally influenced system. The study area includes residential, recreational, and commercial properties. The study area is described in Section 1.3.2 and shown on Figure 1-2.

The topography of the majority of the study area is relatively flat, with gentle slopes to Ferry Creek and the Housatonic River. Based on a review of USGS topographic maps, the majority of the study area lies at topographic elevations of approximately 10 feet. The commercial properties to the north in the vicinity of East Main Street are higher in elevation.

Seven of the 24 properties are outside the 100-year flood plain. Most properties within the study area are located entirely or partially within the 100-year floodplain, as observed from Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Stratford, Connecticut (FEMA, 1992). The 100-year frequency base flood elevation is 10.1 feet; the 10-year frequency flood elevation is 8.5 feet (USACE, 1998).

State- or federally-listed threatened species reported to exist in the vicinity of the study area include the least tern, the atlantic sturgeon, and occasional transient bald eagles and peregrine falcons (NOAA, 1998; CT DEP, 1997a; US DOI, 1997).

The Town of Stratford is located in southwestern Connecticut on the shore of the Long Island Sound between Bridgeport and the Housatonic River. There are two public beaches, five marinas, several fishing piers, and two boat launching areas. The principal industries within the Stratford community include manufacturing of aircraft, air conditioning, chemicals, plastic, paper, rubber goods, electrical and machine parts, and toys. There are approximately 2,200 business establishments in Stratford. The Stratford, Connecticut web page (www.townofstratford.com) states the 2003 population of the Town of Stratford as 49,389 people within the 18.7 square miles of the town.

2.4.2 Surficial Geology

The surficial deposits of the study area are mapped as Stratford outwash sediments, fill deposits, and swamp/marsh deposits (Flint, 1968). Based on borings advanced in or near the study area, the surficial deposits are characterized primarily as a variety of locally derived glacial outwash deposits and ice contact deposits, alluvial deposits, swamp and marsh deposits, and fill materials. Glacial till may be present locally. Overburden consists of a complex sequence of alluvial and outwash deposits (sand and gravel) ranging from silty sands to coarse gravels. Peat/organic silt deposits are common in the study area, frequently underlying fill materials.

Fill consists of a mixture of natural and man-made materials. Fill materials frequently include manufacturing, household, and construction debris usually mixed with natural materials such as silty sand and gravel. Natural materials include various amounts of clay, silt, sand, and gravel. Man-made materials consist of charcoal, asphalt, metal, brick, tile, glass, and other miscellaneous materials, including manufacturing debris. Other fill materials that do not contain visual evidence of man-made debris are present throughout the study area, generally consisting of sands with varying amounts of silt and gravel. This fill is frequently more difficult to distinguish from natural/native deposits. Specific information on the presence or absence of artificial fill materials and contaminated soil intervals was reviewed from the boring logs. Fill was identified based on visual descriptions of soil and sediment samples collected during the field investigations.

Historically, fill originating from the former Raymark Facility has been described as a generally black fine-grained material often containing visible asbestos-containing materials. For the purposes of this report, Raymark waste is defined by its chemical composition as described in Section 2.2. Boring logs are included in Appendix A.

2.4.3 Climate

The study area is located in a temperate-humid climate, characterized by highly changeable weather and large daily and annual temperature variations. The most pronounced topographical effect is the land-sea breeze, an occurrence generally associated with the spring through early autumn months. General temperatures during the summer months average 3 to 5 degrees lower than nearby inland locations. Temperatures during the fall and winter months are moderated because of the proximity of Long Island Sound. Winter snowfall is generally around 10 inches less than areas a few miles inland, also due to the proximity to Long Island Sound.

The local National Oceanic and Atmospheric Administration (NOAA) Climatological Station is located in Stratford, Connecticut at the Bridgeport-Sikorsky Airport. For the past 30 years, data from this station have been used to describe the general climate in the area.

July is the warmest month with an average temperature of 74° F. The coldest month is January with an average temperature of 29.9° F. The maximum temperature observed between 1939 and 1998 was 103° F. The minimum temperature observed during this period was -7° F. Normal annual precipitation for the region is 44.2 inches, with between 3 and 4 inches of rain or water equivalent falling during each month. The area has an average annual snowfall of 25.8 inches which generally occurs between November and April. However, most snowfall occurs in January and February. Averages for these months are 7.4 inches and 7.6 inches, respectively.

Wind speed in the region varies between 9.3 and 13.0 miles per hour (mph) with an average of 11.4 mph. In the warmer months the prevailing wind direction is southwest. In the colder months the prevailing direction is west to northwest (NOAA, 2002).

2.5 Nature and Extent of Contamination – General Approach

This section presents the approach used to characterize the analytical results of samples collected within the OU6 study area to determine the portion of each property that contains Raymark waste. Samples were analyzed to determine the presence or absence of Raymark waste, based on meeting the Raymark waste definition discussed in Section 2.2. A brief discussion of the potential sources of contamination affecting the study area is provided in Section 2.5.1. Section 2.5.2 provides an overview of the contaminants detected. Section 2.5.3 provides a discussion of the background concentrations developed for comparison with the study area concentrations. Section 2.5.4 provides a discussion of how the soil analytical results were evaluated. Summaries of the nature and extent of contamination detected at each of the 24 properties are provided in Sections 3.1 through 3.24. Analytical data used in the evaluation of the nature and extent of contamination can be found in Appendix C. Table 2-1 contains a list of chemical compounds that were used or handled at the Raymark Facility during its operation.

The solid matrix samples from the study area have been divided into soils and wetland soils. Soils are defined as solid matrix samples collected from relatively dry areas located outside designated wetland boundaries and not associated with creeks, creek beds, or the Housatonic River. Wetland soils are defined as solid matrix samples collected from within designated wetland boundaries. It should be noted that these samples may have been designated as either soils or sediments in previous investigations. For the purposes of this report, soils and wetland soils are the same and will be evaluated using the same criteria from the CT RSRs.

2.5.1 Potential Sources of Contamination

The contamination sources in the study area include locations where Raymark waste materials were disposed of (dumped) at residential and commercial properties within or adjacent to the OU6 study area, locations where erosion and/or leaching of the Raymark waste materials is (or was) occurring, and locations where contaminated groundwater discharged to Ferry Creek. The gray areas on the Section 3 figures illustrate the random nature of the Raymark waste disposal practices.

2.5.2 Overview of Chemical Compounds Detected

Brief descriptions of the major classes of chemical contaminants detected in the soils of the former Raymark Facility and the common industrial uses of these chemicals are presented in Sections 2.5.2.1 to 2.5.2.7. Section 2.5.2.8 provides a reference for the specific chemicals known to have been stored, handled, and/or used at the former Raymark Facility during its operation that may have contributed to contamination of the properties within the OU6 study area. An evaluation of the usability of field screening data is included in Section 2.5.2.9. This information provides a reference framework for the chemicals identified in the soils of the 24 properties included in this RI.

2.5.2.1 Volatile Organic Compounds (VOCs)

The VOCs detected in soil samples collected from the former Raymark Facility can be separated into three major groups: chlorinated hydrocarbons, aromatic hydrocarbons, and ketones. Many of these VOCs are organic solvents commonly used in industrial processes for degreasing parts; to prepare metal surfaces prior to painting, coating, or bonding; as constituents of paint thinners and resins; and to extract organic compounds from materials. Additionally, some of the detected VOCs are common components of gasoline and petroleum fuels.

2.5.2.2 Semi-volatile Organic Compounds (SVOCs)

The SVOCs detected in soil samples collected from the former Raymark Facility can be separated into three major groups: phenolic compounds, polynuclear aromatic hydrocarbons (PAHs), and phthalates. SVOCs are common constituents of various industrial products. Phenolic compounds are typically associated with fuels, coal, and petroleum products, and are used in manufacturing friction materials. PAHs are common components of coal tar (bitumen and asphaltic tars), petroleum products (motor and fuel oil), and combustion by-products. Phthalates are typically used as plasticizers in the manufacture of synthetic materials. Phenolic resins were used by Raymark Industries, Inc. in manufacturing friction materials.

2.5.2.3 Pesticides

Pesticides are typically used to control unwanted insects in residential and commercial areas, as well as to prevent crop destruction in agricultural settings. Pesticide formulations may include chlorinated and organophosphorous varieties.

During the operation of the former Raymark Facility, a large portion of the property consisted of vegetated areas. Pesticides may have been used at the former Raymark Facility to control unwanted insect populations. Various types of formulations could have been used, including chlorinated and organophosphorous pesticides. While these chemicals may have been applied at the former Raymark Facility, no documentation of their use has been identified. However, pesticides were identified in the soils on the former Raymark Facility and in the Raymark waste materials on properties excavated during EPA removal actions.

2.5.2.4 Polychlorinated Biphenyls (PCBs)

The PCBs detected in the soil samples collected from the former Raymark Facility consisted solely of Aroclor 1262 and Aroclor 1268. PCBs are extremely stable chemicals with a wide range of physical properties. They have been historically used in plasticizers, adhesives, lubricants, heat transfer fluids, and as dielectric fluids in transformers and capacitors. Aroclor 1262 and Aroclor 1268, specifically, are used as plasticizers in synthetic resins. Aroclor 1268 is also commonly used as a wax extender and plasticizer in rubbers.

No information on PCB usage has been provided directly by Raymark Industries, Inc. documenting the specific use of PCBs as part of their manufacturing process. However, the use of PCBs in the manufacturing of brake linings is documented in the literature. The Raymark Facility was also known as having used and/or manufactured both rubber (gasket materials) and resins (phenolic resins in brake linings). It is assumed that Aroclor 1262 and Aroclor 1268 were used as plasticizers in these materials. Samples containing Aroclors 1262 and 1268 were obtained at the former Raymark Facility. Section 2.2 details the results of this sampling and the linkage to the identification of Raymark waste.

2.5.2.5 Dioxins and Furans

Soil samples from the former Raymark Facility contained detectable concentrations of dioxins and furans. Dioxins and furans are not manufactured commercially. Chlorinated dioxins and furans are formed during the production of chlorinated compounds (such as PCBs, herbicides, pesticides, and chlorophenols), or as a result of incomplete combustion of chlorinated chemical compounds (such as PCBs). The term “dioxins” is commonly used to refer to a specific group of polychlorinated dibenzo-p-dioxin chemical compounds. The toxicity of one specific compound, 2,3,7,8-tetrachloro-dibenzo-p-dioxin (2,3,7,8-TCDD), has been studied more than other known dioxins and furans. The toxicities of all other dioxins and furans are expressed in relation to 2,3,7,8-TCDD. Concentrations of each individual dioxin and furan in a sample are multiplied by Toxicity Equivalent Factors (TEFs) to yield 2,3,7,8-TCDD equivalent concentrations. These values are then totaled to yield total dioxin Toxicity Equivalent (TEQ) concentrations.

2.5.2.6 Metals

Numerous metals were detected in the soil samples collected from the former Raymark Facility. Some metals are naturally occurring components of soil and/or localized mineral deposits, or are the result of decomposition of weathered bedrock. Metals may also be introduced into the environment through various industrial activities including disposal of waste materials or process sludges, and fugitive emissions from various thermal or combustion processes.

Barium, copper, lead, and zinc were the primary metals used at the Raymark Facility to fabricate various brake and friction materials. Each of these metals was detected at elevated concentrations on the former Raymark Facility. Section 2.2 details the results of this sampling and the linkage to the identification of Raymark waste.

2.5.2.7 Asbestos

Asbestos was detected in soil samples collected from the former Raymark Facility. Asbestos is a group of magnesium silicate minerals that contain varying quantities of iron and calcium

silicates. Because of its non-combustible and heat-resistant properties, asbestos was commonly used to manufacture brake linings, gaskets, fireproof fabrics, roofing materials, and electrical and heat insulation, and as a reinforcing agent in rubber and plastics.

Asbestos-containing materials were the primary components in the products manufactured at the former Raymark Facility. Asbestos fibers were mixed with phenolic resins to manufacture brake pads and linings. Asbestos was also used to manufacture friction materials (clutches and transmission plates) and gaskets. Chrysotile was the form of asbestos used at the Raymark Facility. Samples containing asbestos were obtained at the former Raymark Facility. Section 2.2 details the results of this sampling and the linkage to the identification of Raymark waste.

2.5.2.8 Chemical Compounds Used or Handled at the Raymark Facility

A number of chemical compounds and materials were handled, stored, and/or used in manufacturing processes at the former Raymark Facility during its operation. A list of these chemicals, presented in Table 2-1, was developed from information provided in the *RCRA Facility Investigation Report* (ELI, 1995) and the facility's RCRA Part A application (August 15, 1980). No Part B application was ever formally filed for the Facility, so specific information on the operation of the former Raymark Facility is unavailable.

2.5.2.9 Evaluation of Usability of Data

The soil samples collected over the past 10 years to determine if wastes associated with the former Raymark Facility and environs had impacted a property were analyzed using screening techniques and/or by a fixed laboratory using EPA-approved methods. An evaluation of the results of both analytical procedures was conducted to determine whether the results could be used interchangeably for both the identification of the nature and extent of contamination and the human health risk assessment. All asbestos data are considered useable.

The lead, copper, and PCB screening data were evaluated by statistical analysis (linear regression) to determine a potential correlation between the screening data and the results by EPA-approved methods. The linear regression analysis involved a point-by-point comparison

of the data generated by the two methods. The correlation results are presented in Appendix B-3.

The results of the statistical analysis indicated that the screening data collected for copper and lead could be used with the same level of confidence as the data from the EPA-approved methods. A poor correlation was found between the PCB screening and EPA-approved method data. EPA, therefore, deemed the copper and lead screening data acceptable for use quantitatively in the RI and risk assessment and the PCB screening data acceptable for use quantitatively only in determining the nature and extent of contamination. PCB screening data were used in the risk assessment only for discussion in the absence of EPA-approved method data (B&RE, 1997b and 1997c). The screening results were used to provide real-time data necessary to make site decisions about the presence or absence of Raymark waste on the properties sampled, and whether the sample contained lead, copper, asbestos, or Aroclor 1268 at concentrations above or below the Raymark-waste definition benchmarks.

2.5.3 Background Concentrations

As part of the investigation activities conducted by EPA, soil samples were collected from schools, day care centers, and recreational areas around the Town of Stratford. The samples were analyzed for pesticides, PCBs, and metals. Metals results from 34 of 39 sample locations, and pesticides and PCB results from 27 of 37 sample locations, were determined to be representative of background conditions. Because of variability in the analytical data and/or heterogeneity of the samples, average background soil concentrations were developed by averaging the numerical data from samples deemed representative of background conditions. The numerical averages were calculated as the arithmetic average of the detected concentrations and half the detection limits for those compounds/analytes reported as undetected. The average background concentrations for pesticides, PCBs, and metals in soils are presented in Table 2-2. No background soil samples were analyzed for VOCs, SVOCs, dioxins, or furans.

2.5.4 Approach for Evaluating Analytical Results

For purposes of evaluating the nature and extent of contamination, contaminants were compared to the CT RSRs, Regulations of Connecticut State Agencies Section 22a-133k-2, Standards for Soil Remediation (CT DEP, 1996); Pollutant Mobility Criteria (CT PMC) for GB Aquifers, and Direct Exposure Criteria (CT DEC) for soils. Six properties including one residential property, one potential future residential property, one easement across residential property, and three recreational properties, were compared to the CT DEC for residential soils and 20 properties were compared to CT DEC for industrial soils. (Note that two properties were compared to the CT DEC for both residential and industrial soils).

2.5.4.1 Criteria for Identification of Contaminated Soils

Asbestos-containing material is defined in 40 CFR 61 Subpart M, as material containing more than 1 percent asbestos. For purposes of this report, greater than 1 percent asbestos was used to evaluate the presence or absence of asbestos. In Tables 3-1 through 3-24, the greater than 1 percent criterion for asbestos is included on the tables. However, CT DEP does not have a criterion for asbestos in soils. To evaluate the soil analytical results for other contaminants, the CT DEC were used as screening values to help identify contaminants that may pose threats to human health through direct contact with soils. In the case of metals and PCBs, comparisons were made to the Synthetic Precipitation Leaching Procedure (SPLP) or Toxicity Characteristic Leaching Procedure (TCLP) results, if available, for comparison. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to state-determined background concentrations, detection limits, and state-determined ceiling limits. These ceiling limits are maximum concentrations at which a criteria will be set and are generally used for chemicals of very low toxicity.

2.5.4.2 Criteria for Identification of Potential Groundwater Protection Concerns

An evaluation of groundwater is not part of the scope of work for this RI, but will be addressed as part of an area-wide groundwater assessment in the RI report being prepared for OU2. However, a preliminary qualitative assessment of the potential for chemical migration from

soils to groundwater was conducted as part of this RI based on a comparison of maximum chemical concentrations detected in soil to the CT PMC for GB aquifers. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. The comparison allows a preliminary evaluation of the chemicals' potential to migrate to groundwater and potentially impact the quality of groundwater.

Under the CT RSRs (CT DEP, 1996), concerns regarding the leachability of inorganics and PCBs are addressed using TCLP and/or SPLP data. A comparison of property-specific TCLP or SPLP data to CT RSRs for pollutant mobility is provided in Tables 3-1 through 3-24, as appropriate.

The nature and extent of contamination in the soils on a property are presented separately for each of the 24 properties. Summary statistics and a comparison to available benchmarks, described above, are presented in a table for each property in Section 3. In addition, a figure depicting sample locations and identification of Raymark waste areas, and exceedances of CT RSRs, is also provided for each property.

2.6 Contaminant Fate and Transport – General Approach

Fate and transport of contaminants are determined by a variety of factors. The physical and chemical properties of the contaminants and the medium (i.e., soil, groundwater, surface water, air) to which the contaminants are released are all factors that determine the eventual fate of these chemicals. In the study area, the combination of on- and offsite-related contaminants, geologic and hydrogeologic conditions, and surface features influence how contaminated site soils may have migrated into other environmental media (i.e., the underlying groundwater, surface water bodies, and sediments). The contaminant fate and transport in this OU6 RI Report is a qualitative assessment for each property; additional information and field measurements would be required to provide quantitative analyses. A discussion of the fate and transport of contaminants on each of the 24 properties is presented in Section 3.

The Raymark waste used as fill contains VOCs, SVOCs, PCBs, pesticides, dioxins and furans, metals (primarily lead and copper), and asbestos. As discussed in Section 2.4.2, the fill is a

mixture of natural and man-made materials. Natural fill consists of clay, silt, sand, and gravel. Man-made materials consist of charcoal, asphalt, metal, brick, tile, glass, and other miscellaneous man-made materials, including manufacturing debris. Raymark waste (comprised of sludges excavated or dredged from the lagoons, “off-specification” materials that were discarded, and other waste products) was disposed of as fill material throughout the study area, and contamination of many of the properties included in this RI occurred as a result of that filling.

There is also a potential for contaminants to have been released onto a property from other commercial and industrial operations or from groundwater contamination identified in the OU2 Groundwater RI. Past releases of petroleum hydrocarbons, VOCs, SVOCs, and other contaminants from other sources are likely, based on the long history of industrial and commercial activities in the area. Process water and runoff from the Raymark Facility containing these contaminants were directly discharged to Ferry Creek, which runs through the study area. The origins of some of the chemical contamination affecting the properties are indistinguishable. Identifying these potential other sources is not within the scope of this report. However, they will be considered during the evaluation of potential remedies.

Based upon available information, the two primary sources of contaminants at the 24 properties discussed in this report are:

- Disposal of contaminated Raymark wastes, including sludges from the former Raymark Facility lagoons, which were used to fill in low topographic areas. These fill materials have become sources of further contaminant releases to the wetlands, Ferry Creek, the Housatonic River, and other topographically low-lying areas.

- Spills, leaks, and other releases that may have occurred at the property as a result of past storage, usage, or disposal of chemicals and other substances.

There are three primary mechanisms by which contamination from the estimated area of Raymark waste can enter into other environmental media:

- Contaminants in the fill can leach to subsurface soils;

- Erosion and surface runoff can carry contaminated soils into Ferry Creek, Bruce Brook, and the Housatonic River; and

- Contaminants can leach into the groundwater, migrate through advection, and discharge into Ferry Creek, Bruce Brook, or the Housatonic River as baseflow.

The evaluations of contaminant fate and transport in this RI are based on existing property conditions, identification of chemicals present in the environmental media, the physical state of soil and groundwater contaminants, general fate and transport mechanisms, and the interpretation of geologic and hydrogeologic conditions within the study area.

On a property, the fate and transport processes of concern are those that govern the migration of soil contaminants (once released or deposited) to the surrounding environment. Once these contaminants have entered another medium, other fate and transport mechanisms occur that may cause further chemical migration or transformations. This generalized discussion of fate and transport processes is provided so that the observed property-specific contamination conditions presented in Section 3 can be better characterized and understood.

2.6.1 Fate and Transport of Contaminants in Soils

Once organic and inorganic contaminants are released to soils, a variety of processes occur that may cause them to become immobilized, degraded, or to be mobilized to another environmental medium. Some of these processes include:

- Volatilization – Chemicals having high Henry's Law coefficients or vapor pressures will readily enter (volatilize) to the ambient air rather than remain adsorbed to the soil particles. Once in the atmosphere, the chemicals may undergo further transport through additional processes such as advection, diffusion, or dispersion. The chemicals may also be transformed through chemical processes such as hydrolysis or photolysis. SVOCs, metals, PCBs, pesticides, dioxins, and asbestos are generally less volatile than VOCs or are nonvolatile. Therefore, only VOCs will be evaluated for migration into the ambient air.

- Leaching – Chemicals may be transported downward through the soil by water from precipitation or by liquids that infiltrate through the soils. The leaching of chemicals from soils and the subsequent mobilization are controlled by soil properties (i.e., adsorptive capacity, organic carbon content, clay content, or specific surface area) and by chemical properties (i.e., solubility, ability to partition to other phases). Leaching may occur directly when the contaminated soil is in direct contact with the groundwater.

- Runoff/Erosion – In situations where the chemicals remain adsorbed (bound) to soil particles because of the soil's chemical characteristics, chemicals may still be mobilized from contaminated areas to other uncontaminated environmental media. Contaminants can be conveyed over land by runoff that occurs during precipitation events (solubilized in rainwater or adsorbed to suspended particles), or through the erosion of contaminated soils that are present on unstable slopes or topographic features.

- Excavation/Human Activity – Soils can be mobilized during excavation by equipment, or digging by humans or animals. This may occur during on-site construction, renovation of the property, utility repairs, gardening, animal burrowing, etc. Contaminants may be conveyed into the air or into on-site piles allowing contact with humans.

The following paragraphs describe the general movement of contaminants in soils on the 24 properties:

VOC Fate and Transport in Soils - Based on current conditions at the properties, the migration of VOCs through volatilization and erosion runoff appears to be unlikely or limited, because of low VOC concentrations and low frequencies of detection. However, for properties abutting Ferry Creek, the Housatonic River, and Bruce Brook that have exposed stream banks, erosion could cause contaminated soils and fill materials to migrate and be deposited in the water channel.

SVOC Fate and Transport in Soils - Leaching of SVOCs appears to be limited because of their low water solubilities and the degree to which the majority of the properties are covered by pavement and buildings. Also, because SVOCs are typically less soluble than VOCs and are less likely to leach into the groundwater, their impact on groundwater quality is limited.

Erosion of SVOC-contaminated soils from runoff appears to be unlikely or limited because of the extent of paved or covered areas, and flat topography of the properties. For the properties abutting Ferry Creek, Bruce Brook, and the Housatonic River, erosion of the stream banks appears to be introducing some SVOCs into the sediments.

Fate and Transport of PCBs, Pesticides, Dioxins, and Asbestos in Soils - Review of soil, sediment, and groundwater analytical results, current site conditions for each property (ground cover/pavement, flat topography), and the relatively insoluble nature of these contaminants indicate migration through leaching is unlikely or limited. PCBs were detected in only one groundwater sample, and they may be present due to the elevated VOC level in this sample, which can cause the PCBs to be more soluble. An overall evaluation of groundwater contamination, including sample locations, analytical results and fate and transport is presented in the Draft Final OU2 RI (TtNUS, 2000c).

Property soils contaminated by PCBs, pesticides, dioxins, and asbestos are unlikely to be mobilizing into Ferry Creek, Bruce Brook, and the Housatonic River through erosion under current conditions because most ground surface areas are paved, covered, or vegetated. For the properties that abut Ferry Creek, erosion of the stream banks may be causing some PCBs, pesticides, dioxins, and asbestos to migrate into the stream channel.

Fate and Transport of Metals in Soils - Review of soil data, the groundwater analytical results, and current site conditions (ground cover/pavement, flat topography) indicates that metals, in particular, lead, can be mobilized through precipitation infiltration where soluble metal compounds are leached into the underlying soils and groundwater. To evaluate the leaching potential, soil metals concentrations were compared with the background metals levels and with the CT PMC. The CT PMC are defined as the allowable metal concentration in leachate resulting from designated leaching protocols. These protocols include the SPLP, EPA SW-846, Method 1312, or the TCLP, EPA SW-846, Method 1311. The SPLP and TCLP protocols are meant to simulate materials subjected to leaching by acid precipitation and are the accepted methods for evaluating the potential mobility of metals from soils and sediments. Several soil samples were tested under the SPLP protocol and the results are shown in Appendix C.

Erosion of metal-contaminated soils at the 24 properties due to runoff appears to be unlikely because most areas are covered by pavement and/or structures, have flat topography, or have vegetative ground cover or gravel (which decreases erosion). The stream banks at the properties abutting Ferry Creek, Bruce Brook, and the Housatonic River were observed to contain fill materials that were not stabilized (i.e., by rip rap or cover materials). Particularly for Ferry Creek, erosion of the stream banks appears to be contributing some contaminated materials into the Ferry Creek channel. Ferry Creek also received surface water and sediments from upstream sources (i.e., the Raymark Facility), which could have resulted in the deposition of metals in the stream sediments. This potential contaminant transport pathway is evaluated in the three OU3 RI reports (TtNUS 1999b, 2000a, 2000b).

Based on the available data, it is reasonable to conclude that soil contaminants present at the properties that abut Ferry Creek, Bruce Brook, or the Housatonic River, can migrate into surface waterbodies through groundwater transport and discharge, and through erosion of the stream banks. Contaminant transport from properties that do not abut a water source appears to be minimal. The evaluation of the contaminant extent and the likely fate and transport of these chemicals in Ferry Creek have already been investigated under the OU3 RI and the results are presented in the OU3 RI Reports (TtNUS, 1999b, 2000a, and 2000b).

2.7 Human Health Risk Assessment

This section presents the methodology for a baseline human health risk assessment (HHRA) conducted for estimated areas of Raymark waste within the study area described in Sections 1.3 and 2.1. Only the 24 properties with soil samples that meet the definition of Raymark waste, as described in Section 2.2, are included in this HHRA. Table 1-1 presents a listing of, and Figure 1-2 depicts, the OU6 properties. At each property the risk assessment addresses the risks associated with exposure to the portions of the property estimated to contain Raymark waste as shown in Figures 3-1 through 3-24. The objective of the HHRA is to estimate potential current and future risks to the public from the contaminants detected (the four Raymark waste indicator compounds and other contaminants) in the soil samples collected from within these estimated areas of Raymark waste. Each property is evaluated separately. Data collected from each property, but beyond the estimated areas of Raymark waste, while useful in the delineation of the extent of Raymark waste, is not included in this

risk evaluation. Three different types of quantitative evaluations were performed. Non-carcinogenic contaminants are evaluated through estimates of hazard indices. Carcinogenic contaminants are evaluated through estimates of cancer risk. Lead is evaluated through adult and child lead models, which predict blood lead levels. In addition, qualitative evaluations of potential inhalation risks from asbestos exposure are discussed. Soil exposures and resulting risk estimates have been prorated based on the percentages of each property estimated to contain Raymark waste (fraction of Raymark waste, FRW, as shown in Table 1-1 and discussed in Section 2.3). The use of the FRW to prorate exposures in calculations of risk assumes that receptors use all areas of the property on an equal basis. Prorating exposures recognizes that a receptor is unlikely to spend all of their time within the estimated areas of Raymark waste. Rather, a receptor will be exposed to soils from various areas of the property. By prorating the exposure, the resulting risk estimate represents risk from only the estimated areas of Raymark waste. Total risks associated with exposures to an entire property may be higher than presented in this HHRA if contaminants are present beyond the estimated areas of Raymark waste or if receptors spend a higher percentage of time in estimated areas of Raymark waste than that assumed in Table 1-1.

Section 2.7.1 provides an overview of the risk assessment process and a brief explanation of the relationship between the OU3 baseline risk assessments and OU6 baseline risk assessments. Risks identified for large contiguous areas in the OU3 RI provided the basis for further evaluation of individual properties under this OU6 RI. Sections 2.7.2 through 2.7.5 outline the methodology used to conduct the OU6 baseline HHRA. An analysis of the uncertainties associated with the risk assessment is presented in Section 2.7.6. Appendix B-1, Table 1 presents an overview of the various media, exposure points, potential receptors, and exposure pathways evaluated in this risk assessment. The property-specific results of the risk assessment are presented in Section 3. Section 4 presents a summary of the baseline HHRA. The risk assessment conducted for this report follows the most recent guidance from the EPA (EPA, 1989b and 1991a), including regional EPA guidance (EPA, 1989a, 1994c, 1995, 1996c, and 1999b). Tables were prepared following the standard format in accordance with Risk Assessment Guidance for Superfund, Human Health Risk Evaluation Manual (RAGS HHEM) Part D (EPA, 1997c). These tables are presented in Appendix B-1.

2.7.1 Overview of the Risk Assessment Process

The baseline HHRA for the OU6 properties estimates the magnitude of the potential human health risk resulting from exposures to the fraction of each individual property's soils identified as containing Raymark waste. A risk assessment provides the framework for developing risk information necessary to assist in determining the need for remediation at a site and developing potential remedial alternatives for a site. A baseline HHRA consists of five major components, as follows:

- Data evaluation and identification of chemicals of potential concern (COPCs);
- Exposure assessment;
- Toxicity assessment;
- Risk characterization; and
- Characterization of uncertainty in the risk estimates.

To assess potential public health risks, four major aspects of chemical contamination and exposure must be considered: contaminants with toxic characteristics must be found in environmental media; contaminants must be released by either natural processes or by human action; potential exposure points must exist; and human receptors must be present at the point of exposure. Risk is a function of both toxicity and exposure. If any one of the requirements listed above is absent for a specific site, the exposure route is regarded as incomplete and no potential risks will be considered for human receptors.

The baseline HHRA for the OU6 properties estimates the potential for human health risk from exposures to soils identified as Raymark waste at each of 24 properties shown in Figure 1-2. Table 1-1 presents a listing of the OU6 properties.

The data evaluation component of the HHRA is primarily concerned with selecting COPCs that are representative of the type and magnitude of potential human health effects. Both current and historical data are considered in developing a list of COPCs. In turn, these COPCs are used to evaluate potential risks. A generic discussion of the process is contained in Section 2.7.2, and property-specific discussions are presented in Section 3.

The exposure assessment identifies potential human exposure pathways at the study area under consideration. Exposure routes are identified based on information on study area chemical concentrations, chemical release mechanisms, human activity patterns, and other pertinent information to develop a conceptual site model. One overall set of exposure routes was developed for this report, but not all routes are applicable in all OU6 properties. A generic discussion of the exposure assessment is contained in Section 2.7.3. Section 2.7.3.1 presents the conceptual site model. Section 2.7.3.2 presents the potential routes of exposure. Section 2.7.3.3 presents potential human receptors and the relevant exposure assumptions. Section 2.7.3.4 presents exposure pathways and the equations for estimating chemical intake. The property-specific risk assessments (Section 3) present only those routes relevant to each property, and refer to Section 2.7.3 for the details on the estimation methods.

The toxicity assessment presents the available human health criteria for all the selected COPCs. This assessment is contained in Section 2.7.4; however the final lists of COPCs for each property are presented within the property-specific assessments in Section 3. This section is presented early to avoid repetition of the toxicity information in Section 3 because many COPCs are common to many of the properties. Quantitative toxicity indices are presented where they are available. A discussion of health effects and dose-response parameters such as Reference Doses (RfDs) and Cancer Slope Factors (CSFs) is presented for each COPC.

The risk characterization (Section 2.7.5) describes how the estimated intakes are combined with the toxicity information to estimate risks. The actual numerical results of this exercise are presented in the property-specific discussions in Section 3 of this report. General uncertainties associated with the risk assessment process are discussed qualitatively in Section 2.7.6. Uncertainties associated with a particular property are provided in the property-specific sections.

Baseline HHRAs have previously been performed under OU3 for many of the properties now included in OU6 (see Final Area I RI OU3, October 1999 (TtNUS, 1999b); Draft Final Area II RI OU3, November 2000 (TtNUS, 2000a); Draft Final Area III RI OU3, November 2000 (TtNUS, 2000b)). Risks identified in those documents provided the basis for further evaluation of individual properties under OU6. The OU3 risk assessments estimated the human health risk

potential for large contiguous areas for commercial or recreational land-use exposures. OU3 risks from recreational and trespasser exposures were less than the EPA level of concern. However, in several commercial areas, the OU3 risk assessments identified risk levels greater than EPA and CT DEP levels of concern. Those commercial areas and other commercial properties known or suspected to have received fill from the Raymark facility became the focus of OU6.

In the process of identifying properties that had received Raymark waste as fill, four non-commercial properties were identified that had not been evaluated adequately. These four properties described below were also included in the OU6 study area:

- Since Wooster Park is used primarily for recreational purposes and was not included in the OU3 risk assessment, this property was evaluated for recreational use in the OU6 HHRA. Since it abuts residential property, exposure assumptions consistent with frequent recreational use by adults and children were considered.

- While the Vacant Lot at Housatonic Avenue is currently vacant and is land-locked, it is zoned for residential land-use, therefore it was evaluated for future residential use.

- The residential Third Avenue Property was evaluated for residential use.

- The Beacon Point Area is a recreational area, which was previously evaluated under OU3. Since more data is now available for this parcel it was re-evaluated under OU6. This evaluation was for frequent recreational use.

Therefore, while this OU6 risk assessment focused mainly on commercial exposures to soil contaminants, the four properties listed above, used for residential or recreational purposes, were also included in the OU6 risk assessment.

2.7.2 Data Evaluation Methodology

Data evaluation is a property-specific task that uses a variety of information to determine which of the detected chemicals at a study area are most likely to present a risk to potential

receptors. The study area for each property was defined as the area known as the "estimated area of Raymark waste", in which samples meet the definition of Raymark waste as described in Section 2.2. Appendix B-2 provides lists of samples that lie within the estimated areas of Raymark waste at each property. It should be noted that whenever a single sample from a particular location met the definition of Raymark waste, all samples from that location to a depth of 15 feet below ground surface (bgs) were included in the list of samples. The end result of the qualitative selection process was a list of COPCs and representative exposure point concentrations for each medium. Exposure point concentrations (EPCs) are defined as the contaminant concentrations at the point of exposure. The methodology used to identify COPCs for the OU6 RI Report is provided in Section 2.7.2.1. The methodologies used to determine EPCs for the selected COPCs are presented in Section 2.7.2.2.

2.7.2.1 Selection of Chemicals of Potential Concern

COPCs for the baseline HHRA were limited to those chemicals that exceed a selection criterion. For this risk assessment, EPA Region IX risk-based criteria were used to reduce the number of chemicals and exposure routes considered in a risk assessment following EPA Region I guidance and direction. Region IX risk-based criteria are chemical concentrations based on a fixed level of risk from soil exposures through ingestion, dermal, and inhalation pathways. The premise of this screening step is that risk is typically dominated by a few chemicals and that, although dozens may actually be detected, many chemicals may contribute minimally to the total risk.

Maximum detected concentrations in the soils at the estimated areas of Raymark waste at each property were compared to the risk-based screening criteria. If the maximum concentration exceeded the federal screening criteria, that chemical was retained as a COPC for all exposure routes involving soils at that property. For example, if barium was retained for soil, this chemical was evaluated as a COPC for both ingestion and dermal exposure routes.

In general, all available validated data for all contaminants and unvalidated field-screening data for metals from all EPA historical investigations and the recent TtNUS sampling effort were used to identify COPCs for each study area. A list of samples included in the HHRA for each property is presented in Appendix B-2. The individual investigations presented in

Appendix D discuss sample collection, the field-screening methods, and fixed laboratory analysis by EPA Contract Laboratory Program (CLP) methods. Appendix B-3 presents a correlation study, comparing field-screening data to CLP data. The correlation study concluded that field-screening data for metals were comparable to CLP data. However, there was a poor correlation between field-screening data and CLP data for PCBs. This is not unexpected, since the analytical techniques used in the mobile laboratory for PCB analysis differ from the techniques used in fixed laboratories. Detection limits for PCBs vary greatly between the two sets of data. Field-screening data were collected for use in defining the estimated areas of Raymark waste and are useful for that purpose. As discussed in Appendix B-3, there is a good correlation between field-screening data and CLP data, if one considers only the question of whether or not concentrations of PCBs are above 1,000 µg/kg. For this reason, field-screening data for metals, but not PCBs, were included in this HHRA.

Analytical results qualified as rejected, "R", during the data validation process, were not considered because of their potential unreliability. Soil data collected from depths greater than 15 feet (the maximum assumed depth for potential human exposure during excavation/construction) were not used in the COPC selection process. Property-specific COPC summary screening tables are provided in Appendix B-1. The property-specific COPC selection results are discussed in Section 3.

Data evaluation and subsequent risk estimates for dioxins were evaluated through use of dioxin toxicity equivalents (TEQs). The Toxicity Equivalent Factors (TEFs), presented in Appendix B-4, were used to convert concentrations of individual dioxin and furan congeners to TEQs of 2,3,7,8-TCDD. Concentrations of individual dioxins and furans were multiplied by their TEFs to yield 2,3,7,8-TCDD equivalent concentrations. These values were then totaled to yield total dioxin TEQs for each sample. The TEQs could then be compared to the screening toxicity value for 2,3,7,8-TCDD in the COPC selection step. One-half of the detection limit for non-detected dioxin results was included along with positive results in the TEQ summation for each sample.

COPCs were selected based on Region IX risk-based criteria for direct exposure. Direct exposure COPCs are those chemicals detected at maximum concentrations in excess of the risk-based EPA Region IX COPC screening levels for soil contact; these criteria were

developed for the protection of direct human contact with soil. Only chemicals selected as COPCs based on comparisons to direct contact criteria were evaluated quantitatively in the HHRA. The criteria used to identify COPCs are presented in Appendix B-1, Tables 2.1 through 2.24. Property-specific data were also compared to CT RSRs for direct exposure and for groundwater protection, as shown in Tables 3-1 through 3-24, and discussed in the nature and extent portions of Section 3.

COPCs for soils were selected for each individual property for soil samples collected from depths of 0 to15 feet below ground surface (bgs), based on CT DEP's definition of accessible soils. This soil depth is used to account for soil to which residents, recreational visitors, or commercial workers may be potentially exposed, particularly in the future when soils currently located at depth may be brought to the surface during excavation or construction activities. For some properties, the maximum sample depths within the estimated areas of Raymark waste were less than 15 feet bgs due to site-specific field conditions at the time of sampling. At these properties, all available soil samples within the estimated areas of Raymark waste were included in the HHRA. Actual sample depths are presented for individual properties in the Section 3 risk discussions.

The following screening criteria were used to identify COPCs for direct contact exposure to soils:

EPA Region IX Preliminary Remedial Goals (PRGs) for Soil Exposures. PRG concentrations for soil contact for industrial land use were used as COPC selection criteria for commercial properties. PRG concentrations for soil contact for residential land use were used conservatively as COPC selection criteria for the four residential and/or recreational properties. These values were developed using the current EPA Region IX Preliminary Remedial Goals Table (EPA, 2002), which identifies concentrations of potential concern for nearly 600 chemicals in various media (air, drinking water, and soil) using certain reasonable maximum exposure default assumptions. The EPA Region IX industrial and residential soil exposure values were calculated based on the methodology presented in Risk Assessment Guidance for Superfund, Human Health Risk Evaluation Manual, Part B (USEPA 1991b) and consider the ingestion, dermal, and inhalation exposure pathways. For carcinogenic chemicals, the values used for COPC screening are based on a 1E-6 target incremental lifetime cancer risk. The

criteria for non-carcinogenic chemicals are based on a target hazard quotient (HQ) of 1.0. These EPA Region IX industrial and residential soil exposure values for non-carcinogenic chemicals were adjusted to COPC screening levels based on a target hazard quotient (HQ) of 0.1, which is one-tenth of the suggested cumulative target non-carcinogenic risk for a potential receptor. The estimation of cumulative target non-carcinogenic risks is described in greater detail in Section 2.7.5. Since EPA Region I does not advocate quantitative risk assessment of the health effects of aluminum, iron, cobalt, and copper, these EPA Region IX PRGs have been eliminated. The EPA Region IX PRGs for copper and iron are based on provisional oral RfDs. EPA Region I does not endorse their use because these provisional oral RfDs were based on concentrations needed to protect against a deficiency of the compound, rather than on quantitative estimates related to the hazard posed by overexposure (EPA, 1999b). Total chromium present was screened using the EPA Region IX PRG value for hexavalent chromium. The EPA Region IX PRG for hexavalent chromium was selected to be conservative in the absence of chromium speciation data. For PCBs, individual Aroclors were compared to screening criteria for individual Aroclors. All Aroclors were accepted as COPCs if at least one Aroclor was detected at maximum concentrations exceeding COPC screening levels.

EPA Soil Lead Guidance. EPA Region IX has developed residential PRG concentrations for lead, based on the EPA's Office of Solid Waste and Emergency Response (OSWER) soil screening level of 400 mg/kg for residential land use (EPA, 1994b). The EPA's Integrated Exposure Uptake and Biokinetic (IEUBK) model, which estimates the risk to a child resident, is the basis for this soil screening level. The lead screening level based on residential land use was used as a conservative approach for the five residential and/or recreational properties. EPA Region IX has developed industrial PRG concentrations for lead of 750 mg/kg, based on the EPA's Technical Review Workgroup for Lead model (EPA, 1996c and 1996d). The approach focuses on estimating fetal blood-lead concentrations in women exposed to lead contaminated soil in non-residential scenarios. The lead screening level based on industrial land use was used for the remaining commercial properties.

National Emission Standards for Hazardous Air Pollutants Benchmark for Asbestos. EPA Region IX has not developed risk-based concentrations for asbestos. Asbestos was a primary component of friction materials, e.g., gaskets material, sheet packing and friction materials, including clutch facing, transmission plates, and brake linings, manufactured at the former

Raymark Facility. Asbestos is considered a potential inhalation hazard. The National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA Regulation 40 CFR Part 61, Subpart M, Appendix A (EPA, 1990) defines asbestos as material containing more than 1 percent asbestos. Since asbestos was detected at the OU6 properties, the EPA's NESHAP benchmark of 1 percent for an asbestos screening value was used.

Background concentrations for chemicals in soil are presented in Table 2-2 and in Appendix B-1, Tables 2.1 through 2.24. Concentrations in the background soil samples were not used to select COPCs. A discussion of site data in comparison to the established inorganic and organic background levels is provided in the Section 3 uncertainty section for each property. Background concentrations will be considered when developing clean-up levels where an action is recommended.

Frequency of detection was not used as a COPC selection criterion. Essential nutrients, including calcium, magnesium, potassium, and sodium, were not selected as COPCs.

2.7.2.2 Exposure Point Concentrations (EPCs)

According to EPA regional guidance, risk assessments are conducted using an exposure point concentration for each COPC. The exposure point concentration is defined as the 95 percent upper confidence limit (UCL) on the mean and is calculated using the latest risk assessment guidance from EPA (EPA, 1992a, 1992b, and 1994c). A value of one-half the detection limit is substituted for non-detected values in the calculation of the 95 percent UCL on the mean. Because of potential problems with sample heterogeneity, the maximum detected concentration reported for field duplicate pair samples was used to calculate the soil matrix EPCs, at the direction of EPA. Sample lists for each property evaluated are provided in Appendix B-2.

The methodology used in the calculation of the 95 percent UCL on the mean depends on the distribution of the sample set. For this risk assessment, the distribution was determined using the Shapiro-Wilk W-Test (Gilbert, 1987). When the results of the test were inconclusive and the distribution was regarded as undefined, the distribution was assumed to be log normal and

the 95 percent UCL on the mean for log-normally distributed data sets was selected as the exposure point concentration.

For normally distributed data, the calculation of the 95 percent UCL on the mean is a two-step process. First the standard deviation of the sample set must be determined, as follows:

where: S = standard deviation

$$S = \left[\frac{\Sigma(X_i - \bar{X})^2}{(n-1)}\right]^{1/2}$$

X_i = individual sample value

n = number of samples

$\bar{X}$ = mean sample value

The one-sided 95 percent UCL on the mean is then calculated as follows:

$$UCL = \bar{X} + t\left(\frac{S}{n^{1/2}}\right)$$

where: UCL = 95 percent UCL on the mean

$\bar{X}$ = Arithmetic average

t = One-sided t distribution factor ($t_{0.95,\ n-1}$)

S = standard deviation

n = number of samples

For log-normally distributed data sets, the 95 percent UCL on the mean is calculated using the following equation:

$$UCL = \exp\left(\bar{X} + 0.5\,S^2 + \frac{HS}{(n-1)^{1/2}}\right)$$

where: UCL = 95 percent UCL on the mean

exp = Constant (base of the natural log, e)

$\bar{X}$ = Mean of the transformed data

S	=	Standard deviation of the transformed data
H	=	H-statistic (from Gilbert, 1987; $H_{0.95}$)
n	=	Number of samples

This equation uses individual sample results that have been transformed by taking the natural logarithm of the results.

Sample calculations for determining the distribution of a data set, 95 percent UCL on the mean, average, and maximum concentrations are provided in Appendix B-5. After the 95 percent UCL on the mean was calculated, it was compared to the maximum detected concentration within the data set. In data sets in which the calculated 95 percent UCL on the mean exceeded the maximum detected concentration, the maximum detected concentration was used as the exposure point concentration. This is a common problem in small datasets or datasets with high detection limits. Support documentation for the calculation of the 95 percent UCLs on the mean is presented in Appendix B-5. Exposure point concentrations used in the risk assessment are presented in Appendix B-1, Tables 3.1 through 3.24.

2.7.3 Exposure Assessment

The exposure assessment defines and evaluates the exposures that may be experienced by a receptor population. To have an exposure, several factors must be present: there must be a source of contamination, there must be a mechanism through which a receptor can come into contact with the contaminants in that medium, and there must actually (or potentially) be a receptor present at the point of contact.

The exposure assessment presented consists of several sections that characterize the physical site setting and the receptors of concern, identifies the potential contaminant migration and exposure pathways, and presents the equations used to quantify exposure in terms of contaminant intake (dose). Appendix B-6 of this report contains sample calculations for the exposure assessment. Exposure assumptions are presented in Appendix B-1, Tables 4.1 through 4.3. Intakes are presented in Appendix B-1, Tables 7.1 through 7.24 and 8.1 through 8.24.

2.7.3.1 Conceptual Site Model

This section discusses the general conceptual site model for the OU6 properties. A conceptual site model facilitates a consistent and comprehensive evaluation of the risks to human health by creating a framework for identifying the paths by which human health may be impacted by contaminants predicted to exist at the source areas. A conceptual site model depicts the relationships between the following elements necessary to construct a complete exposure pathway:

- Sources and potential COPCs;
- Contaminant release mechanisms and transport pathways;
- Exposure mechanisms and exposure routes; and
- Receptors.

One simple conceptual site model was developed for all the OU6 properties to provide the basis for identifying the potential risks to human health and the environment. The model considers the current and future conditions within the study area, and the actual or potential receptors that might come into contact with the COPCs.

The conceptual site model first considers the contaminant sources assumed to be available, either currently or in the future. For this model, the Raymark Facility waste disposed of within the Study Areas is considered the source. Contaminants may be released from this source by mechanisms such as wind, water erosion, leaching to the subsurface, or excavation within areas of contamination. Once released from the source, contaminants are transported in media such as air, surface water, or groundwater. Receptors may be exposed either directly or indirectly to contaminants in environmental media via a variety of mechanisms. The exposure mechanisms considered include recreation, working outdoors, etc. These exposure mechanisms generally act along one or more exposure routes such as ingestion, inhalation, or direct dermal contact.

The conceptual site model also indicates those exposure routes that are carried through the quantitative risk assessment for each receptor. An objective of developing the conceptual site model is to focus attention on those pathways that contribute the most to the potential impacts

on human health and the environment, and to provide the rationale for screening out other exposure pathways that are minor components of the overall risk.

Sources of Contamination. As discussed in Section 1.3, the Raymark Industries, Inc. (Raymark) Facility manufactured friction materials containing asbestos and non-asbestos materials, metals, phenol-formaldehyde resins, and various adhesives. As a result of these activities, soils at the former Raymark Facility were contaminated primarily with asbestos, lead, and PCBs. Raymark operated from 1919 until 1989, when the plant was shut down and permanently closed. While the Raymark Facility was active, it was common practice for the company to give away its excess manufacturing wastes for use as fill within the Town of Stratford. Each of the OU6 properties received some of this soil/waste/fill.

Contaminant Release and Migration Mechanisms. Chemicals may be released from the study area by a variety of mechanisms. These mechanisms include stormwater runoff and subsequent surface soil erosion, soluble chemicals infiltration and subsequent migration through the subsurface soil to the water table where the chemicals may migrate downgradient, wind erosion of surface soil from unpaved areas, disturbance of contaminants in soil through human excavation or animal burrowing activities, and through cracks in asphalt pavement, if present. Contaminant fate and transport are discussed in Section 2.6.

Exposure Setting. The potential for exposure at these 24 properties is based on several factors, including current and future land uses, human activity patterns, site access controls, and chemical behavior in the environment. Based on these variables, exposure scenarios were developed to characterize the potential for human exposure under current and future site conditions. This exposure evaluation scenario accounts for possible or anticipated changes in land use and site characteristics that may alter exposure and/or concentrations of COPCs in a given medium, in addition to the exposures that may result from current uses of the land.

The exposure assessment is based on the assumption that, in general, chemical compositions for environmental media are identical under current and future site conditions. Under current and future conditions, potential human receptors (residents, recreational visitors, and commercial workers) are assumed to be exposed to soils collected from depths of 0 to 15 feet bgs within estimated areas of Raymark waste. In the future, contaminated soils currently

located at depth and/or beneath pavement to a maximum depth of 15 feet bgs may be brought to the surface during land development (excavation/construction). Current exposures to soils located at depths of 15 feet bgs are unlikely, except in the case of excavation/construction activity. However, in the interest of efficiency in dealing with 24 separate properties and to be consistent with Connecticut's definition of accessible soils, this risk assessment considers one dataset of soils collected from 0 to 15 feet bgs for each property for combined current and future exposures.

A summary of the potentially significant exposures identified for quantitative evaluation is provided in Appendix B-1, Table 1. These exposures were identified based on property-specific information concerning land-use and potentially exposed populations.

Land Use. Individual OU6 properties are described in detail in Section 3. The OU6 properties include 20 commercial properties, two residential properties, and two recreational properties, as listed in Table 1-1. A description of each is included in Section 3. Current use, zoning, and the Strategic Redevelopment Initiative (SRI) report (Maguire, 2003) were considered in the determination of current and reasonably anticipated future uses. Future on-site residents were not included in the HHRA for the 20 OU6 commercial properties. Current land use and zoning at each of the commercial properties suggests that the area is valuable as commercial property and will remain commercial. If the property-use changes, risks would need to be re-evaluated. Based on the SRI report (Maguire, 2003), one commercially-zoned property has a potential future use as a hotel/marina complex. For this reason, both recreational use and commercial use were considered at the Lockwood Avenue Property. Other future uses discussed in the SRI report are consistent with the commercial scenarios evaluated in this RI. One other commercial property (the CT Right-of-Way) includes an easement allowing access to a residential property. In addition to the whole property's consideration for commercial use, the easement area is considered for residential use.

Evidence indicates that each of these properties received wastes from the former Raymark Industries Inc.

Exposed Populations. The OU6 properties are located in Stratford, Fairfield County, Connecticut. The principal industries within the community of Stratford include manufacturing

aircraft, air conditioners, chemicals, plastic, paper, rubber goods, electrical and machine parts, and toys. There were 49,389 people reported to live in the Town in 2003. Potentially exposed populations at each OU6 property are discussed in Section 3.

Receptors. Several potential receptor populations were initially considered for inclusion in the exposure assessment. However, the majority of these receptors were eliminated from further evaluation based on the current land use, site access, COPCs, and the likelihood of exposure. Of the receptors initially considered (residents, recreational visitors, commercial workers, construction workers, and trespassers), the receptors retained for quantitative evaluation are commercial workers, residents, and recreational visitors.

Possible exposures of commercial workers to site-related contaminants would be through commercial/industrial activities within the estimated areas of Raymark waste at individual commercial OU6 properties. For purposes of evaluation of the commercial worker exposures, the commercial worker scenario was defined as an outdoor worker in direct contact with soils 250 days per year. This scenario is protective of commercial workers who may be present less frequently or those who may work primarily indoors. The scenario is also protective of customers, shoppers, and adolescent trespassers who may visit the property frequently. This scenario is not necessarily protective of future residential or recreational land use.

Possible exposures of residents to site-related contaminants would be through play or yard-work activities within the estimated areas of Raymark waste at individual residential OU6 properties.

Possible exposures of recreational visitors to site-related contaminants would be through recreational activities within the estimated areas of Raymark waste at individual recreational OU6 properties. Conservative exposure assumptions were selected for the evaluation of recreational exposures, since nearby residents may visit these properties frequently. The conservative exposure assumptions that were selected for the evaluation of recreational exposures are protective of trespassers.

Construction workers were not included in the HHRA for the OU6 properties. The HHRA was conducted assuming that the commercial worker, resident, or recreational visitor may be in

direct contact with soils as deep as 15 feet bgs on a frequent and long-term basis. Since these long-term scenarios are considered protective of a short-term construction worker scenario, the construction worker scenario was not evaluated separately.

2.7.3.2 Potential Routes of Exposure

A receptor can come into contact with contaminants in a variety of ways, which are generally the result of interactions between a receptor's behavior or lifestyle and an exposure medium. This HHRA defines an exposure route as a stylized description of the behavior that brings a receptor into contact with a contaminated medium. The exposure routes considered in this HHRA are discussed below.

Direct Contact with Soil

Receptors may come into direct contact with soil affected by the release of chemicals from the source areas. During the receptor's period of contact, the individual may be exposed via inadvertent ingestion of a small amount of soil or via dermal absorption of certain contaminants from the soil.

Because of the limited guidance available to estimate soil exposure via dermal contact, dermal risks can only be evaluated quantitatively for contaminants with available soil absorption factors. Several of these chemicals were selected as COPCs for the OU6 properties. Therefore, dermal risks associated with soil were quantitatively addressed in the risk assessment. Dermal contact with other chemicals detected in the site soils may or may not result in a significant exposure. It should be noted that organics such as PAHs, which were detected frequently in the soil samples and selected as COPCs, tend to strongly adhere to organic matter in soil. For these chemicals to be percutaneously absorbed, they must first desorb from soil and diffuse through the skin. Various factors affect the rate of dermal absorption, including the amount of soil on the skin surface, soil characteristics (moisture, pH, organic carbon content, etc.), skin characteristics (thickness, temperature, hydration, etc.), volatilization losses, and chemical-specific properties.

Air

Contact with this medium is based on the scenario that a receptor is immersed in air that contains suspended particulates and volatile organic vapors originating from the source areas as part of daily living. Subsequent exposure of the receptor occurs upon inhalation of the ambient air.

A qualitative comparison of maximum detected soil concentrations and EPA Generic Soil Screening Levels (SSLs) for inhalation, based on intermedia transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. Generic SSLs for inhalation are modeled soil concentrations based on a back calculation of dust concentrations associated with a one-in-a-million (10^{-6}) cancer risk for carcinogens or a hazard quotient (HQ) of one for non-carcinogens. These concentrations are derived from equations combining default exposure information assumptions chosen to be protective of human health for most site conditions with EPA toxicity data. Generally, at sites where contaminant concentrations fall below SSLs, no further action or study is warranted under CERCLA. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at the commercial properties. Appendix B-1 and Tables 2.1 through 2.24 present the inhalation SSLs for residential land-use. For commercial properties with exceedances of residential inhalation SSLs, further evaluation was performed comparing property-specific data to industrial/ commercial inhalation SSLs (EPA, 2001a).

Qualitative evaluations of potential inhalation risks from exposures to asbestos were performed for each property. The presence of pavement and/or vegetative cover at each property reduces the potential for airborne asbestos. Based on field conditions at the OU6 properties, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at the OU6 properties. Disturbances of asbestos-containing soil through excavation will increase the potential for airborne asbestos exposures and associated inhalation risks.

Exposures to fugitive dust and VOCs released from soil were found to be insignificant in most cases based on the qualitative screening and asbestos evaluations. Results of this qualitative comparison and the asbestos evaluations are discussed for individual properties in Section 3.

2.7.3.3 Potential Receptors

Several potential receptors have been identified under current and future land use conditions. These receptors were identified by analyzing the interaction of current and anticipated future land use practices with the identified sources of contamination. Three receptor groups have been defined for this risk assessment. These receptors are as follows:

- Commercial Workers - Adults working 40 hours per week at a commercial facility within the OU6 Study Area. This scenario is protective of current and future commercial workers who may be present less frequently or those who may work primarily indoors, as well as trespassers, customers, and shoppers who may frequent the property. This long-term scenario is also considered to be protective of a short-term construction worker scenario.

- Residents - Residents (adults and children) who reside at properties located in the OU6 Study Area. This scenario is protective of recreational visitors and trespassers, as well as current or future residents and adolescent trespassers.

- Recreational Visitors - Recreational visitors (adults and children) may visit an OU6 property on a frequent basis for play or leisure activities. The conservative exposure assumptions that were selected for the evaluation of recreational exposures are also protective of trespassers.

Table 1 of Appendix B-1 presents the receptors and exposure pathways identified for the individual OU6 properties, and provides the rationale for the quantitative evaluation of the selected exposure pathways.

The receptors were evaluated using the reasonable maximum exposure (RME) scenarios, developed according to EPA guidance (EPA, 1989b and 1994c). The RME is conceptually the "high end" exposure, above the 90TH percentile of the population distribution, but not higher than the individual in the population with the highest exposure. Therefore, the RME scenario represents a "reasonable worst case" exposure scenario.

Commercial Workers

The adult commercial worker was evaluated for exposures to soils at the estimated areas of Raymark waste to a depth of 15 feet bgs, regardless of pavement, for the current and/or future land use scenario. In the future, contaminated soils currently located at depth and/or beneath pavement may be brought to the surface through excavation and land development.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact. Commercial workers are assumed to be exposed to site media 250 days/year and to ingest an average of 100 mg/day for 25 years. The fraction of soil intake derived from the contaminated source is set at the fraction of a property that is estimated to contain Raymark waste (FRW). The same contact rates were used for paved and unpaved Raymark waste areas; although paved areas will reduce worker exposure. Table 1-1 presents the FRW values for all OU6 properties. The use of the FRW value serves to prorate exposures, assuming that receptors spend time within the estimated areas of Raymark waste at a property in direct proportion to the fraction of the total property within the estimated areas of Raymark waste. Exposures and associated risks from contaminants outside the estimated areas of Raymark waste at a property are not evaluated in this risk assessment. Hands, forearms, lower legs, and head are expected to be available for dermal contact with soil. The calculated available skin surface area for dermal contact with soil for adults was 3,300 cm^2. A value of 0.2 mg/cm^2 was used as the soil-to-skin adherence factor for adult commercial workers. This value corresponds to 50th percentile weighted adherence values for heavy equipment operators and utility workers. These are considered high-end soil contact activities (EPA, 2001b).

Residents

Adult and child residents were evaluated for exposures to the soils at the estimated areas of Raymark waste at three properties. The Third Avenue Property is a residential property. While the Vacant Lot at Housatonic Avenue property is currently vacant and is land-locked, it is zoned for residential land-use, therefore it was evaluated for residential use. The CT Right-of-Way property includes an easement allowing access to a residential property; therefore, this easement portion of this property was evaluated for residential use. Residents of these

properties were assumed to be adults and young children. Adult and child residents were evaluated for exposures to soils at the estimated areas of Raymark waste to a depth of 15 feet bgs, regardless of pavement. CT DEP defines accessible soils as those found at depths of 15 feet bgs or less.

Site-specific considerations were used to determine exposure frequencies for residents. Residents were assumed to be exposed 350 days/year. This exposure frequency is the CT DEP and EPA default exposure frequency for residents (EPA, 1991a). Adult receptors are assumed to ingest an average of 100 mg/day for 24 years. Child receptors are assumed to ingest an average of 200 mg/day for 6 years. The fraction of soil intake derived from the contaminated source is set at the fraction of a property that is estimated to contain Raymark waste (FRW). Table 1-1 presents the FRW values for all OU6 properties. The use of the FRW value serves to prorate exposures, assuming that receptors spend time within the estimated areas of Raymark waste at a property in direct proportion to the fraction of the total property within the estimated areas of Raymark waste. Exposures and associated risks from contaminants outside the estimated areas of Raymark waste at a property were not evaluated in this risk assessment. The proposed exposure duration values are based on EPA guidance for RME evaluation (EPA, 1997b). Values for small children for the RME reflect the entire age span for children 0 to 6 years of age.

Hands, forearms, lower legs, feet, and head are expected to be available for dermal contact with soil for young children. Hands, forearms, lower legs, and head are expected to be available for dermal contact with soil for adults. The calculated available skin surface areas for dermal contact with soil for adults and small children (ages 0-6 years) were 5,700 cm^2 and 2,800 cm^2, respectively. Values of 0.07 mg/cm^2 were used as soil-to-skin adherence factors for adult exposures. The adult resident's soil-to-skin adherence factor corresponds to 50th percentile weighted adherence values for gardeners. Gardening is considered a high-end soil contact activity. Values of 0.2 mg/cm^2 were used as soil-to-skin adherence factors for child exposures. These values represent 50th percentile values estimated for children playing in wet soil. This activity is considered a high-end soil contact activity. The values have been recommended in EPA's "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment)" (EPA,

2001b). The values were based on data presented in the 1997 version of the EPA Exposure Factor Handbook.

Recreational Visitors

Adult and child recreational visitors were evaluated for current and future exposures to the soils at the estimated areas of Raymark waste at two properties, Wooster Park and the Beacon Point Area and for potential future exposures to the soils at the estimated areas of Raymark waste at the Lockwood Avenue Property. Recreational visitors to these properties were assumed to be adults and young children. Adult and child recreational visitors were evaluated for exposures to soils at the estimated areas of Raymark waste to a depth of 15 feet bgs, regardless of pavement. CT DEP defines accessible soils as those found at depths of 15 feet bgs or less. These samples were included to address concerns for future exposures when excavation or construction may bring these soils to the surface.

Site-specific considerations were used to determine exposure frequencies for recreational visitors. This receptor was assumed to have a high frequency of exposure such that exposure assumptions for recreational visitors were 150 days/year, due to the presence of residential properties bordering these properties. All other exposure assumptions match those of residents, described above. Adult receptors are assumed to ingest an average of 100 mg/day for 24 years. Child receptors are assumed to ingest an average of 200 mg/day for 6 years. The fraction of soil intake derived from the contaminated source is set at the fraction of a property that is estimated to contain Raymark waste (FRW). Table 1-1 presents the FRW values for all OU6 properties. The use of the FRW value serves to prorate exposures, assuming that receptors spend time in the estimated areas of Raymark waste at a property in direct proportion to the fraction of the property within the estimated areas of Raymark waste. Exposures and associated risks from contaminants outside the estimated areas of Raymark waste are not evaluated in this risk assessment. The proposed exposure duration values are based on EPA guidance for RME evaluation (EPA, 1997b). Values for small children for the RME reflect the entire age span for children 0 to 6 years of age.

Hands, forearms, lower legs, feet, and head are expected to be available for dermal contact with soil for young children. Hands, forearms, lower legs, and head are expected to be

available for dermal contact with soil for adults. The calculated available skin surface areas for dermal contact with soil for adults and small children (ages 0-6 years) were 5,700 cm^2 and 2,800 cm^2, respectively. Values of 0.07 mg/ cm^2 were used as soil-to-skin adherence factors for adult exposures. The adult resident's soil-to-skin adherence factor corresponds to 50th percentile weighted adherence values for gardeners. Gardening is considered a high-end soil contact activity. Values of 0.2 mg/ cm^2 were used as soil-to-skin adherence factors for child exposures. These values represent 50th percentile values estimated for children playing in wet soil. Children playing in wet soil is considered a central tendency soil contact activity. The values have been recommended in EPA's "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment)" (EPA, 2001b). The values were based on data presented in the 1997 version of the EPA Exposure Factor Handbook.

2.7.3.4 Exposure Pathways

An exposure pathway consists of four elements: a source and mechanism of release; a route of contaminant transport through an environmental medium; a contact point for a human receptor; and an exposure route at the point of contact. All four components must be present for the exposure pathway to be considered complete. This section summarizes the potentially complete exposure pathways that were quantitatively evaluated in the risk assessment and provides the rationale for those pathways that were not evaluated. Appendix B-1, Table 1 presents a summary of the potentially complete and incomplete exposure pathways and receptors.

The primary routes of exposure for potential human receptors at the OU6 properties are incidental ingestion of and dermal contact with soil. Other potential exposure routes such as those associated with using groundwater or inhaling fugitive dust and volatile emissions, were not considered quantitatively for the following reasons:

- The shallow aquifer at the OU6 Study Area is not used as a potable water supply at any of the OU6 properties or in the surrounding areas. Shallow groundwater at the study area discharges to Ferry Creek and its tributaries. Thus, domestic groundwater exposures by nearby residents are eliminated. In addition, groundwater at the OU6

properties is not used or expected to be used in the future as a potable water supply because of brackish conditions in most areas and productivity constraints. Groundwater quality in Stratford is being investigated as a separate operable unit.

- Potential exposure to volatile emissions and fugitive dust from soils at the OU6 properties is considered to be minimal, based on the qualitative comparison of OU6 data to the EPA Generic SSLs for transfers from soil to air and field conditions at OU6 properties; thereby eliminating the need for quantitative evaluation of this exposure pathway. Qualitative evaluations of the inhalation pathway are provided.

Quantification of Exposure

Estimates of exposure are based on the contaminant concentrations at the exposure points and on scenario-specific assumptions and intake parameters. The models and equations used to quantify intakes are described in this section and have been obtained from a variety of EPA guidance documents that are cited in the specific intake estimation sections that follow.

Exposures depend on the predicted concentrations of chemicals in environmental media and local land use practices, and both are subject to change over time. This results in a large number of possible combinations of receptors, media, exposure pathways, and concentrations. As mentioned previously, Appendix B-1, Table 1 presents a summary of the exposure pathways evaluated in the quantitative risk assessment. These scenarios (commercial, residential, and recreational scenarios) are applicable under both current and future land use conditions.

Exposure model parameters are presented in Appendix B-1, Tables 4.1, 4.2A, 4.2B, 4.3A, and 4.3B. Table 4.1 presents exposure parameters for commercial properties. Tables 4.2A and 4.2B present exposure parameters for residential properties for adults and children. Tables 4.3A and 4.3B present exposure parameters for recreational properties for adults and children. The values reflect current EPA guidance and comments received from EPA Region I. All parameters are referenced in footnotes on each table. These parameters are used in the equations presented in this section, along with the exposure point concentrations presented in Appendix B-1, Tables 3.1 through 3.24, to calculate intakes, which are used to determine risks.

Individual chemical intakes for each receptor/exposure route combination are presented in Appendix B-1, Tables 7.1 through 7.24 and 8.1 through 8.24. Equations used to quantify intakes are presented below.

Incidental Ingestion of Soil. The estimation of intake of contaminants in soils is determined using the predicted concentration of a contaminant in the OU6 property of interest. This pathway is evaluated for adult commercial workers and both child and adult residents and recreational visitors. In general, intakes associated with soil ingestion are calculated using the following equation:

$$Intake = \frac{(C)(IR)(FRW)(OABS)(EF)(ED)(CF)}{(BW)(AT)}$$

where:	Intake	=	intake of contaminant from soil (mg/kg/day)
	C	=	exposure concentration for soil (mg/kg)
	IR	=	ingestion rate (mg/day)
	FRW	=	fraction ingested from Raymark waste area (decimal fraction)
	OABS	=	oral relative absorption factor (decimal fraction)
	EF	=	exposure frequency (days/yr)
	ED	=	exposure duration (yr)
	CF	=	conversion factor (10^{-6} kg/mg)
	BW	=	body weight (kg)
	AT	=	averaging time (days);
			for non-carcinogens, AT=ED*365 days/yr;
			for carcinogens, AT=70 yr*365 days/yr

Appendix B-1, Tables 4.1, 4.2A, 4.2B, 4.3A, and 4.3B contain summaries of the input parameters for incidental ingestion of soil. Table 1-1 presents FRW values for all OU6 properties.

Dermal Contact with Soil

Dermal contact exposures to soil were evaluated for adult commercial workers and both child and adult residents and recreational users.

The following equation was used to estimate the dermal exposure dose for soil:

$$Dose\ \ (mg/kg/day) = \frac{(C)(FRW)(DABS)(AF)(SA)(EF)(ED)(CF)}{(BW)(AT)}$$

where:	C	=	exposure concentration for soil (mg/kg)
	FRW	=	fraction from Raymark waste area (decimal fraction)
	DABS	=	dermal absorption factor (unitless)
	AF	=	soil-to-skin adherence factor (mg/cm^2)
	SA	=	skin area available for contact (cm^2/day)
	EF	=	exposure frequency (days/year)
	ED	=	exposure duration (years)
	CF	=	conversion factor ($1E^{-6}$ kg/mg)
	BW	=	body weight (kg)
	AT	=	averaging time (70 years * 365 days/year for carcinogens; ED * 365 days/year for non-carcinogens)

Chemical-specific dermal absorption factors (DABS), presented in EPA's "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, (Part E, Supplemental Guidance for Dermal Risk Assessment)" (EPA, 2001b), were used to estimate exposure doses. Unfortunately, limited information regarding dermal absorption is available. The DABS values, where available, for the COPCs are presented in Appendix B-1, Table 5.1. Because of the absence of dermal absorption data, TtNUS qualitatively evaluated dermal exposures to all other COPCs.

Input parameters for dermal contact with soil are summarized in Appendix B-1, Tables 4.1, 4.2A, 4.2B, 4.3A, and 4.3B. Table 1-1 presents FRW values for all OU6 properties.

2.7.4 Toxicity Assessment

The toxicity assessment for the COPCs examines information concerning the potential human health effects of exposure to COPCs. The goal of the toxicity assessment is to provide, for each COPC, a quantitative estimate of the relationship between the magnitude and type of exposure and the severity or probability of human health effects. The toxicity values presented in this section are integrated with the exposure assessment (Section 2.7.3) to characterize the potential for the occurrence of adverse health effects (Section 2.7.5).

The toxicological evaluation involves a critical review and interpretation of toxicity data from epidemiological, clinical, animal, and in vitro studies. This review of the data ideally determines both the nature of the health effects associated with a particular chemical and the probability that a given quantity of a chemical could result in the referenced effect. This analysis defines the relationship between the dose received and the incidence of an adverse effect for the chemicals of potential concern.

The entire toxicological database is used to guide the derivation of cancer slope factors (CSFs) for carcinogenic effects and Reference Doses (RfDs) for non-carcinogenic effects. These data may include epidemiological studies, long-term animal bioassays, short-term tests, and evaluations of molecular structure. Data from these sources are reviewed to determine if a chemical is likely to be toxic to humans. Because of the lack of available human studies, however, the majority of toxicity data used to derive CSFs and RfDs comes from animal studies.

For non-carcinogenic effects, the most appropriate animal model (the species most biologically similar to the human) is identified. Pharmacokinetic data often enter into this determination. In the absence of sufficient data to identify the most appropriate animal model, the most sensitive species is chosen. The RfD is generally derived from the most comprehensive toxicology study that characterizes the dose-response relationship for the critical effect of the chemical. Preference is given to studies using the exposure route of concern; in the absence of such

data, however, an RfD for one route of exposure may be extrapolated from data from a study that evaluated a different route of exposure. Such extrapolation must take into account pharmacokinetic and toxicological differences between the routes of exposure. Uncertainty factors are applied to the highest no-observed-adverse-effect-level (NOAEL) to adjust for inter- and intraspecies variation, deficiencies in the toxicological database, and use of subchronic rather than chronic animal studies. Additional uncertainty factors may be applied to estimate a NOAEL from a lowest-observed-adverse-effect-level (LOAEL) if the key study failed to determine a NOAEL. When chemical-specific data are not sufficient, an RfD may be derived from data for a chemical with structural and toxicological similarity.

CSFs for weight-of-evidence Group A or B chemicals are generally derived from positive cancer studies that adequately identify the target organ in the test animal data and characterize the dose-response relationship. CSFs are derived for Group C compounds for which the data are sufficient, but are not derived for Group D or E chemicals. (An explanation/definition of these weight-of-evidence classes is provided in Section 2.7.4.2). Preference is given to studies using the route of exposure of concern, in which normal physiologic function was not impaired, and in which exposure occurred during most of the animal's lifetime. Exposure and pharmacokinetic considerations are used to estimate equivalent human doses for computation of the CSF. When a number of studies of similar quality are available, the data may be combined in the derivation of the CSF.

Brief summaries of the toxicity profiles for the major COPCs are presented in Appendix B-7. These profiles present a summary of the available literature on carcinogenic and non-carcinogenic effects associated with human exposure to the chemical. For more in depth information see www.epa.gov/iris/indes.html or www.atsdr.cdc.gov/toxpro2.html.

2.7.4.1 Non-carcinogenic Effects

For non-carcinogens, it is assumed that there exists a dose below which no adverse health effects will be seen. Below this "threshold" dose, exposure to a chemical can be tolerated without adverse effects. Therefore, for non-carcinogens, a range of exposure exists that can be tolerated. Toxic effects are manifested only when physiologic protective mechanisms are

overcome by exposures to a chemical above its threshold level. Maternal and developmental endpoints are considered systemic toxicity.

The potential for non-carcinogenic health effects resulting from exposure to chemicals is assessed by comparing an exposure estimate (intake or dose) to an RfD. The RfD is expressed in units of mg/kg/day and represents a daily intake of contaminant per kilogram of body weight that is not sufficient to cause the threshold effect of concern. An RfD is specific to the chemical, the route of exposure, and the duration over which the exposure occurs.

To derive an RfD, EPA reviews all relevant human and animal studies for each compound and selects the study (studies) pertinent to the derivation of the specific RfD. Each study is evaluated to determine the NOAEL or, if the data are inadequate for such a determination, the LOAEL. The NOAEL corresponds to the dose (in mg/kg/day) that can be administered over a lifetime without inducing observable adverse effects. The LOAEL corresponds to the lowest daily dose that induces an observable adverse effect. The toxic effect characterized by the LOAEL is referred to as the "critical effect." To derive an RfD, the NOAEL (or LOAEL) is divided by uncertainty factors to ensure that the RfD will be protective of human health. Uncertainty factors are applied to account for extrapolation of data from laboratory animals to humans (interspecies extrapolation), variation in human sensitivity to the toxic effects of a compound (intraspecies differences), derivation of a chronic RfD based on a subchronic rather than a chronic study, or derivation of an RfD from the LOAEL rather than the NOAEL. In addition to these uncertainty factors, modifying factors between 1 and 10 may be applied to reflect additional qualitative considerations in evaluating the data. For most compounds, the modifying factor is one.

A dermal RfD is developed by multiplying an oral RfD (based on an administered dose) by the gastrointestinal tract absorption factor. The resulting dermal RfD, based on an absorbed dose, is used to evaluate the dermal (absorbed) dose calculated by the dermal exposure algorithms.

EPA's database (IRIS - the Integrated Risk Information System) (EPA, 2003) was consulted as the primary source for RfD values, as well as for CSFs. EPA intends that IRIS supersede all other sources of toxicity information for risk assessment. If values are not available in IRIS, the Health Effects Assessment Summary Tables (HEAST) (EPA, 1997a) are consulted, as well

as the current Region IX EPA Preliminary Remediation Goals (PRGs) Table (EPA, 2002). If no RfD is available from any of these sources, non-carcinogenic risks are not quantified and potential exposures are addressed in the uncertainty section, Section 2.7.6.

Reference Doses for the COPCs at the OU6 properties are presented in Appendix B-1, Table 5.1. This table also includes the primary target organs affected by a particular chemical. This information may be used in the property-specific risk characterization sections to segregate risks by target organ effects when the total Hazard Index is greater than unity.

PCB risk characterization is generally addressed by evaluating total Aroclor concentrations. The PCB non-cancer risk estimates presented in this assessment were based on total Aroclor concentrations. Total Aroclor concentrations were determined on a sample-specific basis by summing individual Aroclor concentrations; one-half the detection limit was used as a surrogate for non-detect results. In situations in which only one or two Aroclors were detected, the total Aroclor value may be strongly influenced by the detection limit values of non-detected Aroclors. For non-carcinogenic risk, only two PCB commercial Aroclor formulations, Aroclor 1016 and Aroclor 1254, have oral RfDs available. The oral RfD for Aroclor 1016 is 7.00E-05 mg/kg/day and the oral RfD for Aroclor 1254 is 2.00E-05 mg/kg/day. PCB non-cancer risk can be evaluated using the total Aroclor concentration and the RfD for the more toxic Aroclor (Aroclor 1254). This approach is conservative and tends to overestimate risks due to the lighter Aroclors. Within the estimated areas of Raymark waste at the OU6 properties, the heavier Aroclors, Aroclor 1262 and Aroclor 1268, generally comprise the majority of the total Aroclor concentration. Due to the high proportion of heavy Aroclors, the use of total Aroclors, in combination with the RfD for Aroclor 1254, for evaluating non-cancer risks, is not likely to significantly overestimate risks.

2.7.4.2 Carcinogenic Effects

The toxicity information considered in the assessment of potential carcinogenic risks includes a slope factor and a weight-of-evidence classification consistent with EPA's 1986 *Guidelines for Carcinogenic Risk Assessment* (EPA, 1986). A revised weight-of-evidence classification system has been developed and presented in the *Draft Revised Guidelines for Carcinogenic Risk Assessment* (EPA, 1999a); however, none of the COPCs for OU6 are impacted at this

time. The 1986 weight-of-evidence classification qualitatively describes the likelihood that a chemical is a human carcinogen and is based on an evaluation of the available data from human and animal studies. A chemical may be placed in one of the following five groups in EPA's 1986 classification system to denote its potential for carcinogenic effects:

- Group A - known human carcinogen
- Group B1 or B2 - probable human carcinogen
- Group C - possible human carcinogen
- Group D – cannot be classified as a human carcinogen because of a lack of data
- Group E - evidence of noncarcinogenicity in humans

The CSF is the toxicity value used to quantitatively express the carcinogenic hazard of cancer-causing chemicals. It is defined in the IRIS glossary as: "An upper-bound, approximately a 95 percent confidence limit, on the increased cancer risk from a lifetime exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg/day, is generally reserved for use in the low-dose region of the dose-response relationship, that is, for exposures corresponding to risks less than 1 in 100." (EPA, 2003). Slope factors are derived from studies of carcinogenicity in humans and/or laboratory animals and are typically calculated for compounds in Groups A, B1, and B2, although some Group C carcinogens also have slope factors and some B2 carcinogens, such as lead, have none. Slope factors are specific to a chemical and route of exposure and are expressed in units of $(mg/kg/day)^{-1}$ for oral routes. CSFs for COPCs at the OU6 properties are presented in Appendix B-1, Table 6.1. The primary source of information for these values is the EPA IRIS database, followed by other EPA sources described for non-carcinogens.

CSFs exist for several (but not all) Group C compounds, which are identified as "possible" human carcinogens. These compounds typically exhibit inadequate evidence of carcinogenicity in humans and limited evidence in animals. No Group C compounds were identified as COPCs.

Dermal CSFs are derived from the corresponding oral values. To derive the dermal CSF, the oral CSF is divided by the gastrointestinal absorption efficiency to determine a CSF based on an absorbed dose rather than an administered dose. The oral CSF is divided by the

absorption efficiency because CSFs are expressed as reciprocal doses. Dermal CSFs and the absorption efficiencies used in their determination are also included in Appendix B-1, Table 6.1. The absorption efficiencies were obtained from Table 4.1, "Summary of Gastrointestinal Absorption Efficiencies and Recommendations for Adjustment of Oral Slope Factors for Specific Compounds" of the EPA's "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment" (EPA, 2001b).

Risk estimates for PAHs have, in the past, assumed that all carcinogenic PAHs have a potency equal to that for benzo(a)pyrene. While benzo(a)pyrene was well studied, other Class B2 PAHs had insufficient data with which to calculate a CSF. EPA has published provisional guidance to assess PAHs (EPA, 1993). Estimated orders of potential potency (rather than a toxicity equivalence factor or TEF) were developed based on skin painting tests and are rounded to one significant figure (based on an order of magnitude). The values are based on a comparable endpoint (complete carcinogenesis after repeated exposure to mouse skin). The quality of the data does not support any greater precision. The orders of potential potency used in this HHRA are presented in Appendix B-8 and are those proposed for use by EPA Region I (EPA, 1994c). EPA has determined that the oral CSF for benzo(a)pyrene is 7.3 $(mg/kg/day)^{-1}$. Oral CSFs for other carcinogenic PAHs were determined by multiplying the oral CSF for benzo(a)pyrene by the estimated order of potential potency for the PAH. These oral CSFs for PAHs became the basis for deriving the dermal CSFs used to evaluate dermal risk from PAHs.

The toxicity and cancer risk characterization of PCBs was conducted according to guidance presented in the EPA technical guidance document entitled, "PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures" (EPA, 1996b). The guidance document suggests a methodology for the risk evaluation of the total Aroclor concentration in an environmental medium.

Risk estimates for dioxins were evaluated through the use of dioxin TEQs as described in Section 2.7.2.1. Dioxin TEQs were used in conjunction with the toxicity value for 2,3,7,8-TCDD of 1.5 E+5 $(mg/kg/day)^{-1}$ from IRIS (EPA, 2003) in determining cancer risk. Use of this cancer slope factor for dioxins may underestimate risks from exposure to dioxins. This CSF is being

reviewed by EPA. EPA has prepared a Draft Dioxin Reassessment (EPA, 2000), which recommends a CSF for dioxins of 1.0E+6 $(mg/kg/day)^{-1}$. Appendix B-9 presents the cancer risks from exposures to dioxins using the CSF of 1.0E+6$(mg/kg/day)^{-1}$. Cancer risks estimated using this approach are approximately an order of magnitude greater than risks calculated using the CSF of 1.5E + 5 $(mg/kg/day)^{-1}$.

2.7.5 Risk Characterization Methodology

This section outlines the methods used to estimate the type and magnitude of potential human health risks associated with the potential exposure to COPCs in soils at estimated areas of Raymark waste at the OU6 properties. The risk results for the individual OU6 properties are presented in Section 3.

Potential human health risks resulting from exposure to COPCs were estimated using algorithms established by EPA. The methods described by EPA are protective of human health and are likely to overestimate (rather than underestimate) risk. The methodology uses specific algorithms to calculate risk as a function of chemical concentration, human exposure parameters, and toxicity.

Risks from hazardous chemicals are calculated for either carcinogenic or non-carcinogenic effects. Some carcinogenic chemicals may also exhibit non-carcinogenic effects. Potential impacts are then characterized for both types of health effects.

2.7.5.1 Non-Carcinogens

The hazards associated with the effects of non-carcinogenic chemicals are evaluated by comparing an exposure level or intake to an RfD. The ratio of the intake to the RfD is called the Hazard Quotient (HQ) and is defined as follows (EPA, 1989b):

$$HQ_i = \frac{Intake_i}{RfD_i}$$

where: HQ_i = Hazard Quotient for chemical "i" (unitless)

$Intake_i$ = Intake of chemical "i" (mg/kg/day), a function of exposure and chemical concentration

RfD_i = Reference Dose of chemical "i" (mg/kg/day)

If the ratio of the intake to the RfD exceeds unity, there exists a potential for non-carcinogenic (toxic) effects to occur. A Hazard Index (HI) is generated by summing the individual HQs for all COPCs. If the value of the HI exceeds unity, there is a potential for non-carcinogenic health effects associated with that particular chemical mixture, and therefore it is necessary to segregate the HQs by target organ effects. The HQ should not be construed as a probability, but rather as a numerical indicator of the extent to which a predicted intake exceeds or is less than an RfD.

2.7.5.2 Chemical Carcinogens

Risks attributable to exposure to chemical carcinogens are estimated as the probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. At low doses, the incremental lifetime cancer risk (ILCR) is determined as follows (EPA, 1989b):

$$ILCR_i = (Intake_i)(CSF_i)$$

where: $ILCR_i$ = Incremental Lifetime Cancer Risk for chemical "i", expressed as a unitless probability

$Intake_i$ = Intake of chemical "i" (mg/kg/day)

CSF_i = Cancer Slope Factor of chemical "i" $(mg/kg/day)^{-1}$

Risks below 1E-6 (or a risk less than 1 in 1 million) are generally considered to be acceptable by EPA, and risks greater than 1E-4 (1 in 10,000) are generally considered to be unacceptable. The CT DEP regulations use 1E-5 (1 in 100,000) as a break point between acceptable and unacceptable risk for cumulative cancer risk from multiple contaminants and a break point of 1E-6 (one-in-a-million) cancer risk for individual contaminants (CT DEP, 1996).

Risks are estimated for all carcinogenic compounds regardless of the class designation (See Section 2.7.4.2).

2.7.5.3 Exposure to Lead

Risks from lead exposure are not evaluated using the same methodology as other contaminants. Residential and recreational child exposure to lead was evaluated using the EPA Integrated Exposure Uptake Biokinetic (IEUBK) Model for lead (EPA, 1994a). This model is designed to estimate blood levels of lead in children (under 7 years of age) based on either default or site-specific input values for air, drinking water, diet, dust, and soil exposure. Since children are a more sensitive subpopulation than adults, exposure to lead by adults in a residential scenario is not generally evaluated. Exposures to lead by non-residential adults (commercial workers) are evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, 1996c and 1996d). The slope factor approach focuses on estimating fetal blood-lead concentrations in women exposed to lead-contaminated soil in non-residential scenarios.

Blood-lead concentration is the most widely used index of internal lead body burdens associated with potential adverse health effects. Studies indicate that infants and young children are extremely susceptible to adverse effects from exposure to lead. Considerable behavioral and developmental impairments have been noted in children with elevated blood-lead levels. The threshold for toxic effects to children from this chemical is believed to be in the range of 10 micrograms/deciliter (µg/dL) to 15 µg/dL. Blood-lead levels greater than 10 µg/dL are considered to be a "concern."

Either the IEUBK Model or the Technical Review Work Group Model for lead was used to address exposures to lead at each OU6 property. Exposure concentrations, as well as default parameters for some input parameters, were used in the evaluation. Because the output of these models is a range of predicted blood-lead concentrations, it is appropriate to input average soil lead concentrations rather than 95 percent UCL on the mean values. Entering a 95 percent UCL on the mean tends to bias the model outputs toward the high end, thus potentially overestimating risk. The exposure point concentrations selected for use in this evaluation are the arithmetic average soil lead concentrations for the exposure areas. In order

to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) is factored into the models. This approach assumes the receptor spends time within the estimated areas of Raymark waste in direct proportion to the fraction of the total property estimated to contain Raymark waste. Exposures outside the estimated areas of Raymark waste are not evaluated. For the IEUBK model, the average lead concentration is multiplied by the FRW to yield a time-weighted average concentration, which is then used as the exposure point concentration. For the EPA Technical Review Workgroup Model, the FRW is included in the intake equations shown in Appendix B-10.

Exposure to lead in soils by adults at the OU6 commercial properties was evaluated using the EPA Technical Review Workgroup for Lead (EPA, December 1996b). The model estimates the 95th percentile blood-lead concentration among fetuses born to women having site exposures. These concentrations are then compared to the established level of concern of 10 μg/dL. An additional step in the process estimates the probability that fetal blood-lead levels will exceed 10 μg/dL. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 μg/dL.

Exposure to lead in soils by children at the OU6 residential and recreational properties was evaluated using the EPA Integrated Exposure Uptake Biokinetic (IEUBK) Model for lead (EPA, 1994a). This model is designed to estimate blood levels of lead in children (under 7 years of age) based on either default or site-specific input values for air, drinking water, diet, dust, and soil exposure. These estimated blood levels of lead are then compared to the established level of concern of 10 μg/dL. An additional step in the process estimates the probability that blood-lead levels will exceed 10 μg/dL. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 μg/dL.

The results of the property-specific lead exposure evaluations are discussed in Section 3. The input parameters used and the results of lead models, estimated blood-lead levels, and probability density histograms are presented in Appendix B-10.

2.7.5.4 Asbestos Evaluation

Quantitative risk estimates (inhalation risk estimates) have not been developed for asbestos in this HHRA. EPA considers asbestos to be a carcinogen for exposures through the inhalation pathway. EPA has published a carcinogenic inhalation unit risk toxicity factor for quantitative cancer risk estimates for asbestos; however, this factor is in units of fibers/ml in ambient air. Use of the EPA unit risk factor requires either measurements of asbestos in air or measurements of the expected amount of asbestos released to the air in respirable dust from asbestos-contaminated soil. At this site, no data are available for asbestos concentrations in air or dust. Recently, a method for measurements of the expected amount of asbestos released to the air in respirable dust from asbestos-contaminated soil has been developed. The accuracy of this method has not been verified and, therefore, EPA has not yet accepted the method for risk assessment and risk management purposes. Asbestos in soil at this site has been reported as a percentage in soil and was measured by a visual microscopic evaluation of the percentage of a soil sample that is comprised of asbestos fibers. This data is insufficient for quantitative risk assessment because it is highly subjective and cannot be used to predict air or dust concentrations.

Asbestos-containing material is defined as material containing more than one percent asbestos (Appendix A to Subpart M of 40 CFR61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is “friable” (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air. For this reason, the definition of asbestos-containing material was used for qualitative evaluations of asbestos exposures.

The presence of pavement and/or vegetative cover at each property reduces the potential for airborne asbestos. Based on field conditions at the OU6 properties, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at the OU6 properties. The asbestos contained in soils may become friable under dry conditions and may become a health concern through inhalation exposures to fibers in dust from the site. Disturbances of asbestos-containing soils through excavation or other human activities will increase the potential for airborne asbestos exposures and associated inhalation risks.

2.7.6 Uncertainties Analysis

There are uncertainties associated with all HHRAs. This section summarizes these uncertainties, and discusses how they may affect the final risk estimates discussed in Section 3.

There is uncertainty associated with all steps of the risk assessment process. Uncertainty in the data evaluation is associated with sampling adequacy, the current status of the predictive databases for development of screening values, the procedures used to include or exclude constituents as chemicals of potential concern, and the methods used and the assumptions made to determine exposure point concentrations. The selection of chemicals of potential concern is based on exposure assumptions and toxicity information, which in turn have associated uncertainties. Uncertainty associated with the exposure assessment includes the values used as input variables for a given intake route and the predictions regarding future land use and population characteristics. Uncertainty in the toxicity assessment includes the quality of the existing data to support dose-response relationships and the weight-of-evidence used for determining the carcinogenicity of chemicals of concern. Uncertainty in risk characterization includes that associated with exposure to multiple chemicals and the cumulative uncertainty from combining conservative assumptions made in earlier activities.

While there are various sources of uncertainty (as described above) throughout the risk assessments, assumptions were made so that the final calculated risks would be conservative estimates that are protective of public health. Thus, the resultant uncertainty in the numerical risk assessments is in how much lower the actual risks are.

Generally, risk assessments carry two types of uncertainty: measurement and informational uncertainty. Measurement uncertainty refers to the variance that can be attributed to sampling techniques and laboratory analysis of contaminants. For example, this type of uncertainty is associated with analytical data collected for each site. The risk assessment reflects the accumulated variances of the individual values used. Informational uncertainty refers to estimates of toxicity and exposure. Often this gap is significant, such as the absence of information on the effects of human exposure to low doses of a chemical, the biological mechanism of action of a chemical, or the behavior of a chemical in soil.

Once the risk assessment is complete, the results must be reviewed and evaluated to identify the type and magnitude of uncertainty involved. Reliance on results from a risk assessment without considering uncertainties, limitations, and assumptions inherent in the process can be misleading. For example, to account for uncertainties in the development of exposure assumptions, conservative estimates must be made to ensure that the particular assumptions made are protective of sensitive subpopulations or the maximum exposed individuals. If a number of conservative assumptions are combined in an exposure model, the resulting calculations can propagate the uncertainties associated with those assumptions, thereby producing a much larger uncertainty for the final results. This uncertainty is biased toward over-predicting both carcinogenic and non-carcinogenic risks. Thus, both the results of the risk assessment and the uncertainties associated with those results must be considered when making risk management decisions.

This interpretation is especially relevant when the risks exceed the point-of-departure for defining "acceptable" risk. For example, when risks calculated using a high degree of uncertainty are below an "acceptable" risk level (1E-6), the interpretation of no significant risk is straightforward. However, when risks calculated using a high degree of uncertainty are above an "acceptable" risk level (1E-4), a conclusion can be difficult unless uncertainty is considered. The risk estimates alone may indicate unacceptable risk; however, if uncertainty is biased toward over-predicting risk, actual risks could fall within acceptable range.

The OU6 risk assessments use exposure and toxicity assumptions from the "high end" of their distributions. These values correspond to the RME scenarios.

Uncertainties within the components of the HHRA are discussed below.

2.7.6.1 Uncertainty in Data Evaluation

Uncertainty is associated with analytical data collected and analyzed for each site. This risk assessment evaluates exposures to individuals limited to portions of each property where samples met the definition of Raymark waste. Portions of the property not meeting the definition of Raymark waste are not included in this evaluation. Any uncertainty associated with the estimated extent of Raymark waste present at a property is thus propagated through

the risk assessment. This uncertainty not only affects which samples are included in datasets for each property, but also the exposure assessment, which relies on prorating of exposure intake based on the percentage of a property estimated to contain Raymark waste. There is uncertainly associated with identification of samples that meet the definition of Raymark waste. The source of this uncertainty is the limited analyses performed on some samples and the margin of error in reporting laboratory results.

As discussed in Appendix D, some of the data are the results of field-screening methods, rather than EPA-approved methods. Unvalidated field-screening data for metals were included in the HHRA. A correlation study, comparing field-screening data to CLP data was performed and is presented in Appendix B-3. The correlation study concluded that field-screening data for metals were comparable to CLP data. However, there was a poor statistical correlation between field-screening data and CLP data for PCBs.

This is not unexpected, since the analytical techniques used in the mobile laboratory for PCB analysis differ from the techniques used in fixed laboratories. Detection limits for PCBs vary greatly between the two sets of data. Field-screening data were collected for use in defining the estimated areas of Raymark waste and are useful for that purpose. As discussed in Appendix B-3, the field-screening data and CLP data were analytically comparable only if one considers the question of whether or not concentrations of PCBs are above 1,000 µg/kg.

For this reason, field-screening data for metals, but not PCBs, were included in this HHRA. Typically, environmental samples analyzed in the field in “real time” may result in slight differences from those analyzed in a fixed-base laboratory. Because one half the detection limit is used as a proxy for non-detected results in determining mean concentrations and 95 percent UCLs, and detection limits for metals in the field screening analyses are higher than in CLP analysis, metals data (copper and lead) including samples analyzed in the field may result in slightly higher exposure point concentrations. Due to the high degree of correlation between field-screening data and CLP data for metals shown in Appendix B-3 and the exclusion of field-screening data for PCBs due to poor statistical correlation with CLP results, it is unlikely that use of the field-screening data contributes significantly to the overall uncertainty of the risk assessment. At most, it may result in risks that are slightly higher than actual conditions. The exclusion of field-screening data for PCBs limits the quantitative risk assessments for some

properties where no samples within the estimated areas of Raymark waste were analyzed for PCBs by CLP methods.

There is a minor amount of uncertainty associated with the selection of COPCs in the quantitative risk assessment. Conservative screening values were used to select COPCs; thus, it is unlikely that any contaminant that may pose a risk was eliminated from the risk assessment. There were chemicals detected for which EPA has little or no information regarding the chemical's toxicity. Without any measure of toxicity, there is often very little that can be done to quantitatively address the potential hazard that the chemical may pose. Furthermore, there are many compounds that are not part of EPA's routine list of analytes. If a compound is not on EPA's routine analyte list, it most likely will not be reported even if present in the environment. This too can have an impact on the selection of chemicals of potential concern.

COPCs were selected if the maximum detected concentration in soils exceeded its respective risk-based screening criterion. Even if the compound was detected at a very low frequency, i.e., less than 5 percent, if the maximum detected concentration exceeded the screening criterion, the compound was still retained for evaluation in the risk assessment. Based on a review of the data, the absence of using frequency of detection as a COPC selection criterion did not result in a significant increase in the number of COPCs evaluated in this risk assessment. Therefore, this does not significantly contribute to the uncertainty of the risk assessment.

Background concentrations were not used to eliminate COPCs. A discussion of uncertainty associated with background concentrations is provided in Section 3 for individual properties where appropriate.

Uncertainty arises from calculation of exposure point concentrations. For several of the OU6 properties, datasets from estimated areas of Raymark waste consisted of small numbers of samples. Additionally, not all samples were analyzed for all potential COPCs. This makes the estimation of the upper 95 percent confidence limit on the mean highly uncertain and, therefore, the maximum detected chemical concentrations were often used to assess RME risks. As a result, the estimations of risk where maximum concentrations were used as

exposure concentrations are most likely overstated because it is unlikely that potential receptors would be exposed to the maximum concentration over the entire exposure period.

The inclusion of soils currently located at depths of as much as 15 feet bgs in the calculation of exposure point concentrations may overestimate current risk to commercial workers, residents, or recreational visitors who do not contact soils at depth. These samples were included to address concerns for future exposures when excavation or construction may bring these soils to the surface.

2.7.6.2 Uncertainty in the Exposure Assessment

Uncertainty in the exposure assessment arises from determination of land use conditions, selection of receptors, and selection of exposure parameters. Each is discussed below.

Exposure Routes and Receptor Identification. Exposure routes and receptor groups were based on discussions with the EPA. This may either under- or over-estimates the risks, with the final result dependent on how well the receptors were defined.

Selection of Exposure Parameters. Each exposure factor selected for use in this risk assessment has some associated uncertainty. Generally, exposure factors are based on surveys of physiological and lifestyle profiles across the United States. The attributes and activities studied in these surveys generally have a broad distribution. To avoid underestimation of exposure, EPA guidelines on the RME receptor were used that generally consist of the 95th percentile for most parameters. Therefore, the selected values for the RME receptor represent the upper bound of the observed or expected habits of the majority of the population.

Many of the exposure parameters were determined from statistical analyses on human population characteristics. Often the database used to summarize a particular exposure parameter (body weight) is quite large. Consequently, the values chosen for such variables in the RME scenario have low uncertainty. For many parameters for which limited information exists (dermal absorption of organic chemicals from soil), there is greater uncertainty.

Many of the quantities used to calculate exposures and risks in this report are selected from a distribution of possible values. For the RME scenario, the value representing the 95th percentile is generally selected for each parameter to ensure that the assessment bounds the actual risks from a postulated exposure.

An additional exposure parameter representing the fraction of a property estimated to contain Raymark waste (FRW) was included in the risk calculations. The resulting risks do not represent the total risks to which a receptor will be exposed unless one assumes soil at other portions of the property is totally clean and that receptors use all areas of the property on an equal basis. Therefore, reasonable maximum risks presented in this risk assessment underestimate risks to receptors who spend a disproportionate amount of their time within the estimated areas of Raymark waste or who contact contaminants in other portions of the property. If one were to assume that a receptor spent all his/her time in the estimated areas of Raymark waste, it would be necessary to remove the FRW factor from the intake equations. The resulting risk estimates would increase proportionally. Appendix B-12 presents a summary of cancer risks, hazard indices, and lead evaluation results with and without the FRW factor.

2.7.6.3 Uncertainty in the Toxicological Evaluation

A toxicity evaluation is a chemical's hazard identification and dose-response assessment. The hazard identification deals with characterizing the nature and strength of the evidence of causation, or the likelihood that a chemical that induces adverse effects in animals will also induce adverse effects in humans. Hazard identification of carcinogenicity is an evaluation of the weight-of-evidence that a chemical causes cancer. Positive animal cancer test data suggest that humans contain tissue(s) that may also manifest a carcinogenic response; however, the animal data cannot necessarily be used to predict the target tissue in humans. In the hazard assessment of non-cancer effects, however, positive animal data suggest the nature of the effects (the target tissues and type of effects) anticipated in humans.

Uncertainty in hazard assessment arises from the nature and quality of the animal and human data. Uncertainty is reduced when similar effects are observed across species, strain, sex, and exposure route; when the magnitude of the response is clearly dose-related; when

pharmacokinetic data indicate a similar fate in humans and animals; when postulated mechanisms of toxicity are similar for humans and animals; and when the chemical of concern is structurally similar to other chemicals for which the toxicity is more completely characterized.

Uncertainty in the dose-response evaluation includes determining a slope factor for the carcinogenic assessment and deriving an RfD for the non-carcinogenic assessment. The slope factor is an upper bound estimate of the human cancer risk per milligram of contaminant per milligram of body weight per day. The RfD is an estimate with uncertainty (spanning perhaps an order of magnitude of daily exposure to humans) below which a person is likely to be without appreciable risk of adverse effect over a lifetime. Uncertainty is introduced from interspecies (animal to human) extrapolation, which, in the absence of quantitative pharmacokinetic or mechanistic data, is usually based on consideration of interspecies differences in basal metabolic rate. Uncertainty also results from intraspecies variation. Most toxicity experiments are performed with animals that are similar in age and genotype so that intragroup biological variation is minimal, but the human population of concern may reflect a great deal of heterogeneity, including unusual sensitivity or tolerance to the COPC. Even toxicity data from human occupational exposure reflect a bias because only those individuals sufficiently healthy to attend work regularly (the "healthy worker effect") and those not unusually sensitive to the chemical are likely to be occupationally exposed.

Finally, uncertainty arises from the quality of the key study from which the quantitative estimate is derived and from the database. For cancer effects, the uncertainty associated with dose-response factors is mitigated by assuming the 95 percent upper bound for the slope factor. Another source of uncertainty in carcinogenic assessment is the method by which data from high doses in animal studies are extrapolated to the dose range expected for environmentally exposed humans. The linearized multistage model, which is used in nearly all quantitative estimations of human risk from animal data, is based on a nonthreshold assumption of carcinogenesis. There is evidence to suggest, however, that epigenetic carcinogens, as well as many genotoxic carcinogens, have a threshold below which they are non-carcinogenic (William and Weisburger, 1991); therefore, the use of the linearized multistage model is conservative for chemicals that exhibit a threshold for carcinogenicity.

Use of the cancer slope factor for dioxins of 1.5E+5 $(mg/kg/day)^{-1}$ from IRIS (EPA, 2003) may underestimate risks from exposure to dioxins. USEPA has prepared a Draft Dioxin Reassessment (EPA, 2000), which recommends a CSF for dioxins of 1.0E+6 $(mg/kg/day)^{-1}$. Appendix B-9 presents the cancer risks for site exposures to dioxins using the dioxin CSF of 1.0E+6 $(mg/kg/day)^{-1}$. Cancer risks estimated using this approach are approximately an order of magnitude greater than risks calculated using the CSF for dioxins of 1.5E+5 $(mg/kg/day)^{-1}$.

For non-cancer effects, additional uncertainty factors may be applied in deriving the RfD to mitigate poor quality of the key study or gaps in the database. Additional uncertainty for non-cancer effects arises from the use of an effect level in estimating an RfD, because this estimation is predicated on the assumption of a threshold below which adverse effects are not expected. Therefore, an uncertainty factor is usually applied to estimate a no-effect level. Additional uncertainty arises in estimating an RfD for chronic exposure from less-than-chronic data. Unless empirical data indicate that effects do not worsen with increasing duration of exposure, an additional uncertainty factor is applied to the no-effect level in the less-than-chronic study. Uncertainty in deriving RfDs is mitigated by the use of uncertainty and modifying factors that normally range between 3 and 10. The resulting combination of uncertainty and modifying factors may reach 1,000 or more.

The derivation of dermal RfDs and CSFs from oral values may cause uncertainty. This is particularly the case when no gastrointestinal absorption rates are available in the literature or when only qualitative statements regarding absorption are available.

Uncertainty also arises in the dose-response assessment for values derived for several principal chemicals of concern by using studies with limitations. For example, Class B2 PAHs for which no toxicity data are available are evaluated using benzo(a)pyrene toxicity data with estimated orders of potential potency. This may either underestimate or overestimate the carcinogenic risks associated with PAHs.

Uncertainty is associated with the exclusion of copper from the quantitative risk assessment. EPA Region I does not generally quantitatively evaluate non-carcinogenic hazards posed by copper because of the lack of an approved toxicity value (RfD). EPA Region IX PRGs for copper are based on a provisional oral RfD, which was based on concentrations needed to

protect against a deficiency of the compound, rather than on quantitative estimates related to the hazard posed by overexposure (EPA, 1999b). Copper is a major contaminant at these properties. Exclusion of copper from this risk assessment may result in an under estimate of non-carcinogenic risks. Qualitative comparisons of site-specific copper concentrations to the EPA Region IX PRG for copper are included in the Section 3 uncertainty discussions, wherever the EPA Region IX PRG was exceeded.

Some uncertainty is associated with the evaluation of chromium, which was assumed to be present in its hexavalent state. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

Uncertainty is associated with evaluating exposures to lead. Two methods have been used in this risk characterization to evaluate lead exposures. Exposures of children to lead were evaluated using EPA's IEUBK model. Uncertainty is associated with the use of default values for exposures to lead via pathways other than soil ingestion. The IEUBK model was developed based on children exposed in a residential scenario. Exposures of commercial workers to lead are evaluated by use of the EPA Technical Review Workgroup Model for lead. This approach focuses on estimating fetal blood-lead concentrations in women exposed to lead contaminated soils in non-residential scenarios. Uncertainty is associated with estimating maternal blood-lead concentrations and with the relationship between maternal blood-lead concentrations and fetal blood-lead concentrations.

Uncertainty is associated with the lack of a quantitative evaluation of inhalation exposures to asbestos. Risks from exposures to asbestos are not quantified due to a lack of toxicity values and reliable models for predicting air concentrations of asbestos from soil concentrations. A qualitative evaluation of asbestos is included for each of the OU6 properties.

Uncertainty in the final calculations of risk results from assumptions made regarding additivity of effects from exposure to multiple compounds from various exposure routes. High uncertainty exists when cancer risks for several substances are summed across different exposure pathways. This assumes that each substance has a similar effect and/or mode of action. Often compounds affect different organs, have different mechanisms of action, and

differ in their fate in the body, so additivity may not be an appropriate assumption. However, the assumption of additivity was made to provide a conservative estimate of risk.

Finally, the risk characterization does not consider antagonistic or synergistic effects. Little or no information is available to determine the potential for antagonism or synergism for the COPCs. Therefore, this uncertainty cannot be discussed for its impact on the risk assessment, since it may either underestimate or overestimate potential human health risk.

Property-specific uncertainties are discussed in Section 3.

2.8 Ecological Risk Evaluation

The objective of the ecological evaluation is to describe the present environmental conditions at each property prior to potential impacts from remedial action activities. If implemented, remedial activities may result in the unavoidable loss of onsite ecological resources. Mitigation or restoration goals would need to be established if important ecological resources (e.g., wetlands, streams, threatened or endangered species) are present in an area designated for remedial action. To help establish goals in the event onsite resources are unavoidably degraded or lost during any response actions, an evaluation of the current site conditions and site flora and fauna is necessary.

An ecological evaluation includes a description of the property and its ecological habitats. The ecological evaluation in this RI does not include an assessment of site contamination, potential risk to ecological receptors, or a description of the ecological habitats of the areas surrounding the commercial properties because property specific sampling of the surroundings (insects, animals, sediments, soils) was not performed. However, given the fact that the properties are all located within the Town of Stratford and are all contaminated with the same waste material, generalizations of the impact of the contaminated waste material on the environment can be made. The ecological conditions were evaluated in the general area of some of the properties under the OU3 RIs. This is referenced in the property write-ups in Section 3 for:

- Lockwood Avenue Property
- 200 Ferry Boulevard

- 230 Ferry Boulevard
- 250 Ferry Boulevard
- 280 Ferry Boulevard
- 300 Ferry Boulevard
- Lot Behind 326 Ferry Boulevard
- Vacant Lot at Housatonic Avenue
- 326 Ferry Boulevard
- Beacon Point Area
- 1 Beacon Point Road
- 575 East Broadway
- 600 East Broadway
- CT Right of Way

However, none of these properties had a site-specific ecologic assessment of the property field conditions; therefore the property by property write-ups in Section 3 are general in nature. Any ecological impacts on a property will be evaluated during the design and cleanup of a parcel, if needed.

2.8.1 General Ecological Setting

The study area consists of 24 properties. The 24 properties consist of developed and undeveloped land. Many of the properties consist of buildings surrounded by paved parking lots with some landscape plantings that provide little wildlife habitat.

The habitat types associated with the undeveloped properties are characteristic of disturbed areas in New England. Much of the area surrounding the study area consists of commercial, industrial, and residential properties with minimal habitat values, with the exception of the Housatonic River and its associated wetlands.

Vegetation along the bank and wetlands of Ferry Creek is dominated by common reed. The upland bank along Ferry Creek typically has a narrow tree line with a dense understory of shrubs and vines. Ferry Creek flows into the Housatonic River.

The Housatonic River is used for recreational fishing, shellfishing, and boating. The mouth of the Housatonic River is considered to be a recreational fishery and a potential source of human food-chain organisms. Coastal waterways are assumed to support various recreational activities, as well as recreational and commercial fishing. The lower Housatonic River, near the mouth of Ferry Creek, contains important commercial seed beds for oyster cultivation. EPA representatives have observed people collecting crabs from the Ferry Creek flood control barrier located on Broad Street.

3.0 PROPERTY EVALUATIONS

This section presents individual property discussions for each of the 24 parcels where Raymark waste has been identified and which form the basis for this report. Each property is discussed using the general framework for preparing remedial investigation reports provided in the EPA guidance (EPA, 1988). All of the discussions are property-specific and include activities currently underway, a physical description of the setting, the nature and extent of known contamination, the assumed contaminant movement, a presentation of the human health and ecological risk assessments, and a summary of the findings.

3.1 Lockwood Avenue Property

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.1.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.1.1 Property Description

This property, approximately 5.3 acres of commercially-zoned (partly waterfront business and partly retail) land, is located east of Lockwood Avenue and Ferry Boulevard in Stratford, Connecticut (Town of Stratford, 1997). The property is unoccupied and undeveloped, and contains no structures. The property is vegetated with common reed in the wetland areas and trees and shrubs in the upland areas. A soil berm is present along Lockwood Avenue and along a portion of Ferry Creek. Potential asbestos waste materials have been observed on the soil berm surface. No storm drains were observed on the property.

Public access to the area is not restricted, although signs discouraging trespassing due to the presence of a potential health threat were posted by the Stratford Health Department. Broad Street is located to the north, with Ferry Creek and the Housatonic River to the east, residential properties on Stratford Avenue to the south, and commercial and residential properties on Lockwood Avenue to the west.

Ferry Creek is connected to Selby Pond by a concrete drainage culvert (approximately 18-inch diameter) that runs through this property (east to west direction). All tidal water entering and leaving Selby Pond passes through this culvert. Reportedly, dredge spoils from past dredging operations in Ferry Creek were deposited on this property. Approximately 60 percent of the area is tidal wetlands, with the remaining area consisting of undeveloped uplands.

3.1.2 Physical Characteristics

According to Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Stratford, Connecticut, this property is located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for the two zones located on the property is

10 and 12 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Twenty-one borings (SB-312S, SB-312D, and SB-312B; B2-SB01 through B2-SB09; and DBL-101 through DBL-109) were advanced on the property to depths of up to 124 feet below ground surface (bgs). Soil boring SB-312B was advanced to bedrock at 90.5 feet bgs and cored into bedrock. Soils noted in borings DBL-101 and DBL-107 through DBL-109 consist of organic materials characteristic of a former marsh and swamp deposit. Fill materials were not identified in the soil from these borings. Soils noted in borings B2-SB01 through B2-SB03, B2-SB05, B2-SB08, B2-SB09, and DBL-102 through DBL-105 consist of fill overlying a former marsh and swamp deposit. The soils encountered below the fill include peat and organic silt. In borings B2-SB04 and B2-SB07, the organic materials overlie glacial outwash and/or ice-contact deposits. In boring DBL-106, silt mixed with asbestos fibers was observed. Refer to Figure 3-1 for boring locations on the property. Boring logs are presented in Appendix A.

One well cluster, MW-312, was installed on this property; borings SB-312S, SB-312D, and SB-312B were completed as monitoring wells. No soil samples were collected from SB-312S and SB-312D. Soil sample locations are shown on Figure 3-1, and include both shallow surface soil samples and deeper samples from the soil borings. The borings were used to describe the fill and native material on the property. All soil sampling locations were used to determine the presence or absence of Raymark waste and identify the locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials placed on the property as a result of human activity. Manmade materials, including potentially asbestos-containing materials (PACM) (asbestos boards, mats, and pads), asphalt, asphalt shingles, brick, clay pipe, cloth, concrete, glass, plastic, slag, sludge-like processed waste, manufacturing debris, and a tar/rubber-like substance were identified in the soil from one or more of the borings. PACM was identified in the soil from borings B2-SB01, B2-SB02, B2-SB05, DBL-103, DBL-104, and DBL-106. The manmade materials were encountered with natural fill materials consisting of sand, with varying amounts of silt and/or gravel, and silt with organic matter. Manmade debris was not identified in borings B2-SB06, B2-SB07, B2-SB09, DBL-101, and DBL-107 through DBL-109. Fill classifications were based on the visual characteristics of soil and sediment samples that were collected during the field investigations. Based on interpretations and field

observations, fill was identified in borings across the entire property. The depth to water was 1 foot to 10 feet bgs, based on the soil moisture content recorded on the boring logs and on 2003 water level measurements from monitoring wells on the property.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste have been estimated by the presence of asbestos, lead, copper and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-1. The estimated areas of Raymark waste make up approximately 34 percent of the property, and are primarily located in the central and southern portions of the property. Approximately 60 percent of the total property is considered tidal wetlands (shown on Figure 1-2). The estimated area of Raymark waste is within the wetland portion of the property with the exception of the small area that abuts Lockwood Avenue. This area is mostly soils in the berms and is vegetated with small shrubs and trees.

3.1.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. Results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria (CT DEC) for commercial/industrial land use and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. Comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. Comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 138 samples collected from 56 locations on this property. Sample locations, with exceedances of the CT DEC and CT PMC, are indicated on Figure 3-1. Samples were analyzed

for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-1 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. See Table 3-1 for the soil summary statistics and comparison to criteria. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. Figure 3-1 also depicts the CT DEC and/or CT PMC criteria exceedances on the property. A complete set of soil analytical results for each property is provided in Appendix C. The discussion below includes all soil samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

Asbestos

One hundred and twenty-one samples were collected from the property and analyzed for asbestos. Asbestos was detected very frequently on the property. Asbestos at greater than 1 percent was detected in 44 of 121 samples. Asbestos detections were scattered throughout the property at depths ranging from ground surface to 14 feet bgs.

Dioxins

Sixteen soil samples were collected from the property for dioxin analysis. Dioxins were detected in all of the samples. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 3.5.2.5 for an explanation of TEQ. TEQ values ranged from 0.001935 µg/kg to 0.351 µg/kg.

Metals

Soil samples were collected from the property and analyzed for metals as follows: 36 samples were analyzed at a fixed laboratory for metals; 71 were screened for copper; and 95 were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered to be of low concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Four metals exceeded the CT DEC regulatory standards;

arsenic, beryllium, chromium, and lead. Metals exceedances were located in the central and southern portions of the property from the ground surface to 10 feet bgs.

SPLP and TCLP Metals

Seven soil samples were also collected for SPLP metals analysis. Cadmium, chromium, copper, and lead exceeded the CT PMC regulatory standards, indicating the potential for leaching into groundwater. The SPLP exceedances were scattered throughout the property, from the ground surface to 6 feet bgs. Based on the data provided in Appendix C for this property, only two out of the seven SPLP samples were from within the estimated area of Raymark waste. Both samples exceeded the CT PMC for lead. No TCLP samples were collected.

Pesticides

Thirty-six soil samples were collected from the property for pesticide analysis. Pesticides were detected fairly frequently on the property. Dieldrin was the only pesticide exceeding the CT DEC. Sixteen soil samples exceeded the CT PMC regulatory standards for pesticides. Pesticide exceedances were located in the central and southern portions of the property from the ground surface to 8 feet bgs.

PCBs

Up to 79 soil samples were collected from the property for analysis of PCBs as Aroclors. PCBs were often detected on the property. Five samples exceeded the CT DEC regulatory standards for Total Aroclors. The PCB exceedances were located in the central and southern portions of the property from the surface to 6 feet bgs. Aroclor 1268 was the primary contributor to total Aroclor exceedances at three of the locations, SB-09, DBL-104 and DBL-106, at depths ranging from ground surface to 4 feet bgs; Aroclor 1254 was the primary contributor to total Aroclor exceedances at B2-SB02 and DBL-103, from 4 to 6 feet bgs. No samples were collected for SPLP PCB analysis.

SVOCs

Thirty-two soil samples were collected from the property for SVOCs analysis. SVOCs were detected frequently on the property. Fourteen samples exceeded the CT DEC and/or CT PMC regulatory standards for SVOCs. SVOC exceedances were scattered throughout the property, from the ground surface to 8 feet bgs.

VOCs

Seventeen soil samples were collected from the property for VOC analysis. VOCs were very rarely detected on the property. There were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from 14 sample locations at multiple depths indicate that Raymark waste is present on the property. The following table displays the locations and contaminant concentrations for the 17 samples from those 14 locations that meet the definition of Raymark waste on this property. These samples are located within the 34 percent of the property shown on Figure 3-1 as the "Estimated Area of Raymark Waste within Property of Interest".

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
DBL-008	0 to 0.5	50	1,470	NA	8,000
DBL-009	0 to 0.5	50	1,860	NA	6,000
DBL-010	0 to 0.5	10	760	NA	7,000
DBL-010	0 to 0.5	10	730	NA	7,000
DBL-012	0 to 0.5	10	880	NA	8,000
DBL-020	0 to 0.5	5	410	NA	2,000
DBL-023	0 to 0.5	40	1,210	NA	2,000
DBL-104	0 to 2	4	1,310	491	17,000
	2 to 4	3	450	230	4,300
DBL-106	0 to 2	15	415	307	8,600
B2-SB02	2 to 4	3	540	370	NA
	6 to 8	5	600	1,000	NA
B2-SB03	2 to 4	30	1,200	580	NA
	6 to 8	20	576	318	480
B2-SB05	6 to 8	10	10,600	7,870	2,200
B2-SB06	2 to 4	3	691	899	2,600
B2-SB09	2 to 4	20	1,700	2,520	7,200

NA- Contaminant was not analyzed

3.1.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas with Raymark waste. The primary pathways for migration of contaminants throughout this property are discussed below.

Approximately 34 percent of the 5.3-acre property is estimated to contain Raymark waste, shown on Figure 3-1 as the "Estimated Area of Raymark Waste within Property of Interest". Most of the waste areas on the property are heavily vegetated with phragmites and other wetland vegetation, with the exception of the waste areas abutting the road. The portion of the property abutting Lockwood Avenue consists of soil berms and is vegetated with shrubs and trees. Approximately 90 percent of the areas estimated to contain Raymark waste are located in the center of the property, while two smaller areas of waste are located along the southern and eastern boundaries of the property.

The wetland on the property contains Raymark waste; some of the waste areas abut both Ferry Creek and the Housatonic River. These wetlands also contain channels that receive tidal water and prevent flooding on the property. The wetlands are vegetated with reeds, thus slowing any overland transport of the sediments. The soils on the parcel are also vegetated, thus slowing any erosion of contaminants into the wetlands on the property or onto Lockwood Avenue.

There are no buildings or paved areas on the property, therefore, contaminants on the property may leach into the surface water and groundwater. For this property, as indicated by the SPLP and other data, metals, pesticides, and SVOCs could potentially leach into the groundwater at concentrations that would adversely impact groundwater quality.

3.1.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at the Lockwood Avenue Property that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on

the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste themselves. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.1.5.1 provides an overview of the Lockwood Avenue Property, Section 3.1.5.2 presents COPCs and EPCs, Section 3.1.5.3 contains information on the potential receptors considered in the HHRA and the routes by which they might be exposed, Section 3.1.5.4 contains the numerical results of the risk assessment, and Section 3.1.5.5 presents property-specific uncertainties. Section 3.1.5.6 presents a property-specific summary of the major risk findings.

3.1.5.1 Overview

The Lockwood Avenue Property is zoned as a partial waterfront business/partial retail property, but it is currently undeveloped. As described in the SRI report, a hotel/marina complex has been proposed as a possible future use of the property. The area covers approximately 5.3 acres. A detailed description of the Lockwood Avenue Property is provided in Section 3.1.1. The areas of the Lockwood Avenue Property estimated to contain Raymark waste represent an estimated 34 percent of the total 5.3-acre property and are shown in Figure 3-1. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.1.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for the target analytes detected in soils within the estimated areas of Raymark waste are summarized in Appendix B-1, Table 2.1.

3.1.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.1 presents a summary of the COPCs for quantitative risk assessment for the Lockwood Avenue Property soils from the estimated areas of Raymark waste to a depth of 15 feet bgs. Direct

exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. Soil data were compared to both industrial and residential COPC screening levels in order to address two different potential future uses of the Lockwood Avenue Property. Those chemicals with concentrations exceeding the industrial COPC selection criteria were selected as COPCs for the commercial worker evaluation. Those chemicals with concentrations exceeding the residential COPC selection criteria were selected as COPCs for the recreational visitor evaluation. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils at the estimated areas of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.1A:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene)
- Aroclors, total (1248, 1254, 1262, and 1268)
- Dieldrin
- Metals (antimony, arsenic, cadmium, chromium, thallium, and lead)
- Dioxins

The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils at the estimated areas of Raymark waste of this property to risk-based COPC screening levels for residential land use, as shown in Appendix B-1, Table 2.1B:

- Asbestos

- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene)
- Aroclors, total (1248, 1254, 1262, and 1268)
- Dieldrin
- Metals (antimony, arsenic, barium, cadmium, chromium, manganese, nickel, thallium, vanadium, zinc, and lead)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for the Lockwood Avenue Property are presented in Appendix B-1, Tables 3.1A and 3.1B. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.1.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the Lockwood Avenue Property and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under future conditions, potential human receptors (commercial workers and recreational visitors) are assumed to be exposed to soil only within the estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The Lockwood Avenue Property is currently an undeveloped area, zoned for waterfront business and retail use, as described in Section 3.1.1. A hotel/marina complex has been proposed as a possible future use of the property.

Potential Receptors

The receptors retained for quantitative evaluation at the Lockwood Avenue Property are future commercial workers and future recreational visitors. Potentially exposed individuals under the commercial scenario are limited to those who may work at the property in the future. Potentially exposed individuals under the recreational scenario include residents who may live nearby or visitors from other areas of Stratford or surrounding towns.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at the property. Under the future land use, commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated areas of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Frequent recreational visitors are evaluated for exposure to soils (0 to 15 feet bgs) in the estimated areas of Raymark waste, under future land use. Persons involved in recreational activities (the frequent recreational visitor) may visit the estimated areas of Raymark waste at Lockwood Avenue Property, thereby coming in contact with potentially contaminated soil. Possible exposures of frequent visitors to site-related contaminants would be through recreational activities, such as walking, or picnicking. Appendix B-1, Table 4.3A presents the exposure assumptions for adult recreational visitors at this and other recreational properties in the RI. Appendix B-1, Table 4.3B presents the exposure assumptions for child recreational visitors at this and other recreational properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at the Lockwood Avenue Property are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from the property is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. The estimated areas of Raymark waste are heavily vegetated with either phragmites or small shrubs and trees. The presence of vegetation reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at commercial and recreational properties. Appendix B-1, Tables 2.1A and 2.1B present available inhalation SSLs for contaminants in soils at the estimated areas of Raymark waste at the Lockwood Avenue Property.

With the exception of those reported for total chromium and dieldrin, all reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a). One sample result out of 15 exceeded the SSL_{AIR} for dieldrin and four sample results out of 15 exceeded the SSL_{AIR} for hexavalent chromium. The average dieldrin concentration detected in the Raymark waste soil samples (190 µg/kg) is less than the SSL_{AIR} for dieldrin (1000 µg/kg). The maximum detected concentration in the Raymark waste soil samples (3270 mg/kg) and the average total chromium concentration detected in the Raymark waste soil samples (410 mg/kg) are greater than the SSL_{AIR} for hexavalent chromium (280 mg/kg). Assuming that the maximum total chromium concentration represents only hexavalent chromium and comparing this maximum concentration to the SSL_{AIR} for chromium, the maximum concentration corresponds to a cancer risk level of approximately 1.2E-05 for residential receptors. This risk level is within EPA's cancer risk range of 10^{-4} to 10^{-6}.

Further evaluation of site-specific total chromium concentrations relative to inhalation SSLs for commercial/industrial land use (EPA, 2001a) reveals that the average total chromium concentration detected in the Raymark waste soil samples (410 mg/kg) is less than the commercial/industrial SSL_{AIR} for hexavalent chromium (510 mg/kg). The maximum detected concentration in the Raymark waste soil samples (3270 mg/kg) is greater than the commercial/industrial SSL_{AIR} for hexavalent chromium (510 mg/kg). Assuming that the maximum total chromium concentration represents only hexavalent chromium and comparing this maximum concentration to the SSL_{AIR} for chromium, the maximum concentration corresponds to a cancer risk level of approximately 6E-06 for commercial/industrial receptors. This risk level is within EPA's cancer risk range of 10^{-4} to 10^{-6}.

The SSL_{AIR} for chromium assumes that chromium is present in the hexavalent state. The assumption that all chromium is in the hexavalent state is likely to be a conservative assumption.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.1.5.4. Asbestos is present in soils within the estimated areas of Raymark waste at the Lockwood Avenue Property. The presence of vegetation and the qualitative comparison to SSLs, suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. Appendix B-1, Table 4.3A and Table 4.3B contain the various assumptions used as input parameters to determine chemical intakes for adult and child recreational visitors through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) is factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for the Lockwood Avenue Property is 0.34. Chemical intake estimates for the commercial scenario at the property are provided in Appendix B-1, Tables 7.1A and 8.1A. Chemical intake estimates for the recreational scenario at the property are provided in Appendix B-1, Tables 7.1B, 7.1C, 8.1B, and 8.1C.

3.1.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for the Lockwood Avenue Property is provided in this section. For the commercial scenario, Appendix B-1, Table 7.1A and Table 8.1A present non-cancer and cancer RME risk estimates, respectively. Appendix B-1, Tables 7.1B and 8.1B present non-cancer and cancer RME risk estimates for adult recreational visitors. Appendix B-1, Tables 7.1C and 8.1C present non-cancer and cancer RME risk estimates for child recreational visitors.

Children represent the more sensitive population for non-cancer risks. For cancer risks the risks to children and adults are added to produce an estimate of risks from lifetime recreational exposures. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Tables 9.1A, 9.1B, and 9.1C. Appendix B-1, Tables 10.1A, 10.1B, and 10.1C reduce the information developed in Appendix B-1, Tables 9.1A, 9.1B, and 9.1C to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker and the recreational visitor at the Lockwood Avenue Property were as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	1.3	0.87	2.1
Frequent Recreational Visitor – Adult (Future)	0.78	0.32	1.1
Frequent Recreational Visitor – Child (Future)	7.2	2.1	9.3

The RME hazard indices (HI) for the commercial worker and for both the child and the adult frequent recreational visitors exposed to soils within the estimated areas of Raymark waste at the property are in excess of unity. Total Aroclor was the main contributor to the hazard index for the commercial worker. Total Aroclor and chromium were the main contributors to the hazard index for the frequent recreational visitors. The chemical-specific (and target-organ specific) hazard quotients for total Aroclor alone are in excess of unity for both commercial receptors and recreational receptors. The chemical-specific (and target-organ specific) hazard quotients for total chromium alone are in excess of unity for recreational receptors. Adverse non-carcinogenic health effects are possible from exposure to Aroclors and chromium. See Tables 7.1A RME, 7.1B RME, and 7.1C RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker and the recreational visitor at the Lockwood Avenue Property were as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	2.9E-05	2.0E-05	4.8E-05
Frequent Recreational Visitor – Adult[(1)] (Future)	1.7E-05	6.8E-06	2.3E-05
Frequent Recreational Visitor – Child[(1)] (Future)	3.9E-05	1.1E-05	5.0E-05

1) Summation of total risk for Frequent Recreational Visitors (adult plus child): 7.3E-05.

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. Cancer risks for the frequent adult and child recreational visitor are added together for a lifetime exposure. The RME risk estimates for the commercial worker and the frequent recreational visitors exposed to soils at the estimated areas of Raymark waste at the Lockwood Avenue Property fall within the EPA cancer risk range (10^{-4} to 10^{-6}), but exceed the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Tables 8.1A RME, 8.1B RME, and 8.1C RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.1A, dioxins, Aroclors, arsenic, and the PAH compounds (benzo(a)pyrene and dibenzo(a,h)anthracene) are the predominant risk drivers for the commercial scenario, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}. As detailed on Appendix B-1, Tables 9.1B and 9.1C, dioxins, Aroclors, arsenic, dieldrin, and the PAH compounds (benzo(a)pyrene and dibenzo(a,h)anthracene) are the predominant risk drivers for the recreational scenario, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}. In addition to the above risks, cancer risks from inhalation of chromium in dust may be as great as 6E-6 for commercial workers and 1.2E-5 for recreational visitors (see discussion in Section 3.1.5.3).

Cancer risk estimates for dioxins, shown on the tables referenced above and included in the discussion above, were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 7.3E-05. Total cancer risks

estimated using the Draft Dioxin Reassessment CSF for dioxin for recreational visitors exposed to soils within the estimated area of Raymark waste at this property are 1.1E-04.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste at the Lockwood Avenue Property. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 10,600 mg/kg. The average lead concentration in this dataset was 785 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 785 mg/kg for soils within the estimated areas of Raymark waste at the property was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) is factored into the intake equations shown in Appendix B-10. The FRW for the Lockwood Avenue Property is 0.34. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated areas of Raymark waste at the property, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 0.5 to 1.2 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to lead in soil by the frequent child recreational visitor was evaluated using the EPA IEUBK Model, as discussed in Section 2.7.4.7. The IEUBK model was developed to evaluate exposures to lead by children in a residential setting. Consequently, using the IEUBK model for child recreational exposures should provide a very conservative evaluation of exposures to lead. The time-weighted exposure point concentration of 267 mg/kg (average lead concentration for soil within the estimated areas of Raymark waste of 785 multiplied by the FRW of 0.34), as well as several default parameters, was used to estimate blood-lead levels for children in a residential setting. The estimated geometric mean blood-lead level for children exposed to lead in soils within the estimated areas of Raymark waste was 4.0 µg/dL, which is less than the established level of concern of 10 µg/dL. The IEUBK model estimates that 2.5 percent of

children exposed to lead in soils at the estimated areas of Raymark waste at the property are expected to have blood-lead levels greater than 10 µg/dL, which is less than the acceptable level of 5 percent. The input parameters used and the results of the IEUBK lead models, estimated blood-lead levels, and probability density histograms are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 41 of 52 soil samples collected from the estimated areas of Raymark waste at a concentration range of 1 to 50 percent. These samples were collected from the 0- to 15-foot bgs interval. The average concentration was 7 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos from the Lockwood Avenue Property. Based on field conditions in the estimated areas of Raymark waste at the property, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.1.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the Lockwood Avenue Property are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the

identification of samples meeting the definition of Raymark waste includes accuracy and precision of the analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 3.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the Lockwood Avenue Property is 5.3 acres, with an estimated 34 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.1.4. The estimated areas of Raymark waste are heavily vegetated with phragmites or small shrubs and trees. No consideration has been given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated areas of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 34 percent of the time, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately three times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown in Appendix B-1, Table 2.1, alongside site-specific data from the estimated areas of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 2.6 to 56 mg/kg, with an average concentration of 12 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Fifty-seven samples were included in the dataset for soils within the estimated areas of Raymark waste; however, 42 of those samples were only analyzed by field-screening methods. Due to limited numbers of samples analyzed for dioxins, PAHs

(benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene), and antimony, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-10. The presence of arsenic, chromium, acetophenone, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, Aroclors, and dieldrin at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Arsenic is present outside the estimated areas of Raymark waste at the Lockwood Avenue Property at concentrations up to 13.8 mg/kg, chromium is present at concentrations up to 126 mg/kg, acetophenone is present at concentrations up to 0.05 mg/kg, benzo(a)anthracene is present at concentrations up to 10 mg/kg, benzo(a)pyrene and benzo(b)fluoranthene are present at concentrations up to 13 mg/kg, dibenzo(a,h)anthracene is present at concentrations up to 1.1 mg/kg, dieldrin is present at concentrations up to 1.7 mg/kg, and Aroclors are present at concentrations up to 133 mg/kg. The individual Aroclors detected are Aroclors 1254, 1262, and 1268. Dioxins were detected outside the estimated areas of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin TEQ concentrations outside the estimated areas of Raymark waste exceed EPA Region IX PRGs for industrial soil in two samples. Asbestos is present outside the estimated areas of Raymark waste at the Lockwood Avenue Property at concentrations up to 30 percent. Lead and copper are also present outside of the estimated areas of Raymark waste at the property, with maximum concentrations of 820 mg/kg and 1,100 mg/kg, respectively. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

3.1.5.6 Summary of Human Health Risk Assessment

This section presents a summary of major risk assessment findings for soils estimated to contain Raymark waste at the Lockwood Avenue Property. Risks to future commercial workers and both child and adult recreational visitors were estimated.

- The RME hazard indices (HI) for future commercial workers and both child and adult recreational visitors exposed to soil within the estimated areas of Raymark waste at the property are in excess of unity. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor and chromium alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposures to Aroclors and chromium.

- The RME cancer risk estimates for future commercial workers and both child and adult recreational visitors exposed to soil within the estimated areas of Raymark waste at the property fall within the EPA cancer risk range (10^{-4} to 10^{-6}) but exceed the CT DEP target total risk level of 10^{-5}. Dioxins, Aroclors, arsenic, dieldrin, and the PAH compounds (benzo(a)pyrene and dibenzo(a,h)anthracene) are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are not anticipated for fetuses of pregnant workers exposed to lead in soil within the estimated areas of Raymark waste at the property.

- Exposure to lead in soil by child recreational visitors was evaluated by use of the IEUBK model. The results of the model indicate that adverse effects are not anticipated for child recreational visitors exposed to lead in soil within the estimated areas of Raymark waste at the property.

- Asbestos was detected in 41 of 52 soil samples collected from the estimated areas of Raymark waste at the Lockwood Avenue Property in the 0- to 15- foot bgs interval at a concentration range of 1 to 50 percent. The average concentration was 7 percent.

3.1.6 Ecological Evaluation

The ecological characterization of the wetlands on this property was addressed under the OU3 Area II RI (TtNUS, 2000a) and is presented in the *Draft Technical Memorandum Wetlands Evaluation, Raymark – Ferry Creek – OU3* (B&RE, 1998). A summary of the findings is presented below. It should be noted however, that no individual evaluation of the ecological impacts on this property was performed.

Most of the area has been significantly disturbed by surrounding development, past uses of Ferry Creek, and filling of wetlands. The wetland areas on the property are dominated by common reed. Upland areas are primarily covered with small trees and shrubs, especially along the soil berm ridge. Woody upland vegetation consists of staghorn sumac (*Rhus typhina*) and quaking aspen. Observations indicate that dredge spoils from Ferry Creek have been deposited in the wetland.

The 1998 wetland evaluation identified six functions exhibited by the vegetated portion of these wetlands. These include flood/flow alteration, sediment shoreline stabilization, sediment/ toxicant retention, groundwater recharge/discharge, nutrient export, and nutrient removal/retention/ transformation.

The property can provide foraging, cover, resting, and breeding habitat for a variety of song and shore birds, small mammals, and reptiles. However, the habitat quality is limited because of the surrounding development, soil contamination, disturbed nature of the area, and the low vegetation diversity. Wildlife identified utilizing the wetland include red-winged blackbird (*Agelaius phoeniceus*) and green heron (*Butorides striatus*). Other wildlife utilize nearby Ferry Creek and are identified in the Wetland Evaluation (B&RE, 1998b).

3.1.7 Summary

This 5.3-acre property abutting the Ferry Creek and Housatonic River confluence contains Raymark waste. Samples containing metals (including total metals and SPLP metals), pesticides, PCBs and SVOCs that exceed CT DEC and/or CT PMC criteria, and asbestos greater than 1 percent are present on the property. Given the current undeveloped property conditions, infiltration and leaching is likely occurring throughout the property.

RME hazard indices for commercial workers and recreational visitors exposed to soil within the estimated areas of Raymark waste indicate that adverse non-carcinogenic health effects are possible. The RME cancer risk estimates fall within the EPA cancer risk range, but exceed the CT DEP target total risk level. Dioxins, Aroclors, arsenic, dieldrin, benzo(a)pyrene, and dibenzo(a,h)anthracene are the predominant risk drivers. Adverse effects are not anticipated for fetuses or pregnant workers exposed to lead in soil within the estimated areas of Raymark waste. The average asbestos concentration was 7 percent in the estimated areas of Raymark waste.

Ecological risks were presented in the OU3 Area II RI (TtNUS, 2000a).

TABLE 3-1
LOCKWOOD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	75	121	4	6	Trace	50	1	44		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	16	16	0.64	0.64	0.01892 J	6.27934 J				
1,2,3,4,6,7,8-HpCDF	16	16	0.33	0.33	0.0135 J	1.31179 J				
1,2,3,4,7,8,9-HpCDF	8	16	0.011	0.013	0.000659 J	0.0507				
1,2,3,4,7,8-HxCDD	7	16	0.0044	0.0029	0.000654	0.00917 J				
1,2,3,4,7,8-HxCDF	14	16	0.1	0.12	0.00277	0.53548 J				
1,2,3,6,7,8-HxCDD	8	16	0.0097	0.014	0.00157 J	0.04341 J				
1,2,3,6,7,8-HxCDF	11	16	0.031	0.039	0.00118	0.13794 J				
1,2,3,7,8,9-HxCDD	6	16	0.0073	0.0064	0.00155 J	0.0154 J				
1,2,3,7,8,9-HxCDF	9	16	0.04	0.069	0.0039 J	0.29296 J				
1,2,3,7,8-PeCDD	4	15	0.0024	0.002	0.000571 J	0.00595 *				
1,2,3,7,8-PeCDF	5	16	0.22	0.69	0.00749 J	3.2535				
2,3,4,6,7,8-HxCDF	7	16	0.019	0.036	0.00099 J	0.085 J				
2,3,4,7,8-PeCDF	15	16	0.059	0.063	0.00143 *	0.35297 J				
2,3,7,8-TCDD	1	16	0.001	0.00028	0.000275 *	0.000275 *				
2,3,7,8-TCDF	14	16	0.056	0.064	0.00266 J	0.31793 J				
OCDD	16	16	2.5	2.5	0.2443 J	10.87169 J				
OCDF	16	16	0.37	0.37	0.022 J	1.235 J				
Total HpCDD	16	16	1.5	1.5	0.01892 J	13.24973 J				
Total HpCDF	16	16	0.82	0.82	0.0283 J	2.9384 J				
Total HxCDD	11	16	0.038	0.053	0.00526 J	0.21285 J				
Total HxCDF	16	16	0.91	0.91	0.0185 J	2.93335				
Total PeCDD	4	15	0.002	0.0018	0.00062 J	0.00398 J				
Total PeCDF	16	16	0.87	0.87	0.021 J	5.42313				
Total TCDD	5	16	0.0036	0.0098	0.000225 J	0.0257 EMPC				
Total TCDF	14	16	0.57	0.65	0.0213 J	3.89387				
Toxicity Equivalency	16	16	0.078	0.078	0.001935 J	0.350845 J				

TABLE 3-1 (cont.)
LOCKWOOD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	36	36	12000	12000	3220	38900 J				
Antimony	6	22	7.2	17.1	1.1 J	51.4	8200	0		
Arsenic	31	36	7.7	8.7	1.5 J	56	10	6		
Barium	36	36	445	445	5.1	3770 J	140000	0		
Beryllium	20	36	0.59	0.83	0.15	5.6	2	1		
Cadmium	24	36	5.4	7.8	0.22	149	1000	0		
Calcium	26	36	4560	5960	1230	37000 J				
Chromium	32	36	192	212	3.6 J	3270 J	100	9		
Cobalt	36	36	8.5	8.5	1.5	23.8	2500	0		
Copper	63	107	348	489	8.3 J	7870 J	76000	0		
Iron	36	36	23800	23800	3960	68100 J				
Lead	94	131	444	599	5.3 J	10600 J	1000	12		
Magnesium	36	36	7120	7120	1140	31600				
Manganese	36	36	236	236	41.2	722 J	47000	0		
Mercury	20	36	0.4	0.66	0.11 J	2.3	610	0		
Nickel	36	36	41.1	41.1	2.9	457 J	7500	0		
Potassium	27	36	2680	3130	560 J	21700 J				
Selenium	5	36	0.82	1.4	0.7 J	3.7 J	10000	0		
Silver	13	35	0.86	1.2	0.38 J	2.9	10000	0		
Sodium	30	36	8630	10300	304 J	187000 *				
Thallium	2	36	1.3	5.3	2.2	8.4	160	0		
Vanadium	36	36	41.1	41.1	7	224	14000	0		
Zinc	36	36	360	360	10.4 J	5930	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	6	6	35600	35600	12000	72900				
Antimony	4	7	13.7	22.6	5	39.4			60	0
Arsenic	7	7	46.8	46.8	0.99 J	112			500	0
Barium	7	7	771	771	37.2 J	2240 J			10000	0
Beryllium	6	7	4.6	5.4	1.3	13.8			40	0

TABLE 3-1 (cont.)
LOCKWOOD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Cadmium	6	7	24.7	28.8	1.4	121			50	1
Calcium	6	6	93200	93200	18500 J	295000				
Chromium	7	7	516	516	2.2 J	2560 J			500	2
Cobalt	6	6	46.8	46.8	6.4	132				
Copper	7	7	3660	3660	48.5 J	14600 J			13000	1
Iron	6	6	47400	47400	7610 J	112000 J				
Lead	7	7	4740	4740	24.1	14600 J			150	5
Magnesium	6	6	22900	22900	13700	29000				
Manganese	6	6	1390	1390	163 J	4020				
Mercury	3	7	0.52	1.1	0.25 J	2.1			20	0
Nickel	7	7	197	197	3.6	630 J			1000	0
Potassium	6	6	14800	14800	7100	18700 J				
Sodium	6	6	83200	83200	27700	138000				
Thallium	2	7	4.3	8.6	7.8	9.3			50	0
Vanadium	7	7	166	166	2.6	492			500	0
Zinc	6	7	2770	3230	161	10300			50000	0
Semivolatile Organic Compounds (UG/KG)										
2,4-Dimethylphenol	3	31	550	1500	130 J	4100	2500000	0	28000	0
2-Methylnaphthalene	7	31	380	98	23 J	260 J	2500000	0	9800	0
2-Methylphenol	1	31	480	680	680	680	2500000	0	70000	0
4-Methylphenol	4	31	460	380	35	1400	2500000	0	7000	0
Acenaphthene	10	31	380	220	28 J	690 J	2500000	0	84000	0
Acenaphthylene	25	32	740	870	28 J	4300 *	2500000	0	84000	0
Acetophenone	2	5	410	38	25 JEB	50 JEB				
Anthracene	25	32	660	760	33 J	3700	2500000	0	400000	0
Benzaldehyde	3	5	380	36	24 JEB	50 JEB				
Benzo(a)anthracene	30	32	1500	1600	44 J	10000	7800	2	1000	13
Benzo(a)pyrene	30	32	1300	1400	51 J	13000 *	1000	10	1000	10
Benzo(b)fluoranthene	30	32	1800	1900	50 J	13000 *	7800	2	1000	13

TABLE 3-1 (cont.)
LOCKWOOD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Benzo(g,h,i)perylene	19	31	660	830	23 J	5300	2500000	0	42000	0
Benzo(k)fluoranthene	29	32	1200	1300	51 J	5700 J	78000	0	1000	12
bis(2-Ethylhexyl)phthalate	20	32	710	900	35 J	10000 *	410000	0	11000	0
Butylbenzylphthalate	2	31	440	60	22 J	99 J	2500000	0	200000	0
Carbazole	20	32	290	290	30 J	1300	290000	0	360	4
Chrysene	30	32	2000	2100	60 J	15000 *	780000	0	1000	13
Dibenzo(a,h)anthracene	21	32	340	280	30 J	1100 J	780	1	1000	1
Dibenzofuran	10	31	390	250	31 J	640 J	2500000	0	5600	0
Diethylphthalate	1	31	440	30	30	30	2500000	0	1100000	0
Dimethylphthalate	1	31	550	2900	2900	2900	2500000	0	1100000	0
Di-n-Butylphthalate	6	31	420	210	22 JEB	600 J	2500000	0	140000	0
Di-n-octylphthalate	1	31	460	120	120 J	120 J	2500000	0	20000	0
Fluoranthene	30	32	3500	3700	100 J	23000	2500000	0	56000	0
Fluorene	17	32	330	370	24 J	1900	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	29	32	650	680	36 J	4500	7800	0	1000	5
Naphthalene	9	31	390	170	38 J	410	2500000	0	56000	0
N-Nitroso-diphenylamine	1	31	470	410	410 J	410 J	1200000	0	1400	0
Pentachlorophenol	2	31	1100	180	150 J	200 J	48000	0	1000	0
Phenanthrene	30	32	2000	2100	44 J	15000	2500000	0	40000	0
Phenol	5	27	460	380	77 JEB	1200	2500000	0	800000	0
Pyrene	30	32	2600	2800	99 J	20000 *	2500000	0	40000	0
Total PAH	5	5	17000	17000	541	36080				
Volatile Organic Compounds (UG/KG)										
2-Butanone	8	17	86	170	2 J	1300 J	1000000	0	80000	0
Acetone	4	17	120	430	62	1500 J	1000000	0	140000	0
Carbon Disulfide	6	16	11	15	3 J	31	1000000	0	140000	0
Styrene	1	17	9	10	10 J	10 J	1000000	0	20000	0
Toluene	3	17	10	11	1 J	28 J	1000000	0	67000	0

TABLE 3-1 (cont.)
LOCKWOOD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

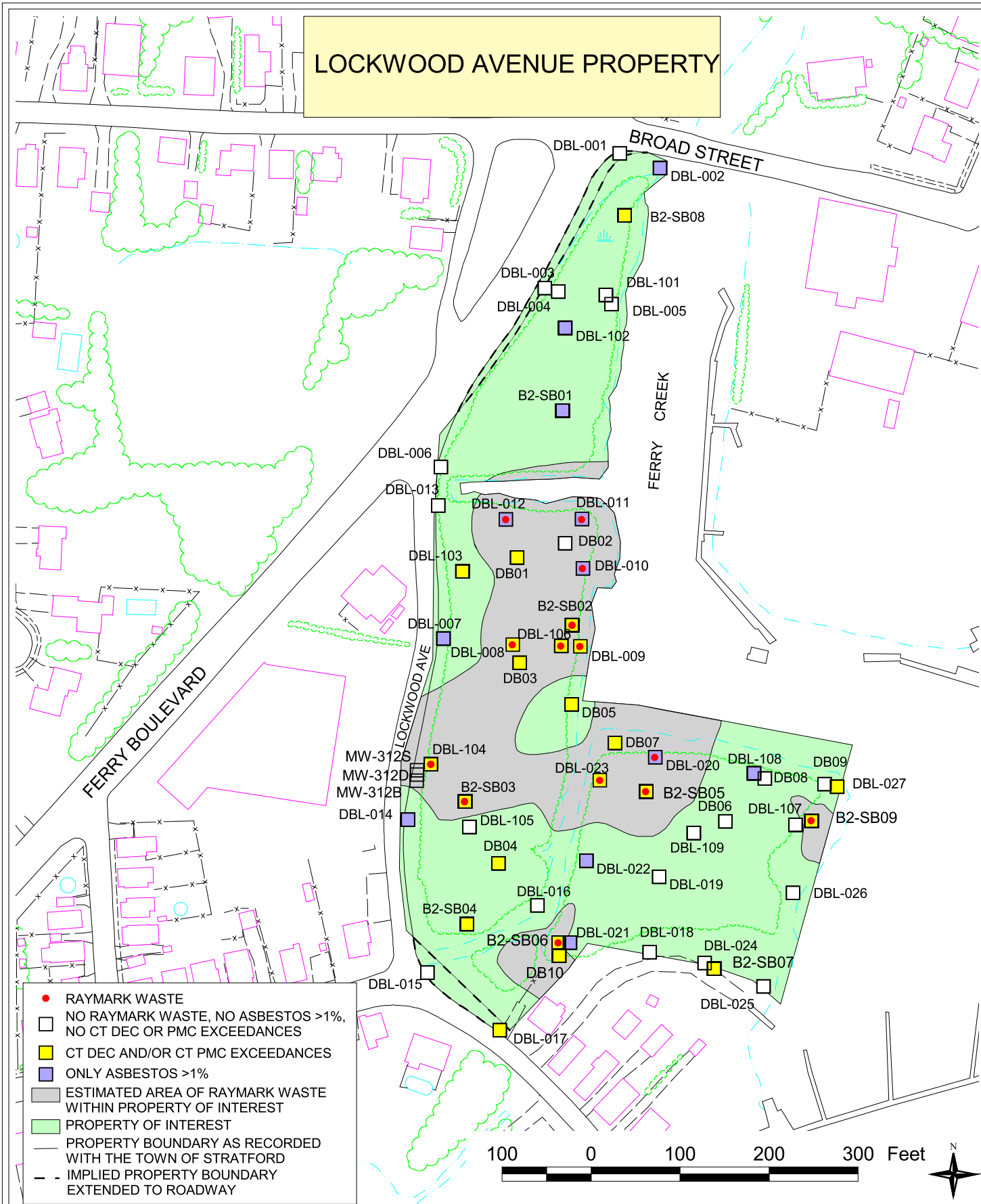
PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG)										
4,4'-DDD	10	36	77	240	0.48 J	2100 *	24000	0	29	4
4,4'-DDE	13	36	62	150	0.12 J	1700 *	17000	0	21	4
4,4'-DDT	10	35	39	110	0.35 J	730	17000	0	21	5
Aldrin	5	36	5.8	0.92	0.05 J	3 J	340	0	0.41	3
alpha-BHC	4	36	5.7	0.24	0.14 J	0.36 J	910	0	1.1	0
alpha-Chlordane	16	36	41	88	0.05 J	1200	2200	0	66	2
Aroclor, Total(4)	57	79	4600	6400	20	130000	10000	5		
Aroclor, Total (Conservative)(5)	57	79	5300	7300	186	133410	10000	5		
Aroclor-1248	2	40	150	840	280	1400	10000	0		
Aroclor-1254	13	79	3000	17000	110	130000 *	10000	2		
Aroclor-1260	3	79	170	330	250	500	10000	0		
Aroclor-1260/62	2	27	140	380	250	500				
Aroclor-1262	21	55	640	1500	53 J	5700 J	10000	0		
Aroclor-1268	52	79	1400	2100	20 J	17000 J	10000	1		
delta-BHC	1	36	5.8	0.74	0.74 J	0.74 J	910	0	1.1	0
Dieldrin	15	35	140	310	0.65 J	2600 J	360	2	7	11
Endosulfan I	1	36	6.1	6.1	6.1	6.1	1200000	0	8400	0
Endosulfan Sulfate	6	36	29	110	0.8 J	490	1200000	0	8400	0
Endrin	3	36	13	29	0.35 J	86	610000	0		
Endrin Aldehyde	9	35	51	160	0.39 J	1200	610000	0		
Endrin Ketone	2	36	12	3.6	0.33 J	6.9	610000	0		
gamma-Chlordane	10	33	33	93	0.38 J	840 *#	2200	0	66	1
Heptachlor Epoxide	6	35	5.6	0.33	0.05 J	1 J	630	0	20	0
Total Organic Carbon (MG/KG)										
Total Organic Carbon	10	10	86000	86000	22500	205000				

TABLE 3-1 (cont.)
LOCKWOOD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-1
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C:\...\OU6_RI_2003.APR	

3.2 200 Ferry Boulevard

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.2.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.2.1 Property Description

This property, approximately 0.6 acres of commercially-zoned (retail) land, is located on Ferry Boulevard in Stratford, Connecticut (Town of Stratford, 1997). It is currently occupied by two businesses. The two-story wooden building that houses the businesses is located at the northern end of the property. Approximately 80 percent of the area around the building is paved and used for parking. The asphalt pavement is in fair condition with minor cracks. The paved area extends to the tree line along the bank of Ferry Creek where a narrow strip of dense shrub and tree vegetation is present. The topography of this property is flat with a sharp drop off to the Ferry Creek channel. A narrow strip of grass is also present along Ferry Boulevard.

Public access to the area is not restricted, although signs discouraging trespassing in Ferry Creek due to the presence of a potential health threat were posted by the Stratford Health Department. Ferry Creek borders the eastern edge of the property, while a commercial property at 190 Ferry Boulevard borders to the south, Ferry Boulevard borders to the west, and the 230 Ferry Boulevard (see Section 3.3) commercial property borders to the north.

No storm water drains were observed at the property. It appears that surface water drains into Ferry Creek, which lies east of the property.

3.2.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of this property are located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for this property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Nine soil borings (FB200-101 through FB200-106, SPIM-103, SP-MW103M, and SP-MW103B) have been advanced on the property at 200 Ferry Boulevard. Soils were not described at boring SP-MW103M. Soil borings FB200-101 through FB200-106 and SPIM-103 were advanced to depths up to 16 feet bgs. Soil boring SP-MW103M was advanced to 38.5 feet bgs. Soil boring SP-MW103B was advanced to bedrock and cored into bedrock. Based on the borings, fill materials overlie silt, clayey sand, silty sand, organic silt, or clay. These materials are characteristic of a former marsh and swamp deposit. Organic soils were not encountered in soil boring FB200-104. This boring was terminated before the bottom of fill was determined because the drilling location may have been in a leachfield. Layers of sand, silt, and gravel beneath the former marsh and swamp deposit in boring SP-MW103B are characteristic of outwash sediments. Refer to Figure 3-2 for boring locations on the property. Boring logs are presented in Appendix A.

Two monitoring wells (MW-103B and MW-103M) were installed in the northeast corner of the property to allow for evaluation of groundwater contaminants. No soil samples were collected from MW-103M and it is not shown on Figure 3-2. Soil sample locations are shown on Figure 3-2, including both shallow surface soil samples and deeper samples from soil borings. The borings were used to describe the fill and native material on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials encountered in borings included potentially asbestos-containing material (PACM), fibrous tiles, asphalt, ash, concrete, glass, roofing shingles, sludge-like processed-waste, and/or wood. PACM was identified in all of the borings containing manmade material. These materials were encountered with natural fill materials consisting of sand with varying amounts of silt and trace amounts of gravel and clay. Additionally, debris was also observed in the natural organic silt and clay layers encountered in FB200-103 (5.5 to 10 feet bgs) and SP-MW103B (8 to 10 feet bgs). Fill classifications were based on the visual characteristics of the soil samples that were collected during several field investigations. Based on interpretations and field observations, fill was identified in borings across the property. The depth to water on the property ranges from 5 to 9 feet bgs, based on the soil moisture content recorded on the boring logs and on 2003 water level measurements from the monitoring wells on the property.

Raymark waste was found in fill materials on this property. The lateral limits of the area of Raymark waste have been estimated by the presence of asbestos, lead, copper and/or Aroclor 1268 that meet the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-2. Approximately seven percent of the property is estimated to contain Raymark waste. Approximately 70 percent of the estimated area of Raymark waste is paved.

3.2.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. Results of samples from all depths, including those collected from below the water table, are compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. Comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. Comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 77 soil samples collected from 20 locations on this property. Sample locations, with exceedances of the CT DEC and CT PMC, are indicated on Figure 3-2. Samples were analyzed for asbestos, dioxins, metals, SPLP and TCLP metals, pesticides, PCBs, SVOCs and VOCs. See Table 3-2 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-2 for the soil data summary statistics and comparison criteria. The discussion below includes all soil samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Seventy-seven soil samples were collected from the property and analyzed for asbestos. Asbestos was detected frequently on the property. Asbestos at 1 percent or greater was found in 32 of the 77 samples; these samples were distributed throughout the property from the ground surface to 12 feet bgs.

Dioxins

Five soil samples were collected from the property for dioxin analysis. Dioxins were detected in four of the five samples. Concentrations ranged from 0.010 µg/kg to 0.665813 µg/kg. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ.

Metals

Soil samples were collected from the property and analyzed for metals as follows: seven samples were analyzed in a fixed laboratory; 37 samples were screened for copper, and 70 samples were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium and sodium. As shown on Table 3-2, chromium exceeded the CT DEC regulatory standard in three samples collected in the northeast area of the property at a depth of 2 to 6 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, one soil sample was collected for SPLP metals analysis and one sample for TCLP metals analysis. No SPLP or TCLP samples were collected from within the estimated area of Raymark waste. There were no exceedances of the CT PMC regulatory standard for either analysis.

Pesticides

Six soil samples were collected from the property for pesticides analysis. Pesticides were detected sporadically on the property. There were no CT DEC regulatory exceedances. Four samples exceeded the CT PMC regulatory standards for pesticides. Pesticide exceedances were located in the northeastern portion of the property, from the ground surface to 4 feet bgs.

PCBs

Seventy-three soil samples were collected from the property for analysis of PCBs as Aroclors. PCBs were not detected frequently on the property. There were no PCB exceedances of the CT DEC regulatory standards. There were no SPLP/TCLP samples collected for PCBs on this property.

SVOCs

Five soil samples were collected from the property for SVOCs analysis. SVOCs were detected sporadically on the property. Four SVOCs, primarily PAHs, exceeded the CT DEC and/or CT PMC regulatory standards. SVOC exceedances were located in the northern area of the property, from the ground surface to 6 feet bgs.

VOCs

Five soil samples were collected from this property for VOCs analysis. VOCs were sporadically detected on the property. There were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from two sample locations indicated the presence of Raymark waste on the property. The following table displays the locations and constituents of the two samples with contaminant concentrations that meet the definition of Raymark waste on this property. These samples are located within the 7 percent of the property shown on Figure 3-2 as the “Estimated Area of Raymark Waste within Property of Interest”.

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
FB-200-101	2 to 4	25	438	444	2,700
SPIM-103	2 to 4	10	817	1,100	3,400

3.2.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas with Raymark waste. The primary pathways for migration of contaminants throughout this property are discussed below.

Approximately 7 percent of the 0.6-acre property was estimated to contain Raymark waste. This waste area is near Ferry Boulevard along the western edge of the property and is entirely paved (see Figure 3-2). It is assumed that minimal erosion and moderate leaching is occurring due to cracks in the pavement and the permeability of the pavement. The portion of the property along Ferry Creek is unpaved, but is not within the estimated area of Raymark waste.

The presence of the building in the northern part of the property reduces the leaching potential in that area of the parcel. However, soil data collected from the property indicates that there is a potential for pesticides and SVOCs to leach into groundwater from contaminated soils. According to the SPLP soil data collected, there appears to be little potential for metals to leach into groundwater at concentrations that would adversely impact groundwater quality. Potential leaching is hindered where pavement or building structures are present.

3.2.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at 200 Ferry Boulevard that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the

FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at 200 Ferry Boulevard may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.2.5.1 provides an overview of the 200 Ferry Boulevard property, Section 3.2.5.2 presents COPCs and EPCs, Section 3.2.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.2.5.4 contains the numerical results of the risk assessment, and Section 3.2.5.5 presents property-specific uncertainties. Section 3.2.5.6 presents a property-specific summary of the major risk findings.

3.2.5.1 Overview

200 Ferry Boulevard is a commercial property of approximately 0.6 acres. A detailed description of 200 Ferry Boulevard is provided in Section 3.2.1. The nature and extent of the contamination detected at 200 Ferry Boulevard is discussed in Section 3.2.3. The area of 200 Ferry Boulevard estimated to contain Raymark waste represents an estimated 7 percent of the total 0.6-acre property, exclusive of any buildings, and is shown in Figure 3-2. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.2.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 200 Ferry Boulevard are summarized in Appendix B-1, Table 2.2.

3.2.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.2 presents a summary of the COPCs for quantitative risk assessment for 200 Ferry Boulevard soils from the estimated area of Raymark waste to a depth of 10 feet bgs. No samples were collected from more than 10 feet bgs within the estimated area of Raymark waste based on property-specific field conditions. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening

levels defined in Section 2.7.2. Only eight samples from two locations at 200 Ferry Boulevard were included within the estimated area of Raymark waste. These samples were collected from depths of 0 to 10 feet bgs and only analyzed using field-screening methods. Field-screening data for metals and asbestos were used to identify COPCs. As described in Appendix B-3, field-screening data for PCBs are inadequate for quantitative risk assessment purposes.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.2:

- Asbestos
- Lead

Because only lead and asbestos have been identified as COPCs for this property, no evaluation of hazard indices or cancer risks was performed. This risk assessment consists of a lead evaluation and a qualitative discussion of asbestos sample results.

Exposure Point Concentrations

Exposure point concentrations used in the lead evaluation for 200 Ferry Boulevard are presented in Appendix B-10, Table 2.

3.2.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 200 Ferry Boulevard. Under current and future conditions, potential human receptors (commercial workers) are assumed to be exposed to soil only within the estimated area of Raymark waste at the property.

Land Use and Access

The property at 200 Ferry Boulevard is a commercial property, as described in Section 3.2.1.

Potential Receptors

The receptors retained for quantitative evaluation at 200 Ferry Boulevard are current and future commercial workers. Potentially exposed individuals are limited to those who work at the property.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at the property. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 10 feet bgs) at a limited area (soils within the estimated area of Raymark waste) only. Appendix B-10, Table 2 presents the exposure assumptions for commercial workers used in the lead evaluation.

Exposure Pathways

The primary routes of exposure for potential human receptors at 200 Ferry Boulevard are incidental ingestion of and dermal contact with soil. Potential exposure to volatile emissions and fugitive dust from the property is considered to be minimal. The portion of the property shown as the estimated area of Raymark waste is entirely paved. The presence of pavement reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposure to asbestos is presented in Section 3.2.5.4. Asbestos is present in soils within the estimated area of Raymark waste at 200 Ferry Boulevard. The presence of pavement suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

3.2.5.4 Risk Characterization

A summary of the quantitative lead evaluation and the qualitative asbestos evaluation for 200 Ferry Boulevard is provided in this section. Results of the evaluations of lead exposures are presented in Appendix B-10.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste at the property. Lead was detected in samples collected from 0 to 10 feet bgs within the estimated area of Raymark waste at a maximum concentration of 817 mg/kg. The average lead concentration in this dataset was 213 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 213 mg/kg for soil within the estimated area of Raymark waste at 200 Ferry Boulevard was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 200 Ferry Boulevard is 0.07. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated area of Raymark waste at 200 Ferry Boulevard, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 0.2 to 0.6 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in all soil samples collected from the estimated area of Raymark waste at a concentration range of 2 to 25 percent. These samples were collected from the 0- to 10-foot bgs interval. The average concentration was 10 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be

noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement in the estimated area of Raymark waste reduces the potential for airborne asbestos at 200 Ferry Boulevard. Based on field conditions in the estimated area of Raymark waste at the property, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.2.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 200 Ferry Boulevard are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 200 Ferry Boulevard property is 0.6 acres, with an estimated 7 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.2.4. The waste area is near Ferry Boulevard along the edge of the property and is entirely paved. No consideration has been given to site characteristics

other than the presence of buildings. Because of the small size of the estimated area of Raymark waste, it is unlikely that individuals will spend all of their time within that area. However, if that were the case, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately 14 times greater than those estimated using the FRW factor.

- Only two locations at 200 Ferry Boulevard were identified as meeting the definition of Raymark waste. A total of eight samples were collected from these two locations. Use of such small datasets adds uncertainty to the risk assessment.

- The samples were only analyzed using field-screening methods. Risk estimates for exposures to the estimated area of Raymark waste were limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. For 200 Ferry Boulevard, sample analyses were limited to lead, copper, and asbestos. Eight samples within the estimated area of Raymark waste were analyzed for PCBs using field-screening methods. Three of these samples exceed the Region IX PRG for industrial soil. These results are inadequate for quantitative risk characterization, however they suggest the presence of PCBs at potential levels of concern. As a result of the limited sample analyses, cancer risk estimates and hazard indices cannot be calculated at this property. It is possible that PCBs and other contaminants are present and that associated exposures exist, which are not quantified in this evaluation.

- Samples collected from depths of 0 to 10 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers. In addition, future commercial workers may be exposed to soils currently located at depths up to 15 feet bgs, which is the depth considered as accessible by CTDEP (CTDEP, 1996). The absence of samples collected in the 10- to 15-foot bgs interval adds uncertainty in the evaluation of risks to future commercial workers.

- A comparison of soils data from the property outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-10. The presence of benzo(a)pyrene and chromium at concentrations greater than CT RSRs for industrial soil suggests that risks

from other areas of the property may be of concern. Chromium is present in soils located outside the estimated area of Raymark waste at concentrations up to 208 mg/kg and benzo(a)pyrene is present at concentrations up to 1.1 mg/kg. Dioxins were detected in soils outside the estimated area of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin TEQ concentrations in soils outside the estimated area of Raymark waste exceed EPA Region IX PRGs for industrial soil in two samples.

Six samples from outside the estimated area of Raymark waste were analyzed for PCBs using CLP methods. While none of these samples had concentrations greater than the CT RSRs for industrial soil, two samples did have total Aroclor concentrations greater than the EPA Region IX PRG for industrial soil. Individual Aroclors detected include Aroclors 1254, 1262, and 1268. Lead was detected at concentrations up to 395 mg/kg. Copper was detected at concentrations up to 997 mg/kg. Asbestos is also present outside the estimated area of Raymark waste at 200 Ferry Boulevard at concentrations up to 8 percent. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.2.5.6 Summary of Human Health Risk Assessment

This section presents a summary of major risk assessment findings for soils estimated to contain Raymark waste at 200 Ferry Boulevard. Risks to commercial workers were estimated.

- Only lead and asbestos have been identified as COPCs in soils within the estimated area of Raymark waste, therefore no evaluation of hazard indices or cancer risks was performed.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are not anticipated for fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste.

- Asbestos was detected in all soil samples collected from the estimated area of Raymark waste at 200 Ferry Boulevard in the 0- to 10-foot bgs interval at a concentration range of 2 to 25 percent. The average concentration was 10 percent.

3.2.6 Ecological Evaluation

No ecologically significant habitats are present on this property. The ecological characterization of the wetlands in the vicinity of this property was addressed under the OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark-Ferry Creek-OU3* (B&RE, 1998). A summary of the findings is presented below. It should be noted, however, that no individual evaluation of the ecological impacts on this property was performed.

Most of the property has been disturbed by surrounding development, past uses of Ferry Creek, and filling of a wetland area prior to developing the property. There are no wetlands on the property, but the parcel abuts Ferry Creek. There is limited vegetation on the parcel as most of the property is covered by a building or pavement (see Figure 3-2).

This property provides only limited use as an area for birds, reptiles, and small mammals to forage, cover, rest and breed because of the level of development, soil contamination, disturbed nature of the area, and the low vegetation density and diversity. Wildlife identified in the area include red-winged blackbird (*Agelaius phoeniceus*) and green heron (*Butorides striatus*).

3.2.7 Summary

This 0.6-acre property abutting Ferry Creek contains Raymark waste. Soil samples containing metals, pesticides, and SVOCs that exceed CT DEC and/or CT PMC criteria and asbestos greater than 1 percent were collected on the property. Dioxins were also detected. Since most of the property is covered by buildings or pavement, only limited infiltration or leaching is likely occurring in the areas of cracked pavement and vegetation. Some erosion along the bank of the property into Ferry Creek is likely occurring.

No evaluation of hazard indices or cancer risks was performed, as lead and asbestos were the only COPCs identified. Adverse effects are not anticipated for fetuses of pregnant workers

exposed to lead in the soils within the estimated area of Raymark waste. The average asbestos concentration in the estimated area of Raymark waste was 10 percent. Quantitative estimates of risks from PCB exposure were not calculated due to a lack of CLP data within the estimated area of Raymark waste; however, screening samples suggest the presence of PCBs at potential levels of concern.

No ecologically significant habitats were identified on the property.

TABLE 3-2
200 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	47	77	2	4	Trace	25	1	32		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	1	5	0.25	0.32	0.319	0.319				
1,2,3,4,6,7,8-HpCDF	3	5	0.33	0.33	0.111	0.44 J				
1,2,3,4,7,8,9-HpCDF	1	5	0.15	0.0054	0.0054	0.0054				
1,2,3,4,7,8-HxCDD	1	5	0.2	0.0026	0.0026	0.0026				
1,2,3,4,7,8-HxCDF	1	5	0.1	0.014	0.0135	0.0135				
1,2,3,6,7,8-HxCDD	1	5	0.15	0.0086	0.0086	0.0086				
1,2,3,6,7,8-HxCDF	1	5	0.14	0.0088	0.0088	0.0088				
1,2,3,7,8,9-HxCDD	1	5	0.25	0.0065	0.0065	0.0065				
1,2,3,7,8,9-HxCDF	1	5	0.056	0.0016	0.0016	0.0016				
1,2,3,7,8-PeCDD	1	5	0.13	0.0018	0.0018	0.0018				
1,2,3,7,8-PeCDF	1	5	0.089	0.0019	0.0019	0.0019				
2,3,4,6,7,8-HxCDF	1	5	0.093	0.014	0.0136	0.0136				
2,3,4,7,8-PeCDF	1	5	0.12	0.0055	0.0055	0.0055				
2,3,7,8-TCDF	1	5	0.071	0.0098	0.0098	0.0098				
OCDD	4	5	3	3.5	3.31 J	3.95				
OCDF	4	5	1.9	2.3	0.274	3.21 J				
Total HpCDD	1	5	0.3	0.59	0.586	0.586				
Total HpCDF	3	5	0.62	0.93	0.251	1.27 J				
Total HxCDD	1	5	0.1	0.06	0.0595	0.0595				
Total HxCDF	1	5	0.081	0.2	0.197	0.197				
Total PeCDD	1	5	0.13	0.011	0.0105	0.0105				
Total PeCDF	1	5	0.1	0.15	0.153	0.153				
Total TCDD	1	5	0.1	0.0073	0.0073	0.0073				
Total TCDF	1	5	0.087	0.089	0.0888	0.0888				
Toxicity Equivalency	4	5	0.28	0.27	0.011 J	0.665813				

TABLE 3-2 (cont.)
200 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	7	7	9030	9030	5410 J	14800				
Arsenic	7	7	5.1	5.1	2.4	6.6	10	0		
Barium	6	7	76.6	85.4	58.2 J	119 J	140000	0		
Beryllium	6	6	0.41	0.41	0.1	0.69 J	2	0		
Cadmium	6	7	1.6	1.8	0.58	4.8	1000	0		
Calcium	7	7	12300	12300	1800	54600				
Chromium	7	7	107	107	23.2	208 J	100	3		
Cobalt	7	7	7.8	7.8	5.7	9.9	2500	0		
Copper	29	44	235	295	33.8 J	1100	76000	0		
Iron	7	7	17500	17500	13400	21400 J				
Lead	45	77	109	166	40.1	817	1000	0		
Magnesium	7	7	5520	5520	2330 J	10700				
Manganese	7	7	202	202	149	244	47000	0		
Mercury	6	7	0.83	0.95	0.17	1.8 J	610	0		
Nickel	7	7	32.5	32.5	16.3	53.7	7500	0		
Potassium	7	7	1710	1710	804 J	3040				
Selenium	1	7	0.48	1.1	1.1	1.1	10000	0		
Silver	1	7	0.29	0.4	0.4	0.4	10000	0		
Sodium	2	6	416	945	640	1250				
Vanadium	7	7	29	29	19.9	45.7 J	14000	0		
Zinc	7	7	377	377	95.3 J	673 J	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	1	1	1800	1800	1800	1800				
Barium	1	1	183	183	183	183			10000	0
Cadmium	1	1	0.81	0.81	0.81	0.81			50	0
Calcium	1	1	7820	7820	7820	7820				
Chromium	1	1	6.1	6.1	6.1	6.1			500	0
Copper	1	1	53.6	53.6	53.6	53.6			13000	0
Iron	1	1	2170	2170	2170	2170				

TABLE 3-2 (cont.)
200 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Lead	1	1	42.2	42.2	42.2	42.2			150	0
Magnesium	1	1	967	967	967	967				
Manganese	1	1	40.4	40.4	40.4	40.4				
Vanadium	1	1	10.2	10.2	10.2	10.2			500	0
Zinc	1	1	168	168	168	168			50000	0
Metals (TCLP) (UG/L)										
Cadmium	1	1	5.3	5.3	5.3	5.3			50	0
Lead	1	1	80.2	80.2	80.2	80.2			150	0
Mercury	1	1	2.2	2.2	2.2	2.2			20	0
Semivolatile Organic Compounds (UG/KG)										
2-Methylnaphthalene	3	5	140	64	64 , J	64 , J	2500000	0	9800	0
4-Chloro-3-methylphenol	2	5	220	64	64 J	64 J				
Acenaphthene	3	5	150	73	55 J	110	2500000	0	84000	0
Acenaphthylene	4	5	200	170	120	190 J	2500000	0	84000	0
Anthracene	4	5	270	260	210	300	2500000	0	400000	0
Benzo(a)anthracene	4	5	1200	1500	990	1800	7800	0	1000	3
Benzo(a)pyrene	4	5	910	1100	950	1100	1000	3	1000	3
Benzo(b)fluoranthene	4	5	1300	1600	1100	1800	7800	0	1000	4
Benzo(g,h,i)perylene	4	5	600	660	650	680 J	2500000	0	42000	0
Benzo(k)fluoranthene	1	5	530	970	970	970	78000	0	1000	0
bis(2-Ethylhexyl)phthalate	1	5	390	260	260	260	410000	0	11000	0
Butylbenzylphthalate	2	5	300	130	59	205	2500000	0	200000	0
Carbazole	4	5	110	61	52 J	76	290000	0	360	0
Chrysene	4	5	1200	1500	1200	1700	780000	0	1000	4
Dibenzo(a,h)anthracene	1	5	380	220	220	220	780	0	1000	0
Dibenzofuran	3	5	140	53	52 J	56	2500000	0	5600	0
Di-n-Butylphthalate	1	5	350	82	82	82	2500000	0	140000	0
Fluoranthene	4	5	1700	2000	1800	2300	2500000	0	56000	0
Fluorene	3	5	190	140	100 J	205	2500000	0	56000	0

TABLE 3-2 (cont.)
200 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Indeno(1,2,3-cd)pyrene	3	5	490	560	540 J	590	7800	0	1000	0
Naphthalene	3	5	140	62	55 J	77	2500000	0	56000	0
N-Nitroso-diphenylamine	3	5	400	480	410	520 J	1200000	0	1400	0
Phenanthrene	4	5	780	890	850 J	1000	2500000	0	40000	0
Phenol	1	5	320	33	33 J	33 J	2500000	0	800000	0
Pyrene	4	5	1700	2000	1500	2500	2500000	0	40000	0
Total PAH	2	2	12000	12000	11602	13256				
Volatile Organic Compounds (UG/KG)										
2-Butanone	1	5	8	7	7	7	1000000	0	80000	0
2-Hexanone	1	5	8	14	14	14	1000000	0	56000	0
4-Methyl-2-Pentanone	4	5	3	3	2 J	6	1000000	0	14000	0
Acetone	1	5	41	60	60	60	1000000	0	140000	0
Bromoform	1	5	7	4	4	4	720000	0	800	0
Carbon Disulfide	3	5	5	3	3 , J	3 , J	1000000	0	140000	0
Ethylbenzene	2	5	6	4	2	7	1000000	0	10100	0
Toluene	1	5	7	6	6	6	1000000	0	67000	0
Total Xylenes	3	5	15	21	7 J	43	1000000	0	19500	0
Trichloroethene	1	5	6	2	2	2	520000	0	1000	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	4	6	8.6	8	1.7 J	11 J	24000	0	29	0
4,4'-DDE	6	6	4.4	4.4	0.74 J	11	17000	0	21	0
4,4'-DDT	4	6	18	20	3.9 J	30	17000	0	21	3
alpha-Chlordane	5	6	2.1	2.3	0.99 J	4.7 J	2200	0	66	0
Aroclor, Total (4)	12	73	310	1000	136	3400	10000	0		
Aroclor, Total (Conservative)(5)	12	73	400	1600	316	4150	10000	0		
Aroclor-1254	1	73	160	130	130	130	10000	0		
Aroclor-1262	5	66	180	190	58 J	480 J	10000	0		
Aroclor-1268	11	73	290	990	65 J	3400	10000	0		

TABLE 3-2 (cont.)
200 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
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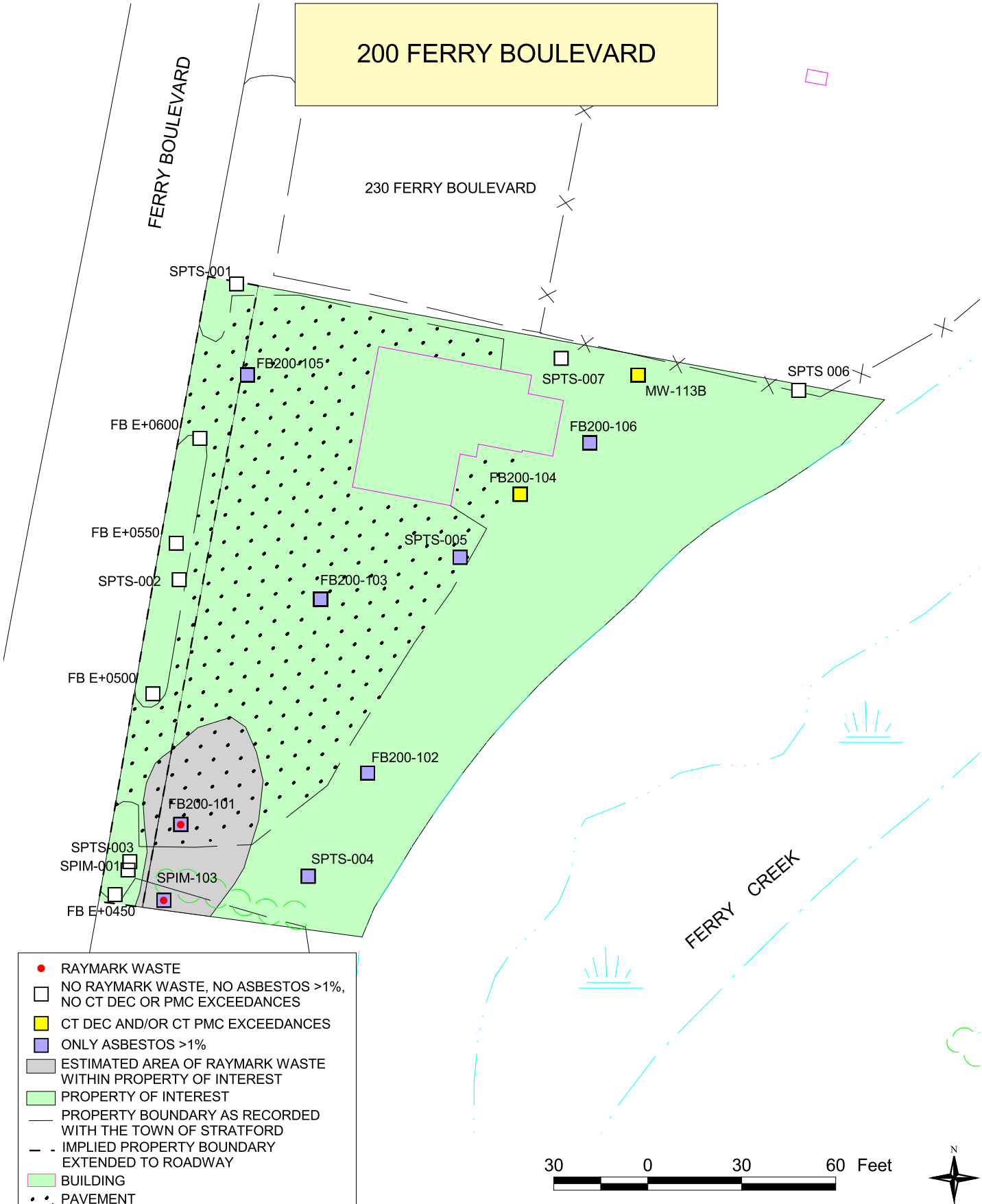
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
beta-BHC	3	6	6.4	7.2	2.5	9.5 J	3200	0	3.9	2
Dieldrin	2	5	3.4	2.7	0.82 J	4.6	360	0	7	0
Endosulfan I	1	6	3.1	2.3	2.3	2.3	1200000	0	8400	0
Endosulfan II	1	6	7.4	17	17 J	17 J	1200000	0	8400	0
Endosulfan Sulfate	2	6	7.5	7.5	4	11	1200000	0	8400	0
Endrin Aldehyde	3	6	5.4	3.3	1.8 J	6.4	610000	0		
Endrin Ketone	2	6	7.9	11	10 J	12	610000	0		
gamma-Chlordane	4	5	2.7	3	1.2 J	6.5	2200	0	66	0
Heptachlor Epoxide	1	6	4.2	8.6	8.6	8.6	630	0	20	0
Methoxychlor	2	6	26	17	6.1 J	27 J	10000000	0	8000	0

Qualifier	Definition
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-2
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.3 230 Ferry Boulevard

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.3.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.3.1 Property Description

This property, approximately 2.5 acres of commercially-zoned (retail) land, is located on Ferry Boulevard in Stratford, Connecticut (Town of Stratford, 1997). The property is currently occupied by a used car dealership. A one-story building, located in the center of the property, is surrounded by deteriorated asphalt pavement for parking. The vast majority of the lot is paved and covered with cars. Numerous cracks and repairs to the asphalt are evident throughout the property, but the asphalt pavement is most deteriorated at the rear of the building, where differential settling has occurred. Previous site observations noted that a fuel storage tank (estimated at 500 gallons) was once located on the asphalt behind the building, however, due to the high volume of vehicles on the lot, the current status of the tank could not be verified. An old fuel pump is also present in the rear parking lot.

A narrow strip of dense shrub and tree vegetation is present along Ferry Creek, outside the eastern fence line. A narrow strip of grass is also present along Ferry Boulevard. The topography of the property is relatively flat with a gentle slope towards Ferry Creek. A seep was identified on the eastern bank of the property in Ferry Creek. Elevated levels (above background) of trichloroethene (TCE) have been detected in surface water samples collected from the seep.

A swale is located along the northern edge of the property. Ferry Creek is located on the eastern edge of the property, 200 Ferry Boulevard (see Section 3.2) is to the south, Ferry Boulevard is to the west, and 250 Ferry Boulevard (see Section 3.4) is to the north, abutting the swale.

A stormwater drain was observed in the front parking lot near Ferry Boulevard. The paved parking lot in the northeast corner of the property is flooded by Ferry Creek during extreme high tide events. Soils at the property, including the swale, are classified as fill material that has

been placed in wetlands (tidal marshes). Brake pads were observed at the surface on the banks of the swale.

The swale is located along the northern border of the property. Town records show that the swale is the result of a DOT drainage easement that has been on the property since 1938. The swale is tidally influenced by water from Ferry Creek and carries surface water drainage from Ferry Boulevard and the surrounding properties to Ferry Creek. The culvert pipe under Ferry Boulevard that leads to the swale has partially collapsed. The steep banks of the swale slope down about 3 feet. Water flow in the swale is restricted due to the dense reeds (*Phragmites australis*) and other debris. Access to the swale is limited from the north and south by a chain-link fence. Public access at the western end of the swale along Ferry Boulevard and the eastern end at Ferry Creek is not restricted. A trail was cleared by unknown entities in July 2002 along the edge of the swale against the fence line, providing clear access to Ferry Creek. Typically, however, this stretch of the property is not cleared and is covered with dense reeds and other vegetation.

A chain-link fence (estimated 6 feet high) restricts access to the side and rear parking lots of the property. The front parking lot has unrestricted public access through the two driveways in front of the building. There is a small, white wooden fence (estimated 2 feet high) running between the front parking lot and Ferry Boulevard. The fence is open at the two driveways. During non-business hours, cars are usually parked in the openings of the fence restricting vehicular access to the property; however, foot traffic is not restricted.

3.3.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of the property at 230 Ferry Boulevard are located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Twelve soil borings (A2-SB02, A2-SB04, A2-SB04A, SPVM-101 through 106, and FBSWL-101 through 103) were advanced on the property to depths of up to 16 feet below ground surface (bgs). Surficial materials in the borings consist of fill overlying peat, silt, or organic silt with varying amounts of clay. The organic materials are characteristic of a former marsh and swamp

deposit. Fuel odors were noted in the soil cuttings from borings A2-SB02 and SPVM-104. Drilling at boring SPVM-104 was terminated before the bottom of fill was encountered because an oily substance was observed. No organic layer was identified prior to terminating the boring. Refer to Figure 3-3 for boring locations on the property. Boring logs are presented in Appendix A. No monitoring wells have been installed on the property.

Three of twelve borings (FBSWL-101, FBSWL-102, and FBSWL-103), each approximately 6 feet in depth, were advanced in the drainage swale. Based on the boring logs, surficial materials primarily consist of fill overlying silt with plant fibers and fine sand, peat, and/or organic silt with trace amounts of sand. The organic materials are characteristic of a former marsh and swamp deposit. Raymark wastes were reportedly disposed of as fill in this area. Brake pads and asbestos were observed at the surface on the banks of the swale. Manmade materials identified in the soil borings included potentially asbestos-containing material (PACM) and plastic sheeting. These materials were encountered with natural fill materials consisting of silt-sand and sand-silt mixtures. Manmade debris was also observed in the organic silt layer encountered in soil boring FBSWL-101.

Soil sample locations are shown on Figure 3-3, including shallow surface samples and deeper samples from soil borings. The borings were used to describe the fill and native material on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials, including brake pads, PACM, brick, asphalt shingles, copper wire, cloth, glass, nails, gasket materials, metal, plastic, rubber, a tar-like substance, tiles, and/or wood were identified in the soil borings. PACM was identified in the majority of the borings on this property. These materials were encountered with natural fill materials consisting of sand, silt, and gravel mixtures. Manmade debris was also identified in the peat, silt, and/or organic silt layers encountered in soil borings A2-SB02, A2-SB04, A2-SB04A, and SPVM-103. Fill classifications were based on the visual characteristics of the soil and sediment samples that were collected during the field investigations. The depth to groundwater ranges from 3 feet to 7 feet bgs, based on the soil moisture content recorded on the boring logs. Based on interpretations and field observations, fill was identified in borings across the entire property.

Raymark waste was found in fill materials on this property. The limits of the area of Raymark waste have been estimated by the presence of asbestos, lead, copper and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-3. Approximately 27.4 percent of this property was estimated to contain Raymark waste. The vast majority of the estimated area of Raymark waste is paved. Only those samples collected in the swale and outside the fence were from uncovered areas.

3.3.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. Results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. Comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 65 samples collected from 28 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-3. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-3 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-3 for the summary statistics and comparison to criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Sixty-three soil samples were collected from the property and analyzed for asbestos. Asbestos was detected frequently on the property. Asbestos was detected in 51 of the 63 samples. Asbestos at greater than 1 percent was detected in 40 of 63 samples. Detections were scattered throughout the property at depths ranging from surface to 14 feet bgs. The maximum amount of asbestos observed at the property was 90 percent.

Dioxins

Six soil samples were collected from the property and analyzed for dioxins. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. TEQ values ranged from 0.0139 µg/kg to 20.14 µg/kg.

Metals

Soil samples were collected from the property and analyzed for metals as follows: 14 at a fixed laboratory; 36 samples were screened for copper; and 49 samples were screened for lead. Metals were detected very frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. There were two metals that exceeded the CT DEC regulatory standards. Chromium had exceedances in 6 samples and lead had exceedances in 12 samples. Exceedances occurred in samples collected from depths ranging from ground surface to 6 feet bgs. Metal exceedances were primarily located in the northern portion of the property, with most exceedances in the shallow intervals, especially in the swale area.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only three out of the five SPLP samples were within the estimated area of Raymark waste. Lead and chromium exceeded the CT PMC standards. No TCLP samples were collected.

Pesticides

Fourteen soil samples were collected from the property and analyzed for pesticides. Pesticides were detected fairly frequently on the property. There were no CT DEC exceedances for pesticides. There were pesticide exceedances of the CT PMC regulatory standards for 4,4'-DDE, gamma-chlordane and dieldrin. Pesticide exceedances were scattered throughout the central and northeastern portion of the property at depths up to 16 feet bgs.

PCBs

Fifty-one soil samples were collected from the property and analyzed for PCBs as Aroclors. Aroclors were detected frequently on the property, with Aroclors 1262 and 1268 both detected in over half of the samples analyzed. Nine samples exceeded the total Aroclor CT DEC standard, with Aroclor 1268 concentrations the primary contributor to the total Aroclor concentration at six of these locations. The PCB exceedances were mostly located in the northern portion of the property in samples collected from the swale at depths of up to 6 feet bgs. No SPLP/TCLP samples for PCBs were collected.

SVOCs

Thirteen soil samples were collected from the property and analyzed for SVOCs. SVOCs were detected frequently on the property. Eight SVOCs exceeded the CT DEC and/or CT PMC regulatory standards. SVOC exceedances, primarily PAHs, were located in the northeastern portion of the property at depths ranging from ground surface to 6 feet bgs.

VOCs

Eight soil samples were collected from the property and analyzed for VOCs. VOCs were sporadically detected on the property. There were no CT DEC exceedances for VOCs. Benzene was the only VOC that exceeded the CT PMC regulatory standards. The exceedance was located in boring A2-SB02 in the central portion of the property, at a depth of 4 to 6 feet bgs.

Raymark Waste

The results from nine soil sample locations indicate that Raymark waste is present on the property. The following table displays the locations and constituents of the 15 samples from those nine locations with contaminant concentrations that meet the definition of Raymark waste. These samples are located within the 27.4 percent of the property shown on Figure 3-3 as the "Estimated Area of Raymark Waste within Property of Interest".

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
A2-SB04A	8 to 10	40	720	780	NA
A2-SS04	2 to 4	5	757	910	2,100
SPVM-101	0 to 2	50	6,140	10,900	16,000
	2 to 4	15	7,340	12,700	19,000
SPVM-102	0 to 2	8	440	480	3,300
FBSWL-101	0 to 2	50	18,200	22,500	67,000
	2 to 4	60	17,300	18,400	74,000
	4 to 6	2	2,750	3,870	32,000
FBSWL-102	0 to 2	55	34,000	30,000	230,000
	2 to 4	50	14,900	26,800	71,000
	4 to 6	2	1,750	2,900	22,000
FBSWL-103	0 to 2	3	1,420	1,360	4,800
	2 to 4	4	1,100	1,730	4,300
SPD-10	0 to 0.5	90	36,300	40,100	160,000
SPD-5	0 to 0.5	90	10,000	NA	10,000

NA- Contaminant was not analyzed

3.3.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants throughout this property are discussed below.

Approximately 27.4 percent of the 2.5-acre parcel is estimated to contain Raymark waste. The waste area is located in the northeastern portion of the property (see Figure 3-3). Over 90 percent of the total property is covered either by a building or pavement. The vast majority of the area estimated to contain Raymark waste is within this paved area. A small portion of the waste area is not covered with pavement. The swale along the northern edge, and the eastern

edge of the property abutting Ferry Creek are vegetated, mostly with grasses which limit erosion of surface soils by wind. The swale is a man-made wetland with dense debris, roots, and reeds that constrict the flow of water, but is a vehicle for transporting sediments/contaminants into Ferry Creek. Slow-moving water likely infiltrates and leaches into the groundwater. Erosion has been observed along the banks of Ferry Creek and the swale. A stormwater drain was visible on the property; its discharge point is unknown.

SPLP data indicate that metals, specifically lead and chromium, could potentially be leaching into groundwater. Other data indicate that pesticides, SVOCs, and VOCs may also be leaching into surface water and groundwater.

3.3.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at 230 Ferry Boulevard that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from the location within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at 230 Ferry Boulevard may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.3.5.1 provides an overview of the 230 Ferry Boulevard property, Section 3.3.5.2 presents COPCs and EPCs, Section 3.3.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.3.5.4 contains the numerical results of the risk assessment, and Section 3.3.5.5 presents property-specific uncertainties. Section 3.3.5.6 presents a property-specific summary of the major risk findings.

3.3.5.1 Overview

230 Ferry Boulevard is a commercial property of approximately 2.5 acres. A detailed description of 230 Boulevard is provided in Section 3.3.1. The nature and extent of the contamination detected at 230 Ferry Boulevard is discussed in Section 3.3.3. The area of the property estimated to contain Raymark waste represents an estimated 27 percent of the total 2.5-acre property, exclusive of any buildings, and is shown in Figure 3-3. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.3.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 230 Ferry Boulevard are summarized in Appendix B-1, Table 2.3.

3.3.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.3 presents a summary of the COPCs for quantitative risk assessment for 230 Ferry Boulevard soils from the estimated area of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.3:

- Asbestos
- Acetophenone

- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene)
- Aroclors, Total (1248, 1262 and 1268)
- Metals (arsenic, barium, chromium, and lead)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 230 Ferry Boulevard are presented in Appendix B-1, Table 3.3. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.3.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 230 Ferry Boulevard and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) are assumed to be exposed to soil only within the estimated area of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 230 Ferry Boulevard is a commercial property, as described in Section 3.3.1.

Potential Receptors

The receptors retained for quantitative evaluation are current and future commercial workers. Potentially exposed individuals are limited to those who work at 230 Ferry Boulevard.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at the property. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated area of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 230 Ferry Boulevard are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from the property is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. The estimated area of Raymark waste is mostly paved with uncovered portions vegetated with grasses and phragmites. The presence of pavement and vegetation reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at commercial properties. Appendix B-1, Table 2.3 presents available inhalation SSLs for contaminants in soils within the estimated area of Raymark waste at the property. With the exception of those reported for total chromium, all reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a). One sample result out of 10 exceeded the SSL_{AIR} for hexavalent chromium. The average total chromium concentration detected in the Raymark waste soil samples (120 mg/kg) is less than the SSL_{AIR} for hexavalent chromium (280 mg/kg). Further evaluation of total chromium concentrations relative to inhalation SSLs for commercial/industrial land use (EPA, 2001a) reveals that all total chromium concentrations detected in the Raymark waste soil samples are less than the commercial/industrial SSL_{AIR} for hexavalent chromium (510 mg/kg). The SSL_{AIR} for chromium assumes that chromium is present in the hexavalent state. The assumption that all chromium is in the hexavalent state is likely to be a conservative assumption.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.3.5.4. Asbestos is present in soils within the estimated area of Raymark waste at 230 Ferry Boulevard. The presence of pavement and vegetation and the qualitative comparison to SSLs suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) is factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 230 Ferry Boulevard is 0.27. Chemical intake estimates for the property are provided in Appendix B-1, Tables 7.3 and 8.3.

3.3.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 230 Ferry Boulevard is provided in this section. Appendix B-1, Table 7.3 and Table 8.3 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.3. Appendix B-1, Table 10.3 reduces the information developed in Appendix B-1, Table 9.3 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 230 Ferry Boulevard were as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	3.8	3.4	7.2

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated area of Raymark waste is in excess of unity. Total Aroclor was the main contributor to the hazard index for the commercial worker. The chemical-specific (and target-organ specific) hazard quotients for total Aroclors alone are in excess of unity for commercial receptors. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Table 7.3 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 230 Ferry Boulevard were as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	2.0E-04	1.1E-04	3.2E-04

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated area of Raymark waste exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.3 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.3, dioxins, Aroclors, arsenic, benzo(a)anthracene, dibenzo(a,h)anthracene, and benzo(a)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

Cancer risk estimates for dioxins, shown on the tables referenced above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated

using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 1.4E-03.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste at the 230 Ferry Boulevard property. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated area of Raymark waste at a maximum concentration of 40,100 mg/kg. The average lead concentration in this dataset was 6,620 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 6,620 mg/kg for soil within the estimated area of Raymark waste at 230 Ferry Boulevard was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) is factored into the intake equations shown in Appendix B-10. The FRW for 230 Ferry Boulevard is 0.27. EPA's stated goal for lead is that individuals exposed would have no more than 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated area of Raymark waste at 230 Ferry Boulevard, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 9 to 12 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 22 of 24 soil samples collected from the estimated area of Raymark waste at a concentration range of trace to 90 percent. These samples were collected from the 0- to 15- foot bgs interval. The average concentration was 22 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61)(EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated area of Raymark waste reduces the potential for airborne asbestos at 230 Ferry Boulevard. Based on field conditions in the estimated area of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.3.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 230 Ferry Boulevard are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 230 Ferry Boulevard property is 2.5 acres, with an estimated 27 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.3.4. The estimated area of Raymark waste is mostly paved. No consideration has been given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated area of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 27 percent of the time, total reasonable maximum

risks for exposure to the estimated area of Raymark waste would be approximately four times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown in Appendix B-1, Table 2.3, alongside site-specific data from the estimated area of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 4.7 to 8.8 mg/kg, with an average concentration of 6.0 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Twenty-four samples were included in the dataset for soils within the estimated area of Raymark waste; however, 14 of those samples were only analyzed by field-screening methods. Due to limited numbers of samples analyzed for dioxins, Aroclors, benzo(a)anthracene, benzo(a)pyrene, and barium, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 15 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-10. The presence of chromium at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Chromium is present in soils located outside the estimated area of Raymark waste at 230 Ferry Boulevard at concentrations up to 102 mg/kg. Dioxins were detected in soils outside the estimated area of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin TEQ concentrations outside the estimated area of Raymark waste exceed EPA Region IX PRGs for industrial soil in one sample.

- Five samples from outside the estimated area of Raymark waste were analyzed for PCBs using CLP methods. While none of these samples had concentrations greater than the CT RSRs for industrial soil, one sample did have total Aroclor concentrations greater than the EPA Region IX PRG for industrial soil. The only individual Aroclor detected was Aroclor 1268. Lead and copper were detected at concentrations up to 900 mg/kg and 501 mg/kg, respectively. Asbestos is also present outside the estimated area of Raymark waste at this property at concentrations up to 20 percent. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.3.5.6 Summary of Human Health Risk Assessment

This section presents a summary of major risk assessment findings for soils estimated to contain Raymark waste at 230 Ferry Boulevard. Risks to current and future commercial workers were estimated.

- The RME hazard indices (HI) for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 230 Ferry Boulevard are in excess of unity. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposure to Aroclors.

- The RME cancer risk estimates for current and future commercial workers exposed to soil within the estimated area of Raymark waste exceed the EPA cancer risk range (10^{-4}

to 10^{-6}) and the CT DEP target total risk level of 10^{-5}. Dioxins, Aroclors, arsenic, benzo(a)anthracene, dibenzo(a,h)anthracene, and benzo(a)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are anticipated for fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste at 230 Ferry Boulevard.

- Asbestos was detected in 22 of 24 soil samples collected from the estimated area of Raymark waste in the 0- to 15- foot bgs interval at a concentration range of trace to 90 percent. The average concentration was 22 percent.

3.3.6 Ecological Evaluation

No ecologically significant habitats are present on this property. Portions of the swale channel are considered to be wetland. No fish or wildlife have been observed in the swale. The small size of the swale, its function as a stormwater drainage ditch, surrounding development, visible surface contamination, and monoculture of *Phragmites australis*, severely limit its present habitat value and ecological functions. The ecological characterization of the wetlands on this property was addressed under the OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark-Ferry Creek-OU3* (B&RE, 1998). A summary of the findings is presented below. It should be noted, however, that no individual evaluation of the ecological impacts to this property was performed.

Most of the property has been disturbed by surrounding development, past uses of Ferry Creek, and filling of a wetland area prior to developing the property. There are no wetlands on the property, but the parcel abuts Ferry Creek. There is limited vegetation on the parcel as most of the property is covered by a building or pavement.

This property provides only limited use as an area for birds, reptiles, and small mammals to forage, cover, rest, and breed because of the level of development, soil contamination,

disturbed nature of the area, and the low vegetation density and diversity. Wildlife identified in the area include red-winged blackbird (*Agelaius phoeniceus*) and green heron (*Butorides striatus*).

3.3.7 Summary

This 2.5-acre commercially zoned property abutting Ferry Creek contains Raymark waste. Soils containing dioxins, metals (including SPLP metals), pesticides, PCBs, SVOCs, and VOCs that exceed CT DEC and/or CT PMC criteria or contain more than 1 percent asbestos are present on the property. For the portion of the property not covered by building or pavement, infiltration and leaching is likely occurring, especially to the rear of the property where the asphalt is cracking. In addition, the slow-moving water in the swale located on the northern edge of the property likely infiltrates and leaches into the groundwater.

RME hazard indices for commercial workers exposed to soil within the estimated area of Raymark waste are in excess of unity, indicating that adverse health effects are possible. The RME cancer risk estimates exceed the EPA cancer risk range and the CT DEP total risk level. Dioxins, aroclors, arsenic, benzo(a)anthracene, dibenzo(a,h)anthracene, and benzo(a)pyrene are the predominant risk drivers. Adverse effects from lead are anticipated for fetuses of pregnant workers exposed to the soil within the estimated area of Raymark waste. The average asbestos concentration in the estimated area of Raymark waste was 22 percent.

Ecological risks have not been quantified; however, some impacts to the environment by onsite contaminants are assumed, especially along Ferry Creek where there is some erosion of the fill along the bank. The swale area appears to have a higher concentration of contaminants in the shallow area, which may erode into Ferry Creek during times of high water.

TABLE 3-3
230 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	51	63	11	14	Trace	90	1	40		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	6	6	0.94	0.94	0.04974 J	4.1 J				
1,2,3,4,6,7,8-HpCDF	6	6	5.9	5.9	0.03641 J	24 J				
1,2,3,4,7,8,9-HpCDF	4	6	0.019	0.026	0.00502	0.0474				
1,2,3,4,7,8-HxCDD	5	6	0.008	0.0081	0.00057 J	0.0154				
1,2,3,4,7,8-HxCDF	6	6	4.6	4.6	0.01003 J	21.4 J				
1,2,3,6,7,8-HxCDD	5	6	0.034	0.04	0.00182 J	0.101				
1,2,3,6,7,8-HxCDF	6	6	1.1	1.1	0.00414 J	4 J				
1,2,3,7,8,9-HxCDD	5	6	0.029	0.033	0.00128 J	0.0732				
1,2,3,7,8,9-HxCDF	3	6	0.0041	0.0044	0.00041	0.0066 EMPC				
1,2,3,7,8-PeCDD	6	6	0.099	0.099	0.000186	0.5512 *				
1,2,3,7,8-PeCDF	6	6	2.4	2.4	0.00551 J	11.5 J				
2,3,4,6,7,8-HxCDF	6	6	1.9	1.9	0.00626 J	8.1 J				
2,3,4,7,8-PeCDF	6	6	5.3	5.3	0.00953 J	26.4 J				
2,3,7,8-TCDD	4	6	0.0028	0.0025	0.000237	0.0047				
2,3,7,8-TCDF	6	6	4.7	4.7	0.00684	24.3 J				
OCDD	6	6	4.3	4.3	1.587	9.2 J				
OCDF	6	6	0.73	0.73	0.05638 J	1.39				
Total HpCDD	6	6	3.3	3.3	0.115	16.55 J				
Total HpCDF	6	6	6.6	6.6	0.05408 J	27.18 J				
Total HxCDD	6	6	1.1	1.1	0.01817 J	5.17 J				
Total HxCDF	6	6	17.5	17.5	0.05966 J	79.72 J				
Total PeCDD	6	6	20.6	20.6	0.000523	122.7 *				
Total PeCDF	6	6	24.7	24.7	0.0531	121.2 J				
Total TCDD	5	6	4.4	5.2	0.000237	26.02 *				
Total TCDF	5	6	14.7	17.6	0.0154	72.78 J				
Toxicity Equivalency	6	6	4.1	4.1	0.0139 J	20.14 J				

TABLE 3-3 (cont.)
230 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	14	14	10900	10900	5120	15700 J				
Arsenic	9	14	5.1	6.6	4.7	8.8	10	0		
Barium	14	14	3620	3620	49.7 J	16700	140000	0		
Beryllium	10	13	0.54	0.62	0.39	0.88	2	0		
Cadmium	9	14	0.65	0.86	0.46	1.8	1000	0		
Calcium	14	14	6000	6000	1190	32600				
Chromium	14	14	98.4	98.4	17.3	301	100	6		
Cobalt	14	14	12.1	12.1	4.5	37	2500	0		
Copper	29	50	3500	5960	26.8	36300	76000	0		
Iron	14	14	20100	20100	9430	29500 J				
Lead	51	63	2610	3210	33	40100	1000	12		
Magnesium	14	14	18000	18000	4210	76700				
Manganese	14	14	236	236	124	324	47000	0		
Mercury	9	14	0.44	0.65	0.1 J	1.5	610	0		
Nickel	14	14	104	104	15	469	7500	0		
Potassium	13	14	1830	1960	713	3640 J				
Selenium	4	14	0.81	0.94	0.47 J	1.6 J	10000	0		
Silver	6	14	0.86	1.6	0.77	2.6	10000	0		
Sodium	12	13	2710	2930	158	17000 J				
Vanadium	14	14	33.3	33.3	15.7	48.7	14000	0		
Zinc	14	14	784	784	51.1 J	3790	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	3	3	10900	10900	1030	25600				
Antimony	1	5	4.3	15.3	15.3	15.3			60	0
Arsenic	4	5	16.1	19.3	1.5 J	65.8			500	0
Barium	5	5	290	290	68.4	720 J			10000	0
Beryllium	1	5	1.4	5.6	5.6	5.6			40	0
Cadmium	2	5	4.5	10.8	0.45	21.1			50	0

TABLE 3-3 (cont.)
230 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Calcium	3	3	37200	37200	8250	73800 J				
Chromium	5	5	215	215	2.3	1060 J			500	1
Cobalt	2	3	16.8	24.6	3.5	45.8				
Copper	5	5	1390	1390	50.1	5190 J			13000	0
Iron	3	3	23100	23100	486	63100 J				
Lead	5	5	519	519	69	1760 J			150	2
Magnesium	3	3	4810	4810	1650	10100				
Manganese	3	3	749	749	11.5	2100 J				
Mercury	1	5	0.22	0.3	0.3	0.3			20	0
Nickel	5	5	37.3	37.3	5.4	146 J			1000	0
Potassium	3	3	2500	2500	1120	4980 J				
Selenium	1	5	3.2	8.2	8.2 J	8.2 J			500	0
Sodium	3	3	4880	4880	3440	7350				
Vanadium	5	5	45.2	45.2	0.76 J	170			500	0
Zinc	5	5	1060	1060	26	4610			50000	0
Semivolatile Organic Compounds (UG/KG)										
1,4-Dichlorobenzene	1	7	340	66	66	66	240000	0	15000	0
2-Methylnaphthalene	7	13	300	260	32 J	990	2500000	0	9800	0
2-Methylphenol	1	13	330	120	120 J	120 J	2500000	0	70000	0
4-Methylphenol	2	13	320	190	170 J	210 J	2500000	0	7000	0
Acenaphthene	8	13	340	320	57 J	1100	2500000	0	84000	0
Acenaphthylene	7	13	420	460	56 J	2100	2500000	0	84000	0
Acetophenone	6	6	880	880	180 J	1600				
Anthracene	11	13	900	980	110 J	5700	2500000	0	400000	0
Benzaldehyde	5	6	520	570	200 JEB	890 JEB				
Benzo(a)anthracene	11	13	1600	1700	140 J	9100 *	7800	1	1000	4
Benzo(a)pyrene	12	13	1600	1700	140 J	9100 *	1000	5	1000	5
Benzo(b)fluoranthene	12	13	1300	1400	160 J	6200 *J	7800	0	1000	5

TABLE 3-3 (cont.)
230 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Benzo(g,h,i)perylene	12	13	720	740	81 J	4300	2500000	0	42000	0
Benzo(k)fluoranthene	12	13	1300	1400	110 J	6300	78000	0	1000	4
bis(2-Ethylhexyl)phthalate	8	13	330	160	93	260 J	410000	0	11000	0
Carbazole	8	13	420	450	65 J	1900	290000	0	360	3
Chrysene	12	13	1800	1900	220 J	9200 *	780000	0	1000	5
Dibenzo(a,h)anthracene	7	13	470	540	130 J	2300	780	1	1000	1
Dibenzofuran	6	13	390	460	24 J	1600	2500000	0	5600	0
Dimethylphthalate	1	13	320	70	70 J	70 J	2500000	0	1100000	0
Di-n-Butylphthalate	3	13	470	130	72 J	210 J	2500000	0	140000	0
Di-n-octylphthalate	1	13	330	30	30 J	30 J	2500000	0	20000	0
Fluoranthene	13	13	3900	3900	160 J	23000 *	2500000	0	56000	0
Fluorene	11	13	410	410	48 J	1700	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	12	13	850	880	100 J	4600	7800	0	1000	2
Naphthalene	6	13	380	420	64 J	1300	2500000	0	56000	0
N-Nitroso-diphenylamine	2	13	330	160	120 J	200 J	1200000	0	1400	0
Phenanthrene	12	13	3000	3200	240 J	19000 *	2500000	0	40000	0
Phenol	7	12	750	990	370 JEB	2400	2500000	0	800000	0
Pyrene	13	13	3800	3800	190 J	23000 *J	2500000	0	40000	0
Total PAH	2	2	14000	14000	2380	26110				
Volatile Organic Compounds (UG/KG)										
1,1,1-Trichloroethane	1	8	15	4	4 J	4 J	1000000	0	40000	0
1,2,4-Trichlorobenzene	1	6	7	2	2 J	2 J	2500000	0	14000	0
1,3-Dichlorobenzene	1	6	7	1	1 J	1 J				
1,4-Dichlorobenzene	3	6	6	2	2 J	3 J	240000	0	15000	0
2-Butanone	6	8	21	15	5 J	34	1000000	0	80000	0
Acetone	4	8	68	100	45 TB	180	1000000	0	140000	0
Benzene	2	8	47	170	3 J	330	200000	0	200	1

TABLE 3-3 (cont.)
230 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG) (cont.)										
Bromomethane	5	8	17	10	3 J	19				
Carbon Disulfide	6	8	14	6	2 J	12 J	1000000	0	140000	0
Chlorobenzene	4	8	14	5	2 J	8 J	1000000	0	20000	0
Chloroethane	4	8	16	8	3 J	14 J	1000000	0	2400	0
Chloromethane	5	8	24	21	3 J	44	440000	0	540	0
cis-1,2-Dichloroethene	2	6	7	4	2 J	6 J				
Ethylbenzene	3	8	130	340	8 J	1000	1000000	0	10100	0
Isopropylbenzene	4	6	4	3	2 J	3 J				
Methyl Acetate	1	6	8	8	8 J	8 J				
Methylcyclohexane	4	6	12	15	5 J	35				
Methylene Chloride	1	8	17	14	14 TB	14 TB	760000	0	1000	0
Toluene	5	8	22	31	3 J	85	1000000	0	67000	0
Total Xylenes	7	8	250	290	2 J	1800	1000000	0	19500	0
Trichloroethene	2	8	15	5	3 J	7 J	520000	0	1000	0
Vinyl Chloride	1	8	15	3	3 J	3 J	3000	0	400	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	1	14	14	6.2	6.2	6.2	24000	0	29	0
4,4'-DDE	2	14	20	80	69	90	17000	0	21	2
alpha-Chlordane	1	14	7	3.9	3.9	3.9	2200	0	66	0
Aroclor, Total (4)	31	51	18000	30000	150	231000	10000	9		
Aroclor, Total (Conservative)(5)	31	51	21000	34000	330	278000	10000	10		
Aroclor-1248	1	18	780	6200	6200 J	6200 J	10000	0		
Aroclor-1262	20	38	5500	9900	120	71000 J	10000	5		
Aroclor-1268	30	49	15000	24000	120	230000	10000	9		
Dieldrin	4	14	21	36	4.6	93	360	0	7	3
Endosulfan II	2	14	13	5.4	2.5 J	8.3	1200000	0	8400	0
Endosulfan Sulfate	6	14	1200	2800	16 #	7300 #	1200000	0	8400	0

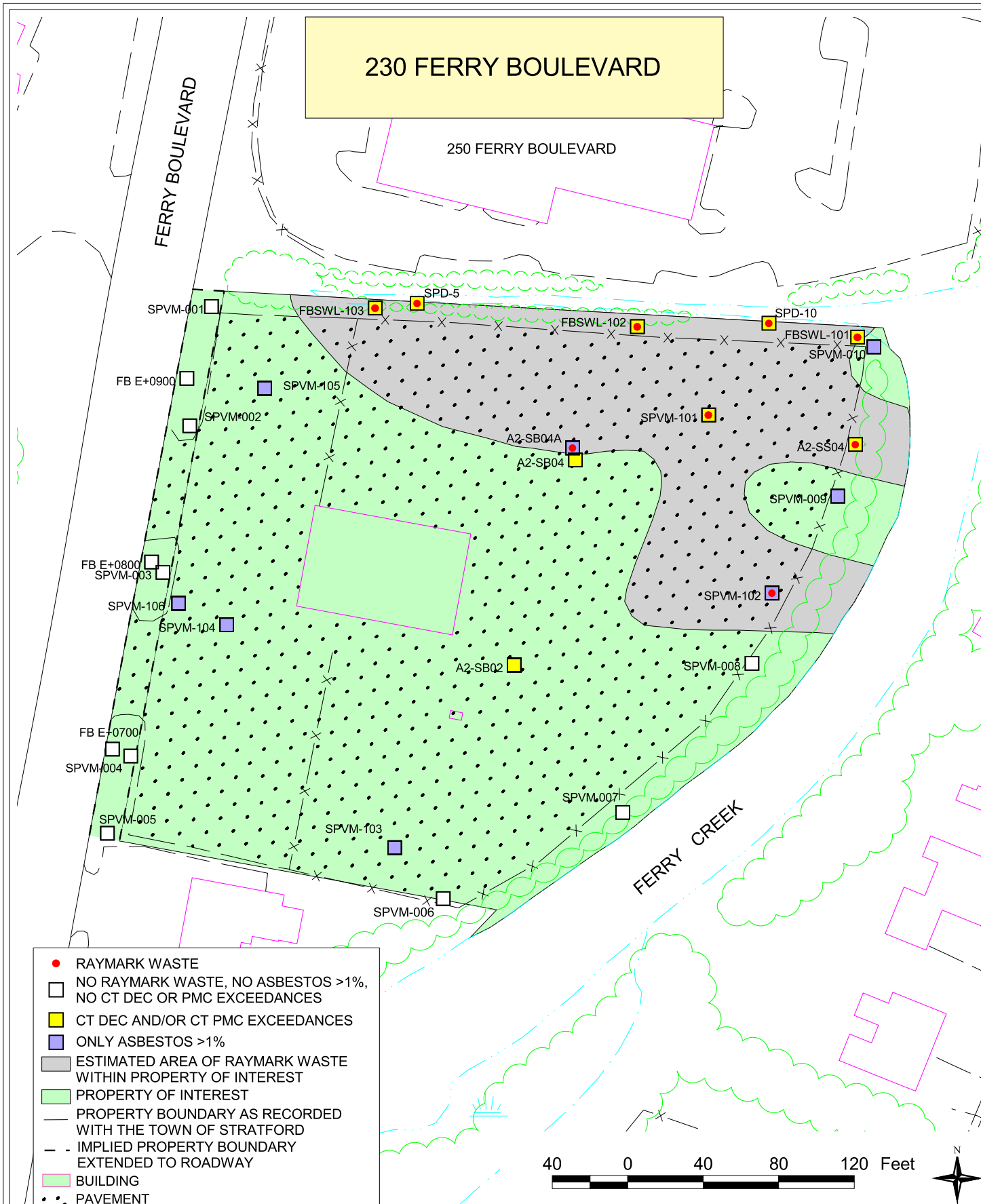
TABLE 3-3 (cont.)
230 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
Endrin Aldehyde	6	14	210	480	14	1400 #	610000	0		
Endrin Ketone	1	14	14	10	10	10	610000	0		
gamma-Chlordane	3	14	25	92	4	260 J	2200	0	66	1
Heptachlor	1	14	7	2.7	2.7	2.7	1300	0	13	0
Methoxychlor	5	14	200	490	7.2 J	1100	10000000	0	8000	0

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate
TB	Trip blank contamination

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-3
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
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3.4 250 Ferry Boulevard

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.4.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.4.1 Property Description

This property, approximately 2.1 acres of commercially-zoned (retail) land, is located on Ferry Boulevard in Stratford, Connecticut (Town of Stratford, 1997). The parcel is presently occupied by a motorcycle dealership. A one-story building is located near the southern side of the property, and most of the remaining area is an asphalt parking lot with small islands of landscape plantings. Recent repairs have been made to the asphalt pavement surface in the front of the property. The asphalt surface in the rear of the building, adjacent to Ferry Creek, is in poor condition with many cracks. A dense cover of reeds is present along the upper bank of Ferry Creek outside the eastern fence line. A narrow gravel strip, approximately 5 to 10 feet wide, separates the 250 and 280 Ferry Boulevard properties. No storm drains were observed on the property.

Access is somewhat restricted by a chain-link fence that surrounds the property. However, the western side of the fence (along Ferry Boulevard) has sliding gates that appear to remain open, allowing access to the premises. The western and northern portions of the fence have a maximum height estimated at 4 feet. The fence along Ferry Creek and the 230 Ferry Boulevard property swale is approximately 6 feet high.

Adjacent properties include the 280 Ferry Boulevard property (see Section 3.5) to the north, Ferry Creek to the east, the swale at 230 Ferry Boulevard (Section 3.3) to the south, and Ferry Boulevard to the west. The topography of the property is flat with a gentle slope towards Ferry Creek. Surface drainage appears to flow to the east towards Ferry Creek.

3.4.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of this property are located within the 100-year floodplain of the Housatonic River. The 100-year

frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Seven soil borings (SP-SB3, SP-SB4, SP-SB8, SP-SB9, and SPDPS-101 through SPDPS-103), ranging in depth from 12 to 18 feet below ground surface (bgs), were advanced on the property. Surficial materials in most borings consist of fill overlying peat, organic silt, clay-like material with organic matter or clayey sand. The organic materials are characteristic of a former marsh and swamp deposit. Soil boring SPDPS-101 consists of fill overlying a gravelly-sand interval at approximately 10 feet bgs. The material in this boring is characteristic of an outwash or ice-contact deposit. Refer to Figure 3-4 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Soil sample locations are shown on Figure 3-4, including both shallow surface soil samples and deeper samples from soil borings. The borings were used to describe the native material and fill on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials, including potentially asbestos containing material (PACM), asphalt, brake shoes, brick, ceramic tiles, charcoal, concrete, fiber pads, glass, plastic, sludge-like processed waste, and wood were identified in the soil from one or more of the borings. PACM was identified in borings SP-SB3, SP-SB4, SP-SB9, and SPDPS-102. These materials were encountered with natural fill consisting of sand, silty-sand and sand-silt mixtures, silt, and gravel. Manmade debris was not identified in soil borings SP-SB8, SPDPS-101, or SPDPS-103. Additionally, debris was not identified in the organic materials beneath the fill. Fill classifications were based on the visual characteristics of the soil and sediment samples collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across the entire property. The depth to groundwater is between 4 and 10 feet bgs, based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste have been estimated by the presence of asbestos, lead, copper and/or Aroclor

1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-4. Approximately 70 percent of this parcel is estimated to contain Raymark waste. Almost the entire waste area is paved, with the exception of the northeastern corner of the property. This unpaved area along the banks of Ferry Creek is vegetated with dense reeds.

3.4.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. Results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. Comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

Seventy-two samples were collected from 25 locations at this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-4. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-4 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-4 for the soil data summary statistics and comparison to criteria. The discussion below includes all soil samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

Asbestos

Sixty-two soil samples were collected from the property and analyzed for asbestos. Asbestos was detected in 55 of the 62 samples collected at this property. There was asbestos present at concentrations greater than 1 percent in 48 samples. Asbestos detections were scattered throughout the property at depths ranging from ground surface to 18 feet bgs.

Dioxins

Up to 14 soil samples were collected from the property and analyzed for dioxins. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. TEQ values ranged from 0.0016 µg/kg to 2.6 µg/kg.

Metals

Soil samples were collected and analyzed for metals as follows: 20 samples were analyzed in a fixed laboratory, 13 were screened for copper; and 45 were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Arsenic, chromium, and lead exceeded the CT DEC regulatory standards. Metals exceedances were scattered throughout the property, with exceedances ranging from ground surface to 14 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, one SPLP sample, from location SPDPS-102 at 4 to 6 feet bgs, was collected for SPLP metals analysis. This location is within the estimated area of Raymark waste. This sample exceeded the CT PMC standard for lead. No TCLP samples were collected.

Pesticides

Seventeen soil samples were collected from the property and analyzed for pesticides. Pesticides were detected frequently on the property. There were 12 samples with pesticide exceedances of the CT PMC regulatory standards. Pesticide exceedances were primarily located along the eastern and western sides of the property at depths up to 14 feet bgs.

PCBs

Up to 65 soil samples were collected from the property and analyzed for PCBs as Aroclors. Aroclors 1262 and 1268 were detected in about 80 percent of the samples collected from the property. A total of 23 samples had exceedances of the CT DEC for total Aroclors. Concentrations of Aroclors 1262 and 1268 were the primary contributors to the total Aroclor exceedances. Exceedances were scattered throughout the property at depths of up to 12 feet bgs.

SVOCs

Fourteen soil samples were collected from the property and analyzed for SVOCs. SVOCs (primarily PAHs) were detected frequently. Mostly PAHs exceeded the CT DEC and CT PMC regulatory standards. SVOC exceedances were scattered throughout the property at depths up to 16 feet bgs.

VOCs

Twelve soil samples were collected from the property and analyzed for VOCs. VOCs were rarely detected. There were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from 17 sample locations indicate that Raymark waste is present on the property. The following table displays the locations and constituents of the 39 samples from the 17 locations with concentrations that meet the definition of Raymark waste on this property. These

samples are located within the 70 percent of the property shown Figure 3-4 as the “Estimated Area of Raymark Waste within Property of Interest”.

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
A2-SS03	0 to 2	3	947	1,250	1,200
SDFB-002	0 to 0.5	20	1,670	NA	20,000
SDFB-003	0 to 0.5	75	1,510	NA	9,000
SPDPS-001	0 to 0.5	10	1,000	950	6,000
SPDPS-002	0 to 0.5	20	1,360	1,980	5,200
SPDPS-005	0 to 0.5	25	2,890	NA	16,000
SP-SB8	0 to 2	5	1,480	1,230	10,000
	2 to 4	3	890	NA	1,800
	4 to 6	15	1,600	NA	1,700
	6 to 8	8	1,300	NA	1,500
SP-SB9	0 to 2	7	850	NA	2,800
	2 to 4	20	880	NA	4,100
DPS-2	0 to 0.5	60	3,506	NA	30,000
DPS-3	0 to 0.5	40	6,550	10,900	28,000
DPS-4	0 to 0.5	90	4,604	NA	18,000
DPS-5	0 to 0.5	70	5,554	NA	28,000
DPS-6	0 to 0.5	60	3,850	3,070	13,000
SP-SB3	2 to 4	5	3,650	3,450	3,900
	2 to 4 (A)	5	1,600	NA	3,000
	2 to 4 (B)	5	5,700	NA	4,800
	10 to 12	3	1,200	1,400	1,500
	14 to 16	2	459	559	2,400
SP-SB4	4 to 6	40	10,500	12,800	1,600
	6 to 8	20	4,200	NA	4,500
	8 to 10	30	3,300	4,600	2,800
	10 to 12	75	8,500	NA	1,700
	12 to 14	35.5	4,300	7,650	855
	12 to 14 (A)	70	6,300	NA	1,300
SPDPS-101	2 to 4	40	2,310	2,870	74,000
	4 to 6	50	3,320	8,040	63,000
	6 to 8	30	2,300	4,690	15,200
	8 to 10	30	998	2,420	8,900
	10 to 12	25	3,350	6,280	19,000
SPDPS-102	2 to 4	5	434	596	910
	4 to 6	70	12,200	15,000	16,000
	6 to 8	60	14,600	16,900	17,000
	8 to 10	70	22,200	29,100	49,000
	10 to 12	80	25,400	30,400	68,000
	12 to 14	2	1,100	1,690	2,600

NA- Contaminant not analyzed
( )- Sample from a duplicate boring

3.4.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 70.3 percent of the 2.1-acre property contains Raymark waste. The waste is located throughout the property as shown in Figure 3-4. More than 90 percent of this property is covered either by a building or pavement, except for the densely vegetated area along the eastern property boundary abutting Ferry Creek. The majority of the areas estimated to contain Raymark waste is covered by pavement, with some lying beneath the densely vegetated northeastern corner of the property. SPLP data indicate that lead could potentially be leaching from contaminated soils into groundwater. Other data indicate that pesticides and SVOCs could be leaching into the groundwater. The asphalt pavement in the front of the property was recently repaired; however, significant cracks are present in the pavement at the rear of the building, providing little impediment to infiltration and leaching. Some erosion was observed along the creek banks. No storm drains were observed on the property. Surface water run off is likely toward Ferry Creek and may increase erosion along Ferry Creek.

3.4.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at 250 Ferry Boulevard that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste themselves. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at 250 Ferry Boulevard may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed

discussion of the HHRA approach is presented in Section 2.7. Section 3.4.5.1 provides an overview of the 250 Ferry Boulevard property, Section 3.4.5.2 presents COPCs and EPCs, Section 3.4.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.4.5.4 contains the numerical results of the risk assessment, and Section 3.4.5.5 presents property-specific uncertainties. Section 3.4.5.6 presents a property-specific summary of the major risk findings.

3.4.5.1 Overview

250 Ferry Boulevard is a commercial property of approximately 2.1 acres. A detailed description of 250 Boulevard is provided in Section 3.4.1. The nature and extent of the contamination detected at 250 Ferry Boulevard is discussed in Section 3.4.3. The areas estimated to contain Raymark waste represent an estimated 70 percent of the total 2.1-acre property, exclusive of any buildings, and are shown in Figure 3.4. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.4.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in the soils within the estimated areas of Raymark waste at 250 Ferry Boulevard are summarized in Appendix B-1, Table 2.4.

3.4.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.4 presents a summary of the COPCs for quantitative risk assessment for 250 Ferry Boulevard soils from the estimated areas of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based

screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations within soils at the estimated areas of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.4:

- Asbestos
- Acetophenone
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene)
- Aroclors, total (1262 and 1268)
- Metals (arsenic, barium, chromium, and lead)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 250 Ferry Boulevard are presented in Appendix B-1, Table 3.4. Listings of sample locations included in the evaluation are presented in Appendix B-2. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.4.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 250 Ferry Boulevard and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) are assumed to be exposed to soil only within the estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 250 Ferry Boulevard is a commercial property, as described in Section 3.4.1.

Potential Receptors

The receptors retained for quantitative evaluation are current and future commercial workers. Potentially exposed individuals are limited to those who work at 250 Ferry Boulevard.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at 250 Ferry Boulevard. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated areas of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 250 Ferry Boulevard are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from the property is considered to be minimal. The estimated areas of Raymark waste are mostly paved with uncovered portions vegetated with dense reeds. The presence of pavement and vegetation reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.4.5.4. Asbestos is present in soils within the estimated areas of Raymark waste at 250 Ferry Boulevard. The presence of pavement and vegetation suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to

determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) is factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 250 Ferry Boulevard is 0.70. Chemical intake estimates for the property are provided in Appendix B-1, Tables 7.4 and 8.4.

3.4.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 250 Ferry Boulevard is provided in this section. Appendix B-1, Table 7.4 and Table 8.4 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.4. Appendix B-1, Table 10.4 reduces the information developed in Appendix B-1, Table 9.4 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 250 Ferry Boulevard are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	6.4	5.7	12.1

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated areas of Raymark waste at 250 Ferry Boulevard is in excess of unity. Total Aroclor was the main contributor to the hazard index for the commercial worker. The chemical-specific (and target-organ specific) hazard quotients for total Aroclor alone are in excess of unity for commercial receptors. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Table 7.4 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 250 Ferry Boulevard are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	1.7E-04	1.2E-04	2.9E-04

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated areas of Raymark waste exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.4 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.4, dioxins, Aroclors, arsenic, and PAH compounds (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene) are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 6.7E-04.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste at 250 Ferry Boulevard property. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 25,400 mg/kg. The average lead concentration in this dataset was 3,700 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 3,700 mg/kg for soil within the estimated areas of Raymark waste was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) is factored into the intake equations shown in Appendix B-10. The FRW for 250 Ferry Boulevard is 0.70. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated areas of Raymark waste at 250 Ferry Boulevard, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 17 to 20 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 51 of 54 soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 90 percent. These samples were collected from the 0- to 15-foot bgs interval. The average concentration was 25 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as: material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos. Based on field conditions in the estimated areas of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.4.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 250 Ferry Boulevard are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 250 Ferry Boulevard property is 2.1 acres, with an estimated 70 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.4.4. The estimated areas of Raymark waste are mostly paved. No consideration has been given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated areas of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 70 percent of the time, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately 1.4 times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown in Appendix B-1, Table 2.4, alongside site-specific data from the estimated areas of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 2.1 to 18.5 mg/kg, with an average concentration of 10.2 mg/kg. Risk due to arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Fifty-five samples were included in the dataset for soils within the estimated areas of Raymark waste; however, 37 of those samples were only analyzed by field-screening methods. Due to limited numbers of samples analyzed for dioxins, Aroclors, acetophenone, PAHs (benzo(a)pyrene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene), and barium, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 15 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-10. The presence of Aroclors and lead at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Lead is present in soils located outside the estimated areas of Raymark waste at 250 Ferry Boulevard at concentrations up to 1,360 mg/kg. Aroclors are present at concentrations up to 16,805 µg/kg. Individual Aroclors detected were Aroclors 1262 and 1268. Asbestos is also present outside the estimated areas of Raymark waste at 250 Ferry Boulevard at concentrations up to five percent. Copper was detected outside of the estimated areas of Raymark waste at concentrations up to 1,980 mg/kg. The samples collected outside of the estimated areas

of Raymark waste at this property were not analyzed for dioxins or semivolatiles. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

3.4.5.6 Summary of Human Health Risk Assessment

This section presents a summary of major risk assessment findings for soil estimated to contain Raymark waste at 250 Ferry Boulevard. Risks to current and future commercial workers were estimated.

- The RME hazard indices (HI) for current and future commercial workers exposed to soil within the estimated areas of Raymark waste at 250 Ferry Boulevard are in excess of unity. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposure to Aroclors.

- The RME cancer risk estimates for current and future commercial workers exposed to soil within the estimated areas of Raymark waste at 250 Ferry Boulevard exceed the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5}. Dioxins, Aroclors, arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are anticipated for fetuses of pregnant workers exposed to lead in soil within the estimated areas of Raymark waste at 250 Ferry Boulevard.

- Asbestos was detected in 51 of 54 soil samples collected from estimated areas of Raymark waste at 250 Ferry Boulevard in the 0- to 15- foot bgs interval at a concentration range of trace to 90 percent. The average concentration was 25 percent.

3.4.6 Ecological Evaluation

No ecologically significant habitats are present on this property. The ecological characterization of the wetlands in the vicinity of this property was addressed under the OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark-Ferry Creek-OU3* (B&RE, 1998). A summary of the findings is presented below. It should be noted, however, that no individual evaluation of the ecological impacts on this property was performed.

Most of the property has been disturbed by surrounding development, past uses of Ferry Creek, and filling of a wetland area prior to developing the property. There are no wetlands on the property, but the parcel abuts Ferry Creek. There is limited vegetation on the parcel as most of the property is covered by a building or pavement.

This property provides only limited use as an area for birds, reptiles, and small mammals to forage, cover, rest and breed because of the level of development, soil contamination, disturbed nature of the area, and the low vegetation density and diversity. Wildlife identified in the area include red-winged blackbird (*Agelaius phoeniceus*) and green heron (*Butorides striatus*).

3.4.7 Summary

This 2.1-acre property abutting Ferry Creek contains Raymark waste. Soil containing metals (including SPLP metals), pesticides, PCBs, and SVOCs that exceed CT DEC and/or CT PMC criteria and asbestos greater than 1 percent are present on the property. Given the current property conditions, with over 90 percent of the property being covered by buildings or pavement, only limited infiltration or leaching is likely occurring, primarily in the areas of cracked pavement. Some erosion of fill along the bank into Ferry Creek has been observed, and surface water runoff from the property into Ferry Creek has likely increased this erosion.

The RME hazard indices for commercial workers exposed to soil within the estimated areas of Raymark waste indicate that adverse non-carcinogenic health effects are possible. The RME cancer risk estimates exceed the EPA cancer risk range and the CT DEP target total risk level. Dioxins, Aroclors, arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene are the primary risk drivers. Adverse

effects are anticipated on fetuses of pregnant workers exposed to lead in soils within the estimated areas of Raymark waste. The average concentration of asbestos in the estimated areas of Raymark waste was 25 percent.

No ecological risks were identified on the property.

TABLE 3-4
250 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	55	62	22	25	Trace	90	1	48		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	9	14	0.18	0.14	0.028	0.3 J				
1,2,3,4,6,7,8-HpCDF	10	14	1.7	2.3	0.027	6.31 J				
1,2,3,4,7,8,9-HpCDF	6	14	0.14	0.045	0.0017 J	0.145				
1,2,3,4,7,8-HxCDD	6	14	0.099	0.0055	0.00088 J	0.0166 J				
1,2,3,4,7,8-HxCDF	9	14	0.95	1.4	0.0107	3.64 J				
1,2,3,6,7,8-HxCDD	7	14	0.14	0.028	0.0017 J	0.1 J				
1,2,3,6,7,8-HxCDF	8	14	0.24	0.29	0.0034 J	0.876				
1,2,3,7,8,9-HxCDD	7	14	0.083	0.023	0.0013 EMPC	0.0848				
1,2,3,7,8,9-HxCDF	5	14	0.05	0.006	0.00064 J	0.0143 J				
1,2,3,7,8-PeCDD	5	14	0.1	0.0045	0.00052 J	0.0128 EMPC				
1,2,3,7,8-PeCDF	7	14	0.26	0.42	0.00085 EMPC	1.2				
2,3,4,6,7,8-HxCDF	9	14	0.51	0.67	0.0039 J	2 J				
2,3,4,7,8-PeCDF	9	14	0.77	1.1	0.0028 J	2.99 J				
2,3,7,8-TCDD	4	13	0.049	0.0017	0.00036 J	0.0027				
2,3,7,8-TCDF	8	14	0.73	1.2	0.0023	3.2 J				
OCDD	12	14	1.9	2.1	0.334 J	12.83				
OCDF	9	14	0.3	0.27	0.0172 J	0.5 J				
Total HpCDD	9	14	0.27	0.28	0.0909 J	0.57 J				
Total HpCDF	10	14	1.8	2.5	0.0371 J	7.13 J				
Total HxCDD	9	14	0.27	0.32	0.0091 J	2.29 J				
Total HxCDF	10	14	3.5	4.9	0.0575 J	14.21 J				
Total PeCDD	9	14	0.57	0.74	0.0004 J	4.59 *				
Total PeCDF	10	14	2.7	3.8	0.0267 J	12.7 J				
Total TCDD	7	14	0.91	0.029	0.000374 J	0.11 J				
Total TCDF	9	14	2.2	3.4	0.0175 J	10.33 J				
Toxicity Equivalency	12	13	0.67	0.71	0.0016 J	2.6 J				

TABLE 3-4 (cont.)
250 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	20	20	7820	7820	3800	13500				
Arsenic	19	20	7.7	8	2.1 J	18.5	10	5		
Barium	19	20	3660	3850	74.3 J	14500	140000	0		
Beryllium	12	20	0.32	0.43	0.1 J	0.65	2	0		
Cadmium	6	20	0.51	1.1	0.6	1.8	1000	0		
Calcium	20	20	2650	2650	791 J	11900 J				
Chromium	20	20	50.2	50.2	8.2 J	141	100	3		
Cobalt	20	20	11.8	11.8	4.7	34.2	2500	0		
Copper	30	33	5430	5960	17.4 J	30400 J	76000	0		
Iron	20	20	17400	17400	10100	26800				
Lead	63	65	3200	3300	32	25400	1000	38		
Magnesium	20	20	15900	15900	2220 J	57200 J				
Manganese	20	20	219	219	91.7 J	546	47000	0		
Mercury	12	20	0.11	0.15	0.08 J	0.23	610	0		
Nickel	20	20	114	114	7.7 J	520	7500	0		
Potassium	18	20	1280	1380	554 J	3190				
Selenium	1	20	0.52	0.9	0.9 J	0.9 J	10000	0		
Silver	7	20	0.7	1.3	0.5 J	2.8 J	10000	0		
Sodium	13	20	2050	3070	145	15700				
Thallium	1	19	0.43	0.72	0.72	0.72	160	0		
Vanadium	20	20	30.5	30.5	11.8	60.8	14000	0		
Zinc	20	20	826	826	30 J	3260 J	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	1	1	178	178	178 J	178 J				
Barium	1	1	405	405	405	405			10000	0
Cadmium	1	1	0.6	0.6	0.6 J	0.6 J			50	0
Calcium	1	1	11700	11700	11700	11700				
Copper	1	1	693	693	693 J	693 J			13000	0

TABLE 3-4 (cont.)
250 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Iron	1	1	243	243	243 J	243 J				
Lead	1	1	177	177	177	177			150	1
Magnesium	1	1	2900	2900	2900	2900				
Manganese	1	1	112	112	112 J	112 J				
Nickel	1	1	30.5	30.5	30.5	30.5			1000	0
Selenium	1	1	3.4	3.4	3.4 J	3.4 J			500	0
Zinc	1	1	280	280	280 J	280 J			50000	0
Semivolatile Organic Compounds (UG/KG)										
1,1'-Biphenyl	3	6	380	500	370 J	650				
2,4-Dimethylphenol	5	14	2900	4000	1000 J	10000 *	2500000	0	28000	0
2-Methylnaphthalene	6	14	1400	1100	45 J	5700 J	2500000	0	9800	0
2-Methylphenol	3	14	2200	500	370 J	670	2500000	0	70000	0
4-Methylphenol	6	14	2500	2500	130 J	7000 J	2500000	0	7000	0
Acenaphthene	8	14	1900	2100	40 J	15000 J	2500000	0	84000	0
Acenaphthylene	9	14	2100	560	97 J	3200 J	2500000	0	84000	0
Acetophenone	4	6	1800	2500	60 J	9400 *				
Anthracene	12	14	1300	1400	210 J	6500 J	2500000	0	400000	0
Benzaldehyde	3	6	1200	2100	240 J	5100 *J				
Benzo(a)anthracene	13	13	2600	2600	150 J	13000	7800	1	1000	7
Benzo(a)pyrene	13	14	3200	2300	160 J	12000	1000	6	1000	6
Benzo(b)fluoranthene	14	14	2500	2500	210 J	11000	7800	1	1000	8
Benzo(g,h,i)perylene	13	14	2100	1100	120 J	3700 J	2500000	0	42000	0
Benzo(k)fluoranthene	10	14	2700	1900	160 J	11000 J	78000	0	1000	3
bis(2-Ethylhexyl)phthalate	8	14	6000	9200	53 J	65000 J	410000	0	11000	1
Butylbenzylphthalate	1	14	2100	28	28 J	28 J	2500000	0	200000	0
Carbazole	10	11	2200	850	70 J	6500 J	290000	0	360	2
Chrysene	14	14	3300	3300	200 J	14000	780000	0	1000	10
Dibenzo(a,h)anthracene	6	14	2100	230	120 J	370 J	780	0	1000	0

TABLE 3-4 (cont.)
250 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Dibenzofuran	8	14	1400	1100	45 J	7600 J	2500000	0	5600	1
Di-n-Butylphthalate	7	14	2400	4100	49 J	15000 J	2500000	0	140000	0
Fluoranthene	12	14	5800	4900	280 J	32000	2500000	0	56000	0
Fluorene	11	14	1700	1500	80 J	11000 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	13	14	2300	1200	120 J	5700	7800	0	1000	2
Naphthalene	7	14	1500	1300	22 J	7700 J	2500000	0	56000	0
N-Nitroso-diphenylamine	1	14	2100	26	26 J	26 J	1200000	0	1400	0
Phenanthrene	14	14	5300	5300	130 J	31000 J	2500000	0	40000	0
Phenol	6	14	2500	1500	75 J	4200	2500000	0	800000	0
Pyrene	14	14	5900	5900	330 J	32000	2500000	0	40000	0
Volatile Organic Compounds (UG/KG)										
1,1-Dichloroethane	1	12	10	10	10 J	10 J	1000000	0	14000	0
1,2,4-Trichlorobenzene	1	7	9	1	1 J	1 J	2500000	0	14000	0
1,2-Dichloroethene (total)	1	5	9	11	11 J	11 J	1000000	0	14000	0
2-Butanone	10	12	53	62	16	150	1000000	0	80000	0
4-Methyl-2-Pentanone	2	12	12	23	15 J	31 J	1000000	0	14000	0
Acetone	8	12	250	360	76	650 J	1000000	0	140000	0
Benzene	5	12	8	6	1 J	9 J	200000	0	200	0
Bromoform	4	12	8	4	2 J	5 J	720000	0	800	0
Bromomethane	1	12	10	7	7 J	7 J				
Carbon Disulfide	11	12	28	30	1 J	260	1000000	0	140000	0
Chlorobenzene	6	12	94	180	5 J	950 *	1000000	0	20000	0
Chloroethane	2	12	10	11	10 J	11 J	1000000	0	2400	0
Chloromethane	3	12	10	15	11 J	20 J	440000	0	540	0
cis-1,2-Dichloroethene	3	7	20	34	2 J	98				
Ethylbenzene	6	12	23	37	1 J	85 J	1000000	0	10100	0
Isopropylbenzene	4	7	5	4	2 J	5 J				

TABLE 3-4 (cont.)
250 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG) (cont.)										
Methyl tert-Butyl Ether	1	7	9	2	2 J	2 J				
Methylcyclohexane	3	7	7	4	3 J	5 J				
Methylene Chloride	1	12	12	32	32 J	32 J	760000	0	1000	0
Toluene	7	12	600	1000	3 J	4200 *	1000000	0	67000	0
Total Xylenes	8	12	110	160	5 J	480 J	1000000	0	19500	0
trans-1,2-Dichloroethene	1	7	9	4	4 J	4 J				
Trichloroethene	4	12	8	5	3 J	9 J	520000	0	1000	0
Vinyl Chloride	1	12	10	11	11 J	11 J	3000	0	400	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	7	17	51	93	5 J	350	24000	0	29	3
4,4'-DDE	9	16	39	56	4.3 J	150	17000	0	21	5
4,4'-DDT	8	15	150	260	3.7 J	960 J	17000	0	21	5
alpha-Chlordane	6	17	11	12	1.3 J	37 J	2200	0	66	0
Aroclor, Total (4)	54	65	15000	18000	270	178000	10000	23		
Aroclor, Total (Conservative)(5)	54	65	16000	19000	430	180340	10000	23		
Aroclor-1248	1	19	160	47	47	47	10000	0		
Aroclor-1260	3	59	270	1200	500	2000	10000	0		
Aroclor-1260/62	3	4	910	1200	500	2000				
Aroclor-1262	42	51	7800	9400	230 J	110000 *	10000	7		
Aroclor-1268	51	60	9500	11000	140 J	74000 J	10000	16		
beta-BHC	1	17	8.5	5.4	5.4	5.4	3200	0	3.9	1
Dieldrin	6	17	18	21	3.3 J	89	360	0	7	4
Endosulfan I	2	17	8.9	9.5	5	14 J	1200000	0	8400	0
Endosulfan Sulfate	7	17	1200	2900	35	7900 *#	1200000	0	8400	0
Endrin	1	16	25	160	160 J	160 J	610000	0		
Endrin Aldehyde	8	16	350	690	15 #	1900 *#	610000	0		
Endrin Ketone	3	17	44	170	4.3	410 J	610000	0		

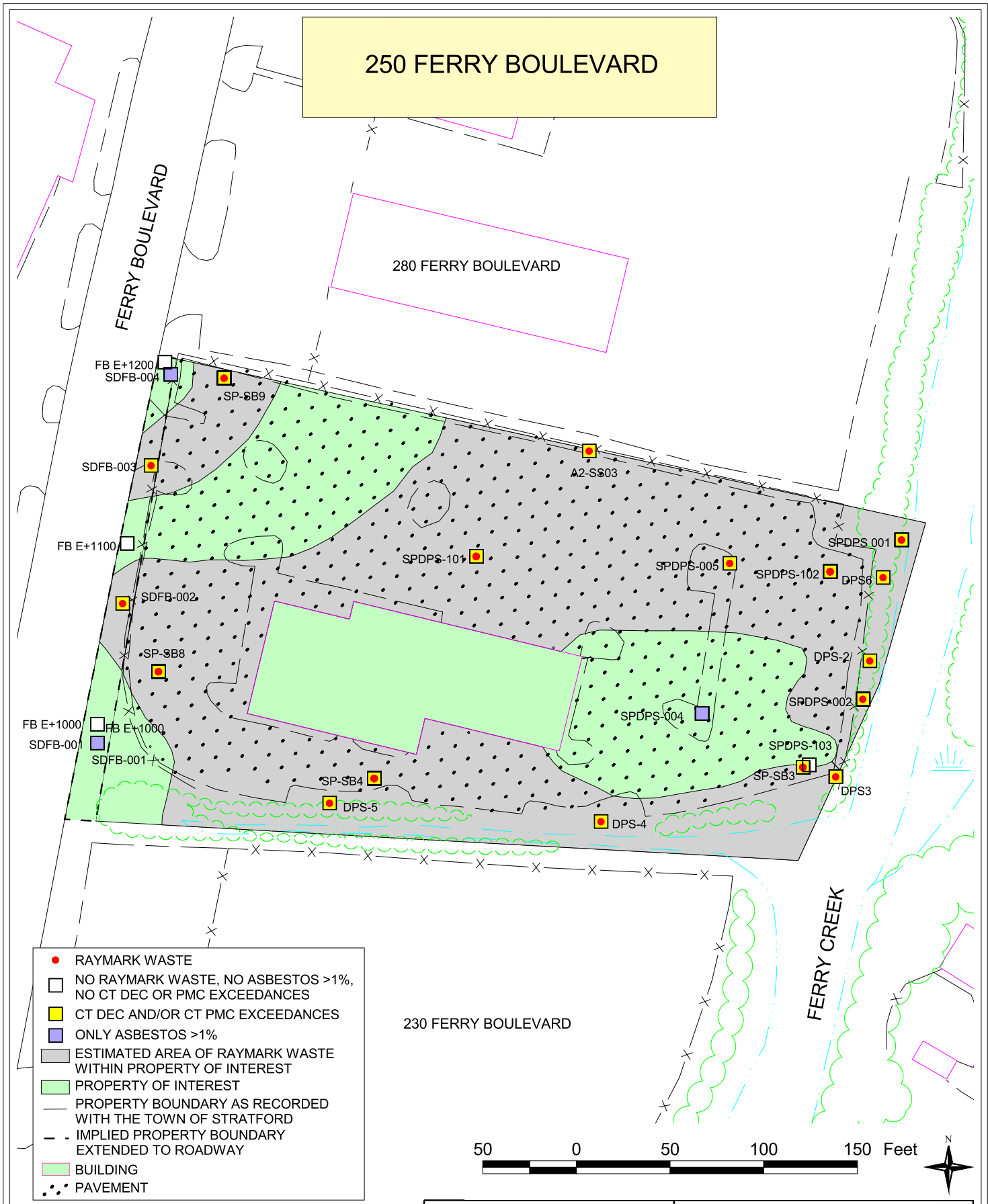
TABLE 3-4 (cont.)
250 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
gamma-Chlordane	8	17	15	23	4.9 J	71 J	2200	0	66	1
Heptachlor	1	17	8	2.7	2.7 J	2.7 J	1300	0	13	0
Heptachlor Epoxide	1	17	8.1	5.9	5.9 J	5.9 J	630	0	20	0
Methoxychlor	5	16	340	940	41	2300	10000000	0	8000	0

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-4
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	(978)658-7899

3.5 280 Ferry Boulevard

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.5.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.5.1 Property Description

This property, approximately 1.6 acres of commercially-zoned (retail) land, is located on Ferry Boulevard in Stratford, Connecticut (Town of Stratford, 1997). It is currently occupied as a boat sales, service, and storage facility. A two-story building that is used for boat sales and repair is located on the property. Repair bays are located on the northern and southern sides of the building. Most of the remaining property is covered by asphalt paving. Some areas of the asphalt have large cracks, especially the area behind the building. The parking lot is primarily used for boat storage and vehicle parking. Access by the public is somewhat restricted by a chain-link fence on three sides of the property. The property is unfenced along Ferry Boulevard, however the chain link fence extends out from the front of the building, running east to west. Both sides of the fence have sliding gates with barbed wire. The gates are closed during non-business hours, restricting public access to the rear of the property. The back of the property is accessible during the day.

During investigations at the property, several 55-gallon drums were noted along the northern side of the building as well as on the south side of the parcel. Some of these drums were labeled as engine oil, however, the contents were not verified. There was also an approximately 500-gallon metal storage container located adjacent to the drums on the south side of the property. Several other drums, plastic containers, and boat parts were also scattered along the southern edge of the property. Numerous piles of broken palettes, tires, and other debris were scattered about the rear of the property, as well as along the northern border of the property, abutting 300 Ferry Boulevard (see Section 3.6). Several plastic 5-gallon containers were stored on gravel at the southeast corner of the property near Ferry Creek. Previous site investigations have reported that the containers appear to contain waste oil or other waste product. Three empty 500-gallon storage tanks were present near the containers.

Ferry Creek is located on the eastern edge of the property, with the 250 Ferry Boulevard (see Section 3.4) property to the south, Ferry Boulevard to the west, and the 300 Ferry Boulevard commercial property to the north (see Section 3.6). The topography is flat with a steep drop-off towards the Ferry Creek channel.

Storm water drains were observed in the parking lot and appear to drain towards Ferry Creek. Soils at the property are classified as fill soils that have been placed in wetlands (tidal marshes).

3.5.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of this property are located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for this property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Six soil borings (A2-SB01, A2-SB03, SP-SB2, and SPHM-101 through 103), were advanced to depths of up to 16 feet below ground surface (bgs). Boring A2-SB01 was discontinued before reaching clean native soil and was not used to describe natural materials on this property. Boring logs for A2-SB03, SP-SB2, and SPHM-101 indicate that surficial materials primarily consist of fill overlying peat or organic silt with trace amounts of clay, gravel, plant fibers, and twigs. The organic materials are characteristic of a former marsh and swamp deposit. Native soil in borings SPHM-102 and SPHM-103 consisted of fine sand and silt with trace amounts of more coarse material, which is characteristic of alluvial, ice contact, and glacial-outwash deposits. Refer to Figure 3-5 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells have been installed on this property. Soil sample locations are shown on Figure 3-5 and include both shallow surface soil samples and deeper samples from soil borings. The borings were used to describe the fill and native materials on the property. All sampling locations were used to determine the presence or absence of Raymark waste and to identify the areas that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials placed on the property as a result of human activity. Manmade materials, including potentially asbestos-containing material

(PACM) (brake pads and fibrous mats and pads), asphalt, ash and cinders, brake pads, brick, concrete, gaskets, roofing shingles, and manufacturing debris, were identified in the soil from one or more of the borings. These materials were encountered with natural fill materials consisting of sand with varying amounts of silt and gravel. Fill classifications were based on the visual characteristics of the soil and sediment samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across the entire property. The depth to water ranges from 5 to 13 feet bgs, based on soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper and/or Aroclor 1268 meeting the definition of Raymark waste as defined in Section 2.2 of this report. These limits are shown on Figure 3-5. Approximately 77.6 percent of this property is estimated to contain Raymark waste. The entire estimated areas of Raymark waste are paved with the exception of approximately 10 percent of the waste area along the eastern property boundary abutting Ferry Creek, which is vegetated with dense reeds.

3.5.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. Results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 53 samples collected from 18 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-5. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs and VOCs. See Table 3-5 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-5 for the soil data summary statistics and comparison criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

Asbestos

Fifty-three soil samples were collected from the property and analyzed for asbestos. Asbestos was detected very frequently on the property, at values of up to 90 percent in some areas of the property. Asbestos at greater than 1 percent was found in 45 of the 53 samples and these samples were distributed throughout the property and at depths of up to 16 feet bgs.

Dioxins

Up to eleven soil samples were collected from the property and analyzed for dioxins. Dioxins were detected frequently at the property. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. The highest TEQ value was 7.4 µg/kg.

Metals

Soil samples were collected from the property and analyzed for metals as follows: 16 samples were analyzed for metals in a fixed laboratory, 23 samples were screened for copper, and 37 samples were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium and sodium. Chromium and lead exceeded the CT DEC

regulatory standards at locations that are scattered throughout the property, and at depths of up to 16 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, 3 of the three SPLP samples were from within the estimated area of Raymark waste. All three samples exceeded the CT PMC standard for lead. The highest lead exceedance was at a depth of 2 to 4 feet bgs in sample SPHM-101, located in the central area of the property within the estimated area of Raymark waste. No TCLP samples were collected.

Pesticides

Sixteen soil samples were collected from the property and analyzed for pesticides. Pesticides were detected sporadically on the property. There were no CT DEC regulatory exceedances. There were nine pesticide exceedances of the CT PMC regulatory standards. Pesticide exceedances were located in the central and eastern portions of the property at depths ranging from the surface to 12 feet bgs.

PCBs

Forty-one soil samples were collected from the property and analyzed for PCBs as Aroclors. PCBs, specifically Aroclor 1262 and 1268, were detected frequently on the property. Twenty-two samples exceeded the CT DEC regulatory standards for PCBs. PCB exceedances for total Aroclors, were located throughout the property at depths ranging from ground surface to 16 feet bgs. Aroclor 1262 and 1268 concentrations were the primarily contributors to the total Aroclor exceedances. No SPLP/TCLP PCB samples were collected.

SVOCs

Fourteen soil samples were collected from the property and analyzed for SVOCs. SVOCs were detected sporadically on the property. Twelve samples exceeded of the CT DEC and/or CT PMC regulatory standards for SVOCs. SVOC exceedances were located in the central area of

the property, at locations A2-SB01, SPHM-101 and SP-SB2, from the ground surface to 16 feet bgs.

VOCs

Ten soil samples were collected from the property and analyzed for VOCs. VOCs were not frequently detected on the property. There were no VOC exceedances of the CT DEC or CT PMC regulatory standards.

Raymark Waste

The results from 12 sample locations indicate that Raymark waste is present on the property. The following table displays the locations and constituents of the 37 samples from those 12 locations with concentrations that meet the definition of Raymark waste on this property. These samples are located within the 77 percent of the property shown on Figure 3-5 as the "Estimated Area of Raymark Waste within Property of Interest".

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
A2-SB01	0 to 2	3	1,600	2,600	NA
	2 to 4	20	5,500	9,200	NA
	4 to 6	20	2,900	4,200	NA
	6 to 8	40	22,000	26,900	27,000
	8 to 10	40	18,000	27,000	NA
	10 to 12	40	24,000	40,000	NA
	12 to 14	40	7,400	10,000	NA
	14 to 16	10	14,700	15,900	39,000
A2-SB03	0 to 2	3	2,490	2,640	32,000
	4 to 6	2	790	1,000	NA
SPHM-002	0 to 0.5	20	2,885	NA	160,000
SP-SB2	0 to 2	4	690	810	1,200
	2 to 4	34	13,600	25,200	57,000
	2 to 4(A)	8	440	NA	1,300
	2 to 4(B)	60	13,600	25,200	57,000
	4 to 6	55	7,350	9,200	1,470
	4 to 6(B)	40	1,700	NA	2,700
SPHMB+200	0 to 0.5	40	2,108	NA	13,000
SPHMB+300	0 to 0.5	20	6,196	NA	16,000
SPHMB+370	0 to 0.5	10	1,015	NA	10,000

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
SPHM-101	0 to 2	7	579	790	1,300
	2 to 4	50	12,500	38,400	ND
	4 to 6	60	24,800	40,900	ND
	6 to 8	60	23,100	27,700	ND
	8 to 10	60	30,500	41,800	ND
	10 to 12	70	41,700	45,100	37,000
	12 to 14	30	26,800	27,300	ND
SPHM-102	0 to 2	40	7,050	10,400	53,000
	2 to 4	60	8,650	19,900	24,000
	4 to 6	60	12,100	18,000	10,000
	6 to 8	70	7,420	10,900	17,000
	8 to 10	70	20,000	32,200	64,000
	10 to 12	75	9,800	18,400	42,000
SPHM-103	0 to 2	8	792	690	2,800
	2 to 4	5	492	397	1,600
SPD-3	0 to 0.5	90	2,847	NA	27,000
SPD-4	0 to 0.5	70	14,300	33,200	17,000

NA- Contaminant not analyzed
ND- Contaminant not detected
( )- Sample from duplicate boring

3.5.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas with Raymark waste. The primary pathways for migration of contaminants throughout this property are discussed below.

Approximately 77.6 percent of the 1.6-acre property is estimated to contain Raymark waste. The waste is located throughout the property (see Figure 3-5). Over 90 percent of this property is covered either by a building or pavement. Only the rear of the property, which abuts to Ferry Creek, is uncovered. Most of soils estimated to contain Raymark waste are covered by pavement, with only about 10 percent of the waste area covered with vegetation.

There is potential for infiltration to occur as the paved areas are heavily cracked. Some erosion was observed along the creek bank. SPLP data indicate that lead could potentially leach from contaminated soils into the groundwater. Other data indicate that pesticides and SVOCs may

also pose a leaching threat to groundwater. Storm water drains were visible on the property, but discharge points were not investigated.

3.5.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at 280 Ferry Boulevard that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at 280 Ferry Boulevard may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.5.5.1 provides an overview of the 280 Ferry Boulevard property, Section 3.5.5.2 presents COPCs and EPCs, Section 3.5.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.5.5.4 contains the numerical results of the risk assessment, and Section 3.5.5.5 presents property-specific uncertainties. Section 3.5.5.6 presents a property-specific summary of the major risk findings.

3.5.5.1 Overview

280 Ferry Boulevard is a commercial property of approximately 1.6 acres. A detailed description of 280 Ferry Boulevard is provided in Section 3.5.1. The nature and extent of the contamination detected at 280 Ferry Boulevard is discussed in Section 3.5.3. The areas of 280 Ferry Boulevard estimated to contain Raymark waste represent an estimated 78 percent of the total 1.6-acre property, exclusive of any buildings, and are shown in Figure 3-5. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.5.2. Listings of samples included in the risk evaluation are presented in Appendix B-2.

Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 280 Ferry Boulevard are summarized in Appendix B-1, Table 2.5.

3.5.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.5 presents a summary of the COPCs for quantitative risk assessment for 280 Ferry Boulevard soils from the estimated areas of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data, except soil data collected from depths greater than 15 feet, were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.5:

- Asbestos
- Trichloroethene
- Acetophenone
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene)
- Aroclors, total (1242, 1248, 1254, 1262, and 1268)
- Metals (arsenic, barium, chromium, and lead)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 280 Ferry Boulevard are presented in Appendix B-1, Table 3.5. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.5.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 280 Ferry Boulevard and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated areas of Raymark waste at the property.

Land Use and Access

The property at 280 Ferry Boulevard is a commercial property, described in Section 3.5.1.

Potential Receptors

The receptors retained for quantitative evaluation at 280 Ferry Boulevard are current and future commercial workers. Potentially exposed individuals are limited to those who work at 280 Ferry Boulevard.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at 280 Ferry Boulevard. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated areas of Raymark waste) only. Appendix

B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 280 Ferry Boulevard are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from 280 Ferry Boulevard is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. The estimated areas of Raymark waste are almost entirely paved, with the exception of dense reeds abutting Ferry Creek. The presence of pavement and vegetation reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on intermedia transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at commercial properties. Appendix B-1, Table 2.5 presents available inhalation SSLs for contaminants in soils at the estimated areas of Raymark waste at the 280 Ferry Boulevard property. Exposures to fugitive dust and VOCs released from soil were found to be insignificant based on the qualitative screening. All reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a).

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.5.5.4. Asbestos is present in soils within the estimated areas of Raymark waste at 280 Ferry Boulevard. The presence of pavement and dense vegetation and the qualitative comparison to SSLs suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. As

directed by EPA, in order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.6. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 280 Ferry Boulevard is 0.78. Chemical intake estimates for 280 Ferry Boulevard are provided in Appendix B-1, Tables 7.5 and 8.5.

3.5.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 280 Ferry Boulevard is provided in this section. Appendix B-1, Table 7.5 and Table 8.5 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.5. Appendix B-1, Table 10.5 reduces the information developed in Appendix B-1, Table 9.5 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 280 Ferry Boulevard are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	4.4	3.9	8.2

The RME hazard indices (HI) for the commercial worker exposed to soils within the estimated areas of Raymark waste at 280 Ferry Boulevard are in excess of unity. Total Aroclor was the main contributor to the hazard index for the commercial worker. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity for commercial receptors. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Table 7.5 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 280 Ferry Boulevard are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	2.0E-04	1.3E-04	3.3E-04

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated areas of Raymark Waste at 280 Ferry Boulevard exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.5 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.5, dioxins, Aroclors, arsenic, and PAH compounds (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene) are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 9.8E-04.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste at the 280 Ferry Boulevard property. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 41,700 mg/kg. The average lead concentration in this dataset was 8,670 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 8,670 mg/kg for soil within the estimated areas of Raymark waste at 280 Ferry Boulevard was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) is factored into the intake equations shown in Appendix B-10. The FRW for 280 Ferry Boulevard is 0.78. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated areas of Raymark waste at 280 Ferry Boulevard, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 57 to 59 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 45 of 47 soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 90 percent. These samples were collected from the 0- to 15-foot bgs interval. The average concentration was 32 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos at 280 Ferry Boulevard. Based on field conditions in the estimated areas of Raymark waste at 280 Ferry Boulevard, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.5.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 280 Ferry Boulevard are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 280 Ferry Boulevard property is 1.6 acres, with an estimated 77 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.5.4. The estimated areas of Raymark waste are almost entirely paved, with the exception of dense reeds abutting Ferry Creek. No consideration has been given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated areas of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 77 percent of the time, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately 1.3 times greater than those estimated using the FRW factor.

- Copper concentrations exceeded the EPA Region IX industrial soil PRG of 41,000 mg/kg in 280 Ferry Boulevard soils; however, due to the lack of an approved toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in 280 Ferry Boulevard soils (0 to 15 feet bgs) at

concentrations ranging from 39.1 mg/kg to 45,100 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown in Appendix B-1, Table 2.5 alongside site-specific data from the estimated areas of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 3.9 to 9.7 mg/kg, with an average concentration of 5.9 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Forty-seven samples were included in the dataset for soils within the estimated areas of Raymark waste; however, 33 samples were only analyzed by field-screening methods. Due to limited numbers of samples analyzed for trichloroethene, acetophenone, and PAHs, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 15 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-10. No contaminants were detected at concentrations greater than CT RSRs for industrial soil in the two samples collected from outside the estimated areas of Raymark waste at 280 Ferry Boulevard. Asbestos is present outside the estimated areas of Raymark waste at 280 Ferry Boulevard at concentrations up to 10 percent. Lead is present at concentrations up to 250 mg/kg. Two samples from outside the estimated areas of Raymark waste were analyzed for PCBs using CLP methods. Neither of these samples had concentrations greater than the CT RSRs for industrial soil or the EPA Region IX PRG for industrial soil. Individual Aroclors detected were Aroclors 1262 and 1268. Copper was detected at concentrations up to 141 mg/kg. No CLP analysis of dioxins was performed. Total risks for a receptor exposed to soils throughout the property are likely to exceed those estimated based only on the areas of Raymark waste.

3.5.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at 280 Ferry Boulevard. Risks to commercial workers were estimated.

- The RME hazard indices (HI) for current and future commercial workers exposed to soil within the estimated areas of Raymark waste at 280 Ferry Boulevard are in excess of unity. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposures to Aroclors.

- The RME cancer risk estimates for commercial workers exposed to soil within the estimated areas of Raymark waste at 280 Ferry Boulevard exceed the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5}. Dioxins, Aroclors, arsenic, and PAH compounds (benzo(a)pyrene, benzo(a)anthracene, benzo(b) fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene) are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are anticipated for fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste at 280 Ferry Boulevard.

- Asbestos was detected in 45 of 47 soil samples collected from the estimated areas of Raymark waste at 280 Ferry Boulevard in the 0- to 15- foot bgs interval at a concentration range of trace to 90 percent. The average concentration was 32 percent.

3.5.6 Ecological Evaluation

No ecologically significant habitats are located on this property. The ecological characterization of the wetlands in the vicinity of this property was addressed under the OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark-Ferry Creek-OU3* (B&RE, 1998). A summary of the findings is presented below. It should be noted, however, that no individual evaluation of the ecological impacts on this property was performed.

Most of the property has been disturbed by surrounding development, past uses of Ferry Creek, and filling of a wetland area prior to developing the property. There are no wetlands on the property, but the property abuts Ferry Creek. There is limited vegetation on the property as most of the property is covered by a building or pavement (see Figure 3-5).

This property provides only limited use as an area for birds, reptiles, and small mammals to forage, cover, rest and breed because of the level of development, soil contamination, disturbed nature of the area, and the low vegetation density and diversity. Wildlife identified in the area include red-winged blackbird (*Agelaius phoeniceus*) and green heron (*Butorides striatus*).

3.5.7 Summary

This 1.6-acre property abutting Ferry Creek contains Raymark waste. Soils containing elevated dioxins, metals (including SPLP metals), pesticides, PCBs and/or SVOCs that exceed CT DEC and/or CT PMC criteria and asbestos greater than 1 percent, are present on the property. Most

of the property is covered by buildings or pavement, however, due to permeability of pavement and the significant cracks in the pavement, infiltration of precipitation is likely occurring. Exceedances of the CT PMC indicate leaching of contaminants from soils to groundwater may be occurring. Some erosion of fill along the bank into Ferry Creek has been identified.

The RME hazard indices for commercial workers exposed to soil within the estimated areas of Raymark waste are in excess of unity, indicating adverse non-carcinogenic health effects. The RME cancer risk estimates exceed the EPA cancer risk range and the CT DEP target total risk level. Dioxin, Aroclors, arsenic, and PAH compounds (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3,-cd)pyrene) are the predominant risk drivers. Adverse effects are anticipated for fetuses of pregnant workers exposed to lead in the soil within the estimated areas of Raymark waste. The average asbestos concentration was 38 percent.

No ecologically significant habitats have been identified on the property. It is unlikely that ecological receptors are being adversely impacted by the presence of Raymark waste on this property.

TABLE 3-5
280 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	51	53	29	30	Trace	90	1	45		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	9	11	0.68	0.77	0.0394	1.77 J				
1,2,3,4,6,7,8-HpCDF	9	11	5.1	6.1	0.289	15.7 &				
1,2,3,4,7,8,9-HpCDF	9	11	0.24	0.25	0.0052 J	1.3433 *				
1,2,3,4,7,8-HxCDD	8	11	0.03	0.013	0.00082 J	0.0285 J				
1,2,3,4,7,8-HxCDF	11	11	3.4	3.4	0.144	8.3 J				
1,2,3,6,7,8-HxCDD	8	11	0.075	0.074	0.0026 J	0.191				
1,2,3,6,7,8-HxCDF	9	11	1	1.2	0.0371	2.75 &				
1,2,3,7,8,9-HxCDD	8	11	0.069	0.073	0.0025 J	0.19 J				
1,2,3,7,8,9-HxCDF	8	11	0.017	0.011	0.00066 EMPC	0.0347				
1,2,3,7,8-PeCDD	8	11	0.12	0.016	0.00056 EMPC	0.0434 EMPC				
1,2,3,7,8-PeCDF	9	11	1.5	1.6	0.0361	4.36 &				
2,3,4,6,7,8-HxCDF	11	11	1.9	1.9	0.0823	4.62 &				
2,3,4,7,8-PeCDF	11	11	3.2	3.2	0.112	8.85 &				
2,3,7,8-TCDD	8	11	0.036	0.0038	0.00028 J	0.0097				
2,3,7,8-TCDF	11	11	3.1	3.1	0.0797	8.86 &				
OCDD	9	11	2.9	3.1	0.44 J	7.349 J				
OCDF	9	11	1.1	1.2	0.0853	3.67				
Total HpCDD	9	11	1.2	1.4	0.0853 J	3.23 J				
Total HpCDF	9	11	5.6	6.7	0.33 J	17.02 J&				
Total HxCDD	9	11	0.37	0.44	0.0091 J	1.62 J				
Total HxCDF	11	11	13.2	13.2	0.566 J	37.07 J&				
Total PeCDD	9	11	1.1	1.2	0.008 J	10.11 *				
Total PeCDF	11	11	13.9	13.9	0.45 JEB	44.55 JEB&				
Total TCDD	8	11	0.63	0.068	0.0028 JEB	0.132 JEB				
Total TCDF	11	11	9.2	9.2	0.211 JEB	31.88 JEB&				
Toxicity Equivalency	11	11	2.8	2.8	0.097 J	7.4 J				

TABLE 3-5 (cont.)
280 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	16	16	7620	7620	4360	17600 J				
Antimony	4	15	1.4	1.5	0.79 J	2.4 J	8200	0		
Arsenic	12	16	5.9	6.8	3.9	9.7	10	0		
Barium	16	16	6490	6490	42.7	13600	140000	0		
Beryllium	6	16	0.3	0.52	0.3	0.92	2	0		
Cadmium	9	16	1.1	1.7	0.66	3.2	1000	0		
Calcium	16	16	2330	2330	594	3560				
Chromium	16	16	99.3	99.3	13.4	180	100	10		
Cobalt	16	16	17.5	17.5	5	28.2	2500	0		
Copper	36	39	14600	15800	39.1	45100 J	76000	0		
Iron	16	16	19800	19800	10900 J	26700 J				
Lead	51	53	7710	8010	25	41700 J	1000	32		
Magnesium	16	16	36900	36900	1820 J	77600				
Manganese	16	16	270	270	174	364 J	47000	0		
Mercury	4	16	0.079	0.14	0.06	0.23 J	610	0		
Nickel	16	16	260	260	7.1	471	7500	0		
Potassium	14	16	1410	1580	666	3520 J				
Selenium	10	16	1.7	2.3	0.88 J	6.8 J	10000	0		
Silver	8	16	1.5	2.6	1.3	4.1	10000	0		
Sodium	11	16	1980	2760	213	13100 J				
Vanadium	16	16	24.7	24.7	2	45.8	14000	0		
Zinc	16	16	2700	2700	43.6 J	9180 J	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	3	3	947	947	173	2480 J				
Barium	3	3	409	409	243	709			10000	0
Cadmium	1	3	1.2	3.1	3.1	3.1			50	0
Calcium	3	3	5930	5930	3210	10200				
Chromium	1	3	3.8	10.3	10.3	10.3			500	0
Cobalt	1	3	5.2	13.7	13.7	13.7				

TABLE 3-5 (cont.)
280 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Copper	3	3	1540	1540	480	2570 J			13000	0
Iron	3	3	1140	1140	170	2980 J				
Lead	3	3	881	881	609	1090			150	3
Magnesium	3	3	5840	5840	1670	9970				
Manganese	3	3	239	239	9.2	652				
Mercury	1	3	0.3	0.3	0.3	0.3			20	0
Nickel	3	3	23.2	23.2	4.5	40.6			1000	0
Potassium	2	2	1960	1960	1400	2530				
Sodium	2	2	9600	9600	990	18200				
Vanadium	1	3	2.3	5.9	5.9	5.9			500	0
Zinc	3	3	701	701	91	1710			50000	0
Semivolatile Organic Compounds (UG/KG)										
1,1'-Biphenyl	7	7	1200	1200	31 J	3200 J				
2,4-Dichlorophenol	1	14	2800	23	23	23				
2,4-Dimethylphenol	12	14	7200	7000	58 J	21000	2500000	0	28000	0
2,4-Dinitrotoluene	1	14	2700	230	230 J	230 J				
2-Methylnaphthalene	11	14	2900	2100	44 J	12000 J	2500000	0	9800	1
2-Methylphenol	9	14	2500	950	130 J	2000 J	2500000	0	70000	0
4-Methylphenol	11	14	4400	4000	39 J	9800	2500000	0	7000	2
Acenaphthene	10	14	3700	3500	39 J	12000 J	2500000	0	84000	0
Acenaphthylene	9	14	2600	1100	100 J	5700	2500000	0	84000	0
Acetophenone	4	7	2400	3500	500	7000 J				
Anthracene	11	14	6000	6100	35 J	18000	2500000	0	400000	0
Benzaldehyde	7	7	630	630	28 JEB	1500 JEB				
Benzo(a)anthracene	13	14	6300	6700	120 J	20000	7800	4	1000	10
Benzo(a)pyrene	13	14	5300	5700	150 J	17000	1000	10	1000	10
Benzo(b)fluoranthene	13	14	5200	5600	150 J	18000	7800	3	1000	10
Benzo(g,h,i)perylene	11	14	3800	3200	130 J	9900 J	2500000	0	42000	0
Benzo(k)fluoranthene	13	14	4500	4800	150 J	14000	78000	0	1000	8

TABLE 3-5 (cont.)
280 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
bis(2-Ethylhexyl)phthalate	5	14	2300	450	130 J	1000 J	410000	0	11000	0
Carbazole	10	14	4200	4100	54 J	17000	290000	0	360	7
Chrysene	13	14	9600	10000	740	27000 *	780000	0	1000	10
Dibenzo(a,h)anthracene	10	14	2300	1500	98 J	3900 J	780	4	1000	4
Dibenzofuran	8	14	3400	3700	32 J	9200 J	2500000	0	5600	3
Diethylphthalate	1	14	2800	45	45	45	2500000	0	1100000	0
Dimethylphthalate	3	14	2700	150	65	230 J	2500000	0	1100000	0
Di-n-Butylphthalate	3	14	2900	1500	63 J	2700 J	2500000	0	140000	0
Di-n-octylphthalate	1	14	2800	34	34	34	2500000	0	20000	0
Fluoranthene	12	14	19000	22000	1100	66000	2500000	0	56000	2
Fluorene	10	14	5200	5500	84 J	16000 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	9	14	3800	4000	420	10000 J	7800	2	1000	5
Naphthalene	11	14	3500	2900	37 J	10000 J	2500000	0	56000	0
N-Nitroso-diphenylamine	5	14	2600	1900	380	4200	1200000	0	1400	3
Phenanthrene	11	14	22000	27000	350 J	82000	2500000	0	40000	4
Phenol	12	14	3200	2300	35 JEB	8600 JEB	2500000	0	800000	0
Pyrene	13	14	13000	14000	370 J	46000	2500000	0	40000	1
Total PAH	2	2	45000	45000	20800	68440				
Volatile Organic Compounds (UG/KG)										
1,1,2,2-Tetrachloroethane	2	10	17	33	33 J	33 J	29000	0	100	0
1,1-Dichloroethane	1	10	20	12	12 J	12 J	1000000	0	14000	0
1,2-Dichloroethene (total)	2	3	510	730	730 J	730 J	1000000	0	14000	0
2-Butanone	7	10	45	43	18	100	1000000	0	80000	0
4-Methyl-2-Pentanone	4	10	29	32	11	59 J	1000000	0	14000	0
Acetone	8	10	300	340	89 EB	1400	1000000	0	140000	0
Benzene	5	10	25	19	4 J	59 J	200000	0	200	0
Bromomethane	2	10	21	18	11 J	25 J				
Carbon Disulfide	5	10	30	43	5 J	78 J	1000000	0	140000	0
Chlorobenzene	7	10	690	970	21 J	6500 *	1000000	0	20000	0

TABLE 3-5 (cont.)
280 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG) (cont.)										
Chloroethane	3	10	29	41	19	70	1000000	0	2400	0
Chloromethane	4	10	47	76	19	180	440000	0	540	0
cis-1,2-Dichloroethene	4	7	11	15	5 J	31 J				
Cyclohexane	1	7	7	13	13 J	13 J				
Ethylbenzene	9	10	270	300	4 J	1300 *J	1000000	0	10100	0
Isopropylbenzene	5	7	20	27	2 J	81 J				
Methyl tert-Butyl Ether	1	7	6	6	6 J	6 J				
Methylcyclohexane	5	7	17	22	3 J	53 J				
Toluene	10	10	1000	1000	2 J	2100 *	1000000	0	67000	0
Total Xylenes	9	10	1400	1500	22	5200 *	1000000	0	19500	0
Trichloroethene	7	10	76	97	2 J	330 J	520000	0	1000	0
Vinyl Chloride	3	10	23	42	23 J	51 J	3000	0	400	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	1	16	44	3.5	3.5	3.5	24000	0	29	0
4,4'-DDE	2	15	47	40	34	45	17000	0	21	2
4,4'-DDT	2	16	100	470	460	480	17000	0	21	2
alpha-Chlordane	2	16	22	0.84	0.69 J	1 J	2200	0	66	0
Aroclor, Total (4)	40	41	47000	48000	68	171000	10000	22		
Aroclor, Total (Conservative)(5)	40	41	51000	52000	243	235000	10000	23		
Aroclor-1242	2	16	840	4100	4100	4100	10000	0		
Aroclor-1248	1	16	540	1200	1200	1200	10000	0		
Aroclor-1254	2	31	1500	3800	3800	3800	10000	0		
Aroclor-1262	29	32	37000	41000	55 J	160000 *	10000	16		
Aroclor-1268	35	41	18000	21000	35 J	160000	10000	17		
Dieldrin	4	16	32	27	0.37 J	56	360	0	7	3
Endosulfan I	2	16	19	41	41 J	41 J	1200000	0	8400	0
Endosulfan II	1	16	43	1.1	1.1 J	1.1 J	1200000	0	8400	0

TABLE 3-5 (cont.)
280 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

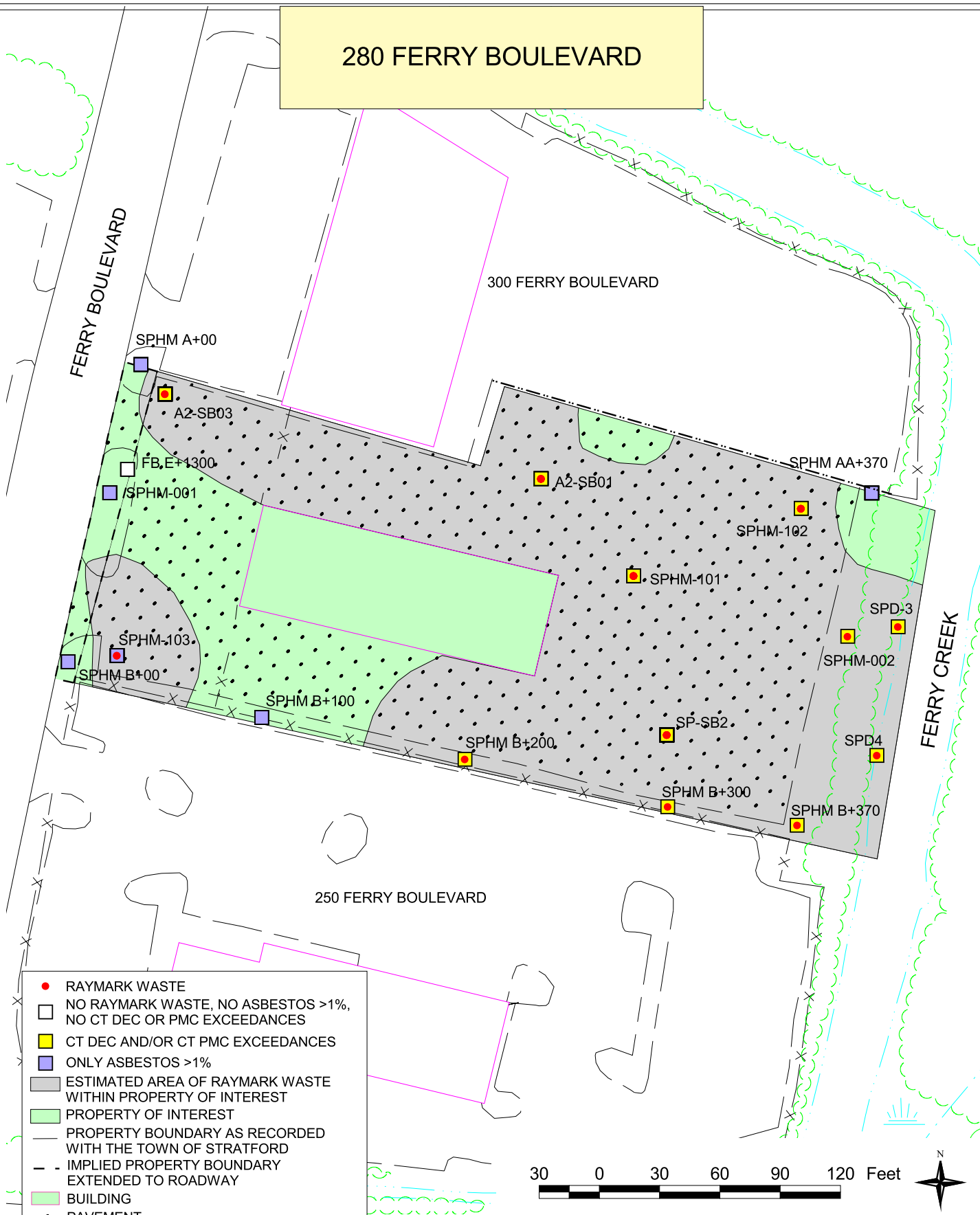
PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
Endosulfan Sulfate	7	16	2400	5300	150 *#	9800 *#	1200000	0	8400	2
Endrin Aldehyde	10	15	780	1100	23 #	2000 , *#	610000	0		
Endrin Ketone	1	16	44	9.7	9.7	9.7	610000	0		
gamma-Chlordane	5	16	29	54	0.65 J	120 J	2200	0	66	1
Heptachlor	1	16	22	0.25	0.25 J	0.25 J	1300	0	13	0
Methoxychlor	5	15	390	610	360	1200	10000000	0	8000	0

Qualifier	Definition
#	Possible false positive due to interference
&	From dilution analysis
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.

280 FERRY BOULEVARD



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-5
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.6 300 Ferry Boulevard

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.6.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.6.1 Property Description

This property, approximately 1.6 acres of commercially-zoned (retail) land, is located on Ferry Boulevard in Stratford, Connecticut (Town of Stratford, 1997). The property presently consists of a one-story building complex of small businesses. Most of the remaining property is a paved asphalt parking lot. Several areas of the asphalt are in a deteriorated condition. A narrow grass strip with landscape plantings parallels Ferry Boulevard in front of the stores. Access to the rear parking lot area, which is used for vehicle and equipment storage, is restricted by a chain-link fence, which is locked after business hours. During business hours, access to the rear parking lot is not restricted. The fence along the southern boundary is approximately 3 feet in height while the fence along the eastern and northern property boundaries is approximately 6 feet in height.

Ferry Creek is located along the northern and eastern borders of the property. Ferry Boulevard is located to the west and the commercial property at 280 Ferry Boulevard (see Section 3.5) is located to the south. The topography is flat with a steep drop-off towards Ferry Creek. Surface drainage appears to flow towards storm drains and Ferry Creek.

3.6.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of this property are located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Nine soil borings (SP-MW111M, SP-MW111D, SP-MW112M, SP-MW112D, SP-MW112B, and SPSC-101 through 104) were advanced on the property at 300 Ferry Boulevard. Total depths range from 4 to 90 feet below ground surface (bgs). Soil and/or rock were described in six of

the borings. Boring logs for SP-MW111D, SP-MW112B, and SPSC-101 through 104 indicate surficial materials primarily consist of fill overlying sandy clay, peat, organic silt, or organic matter. These materials are characteristic of a former marsh and swamp deposit. Soil borings SP-MW111D and SP-MW112B indicate that sand and gravel deposits lie between the organic materials and bedrock. The sand and gravel sediments are characteristic of locally derived outwash deposits and ice contact deposits. Refer to Figure 3-6 for boring locations on the property. Boring logs are presented in Appendix A.

Two clusters (MW-111 and MW-112) of three wells each were installed in the northwest and northeast corners of this property. No soil samples were collected from SP-MW111M and SP-M112M, and they are not shown on Figure 3-6. Soil sample locations are shown on Figure 3-6, including both shallow surface soil samples and deeper samples from borings. The borings were used to describe the fill and native material on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials placed on the property as a result of human activity. Manmade materials, including potentially asbestos-containing material (PACM) – (fibrous mats and pads and brake pads and shoes), asphalt, ash, brick, ceramic-like tiles, charcoal, concrete, and roofing shingles were identified in the soil from one or more of the borings. PACM was identified in borings SPSC-101, SPSC-102, SPSC-104, and SP-MW112B. The manmade materials were encountered with natural fill materials consisting of sand with varying amounts of silt and gravel. Manmade debris was not identified in borings SP-MW111D and SPSC-103. Additionally, debris was not identified in the organic materials beneath the fill. Fill classifications were based on the visual characteristics of the soil and sediment samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across the property. The depth to water ranges from 3 to 9 feet bgs, based on soil moisture content recorded on the boring logs and on 2003 water level measurements from monitoring wells on the property.

Raymark waste was found in fill materials on this property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper and/or Aroclor 1268 meeting the definition of Raymark waste as defined in Section 2.2 of this report. These limits are shown on Figure 3-6. Approximately 67 percent of the property is estimated to contain

Raymark waste. The vast majority of the parcel is paved. Over 90 percent of the waste area is within the paved portion of the property. The remaining waste area that is not paved is located along the northern boundary abutting Ferry Creek and is vegetated with grasses and reeds.

3.6.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. Results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 82 soil samples collected from 31 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-6. Samples were analyzed for asbestos, dioxins, metals, TCLP and SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-6 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-6 for the soil data summary statistics and comparison criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Eighty-two soil samples were collected from the property and analyzed for asbestos. Asbestos was detected frequently on the property. Asbestos at greater than 1 percent was found in 37 of the 82 samples. Asbestos detections were scattered throughout the property at depths of up to 10 feet bgs.

Dioxins

Six soil samples were collected from the property and analyzed for dioxins. Dioxins were detected in five of the six samples. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. The highest TEQ value was 0.9737 µg/kg.

Metals

Soil samples were collected from the property and analyzed for metals as follows: 13 samples were analyzed for metals at a fixed laboratory, 16 samples were screened for copper, and 69 samples were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium and sodium. There were metals exceedances of the CT DEC regulatory standards for arsenic and lead. Arsenic exceedances were located in the northwest area of the property, from the surface to 10 feet bgs. Lead exceedances were scattered throughout the property at depths of up to 10 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, two soil samples were collected for SPLP metal analysis and two samples were also collected for TCLP metal analysis. One SPLP and one TCLP sample were from within the estimated area of Raymark waste. Lead exceeded the CT PMC at all four samples for both leaching tests. The highest lead exceedance was detected from 8 to 10 feet bgs in sample MW-112B, located in the eastern portion of the property and within the estimated area of Raymark waste.

Pesticides

Ten soil samples were collected from the property and analyzed for pesticides. Pesticides were detected sporadically on the property. There were no CT DEC pesticide exceedances. There were exceedances of the CT PMC regulatory standards for aldrin and beta-BHC. Pesticide exceedances were located only in the eastern area of the property, in sample MW-112B, at a depth of 6 to 8 feet bgs.

PCBs

Up to 80 soil samples were collected from the property and analyzed for PCBs as Aroclors. PCBs were detected frequently. PCB concentrations in 16 samples exceeded the CT DEC regulatory standards for total Aroclors. PCB exceedances were scattered throughout the property at depths ranging from the surface to 10 feet bgs. The highest detection (230,000 µg/kg) of Aroclor 1268 was located at SPSC-101 in the southeastern area of the property, at 8 to 10 feet bgs. Aroclors 1262 and 1268 were the primary contributors to total Aroclor exceedances throughout the property. No SPLP/TCLP samples for PCBs were collected.

SVOCs

Nine soil samples were collected from the property and analyzed for SVOCs. SVOCs were detected frequently. Benzo(a)pyrene exceeded the CT DEC and CT PMC. In addition, six other PAHs exceeded the CT PMC regulatory standards. SVOC exceedances were scattered throughout the property from ground surface to 2 feet and from 8 to 10 feet bgs.

VOCs

Eight samples were collected from the property and analyzed for VOCs. VOCs were rarely detected on the property. There were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from 15 sample locations indicate the presence of Raymark waste on the property. The following table displays the locations and constituents of the 29 samples from the 15 locations that have contaminant concentrations that meet the definition of Raymark waste on this property. These samples are located within the 67 percent of the property shown on Figure 3-6 as the "Estimated Area of Raymark Waste within Property of Interest".

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
SPHM A+100	0 to 0.5	20	1,225	NA	17,000
SPHM A+175	0 to 0.5	5	4,650	NA	7,000
SPHM AA+200	0 to 0.5	8	6,225	NA	10,000
SPHM AA+300	0 to 0.5	10	810	NA	9,000
SPSC A+150	0 to 0.5	50	4,329	NA	20,000
SPSC A+250	0 to 0.5	10	1,240	NA	3,000
SPSC A+300	0 to 0.5	10	550	NA	2,000
SPSC B+00	0 to 0.5	5	1,530	NA	5,000
SPSC D+00	0 to 0.5	3	740	NA	4,000
FB E+1550	0 to 0.5	10	1,100	NA	4,000
A2-SS02	0 to 2	2	5,390	5,140	9,800
MW-112B	0 to 2	5	780	NA	1,100
	2 to 4	15	10,000	NA	2,500
	6 to 8	15	5,390	7,850	2,400
	8 to 10	10	1,870	2,830	1,150
	8 to 10 (A)	10	1,870	2,830	2,200
SPSC-101	0 to 2	60	5,580	9,730	10,000
	2 to 4	70	9,250	16,600	6,700
	4 to 6	55	10,600	21,700	5,100
	6 to 8	75	9,250	14,400	14,000
	8 to 10	75	46,000	37,000	230,000
SPSC-102	0 to 2	60	6,090	12,000	14,000
	2 to 4	70	9,870	13,000	31,000
	4 to 6	70	8,790	10,400	42,000
	6 to 8	70	4,320	10,600	17,000
	8 to 10	50	3,540	5,760	7,300
SPSC-104	0 to 2	60	3,050	3,360	22,000
	2 to 4	7	2,220	1,570	4,000
	4 to 6	5	425	504	3,300

NA – Contaminant was not analyzed
(A) – Sample from a duplicate boring

3.6.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants throughout this property are discussed below.

Approximately 67 percent of this 1.6-acre property is estimated to contain Raymark waste. The waste area spreads throughout most of the parcel (see Figure 3-6). Most of the waste area is located within the paved portions of the property except for a small area abutting Ferry Creek to the north which is vegetated with dense reeds. Over 90 percent of this property is covered either by a building or pavement, thereby limiting infiltration and leaching. Only the northern and eastern (rear) portions of the property along Ferry Creek are not covered with pavement. It is assumed that leaching from contaminated soils could be occurring due to cracks in the pavement, and that erosion of contaminated soils along the northern portion of the property could be occurring. The unpaved area along Ferry Creek does not contain Raymark waste. Storm drains were observed on the property, but the output of the drains was not investigated. They likely discharge to Ferry Creek.

SPLP data indicate that there is a possibility that lead is leaching into groundwater from contaminated soils on the property. Other data indicate that pesticides and SVOCs may also be leaching into the groundwater.

3.6.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at 300 Ferry Boulevard that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at 300 Ferry Boulevard may

be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.6.5.1 provides an overview of the 300 Ferry Boulevard property, Section 3.6.5.2 presents COPCs and EPCs, Section 3.6.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.6.5.4 contains the numerical results of the risk assessment, and Section 3.6.5.5 presents property-specific uncertainties. Section 3.6.5.6 presents a property-specific summary of the major risk findings.

3.6.5.1 Overview

300 Ferry Boulevard is a commercial property of approximately 1.6 acres. A detailed description of the property is provided in Section 3.6.1. The nature and extent of the contamination detected at 300 Ferry Boulevard is discussed in Section 3.6.3. The area of 300 Ferry Boulevard estimated to contain Raymark waste represents an estimated 67 percent of the total 1.6-acre property, exclusive of any buildings, and is shown in Figure 3-6. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.6.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 300 Ferry Boulevard are summarized in Appendix B-1, Table 2.6.

3.6.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.6 presents a summary of the COPCs for quantitative risk assessment for 300 Ferry Boulevard soils from the estimated area of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.6:

- Asbestos
- Acetophenone
- Benzo(a)pyrene
- Aroclors, Total (1262 and 1268)
- Metals (arsenic, cadmium, chromium, and lead)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 300 Ferry Boulevard are presented in Appendix B-1, Table 3.6. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.6.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 300 Ferry Boulevard and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 300 Ferry Boulevard is a commercial property, as described in Section 3.6.1.

Potential Receptors

The receptors retained for quantitative evaluation at 300 Ferry Boulevard are current and future commercial workers. Potentially exposed individuals are limited to those who work at 300 Ferry Boulevard.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at 300 Ferry Boulevard. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated area of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 300 Ferry Boulevard are incidental ingestion of, and dermal contact, with soil. Potential exposure to volatile emissions and fugitive dust from the property is considered to be minimal. The estimated area of Raymark waste is mostly paved with some portions vegetated with dense reeds. The presence of pavement and vegetation reduces the likelihood of inhalation exposure.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.6.5.4. Asbestos is present in soils within the estimated area of Raymark waste at 300 Ferry Boulevard. The presence of pavement and vegetation suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) were factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 300 Ferry Boulevard is 0.67. Chemical intake estimates are provided in Appendix B-1, Tables 7.6 and 8.6.

3.6.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 300 Ferry Boulevard is provided in this section. Appendix B-1, Table 7.6 and Table 8.6 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.6. Appendix B-1, Table 10.6 reduces the information developed in Appendix B-1, Table 9.6 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 300 Ferry Boulevard are as follows:

	Ingestion	**Dermal**	**Total**
Commercial Worker (Current and future)	9.6	8.8	18.4

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated area of Raymark waste at 300 Ferry Boulevard is in excess of unity. Total Aroclor was the main contributor to the hazard index for the commercial worker. The chemical-specific (and target-

organ specific) hazard quotients for total Aroclor alone are in excess of unity for commercial receptors. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Table 7.6 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 300 Ferry Boulevard are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	1.5E-04	1.3E-04	2.8E-04

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated area of Raymark waste exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.6 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.6, dioxins, Aroclors, arsenic, and benzo(a)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 3.6E-04.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste at the 300 Ferry Boulevard property. Lead was detected in samples collected from 0 to 15 feet bgs within

the estimated area of Raymark waste at a maximum concentration of 46,000 mg/kg. The average lead concentration in this dataset was 5,480 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 5,480 mg/kg for soil within the estimated area of Raymark waste was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for 300 Ferry Boulevard is 0.67. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated area of Raymark waste at 300 Ferry Boulevard, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 28 to 31 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 31 of 35 soil samples collected from the estimated area of Raymark waste at a concentration range of 2 to 75 percent. These samples were collected in the 0- to 15- foot bgs interval. The average concentration was 28 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated area of Raymark waste reduces the potential for airborne asbestos at 300 Ferry Boulevard. Based on field conditions in the estimated area of Raymark waste at 300 Ferry Boulevard, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.6.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 300 Ferry Boulevard are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 300 Ferry Boulevard property is 1.6 acres, with an estimated 67 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.6.4. The estimated area of Raymark waste is mostly paved. Unpaved portions are vegetated with dense reeds. No consideration has been given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated area of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 67 percent of the time, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately 1.5 times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown in Appendix B-1, Table 2.6, alongside site-specific data from the estimated area of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at

concentrations ranging from 4.6 to 10 mg/kg, with an average concentration of 6.2 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Thirty-five samples were included in the dataset for soils within the estimated area of Raymark waste; however, 28 of those samples were only analyzed by field screening methods. Due to the limited numbers of samples analyzed for Aroclors, acetophenone, and cadmium, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 15 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-10. The presence of arsenic and benzo(a)pyrene at concentrations greater than CT RSRs for industrial soil suggests that risks from other area of the property may be of concern. Arsenic is present in soils located outside the estimated area of Raymark waste at 300 Ferry Boulevard at concentrations up to 44 mg/kg and benzo(a)pyrene is present at concentrations up to 2.5 mg/kg. Four samples from outside the estimated area of Raymark waste were analyzed for PCBs using CLP methods. While none of these samples had

concentrations greater than the CT RSRs for industrial soil, one sample did have total Aroclor concentrations greater than the EPA Region IX PRG for industrial soil. The individual Aroclors detected were Aroclor 1262 and Aroclor 1268. Copper and lead were detected at concentrations up to 335 mg/kg and 710 mg/kg, respectively. Asbestos is also present outside the estimated area of Raymark waste at 300 Ferry Boulevard at concentrations up to 10 percent. Dioxins were detected outside the estimated area of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin TEQ concentrations outside the estimated area of Raymark waste exceed EPA Region IX PRGs for industrial soil in one sample. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than those for the estimated area of Raymark waste alone.

3.6.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at 300 Ferry Boulevard. Risks to current and future commercial workers were estimated.

- The RME hazard indices (HI) for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 300 Ferry Boulevard are in excess of unity. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposure to Aroclors.

- The RME cancer risk estimates for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 300 Ferry Boulevard exceed the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5}. Dioxins, Aroclors, arsenic, and benzo(a)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects

are anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste at 300 Ferry Boulevard.

- Asbestos was detected in 31 of 35 soil samples collected from the estimated area of Raymark waste at 300 Ferry Boulevard in the 0- to 15- foot bgs interval at a concentration range of 2 to 75 percent. The average concentration was 28 percent.

3.6.6 Ecological Evaluation

No ecologically important habitats are present on this property. The ecological characterization of the wetlands in the vicinity of this property was addressed under the OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark-Ferry Creek-OU3* (B&RE, 1998). A summary of the findings is presented below. It should be noted, however, that no individual evaluation of the ecological impacts on this property were performed.

Most of the property has been disturbed by surrounding development, past uses of Ferry Creek, and filling of a wetland area prior to developing the property. There are no wetlands on the property, but the parcel abuts Ferry Creek. There is limited vegetation on the parcel as most of the property is covered by a building or pavement.

This property provides only limited use as an area for birds, reptiles, and small mammals to forage, cover, rest and breed because of the level of development, soil contamination, disturbed nature of the area, and the low vegetation density and diversity. Wildlife identified in the area include red-winged blackbird (*Agelaius phoeniceus*) and green heron (*Butorides striatus*).

3.6.7 Summary

This 1.6-acre property abutting Ferry Creek contains Raymark waste. Soils containing metals (including SPLP and TCLP metals), pesticides, PCBs, and SVOCs that exceed CT DEC and/or CT PMC criteria and/or that contain more than 1 percent asbestos are present on the property. Since most of the property is covered by buildings or pavement, only limited infiltration or leaching is likely occurring, and only in the areas of cracked pavement. There appears to be some erosion of fill along the bank into Ferry Creek.

The RME hazard indices for commercial workers exposed to soil within the estimated area of Raymark waste are in excess of unity, indicating that adverse non-carcinogenic health effects are possible. The RME cancer risk estimates exceed the EPA cancer risk range and the CTDEP target total risk level. Adverse effects are anticipated for fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste. The average asbestos concentration was 28 percent in the estimated areas of Raymark waste.

No ecological risks were identified on the property.

TABLE 3-6
300 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	60	82	13	17	Trace	75	1	37		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	3	6	0.22	0.12	0.0236	0.194				
1,2,3,4,6,7,8-HpCDF	3	6	0.63	0.98	0.0939	1.9 $				
1,2,3,4,7,8,9-HpCDF	2	6	0.18	0.013	0.01 J	0.016				
1,2,3,4,7,8-HxCDD	2	6	0.15	0.0023	0.002 EMPC	0.0025 EMPC				
1,2,3,4,7,8-HxCDF	4	6	0.41	0.54	0.0641	1.15				
1,2,3,6,7,8-HxCDD	2	6	0.1	0.01	0.0093 EMPC	0.0112 EMPC				
1,2,3,6,7,8-HxCDF	3	6	0.1	0.11	0.0186	0.192				
1,2,3,7,8,9-HxCDD	2	6	0.063	0.0077	0.0073 J	0.008				
1,2,3,7,8,9-HxCDF	2	6	0.062	0.0012	0.00097 J	0.0014 J				
1,2,3,7,8-PeCDD	2	6	0.1	0.0021	0.0021 EMPC, J	0.0021 EMPC, J				
1,2,3,7,8-PeCDF	3	6	0.14	0.13	0.0257	0.194				
2,3,4,6,7,8-HxCDF	4	6	0.25	0.29	0.0342	0.662				
2,3,4,7,8-PeCDF	4	6	0.3	0.39	0.0622	0.681				
2,3,7,8-TCDD	2	6	0.089	0.00061	0.00054 EMPC	0.00068 J				
2,3,7,8-TCDF	4	6	0.21	0.28	0.0514	0.366 J				
OCDD	5	6	1.2	1.4	0.154 J	2.215				
OCDF	3	6	0.32	0.26	0.0566 J	0.391				
Total HpCDD	3	6	0.25	0.19	0.0481 J	0.364 J				
Total HpCDF	3	6	0.69	1.1	0.111 J	2.05 J$				
Total HxCDD	2	6	0.074	0.043	0.0295 J	0.0566 J				
Total HxCDF	4	6	1.1	1.7	0.26 J	3.89 J				
Total PeCDD	3	6	0.12	0.024	0.0046 J	0.0463 EMPC				
Total PeCDF	4	6	0.96	1.4	0.28 JEB	2.41 JEB				
Total TCDD	3	6	0.091	0.0044	0.00061 EMPC	0.0066 JEB				
Total TCDF	4	6	0.66	0.94	0.174 JEB	1.34 J				
Toxicity Equivalency	5	6	0.4	0.46	0.05 J	0.9737265				

TABLE 3-6 (cont.)
300 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	13	13	9940	9940	4010 J	16100				
Antimony	2	13	1.4	0.96	0.96 J	0.97 J	8200	0		
Arsenic	13	13	10.1	10.1	2.2	44.5	10	3		
Barium	13	13	1060	1060	20.9	3420	140000	0		
Beryllium	8	13	0.35	0.49	0.32 , J	0.8 J	2	0		
Cadmium	6	13	4	8.4	0.24 J	47.3	1000	0		
Calcium	12	13	3380	3600	1660	12400				
Chromium	13	13	48.5	48.5	6.5 J	92.4 J	100	0		
Cobalt	13	13	8.6	8.6	4.2	15.4	2500	0		
Copper	24	29	6210	7480	10.6	37000	76000	0		
Iron	13	13	20400	20400	10200	32300				
Lead	55	82	2430	3620	2.1 J	46000	1000	26		
Magnesium	13	13	7910	7910	1770	20900				
Manganese	13	13	249	249	93.8	350	47000	0		
Mercury	2	13	0.15	0.52	0.13	0.9	610	0		
Nickel	13	13	40.8	40.8	6	116	7500	0		
Potassium	13	13	1750	1750	661 J	2840				
Selenium	5	13	0.79	1.4	1.1 J	1.7 , J	10000	0		
Silver	4	12	0.55	1.2	0.39 J	1.7 J	10000	0		
Sodium	8	13	335	470	176 J	709				
Thallium	1	13	0.65	2.6	2.6 J	2.6 J	160	0		
Vanadium	13	13	30.8	30.8	14	44.2	14000	0		
Zinc	13	13	1050	1050	19.1 J	8680 J	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	2	2	2710	2710	1060 J	4360				
Antimony	1	2	5.4	8.3	8.3	8.3			60	0
Barium	2	2	193	193	182	204			10000	0
Cadmium	1	2	0.59	0.68	0.68 J	0.68 J			50	0
Calcium	2	2	12100	12100	8830	15400				

TABLE 3-6 (cont.)
300 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Chromium	2	2	6	6	5.7	6.3			500	0
Cobalt	1	2	2.2	4	4	4				
Copper	2	2	444	444	197	690 J			13000	0
Iron	2	2	3740	3740	965 J	6510				
Lead	2	2	426	426	417	436			150	2
Magnesium	2	2	1520	1520	1110	1930				
Manganese	2	2	97.6	97.6	46.3 J	149				
Mercury	1	2	1	1.5	1.5	1.5			20	0
Nickel	2	2	11.2	11.2	10.2	12.1			1000	0
Potassium	1	1	2150	2150	2150	2150				
Sodium	1	1	1260	1260	1260	1260				
Vanadium	2	2	8.6	8.6	3.7	13.5			500	0
Zinc	2	2	182	182	164	201 J			50000	0
Metals (TCLP) (UG/L)										
Cadmium	2	2	13	13	2.7	23.2			50	0
Chromium	1	2	13.7	23.1	23.1	23.1			500	0
Lead	2	2	37800	37800	230	75300			150	2
Selenium	1	2	1.8	2.3	2.3 J	2.3 J			500	0
Semivolatile Organic Compounds (UG/KG)										
2,4-Dimethylphenol	5	9	520	560	46 J	2200 J	2500000	0	28000	0
2-Methylnaphthalene	5	9	180	120	52 J	230 J	2500000	0	9800	0
2-Methylphenol	3	9	290	95	28 J	170 J	2500000	0	70000	0
4-Methylphenol	5	9	330	220	40 J	500 J	2500000	0	7000	0
4-Nitrophenol	1	9	750	43	43 J	43 J	2500000	0	11000	0
Acenaphthene	5	9	150	65	31 J	160	2500000	0	84000	0
Acenaphthylene	7	9	200	200	45 J	490 J	2500000	0	84000	0
Acetophenone	1	3	200	180	180 J	180 J				
Anthracene	7	9	250	270	84 J	880	2500000	0	400000	0
Benzaldehyde	3	3	77	77	60 JEB	110 JEB				

TABLE 3-6 (cont.)
300 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Benzo(a)anthracene	7	9	790	960	280 J	3200	7800	0	1000	2
Benzo(a)pyrene	7	9	750	910	310 J	2500	1000	2	1000	2
Benzo(b)fluoranthene	6	9	980	1400	530	3800	7800	0	1000	2
Benzo(g,h,i)perylene	7	9	510	600	80 J	2000 J	2500000	0	42000	0
Benzo(k)fluoranthene	6	9	590	640	340 J	1500 J	78000	0	1000	1
bis(2-Ethylhexyl)phthalate	1	9	320	140	140 J	140 J	410000	0	11000	0
Carbazole	6	9	160	130	52 J	400	290000	0	360	1
Chrysene	7	9	1100	1400	480 J	3600	780000	0	1000	3
Dibenzo(a,h)anthracene	6	9	230	240	36 J	670 J	780	0	1000	0
Dibenzofuran	5	9	160	91	32 J	250	2500000	0	5600	0
Di-n-Butylphthalate	1	9	320	160	160 J	160 J	2500000	0	140000	0
Fluoranthene	7	9	1700	2100	710	6300	2500000	0	56000	0
Fluorene	6	9	200	200	44 J	690	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	7	9	510	600	100 J	1700 , J	7800	0	1000	2
Naphthalene	6	9	180	150	51 J	340 J	2500000	0	56000	0
N-Nitroso-diphenylamine	3	9	320	200	36 J	490 J	1200000	0	1400	0
Phenanthrene	7	9	1300	1600	520	5800	2500000	0	40000	0
Phenol	6	9	460	550	37 JEB	1800 J	2500000	0	800000	0
Pyrene	7	9	1800	2300	540	8700	2500000	0	40000	0
Total PAH	3	3	23000	23000	5865	40380				
Volatile Organic Compounds (UG/KG)										
2-Butanone	3	8	15	28	4 J	76	1000000	0	80000	0
Acetone	3	8	78	190	16	360 J	1000000	0	140000	0
Benzene	1	8	5	3	3 J	3 J	200000	0	200	0
Bromoform	1	8	5	1	1 J	1 J	720000	0	800	0
Carbon Disulfide	4	8	13	19	2 J	53	1000000	0	140000	0
Chlorobenzene	2	8	6	10	6 J	13 J	1000000	0	20000	0
Chloromethane	1	8	5	4	4 J	4 J	440000	0	540	0

TABLE 3-6 (cont.)
300 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG) (cont.)										
cis-1,2-Dichloroethene	2	3	13	18	1 J	35				
Cyclohexane	1	3	4	3	3 J	3 J				
Ethylbenzene	2	8	12	31	19	43 J	1000000	0	10100	0
Isopropylbenzene	1	3	3	2	2 J	2 J				
Methyl Acetate	2	3	5	6	2 J	9 J				
Methylcyclohexane	1	3	6	9	9 J	9 J				
Methylene Chloride	2	8	15	41	5 J	77	760000	0	1000	0
Toluene	2	8	15	43	37 J	49	1000000	0	67000	0
Total Xylenes	2	8	45	160	140	190 J	1000000	0	19500	0
trans-1,2-Dichloroethene	1	3	3	2	2 J	2 J				
Trichloroethene	1	8	6	6	6 J	6 J	520000	0	1000	0
Vinyl Chloride	1	8	5	2	2 J	2 J	3000	0	400	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	4	10	12	11	4.1	22	24000	0	29	0
4,4'-DDE	2	10	11	16	14	17	17000	0	21	0
Aldrin	1	10	4.4	2.1	2.1 J	2.1 J	340	0	0.41	1
alpha-Chlordane	1	10	5	4	4 J	4 J	2200	0	66	0
Aroclor, Total (4)	47	80	13000	21000	200	230000	10000	16		
Aroclor, Total (Conservative)(5)	47	80	14000	23000	260	290000	10000	17		
Aroclor-1248	1	11	770	250	250	250	10000	0		
Aroclor-1262	25	59	8200	19000	140	103000	10000	11		
Aroclor-1268	47	80	6600	11000	120	230000	10000	10		
beta-BHC	1	10	4.6	4.2	4.2 J	4.2 J	3200	0	3.9	1
Dieldrin	1	10	10	5.3	5.3	5.3	360	0	7	0
Endosulfan I	1	10	4.6	3.9	3.9 J	3.9 J	1200000	0	8400	0
Endosulfan II	2	10	8	4.7	2.4 J	7	1200000	0	8400	0
Endosulfan Sulfate	5	10	200	390	6	1300 *#	1200000	0	8400	0
Endrin Aldehyde	7	10	94	130	4.8	530	610000	0		

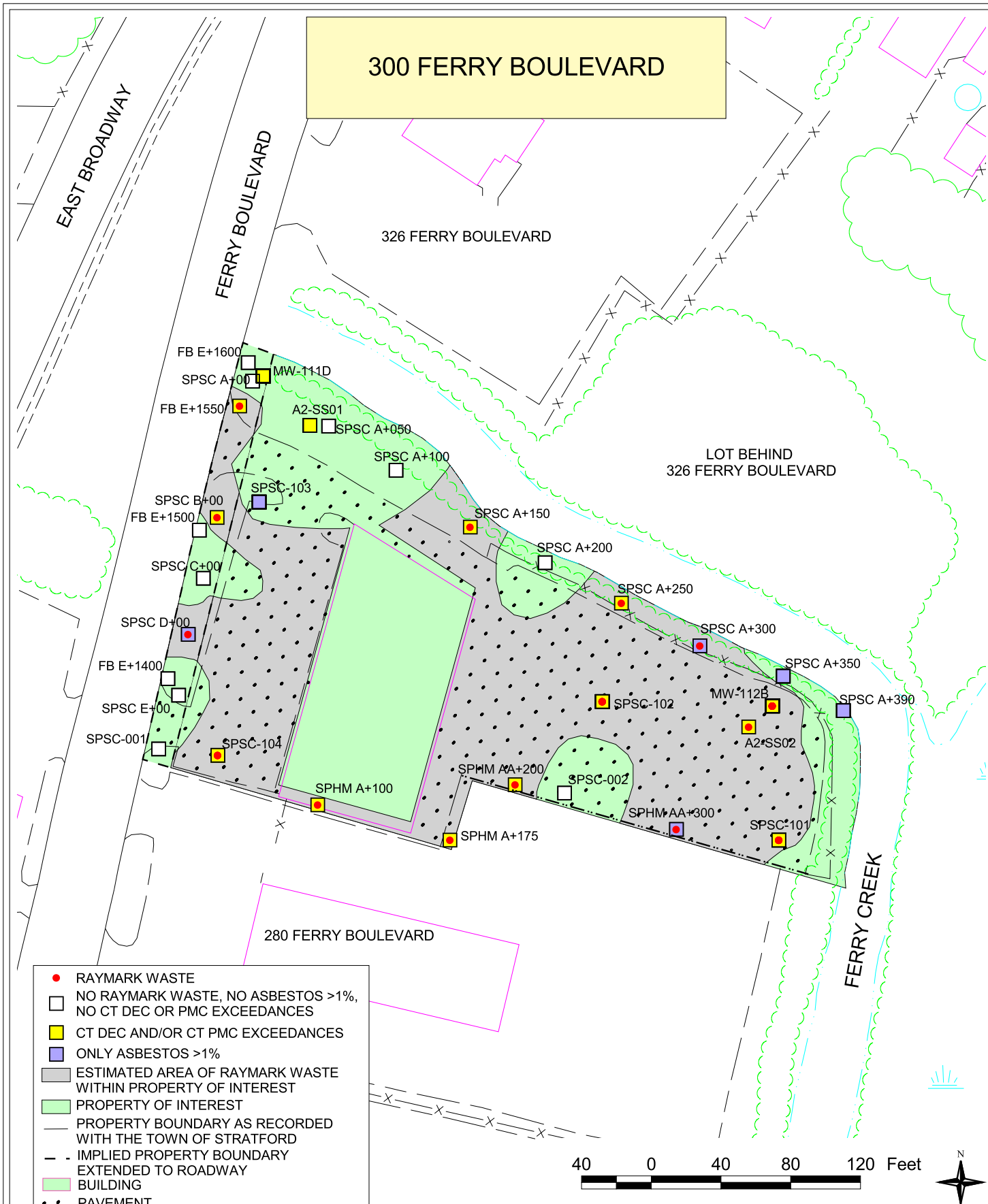
TABLE 3-6 (cont.)
300 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
gamma-Chlordane	2	10	4.2	2	1.9 J	2.1 J	2200	0	66	0
Methoxychlor	1	9	53	30	30	30	10000000	0	8000	0

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-6
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.7 Lot Behind 326 Ferry Boulevard

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.7.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.7.1 Property Description

This property, approximately 1.7 acres of commercially-zoned (retail) land, is located on Ferry Boulevard in Stratford, Connecticut, behind the 326 Ferry Boulevard property (see Section 3.9) (Town of Stratford, 1997). The majority of the property is undeveloped and covered by open-field and woodland vegetation. Old concrete foundations of unknown origin are located in the southern portion of the property. According to town records the parcel extends approximately 60 feet northwest, past the chain-link fence separating the paved restaurant parking lot from the vegetated area. The boundaries of the parcel also extend approximately 70 feet northeast from the border with Ferry Creek. The northwest area of the property is also part of the restaurant parking lot, and is paved. There is no Raymark waste present in any of the paved portions of the Lot Behind 326 Ferry Boulevard. The site topography is flat with a steep drop-off to Ferry Creek.

Public access to the vegetated portion of the property is limited from the north and west areas by chain-link fence. Public access is not restricted from the south or east. Piles of grass clippings and yard debris have been dumped throughout this area. Asbestos brake linings have been observed along the surface of the Ferry Creek bank.

Residential properties on Willow Avenue are located to the northeast, with the vacant lot at Housatonic Avenue (see Section 3.8) to the southeast, Ferry Creek to the southwest, and the business located at 326 Ferry Boulevard to the northwest.

3.7.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of this property are located within the 100-year floodplain of the Housatonic River. The 100-year

frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Sixteen borings (SB-528S and SB-528SG; A3-SB01; SP-MW110S, 110M, and 110D; SPBG1-101, SPBG1-102 and SPBG1-106; SPBG2-101 through 105; SPDA-E222, S132; and SPDA-101), to depths up to 55 feet below ground surface (bgs), were advanced on the property. Surficial materials noted in borings SB-528S and A3-SB01 consist of fill overlying mixed sand and gravel units with trace silt, which are characteristic of a locally derived glacial outwash and/or ice contact deposit. Soils noted in SPDA-E222,S132 and SP-MW110D consist of fill overlying a former marsh and swamp deposit, which overlies an outwash or ice-contact deposit. Soil encountered below fill materials in the two borings consists of organic silt and peat with trace clay and fibrous plant matter; silty sand; sand; and/or gravelly sand with trace silt. Bedrock was encountered at 54 feet bgs in SP-MW110D. In boring SPBG2-101, soil consisted of sand and silty sand mixed with debris from 0 to 15.5 feet bgs. Surficial materials noted in borings SPBG1-101, SPBG1-102, SPBG1-106, SPBG2-102 through 105, and SPDA-101 consist of fill overlying sand or silt with varying amounts of organics. Refer to Figure 3-7 for boring locations on the property. Boring logs are presented in Appendix A.

Five wells in two clusters (MW-110 and MW-528 wells) and a single piezometer (SPDA-E222, S132) were installed on this property. Sample locations are shown on Figure 3-7, including both shallow surface samples and samples from deeper soil borings. No soil samples were collected from SB-528SG, SP-MW110M, and SP-MW110S. The borings were used to describe the fill and native material on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials placed on the property as a result of human activity. Manmade materials were identified in the soil from all of the borings with soil descriptions and included potentially asbestos-containing material (PACM) (asbestos fibers and tiles), asphalt shingles, ceramic tiles, charcoal, electric plugs, fibrous green tiles, floor tiles, glass, metal, nails, plastic, roofing and siding tiles, rubber, sludge-like processed waste, and tar paper. PACM was identified in the soil from borings A3-SB01, SP-528S, SPBG1-101, SPBG1-102, SPBG1-106, SPBG2-101 through 105, SPDA-E222, S132, and SPDA-101. The manmade materials were encountered with natural fill materials consisting of sand, silty sand

and sand-silt mixtures, and organic material. Fill classifications were based on the visual characteristics of the soil and sediment samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across most of the property. The depth to water on the property ranges from 0.3 to 7 feet bgs, based on the soil moisture content recorded on the boring logs and on 2003 water level measurements from monitoring wells on the property.

Raymark waste was found in fill materials on this property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-7. An estimated 42.8 percent of the property contains Raymark waste. All of the waste present on this property is within the vegetated areas.

3.7.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 88 soil samples collected from 24 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-7. Samples were analyzed for asbestos, dioxins, metals, SPLP and TCLP metals, pesticides, PCBs, SVOCs and VOCs. See Table 3-7 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-7 for the soil data summary statistics and comparison criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Eighty-six soil samples were collected from the property and analyzed for asbestos. Asbestos was detected frequently on the property. Asbestos at greater than 1 percent was found in 52 of the 86 samples and these samples were distributed throughout the property. Asbestos was detected at the property at depths of up to 40 feet bgs.

Dioxins

Six soil samples were collected from the property and analyzed for dioxins. Dioxins were detected in five of the six samples. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. The highest TEQ value was 2.48 µg/kg.

Metals

Soil samples were collected from the property and analyzed for metals as follows: 21 samples were analyzed for metals in a fixed laboratory; 37 samples were screened for copper; and 66 samples collected and screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Arsenic, chromium, and lead concentrations at this property exceed the CT DEC regulatory standards. The only arsenic exceedance was located in the northern area of the property, at a depth of 2 to 4 feet bgs. Lead exceeded the CT DEC standard at several locations in the eastern and southern portions of the property, from the ground surface to 10 feet bgs. The chromium exceedance was detected along the eastern border of the property from 2 to 4 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only one of the three SPLP samples was located within the estimated area of Raymark waste. The Toxicity Characteristic Leaching Procedure (TCLP) sample that was collected was also located within the estimated area of Raymark waste and exceeded the CT PMC standard for lead. For SPLP analysis, copper and lead exceeded the CT PMC regulatory standard for all three samples, including the one located within the estimated area of Raymark waste. All of the exceedances indicate the potential for metals to leach into the groundwater. For SPLP samples, the highest copper and lead exceedance was from the ground surface to 2 feet bgs at location A3-SB01, in the central area of the property. For the TCLP sample, the lead exceedance was at a depth of 10 to 12 feet bgs in sample MW-110D, located in the central area of the property. For SPLP samples, the highest copper and lead exceedance was from the ground surface to 2 feet bgs at location A3-SB01, in the central area of the property.

Pesticides

Twenty-one samples were collected from the property and analyzed for pesticides. Pesticides were not frequently detected on the property. There were no CT DEC exceedances for pesticides. Seven pesticides exceeded the CT PMC regulatory standards in six samples from the ground surface to 6 feet bgs. The samples were distributed throughout the property.

PCBs

Up to 81 soil samples were collected from the property and analyzed for PCBs as Aroclors. PCBs were detected in approximately 60 percent of the samples analyzed. Fourteen samples exceeded the CT DEC regulatory standards for total Aroclors at depths of up to 10 feet bgs. These exceedances were scattered throughout the property. In 10 of the 14 samples that exceeded the CT DEC, Aroclor 1268 concentrations were the primary contributors to the exceedance in the sample. No SPLP/TCLP samples for PCBs were collected.

SVOCs

Twenty soil samples were collected from the property and analyzed for SVOCs. SVOCs were detected frequently on the property. Benzo(a)pyrene was the only SVOC that exceeded the CT DEC standard on the property. Five SVOCs, primarily PAHs, exceeded the CT PMC standards. SVOC exceedances were located in the central portions of the property, ranging in depth from ground surface to 6 feet bgs.

VOCs

Eighteen soil samples were collected from the property and analyzed for VOCs. VOCs were not frequently detected on the property. There were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from 10 soil sample locations indicate the presence of Raymark waste on the property. The following table displays the locations and constituents of the 19 samples from the 10 locations with contaminant concentrations that meet the definition of Raymark waste on this property. These samples are located within the 43 percent of the property shown on Figure 3-7 as the "Estimated Area of Raymark Waste within Property of Interest".

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
A3-SB01	0 to 2	40	1,020	1,550	3,200
	2 to 4	20	620	990	NA
SPBG2-102	0 to 2	20	3,140	4,440	36,000
	8 to 10	2	739	735	10,000
SPBG2-103	0 to 2	7	3,100	3,470	38,000
SPBG2-104	0 to 2	1,150	1,710	28,000	58,000
	2 to 4	50	9,440	15,000	160,000
	4 to 6	40	1,150	1,710	28,000
SPBG2-105	0 to 2	3	1,730	2,630	18,000
SPBG2 A+050	0 to 0.5	5	510	NA	2,000
SPBG2 B+150	0 to 0.5	5	660	NA	3,000
SPBG2 A+267	0 to 0.5	20	3,560	NA	7,000
SPDA E222,	0 to 2.5	45	9,960	NA	13,000

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
S132	8 to 10	45	7,120	NA	10,000
	10 to 10.3	46	1,250	NA	2,000
SPDA-101	0 to 2	3	856	831	4,700
	2 to 4	60	12,900	10,900	95,000
	4 to 6	10	4,970	4,170	850

NA – Contaminant was not analyzed

3.7.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants throughout this property are discussed below.

Approximately 43 percent of this 1.7-acre property is estimated to contain Raymark waste. This waste area is primarily located in the center and along the southern boundary of the parcel. Some of the waste area also extends to the eastern property boundary (see Figure 3-7). A very small portion of the total property is considered tidal wetlands; however, most of the estimated area of Raymark waste is not within the wetland. The wetland area is completely vegetated and lies along the edge of Ferry Creek, where the topography drops off sharply. Erosion of the bank has revealed asbestos brake linings. The areas of the property estimated to contain Raymark waste are entirely located within the vegetated portions of the property. It is likely that infiltration and leaching into groundwater is occurring. The wetland is vegetated with reeds, thus slowing any overland transport of the sediments.

There are no buildings on the property; areas northwest of the fence are paved. Contaminants on the unpaved portions of the property may leach into the surface water and groundwater. For this property, as indicated by the SPLP and TCLP metal results and other data collected, metals, pesticides, and SVOCs may leach into the groundwater from contaminated soils.

3.7.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at the Lot Behind 326 Ferry Boulevard property that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at the Lot Behind 326 Ferry Boulevard may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.7.5.1 provides an overview of the Lot Behind 326 Ferry Boulevard property, Section 3.7.5.2 presents COPCs and EPCs, Section 3.7.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.7.5.4 contains the numerical results of the risk assessment, and Section 3.7.5.5 presents property-specific uncertainties. Section 3.7.5.6 presents a property-specific summary of the major risk findings.

3.7.5.1 Overview

The Lot Behind 326 Ferry Boulevard property is zoned for retail use, but is currently undeveloped. The area covers approximately 1.7 acres. A detailed description of the property is provided in Section 3.7.1. The nature and extent of the contamination detected at the property is discussed in Section 3.7.3. The area of the Lot Behind 326 Ferry Boulevard estimated to contain Raymark waste represents an estimated 43 percent of the total 1.7-acre property and is shown in Figure 3-7. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.7.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic

mean) for target analytes detected in soils within the estimated area of Raymark waste are summarized in Appendix B-1, Table 2.7.

3.7.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.7 presents a summary of the COPCs for quantitative risk assessment for the Lot Behind 326 Ferry Boulevard soils from the estimated area of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.7:

- Asbestos
- Benzo(a)pyrene
- Aroclors, Total (1262 and 1268)
- Dieldrin
- Metals (arsenic, barium, chromium, and lead)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for the Lot Behind 326 Ferry Boulevard are presented in Appendix B-1, Table 3.7. Support documentation for the

calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.7.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the Lot Behind 326 Ferry Boulevard property and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The Lot Behind 326 Ferry Boulevard property is currently undeveloped, but is zoned for retail use, as described in Section 3.7.1.

Potential Receptors

The receptors retained for quantitative evaluation at the Lot Behind 326 Ferry Boulevard property are future commercial workers. Potentially exposed individuals are limited to those who may work at the property in the future.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at the property. Under the future land use, commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated area of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties.

Exposure Pathways

The primary routes of exposure for potential human receptors at the Lot Behind 326 Ferry Boulevard property are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from the property is considered to be minimal. The estimated area of Raymark waste is heavily vegetated. The presence of vegetation reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.7.5.4. Asbestos is present in soils within the estimated area of Raymark waste at the property. The presence of vegetation suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for the Lot Behind 326 Ferry Boulevard is 0.43. Chemical intake estimates the property are provided in Appendix B-1, Tables 7.7 and 8.7.

3.7.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for the Lot Behind 326 Ferry Boulevard property is provided in this section. Appendix B-1, Table 7.7 and Table 8.7 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.7. Appendix B-1, Table 10.7 reduces the information

developed in Appendix B-1, Table 9.7 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at the Lot Behind 326 Ferry Boulevard property are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	4.7	4.3	9.0

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated area of Raymark waste at the Lot Behind 326 Ferry Boulevard property is in excess of unity. Total Aroclor was the main contributor to the hazard index for the commercial worker. The chemical-specific (and target-organ specific) hazard quotients for total Aroclor alone are in excess of unity for commercial receptors. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Table 7.7 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at the Lot Behind 326 Ferry Boulevard property are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	9.7E-05	7.3E-05	1.7E-04

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated area of Raymark waste exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.7 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.7, dioxins, Aroclors, arsenic, and benzo(a)pyrene are the

predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 3.9E-04.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste at the Lot Behind 326 Ferry Boulevard property. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated area of Raymark waste at a maximum concentration of 12,900 mg/kg. The average lead concentration in this dataset was 1,930 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 1,930 mg/kg for soil within the estimated area of Raymark waste at the property was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for the Lot Behind 326 Ferry Boulevard property is 0.43. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated area of Raymark waste at the property, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 2 to 4 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 30 of 36 soil samples collected from the estimated area of Raymark waste at a concentration range of trace to 60 percent. These samples were collected from the 0- to 15- bgs foot interval. The average concentration was 13 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of vegetative cover in the estimated area of Raymark waste reduces the potential for airborne asbestos at the Lot Behind 326 Ferry Boulevard property. Based on field conditions in the estimated areas of Raymark waste at the property, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.7.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the Lot Behind 326 Ferry Boulevard property are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the Lot Behind 326 Ferry Boulevard property is 1.7 acres, with an estimated 43 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.7.4. The estimated area of Raymark waste is heavily vegetated. No consideration has been given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated area of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 43 percent of the time, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately 2.3 times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2.2. Average background concentrations are also shown in Appendix B-1, Table 2.7, alongside site-specific data from the estimated area of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 1.7 to 9.3 mg/kg, with an average concentration of 6.2 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Thirty-seven samples were included in the dataset for soils within the estimated area of Raymark waste; however, 31 of the samples were only analyzed by field-screening methods. Due to the limited numbers of samples analyzed for dioxins, Aroclors, benzo(a)pyrene, dieldrin, barium, and chromium, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and the small datasets adds uncertainty to the risk estimates.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-10. The presence of arsenic, benzo(a)pyrene, dieldrin, and Aroclors at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Arsenic is present in soils located outside the estimated area of Raymark waste at the Lot Behind 326 Ferry Boulevard at concentrations up to 12.2 mg/kg, benzo(a)pyrene is present at concentrations up to 1.1 mg/kg, dieldrin is present at concentrations up to 0.77 mg/kg and Aroclors are present outside the estimated area of Raymark waste at concentrations up to 138 mg/kg. The individual Aroclors detected were Aroclors 1254, 1262, and 1268.

  Dioxins were detected outside the estimated area of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin TEQ concentrations outside the estimated area of Raymark waste exceed EPA Region IX PRGs for industrial soil in one sample. Asbestos was also present outside the estimated area of Raymark waste at concentrations up to 20 percent. Copper and lead were detected in the soils outside of the estimated area of Raymark waste at maximum concentrations of 187 mg/kg and 710 mg/kg, respectively. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than those for the estimated area of Raymark waste alone.

3.7.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at the Lot Behind 326 Ferry Boulevard property. Risks to future commercial workers were estimated.

- The RME hazard indices (HI) for future commercial workers exposed to soil within the estimated area of Raymark waste at the property are in excess of unity. The chemical-

specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposure to Aroclors.

- The RME cancer risk estimate for future commercial workers exposed to soils within the estimated area of Raymark waste exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5}. Dioxins, Aroclors, arsenic, and benzo(a)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste at the Lot Behind 326 Ferry Boulevard property.

- Asbestos was detected in 30 of 36 soil samples collected from the estimated area of Raymark waste at the property in the 0- to 15- foot bgs interval at a concentration range of trace to 60 percent. The average concentration was 13 percent.

3.7.6 Ecological Evaluation

The ecological characterization of the wetlands on and in the vicinity of this property was addressed OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetland Evaluation Raymark OU-3* (B&RE, 1998). A summary of the findings is presented below. It should be noted, however, that no individual evaluation of the environmental impacts on this property was performed.

The property is undeveloped and is characterized by early successional field vegetation and mix of shrubs and trees. The dominant vegetation includes black locust, quaking aspen, black cherry (*Prunus serotina*), gray birch, upland grasses, and goldenrods (*Solidago spp*.). The field vegetation is dominated by upland grasses, common ragweed (*Ambrosia artemisiifolia*), goldenrods (*Solidago spp*.), and asters (*Aster spp*.).

This upland area can provide habitat for a variety of small birds, mammals, and reptiles. However, the surrounding commercial and residential development, small size of the property, contaminated soils, and prior disturbances limit its use by wildlife, especially those that require a large habitat range. Wildlife identified at the site include small mammals, songbirds, reptiles, and insects.

3.7.7 Summary

This 1.7-acre property abutting Ferry Creek contains Raymark waste. Soils containing dioxins, metals (including SPLP and TCLP metals), pesticides, PCBs and SVOCs that exceed CT DEC and/or CT PMC criteria and elevated dioxin and asbestos are present on the property. Given the current undeveloped property conditions, infiltration and leaching are likely occurring throughout the property.

The RME hazard indices for commercial workers exposed to soil within the estimated area of Raymark waste are in excess of unity, indicating possible adverse non-carcinogenic health effects. The RME cancer risk estimate exceeds the EPA cancer risk range and the CT DEP target total risk level. Dioxins, Aroclors, arsenic, and benzo(a)pyrene are the predominant risk drivers. Adverse effects are anticipated for fetuses of pregnant workers exposed to lead in soils within the estimated area of Raymark waste. The average asbestos concentration in the estimated area of Raymark waste was 13 percent.

Ecological risks were present in the OU3 Area I RI and have not been quantified for this property; however, some impacts to ecological receptors may be occurring at this property.

TABLE 3-7
LOT BEHIND 326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Amosite	1	1	1	1	1	1				
Asbestos	70	86	8	10	0.9	60	1	52		
Chrysotile	1	1	19	19	19	19				
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	2	6	0.61	0.48	0.0676	0.886				
1,2,3,4,6,7,8-HpCDF	3	6	2.4	4.4	0.0568 EMPC	12.96 &				
1,2,3,4,7,8,9-HpCDF	2	6	0.32	0.057	0.0033 J	0.111				
1,2,3,4,7,8-HxCDD	1	6	0.21	0.017	0.017	0.017				
1,2,3,4,7,8-HxCDF	3	6	0.94	1.5	0.0049	4.62 &				
1,2,3,6,7,8-HxCDD	3	6	0.29	0.034	0.0044 EMPC	0.0854				
1,2,3,6,7,8-HxCDF	2	6	0.4	0.78	0.0028 J	1.56				
1,2,3,7,8,9-HxCDD	2	6	0.29	0.031	0.0043 J	0.0568				
1,2,3,7,8,9-HxCDF	1	6	0.11	0.022	0.022	0.022				
1,2,3,7,8-PeCDD	1	6	0.33	0.011	0.0114 EMPC	0.0114 EMPC				
1,2,3,7,8-PeCDF	2	6	0.39	0.64	0.0013 EMPC	1.27 &				
2,3,4,6,7,8-HxCDF	3	6	0.49	0.59	0.0023 J	1.77 &				
2,3,4,7,8-PeCDF	3	6	0.48	0.8	0.0029 J	2.38 &				
2,3,7,8-TCDD	2	6	0.16	0.0019	0.00039 J	0.0035				
2,3,7,8-TCDF	3	6	0.56	0.89	0.002	2.65 EMPC&				
OCDD	4	6	2.6	3.1	1.08	4.91 J&				
OCDF	3	6	0.73	0.81	0.0255	2.26				
Total HpCDD	3	6	1	1.3	0.165 J	1.93 EMPC&				
Total HpCDF	3	6	2.6	4.9	0.0205 J	14.53 EMPC&				
Total HxCDD	3	6	0.27	0.21	0.0158 J	0.535 EMPC				
Total HxCDF	3	6	3.6	6.9	0.0744 J	20.6 &				
Total PeCDD	2	6	0.39	0.18	0.0017 EMPC	0.359 EMPC				
Total PeCDF	3	6	2.9	5.6	0.0382 JEB	16.85 EMPC&				
Total TCDD	2	6	0.18	0.057	0.0025 JEB	0.111 EMPC				
Total TCDF	3	6	1.9	3.6	0.025 JEB	10.71 EMPC&				
Toxicity Equivalency	5	6	0.59	0.63	0.00292 J	2.48				

TABLE 3-7 (cont.)
LOT BEHIND 326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	21	21	9320	9320	6760 J	14800				
Antimony	2	21	0.92	3	2.7 J	3.2 J	8200	0		
Arsenic	21	21	5.9	5.9	1.7 J	12.2	10	1		
Barium	20	21	939	986	30.9	10500	140000	0		
Beryllium	10	21	0.36	0.57	0.35	1	2	0		
Cadmium	5	21	0.26	0.68	0.44 J	0.92 J	1000	0		
Calcium	21	21	36500	36500	1110	227000 J				
Chromium	21	21	28.5	28.5	10	105	100	1		
Cobalt	21	21	6.6	6.6	3.9	12.9	2500	0		
Copper	41	58	1050	1440	7.3	15000	76000	0		
Iron	21	21	13300	13300	10800	16500				
Lead	70	87	914	1130	4.1	12900	1000	13		
Magnesium	21	21	11800	11800	2550	59100				
Manganese	21	21	187	187	131	289	47000	0		
Mercury	15	21	0.4	0.54	0.074 J	5.9	610	0		
Nickel	21	21	49.4	49.4	7.6	192	7500	0		
Potassium	20	21	1070	1110	521	2810				
Selenium	2	21	0.7	1.4	1.3 J	1.5	10000	0		
Silver	7	21	0.4	0.86	0.18 J	3.2 J	10000	0		
Sodium	11	21	322	516	42.1	1410				
Vanadium	21	21	27.4	27.4	15.6	44.8	14000	0		
Zinc	21	21	167	167	25.7	916	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	1	1	50900	50900	50900 J	50900 J				
Antimony	3	3	7	7	4.9	10.3			60	0
Arsenic	3	3	47.2	47.2	1.3 J	92.2			500	0
Barium	3	3	1730	1730	109	4640 J			10000	0
Beryllium	1	3	2	5.6	5.6	5.6			40	0
Cadmium	2	3	6	9	0.84	17.1			50	0

TABLE 3-7 (cont.)
LOT BEHIND 326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Calcium	1	1	429000	429000	429000 J	429000 J				
Chromium	3	3	63.1	63.1	2.6	176 J			500	0
Cobalt	1	1	51	51	51 J	51 J				
Copper	3	3	11000	11000	78.2	32700 J			13000	1
Iron	1	1	57800	57800	57800 J	57800 J				
Lead	3	3	9490	9490	1.4	28300 J			150	2
Magnesium	1	1	26100	26100	26100	26100				
Manganese	1	1	2200	2200	2200 J	2200 J				
Nickel	3	3	91.9	91.9	13.4 J	242 J			1000	0
Potassium	1	1	6200	6200	6200 J	6200 J				
Selenium	3	3	4.3	4.3	3.1 J	5.5 J			500	0
Silver	1	3	0.59	0.52	0.52 J	0.52 J			360	0
Sodium	1	1	1810	1810	1810 J	1810 J				
Thallium	1	3	2.8	6.5	6.5	6.5			50	0
Vanadium	3	3	171	171	25	377			500	0
Zinc	3	3	1410	1410	14.6 J	4050			50000	0
Metals (TCLP) (UG/L)										
Arsenic	1	1	2.7	2.7	2.7 J	2.7 J			500	0
Chromium	1	1	4.8	4.8	4.8 J	4.8 J			500	0
Lead	1	1	183	183	183	183			150	1
Mercury	1	1	0.74	0.74	0.74	0.74			20	0
Selenium	1	1	2.6	2.6	2.6 J	2.6 J			500	0
Semivolatile Organic Compounds (UG/KG)										
1,2-Dichlorobenzene	1	5	230	180	180 J	180 J	1000000	0	3100	0
2,4-Dimethylphenol	2	15	230	180	180 , J	180 , J	2500000	0	28000	0
2-Methylnaphthalene	9	20	170	84	39 J	220 J	2500000	0	9800	0
2-Methylphenol	1	15	230	150	150 J	150 J	2500000	0	70000	0
4-Methylphenol	3	15	200	79	44 J	130 J	2500000	0	7000	0
Acenaphthene	7	14	170	68	47 J	92 J	2500000	0	84000	0

TABLE 3-7 (cont.)
LOT BEHIND 326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Acenaphthylene	10	20	200	150	80 J	280 , J	2500000	0	84000	0
Anthracene	14	20	220	220	96 J	460	2500000	0	400000	0
Benzo(a)anthracene	17	20	570	640	170 J	1800 J	7800	0	1000	3
Benzo(a)pyrene	17	20	420	460	96 J	1100	1000	1	1000	1
Benzo(b)fluoranthene	18	20	560	600	24 J	1500	7800	0	1000	2
Benzo(g,h,i)perylene	13	20	230	230	71	680 J	2500000	0	42000	0
Benzo(k)fluoranthene	16	20	450	500	160 J	1100	78000	0	1000	1
bis(2-Ethylhexyl)phthalate	13	20	180	150	30 J	830	410000	0	11000	0
Carbazole	13	20	150	110	45 J	230 J	290000	0	360	0
Chrysene	18	20	710	760	23 J	2100	780000	0	1000	4
Dibenzo(a,h)anthracene	7	20	240	220	140 J	330 , J	780	0	1000	0
Dibenzofuran	6	20	200	81	40 J	150 J	2500000	0	5600	0
Di-n-Butylphthalate	8	20	190	100	26 J	200 J	2500000	0	140000	0
Di-n-octylphthalate	1	20	230	12	12 J	12 J	2500000	0	20000	0
Fluoranthene	18	20	1200	1300	32 J	2800	2500000	0	56000	0
Fluorene	12	20	160	120	52 J	260 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	16	20	350	380	69 J	930	7800	0	1000	0
Naphthalene	9	20	200	130	37 J	240 J	2500000	0	56000	0
Phenanthrene	18	20	850	920	22 J	2900	2500000	0	40000	0
Phenol	1	13	480	3600	3600	3600	2500000	0	800000	0
Pyrene	19	20	1700	1700	33 J	6600 J*	2500000	0	40000	0
Volatile Organic Compounds (UG/KG)										
1,2-Dichlorobenzene	2	15	6	2	2 J	3 J	1000000	0	3100	0
2-Butanone	11	18	16	22	2 J	36	1000000	0	80000	0
Acetone	8	18	47	95	37	140 J	1000000	0	140000	0
Benzene	9	18	4	3	1 J	7 J	200000	0	200	0
Bromomethane	1	18	6	1	1 J	1 J				
Carbon Disulfide	15	18	18	20	1 J	85 J	1000000	0	140000	0

TABLE 3-7 (cont.)
LOT BEHIND 326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG) (cont.)										
Chlorobenzene	1	18	8	29	29	29	1000000	0	20000	0
cis-1,2-Dichloroethene	1	15	6	2	2 J	2 J				
Cyclohexane	9	15	6	6	2 J	12 J				
Ethylbenzene	10	18	13	19	2 J	41	1000000	0	10100	0
Isopropylbenzene	3	15	6	7	0.7 J	14 J				
Methyl Acetate	1	15	6	2	2 J	2 J				
Methyl tert-Butyl Ether	3	15	10	25	23 J	29				
Methylcyclohexane	10	15	8	8	1 J	16				
Toluene	13	18	11	13	1 J	50	1000000	0	67000	0
Total Xylenes	13	18	53	72	1 J	190	1000000	0	19500	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	2	21	11	52	6.7 J	98 J	24000	0	29	1
4,4'-DDE	13	21	36	53	2.2 J	530	17000	0	21	2
4,4'-DDT	7	21	12	21	3.8 J	58 #	17000	0	21	3
alpha-Chlordane	5	21	6.6	17	2.3	46	2200	0	66	0
Aroclor, Total (4)	52	81	13000	20000	170	290000	10000	14		
Aroclor, Total (Conservative)(5)	52	81	14000	22000	359.5	322000	10000	14		
Aroclor-1254	1	72	1700	83000	83000 *	83000 *	10000	1		
Aroclor-1260	2	72	740	9000	7000	11000	10000	1		
Aroclor-1262	38	65	6500	11000	92 J	130000 J	10000	7		
Aroclor-1268	51	81	6700	11000	74	160000 J	10000	10		
beta-BHC	1	21	3.9	5	5	5	3200	0	3.9	1
delta-BHC	1	21	3.6	4	4 J	4 J	910	0	1.1	1
Dieldrin	5	21	47	190	2.6 J	770	360	1	7	4
Endosulfan II	4	21	8.8	17	8.3 J	31 #	1200000	0	8400	0
Endosulfan Sulfate	10	21	140	280	3.8 J	2300 *#	1200000	0	8400	0
Endrin	1	21	7.3	6.4	6.4	6.4	610000	0		
Endrin Aldehyde	7	21	160	480	6.2 #	2200 *#	610000	0		

TABLE 3-7 (cont.)
LOT BEHIND 326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

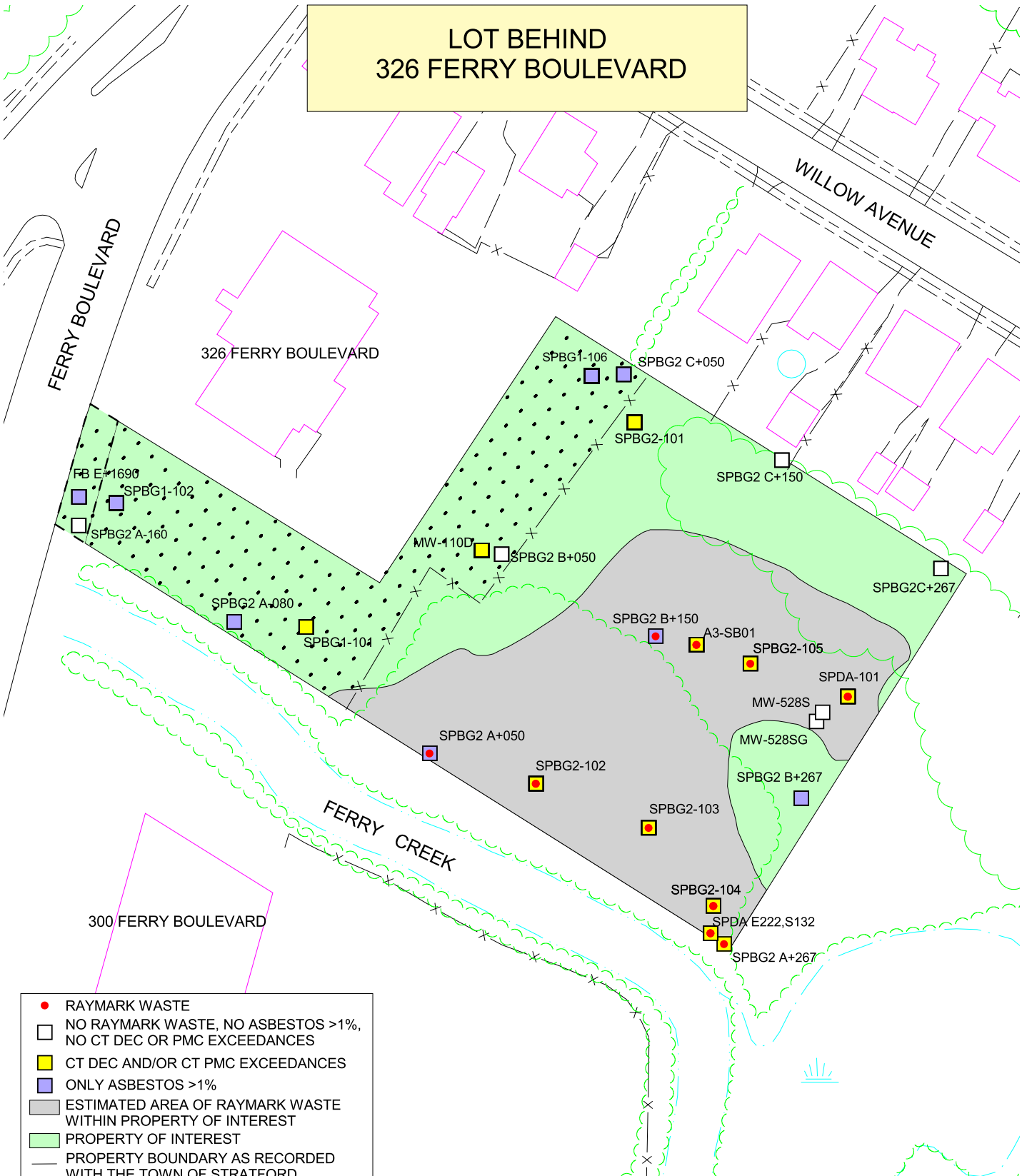
PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
Endrin Ketone	5	21	8.6	8.6	5.1	13	610000	0		
gamma-Chlordane	4	21	7.1	25	6.3	73 #	2200	0	66	1
Heptachlor	1	21	3.8	2.8	2.8	2.8	1300	0	13	0
Heptachlor Epoxide	4	21	4.3	6.5	2.5	9.9 #	630	0	20	0
Methoxychlor	5	21	100	360	39	680 #	10000000	0	8000	0

Qualifier	Definition
#	Possible false positive due to interference
&	From dilution analysis
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.

LOT BEHIND
326 FERRY BOULEVARD



- RAYMARK WASTE
- NO RAYMARK WASTE, NO ASBESTOS >1%, NO CT DEC OR PMC EXCEEDANCES
- CT DEC AND/OR CT PMC EXCEEDANCES
- ONLY ASBESTOS >1%
- ESTIMATED AREA OF RAYMARK WASTE WITHIN PROPERTY OF INTEREST
- PROPERTY OF INTEREST
- PROPERTY BOUNDARY AS RECORDED WITH THE TOWN OF STRATFORD
- IMPLIED PROPERTY BOUNDARY EXTENDED TO ROADWAY
- BUILDING
- PAVEMENT

NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-7
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.8 Vacant Lot at Housatonic Avenue

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.8.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.8.1 Property Description

This property, approximately 0.5 acres of residentially-zoned land, is located between Ferry Boulevard and Housatonic Avenue in Stratford, Connecticut (Town of Stratford, 1997). The property is undeveloped, vegetated with grasses, shrubs, and trees, and has no road frontage. The topography is flat with a gentle slope towards Ferry Creek. Surface drainage appears to flow in a south-southeast direction into the Ferry Creek wetlands. Public access to the property from the north, south, and west is not restricted. There is a fence that runs behind the Housatonic Avenue properties, however the fence has a gate and does not extend along the entire property length. No storm drains were observed on the property.

Residential properties are located to the north and east of the property (Willow and Housatonic Avenue, respectively), Ferry Creek wetlands are located to the south, and the vacant lot behind 326 Ferry Boulevard (see Section 3.7) is located to the west.

3.8.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, this property is located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Seven borings (A3-SB02; SPDA-E228 N0; SPDA-E275, S130; SPDA-E325, S38; and SPDA-102 through 104), to depths of up to 16 feet below ground surface (bgs), were advanced on the property. Surficial materials noted in boring A3-SB02 consist of fill overlying sediments characteristic of marsh and swamp deposits (organic silt and peat) which overlies glacial outwash or ice contact deposits (silt, silty sand, and sand). Soils noted in borings SPDA-E2228 N0, SPDA-102, and SPDA-103 consist of fill overlying silty sand with varied amounts of gravel,

which is characteristic of alluvial and glacial outwash deposits. In borings SPDA-104; SPDA-E275, S130; and SPDA-E325, S38 fill overlies organic silt and peat from a marsh and swamp deposit. Refer to Figure 3-8 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on the property. Soil sample locations are shown on Figure 3-8, including both shallow surface soil samples and deeper samples from soil borings. The borings were used to describe the fill and native material on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

The fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Man-made materials were identified in the soil from borings A3-SB2, SPDA-E275 S130, SPDA-325 538, SPDA-E228 N0, and SPDA-104, including PACM (potentially asbestos-containing materials) namely asbestos fiber, pads and tiles, and asphalt, asphalt shingles, brake pads, brick, glass, green tiles, house siding, plastic, slag, wax-like material and/or manufacturing debris. PACM was identified in all five borings. These materials were encountered with natural fill materials consisting of sand, silty sand, and silt with fine sand. Man-made debris was not observed in borings SPDA-102 or SPDA-103; however, the silty sand material in these borings is likely natural fill. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across most of the property. The presence of fill has not been determined at depth in the area northeast of SPDA-E228 N0. The depth to water ranges from 3.1 feet bgs to 10 feet bgs, based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-8. Approximately one-third of this property contains Raymark waste. The entire waste areas are heavily vegetated.

3.8.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for residential soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 53 soil samples collected from 18 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-8. Samples were analyzed for asbestos, dioxin, metals, SPLP and TCLP metals, pesticides, TCLP pesticides, PCBs, TCLP PCBs, SVOCs, TCLP SVOCs, VOCs, and TCLP VOCs. See Table 3-8 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-8 for the soil data summary statistics and comparison to criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

<u>Asbestos</u>

Forty-nine soil samples were collected from the property and analyzed for asbestos. Asbestos was detected in 41 of the 49 samples collected at the property. Observable asbestos at greater

than 1 percent was found in 31 of 49 samples. Asbestos detections were scattered throughout the property from the ground surface to 16 feet bgs.

Dioxins

Nine soil samples were collected from the property and analyzed for dioxins. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. TEQ values ranged from 0.0149 µg/kg to 10.539 µg/kg.

Metals

Soil samples were collected from the property and analyzed for metals as follows: 10 samples were analyzed for metals in a fixed laboratory; nine were screened for copper; and 33 were screened for lead. Metals were detected very frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Lead and copper were detected in almost all of the samples analyzed. Barium, chromium, copper, and lead exceeded the CT DEC regulatory standards at this property. Metals exceedances were located in central and southern portions of the property from the ground surface to 10 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only one sample was collected for SPLP metals analysis. Two samples were also collected for TCLP metals analysis. These samples were collected from within the estimated area of Raymark waste. Samples exceeded the CT PMC for lead. Barium, copper, nickel, and zinc also exceeded the CT PMC for SPLP metals, indicating the potential for leaching into groundwater. The TCLP lead exceedance was at location SPDAC-E275, S130 from 0.4 to 1.5 feet bgs. The SPLP metals exceedances were from location A3-SB02 from 6 to 8 feet bgs.

Pesticides

Ten soil samples were collected from the property and analyzed for pesticides. Pesticides were not frequently detected on the property. 4,4-DDT was the only pesticide that exceeded the CT PMC and CT DEC regulatory standards. Pesticide exceedances were located in the central and western portions of the property at ground surface and at 6 to 8 feet bgs.

TCLP Pesticides

The CT PMC regulatory standards were not exceeded for the one sample analyzed for TCLP pesticides.

PCBs

Forty-four samples were collected from the property and analyzed for PCBs as Aroclors. PCBs were frequently detected on the property, with 25 samples exceeding the CT DEC for total Aroclors. The concentrations of Aroclor 1262 and 1268 were primary contributors to the total Aroclor exceedances. PCB exceedances were located in the central and western portions of the property at depths ranging from the ground surface to 10 feet bgs.

TCLP PCBs

One sample was collected for TCLP PCBs analysis at this property. There were no exceedances of the CT PMC in the sample.

SVOCs

Nine soil samples were collected from the property and analyzed for SVOCs. SVOCs, mainly PAHs, were frequently detected on the property. Nine SVOCs exceeded the CT DEC and/or CT PMC regulatory standards. SVOC exceedances were located in the western half of the property from the ground surface to 10 feet bgs.

TCLP SVOCs

One soil sample was collected for TCLP SVOCs analysis at this property. There were no TCLP SVOC exceedances of the CT PMC in the one sample analyzed.

VOCs

Eight soil samples were collected from the property and analyzed for VOCs. VOCs were rarely detected on the property. There were no exceedances of the CT DEC or the CT PMC regulatory standards.

TCLP VOCs

One sample was collected for TCLP VOCs analysis at this property. There were no exceedances of the CT PMC regulatory standards.

Raymark Waste

The results from seven different sample locations indicated the presence of Raymark waste on the property. The following table displays the locations and constituents of the 13 samples from those 7 locations with contaminant concentrations that meet the definition of Raymark waste on this property. These samples are within the 32.9 percent of the property shown on Figure 3-8 as the "Estimated Area of Raymark Waste within Property of Interest".

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
SPD G4	0 to 0.5	80	17,100	27,900	ND
SPD H3	0 to 0.5	70	7,270	2,930	3,000
A3-SB02	6 to 8	50	35,400	29,600	52,000
SPDA E228, N0	0.6 to 2.2	45	8,190	NA	21,000
	4.0 to 5.9	47	4,340	NA	20,000
SPDAC-E275, S130	0.4 to 1.5	30	26,000	34,600	37,000
	3.1 to 3.7	20	4,460	5,850	12,000
	9.5 to 10.0	15	9,600	10,500	19,000
SPDA-104	2 to 4	50	14,100	24,800	99,000
	4 to 6	60	18,900	25,400	120,000
	6 to 8	60	10,600	17,500	67,000

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
SPDA E325, S38	5.9 to 6.8	40	10,000	NA	10,000
	8.0 to 8.6	30	10,000	NA	6,000

NA- Contaminant not analyzed
ND- Contaminant was not detected

3.8.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 33 percent of this 0.5-acre property is estimated to contain by Raymark waste. The waste is located throughout the property, as shown on Figure 3-8. The property is vacant and is entirely vegetated with grasses, shrubs, and trees. The property is relatively flat, then slopes into Ferry Creek. Erosion of the bank has revealed brake linings. As indicated by SPLP and TCLP data, it is likely there is leaching of metals or organic contaminants into the groundwater. Because of the lack of impermeable surfaces on the property, infiltration of rain water and surface water runoff are likely occurring. Erosion of waste materials on the bank of Ferry Creek has been observed, indicating a potential source of contaminants to Ferry Creek sediments and surface water.

3.8.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at the Vacant Lot at Housatonic Avenue that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at the Vacant Lot at Housatonic Avenue may be higher than presented in this HHRA if contaminants beyond

the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.8.5.1 provides an overview of the Vacant Lot at Housatonic Avenue property, Section 3.8.5.2 presents COPCs and EPCs, Section 3.8.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.8.5.4 contains the numerical results of the risk assessment, and Section 3.8.5.5 presents property-specific uncertainties. Section 3.8.5.6 presents a property-specific summary of the major risk findings.

3.8.5.1 Overview

The Vacant Lot at Housatonic Avenue is an undeveloped property zoned for residential land-use. The property covers approximately 0.5 acres. A detailed description of the property is provided in Section 3.8.1. The nature and extent of the contamination detected at the Vacant Lot at Housatonic Avenue is discussed in Section 3.8.3. The areas of the property estimated to contain Raymark waste represent an estimated 33 percent of the total 0.5-acre property and are shown in Figure 3-8. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.8.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated areas of Raymark waste are summarized in Appendix B-1, Table 2.8.

3.8.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.8 presents a summary of the COPCs for quantitative risk assessment for the Vacant Lot at Housatonic Avenue soils from the estimated areas of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data except soil data collected from depths greater than 15 feet, were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for residential soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste at this property to risk-based COPC screening levels for residential land use, as shown in Appendix B-1, Table 2.8:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene)
- Pesticides (4,4'-DDT and endrin ketone)
- Aroclors, total (1248, 1254, 1262, and 1268)
- Metals (antimony, arsenic, barium, chromium, lead, manganese, nickel, vanadium, and zinc)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for the Vacant Lot at Housatonic Avenue are presented in Appendix B-1, Table 3.8. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.8.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the Vacant Lot at Housatonic Avenue and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under future conditions, potential human receptors (residents) were assumed to be exposed to soil only within the estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The Vacant Lot at Housatonic Avenue is an undeveloped property zoned for residential land-use, as described in Section 3.8.1.

Potential Receptors

The receptors retained for quantitative evaluation at the Vacant Lot at Housatonic Avenue were future residents. Potentially exposed individuals include residents who may live at this property in the future.

The Vacant Lot at Housatonic Avenue is zoned residential. Potential future residents were evaluated for exposure to soils (0 to 15 feet bgs) in the estimated areas of Raymark waste. Persons residing at the property in the future may contact soil within the estimated areas of Raymark waste through play or yard work at their home. Appendix B-1, Table 4.2A presents the exposure assumptions for adult residents at this and other recreational and residential properties in the RI. Appendix B-1, Table 4.2B presents the exposure assumptions for child residents at this and other recreational and residential properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at the Vacant Lot at Housatonic Avenue are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from the property is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. Estimated areas of Raymark waste are heavily vegetated. The presence of vegetation reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to

determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios. Appendix B-1, Table 2.8 presents available inhalation SSLs for contaminants in soils within the estimated areas of Raymark waste at the property. All reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a).

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.8.5.4. Asbestos is present in soils within the estimated areas of Raymark waste at the property. The presence of vegetation and the qualitative comparison to SSLs suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.2A and Table 4.2B contain the various assumptions used as input parameters to determine chemical intakes for adult and child residents through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for the Vacant Lot at Housatonic Avenue is 0.33. Chemical intake estimates are provided in Appendix B-1, Tables 7.8 and 8.8.

3.8.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for the Vacant Lot at Housatonic Avenue is provided in this section. Appendix B-1, Table 7.8 and Table 8.8 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.8. Appendix B-1, Table 10.8 reduces the information developed in Appendix B-1, Table 9.8 to the major risk drivers. Tables 7.8A, 8.8A, 9.8A, and 10.8A in Appendix B-1 present non-cancer and cancer RME risk estimates for adult residents.

Tables 7.8B, 8.8B, 9.8B, and 10.8B present non-cancer and cancer RME risk estimates for child residents. Children represent the more sensitive population for non-cancer risks. For cancer risk estimates, risks to children and adults are added to produce an estimate of risks from lifetime exposures. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the future resident at the Vacant Lot at Housatonic Avenue are as follows:

	Ingestion	Dermal	Total
Resident – Adult (Future)	1.6	0.8	2.4
Resident – Child (Future)	15.0	5.3	20

The RME hazard index (HI) for the resident exposed to soils within the estimated areas of Raymark waste at the property is in excess of unity. Total Aroclor was the main contributor to the hazard index for the resident. The chemical-specific (and target-organ specific) hazard quotients for total Aroclor alone are in excess of unity for both adult and child residents. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Tables 7.8A RME and 7.8B RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the future resident at the Vacant Lot at Housatonic Avenue are as follows:

	Ingestion	Dermal	Total
Resident – Adult[(1)] (Future)	1.5E-04	4.6E-05	2.0E-04
Resident – Child[(1)] (Future)	3.6E-04	7.5E-05	4.3E-04

1) Summation of total risk for Future Resident (adult plus child): 6.3E-04.

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. Cancer risks for the adult and child resident are added together for a lifetime exposure. The RME risk estimate for the future resident exposed to soils within the estimated areas of Raymark waste exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and exceeds the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Tables 8.8A RME and 8.8B RME in Appendix B-1 for details on the cancer risk calculations. As detailed on Appendix B-1, Tables 9.8A and 9.8B, cancer risks for dioxin, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic, and Aroclors in soils are the predominant risk drivers. Cancer risks for these contaminants exceed the CT DEP target risk level of 10^{-6} for single contaminants.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for future residents exposed to soils within the estimated areas of Raymark waste at this property are 3.4E-03.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste at the Vacant Lot at Housatonic Avenue. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 35,400 mg/kg. The average lead concentration in this dataset was 8,590 mg/kg.

Exposure to lead in soil by the future child resident was evaluated using the EPA IEUBK Model, as discussed in Section 2.7.4.7. The IEUBK model was developed to evaluate exposures to lead by children in a residential setting. The time-weighted exposure point concentration of 2,835 mg/kg (average lead concentration for soil within the estimated areas of Raymark waste of 8,590 multiplied by the FRW of 0.33), as well as several default parameters, were used to estimate blood-lead levels for children in a residential setting. The estimated geometric mean blood-lead level for children exposed to lead in soils within the estimated areas of Raymark waste was 19 µg/dL, which is greater than the established level of concern of 10 µg/dL. The

IEUBK model estimates that 91 percent of children exposed to lead in soils at the estimated areas of Raymark waste at the property are expected to have blood-lead levels greater than 10 µg/dL, which exceeds the acceptable level of 5 percent. The input parameters used and the results of the IEUBK lead models, estimated blood-lead levels, and probability density histograms are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 34 of 35 soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 80 percent. These samples were collected from the 0- to 15- foot bgs interval. The average concentration was 26 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos at the property. Based on field conditions in the estimated areas of Raymark waste at the Vacant Lot at Housatonic Avenue, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.8.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the Vacant Lot at Housatonic Avenue are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the

percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the Vacant Lot at Housatonic Avenue property is 0.5 acres, with an estimated 33 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.8.4. Currently, the entire site, including the estimated areas of Raymark waste, is vegetated with grasses, shrubs, and trees. Because of the small size of the estimated areas of Raymark waste, it is unlikely that individuals will spend all of their time within those areas. However, if that were the case, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately three times greater than those estimated using the FRW factor.

- Copper concentrations exceeded the EPA Region IX residential soil PRG of 3,100 mg/kg in the Vacant Lot at Housatonic Avenue soils; however, due to the lack of an approved toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste and was reported in property soils (0 to 15 feet bgs) at concentrations ranging from 42.3 mg/kg to 34,600 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown on Appendix B-1, Table 2.8 alongside site-specific data from the estimated area of Raymark waste. Antimony, with an average background concentration of 2.86 mg/kg, was detected in one of ten samples at a concentration of 6.5 mg/kg. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 1.8 to 9.7 mg/kg, with an average concentration of 5.9 mg/kg. Manganese, with an average background concentration of 306 mg/kg, was detected at concentrations ranging from 83.6 to 592 mg/kg, with an average concentration of 280 mg/kg. Vanadium, with an average background concentration of 34.2 mg/kg, was detected at

concentrations ranging from 6.6 to 77 mg/kg, with an average concentration of 32.8 mg/kg. Risks due to antimony, arsenic, manganese, and vanadium may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Thirty-eight samples, 28 of which were only analyzed by field-screening methods, were included in the dataset for soils within the estimated areas of Raymark waste. Due to the limited numbers of samples analyzed for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, 4,4'-DDT, antimony, nickel, vanadium, zinc, and dioxins, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-10. The presence of PAHs, lead, and PCBs at concentrations greater than CT RSRs for residential soil suggests that risks from other areas of the property may be of concern. The single sample collected from outside the estimated areas of Raymark waste and analyzed by CLP methods contained benzo(a)anthracene at a concentration of 2.2 mg/kg, benzo(a)pyrene at a concentration of 2 mg/kg, benzo(b)fluoranthene at a concentration of 2 mg/kg, dibenzo(a,h) anthracene at a concentration of 0.37 mg/kg, indeno(1,2,3-cd)pyrene at a concentration of 0.96 mg/kg, and PCBs as total Aroclors at a concentration of 1.29 mg/kg. The individual Aroclors detected were Aroclors 1254, 1262, and 1268. Lead was present at concentrations up to 670 mg/kg in the 14 samples analyzed for lead.

- Dioxins were detected in soils outside the estimated areas of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin concentrations in soils outside the estimated areas of Raymark waste were reported at 0.015 µg/kg, which is greater than the EPA Region IX PRGs for residential soil. Copper was detected at concentrations up to 1,410 mg/kg. Asbestos was also present outside the estimated areas of Raymark waste at the Vacant Lot at Housatonic Avenue at concentrations up to 80 percent. Thus, a resident's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

3.8.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at the Vacant Lot at Housatonic Avenue. Risks to potential future residents were estimated.

- The RME hazard indices (HI) for residents exposed to soil within the estimated areas of Raymark waste are in excess of unity. The chemical-specific (and target organ-specific) hazard quotients for total Aroclors alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposures to Aroclors.

- The RME cancer risk estimates for future residents exposed to soil within the estimated areas of Raymark waste exceed the EPA cancer risk range (10^{-4} to 10^{-6}) and exceed the CT DEP target total risk level of 10^{-5}. Dioxin, Aroclors, arsenic, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h) anthracene, are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by child residents was evaluated by use of the IEUBK model. The results of the model indicate that adverse effects are anticipated for future child residents exposed to lead in soil within the estimated areas of Raymark waste.

- Asbestos was detected in 34 of 35 soil samples collected from the estimated areas of Raymark waste at the property in the 0- to 15- bgs foot interval at a concentration range of trace to 80 percent. The average concentration was 26 percent.

3.8.6 Ecological Evaluation

The ecological characterization of the wetlands on this property and ecological risks in the vicinity of the property were evaluated under the OU3 RI Area I (TtNUS, 1999b) and the *Draft Technical Memorandum Wetland Evaluation, Raymark – Ferry Creek – OU3 (*B&RE, 1998*)*. A summary of the findings is presented below. It should be noted however, that no individual evaluation of the ecological impacts was performed.

The property is undeveloped but has been filled and disturbed in the past. The parcel is vegetated with early successional grasses, shrubs, and trees indicative of disturbed areas. The vegetation is similar to the species located at the lot behind the 326 Ferry Boulevard property (see Section 3.7). This upland area and surrounding undeveloped areas can provide habitat for a variety of small birds, mammals, and reptiles. However, the small size of the property, the surrounding commercial and residential development, and past property disturbances limit use by wildlife, especially those that require a large habitat range. The nearest water source, Ferry Creek, is also contaminated with Raymark related wastes. Risks to ecological receptors in the vicinity of this property were identified in surface water and sediment.

3.8.7 Summary

This 0.5-acre property abutting Ferry Creek contains Raymark waste. Soil containing metals, pesticides, PCBs, and SVOCs that exceed the CT DEC and/or CT PMC or that contain more than 1 percent asbestos are present on the property. Erosion, infiltration, and leaching of contaminants are key factors contributing to contaminant migration at this property.

The RME hazard indices for residents exposed to soil within the estimated areas of Raymark waste are slightly in excess of unity, indicating that adverse non-carcinogenic health effects are possible. The RME cancer risks estimates slightly exceed the EPA cancer risk range and exceed the CT DEP target total risk level. Dioxin, Aroclors, arsenic, benzo(a)pyrene, and dibenzo(a,h)anthracene are the primary risk drivers. Adverse effects are anticipated for child residents exposed to lead in soils within the estimated areas of Raymark waste. The average asbestos concentration in the estimated areas of Raymark waste was 26 percent.

Ecological risks were identified in the vicinity of this property, however, no individual evaluation of the environmental risks on this property was performed.

TABLE 3-8
VACANT LOT AT HOUSATONIC AVENUE - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	41	49	21	25	Trace	80	1	31		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	9	9	0.72	0.72	0.049 J	4.2				
1,2,3,4,6,7,8-HpCDF	9	9	4.6	4.6	0.047 J	29.425				
1,2,3,4,7,8,9-HpCDF	5	9	0.043	0.076	0.02 J	0.23				
1,2,3,4,7,8-HxCDD	2	9	0.0057	0.017	0.003 J	0.0302				
1,2,3,4,7,8-HxCDF	9	9	2.5	2.5	0.012 J	12.024				
1,2,3,6,7,8-HxCDD	8	9	0.031	0.034	0.004 *	0.18				
1,2,3,6,7,8-HxCDF	8	9	0.68	0.76	0.004 J	3.9				
1,2,3,7,8,9-HxCDD	4	9	0.023	0.051	0.009	0.17				
1,2,3,7,8,9-HxCDF	1	9	0.0026	0.012	0.012	0.012				
1,2,3,7,8-PeCDD	1	9	0.0057	0.037	0.0372	0.0372				
1,2,3,7,8-PeCDF	9	9	1.3	1.3	0.006 J	6.8				
2,3,4,6,7,8-HxCDF	9	9	1.3	1.3	0.007 J	6.918				
2,3,4,7,8-PeCDF	9	9	2.4	2.4	0.013 J	13.003				
2,3,7,8-TCDD	1	9	0.0017	0.0079	0.00793	0.00793				
2,3,7,8-TCDF	9	9	2.2	2.2	0.013 J	9.93				
OCDD	9	9	4.8	4.8	0.893	16				
OCDF	8	9	0.71	0.79	0.249 J	3.637				
Total HpCDD	9	9	1.2	1.2	0.103 J	7.1				
Total HpCDF	9	9	5.1	5.1	0.071 J	32.044				
Total HxCDD	9	9	0.084	0.084	0.01 J	0.372				
Total HxCDF	9	9	9.6	9.6	0.077 J	49.227				
Total PeCDD	2	9	0.063	0.02	0.003 J	0.0372				
Total PeCDF	9	9	10.9	10.9	0.094 J	45.8				
Total TCDD	5	9	0.012	0.021	0.0016	0.038				
Total TCDF	9	9	4.6	4.6	0.031 J	14.926				
Toxicity Equivalency	9	9	2	2	0.0149 J	10.539				

TABLE 3-8 (cont.)
VACANT LOT AT HOUSATONIC AVENUE - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	11	11	7650	7650	3830	12100				
Antimony	1	11	6.1	6.5	6.5	6.5	27	0		
Arsenic	10	11	5.8	6.1	1.8 J	9.7 J	10	0		
Barium	11	11	7530	7530	29.5	21000	4700	6		
Beryllium	9	11	0.55	0.63	0.29	0.87 J	2	0		
Cadmium	1	11	0.75	2.4	2.4	2.4	34	0		
Calcium	11	11	3390	3390	470	9330				
Chromium	11	11	95.9	95.9	9.6	227	100	6		
Cobalt	11	11	18.7	18.7	3.4	46.8	1000	0		
Copper	19	20	10800	11400	42.3 J	34600	2500	10		
Iron	11	11	15800	15800	9970	22900				
Lead	42	44	6120	6400	17.1 J	35400	400	24		
Magnesium	11	11	32800	32800	2870	95400				
Manganese	11	11	278	278	83.6	592 J	1600	0		
Mercury	6	11	0.18	0.26	0.16	0.51	20	0		
Nickel	11	11	219	219	9.1	580	1400	0		
Potassium	10	11	1110	1220	498	2080				
Silver	9	11	2.6	2.8	0.35 J	4.3 J	340	0		
Sodium	9	11	416	503	112	2180				
Vanadium	11	11	32.6	32.6	6.6	77 J	470	0		
Zinc	11	11	1070	1070	22.4	4730	20000	0		
Metals (SPLP) (UG/L)										
Aluminum	1	1	18300	18300	18300	18300				
Antimony	1	1	5.2	5.2	5.2	5.2			60	0
Arsenic	1	1	26.9	26.9	26.9	26.9			500	0
Barium	1	1	11500	11500	11500	11500			10000	1
Beryllium	1	1	2	2	2	2			40	0
Cadmium	1	1	22.4	22.4	22.4	22.4			50	0

TABLE 3-8 (cont.)
VACANT LOT AT HOUSATONIC AVENUE - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Calcium	1	1	85400	85400	85400	85400				
Chromium	1	1	286	286	286	286			500	0
Cobalt	1	1	121	121	121	121				
Copper	1	1	131000	131000	131000	131000			13000	1
Iron	1	1	84900	84900	84900	84900				
Lead	1	1	603000	603000	603000	603000			150	1
Magnesium	1	1	51600	51600	51600	51600				
Manganese	1	1	3710	3710	3710	3710				
Mercury	1	1	0.25	0.25	0.25	0.25			20	0
Nickel	1	1	1910	1910	1910	1910			1000	1
Sodium	1	1	3980	3980	3980	3980				
Thallium	1	1	21.9	21.9	21.9	21.9			50	0
Vanadium	1	1	112	112	112	112			500	0
Zinc	1	1	59600	59600	59600	59600			50000	1
Metals (TCLP) (UG/L)										
Barium	2	2	5390	5390	3770	7010			10000	0
Cadmium	2	2	7.4	7.4	7.4	7.4			50	0
Lead	2	2	375000	375000	375000	375000			150	2
Semivolatile Organic Compounds (UG/KG)										
2,4-Dimethylphenol	4	9	1700	3200	280 J	11000	1000000	0	28000	0
2-Methylnaphthalene	4	9	480	390	20 J	1000	474000	0	9800	0
2-Methylphenol	3	9	430	260	82	390	1000000	0	70000	0
4-Methylphenol	3	9	490	430	160	850	340000	0	7000	0
Acenaphthene	6	9	280	280	33 J	990	1000000	0	84000	0
Acenaphthylene	5	9	560	250	60 J	460	1000000	0	84000	0
Anthracene	6	9	890	1200	130 J	2400	1000000	0	400000	0
Benzo(a)anthracene	7	9	2300	2800	21 J	6700	1000	4	1000	4
Benzo(a)pyrene	7	9	2000	2500	310	5700	1000	4	1000	4

TABLE 3-8 (cont.)
VACANT LOT AT HOUSATONIC AVENUE - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Benzo(b)fluoranthene	7	9	2100	2700	310	6200	1000	4	1000	4
Benzo(g,h,i)perylene	8	9	1000	1200	80	2600	1000000	0	42000	0
Benzo(k)fluoranthene	6	9	1700	2400	560 J	4700	8400	0	1000	4
Butylbenzylphthalate	1	9	730	41	41 J	41 J	1000000	0	200000	0
Carbazole	6	9	420	490	52 J	1200	31000	0	360	3
Chrysene	9	9	3400	3400	22 J	7200	84000	0	1000	8
Dibenzo(a,h)anthracene	4	9	500	740	370 J	1000	84	4	1000	0
Dibenzofuran	5	9	310	340	100 J	770	270000	0	5600	0
Diethylphthalate	2	9	710	160	35	295	1000000	0	1100000	0
Di-n-Butylphthalate	7	9	470	320	24 J	1300	1000000	0	140000	0
Fluoranthene	9	9	4700	4700	54 J	14000	1000000	0	56000	0
Fluorene	8	9	340	360	51 J	1200	1000000	0	56000	0
Indeno(1,2,3-cd)pyrene	6	9	1100	1500	400 J	3000	840	4	1000	3
Naphthalene	3	9	540	590	38 J	1400	1000000	0	56000	0
N-Nitroso-diphenylamine	2	9	740	1700	540 J	2900	130000	0	1400	1
Phenanthrene	9	9	3200	3200	74 J	8800	1000000	0	40000	0
Phenol	3	7	1100	1800	1700	2000	1000000	0	800000	0
Pyrene	9	9	5800	5800	39 J	18000	1000000	0	40000	0
Total PAH	3	3	29000	29000	210	80580				
Volatile Organic Compounds (UG/KG)										
1,1,1-Trichloroethane	2	7	6	6	4	9	500000	0	40000	0
Acetone	1	7	42	220	220	220	500000	0	140000	0
Carbon Disulfide	1	7	6	2	2	2	500000	0	140000	0
Methylene Chloride	1	7	22	7	7	7	82000	0	1000	0
Toluene	1	8	7	7	7 J	7 J	500000	0	67000	0

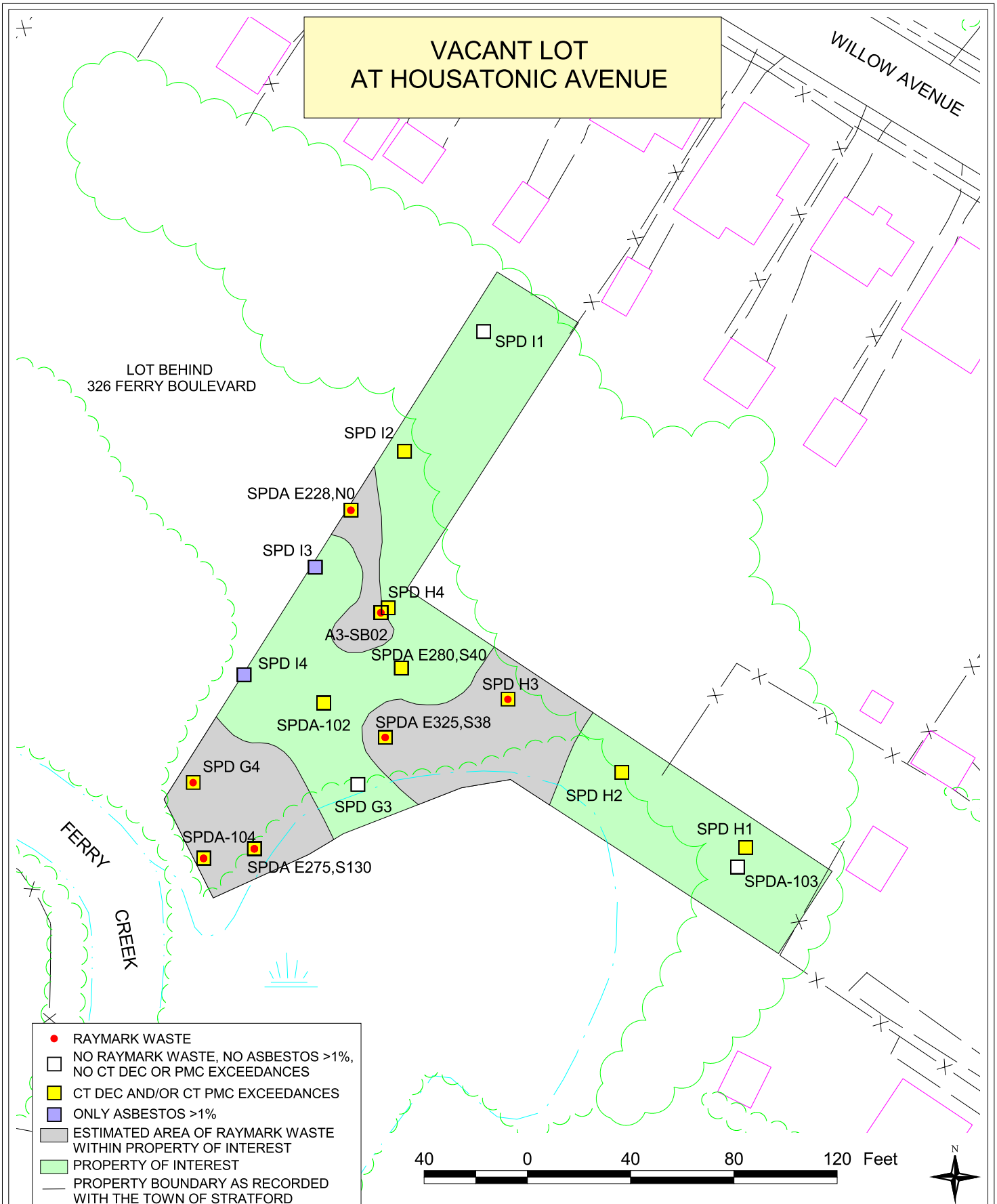
TABLE 3-8 (cont.)
VACANT LOT AT HOUSATONIC AVENUE - SOIL ANALYTICAL RESULTS **
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG)										
4,4'-DDT	2	5	950	2400	110	4600 J	1800	1	21	2
Aroclor, Total (4)	33	44	26000	34000	124	218000	1000	25		
Aroclor, Total (Conservative) (5)	33	44	28000	37000	234	234000	1000	28		
Aroclor-1248	4	10	460	890	310 J	1400	1000	2		
Aroclor-1254	5	43	1200	2200	100 J	8400	1000	3		
Aroclor-1260	10	43	2500	7400	500	33000	1000	7		
Aroclor-1260/62	5	9	2400	4300	500	10000				
Aroclor-1262	19	20	24000	25000	63 J	98000 J	1000	11		
Aroclor-1268	28	43	13000	20000	61 J	120000 J	1000	15		
Endosulfan I	2	10	15	30	30	30	410000	0	8400	0
Endrin	1	7	30	92	92	92	20000	0		
Endrin Ketone	2	10	220	1000	7.5	2000	20000	0		
gamma-Chlordane	1	8	14	38	38	38	490	0	66	0

Qualifier	Definition
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR RESIDENTIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-8
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887
CHECKED BY: D. CHISHOLM / FILE: C:\...\OU6_RI_2003.APR	(978)658-7899

3.9 326 Ferry Boulevard

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.9.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.9.1 Property Description

This property, approximately 0.8 acres of commercially-zoned (retail) land, is located on Ferry Boulevard in Stratford, Connecticut (Town of Stratford, 1997). The parcel is presently occupied by a restaurant, located in the only building on the property. The remainder of the parcel is a paved parking lot. The topography of the parcel is flat throughout, with an approximate 2-foot elevation change running from north to south across the property. Surface water and storm drains drain to Ferry Creek. Access to the property is not restricted.

Abutting the property to the west is Ferry Boulevard. To the east, the parcel abuts a heavily vegetated, vacant parcel referred to in this report as "Lot Behind 326 Ferry Boulevard" (see Section 3.7). A portion of the "Lot Behind 326 Ferry Boulevard" property extends to form the southern boundary of this property. To the north, the parcel is fenced and bordered by a gasoline station and several residential properties, some of which had removal actions conducted by EPA between 1993 and 1995.

3.9.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of this property are located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Seven soil borings (SP-SB1, SPBG1-103 through 105, and SPBG1-201 through 203), were advanced at the property, to depths up to 14 feet below ground surface (bgs). Surficial materials consist of fill, which overlies materials characteristic of glacial outwash and ice-contact deposits (SPBG1-103, SPBG1-104, SPBG1-105, SPBG1-202, and SPBG1-203), or former marsh and swamp deposits (SP-SB1). At SPBG1-201, the former marsh and swamp deposits

have been reworked and mixed with debris and as such are classified as fill. Soils encountered below the fill include peat with some silt or medium to fine sand with varied amounts of silt, coarse sand, and/or gravel. Refer to Figure 3-9 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Soil sample locations are shown on Figure 3-9, including both shallow surface soil samples and deeper samples from soil borings. The borings were used to describe the depth of the fill on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity, as well as reworked native materials. Manmade materials identified in the soil from borings SPBG1-103 through SPBG1-105 and SPBG1-201 through SPBG1-203 included PACM, asphalt, brick, and tile fragments. PACM (potentially asbestos containing material) namely, asbestos fibers, tile and possible asbestos sheet, was observed in the soil from SPBG1-104, SPBG1-105, SPBG1-202, and SPBG1-203. These materials were encountered with natural fill consisting of sand, silty sand, and gravel mixtures. Fill classifications were based on the visual characteristics of the soil and sediment samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across the entire property. The depth to water ranges from 4 to 5.5 feet bgs based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill material on this property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-9. An estimated 9.5 percent of the property contains Raymark waste. Nearly the entire waste area is covered with pavement.

3.9.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations

throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

A total of 41 soil samples were collected from 10 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-9. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-9 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC regulatory standards. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-9 for the soil data summary statistics and comparison criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Forty-one soil samples were collected from the property and screened for asbestos. Asbestos was detected in 34 samples. Asbestos at greater than 1 percent was found in 20 of the 41 samples. Asbestos detections were scattered throughout the property at depths ranging from ground surface to 14 feet bgs.

Dioxins

Three soil samples from this property were collected and analyzed for dioxins. Dioxins were detected at the property. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ)

values. See Section 2.5.2.5 for an explanation of TEQ. The maximum TEQ value detected at this property was 0.031 µg/kg.

Metals

Soil samples were collected from this property and analyzed for metals as follows: eight soil samples were analyzed at a fixed laboratory for metals; 22 samples were screened for copper; and 33 samples were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Arsenic was the only metal that exceeded the CT DEC regulatory standards. The exceedance was located in the northwest corner of the property at a depth of 4 to 6 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only one soil sample was collected for SPLP metals analysis from within the estimated area of Raymark waste. This sample did not exceed the CT PMC standard for lead. There were no TCLP samples collected.

Pesticides

Eight soil samples were collected and analyzed for pesticides. Pesticides were frequently detected on the property. One sample exceeded the CT PMC regulatory standards for 4,4-DDE, and one sample exceeded the CT PMC standards for 4,4-DDT. The CT DEC standards were not exceeded. Pesticide exceedances were detected along the northern border at SPBG1-201 from 0 to 2 feet bgs and 6 to 8 feet bgs.

PCBs

Forty-one soil samples were collected and analyzed for PCBs as Aroclors. Aroclors 1262 and 1268 were detected infrequently on the property. There were no total Aroclors exceedances of CT DEC regulatory standards on the property. There were no SPLP-PCB or TCLP-PCB samples collected.

SVOCs

Eight soil samples were collected and analyzed for SVOCs. SVOCs were detected frequently on the property. There were two exceedances of the CT DEC for benzo(a)pyrene along the northern property boundary. Six SVOCs, primarily PAHs, exceeded the CT PMC in two samples at the northeast corner of the property, from 4 to 8 feet bgs.

VOCs

Eight soil samples were collected and analyzed for VOCs at this property. VOCs were not frequently detected. There were no CT DEC exceedances on the property. Two samples exceeded the CT PMC for benzene in the northwest corner (adjacent to the gasoline station) of the property at a depth of 4 to 6 feet.

Raymark Waste

The results from one sample location indicate the presence of Raymark waste on this property. The table below displays the location and constituents that meet the Raymark waste definition on this property. This sample is located within the 10 percent of the property shown on Figure 3-9 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft/bgs)	Asbestos (%)	Lead (mg/kg)	Copper mg/kg	Aroclor 1268 µg/kg
SPBG1-201	8 to 10	1.8	731	635	2.4

3.9.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants are discussed below.

Approximately 10 percent of this 0.8-acre property is estimated to contain Raymark waste. The waste is located in the northeast portion of the property, and is covered almost entirely with pavement (see Figure 3-9). Over 90 percent of this property is covered by either a building or

pavement. Surface water runoff drains to storm drains and into Ferry Creek. Raymark waste is present beneath a mostly paved area along the northern property boundary.

The paving at this property is in good condition, so surface water infiltration and erosion are likely minimal. SPLP metals data indicate that metals are not likely to leach from contaminated soil into the groundwater. Other data indicate that pesticides, SVOCs, and VOCs may pose a leaching threat to groundwater.

3.9.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for a portion of the parcel located at 326 Ferry Boulevard that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at 326 Ferry Boulevard may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.9.5.1 provides an overview of the 326 Ferry Boulevard property, Section 3.9.5.2 presents COPCs and EPCs, Section 3.9.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.9.5.4 contains the numerical results of the risk assessment, and Section 3.9.5.5 presents property-specific uncertainties. Section 3.9.5.6 presents a property-specific summary of the major risk findings.

3.9.5.1 Overview

326 Ferry Boulevard is a commercial property of approximately 0.8 acres. A detailed description of the property is provided in Section 3.9.1. The nature and extent of the

contamination detected is discussed in Section 3.9.3. The area of 326 Ferry Boulevard estimated to contain Raymark waste represents an estimated 10 percent of the total 0.8-acre property, exclusive of any buildings, and is shown in Figure 3.9. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.9.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 326 Ferry Boulevard are summarized in Appendix B-1, Table 2.9.

3.9.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.9 presents a summary of the COPCs for quantitative risk assessment for 326 Ferry Boulevard soils from the estimated area of Raymark waste to a depth of 12 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.9:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene)
- Aroclors, Total (1260 and 1268)
- Arsenic
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 326 Ferry Boulevard are presented in Appendix B-1, Table 3.9. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.9.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 326 Ferry Boulevard and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 326 Ferry Boulevard is a commercial property, as described in Section 3.9.1.

Potential Receptors

The receptors retained for quantitative evaluation at 326 Ferry Boulevard are current and future commercial workers. Potentially exposed individuals are limited to those who work at 326 Ferry Boulevard.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at 326 Ferry Boulevard. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 12 feet bgs) at a limited area (soils within the estimated area of Raymark waste) only. Appendix

B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 326 Ferry Boulevard are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from 326 Ferry Boulevard is considered to be minimal. The estimated area of Raymark waste at 326 Ferry Boulevard is under pavement. The presence of pavement reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.9.5.4. Asbestos is present in soils within the estimated area of Raymark waste at 326 Ferry Boulevard. The presence of pavement suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 326 Ferry Boulevard is 0.10. Chemical intake estimates are provided in Appendix B-1, Tables 7.9 and 8.9.

3.9.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 326 Ferry Boulevard is provided in this section. Appendix B-1, Table 7.9 and Table 8.9 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic

risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.9. Appendix B-1, Table 10.9 reduces the information developed in Appendix B-1, Table 9.9 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 326 Ferry Boulevard are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	0.02	0.02	0.04

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated area of Raymark waste at 326 Ferry Boulevard is less than unity, indicating that adverse non-carcinogenic health effects are not anticipated under the conditions in the exposure assessment. See Table 7.9 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 326 Ferry Boulevard are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	1.7E-06	1.1E-06	2.8E-06

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated area of Raymark waste falls within the EPA cancer risk range (10^{-4} to 10^{-6}) and does not exceed the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.9 RME in Appendix B-1 for details on the cancer risk

calculations. As detailed on Appendix B-1, Table 9.9, the cancer risk for benzo(a)pyrene is greater than the CT DEP target risk level for single contaminants of 10^{-6} .

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 3.4E-06.

Exposure to Lead

Lead was not identified as a COPC in soils within the estimated area of Raymark waste at 326 Ferry Boulevard.

Exposure to Asbestos

Asbestos was detected in all soil samples collected from the estimated area of Raymark waste at a concentration range of trace to eight percent. These samples were collected from the 0- to 12-foot bgs interval. The average concentration was 3 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is “friable” (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement in the estimated area of Raymark waste reduces the potential for airborne asbestos at 326 Ferry Boulevard. Based on field conditions in the estimated area of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.9.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 326 Ferry Boulevard are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 326 Ferry Boulevard property is 0.8 acres, with an estimated 10 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.9.4. The estimated area of Raymark waste at the property is under pavement. No consideration was given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated area of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 10 percent of the time, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately 10 times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown on Appendix B-1, Table 2.9, alongside site-specific data from the estimated area of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 2.4 to 9.6 mg/kg, with an average concentration of 4.7 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Six CLP samples were included in the dataset for soils within the estimated area of Raymark waste; only one sample included analysis for dioxins. Due to the limited numbers of samples analyzed for dioxins, Aroclors, benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, and arsenic, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 12 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers. Additionally, future commercial workers may be exposed to soils currently located at depths up to 15 feet bgs, which is the depth considered as accessible by CT DEP (CT DEP, 1996). The absence of samples collected in the 12- to 15-foot interval adds uncertainty in the evaluation of risks to future commercial workers.

- A comparison of soil data from the property outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-10. The presence of arsenic at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Arsenic is present in soils located outside the estimated area of Raymark waste at concentrations up to 12.6 mg/kg. Asbestos is present outside the estimated area of Raymark waste at concentrations up to 20 percent. Copper and lead are also present outside of the estimated area of Raymark waste at the property, at maximum concentrations of 201 mg/kg and 840 mg/kg, respectively. Aroclors were present outside the estimated area of Raymark waste at this property at concentrations up to 0.25 mg/kg. The individual Aroclors detected were Aroclor 1262 and Aroclor 1268. Samples collected outside the estimated area of Raymark waste were not analyzed for dioxins. Thus, a commercial worker's exposure

and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.9.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at 326 Ferry Boulevard. Risks to current and future commercial workers were estimated.

- The RME hazard indices (HI) for current and future commercial workers exposed to soil within the estimated area of Raymark waste do not exceed unity. Adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment.

- The RME cancer risk estimates for current and future commercial workers exposed to soil within the estimated area of Raymark waste at do not exceed the EPA cancer risk range (10^{-4} to 10^{-6}) or the CT DEP target total risk level of 10^{-5}. The risk estimate for benzo(a)pyrene exceeds the CT DEP target risk level for single contaminants of 10^{-6}.

- Asbestos was detected in all six soil samples collected from the estimated area of Raymark waste in the 0- to 12- foot bgs interval at a concentration range of trace to 8 percent. The average concentration was 3 percent.

3.9.6 Ecological Evaluation

No formal individual evaluation of the environmental impacts to this property was performed; however, the property is located in the general A-3 study area presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark-Ferry Creek – OU3,* (B&RE, 1998). Since this property is either mostly paved or covered by a building minimal ecological impacts are assumed.

3.9.7 Summary

This 0.8-acre property abutting Ferry Creek contains Raymark soil waste at one location along the northern property boundary. This location abuts a known EPA removal action property. Soils containing metals, pesticides, SVOCs, and VOCs that exceed CT DEC and/or CT PMC criteria and asbestos greater than 1 percent are present on the property. Surface water infiltration and erosion are likely minimal at this property. Leaching of contaminants from soils is likely based on analytical results.

The RME hazard indices for commercial workers exposed to soils within the estimated area of Raymark waste indicate that adverse non-carcinogenic effects are not anticipated. The RME cancer risk estimates do not exceed the EPA cancer risk range or the CT DEP target total risk level. Benzo(a)pyrene exceeds the CT DEP target risk level for single contaminants. The average asbestos concentration in the estimated area of Raymark waste was 3 percent.

Minimal ecological impacts are anticipated based on the lack of ecological habitats present on the property.

TABLE 3-9
326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	34	41	3	3	Trace	20	1	20		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	1	3	0.74	2	2.04	2.04				
1,2,3,4,6,7,8-HpCDF	1	3	0.11	0.26	0.265	0.265				
1,2,3,4,7,8,9-HpCDF	1	3	0.049	0.0074	0.0074	0.0074				
1,2,3,4,7,8-HxCDF	1	3	0.045	0.0061	0.0061	0.0061				
1,2,3,6,7,8-HxCDD	1	3	0.11	0.03	0.0303	0.0303				
1,2,3,6,7,8-HxCDF	1	3	0.047	0.0014	0.0014	0.0014				
1,2,3,7,8,9-HxCDD	1	3	0.09	0.01	0.0104	0.0104				
1,2,3,7,8,9-HxCDF	1	3	0.084	0.0023	0.0023	0.0023				
2,3,4,6,7,8-HxCDF	1	3	0.098	0.0033	0.0033	0.0033				
2,3,7,8-TCDD	1	3	0.05	0.0015	0.0015	0.0015				
2,3,7,8-TCDF	1	3	0.0075	0.0025	0.0025	0.0025				
OCDD	1	3	5.9	17.3	17.28	17.28				
OCDF	1	3	0.4	0.94	0.94	0.94				
Total HpCDD	1	3	1.8	5.1	5.07	5.07				
Total HpCDF	1	3	0.43	1.2	1.23	1.23				
Total HxCDD	1	3	0.33	0.77	0.766	0.766				
Total HxCDF	1	3	0.16	0.35	0.35	0.35				
Total PeCDD	1	3	0.19	0.048	0.0477	0.0477				
Total PeCDF	1	3	0.044	0.061	0.0606	0.0606				
Toxicity Equivalency	1	3	0.16	0.031	0.031	0.031				
Metals (MG/KG)										
Aluminum	8	8	9000	9000	7180	11500				
Arsenic	8	8	6.7	6.7	2.4	12.6 J	10	2		
Barium	8	8	197	197	47.6 J	634	140000	0		
Calcium	8	8	34200	34200	2630 J	134000 J				
Chromium	8	8	22	22	16.3 J	28.3	100	0		

TABLE 3-9 (cont.)
326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG) (cont.)										
Cobalt	6	8	4	4.2	2.8	6.8	2500	0		
Copper	12	30	109	150	14	635	76000	0		
Iron	8	8	13300	13300	9630	19400				
Lead	34	41	141	167	11	840	1000	0		
Magnesium	8	8	7300	7300	3590	15900				
Manganese	8	8	196	196	138	292	47000	0		
Mercury	5	8	0.13	0.18	0.074 J	0.38	610	0		
Nickel	8	8	30.5	30.5	12.5 J	64.5	7500	0		
Potassium	8	8	1110	1110	530	1820				
Sodium	6	8	435	492	117 J	1020				
Vanadium	8	8	24	24	15.6 J	32.8	14000	0		
Zinc	8	8	72.4	72.4	43.2 J	112	610000	0		
Metals (SPLP) (UG/L)										
Antimony	1	1	5.4	5.4	5.4	5.4			60	0
Arsenic	1	1	8.3	8.3	8.3	8.3			500	0
Barium	1	1	220	220	220	220			10000	0
Chromium	1	1	1.3	1.3	1.3	1.3			500	0
Copper	1	1	27	27	27	27			13000	0
Lead	1	1	7.7	7.7	7.7	7.7			150	0
Nickel	1	1	3.8	3.8	3.8	3.8			1000	0
Selenium	1	1	9.5	9.5	9.5	9.5			500	0
Vanadium	1	1	45	45	45	45			500	0
Semivolatile Organic Compounds (UG/KG)										
2-Methylnaphthalene	2	8	920	1300	1300 J	1300 J	2500000	0	9800	0
4-Methylphenol	2	8	690	320	180 J	470	2500000	0	7000	0
Acenaphthene	5	8	590	760	43 J	1400 J	2500000	0	84000	0
Acenaphthylene	5	8	470	130	77 J	260 J	2500000	0	84000	0
Anthracene	5	8	400	420	75 J	1200 J	2500000	0	400000	0

TABLE 3-9 (cont.)
326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Benzaldehyde	2	6	770	200	93 JEB	310 JEB				
Benzo(a)anthracene	8	8	800	800	290 J	2600 J	7800	0	1000	2
Benzo(a)pyrene	8	8	880	880	360 J	2600 J	1000	2	1000	2
Benzo(b)fluoranthene	8	8	850	850	420 J	1900 J	7800	0	1000	2
Benzo(g,h,i)perylene	8	8	340	340	83 J	810 J	2500000	0	42000	0
Benzo(k)fluoranthene	8	8	770	770	140 J	2600 J	78000	0	1000	2
bis(2-Ethylhexyl)phthalate	2	8	2500	1900	1900 J	1900 J	410000	0	11000	0
Caprolactam	1	6	760	49	49 J	49 J				
Carbazole	6	8	280	250	55 J	670 J	290000	0	360	1
Chrysene	8	8	950	950	380 J	2900 J	780000	0	1000	2
Dibenzo(a,h)anthracene	3	8	540	180	80 J	290 J	780	0	1000	0
Dibenzofuran	2	8	690	400	400 J	400 J	2500000	0	5600	0
Di-n-Butylphthalate	1	8	740	790	790 EB	790 EB	2500000	0	140000	0
Fluoranthene	8	8	1700	1700	630	5400	2500000	0	56000	0
Fluorene	6	8	450	480	66 J	790 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	8	8	370	370	88 J	890 J	7800	0	1000	0
Naphthalene	5	8	1200	1700	57 J	3800 J	2500000	0	56000	0
Phenanthrene	8	8	1300	1300	330 J	4800 J	2500000	0	40000	0
Phenol	2	8	1400	3200	1900	4500 *	2500000	0	800000	0
Pyrene	8	8	1500	1500	580 , J	4600 J	2500000	0	40000	0
Total PAH	1	1	12000	12000	11850	11850				
Volatile Organic Compounds (UG/KG)										
1,2,4-Trichlorobenzene	2	6	58	160	26 J	290	2500000	0	14000	0
1,2-Dichlorobenzene	4	6	61	88	2 J	320	1000000	0	3100	0
1,3-Dichlorobenzene	2	6	16	30	6 J	54				
1,4-Dichlorobenzene	2	6	96	270	49 J	490	240000	0	15000	0
2-Butanone	4	8	99	180	25	380 J	1000000	0	80000	0

TABLE 3-9 (cont.)
326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG) (cont.)										
Acetone	5	8	550	630	74	1100 *	1000000	0	140000	0
Benzene	6	8	310	400	2 J	1200	200000	0	200	2
Bromomethane	1	8	15	48	48 J	48 J				
Carbon Disulfide	4	8	18	29	16 J	44 J	1000000	0	140000	0
Chlorobenzene	2	8	31	99	28 J	170	1000000	0	20000	0
Chloromethane	3	8	10	13	2 J	24 J	440000	0	540	0
cis-1,2-Dichloroethene	1	6	10	2	2 J	2 J				
Cyclohexane	2	6	10	6	5 J	8 J				
Ethylbenzene	5	8	38	54	13 J	110	1000000	0	10100	0
Isopropylbenzene	2	6	10	8	2 J	14 J				
Methyl Acetate	2	6	370	1100	350	1800				
Methyl tert-Butyl Ether	1	6	10	4	4 J	4 J				
Methylcyclohexane	3	6	8	9	3 J	18 J				
Toluene	8	8	78	78	3 J	200	1000000	0	67000	0
Total Xylenes	6	8	160	220	5 J	560	1000000	0	19500	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	2	8	5.6	14	9.9	19 #	24000	0	29	0
4,4'-DDE	4	8	7.8	13	5.4	23 #	17000	0	21	1
4,4'-DDT	2	8	7.2	20	9.4	30 #	17000	0	21	1
alpha-Chlordane	1	8	2.9	13	13	13	2200	0	66	0
Aroclor, Total (4)	14	41	390	860	58	3600	10000	0		
Aroclor, Total (Conservative) (5)	16	41	470	970	210	3971	10000	0		
Aroclor-1260	4	28	150	600	94	1300	10000	0		
Aroclor-1262	7	36	140	250	26 J	550	10000	0		
Aroclor-1268	14	41	300	580	32 J	2400	10000	0		
beta-BHC	1	8	1.6	3.2	3.2 J	3.2 J	3200	0	3.9	0

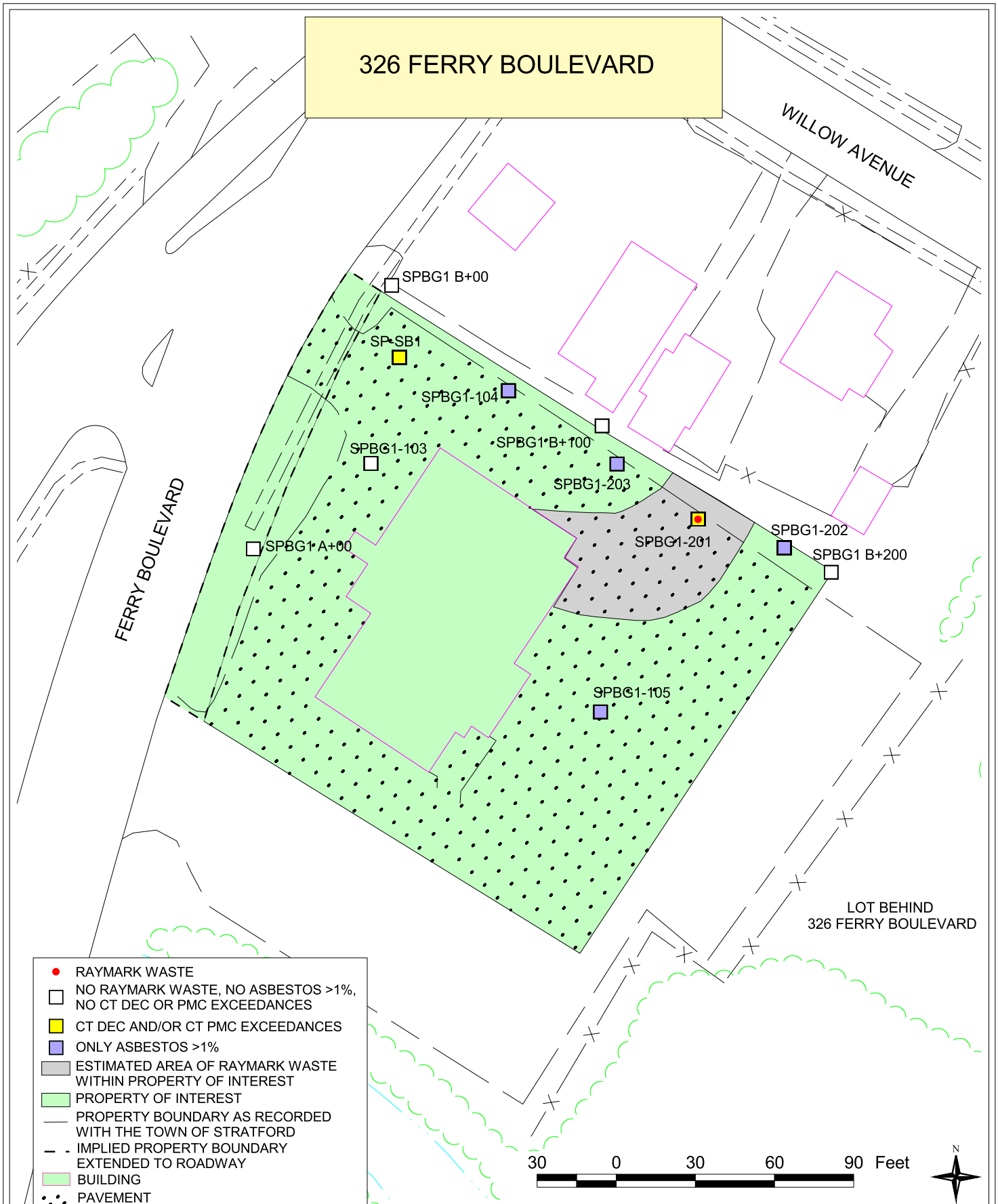
TABLE 3-9 (cont.)
326 FERRY BOULEVARD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
Endosulfan Sulfate	3	8	5.3	9.9	4.5 #	18 #	1200000	0	8400	0
Endrin Aldehyde	4	8	8.9	16	7.4 #	29 #	610000	0		
gamma-Chlordane	1	8	2.3	7.8	7.8	7.8	2200	0	66	0

Qualifier	Definition
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
#	Possible false positive due to interference
EB	Equipment blank contamination
J	Quantitation approximate
U	Not detected
UJ	Detection limit approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-9
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	(978)658-7899

3.10 576 East Broadway

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.10.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.10.1 Property Description

This property, approximately 1.3 acres of commercially-zoned (light industrial) land, is located on East Broadway in Stratford, Connecticut (Town of Stratford, 1997). This parcel is presently occupied by a wood shop and warehouse. The buildings and an asphalt parking lot comprise approximately 0.4 acres of the property. Some large cracks were observed in the pavement. The pavement area is surrounded by a chain-link fence along the northern, western, and southern edges, which restricts public access. Access is not restricted along East Broadway. The remaining wooded area of the property is isolated from the buildings and pavement area by this fence.

The two buildings on the property are connected by a narrow, covered corridor. One building is a wood frame building covered with shingles, while the other building is constructed of concrete blocks. The structures occupy approximately 3,000 square feet. The property had been a machine job shop since approximately 1957, and appears to have been undeveloped prior to that time. Wastes generated during the machine shop operations included metal grinding dusts, waste lube oil, kerosene, and trichloroethene (degreasing). According to CT DEP inspection reports, wastes were hauled off-site for disposal.

Ferry Creek forms the northeastern property line adjacent to the 335 Ferry Boulevard property. East Broadway is located to the east and the undeveloped 600 East Broadway property is located to the west (see Section 3.11). A tributary of Longbrook Stream bisects the northern portion of the property and enters Ferry Creek (see Figure 3-10).

No storm water drains are located in the parking lot. The property is relatively flat with a slight downward slope to the northwest. It appears that runoff from the pavement flows to the northwest, away from East Broadway. A manhole cover was observed in the pavement at the north end of the building. The manhole may lead to a septic tank pumping access point, but the

manhole cover was not opened for verification. Historically, drums have been (reportedly) stored on the property.

3.10.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, this property is located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Seven soil borings (A1-SB03, A1-SB10, MF-SB5, MF-SB6, PP-101, PP-102, and PP-105) were advanced on the property. Total depths range from 1 to 22 feet below ground surface (bgs). Boring logs for A1-SB10 and MF-SB5 indicate soils which consist of fill overlying a sand unit at approximately 14 feet bgs, and 21.5 feet bgs, respectively. These materials are characteristic of locally derived outwash deposits and/or ice contact deposits. Oil stains were noted in soils at boring A1-SB10 at approximately 6 to 8 feet bgs. Soil boring A1-SB03 consists of fill, sand, and silt and includes a very thin interval of peat at approximately 14 feet bgs. Soil encountered in boring MF-SB6 consists of fill, which overlies clayey silt with peat and silty clay. Surficial materials in soil borings PP-101 and PP-102 consist of fill overlying organic silt. The organic materials are characteristic of a former marsh and swamp deposit. After multiple attempts, soil boring PP-105 was terminated at 1 foot bgs due to refusal. Soil observed at this shallow depth consisted of sand with silt and trace amounts of gravel. Refer to Figure 3-10 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Sample locations are shown on Figure 3-10, including both shallow surface soil samples and deeper samples from borings. The borings were used to describe the fill and native material on the property. All sample locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials placed on the property as a result of human activity. Manmade materials, including potentially asbestos containing material (PACM) (including fibrous asbestos mats and pads), asphalt, brake pads, brick, cinders, coal, concrete, gasket material, glass, metal debris, plastic, steel, and tiles were identified in the soil

from one or more of the borings. PACM was identified in the soil from borings A1-SB03, A1-SB10, MF-SB6, and PP-101. The manmade materials were encountered with natural fill materials consisting of sand with varying amounts of silt and/or gravel. Manmade debris was not identified in borings PP-102 or PP-105. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings in the central and southeastern portions of the property. The presence of fill was not determined at depth in the area northeast of boring location A1-SB10. The depth to water on the property ranges from 6 to 9 feet bgs, with an average of 6.8 feet bgs, based on soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-10. Approximately 42 percent of this property is estimated to contain Raymark waste; one third is covered with pavement, while the rest is vegetated.

3.10.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 87 soil samples collected from 40 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-10. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs and VOCs. See Table 3-10 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-10 for the soil data summary statistics and comparison criteria. The discussion below includes all samples collected on this property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Eighty-one soil samples were collected from the property and analyzed for asbestos. Asbestos was detected frequently on the property. Asbestos at greater than 1 percent was found in 51 of the 81 samples and these samples were distributed throughout the property. Asbestos was detected in samples at depths of up to 16 feet bgs.

Dioxins

Twelve soil samples were collected from the property and analyzed for dioxins. Dioxins were detected in the majority of the samples. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. The highest TEQ value was 16.794 µg/kg.

Metals

Soil samples were collected from the property and analyzed for metals as follows: 16 samples were analyzed for metals in a fixed laboratory; 22 samples were screened for copper, and 65 samples were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Metals exceedances of the CT DEC for

arsenic, chromium, and lead were located in the central and southwestern portions of the property. Metals exceedances were detected at depths of up to 12 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, both of the two SPLP samples collected were from the estimated area of Raymark waste. Both samples exceeded the CT PMC for lead. Barium, copper, and nickel also exceeded the CT PMC. The highest exceedance for all of these metals was at a depth of 6 to 8 feet bgs in sample A1-SB03, located in the central area of the property, within the estimated area of Raymark waste. No TCLP samples were collected on this property.

Pesticides

Sixteen soil samples were collected from the property and analyzed for pesticides. Pesticides were detected sporadically on the property. There were seven pesticides that exceeded the CT PMC regulatory standards. One pesticide, dieldrin, also exceeded the CT DEC. Pesticide exceedances were located in the central and southwestern portions of the property from the surface to 10 feet bgs.

PCBs

Sixty-seven soil samples were collected from the property and analyzed for PCBs as Aroclors. PCBs, especially Aroclors 1262 and 1268, were detected in more than half the samples from this property. Eight samples had CT DEC exceedances for total Aroclors. These samples were located in the central and southern areas of the property at depths of up to 8 feet bgs. In seven of the sample locations where total Aroclors exceeded the CT DEC regulatory standard, Aroclors 1262 and/or 1268 were the primary contributors to the total Aroclor concentration. No SPLP or TCLP PCB samples were collected on this property.

SVOCs

Thirteen soil samples were collected from the property and analyzed for SVOCs. SVOCs, primarily PAHs, were detected frequently on the property. Eight SVOCs exceeded the CT PMC

regulatory standard, with benzo(a)pyrene also exceeding the CT DEC standard. SVOC exceedances were located in the central and southern portions of the property from the ground surface to 10 feet bgs.

VOCs

Eight samples were collected from the property and analyzed for VOCs. VOCs were not frequently detected on the property. There were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from 17 sample locations indicate that Raymark waste is present on the property. The following table displays the locations and contaminants of concentrations for the 30 samples that meet the definition of Raymark waste on this property. These samples are located within the 42 percent of the property shown on Figure 3-10 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
A1-SB03	0 to 2	20	1,700	2,700	NA
	2 to 4	10	1,500	3,300	NA
	4 to 6	5	1,700	2,400	NA
	6 to 8	40	19,300	29,800	26,000
	8 to 10	20	6,600	10,000	NA
	10 to 12	20	1,500	1,800	NA
A1-SB10	0 to 2	40	6,100	13,400	2,400
	4 to 6	20	520	770	NA
	6 to 8	15	510	1,300	NA
	8 to 10	5	490	840	NA
MF-SB6	0 to 2	15	840	1,800	810
	2 to 4	50	9,600	6,390	49,000
PP-EF+100	0 to 0.5	5	3,570	6,100	510
PP-101	0 to 2	2	1,250	2,060	10,000
	2 to 4	60	13,100	59,400	61,000
	4 to 6	10	1,750	37,100	5,300
	6 to 8	20	10,700	16,600	7,800
	8 to 10	3	5,650	6,480	2,900
MF E + 080	0 to 0.5	40	2,167	NA	6,000
MF E + 100	0 to 0.5	50	2,964	NA	7,000
PPCD + 00	0 to 0.5	20	885	NA	2,000

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
PPDDE + 00	0 to 0.5	5	486	NA	2,000
PPDDE + 100	0 to 0.5	40	804	NA	4,000
PPDE + 00	0 to 0.5	30	927	NA	7,000
PPDE + 050	0 to 0.5	10	499	NA	2,000
PPDE + 100	0 to 0.5	20	1,321	NA	4,000
MFP-1	0 to 0.5	75	14,100	16,800	2,200
MFP-2	0 to 0.5	75	8,730	15,100	2,900
MFP-4	0 to 0.5	50	10,000	NA	26,000
MFP-5	0 to 0.5	90	24,700	42,000	270,000

NA – Contaminant not analyzed

3.10.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants throughout this property are discussed below.

Approximately 42 percent of this 1.3-acre property is estimated to contain Raymark waste, which is located throughout the property (see Figure 3-10). Approximately one-third of the waste is located under a paved area, which is significantly cracked and provides little impediment to infiltration and leaching. The remaining waste areas are located in the wooded portion of the property, which also provides little impediment to infiltration and leaching, but does minimize erosion of surface soils. No storm drains were observed on the property; surface water runoff flows toward Ferry Creek.

SPLP data indicate that metals may be leaching into groundwater from contaminated soils. Other data indicate that some leaching of pesticides and SVOCs into groundwater from contaminated soils may also be occurring.

3.10.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at 576 East Broadway that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil

exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste themselves. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at 576 East Broadway may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.10.5.1 provides an overview of the 576 East Broadway property, Section 3.10.5.2 presents COPCs and EPCs, Section 3.10.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.10.5.4 contains the numerical results of the risk assessment, and Section 3.10.5.5 presents property-specific uncertainties. Section 3.10.5.6 presents a property-specific summary of the major risk findings.

3.10.5.1 Overview

576 East Broadway is a commercial property of approximately 1.3 acres. A detailed description of the property is provided in Section 3.10.1. The nature and extent of the contamination detected at 576 East Broadway is discussed in Section 3.10.3. The areas of the property estimated to contain Raymark waste represent an estimated 42 percent of the total 1.3-acre property, exclusive of any buildings, and are shown in Figure 3-10. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.10.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated areas of Raymark waste at 576 East Broadway are summarized in Appendix B-1, Table 2.10.

3.10.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.10 presents a summary of the COPCs for quantitative risk assessment for 576 East Broadway soils

from the estimated areas of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.10:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene)
- Dieldrin
- Aroclors, Total (1254, 1262, and 1268)
- Metals (arsenic, barium, chromium, lead, and thallium)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 576 East Broadway are presented in Appendix B-1, Table 3.10. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.10.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 576 East Broadway and identifies the rationale for the selection of exposure input parameters used

to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 576 East Broadway is a commercial property, as described in Section 3.10.1.

Potential Receptors

The receptors retained for quantitative evaluation at 576 East Broadway are current and future commercial workers. Potentially exposed individuals are limited to those who work at 576 East Broadway.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated areas of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 576 East Broadway are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. Portions of the estimated areas of Raymark waste at 576 East Broadway are located beneath pavement. The presence of pavement reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at commercial properties. Appendix B-1, Table 2.10 presents available inhalation SSLs for contaminants in soils within the estimated areas of the Raymark waste at the 576 East Broadway property. With the exception of those reported for total chromium and dieldrin, all reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a). For both total chromium and dieldrin, one sample out of 14 had reported concentrations greater than the SSL_{AIR}. The average total chromium concentration detected in the Raymark waste soil samples (157 mg/kg) is less than the SSL_{AIR} for hexavalent chromium (280 mg/kg). The average dieldrin concentration detected in the Raymark waste soil samples (230 mg/kg) is less than the SSL (1,000 mg/kg).

Further evaluation of site-specific total chromium concentrations relative to inhalation SSLs for commercial/industrial land-use (EPA, 2001a) reveals that the maximum detected concentration in the Raymark waste soil samples (906 mg/kg) is greater than the commercial/industrial SSL_{AIR} for hexavalent chromium (510 mg/kg). Assuming that the maximum total chromium concentration represents only hexavalent chromium and comparing the maximum concentration to the SSL_{AIR} for chromium, this concentration corresponds to a cancer risk level of approximately 2E-06 for commercial/industrial receptors. This risk level is within EPA's cancer risk range of 10^{-4} to 10^{-6}. The SSL_{AIR} for chromium assumes that chromium is present in the hexavalent state. The assumption that all chromium is in the hexavalent state is likely to be a conservative assumption.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.10.5.4. Asbestos is present in soils within the estimated areas of Raymark waste at 576 East Broadway. The presence of pavement and the qualitative comparison to SSLs suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 576 East Broadway is 0.42. Chemical intake estimates are provided in Appendix B-1, Tables 7.10 and 8.10.

3.10.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 576 East Broadway is provided in this section. Appendix B-1, Table 7.10 and Table 8.10 present reasonable maximum non-cancer and cancer risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.10. Appendix B-1, Table 10.10 reduces the information developed in Appendix B-1, Table 9.10 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 576 East Broadway are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	8.7	7.8	16.4

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated areas of Raymark waste at 576 East Broadway is in excess of unity. Total Aroclor was the main contributor to the hazard index for the commercial worker. The chemical-specific (and target-organ specific) hazard quotients for total Aroclor alone are in excess of unity for commercial

receptors. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Table 7.10 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 576 East Broadway are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	3.2E-04	1.9E-04	5.0E-04

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated areas of Raymark waste exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.10 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.10, dioxins, Aroclors, arsenic, dieldrin, and benzo(a)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}. In addition to the above risks, cancer risks from inhalation of chromium in dust may be as great as 2E-06 (see discussion in Section 3.10.5.3).

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 2.0E-03.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste at the 576 East Broadway property. Lead was detected in samples collected from 0 to 15 feet bgs within

the estimated areas of Raymark waste at a maximum concentration of 24,700 mg/kg. The average lead concentration in this dataset was 3,790 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 3,790 mg/kg for soil within the estimated areas of Raymark waste at 576 East Broadway was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for 576 East Broadway is 0.42. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated areas of Raymark waste, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 7 to 10 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 40 of the 41 soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 90 percent. These samples were collected from the 0- to 15- foot bgs interval. The average concentration was 23 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos. Based on field conditions in the estimated areas of Raymark waste at 576 East Broadway, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.10.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 576 East Broadway are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 576 East Broadway property is 1.3 acres, with an estimated 42 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.10.4. A portion of the estimated areas of Raymark waste is located within the paved area, which is significantly cracked. The remainder is located within wooded portions of the property. No consideration was given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated areas of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 42 percent of the time, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately two times greater than those estimated using the FRW factor.

- Copper concentrations exceed the EPA Region IX industrial soil PRG of 41,000 mg/kg in 576 East Broadway soils; however due to the lack of an approved toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in 576 East Broadway soils (0 to 15 feet bgs) at

concentrations ranging from 14 mg/kg to 59,400 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown on Appendix B-1, Table 2.10 alongside site-specific data from the estimated area of Raymark waste. Thallium, with an average background concentration of 6.7 mg/kg, was detected at concentrations ranging from 3.6 to 13.2 mg/kg, with an average concentration of 1.7 mg/kg. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 0.9 to 21.9 mg/kg, with an average concentration of 8.1 mg/kg. Risks due to thallium and arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$

- Forty-one samples were included in the dataset for soils within estimated areas of Raymark waste; however, 27 of the samples were only analyzed by field-screening methods. Due to limited numbers of samples analyzed for total Aroclor, dioxins, barium, and PAHs, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 15 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent

chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of lead at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Lead is present in soils located outside the estimated areas of Raymark waste at 576 East Broadway at concentrations up to 4,222 mg/kg. Four samples from outside the estimated areas of Raymark waste were analyzed for PCBs using CLP methods. While none of these samples had concentrations greater than the CT RSRs for industrial soil, one sample did have total Aroclor concentrations greater than the EPA Region IX PRG for industrial soil. The only individual Aroclor detected was Aroclor 1268. Copper was detected at concentrations up to 516 mg/kg. Asbestos is also present outside the estimated areas of Raymark waste at concentrations up to 80 percent. No analysis of dioxins or SVOCs was performed in samples from outside the estimated areas of Raymark waste. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that for the estimated areas of Raymark waste alone.

3.10.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at 576 East Broadway. Risks to commercial workers were estimated.

- The RME hazard indices (HI) for current and future commercial workers exposed to soil within the estimated areas of Raymark waste are in excess of unity. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposures to Aroclors.

- The RME cancer risk estimates for commercial workers exposed to soil within the estimated areas of Raymark waste at 576 East Broadway exceed the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5}. Dioxins, Aroclors,

arsenic, dieldrin, and benzo(a)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are anticipated for fetuses of pregnant workers exposed to lead in soil within the estimated areas of Raymark waste at 576 East Broadway.

- Asbestos was detected in 40 of the 41 soil samples collected from the estimated areas of Raymark waste in the 0- to 15- foot bgs interval at a concentration range of trace to 90 percent. The average concentration was 23 percent.

3.10.6 Ecological Evaluation

The ecological characterization of the wetlands adjacent to this property was addressed under the OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetland Evaluation*, *Raymark-Ferry Creek-OU3* (B&R, 1998). A summary of the findings is presented below. It should be noted, however, that no individual evaluation of the ecological impacts to this property were evaluated.

No ecologically significant habitats were identified on the developed area of the property. There are not wetlands on the property, but the parcel abuts Ferry Creek. The wooded area consists of early successional vegetation species that have colonized a disturbed fill area. Dominant tree species include quaking aspen, black locust, gray birch, Norway maple, and red oak (*Quercus rubra*). A number of upland species provide shade for the Ferry Creek channel.

3.10.7 Summary

This 1.3-acre property abutting Ferry Creek contains Raymark waste. Soils containing asbestos, metals, SPLP metals, pesticides, PCBs, and SVOCs that exceed CT DEC and/or CT PMC criteria and asbestos greater than 1 percent are present on the property. Given the current property conditions, some infiltration and leaching are likely occurring throughout the property.

The RME hazard indices for commercial workers exposed to soil within the estimated areas of Raymark waste are in excess of unity indicating that adverse non-carcinogenic health effects are possible. The RME cancer risk estimates exceed the EPA cancer risk range and the CT DEP target total risk level. The predominant risk drivers are dioxins, Aroclors, arsenic, dieldrin, and benzo(a)pyrene. Adverse effects are anticipated for fetuses of pregnant workers exposed to lead in soils within the estimated areas of Raymark waste. The average asbestos concentration in the estimated areas of Raymark waste was 22 percent.

It is possible that ecological receptors on the property have been impacted by contaminants in areas estimated to contain Raymark waste, however, no ecologically significant habitats were identified.

TABLE 3-10
576 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	70	81	16	19	Trace	90	1	51		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	11	12	1.5	1.6	0.0303	5.4 J				
1,2,3,4,6,7,8-HpCDF	11	12	6.5	7.1	0.0858	46.1 J				
1,2,3,4,7,8,9-HpCDF	8	12	0.085	0.12	0.0016 J	0.5 J				
1,2,3,4,7,8-HxCDD	7	12	0.05	0.031	0.001 J	0.1 J				
1,2,3,4,7,8-HxCDF	9	12	3.1	4.1	0.0234	21 J				
1,2,3,6,7,8-HxCDD	9	12	0.24	0.27	0.0021 J	1.7 J				
1,2,3,6,7,8-HxCDF	10	12	0.98	1.2	0.0044 J	5 J				
1,2,3,7,8,9-HxCDD	8	12	0.11	0.11	0.0044 J	0.425				
1,2,3,7,8,9-HxCDF	7	12	0.049	0.045	0.00056 J	0.2628 *				
1,2,3,7,8-PeCDD	9	12	0.39	0.46	0.00058 J	2.4				
1,2,3,7,8-PeCDF	10	12	1.4	1.7	0.0024 J	8.3 J				
2,3,4,6,7,8-HxCDF	9	12	1.7	2.2	0.0124	10.6 J				
2,3,4,7,8-PeCDF	10	12	2.8	3.3	0.0089	20.3 J				
2,3,7,8-TCDD	6	12	0.02	0.011	0.00013 EMPC	0.0331				
2,3,7,8-TCDF	10	12	1.7	2	0.0073	11.2 J				
OCDD	11	12	4.3	4.7	0.203 J	12.4 J				
OCDF	9	12	1	1.3	0.0156 J	4.5 J				
Total HpCDD	11	12	2.5	2.7	0.0723 J	9.37 J				
Total HpCDF	11	12	7.4	8.1	0.106 J	52.59 J				
Total HxCDD	10	12	0.74	0.86	0.0105 J	3.61 J				
Total HxCDF	11	12	13.1	14.3	0.101 J	96.82 J				
Total PeCDD	10	12	3.3	3.9	0.0027 J	35.77 *				
Total PeCDF	11	12	12.5	13.6	0.0459 JEB	101.52 J				
Total TCDD	7	12	1.5	0.017	0.0024 JEB	0.0539 JEB				
Total TCDF	11	12	4.8	5.3	0.0277 JEB	41 J				
Toxicity Equivalency	11	12	2.5	2.7	0.012 J	16.794 J				

TABLE 3-10 (cont.)
576 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	16	16	8080	8080	2950	18900 J				
Antimony	5	9	4	5.7	1.3 J	17.8 J	8200	0		
Arsenic	15	16	7.7	8.2	0.9	21.9	10	4		
Barium	16	16	4110	4110	16.3 J	17000	140000	0		
Beryllium	11	16	0.37	0.49	0.23	1.1 J	2	0		
Cadmium	12	16	2.7	3.5	0.19	27.7	1000	0		
Calcium	16	16	2440	2440	570 J	10700				
Chromium	16	16	141	141	5.1 J	906	100	7		
Cobalt	16	16	18.4	18.4	1.8	74.6	2500	0		
Copper	31	38	6110	7470	13.8	59400 J	76000	0		
Iron	16	16	30200	30200	6600	199000				
Lead	64	81	2120	2680	3.3	24700	1000	24		
Magnesium	16	16	22900	22900	1300	81600				
Manganese	16	16	341	341	48.8	1020 J	47000	0		
Mercury	9	16	0.17	0.27	0.07 J	0.93	610	0		
Nickel	16	16	179	179	4.4	530	7500	0		
Potassium	13	16	1090	1290	565	2650				
Selenium	5	16	1.7	3.8	1.1 J	10.8	10000	0		
Silver	10	16	4.7	7.2	0.23 J	41.8	10000	0		
Sodium	10	15	3100	4610	104	42500				
Thallium	2	16	1.5	8.4	3.6 J	13.2 J	160	0		
Vanadium	16	16	34.1	34.1	10.2	131	14000	0		
Zinc	16	16	1300	1300	14.2	4450 J	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	2	2	20100	20100	14300 J	26000 J				
Antimony	1	2	6.8	11.1	11.1	11.1			60	0
Arsenic	2	2	116	116	91.6	140			500	0
Barium	2	2	13700	13700	7430 J	20000 J			10000	1

TABLE 3-10 (cont.)
576 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Beryllium	1	2	1.4	2.4	2.4	2.4			40	0
Cadmium	2	2	22.2	22.2	16.5	27.9			50	0
Calcium	2	2	33200	33200	15500 J	50800 J				
Chromium	2	2	327	327	156 J	498 J			500	0
Cobalt	2	2	110	110	42.6	177 J				
Copper	2	2	459000	459000	174000 *J	744000 *J			13000	2
Iron	2	2	118000	118000	28300 J	207000 J				
Lead	2	2	324000	324000	95500 *J	553000 *J			150	2
Magnesium	2	2	47400	47400	22000	72800				
Manganese	2	2	1680	1680	1050 J	2320 J				
Mercury	1	2	0.18	0.25	0.25 J	0.25 J			20	0
Nickel	2	2	2210	2210	856 J	3560			1000	1
Potassium	1	2	3400	5230	5230 J	5230 J				
Sodium	2	2	2310	2310	494	4120 J				
Thallium	2	2	25.4	25.4	12.5	38.3			50	0
Vanadium	2	2	186	186	128	245			500	0
Zinc	2	2	24100	24100	20100	28100			50000	0
Semivolatile Organic Compounds (UG/KG)										
2,4-Dimethylphenol	7	13	890	790	26 J	3800 J	2500000	0	28000	0
2-Methylnaphthalene	2	13	1200	58	30 J	87 J	2500000	0	9800	0
2-Methylphenol	4	13	1200	260	210 J	390 J	2500000	0	70000	0
3,3'-Dichlorobenzidine	1	13	1000	540	540 J	540 J	13000	0	330	1
4-Methylphenol	8	13	990	310	40 J	620 J	2500000	0	7000	0
4-Nitrophenol	1	13	3100	80	80 J	80 J	2500000	0	11000	0
Acenaphthene	4	13	510	380	26 J	890 J	2500000	0	84000	0
Acenaphthylene	5	13	1200	130	23 J	280 J	2500000	0	84000	0
Anthracene	7	13	570	430	33 J	1200 J	2500000	0	400000	0
Benzaldehyde	3	4	97	70	26 JEB	130 JEB				

TABLE 3-10 (cont.)
576 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Benzo(a)anthracene	11	13	740	830	40 J	3200 J	7800	0	1000	3
Benzo(a)pyrene	12	13	690	740	41 J	2000 J	1000	3	1000	3
Benzo(b)fluoranthene	12	13	820	880	40 J	2900 J	7800	0	1000	4
Benzo(g,h,i)perylene	9	13	850	330	110 J	600 J	2500000	0	42000	0
Benzo(k)fluoranthene	11	13	950	900	37 J	3000 J	78000	0	1000	3
bis(2-Ethylhexyl)phthalate	1	13	1300	1500	1500	1500	410000	0	11000	0
Butylbenzylphthalate	2	13	1200	250	32 J	470 J	2500000	0	200000	0
Carbazole	7	13	410	290	26 J	970 J	290000	0	360	2
Chrysene	12	13	2000	2100	51 J	11000 J	780000	0	1000	3
Dibenzo(a,h)anthracene	4	13	1200	110	36 J	210 J	780	0	1000	0
Dibenzofuran	5	13	970	140	34 J	480 J	2500000	0	5600	0
Diethylphthalate	1	13	1200	54	54 J	54 J	2500000	0	1100000	0
Dimethylphthalate	2	13	1200	220	150 J	280 J	2500000	0	1100000	0
Di-n-Butylphthalate	4	13	520	400	32	1200 J	2500000	0	140000	0
Fluoranthene	11	13	1800	2000	86 J	8600 J	2500000	0	56000	0
Fluorene	5	13	530	420	43 J	1200 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	11	13	440	480	27 J	1400 J	7800	0	1000	1
Naphthalene	6	13	670	250	28 J	1100 J	2500000	0	56000	0
N-Nitroso-diphenylamine	4	13	710	360	36 J	1300 J	1200000	0	1400	0
Pentachlorophenol	1	13	3100	30	30 J	30 J	48000	0	1000	0
Phenanthrene	12	13	1400	1500	50 J	9400 J	2500000	0	40000	0
Phenol	8	13	1400	1200	120 JEB	2200	2500000	0	800000	0
Pyrene	11	13	1700	2000	110 J	8700 J	2500000	0	40000	0
Total PAH	2	2	28000	28000	843	54590				
Volatile Organic Compounds (UG/KG)										
2-Butanone	5	8	13	16	5 J	45	1000000	0	80000	0
Acetone	3	8	66	120	42	210	1000000	0	140000	0

TABLE 3-10 (cont.)
576 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG) (cont.)										
Benzene	1	8	6	3	3 J	3 J	200000	0	200	0
Carbon Disulfide	5	8	6	5	1 J	16 J	1000000	0	140000	0
Chlorobenzene	2	8	9	18	5 J	32 J	1000000	0	20000	0
Ethylbenzene	1	8	7	12	12 J	12 J	1000000	0	10100	0
Methyl Acetate	1	5	6	7	7 J	7 J				
Methylene Chloride	1	8	7	4	4 J	4 J	760000	0	1000	0
Toluene	5	8	35	53	2 J	250 J	1000000	0	67000	0
Total Xylenes	1	8	18	100	100	100	1000000	0	19500	0
Trichloroethene	1	8	6	2	2 J	2 J	520000	0	1000	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	2	16	12	9.7	8.3 J	11	24000	0	29	0
4,4'-DDE	8	16	170	320	4.2 J	2400 *	17000	0	21	2
4,4'-DDT	3	15	15	25	13 J	37	17000	0	21	2
alpha-Chlordane	7	16	14	25	2.4	76	2200	0	66	1
Aroclor, Total (4)	42	67	16000	25000	87	400000	10000	8		
Aroclor, Total (Conservative) (5)	42	67	17000	26000	259.5	413300	10000	12		
Aroclor-1254	4	62	3800	55000	1300	210000 *	10000	1		
Aroclor-1262	16	41	7600	19000	150	130000 J	10000	4		
Aroclor-1268	42	67	7900	12000	87	270000	10000	6		
beta-BHC	1	16	6.4	4.4	4.4 J	4.4 J	3200	0	3.9	1
delta-BHC	1	16	6.4	9.2	9.2 J	9.2 J	910	0	1.1	1
Dieldrin	7	16	200	450	6.7	3000 *	360	1	7	6
Endosulfan I	1	16	9.9	66	66 J	66 J	1200000	0	8400	0
Endosulfan II	2	16	14	25	22	28 J	1200000	0	8400	0
Endosulfan Sulfate	5	16	480	1500	320 *#	5500 *#	1200000	0	8400	0
Endrin	1	16	16	80	80	80	610000	0		
Endrin Aldehyde	6	15	400	950	7.8	5400 *#	610000	0		

TABLE 3-10 (cont.)
576 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
Endrin Ketone	2	16	24	110	12	200 J	610000	0		
gamma-Chlordane	4	15	14	42	9.7 J	130 J	2200	0	66	1
Heptachlor	2	16	6.4	8.1	4.2 J	12 J	1300	0	13	0
Heptachlor Epoxide	3	16	6.5	11	9	14 J	630	0	20	0
Methoxychlor	3	15	130	420	44	1100	10000000	0	8000	0

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.

576 EAST BROADWAY

335 FERRY BOULEVARD

LONGBROOK TRIBUTARY

FERRY CREEK

PP-105

MF G+100

MF F+100

MF F+050

MFP-2

MFP-5

A1-SB11

MFP-1

PP EF+110

PP-EF+100

MF F-010

MFP-4

PP EF+050

A1-SB03

MF E+100

MF-SB5

MFP-3

MF E+080

PP EF+00

PP DE+110

MF E+050

MF E+00

PP-DDE+110

PP DE+100

MF-SB6

PP DE+050

EB W+400

PP DDE+100

PP DE+00

PP DDE+050

PP DDE+00

MF D+100

MF D+00

600 EAST BROADWAY

PP-101

PP CD+110

EB W+500

PP CD+100

PP-102

PP CD+050

PP CD+00

FERRY BOULEVARD

CT RIGHT OF WAY

EAST BROADWAY

- RAYMARK WASTE
- NO RAYMARK WASTE, NO ASBESTOS >1%, NO CT DEC OR PMC EXCEEDANCES
- CT DEC AND/OR CT PMC EXCEEDANCES
- ONLY ASBESTOS >1%
- ESTIMATED AREA OF RAYMARK WASTE WITHIN PROPERTY OF INTEREST
- PROPERTY OF INTEREST
- PROPERTY BOUNDARY AS RECORDED WITH THE TOWN OF STRATFORD
- IMPLIED PROPERTY BOUNDARY EXTENDED TO ROADWAY
- BUILDING
- PAVEMENT

50 0 50 100 150 Feet

N

NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-10
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.11 600 East Broadway

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.11.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.11.1 Property Description

This property, approximately 4.5 acres of commercially-zoned (light industrial) land, is located on the west side of East Broadway in Stratford, Connecticut (Town of Stratford, 1997). The parcel is presently undeveloped. At one time, the majority of the property was an active industrial waste disposal area (HRP Associates, 1987). The property is now overgrown and the central portion is an open field vegetated with grasses, weeds, shrubs, and large trees around the site perimeter. A storm drain is located in the street in front of the property. Public access to the property is restricted along the eastern, southern, and western property lines by a chain-link fence. Public access is unrestricted along the northern side of the property near Ferry Creek.

A vacant lot adjacent to Interstate Route 95 (see Section 3.12), and Longbrook stream (a tributary into Ferry Creek) are located to the north, with the 576 East Broadway commercial property (see Section 3.10) and East Broadway itself to the east, and residential properties to the south and west. A vacant lot and a small commercial shopping center are located to the east across East Broadway.

Soils classified as construction debris fill (i.e., concrete blocks) are evident on much of the surface of the northern section of the property. The southeastern section of the property has a 3-inch thick gravel layer covering approximately 3,500 square feet of the property.

3.11.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, this property is entirely located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Twenty-eight borings (MF-101 through MF-106; MF-SB1 through MF-SB8; MW-101 through MW-104 clusters; and PP-103 and PP-104) were advanced on the property to depths up to 109.5 ft below ground surface (bgs). Soils were described in 20 of the 28 borings. Borings were advanced to refusal or until the bedrock surface was potentially encountered. Bedrock was confirmed and cored in borings MF-MW103D and SB-104B. Based on the boring logs, soils noted in borings MF-SB1, MF-SB2, MF-101 through MF-106, PP-103, and PP-104 consist of fill, which overlies swamp and marsh deposits. Soils encountered below fill include peat, organic silt, sandy silt, silt, trace gravel, and/or organic material. Soils noted in borings MF-SB3, MF-SB4, MF-SB7, MF-SB8, MF-MW-101D, MF-MW-102D, MF-MW103D, and MF-MW104D consisted of fill materials and marsh and swamp deposits, which overlie locally derived glacial outwash and/or ice contact deposits. Soils encountered below the marsh deposits included sand with varying amounts of silt, and gravel. Refer to Figure 3-11 for boring locations. Boring logs are presented in Appendix A.

Four well clusters were installed throughout the property to monitor groundwater contamination. Sample locations are shown on Figure 3-11, including both shallow surface samples and deeper samples from soil borings. Borings with no samples collected are not shown on Figure 3-11. The borings were used to describe the fill and native materials on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials placed on the property as a result of human activity. Fill debris identified in the soil from one or more borings included potentially asbestos-containing materials (PACM), asbestos fibers, asphalt, brake pads, brick, broken rock, cinders, concrete, debris, glass, nails, roofing shingles, rubber soles, slag, and wood. PACM was identified in the soil from borings MF-SB2, MF-SB6 through MF-SB8, MF-MW102D, MF-MW103D, PP-103, PP-104, MF-102, MF-104, and MF-105. These materials were encountered with natural fill consisting of sand, silty sand and sand-silt mixtures, gravelly silty sand, and sand and gravel. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. The depth to water ranges from 3.5 to 12 feet bgs, based on the soil moisture content recorded on the boring logs and on 2003 water level measurements from monitoring wells on the property.

Raymark waste was found in fill materials throughout this property. The lateral limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-11. Approximately 21 percent of the property is estimated to contain Raymark waste. The waste areas are predominantly covered with grasses, shrubs, and trees. Some of the waste areas in the southeastern portion of the property have been covered with gravel.

3.11.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 350 soil samples collected from 66 locations at this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-11. Samples were analyzed for asbestos, dioxins, metals, SPLP and TCLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-11 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-11 for the soil data summary statistics and comparison to criteria. The discussion below includes all soil samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

Asbestos

Three-hundred and forty soil samples were collected from the property and analyzed for asbestos. Asbestos was detected in 202 of the 340 samples collected at this property. There was asbestos present at concentrations greater than 1 percent in 77 samples. Asbestos detections were scattered throughout the property at depths ranging from ground surface to 16 feet bgs. The highest amount of asbestos detected was 85 percent.

Dioxins

Twenty-nine soil samples were collected from the property and analyzed for dioxins. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. TEQ values ranged from 0.00068 µg/kg to 1.03 µg/kg.

Metals

Soil samples collected from this property were analyzed for metals as follows: 46 samples were analyzed at a fixed laboratory for metals; 77 were screened for copper; and 296 were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Arsenic, chromium, copper, and lead concentrations exceeded the CT DEC regulatory standards. Metals exceedances were primarily located in the southern half of the property at the ground surface and from 6 to 10 feet bgs, however exceedances were found up to 18 feet bgs at three locations. Lead and copper exceedances were also concentrated in the southern half of the property. The maximum concentrations of both contaminants were detected in the same sample, MW103D, located on the eastern property border, at a depth of 6 to 8 feet bgs.

SPLP and TCLP Metals

Four soil samples were collected for SPLP metals analysis and four samples were collected for TCLP metals analysis. Based on the data provided in Appendix C for this property, only two out of the four SPLP samples collected were from within the estimated area of Raymark waste.

One of the SPLP samples exceeded the CT PMC for lead. The SPLP exceedance was at location A1-SS01 from surface to 2 feet bgs. Also based on the data provided in Appendix C for this property, three of the four TCLP samples collected were from within the estimated area of Raymark waste. All of the TCLP samples exceeded the CT PMC standard for lead. The TCLP exceedances were at location MF-MW103 from 6 to 8 feet bgs and 16 to 18 feet bgs, and at locations MF-SB4 at 4 to 6 feet bgs, and MF-SB8 at 6 to 8 feet bgs.

Pesticides

Forty-three soil samples were collected from the property and analyzed for pesticides. Pesticides were detected infrequently. Pesticide concentrations did not exceed the CT DEC standards. Eleven samples exceeded the CT PMC regulatory standards for pesticides. Pesticide exceedances were scattered throughout the property at depths up to 16 feet bgs.

PCBs

Three-hundred and forty samples were collected from the property and analyzed for PCBs as Aroclors. PCBs were detected in about 20 percent of the samples from this property. There were nine exceedances of the CT DEC regulatory standards for total Aroclors. The PCB exceedances were scattered throughout the property at depths ranging from ground surface to 16 feet bgs. No samples were collected for SPLP/TCLP PCB analysis.

SVOCs

Up to 39 samples were collected from the property and analyzed for SVOCs. SVOCs were detected frequently on the property. Nine samples had SVOC exceedances, primarily PAHs, of the CT DEC and/or CT PMC regulatory standards. SVOC exceedances were primarily located in the southern area of the property from the surface to 6 feet bgs.

VOCs

Up to 31 samples were collected from the property and analyzed for VOCs. VOCs were rarely detected on the property. There were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from 28 samples collected from 13 different locations indicate that Raymark waste is present on the property. The following table displays the locations of the samples with contaminant concentrations that meet the definition of Raymark waste on this property. These samples are located within the 21 percent of the property shown on Figure 3-11 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
A1-SS01	0 to 2	20	3,580	6,990	NA
	2 to 4	20	2,040	3,780	NA
MF-104	2 to 4	60	1,620	3,890	NA
MF-A+400	0 to 0.5	80	9,130	15,800	NA
MF-SB2	2 to 4	5	1,000	NA	1,700
	4 to 6	15	1,200	NA	1,100
	6 to 8	10	678	742	1,200
MF-SB4	2 to 4	2	420	NA	3,400
	4 to 6	2	10,600	13,900	NA
	12 to 14	15	3,220	6,260	NA
	14 to 16	30	502.5	1,013.25	NA
	16 to 18	9	1,215	3,160	NA
MF- SB7	4 to 6	50	1,690	4,000	NA
	14 to 16	50	3,980	2,370	50,000
MW - 101D	2 to 4	9	930	805	2,700
	2 to 4 (A)	15	1,600	NA	5,300
MW - 102D	4 to 6	70	7,450	10,900	1,800
	6 to 8	52.5	3,555	6,465	NA
MW - 103D	6 to 8	70	25,600	97,900	NA
	8 to 10	80	14,900	34,600	9,300
MF-TP2	5 to 6	35	1,290	2,270	NA
MFP-6	0 to 0.5	80	10,600	23,200	14,000
PP-103	2 to 4	7	2,410	NA	26,000
	4 to 6	70	9,805	6,980	72,000
	6 to 8	60	16,850	5,240	84,000
	8 to 10	30	6,130	3,180	49,000
PP-104	2 to 4	4	553	448	3,100
	4 to 6	10	1,900	1,750	10,000

NA- Contaminant was not analyzed
( )- Sample from a duplicate boring

3.11.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 21 percent of this 4.5-acre property is estimated to contain Raymark waste. The waste areas are scattered throughout the property (see Figure 3-11). This property is undeveloped and primarily vegetated with grasses, shrubs, and trees. The southeastern portion of the property is covered with gravel.

Given this property's undeveloped status, infiltration of surface water is most likely occurring. It is assumed that there is little or no erosion occurring on the property, except along the northern edges of the parcel in the Longbrook Tributary and Ferry Creek stream beds. SPLP and TCLP data indicate that metals could potentially leach from contaminated soils to the groundwater. Other data indicate that pesticides and SVOCs could also leach into the groundwater.

3.11.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the parcel located at 600 East Broadway that was found to contain Raymark waste in soil. Data collected from this parcel, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire parcel at 600 East Broadway may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.11.5.1 provides an overview of the 600

East Broadway property, Section 3.11.5.2 presents COPCs and EPCs, Section 3.11.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.11.5.4 contains the numerical results of the risk assessment, and Section 3.11.5.5 presents property-specific uncertainties. Section 3.11.5.6 presents a property-specific summary of the major risk findings.

3.11.5.1 Overview

600 East Broadway is currently an undeveloped commercial property zoned for light industrial use. The area covers approximately 4.5 acres. A detailed description of the property is provided in Section 3.11.1. The nature and extent of the contamination detected at 600 East Broadway is discussed in Section 3.11.3. The areas of 600 East Broadway estimated to contain Raymark waste represent an estimated 21 percent of the total 4.5-acre property and are shown in Figure 3-11. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.11.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated areas of Raymark waste at 600 East Broadway are summarized in Appendix B-1, Table 2.11.

3.11.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.11 presents a summary of the COPCs for quantitative risk assessment for 600 East Broadway soils from the estimated areas of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data, except soil data collected from depths greater than 15 feet bgs, were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of

EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.11:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene)
- Trichloroethene
- Aroclors, Total (1254, 1262, and 1268)
- Metals (arsenic, barium, chromium, lead, and zinc)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 600 East Broadway are presented in Appendix B-1, Table 3.11. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.11.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 600 East Broadway and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 600 East Broadway is currently an undeveloped commercial property, as described in Section 3.11.1.

Potential Receptors

The receptors retained for quantitative evaluation at 600 East Broadway are future commercial workers. Potentially exposed individuals are limited to those who may work at 600 East Broadway in the future.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities. Under the future land use, commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated areas of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 600 East Broadway are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from 600 East Broadway is considered to be minimal. The estimated areas of Raymark waste are heavily vegetated with grasses, trees, and shrubs. Some areas are covered with gravel. The presence of vegetation and gravel reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.11.5.4. Asbestos is present in soils within the estimated areas of Raymark waste at 600 East Broadway. The presence of vegetation suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.6. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 600 East Broadway is 0.21. Chemical intake estimates are provided in Appendix B-1, Tables 7.11 and 8.11.

3.11.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 600 East Broadway is provided in this section. Appendix B-1, Table 7.11 and Table 8.11 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.11. Appendix B-1, Table 10.11 reduces the information developed in Appendix B-1, Table 9.11 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the future commercial worker at 600 East Broadway are as follows:

	Ingestion	**Dermal**	**Total**
Commercial Worker (Future)	1.0	0.8	1.8

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated areas of Raymark waste at 600 East Broadway is in excess of unity. Total Aroclor was the main contributor to the hazard index for the commercial worker. The chemical-specific (and target-organ specific) hazard quotients for total Aroclor alone are in excess of unity for commercial

receptors. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Table 7.11 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the future commercial worker at 600 East Broadway are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	2.4E-05	1.6E-05	4.0E-05

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated areas of Raymark waste are within the EPA cancer risk range (10^{-4} to 10^{-6}) but exceed the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.11 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.11, dioxins, Aroclors, arsenic, and benzo(a)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}. In addition to the above risks, cancer risks from inhalation of chromium in dust may be as great as 2E-06 (see discussion in Section 3.11.5.3).

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 5.9E-05.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste at the 600 East Broadway Property. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 25,600 mg/kg. The average lead concentration in this dataset was 2,320 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 2,320 mg/kg for soil within the estimated areas of Raymark waste was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for 600 East Broadway is 0.21. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated areas of Raymark waste at 600 East Broadway, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 1.0 to 2.1 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 69 of the 80 soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 85 percent. These samples were collected from the 0- to 15-foot bgs interval. The average concentration was 19 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of vegetative cover and gravel in the estimated areas of Raymark waste reduces the potential for airborne asbestos at the 600 East Broadway property. Based on field

conditions in the estimated areas of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.11.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 600 East Broadway are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 600 East Broadway property is 4.5 acres, with an estimated 21 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.11.4. The estimated areas of Raymark waste are heavily vegetated with trees and shrubs. Additionally, some areas are covered by gravel. No consideration was given to site characteristics. It is conceivable that individuals may spend all of their time within the estimated areas of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 21 percent of the time, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately five times greater than those estimated using the FRW factor.

- Copper concentrations exceed the EPA Region IX industrial soil PRG of 41,000 mg/kg in 600 East Broadway soils; however due to the lack of a verifiable toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in 600 East Broadway soils (0 to 15 feet bgs) at concentrations ranging from 21 mg/kg to 97,900 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Eighty-nine samples were included in the dataset for soils within the estimated areas of Raymark waste; however, 72 of the samples were only analyzed by field-screening methods. Due to the limited numbers of samples analyzed for trichloroethene, barium, and PAHs, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-10. The presence of PAHs, arsenic, and lead at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Benzo(a)anthracene is present in soils located outside the estimated areas of Raymark waste at 600 East Broadway at concentrations up to 10 mg/kg. Benzo(a)pyrene is present at concentrations up to 9.2 mg/kg, benzo(b)fluoranthene at concentrations up to 13 mg/kg, dibenzo(a,h)anthracene at concentrations up to 1.5 mg/kg, arsenic at concentrations up to 107 mg/kg, and lead at concentrations up to 2,600 mg/kg. Nineteen samples from outside the estimated

areas of Raymark waste were analyzed for PCBs using CLP methods. While none of these samples had concentrations greater than the CT RSRs for industrial soil, one sample did have total Aroclor concentrations greater than the EPA Region IX PRG for industrial soil. The individual Aroclors detected were Aroclor 1262 and Aroclor 1268. Dioxins were detected outside the estimated areas of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin TEQ concentrations outside the estimated areas of Raymark waste were less than the EPA Region IX PRGs for industrial soil. Copper was detected at concentrations up to 490 mg/kg. Asbestos is also present outside the estimated areas of Raymark waste at concentrations up to 60 percent. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

3.11.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils at the estimated areas of Raymark waste at 600 East Broadway. Risks to future commercial workers were estimated.

- The RME hazard indices (HI) for future commercial workers exposed to soil with the estimated areas of Raymark waste at 600 East Broadway are in excess of unity. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposures to Aroclors.

- The RME cancer risk estimates for commercial workers exposed to soil within the estimated areas of Raymark waste at 600 East Broadway fall within the EPA cancer risk range (10^{-4} to 10^{-6}) and exceed the CT DEP target total risk level of 10^{-5}. Dioxins, Aroclors, arsenic, and benzo(a)pyrene are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects

are not anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated areas of Raymark waste at 600 East Broadway.

- Asbestos was detected in 69 of the 80 soil samples collected from the estimated areas of Raymark waste in the 0- to 15- foot bgs interval at a concentration range of trace to 85 percent. The average concentration was 19 percent.

3.11.6 Ecological Evaluation

The ecological characterization of the wetlands adjacent to this property was addressed under the OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark - Ferry Creek - OU3* (B&RE, 1998). A summary of the findings is presented below. No individual evaluation of the ecological impacts on this property were conducted.

The property is undeveloped but has been significantly disturbed by filling operations. The central portion of the property is currently an open field vegetated with upland grasses and weeds. Shrubs and trees are generally located along the site perimeter and include black locust, trembling aspen, gray birch, Norway maple, white birch (*Betula papyrifera*), and red oak. This upland area can provide habitat for a variety of small birds, mammals, and reptiles.

The surrounding commercial and residential development, and the presence of contaminated soils limit use of the property by wildlife, especially those that require a large habitat range. Wildlife observed in the area include American crow (*Corvus brachyrynchos*), black-capped chickadee (*Parus atricapillus*), common grackle (*Quiscalus quiscula*), european starling (*Sturnus vulgaris*), tree swallow (*Techycineta bicolor*), and eastern garter snake (*Thamnophis sirtalis*).

The abutting Longbrook Tributary and Ferry Creek are ecological resources that have been impacted by fill. The stream and surrounding wetland areas are only marginally functional as a resource area. Risks to ecological receptors have been identified in Ferry Creek sediments and surface water. Impacts from Raymark waste in soils have not been evaluated quantitatively.

3.11.7 Summary

This 4.5-acre, commercially-zoned vacant property located on the west side of East Broadway contains Raymark waste. Soils containing elevated total metals, SPLP metals, TCLP metals, pesticides, PCBs, and SVOCs that exceed CT DEC and/or CT PMC and asbestos greater than 1 percent are present on the property. Given the undeveloped property conditions, infiltration and leaching are potentially occurring throughout the property.

The RME hazard indices for commercial workers exposed to soils within the estimated areas of Raymark waste are in excess of unity, indicating non-carcinogenic adverse health effects. The RME cancer risk estimates fall within the EPA cancer risk range and exceed the CT DEP target total risk level. Dioxins, Aroclors, arsenic, and benzo(a)pyrene are the predominant risk drivers. Adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soils at the estimated areas of Raymark waste. The average asbestos concentration in the estimated areas of Raymark waste was 19 percent.

Ecological risks have not been quantified; however, some impacts to the ecological receptors are likely.

TABLE 3-11
600 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	202	340	6	10	Trace	85	1	77		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	5	29	0.28	0.84	0.0683 J	1.7 J				
1,2,3,4,6,7,8-HpCDF	6	29	0.54	2.3	0.03013 J	8.22 J				
1,2,3,4,7,8-HxCDD	1	29	0.18	0.00079	0.000789 J	0.000789 J				
1,2,3,4,7,8-HxCDF	4	29	0.25	1.1	0.00396 J	3.16 J				
1,2,3,6,7,8-HxCDD	1	29	0.19	0.0023	0.00232 J	0.00232 J				
1,2,3,6,7,8-HxCDF	1	29	0.12	0.0017	0.00173 J	0.00173 J				
1,2,3,7,8,9-HxCDD	1	29	0.16	0.0024	0.00241 J	0.00241 J				
1,2,3,7,8-PeCDD	1	29	0.18	0.00054	0.000544 *	0.000544 *				
1,2,3,7,8-PeCDF	1	29	0.11	0.1	0.1 J	0.1 J				
2,3,4,6,7,8-HxCDF	4	29	0.17	0.55	0.00319 J	1.58 J				
2,3,4,7,8-PeCDF	5	29	0.13	0.23	0.00163 J	0.79 J				
2,3,7,8-TCDF	6	29	0.096	0.18	0.0022 *	0.64				
OCDD	9	29	1.3	3.2	0.68	6.2 J				
OCDF	5	29	0.55	1.8	0.0051 J	6.65				
Total HpCDD	5	29	0.32	1.1	0.157 J	2.79 J				
Total HpCDF	6	29	0.57	2.4	0.0711 J	8.22 J				
Total HxCDD	2	29	0.15	0.41	0.01638 J	0.8 J				
Total HxCDF	5	29	0.57	3	0.02713 J	10.58 J				
Total PeCDD	2	29	0.19	0.17	0.00138 J	0.34 *				
Total PeCDF	6	29	0.24	0.86	0.0108 EMPC	2.65 J				
Total TCDF	5	29	0.18	0.68	0.0198 EMPC	2.41 J				
Toxicity Equivalency	12	28	0.24	0.23	0.00068 J	1.03 J				
Metals (MG/KG)										
Aluminum	46	46	8050	8050	1030	19600				
Antimony	4	44	2	6.9	2.9 J	16.5 J	8200	0		
Arsenic	46	46	22.5	22.5	1.2	263 J	10	20		
Barium	45	46	1660	1700	17.6	10900	140000	0		

TABLE 3-11 (cont.)
600 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG) (cont.)										
Beryllium	18	45	0.35	0.67	0.29	2	2	0		
Cadmium	6	44	0.62	3.2	0.22	6.3	1000	0		
Calcium	37	46	2700	3190	647	14100 J				
Chromium	46	46	51.5	51.5	4.2	240	100	8		
Cobalt	46	46	10.8	10.8	1.6	27.9	2500	0		
Copper	91	123	2370	3160	7.4	97900	76000	1		
Iron	46	46	24200	24200	6690	89900				
Lead	172	342	639	1250	2 J	25600 J	1000	35		
Magnesium	46	46	13400	13400	235	68600				
Manganese	46	46	216	216	13.3 J	451	47000	0		
Mercury	27	46	0.48	0.78	0.07 , J	4.3	610	0		
Nickel	46	46	93.7	93.7	5.3	566	7500	0		
Potassium	42	46	1570	1700	383	3930				
Selenium	13	46	1.5	3.4	0.52 J	8.8	10000	0		
Silver	14	39	0.99	2.2	0.34	7.2 J	10000	0		
Sodium	14	44	678	1630	133	9030				
Thallium	3	46	0.68	3.7	1.5	5.2	160	0		
Vanadium	46	46	29.9	29.9	7	97.5 J	14000	0		
Zinc	46	46	1000	1000	6.8	24000 J	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	3	3	1580	1580	67.8	3120				
Arsenic	2	4	10.1	16.7	11.8	21.6			500	0
Barium	4	4	522	522	44.9	1510			10000	0
Calcium	3	3	7980	7980	5100	13300				
Chromium	3	4	8.8	11.6	2.8	28.8			500	0
Cobalt	1	3	1.9	3.8	3.8	3.8				
Copper	3	4	1460	1950	87.5	5500			13000	0
Iron	3	3	4240	4240	254	7400				
Lead	4	4	662	662	21.6	2390			150	1

TABLE 3-11 (cont.)
600 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Magnesium	3	3	4340	4340	627	11200				
Manganese	3	3	50.8	50.8	4.9	78				
Nickel	3	4	23.8	31.5	3.8	74.9			1000	0
Potassium	3	3	1400	1400	850	1730				
Selenium	1	4	2.8	3.8	3.8 J	3.8 J			500	0
Sodium	3	3	923	923	248	1610				
Vanadium	4	4	17.5	17.5	2.5	53.6			500	0
Zinc	4	4	347	347	12.1 J	1020			50000	0
Metals (TCLP) (UG/L)										
Arsenic	1	4	9.6	27.8	27.8	27.8			500	0
Barium	2	4	559	814	607	1020			10000	0
Cadmium	2	4	16.1	31.1	20.8	41.4			50	0
Lead	4	4	66000	66000	244	262000			150	4
Selenium	1	4	5.1	3	3 J	3 J			500	0
Semivolatile Organic Compounds (UG/KG)										
1,1'-Biphenyl	1	6	200	36	36	36				
2,4-Dimethylphenol	8	39	700	560	52 J	2200 J	2500000	0	28000	0
2-Methylnaphthalene	12	39	620	140	37 J	460	2500000	0	9800	0
2-Methylphenol	8	39	700	460	110 J	790	2500000	0	70000	0
4-Methylphenol	11	39	840	990	81 J	4800 J	2500000	0	7000	0
4-Nitrophenol	1	39	1700	460	460 J	460 J	2500000	0	11000	0
Acenaphthene	12	38	600	280	42 J	1500 J	2500000	0	84000	0
Acenaphthylene	10	39	720	360	31 J	1000	2500000	0	84000	0
Anthracene	16	39	750	650	26 J	3500 J	2500000	0	400000	0
Benzo(a)anthracene	19	39	1200	1600	58 J	10000 J	7800	1	1000	7
Benzo(a)pyrene	21	39	1100	1300	62 J	9200 J	1000	6	1000	6
Benzo(b)fluoranthene	22	39	1300	1600	72 J	13000 J	7800	1	1000	6
Benzo(g,h,i)perylene	17	39	870	920	63 J	5700 J	2500000	0	42000	0
Benzo(k)fluoranthene	16	39	920	960	76 J	4100 J	78000	0	1000	4

TABLE 3-11 (cont.)
600 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
bis(2-Ethylhexyl)phthalate	12	39	830	780	56	3900	410000	0	11000	0
Butylbenzylphthalate	1	39	670	50	50 J	50 J	2500000	0	200000	0
Carbazole	11	39	650	500	50 J	3100 J	290000	0	360	3
Chrysene	21	39	1300	1700	100 J	9800 J	780000	0	1000	8
Dibenzo(a,h)anthracene	10	39	650	320	47 J	1500	780	1	1000	1
Dibenzofuran	10	39	600	320	50 J	950 J	2500000	0	5600	0
Diethylphthalate	3	39	660	64	58 JTB	72 JTB	2500000	0	1100000	0
Dimethylphthalate	4	39	660	210	67 J	460	2500000	0	1100000	0
Di-n-Butylphthalate	11	39	670	290	48 J	750	2500000	0	140000	0
Di-n-octylphthalate	2	39	660	190	72 J	310	2500000	0	20000	0
Fluoranthene	22	39	1900	2900	45 J	17000 J	2500000	0	56000	0
Fluorene	13	39	650	450	64 J	1900 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	18	39	880	900	65 J	5200 J	7800	0	1000	5
Naphthalene	14	39	580	150	51 J	440 J	2500000	0	56000	0
N-Nitroso-diphenylamine	2	39	640	160	140 J	190 J	1200000	0	1400	0
Phenanthrene	23	39	1600	2100	100 J	15000 J	2500000	0	40000	0
Phenol	8	39	1000	2300	250	6100	2500000	0	800000	0
Pyrene	25	39	2100	2900	62 J	21000 J	2500000	0	40000	0
Total PAH	7	8	15000	17000	1550	58985				
Volatile Organic Compounds (UG/KG)										
1,1,1-Trichloroethane	1	31	10	44	44	44	1000000	0	40000	0
1,1-Dichloroethane	5	31	13	40	5 J	150	1000000	0	14000	0
1,2-Dichloroethene (total)	3	25	12	31	11 J	66	1000000	0	14000	0
2-Butanone	2	31	16	130	11 J	250	1000000	0	80000	0
Acetone	4	31	65	410	51 J	810	1000000	0	140000	0
Carbon Disulfide	6	31	13	40	1 J	130	1000000	0	140000	0
Chloromethane	1	31	8	4	4 J	4 J	440000	0	540	0
Ethylbenzene	1	31	8	2	2 J	2 J	1000000	0	10100	0

TABLE 3-11 (cont.)
600 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG) (cont.)										
Isopropylbenzene	1	6	6	6	6 J	6 J				
Tetrachloroethene	3	31	9	19	1	29 J	110000	0	1000	0
Toluene	1	31	8	3	3 J	3 J	1000000	0	67000	0
Total Xylenes	1	31	9	18	18 J	18 J	1000000	0	19500	0
Trichloroethene	3	31	14	70	5 J	120	520000	0	1000	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	4	42	5.9	6.9	0.99 J	16 J	24000	0	29	0
4,4'-DDE	7	41	6.3	13	1.2 J	66 J	17000	0	21	1
4,4'-DDT	10	39	7.3	6.7	1.7 J	18	17000	0	21	0
Aldrin	4	42	3.2	11	0.75 J	37 J	340	0	0.41	4
alpha-BHC	2	42	3	0.66	0.56 J	0.76 J	910	0	1.1	0
alpha-Chlordane	14	43	6.1	13	1 J	71 J	2200	0	66	1
Aroclor, Total(4)	73	340	2400	11000	3	192000	10000	9		
Aroclor, Total (Conservative)(5)	73	340	2500	11000	170.5	192000	10000	10		
Aroclor-1248	3	43	82	340	190	650	10000	0		
Aroclor-1254	3	327	120	2900	180	8400 *J	10000	0		
Aroclor-1260	1	327	95	650	650	650	10000	0		
Aroclor-1262	63	306	1400	6500	39 J	108000	10000	7		
Aroclor-1268	68	340	1200	5500	3 J	84000	10000	7		
beta-BHC	1	40	3.1	3.5	3.5 J	3.5 J	3200	0	3.9	0
delta-BHC	3	42	3.1	2	0.45 J	4	910	0	1.1	2
Dieldrin	8	42	4.9	6.8	0.49 J	23 J	360	0	7	2
Endosulfan I	8	43	4.9	16	1.4 J	74 J	1200000	0	8400	0
Endosulfan II	2	42	6	3.3	1.4 J	5.2 J	1200000	0	8400	0
Endosulfan Sulfate	6	43	5.9	7.1	1.4 J	20 #	1200000	0	8400	0
Endrin	3	42	5.6	3.7	0.71 J	5.7	610000	0		
Endrin Aldehyde	5	42	6.5	12	7.5 J	18 J	610000	0		
Endrin Ketone	3	42	6.1	4.5	2.5 J	6.8	610000	0		

TABLE 3-11 (cont.)
600 EAST BROADWAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
gamma-Chlordane	13	40	6.6	17	0.85 J	87 J	2200	0	66	2
Heptachlor	5	42	3.2	3	0.25 J	11 J	1300	0	13	0
Heptachlor Epoxide	6	40	4	13	1.3 J	63 J	630	0	20	1
Methoxychlor	5	42	31	12	3.3 J	22	10000000	0	8000	0

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate
TB	Trip blank contamination
U	Not detected
UJ	Detection limit approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.

600 EAST BROADWAY

INTERSTATE 95

LONGBROOK TRIBUTARY

MEADOW STREET

BLAKEMAN PLACE

EAST BROADWAY

FERRY BOULEVARD

FERRY CREEK

MF G+265
MF-G+200
MF-106
MW-104D
MFTP4
MF F+279
MF F+200
PP-104
MF E+325
MF E+300
MF-105
MF-SB8
PP-103
MF E+200
A1-SS04
MF D+335
MF D+300
MF D+200
MF C+360
MF-SB4
MW-103D
MF C+300
A1-SS03
MF C+200
MF B+425
MF-SB3
MF-C+100
MF C+050
MF B+400
MFP-6
MF B+300
MF-104
A1-SS02
MF-TP2
MF-TP3
MF C+00
EB W+600
MF-SB2
MF-102
MF-SB7
MF B+200
MF B+100
MF-A+400
MF B+050
MF A+300
MF B+00
A1-SS01
MF-SB1
MF-101
MW-101D
MF-103
MF A+200
EB W+700
MF AY2
MF AY4
MW-102D
MF A+100
MF AZ+365
MF A+050
MF AY1
MF AY3
MF-TP1
MF-AZ+300
EB W+800
MF A+00
MF AY0

RAYMARK WASTE
NO RAYMARK WASTE, NO ASBESTOS >1%, NO CT DEC OR PMC EXCEEDANCES
CT DEC AND/OR CT PMC EXCEEDANCES
ONLY ASBESTOS >1%
ESTIMATED AREA OF RAYMARK WASTE WITHIN PROPERTY OF INTEREST
PROPERTY OF INTEREST
PROPERTY BOUNDARY AS RECORDED WITH THE TOWN OF STRATFORD
IMPLIED PROPERTY BOUNDARY EXTENDED TO ROADWAY

100 0 100 200 Feet

N

NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-11
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	(978)658-7899

3.12 Vacant DOT Lot Abutting I-95

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.12.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.12.1 Property Description

This property, approximately 2.4 acres of commercially-zoned (light industrial) land, is located on the western side of Ferry Boulevard in Stratford, Connecticut (Town of Stratford, 1997). The property is publicly owned and contains no structures. The property is undeveloped and vegetated with grasses, trees, and shrubs, with some paved sidewalks. Approximately 50 percent of this property is a steep embankment along Interstate Route 95 (I-95). No storm drains were observed on this property, although there are storm drains in the surrounding areas.

Public access to the property from adjacent areas is not restricted with the exception of a portion of chain-link fence along 600 East Broadway (see Section 3.11) and along part of I-95. Ferry Boulevard is located to the east, with 335 Ferry Boulevard and Ferry Creek located to the south, I-95 to the north, and a vacant lot located to the west. Portions of the property abut the 345 Ferry Boulevard property to the west, north, and east. Two properties, 576 East Broadway (see Section 3.10) and 600 East Broadway (see Section 3.11), are on the other side of Ferry Creek. Residential properties are located near the southwest corner of the property. A portion of a Longbrook tributary flows from west to east along the southern property boundary into Ferry Creek. The tributary flows from the west through a culvert, and across the southwestern portion of the property. The tributary is rip-rapped with cobbles. Another drainage swale is located in the central portion of the property. This drainage feature appears to collect runoff from I-95, and flows west, into Ferry Creek.

3.12.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, a portion of this property is located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the 100-year floodplain on this property.

Eighteen borings (A1-SB07 and A1-SB10; SB-212 and SB-212M/D; SLE-101; VPA95-101 through VPA95-107; VPA95-201 and VPA95-202; and SB-503S, SB-503D, SB-503M, and SB-503B), were advanced on the property to various depths of up to 104 feet below ground surface (bgs). Soil borings SB-212B and SB-503B were advanced to bedrock and cored into bedrock. All SB-212 and SB-503 borings were subsequently converted to monitoring wells. Soils were not logged or sampled at SB-212M/D. Surficial materials noted in SB-212B and A1-SB04 consist of fine to coarse sand and gravel, which may be characteristic of alluvial, outwash and/or ice contact deposits. An interbed of silt was observed at 31.5 to 34.5 feet bgs. According to the boring logs, soils noted in borings SB-503B, VPA95-101, and VPA95-104 through VPA95-106 consist of fill overlying organic silt, sand with silt, or silt, which are characteristic of a former marsh and swamp deposit. Material below the marsh and swamp deposits in boring SB-503B included sand with varying amounts of silt and gravel, as well as lenses of silty clay. Petroleum odors were detected from 6 to 10 feet bgs in VPA95-101. A petroleum odor was also noted at boring A1-SB07, at approximately 14 feet bgs. Sand and gravelly sand noted in borings A1-SB07, SLE-101, and VPA95-102,103, 201, and 202 may represent fill materials. Refer to Figure 3-12 for boring locations. Boring logs are presented in Appendix A.

Two well clusters, MW-503 and MW-212, both consisting of four monitoring wells, were installed on this property and are designated SB-503S/M/D/B, SB-212S/B, and SB-212D/M. Soil sample locations are shown on Figure 3-12, including both shallow surface soil samples and deeper samples from soil borings. The borings were used to describe the fill and native material on the property. All sampling points were used to determine the presence or absence of Raymark waste and identify the locations that exceed the Connecticut RSRs. Soil samples were not collected from SB-212D/M, SB-503S, SB-503M, and SB-503D.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials identified in the soil included PACM (potentially asbestos-containing material) namely asbestos tiles, and brick, ceramic, glass and/or plastic. These materials were mixed with natural fill materials consisting of sand, silty sand, silt, and/or organic silt. Presumably, this entire property has been filled. The depth to water on the property ranges from 3 to 14 feet bgs, based on the soil moisture content recorded on the boring logs and on 2003 water level measurements from monitoring wells on the property.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as presented in Section 2.2 of this report. These estimated limits are shown of Figure 3-12. Approximately nine percent of this property is estimated to contain Raymark waste. The five estimated areas of Raymark waste are located in both paved and unpaved portions of the property.

3.12.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 93 samples collected from 46 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-12. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs and VOCs. See Table 3-12 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-12 for the soil data summary statistics and comparison criteria. The discussion below includes all soil samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

Asbestos

Eighty-one samples were collected from the property and analyzed for asbestos. Asbestos was detected in more than half of the samples collected from the property, with amounts greater than one percent found in 41 of 81 samples. Asbestos detections were scattered throughout the property at depths ranging from ground surface to 12 feet bgs.

Dioxins

Six soil samples were collected from the property and analyzed for dioxins. Dioxins were detected in the western and central areas of the property, from the surface to 12 feet bgs. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for explanation of TEQ. The maximum TEQ value for this property was 0.0869 µg/kg.

Metals

Soil samples were collected from the property and analyzed for metals as follows: 25 samples were analyzed in a fixed laboratory; 34 samples were screened for copper; and 60 samples were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered to be of low concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Lead concentrations exceeded the CT DEC regulatory standards in nine samples, located primarily in the western and central portions of the property from the surface to 8 feet bgs. Arsenic concentrations also exceeded the CT DEC in one sample.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only two of the six SPLP samples were from within the estimated area of Raymark waste. Lead was the only metal that exceeded the CT PMC regulatory standards, indicating the potential for leaching into groundwater. The highest lead exceedance was detected from the surface to 2 feet bgs in sample A1-SS06, located on a narrow strip of land in the eastern area of the property outside the estimated area

of Raymark waste. No other metals concentrations exceeded the CT PMC. No TCLP samples were collected on this property.

Pesticides

Twenty-four soil samples were collected from the property for pesticides analysis. Pesticides were detected infrequently on the property. There were eight pesticide exceedances of the CT PMC regulatory standards. The pesticide exceedances were primarily located in the western and southern areas of the property. The depths of the exceedances ranged from surface to four feet bgs. There were no CT DEC exceedances.

PCBs

Up to 70 soil samples were collected from the property for PCB analysis as Aroclors. Aroclors 1262 and 1268 were detected in approximately half of the samples from this property. Total PCBs exceeded the CT DEC regulatory standards in four samples in the western portion of the property. The total Aroclor exceedances ranged in depth from the surface to 8 feet bgs. In all four samples with exceedances, Aroclor 1268 was the primary contributor to the total Aroclor exceedances. No SPLP or TCLP PCB samples were collected from this property.

SVOCs

Fifteen soil samples were collected from the property for SVOC analysis. SVOCs were detected throughout the property, primarily in the form of PAHs. Benzo(a)pyrene exceeded the CT DEC and CT PMC criteria in three samples. In addition, five other SVOCs exceeded the CT PMC criteria. SVOC exceedances were scattered throughout the property from the surface to 10 feet bgs.

VOCs

Fifteen samples were collected from the property for VOCs analysis. VOCs were not frequently detected on the property. There were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from seven sample locations indicate that Raymark waste is present on the property. The following table displays the locations and constituents of the nine samples from the seven locations with contaminants at concentrations that meet the definition of Raymark waste on this property. These samples are located within the 8.7 percent of the property shown on Figure 3-12 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
A1-SS05	2 to 4	5	544	551	1,900
A1-SB07	6 to 8	5	1,590	1,030	3,400
SB-503B	2 to 4	4	600	588	3,000
VPA95-105	4 to 6	20	2,100	1,400	15,000
	6 to 8	15	658	843	20,000
VPA95-106	0 to 2	15	1,140	929	9,700
VPA95-107	0 to 2	40	6,140	3,720	41,000
	2 to 4	20	7,360	2,900	93,000
EBW+100	0 to 0.5	2	2,080	NA	3,000

NA- Contaminant was not analyzed

3.12.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas with Raymark waste. The primary pathways for migration of contaminants throughout this property are discussed below.

Approximately nine percent of this 2.4-acre property is estimated to contain Raymark waste. There are five separate waste areas on this property (see Figure 3-12). The largest waste area, which comprises approximately 37 percent of the waste on the property, is located directly behind the 345 Ferry Boulevard property, and straddles a drainage swale that parallels I-95 and empties into Ferry Creek. The portion of the waste area on the north side of the swale is vegetated, while the portion of the waste area south of the swale is paved. A second, smaller waste area is located approximately 30 feet southwest of the largest area of waste, and comprises about 12 percent of the total waste on the property. This area also straddles the drainage swale to the north and south and contains both vegetated and paved portions. Two

waste areas which comprise 29 and 10 percent of the total waste area are located in the southwestern end of the property. Both of these waste areas are located near the Longbrook tributary, which flows into Ferry Creek, and are heavily vegetated with phragmites and other wetland vegetation. The remaining waste area is located in front of 335 Ferry Boulevard and is covered with pavement. This area is the smallest, comprising about 7 percent of the total waste area for this property.

It is likely infiltration is occurring in the vegetated areas of the property as well as in any areas of cracked pavement. Erosion of soils along the banks of Ferry Creek is also likely. SPLP data indicate lead may be leaching into groundwater. Other data indicate that SVOCs and pesticides in soils may also be leaching into groundwater.

3.12.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at the Vacant DOT Lot Abutting I-95 property that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire property may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.12.5.1 provides an overview of the Vacant DOT Lot Abutting I-95; Section 3.12.5.2 presents COPCs and EPCs; Section 3.12.5.3 contains information on the potential receptors considered and the routes by which they might be exposed; Section 3.12.5.4 contains the numerical results of the risk assessment; and Section 3.12.5.5 presents property-specific uncertainties. Section 3.12.5.6 presents a property-specific summary of the major risk findings.

3.12.5.1 Overview

The Vacant DOT Lot Abutting I-95 is currently an undeveloped commercial property zoned for light industrial use. The area covers approximately 2.4 acres. A detailed description of the property is provided in Section 3.12.1. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.12.2. The nature and extent of the contamination detected at the Vacant DOT Lot Abutting I-95 1s discussed in Section 3.12.3. The areas of the Vacant DOT Lot Abutting I-95 estimated to contain Raymark waste represent an estimated 9 percent of the total 2.4-acre property and are shown in Figure 3-12. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated areas of Raymark waste are summarized in Appendix B-1, Table 2.12.

3.12.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.12 presents a summary of the COPCs for quantitative risk assessment for the Vacant DOT Lot Abutting I-95 soils from the estimated areas of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste of this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.12:

- Asbestos
- PAHs (benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene)
- Aroclors, Total (1268)
- Metals (arsenic, chromium, and lead)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for the property are presented in Appendix B-1, Table 3.12. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.12.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the Vacant DOT Lot Abutting I-95 and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The Vacant DOT Lot Abutting I-95 property is currently an undeveloped commercial property, as described in Section 3.12.1.

Potential Receptors

The receptors retained for quantitative evaluation at the Vacant DOT Lot Abutting I-95 property are future commercial workers. Potentially exposed individuals are limited to those who may work at the property in the future.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities. Under the future land use, commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated areas of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at the Vacant DOT Lot Abutting I-95 are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust is considered to be minimal. The estimated areas of Raymark waste include paved and unpaved areas, as well as areas covered by wetland vegetation and/or phragmites. The presence of pavement and vegetation reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.12.5.4. Asbestos is present in soils within the estimated areas of Raymark waste of the Vacant DOT Lot Abutting I-95 property. The presence of pavement and vegetation suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the

property sizes and FRW values for each property. The FRW for the Vacant DOT Lot Abutting I-95 is 0.09. Chemical intake estimates are provided in Appendix B-1, Tables 7.12 and 8.12.

3.12.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for the Vacant DOT Lot Abutting I-95 is provided in this section. Appendix B-1, Table 7.12 and Table 8.12 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.12. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the future commercial worker at the Vacant DOT Lot Abutting I-95 property are as follows:

	Ingestion	**Dermal**	**Total**
Commercial Worker (Future)	0.11	0.09	0.2

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated areas of Raymark waste at the Vacant DOT Lot Abutting I-95 property is less than unity indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment. See Table 7.12 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the future commercial worker at the Vacant DOT Lot Abutting I-95 property are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	2.9E-06	2.1E-06	5.0E-06

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated areas of Raymark waste is within the EPA cancer risk range (10^{-4} to 10^{-6}) and less than the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.12 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.12, Aroclors have estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 6.7E-06.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste of the Vacant DOT Lot Abutting I-95 property. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 7,360 mg/kg. The average lead concentration in this dataset was 991 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 991 mg/kg for soil within the estimated areas of Raymark waste at the Vacant DOT Lot Abutting I-95 property was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for the Vacant DOT Lot Abutting I-95 property is

0.09. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated areas of Raymark waste at the property, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 0.2 to 0.7 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 21 of the 25 soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 40 percent. These samples were collected from the 0- to 15- foot bgs interval. The average concentration was 6 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos at the property. Based on field conditions in the estimated areas of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.12.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the Vacant DOT Lot Abutting I-95 property are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the

percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the Vacant DOT Lot Abutting I-95 property is 2.4 acres, with an estimated 9 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.12.4. The estimated areas of Raymark waste include paved and unpaved areas and are heavily vegetated with wetland vegetation or phragmites. No consideration was given to site characteristics. It is conceivable that individuals may spend all of their time within the estimated areas of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 9 percent of the time, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately 11 times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 3.6 to 18.7 mg/kg, with an average concentration of 5.1 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxin based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Twenty-five samples, twelve of which were only analyzed by field-screening methods, were included in the dataset for soils within the estimated areas of Raymark waste. Due to the limited numbers of samples analyzed for total Aroclor, dioxins, and PAHs,

maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to risk estimates.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of lead at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Lead is present in soils located outside the estimated areas of Raymark waste at the Vacant DOT Lot Abutting I-95 property at concentrations up to 1800 mg/kg. Fourteen samples from outside the estimated areas of Raymark waste were analyzed for PCBs using CLP methods. None of these samples had concentrations greater than the CT RSRs for industrial soil or the EPA Region IX PRG for industrial soil. The individual Aroclors detected were Aroclors 1254, 1262, and 1268. Copper was detected at concentrations up to 526 mg/kg. Asbestos is present outside the estimated areas of Raymark waste at the property at concentrations up to 10 percent. No analysis of dioxins was performed in samples from outside the estimated areas of Raymark waste. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

3.12.5.6 Summary of Risk Human Health Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at the Vacant DOT Lot Abutting I-95 property. Risks to future commercial workers were estimated.

- The RME hazard indices (HI) for future commercial workers exposed to soil within the estimated areas of Raymark waste at the Vacant DOT Lot Abutting I-95 property are less than unity. Adverse non-carcinogenic health effects are not expected.

- The RME cancer risk estimate for commercial workers exposed to soil within the estimated areas of Raymark waste at the property falls within the EPA cancer risk range (10^{-4} to 10^{-6}) and is less than the CT DEP target total risk level of 10^{-5}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated areas of Raymark waste at the property.

- Asbestos was detected in 21 of the 25 soil samples collected from the estimated areas of Raymark waste at the Vacant DOT Lob Abutting 95 property in the 0- to 15- foot bgs interval at a concentration range of trace to 40 percent. The average concentration was 6 percent.

3.12.6 Ecological Evaluation

The ecological characterization of the wetlands on or near this property was addressed under the OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetlands Evaluation, Raymark-Ferry Creek-OU3* (B&RE, 1998). A summary of the findings is presented below. It should be noted, however, that no individual evaluation of the ecological impacts on this property was performed.

The property is primarily undeveloped and is dominated by upland grass vegetation. Trees and shrubs present on the property include white pine, mulberry, quaking aspen, and gray birch (B&RE 1998b). The property can provide habitat for small birds, reptiles, and mammals. However, because the property is an area of dense residential development, abuts I-95 and Ferry Boulevard and a large portion of the property is mowed regularly, the habitat value of the area is significantly limited.

A portion of the Longbrook tributary flows from west to east outside of the southern property boundary. The tributary flows into Ferry Creek near where Ferry Creek passes under I-95. Longbrook is culverted in the western portion of the site and becomes an open brook near the eastern portion of the property. The open brook portion of the stream is unvegetated and rip-

rapped with cobble-sized rock. Ferry Creek and Longbrook, tidally influenced streams, are ecological resources that have been impacted by filling and are only marginally functional as a resource area.

3.12.7 Summary

This 2.4-acre property abutting Ferry Creek contains Raymark waste. Samples containing metals (including SPLP metals), pesticides, PCBs, and SVOCs that exceed CT DEC and/or CT PMC criteria and asbestos greater than one percent are present on the property. Given the undeveloped property conditions and soil analytical results, infiltration and leaching are likely occurring throughout the property.

The RME hazard indices for commercial workers exposed to soil within the estimated areas of Raymark waste are less than unity, indicating that adverse non-carcinogenic health effects are not expected. The RME cancer risk estimate falls within the EPA cancer risk range and is less than the CT DEP target total risk level. Adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soils within the estimated areas of Raymark waste. The average asbestos concentration at the estimated areas of Raymark waste was 6 percent.

The location of this property in a dense residential area near I-95, and the regular mowing of this property, limit the habitat value of this property. Therefore, it is unlikely that ecological receptors at this property are being adversely impacted by the presence of Raymark waste.

TABLE 3-12
VACANT DOT LOT ABUTTING I-95 - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	41	81	2	5	0.9 , *	40	1	24		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	6	6	0.16	0.16	0.0053 EMPC	0.718				
1,2,3,4,6,7,8-HpCDF	6	6	0.27	0.27	0.017	0.879				
1,2,3,4,7,8,9-HpCDF	3	6	0.0033	0.0062	0.00055 J	0.0116				
1,2,3,4,7,8-HxCDF	6	6	0.066	0.066	0.0047 J	0.191				
1,2,3,6,7,8-HxCDD	3	6	0.0061	0.012	0.0026 J	0.0262				
1,2,3,6,7,8-HxCDF	6	6	0.013	0.013	0.001 J	0.0414				
1,2,3,7,8,9-HxCDD	1	6	0.002	0.011	0.0107 EMPC	0.0107 EMPC				
1,2,3,7,8-PeCDD	1	6	0.00081	0.0042	0.0042 EMPC	0.0042 EMPC				
1,2,3,7,8-PeCDF	4	6	0.0039	0.0057	0.00054 EMPC	0.0186				
2,3,4,6,7,8-HxCDF	6	6	0.033	0.033	0.0037 J	0.0865				
2,3,4,7,8-PeCDF	6	6	0.02	0.02	0.0018 J	0.051				
2,3,7,8-TCDD	1	6	0.00032	0.0014	0.0014	0.0014				
2,3,7,8-TCDF	6	6	0.012	0.012	0.0011 EMPC	0.0369 !				
OCDD	6	6	1.1	1.1	0.108	3.73 J$				
OCDF	6	6	0.11	0.11	0.0025 J	0.521				
Total HpCDD	6	6	0.31	0.31	0.0135 J	1.33				
Total HpCDF	6	6	0.39	0.39	0.0201 J	1.42 EMPC				
Total HxCDD	6	6	0.029	0.029	0.0024 J	0.114 EMPC				
Total HxCDF	6	6	0.42	0.42	0.0222 J	1.4 EMPC				
Total PeCDD	5	6	0.0081	0.0097	0.00078 EMPC	0.0309 EMPC				
Total PeCDF	6	6	0.24	0.24	0.0121 J	0.945 EMPC				
Total TCDD	4	6	0.0063	0.0093	0.00058 J	0.0322 EMPC				
Total TCDF	6	6	0.16	0.16	0.0025 J	0.773 EMPC				
Toxicity Equivalency	6	6	0.029	0.029	0.0022 J	0.0869				

TABLE 3-12 (cont.)
VACANT DOT LOT ABUTTING I-95 - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	25	25	9820	9820	443	24700				
Antimony	4	21	2.9	6.8	1.8 J	12.4 J	8200	0		
Arsenic	19	25	4.2	5	0.83	18.7	10	1		
Barium	25	25	295	295	2.4	3820	140000	0		
Beryllium	17	25	0.44	0.56	0.22 J	1.3 J	2	0		
Cadmium	11	25	0.46	0.7	0.19	1.3	1000	0		
Calcium	25	25	4780	4780	130 J	30200				
Chromium	24	25	25.7	26.7	9.2	68.5	100	0		
Cobalt	25	25	7.7	7.7	0.3 J	21.5	2500	0		
Copper	39	59	327	431	2.1 J	3720	76000	0		
Iron	25	25	15700	15700	729	29900				
Lead	61	85	506	688	18.7 J	7360	1000	9		
Magnesium	25	25	5350	5350	234	24300				
Manganese	25	25	195	195	14.6	330	47000	0		
Mercury	9	25	0.16	0.33	0.13	0.7	610	0		
Nickel	25	25	23.8	23.8	0.78 J	80.9	7500	0		
Potassium	24	25	1570	1620	147	3520 J				
Selenium	1	25	0.49	2.4	2.4 J	2.4 J	10000	0		
Silver	10	25	0.64	0.89	0.33	1.7 J	10000	0		
Sodium	13	25	371	664	74.6	2320 J				
Thallium	2	25	0.44	0.24	0.24 J	0.25	160	0		
Vanadium	25	25	26.5	26.5	1.1 J	53 J	14000	0		
Zinc	25	25	138	138	4.3 J	720 J	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	5	5	23500	23500	1210	39800				
Arsenic	5	6	15.6	18	1.5 J	31			500	0
Barium	6	6	640	640	53.8	1490			10000	0
Beryllium	4	6	2	2.8	1.4	4			40	0

TABLE 3-12 (cont.)
VACANT DOT LOT ABUTTING I-95 - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Cadmium	4	6	2.9	4.2	1.1	6.7			50	0
Calcium	5	5	20200	20200	11900	24200				
Chromium	6	6	19.9	19.9	2.9 J	36.3			500	0
Cobalt	4	5	17	21	17.6	26				
Copper	6	6	297	297	93.1	547			13000	0
Iron	5	5	14600	14600	991	22900				
Lead	6	6	693	693	60	1580			150	4
Magnesium	5	5	4650	4650	3130	9010				
Manganese	5	5	1160	1160	25.9	1790 J				
Nickel	6	6	19.5	19.5	2.6	37.8			1000	0
Potassium	1	5	1450	2940	2940	2940				
Sodium	5	5	5530	5530	1050	20800				
Vanadium	6	6	43.8	43.8	2.8	86.9			500	0
Zinc	5	6	238	285	15	550			50000	0
Semivolatile Organic Compounds (UG/KG)										
2,4-Dimethylphenol	1	14	420	160	160 J	160 J	2500000	0	28000	0
2-Methylphenol	1	14	440	380	380 J	380 J	2500000	0	70000	0
4-Methylphenol	1	14	440	370	370 J	370 J	2500000	0	7000	0
Acenaphthylene	10	15	310	240	24	740 J	2500000	0	84000	0
Anthracene	10	15	290	200	30	580 J	2500000	0	400000	0
Benzaldehyde	1	7	470	46	46 JEB	46 JEB				
Benzo(a)anthracene	12	12	650	650	36 J	1900 J	7800	0	1000	3
Benzo(a)pyrene	13	15	630	690	41 J	2300 J	1000	3	1000	3
Benzo(b)fluoranthene	13	15	830	920	41 J	3300	7800	0	1000	4
Benzo(g,h,i)perylene	12	15	440	490	46 J	2000 J	2500000	0	42000	0
Benzo(k)fluoranthene	13	15	640	700	40 J	2200 J	78000	0	1000	3
bis(2-Ethylhexyl)phthalate	7	15	610	730	22 JEB	3600	410000	0	11000	0

TABLE 3-12 (cont.)
VACANT DOT LOT ABUTTING I-95 - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Butylbenzylphthalate	4	15	460	130	44 J	290	2500000	0	200000	0
Carbazole	7	13	350	110	38 J	190 J	290000	0	360	0
Chrysene	13	15	750	830	52 J	2600	780000	0	1000	3
Dibenzo(a,h)anthracene	6	15	440	180	43 J	400 J	780	0	1000	0
Dibenzofuran	1	15	470	46	46	46	2500000	0	5600	0
Di-n-Butylphthalate	4	15	380	110	42 J	210 JEB	2500000	0	140000	0
Di-n-octylphthalate	1	15	440	570	570 J	570 J	2500000	0	20000	0
Fluoranthene	13	15	1200	1300	82 J	3700	2500000	0	56000	0
Fluorene	5	15	350	130	23 J	260 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	13	13	520	520	27 J	1700 J	7800	0	1000	2
Naphthalene	2	15	370	180	150 J	200 J	2500000	0	56000	0
Phenanthrene	13	15	650	710	41 J	2000 J	2500000	0	40000	0
Phenol	7	12	1700	2600	86 JEB	9800 J	2500000	0	800000	0
Pyrene	13	15	1300	1400	78 J	3800	2500000	0	40000	0
Total PAH	2	2	10000	10000	1936	17980				
Volatile Organic Compounds (UG/KG)										
1,1,1-Trichloroethane	1	15	21	2	2 J	2 J	1000000	0	40000	0
1,1-Dichloroethane	3	15	27	77	12 J	190	1000000	0	14000	0
1,1-Dichloroethene	2	15	22	45	33 J	57	9500	0	1400	0
2-Butanone	15	15	19	19	2 J	52	1000000	0	80000	0
Acetone	4	15	76	180	120 J	270 J	1000000	0	140000	0
Benzene	3	15	22	5	0.5 J	13 J	200000	0	200	0
Bromomethane	2	15	21	2	2	3 J				
Carbon Disulfide	8	15	30	22	2 J	76	1000000	0	140000	0
Chlorobenzene	1	15	17	17	17 J	17 J	1000000	0	20000	0
Chloroform	1	15	22	1	1 J	1 J	940000	0	1200	0
Chloromethane	1	15	21	0.8	0.8 J	0.8 J	440000	0	540	0

TABLE 3-12 (cont.)
VACANT DOT LOT ABUTTING I-95 - SOIL ANALYTICAL RESULTS**
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PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG) (cont.)										
cis-1,2-Dichloroethene	4	13	48	120	3	260				
Cyclohexane	1	13	24	4	4 J	4 J				
Methyl Acetate	1	13	24	15	15 J	15 J				
Methylcyclohexane	1	13	24	2	2 J	2 J				
Methylene Chloride	1	15	22	2	2 J	2 J	760000	0	1000	0
Tetrachloroethene	1	15	21	1	1 J	1 J	110000	0	1000	0
Toluene	4	15	21	3	0.9 J	8 J	1000000	0	67000	0
Total Xylenes	1	15	22	1	1 J	1 J	1000000	0	19500	0
trans-1,2-Dichloroethene	1	13	24	17	17 J	17 J				
Trichloroethene	2	15	23	50	2	98 J	520000	0	1000	0
Vinyl Chloride	3	15	19	21	6 J	41	3000	0	400	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	2	24	5.3	17	13	21	24000	0	29	0
4,4'-DDE	3	24	7.4	36	4.6	89	17000	0	21	1
4,4'-DDT	6	22	15	45	3.7 J	190	17000	0	21	2
alpha-Chlordane	2	24	11	120	2.4	230	2200	0	66	1
Aroclor, Total(4)	41	67	4600	7400	56	139000	10000	4		
Aroclor, Total (Conservative)(5)	40	67	5200	8600	209.5	151000	10000	5		
Aroclor-1248	1	28	73	44	44 J	44 J	10000	0		
Aroclor-1254	9	68	280	370	25 J	750	10000	0		
Aroclor-1260	2	68	260	510	270	750	10000	0		
Aroclor-1262	20	47	1900	4400	53	46000 J	10000	2		
Aroclor-1268	36	70	3100	5900	54	93000 J	10000	4		
beta-BHC	1	24	2.2	3.1	3.1	3.1	3200	0	3.9	0
Dieldrin	2	24	4.9	11	7.8	14	360	0	7	2
Endosulfan Sulfate	7	24	49	160	13 #	630 #	1200000	0	8400	0
Endrin Aldehyde	8	24	13	33	4.3 #	120 #	610000	0		

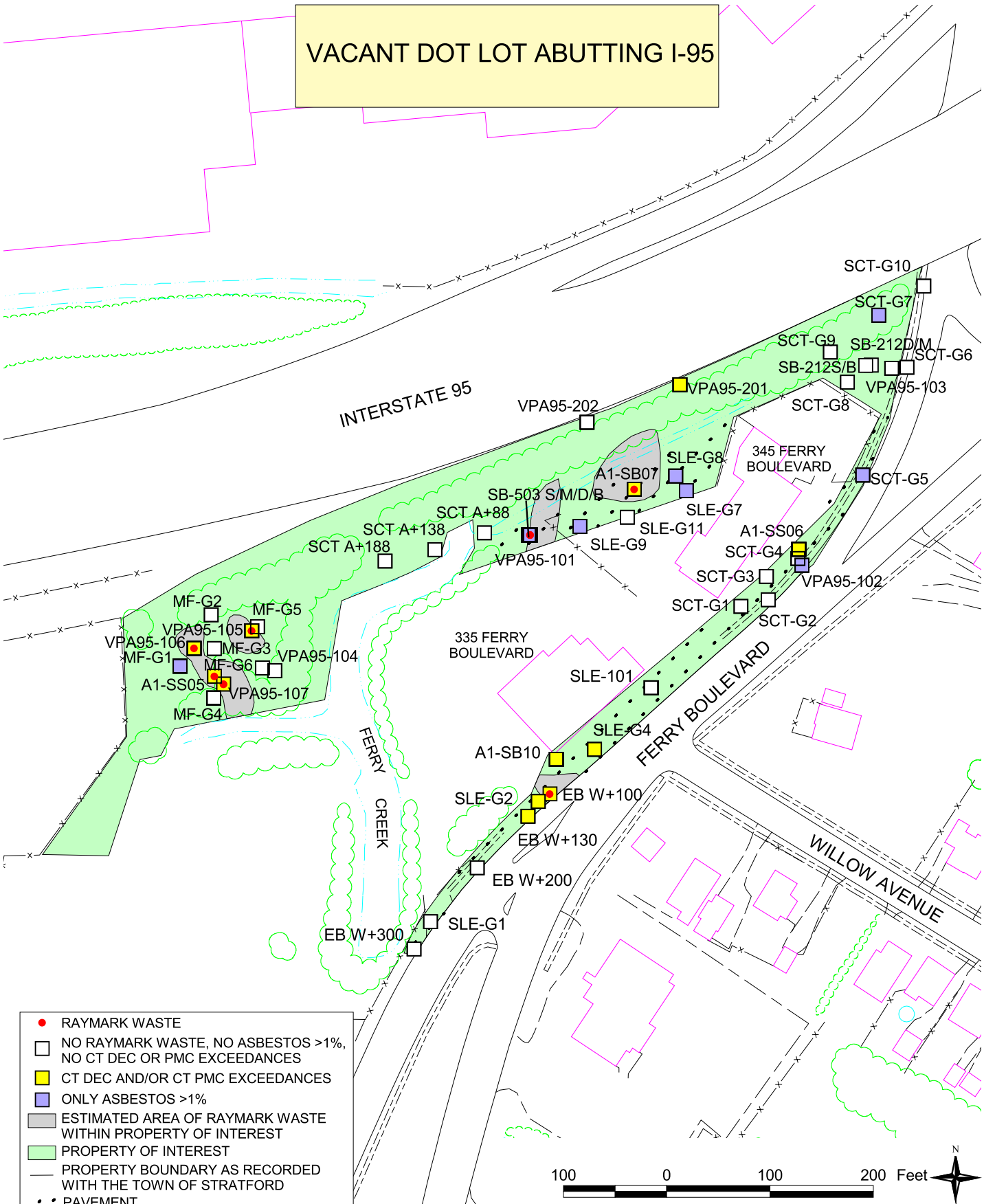
TABLE 3-12 (cont.)
VACANT DOT LOT ABUTTING I-95 - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG)										
Endrin Ketone	2	23	4.4	4.4	3.9	4.9 J	610000	0		
gamma-Chlordane	5	23	5	17	1.1 J	74 J	2200	0	66	1
Heptachlor Epoxide	1	24	3.4	42	42 J	42 J	630	0	20	1
Methoxychlor	1	24	22	34	34	34	10000000	0	8000	0

Qualifier	Definition
!	From dilution analysis
#	Possible false positive due to interference
$	From dilution analysis
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-12
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.13 CT Right-of-Way

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.13.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.13.1 Property Description

This property, approximately 1.9 acres of commercially-zoned (light industrial) land, is located on the western edge of Ferry Boulevard abutting several business, residence, and vacant parcels in Stratford, Connecticut (Town of Stratford, 1997). The parcel is a thin strip of land, both paved and unpaved, that currently serves as a DOT easement. The easement runs north from the intersection of Broad Street and Ferry Boulevard, through the parking lot of a strip mall located at 167-189 Ferry Boulevard, over the driveway of a residential parcel at 191 Ferry Boulevard, abuts the rear of several residential parcels, crosses two vacant vegetated parcels and the paved parking lot of 273 Ferry Boulevard, and ends at the lot at the intersection of Ferry Boulevard and East Broadway. There are no buildings located on this parcel. The ground surface varies between paved and vegetated. The triangular-shaped portion of the lot that comprises the northernmost portion of the property is covered with grass that the town maintains through regular mowing. The only feature present on this portion of the lot is a small stone monument located in the center of the property. There are no storm drains present on this northernmost portion, and Ferry Creek is culverted under this portion of the property.

Public access to the property is not restricted. The intersection of Ferry Boulevard and East Broadway comprises the northern border of the parcel. Ferry Boulevard lies to the east of the entire parcel. The southern boundary of this parcel is Broad Street. In the northernmost portion of the property East Broadway lies to the west. The abutting properties to the west are the parking lot of 273 Ferry Boulevard, a vegetated parcel, several residential parcels, and the strip mall parking lot, moving from north to south. The 576 East Broadway property (see Section 3.10) is located on the opposite side of East Broadway to the northwest.

3.13.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of this property are located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevation for the property is 10 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Eighteen soil borings (FB189-201, FB189-204 through 206, FB191-201 and 202, FBEL-102, 105 and 107, A1-SB01, A1-SB02, FBROW-101 through 105, SB-520SG, and SB-520S) were advanced on the property to depths of up to 22 feet below ground surface (bgs). Soils were not described in boring SB-520SG. Soils noted in borings FB189-201, 204, and 205; FB191-201; FBEL-102, 105, and 107; FBROW-101 through 103; FBROW-105; and SB-520S consist of fill, which overlies sand with varying amounts of silt, trace gravel, and/or trace organics. Materials below the fill may be characteristic of outwash and/or ice-contact deposits. In soil borings A1-SB01, A1-SB02, FB189-206, FB191-202, and FBROW-104, fill overlies soil which may be characteristic of a former marsh and swamp deposit. Soils encountered below the fill in these borings consist of peat or silt-sand mixture with organic material. Refer to Figure 3-13 for boring locations on the property. Boring logs are presented in Appendix A.

Two monitoring wells, MW-520S (a groundwater well) and MW-520SG (a soil gas monitoring station), were installed on this property. MW-520SG is not shown on Figure 3-13 because no soil samples were collected during advancement. Sample locations are shown on Figure 3-13, including both shallow surface samples and deeper samples from soil borings. The borings were used to describe the fill and native material on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify the locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Fill debris identified in soil borings included asphalt, brick, concrete, gasket material, glass, and pipe or tile fragments. These materials were encountered with natural fill consisting of mixtures of sand, silt, and gravel. Potentially asbestos-containing material (PACM) was also observed in the soil from FB191-201 in the form of fibers. Fill classifications were based on the visual characteristics of the soil and sediment samples that were collected during the field investigations. Based on interpretations and field observations, fill

was identified in borings across the property. The depth to water ranges from 3.5 to 9 feet bgs, based on the soil moisture content recorded on the boring logs, and on 2003 water level measurements from the monitoring well on the property.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-13. Raymark waste is present on approximately 5 percent of this property. Two of the three Raymark waste areas are vegetated with grasses that are maintained by regular mowing and one area is under pavement.

3.13.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 86 samples collected from 29 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-13. Samples were analyzed for asbestos, metals, SPLP metals, pesticides, PCBs, VOCs, SVOCs, and dioxin. See Table 3-13 for number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC

and/or CT PMC. A complete set of analytical results for each property is provided in Appendix C. See Table 3-13 for the summary statistics and comparison criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

Asbestos

Eighty-five samples were collected from the property and analyzed for asbestos. Asbestos was detected in 50 of the 85 samples collected from the property. Asbestos at greater than 1 percent was found in 19 of the 85 samples. These samples were distributed throughout the property, and to a maximum depth of 12 feet bgs. The maximum amount of asbestos observed was 15.9 percent.

Dioxins

Two soil samples were collected from this property and analyzed for dioxins. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. The TEQ values of these samples were 0.024 µg/kg and 0.026 µg/kg.

Metals

Samples were collected from the property and analyzed for metals as follows: 16 samples were analyzed at a fixed laboratory; 55 samples were screened for copper; and 67 samples were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. The metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Arsenic, chromium, and lead exceeded the CT DEC regulatory standards on this parcel at two sample locations located throughout the property at depths ranging from surface to 4 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only two of the four SPLP metals samples were taken from within the estimated area of Raymark waste. Two samples exceeded

the CT PMC for lead. The highest exceedance for lead was at a depth of 0 to 2 feet bgs in sample A1-SB02, located within the estimated area of Raymark waste. No TCLP metals samples were collected at this property.

Pesticides

Sixteen soil samples were collected from the property and analyzed for pesticides. Pesticides were frequently detected. Three pesticides, delta-BHC, 4,4'-DDE, and 4,4'-DDT, exceeded the CT PMC regulatory standard. These exceedances ranged from ground surface to 10 feet bgs. No pesticides exceeded the CT DEC at this property.

PCBs

Up to 64 soil samples were collected from the property and analyzed for PCBs as Aroclors. Aroclor 1262 and 1268 were detected in approximately half of the samples from throughout the property. Total Aroclors exceeded CT DEC regulatory standards in one sample at a depth ranging from ground surface to 2 feet bgs. No SPLP or TCLP PCB samples were collected.

SVOCs

Sixteen samples were collected from the property and analyzed for SVOCs. SVOCs were detected frequently on the property. Benzo(a)pyrene exceeded the CT DEC and CT PMC criteria in six samples. Five other SVOCs (PAHs) exceeded the CT PMC at this property. SVOC exceedances occurred at depths ranging from ground surface to 14 feet bgs. SVOC exceedances were scattered throughout the property.

VOCs

Ten soil samples were collected from this property for VOCs analysis. VOCs were rarely detected on the property. There were no compounds that exceeded the CT DEC or CT PMC regulatory standards.

Raymark Waste

The results from five sample locations indicate that Raymark waste is present on the property. The following table displays the locations and constituents of the seven samples from those five locations that meet the definition of Raymark waste on this property. These samples are located within the 5 percent of the property shown on Figure 3-13 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
A1-SD04	2 to 4	10	1,810	1,450	1,800
A1-SB02	6 to 8	3	580	340	NA
FBROW-105	0 to 2	8	732	1,220	19,000
	2 to 4	4	504	390	5,100
FB189-204	2 to 4	1.9	750	816	3,100
FB191-201	4 to 6	4.5	509	357	1,100
	8 to 10	2.4	982	473	990

NA- Contaminant not analyzed

3.13.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas with Raymark waste. The primary pathways for migration of contaminants throughout this property are discussed below.

Approximately 5 percent of this 1.9-acre property is estimated to contain Raymark waste. This parcel is undeveloped, but closely abuts several businesses. The parcel varies between being paved and vegetated with grasses that are mowed regularly by the town. There are three areas of waste present on the property. The waste areas are not continuous; one is located along in the northernmost portion of the property, a second is just south of this northernmost area, and the third is closer to the southern parcel boundary. The northernmost waste area is approximately 10 percent larger than the waste area located just south, but both are entirely vegetated with grass. The third, southernmost waste area is located beneath a paved residential driveway (see Figure 3-13).

SPLP data for the two northern waste areas indicate that metals, specifically lead, could be leaching into groundwater. Other data indicate that some leaching of pesticides and SVOCs into the groundwater may also be occurring. Infiltration of precipitation and surface water runoff, as well as leaching are enhanced at the two northern waste areas by the lack of horizontal barriers such as buildings or pavement. It is assumed that there is little erosion in the northern waste areas, based on the relatively flat contours and the established vegetation of the property. Due to the paved nature of the southern waste area, it is assumed little infiltration is taking place. According to SPLP data, metals do not appear to be leaching to groundwater in this area; however, other data indicate that pesticides and SVOCs in soils may be leaching into the groundwater.

3.13.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the CT Right-of-Way property that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire CT Right-of-Way property may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.13.5.1 provides an overview of the CT Right-of-Way property, Section 3.13.5.2 presents COPCs and EPCs, Section 3.13.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.13.5.4 contains the numerical results of the risk assessment, and Section 3.13.5.5 presents property-specific uncertainties. Section 3.13.5.6 presents a property-specific summary of the major risk findings.

3.13.5.1 Overview

The CT Right-of-Way is currently an undeveloped commercial property zoned for light industrial use. The area covers approximately 1.9 acres. A portion of the property is an easement allowing access to a residential property. The area of this easement covers approximately 0.1 acres and is henceforth referred to as the residential portion of the CT Right-of-Way. A detailed description of the property is provided in Section 3.13.1. The nature and extent of the contamination detected at the CT Right-of-Way property is discussed in Section 3.13.3. The areas of the CT Right-of-Way estimated to contain Raymark waste represent an estimated 5 percent of the total 1.9-acre property and are shown in Figure 3-13. The area of the residential portion of the CT Right-of-Way estimated to contain Raymark waste represents an estimated 43 percent of the total 0.1-acre. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.13.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. A subset of this list including only samples from the estimated area of Raymark waste within the residential portion of the CT Right-of-Way is also presented. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated areas of Raymark waste at the entire CT Right-of-Way property and at the residential portion of the CT Right-of-Way are summarized in Appendix B-1, Tables 2.13A and 2.13B, respectively.

3.13.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Tables 2.13A and 2.13B present summaries of the COPCs for quantitative risk assessment for the CT Right-of-Way soils from the estimated areas of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA

Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. Soil data from the entire CT Right-of-Way property were compared to industrial COPC screening levels. Those chemicals with concentrations exceeding the industrial COPC screening criteria were selected as COPCs for the commercial worker evaluation. Soil data from the residential portion of the CT Right-of-Way property were compared to residential COPC screening levels. Those chemicals with concentrations exceeding the residential COPC screening criteria were selected as COPCs for the resident evaluation. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste of this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.13A:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h) anthracene)
- Aroclors, total (1262 and 1268)
- Metals (arsenic, chromium, and lead)

The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils at the estimated area of Raymark waste of the residential portion of this property to risk-based COPC screening levels for residential land use, as shown in Appendix B-1, Table 2.13B:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene)
- Aroclors, total (1262 and 1268)
- Dioxins
- Metals (arsenic, barium, manganese, and lead)

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for the CT Right-of-Way property are presented in Appendix B-1, Tables 3.13A and 3.13B. Support documentation

for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.13.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the CT Right-of-Way property and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Under current and future conditions, potential human receptors (residents) were assumed to be exposed to soil only within the estimated area of Raymark waste at the residential portion of the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The CT Right-of-Way is a currently undeveloped commercial property, as described in Section 3.13.1. A portion of the property is an easement allowing access to a residential property.

Potential Receptors

The receptors retained for quantitative evaluation at the CT Right-of-Way are future commercial workers and current and future residents. Potentially exposed individuals under the commercial scenario are limited to those who may work at the property in the future. Potentially exposed individuals under the residential scenario include residents who live at the residential property accessed via the easement.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities. Under the future land use,

commercial workers were evaluated for exposure to soils (0 to 15 feet bgs) at a limited area (soils within the estimated areas of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI. The CT Right-of-Way is primarily commercial, however, since it includes an easement allowing access to a residential property, this risk assessment identified residents as the most sensitive receptor for the easement portion of the property. Residents were evaluated for exposure to soils (0 to 14 feet bgs) in the estimated area of Raymark waste at the residential portion of the property, under current and future land use. Persons residing at the residential property accessed via the easement may contact soil within the estimated area of Raymark waste through play or yard-work at their home. Appendix B-1, Table 4.2A presents the exposure assumptions for adult residents at this and other residential properties in the RI. Appendix B-1, Table 4.2B presents the exposure assumptions for child residents at this and other residential properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at the CT Right-of-Way property are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from soils at the property is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. The estimated area of Raymark waste at the residential portion of the property is located beneath pavement. The other estimated areas of Raymark waste are vegetated with grasses. The presence of pavement and vegetation reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at commercial properties. Appendix B-1, Table 2.13A presents available inhalation SSLs for contaminants in soils within the estimated areas of Raymark waste soils at the property.

With the exception of those reported for total chromium, all reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a). Total chromium was

detected slightly exceeding the SSL_{AIR} for hexavalent chromium in one sample, which was collected from the non-residential portion of the property. The average total chromium concentration detected in the Raymark waste soil samples (41.6 mg/kg) is less than the SSL_{AIR} for hexavalent chromium (280 mg/kg). Further evaluation of total chromium concentrations relative to inhalation SSLs for commercial/industrial land use (EPA, 2001a) reveals that all total chromium concentrations detected in the Raymark waste soil samples are less than the commercial/industrial SSL_{AIR} for hexavalent chromium (510 mg/kg). The SSL_{AIR} for chromium assumes that chromium is present in the hexavalent state. The assumption that all chromium is in the hexavalent state is likely to be a conservative assumption.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.13.5.4. Asbestos is present in soils within the estimated areas of Raymark waste of the CT Right-of-Way. The presence of vegetation and pavement and the qualitative comparison to SSLs suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. Appendix B-1, Table 4.2A and Table 4.2B contain the various assumptions used as input parameters to determine chemical intakes for adult and child residents through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for the entire CT Right-of-Way property is 0.05. The FRW for the residential portion of the CT Right-of-Way property is 0.43. Chemical intake estimates for the commercial scenario at the CT Right-of-Way are provided in Appendix B-1, Tables 7.13A and 8.13A. Chemical intake estimates for the residential scenario at the CT Right-of-Way are provided in Appendix B-1, Tables 7.13B, 7.13C, 8.13B, and 8.13C.

3.13.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for the CT Right-of-Way is provided in this section. For the commercial scenario, Appendix B-1, Table 7.13A and Table 8.13A present reasonable maximum non-cancer and cancer risk estimates, respectively. For the adult resident scenario, Appendix B-1, Table 7.13B and Table 8.13B present reasonable maximum non-cancer and cancer risk estimates, respectively. For the child resident scenario, Appendix B-1, Table 7.13C and Table 8.13C present reasonable maximum non-cancer and cancer risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Tables 9.13A, 9.13B, and 9.13C. Appendix B-1, Tables 10.13B and 10.13C reduce the information developed in Appendix B-1, Tables 9.13B and 9.13C to the major risk drivers. Children represent the more sensitive population for non-cancer risks for residents. For cancer risks under the residential scenario, the risks to children and adults are added to produce an estimate of risks from lifetime exposures. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the future commercial worker and current and future residents at the CT Right-of-Way property are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	0.02	0.01	0.03
Resident – Adult (Current and future)	0.17	0.09	0.26
Resident – Child (Current and future)	1.6	0.57	2.2

RME hazard indices for the future commercial worker exposed to soils within the estimated areas of Raymark waste at the CT Right-of-Way are less than unity, indicating that adverse non-carcinogenic health effects are not anticipated for these receptors under the conditions established in the exposure assessment. The RME hazard indices for the adult resident exposed to soils within the estimated area of Raymark waste at the residential portion of the CT

Right-of-Way are less than unity, indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment for adult residents. RME hazard indices (HI) for the child resident exposed to soils within the estimated area of Raymark waste at the residential portion of the CT Right-of-Way are in excess of unity. Total Aroclor was the main contributor to the hazard index for the child resident. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity for child residents. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Tables 7.13A RME, 7.13B RME, and 7.13C RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the future commercial worker and current and future residents at the CT Right-of-Way property are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	1.2E-06	5.7E-07	1.8E-06
Resident – Adult[(1)] (Current and future)	7.8E-06	3.4E-06	1.1E-05
Resident – Child[(1)] (Current and future)	1.8E-05	5.5E-06	2.4E-05

1) Summation of total risk for Resident (adult plus child): 3.5E-05.

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. Cancer risks for the adult and child resident are added together for a lifetime exposure. The RME risk estimate for the commercial worker exposed to soils within the estimated areas of Raymark waste at the CT Right-of-Way falls within the EPA cancer risk range (10^{-4} to 10^{-6}) and is less than the CT DEP target total risk level of 10^{-5} for multiple contaminants. The RME risk estimate for the resident exposed to soils within the estimated areas of Raymark waste at the residential portion of the CT Right-of-Way falls within the EPA cancer risk range (10^{-4} to 10^{-6}) but is greater than the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Tables 8.13A RME, 8.13B RME, and 8.13C RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.13A, under the commercial scenario arsenic, cancer risks for each individual contaminant are less than the CT DEP target risk level for single contaminants of 10^{-6}. As detailed on Appendix B-1, Tables 9.13B and 9.13C, under the residential scenario cancer

risks for benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, Aroclors, arsenic, and dioxins are greater than the CT DEP target risk level of 10^{-6} for single contaminants.

Cancer risk estimates for dioxins, shown on the tables cited above for the residential scenario and included in the discussion above, were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for residents exposed to soils within the estimated area of Raymark waste at the residential portion of this property are 4.4E-05.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste of the CT Right-of-Way. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated areas of Raymark waste at the entire property at a maximum concentration of 1,810 mg/kg. The average lead concentration in this dataset was 401 mg/kg. Lead was detected in samples collected from 0 to 14 feet bgs within the estimated areas of Raymark waste at the residential portion of the property at a maximum concentration of 982 mg/kg. The average lead concentration in this dataset was 494 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 401 mg/kg for soil within the estimated areas of Raymark waste was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for the CT Right-of-Way is 0.05. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated areas of Raymark waste, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 0.2 to 0.6 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to lead in soil by the child resident was evaluated using the EPA IEUBK Model, as discussed in Section 2.7.4.7. The IEUBK model was developed to evaluate exposures to lead by children in a residential setting. The time-weighted exposure point concentration of 212 mg/kg (average lead concentration of 494 multiplied by the FRW of 0.43), as well as several default parameters, was used to estimate blood-lead levels for children in a residential setting.

The estimated geometric mean blood-lead level for children exposed to lead in Raymark waste soil at the residential portion of CT Right-of-Way was 3.5 µg/dL, which is less than the established level of concern of 10 µg/dL. The IEUBK model estimates that 0.13 percent of children are expected to have blood-lead levels greater than 10 µg/dL, which does not exceed the acceptable level of 5 percent. The input parameters used and the results of the IEUBK lead models, estimated blood-lead levels, and probability density histograms are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 19 of the 24 soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 15.9 percent. These samples were collected from the 0- to 15- foot bgs interval. The average concentration was 3 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is “friable” (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos at the CT Right-of-Way. Based on field conditions in the estimated areas of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.13.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the CT Right-of-Way property are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures, assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the CT Right-of-Way property is 1.9 acres, with an estimated 5 percent containing Raymark waste. The area of the residential portion of the CT Right-of-Way property is 0.1 acres, with an estimated 43 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.13.4. There are three distinct areas of Raymark waste on the property. The area within the residential portion of the property is covered by pavement. The other two areas estimated to contain Raymark waste are vegetated with grasses that are maintained by mowing. No consideration was given to site characteristics other than the presence of buildings. Because of the small size of the estimated areas of Raymark waste, it is unlikely that individuals will spend all of their time within those areas. However, if that were the case, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately 20 times greater than those estimated using the FRW factor for commercial workers and two times greater for residents.

- Dioxins were selected as COPCs for the residential scenario. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5

$(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Only 24 samples were included in the dataset for soils within the estimated areas of Raymark waste across the entire property. Fourteen of those samples were only analyzed by field-screening methods. Due to the limited numbers of samples analyzed for dibenzo(a,h)anthracene within the dataset for the commercial scenario, maximum concentrations were used to evaluate risks to this contaminant. Only nine samples were included in the dataset for soils within the estimated area of Raymark waste within the residential portion of the property. Three of those samples were only analyzed by field-screening methods. Due to the limited numbers of samples analyzed for benzo(a)anthracene and dioxins within the dataset for the residential scenario, maximum concentrations were used to evaluate risks to these contaminants. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- In the absence of chromium speciation data, toxicity values for the more toxic species, chromium VI, were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of arsenic and benzo(a)pyrene at concentrations greater than CT RSRs for industrial soil indicates that risks from other areas of the property may be of concern. Arsenic is present in soils located outside the estimated areas of Raymark waste at concentrations up to 26.2 mg/kg. Benzo(a)pyrene is present in soils located outside the estimated areas of Raymark waste at concentrations up to 6.4 mg/kg. Dioxins were analyzed for outside the estimated areas of Raymark waste in one sample. Dioxins were detected outside the estimated areas of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin concentrations outside the estimated areas of Raymark waste are slightly less than the EPA Region IX PRGs for industrial soil. Ten samples from outside the estimated areas of Raymark waste were analyzed for PCBs using CLP methods. None

of these samples had concentrations greater than the CT RSRs for industrial soil or the EPA Region IX PRG for industrial soil. The individual Aroclors detected were Aroclor 1262 and Aroclor 1268. Lead was detected at concentrations up to 920 mg/kg. Copper was detected at concentrations up to 531 mg/kg. Asbestos is also present outside the estimated areas of Raymark waste at concentrations up to 5 percent. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

- A comparison of property soils data from within the residential portion of the property, but outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of arsenic, lead, benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, and PCBs at concentrations greater than CT RSRs for residential soil indicates that risks from other areas of the property may be of concern. Arsenic is present in soils located outside the estimated areas of Raymark waste at concentrations up to 26.2 mg/kg. Benzo(a)anthracene is present in soils located outside the estimated areas of Raymark waste at concentrations up to 1.2 mg/kg. Benzo(a)pyrene is present in soils located outside the estimated areas of Raymark waste at concentrations up to 1.2 mg/kg. Dibenzo(a,h)anthracene is present in soils located outside the estimated areas of Raymark waste at concentrations up to 0.27 mg/kg. Total Aroclors are present in soils located outside the estimated areas of Raymark waste at concentrations up to 3.9 mg/kg. The individual Aroclors detected were Aroclor 1262 and Aroclor 1268. Lead was detected at concentrations up to 899 mg/kg. Dioxins were not analyzed for outside the estimated areas of Raymark waste. Copper was detected at concentrations up to 531 mg/kg. Asbestos is present outside the estimated area of Raymark waste at trace concentrations. Thus, a resident's exposure and risk from the entire residential portion of the property are likely to be greater than that estimated for the area of Raymark waste within the residential portion of the property alone.

3.13.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at the CT Right-of-Way property. Risks to future commercial workers worker and current and future residents were estimated.

- RME hazard indices (HI) for the future commercial workers worker exposed to soil within the estimated areas of Raymark waste at the CT Right-of-Way were less than unity, indicating that adverse non-carcinogenic health effects are not anticipated for these receptors under the conditions established in the exposure assessment. RME hazard indices (HI) for the child resident, but not the adult, exposed to soil within the estimated area of Raymark waste at the residential portion of the CT Right-of-Way were in excess of unity. The chemical specific (and target organ-specific) hazard quotients for total Aroclors alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposures to Aroclors.

- The RME cancer risk estimate for the commercial worker exposed to soil within the estimated areas of Raymark waste falls within the EPA cancer risk range (10^{-4} to 10^{-6}) and is less than the CT DEP target total risk level of 10^{-5} for multiple contaminants. The RME cancer risk estimates for residents exposed to soil at the estimated area of Raymark waste at the residential portion of the property fall within the EPA cancer risk range (10^{-4} to 10^{-6}) but are greater than the CT DEP target total risk level of 10^{-5}. Cancer risks for benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, Aroclors, arsenic, and dioxins exceed the CT DEP target risk level of 10^{-6} for single contaminants.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated areas of Raymark waste at the CT Right-of-Way.

- Exposure to lead in soil by child residents was evaluated by use of the IEUBK model. The results of the model indicate that adverse effects are not anticipated for child residents exposed to lead in soil at the estimated area of Raymark waste at the residential portion of the property.

- Asbestos was detected in 19 of the 24 soil samples collected in the 0- to 15- bgs foot interval from the estimated areas of Raymark waste at a concentration range of trace to 15.9 percent. The average concentration was 3 percent.

3.13.6 Ecological Evaluation

No ecologically significant habitats appear to be located on this property. The ecological characterization of the wetlands in the vicinity of this property were addressed under OU3 RI Area I (TtNUS, 1999a) and is presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark-Ferry Creek-OU3 (*B&RE, 1998b*).*

This property is undeveloped but has been disturbed by filling operations at the various properties abutting the parcel, as well as activities along Ferry Boulevard. The property is covered by pavement in some areas, as well as grass that receives regular mowing by the town. No formal ecological evaluation was performed. Given the surrounding development and property disturbances, it is unlikely that there are ecological receptors that are being adversely impacted by the presence of Raymark waste on this property.

3.13.7 Summary

This approximately 1.9 acre property is a DOT easement that runs along the western side of Ferry Boulevard, adjacent to several residential, commercial and vacant properties. This parcel contains Raymark waste at the northern and southern ends. Soil samples containing metals, pesticides, total Aroclors, and SVOCs exceeding state criteria, dioxin, and greater than one percent asbestos were collected on the property. Given the undeveloped property conditions, infiltration and leaching is likely occurring in the two northern areas of Raymark waste.

The human health risk assessment concluded that adverse non-carcinogenic health risks are possible for child residents, but are not anticipated for commercial workers or adult residents exposed to soils within the estimated areas of Raymark waste. The cancer risk estimates for commercial workers and residents exposed to soils within the estimated areas of Raymark waste fall within the EPA cancer risk range. The cancer risk estimates for commercial workers exposed to soils within the estimated areas of Raymark waste is less than the CT DEP target total risk level. The cancer risk estimates for residents exposed to soils within the estimated area of Raymark waste at the residential portion of the property are greater than the CT DEP target total risk level. Cancer risks for benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, Aroclors, arsenic, and dioxins exceed the CT DEP target risk level of 10^{-6} for single contaminants. Adverse effects are not anticipated on fetuses of pregnant workers

or child residents exposed to lead in the soil within the estimated areas of Raymark waste. Asbestos was detected at an average concentration of 3 percent in the estimated areas of Raymark waste.

Ecological risks have not been quantified for this property.

TABLE 3-13
CT RIGHT OF WAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	50	85	1	2	0.9 , *	15.9 *	1	19		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	2	2	0.15	0.15	0.0189	0.276				
1,2,3,4,6,7,8-HpCDF	2	2	0.28	0.28	0.19	0.369				
1,2,3,4,7,8,9-HpCDF	2	2	0.0039	0.0039	0.0036	0.0042 J				
1,2,3,4,7,8-HxCDD	2	2	0.0031	0.0031	0.00033 EMPC	0.0058				
1,2,3,4,7,8-HxCDF	2	2	0.064	0.064	0.0423	0.0857				
1,2,3,6,7,8-HxCDD	2	2	0.0086	0.0086	0.0012 J	0.016				
1,2,3,6,7,8-HxCDF	2	2	0.015	0.015	0.0112	0.018				
1,2,3,7,8,9-HxCDD	2	2	0.0057	0.0057	0.00096 J	0.0105				
1,2,3,7,8-PeCDD	1	2	0.0017	0.0033	0.0033	0.0033				
1,2,3,7,8-PeCDF	2	2	0.0038	0.0038	0.0031	0.0045 J				
2,3,4,6,7,8-HxCDF	2	2	0.026	0.026	0.0225	0.0302 J				
2,3,4,7,8-PeCDF	2	2	0.013	0.013	0.012	0.014				
2,3,7,8-TCDF	2	2	0.0047	0.0047	0.0047 , J	0.0047 , J				
OCDD	2	2	2	2	1.58	2.44				
OCDF	2	2	0.067	0.067	0.0621	0.0711				
Total HpCDD	2	2	0.26	0.26	0.0392 J	0.479				
Total HpCDF	2	2	0.34	0.34	0.262	0.416 J				
Total HxCDD	1	2	0.047	0.091	0.0911	0.0911				
Total HxCDF	2	2	0.35	0.35	0.284	0.415 EMPC				
Total PeCDF	2	2	0.13	0.13	0.114 EMPC	0.146				
Total TCDF	2	2	0.09	0.09	0.0595 EMPC	0.12				
Toxicity Equivalency	2	2	0.025	0.025	0.024 J	0.026				
Metals (MG/KG)										
Aluminum	16	16	9660	9660	4640	32100 J				
Antimony	1	12	1.2	8.8	8.8 J	8.8 J	8200	0		
Arsenic	16	16	11.5	11.5	2.5	80.3	10	2		

TABLE 3-13 (cont.)
CT RIGHT OF WAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG) (cont.)										
Barium	16	16	387	387	32.9	1390	140000	0		
Beryllium	7	16	0.35	0.63	0.31	1.6	2	0		
Cadmium	5	16	0.54	1.6	0.083 J	7.1 J	1000	0		
Calcium	16	16	1700	1700	704	5980				
Chromium	16	16	31.3	31.3	6.1	287	100	1		
Cobalt	16	16	5.8	5.8	2.3	19.5 J	2500	0		
Copper	43	71	192	244	21.8 J	1450 J	76000	0		
Iron	16	16	16900	16900	7490	64500				
Lead	63	83	240	301	21	1810 J	1000	1		
Magnesium	16	16	3850	3850	1600	13200				
Manganese	16	16	195	195	109 J	492	47000	0		
Mercury	3	16	0.044	0.074	0.054 J	0.088 J	610	0		
Nickel	16	16	20.7	20.7	5.7	117 J	7500	0		
Potassium	16	16	1230	1230	627	2430				
Selenium	3	16	0.44	0.59	0.54 J	0.64	10000	0		
Sodium	16	16	411	411	95 J	2170 J				
Thallium	1	12	0.91	3.5	3.5	3.5	160	0		
Vanadium	16	16	31.9	31.9	11.3	143	14000	0		
Zinc	16	16	138	138	34.5	588	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	2	2	40000	40000	37100 J	42900 J				
Arsenic	2	4	11.3	21.4	12.2	30.5			500	0
Barium	3	4	785	1000	283 J	1740 J			10000	0
Beryllium	2	4	2.3	4.5	4.3	4.8			40	0
Cadmium	3	4	4.2	5.5	0.31 J	10.2			50	0
Calcium	2	2	21600	21600	21300 J	21800 J				
Chromium	2	4	12.2	23.5	21.2 J	25.8 J			500	0
Cobalt	2	2	21.2	21.2	21.1	21.3				

TABLE 3-13 (cont.)
CT RIGHT OF WAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Copper	4	4	995	995	38.9	2620 J			13000	0
Iron	2	2	23400	23400	15400 J	31500 J				
Lead	4	4	1840	1840	67.1	4960 J			150	2
Magnesium	2	2	3150	3150	2840	3460				
Manganese	2	2	1740	1740	1510 J	1970 J				
Nickel	4	4	23.9	23.9	2.7 J	43.7 J			1000	0
Potassium	1	2	2540	3980	3980 J	3980 J				
Sodium	2	2	7700	7700	7140	8260				
Thallium	1	4	3.2	6.2	6.2	6.2			50	0
Vanadium	3	4	65.8	87.6	2.8	148			500	0
Zinc	3	4	333	440	47.6 J	756			50000	0
Semivolatile Organic Compounds (UG/KG)										
1,1'-Biphenyl	1	10	250	140	140 J	140 J				
2-Methylnaphthalene	4	16	650	180	37 J	610	2500000	0	9800	0
Acenaphthene	6	16	660	420	39 J	2000 J	2500000	0	84000	0
Acenaphthylene	15	16	440	410	72 J	1600 J	2500000	0	84000	0
Anthracene	15	16	520	500	52 J	2900 J	2500000	0	400000	0
Benzo(a)anthracene	16	16	1500	1500	320 J	6800 J	7800	0	1000	7
Benzo(a)pyrene	16	16	1400	1400	320 J	6400 J	1000	6	1000	6
Benzo(b)fluoranthene	16	16	1400	1400	340 J	6000 J	7800	0	1000	4
Benzo(g,h,i)perylene	16	16	510	510	160 J	2600 J	2500000	0	42000	0
Benzo(k)fluoranthene	16	16	1500	1500	250 J	6000 J	78000	0	1000	6
bis(2-Ethylhexyl)phthalate	4	16	810	1200	41 JEB	4200	410000	0	11000	0
Carbazole	13	16	520	140	36 J	350	290000	0	360	0
Chrysene	16	16	1600	1600	350 J	7300 J	780000	0	1000	7
Dibenzo(a,h)anthracene	8	16	640	180	96 J	280	780	0	1000	0
Dibenzofuran	9	16	560	180	42 J	460	2500000	0	5600	0

TABLE 3-13 (cont.)
CT RIGHT OF WAY - SOIL ANALYTICAL RESULTS**
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RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Fluoranthene	16	16	3500	3500	520 J	17000 J	2500000	0	56000	0
Fluorene	15	16	320	280	29 J	1200 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	16	16	720	720	170 J	3800 J	7800	0	1000	2
Naphthalene	5	16	560	150	43 J	290 J	2500000	0	56000	0
Phenanthrene	16	16	1800	1800	200 J	12000 J	2500000	0	40000	0
Phenol	2	16	610	520	290	740 J	2500000	0	800000	0
Pyrene	16	16	2900	2900	510 J	14000 J	2500000	0	40000	0
Total PAH	1	1	7700	7700	7690	7690				
Volatile Organic Compounds (UG/KG)										
Acetone	1	10	18	110	110	110	1000000	0	140000	0
Methyl Acetate	1	10	5	15	15	15				
Toluene	1	10	4	7	7 J	7 J	1000000	0	67000	0
Trichloroethene	1	10	3	1	1 J	1 J	520000	0	1000	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	10	16	6.3	8.8	3.8	17 J	24000	0	29	0
4,4'-DDE	9	16	13	22	1.8 J	100	17000	0	21	2
4,4'-DDT	11	16	54	78	4.3	510	17000	0	21	7
alpha-BHC	2	16	0.9	0.17	0.083 J	0.26 J	910	0	1.1	0
alpha-Chlordane	3	16	1.5	3.7	0.78 J	7.8	2200	0	66	0
Aroclor, Total (4)	38	55	1600	2400	30	29000	10000	1		
Aroclor, Total (Conservative) (5)	38	55	1900	2800	193.5	34500	10000	1		
Aroclor-1262	30	61	760	1500	58 J	10000 J	10000	0		
Aroclor-1268	39	64	870	1400	30 J	19000 J	10000	1		
delta-BHC	2	16	1	1.4	1.1 J	1.6	910	0	1.1	1
Endosulfan II	1	14	2.4	8.3	8.3	8.3	1200000	0	8400	0
Endosulfan Sulfate	2	16	2.3	5.2	1.6 J	8.9	1200000	0	8400	0

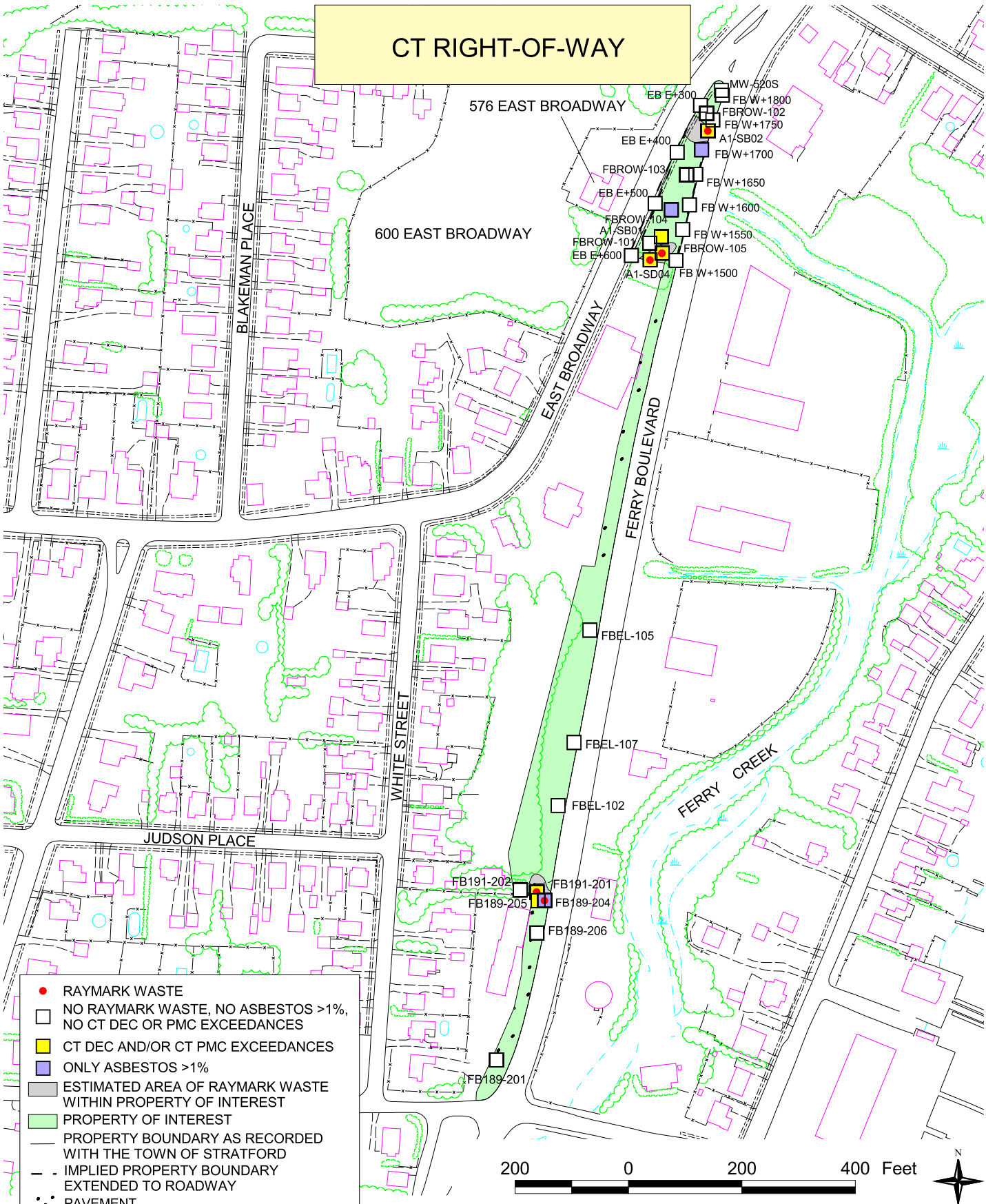
TABLE 3-13 (cont.)
CT RIGHT OF WAY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
Endrin	1	16	1.8	0.46	0.46 J	0.46 J	610000	0		
Endrin Aldehyde	1	16	4.3	39	39	39	610000	0		
Endrin Ketone	2	16	2.6	7.6	4.2 #	11 J#	610000	0		
gamma-Chlordane	6	16	1.7	2.8	1.7 J	6.3	2200	0	66	0
Heptachlor	2	16	1	0.98	0.86 J	1.1 J	1300	0	13	0
Heptachlor Epoxide	1	16	0.94	0.22	0.22 J	0.22 J	630	0	20	0
Total Organic Carbon (MG/KG)										
Total Organic Carbon	2	2	57000	57000	29800	84600				

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-13
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.14 304 East Main Street

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.14.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.14.1 Property Description

This property, approximately 0.3 acres of commercially-zoned (retail/light industrial) land, is located on East Main Street in Stratford, Connecticut (Town of Stratford, 1997). The property is currently occupied by a small business. The only permanent structure on the property is a one-story, stucco building located along the western edge of the property. A fence, running north to south, bisects the property and extends behind the abutting 302 and 340 East Main Street (see Section 3.15) properties as well. The area from East Main Street extending east to the fence (roughly half of the property) is paved and contains the lone building. The area west of the fence in the rear of the property is not paved and is contiguous with the rear portions of the adjacent 302 and 340 East Main Street properties. No storm drains were visible on the property, although one is nearby on East Main Street. Various trailers, sheds, piles of debris, and machinery were observed on the rear portions of all three of these properties. The three properties have the same owner, and in conversations with this owner, he indicated that he uses all three lots interchangeably for storage.

The Town DPW lot (see Section 3.18) is located on the opposite side of East Main Street to the west, with commercial and residential properties to the north and south. A large office building at 250 East Main Street (see Section 3.17) abuts the property to the east. Public access is limited to the rear of the property by a chain-link fence with barbed wire.

3.14.2 Physical Characteristics

The property is located outside the 100-year floodplain of the Housatonic River, as observed from Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Stratford, Connecticut (FEMA, 1992). The 100-year floodplain is delineated on Figure 1-2.

Eight soil borings (ES304-101 through 104, ES340-105, and ES304-201 through ES304-202), were advanced on the property to depths of up to 14 feet below ground surface (bgs). Soil in ES304-102 may be characteristic of native materials. In borings ES304-101, 103, 104, 201, and 202, and ES340-105, fill overlies soils characteristic of a former marsh and swamp deposit. These soils consist of peat, silt with trace amounts of fine sand and organic material, sandy silt with trace amounts of organic material, or organic silt. Sands with an appreciable amount of fines were logged beneath the marsh and swamp deposit in borings ES304-101 and ES304-103. Sands with few fines were noted below the silty sand layer in boring ES304-102. All of the materials beneath the marsh and swamp deposit may be characteristic of locally derived outwash deposits and/or ice-contact deposits. Soil below the asphalt sub-base in boring ES304-102 consists of sand with trace percentages of silt and gravel and may be native material. Refer to Figure 3-14 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Soil sample locations are shown on Figure 3-14. The borings were used to describe the fill and native material on the property. All soil sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Fill debris identified in the soil from borings ES304-101, ES304-103, ES304-104, and ES340-105 included PACM (potentially asbestos-containing material), brick, glass, metal wire, and slag. PACM was noted in borings ES304-104 and ES340-105. The manmade materials were encountered with natural fill consisting of sand, silty sand, and varying amounts of gravel. Debris was not identified beneath the asphalt surface in boring ES304-102. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was only identified in borings in the central and eastern portions of the property. Fill was not identified in boring ES304-102. The depth to water ranges from 2.5 to 9 feet bgs, based on soil moisture content recorded on boring logs.

Raymark waste was found in fill materials on this property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These

approximate limits are shown on Figure 3-14. Approximately 41.7 percent of this property is estimated to contain Raymark waste. Most of the estimated area of Raymark waste is located on the rear (east) of the property and is partially covered with grass.

3.14.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

A total of 34 soil samples were collected from eight locations on this property. Sample locations with exceedances of CT DEC and CT PMC are indicated on Figure 3-14. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-14 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-14 for the soil data summary statistics and comparison to criteria. The discussion below includes all soil samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Thirty-four samples were collected from the property and analyzed for asbestos. Asbestos was detected 24 of the 34 samples. Asbestos at greater than 1 percent was found in 11 of the 34 samples. These detections were scattered throughout the property at depths ranging from 2 to 10 feet bgs. The maximum amount of asbestos observed at the property was 50 percent.

Dioxins

One sample was collected from the property and analyzed for dioxins. Dioxins were detected in this sample, ES304-104, at a depth of 4 to 6 feet bgs, located in the eastern area of the property. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for explanation of TEQ. The TEQ value was 0.474 µg/kg.

Metals

Samples were collected from the property and analyzed for metals as follows: nine samples were analyzed for metals in a fixed laboratory; and 24 samples were screened for copper and lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Arsenic and lead concentrations exceeded the CT DEC regulatory standards. Arsenic concentrations exceeded the CT DEC at two sample locations, both located in the eastern area of the property at depths ranging from 2 to 10 feet bgs. Lead concentrations exceeded the CT DEC in two sample locations, at depths ranging from 2 to 8 feet bgs, in the central and eastern areas of the property. The highest concentrations of both lead and arsenic were detected at sample location, ES304-104, at a depth of 6 to 8 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, one sample was collected and analyzed for SPLP metals. Lead was the only metal to exceed the CT PMC. This one CT PMC exceedance was located within the estimated area of Raymark waste at a depth of 2 to 4 feet

bgs, indicating the potential for lead to leach into groundwater at this location. No TCLP samples were collected on this property.

Pesticides

Eight soil samples were collected from the property and analyzed for pesticides. Pesticides were detected sporadically on the property, with no exceedances of the CT DEC regulatory standards. Three pesticides exceeded the CT PMC regulatory standard at depths ranging from ground surface to 6 feet bgs. These exceedances were all located in the eastern portion of the property.

PCBs

Up to 31 soil samples were collected from the property and analyzed for PCBs as Aroclors. PCBs were detected in more than half of the samples from this property. Six samples exceeded the CT DEC for total Aroclors. These exceedances ranged in depth from 2 to 10 feet bgs, and were concentrated on the eastern half of the property. The total PCB concentrations at these locations were comprised primarily of Aroclors 1262 and 1268. No SPLP/TCLP PCB samples were collected.

SVOCs

Seven soil samples were collected from the property and analyzed for SVOCs. SVOCs were detected sporadically on the property. One SVOC, bis(2-ethylhexyl)phthalate, exceeded the CT PMC regulatory standard; no SVOCs exceeded the CT DEC regulatory standard. This exceedance was located in the northeastern corner of the property, at a depth of 2 to 4 feet bgs.

VOCs

Eight soil samples were collected from the property and analyzed for VOCs. VOCs were not frequently detected on the property. There were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from three sample locations indicate that Raymark waste is present on the property. The following table displays the location and constituents of the nine samples that meet the definition of Raymark waste on this property. These samples are located within the 41.7 percent of the property shown on Figure 3-14 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
ES304-104	2 to 4	30	417	218	5,200
	4 to 6	25	12,700	24,100	190,000
	6 to 8	30	43,400	25,100	NA
ES304-201	2 to 4	3	2,480	2,780	17,000
	4 to 6	10	4,250	6,730	63,000
	6 to 8	27	7,130	6,740	5,600
	8 to 10	1.6	1,110	1,790	6,900
ES340-105	2 to 4	40	10,100	20,900	150,000
	4 to 6	50	5,260	17,400	220,000

NA – Contaminant was not analyzed

3.14.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 44 percent of the 0.3-acre property exclusive of buildings contains Raymark waste. The waste is located along the eastern end of the property (see Figure 3-14). Over 75 percent of the entire property is covered by either a building, pavement, or debris. The figure shows buildings and pavement, but does not show the area covered by debris. Most of the contaminated soils are covered by grass. As indicated by SPLP and other data, metals, pesticides, and SVOCs may leach into the groundwater.

It is assumed that the cracked pavement and debris areas allow limited infiltration. SPLP data indicate that lead could potentially leach from contaminated soils into the groundwater. Other data indicate that pesticides and SVOCs could leach into the groundwater. No storm drains

were visible on the property, although one is nearby on East Main Street. Dirt patches in the rear of the property could allow for some limited erosion of surface soils.

3.14.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at 304 East Main Street that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire property at 304 East Main Street may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.14.5.1 provides an overview of the 304 East Main Street property, Section 3.14.5.2 presents COPCs and EPCs, Section 3.14.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.14.5.4 contains the numerical results of the risk assessment, and Section 3.14.5.5 presents property-specific uncertainties. Section 3.14.5.6 presents a property-specific summary of the major risk findings.

3.14.5.1 Overview

304 East Main Street is a commercial property of approximately 0.3 acres. A detailed description of the property is provided in Section 3.14.1. The nature and extent of the contamination detected at 304 East Main Street is discussed in Section 3.14.3. The area of the property estimated to contain Raymark waste represents an estimated 44 percent of the total 0.3-acre property, exclusive of any buildings, and is shown in Figure 3.14. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.14.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics

(frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at the 304 East Main Street property are summarized in Appendix B-1, Table 2.14.

3.14.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.14 presents a summary of the COPCs for quantitative risk assessment for 304 East Main Street soils from the estimated area of Raymark waste to a depth of 12 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste of this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.14:

- Asbestos
- Acetophenone
- Benzo(a)pyrene
- Aroclors, Total (1262 and 1268)
- Metals (arsenic, barium, chromium, lead, and zinc)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for the 304 East Main Street property are presented in Appendix B-1, Table 3.14. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.14.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 304 East Main Street and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 304 East Main Street is a commercial property, as described in Section 3.14.1.

Potential Receptors

The receptors retained for quantitative evaluation at 304 East Main Street are current and future commercial workers. Potentially exposed individuals are limited to those who work at 304 East Main Street.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 12 feet bgs) at a limited area (soils within the estimated area of Raymark waste) only. Appendix B-1, Table 4.1 presents

the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 304 East Main Street are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from the property is considered to be minimal. Most of the estimated area of Raymark waste is covered by grass. The presence of grass reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.14.5.4. Asbestos is present in soils within the estimated area of Raymark waste of 304 East Main Street. The presence of grass suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 304 East Main Street is 0.44. Chemical intake estimates are provided in Appendix B-1, Tables 7.14 and 8.14.

3.14.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 304 East Main Street is provided in this section. Appendix B-1, Table 7.14 and Table 8.14 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and

carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.14. Appendix B-1, Table 10.14 reduces the information developed in Appendix B-1, Table 9.14 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 304 East Main Street are as follows:

	Ingestion	**Dermal**	**Total**
Commercial Worker (Current and future)	11.1	10.1	21.2

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated area of Raymark waste is in excess of unity. Total Aroclor was the main contributor to the hazard index for the commercial worker. The chemical-specific (and target-organ specific) hazard quotients for total Aroclor alone are in excess of unity for commercial receptors. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. See Table 7.14 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 304 East Main Street are as follows:

	Ingestion	**Dermal**	**Total**
Commercial Worker (Current and future)	2.0E-04	1.5E-04	3.1E-04

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated area of Raymark waste exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5} for multiple

contaminants. See Table 8.14 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.14, dioxins, Aroclors, and arsenic are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 3.6E-04.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste of the 304 East Main Street property. Lead was detected in samples collected from 0 to 12 feet bgs within the estimated area of Raymark waste at a maximum concentration of 43,400 mg/kg. The average lead concentration in this dataset was 5,910 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 5,910 mg/kg for soil within the estimated area of Raymark waste was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for 304 East Main Street is 0.44. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated area of Raymark waste at 304 East Main Street, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 17 to 20 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 15 of the 16 soil samples collected from the estimated area of Raymark waste at a concentration range of trace to 50 percent. These samples were collected from the 0- to 12-foot bgs interval. The average concentration was 16 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of grass in the estimated area of Raymark waste reduces the potential for airborne asbestos at 304 East Main Street. Based on field conditions in the estimated area of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.14.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 304 East Main Street are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the

percent of the property estimated to contain Raymark waste. The total area of the 304 East Main Street property is 0.3 acres, with an estimated 44 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.14.4. The estimated area of Raymark waste at this property is mostly covered by grass. No consideration was given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated area of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 44 percent of the time, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately 2.3 times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown in Appendix B-1, Table 2.14, along side site-specific data from the estimated area of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 4.6 to 21.9 mg/kg, with an average concentration of 11.7 mg/kg. Chromium, with an average background concentration of 17.0 mg/kg, was detected at concentrations ranging from 3.6 to 76.5 mg/kg, with an average concentration of 26.5 mg/kg. Risks due to arsenic and chromium may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Fifteen samples were included in the dataset for soils within the estimated area of Raymark waste; however, six of the samples were only analyzed by field-screening methods. Due to the limited numbers of samples analyzed for dioxins, Aroclors, acetophenone, barium, chromium, and zinc, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 12 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers. Additionally, future commercial workers may be exposed to soils currently located at depths up to 15 feet bgs, which is the depth considered as accessible by CT DEP (CT DEP, 1996). The absence of samples collected in the 12- to 15- foot bgs interval adds uncertainty to risks estimated for the future commercial worker.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of soils data from the property outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of lead at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Lead is present in soils located outside the estimated area of Raymark waste of 304 East Main Street at concentrations up to 1,300 mg/kg. Asbestos also is present outside the estimated area of Raymark waste at concentrations up to 2 percent. Samples collected outside of the estimated area of Raymark waste were not analyzed for dioxins. There were no samples analyzed for PCBs by CLP methods, however, field-screening PCB results showed total Aroclors present at a maximum concentration of 1.06 mg/kg, slightly exceeding the EPA Region IX PRGs for industrial soil (1.0 mg/kg). The Aroclor detected was Aroclor 1268. Copper was also detected in the soils outside of the estimated area of Raymark waste, at a maximum concentration of 4,010 mg/kg. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.14.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at 304 East Main Street. Risks to current and future commercial workers were estimated.

- The RME hazard indices (HI) for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 304 East Main Street are in excess of unity. The chemical-specific (and target-organ specific) hazard quotients for total Aroclor alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposure to Aroclors.

- The RME cancer risk estimates for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 304 East Main Street exceed the EPA cancer risk range (10^{-4} to 10^{-6}) and the CT DEP target total risk level of 10^{-5}. Dioxin, Aroclors, and arsenic are the predominant risk drivers, with estimated cancer risks greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste at 304 East Main Street.

- Asbestos was detected in 15 of the 16 soil samples collected from the estimated area of Raymark waste at 304 East Main Street in the 0- to 12- foot bgs interval at a concentration range of trace to 50 percent. The average concentration was 16 percent.

3.14.6 Ecological Evaluation

No formal ecological evaluation of this property has been performed. Since most of the property has been disturbed by development and filling, it is unlikely that there are ecological receptors that are being adversely impacted by the presence of Raymark waste on this property.

3.14.7 Summary

This 0.3-acre property contains Raymark waste. It appears that Raymark waste is present on the eastern portion of the property behind the fence. Samples containing metals, SPLP metals, pesticides, PCBs, and/or SVOCs that exceed the CT DEC and/or CT PMC criteria, and/or asbestos at greater than 1 percent were collected from the property. Limited infiltration is likely occurring in areas of the property containing buildings, sheds, debris, or pavement. The grass area at the rear of the property would support some infiltration, and analytical results indicate that some limited leaching of lead, pesticides, and SVOCs may be occurring. Some erosion of surface soils may be occurring at the rear of the property where vegetation is sparse.

The RME hazard indices for commercial workers exposed to soils within the estimated area of Raymark waste are in excess of unity, indicating that non-carcinogenic health effects are possible. The RME cancer risk estimates exceed the EPA cancer risk range and the CT DEP target total risk level. Dioxin, Aroclors, and arsenic are the predominant risk drivers. Adverse effects are anticipated on fetuses of pregnant workers exposed to lead in the soil within the estimated area of Raymark waste. The average asbestos concentration in the estimated area of Raymark waste was 16 percent.

Since no ecologically significant habitats were identified on the property, ecological risks were not evaluated.

TABLE 3-14
304 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	24	34	8	11	Trace	50	1	11		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	1	1	0.17	0.17	0.172	0.172				
1,2,3,4,6,7,8-HpCDF	1	1	1.2	1.2	1.25 $	1.25 $				
1,2,3,4,7,8,9-HpCDF	1	1	0.014	0.014	0.0138 EMPC	0.0138 EMPC				
1,2,3,4,7,8-HxCDF	1	1	1.4	1.4	1.4	1.4				
1,2,3,6,7,8-HxCDF	1	1	0.16	0.16	0.157	0.157				
1,2,3,7,8-PeCDF	1	1	0.16	0.16	0.155 J	0.155 J				
2,3,4,6,7,8-HxCDF	1	1	0.46	0.46	0.457	0.457				
2,3,4,7,8-PeCDF	1	1	0.47	0.47	0.469	0.469				
2,3,7,8-TCDF	1	1	0.17	0.17	0.166 !	0.166 !				
OCDD	1	1	1.9	1.9	1.86 J	1.86 J				
OCDF	1	1	0.53	0.53	0.527 J	0.527 J				
Total HpCDD	1	1	0.34	0.34	0.341	0.341				
Total HpCDF	1	1	1.4	1.4	1.36 EMPC$	1.36 EMPC$				
Total HxCDF	1	1	2.7	2.7	2.66 EMPC$	2.66 EMPC$				
Total PeCDD	1	1	0.15	0.15	0.146 EMPC	0.146 EMPC				
Total PeCDF	1	1	2.8	2.8	2.78 EMPC	2.78 EMPC				
Total TCDF	1	1	0.89	0.89	0.886 EMPC	0.886 EMPC				
Toxicity Equivalency	1	1	0.47	0.47	0.474	0.474				
Metals (MG/KG)										
Aluminum	9	9	4920	4920	1000 J	8040				
Antimony	3	8	5.8	14.2	3.9 J	34.5 J	8200	0		
Arsenic	7	7	11.7	11.7	4.6	21.9	10	5		
Barium	9	9	2420	2420	41.1	8110	140000	0		
Beryllium	1	8	0.15	0.34	0.34	0.34	2	0		
Cadmium	4	7	4.3	7.4	5.6	9.8	1000	0		
Calcium	9	9	2940	2940	874 J	7390 J				

TABLE 3-14 (cont.)
304 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG) (cont.)										
Chromium	9	9	26.5	26.5	3.6 J	76.5	100	0		
Cobalt	8	9	6.4	7.2	1 J	16.4 J	2500	0		
Copper	27	33	3510	4280	46 J	25100	76000	0		
Iron	9	9	15100	15100	1720 J	38100				
Lead	30	33	2860	3150	63.1 J	43400	1000	9		
Magnesium	9	9	13300	13300	1740	32900 J				
Manganese	9	9	152	152	42.3 J	354	47000	0		
Mercury	5	7	0.13	0.17	0.069 J	0.45	610	0		
Nickel	9	9	73.6	73.6	3.3 J	209	7500	0		
Potassium	9	9	710	710	206	1230				
Selenium	2	7	1.4	3.3	0.55 J	6.1 J	10000	0		
Silver	4	7	1.3	2.1	0.87 J	4.3	10000	0		
Sodium	7	9	1920	2450	99.3 J	5690				
Vanadium	9	9	14	14	1.9 J	24.1	14000	0		
Zinc	9	9	4210	4210	59.7	18400	610000	0		
Metals (SPLP) (UG/L)										
Arsenic	1	1	2.1	2.1	2.1	2.1			500	0
Barium	1	1	1110	1110	1110	1110			10000	0
Cadmium	1	1	3.4	3.4	3.4	3.4			50	0
Chromium	1	1	2.6	2.6	2.6	2.6			500	0
Copper	1	1	1170	1170	1170	1170			13000	0
Lead	1	1	439	439	439	439			150	1
Nickel	1	1	13.7	13.7	13.7 J	13.7 J			1000	0
Vanadium	1	1	3.1	3.1	3.1	3.1			500	0
Zinc	1	1	536	536	536	536			50000	0

TABLE 3-14 (cont.)
304 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG)										
2,4-Dimethylphenol	1	6	250	390	390 J	390 J	2500000	0	28000	0
2-Methylnaphthalene	2	6	180	92	85 J	100 J	2500000	0	9800	0
2-Methylphenol	2	6	200	200	150 J	260 J	2500000	0	70000	0
4-Methylphenol	3	6	210	220	120 J	290 J	2500000	0	7000	0
Acenaphthene	1	3	170	56	56 J	56 J	2500000	0	84000	0
Acenaphthylene	1	6	200	74	74 J	74 J	2500000	0	84000	0
Acetophenone	2	3	230	250	190 J	300 J				
Anthracene	4	6	140	110	49 J	200 J	2500000	0	400000	0
Benzaldehyde	1	7	280	590	590 JEB	590 JEB				
Benzo(a)anthracene	6	6	290	290	150 J	510	7800	0	1000	0
Benzo(a)pyrene	5	6	210	200	140 J	300 J	1000	0	1000	0
Benzo(b)fluoranthene	5	6	240	240	190 J	340 J	7800	0	1000	0
Benzo(g,h,i)perylene	2	6	170	74	69 J	80 J	2500000	0	42000	0
Benzo(k)fluoranthene	5	6	200	190	160 J	270 J	78000	0	1000	0
bis(2-Ethylhexyl)phthalate	6	7	2700	3100	46 J	15000	410000	0	11000	1
Carbazole	2	6	170	76	72 J	80 J	290000	0	360	0
Chrysene	6	6	310	310	200 J	680	780000	0	1000	0
Dibenzo(a,h)anthracene	2	6	180	110	97 J	120 J	780	0	1000	0
Dibenzofuran	2	6	160	53	45 J	61 J	2500000	0	5600	0
Diethylphthalate	1	6	200	63	63 J	63 J	2500000	0	1100000	0
Di-n-Butylphthalate	1	6	200	89	89 J	89 J	2500000	0	140000	0
Fluoranthene	6	6	570	570	280 J	1200	2500000	0	56000	0
Fluorene	3	6	140	81	65 J	100 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	5	6	200	190	94 J	300 J	7800	0	1000	0
Naphthalene	3	6	160	120	75 J	150 J	2500000	0	56000	0
N-Nitroso-diphenylamine	1	6	210	120	120 J	120 J	1200000	0	1400	0
Phenanthrene	6	6	380	380	160 J	750	2500000	0	40000	0
Phenol	2	6	1200	3200	2800	3600 J	2500000	0	800000	0
Pyrene	6	6	620	620	370 J	1100	2500000	0	40000	0

TABLE 3-14 (cont.)
304 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG)										
2-Butanone	7	8	44	49	1 J	150 J	1000000	0	80000	0
Acetone	4	8	270	540	140 J	1000 J	1000000	0	140000	0
Benzene	4	7	9	13	1 J	35 J	200000	0	200	0
Carbon Disulfide	7	7	8	8	0.8 J	31	1000000	0	140000	0
Chlorobenzene	1	6	5	2	2 J	2 J	1000000	0	20000	0
Chloromethane	1	6	6	12	12 J	12 J	440000	0	540	0
Cyclohexane	2	6	48	140	21	250				
Ethylbenzene	2	6	6	10	4 J	15 J	1000000	0	10100	0
Isopropylbenzene	2	6	7	12	10 J	14 J				
Methyl Acetate	1	6	7	17	17 J	17 J				
Methyl tert-Butyl Ether	1	6	5	1	1 J	1 J				
Methylcyclohexane	3	6	160	310	0.9 J	910 *				
Toluene	3	7	13	25	2 J	51 J	1000000	0	67000	0
Total Xylenes	4	7	33	54	0.9 J	170 J	1000000	0	19500	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	1	6	61	5.7	5.7	5.7	24000	0	29	0
4,4'-DDE	2	6	98	160	7.7	320	17000	0	21	1
4,4'-DDT	2	6	630	1800	26	3500	17000	0	21	2
alpha-Chlordane	2	6	32	6	2.1	10	2200	0	66	0
Aroclor, Total (4)	24	31	39000	50000	100	500000	10000	6		
Aroclor, Total (Conservative) (5)	24	31	40000	52000	210	510850	10000	6		
Aroclor-1262	18	30	18000	30000	40	280000 *	10000	4		
Aroclor-1268	24	31	21000	28000	70	220000 *	10000	5		
Endosulfan Sulfate	7	8	5000	4800	7.9 #	21000 *#	1200000	0	8400	2
Endrin	2	6	200	520	320	730	610000	0		
Endrin Aldehyde	6	7	710	830	6.3 #	2000 #	610000	0		
Endrin Ketone	1	6	61	5.4	5.4	5.4	610000	0		
gamma-Chlordane	1	6	31	6.1	6.1	6.1	2200	0	66	0
Methoxychlor	1	6	420	1200	1200	1200	10000000	0	8000	0

TABLE 3-14 (cont.)
304 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

Qualifier	Definition
!	From dilution analysis
#	Possible false positive due to interference
$	From dilution analysis
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.

- RAYMARK WASTE
- NO RAYMARK WASTE, NO ASBESTOS >1%, NO CT DEC OR PMC EXCEEDANCES
- CT DEC AND/OR CT PMC EXCEEDANCES
- ESTIMATED AREA OF RAYMARK WASTE WITHIN PROPERTY OF INTEREST
- PROPERTY OF INTEREST
- PROPERTY BOUNDARY AS RECORDED WITH THE TOWN OF STRATFORD
- IMPLIED PROPERTY BOUNDARY EXTENDED TO ROADWAY
- BUILDING
- PAVEMENT

30 0 30 60 90 Feet

N

NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-14
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.15 340 East Main Street

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.15.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.15.1 Property Description

This property, approximately 0.3 acres of commercially-zoned (retail/light industrial) land, is located on East Main Street in Stratford, Connecticut (Town of Stratford, 1997). A collector's shop is currently located in the building located along the western edge of the property. This small one-story building is constructed of brick and wood. A fence runs north to south, bisecting the property, and extends behind 302 and 304 East Main Street (see Section 3.14) as well. The area from East Main Street extending east to the fence (roughly half of the property) is paved and contains the lone building. The area east of the fence in the rear of the property is not paved and is contiguous with the rear portions of the adjacent 302 and 304 East Main Street properties. No storm drains were visible on the property, although one is nearby on East Main Street. Various trailers, sheds, piles of debris, and machinery are stored on the rear portion of all three of these properties. The three properties have the same owner, and in conversations with this owner, he indicated that he uses all three lots interchangeably for storage.

The Town DPW lot (see Section 3.18) is located on the opposite side of East Main Street to the west, with commercial and residential properties to the north and south. A large asphalt parking lot abuts the property to the east with light industrial facilities to the southeast. Public access is restricted at the rear of the property by a chain-link fence with barbed wire.

3.15.2 Physical Characteristics

This property is located outside the 100-year floodplain of the Housatonic River, as observed from Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Stratford, Connecticut (FEMA, 1992). The 100-year floodplain is delineated on Figure 1-2.

Eight soil borings (ES340-101 through 104; ES-340-106 and 107; ES340-201, and 202), were advanced on the property at depths up to 10 feet below ground surface (bgs). Sand with

varying amounts of silt and gravel were noted in borings ES340-101 and 102. Materials from these borings may represent native alluvial, glacial outwash, and/or ice-contact deposits. In soil borings ES340-103, 104, 106, 107, 201, and 202, fill overlies materials characteristic of a former marsh and swamp deposit. Soil encountered below the fill in these borings primarily consists of organic silt and peat. Refer to Figure 3-15 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Soil sample locations are shown on Figure 3-15. Some of these locations are shallow surface samples and some are borings. The borings were used to describe the fill and native material on the property. All soil sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. No debris was identified beneath the asphalt surface in borings ES340-101 and 102. Fill debris identified in the soil from borings ES340-103, 104, 106, 107, 201, and 202 included PACM (potentially asbestos-containing material), brick, “burlap” sheet material, glass, resin fragments, shingles, and tile. PACM was identified in all of the borings. The manmade materials were encountered with natural fill consisting of sand, some silt, and a trace percentage of gravel. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was only identified in borings in the central and eastern portions of the property. Fill was not identified in borings ES340-101 or ES340-102. Based on the soil moisture content recorded on the boring logs, the depth to water ranges from 2 to 7 feet bgs at this property.

Raymark waste was found in fill material on this property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-15. Approximately 72 percent of the property is estimated to contain Raymark waste. The majority of the estimated area of Raymark waste is covered by grass.

3.15.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

A total of 33 samples were collected from eight locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-15. Samples were analyzed for asbestos, and screened for lead, copper, and PCBs. No additional analyses were performed for soil samples from this property. See Table 3-15 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-15 for the soil sample summary statistics and comparison criteria. The discussion below includes all soil samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

<u>Asbestos</u>

Thirty-three samples were collected from the property and analyzed for asbestos. Asbestos was detected in 29 of the 33 samples collected at the property. Asbestos at greater than 1

percent was found in 16 of the 33 samples and these samples were distributed throughout the property. The maximum amount of asbestos observed at the property was 70 percent.

Dioxins

No dioxin samples were collected on this property.

Metals

Thirty-three samples were collected from the property and screened for lead and copper. These metals were detected frequently on the property. Lead concentrations exceeded the CT DEC in nine samples, while copper concentrations exceeded the CT DEC in one sample. Metals exceedances were spread throughout the property at depths ranging from ground surface to 8 feet bgs. No SPLP or TCLP metals samples were collected at this property.

Pesticides

No pesticide samples were collected on this property.

PCBs

Thirty-three samples were collected from the property and screened for PCBs as Aroclors. PCBs, namely Aroclors 1262 and 1268, were detected frequently at this property. Total Aroclors concentrations exceeded the CT DEC regulatory standard in eight samples. These exceedances were scattered throughout the property at depths ranging from ground surface to 10 feet bgs. At all locations with exceedances, Aroclor 1268 was the primary contributor to the total Aroclor concentration. No SPLP or TCLP samples for PCBs were collected at this property.

SVOCs

No SVOC samples were collected on this property.

VOCs

No VOC samples were collected on this property.

Raymark Waste

The results from five sample locations indicate the presence of Raymark waste on this property. The following table displays the location and constituents of the 14 samples that meet the definition of Raymark waste. These samples are located within the 72.4 percent of the property shown on Figure 3-15 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
ES340-103	2 to 4	30	5,700	3,790	3,500
	4 to 6	70	6,620	4,850	13,000
	6 to 8	5	3,640	1,230	34,000
	8 to 10	3	606	255	1,800
ES340-104	2 to 4	7	660	452	1,500
	4 to 6	70	472	486	3,000
	6 to 8	40	18,700	87,900	200,000
ES340-106	0 to 2	2	741	1,780	1,600
	4 to 6	3	422	753	300
ES340-201	2 to 4	1.5	2,910	6,100	41,000
ES340-202	0 to 2	3.25	5,190	15,600	21,000
	2 to 4	16	27,000	32,700	14,000
	4 to 6	26.1	11,000	20,900	8,000
	6 to 8	18.75	9,450	11,100	1,100

3.15.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 72.4 percent of the 0.3-acre property exclusive of the building is estimated to contain Raymark waste. The waste is located along the eastern side of the property (see Figure

3-15). Over 75 percent of the entire property is covered by either a building, pavement, or debris. The figure shows the building and pavement, but does not show the area covered by debris. Most of the contaminated soils are covered by grass. It is assumed that the grass areas allow limited infiltration or leaching into the groundwater. However, no SPLP, SVOC, or VOC samples were collected, so it is unknown what, if any, leaching is occurring. No storm drains were visible on the property, although one is nearby on East Main Street. The property does not abut any water bodies.

3.15.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at 340 East Main Street that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire property at 340 East Main Street may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.15.5.1 provides an overview of the 340 East Main Street property, Section 3.15.5.2 presents COPCs and EPCs, Section 3.15.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.15.5.4 contains the numerical results of the risk assessment, and Section 3.15.5.5 presents property-specific uncertainties. Section 3.15.5.6 presents a property-specific summary of the major risk findings.

3.15.5.1 Overview

340 East Main Street is a commercial property of approximately 0.3 acres. A detailed description of the property is provided in Section 3.15.1. The nature and extent of the

contamination detected at 340 East Main Street is discussed in Section 3.15.3. The area of the property estimated to contain Raymark waste represents an estimated 72 percent of the total 0.3-acre property, exclusive of any buildings, and is shown in Figure 3-15. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.15.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 340 East Main Street are summarized in Appendix B-1, Table 2.15.

3.15.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.15 presents a summary of the COPCs for quantitative risk assessment for 340 East Main Street soils from the estimated area of Raymark waste to a depth of 10 feet bgs. No samples were collected from more than 10 feet bgs within the estimated area of Raymark waste due to site-specific field conditions. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. Twenty-three samples at 340 East Main Street were included within the estimated area of Raymark waste. These samples were collected from depths of 0 to 10 feet bgs and only analyzed for lead and copper (by field-screening methods) and asbestos. One sample was analyzed using CLP methods for PCBs. These data were used to identify COPCs.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.15:

- Asbestos
- Lead

- Aroclors, Total (1262 and 1268)

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 340 East Main Street are presented in Appendix B-1, Table 3.15. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.15.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 340 East Main Street and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 340 East Main Street is a commercial property, as described in Section 3.15.1.

Potential Receptors

The receptors retained for quantitative evaluation at 340 East Main Street are current and future commercial workers. Potentially exposed individuals were limited to those who work at 340 East Main Street.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 10 feet bgs) at a limited

area (soils within the estimated area of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 340 East Main Street are incidental Ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from 340 East Main Street is considered to be minimal. The estimated area of Raymark waste is mostly mowed grass, however, there are some areas under pavement. The presence of vegetation and pavement reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposure to asbestos is presented in Section 3.15.5.4. Asbestos is present in soils within the estimated area of Raymark waste at 340 East Main Street. The presence of vegetation and pavement suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.4. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 340 East Main Street is 0.72. Chemical intake estimates are provided in Appendix B-1, Tables 7.15 and 8.15.

3.15.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 340 East Main Street is provided in this section. Appendix B-1, Table 7.15 and Table 8.15 present non-cancer and cancer RME risk estimates,

respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.15. Appendix B-1, Table 10.15 reduces the information developed in Appendix B-1, Table 9.15 to the major risk drivers. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 340 East Main Street are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	0.04	0.04	0.08

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated area of Raymark waste at 340 East Main Street is less than unity indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment. See Table 7.15 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 340 East Main Street are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	6.0E-07	5.6E-07	1.2E-06

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated area of Raymark waste at 340 East Main Street is within the EPA cancer risk range (10^{-4} to 10^{-6}) and is less than the CT DEP target

total risk level of 10^{-5} for multiple contaminants. See Table 8.15 RME in Appendix B-1 for details on cancer risk calculations.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste at the 340 East Main Street property. Lead was detected in samples collected from 0 to 10 feet bgs within the estimated area of Raymark waste at a maximum concentration of 27,000 mg/kg. The average lead concentration in this dataset was 4,140 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 4,140 mg/kg for soil within the estimated area of Raymark waste at 340 East Main Street was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 340 East Main Street is 0.72. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated area of Raymark waste at 340 East Main Street, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 21 to 24 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 21 of the 23 soil samples collected from the estimated area of Raymark waste at a concentration range of trace to 70 percent. These samples were collected from the 0- to 10-foot bgs interval. The average concentration was 14 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos

is considered a potential inhalation hazard if it is “friable” (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated area of Raymark waste reduces the potential for airborne asbestos at the 340 East Main Street property. Based on field conditions in the estimated area of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.15.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 340 East Main Street are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 340 East Main Street property is 0.3 acres, with an estimated 72 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.15.4. The estimated area of Raymark waste is mostly mowed grass with some areas of pavement. No consideration was given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated area of Raymark waste. In this case, because risks were

estimated assuming individuals would only be exposed to contaminated soils 72 percent of the time, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately 1.4 times greater than those estimated using the FRW factor.

- Copper concentrations exceed the EPA Region IX industrial soil PRG of 41,000 mg/kg in 340 East Main Street soils; however due to the lack of a verifiable toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in 340 East Main Street soils (0 to 10 feet bgs) at concentrations ranging from 143 mg/kg to 87,900 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

- Twenty-three samples were included in the dataset for soils within the estimated area of Raymark waste; however, 22 of the samples were only analyzed by field-screening methods. Only one sample was analyzed by CLP methods for PCBs. For this reason, data are not available for risk assessment purposes for the majority of COPCs that have been identified at other properties known to have received Raymark waste. Based on a comparison to the other properties, it is likely that other contaminants are present and that associated exposures exist, which were not quantified in this evaluation. Cancer risk estimates and hazard indices were only calculated for PCBs at this property using the results of a single sample. The use of single sample dataset adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 10 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers. In addition, future commercial workers may be exposed to soils currently located at depths up to 15 feet bgs, which is the depth considered as accessible by CT DEP (CT DEP, 1996). The absence of samples collected in the 10-to 15- foot bgs interval adds uncertainty in the evaluation of the risks to future commercial workers.

- A comparison of soils data from the property outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-11. No contaminants were detected at

concentrations greater than CT RSRs for industrial soil in the ten samples analyzed by field-screening methods or the two samples analyzed by CLP methods for PCBs. Lead was detected in soils located outside the estimated area of Raymark waste at concentrations up to 639 mg/kg. Copper was detected at concentrations up to 411 mg/kg. Asbestos was not detected above 1 percent. No analysis of dioxins or SVOCs was performed. The commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.15.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at 340 East Main Street. Risks to commercial workers were estimated.

- The RME hazard index (HI) for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 340 East Main Street is less than unity, indicating that adverse non-carcinogenic health effects are not anticipated.

- The RME cancer risk estimate for commercial workers exposed to soil within the estimated area of Raymark waste at 340 East Main Street is within the EPA cancer risk range (10^{-4} to 10^{-6}) and is less than the CT DEP target total risk level of 10^{-5} for multiple contaminants.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste at 340 East Main Street.

- Asbestos was detected in 21 of the 23 soil samples collected from the estimated area of Raymark waste at 340 East Main Street in the 0- to 10- foot bgs interval at a concentration range of trace to 70 percent. The average concentration was 14 percent.

3.15.6 Ecological Evaluation

No ecological evaluation of this property has been performed. Since much of the property has been disturbed by development and filling, it is unlikely that there are ecological receptors that are being adversely impacted by the presence of Raymark waste on this property.

3.15.7 Summary

This 0.3-acre property along East Main Street contains Raymark waste on the eastern portion of the property behind the fence. Soil samples containing metals and PCBs that exceed the CT DEC criteria and asbestos at greater than 1 percent were collected on the property. Infiltration is likely occurring in the vegetated area of this property. The potential for contaminants to leach into groundwater has not been evaluated for this property. No SPLP samples were taken, so it is unknown if any leaching is occurring. Erosion is not likely since most of the property is covered with vegetation, pavement, and a building. Since most of the property is covered by a building or pavement, only limited infiltration or leaching is occurring in the areas of cracked pavement.

The RME hazard index for commercial workers exposed to soil within the estimated area of Raymark waste is less than unity, indicating that adverse non-carcinogenic health effects are not anticipated. The RME cancer risk index is less than the EPA cancer risk range and the CT DEP target total risk level. Adverse effects are anticipated on fetuses of pregnant workers exposed to lead in soils within the estimated area of Raymark waste. The average asbestos concentration in the estimated area of Raymark waste was 14 percent.

No ecological risks have been identified on the property.

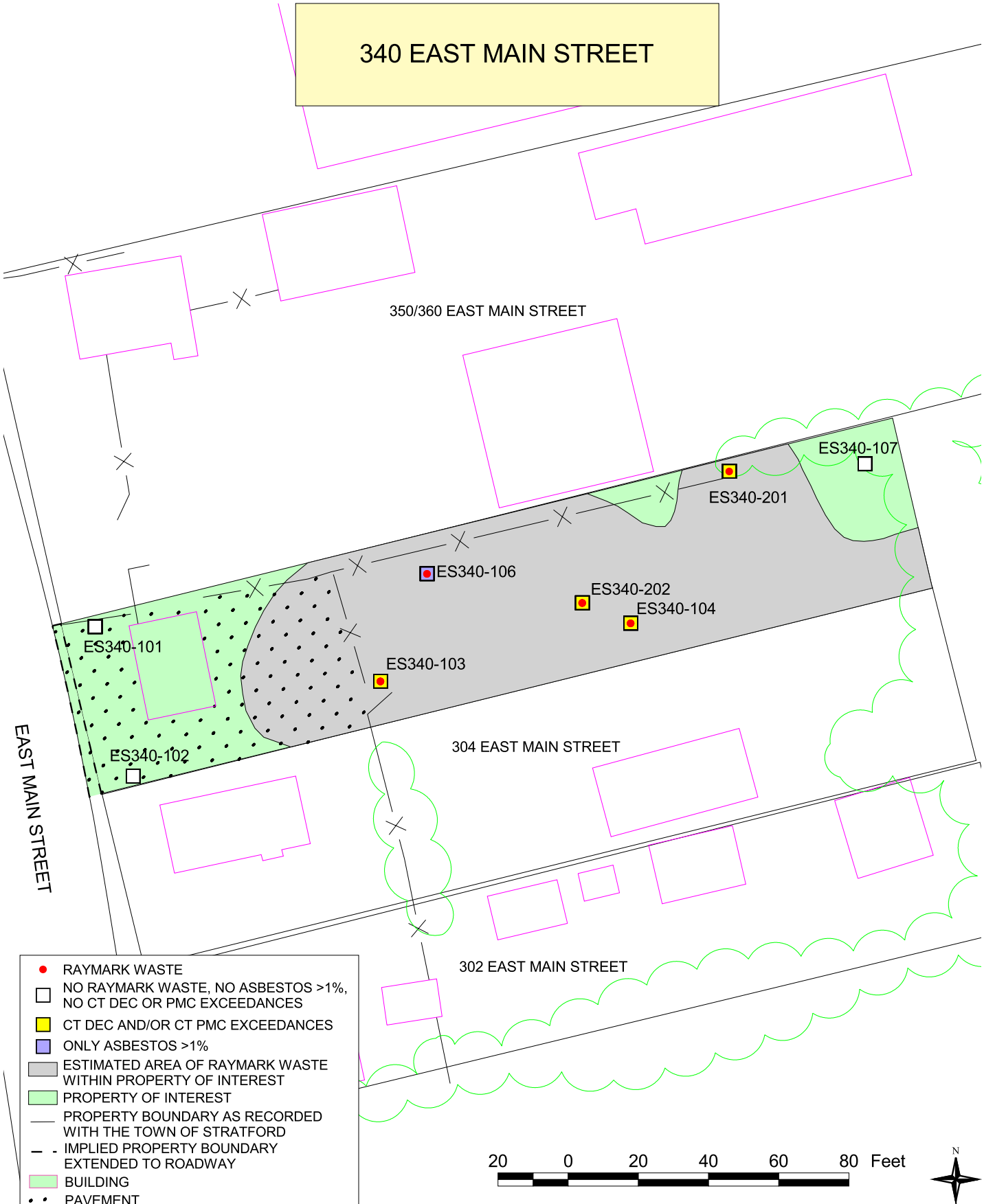
TABLE 3-15
340 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	29	33	10	11	Trace	70	1	16		
Metals (MG/KG)										
Copper	25	33	5840	7680	22	87900	76000	1		
Lead	26	33	2920	3690	40	27000	1000	9		
Pesticide/PCB (UG/KG)										
Aroclor, Total(4)	24	33	21000	28000	90	348000	10000	8		
Aroclor, Total (Conservative)(5)	24	33	21000	28000	490	348000	10000	8		
Aroclor-1262	22	33	8500	13000	95 J	148000	10000	7		
Aroclor-1268	24	33	12000	16000	90	200000	10000	7		

Qualifier	Definition
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-15
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	(978)658-7899

3.16 380 East Main Street

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.16.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.16.1 Property Description

This property, approximately 0.5 acres of commercially-zoned (retail/light industrial) land, is located on East Main Street in Stratford, Connecticut (Town of Stratford, 1997). The property is presently utilized as a manufacturing facility. The front (western) half of the property is paved while the rear (eastern) half is occupied by a one-story building. There is a small unpaved area to the rear of the building that is only accessible from the interior of the building as there is a fence and retaining wall directly abutting either side of the building. This small area is overgrown with vegetation, and scattered with debris. About 10 feet from the back of the building, there is an approximately 6-foot sharp decline to the 250 East Main Street parking lot (see Section 3.17). There is a short retaining fence at the foot of this decline, through which several layers of non-native materials are visible. Surface water drains toward storm drains near the property.

Surrounding this property, are the parking lot of 250 East Main Street to the east, mixed residential and commercial properties to the north and south, and the town DPW Lot (see Section 3.18) located across East Main Street to the west. Generally, the site topography is flat with an approximate 6-foot decline in the eastern portion of the property into the adjacent parking lot. Access to the property is restricted by a fence and gate that are locked during non-business hours.

3.16.2 Physical Characteristics

This property is located outside the 100-year floodplain of the Housatonic River, as observed from Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Stratford, Connecticut (FEMA, 1992). The 100-year floodplain is delineated on Figure 1-2.

Eight soil borings (ES380-101 through 106, 201 and 202) were advanced at the property to depths of up to 12 feet below ground surface (bgs). Three of the borings (ES380-105, 106, and

202) encountered refusal before reaching native material. Soils noted in borings ES380-101 through 104 and 201 consist of materials characteristic of glacial outwash and ice-contact deposits. Native material in the borings included fine to coarse sand and fine to medium sand with some percentage of gravel and/or silt. Fill was noted overlying the native soils in borings ES380-101, 103, 104, and 202. Refer to Figure 3-16 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Soil sample locations are shown on Figure 3-16. The borings were used to describe the fill and native material on the property. All soil sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials identified in the soil from borings ES380-101, 103, 104, 201, and 202 included asphalt and/or slag. These materials were encountered with natural fill materials consisting of sand and silty sand mixtures. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings on the western, southern, and eastern edges of the property. The depth to water is 10 feet, based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on the property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2. These limits are shown on Figure 3-16. Approximately 0.9 percent of the property is estimated to contain Raymark waste. The estimated area of Raymark waste is covered with vegetation and debris.

3.16.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial

soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 20 samples collected from eight locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-16. Samples were analyzed for asbestos, metals, PCBs, VOCs, SVOCs, and pesticides. See Table 3-16 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC regulatory standards. A complete set of soil data analytical results for each property is provided in Appendix C. See Table 3-16 for the soil data summary statistics and comparison criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Twenty soil samples were collected from the property and analyzed for asbestos. Asbestos was detected in three of the 20 samples. Asbestos at greater than 1 percent was found in one sample taken from the northeast corner of the property. The maximum amount of asbestos observed at the property was 2 percent.

Dioxins

No dioxin samples were collected on this property.

Metals

Soil samples were collected and analyzed for metals from this property as follows: one sample was analyzed in a fixed laboratory for metals; and 19 samples were screened for lead and copper. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Lead concentrations exceeded the CT DEC at this property in the northeast corner, from ground surface to 1.5 feet bgs. No SPLP/TCLP metals samples were collected.

SPLP and TCLP Metals

No SPLP or TCLP metal samples were collected and analyzed for this property, either within the estimated area of Raymark waste or outside the area.

Pesticides

One soil sample was collected and analyzed for pesticides. Only one pesticide was detected on the property, and at levels below the CT DEC regulatory standards. There were no exceedances of CT PMC standards.

PCBs

Twenty soil samples were collected and analyzed for PCBs as Aroclors. PCBs were detected frequently, especially Aroclors 1262 and 1268. No PCB concentrations exceeded the CT DEC regulatory standards. No SPLP/TCLP PCB samples were collected.

SVOCs

One soil sample was collected from the property and analyzed for SVOCs. SVOCs, mainly PAHs, were frequently detected in this sample. No SVOCs exceeded the CT PMC or CT DEC criteria.

VOCs

One soil sample was collected and analyzed for VOCs from the property. Only traces of two VOCs were detected in this sample, at concentrations below the CT DEC and CT PMC criteria.

Raymark Waste

The results from one sample location indicated the presence of Raymark waste on the property. The table below displays the location and constituents of the sample that meet the Raymark waste definition on this property. This sample is located within the 0.9 percent of the property shown on Figure 3-16 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
ES380-106	0 to 1.5	2	1,500	2,500	110

3.16.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 1 percent of this 0.5-acre property exclusive of the building is estimated to contain Raymark waste. The waste area is located in the northeast corner of the property (see Figure 3-16). Roughly 90 percent of the entire property is covered by either a building, pavement, or debris. The figure shows the building and pavement, but does not show the area covered by debris. The pavement is not heavily cracked, so infiltration and leaching into the groundwater is likely somewhat limited. Surface water drains toward storm drains near the property. The area where Raymark waste is present is the only unpaved area on the property, and is behind the building, along the eastern property boundary. Analytical data do not indicate leaching of contaminants, however SPLP metals or PCBs were not collected.

3.16.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at 380 East Main Street that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire property at 380 East Main Street may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.16.5.1 provides an overview of the 380 East Main Street property, Section 3.16.5.2 presents COPCs and EPCs, Section 3.16.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.16.5.4 contains the numerical results of the risk assessment, and Section 3.16.5.5 presents property-specific uncertainties. Section 3.16.5.6 presents a property-specific summary of the major risk findings.

3.16.5.1 Overview

380 East Main Street is a commercial property of approximately 0.5 acres. A detailed description of the property is provided in Section 3.16.1. The nature and extent of the contamination detected at 380 East Main Street is discussed in Section 3.16.3. The area of the property estimated to contain Raymark waste represents an estimated 1 percent of the total 0.5-acre property, exclusive of any buildings, and is shown in Figure 3-16. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.16.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 380 East Main Street are summarized in Appendix B-1, Table 2.16.

3.16.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.16 presents a summary of the COPCs for quantitative risk assessment for 380 East Main Street soils from the estimated area of Raymark waste to a depth of 1.5 feet bgs. No samples were collected from more than 1.5 feet bgs within the estimated area of Raymark waste due to site-specific field conditions. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. Only one sample at 380 East Main Street was identified as meeting the definition of Raymark waste. This sample was collected from depths of 0 to 1.5 feet bgs and analyzed for PCBs (by CLP methods), metals (by field-screening methods), and asbestos. These data were used to identify COPCs.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.16:

- Asbestos
- Lead

Because only lead and asbestos have been identified as COPCs for this property, no evaluation of hazard indices or cancer risks is provided. This risk assessment consists of a lead evaluation and a qualitative discussion of asbestos sample results.

Exposure Point Concentrations

Exposure point concentrations used in the lead evaluation for 380 East Main Street are presented in Appendix B-10, Table 16.

3.16.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 380 East Main Street. Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property.

Land Use and Access

The property at 380 East Main Street is a commercial property, as described in Section 3.16.1.

Potential Receptors

The receptors retained for quantitative evaluation at 380 East Main Street are current and future commercial workers. Potentially exposed individuals were limited to those who work at 380 East Main Street.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 1.5 feet bgs) at a limited area (soils within the estimated area of Raymark waste) only. Appendix B-10, Table 16 presents the exposure assumptions for commercial workers used in the lead evaluation.

Exposure Pathways

The primary routes of exposure for potential human receptors at 380 East Main Street are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust is considered to be minimal. The estimated area of Raymark waste is overgrown with vegetation. The presence of vegetation reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.16.5.4. Asbestos is present in soils within the estimated area of Raymark waste of the 380 East Main Street property. The presence of pavement suggests that exposures to

fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

3.16.5.4 Risk Characterization

A summary of the quantitative lead evaluation and the qualitative asbestos evaluation for 380 East Main Street is provided in this section. Results of the evaluations of lead exposures are presented in Appendix B-10.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste at the 380 East Main Street property. Lead was detected at a concentration of 1,500 mg/kg in the single sample identified as Raymark waste.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 1,500 mg/kg for soil within the estimated areas of Raymark waste at 380 East Main Street was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 380 East Main Street is 0.01. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated area of Raymark waste at 380 East Main Street, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 0.2 to 0.6 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in the one soil sample collected from the estimated area of Raymark waste at a concentration of 2 percent. This sample was collected from the 0- to 1.5- foot bgs

interval. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of vegetative cover in the estimated area of Raymark waste reduces the potential for airborne asbestos at the 380 East Main Street property. Based on field conditions in the estimated area of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.16.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 380 East Main Street are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 380 East Main Street property is 0.5 acres, with an estimated 1 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is

provided in Section 3.16.4. The estimated area of Raymark waste is overgrown with vegetation. No consideration was given to site characteristics other than the presence of buildings. Because of the small size of the estimated area of Raymark waste, it is unlikely that individuals will spend all of their time within those areas. However, if that were the case, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately 110 times greater than those estimated using the FRW factor.

- Only one sample at 380 East Main Street was identified as meeting the definition of Raymark waste. Use of such small datasets adds uncertainty to the risk assessment.

- The one sample of the dataset was only analyzed for PCBs (by CLP methods) and for metals (by field-screening methods). For this reason, data are not available for risk assessment purposes for the majority of COPCs that have been identified at other properties known to have received Raymark waste. Based on a comparison to the other properties, it is possible that other contaminants are present and that associated exposures exist, which were not quantified in this evaluation. Since PCBs were not detected at concentrations greater than screening values, cancer risk estimates and hazard indices cannot be calculated at this property.

- The one sample included in the risk assessment for current and future commercial workers was collected from depths of 0 to 1.5 feet bgs. Future exposures to commercial workers are likely to involve contact with soils currently located at depths to 15 feet bgs, which is the depth considered as accessible by CT DEP (CT DEP, 1996). The absence of samples collected in the 1.5- to 15- foot bgs interval adds uncertainty in the evaluation of the risks to future commercial workers.

- A comparison of soils data from the property outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-11. No contaminants were detected at concentrations greater than CT RSRs for industrial soil in the 18 samples analyzed by field-screening methods or the one sample analyzed by CLP methods. Lead is present in soils located outside the estimated area of Raymark waste at 380 East Main Street at concentrations up to 211 mg/kg. Copper was detected at concentrations up to 2,050 mg/kg. Asbestos was not detected above 1 percent. No analysis of dioxins or PCBs was

performed. A commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.16.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark at 380 East Main Street. Risks to commercial workers were estimated.

- Only lead and asbestos have been identified as COPCs for soils within the estimated area of Raymark waste at 380 East Main Street, therefore an evaluation of hazard indices and cancer risks is not provided.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste at 380 East Main Street.

- Asbestos was detected in the one soil sample collected from the estimated area of Raymark waste at 380 East Main Street in the 0- to 1.5- foot bgs interval at a concentration of 2 percent.

3.16.7 Ecological Evaluation

No formal ecological evaluation has been conducted for this property. However, because the majority of the property is covered by building or pavement, and because the area with known Raymark waste is small, ecological impacts are assumed to be minimal.

3.16.7 Summary

One sample collected from this 0.5-acre property indicates the presence of Raymark waste. One sample contained lead that exceeded the CT DEC; there were no exceedances of the CT PMC regulatory standards. An asbestos level greater than 1 percent was present at one

location on the property. The majority of the property is paved or covered by a building so it is assumed that minimal infiltration and leaching are only occurring in the rear of the property.

An evaluation of hazard indices and cancer risks is not provided, as only lead and asbestos have been identified as COPCs in soils within the estimated area of Raymark waste. Adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soils within the estimated area of Raymark waste. The average asbestos concentration is 2 percent. It is unlikely ecological receptors exist at the property or are being adversely impacted by Raymark waste at this property.

TABLE 3-16
380 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	3	20	0.2	1	Trace	2	1	1		
Metals (MG/KG)										
Aluminum	1	1	6990	6990	6990	6990				
Antimony	1	1	0.92	0.92	0.92 J	0.92 J	8200	0		
Arsenic	1	1	4.4	4.4	4.4	4.4	10	0		
Barium	1	1	75.5	75.5	75.5	75.5	140000	0		
Cadmium	1	1	0.85	0.85	0.85	0.85	1000	0		
Calcium	1	1	2020	2020	2020	2020				
Chromium	1	1	12.5	12.5	12.5	12.5	100	0		
Cobalt	1	1	7	7	7	7	2500	0		
Copper	16	20	610	738	46 J	2500	76000	0		
Iron	1	1	12600	12600	12600	12600				
Lead	10	20	135	221	41 J	1500	1000	1		
Magnesium	1	1	2970	2970	2970	2970				
Manganese	1	1	240	240	240 J	240 J	47000	0		
Mercury	1	1	0.11	0.11	0.11 J	0.11 J	610	0		
Nickel	1	1	14.2	14.2	14.2	14.2	7500	0		
Potassium	1	1	1390	1390	1390 J	1390 J				
Silver	1	1	1.2	1.2	1.2 J	1.2 J	10000	0		
Vanadium	1	1	21.7	21.7	21.7	21.7	14000	0		
Zinc	1	1	168	168	168	168	610000	0		
Semivolatile Organic Compounds (UG/KG)										
2-Methylnaphthalene	1	1	36	36	36 J	36 J	2500000	0	9800	0
Acenaphthene	1	1	38	38	38 J	38 J	2500000	0	84000	0
Acenaphthylene	1	1	170	170	170 J	170 J	2500000	0	84000	0
Acetophenone	1	1	25	25	25 JEB	25 JEB				
Anthracene	1	1	200	200	200 J	200 J	2500000	0	400000	0
Benzo(a)anthracene	1	1	900	900	900 J	900 J	7800	0	1000	0

TABLE 3-16 (cont.)
380 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

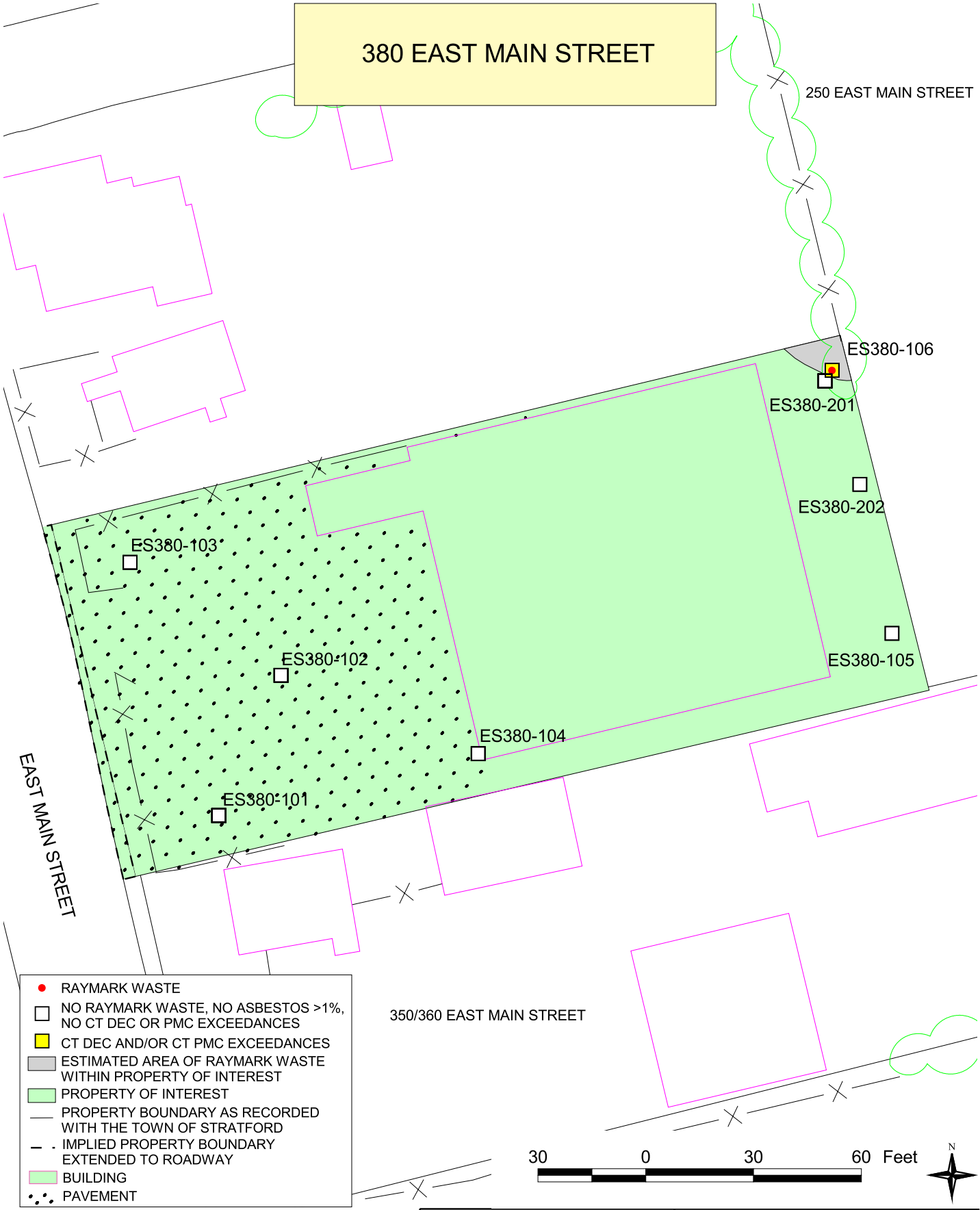
PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Benzo(a)pyrene	1	1	940	940	940	940	1000	0	1000	0
Benzo(b)fluoranthene	1	1	900	900	900	900	7800	0	1000	0
Benzo(g,h,i)perylene	1	1	420	420	420	420	2500000	0	42000	0
Benzo(k)fluoranthene	1	1	820	820	820	820	78000	0	1000	0
Carbazole	1	1	65	65	65 J	65 J	290000	0	360	0
Chrysene	1	1	950	950	950	950	780000	0	1000	0
Dibenzo(a,h)anthracene	1	1	150	150	150 J	150 J	780	0	1000	0
Dibenzofuran	1	1	35	35	35 J	35 J	2500000	0	5600	0
Di-n-Butylphthalate	1	1	19	19	19 JEB	19 JEB	2500000	0	140000	0
Fluoranthene	1	1	1700	1700	1700	1700	2500000	0	56000	0
Fluorene	1	1	61	61	61 J	61 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	1	1	440	440	440	440	7800	0	1000	0
Naphthalene	1	1	37	37	37 J	37 J	2500000	0	56000	0
Phenanthrene	1	1	840	840	840	840	2500000	0	40000	0
Pyrene	1	1	1600	1600	1600	1600	2500000	0	40000	0
Volatile Organic Compounds (UG/KG)										
1,1,1-Trichloroethane	1	1	1	1	1 J	1 J	1000000	0	40000	0
2-Butanone	1	1	4	4	4 J	4 J	1000000	0	80000	0
Pesticide/PCB (UG/KG)										
Aroclor, Total(4)	7	20	110	220	110	480	10000	0		
Aroclor, Total (Conservative)(5)	7	20	160	360	223	590	10000	0		
Aroclor-1262	6	20	55	66	50 J	100 J	10000	0		
Aroclor-1268	7	20	89	160	52 J	380 J	10000	0		
Endrin Ketone	1	1	4.4	4.4	4.4	4.4	610000	0		

TABLE 3-16 (cont.)
380 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

Qualifier	Definition
EB	Equipment blank contamination
J	Quantitation approximate
U	Not detected
UJ	Detection limit approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-16
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.17 250 East Main Street

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.17.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.17.1 Property Description

This property, approximately 16.7 acres of commercially-zoned (retail/light industrial) land, is located on East Main Street in Stratford, Connecticut (Town of Stratford, 1997). This property is currently occupied by an operating manufacturing business. The western half of the property is almost entirely paved and contains one large building. There are a few landscaped areas along East Main Street, near the main entrance to the property. The remainder of the property to the east is vegetated with some scattered debris piles present. Generally, the site topography is flat with a drop off along the eastern property border to the Housatonic River.

Surrounding this property to the north are residential properties and a wetland, with East Main Street and commercial properties to the west. The eastern portion of the property is dominated by woodlands, which continue to the Housatonic River. Along the southern border elevated train tracks are present atop a steep embankment. Commercial properties lie south of the embankment. Public access to the property from East Main Street and Avery Street is restricted by a fence and gates that are locked during non-business hours. No storm drains were observed on the western portion of the property.

3.17.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut portions of this property are located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood evaluation is 10 feet (FEMA, 1992). The 100-year floodplain boundary for this property is delineated on Figure 1-2.

Fourteen soil borings (DI-201 through DI-210; ES304-203; and SB-309B, SB-309D, and SB-309S), at depths of up to 130 feet below ground surface (bgs), were advanced at the property. One boring, DI-209, had refusal before reaching native material. Surficial materials noted in

borings ES304-203, DI-203, DI-204, DI-208, and DI-210 consist of fill overlying peat, which is characteristic of former marsh deposits. Soils noted in borings DI-201, DI-202, and DI-206 consist of fine to medium sand with trace amounts of gravel. Soils noted in boring SB-309B consist of fine to coarse sand with silt lenses from ground surface to 15 feet bgs and mixed sand and gravel from 15 to 96 feet bgs, with sections of fine sand. Soils noted in borings DI-205 and DI-207 consist of similar materials with a layer of fill at the surface. The sand and gravel are characteristic of glacial outwash, alluvial, and/or ice-contact deposits. Refer to Figure 3-17 for boring locations on the property. Boring logs are presented in Appendix A.

Borings SB-309B, D, and S were completed as monitoring wells (MW-309B, MW-309D, and MW-309S). Soil sample locations, shown on Figure 3-17, were used to describe the fill and native material on the property, to determine the presence or absence of Raymark waste, and to identify those locations that exceed the Connecticut RSRs. No soil samples were collected from borings SB-309D and SB-309S.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials identified in the soil from borings ES304-203, DI-204, DI-209, and DI-210 included asphalt, brake pads, concrete, slag, sludge, and/or tiles. Potentially asbestos-containing material (PACM), including red and blue asbestos material, possible asbestos tile, and brake pads, was observed in the soil from borings ES304-203, DI-209 and DI-210. These materials were encountered with natural fill materials consisting of sand and gravel mixtures and reworked native material (peat). Manmade debris was not observed in borings DI-205 and 207; however, the sand and gravel in these borings may represent natural fill. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings along the northwest and western edges of the property line. The depth to water ranges from 2.7 to 8 feet, based on the soil moisture content recorded on the boring logs and on the 2003 water level measurements from monitoring wells on the property.

Raymark waste was found in fill materials on the property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits

are shown on Figure 3-17. One percent of the property is estimated to contain Raymark waste. The waste area is covered with vegetation.

3.17.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 54 samples collected from 12 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-17. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-17 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC regulatory standards. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-17 for the soil data summary statistics and comparison criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Forty-six soil samples were collected from the property and analyzed for asbestos. Asbestos was detected in 15 of the 46 samples. Asbestos at greater than 1 percent was found in 8 of the 46 samples. Asbestos detections were located in the northern and western parts of the property at depths ranging from surface to 8 feet bgs.

Dioxins

One soil sample was collected from sample location DI-210 at a depth of 2 to 4 feet bgs and analyzed for dioxins. Dioxins were detected in this sample, collected at the western portion of the property, adjacent to 340 East Main Street. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. The TEQ value for this sample is 0.0084 µg/kg.

Metals

Soil samples were collected from this property and analyzed for metals as follows: five soil samples were analyzed for metals in a fixed laboratory; 39 samples were screened for copper and lead. Metals were not frequently detected on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Chromium and lead concentrations exceeded the CT DEC regulatory standards at this property. All metals exceedances were located in the western portion of the property.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only one soil sample, DI-210 from 2 to 4 feet bgs, was collected for the SPLP metals analysis. This sample was collected from within the estimated area of Raymark waste. This sample did not exceed the CT PMC standards for lead. There were no TCLP sample collected.

Pesticides

Five soil samples were collected and analyzed for pesticides. There were no pesticide concentrations that exceeded CT DEC regulatory standards. Pesticides were not frequently detected on the property. There were three exceedances of the CT PMC regulatory standards for pesticides; these exceedances were all located in the western portion of the property from ground surface to four feet bgs.

PCBs

Up to 44 soil samples were collected and analyzed for PCBs as Aroclors. PCBs were detected in roughly one-quarter of the samples collected. Total Aroclor concentrations exceeded the CT DEC regulatory standards at one location, in the western portion of the property, at depths ranging from 2 to 6 feet bgs. No SPLP or TCLP samples for PCBs were collected on this property.

SVOCs

Five soil samples were collected from one sample location and analyzed for SVOCs. SVOCs were detected frequently on the property. Concentrations of five SVOCs, primarily PAHs, exceeded the CT PMC regulatory criteria. Benzo(a)pyrene concentrations also exceeded the CT DEC regulatory criteria. SVOC exceedances were located in the same sample in the northwestern portion of the property, from ground surface to two feet bgs.

VOCs

Five soil samples were collected the property and analyzed for VOCs. VOCs were detected sporadically on the property. There were no VOC exceedances of the CT DEC or CT PMC regulatory standards.

Raymark Waste

The results from two sample locations indicate the presence of Raymark waste on the property. The following table displays the location and constituents of the four samples from those two

locations that meet the definition of Raymark waste on this property. These samples are located within the 1.1 percent of the property shown on Figure 3-17 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
DI-210	6 to 8	8.9	1,880	6,140	360
ES304-203	2 to 4	35	10,900	33,600	305,000
	4 to 6	5	4,010	13,900	66,000
	6 to 8	3	9,150	9,370	5,500

3.17.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 1.1 percent of this 16.7-acre property is estimated to contain Raymark waste. The waste area is located in the western corner of the property (see Figure 3-17). While much of the property is located in the floodplain, the portion of the property with Raymark waste is not. The waste area contains weeds, small shrubs, and disturbed fill. Over 70 percent of this property is covered by a building or pavement. The uncovered area, located in the eastern side of the property, is vegetated, with some large trees and grasses, and also contains some debris.

It is assumed that there is some infiltration or leaching into the groundwater as the paved area is cracked, and almost one-third of the property is unpaved. As indicated by the analytical data, pesticides and SVOCs may leach into the groundwater. SPLP data do not indicate leaching of metals into groundwater.

3.17.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at 250 East Main Street that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk

evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire property at 250 East Main Street may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.17.5.1 provides an overview of the 250 East Main Street property, Section 3.17.5.2 presents COPCs and EPCs, Section 3.17.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.17.5.4 contains the numerical results of the risk assessment, and Section 3.17.5.5 presents property-specific uncertainties. Section 3.17.5.6 presents a property-specific summary of the major risk findings.

3.17.5.1 Overview

250 East Main Street is a commercial property of 16.7 acres. A detailed description of the property is provided in Section 3.17.1. The nature and extent of the contamination detected at 250 East Main Street is discussed in Section 3.17.3. The area of the property estimated to contain Raymark waste represents approximately 1 percent of the total 16.7-acre property, exclusive of any buildings, and is shown in Figure 3.17. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.17.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 250 East Main Street are summarized in Appendix B-1, Table 2.17.

3.17.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.17 presents a summary of the COPCs for quantitative risk assessment for 250 East Main Street soils from the estimated area of Raymark waste to a depth of 10 feet bgs. Direct exposure

COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste of this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.17:

- Asbestos
- Benzo(a)pyrene
- Aroclors, Total (1268)
- Metals (arsenic, chromium, and lead)

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 250 East Main Street are presented in Appendix B-1, Table 3.17. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.17.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 250 East Main Street and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 250 East Main Street is a commercial property, as described in Section 3.17.1.

Potential Receptors

The receptors retained for quantitative evaluation at 250 East Main Street are current and future commercial workers. Potentially exposed individuals were limited to those who work at 250 East Main Street.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 10 feet bgs) at a limited area (soils within the estimated area of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at 250 East Main Street are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. The estimated area of Raymark waste is heavily vegetated with weeds and small shrubs. The presence of vegetation reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at commercial properties.

Appendix B-1, Table 2.17 presents available inhalation SSLs for contaminants in soils within the estimated area of Raymark waste at the 250 East Main Street property. All reported soil concentrations, with the exception of total chromium, are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a). One sample result out of five exceeded the SSL_{AIR} for hexavalent chromium. Further evaluation of total chromium concentrations relative to inhalation SSLs for commercial/industrial land use (EPA, 2001a) reveals that the all total chromium concentrations detected in the Raymark waste soil samples are less than the commercial/industrial SSL_{AIR} for hexavalent chromium (510 mg/kg). The SSL_{AIR} for chromium assumes that chromium is present in the hexavalent state. The assumption that all chromium is in the hexavalent state is likely to be a conservative assumption.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.17.5.4. Asbestos is present in soils within the estimated area of Raymark waste at 250 East Main Street. The presence of vegetation and the qualitative comparison to SSLs suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.6. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 250 East Main Street is one percent. Chemical intake estimates for 250 East Main Street are provided in Appendix B-1, Tables 7.17 and 8.17.

3.17.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for the 250 East Main Street property is provided in this section. Appendix B-1, Table 7.17 and Table 8.17 present non-cancer and cancer RME risk

estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.17. The results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 250 East Main Street are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	0.0035	0.0020	0.0054

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated area of Raymark waste at 250 East Main Street is less than unity, indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment. See Table 7.17 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 250 East Main Street are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	1.2E-07	6.6E-08	1.8E-07

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated area of Raymark waste at 250 East Main Street does not exceed the EPA cancer risk range (10^{-4} to 10^{-6}), the CT DEP target total

risk level of 10^{-5} for multiple contaminants, or the CT DEP target risk level of 10^{-6} for single contaminants. See Table 8.17 RME in Appendix B-1 for details on cancer risk calculations.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste at the 250 East Main Street property. Lead was detected in samples collected from 0 to 10 feet bgs within the estimated area of Raymark waste at a maximum concentration of 10,900 mg/kg. The average lead concentration in this dataset was 2,730 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 2,730 mg/kg for soil within the estimated area of Raymark waste at 250 East Main Street was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for 250 East Main Street is 0.01. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated area of Raymark waste at 250 East Main Street, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 0.2 to 0.6 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 8 of the 10 soil samples collected from the estimated area of Raymark waste at a concentration range of 1.3 to 80 percent. These samples were collected in the 0- to 10-foot bgs interval. The average concentration was 14 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of vegetative cover in the estimated area of Raymark waste reduces the potential for airborne asbestos at 250 East Main Street. Based on field conditions in the estimated area of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.17.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 250 East Main Street are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 250 East Main Street property is 16.7 acres, with one percent estimated to contain Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.17.4. The estimated area of Raymark waste at this property is heavily vegetated. No consideration was given to site characteristics other than the presence of buildings. Because of the small size of the estimated area of Raymark waste, it is unlikely that individuals will spend all of their time within that area. However, if that were the case, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately 100 times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown on Appendix B-1, Table 2.17, alongside site-specific data from the estimated area of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 2.7 to 10 mg/kg, with an average concentration of 6.5 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Ten samples were included in the dataset for soils within the estimated area of Raymark waste; however, five of those samples were only analyzed by field-screening methods. Due to the limited numbers of samples analyzed for benzo(a)pyrene, Aroclors, arsenic, and chromium, maximum concentrations were used to evaluate risks from these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 10 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers. Additionally, future commercial workers may be exposed to soils currently located at depths up to 15 feet bgs, which is the depth considered as accessible by CT DEP (CT DEP, 1996). The absence of samples collected in the 10- to 15- foot bgs interval adds uncertainty to the risks estimated for the future commercial worker.

- A comparison of soils data from the property outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-11. Maximum soil concentrations did not exceed CT RSRs for industrial soil. Three samples from outside the estimated area of Raymark waste were analyzed for PCBs using CLP methods. While none of these samples had concentrations greater than the CT RSRs for industrial soil, one sample did have total Aroclor concentrations greater than the EPA Region IX PRG for industrial soil. The individual Aroclors detected were Aroclor 1254, Aroclor 1260, and Aroclor 1268. Asbestos was detected in the soils located outside the estimated area of Raymark waste at 250 East Main Street at trace concentrations. Copper and lead were also detected in the soils located outside the estimated area of Raymark waste at this property, at concentrations up to 521 mg/kg and 391 mg/kg, respectively. Samples collected outside

the estimated area of Raymark waste were not analyzed for dioxins. A commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.17.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain the Raymark waste at 250 East Main Street. Risks to current and future commercial workers were estimated.

- The RME hazard indices (HI) for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 250 East Main Street do not exceed unity. Adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment.

- The RME cancer risk estimates for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 250 East Main Street do not exceed the EPA cancer risk range (10^{-4} to 10^{-6}), the CT DEP target total risk level of 10^{-5}, or the CT DEP target risk level of 10^{-6} for single contaminants.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste at 250 East Main Street.

- Asbestos was detected in eight of the 10 soil samples collected from the estimated area of Raymark waste in the 0- to 10- foot bgs interval at a concentration range of 1.3 to 80 percent. The average concentration was 14 percent.

3.17.6 Ecological Evaluation

No formal ecological evaluation was performed on this property. However, no ecologically important habitants appear to be present on this property in the estimated area of Raymark

waste. The eastern border of the property near the Housatonic River may support a variety of ecological habitats. It is not likely, based on the small area of Raymark waste and its location on this property, that ecological receptors are being adversely impacted by contaminants in the waste materials.

3.17.7 Summary

This property, 16.7 acres on the eastern side of East Main Street, has Raymark waste in a small area along the western portion of the property. Samples containing elevated asbestos, and concentrations of metals, pesticides, PCBs and SVOCs exceeding the CT DEC and/or CT PMC are present on this property. It is assumed that infiltration and leaching are taking place on all of the unpaved areas of the property, and to a lesser extent in the paved area, due to cracking, and the permeability of pavement.

The RME hazard indices for commercial workers exposed to soils within the estimated area of Raymark waste do not exceed unity, indicating that adverse non-carcinogenic health effects are not anticipated. The RME cancer risk estimates are less than the EPA target cancer range and the CT DEP target total risk level. Adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soils within the estimated area of Raymark waste. The average asbestos concentration was 14 percent.

The relatively small area and location of Raymark waste limit the exposure of contaminants to ecological receptors. Adverse impacts are unlikely.

TABLE 3-17
250 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	15	46	3	10	Trace	80	1	8		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	1	1	0.023	0.023	0.023	0.023				
1,2,3,4,6,7,8-HpCDF	1	1	0.052	0.052	0.0517 J	0.0517 J				
1,2,3,4,7,8-HxCDF	1	1	0.0085	0.0085	0.0085 J	0.0085 J				
1,2,3,6,7,8-HxCDD	1	1	0.0026	0.0026	0.0026 J	0.0026 J				
1,2,3,6,7,8-HxCDF	1	1	0.0018	0.0018	0.0018 J	0.0018 J				
1,2,3,7,8-PeCDF	1	1	0.00079	0.00079	0.00079 EMPC	0.00079 EMPC				
2,3,4,6,7,8-HxCDF	1	1	0.0032	0.0032	0.0032 EMPC	0.0032 EMPC				
2,3,4,7,8-PeCDF	1	1	0.0031	0.0031	0.0031 EMPC	0.0031 EMPC				
2,3,7,8-TCDD	1	1	0.0042	0.0042	0.0042 J	0.0042 J				
2,3,7,8-TCDF	1	1	0.0022	0.0022	0.0022 J	0.0022 J				
OCDD	1	1	0.25	0.25	0.249	0.249				
OCDF	1	1	0.059	0.059	0.0593	0.0593				
Total HpCDD	1	1	0.041	0.041	0.0413 J	0.0413 J				
Total HpCDF	1	1	0.058	0.058	0.0575 EMPC	0.0575 EMPC				
Total HxCDF	1	1	0.043	0.043	0.0429 EMPC	0.0429 EMPC				
Total PeCDF	1	1	0.023	0.023	0.0228 EMPC	0.0228 EMPC				
Total TCDF	1	1	0.043	0.043	0.0429 EMPC	0.0429 EMPC				
Toxicity Equivalency	1	1	0.0084	0.0084	0.0084 J	0.0084 J				
Metals (MG/KG)										
Aluminum	5	5	6770	6770	2790 J	10100				
Antimony	2	4	0.82	1.4	1.1 J	1.6 J	8200	0		
Arsenic	4	4	6.5	6.5	2.7	10	10	0		
Barium	5	5	485	485	162	923	140000	0		
Beryllium	2	5	0.42	0.81	0.78	0.84	2	0		
Cadmium	1	5	0.27	1	1 J	1 J	1000	0		
Calcium	5	5	1740	1740	581	3740 J				

TABLE 3-17 (cont.)
250 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG) (cont.)										
Chromium	5	5	83.4	83.4	12.4	337	100	1		
Cobalt	5	5	16	16	3.6 J	46.1 J	2500	0		
Copper	13	44	1530	5010	30.7 J	33600	76000	0		
Iron	5	5	20600	20600	10300 J	36600				
Lead	18	44	657	1580	26.8 J	10900	1000	4		
Magnesium	5	5	36500	36500	3610	159000				
Manganese	5	5	344	344	199 J	473 J	47000	0		
Mercury	3	4	0.15	0.19	0.077 J	0.41	610	0		
Nickel	5	5	195	195	17.8	835	7500	0		
Potassium	5	5	700	700	479 J	1210				
Silver	1	4	0.2	0.39	0.39 J	0.39 J	10000	0		
Sodium	2	5	1090	2640	104 J	5180 J				
Vanadium	5	5	21.7	21.7	9 J	31.2 J	14000	0		
Zinc	5	5	396	396	141	673	610000	0		
Metals (SPLP) (UG/L)										
Antimony	1	1	3.2	3.2	3.2 J	3.2 J			60	0
Barium	1	1	463	463	463	463			10000	0
Chromium	1	1	2.2	2.2	2.2	2.2			500	0
Copper	1	1	45.2	45.2	45.2 J	45.2 J			13000	0
Lead	1	1	33.5	33.5	33.5	33.5			150	0
Nickel	1	1	90.9	90.9	90.9	90.9			1000	0
Zinc	1	1	370	370	370	370			50000	0
Semivolatile Organic Compounds (UG/KG)										
2,4-Dimethylphenol	2	4	350	160	83 J	240 J	2500000	0	28000	0
2-Methylnaphthalene	1	4	360	100	100 J	100 J	2500000	0	9800	0
2-Methylphenol	4	5	410	290	86 J	670	2500000	0	70000	0
4-Methylphenol	4	5	420	300	110 J	670	2500000	0	7000	0
Acenaphthene	1	4	280	380	380 J	380 J	2500000	0	84000	0

TABLE 3-17 (cont.)
250 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Acetophenone	1	4	350	65	65 J	65 J				
Anthracene	1	4	330	580	580 J	580 J	2500000	0	400000	0
Benzaldehyde	1	5	430	510	510 JEB	510 JEB				
Benzo(a)anthracene	4	4	370	370	38 J	1300 J	7800	0	1000	1
Benzo(a)pyrene	4	5	380	410	40 J	1300 J	1000	1	1000	1
Benzo(b)fluoranthene	2	4	450	620	48 J	1200 J	7800	0	1000	1
Benzo(g,h,i)perylene	1	4	380	780	780 J	780 J	2500000	0	42000	0
Benzo(k)fluoranthene	2	4	450	620	39 J	1200 J	78000	0	1000	1
Carbazole	1	4	260	290	290 J	290 J	290000	0	360	0
Chrysene	4	4	450	450	56 J	1500 J	780000	0	1000	1
Di-n-Butylphthalate	2	5	620	870	640 JEB	1100 EB	2500000	0	140000	0
Fluoranthene	4	4	800	800	83 J	2700	2500000	0	56000	0
Fluorene	2	4	200	170	85 J	260 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	1	4	390	830	830 J	830 J	7800	0	1000	0
Phenanthrene	4	4	690	690	57 J	2300	2500000	0	40000	0
Phenol	2	4	3900	7200	310 J	14000 *	2500000	0	800000	0
Pyrene	4	4	730	730	84 J	2400	2500000	0	40000	0
Volatile Organic Compounds (UG/KG)										
2-Butanone	3	5	27	42	6 J	110 J	1000000	0	80000	0
Acetone	5	5	200	200	8 J	710 *J	1000000	0	140000	0
Benzene	2	5	3	3	2 J	4 J	200000	0	200	0
Cyclohexane	1	5	11	44	44 J	44 J				
Methyl Acetate	2	5	28	66	42 J	91 J				
Methyl tert-Butyl Ether	3	5	28	44	0.6 J	130 J				
Methylcyclohexane	2	5	9	18	1 J	35 J				
Toluene	3	5	3	4	1 J	5 J	1000000	0	67000	0
Total Xylenes	1	5	43	5	5 J	5 J	1000000	0	19500	0

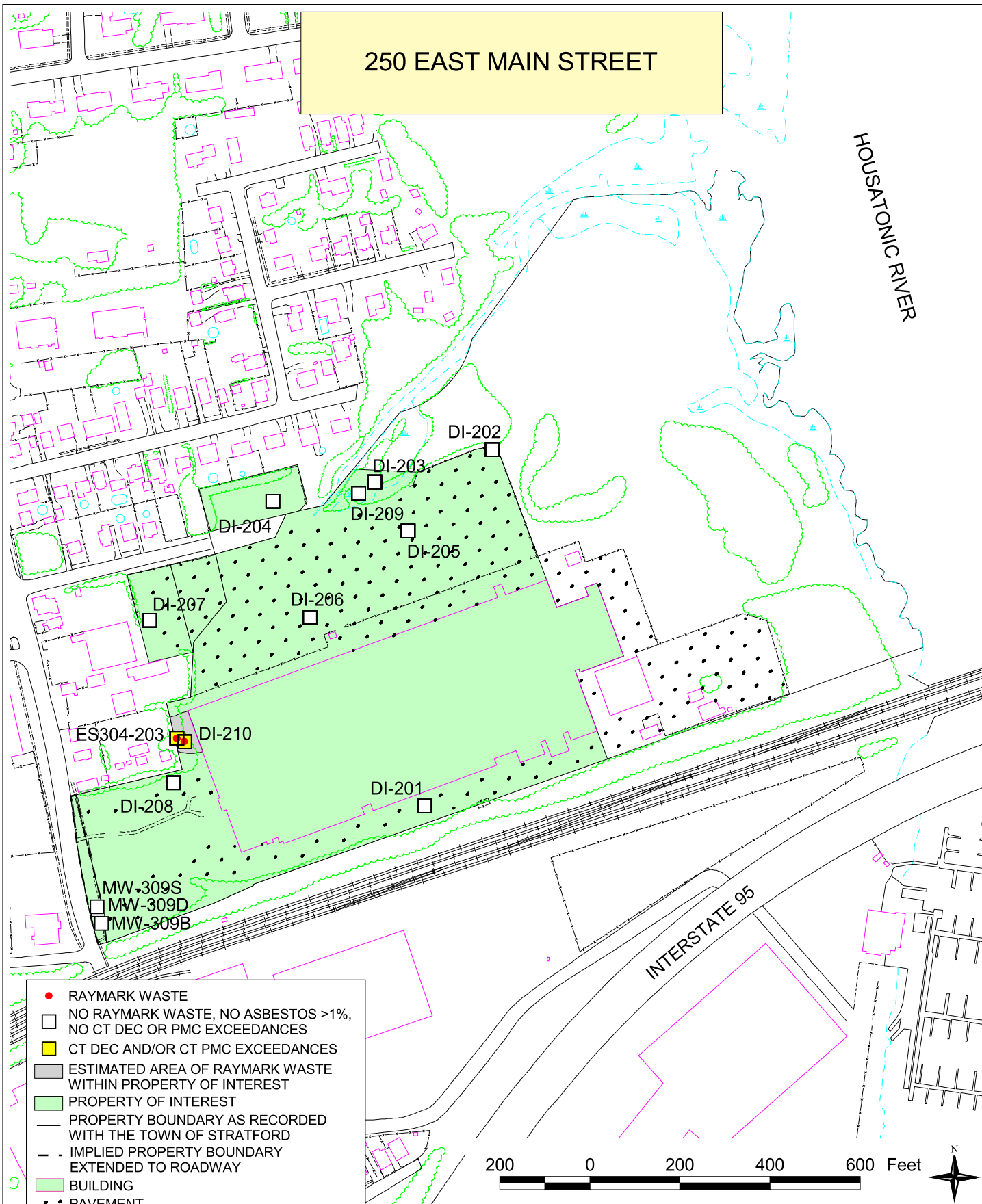
TABLE 3-17 (cont.)
250 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG)										
4,4'-DDD	1	5	11	48	48	48	24000	0	29	1
4,4'-DDE	4	5	8.7	10	4.2 #	22 #	17000	0	21	1
4,4'-DDT	2	5	8.1	18	4.1 #	31	17000	0	21	1
alpha-Chlordane	2	5	7.6	18	2.1	33 *	2200	0	66	0
Aroclor, Total (4)	16	44	15000	41000	48	510000	10000	2		
Aroclor, Total (Conservative) (5)	16	44	15000	41000	196	510000	10000	2		
Aroclor-1254	2	8	170	620	270	970	10000	0		
Aroclor-1260	2	8	120	410	48	770	10000	0		
Aroclor-1262	6	44	6100	44000	140	205000	10000	2		
Aroclor-1268	13	44	8900	30000	87	305000	10000	2		
gamma-Chlordane	1	5	1.5	3.6	3.6	3.6	2200	0	66	0
Heptachlor Epoxide	1	5	1.6	4.2	4.2	4.2	630	0	20	0
Total Organic Carbon (mg/kg)										
Total Organic Carbon	1	1	160	160	162 J	162 J				

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-17
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.18 DPW Lot

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.18.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.18.1 Property Description

This property, approximately 6.4 acres of commercially-zoned (town-owned) land, is located on Frog Pond Lane in Stratford, Connecticut (Town of Stratford, 1997). This property is owned by the town and used as the Stratford Department of Public Works (DPW) garages, storage lot, and offices. The property contains a total of nine structures, including three garages, two spherical storage buildings, a gasoline pumping station, a loading structure, and two buildings housing the DPW offices.

Almost the entire property is paved, with the exception of a few areas with landscaped plantings, and the perimeter of the lot, which is grassy with some trees planted along the adjacent roads. In addition to the structures, there are several debris storage piles located on various parts of the lot containing large cement blocks, plows, and other equipment. There are also a variety of vehicles, including large trucks, parked sporadically on the lot. Nearly the entire property is surrounded by a 6- to 8-foot chain-link fence, except for a portion of the property along East Main Street and Patterson Avenue where large buildings serve as a barrier for access. The two main gates are located on Patterson Avenue and Frog Pond Lane, with posted signs warning against trespassing. The gates are locked during non-business hours, restricting public access during that time. During the day, the gates remain open. Numerous storm drains were observed throughout the property.

The lot is triangular in shape, and is bordered by East Main Street to the east, Patterson Avenue to the north, and by Frog Pond Lane to the west and south. The restaurant at 251 East Main Street (see Section 3.19) abuts the southeastern corner of the property. The properties across East Main Street are a mix of commercial and residential, while the adjacent properties along Patterson Avenue are all residential. The Raybestos Memorial Ballfield (OU4 of the Raymark Superfund Site) is located on the opposite side of Frog Pond Lane, along with railroad tracks.

3.18.2 Physical Characteristics

This property is located outside the 100-year floodplain of the Housatonic River, as observed from Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Stratford, Connecticut (FEMA, 1992). The 100-year floodplain is delineated on Figure 1-2.

Twelve soil borings (DPW-101 through DPW-106; DPW-201 through DPW-204; and SB-216B and SB-216DB) were advanced on the property to depths of up to 18 feet below ground surface (bgs). Borings SB-216B and 216DB were both completed as monitoring wells. Boring DPW-204 was advanced adjacent to DPW-102 for soil sample collection only; soil descriptions from DPW-102 were used for fill thickness and characterization. Soils noted in boring DPW-101 included fill overlying peat, which is characteristic of a former swamp or marsh deposit. Soil encountered below the fill in borings DPW-102, DPW-104, DPW-105, and DPW-106 includes sand, silty sand, and trace percentages of gravel. No debris was observed in the soil from borings DPW-103, DPW-201 through DPW-203, and SB-216B; the sand with varying amounts of silt and gravel likely represents natural material. Refer to Figure 3-18 for boring locations on the property. Boring logs are presented in Appendix A.

Two monitoring wells, MW-216B and MW-216DB, were installed to allow evaluation of groundwater contaminants. Soil sample locations are shown on Figure 3-18. No samples were collected from boring SB-216DB. The sample locations indicate borings used to describe the fill and native material on the property, and locations used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Fill debris was identified in borings DPW-101, 102, 104 through 106, and 201 through 203. The debris included potentially asbestos-containing material (PACM), ash, asphalt, brick, concrete, glass, plastic, slag, and/or tile. These materials were encountered with natural fill consisting of sand, silty sand, and a trace percentage of gravel. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in all borings in the eastern portion of this property, with the exception of DPW-201. Fill was not identified in soil borings DPW-103, DPW-201 through 203, and SB-216B. The depth to groundwater on this property ranges from 7.5 to 11.5 feet bgs, based on the soil moisture

content recorded on the boring logs, and on 2003 water level measurements from monitoring wells on the property.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-18.

3.18.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 51 samples collected from 11 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-18. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-18 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-18 for the soil data summary statistics and comparison to criteria.

The discussion below includes all samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

Asbestos

Forty-eight soil samples were collected from the property and analyzed for asbestos. Asbestos was detected in 15 of the 48 samples from the property. Observable asbestos at greater than 1 percent was found in three of 48 samples. Asbestos detections were found in the northeastern and southeastern portion of the property at depths ranging from 4 to 8 feet bgs. The maximum amount of asbestos observed at the property was 30 percent.

Dioxins

One sample was collected from this property and analyzed for dioxins. Dioxins were detected on the property. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. A TEQ value of 0.0019 µg/kg was detected in sample DPW-204 at a depth of 4 to 6 feet bgs from the southern portion of the property.

Metals

Samples were collected from this property and analyzed for metals as follows: five samples were analyzed in a fixed laboratory, and 43 samples were screened for copper and lead. Metals were detected frequently on the property. Lead and arsenic concentrations exceeded the CT DEC regulatory standards at this property. There were five lead and two arsenic exceedances located primarily in the eastern half of the property, at depths ranging from 4 to 12 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only one sample was collected for the SPLP metals analysis. This sample was not located within the estimated areas of Raymark waste. This one sample did not exceed the CT PMC standard for lead. No TCLP samples were collected.

Pesticides

Five soil samples were collected from this property and analyzed for pesticides. Pesticides were not frequently detected on the property. No pesticide concentrations exceeded the CT DEC standards, however four pesticide concentrations exceeded the CT PMC standards in one sample. The pesticide exceedances were detected in the southern end of the property, at the ground surface.

PCBs

Forty-eight soil samples were collected from the property and analyzed for PCBs as Aroclors. There were no exceedances of the CT DEC regulatory standards for PCBs at the property. No SPLP or TCLP PCB samples were collected at this property.

SVOCs

Five soil samples were collected and analyzed for SVOCs from the property. SVOCs, primarily PAHs, were detected frequently. The concentrations of five SVOCs exceeded the CT PMC, and one of these, benzo(a)pyrene, also exceeded the CT DEC regulatory standards. These exceedances were located at the surface in the southern end of the property.

VOCs

Five soil samples were collected and analyzed for VOCs from the property. VOCs were rarely detected, and no VOCs were detected at concentrations exceeding the CT DEC or CT PMC regulatory standards.

Raymark Waste

The results from two samples indicate the presence of Raymark waste on this property. The following table displays the location and constituents of the two samples that meet the Raymark waste definition on this property. These samples are located within approximately 16 percent of the property shown on Figure 3-18 as the “Estimated Area of Raymark Waste within Property of Interest.”

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
DPW-102	4 to 6	30	2,160	603	ND
DPW-104	6 to 8	20	1,030	322	ND

ND- Contaminant was not detected

3.18.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 16 percent of this 6.4-acre property is estimated to contain Raymark waste. The waste areas are located along the southern property boundary and the northeast corner of the property (see Figure 3-18). The property is not located in the floodplain. The waste area along the eastern border is covered by a building and pavement; the waste area along the southern border is partially covered by pavement and partially by grass. Although some of the pavement is cracked, it is assumed that only minimal infiltration is occurring. Erosion is also minimized by the presence of buildings and pavement. Surface water runoff is managed by on-site storm drains.

SPLP data do not indicate that metals are leaching into the groundwater, however, other data indicate that pesticides and SVOCs may be leaching.

3.18.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at the DPW Lot that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire DPW Lot property may be higher

than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.18.5.1 provides an overview of the DPW Lot property, Section 3.18.5.2 presents COPCs and EPCs, Section 3.18.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.18.5.4 contains the numerical results of the risk assessment, and Section 3.18.5.5 presents property-specific uncertainties. Section 3.18.5.6 presents a property-specific summary of the major risk findings.

3.18.5.1 Overview

The DPW Lot is a commercial property of approximately 6.4 acres. A detailed description of the property is provided in Section 3.18.1. The nature and extent of the contamination detected at the DPW Lot is discussed in Section 3.18.3. The areas of the property estimated to contain Raymark waste represent an estimated 16 percent of the total 6.4-acre property, exclusive of any buildings, and are shown in Figure 3-21. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.18.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated areas of Raymark waste at the DPW Lot are summarized in Appendix B-1, Table 2.18.

3.18.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.18 presents a summary of the COPCs for quantitative risk assessment for the DPW Lot soils from the estimated areas of Raymark waste to a depth of 12 feet bgs. No samples were collected more than 12 feet bgs within the estimated areas of Raymark waste due to site-specific field conditions. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. Only twelve samples were included within the estimated areas of Raymark waste. These samples were collected from depths of 0 to 12 feet bgs and analyzed using field-screening methods. Two

of the samples were also analyzed for PCBs using CLP methods. These data were used to identify COPCs.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste of this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.18:

- Asbestos
- Lead

Because only lead and asbestos have been identified as COPCs for this property, an evaluation of hazard indices or cancer risks is not provided. This risk assessment consists of a lead evaluation and a qualitative discussion of asbestos sample results.

Exposure Point Concentrations

Exposure point concentrations used in the lead evaluation for the DPW Lot are presented in Appendix B-10, Table 18.

3.18.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the DPW Lot. Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated areas of Raymark waste at the property.

Land Use and Access

The DPW Lot is a commercial property, as described in Section 3.18.1.

Potential Receptors

The receptors retained for quantitative evaluation at the DPW Lot are current and future commercial workers. Potentially exposed individuals were limited to those who work at the DPW Lot.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 12 feet bgs) at a limited area (soils within the estimated areas of Raymark waste) only. Appendix B-10, Table 18 presents the exposure assumptions for commercial workers used in the lead evaluation.

Exposure Pathways

The primary routes of exposure for potential human receptors at the DPW Lot are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust is considered to be minimal. The estimated areas of Raymark waste include some paved areas and some grassy areas. The presence of pavement and vegetation reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.18.5.4. Asbestos is present in soils within the estimated areas of Raymark waste of the DPW Lot property. The presence of pavement and vegetation suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

3.18.5.4 Risk Characterization

A summary of the quantitative lead evaluation and the qualitative asbestos evaluation for the DPW Lot is provided in this section. Results of the evaluations of lead exposures are presented in Appendix B-10.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste at the DPW Lot. Lead was detected in samples collected from 0 to 12 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 2,160 mg/kg. The average lead concentration in this dataset was 398 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 398 mg/kg for soil within the estimated areas of Raymark waste at the DPW Lot was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. Table 1-1 presents the property sizes and FRW values for each property. The FRW for the DPW Lot is 0.16. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated areas of Raymark waste at the DPW Lot, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 0.2 to 0.7 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in five of the twelve soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 30 percent. These samples were collected from the 0- to 12- foot bgs interval. The average concentration was 5 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this

parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos at the DPW Lot property. Based on field conditions in the estimated areas of Raymark waste at the DPW Lot, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.18.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the DPW Lot are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the DPW Lot is 6.4 acres, with an estimated 16 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.18.4. The estimated area of Raymark waste include some paved and some grassy areas. No consideration was given to site characteristics other than the presence

of buildings. Because of the small size of the estimated areas of Raymark waste, it is unlikely that individuals will spend all of their time within those areas. However, if that were the case, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately seven times greater than those estimated using the FRW factor.

- Only two locations at the DPW Lot were identified as meeting the definition of Raymark waste. A total of 12 samples were collected from these two locations. Use of such small datasets adds uncertainty to the risk assessment.

- Ten of the samples in the dataset were only analyzed using field-screening methods. The remaining two samples were analyzed for PCBs (by CLP methods), for metals (by field-screening methods), and for asbestos. For this reason, data are not available for risk assessment purposes for the majority of COPCs that have been identified at other properties known to have received Raymark waste. Based on a comparison to these other properties, it is possible that other contaminants are present and that associated risks exist, which were not quantified in this evaluation. Since PCBs were not detected above COPC selection criteria, cancer risk estimates and hazard indices cannot be calculated at this property.

- Samples collected from depths of 0 to 12 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers. In addition, future commercial workers may be exposed to soils currently located at depths up to 15 feet bgs, which is the depth considered as accessible by CT DEP (CT DEP, 1996). The absence of samples collected in the 12-to 15- foot bgs interval adds uncertainty in the evaluation of the risks to future commercial workers.

- A comparison of data from soils outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of benzo(a)pyrene, arsenic, and lead at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Arsenic is present in soils located outside the estimated areas of Raymark waste at the DPW Lot at concentrations up to 16.9 mg/kg,

lead is present at concentrations up to 2,020 mg/kg, and benzo(a)pyrene is present at concentrations up to 1.1 mg/kg. Dioxins were detected outside the estimated areas of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin concentrations outside the estimated areas of Raymark waste are less than the EPA Region IX PRGs for industrial soil. Eight samples from outside the estimated areas of Raymark waste were analyzed for PCBs using CLP methods. None of these samples had concentrations above the CT RSRs for industrial soil or the EPA Region IX PRG for industrial soil. The individual Aroclors detected were Aroclor 1254, Aroclor 1260, and Aroclor 1268. Copper was detected at concentrations up to 785 mg/kg. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

3.18.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at the DPW Lot property. Risks to commercial workers were estimated.

- Only lead and asbestos were identified as COPCs for soils within the estimated areas of Raymark waste at the DPW Lot property, therefore an evaluation of hazard indices and cancer risks is not provided.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated areas of Raymark waste at the DPW Lot property.

- Asbestos was detected in five of the 12 soil samples collected from the estimated areas of Raymark waste in the 0- to 12- foot bgs interval at a concentration range of trace to 30 percent. The average concentration was 5 percent.

3.18.6 Ecological Evaluation

No formal ecological evaluation was performed on this property; however, it is assumed that there are no ecological receptors on this property as almost the entire property is paved or covered with buildings.

3.18.7 Summary

This 6.4-acre property is zoned for municipal use, owned by the town, and used as the Stratford DPW garages, storage lot and offices. Given the current property conditions, with over 90 percent of the property covered by buildings or pavement, only limited infiltration or leaching is likely occurring, and only in the areas of cracked pavement. Samples containing metals, pesticides, and SVOCs at concentrations exceeding the CT DEC and/or CT PMC, and asbestos above 1 percent are present in this property.

An evaluation of hazard indices and cancer risks is not provided, as lead and asbestos were the only COPCs identified in soils within the estimated area of Raymark waste. Adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soils within the estimated area of Raymark waste. The average asbestos concentration was 5 percent in the estimated areas of Raymark waste.

It is assumed there are no ecological receptors present on the property due to poor habitat conditions.

TABLE 3-18
DPW LOT - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	21	54	1	3	Trace	30	1	3		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	1	1	0.01	0.01	0.0103	0.0103				
1,2,3,4,6,7,8-HpCDF	1	1	0.0095	0.0095	0.0095 J	0.0095 J				
1,2,3,4,7,8-HxCDF	1	1	0.0041	0.0041	0.0041 J	0.0041 J				
1,2,3,6,7,8-HxCDF	1	1	0.0018	0.0018	0.0018 J	0.0018 J				
1,2,3,7,8-PeCDF	1	1	0.00082	0.00082	0.00082 EMPC	0.00082 EMPC				
2,3,4,6,7,8-HxCDF	1	1	0.001	0.001	0.001 EMPC	0.001 EMPC				
2,3,4,7,8-PeCDF	1	1	0.0011	0.0011	0.0011 EMPC	0.0011 EMPC				
2,3,7,8-TCDF	1	1	0.0035	0.0035	0.0035 EMPC	0.0035 EMPC				
OCDD	1	1	0.44	0.44	0.441 J	0.441 J				
Total HpCDD	1	1	0.028	0.028	0.0284 J	0.0284 J				
Total HpCDF	1	1	0.015	0.015	0.0154 EMPC	0.0154 EMPC				
Total HxCDF	1	1	0.013	0.013	0.0132 EMPC	0.0132 EMPC				
Toxicity Equivalency	1	1	0.0019	0.0019	0.0019 J	0.0019 J				
Metals (MG/KG)										
Aluminum	5	5	8040	8040	6780	9030				
Antimony	2	5	2.1	4.6	3.2	6	8200	0		
Arsenic	5	5	9.6	9.6	2.7	16.9	10	2		
Barium	5	5	234	234	68.9	460	140000	0		
Beryllium	1	5	0.36	0.94	0.94	0.94	2	0		
Cadmium	3	5	2.1	3.4	1	6	1000	0		
Calcium	5	5	2450	2450	736 J	6380 J				
Chromium	5	5	25.2	25.2	12.6	47.1	100	0		
Cobalt	5	5	5.5	5.5	3.4	8.7 J	2500	0		
Copper	40	118	104	146	12.1 J	785	76000	0		
Iron	5	5	52400	52400	14000	145000				
Lead	87	118	279	366	5.5 J	7190	1000	7		

TABLE 3-18 (cont.)
DPW LOT - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG) (cont.)										
Magnesium	5	5	2210	2210	1400	3290				
Manganese	5	5	299	299	118	572	47000	0		
Mercury	4	5	0.25	0.31	0.12	0.55	610	0		
Nickel	5	5	86.8	86.8	10.9	299	7500	0		
Potassium	5	5	935	935	658	1570				
Selenium	1	5	1.3	3.6	3.6 J	3.6 J	10000	0		
Silver	1	5	0.39	1.5	1.5	1.5	10000	0		
Sodium	2	5	123	250	224 J	275 J				
Vanadium	5	5	25.7	25.7	21.5	31.7 J	14000	0		
Zinc	5	5	481	481	44.8	1200	610000	0		
Metals (SPLP) (UG/L)										
Barium	1	1	375	375	375	375			10000	0
Chromium	1	1	1.3	1.3	1.3	1.3			500	0
Copper	1	1	37	37	37 J	37 J			13000	0
Lead	1	1	69.2	69.2	69.2	69.2			150	0
Zinc	1	1	57.9	57.9	57.9	57.9			50000	0
Semivolatile Organic Compounds (UG/KG)										
Acenaphthene	1	5	1400	42	42 J	42 J	2500000	0	84000	0
Acenaphthylene	2	5	1300	260	150 J	360 J	2500000	0	84000	0
Anthracene	2	5	1300	250	190 J	300 J	2500000	0	400000	0
Benzaldehyde	1	5	1400	49	49 JEB	49 JEB				
Benzo(a)anthracene	3	5	1600	680	80 J	1100 J	7800	0	1000	1
Benzo(a)pyrene	3	5	1500	660	75 J	1100 J	1000	1	1000	1
Benzo(b)fluoranthene	3	5	1500	650	99 J	1100 J	7800	0	1000	1
Benzo(g,h,i)perylene	3	5	1500	540	99 J	830 J	2500000	0	42000	0
Benzo(k)fluoranthene	3	5	1600	690	56 J	1300 J	78000	0	1000	1
Carbazole	2	5	1300	160	110 J	210 J	290000	0	360	0
Chrysene	3	5	1700	870	110 J	1500 J	780000	0	1000	1

TABLE 3-18 (cont.)
DPW LOT - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

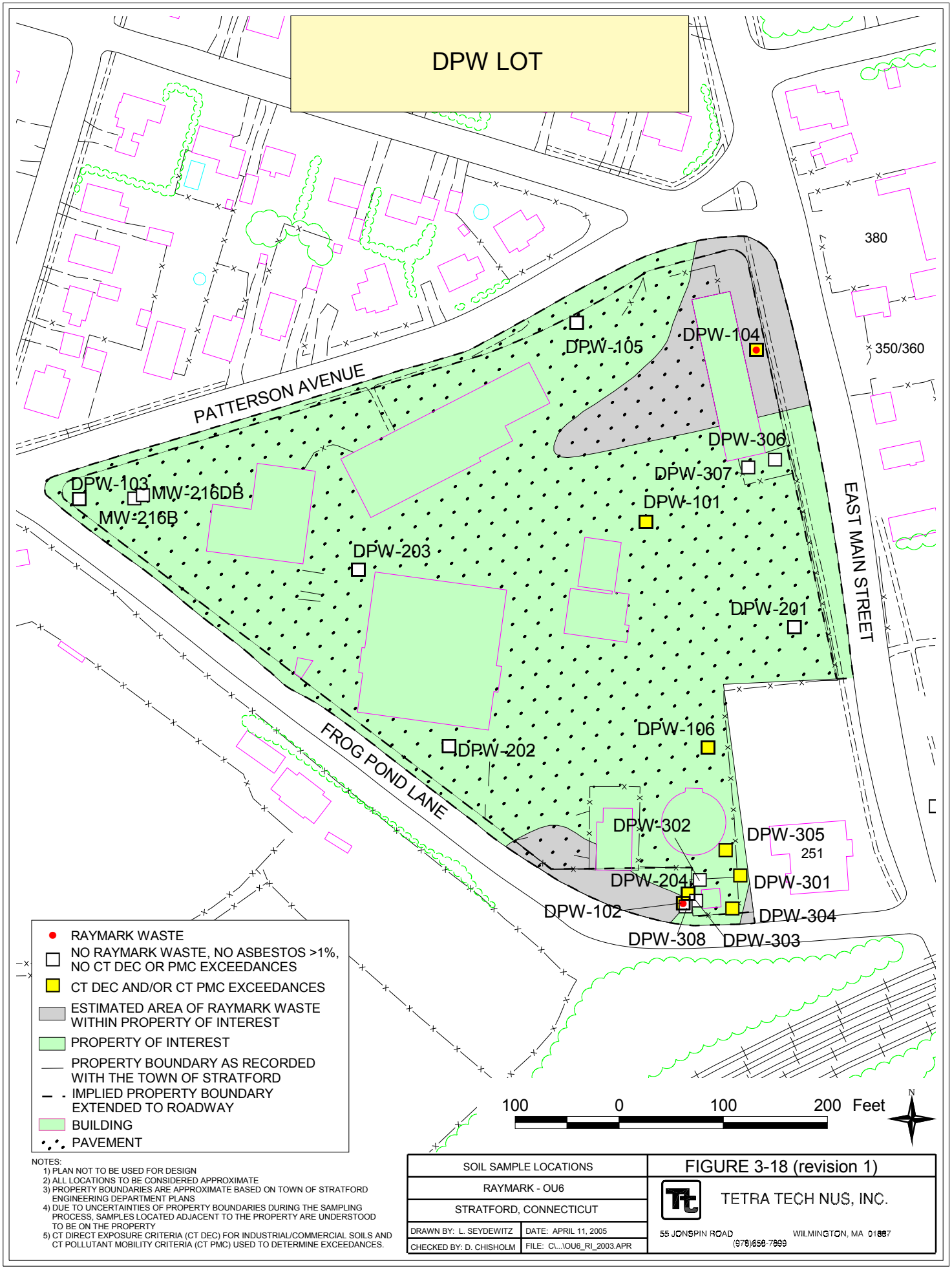
PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Dibenzo(a,h)anthracene	1	5	1400	250	250 J	250 J	780	0	1000	0
Fluoranthene	3	5	2100	1600	130 J	3000	2500000	0	56000	0
Fluorene	2	5	1300	170	91 J	250 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	3	5	1500	520	76 J	880 J	7800	0	1000	0
Phenanthrene	3	5	1800	1200	85 J	2400	2500000	0	40000	0
Pyrene	3	5	2000	1400	150 J	2600 J	2500000	0	40000	0
Volatile Organic Compounds (UG/KG)										
Acetone	5	5	180	180	20	740 J	1000000	0	140000	0
Benzene	1	5	8	4	4 J	4 J	200000	0	200	0
Methyl Acetate	1	5	20	79	79	79				
Toluene	1	5	7	2	2 J	2 J	1000000	0	67000	0
Pesticide/PCB (UG/KG)										
4,4'-DDE	1	5	49	240	240 *	240 *	17000	0	21	1
4,4'-DDT	3	5	65	110	5.5	310 *	17000	0	21	1
alpha-Chlordane	1	5	41	200	200 *	200 *	2200	0	66	1
Aroclor, Total (4)	15	55	140	270	37	698	10000	0		
Aroclor, Total (Conservative) (5)	15	55	190	460	185	800	10000	0		
Aroclor-1254	2	48	63	340	170	510	10000	0		
Aroclor-1260	1	48	52	81	81	81	10000	0		
Aroclor-1262	6	55	84	120	78 J	180 J	10000	0		
Aroclor-1268	13	55	110	200	37 J	400	10000	0		
Endrin Aldehyde	1	5	3	7.2	7.2	7.2	610000	0		
Endrin Ketone	1	5	2.5	5.1	5.1 #	5.1 #	610000	0		
gamma-Chlordane	1	5	27	130	130 *	130 *	2200	0	66	1
Heptachlor	1	5	2.2	7.5	7.5	7.5	1300	0	13	0
Heptachlor Epoxide	1	5	3	11	11	11	630	0	20	0
Total Organic Carbon (mg/kg)										
Total Organic Carbon	3	3	1900	1900	1116 J	2419				

TABLE 3-18 (cont.)
DPW LOT - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-18 (revision 1)
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 11, 2005	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.19 251 East Main Street

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.19.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.19.1 Property Description

This property, approximately 0.7 acres of commercially-zoned (retail) land, is located on East Main Street in Stratford, Connecticut (Town of Stratford, 1997). There is a one-story building located on the southern portion of the property. The remainder of the property is paved except for the southeast corner, which is covered by landscape plantings around the building entrance. There is a fence that runs along the western and northern property boundaries. Access to the remainder of the property is unrestricted. No storm drains were observed on the property, however storm drains were observed along East Main Street and at the property to the north and east (DPW lot).

The DPW Lot surrounds this property to the west and north (see Section 3.18). The main entrance to 250 East Main Street (see Section 3.17) lies across East Main Street to the east, and Frog Pond Lane abuts the property to the south. The site topography is flat.

3.19.2 Physical Characteristics

This property is located outside the 100-year floodplain of the Housatonic River, as observed from Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Stratford, Connecticut (FEMA, 1992). The 100-year floodplain is delineated on Figure 1-2.

Six soil borings (ES251-201 through ES251-206) were advanced at the property to depths of up to 16 feet below ground surface (bgs). Boring ES251-206 was advanced 4 feet away from ES251-202; only soil descriptions for ES251-206 are used to describe the fill and soils encountered. Soils noted in borings ES251-201, 203, and 206 consist of fill overlying silty sand with varied amounts of organics (roots). Materials noted in borings ES251-204 and 205 consist of fill overlying gravelly sand. The native materials are characteristic of glacial outwash, alluvial,

and/or ice-contact deposits. Refer to Figure 3-19 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Soil sample locations are shown on Figure 3-19. The sample locations indicate borings used to describe the fill and natural materials on the property. All sample locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials identified in the soil from borings ES251-201, 203, 205, and 206 included potentially asbestos-containing material (PACM), asphalt, clay pipe and ceramic fragments, coal, concrete, glass, leather, metal, resin, shingles, slag, and/or wire insulation. PACM (asbestos fibers) was observed in the soil from ES251-203. These materials were encountered with natural fill materials consisting of sand, silty sand, and gravel mixtures. Manmade debris was not observed in boring ES251-204; however, the sand and silty sand with gravel in these borings may represent natural fill. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across the entire property. The depth to groundwater ranges from 4 to 11 feet bgs, based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on the property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-19. An estimated 15 percent of the property is estimated to contain Raymark waste. The waste area is entirely paved.

3.19.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. Results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial

soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 26 samples collected from six locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-19. Samples were analyzed for asbestos, metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-19 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soils contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-19 for the soil data summary statistics and comparison criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Twenty-six soil samples were collected from the property and analyzed for asbestos. Asbestos was rarely detected on the property. Asbestos at greater than 1 percent was found in one sample, in the southern portion of the property.

Dioxins

No dioxin samples were collected on this property.

Metals

Soil samples were collected from this property and analyzed for metals as follows: six samples were analyzed for metals at a fixed laboratory and 20 samples were screened for copper and lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium and sodium. Arsenic concentrations exceeded the CT DEC regulatory standard in one sample collected in the central area of the property at a depth of 6 to 8 feet bgs. No SPLP or TCLP metals samples were collected at this property.

SPLP and TCLP Metals

There were no SPLP or TCLP metals collected on this property.

Pesticides

Six soil samples were collected from the property and analyzed for pesticides. Pesticides were detected sporadically on the property, with no pesticide concentrations exceeding the CT DEC regulatory standards. The concentration of two pesticides, 4,4-DDT and 4,4-DDE, exceeded the CT PMC regulatory standards in the same sample. Pesticide exceedances were located in the central portion of the property, from 2 to 4 feet bgs.

PCBs

Twenty-six soil samples were collected from the property and analyzed for PCBs as Aroclors. PCBs were not frequently detected on the property. There were no PCB exceedances of the CT DEC regulatory standards. No SPLP or TCLP samples were collected for PCBs on this property.

SVOCs

Six soil samples were collected from the property and analyzed for SVOCs. SVOCs were detected sporadically on the property. Concentrations of six SVOCs, all PAHs, exceeded the

CT PMC regulatory standards. Concentrations of two of those SVOCs, benzo(a)pyrene and dibenzo(a,h) anthracene, exceeded the CT DEC as well. SVOC exceedances were located in the central part of the property, at depths ranging from ground surface to 6 feet bgs.

VOCs

Six samples were collected from this property and analyzed for VOCs. VOCs were sporadically detected on the property, with no VOC concentrations exceeding the CT DEC regulatory standards. Trichloroethene concentrations exceeded the CT PMC regulatory standard in one sample collected in the central portion of the property from 4 to 6 feet bgs.

Raymark Waste

The results from one sample location indicated the presence of Raymark waste. The table below displays the location and constituents of the sample that meets the Raymark waste definition on this property. This sample is located within the 15 percent of the property shown on Figure 3-19 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
ES251-203	4 to 6	6.7	489	764	ND

ND- Contaminant was not detected

3.19.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 15 percent of the 0.7-acre property is estimated to contain Raymark waste. The waste is located along the southwest corner of the property (see Figure 3-19). Most of the waste area is covered by pavement. Almost the entire property is covered either by a building or pavement, with the exception of some landscaping near the front entrance, along East Main Street.

It is assumed there is some infiltration or leaching into the groundwater in the cracked paved area and in the plantings. It is unknown if metals are potentially leaching into the groundwater as no SPLP or TCLP metals samples were collected. Analytical results indicate pesticides, SVOCs, and VOCs may be leaching into groundwater.

3.19.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at 251 East Main Street that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire property at 251 East Main Street may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.19.5.1 provides an overview of the 251 East Main Street property, Section 3.19.5.2 presents COPCs and EPCs, Section 3.19.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.19.5.4 contains the numerical results of the risk assessment, and Section 3.19.5.5 presents property-specific uncertainties. Section 3.19.5.6 presents a property-specific summary of the major risk findings.

3.19.5.1 Overview

251 East Main Street is a commercial property of approximately 0.7 acres. A detailed description of the property is provided in Section 3.19.1. The nature and extent of the contamination detected at 251 East Main Street is discussed in Section 3.19.3. The area of the property estimated to contain Raymark waste represents an estimated 15 percent of the total 0.7-acre property, exclusive of any buildings, and is shown in Figure 3-19. Property-specific site

conditions within the estimated area of Raymark waste are described in Section 3.19.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 251 East Main Street are summarized in Appendix B-1, Table 2.19.

3.19.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.19 presents a summary of the COPCs for quantitative risk assessment for 251 East Main Street soils from the estimated area of Raymark waste. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. Only one location at 251 East Main Street was identified as meeting the definition of Raymark waste. Four samples were collected at this location from depths of 0 to 8 feet bgs. These samples were only analyzed using field-screening methods. No samples were collected more than 10 feet bgs within the estimated area of Raymark waste due to site-specific field conditions.

Maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. Only asbestos was identified as a direct exposure COPC based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.19.

Because only asbestos has been identified as a COPC for this property, evaluations of hazard indices, cancer risks, and lead are not provided. This risk assessment consists of a qualitative discussion of asbestos sample results.

3.19.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 251 East Main Street.

251 East Main Street is a commercial property, described in Section 3.19.1. Under current and future conditions, potential human receptors (commercial workers who work at 251 East Main Street) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities.

The primary routes of exposure for potential human receptors at 251 East Main Street are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from 251 East Main Street is considered to be minimal. The estimated area of Raymark waste is almost entirely under pavement. The presence of pavement reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.19.5. Asbestos is present in soils within the estimated area of Raymark waste of the 251 East Main Street property. The presence of pavement suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

3.19.5.4 Exposure to Asbestos

A summary of the qualitative asbestos evaluation for 251 East Main Street is provided in this section.

Asbestos was detected in one of the four soil samples collected from the estimated area of Raymark waste at a concentration of 6.7 percent. These samples were collected from the 0- to 8-foot bgs interval. The average concentration was 2 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be

noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is “friable” (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement in the estimated area of Raymark waste reduces the potential for airborne asbestos at the 251 East Main Street property. Based on field conditions in the estimated area of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.19.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the 251 East Main Street property are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment through the selection of samples included in the evaluation. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- Only one location at 251 East Main Street was identified as meeting the definition of Raymark waste. A total of four samples were collected from this location. Use of such small datasets adds uncertainty to the risk assessment.

- These samples were only analyzed using field-screening methods. Risk estimates for exposures to the estimated areas of Raymark waste were limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. For 251 East Main Street, sample analyses were limited to lead, copper, PCBs, and asbestos. Four samples within the estimated area of Raymark waste were

analyzed for PCBs using field-screening methods. None of these samples reported detectable concentrations of PCBs. These results suggest the absence of PCBs at potential levels of concern. As a result of the limited sampling analyses, cancer risk estimates and hazard indices cannot be calculated at this property. It is possible that other contaminants are present and that associated exposures exist, which are not quantified in this evaluation.

- The samples included in the risk assessment for current and future commercial workers were collected from depths of 0 to 8 feet bgs. Asbestos was only detected in the sample from 4 to 6 feet bgs. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, contact with asbestos may not occur for current commercial workers.

- A comparison of data from soils outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of benzo(a)pyrene, dibenzo(a,h)anthracene, and arsenic at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Arsenic is present in soils located outside the estimated area of Raymark waste of 251 East Main Street at concentrations up to 12.3 mg/kg, benzo(a)pyrene is present at concentrations up to 3.8 mg/kg, and dibenz(a,h)anthracene is present at concentrations up to 0.95 mg/kg. Six samples from outside the estimated area of Raymark waste were analyzed for PCBs using CLP methods. While none of these samples had concentrations above the CT RSRs for industrial soil, one sample did have total Aroclor concentrations greater than the EPA Region IX PRG for industrial soil. The individual Aroclors detected were Aroclor 1260, Aroclor 1262, and Aroclor 1268. Lead was detected at concentrations up to 505 mg/kg. Copper was detected at concentrations up to 612 mg/kg. Asbestos was not detected outside the estimated area of Raymark waste at 251 East Main Street. The samples collected from outside the estimated area of Raymark waste at this property were not analyzed for dioxins. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.19.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at 251 East Main Street. Risks to commercial workers were estimated.

- Only asbestos has been identified as a COPC for soils within the estimated area of Raymark waste at this property, therefore an evaluation of lead exposures, hazard indices, and cancer risks is not provided.

- Asbestos was detected in the one of the four soil samples collected from the estimated area of Raymark waste at 251 East Main Street at a concentration of 6.7 percent. These samples were collected from the 0- to 8- foot bgs interval. The average concentration was 2 percent.

3.19.6 Ecological Evaluation

No formal ecological evaluation was performed on this property. Given that it is a small property with no real open space and is almost entirely paved or covered by a building, it is assumed that no ecological habitats are present on the property, and that no ecological receptor could be adversely impacted by contaminants in the estimated area of Raymark waste.

3.19.7 Summary

This property, approximately 0.7 acres, contains Raymark waste in a small portion of the property. Samples with concentrations of metals, pesticides, SVOCs, and VOCs exceeding the CT DEC and/or CT PMC, as well as asbestos at greater than 1 percent were found on this property. It is assumed that some infiltration is occurring in the unpaved areas of the property.

An evaluation of lead exposure, hazard indices, and cancer risks is not provided, as only asbestos was identified as a COPC in soils within the estimated area of Raymark waste. The average asbestos concentration in the estimated area of Raymark waste is 2 percent. It is assumed that no ecological habitats are present on the property, and that no ecological receptor could be adversely impacted by contaminants in the estimated area of Raymark waste.

TABLE 3-19
251 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	1	26	0.3	7	6.7	6.7	1	1		
Metals (MG/KG)										
Aluminum	6	6	7700	7700	5130	13500				
Arsenic	5	6	4.1	4.9	2.7	12.3	10	1		
Barium	6	6	87.7	87.7	23.4	160	140000	0		
Beryllium	2	6	0.21	0.48	0.42	0.55	2	0		
Cadmium	1	6	0.32	1.6	1.6 J	1.6 J	1000	0		
Calcium	6	6	3790	3790	878 J	9550				
Chromium	6	6	18.1	18.1	5.6	42	100	0		
Cobalt	6	6	3.7	3.7	1.5	6.4 J	2500	0		
Copper	19	26	132	144	7.9 J	764	76000	0		
Iron	6	6	21400	21400	6980	72200				
Lead	25	26	127	130	6.3 J	505 J	1000	0		
Magnesium	6	6	2460	2460	1750	3330				
Manganese	6	6	193	193	77.1 J	451 J	47000	0		
Mercury	3	6	0.14	0.26	0.054 J	0.4	610	0		
Nickel	6	6	19.8	19.8	5.1	64.4 J	7500	0		
Potassium	6	6	810	810	534	1400				
Vanadium	6	6	27.1	27.1	11.1	49.1	14000	0		
Zinc	6	6	143	143	14.5 J	452 J	610000	0		
Semivolatile Organic Compounds (UG/KG)										
Acenaphthylene	2	6	1700	880	770 J	1000 J	2500000	0	84000	0
Acetophenone	1	6	2000	44	44 J	44 J				
Anthracene	2	6	1500	530	530 J	540 J	2500000	0	400000	0
Benzo(a)anthracene	4	6	1600	2200	590 J	4000	7800	0	1000	3
Benzo(a)pyrene	3	6	2300	2700	710 J	3800	1000	2	1000	2
Benzo(b)fluoranthene	4	6	1500	2100	700 J	3500	7800	0	1000	3
Benzo(g,h,i)perylene	2	6	2000	2000	2000 J	2000 J	2500000	0	42000	0
Benzo(k)fluoranthene	3	6	2300	2700	560 J	3900 J	78000	0	1000	2

TABLE 3-19 (cont.)
251 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

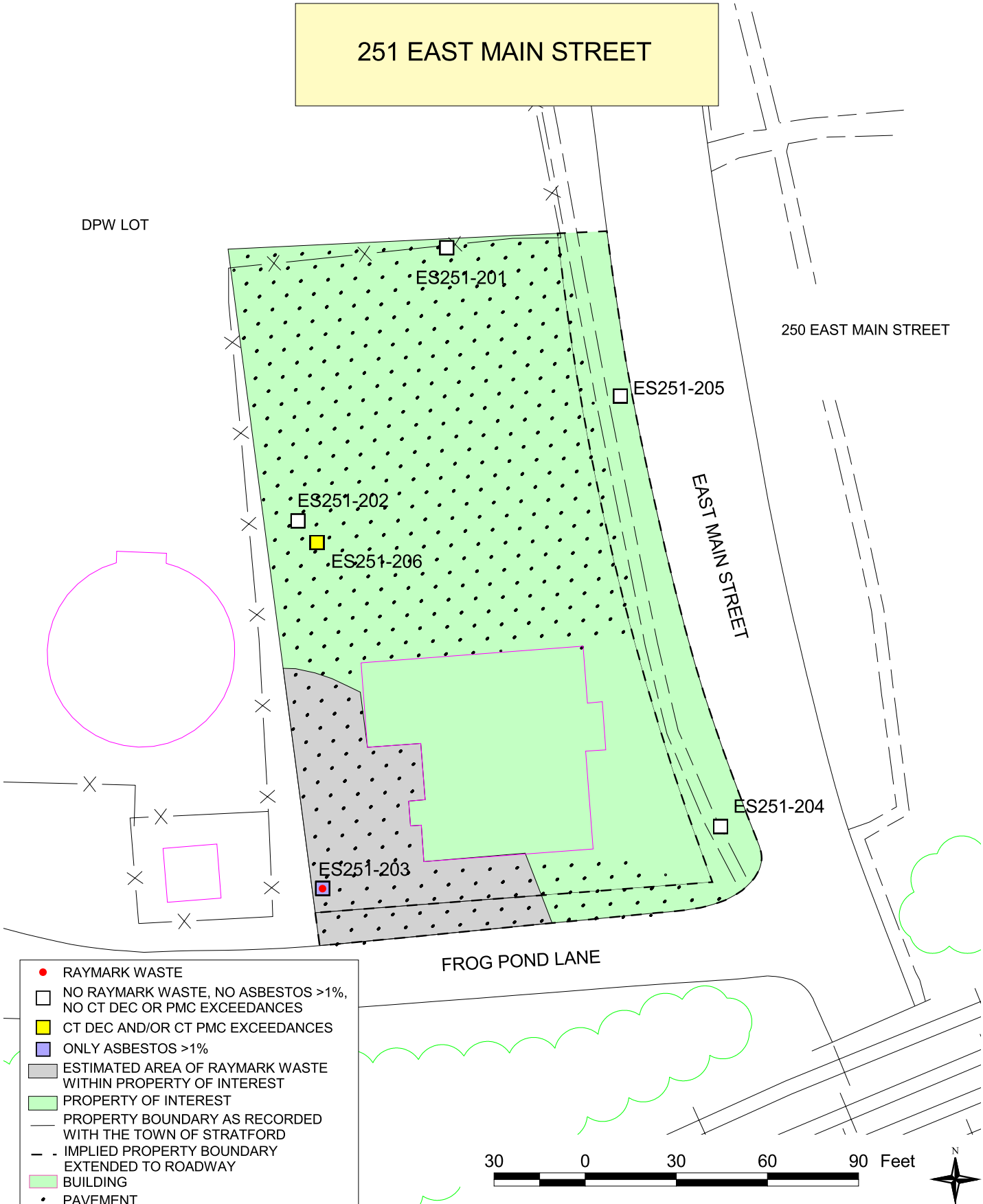
PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Chrysene	4	6	2000	2900	810 J	5100	780000	0	1000	3
Dibenzo(a,h)anthracene	1	6	1900	950	950 J	950 J	780	1	1000	0
Fluoranthene	4	6	2700	3900	1000 J	7300	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	2	6	2200	2400	2300 J	2500 J	7800	0	1000	2
Phenanthrene	3	6	1400	1900	720 J	2700	2500000	0	40000	0
Pyrene	4	6	3300	4800	1100 J	7400	2500000	0	40000	0
Volatile Organic Compounds (UG/KG)										
1,4-Dichlorobenzene	1	6	5	4	4	4	240000	0	15000	0
Acetone	5	6	66	78	31	130	1000000	0	140000	0
Benzene	1	6	6	8	8	8	200000	0	200	0
Carbon Disulfide	1	6	6	3	3 J	3 J	1000000	0	140000	0
cis-1,2-Dichloroethene	1	6	7	13	13	13				
Methyl Acetate	1	6	9	23	23	23				
Methyl tert-Butyl Ether	3	6	40	73	10	160				
Toluene	1	6	12	41	41	41	1000000	0	67000	0
Trichloroethene	4	6	670	1000	3 J	3600	520000	0	1000	1
Pesticide/PCB (UG/KG)										
4,4'-DDD	2	6	4.4	9.2	5.3	13	24000	0	29	0
4,4'-DDE	2	6	15	42	7.2	77 *	17000	0	21	1
4,4'-DDT	4	6	52	76	12	260 *	17000	0	21	1
Aroclor, Total (4)	3	26	97	420	120	920	10000	0		
Aroclor, Total (Conservative) (5)	6	26	160	510	278	1077	10000	0		
Aroclor-1254	1	26	56	230	230	230	10000	0		
Aroclor-1260	2	26	59	130	120	140	10000	0		
Aroclor-1262	2	26	72	300	130	480	10000	0		
Aroclor-1268	3	26	79	270	160	440	10000	0		
Endosulfan Sulfate	1	6	3.4	10	10	10	1200000	0	8400	0
Endrin Aldehyde	1	6	4.7	18	18	18	610000	0		
Endrin Ketone	4	6	11	16	7.1 J#	24	610000	0		

TABLE 3-19 (cont.)
251 EAST MAIN STREET - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-19
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.20 Beacon Point Area

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.20.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.20.1 Property Description

This property, approximately 7.4 acres of commercially-zoned (town-owned waterfront business) land, is located at the intersection of Birdseye Street and Beacon Point Road in Stratford, Connecticut (Town of Stratford, 1997). The area encompasses tidally-influenced undeveloped wetlands, a vacant vegetated area, several public boat launches, and a paved parking lot. There are two buildings on the property. A small concession stand is located approximately 30 feet from the intersection of Beacon Point Road and Birdseye Street. A second, larger two-story building is located directly adjacent to the public boat launch and houses the Coast Guard Auxiliary. The northern-most end of the property is grass-covered and extends west along Birdseye Street. There is a guard rail present along the edge of this grass-covered area. A swale, lined with trees, lies between this grassy area and the street. Access to this grassy area is not restricted, although there are several large concrete blocks lining the edge of the vacant lot abutting the pavement. The northeastern portion of the property is paved and also has a wooden pier with benches and walkways. The central portion of the property is a paved parking lot that extends south. South of this paved lot are undeveloped wetlands that are tidally influenced. The property is currently used as a recreation area by the town. Access is not restricted.

Surrounding the property to the north are the Tide Harbor Condominiums and adjacent wetlands. Beacon Point Road comprises the majority of the western property line, with the Stratford Publicly-Owned Treatment Works (POTW) located on the opposite side of Beacon Point Road. South of the tidal wetlands lies 1 Beacon Point Road (see Section 3.21). The entire eastern border of this property is the Housatonic River.

3.20.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, this property is located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevations for the three zones on the property are 10, 11, and 12 feet (FEMA, 1992). The 100-year floodplain boundary for this property is shown on Figure 1-2.

Twenty-two soil borings (BPA-201 through BPA-210, BR-101 through BR-104 and D-SB02 through D-SB09) were advanced at the property to depths up to 20 feet below ground surface (bgs). Borings BR-101 through 104 and D-SB08 did not reach the native material below the fill. Surficial materials noted in borings BPA-201 through 207, BPA-210, D-SB03 through D-SB07, and D-SB09 consist of fill overlying peat and silt with varying amounts of fine sand, clay, and organics, which are characteristic of former marsh and swamp deposits. Soils noted in borings BPA-208, BPA-209, and D-SB02 consist of fill overlying fine to coarse sand with varied amounts of gravel, which is characteristic of alluvial glacial outwash and ice-contact deposits. Refer to Figure 3-20 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Sample points are shown on Figure 3-20, including both shallow surface soil samples and deeper samples from soil borings. The borings were used to describe the fill and native materials on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity, as well as reworked native material (boring D-SB08). Manmade materials were identified in all of the borings and included PACM (potentially asbestos-containing material) – a thin, fibrous, paper-like material, ash, asphalt, brick, ceramic pieces, charcoal, concrete, copper wire, glass, metal fragments, plastic, rubber gaskets, shingles, and/or slag. PACM was identified in borings D-SB04 and D-SB02. The manmade materials were encountered with natural fill consisting of fine to coarse sand with varying amounts of fines and/or gravel. Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across the entire property. The depth to

groundwater ranges from 2 to 8 feet bgs, based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on the property. The limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-20. An estimated 15 percent of the property contains Raymark waste, and about one-third of that area is covered by pavement. The rest is covered by vegetation.

3.20.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for residential soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 172 samples collected from 66 locations at this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-20. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-20 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC regulatory standards. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-20 for the soil data summary statistics and comparison

to criteria. The discussion below includes all samples collected on this property, not just those determined to be within the estimated areas of Raymark waste.

Asbestos

One hundred and sixty-nine soil samples were collected from the property and analyzed for asbestos. Asbestos was detected in 58 of the 169 soil samples collected at this property. Asbestos at greater than 1 percent was reported in 22 samples. Asbestos detections were scattered throughout the property at depths ranging from ground surface to 14 feet bgs.

Dioxins

Five soil samples were collected from the property and analyzed for dioxins. Dioxins were detected on the property. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. The maximum TEQ value was 7.81 µg/kg.

Metals

Soil samples were collected from this property and analyzed for metals as follows: 29 samples were analyzed in a fixed laboratory, 104 samples were screened for copper; and 142 samples were screened for lead. Metals were detected with high frequency on the property. Some metals detected are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Concentrations of arsenic, barium, cadmium, chromium, copper, and lead exceeded the CT DEC regulatory standards in samples collected throughout the property at depths of up to 16 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only 3 out of the six SPLP samples were from within the estimated area of Raymark waste. Each of the 3 samples exceeded the CT PMC standard for lead and one of the samples also exceeded for copper. There were no TCLP samples collected for this property.

Pesticides

Twenty-nine soil samples were collected from the property and analyzed for pesticides. Concentrations of two pesticides exceeded CT PMC regulatory standards at two different locations at the property. One exceedance was at a depth of 4 to 6 feet bgs in the northern portion of the property while the other was at ground surface in the southern portion of the property. No pesticide concentrations exceeded CT DEC regulatory standards.

PCBs

Up to 125 soil samples were collected from the property and analyzed for PCBs as Aroclors. While PCBs were not frequently detected, there were seven exceedances of CT DEC regulatory standards for total Aroclors. These exceedances were detected at depths ranging from ground surface to 6 feet bgs in both the northern and southern boundaries. The concentrations of Aroclors 1262 and 1268 were primary contributors to the total Aroclor exceedance at these locations. No SPLP or TCLP PCB samples were collected on this property.

SVOCs

Twenty-three soil samples were collected from the property and analyzed for SVOCs. SVOCs were detected frequently throughout the property. Concentrations of 11 SVOCs, primarily PAHs, exceeded the CT PMC and/or CT DEC regulatory standards. SVOC exceedances were detected throughout the property at depths ranging from ground surface to 16 feet bgs.

VOCs

Twelve soil samples were collected from the property and analyzed for VOCs. VOCs were detected infrequently and there were no VOC concentrations that exceeded either CT PMC or CT DEC regulatory standards.

Raymark Waste

Fifteen soil samples collected from nine different sample locations indicate that Raymark waste is present on the property. The following table displays the location and constituents of the 15

samples that meet the definition of Raymark waste. These samples are located within the 15 percent of the property shown on Figure 3-20 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor-1268 (µg/kg)
BPM A+09	0 to 0.5	30	5,170	NA	6,000
BPM A+50	0 to 0.5	5	1,670	NA	3,000
BPM B+50	0 to 0.5	10	1,750	1,860	ND
D-SB02	0 to 2	20	14,000	26,000	NA
	2 to 4	40	49,000	69,600	39,000
	4 to 6	25	30,000	45,000	NA
	6 to 8	20	20,000	31,000	NA
	8 to 10	20	8,200	13,000	NA
D-SB03	0 to 2	2	688	1,150	ND
	4 to 6	3	450	890	NA
D-SB04	8 to 10	2	2500	760	NA
D-SB06	2 to 4	3	663	765	910
D-SB08	4 to 6	2	1,100	1,400	NA
BPA-210	2 to 4	1.9	721	519	550
	4 to 6	1.8	755	597	420

NA- Contaminant was not analyzed
ND- Contaminant was not detected

3.20.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately fifteen percent of this 7.4-acre property is estimated to contain Raymark waste. See Figure 3-20.

Roughly half of this property is covered by pavement. The remainder of the property is either wetland, or vegetated with trees, shrubs, and short grasses. There is one building present, and a small concession stand. The parking lot was fairly recently paved so cracking is minimal. The Raymark waste is present throughout the property, in areas that are both paved and vegetated.

It is assumed that infiltration and erosion could be occurring in the unpaved areas of this property. SPLP and other data indicate that leaching of metals, pesticides, and SVOCs could adversely impact groundwater quality.

3.20.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at Beacon Point Area that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire Beacon Point Area property may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.20.5.1 provides an overview of the Beacon Point Area property, Section 3.20.5.2 presents COPCs and EPCs, Section 3.20.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.20.5.4 contains the numerical results of the risk assessment, and Section 3.20.5.5 presents property-specific uncertainties. Section 3.20.5.6 presents a property-specific summary of the major risk findings.

3.20.5.1 Overview

The Beacon Point Area is a recreational property, owned by the Town of Stratford. The area covers approximately 7.4 acres. A detailed description of the property is provided in Section 3.20.1. The nature and extent of the contamination detected at Beacon Point Area is discussed in Section 3.20.3. The areas of the property estimated to contain Raymark waste represent an estimated 15 percent of the total 7.4-acre property, exclusive of any buildings, and are shown in Figure 3-20. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.20.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes

detected in soils within the estimated areas of Raymark waste at the property are summarized in Appendix B-1, Table 2.20.

3.20.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.20 presents a summary of the COPCs for quantitative risk assessment for Beacon Point Area soils from the estimated areas of Raymark waste to a depth of 15 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for residential soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste of this property to risk-based COPC screening levels for residential land use, as shown in Appendix B-1, Table 2.20:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene)
- Aroclors, Total (1262 and 1268)
- Metals (arsenic, barium, cadmium, chromium, lead, manganese, nickel, and zinc)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for Beacon Point Area are presented in Appendix B-1, Table 3.20. Support documentation for the calculation of

dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.20.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the Beacon Point Area property and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (recreational visitors) were assumed to be exposed to soil within the estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The Beacon Point Area property is a recreational area owned by the Town of Stratford, as described in Section 3.20.1.

Potential Receptors

The receptors retained for quantitative evaluation are current and future recreational visitors. Potentially exposed individuals include residents who may live nearby or visitors from other areas of Stratford or surrounding towns.

Beacon Point Area is primarily recreational. Frequent recreational visitors were evaluated for exposure to soils (0 to 15 feet bgs) in the estimated areas of Raymark waste, under current and future land use. Persons involved in recreational activities (the frequent recreational visitor) may visit the estimated areas of Raymark waste at Beacon Point Area, thereby coming in contact with potentially contaminated soil. Possible exposures of frequent visitors to site-related contaminants would be through recreational activities, such as walking, or picnicking. Appendix B-1, Table 4.3A presents the exposure assumptions for adult recreational visitors at this and

other recreational properties in the RI. Appendix B-1, Table 4.3B presents the exposure assumptions for child recreational visitors at this and other recreational properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at the Beacon Point Area are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from the Beacon Point Area is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. Portions of the estimated areas of Raymark waste at the Beacon Point Area are located beneath pavement. The presence of pavement reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at recreational properties. Appendix B-1, Table 2.20 presents available inhalation SSLs for contaminants in soils within the estimated areas of Raymark waste at the Beacon Point Area property. All reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a).

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.20.5.4. Asbestos is present in soils within the estimated areas of Raymark waste of Beacon Point Area. The presence of pavement and the qualitative comparison to SSLs suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.3A and Table 4.3B contain the various assumptions used as input parameters to determine chemical intakes for adult and child recreational visitors through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in

Section 2.7.3.6. Table 1-1 presents the property sizes and FRW values for each property. The FRW for the Beacon Point Area is 0.15. Chemical intake estimates for the Beacon Point Area are provided in Appendix B-1, Tables 7.20 and 8.20.

3.20.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for the Beacon Point Area is provided in this section. Appendix B-1, Table 7.20 and Table 8.20 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.20. Appendix B-1, Table 10.20 reduces the information developed in Appendix B-1, Table 9.20 to the major risk drivers. Tables 7.20A, 8.20A, 9.20A, and 10.20A present non-cancer and cancer RME risk estimates for adult recreational visitors. Tables 7.20B, 8.20B, 9.20B, and 10.20B present non-cancer and cancer RME risk estimates for child recreational visitors. Children represent the more sensitive population for non-cancer risks. For cancer risks the risks to children and adults are added to produce an estimate of risks from lifetime exposures. Results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the recreational visitor at Beacon Point Area are as follows:

	Ingestion	**Dermal**	**Total**
Frequent Recreational Visitor – Adult Current and future)	0.34	0.17	0.51
Frequent Recreational Visitor – Child (Current and future)	3.2	1.1	4.3

The RME hazard indices (HI) for the child frequent recreational visitor exposed to soils within the estimated areas of Raymark waste at the Beacon Point Area are in excess of unity. Total Aroclor was the main contributor to the hazard index for the child recreational visitor. The chemical-specific (and target organ-specific) hazard quotients for the total Aroclor alone are in excess of unity for child recreational visitors. Adverse non-carcinogenic health effects are

possible from exposure to Aroclors. The RME hazard indices for adult frequent recreational visitors exposed to soils within the estimated areas of Raymark waste at the Beacon Point Area are less than unity, indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment for adult recreational visitors. See Tables 7.20A RME and 7.20B RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the recreational visitor at Beacon Point Area are as follows:

	Ingestion	Dermal	Total
Frequent Recreational Visitor – Adult[1] (Current and future)	2.6E-05	8.2E-06	3.4E-05
Frequent Recreational Visitor – Child[1] (Current and future)	6.0E-05	1.4E-05	7.4E-05

1) Summation of total risk for Frequent Recreational User (adult plus child): 1.10E-04.

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. Cancer risks for the frequent adult and child recreational visitor are added together for a lifetime exposure. The RME risk estimate for the recreational visitor exposed to soils within the estimated areas of Raymark waste slightly exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and exceeds the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Tables 8.20A RME and 8.20B RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Tables 9.20A and 9.20B, cancer risks for dioxin, benzo(a)pyrene, dibenzo(a,h)anthracene, arsenic, and Aroclors in soils exceed the CT DEP target risk level of 10^{-6} for single contaminants when the two age groups are added together for a lifetime exposure.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated

using the Draft Dioxin Reassessment CSF for dioxin for recreational visitors exposed to soils within the estimated area of Raymark waste at this property are 5.1E-04.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste of the Beacon Point Area property. Lead was detected in samples collected from 0 to 15 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 49,000 mg/kg. The average lead concentration in this dataset was 3,080 mg/kg.

Exposure to lead in soil by the frequent child recreational visitor was evaluated using the EPA IEUBK Model, as discussed in Section 2.7.4.7. The IEUBK model was developed to evaluate exposures to lead by children in a residential setting. Consequently, using the IEUBK model for child recreational exposures should provide a very conservative evaluation of exposures to lead. The time-weighted exposure point concentration of 462 mg/kg (average lead concentration for soil within the estimated areas of Raymark waste of 3,080 multiplied by the FRW of 0.15), as well as several default parameters, was used to estimate blood-lead levels for children in a residential setting. The estimated geometric mean blood-lead level for children exposed to lead in soils within the estimated areas of Raymark waste was 5.6 µg/dL, which is less than the established level of concern of 10 µg/dL. The IEUBK model estimates that 10.8 percent of children are expected to have blood-lead levels greater than 10 µg/dL, which exceeds the acceptable level of 5 percent. The input parameters used and the results of the IEUBK lead models, estimated blood-lead levels, and probability density histograms are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 31 of the 50 soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 40 percent. These samples were collected from the 0- to 15- foot bgs interval. The average concentration was 4 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos

is considered a potential inhalation hazard if it is “friable” (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos at the Beacon Point Area. Based on field conditions in the estimated areas of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.20.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the Beacon Point Area are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the Beacon Point Area property is 7.4 acres, with an estimated 15 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.20.4. Portions of the estimated areas of Raymark waste are covered by pavement. The remaining portions are vegetated with trees, shrubs, and short grasses. It is conceivable that individuals may spend all of their time within the estimated areas of Raymark waste. In this case, because risks were estimated

assuming individuals would only be exposed to contaminated soils 15 percent of the time, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately seven times greater than those estimated using the FRW factor.

- Copper concentrations exceed the EPA Region IX residential soil PRG of 3,100 mg/kg in Beacon Point Area soils; however, due to the lack of an approved toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in Beacon Point Area soils (0 to 15 feet bgs) at concentrations ranging from 22.7 mg/kg to 69,600 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Fifty samples, 39 of which were only analyzed by field-screening methods, were included in the dataset for soils within the estimated areas of Raymark waste. Due to the limited numbers of samples analyzed for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, PCBs, barium, and dioxins, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 15 feet bgs were included in the risk assessment for current and future recreational visitors. Current exposures to recreational visitors are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current recreational visitors.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of data from soils outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of PAHs, arsenic, cadmium, chromium, copper, lead, and PCBs at concentrations greater than CT RSRs for residential soil suggests that risks from other areas of the property may be of concern. Benzo(a)anthracene is present in soils located outside the estimated areas of Raymark waste at concentrations up to 23 mg/kg. Benzo(a)pyrene is present at concentrations up to 21 mg/kg, benzo(b)fluoranthene at concentrations up to 18 mg/kg, benzo(k)fluoranthene at concentrations up to 17 mg/kg, dibenzo(a,h)anthracene at concentrations up to 2.3 mg/kg, indeno(1,2,3-cd)pyrene at concentrations up to 4.4 mg/kg, arsenic at concentrations up to 15.9 mg/kg, cadmium at concentrations up to 88.6 mg/kg, chromium at concentrations up to 124 mg/kg, copper was detected at concentrations up to 1,410 mg/kg, lead at concentrations up to 3,050 mg/kg, and PCBs are present as total Aroclors at a concentration of 1.35 mg/kg. The individual Aroclors detected were Aroclors 1254, 1262, and 1268. Dioxins were detected outside the estimated areas of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin TEQ concentrations outside the estimated areas of Raymark waste were reported at 0.025 µg/kg, which is greater than the EPA Region IX PRGs for residential soil. Asbestos is also present outside the estimated areas of Raymark waste at the Beacon Point Area at concentrations up to 20 percent. Thus, a recreational visitor's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

3.20.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at the Beacon Point Area. Risks to recreational visitors were estimated.

- RME hazard indices (HI) for the child, but not the adult, frequent recreational visitors exposed to soil within the estimated areas of Raymark waste at the Beacon Point Area were in excess of unity. The chemical-specific (and target organ-specific) hazard quotients for total Aroclors alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposures to Aroclors.

- RME cancer risks for the frequent adult and child recreational visitor are added together for a lifetime exposure. The risk estimate for the recreational visitor exposed to soil within the estimated areas of Raymark waste at the Beacon Point Area slightly exceeds the EPA cancer risk range (10^{-4} to 10^{-6}) and exceeds the CT DEP target total risk level of 10^{-5} for multiple contaminants. Cancer risks for dioxin, benzo(a)pyrene, dibenzo(a,h)anthracene, arsenic, and Aroclors in soils exceed the CT DEP target risk level of 10^{-6} for single contaminants.

- Exposure to lead in soil by child recreational visitors was evaluated by use of the IEUBK model. The results of the model indicate that adverse effects are anticipated for child recreational visitors exposed to lead in soil within the estimated areas of Raymark waste at the Beacon Point Area.

- Asbestos was detected in 31 of the 50 soil samples collected from the estimated areas of Raymark waste at the Beacon Point Area in the 0- to 15- foot interval at a concentration range of trace to 40 percent. The average concentration was 4 percent.

3.20.6 Ecological Evaluation

The ecological characterization of the wetlands on this property was addressed under the OU3 Area I RI (TtNUS, 1999b) and is presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark-Ferry Creek-OU3* (B&RE, 1998). A summary of the findings is presented below. It should be noted, however, that no individual evaluation of the ecological impacts to this property was performed.

Most of the property has been disturbed by surrounding development, past uses of Ferry Creek, and filling of a wetland area prior to developing the property. There are wetlands abutting this property, and the property abuts the Housatonic River. There is limited vegetation on the property as most of the property is covered by a building or pavement. This property provides only limited use as an area for birds, reptiles, and small mammals to forage, cover, rest, and breed because of the level of development, soil contamination, disturbed nature of the area, and the low vegetation density and diversity. Wildlife identified in the area include red-winged blackbird (*Agelaius phoeniceus*) and green heron (*Butorides striatus*). Most wildlife utilize Ferry Creek rather than this property.

Black-crowned night herons and red-winged blackbirds have been observed around the property. Geese, swans and other shore birds are routinely fed by citizens on and around the property. State or federally listed threatened species reported to exist in the vicinity of the property include the Atlantic sturgeon and occasional transient bald eagles and peregrine falcons (NOAA, 1998; CT DEP, 1997; US DOI, 1997).

3.20.7 Summary

This property, approximately 7.4 acres located along the Housatonic River, contains Raymark waste throughout the northern and southern areas of the property. Samples containing concentrations of metals, pesticides, PCBs, and SVOCs exceeding CT DEC and/or CT PMC regulatory standards as well as elevated dioxin and asbestos levels were detected throughout the property. It is likely that erosion and infiltration are occurring in non-paved areas, and in areas where the pavement may be in poor condition. Leaching of contaminants is likely occurring.

RME hazard indices for child and adult recreational visitors exposed to soils within the estimated areas of Raymark waste are in excess of unity, indicating that adverse non-carcinogenic health effects are possible. The RME cancer risk estimate slightly exceeds the EPA cancer risk range and exceeds the CT DEP target-total risk level. Cancer risks for dioxin, benzo(a)pyrene, dibenzo(a,h)anthracene, arsenic, and Aroclors exceed the CT DEP target single-contaminant risk level. Adverse effects are anticipated for child recreational visitors exposed to lead in soils within the estimated areas of Raymark waste. The average asbestos concentration was 4 percent in the estimated areas of Raymark waste.

Ecological receptors are present on or near this property, and impacts from Raymark waste are possible.

TABLE 3-20
BEACON POINT AREA - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	58	169	2	5	Trace	40	1	22		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	5	5	0.63	0.63	0.0289	2.88 J				
1,2,3,4,6,7,8-HpCDF	5	5	1.1	1.1	0.007 J	5.484 J				
1,2,3,4,7,8,9-HpCDF	4	5	0.06	0.075	0.00089 J	0.291 J				
1,2,3,4,7,8-HxCDD	5	5	0.0096	0.0096	0.00045 J	0.0443 J				
1,2,3,4,7,8-HxCDF	4	5	1.2	1.5	0.01227 J	5.947 J				
1,2,3,6,7,8-HxCDD	5	5	0.057	0.057	0.000896 J	0.27 J				
1,2,3,6,7,8-HxCDF	4	5	0.73	0.91	0.00474 J	3.632 J				
1,2,3,7,8,9-HxCDD	5	5	0.065	0.065	0.00108 J	0.311 J				
1,2,3,7,8,9-HxCDF	1	5	0.0061	0.03	0.0297 J	0.0297 J				
1,2,3,7,8-PeCDD	5	5	0.016	0.016	0.000333 J	0.074 J				
1,2,3,7,8-PeCDF	4	5	1.2	1.5	0.004 J	6.159 J				
2,3,4,6,7,8-HxCDF	4	5	0.85	1.1	0.0061 J	4.209 J				
2,3,4,7,8-PeCDF	4	5	2	2.5	0.00463 J	9.995 *				
2,3,7,8-TCDD	1	4	0.0035	0.013	0.0133 J	0.0133 J				
2,3,7,8-TCDF	3	3	3.1	3.1	0.0066 J	9.145 J				
OCDD	5	5	3.1	3.1	0.80159 J	5.705 J				
OCDF	4	5	0.85	1.1	0.017 J	3.855 J				
Total HpCDD	5	5	1.2	1.2	0.0621 J	5.115 J				
Total HpCDF	5	5	1.6	1.6	0.01307 J	7.609 J				
Total HxCDD	4	5	0.44	0.55	0.000246 J	2.133 J				
Total HxCDF	5	5	4.9	4.9	0.01025 J	24.015 J				
Total PeCDD	5	5	0.068	0.068	0.000745 J	0.287 J				
Total PeCDF	5	5	2.8	2.8	0.00662 J	13.666 J				
Total TCDD	2	4	0.0039	0.0068	0.000394 J	0.0133 J				
Total TCDF	4	4	4	4	0.01204 J	16.043 J				
Toxicity Equivalency	5	5	1.6	1.6	0.00391 J	7.81 J				

TABLE 3-20 (cont.)
BEACON POINT AREA - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	29	29	9690	9690	4200	28400 J				
Antimony	4	24	2.8	11.4	2.8	16.6 J	27	0		
Arsenic	17	29	7	10	3.2 J	35.5	10	6		
Barium	29	29	852	852	27.1	19700	4700	1		
Beryllium	19	29	0.38	0.49	0.26	0.6	2	0		
Cadmium	20	26	7.2	9.3	0.44	88.6	34	2		
Calcium	29	29	5340	5340	834	23200				
Chromium	29	29	43	43	12.2	199	100	2		
Cobalt	29	29	8.7	8.7	3.9	32.6	1000	0		
Copper	96	133	1870	2550	11	69600	2500	9		
Iron	29	29	33200	33200	10100	123000				
Lead	151	171	1060	1190	3.9 J	49000	400	48		
Magnesium	29	29	7770	7770	2130	77200				
Manganese	29	29	329	329	133	938	1600	0		
Mercury	14	29	0.24	0.42	0.049 J	1.1 , J	20	0		
Nickel	29	29	46.5	46.5	9.8	547	1400	0		
Potassium	29	29	1570	1570	502	2720 J				
Selenium	5	26	0.96	1.5	0.8 J	2.2 J	340	0		
Silver	11	29	1.4	3.2	0.67	10.5	340	0		
Sodium	22	27	1750	2100	258 J	5500				
Vanadium	26	29	23.2	25.1	12.7 J	39.6 J	470	0		
Zinc	29	29	579	579	45.6	3830	20000	0		
Metals (SPLP) (UG/L)										
Aluminum	5	5	10600000	10600000	63.3	52800000 J				
Antimony	2	6	4.7	9.7	7	12.4			60	0
Arsenic	3	6	9.5	16.4	7.3	33.5			500	0
Barium	5	6	728	848	21.4	2800 J			10000	0
Beryllium	1	6	1.1	4.4	4.4	4.4			40	0
Cadmium	2	6	4.2	11.6	9.2	14.1			50	0

TABLE 3-20 (cont.)
BEACON POINT AREA - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Calcium	5	5	56600	56600	5700	233000 J				
Chromium	3	6	27.3	54.1	2.4	157 J			500	0
Cobalt	2	5	13.6	32.4	7.8	57.1 J				
Copper	5	6	4330	5190	34	25000 J			13000	1
Iron	5	5	10600	10600	53.6	49700 J				
Lead	6	6	2780	2780	3.1	16100 J			150	3
Magnesium	5	5	10000	10000	1120	40300				
Manganese	5	5	888	888	16.6	3930 J				
Nickel	4	6	36.3	54.2	3 J	163 J			1000	0
Potassium	5	5	4240	4240	815	12300 J				
Sodium	5	5	17900	17900	1070	37300				
Vanadium	4	6	31.8	47.5	2.3	156			500	0
Zinc	5	6	784	938	10.2	3880			50000	0
Semivolatile Organic Compounds (UG/KG)										
2,4-Dimethylphenol	1	23	690	1600	1600	1600	1000000	0	28000	0
2-Methylnaphthalene	8	23	710	520	89 J	2300	474000	0	9800	0
2-Methylphenol	1	23	640	540	540 J	540 J	1000000	0	70000	0
4-Methylphenol	2	23	660	600	460	730	340000	0	7000	0
4-Nitroaniline	1	23	1700	2500	2500	2500	200000	0	4200	0
Acenaphthene	9	23	790	860	72 J	2000	1000000	0	84000	0
Acenaphthylene	11	23	730	750	50 J	5100	1000000	0	84000	0
Acetophenone	6	6	290	290	150 J	540 J				
Anthracene	16	23	1100	1400	67 J	5400	1000000	0	400000	0
Benzaldehyde	5	6	340	63	48 JEB	78 JEB				
Benzo(a)anthracene	17	23	3200	4200	75 J	23000 *J	1000	10	1000	10
Benzo(a)pyrene	20	23	3000	3500	76 J	21000 *J	1000	9	1000	9
Benzo(b)fluoranthene	17	23	2700	3600	72 J	18000 *J	1000	9	1000	9
Benzo(g,h,i)perylene	18	23	1400	1700	54 J	7900 *J	1000000	0	42000	0
Benzo(k)fluoranthene	17	23	2300	3000	84 J	17000 *J	8400	2	1000	9

TABLE 3-20 (cont.)
BEACON POINT AREA - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
bis(2-Ethylhexyl)phthalate	5	23	640	290	46 J	930	44000	0	11000	0
Carbazole	9	17	790	690	110 J	2100	31000	0	360	5
Chrysene	19	23	4200	5100	54 J	26000 *J	84000	0	1000	11
Dibenzo(a,h)anthracene	11	23	610	840	81 J	2300	84	10	1000	4
Dibenzofuran	9	23	660	530	64 J	1800	270000	0	5600	0
Diethylphthalate	3	23	1200	6100	100 J	18000 J	1000000	0	1100000	0
Dimethylphthalate	1	23	620	89	89 J	89 J	1000000	0	1100000	0
Di-n-Butylphthalate	2	23	680	750	300 J	1200 J	1000000	0	140000	0
Fluoranthene	19	23	8100	9700	100 J	76000 *J	1000000	0	56000	1
Fluorene	13	23	820	1100	110 J	5200	1000000	0	56000	0
Indeno(1,2,3-cd)pyrene	18	23	1400	1700	52 J	7700 *J	840	8	1000	7
Naphthalene	10	23	690	440	61 J	1600	1000000	0	56000	0
N-Nitroso-diphenylamine	1	23	630	260	260 J	260 J	130000	0	1400	0
Phenanthrene	19	23	5800	7000	97 J	41000 *J	1000000	0	40000	1
Phenol	1	21	740	1800	1800	1800	1000000	0	800000	0
Pyrene	18	23	8300	10000	130 J	74000 *J	1000000	0	40000	1
Total PAH	2	2	18000	18000	4814	30520				
Volatile Organic Compounds (UG/KG)										
2-Butanone	4	12	74	22	9 J	62 J	500000	0	80000	0
Acetone	4	12	110	88	15 JTB	210 J	500000	0	140000	0
Carbon Disulfide	7	12	76	19	2 J	47 J	500000	0	140000	0
Methylene Chloride	1	12	110	5	5 JTB	5 JTB	82000	0	1000	0
Toluene	2	12	68	4	4 JEB	5 JEB	500000	0	67000	0
Trichloroethene	2	12	68	2	1 J	4 J	56000	0	1000	0

TABLE 3-20 (cont.)
BEACON POINT AREA - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

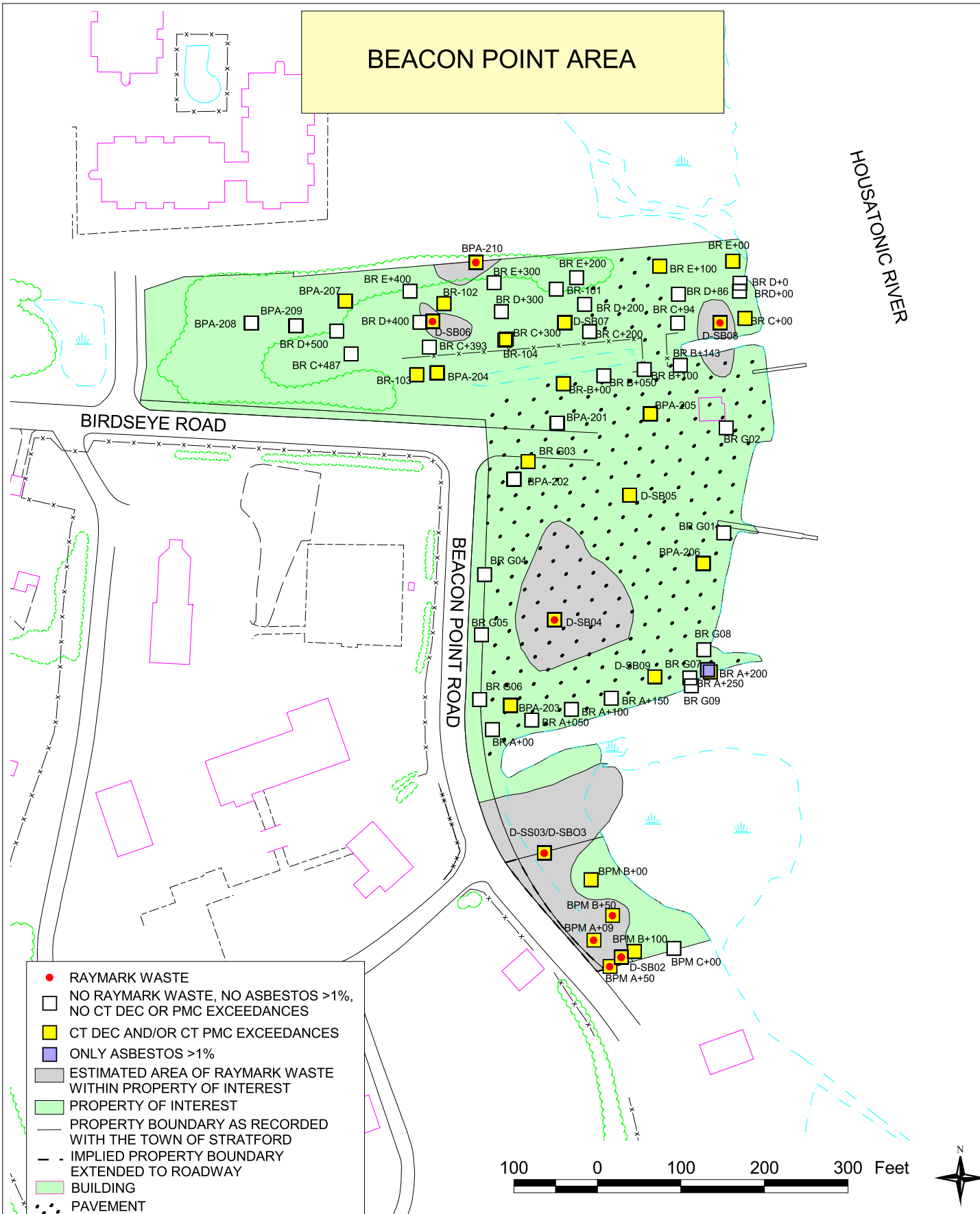
PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG)										
4,4'-DDD	3	29	7.2	6.8	5.8 J	7.9 J	2600	0	29	0
4,4'-DDE	3	29	7.1	6.1	4.5	7 J	1800	0	21	0
4,4'-DDT	3	28	7.3	12	7.6 J	17 J	1800	0	21	0
Aldrin	1	29	3.5	2.2	2.2 J	2.2 J	36	0	0.41	1
alpha-BHC	1	29	3.4	0.52	0.52 J	0.52 J	97	0	1.1	0
alpha-Chlordane	1	29	3.5	2.5	2.5	2.5	490	0	66	0
Aroclor, Total (4)	25	125	1100	5100	50	64000	1000	7		
Aroclor, Total (Conservative) (5)	35	125	1400	4600	199	68750	1000	13		
Aroclor-1254	10	125	160	280	99	490	1000	0		
Aroclor-1260	6	125	210	1600	120	6000	1000	2		
Aroclor-1260/62	5	24	590	2000	500	6000				
Aroclor-1262	18	87	800	3700	50	30000 J	1000	4		
Aroclor-1268	18	125	570	3100	85 J	39000 *	1000	4		
Dieldrin	1	29	6.9	7.2	7.2	7.2	38	0	7	1
Endosulfan I	2	29	18	220	22 J	420 J	410000	0	8400	0
Endosulfan Sulfate	1	29	7.5	24	24 J	24 J	410000	0	8400	0
Endrin	1	29	6.9	7.9	7.9 J	7.9 J	20000	0		
Endrin Aldehyde	3	29	35	300	9.6 J	830	20000	0		
Endrin Ketone	3	29	8.2	19	5.7 #J	32 J	20000	0		
gamma-Chlordane	4	29	4	5.3	2.3 J	9.7	490	0	66	0
Heptachlor Epoxide	2	29	3.6	3.9	2.6	5.2	67	0	20	0
Total Organic Carbon (MG/KG)										
Total Organic Carbon	1	1	2000	2000	2000	2000				

TABLE 3-20 (cont.)
BEACON POINT AREA - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
J	Quantitation approximate
TB	Trip blank contamination

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR RESIDENTIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-20
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.21 1 Beacon Point Road

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.21.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.21.1 Property Description

This property, approximately 0.9 acres of commercially-zoned (waterfront business) land, is located on Beacon Point Road in Stratford, Connecticut (Town of Stratford, 1997). A two-story wooden structure is the only building on the property. The remaining area consists of a deteriorating asphalt parking lot and boat storage areas on either side of the building. A chain-link fence restricts public access to both boat storage yards on the property. There is a fence along the eastern portion of the property parallel to the Housatonic River. There is no access restriction to the paved parking area in front of the building. Approximately five percent of the property is paved. No storm drains were observed on the property.

The Housatonic River and associated wetlands are located to the north, east, and south; the Town of Stratford Publicly-Owned Treatment Works (POTW), a wastewater treatment plant, is located to the west. The seawall along the river on the eastern portion of the property is constructed of large boulders, concrete, and asphalt. North of the tidal wetlands is the Beacon Point Area (see Section 3.20). Soil at the property is classified as fill that has been placed in wetlands (tidal marshes).

3.21.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, this property is located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood evaluations across this property are 10, 11, and 12 feet (FEMA, 1992). The 100-year floodplain boundary for this property is shown on Figure 1-2.

Seven soil borings (D-SB01 and BPM-101 through BPM-106) were advanced at the property, to depths of up to 16 feet below ground surface (bgs). Surficial materials noted in D-SB02, BPM-101, and BPM-104 through BPM-106 consist of fill, which overlies sediments characteristic of

glacial outwash and ice-contact deposits (BPM-105 and BPM-106) or former marsh and swamp deposits (BPM-101 and BPM-104). Soils encountered below the fill include fine to coarse sand, sandy fine and coarse gravel, or organic silt with a trace percentage of fine sand. Based on the boring logs, soil in borings D-SB01, BPM-102, and BPM-103 is mixed with debris. Refer to Figure 3-21 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Sample locations are shown on Figure 3-21, including both shallow surface samples and deeper samples from soil borings. The borings were used to describe the fill and native material on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials identified in the soil from borings D-SB01 and BPM-101 through BPM-104 included PACM (potentially asbestos-containing material), concrete, and/or slag. PACM (asbestos fibers) was observed in the soil from BPM-101 and BPM-102. These materials were encountered with natural fill materials consisting of sand, silty sand, and gravel mixtures. Manmade debris was not observed in borings BPM-105 and BPM-106; however, the well-graded sand and silty fine sand in these borings may represent natural fill. Fill classifications were based on the visual characteristics of the soil and sediment samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across the entire property. The depth to water ranges from 5 to 13 feet bgs based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on this property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-21. Approximately 12 percent of this property is estimated to contain Raymark waste. This waste area is covered by soil and vegetation.

3.21.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 58 samples collected from 28 locations at this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-21. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-21 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC regulatory standards. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-21 for the soil data summary statistics and comparison to criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

<u>Asbestos</u>

Fifty-seven soil samples were collected and analyzed for asbestos from the property. Asbestos was detected in 15 of the 57 soil samples. Asbestos was present at concentrations greater than 1 percent in eight of the samples. Detections of asbestos were scattered throughout the property at various depths.

Dioxins

Two soil samples were collected and analyzed for dioxins from the property. Dioxins were detected in both samples, at 0.0079 µg/kg and 0.769 µg/kg. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See 2.5.2.5 for an explanation of TEQ.

Metals

Soil samples were collected from the property and analyzed for metals as follows: nine soil samples were analyzed for metals in a fixed laboratory; 29 samples were screened for copper; and 49 samples were screened for lead. Some metals detected are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Chromium and lead concentrations exceeded the CT DEC regulatory standard at this property. Chromium concentrations exceeded the standard in six samples scattered throughout the property at depths of up to 9 feet bgs. Lead concentrations exceeded the CT DEC regulatory standard at two sample locations in the northern area of the property at a depth ranging from 2 to 8 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, neither of the two SPLP samples were collected from the estimated area of Raymark waste. Neither of these samples exceeded the CT PMC standard for lead. There were no TCLP samples collected for this property.

Pesticides

Eight soil samples were collected and analyzed for pesticides from this property. Pesticides were frequently detected, with concentrations of three pesticides exceeding the CT PMC at five locations on the property. These exceedances were primarily located in the northern part of the property at depths ranging from ground surface to 8 feet bgs. There were no pesticide CT DEC exceedances.

PCBs

Up to 55 soil samples were collected and analyzed for PCBs as Aroclors. PCBs were not frequently detected at this property. Total Aroclor concentrations exceeded the CT DEC at two locations on this property, both located in the northern portion of the property. Aroclor 1268 was the primarily contributor to one of these exceedances, at location BPM-102 from 2 to 4 feet bgs. No SPLP or TCLP PCB samples were collected on this property.

SVOCs

Six soil samples were collected from this property and analyzed for SVOCs. SVOCs, primarily PAHs, were frequently detected throughout the property. Concentrations of nine SVOCs exceeded the CT DEC and/or CT PMC at this property. These exceedances were all detected at location BPM-102, from the ground surface to 8 feet bgs.

VOCs

Five samples were collected and analyzed for VOCs at this property. VOCs were not frequently detected on the property. No VOC concentrations exceeded either CT PMC or CT DEC regulatory standards.

Raymark Waste

The results from three sample locations indicate that Raymark waste is present on the property. The following table displays the location and constituents of the six samples that meet the definition of Raymark waste. These samples are located within the 12 percent of the property shown on Figure 3-21 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
BPMB+150	0 to 0.5	5	870	NA	3,200
BPM-101	4 to 6	20	960	2,250	330
	6 to 8	60	14,800	40,700	7,400
BPM-102	2 to 4	15	3,310	6,600	23,000
	4 to 6	4	558	999	1,800
	6 to 8	3	625	1,000	2,000

NA- Contaminant not analyzed

3.21.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 12 percent of this 0.9-acre property is estimated to contain Raymark waste. The waste is located in the northwest corner of the property, away from the Housatonic River, but still within the floodplain (see Figure 1-2). Approximately 40 percent of the property is covered by a building and asphalt paving. The remaining area is covered by gravel or tidal grasses.

It is likely there is some infiltration or leaching into the groundwater, primarily in unpaved areas. No storm drains were noted. A large sea wall, constructed of boulders, concrete, and asphalt, abuts the rivers edge; erosion in the tidal areas was noted. Analytical data indicate that pesticides and SVOCs may pose a leaching threat to groundwater.

3.21.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at 1 Beacon Point Road that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire property at 1 Beacon Point Road may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.21.5.1 provides an overview of the 1 Beacon Point Road property, Section 3.21.5.2 presents COPCs and EPCs, Section 3.21.5.3 contains information on the potential receptors considered and the

routes by which they might be exposed, Section 3.21.5.4 contains the numerical results of the risk assessment, and Section 3.21.5.5 presents property-specific uncertainties. Section 3.21.5.6 presents a property-specific summary of the major risk findings.

3.21.5.1 Overview

The property 1 Beacon Point Road is a commercial property of approximately 0.9 acres. A detailed description of the property is provided in Section 3.21.1. The nature and extent of the contamination detected at the property is discussed in Section 3.21.3. The area of 1 Beacon Point Road estimated to contain Raymark waste represents an estimated 12 percent of the total 0.9-acre property, exclusive of any buildings, and is shown in Figure 3.21. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.21.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated area of Raymark waste at 1 Beacon Point Road are summarized in Appendix B-1, Table 2.21.

3.21.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.21 presents a summary of the COPCs for quantitative risk assessment for 1 Beacon Point Road soils from the estimated area of Raymark waste to a depth of 10 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of

Raymark waste of this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.21:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene)
- Aroclors, Total (1254, 1262, and 1268)
- Metals (arsenic, chromium, lead, and manganese)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for 1 Beacon Point Road are presented in Appendix B-1, Table 3.21. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.21.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at 1 Beacon Point Road and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The property at 1 Beacon Point Road is a commercial property area, as described in Section 3.21.1.

Potential Receptors

The receptors retained for quantitative evaluation at 1 Beacon Point Road are current and future commercial workers. Potentially exposed individuals were limited to those who work at 1 Beacon Point Road.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at the property. Under the current and future land use, commercial workers were evaluated for exposure to soils (0 to 10 feet bgs) at a limited area (soils within the estimated area of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties.

Exposure Pathways

The primary routes of exposure for potential human receptors at 1 Beacon Point Road are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. Much of the estimated area of Raymark waste is under pavement, with areas of tidal grasses or gravel. The presence of pavement and vegetation reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at commercial properties. Appendix B-1, Table 2.21 presents available inhalation SSLs for contaminants in soils within the estimated area of Raymark waste at the 1 Beacon Point Road property. With the exception of those reported for total chromium, all reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a). Two sample results out of four exceeded the SSL_{AIR} for hexavalent chromium. The average total chromium concentration detected in the Raymark waste soil samples (410 mg/kg) is greater than the SSL_{AIR} for hexavalent chromium (280 mg/kg). Further evaluation of total chromium concentrations relative

to inhalation SSLs for commercial/industrial land use (EPA, 2001a) reveals that the average total chromium concentration detected in the Raymark waste soil samples (1,200 mg/kg) and the maximum (4,270 mg/kg) are also greater than the commercial/industrial SSL_{AIR} for hexavalent chromium (510 mg/kg). If the maximum total chromium concentration is assumed to represent 100% hexavalent chromium and the maximum chromium concentration is compared to the SSL_{AIR} for chromium, associated cancer risks for commercial/industrial receptors would be approximately 8×10^{-6}. This risk level is within EPA's cancer risk range of 10^{-4} to 10^{-6}. The SSL_{AIR} for chromium assumes that chromium is present in the hexavalent state. The assumption that all chromium is in the hexavalent state is likely to be a conservative assumption.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.21.5.4. Asbestos is present in soils within the estimated area of Raymark waste at 1 Beacon Point Road. The presence of pavement and vegetation suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.6. Table 1-1 presents the property sizes and FRW values for each property. The FRW for 1 Beacon Point Road is 0.12. Chemical intake estimates are provided in Appendix B-1, Tables 7.21 and 8.21.

3.21.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for 1 Beacon Point Road is provided in this section. Appendix B-1, Table 7.21 and Table 8.21 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and

carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.21. Appendix B-1, Table 10.21 reduces the information developed in Appendix B-1, Table 9.21 to the major risk drivers. The results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at 1 Beacon Point Road are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	0.13	0.054	0.19

The RME hazard index for the commercial worker exposed to soils within the estimated area of Raymark waste at 1 Beacon Point Road is less than unity, indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment. See Table 7.21 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at 1 Beacon Point Road are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Current and future)	4.6E-06	3.5E-06	8.2-06

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated area of Raymark waste does not exceed the EPA cancer risk range (10^{-4} to 10^{-6}) but does exceed the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.21 RME in Appendix B-1 for details on

cancer risk calculations. As detailed on Appendix B-1, Table 9.21, cancer risks for benzo(a)pyrene, dibenzo(a,h)anthracene, Aroclors, and dioxin are greater than the CT DEP target risk level for single contaminants of 10^{-6}. In addition to the above risks, cancer risks from inhalation of chromium in dust may be as great as 8E-06 (see discussion in Section 3.21.5.3.).

Cancer risk estimates for dioxins, shown on the tables referenced above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 1.6E-05.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste at the 1 Beacon Point Road property. Lead was detected in samples collected from 0 to 10 feet bgs within the estimated area of Raymark waste at a maximum concentration of 14,800 mg/kg. The average lead concentration in this dataset was 2,210 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 2,210 mg/kg for soil within the estimated area of Raymark waste at 1 Beacon Point Road was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for 1 Beacon Point Road is 0.12. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated area of Raymark waste at 1 Beacon Point Road, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 0.5 to 1.2 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in nine of the 10 soil samples collected from the estimated area of Raymark waste at a concentration range of trace to 60 percent. These samples were collected from the 0- to 10-foot bgs interval. The average concentration was 11 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of pavement and vegetative cover in the estimated area of Raymark waste reduces the potential for airborne asbestos at 1 Beacon Point Road. Based on field conditions in the estimated area of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.21.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for 1 Beacon Point Road are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the 1 Beacon Point Road property is 0.9 acres, with an estimated 12 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.21.4. The estimated area of Raymark waste is covered by either pavement, gravel, or tidal grasses. No consideration has been given to site characteristics other than the presence of buildings. It is conceivable that individuals may spend all of their time within the estimated area of Raymark waste. In this case, because risks were estimated assuming individuals would only be exposed to contaminated soils 12 percent of the time, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately eight times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2.2. Average background concentrations are also shown on Appendix B-1, Table 2.21 alongside site-specific data from the estimated area of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 2.3 to 3.9 mg/kg, with an average concentration of 3.0 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Ten samples were included in the dataset for soils within the estimated area of Raymark waste; however, six of the samples were only analyzed by field-screening methods. Due to the limited numbers of samples analyzed for dioxins, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, Aroclors, arsenic, chromium, and manganese, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 10 feet bgs were included in the risk assessment for current and future commercial workers. Current exposures to commercial workers are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current commercial workers. Additionally, future commercial workers may be exposed to soils currently located at depths up to 15 feet bgs, which is the depth considered as accessible by CT DEP (CT DEP, 1996). The absence of samples collected in the 10- to 15-foot bgs interval adds uncertainty in the evaluation of risks to future commercial workers.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of data from soils outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of chromium at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Chromium is present in soils located outside the estimated area of Raymark waste at 1 Beacon Point Road at concentrations up to 3,560 mg/kg. Six samples from outside the estimated area of Raymark waste were analyzed for PCBs using CLP methods. While none of these samples had concentrations greater than the CT RSRs for industrial soil, one sample did have total Aroclor concentrations greater than the EPA Region IX PRG for industrial soil. The individual Aroclors detected were Aroclor 1254, Aroclor 1262, and Aroclor 1268. Dioxins were detected outside the estimated area of Raymark waste at a maximum concentration of 0.008 µg/kg; however, no CT RSRs are available for dioxins. Copper and lead are present in the soils outside the estimated area of Raymark waste at concentrations up to 512 mg/kg, and 710 mg/kg, respectively. Asbestos is also present in the soils outside the estimated area of Raymark waste at concentrations up to five percent. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.21.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at 1 Beacon Point Road. Risks to current and future commercial workers were estimated.

- The RME hazard indices (HI) for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 1 Beacon Point Road do not exceed unity. Adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment.

- The RME cancer risk estimates for current and future commercial workers exposed to soil within the estimated area of Raymark waste at 1 Beacon Point Road do not exceed the EPA cancer risk range (10^{-4} to 10^{-6}) but do exceed the CT DEP target total risk level of 10^{-5}. The cancer risks for benzo(a)pyrene, dibenzo(a,h)anthracene, Aroclors, and dioxin are greater than the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated area of Raymark waste at 1 Beacon Point Road.

- Asbestos was detected in nine of the 10 soil samples collected from the estimated area of Raymark waste at 1 Beacon Point Road in the 0- to 10- foot bgs interval at a concentration range of trace to 60 percent. The average concentration was 11 percent.

3.21.6 Ecological Evaluation

The ecological characterization of this property was addressed under OU3 Area III RI (TtNUS, 2000b) and is presented in the *Draft Technical Memorandum Wetland Evaluation, Raymark-Ferry Creek-OU3* (BR&E, 1998). It should be noted however, that no individual evaluation of the ecological impacts to this property was performed.

Most of this property has gravel cover or is vegetated with upland grasses and staghorn sumac. Approximately 5 to10 percent of the property is asphalt paved. The vegetated area may provide minimal habitat for some small birds and mammals, however, its use is limited by the habitat's small size (less than 1/4 acre), surrounding development, and site disturbances.

3.21.7 Summary

This approximately 0.9-acre property abutting the Housatonic River contains Raymark waste. Samples containing concentrations of metals, pesticides, PCBs, and SVOCs that exceed CT DEC, CT PMC criteria, and/or greater than 1 percent asbestos are present on the property. Given the current property conditions, some infiltration and leaching are likely occurring throughout the property. Soil analytical results for pesticides and SVOCs indicate the potential for adverse impacts to groundwater.

Based on the RME hazard indices, adverse non-carcinogenic health effects are not anticipated. The RME cancer risk estimates for commercial workers exposed to soils within the estimated area of Raymark waste do not exceed the EPA cancer risk range, but do exceed the CT DEP target total risk level. Benzo(a)pyrene, dibenzo(a,h)anthracene, Aroclors, and dioxin are the primary drivers for the CT DEP exceedance. Adverse effects on fetuses of pregnant workers exposed to lead in soils within the estimated area of Raymark waste are not expected. The average asbestos concentration was 11 percent.

No ecologically significant habitats have been identified on the property and impacts to ecological receptors are likely minimal.

TABLE 3-21
1 BEACON POINT ROAD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	15	57	2	8	Trace	60	1	8		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	2	2	0.16	0.16	0.0305	0.281				
1,2,3,4,6,7,8-HpCDF	2	2	1.1	1.1	0.0257	2.16 %				
1,2,3,4,7,8,9-HpCDF	2	2	0.047	0.047	0.000922	0.0939				
1,2,3,4,7,8-HxCDD	2	2	0.0031	0.0031	0.0024 J	0.00378				
1,2,3,4,7,8-HxCDF	2	2	0.65	0.65	0.00963	1.29				
1,2,3,6,7,8-HxCDD	2	2	0.0097	0.0097	0.00332	0.016				
1,2,3,6,7,8-HxCDF	2	2	0.2	0.2	0.00321	0.389				
1,2,3,7,8,9-HxCDD	2	2	0.0055	0.0055	0.0016	0.0094				
1,2,3,7,8,9-HxCDF	1	2	0.0032	0.0063	0.0063 EMPC	0.0063 EMPC				
1,2,3,7,8-PeCDD	2	2	0.0017	0.0017	0.00049	0.003 J				
1,2,3,7,8-PeCDF	2	2	0.25	0.25	0.00385	0.488				
2,3,4,6,7,8-HxCDF	2	2	0.22	0.22	0.00592	0.444				
2,3,4,7,8-PeCDF	2	2	0.44	0.44	0.00649	0.868				
2,3,7,8-TCDD	2	2	0.00074	0.00074	0.000176	0.0013				
2,3,7,8-TCDF	2	2	0.33	0.33	0.00394	0.647 %!				
OCDD	2	2	0.59	0.59	0.363	0.821 J				
OCDF	2	2	0.2	0.2	0.0174	0.385 J				
Total HpCDD	2	2	0.3	0.3	0.0561	0.552				
Total HpCDF	2	2	1.4	1.4	0.0348	2.7 EMPC%				
Total HxCDD	2	2	0.068	0.068	0.0143	0.122 EMPC				
Total HxCDF	2	2	1.8	1.8	0.038	3.54 EMPC%				
Total PeCDD	2	2	0.25	0.25	0.00462	0.495 EMPC				
Total PeCDF	2	2	1.8	1.8	0.0322	3.53 EMPC%				
Total TCDD	2	2	0.021	0.021	0.000176	0.0416 EMPC				
Total TCDF	2	2	1.2	1.2	0.00722	2.42 EMPC%				
Toxicity Equivalency	2	2	0.39	0.39	0.00786636	0.769				

TABLE 3-21 (cont.)
1 BEACON POINT ROAD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	9	9	9180	9180	1090 J	14700 J				
Antimony	5	8	8.8	13.4	2.4	22.8 J	8200	0		
Arsenic	5	9	3.3	4.3	2.3 J	9.3	10	0		
Barium	9	9	560	560	28	3550	140000	0		
Beryllium	5	9	0.37	0.54	0.25	0.65	2	0		
Cadmium	5	7	1.5	2.1	0.44	4.2 J	1000	0		
Calcium	9	9	60500	60500	2920	166000 J				
Chromium	9	9	1430	1430	19	4270	100	6		
Cobalt	9	9	14.1	14.1	3.2 , J	83.5	2500	0		
Copper	31	38	1520	1830	11.4 J	40700	76000	0		
Iron	9	9	21100	21100	11700	40100 J				
Lead	43	58	485	636	6.4 J	14800	1000	2		
Magnesium	9	9	23100	23100	3430	71300				
Manganese	9	9	2390	2390	173 J	7220 J	47000	0		
Mercury	4	9	0.11	0.18	0.13 J	0.24 J	610	0		
Nickel	9	9	293	293	15.7	1420	7500	0		
Potassium	9	9	1060	1060	58.2 J	2310 J				
Selenium	5	9	2.8	4.6	1.1 J	6.6 J	10000	0		
Silver	7	9	0.56	0.63	0.45	0.81 J	10000	0		
Sodium	7	9	737	920	242	1690 J				
Thallium	1	7	0.8	2.8	2.8 J	2.8 J	160	0		
Vanadium	9	9	60.5	60.5	7.8 J	158	14000	0		
Zinc	9	9	214	214	64.1	568	610000	0		
Metals (SPLP) (UG/L)										
Aluminum	2	2	2710	2710	2710	2710				
Barium	2	2	10.2	10.2	10.2	10.2			10000	0
Calcium	2	2	55500	55500	55500	55500				
Chromium	2	2	95.1	95.1	95.1	95.1			500	0
Copper	2	2	8.8	8.8	8.8	8.8			13000	0

TABLE 3-21 (cont.)
1 BEACON POINT ROAD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (SPLP) (UG/L) (cont.)										
Magnesium	2	2	59	59	59	59				
Potassium	2	2	1070	1070	1070	1070				
Selenium	2	2	12.1	12.1	12.1	12.1			500	0
Sodium	2	2	530	530	530	530				
Vanadium	2	2	31.2	31.2	31.2	31.2			500	0
Semivolatile Organic Compounds (UG/KG)										
1,1'-Biphenyl	1	3	370	52	52 J	52 J				
2,4-Dimethylphenol	1	4	330	78	78 J	78 J	2500000	0	28000	0
2-Methylnaphthalene	2	6	270	88	56 J	120 J	2500000	0	9800	0
Acenaphthene	4	6	450	580	200 J	950 J	2500000	0	84000	0
Acenaphthylene	5	6	300	320	69 J	1000 J	2500000	0	84000	0
Anthracene	5	6	1600	1900	100 J	4900 J	2500000	0	400000	0
Benzaldehyde	1	3	390	120	120 JEB	120 JEB				
Benzo(a)anthracene	5	6	4700	5600	310 J	15000 *J	7800	1	1000	4
Benzo(a)pyrene	5	6	3900	4700	270 J	14000 J	1000	4	1000	4
Benzo(b)fluoranthene	5	6	3900	4700	260 J	12000 *J	7800	1	1000	4
Benzo(g,h,i)perylene	5	6	640	730	220 J	2000 J	2500000	0	42000	0
Benzo(k)fluoranthene	5	6	4000	4700	240 J	14000 *J	78000	0	1000	4
bis(2-Ethylhexyl)phthalate	4	5	250	98	41 J	190 J	410000	0	11000	0
Carbazole	4	6	370	460	230 J	790 J	290000	0	360	2
Chrysene	5	6	4700	5700	490	15000 *J	780000	0	1000	4
Dibenzo(a,h)anthracene	5	6	1000	1200	75 J	3500 J	780	2	1000	2
Dibenzofuran	4	6	270	300	120 J	430 J	2500000	0	5600	0
Fluoranthene	5	6	10000	12000	710	31000 *J	2500000	0	56000	0
Fluorene	4	6	640	870	290 J	1400 J	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	5	6	2400	2800	150 J	9100 J	7800	1	1000	3
Naphthalene	3	6	230	57	40 J	87 J	2500000	0	56000	0
Phenanthrene	5	6	6900	8300	290 J	19000 *J	2500000	0	40000	0
Phenol	1	4	380	280	280 JEB	280 JEB	2500000	0	800000	0

TABLE 3-21 (cont.)
1 BEACON POINT ROAD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Pyrene	5	6	13000	16000	1100	42000 *J	2500000	0	40000	1
Total PAH	1	1	4300	4300	4284	4284				
Volatile Organic Compounds (UG/KG)										
2-Butanone	3	5	11	16	3 J	33	1000000	0	80000	0
Acetone	4	5	50	62	40	100	1000000	0	140000	0
Benzene	1	5	4	2	2 J	2 J	200000	0	200	0
Bromomethane	1	5	4	1	1 J	1 J				
Carbon Disulfide	3	5	4	4	1 J	8	1000000	0	140000	0
Chloromethane	1	5	4	3	3 J	3 J	440000	0	540	0
Ethylbenzene	2	5	3	1	1 J	1 J	1000000	0	10100	0
Toluene	3	5	4	4	2 J	6 J	1000000	0	67000	0
Total Xylenes	2	5	6	8	5 J	12	1000000	0	19500	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	1	8	5.6	25	25 J	25 J	24000	0	29	0
4,4'-DDE	3	8	16	38	15 #	74 J	17000	0	21	2
4,4'-DDT	5	8	43	67	7.7 #	230 J	17000	0	21	4
Aroclor, Total (4)	18	55	1300	3800	41	23000	10000	2		
Aroclor, Total (Conservative) (5)	18	55	1500	4500	217	23810	10000	2		
Aroclor-1254	4	55	200	1100	120	2400 *	10000	0		
Aroclor-1260	2	55	150	1500	750	2300	10000	0		
Aroclor-1260/62	2	20	260	1500	750	2300				
Aroclor-1262	9	35	640	2300	94 J	13000 J	10000	1		
Aroclor-1268	16	55	800	2500	36 J	23000 *	10000	1		
Dieldrin	4	8	15	23	4.5 #	49	360	0	7	3
Endosulfan Sulfate	4	8	380	750	69 *#	2500 *#	1200000	0	8400	0
Endrin	1	8	3.9	11	11 J	11 J	610000	0		
Endrin Aldehyde	4	8	100	200	38 #	670 *#	610000	0		
Endrin Ketone	1	8	6.6	12	12	12	610000	0		

TABLE 3-21 (cont.)
1 BEACON POINT ROAD - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

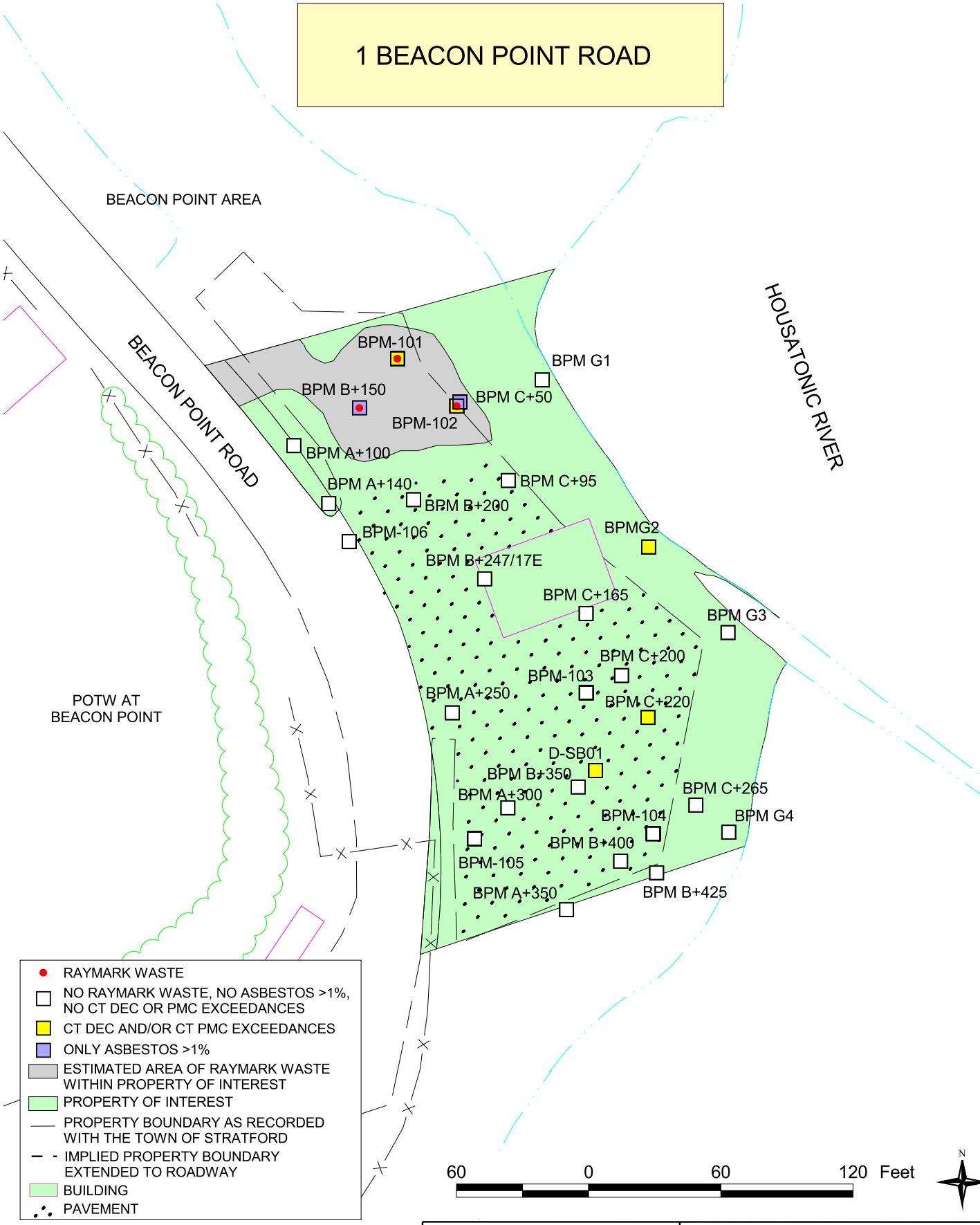
PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
gamma-Chlordane	3	8	6.1	11	5.4 #	17	2200	0	66	0
Heptachlor Epoxide	2	8	3.1	2.5	2.1	2.8 #	630	0	20	0
Methoxychlor	4	8	69	100	31 #	270	10000000	0	8000	0

Qualifier	Definition
!	From dilution analysis
#	Possible false positive due to interference
%	From dilution analysis
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.

1 BEACON POINT ROAD



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-21
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	(978)658-7899

3.22 Airport Property North of Marine Basin

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.22.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.22.1 Property Description

This property, approximately 15.1 acres of commercially-zoned (coastal industrial) land, is located on Main Street in Stratford, Connecticut (Town of Stratford, 1997). The property is a vacant, grassy lot that stretches approximately 850 feet along Main Street. The lot is flat and maintained by Sikorsky Memorial Airport as a clear zone for the airport runways located south of the property, on the opposite side of Main Street. There are no buildings located on the property. The only feature is a dirt driveway that runs through the southern portion of the property and leads to residences located near the Housatonic River, approximately 2,000 feet east of Main Street.

A fence runs the length of the southwest property border, along Main Street. The remaining border is not fenced. Another large lot vegetated with tall grasses and phragmites borders the property to the northeast. A tributary flowing toward the Housatonic River is located on the southern portion of the property, while commercial buildings that are part of the airport lie to the north. According to property boundaries obtained through the Town of Stratford, the southern boundary of this property runs through the middle of the Stratford landfill, while the eastern boundary runs along the Housatonic River. Historical information focused the investigation on the area along Main Street and the area between the driveway and the drainage tributary from Main Street. Access to the property is not restricted.

3.22.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of this property are located within the 100-year floodplain of the Housatonic River. The 100-year frequency base flood elevations for the two zones located on the property are 10 and 11 feet (FEMA, 1992). The 100-year floodplain is delineated on Figure 1-2.

Twenty-four soil borings (BA2-201 through BA2-223, and BA2-205A), were advanced at the property up to depths of 14 feet below ground surface (bgs). BA2-205A was re-drilled for sample collection only and was not used to describe the native material and fill. Surficial materials noted in borings BA2-201 through 203 and BA2-207 through 211 consist of medium sand with varied amounts of fine sand, gravel, and fines. Soils noted in borings BA2-204 through 206, 214, and 216 consist of fill overlying medium sand or fine to coarse sand with some fines and gravel. The native materials in these borings are characteristic of an alluvial, glacial outwash and/or ice contact deposit. Materials noted in borings BA2-217 and 219 through 223 consist of fill overlying peat and/or organic silt, which indicate former swamp and marsh deposits. In borings BA2-212, 213, 215, and 218, the fill and organic material overlies fine to coarse sand or silty sand. The sand and gravel overlying organic layers in borings BA2-212, 217, 221, and 223 may represent fill material. Refer to Figure 3-22 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Soil sample locations are shown on Figure 3-22, including shallow surface samples and deeper sample from soil borings. The borings were used to describe the fill and native material on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials were identified in the soil from borings BA2-204 through 206 and 208, 212, 214 through 216, 218 through 220, and 222. Manmade materials included PACM (potentially asbestos-containing material), asphalt, brick, concrete, glass, plastic, possible sludge, and a steel bar. PACM (asbestos fibers) was observed in the soil from borings BA2-208 and 219. These materials were encountered with natural fill materials consisting of sand and gravel mixtures, reworked peat, and medium sand. Manmade debris was not observed in borings BA2-212, 217, 221, and 223; however, the fine to coarse sand in these borings may represent natural fill. Fill classifications were based on the visual characteristics of the soil and sediment samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings in the southwest corner of the property, around the dirt road by the Stratford landfill and Main Street. The depth to water ranges from 0.5 to 7.5 feet bgs, based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-22. Approximately 7 percent of the property is estimated to contain Raymark waste. That area is covered with grass and small shrubs.

3.22.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for commercial/industrial soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 101 soil samples collected from 43 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-22. Samples were analyzed for asbestos, dioxins, metals, SPLP metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-22 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC regulatory standards. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-22 for the soil data summary statistics and comparison criteria. The discussion below includes all soil samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

Asbestos

One-hundred soil samples were collected and analyzed for asbestos. Asbestos was detected in 42 of the 100 samples collected. Asbestos at greater than 1 percent was found in 12 of the 100 samples, ranging at depths from ground surface to 6 feet bgs, mostly in the eastern portion of the property.

Dioxins

One soil sample was collected and analyzed for dioxins on this property. Dioxins were detected in this sample. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. The TEQ value detected at this property was 0.011 µg/kg.

Metals

Soil samples from this property were collected and analyzed for metals as follows: five soil samples were analyzed for metals at a fixed laboratory; 79 samples were screened for copper; and 96 samples were screened for lead. Metals were frequently detected on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered to be not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Lead concentrations exceeded the CT DEC regulatory standard at five locations. These exceedances were all located in the eastern portion of the property at depths ranging from ground surface to 4 feet bgs.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only one sample was collected, location BA2-205A, to a depth of 2 feet bgs, for SPLP metals analysis. This location is within the estimated areas of Raymark waste. This sample did not exceed the CT PMC standards for lead.

Pesticides

Five soil samples were collected and analyzed for pesticides. Pesticides were rarely detected on the property. No pesticide concentrations exceeded the CT DEC regulatory standards; three pesticide concentrations exceeded the CT PMC regulatory standards. These exceedances were located near the western corner and southeastern end of the property to a maximum depth of 4 feet bgs.

PCBs

Up to 100 soil samples were collected and analyzed for PCBs as Aroclors. Aroclor 1268 was detected in less than one-quarter of the samples. Total Aroclor concentrations exceeded the CT DEC regulatory standards at one surficial location, near the western edge and eastern side of the property. No SPLP or TCLP PBC samples were collected on this property.

SVOCs

Three soil samples were collected and analyzed for SVOCs from the property. Concentrations of 11 SVOCs, primarily PAHs, exceeded the CT DEC and/or CT PMC regulatory standards. These exceedances were located in the eastern end of the property a depths ranging from ground surface to 4 feet bgs.

VOCs

Three soil samples were collected and analyzed for VOCs from the property. Only three VOCs were detected on the property at concentrations below the CT DEC or CT PMC regulatory standards.

Raymark Waste

The results from eight sample locations indicate the presence of Raymark waste on the property. See Section 2.2 for the definition of Raymark waste. The following table displays the location and constituents of the 10 samples from the eight locations that meet the definition of

Raymark waste. These samples are located with approximately 17 percent of the property shown on Figure 3-22 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
BA2-205	0 to 2	1.1	598	981	1,600
BA2-205A	0 to 2	1.5	590	977	NA
BA2-208	0 to 2	27.5	2,060	3,870	ND
	2 to 4	21.6	3,100	6,890	ND
BA2-212	2 to 4	7.2	2,060	3,020	470
BA2-213	0 to 2	6.9	731	1,150	1,200
	2 to 4	40	9,340	18,700	650
BA2-218	2 to 4	1.5	707	1,410	ND
BA2-219	0 to 2	8	1,140	8,320	1,700
BA2-222	4 to 6	10.8	816	835	170

NA- Contaminant was not analyzed
ND- Contaminant was not detected

3.22.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 7 percent of this 15.1-acre property is estimated to contain Raymark waste (see Figure 3-22). The waste area is located primarily along the southern end of the property. None of this property is paved. The entire property is grass-covered, with some small shrubs scattered throughout. It is likely that infiltration is occurring due to the lack of pavement or buildings.

Analytical data indicate that pesticides and SVOCs are potentially leaching into the groundwater from contaminated soils. SPLP metals analysis does not indicate a threat of leaching into the groundwater.

3.22.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at the Airport Property North of Marine Basin that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated

areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste themselves. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire property at the Airport Property North of Marine Basin may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.22.5.1 provides an overview of the Airport Property North of Marine Basin, Section 3.22.5.2 presents COPCs and EPCs, Section 3.22.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.22.5.4 contains the numerical results of the risk assessment, and Section 3.22.5.5 presents property-specific uncertainties. Section 3.22.5.6 presents a property-specific summary of the major risk findings.

3.22.5.1 Overview

The Airport Property North of Marine Basin is zoned for industrial use, but is currently undeveloped. The area covers approximately 15.1 acres. A detailed description of the property is provided in Section 3.22.1. The nature and extent of the contamination detected at the Airport Property North of Marine Basin is discussed in Section 3.22.3. The areas of the property estimated to contain Raymark waste represent an estimated 7 percent of the total 15.1-acre property and are shown in Figure 3.22. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.22.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated areas of Raymark waste at Airport Property North of Marine Basin are summarized in Appendix B-1, Table 2.22.

3.22.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.22 presents a summary of the COPCs for quantitative risk assessment for the Airport Property North of Marine Basin soils from the estimated areas of Raymark waste to a depth of 14 feet bgs. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for industrial soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste at this property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.22:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k) fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene)
- Metals (arsenic and lead)

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for the Airport Property North of Marine Basin are presented in Appendix B-1, Table 3.22. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.22.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the Airport Property North of Marine Basin and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under future conditions, potential human receptors (commercial workers) were assumed to be exposed to soil only within the estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The Airport Property North of Marine Basin is currently an undeveloped area, zoned for industrial use, as described in Section 3.22.1.

Potential Receptors

The receptors retained for quantitative evaluation at the property are future commercial workers. Potentially exposed individuals were limited to those who may work at Airport Property North of Marine Basin in the future.

Possible exposures of commercial workers to site-related contaminants would be through inadvertent contact during commercial/industrial activities at the property. Under the future land use, commercial workers were evaluated for exposure to soils (0 to 14 feet bgs) at a limited area (soils within the estimated areas of Raymark waste) only. Appendix B-1, Table 4.1 presents the exposure assumptions for commercial workers at this and other commercial properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at the Airport Property North of Marine Basin are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from the Airport Property North of Marine Basin is considered to be minimal. The estimated areas of Raymark waste are grassy with scattered shrubs. The presence of vegetation reduces the likelihood of inhalation exposures.

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.22.5.4. Asbestos is present in soils within the estimated areas of Raymark waste at the property. The presence of vegetation suggests that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.1 contains the various assumptions used as input parameters to determine chemical intakes for commercial workers through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.6. Table 1-1 presents the property sizes and FRW values for each property. The FRW for the Airport Property North of Marine Basin is 0.07. Chemical intake estimates for the Airport Property North of Marine Basin are provided in Appendix B-1, Tables 7.22 and 8.22.

3.22.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for the Airport Property North of Marine Basin is provided in this section. Appendix B-1, Table 7.22 and Table 8.22 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.22. Appendix B-1, Table 10.22 reduces the information

developed in Appendix B-1, Table 9.22 to the major risk drivers. The results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the commercial worker at the Airport Property North of Marine Basin are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	0.0012	0.0002	0.0014

The RME hazard index (HI) for the commercial worker exposed to soils within the estimated areas of Raymark waste at the Airport Property North of Marine Basin is less than unity, indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment. See Table 7.22 RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the commercial worker at the Airport Property North of Marine Basin are as follows:

	Ingestion	Dermal	Total
Commercial Worker (Future)	1.1E-05	9.5E-06	2.1E-05

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. The RME risk estimate for the commercial worker exposed to soils within the estimated areas of Raymark waste does not exceed the EPA cancer risk range (10^{-4} to 10^{-6}) but does exceed the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Table 8.22 RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Table 9.22, cancer risk estimates for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene are greater than the CT DEP target risk level for single contaminants of 10^{-6}.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for commercial workers exposed to soils within the estimated area of Raymark waste at this property are 3.6E-05.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste at the Airport Property North of Marine Basin. Lead was detected in samples collected from 0 to 14 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 9,340 mg/kg. The average lead concentration in this dataset was 989 mg/kg.

Exposure to lead in soil by the commercial worker was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d), as discussed in Section 2.7.4.7. The exposure point concentration of 989 mg/kg for soil within the estimated areas of Raymark waste was used to estimate the probability that the fetal blood-lead levels of fetuses born to workers exposed to lead in a commercial setting will exceed 10 µg/dL. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Appendix B-10. The FRW for the Airport Property North of Marine Basin is 0.07. EPA's stated goal for lead is that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 µg/dL. Under the commercial scenario for the estimated areas of Raymark waste at the Airport Property North of Marine Basin, the range of probabilities that the fetal blood-lead concentration exceeds 10 µg/dL is 0.2 to 0.7 percent. The input parameters used and the results of lead models are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 21 of the 28 soil samples collected from the estimated areas of Raymark waste at a concentration range of trace to 40 percent. These samples were collected in the 0- to 14- foot bgs interval. The average concentration was 5 percent. Although

quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is "friable" (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos at the property. Based on field conditions in the estimated areas of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.22.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the Airport Property North of Marine Basin are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste. Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the Airport Property North of Marine Basin is 15.1 acres, with an estimated 7 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.22.4. The estimated areas of Raymark

waste are vegetated with grass and small shrubs. No consideration was given to site characteristics other than the presence of buildings. Because of the small size of the estimated areas of Raymark waste, it is unlikely that individuals will spend all of their time within those areas. However, if that were the case, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately eight times greater than those estimated using the FRW factor.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2.2. Average background concentrations are also shown in Appendix B-1, Table 2.22, alongside site-specific data from the estimated areas of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 2.4 to 5.2 mg/kg, with an average concentration of 3.7 mg/kg. Risks due to arsenic may be attributable to background conditions.

- Samples were not collected in the 14- to 15- foot bgs interval due to site-specific field conditions. The depth considered as accessible by CT DEP is 15 feet bgs (CT DEP, 1996). Therefore, uncertainty is added to the estimated risks to the future commercial worker.

- Twenty-eight samples were included in the dataset for soils within the estimated areas of Raymark waste; however, 25 of those samples were only analyzed by field-screening methods. Due to the limited numbers of samples analyzed for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and arsenic, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- A comparison of data from soils outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of Aroclors at concentrations greater than CT RSRs for industrial soil suggests that risks from other areas of the property may be of concern. Total Aroclors are present in soils located outside the estimated areas of Raymark waste at the Airport Property North of Marine Basin at concentrations up to 19.5 mg/kg. The individual Aroclors detected include Aroclor 1260, Aroclor 1262, and Aroclor 1268. Asbestos is also present outside the estimated areas of Raymark waste

at this property at concentrations up to 3 percent. Samples collected outside the estimated areas of Raymark waste at this property were not analyzed for dioxins. Copper and lead were detected outside the estimated areas of Raymark waste at concentrations up to 1,800 mg/kg and 510 mg/kg, respectively. Thus, a commercial worker's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

3.22.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at the Airport Property North of Marine Basin. Risks to future commercial workers were estimated.

- The RME hazard indices (HI) for future commercial workers exposed to soil within the estimated areas of Raymark waste at the Airport Property North of Marine Basin do not exceed unity. Adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment.

- The RME cancer risk estimates for future commercial workers exposed to soil within the estimated areas of Raymark waste at the property do not exceed the EPA cancer risk range (10^{-4} to 10^{-6}) but exceed the CT DEP target total risk level of 10^{-5}. Cancer risk estimates for benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and dibenzo(a,h)anthracene exceed the CT DEP target risk level for single contaminants of 10^{-6}.

- Exposure to lead in soil by commercial workers was evaluated by use of a slope-factor approach developed by the EPA Technical Review Workgroup for Lead (EPA, December 1996d). The results of the slope-factor approach indicate that adverse effects are not anticipated on fetuses of pregnant workers exposed to lead in soil within the estimated areas of Raymark waste at the property.

- Asbestos was detected in 21 of the 28 soil samples collected from the estimated areas of Raymark waste in the 0- to 14- foot bgs interval at a concentration range of trace to 40 percent. The average concentration was 5 percent.

3.22.6 Ecological Evaluation

No formal ecological evaluation was performed on this property to determine what, if any, ecological receptors are present on the property. Given the location of the property near the Housatonic River and the open undeveloped nature of the property, it is likely a habitat for ecological receptors. It is unknown if those receptors are being adversely impacted by contaminants in Raymark waste.

3.22.7 Summary

This 15.1-acre property contains Raymark waste in the southeastern portion of the property. Samples containing elevated asbestos and concentrations of total metals, SPLP metals, pesticides, PCBs, and SVOCs that exceed CT DEC and/or CT PMC were collected from this property.

The RME hazard indices indicate that adverse non-carcinogenic health effects are not anticipated for commercial workers exposed to soils within the estimated areas of Raymark waste. RME cancer risk estimates do not exceed the EPA cancer risk range, but do exceed the CT DEP target total risk level. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and dibenzo(a,h)anthracene are the primary risk drivers. Adverse effects are not expected on fetuses of pregnant workers exposed to lead in soils within the estimated areas of Raymark waste. The average asbestos concentration was 5 percent.

An ecological evaluation to determine the effects of Raymark waste on ecological receptors was not conducted on this property.

TABLE 3-22
AIRPORT PROPERTY NORTH OF MARINE BASIN - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	42	100	2	4	Trace	40	1	12		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	1	1	0.049	0.049	0.0492	0.0492				
1,2,3,4,6,7,8-HpCDF	1	1	0.04	0.04	0.04	0.04				
1,2,3,4,7,8,9-HpCDF	1	1	0.0021	0.0021	0.0021	0.0021				
1,2,3,4,7,8-HxCDD	1	1	0.00081	0.00081	0.00081	0.00081				
1,2,3,4,7,8-HxCDF	1	1	0.014	0.014	0.0142	0.0142				
1,2,3,6,7,8-HxCDD	1	1	0.0037	0.0037	0.0037	0.0037				
1,2,3,6,7,8-HxCDF	1	1	0.0081	0.0081	0.0081	0.0081				
1,2,3,7,8,9-HxCDD	1	1	0.0024	0.0024	0.0024	0.0024				
1,2,3,7,8-PeCDD	1	1	0.00099	0.00099	0.00099	0.00099				
2,3,4,6,7,8-HxCDF	1	1	0.012	0.012	0.012	0.012				
2,3,4,7,8-PeCDF	1	1	0.0078	0.0078	0.0078	0.0078				
2,3,7,8-TCDF	1	1	0.0083	0.0083	0.0083	0.0083				
OCDD	1	1	1.2	1.2	1.19	1.19				
OCDF	1	1	0.02	0.02	0.0199	0.0199				
Total HpCDD	1	1	0.098	0.098	0.0979	0.0979				
Total HpCDF	1	1	0.069	0.069	0.0691	0.0691				
Total HxCDD	1	1	0.036	0.036	0.0355	0.0355				
Total HxCDF	1	1	0.23	0.23	0.231	0.231				
Total PeCDF	1	1	0.41	0.41	0.407	0.407				
Total TCDD	1	1	0.01	0.01	0.0102	0.0102				
Total TCDF	1	1	0.66	0.66	0.656	0.656				
Toxicity Equivalency	1	1	0.011	0.011	0.011	0.011				
Metals (MG/KG)										
Aluminum	5	5	10200	10200	5820	13400				
Arsenic	5	5	4	4	2.4	5.2	10	0		
Barium	5	5	165	165	29.1	642	140000	0		
Beryllium	2	5	0.3	0.45	0.45 J	0.45 J	2	0		

TABLE 3-22 (cont.)
AIRPORT PROPERTY NORTH OF MARINE BASIN - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG) (cont.)										
Calcium	5	5	1210	1210	644 J	1840 J				
Chromium	5	5	21.8	21.8	13.4	27.8	100	0		
Cobalt	5	5	6.4	6.4	3.6	9.6	2500	0		
Copper	39	84	774	1580	9.9 J	18700	76000	0		
Iron	5	5	14800	14800	9030	17100				
Lead	69	101	345	495	4.1 J	9340	1000	7		
Magnesium	5	5	4340	4340	2590	6000				
Manganese	5	5	228	228	158	305 J	47000	0		
Mercury	1	5	0.042	0.058	0.058 J	0.058 J	610	0		
Nickel	5	5	21.6	21.6	12.2 J	45.2	7500	0		
Potassium	5	5	1680	1680	934	2690				
Sodium	4	5	1050	1310	126 J	4520 J				
Vanadium	5	5	28.9	28.9	19.8	37.2	14000	0		
Zinc	5	5	72.9	72.9	33.1	142	610000	0		
Metals (SPLP) (UG/L)										
Barium	1	1	246	246	246	246			10000	0
Chromium	1	1	0.71	0.71	0.71	0.71			500	0
Copper	1	1	65.1	65.1	65.1	65.1			13000	0
Lead	1	1	35.3	35.3	35.3	35.3			150	0
Semivolatile Organic Compounds (UG/KG)										
2-Methylnaphthalene	2	3	1500	2200	220 J	4200	2500000	0	9800	0
Acenaphthene	3	3	1600	1600	83 J	4400	2500000	0	84000	0
Acenaphthylene	3	3	2700	2700	90 J	7100	2500000	0	84000	0
Anthracene	3	3	5100	5100	190 J	14000	2500000	0	400000	0
Benzo(a)anthracene	3	3	16000	16000	570	43000	7800	1	1000	2
Benzo(a)pyrene	3	3	14000	14000	430	36000	1000	2	1000	2
Benzo(b)fluoranthene	3	3	12000	12000	430	31000	7800	1	1000	2
Benzo(g,h,i)perylene	3	3	11000	11000	270 J	29000	2500000	0	42000	0
Benzo(k)fluoranthene	3	3	14000	14000	350 J	37000	78000	0	1000	2

TABLE 3-22 (cont.)
AIRPORT PROPERTY NORTH OF MARINE BASIN - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Industrial) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Carbazole	3	3	2100	2100	71 J	5800	290000	0	360	2
Chrysene	3	3	18000	18000	620	47000	780000	0	1000	2
Dibenzo(a,h)anthracene	3	3	4500	4500	140 J	12000	780	2	1000	2
Dibenzofuran	3	3	1200	1200	49 J	3300	2500000	0	5600	0
Fluoranthene	3	3	26000	26000	1200	70000	2500000	0	56000	1
Fluorene	3	3	4000	4000	170 J	11000	2500000	0	56000	0
Indeno(1,2,3-cd)pyrene	3	3	9800	9800	260 J	26000	7800	1	1000	2
Naphthalene	1	3	1900	4700	4700	4700	2500000	0	56000	0
Phenanthrene	3	3	20000	20000	850	55000	2500000	0	40000	1
Pyrene	3	3	27000	27000	1100	71000	2500000	0	40000	1
Volatile Organic Compounds (UG/KG)										
2-Butanone	1	3	10	18	18	18	1000000	0	80000	0
Acetone	3	3	80	80	17 J	170	1000000	0	140000	0
Methyl Acetate	2	3	11	15	12	18				
Pesticide/PCB (UG/KG)										
4,4'-DDE	1	5	13	42	42	42	17000	0	21	1
4,4'-DDT	2	5	22	31	15	47	17000	0	21	1
alpha-Chlordane	1	5	1.7	1.1	1.1 J	1.1 J	2200	0	66	0
Aroclor, Total (4)	35	100	610	1400	21	16000	10000	1		
Aroclor, Total (Conservative) (5)	42	100	860	1800	93	19520	10000	2		
Aroclor-1254	9	47	350	1500	110	6700	10000	0		
Aroclor-1260	17	47	610	1600	21 J	16000	10000	1		
Aroclor-1262	15	82	290	770	30	2900	10000	0		
Aroclor-1268	17	100	280	770	23	3100	10000	0		
Endosulfan II	1	4	3.9	3.6	3.6 J	3.6 J	1200000	0	8400	0
Endosulfan Sulfate	2	5	13	30	11	48	1200000	0	8400	0
Endrin Ketone	2	5	8.9	19	8.8	30	610000	0		
gamma-Chlordane	3	5	98	160	6.8	380	2200	0	66	2

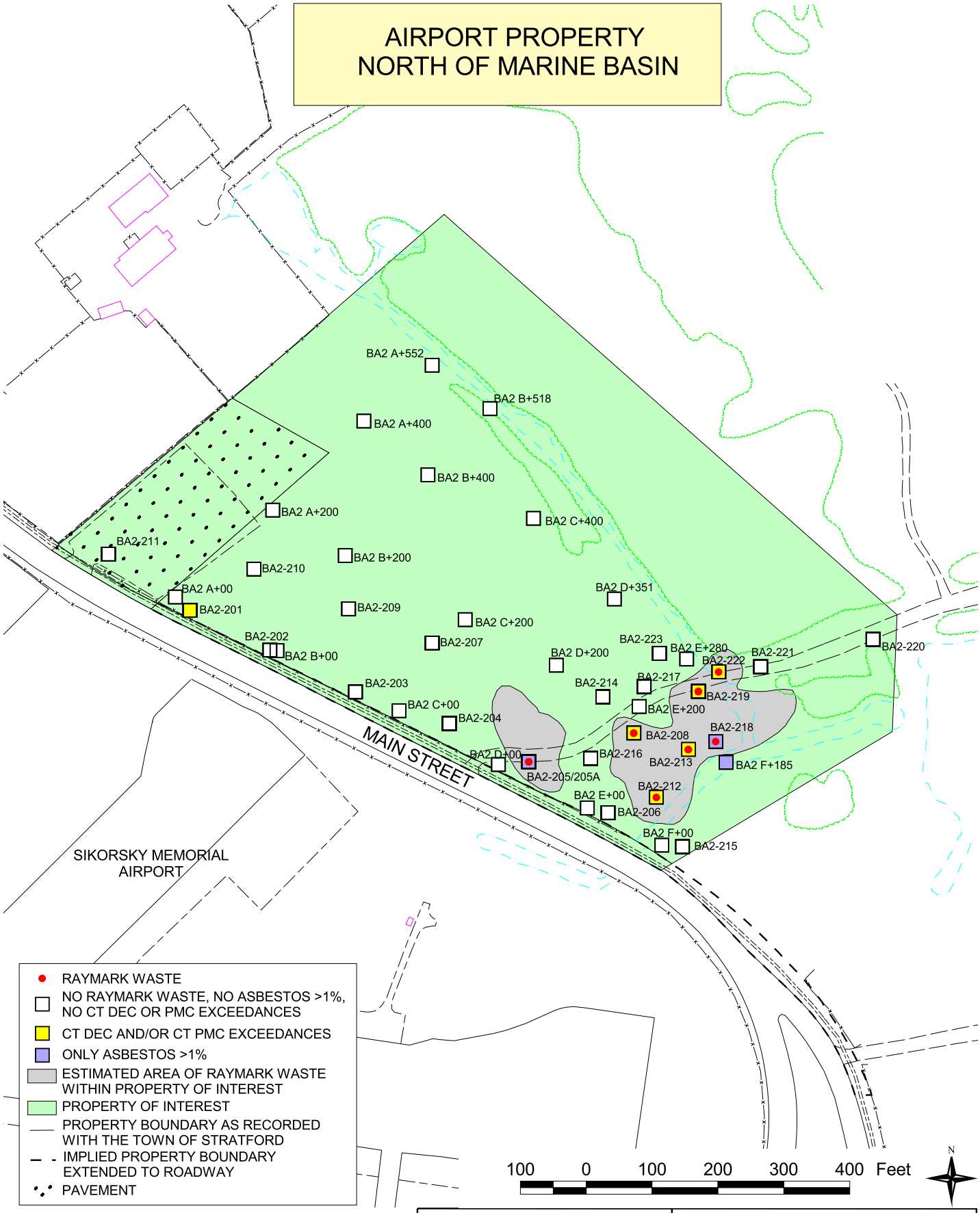
TABLE 3-22 (cont.)
AIRPORT PROPERTY NORTH OF MARINE BASIN - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

Qualifier	Definition
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.

AIRPORT PROPERTY NORTH OF MARINE BASIN



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR INDUSTRIAL/COMMERCIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-22
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ — DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887
CHECKED BY: D. CHISHOLM — FILE: C\...\OU6_RI_2003.APR	(978)658-7899

3.23 Wooster Park

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.23.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.23.1 Property Description

This property, approximately 4 acres of municipal land in a residential area, is located in the northernmost part of Wooster Park in Stratford, Connecticut (Town of Stratford, 1997). The property is undeveloped and heavily wooded with large old-growth trees. Approximately 150 feet along Quail Street and the southeastern corner of the property are cleared grassy areas that appear to be maintained as a lawn. The topography of the property is flat. Bruce Brook runs along the eastern border, behind the Salvia Street residences. Bruce Brook flows beneath Quail Street through a culvert, and through Wooster Park into Wooster Pond. The property has no structures; however, a sand and soil path has been built throughout the property woodlands. Children have been frequently observed riding bikes along these paths. Surface drainage appears to flow in a south-southeast direction into the stream. Public access to the property from adjacent areas is not restricted.

The property is bordered by Quail Street to the south, residential properties on Salvia Street and Bruce Brook to the east, Old Spring Road to the north and residential properties on Karen Avenue to the west. No residential properties directly abut the park along the north side of Quail Street.

3.23.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, portions of this property are located within the 100-year floodplain of the Housatonic River. The base flood elevation for the property is 99 feet (FEMA, 1992). The 100-year floodplain boundary is delineated on Figure 1-2 for this property.

Sixteen soil borings (WP-101 through 110 and WP-201 through 206) were advanced to depths of up to 8 feet below ground surface (bgs) throughout the property. Borings WP-101 through

104 and WP-201 through 203 were located in grassy areas along Quail Street and Salvia Street. Borings WP-105 through 110 and WP-204 through 206 were located in wooded areas on the property. Soil observed in borings WP-101, WP-104 through WP-110, WP-204, and WP-205 primarily consisted of silty sand, with trace gravel, and fine to coarse sand at depth. Soil observed in borings WP-102, WP-103, WP-202, and WP-206 consisted of poorly graded medium to fine sands. These materials are characteristic of an alluvial, glacial outwash and/or ice contact deposit. Native soil encountered in borings WP-201 and WP-203 consisted of silty clay, with organics at WP-203. The soils in these borings are characteristic of a marsh or swamp deposit. Refer to Figure 3-23 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Sample locations are shown on Figure 3-23, including shallow surface samples and some from deeper soil borings. The borings were used to describe the depth of the fill on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill consists of natural materials that were placed on the property as a result of human activity. The poorly graded sand above the native silty sand in borings WP-102, WP-203, and WP-206 is considered to be fill. Man-made debris was observed in borings WP-201 (asphalt, dark clay-like material with long fibers) and WP-202 (asphalt, brick fragments, and coal). Fill classifications were based on the visual characteristics of the soil samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings WP-102, WP-201, WP-202, WP-203, and WP-206, in the middle of the southern end of Wooster Park, along Quail Street. Depth to groundwater ranges from 4 to 8 feet bgs, with an average depth of 6 feet bgs, based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on this property. The lateral limits of the areas of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-23. Approximately 4 percent of the property is estimated to contain Raymark waste. The waste areas are soil covered or vegetated.

3.23.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for residential soils (CT DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

There were 73 soil samples collected from 54 locations on this property. Sample locations with exceedances of the CT DEC and CT PMC are indicated on Figure 3-23. Samples were analyzed for asbestos, dioxins, metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-23 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-23 for the soil data summary statistics and comparison to criteria. The discussion below includes all soil samples collected on the property, not just those determined to be within the estimated areas of Raymark waste.

<u>Asbestos</u>

Seventy-three soil samples were collected from the property and analyzed for asbestos. Asbestos was detected in 13 samples. Asbestos detections at greater than 1 percent were found in seven samples. Asbestos detections were found primarily in the southern portion of the property at depths ranging from ground surface to 6 feet bgs.

Dioxins

One soil sample was collected from the property and analyzed for dioxin. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. Dioxin was detected at this property at a TEQ value of 2 µg/kg at a depth of 2 feet to 4 feet bgs.

Metals

Soil samples were collected from this property and analyzed for metals as follows: six soil samples were analyzed at a fixed laboratory; 32 soil samples were screened for copper; and 67 soil samples were screened for lead. Metals were detected frequently on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Lead, barium, and copper concentrations exceeded the CT DEC regulatory standards at this property. The exceedances were located from the ground surface to 6 feet bgs in the southern portion of the property.

SPLP and TCLP Metals

Based on the data provided in Appendix C for this property, only one SPLP sample was collected. This location is within the estimated area of Raymark waste. This sample does not exceed the CT PMC standard.

Pesticides

Five soil samples were collected from the property and analyzed for pesticides. Pesticides were detected in five samples at concentrations exceeding the CT PMC regulatory standards. Dieldrin was the only pesticide that exceeded the CT DEC at this property. Pesticide exceedances were located in the southern portion of the property at depths of up to 6 feet bgs.

PCBs

Seventy-one soil samples were collected from the property and analyzed for PCBs as Aroclors. Only Aroclors 1262 and 1268 were detected on the property. Total Aroclor concentrations exceeded the CT DEC regulatory standards in five samples located in the southern portion of the property, from depths ranging from ground surface to 6 feet bgs. Aroclor 1268 concentrations contributed to the total Aroclor exceedance in five of these samples. No SPLP/TCLP PCB samples were collected.

SVOCs

Three soil samples were collected from the property and analyzed for SVOCs. SVOCs were detected frequently on the property. Concentrations of nine SVOCs (mostly PAHs) exceeded the CT DEC and/or the CT PMC regulatory standards. SVOC exceedances were located in the southern portion of the property at depths of 0 to 6 feet bgs.

VOCs

Three soil samples were collected from the property and analyzed for VOCs. VOCs were not frequently detected on the property and there were no VOC exceedances of the CT DEC or the CT PMC regulatory standards.

Raymark Waste

The results from three soil sample locations indicate the presence of Raymark waste on the property. See Section 2.2 for the definition of Raymark waste. The following table displays the location and constituents of the four samples from the three locations that meet the definition of Raymark waste. These samples are located within the approximately 4 percent of the property shown on Figure 3-23 as the “Estimated Area of Raymark Waste within Property of Interest.”

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor 1268 (µg/kg)
WP-102	0 to 2	12	1,270	2,370	NA
WP-201	2 to 4	4.6	5,640	7,060	20,000
	4 to 6	3.4	17,300	14,000	43,000
WP-0B-B+50	0 to 0.5	60	1,030	977	ND

NA- Contaminant was not analyzed
ND- Contaminant was not detected

3.23.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 4 percent of this 4-acre property is estimated to contain Raymark waste. The waste areas are located in along the southern boundary of the property (see Figure 3-23). This property is almost entirely heavily wooded. The property is relatively flat until it reaches the stream where it slopes down. It is likely that some infiltration is occurring. Erosion of soils is possible in the areas along Bruce Brook. Heavy vegetation reduces the impact of wind on the erosion of surface soil.

The analytical data indicate there is some leaching of pesticides and SVOCs into the groundwater. SPLP data indicate metals are not leaching from soils into the groundwater.

3.23.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at Wooster Park that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated areas of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated areas of Raymark waste. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal

basis. Total risks associated with the exposure to the entire property at Wooster Park may be higher than presented in this HHRA if contaminants beyond the estimated areas of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated areas of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.23.5.1 provides an overview of the Wooster Park property, Section 3.23.5.2 presents COPCs and EPCs, Section 3.23.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.23.5.4 contains the numerical results of the risk assessment, and Section 3.23.5.5 presents property-specific uncertainties. Section 3.23.5.6 presents a property-specific summary of the major risk findings.

3.23.5.1 Overview

Wooster Park is a recreational property, owned by the Town of Stratford. The area covers approximately 4 acres. A detailed description of the property is provided in Section 3.23.1. The nature and extent of the contamination detected at Wooster Park is discussed in Section 3.23.3. The areas of Wooster Park estimated to contain Raymark waste represent an estimated 4 percent of the total 4-acre property and are shown in Figure 3-23. Property-specific site conditions within the estimated areas of Raymark waste are described in Section 3.23.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in soils within the estimated areas of Raymark waste at Wooster Park are summarized in Appendix B-1, Table 2.23.

3.23.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.23 presents a summary of the COPCs for quantitative risk assessment for Wooster Park soils from the estimated areas of Raymark waste to a depth of 6 feet bgs. No samples were collected more than 6 feet bgs within the estimated areas of Raymark waste based on site-specific field conditions. Direct exposure COPCs were identified based on a comparison of site data from the estimated areas of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on EPA Region IX PRGs for residential soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated areas of Raymark waste of the property to risk-based COPC screening levels for commercial land use, as shown in Appendix B-1, Table 2.23:

- Asbestos
- PAHs (acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k) fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene)
- Semi-Volatile Organic Compounds (SVOCs) (acetophenone)
- Aroclors, Total (1262 and 1268)
- Metals (arsenic, barium, chromium, lead, manganese, and nickel)
- Dioxins

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations are described in Section 2.7.2. Exposure point concentrations used in the risk assessment for Wooster Park are presented in Appendix B-1, Table 3.23. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.23.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at Wooster Park and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (recreational visitors) were assumed to be exposed to soil only within the estimated areas of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

Wooster Park is a recreational area owned by the Town of Stratford, as described in Section 3.23.1.

Potential Receptors

The receptors retained for quantitative evaluation at Wooster Park are current and future recreational visitors. Potentially exposed individuals include residents who may live nearby or visitors from other areas of Stratford or surrounding towns.

Wooster Park is primarily recreational. Frequent recreational visitors were evaluated for exposure to soils (0 to 6 feet bgs) in the estimated areas of Raymark waste, under current and future land use. Persons involved in recreational activities (the frequent recreational visitor) may visit the estimated areas of Raymark waste at Wooster Park, thereby coming in contact with potentially contaminated soil. Possible exposures of frequent visitors to site-related contaminants would be through recreational activities, such as walking, or picnicking. Appendix B-1, Table 4.3A presents the exposure assumptions for adult recreational visitors at this and other recreational properties in the RI. Appendix B-1, Table 4.3B presents the exposure assumptions for child recreational visitors at this and other recreational properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at Wooster Park are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from Wooster Park is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. The estimated areas of Raymark waste at Wooster Park are vegetated. The presence of vegetation reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios and are therefore relatively conservative values for potential receptors at recreational properties. Appendix B-1, Table 2.23 presents available inhalation SSLs for contaminants in soils within the estimated areas of Raymark waste at the Wooster Park property. All reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a).

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.23.5.4. Asbestos is present in soils within the estimated areas of Raymark waste at Wooster Park. The presence of vegetation and the qualitative comparison to SSLs suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.3A and Table 4.3B contain the various assumptions used as input parameters to determine chemical intakes for adult and child recreational visitors through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.6. Table 1-1 presents the property sizes and FRW values for each property. The FRW for Wooster Park is 0.04. Chemical intake estimates for Wooster Park are provided in Appendix B-1, Tables 7.23 and 8.23.

3.23.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for Wooster Park is provided in this section. Appendix B-1, Table 7.23 and Table 8.23 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1,

Table 9.23. Appendix B-1, Table 10.23 reduces the information developed in Appendix B-1, Table 9.23 to the major risk drivers. Tables 7.23A, 8.23A, 9.23A and 10.23A present non-cancer and cancer RME risk estimates for adult recreational visitors. Tables 7.23B, 8.23B, 9.23B, and 10.23A present non-cancer and cancer RME risk estimates for child recreational visitors. Children represent the more sensitive population for non-cancer risks. For cancer risks, the risks to children and adults are added to produce an estimate of risks from lifetime exposures. The results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the recreational visitor at Wooster Park are as follows:

	Ingestion	**Dermal**	**Total**
Frequent Recreational Visitor – Adult (Current and future)	0.055	0.028	0.083
Frequent Recreational Visitor – Child (Current and future)	0.51	0.18	0.70

The RME hazard index for the frequent recreational visitor exposed to soils within the estimated areas of Raymark waste at Wooster Park is less than unity indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment. See Tables 7.23A RME and 7.23B RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the recreational visitor at Wooster Park are as follows:

	Ingestion	**Dermal**	**Total**
Frequent Recreational Visitor – Adult[(1)] (Current and future)	3.7E-06	1.6E-06	5.3E-06
Frequent Recreational Visitor – Child[(1)] (Current and future)	8.6E-06	2.6E-06	1.1E-05

1) Summation of total risk for Frequent Recreational User (adult plus child): 1.6E-05.

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. Cancer risks for the frequent adult and child recreational visitor are added together for a lifetime exposure. The RME risk estimate for the recreational visitor exposed to soils within the estimated areas of Raymark waste at Wooster Park falls within the EPA cancer risk range (10^{-4} to 10^{-6}) and slightly exceeds the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Tables 8.23A RME and 8.23B RME in Appendix B-1 for details on cancer risk calculations. As detailed on Appendix B-1, Tables 9.23A and 9.23B, cancer risks for dioxin, benzo(a)pyrene, and Aroclors exceed the CT DEP target risk level of 10^{-6} for single contaminants when the two age groups are added together for a lifetime exposure.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for recreational visitors exposed to soils within the estimated area of Raymark waste at this property are 4.4E-05.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated areas of Raymark waste at the Wooster Park property. Lead was detected in samples collected from 0 to 6 feet bgs within the estimated areas of Raymark waste at a maximum concentration of 17,300 mg/kg. The average lead concentration in this dataset was 4,250 mg/kg.

Exposure to lead in soil by the frequent child recreational visitor was evaluated using the EPA IEUBK Model, as discussed in Section 2.7.4.7. The IEUBK model was developed to evaluate exposures to lead by children in a residential setting. Consequently, using the IEUBK model for child recreational exposures should provide a very conservative evaluation of exposures to lead. The time-weighted exposure point concentration of 170 mg/kg (average lead concentration in soils within the estimated area of Raymark waste of 4,250 multiplied by the FRW of 0.04), as well as several default parameters, was used to estimate blood-lead levels for children in a residential setting. The estimated geometric mean blood-lead level for children exposed to lead

in soil within the estimated areas of Raymark waste at Wooster Park was 3.1 µg/dL, which is less than the established level of concern of 10 µg/dL. The IEUBK model estimates that 0.69 percent of children are expected to have blood-lead levels greater than 10 µg/dL, which does not exceed the acceptable level of 5 percent. The input parameters used and the results of the IEUBK lead models, estimated blood-lead levels, and probability density histograms are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in five of the six soil samples collected from the estimated areas of Raymark waste at a concentration range of 2 to 60 percent. These samples were collected from the 0- to 6- foot bgs interval. The average concentration was 14 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is “friable” (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of vegetative cover in the estimated areas of Raymark waste reduces the potential for airborne asbestos at Wooster Park. Based on field conditions in the estimated areas of Raymark waste at Wooster Park, it is likely that asbestos does not currently present a significant inhalation risk from the estimated areas of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.23.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for Wooster Park are presented in the following narrative.

- Uncertainty associated with the extent of the estimated areas of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the

exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated areas of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the Wooster Park property is 4 acres, with an estimated 4 percent containing Raymark waste. A physical description of the estimated areas of Raymark waste at the property is provided in Section 3.23.4. The estimated areas of Raymark waste are vegetated with low grasses or trees. No consideration was given to site characteristics other than the presence of buildings. Because of the small size of the estimated areas of Raymark waste, it is unlikely that individuals will spend all of their time within those areas. However, if that were the case, reasonable maximum risks for exposure to the estimated areas of Raymark waste would be approximately 25 times greater than those estimated using the FRW factor.

- Copper concentrations exceed the EPA Region IX residential soil PRG of 3,100 mg/kg in Wooster Park soils; however, due to the lack of an approved toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in Wooster Park soils (0 to 6 feet bgs) at concentrations ranging from 20.1 mg/kg to 14,000 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown in Appendix B-1, Table 2.23 alongside site-specific data from the estimated areas of Raymark waste. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 3.3 to 5.6 mg/kg, with an average concentration of 4.5 mg/kg. Manganese, with an average background concentration of 306 mg/kg, was detected at concentrations ranging from 172 to 321 mg/kg, with an average

concentration of 235 mg/kg. Risks due to arsenic and manganese may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5 x 10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0 x 10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5 x 10^5 $(mg/kg/day)^{-1}$.

- Only six samples were included in the dataset for soils within the estimated areas of Raymark waste. Two of those samples were only analyzed by screening methods. Due to the limited numbers of samples analyzed for PAHs, SVOCs, dioxins, arsenic, chromium, manganese, and nickel, maximum concentrations were used to evaluate risks for these parameters. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 6 feet bgs were included in the risk assessment for current and future recreational visitors. Current exposures to recreational visitors are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current recreational visitors. In addition, future recreational visitors may be exposed to soils currently located at depths up to 15 feet bgs, which is the depth considered as accessible by CTDEP (CTDEP, 1996). The absence of samples collected in the 6-to 15- foot bgs interval adds uncertainty in the evaluation of risks to future recreational visitors.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of data from soils outside the estimated areas of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of dieldrin and lead at concentrations greater than CT RSRs for residential soil suggests that risks from other areas of the property may be of concern. Dieldrin was present in soils located outside the estimated

areas of Raymark waste at Wooster Park at concentrations up to 220 µg/kg and lead was present at concentrations up to 790 µg/kg. Dioxins were not reported outside the estimated areas of Raymark waste. PCBs were not reported using CLP methods for samples collected outside the estimated areas of Raymark waste. Copper was detected at concentrations up to 636 mg/kg. Asbestos was also present outside the estimated areas of Raymark waste at Wooster Park at concentrations up to 20 percent. Thus, a recreational visitor's exposure and risk from the entire property are likely to be greater than that estimated for the areas of Raymark waste alone.

3.23.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at Wooster Park. Risks to recreational visitors were estimated.

- All RME hazard indices (HI) for the recreational visitors exposed to soil within the estimated areas of Raymark waste at Wooster Park were less than unity, indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment.

- RME cancer risks for the frequent adult and child recreational visitor are added together for a lifetime exposure. The cancer risk estimates for recreational visitors exposed to soil within the estimated areas of Raymark waste at Wooster Park fall within the EPA cancer risk range (10^{-4} to 10^{-6}) and are slightly in excess of the CT DEP target total risk level for multiple contaminants of 10^{-5}. Cancer risks for dioxin, benzo(a)pyrene, and Aroclors exceed the CT DEP target risk level of 10^{-6} for single contaminants.

- Exposure to lead in soil by child recreational visitors was evaluated by use of the IEUBK model. The results of the model indicate that adverse effects are not anticipated for child recreational visitors exposed to lead in soil within the estimated areas of Raymark waste at Wooster Park.

- Asbestos was detected in five of the six soil samples collected from the estimated areas of Raymark waste in the 0- to 6- foot bgs interval at a concentration range of 2 to 60 percent. The average concentration was 14 percent.

3.23.6 Ecological Evaluation

No formal ecological evaluation was performed on this property, so the impact of Raymark waste on on-site ecological receptors is unknown.

3.23.7 Summary

This 4-acre property contains Raymark waste in a small portion of the property. Soil samples containing concentrations of metals, pesticides, SVOCs, and PCBs that exceed CT DEC, CT PMC, and/or asbestos greater than 1 percent were collected from the property. Infiltration, leaching, and some erosion into Bruce Brook, are likely occurring at the property.

RME hazard indices for recreational visitors exposed to soil within the estimated areas of Raymark waste indicate that adverse non-carcinogenic health effects are not anticipated. The cancer risk estimates fall within the EPA cancer risk range and are slightly in excess of the CT DEP target total risk level. Dioxin, benzo(a)pyrene, and Aroclor concentrations exceed the CT DEP target risk level for single contaminants. Adverse effects are not anticipated for child recreational visitors exposed to soils within the estimated areas of Raymark waste. The average asbestos concentration in the waste areas was 14 percent.

Impacts by Raymark waste on ecological receptors have not been investigated.

TABLE 3-23
WOOSTER PARK - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	13	73	2	8	Trace	60	1	7		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	1	1	0.3	0.3	0.3	0.3				
1,2,3,4,6,7,8-HpCDF	1	1	2.6	2.6	2.61 #	2.61 #				
1,2,3,4,7,8,9-HpCDF	1	1	0.082	0.082	0.0816	0.0816				
1,2,3,4,7,8-HxCDD	1	1	0.0044	0.0044	0.0044 J	0.0044 J				
1,2,3,4,7,8-HxCDF	1	1	3.7	3.7	3.69	3.69				
1,2,3,6,7,8-HxCDD	1	1	0.027	0.027	0.0273	0.0273				
1,2,3,6,7,8-HxCDF	1	1	0.77	0.77	0.769	0.769				
1,2,3,7,8,9-HxCDD	1	1	0.018	0.018	0.0185	0.0185				
1,2,3,7,8,9-HxCDF	1	1	0.0088	0.0088	0.0088 J	0.0088 J				
1,2,3,7,8-PeCDD	1	1	0.0027	0.0027	0.0027 EMPC	0.0027 EMPC				
1,2,3,7,8-PeCDF	1	1	0.82	0.82	0.819	0.819				
2,3,4,6,7,8-HxCDF	1	1	1.3	1.3	1.28	1.28				
2,3,4,7,8-PeCDF	1	1	2.4	2.4	2.44	2.44				
2,3,7,8-TCDD	1	1	0.0016	0.0016	0.0016 J	0.0016 J				
2,3,7,8-TCDF	1	1	1.3	1.3	1.28 #	1.28 #				
OCDD	1	1	2	2	1.95	1.95				
OCDF	1	1	1.3	1.3	1.34	1.34				
Total HpCDD	1	1	0.54	0.54	0.541 J	0.541 J				
Total HpCDF	1	1	2.6	2.6	2.61 J#	2.61 J#				
Total HxCDD	1	1	0.2	0.2	0.196 EMPC	0.196 EMPC				
Total HxCDF	1	1	7.1	7.1	7.07 J#	7.07 J#				
Total PeCDD	1	1	0.042	0.042	0.0415 EMPC	0.0415 EMPC				
Total PeCDF	1	1	4.2	4.2	4.25 EMPC#	4.25 EMPC #				
Total TCDD	1	1	0.047	0.047	0.0466 EMPC	0.0466 EMPC				
Total TCDF	1	1	2.8	2.8	2.8 EMPC#	2.8 EMPC #				
Toxicity Equivalency	1	1	2	2	2 J	2 J				

TABLE 3-23 (cont.)
WOOSTER PARK - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG)										
Aluminum	6	6	9750	9750	5550	21000				
Arsenic	6	6	4.8	4.8	3.3	6.1	10	0		
Barium	6	6	3920	3920	33.8 J	14300	4700	2		
Beryllium	3	6	0.44	0.71	0.54 J	1 J	2	0		
Cadmium	3	6	0.4	0.61	0.4	0.83	34	0		
Calcium	6	6	1150	1150	306 J	1770				
Chromium	6	6	30.3	30.3	11.2	75.4	100	0		
Cobalt	6	6	7	7	2.9 J	13.3	1000	0		
Copper	16	38	756	1660	20.1	14000 J	2500	2		
Iron	6	6	13800	13800	11700 J	16400				
Lead	52	73	464	631	10.5 J	17300	400	6		
Magnesium	6	6	9920	9920	1890	30200				
Manganese	6	6	216	216	119 J	321	1600	0		
Nickel	6	6	71.7	71.7	8.8	238	1400	0		
Potassium	6	6	1190	1190	557 J	1670				
Silver	2	6	0.4	0.76	0.43 J	1.1	340	0		
Sodium	4	6	116	151	125 J	164				
Vanadium	6	6	26.2	26.2	20.5	34.5	470	0		
Zinc	6	6	399	399	37.4	1440	20000	0		
Metals (SPLP) (UG/L)										
Barium	1	1	584	584	584	584			10000	0
Chromium	1	1	0.66	0.66	0.66 J	0.66 J			500	0
Copper	1	1	239	239	239 J	239 J			13000	0
Lead	1	1	136	136	136	136			150	0
Nickel	1	1	12.8	12.8	12.8	12.8			1000	0
Selenium	1	1	6.1	6.1	6.1 J	6.1 J			500	0
Zinc	1	1	36.5	36.5	36.5	36.5			50000	0

TABLE 3-23 (cont.)
WOOSTER PARK - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG)										
1,1'-Biphenyl	2	3	1400	1200	1100 J	1300 J				
2,4-Dimethylphenol	2	3	2000	2200	1200 J	3200 J	1000000	0	28000	0
2-Methylnaphthalene	3	3	2800	2800	1300	4100 J	474000	0	9800	0
2-Methylphenol	2	3	1000	650	440 J	860 J	1000000	0	70000	0
4-Methylphenol	2	3	2200	2500	1700 J	3300 J	340000	0	7000	0
Acenaphthene	3	3	1400	1400	1200	1600 J	1000000	0	84000	0
Acenaphthylene	3	3	6000	6000	5400 J	6500	1000000	0	84000	0
Acetophenone	1	3	1500	750	750 J	750 J				
Anthracene	3	3	6100	6100	5600	6700	1000000	0	400000	0
Benzaldehyde	1	3	1600	1200	1200 JEB	1200 JEB				
Benzo(a)anthracene	3	3	21000	21000	18000	24000	1000	3	1000	3
Benzo(a)pyrene	3	3	16000	16000	13000	19000	1000	3	1000	3
Benzo(b)fluoranthene	3	3	15000	15000	10000	18000	1000	3	1000	3
Benzo(g,h,i)perylene	3	3	7400	7400	5700	8800	1000000	0	42000	0
Benzo(k)fluoranthene	3	3	15000	15000	13000	16000	8400	3	1000	3
Carbazole	3	3	1900	1900	1200	2300 J	31000	0	360	3
Chrysene	3	3	23000	23000	20000	25000	84000	0	1000	3
Dibenzo(a,h)anthracene	1	3	2800	3800	3800	3800	84	1	1000	1
Dibenzofuran	3	3	2200	2200	1300	2900 J	270000	0	5600	0
Fluoranthene	3	3	33000	33000	28000	42000	1000000	0	56000	0
Fluorene	3	3	5600	5600	4100	6500	1000000	0	56000	0
Indeno(1,2,3-cd)pyrene	3	3	7900	7900	6000	9400	840	3	1000	3
Naphthalene	3	3	3200	3200	910	5600	1000000	0	56000	0
Phenanthrene	3	3	24000	24000	21000	26000	1000000	0	40000	0
Phenol	2	3	2400	2600	1800 J	3500 J	1000000	0	800000	0
Pyrene	3	3	39000	39000	32000	44000	1000000	0	40000	2

TABLE 3-23 (cont.)
WOOSTER PARK - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Volatile Organic Compounds (UG/KG)										
2-Butanone	1	3	8	18	18	18	500000	0	80000	0
Acetone	3	3	44	44	13 J	84 J	500000	0	140000	0
Benzene	1	3	2	0.9	0.9 J	0.9 J	21000	0	200	0
Carbon Disulfide	1	3	3	3	3 J	3 J	500000	0	140000	0
Chlorobenzene	1	3	12	32	32 J	32 J	500000	0	20000	0
cis-1,2-Dichloroethene	1	3	2	0.7	0.7 J	0.7 J				
Cyclohexane	1	3	4	5	5 J	5 J				
Ethylbenzene	1	3	38	110	110 *J	110 *J	500000	0	10100	0
Isopropylbenzene	1	3	12	31	31 J	31 J				
Methyl Acetate	1	3	4	7	7	7				
Methylcyclohexane	2	3	18	25	1	49 J				
Toluene	2	3	340	500	2	1000 *J	500000	0	67000	0
Total Xylenes	2	3	200	300	2	600 *J	500000	0	19500	0
Pesticide/PCB (UG/KG)										
4,4'-DDE	2	4	42	70	65 #	75 #	1800	0	21	2
4,4'-DDT	3	5	31	38	1.2 J	68	1800	0	21	2
alpha-Chlordane	1	4	14	31	31 J*	31 J*	490	0	66	0
Aroclor, Total(4)	7	71	1400	13000	250	43000	1000	5		
Aroclor, Total (Conservative)(5)	11	71	1600	9900	485	44575	1000	7		
Aroclor-1262	7	36	840	4100	320	14000 J	1000	3		
Aroclor-1268	8	71	1100	8900	180	43000 *	1000	4		
Dieldrin	1	5	57	220	220 J	220 J	38	1	7	1
Endosulfan I	1	4	73	270	270 J	270 J	410000	0	8400	0
Endosulfan Sulfate	1	4	27	49	49	49	410000	0	8400	0
Endrin Ketone	1	4	33	75	75	75	20000	0		
gamma-Chlordane	1	4	120	450	450	450	490	0	66	1
Methoxychlor	2	4	150	200	120	270	340000	0	8000	0

TABLE 3-23 (cont.)
WOOSTER PARK - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

Qualifier	Definition
#	Possible false positive due to interference
*	From dilution analysis or Estimated Maximum Possible Concentration (Dioxins only)
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.

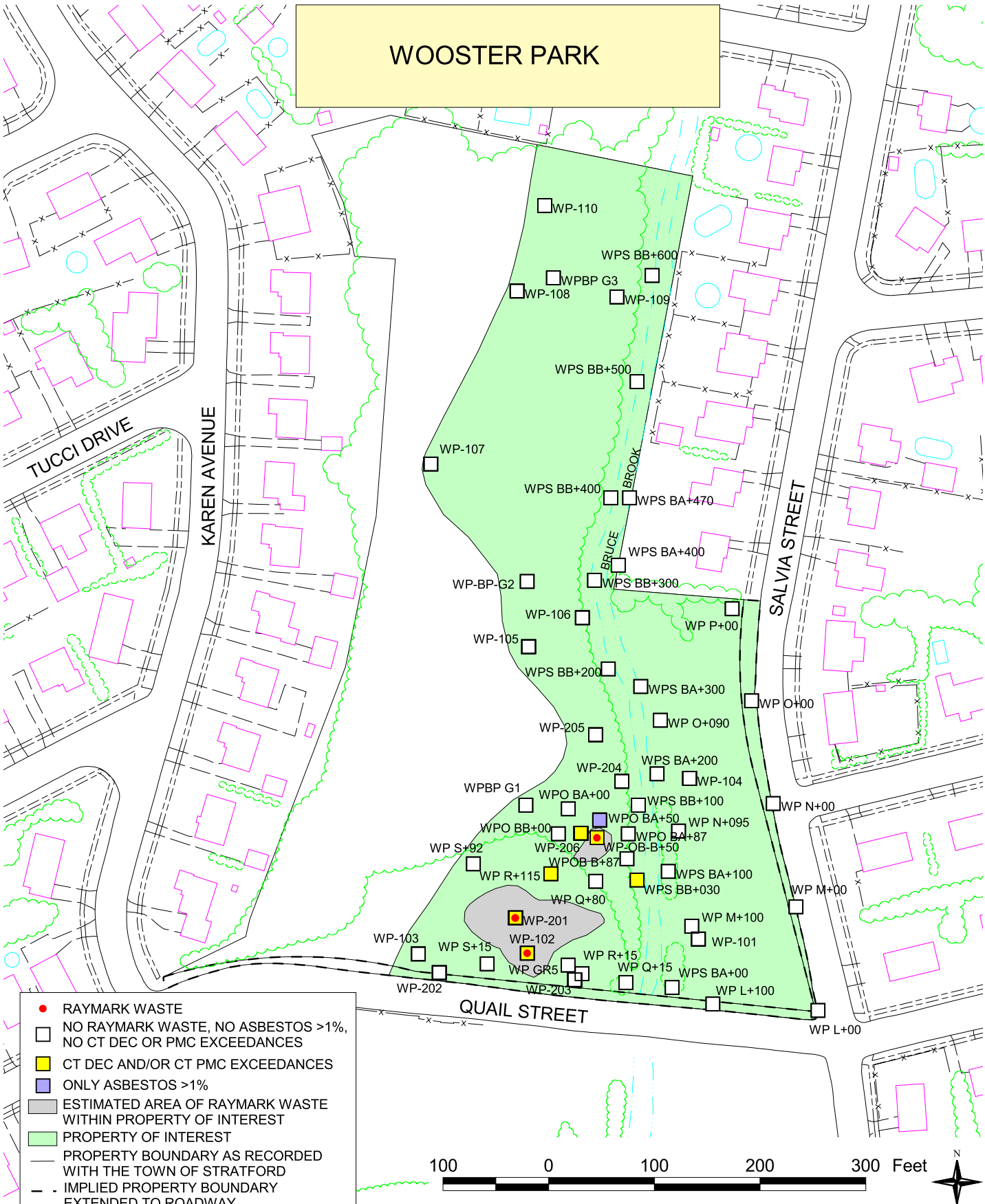
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.

(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.

(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.

(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.

(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR RESIDENTIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-23
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 27, 2004	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

3.24 Third Avenue Property

This property is one of the 24 properties evaluated in this report (see Figure 1-2). Raymark waste has been found in fill materials on this property. See Section 3.24.3 for a table detailing the soil sample locations determined to contain Raymark waste at this property.

3.24.1 Property Description

This property, approximately 0.3 acres of residentially-zoned land, is located on Third Avenue in Stratford, Connecticut (Town of Stratford, 1997). This property is occupied by a private home. The southern half of the property is grass-covered and maintained as a lawn, while the house sits on the northeastern portion of the lot. There is a paved driveway leading to the garage (attached to the house), and shrubs planted between the front of the house and Third Avenue. An approximately 3-foot high fence runs from the rear of the house, south across the lawn and along the southern, western, and northern property lines to enclose the back yard. This fence has an unlocked gate. There is a small vegetable garden in the northwestern corner of the property. The nearest storm drain is located on Third Avenue in front of the property.

This property is bordered by residential properties to the north and south. Third Avenue lies to the east, and the Fourth Avenue Pond abuts the property to the west. The EPA has conducted removal actions at both adjacent residential properties because of the presence of Raymark waste.

3.24.2 Physical Characteristics

According to FEMA Flood Insurance Rate Maps for Stratford, Connecticut, this property is located within the 100-year floodplain of Long Island Sound. The 100-year frequency base flood elevation for the property is 12 feet (FEMA, 1992). See Figure 1-2 for the boundary of the floodplain on this property.

Twenty-two soil borings (3A35-201 through 206 and 3A35-301 through 316) have been advanced at the property, to depths of up to 14 feet below ground surface (bgs). Soils noted in all of the borings consist of fill overlying the native material, which includes varied amounts of fine sand and silt with some organic material. The native material is characteristic of former

marsh and swamp deposits. Refer to Figure 3-24 for boring locations on the property. Boring logs are presented in Appendix A.

No monitoring wells were installed on this property. Sample locations are shown on Figure 3-24, including both shallow surface samples and deeper samples from soil borings. The borings were used to describe the fill and native materials on the property. All sampling locations were used to determine the presence or absence of Raymark waste and identify those locations that exceed the Connecticut RSRs.

Fill on this property consists of both natural and manmade materials that were placed on the property as a result of human activity. Manmade materials identified in the soil from the borings include potentially asbestos-containing material (PACM), asphalt, brick, glass, metal debris, plastic, concrete, copper pieces, and/or tile. PACM (asbestos fibers and fabric) was observed in the soil from borings 3A35-202, 204, 205, 301, 305 through 308, 311, and 314. The manmade materials were encountered with natural fill materials consisting of sand and gravel mixtures with varied amounts of silt. Fill classifications were based on the visual characteristics of the soil and sediment samples that were collected during the field investigations. Based on interpretations and field observations, fill was identified in borings across the entire property. The depth to groundwater ranges from 4 feet to 10 feet bgs, based on the soil moisture content recorded on the boring logs.

Raymark waste was found in fill materials on this property. The lateral limits of the area of Raymark waste were estimated by the presence of asbestos, lead, copper, and/or Aroclor 1268 meeting the definition of Raymark waste, as defined in Section 2.2 of this report. These limits are shown on Figure 3-24. An estimated 13 percent of the property contains Raymark waste. Grass covers the waste areas except for a small fraction, which is covered by pavement.

3.24.3 Nature and Extent of Contamination

Contaminant concentrations in all soil samples collected at this property were compared to the Connecticut RSRs (CT DEP, 1996) to determine the potential impact of the contaminants on soils and groundwater and to provide an understanding of relative contaminant concentrations throughout the property. The results of samples from all depths, including those collected from below the water table, were compared to the direct exposure criteria for residential soils (CT

DEC) and to the pollutant mobility criteria (CT PMC) for GB areas. CT DECs are regulatory criteria for soil based predominantly on risk from exposures via the ingestion pathway with consideration given to background concentrations, detection limits, and ceiling limits. A comparison of individual property contaminant data to CT DEC serves to evaluate the potential for contaminants in soils to present a risk to human health. CT PMCs are regulatory criteria for soil based on ambient water quality criteria and modeling the migration of contaminants from soil to groundwater. A comparison of individual property contaminant data to CT PMC serves to evaluate the potential for contaminants in soils to impact groundwater quality.

One hundred thirty-four soil samples were collected from 34 locations at this property. Sample locations with exceedances of the CT DEC and CT PMC standards are indicated on Figure 3-24. Samples were analyzed for asbestos, dioxins, metals, pesticides, PCBs, SVOCs, and VOCs. See Table 3-24 for the number of samples analyzed for each contaminant.

A summary of the nature and extent of soil contamination is discussed below by contaminant group. The evaluation focuses on contaminants whose concentrations exceed the CT DEC and/or CT PMC regulatory standards. A complete set of soil analytical results for each property is provided in Appendix C. See Table 3-24 for the soil data summary statistics and comparison to criteria. The discussion below includes all samples collected on the property, not just those determined to be within the estimated area of Raymark waste.

Asbestos

Sixty-six soil samples were collected and analyzed for asbestos. Asbestos was detected in 32 samples. Asbestos at greater than 1 percent was detected in 20 of the 66 samples. All of the asbestos detections greater than 1 percent are located along the northern property line.

Dioxins

Two soil samples were collected and analyzed for dioxins from this property. Dioxin concentrations are expressed as Toxicity Equivalents (TEQ) values. See Section 2.5.2.5 for an explanation of TEQ. The TEQ values of these samples were 0.015 µg/kg and 0.0028 µg/kg.

Metals

Soil samples were collected from this property and analyzed for metals as follows: nine soil samples were analyzed at a fixed laboratory for metals; 107 samples were screened for copper; and 125 samples were screened for lead. Metals were frequently detected on the property. Some metals are components of essential nutrients, occur naturally, or are present at such low concentrations that they are considered not of concern. These metals include aluminum, calcium, iron, magnesium, potassium, and sodium. Arsenic, barium, chromium, copper, and lead concentrations exceeded CT DEC regulatory standards. The highest concentrations of both lead and copper were detected at 8 to 10 feet bgs along the northern property border. The other CT DEC exceedances were also located along the northern property border.

SPLP and TCLP Metals

No SPLP and TCLP samples were collected for this property.

Pesticides

Eight soil samples were collected and analyzed for pesticides from the property. Pesticides were fairly frequently detected on the property. Four pesticides exceeded the CT PMC, and one pesticide, dieldrin, exceeded the CT DEC regulatory standard as well. These exceedances ranged in depth from 2 to 10 feet bgs, and were all located along the northern property border.

PCBs

Sixty-six soil samples were collected and analyzed for PCBs as Aroclors from this property. Total Aroclor concentrations exceeded the CT DEC regulatory standards at 11 locations. These exceedances were detected from 4 to 10 feet bgs along the northern half of the property boundary. Aroclors 1262 and 1268 were the primary contributors to the total Aroclor concentrations in these samples. No SPLP/TCLP PCB samples were collected.

SVOCs

Seven soil samples were collected from the property and analyzed for SVOCs. SVOCs were detected with high frequency. Concentrations of eight SVOCs, primarily PAHs, exceeded the CT DEC and/or the CT PMC at this property, at depths ranging from ground surface to 8 feet bgs. These exceedances were primarily located along the northern property boundary.

VOCs

Seven soil samples were collected and analyzed for VOCs from this property. VOCs were rarely detected and there were no CT PMC or CT DEC regulatory standard exceedances on the property.

Raymark Waste

The results from 17 soil samples indicate the presence of Raymark waste on the property. The following table displays the locations and constituents of the 17 samples from the 10 locations with contaminants at levels that meet the definition of Raymark waste on this property. These samples are located within the 13 percent of the property shown on Figure 3-24 as the "Estimated Area of Raymark Waste within Property of Interest."

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor-1268 (µg/kg)
3A35-201	4 to 6	10	980	1,200	NA
3A35-202	6 to 8	10	3,240	4,120	970
	8 to 10	9	11,700	25,000	16,000
3A35-301	2 to 4	35	1,680	2,510	NA
3A35-302	4 to 6	3	402	733	NA
3A35-305	6 to 8	35	6,570	15,700	6,100
	8 to 10	35	13,800	28,100	NA
3A35-306	6 to 8	35	4,190	8,130	NA
	8 to 10	40	10,800	20,100	4,400

Sample Location	Depth Interval (ft bgs)	Asbestos (%)	Lead (mg/kg)	Copper (mg/kg)	Aroclor-1268 (µg/kg)
3A35-307	8 to 10	21	1,760	1,640	NA
	10 to 11	21	3,170	4,300	600
3A35-308	6 to 8	14	984	2,150	500
	8 to 9	10	7,810	17,600	1,200
	9 to 10	15	6,730	10,400	NA
3A35-311	10 to 11	30	4,130	9,220	500
3A35-314	2 to 4	25	3,930	7,740	400
	4 to 6	24	1,670	2,560	NA

NA – Contaminant was not analyzed

3.24.4 Fate and Transport

Section 2.6 discusses the general approach to contaminant fate and transport and the mechanisms governing fate and transport of contaminants from areas of Raymark waste. The primary pathways for migration of contaminants for this property are discussed below.

Approximately 13 percent of this 0.3-acre property is estimated to contain Raymark waste. The waste area is located along the northern property boundary (See Figure 3-24). A large portion of the property is covered by a house and a paved driveway. The waste area is covered with grass. Sedimentation and erosion controls have been installed to restore the edge of the pond and prevent erosion at the western property line abutting the Fourth Avenue Pond. It is assumed that infiltration is occurring throughout uncovered areas.

Analytical data indicate that SVOCs and pesticides concentrations exceeding CTPMC standards may be leaching from contaminated soil into the groundwater. Samples from this property were not analyzed for SPLP metals or PCBs.

Any remedial action plan should consider protection of the adjacent pond.

3.24.5 Baseline Human Health Risk Assessment

This section contains the baseline human health risk assessment (HHRA) performed for the portion of the property located at the Third Avenue Property that was found to contain Raymark waste in soil. Data collected from this property, but beyond the estimated area of Raymark waste, while useful in the delineation of Raymark waste, were not included in this risk evaluation. Soil exposures and the resulting risk estimates have thus been prorated based on the percentage of the property estimated to contain Raymark waste (FRW shown in Table 1-1). Risk estimates for exposures to the estimated area of Raymark waste are limited by the extent of sample collection and analysis from locations within the estimated area of Raymark waste itself. The use of the FRW in calculations of risk assumes that receptors use all areas of the property on an equal basis. Total risks associated with the exposure to the entire property at the Third Avenue Property may be higher than presented in this HHRA if contaminants beyond the estimated area of Raymark waste are present or if receptors spend a higher percentage of their time within the estimated area of Raymark waste than that assumed in Table 1-1. A more detailed discussion of the HHRA approach is presented in Section 2.7. Section 3.24.5.1 provides an overview of the Third Avenue Property, Section 3.24.5.2 presents COPCs and EPCs, Section 3.24.5.3 contains information on the potential receptors considered and the routes by which they might be exposed, Section 3.24.5.4 contains the numerical results of the risk assessment, and Section 3.24.5.5 presents property-specific uncertainties. Section 3.24.5.6 presents a property-specific summary of the major risk findings.

3.24.5.1 Overview

The Third Avenue Property is a residential property of approximately 0.3 acres. A detailed description of the property is provided in Section 3.24.1. The nature and extent of the contamination detected at the Third Avenue Property is discussed in Section 3.24.3. The area of the Third Avenue Property estimated to contain Raymark waste represents an estimated 13 percent of the total 0.3-acre property, exclusive of any buildings, and is shown in Figure 3-27. Property-specific site conditions within the estimated area of Raymark waste are described in Section 3.24.2. Listings of samples included in the risk evaluation are presented in Appendix B-2. Descriptive statistics (frequency of detection, range of positive detections, range of non-detects, location of maximum detections, and arithmetic mean) for target analytes detected in

soils within the estimated area of Raymark waste at the Third Avenue Property are summarized in Appendix B-1, Table 2.24.

3.24.5.2 Data Evaluation

The COPC selection process for soil is summarized in Section 2.7.2. Appendix B-1, Table 2.24 presents a summary of the COPCs for quantitative risk assessment for the Third Avenue Property soils from the estimated area of Raymark waste to a depth of 12 feet bgs. No samples were collected more than 12 feet bgs within the estimated area of Raymark waste based on site-specific field conditions. Direct exposure COPCs were identified based on a comparison of site data from the estimated area of Raymark waste to the COPC screening levels defined in Section 2.7.2. All validated CLP data were used to identify COPCs. Screening data were also used for metals.

Direct Exposure COPCs

The maximum detections in soil were compared to COPC screening levels based on Region IX PRGs for residential soils. As discussed in Section 2.7.2, EPA Region I recommends the use of EPA Region IX PRGs for COPC selection (EPA, 1994c). EPA Region IX PRGs are risk-based screening criteria. The following chemicals were identified as direct exposure COPCs based on a comparison of maximum concentrations in soils within the estimated area of Raymark waste of this property to risk-based COPC screening levels for residential land use, as shown in Appendix B-1, Table 2.24:

- Asbestos
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h) anthracene, and indeno(1,2,3-cd)pyrene)
- Acetophenone
- Aroclors, Total (1262 and 1268)
- Metals (antimony, arsenic, barium, chromium, lead, manganese, nickel, and zinc)
- Dioxins
- Pesticides (dieldrin)

Exposure Point Concentrations

The methods used to identify appropriate exposure point concentrations were described in Section 2.7.2. Exposure point concentrations used in the risk assessment for the Third Avenue Property are presented in Appendix B-1, Table 3.24. Support documentation for the calculation of dioxin TEQ concentrations is presented in Appendix B-4. Support documentation for the calculation of 95 percent UCLs for COPCs is presented in Appendix B-5.

3.24.5.3 Exposure Assessment

The exposure assessment contains a discussion of the potential for human exposure at the Third Avenue Property and identifies the rationale for the selection of exposure input parameters used to estimate exposure intakes. A detailed description of the potential receptors, exposure routes, and intake estimation methods used in the exposure assessment is presented in Section 2.7.3. Area-specific information regarding exposure is provided in this section.

Under current and future conditions, potential human receptors (residents) were assumed to be exposed to soil only within the estimated area of Raymark waste at the property under reasonable maximum exposure (RME) conditions.

Land Use and Access

The Third Avenue Property is a residential property, as described in Section 3.24.1.

Potential Receptors

The receptors retained for quantitative evaluation at the Third Avenue Property are current and future residents. Potentially exposed individuals include residents who live at this property.

The Third Avenue Property is residential. Residents were evaluated for exposure to soils (0 to 12 feet bgs) in the estimated area of Raymark waste, under current and future land use. Persons residing at the Third Avenue Property may contact soil within the estimated area of Raymark waste at the property through play or yard work at their home. Appendix B-1, Table 4.2A presents the exposure assumptions for adult residents at this and other residential

properties in the RI. Appendix B-1, Table 4.2B presents the exposure assumptions for child residents at this and other residential properties in the RI.

Exposure Pathways

The primary routes of exposure for potential human receptors at the Third Avenue Property are incidental ingestion of, and dermal contact with, soil. Potential exposure to volatile emissions and fugitive dust from the Third Avenue Property is considered to be minimal. Qualitative evaluations of the inhalation pathway are provided below. The estimated area of Raymark waste at the Third Avenue Property is covered by grass. The presence of vegetation reduces the likelihood of inhalation exposures.

A qualitative comparison of maximum detected soil concentrations and EPA Generic SSLs for inhalation, based on inter-media transfer from soil to air (EPA, 1996a), was performed to determine if additional quantitative analysis of this potential exposure pathway was warranted. The inhalation SSLs are based on residential land use and lifetime exposure scenarios. Appendix B-1, Table 2.24 presents available inhalation SSLs for contaminants in soils within the estimated area of Raymark waste at the Third Avenue Property. All reported soil concentrations are less than the EPA Generic SSLs for transfers from soil to air (EPA, 1996a).

A qualitative evaluation of potential inhalation risks from exposures to asbestos is presented in Section 3.24.5.4. Asbestos is present in soils within the estimated area of Raymark waste at the Third Avenue Property. The presence of vegetation and the qualitative comparison to SSLs suggest that exposures to fugitive dust and volatile emissions are currently insignificant, thereby eliminating the need for quantitative evaluation of this exposure pathway.

Estimates of Chemical Intake

Estimates of chemical intake were calculated using the equations presented in Section 2.7.4. Appendix B-1, Table 4.2A and Table 4.2B contain the various assumptions used as input parameters to determine chemical intakes for adult and child residents through ingestion and dermal contact. In order to prorate exposures, the fraction of the property estimated to contain Raymark waste (FRW) was factored into the intake equations shown in Section 2.7.3.6. Table 1-1 presents the property sizes and FRW values for each property. The FRW for the Third

Avenue Property is 0.13. Chemical intake estimates for the Third Avenue Property are provided in Appendix B-1, Tables 7.24 and 8.24.

3.24.5.4 Risk Characterization

The methods used to estimate the type and magnitude of potential human health risks associated with the exposures to COPCs in soils are described in Section 2.7.5. A summary of the quantitative risk assessment for the Third Avenue Property is provided in this section. Appendix B-1, Table 7.24 and Table 8.24 present non-cancer and cancer RME risk estimates, respectively. Sample calculations are provided in Appendix B-6. Total non-carcinogenic and carcinogenic risks for each exposure route, as well as the cumulative risk, are summarized in Appendix B-1, Table 9.24. Appendix B-1, Table 10.24 reduces the information developed in Appendix B-1, Table 9.24 to the major risk drivers. Tables 7.24A, 8.24A, 9.24A, and 10.24A present non-cancer and cancer RME risk estimates for adult residents. Tables 7.24B, 8.24B, 9.24B, and 10.24B present non-cancer and cancer RME risk estimates for child residents. Children represent the more sensitive population for non-cancer risks. For cancer risks, the risks to children and adults are added to produce an estimate of risks from lifetime exposures. The results of the evaluations of lead exposures are presented in Appendix B-10.

Non-Carcinogenic Risks

RME hazard indices developed for the resident at the Third Avenue Property are as follows:

	Ingestion	**Dermal**	**Total**
Resident – Adult (Current and future)	0.37	0.18	0.55
Resident – Child (Current and future)	3.5	1.2	4.6

RME hazard indices (HI) for the child resident exposed to soils within the estimated area of Raymark waste at the Third Avenue Property are in excess of unity. Total Aroclor was the main contributor to the hazard index for the child resident. The chemical-specific (and target organ-specific) hazard quotients for total Aroclor alone are in excess of unity for child residents. Adverse non-carcinogenic health effects are possible from exposure to Aroclors. The RME hazard indices for the adult resident exposed to soils within the estimated area of Raymark

waste at the Third Avenue Property are less than unity, indicating that adverse non-carcinogenic health effects are not anticipated under the conditions established in the exposure assessment for adult residents. See Tables 7.24A RME and 7.24B RME in Appendix B-1 for details on non-cancer hazard index calculations.

Carcinogenic Risks

Incremental RME cancer risk estimates for the resident at the Third Avenue Property are as follows:

	Ingestion	Dermal	Total
Resident – Adult[1] (Current and future)	7.2E-06	3.4E-06	1.1E-05
Resident – Child[1] (Current and future)	1.7E-05	5.6E-06	2.2E-05

1) Summation of total risk for Residents (adult plus child): 3.3E-05.

The EPA cancer risk range is 10^{-4} to 10^{-6}. The CT DEP target cancer risk level is 10^{-6} for single contaminants and 10^{-5} for total risk from multiple contaminants. Cancer risks for the adult and child resident are added together for a lifetime exposure. The RME risk estimate for the resident exposed to soils within the estimated area of Raymark waste at the Third Avenue Property falls within the EPA cancer risk range (10^{-4} to 10^{-6}), but exceeds the CT DEP target total risk level of 10^{-5} for multiple contaminants. See Tables 8.24A RME and 8.24B RME in Appendix B-1 for details on cancer risk calculations. As detailed in Appendix B-1, Tables 9.24A and 9.24B, cancer risks for Aroclors, arsenic, and benzo(a)pyrene exceed the CT DEP target risk level of 10^{-6} for single contaminants.

Cancer risk estimates for dioxins, shown on the tables cited above and included in the discussion above were calculated using the CSF for 2,3,7,8-TCDD of 1.5E+5 $(mg/kg/d)^{-1}$ from IRIS (EPA, 2003). As discussed in Section 2.7.4.2, this CSF is undergoing EPA review. Cancer risk estimates for dioxins calculated using the CSF for dioxins of 1E+6 $(mg/kg/d)^{-1}$ from the Draft Dioxin Reassessment (EPA, 2000) are presented in Appendix B-9. Total cancer risks estimated using the Draft Dioxin Reassessment CSF for dioxin for residents exposed to soils within the estimated area of Raymark waste at this property are 3.5E-05.

Exposure to Lead

Lead was identified as a COPC in soils within the estimated area of Raymark waste of the Third Avenue Property. Lead was detected in samples collected from 0 to 12 feet bgs within the estimated area of Raymark waste at a maximum concentration of 11,700 mg/kg. The average lead concentration in this dataset was 1,820 mg/kg.

Exposure to lead in soil by the child resident was evaluated using the EPA IEUBK Model, as discussed in Section 2.7.4.7. The IEUBK model was developed to evaluate exposures to lead by children in a residential setting. The time-weighted exposure point concentration of 237 mg/kg (average lead concentration in soils within the estimated area of Raymark waste of 1,820 multiplied by the FRW of 0.13), as well as several default parameters, was used to estimate blood-lead levels for children in a residential setting. The estimated geometric mean blood-lead level for children exposed to lead in soils within the estimated area of Raymark waste at the Third Avenue Property was 3.6 µg/dL, which is less than the established level of concern of 10 µg/dL. The IEUBK model estimates that 1.6 percent of children are expected to have blood-lead levels greater than 10 µg/dL, which does not exceed the acceptable level of 5 percent. The input parameters used and the results of the IEUBK lead models, estimated blood-lead levels, and probability density histograms are presented in Appendix B-10.

Exposure to Asbestos

Asbestos was detected in 23 of the 24 soil samples collected from the estimated area of Raymark waste at a concentration range of trace to 40 percent. These samples were collected from the 0- to 12- foot bgs interval. The average concentration was 17 percent. Although quantitative risk estimates (inhalation risk estimates) have not been developed for this parameter, it should be noted that asbestos-containing material is defined as material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). Asbestos is considered a potential inhalation hazard if it is “friable” (can be crumbled, pulverized, or reduced to powder) and, consequently, subject to entrainment/migration into the air.

The presence of vegetative cover in the estimated area of Raymark waste reduces the potential for airborne asbestos at 35 Third Avenue. Based on field conditions in the estimated area of Raymark waste, it is likely that asbestos does not currently present a significant inhalation risk

from the estimated area of Raymark waste at this property. If asbestos containing soils are disturbed, the potential for airborne asbestos exposure and associated inhalation risks exists.

3.24.5.5 Uncertainties

A detailed discussion of uncertainties associated with the various aspects of risk assessment, in general, was provided in Section 2.7.6. Area-specific uncertainties for the Third Avenue Property are presented in the following narrative.

- Uncertainty associated with the extent of the estimated area of Raymark waste adds uncertainty in the risk assessment. The associated uncertainties propagate through the risk assessment, not only in which samples are included in the evaluation, but also in the exposure assessment, which relies on prorating of exposure intake based on the percentage of the property estimated to contain Raymark waste (FRW). Uncertainty in the identification of samples meeting the definition of Raymark waste includes accuracy and precision of analytical methods. Limitations in the determination of the areal extent of Raymark waste for each property are discussed in Section 2.3.

- The use of the FRW factor in prorating exposures assumes that individual receptors will spend time within the estimated area of Raymark waste in direct proportion to the percent of the property estimated to contain Raymark waste. The total area of the Third Avenue Property is 0.3 acres, with an estimated 13 percent containing Raymark waste. A physical description of the estimated area of Raymark waste at the property is provided in Section 3.24.4. The estimated area of Raymark waste is covered by grass. No consideration was given to site characteristics other than the presence of buildings. Because of the small size of the estimated area of Raymark waste, it is unlikely that individuals will spend all of their time within that area. However, if that were the case, reasonable maximum risks for exposure to the estimated area of Raymark waste would be approximately eight times greater than those estimated using the FRW factor.

- Copper concentrations exceed the EPA Region IX residential soil PRG of 3,100 mg/kg in the Third Avenue Property soils; however, due to the lack of an approved toxicity value, no quantitative estimate of risks can be performed. Copper is a significant contaminant in Raymark waste. It is reported in the Third Avenue Property soils (0 to 12 feet bgs) at

concentrations ranging from 21.9 mg/kg to 28,100 mg/kg. The absence of a quantitative risk evaluation of copper may result in an underestimate of total non-cancer risks.

- Soil concentrations in background locations are discussed in Section 2.5.3 and presented in Table 2-2. Average background concentrations are also shown in Appendix B-1, Table 2.24 alongside site-specific data from the estimated area of Raymark waste. Antimony, with an average background concentration of 2.86 mg/kg, was detected in one of the six samples at a concentration of 4.2 mg/kg. Arsenic, with an average background concentration of 5.67 mg/kg, was detected at concentrations ranging from 2.8 to 12.2 mg/kg, with an average concentration of 8.4 mg/kg. Manganese, with an average background concentration of 306 mg/kg, was detected at concentrations ranging from 209 to 364 mg/kg, with an average concentration of 257 mg/kg. Risks due to antimony, arsenic, and manganese may be attributable to background conditions.

- Dioxins were selected as COPCs. Since new toxicological information has become available, cancer risks based on the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$ may underestimate risks. Cancer risks from dioxins based on the proposed CSF of 1.0×10^6 $(mg/kg/day)^{-1}$ for dioxins are presented in Appendix B-9. These risks are approximately an order of magnitude greater than risks estimated using the CSF of 1.5×10^5 $(mg/kg/day)^{-1}$.

- Fifty-four samples were included in the dataset for soils within the estimated area of Raymark waste and 48 of the samples were only analyzed using field-screening methods. Because of the limited numbers of samples for most of the COPCs, maximum concentrations were used to evaluate risks for all COPCs except arsenic, manganese, and lead. The use of maximum concentrations and small datasets adds uncertainty to the risk estimates.

- Samples collected from depths of 0 to 12 feet bgs were included in the risk assessment for current and future residents. Current exposures to residents are likely to involve only contact with surface soils. For this reason, inclusion of deeper soils adds uncertainty to the estimate of risks for current residents. In addition, future residents may be exposed to soils currently located at depths up to 15 feet bgs, which is the depth considered as accessible by CTDEP (CT DEP, 1996). The absence of samples collected in the 12-to 15- foot bgs interval adds uncertainty in the evaluation of risks to future residents.

- In the absence of chromium speciation data, toxicity values for chromium VI were used to estimate risks from measured total chromium concentrations. Since hexavalent chromium is considered to be more toxic than the trivalent state, which is more common, risks for this chemical are probably overestimated to some degree.

- A comparison of data from soils outside the estimated area of Raymark waste to CT RSRs is provided in Appendix B-11. The presence of PAHs and lead at concentrations greater than CT RSRs for residential soil suggests that risks from other areas of the property may be of concern. Benzo(a)anthracene is present in soils located outside the estimated area of Raymark waste at concentrations up to 3.3 mg/kg, benzo(a)pyrene is present at concentrations up to 3.1 mg/kg, benzo(b)fluoranthene is present at concentrations up to 2.9 mg/kg, dibenzo(a,h)anthracene is present at concentrations up to 0.62 mg/kg, indeno(1,2,3-cd)pyrene is present at concentrations up to 1.5 mg/kg, and lead is present at concentrations up to 1,040 mg/kg. Dioxins were detected outside the estimated area of Raymark waste; however, no CT RSRs are available for dioxins. Dioxin concentrations outside the estimated area of Raymark waste were less than the EPA Region IX PRGs for residential soil. Forty-one samples from outside the estimated area of Raymark waste were analyzed for PCBs. While none of these samples had concentrations greater than the CT RSRs for residential soil, two samples did have total Aroclor concentrations greater than the EPA Region IX PRG for residential soil. The individual Aroclors detected were Aroclors 1248, 1260, 1262, and 1268. Copper was detected at concentrations up to 1,410 mg/kg. Asbestos is also present outside the estimated area of Raymark waste at the Third Avenue Property at concentrations up to 1.7 percent. Thus, a resident's exposure and risk from the entire property are likely to be greater than that estimated for the area of Raymark waste alone.

3.24.5.6 Summary of Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for soils estimated to contain Raymark waste at the Third Avenue Property. Risks to residents were estimated.

- RME hazard indices (HI) for the child resident, but not the adult, exposed to soil within the estimated area of Raymark waste at the Third Avenue Property were in excess of unity. The chemical specific (and target organ-specific) hazard quotients for total

Aroclors alone are in excess of unity. Adverse non-carcinogenic health effects are possible from exposures to Aroclors.

- The RME cancer risk estimate for the resident exposed to soil within the estimated area of Raymark waste above the Third Avenue Property falls within the EPA cancer risk range (10^{-4} to 10^{-6}) and above the CT DEP target total risk level of 10^{-5} for multiple contaminants. Cancer risks for Aroclors, arsenic, and benzo(a)pyrene exceed the CT DEP target risk level of 10^{-6} for single contaminants.

- Exposure to lead in soil by child residents was evaluated by use of the IEUBK model. The results of the model indicate that adverse effects are not anticipated for child residents exposed to lead in soil within the estimated area of Raymark waste at the Third Avenue Property.

- Asbestos was detected in 23 of the 24 soil samples collected from the estimated area of Raymark waste at the Third Avenue Property in the 0- to 12- foot bgs interval at a concentration range of trace to 40 percent. The average concentration was 17 percent.

3.24.6 Ecological Evaluation

No formal ecological evaluation was performed on this property. However, given the property's location in a residential area, it is not likely the property serves as a habitat for ecological receptors, and Raymark waste is not likely to adversely impact those receptors.

3.24.7 Summary

This residential property, approximately 0.3 acres, contains Raymark waste located along the northern border of the property. Samples containing concentrations of asbestos and metals, SVOCs, and PCBs that exceed the CT DEC standards are present on the property. Pesticides and SVOCs were present at concentrations exceeding the CT PMC. Given the high groundwater table, it is assumed there is infiltration and leaching of contaminants into the groundwater.

RME hazard indices for the child resident exposed to soils within the estimated area of Raymark waste indicate that adverse non-carcinogenic health effects are possible. The RME cancer risk estimate falls within the EPA target cancer range and below the CT DEP target total risk level. Aroclors, arsenic, and benzo(a)pyrene concentrations exceed the CT DEP target risk level for single contaminants. Adverse effects are not indicated for child residents exposed to lead in soils within the estimated area of Raymark waste. The average asbestos concentration was 17 percent.

Given the property's location in a residential area, it is not likely the property serves as a habitat for ecological receptors, and Raymark waste is not likely to adversely impact those receptors.

TABLE 3-24
THIRD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Asbestos (%)										
Asbestos	32	66	6	13	Trace	40	1	6		
Dioxin (UG/KG)										
1,2,3,4,6,7,8-HpCDD	1	2	0.13	0.11	0.111	0.111				
1,2,3,4,6,7,8-HpCDF	1	2	0.048	0.047	0.0466	0.0466				
1,2,3,4,7,8,9-HpCDF	1	2	0.027	0.0031	0.0031 J	0.0031 J				
1,2,3,4,7,8-HxCDF	1	2	0.036	0.022	0.0223	0.0223				
1,2,3,6,7,8-HxCDD	1	2	0.053	0.0064	0.0064 J	0.0064 J				
1,2,3,6,7,8-HxCDF	1	2	0.054	0.0071	0.0071 J	0.0071 J				
1,2,3,7,8,9-HxCDD	1	2	0.052	0.0039	0.0039 J	0.0039 J				
1,2,3,7,8-PeCDF	1	2	0.028	0.0054	0.0054 J	0.0054 J				
2,3,4,6,7,8-HxCDF	1	2	0.03	0.0093	0.0093 J	0.0093 J				
2,3,4,7,8-PeCDF	1	2	0.032	0.015	0.0145	0.0145				
2,3,7,8-TCDF	1	2	0.032	0.014	0.0139 J	0.0139 J				
OCDD	2	2	2.1	2.1	1.44 J	2.8 J				
OCDF	1	2	0.068	0.036	0.0356 J	0.0356 J				
Total HpCDD	1	2	0.17	0.18	0.185 J	0.185 J				
Total HpCDF	1	2	0.06	0.07	0.0703 J	0.0703 J				
Total HxCDD	1	2	0.047	0.043	0.0435 J	0.0435 J				
Total HxCDF	1	2	0.066	0.082	0.0815 J	0.0815 J				
Total PeCDF	1	2	0.056	0.061	0.061 EMPC	0.061 EMPC				
Total TCDF	1	2	0.059	0.068	0.0676 EMPC	0.0676 EMPC				
Toxicity Equivalency	2	2	0.0089	0.0089	0.0028 J	0.015 J				
Metals (MG/KG)										
Aluminum	9	9	10100	10100	3660	14400				
Antimony	1	8	1.9	4.2	4.2 J	4.2 J	27	0		
Arsenic	9	9	7.2	7.2	2.8	12.2	10	3		
Barium	9	9	1380	1380	29.6	9930	4700	1		
Beryllium	6	9	0.38	0.51	0.43	0.62	2	0		

TABLE 3-24 (cont.)
THIRD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Metals (MG/KG) (cont.)										
Cadmium	1	9	0.28	1	1	1	34	0		
Calcium	9	9	1750	1750	1070 J	2390 J				
Chromium	9	9	39.6	39.6	11.8	156 J	100	1		
Cobalt	8	9	7.8	8.4	3.8	20.3	1000	0		
Copper	45	116	1670	4170	10.7 J	28100 J	2500	14		
Iron	9	9	17700	17700	10400	34000				
Lead	113	134	809	954	11.2	18200	400	22		
Magnesium	9	9	11200	11200	2110	53100				
Manganese	9	9	284	284	209	364 J	1600	0		
Mercury	6	9	0.089	0.11	0.045 J	0.23 J	20	0		
Nickel	9	9	75.5	75.5	11.3	439	1400	0		
Potassium	9	9	1440	1440	414	2600				
Silver	2	9	1.2	4.2	1.5 J	7	340	0		
Sodium	3	9	610	1650	211	4330				
Vanadium	9	9	30.5	30.5	17.8	43.3	470	0		
Zinc	9	9	954	954	42.9 J	7270 J	20000	0		
Semivolatile Organic Compounds (UG/KG)										
2,4-Dimethylphenol	1	7	590	370	370 J	370 J	1000000	0	28000	0
2-Methylnaphthalene	1	7	490	110	110 J	110 J	474000	0	9800	
4-Methylphenol	1	7	690	1100	1100	1100	340000	0	7000	0
Acenaphthene	2	7	520	270	76 J	460 J	1000000	0	84000	0
Acenaphthylene	6	7	310	300	60 J	640 J	1000000	0	84000	0
Acetophenone	3	6	480	150	44	310 J				
Anthracene	5	7	430	500	110 J	1200 J	1000000	0	400000	0
Benzaldehyde	1	6	500	150	150 JEB	150 JEB				
Benzo(a)anthracene	6	7	1400	1600	250 J	3300 J	1000	4	1000	4
Benzo(a)pyrene	6	7	1300	1500	260 J	3100 J	1000	3	1000	3
Benzo(b)fluoranthene	6	7	1200	1400	240 J	2900 J	1000	3	1000	3

TABLE 3-24 (cont.)
THIRD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Semivolatile Organic Compounds (UG/KG) (cont.)										
Benzo(g,h,i)perylene	6	7	420	440	150 J	910 J	1000000	0	42000	
Benzo(k)fluoranthene	6	7	1200	1400	210 J	3000 J	8400	0	1000	3
Butylbenzylphthalate	2	7	480	97	74	120 J	1000000	0	200000	0
Carbazole	3	3	290	290	53	610 J	31000	0	360	1
Chrysene	6	7	1600	1800	310 J	3800 J	84000	0	1000	4
Dibenzo(a,h)anthracene	2	7	570	440	260 J	620 J	84	2	1000	0
Dibenzofuran	2	7	490	170	65 J	270 J	270000	0	5600	0
Di-n-Butylphthalate	1	7	740	1800	1800 J	1800 J	1000000	0	140000	0
Fluoranthene	6	7	2700	3100	440	7600 J	1000000	0	56000	0
Fluorene	3	7	550	310	51	660 J	1000000	0	56000	0
Indeno(1,2,3-cd)pyrene	6	7	620	670	150 J	1500 J	840	2	1000	2
Naphthalene	2	7	470	73	47	99 J	1000000	0	56000	0
Phenanthrene	6	7	1700	2000	180 J	5800 J	1000000	0	40000	0
Pyrene	5	6	2500	3000	460	6900 J	1000000	0	40000	0
Volatile Organic Compounds (UG/KG)										
Acetone	4	7	110	170	38	550 J	500000	0	140000	0
Benzene	1	7	4	1	1 J	1 J	21000	0	200	0
Carbon Disulfide	2	7	5	7	0.9	13 J	500000	0	140000	0
Ethylbenzene	1	7	4	2	2 J	2 J	500000	0	10100	0
Methyl Acetate	1	6	5	3	3 J	3 J				
Toluene	1	7	7	22	22 J	22 J	500000	0	67000	0
Total Xylenes	1	7	6	13	13 J	13 J	500000	0	19500	0
Pesticide/PCB (UG/KG)										
4,4'-DDD	2	6	13	19	3 J	35	2600	0	29	1
4,4'-DDE	8	8	53	53	4.9 J#	230 #	1800	0	21	3
4,4'-DDT	8	8	40	40	5.1	170 #	1800	0	21	2
alpha-Chlordane	6	8	16	18	2.3	56 J	490	0	66	0

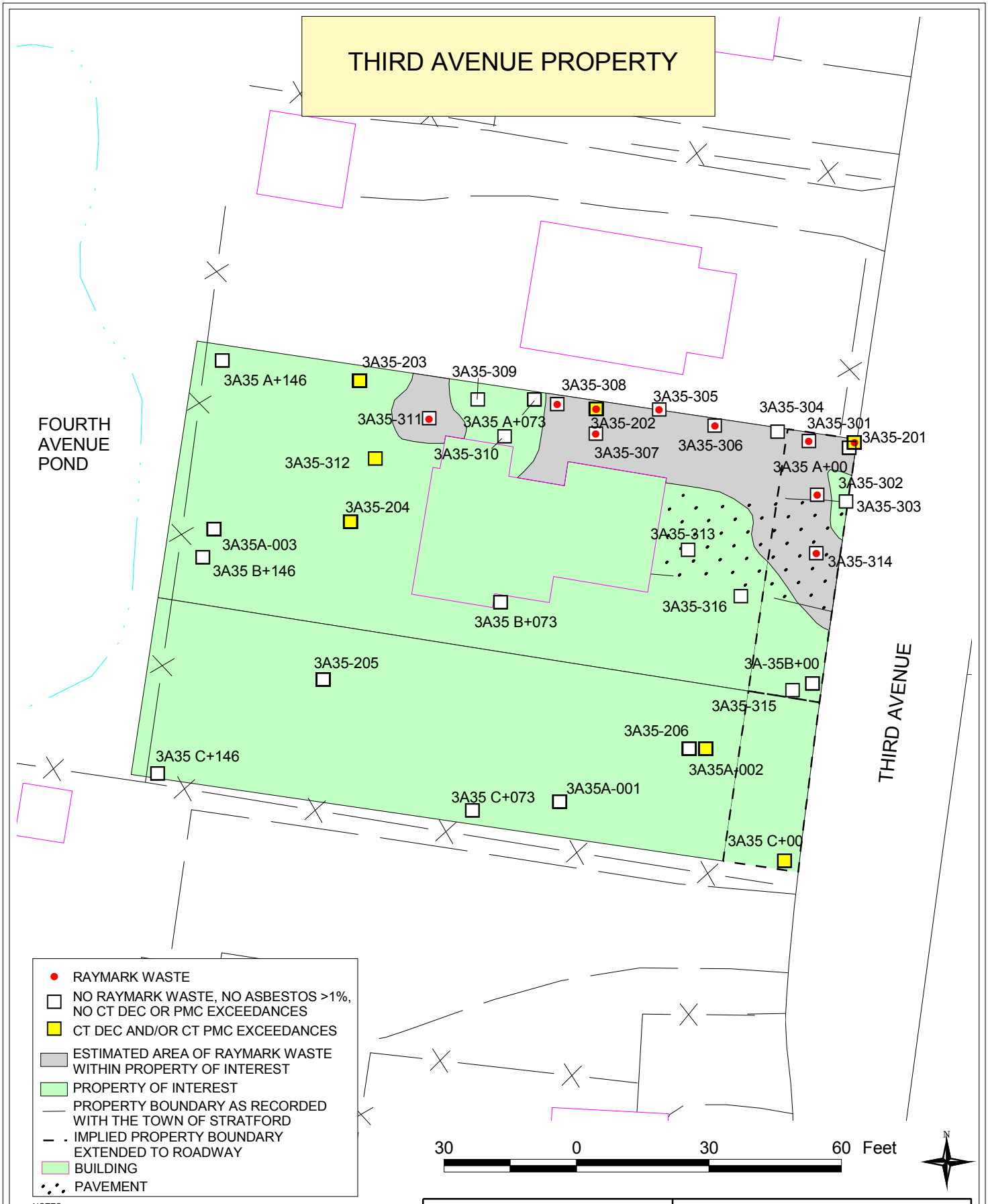
TABLE 3-24 (cont.)
THIRD AVENUE PROPERTY - SOIL ANALYTICAL RESULTS**
SUMMARY STATISTICS AND COMPARISON TO CRITERIA
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

PARAMETER	Positive Detects	Number of Samples Analyzed	Average Conc.	Average Detected Conc.	Minimum Detected Conc.	Maximum Detected Conc.	CT DEC (Residential) (1) (2)	Number of Exceedances of CT DEC (1) (2)	CT PMC (GB) (3)	Number of Exceedances of CT PMC (3)
Pesticide/PCB (UG/KG) (cont.)										
Aroclor, Total (4)	17	66	1200	4400	47	33000	1000	11		
Aroclor, Total (Conservative) (5)	17	66	1300	4800	219	35800	1000	11		
Aroclor-1248	1	14	110	640	640	640	1000	0		
Aroclor-1260	3	52	94	42	28	52	1000	0		
Aroclor-1262	15	47	970	2800	57 J	17000	1000	9		
Aroclor-1268	13	66	590	2500	41	16000	1000	5		
Dieldrin	2	6	14	22	4.1	40	38	1	7	1
Endosulfan II	1	8	6.3	2	2 J	2 J	410000	0	8400	0
Endrin Ketone	2	7	7.8	5	4.3	5.6	20000	0		
gamma-Chlordane	6	8	10	10	1.7 J	33 J	490	0	66	0
Heptachlor	1	8	3.3	1.3	1.3 J	1.3 J	140	0	13	0

Qualifier	Definition
#	Possible false positive due to interference
EB	Equipment blank contamination
EMPC	Estimated Maximum Possible Concentration
J	Quantitation approximate

Notes:

** Analytical results in this table are from samples collected throughout the property, not just the estimated area of Raymark Waste.
(1) Asbestos is included with a criterion of 1% in the CT DEC column for comparison purposes. It's criterion is not a promulagated CT Remediation Standard Regulation.
(2) CT DEC - Direct Exposure Criteria for Residential or Commercial/Industrial Soils. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(3) CT PMC - Pollutant Mobility Criteria for soils in a GB aquifer area. CT Remediation Standard Regulations, January 1996, and additional approved criteria.
(4) Aroclor, Total is the sum of the results of all detected individual Aroclors.
(5) Aroclor, Total (Conservative) is the sum of the results of all detected individual Aroclors and one half the detection limit of non detected individual Aroclors.



NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) DUE TO UNCERTAINTIES OF PROPERTY BOUNDARIES DURING THE SAMPLING PROCESS, SAMPLES LOCATED ADJACENT TO THE PROPERTY ARE UNDERSTOOD TO BE ON THE PROPERTY
5) CT DIRECT EXPOSURE CRITERIA (CT DEC) FOR RESIDENTIAL SOILS AND CT POLLUTANT MOBILITY CRITERIA (CT PMC) USED TO DETERMINE EXCEEDANCES.

SOIL SAMPLE LOCATIONS	FIGURE 3-24 (revision 1)
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 11, 2005	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
CHECKED BY: D. CHISHOLM / FILE: C\...\OU6_RI_2003.APR	

4.0 SUMMARY AND CONCLUSIONS

The soil data evaluated in this report were collected under various investigation programs by federal, state, and private contractors. These investigations were performed by numerous entities over a 11-year period (1993 – 2004) and a very large volume of data was collected. Biota, surface water, groundwater, air, sediment, and soil samples were collected. As discussed in Section 1.0, the Raymark Industries, Inc. Superfund site was separated into nine Operable Units. The subject of this RI Report is Operable Unit 6. The medium under discussion for this operable unit is soil. Groundwater is not included within the scope of this operable unit. Other work assignments include the operable units for the various media.

The OU6 study area covers approximately 79.3 acres and consists of 24 properties that have been impacted by Raymark waste. Much of the study area is located within the 100-year floodplain in the Housatonic River Basin, a tidally influenced system. The topography of the majority of the study area is relatively flat, with gentle slopes to Ferry Creek and the Housatonic River.

4.1 Nature and Extent of Contamination Summary

This section summarizes the known nature and estimated extent of the contamination for each of the 24 properties included in the OU6 study area. Individual property evaluations are presented in Section 3.

4.1.1 Nature of the Contamination

As discussed in Section 2.2, Raymark waste is defined by the presence of lead, asbestos, and either copper, or Aroclor 1268 above specific concentrations. Other contaminants, including VOCs, SVOCs, pesticides, other PCB Aroclors, dioxins, and other metals, were also detected within areas of Raymark waste. These waste contaminants were found both in the fill materials on the former Raymark Facility and on properties throughout the OU6 study area as shown on Figure 1-2, and on the figures in Section 3 as “Estimated Area of Raymark Waste Within Property of Interest.” The pattern of contamination indicates various disposal practices (dumping/placement, erosion) on each property.

The sections below summarize, for each analyte group (not just limited to Raymark waste indicator contaminants), the number of properties that contained soil samples with exceedances of the comparison (regulatory) criteria, without regard to the location of the estimated area of Raymark waste. Each property is evaluated individually in Section 3. For details on concentrations of specific contaminants for each property, and the regulatory criterion exceeded, refer to the tables in Section 3 entitled "Summary Statistics and Comparison to Criteria." A complete set of soil boring logs is presented in Appendix A; analytical results for each property are presented in Appendix C.

4.1.2 Extent of Contamination

Raymark waste, as defined in Section 2.2, was identified in the soils of the 24 properties discussed in this RI Report. This contamination is the result of waste deposited as fill on properties in the OU6 study area through transport of waste directly from the former Raymark Facility or from other areas of contamination. The fill that was investigated in the study area is a mixture of natural and man-made materials. Natural fill consists of clay, silt, sand, and gravel. Man-made fill materials consist of asphalt, metal, brick, glass, and other miscellaneous man-made materials, including manufacturing debris that contains Raymark waste. The sections below summarize all the soil data from each property, not just the data from the estimated areas of Raymark waste, and not limited to Raymark waste indicator contaminants.

4.1.3 Asbestos

Asbestos is an identified Raymark waste indicator contaminant and was found in soils on all 24 properties, exceeding the 1 percent definition (discussed in Section 2.2).

4.1.4 Dioxins

Dioxins, expressed as toxicity equivalents, were analyzed for and detected in soils at 21 of the 24 properties. CT DEC and CT PMC regulatory standards are not available for dioxins and furans. Dioxins were not analyzed at three properties: 251 East Main Street, 340 East Main Street, and 380 East Main Street.

4.1.5 Metals

Metals were analyzed for and detected in soils at all 24 properties. The CT DEC was exceeded for at least one metal at every property. SPLP and/or TCLP metals were analyzed at 20 of the 24 properties with the CT PMC exceeded at 14 properties (primarily for lead).

4.1.6 Pesticides

Pesticides were analyzed for and detected in soil samples from 23 of the 24 properties. Pesticide concentrations exceeded the CT DEC at three of these properties. The CT PMC were exceeded at 22 properties. No samples were analyzed for pesticides at 340 East Main Street.

4.1.7 Polychlorinated Biphenyls (PCBs)

PCBs, as Aroclors, were analyzed for and detected in soils at all 24 properties within the study area. Total Aroclor concentrations exceeded the CT DEC at 18 properties. At 17 of those properties, the Aroclor 1268 concentration also exceeded the CT DEC. Only Aroclor 1268 is identified as a Raymark waste contaminant. The following properties did not have exceedances of total Aroclors: 200 Ferry Boulevard, 326 Ferry Boulevard, 380 East Main Street, DPW Lot, and 251 East Main Street. One property, Vacant Lot at Housatonic Avenue, also had one TCLP sample, but the concentrations did not exceed the CT PMC.

4.1.8 Semi-volatile Organic Compounds (SVOCs)

SVOCs were analyzed for and detected in soils at 23 of the 24 properties. Concentrations of SVOCs, mainly PAHs, exceeded the CT DEC at 21 of these 23 properties while concentrations exceeded the CT PMC at 22 properties. No samples were analyzed for SVOCs at 340 East Main Street.

4.1.9 Volatile Organic Compounds (VOCs)

VOCs were sampled in soils from 23 of the 24 properties, and were detected in all 23 of these properties. Three of the properties (230 Ferry Boulevard, 251 East Main Street, and 326 Ferry Boulevard) contained VOC concentrations that exceeded the CT PMC; no exceedances of the CT DEC were noted. No samples were analyzed for VOCs at one property: 340 East Main Street.

4.2 Contaminant Fate and Transport Summary

Contaminant fate and transport in the environment are controlled by a number of factors, including, but not limited to: chemical and physical properties of the contaminants, geologic formations, hydrologic conditions, aquifer conductivity, topography, precipitation, human actions, and tidal flow.

The contaminants identified in the nature and extent discussion are associated with activities at the former Raymark Facility. The placement of the contaminated waste as fill on properties within the OU6 study area is the predominant source of soil contamination and is assumed to be the primary source of contamination to underlying groundwater, and to surface water and sediments in some areas. The placement of the contaminated waste has resulted in the direct and indirect release of contamination into the saturated and unsaturated soils within the study area. Major pathways of migration are erosion and runoff from the Raymark waste at the numerous properties abutting Ferry Creek or the Housatonic River. Water flowing through these properties also eroded the banks of Ferry Creek where Raymark waste had been disposed of on properties bordering the creek. Exceedances of the CT PMC at 22 of the 24 properties indicate the possibility that contaminants in soil at these properties will leach into groundwater in excess of state allowable concentrations. One of the remaining properties (340 East Main Street) had insufficient data for comparison to CT PMC and the other property (380 East Main Street) had no exceedances of CT PMC for available data, but lacked sufficient data to determine leaching of metals or PCBs.

4.3 Risk Assessment Summary

The risk evaluation for this RI focused on the human health risk assessment. An ecological evaluation was also conducted, but a quantitative ecological risk assessment was not performed.

4.3.1 Human Health Risk Assessment

This section presents a summary of the major risk assessment findings for the OU6 properties. Baseline human health risk assessments were performed only for the portions of each of the OU6 properties that were estimated to contain Raymark waste in soil. Soil exposures and resulting cancer risk estimates, non-cancer hazard index estimates, and lead evaluations for each property were prorated based on the percentage of the property estimated to contain Raymark waste. Risk estimates for exposures to the estimated areas of Raymark waste are limited by the extent of sample collection and analysis from within the estimated areas of Raymark waste. These risk assessments focused on commercial use for 20 of the individual properties. Recreational use was evaluated at three properties, the Lockwood Avenue Property, Beacon Point Area, and Wooster Park. (Note that the Lockwood Avenue Property was evaluated both as a commercial property and as a future recreational property.) Residential use was evaluated at three properties: the Third Avenue Property, a portion of the CT Right-of-Way, and the Vacant Lot at Housatonic Avenue. Commercial exposure assessments are protective of commercial workers, customers, shoppers, and trespassers. Recreational exposure assessments are protective of recreational visitors and trespassers. Residential exposure assessments are protective of all current and possible future uses.

Three different types of quantitative evaluations were performed. Non-carcinogenic contaminants were evaluated through estimates of hazard indices. The resulting hazard indices were compared to unity. Hazard indices greater than one indicate a potential for non-carcinogenic health effects. Carcinogenic contaminants were evaluated through estimates of cancer risk. Cancer risk estimates were compared to EPA's cancer risk range of 1×10^{-4} to 1×10^{-6}. Risks below 1×10^{-6} (or a risk less than 1 in 1 million) are generally considered to be acceptable by EPA, and risks greater than 1×10^{-4} (1 in 10,000) are generally considered to be unacceptable. Lead was evaluated through adult and child lead models, which predict blood-

lead levels. The resulting blood-lead levels and the estimated probability that those blood-lead levels would exceed 10 μg/dL were compared to EPA's stated goal for lead, that individuals exposed would have no more than a 5 percent probability of exceeding the level of concern of 10 μg/dL.

Quantitative inhalation risk assessments for asbestos in soils were not performed in this HHRA because the available data are inadequate for quantitative risk assessment and a reliable method for estimating asbestos concentrations in air from soil data has not been accepted by EPA. Instead, qualitative comparisons of soil data to the definition of asbestos-containing materials were used to evaluate potential exposures to asbestos. Pavement and vegetative cover at most of the OU6 properties reduce the potential for inhalation exposures. However, disturbances of asbestos-containing soil through digging would increase the potential for airborne asbestos exposure and associated inhalation risks. This underscores the importance of avoiding disturbing soils prior to remediation and using health protective measures during remediation.

Summaries of the major risk assessment findings for each of the individual OU6 properties are provided in Section 3. Asbestos was present at concentrations of potential concern (greater than one percent) at all 24 properties. This fact alone may be sufficient to justify remedial actions. The quantitative risk assessments estimated potential risks from the estimated areas of Raymark waste to commercial workers in excess of EPA acceptable limits for 10 properties, to recreational visitors for one property, and to residents for three properties. In addition to these 14 properties, estimated potential risks from the estimated areas of Raymark waste at six properties, including five commercial properties and one recreational property, with lead evaluations and non-cancer hazard indices that did not meet EPA's levels of concern, fall within EPA's cancer risk range of 1×10^{-4} to 1×10^{-6}.[1] At each of these properties, carcinogenic PAHs, (benzo(a)pyrene, benzo(a)anthracene, benzo(b) fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene), arsenic, total Aroclors (PCBs), dioxin/furans, dieldrin, and lead were the predominant risk drivers.

[1] Cancer risks at these six properties also exceeded the CT target risk levels of 1×10^{-5} for cancer risks of multiple contaminants and 1×10^{-6} for individual contaminants.

Among the five commercial properties without predicted unacceptable risks from lead or hazard indices, or cancer risks greater than 1×10^{-4} or between 1×10^{-4} and 1×10^{-6}, only 250 East Main Street had useable data for quantitative risk assessment for hazard indices, cancer risks, and lead evaluations. These risks were at acceptable levels (cancer risks smaller than EPA's cancer risk range). The remaining four properties (251 East Main Street, 200 Ferry Boulevard, 380 East Main Street, and the DPW Lot) had data available for quantitative lead evaluation; however, there were insufficient data to analyze hazard indices and cancer risks from other contaminants. The quantitative lead evaluations for these properties demonstrated acceptable lead levels. One of these four properties had lead levels below criteria for COPC selection (1000 ppm for commercial properties), such that no quantitative evaluation of lead was needed. Blood-lead levels at the other three properties exceeded 10 ug/dL in fewer than one percent of individuals. Fixed-laboratory data, rather than field-screening data, are needed for quantitative evaluations of hazard indices and cancer risks. These four properties had little or no fixed-laboratory data available to analyze hazard indices and cancer risks. 380 East Main Street and the DPW lot had limited fixed-laboratory data for PCBs only (one or two samples), but no detections of PCBs above the criteria for COPC selection (1 ppm) and no fixed-laboratory analysis of other contaminants. 251 East Main Street and 200 Ferry Boulevard had no fixed laboratory data from within the estimated area of Raymark waste for any contaminants. Further sampling at these locations is advisable before concluding that cancer risks and hazard indices are, or are not, at acceptable levels.

The results of the human health risk assessments are presented on Table 4-1. The results of two different cancer risk evaluations for dioxins are presented to provide more complete information about potential risk. The toxicity of dioxin is under review by EPA and a more protective cancer slope factor (CSF) has been proposed. Risk estimates based on both the current CSF and the proposed CSF have been included in this report and are shown on Table 4-1.

There are uncertainties associated with the risk assessments due to limited sampling at individual properties, uncertainty related to the extent of Raymark waste, and the types of analyses performed at many of the properties. As a result, at some properties there are insufficient data to provide a quantitative estimate of hazard indices, cancer risk, or lead levels, and at other properties estimates of hazard indices and cancer risks from some contaminants

were based on maximum detected concentrations. At each property, the presence of contamination outside the areas of Raymark waste suggests that exposures and risks from the entire property are likely to be greater than those estimated for the Raymark waste areas alone. To address uncertainty resulting from the use of the FRW factor in estimating risks, Appendix B-12, Table 1 provides a summary of cancer risks, health hazard indices, and lead evaluations with and without the FRW factor, displaying maximum risk estimates for exposures within the estimated areas of Raymark waste at each property to aid in management decisions.

4.3.2 Ecological Risk Evaluation

None of the 24 study area properties have been individually evaluated for ecological impacts under this Operable Unit No. 6. Many of the properties are located within areas that were included in the ecological risk evaluation included in the three OU3 RIs (TtNUS, 1999b, 2000a, 2000b), and the *Wetlands Evaluation, Raymark-Ferry Creek-OU3 Technical Memorandum* (B&RE, 1998). Some information from these reports has been included in the property-specific evaluations in Section 3.

In general, there are few if any known ecological impacts on the study area properties from the contaminants evaluated in this RI, provided that contact with waste materials, erosion, and contaminant migration is controlled. The exceptions are properties where the wetlands within the study area have been compromised by the placement of fill. There are, however, important ecological resources surrounding a number of these properties. These resources, which include Ferry Creek, the Housatonic River, Wooster Park, and other wetlands, will need to be considered in any remediation plans for an individual property.

4.4 Conclusions

By definition, only those properties with samples meeting the definition of Raymark waste are included in this RI Report (refer to Section 2.2 for the definition of Raymark waste). The interpretation of the data and information compiled for this RI indicates that:

- In addition to Raymark waste indicator contaminants (asbestos, lead, copper, and Aroclor 1268), fill throughout the study area is also contaminated with VOCs, SVOCs, pesticides, other PCBs, dioxins, furans, and metals. In many areas, the concentrations of contaminants exceed the CT DEC or the CT PMC.

- Analysis of soil samples reveals widespread contamination. Although contamination is ubiquitous across the study area, the contaminants and concentrations are not uniformly distributed, due, primarily, to irregular fill dumping practices. The sample location maps in Section 3 identify the estimated areas of Raymark waste on each property.

- Inhalation risks from asbestos were evaluated qualitatively, and are not quantified as part of the estimated potential risks to human health. Asbestos is present at concentrations greater than 1 percent at all 24 properties. This fact alone may be sufficient to justify remediation.

- The potential risk to human health from estimated areas of Raymark waste is in excess of EPA acceptable limits or levels of concern based on estimates of hazard indices, cancer risk, and/or modeled blood lead levels at 14 of the 24 study area properties. Cancer risks at six additional properties fall within EPA's cancer risk range between 1 in 10,000 or 1×10^{-4} and 1 in a million or 1×10^{-6}.[2]

- Although no quantitative ecological risk assessment was performed as part of this RI, based on available data, minimal ecological risk is assumed for the properties within the OU6 study area, assuming erosion and migration of wastes are controlled.

- This RI was developed only for soils contamination and does not include an assessment of other media, such as sediments, surface water, and groundwater.

A small number of additional properties still need to be investigated due to access issues at specific properties that were previously included in the over 200 properties evaluated initially

[2] Cancer risks at these six properties also exceeded CT target risk levels of 1×10^{-5} for multiple contaminants and 1×10^{-6} for individual contaminants.

as part of OU6. These properties will be evaluated in the future by EPA to determine the potential presence of Raymark waste.

TABLES

TABLE 1-1
LIST OF PROPERTIES
REMEDIAL INVESTIGATION
RAYMARK - OU6
STRATFORD, CONNECTICUT

Report Section	Property Name	Zoning*	Total Area of Property (acres)	Total Area of Property (sf)	Estimated Area of Raymark Waste (sf)	Area of Buildings (sf)	Percentage of Site with Raymark Waste**	Fraction of Site with Raymark Waste (FRW)
3.1	Lockwood Avenue Property	Part Waterfront Business/part retail	5.3	231,822	78,736	0	34.0	0.34
3.2	200 Ferry Boulevard	Retail	0.6	28,142	1,882	2,127	7.2	0.07
3.3	230 Ferry Boulevard	Retail	2.5	108,530	28,507	4,567	27.4	0.27
3.4	250 Ferry Boulevard	Retail	2.1	89,894	56,121	10,076	70.3	0.70
3.5	280 Ferry Boulevard	Retail	1.6	70,613	48,737	7,780	77.6	0.78
3.6	300 Ferry Boulevard	Retail	1.6	67,582	37,331	11,841	67.0	0.67
3.7	Lot Behind 326 Ferry Boulevard	Retail	1.7	75,953	32,497	0	42.8	0.43
3.8	Vacant Lot at Housatonic Avenue	Residential	0.5	20,266	6,662	0	32.9	0.33
3.9	326 Ferry Boulevard	Retail	0.8	35,491	2,731	6,837	9.5	0.10
3.10	576 East Broadway	Light Industrial	1.3	55,995	22,333	2,718	41.9	0.42
3.11	600 East Broadway	Light Industrial	4.5	194,847	41,350	0	21.2	0.21
3.12	Vacant DOT Lot Abutting I-95	Partially zoned Light Industrial	2.4	105,240	9,134	0	8.7	0.09
3.13	CT Right of Way - Commercial Exposure	Retail/Light Industrial	1.9	81,559	4,347	0	5.3	0.05
	CT Right of Way - Residential Exposure	Retail/Light Industrial	0.1	3,238	1,396	0	43.1	0.43
3.14	304 East Main Street	Retail/Light Industrial	0.3	12,706	4,813	1,675	43.6	0.44
3.15	340 East Main Street	Retail/Light Industrial	0.3	12,289	8,501	540	72.4	0.72
3.16	380 East Main Street	Retail/Light Industrial	0.5	23,180	129	9,356	0.9	0.01
3.17	250 East Main Street	Retail/Light Industrial	16.7	726,778	4,261	325,471	1.1	0.01
3.18	DPW Lot	Town Owned – Municipal	6.4	278,820	27,197	51,688	12.0	0.12
3.19	251 East Main Street	Retail	0.7	30,222	3,447	4,299	13.3	0.13
3.20	Beacon Point Area	Town-owned/ Waterfront Business	7.4	280,045	43,121	828	15.4	0.15
3.21	1 Beacon Point Road	Waterfront Business	0.9	39,677	4,392	2,071	11.7	0.12
3.22	Airport Property North of Marine Basin	Coastal Industrial	15.1	655,580	46,595	0	7.1	0.07
3.23	Wooster Park	Town Owned – Municipal	4.0	172,961	7,112	0	4.1	0.04
3.24	Third Avenue Property	Residential	0.3	15,004	1,706	1,562	12.7	0.13

* - Reference: Zoning Map, Town Planning and Zoning, Stratford, Connecticut. Prepared August 1988, revised March 14, 1997
** - Percentage of site with Raymark Waste is the estimated area of Raymark Waste divided by the area of accessible soils at the property.
Accessible soils are the total area of the property minus the area of the buildings.

TABLE 2-1
CHEMICAL COMPOUNDS USED OR HANDLED AT THE RAYMARK FACILITY
REMEDIAL INVESTIGATION
RAYMARK – OU6
STRATFORD, CONNECTICUT

CHEMICAL COMPOUND/MATERIAL	DESCRIPTION	INFORMATION SOURCES			
		No. 1	No. 2	No. 3	No. 4
Acetone	2-Propanone	X		X	
Adhesive CR04					X
Alcohol			X		X
Aluminum	Alumina		X		X
Ammonia Aqua		X			X
Arco 4545					X
Asbestos			X	X	X
Boiler Feed Water		X			
1-Butanol	N-Butyl Alcohol			X	
2-Butanone	MEK			X	
N-Butyl Alcohol				X	
Carbon Tetrachloride	Perchloromethane			X	
Caustic	Sodium Hydroxide	X			X
Caustic Liquid/Sludge	Sodium Hydroxide				X
China Oil					X
Chinawood Oil	Meta Para Cresol; Phenolic Mixture	X			
Ching Oil					X
Chlorinated Fluorocarbons				X	
Coal	Natural Solid		X		
Coal Tar Resin	Petroleum-Like Fuel				X
Copper			X		
Cotton			X		
Cresolic Acid	Cresol; Methylphenol			X	
Cresylic Acid	Cresol; Methylphenol	X		X	X
Denatured Alcohol		X			
Denatured Ethanol					X
Dust (Dry)					X
Dust (Wet)					X
Fiberglass Fibers			X		
Fire Water		X			
Formaldehyde Resin					X
Formaldehyde (37%)		X		X	
#2 Fuel Oil	Diesel Oil	X			
#6 Fuel Oil		X	X		
Gilsonite	Asphaltic Material				X
Graphite	Black Lead		X		
Hexamethylene Tetramine	Methanamine				X
Hycar Rubber			X		
Hydraulic Oil			X		
Iron Hydroxide Sludge			X		
Latex	Hydrocarbon Polymer	X	X		X

TABLE 2-1 (cont.)
CHEMICAL COMPOUNDS USED OR HANDLED AT THE RAYMARK FACILITY
REMEDIAL INVESTIGATION
RAYMARK – OU6
STRATFORD, CONNECTICUT

CHEMICAL COMPOUND/MATERIAL	DESCRIPTION	INFORMATION SOURCES			
		No. 1	No. 2	No. 3	No. 4
Lead			X	X	X
Linseed Oil	Flaxseed Oil	X			
Liquid Phenolic Resin	Condensation of Phenol with Aldehydes		X		
Meta Para Cresol	Phenolic Mixture	X			
Methanol	Methyl Alcohol				X
Methylbenzene	Toluene			X	
Methyl Chloride	Dichloromethane			X	
Methyl Chloroform	1,1,1-Trichloroethane		X	X	
Methylethyl Ketone	2-Butanone	X		X	X
Methylphenol	Cresol			X	
Mineral Spirits					X
Monochlorobenzene	Phenyl Chloride	X			X
Muriatic Acid	Hydrochloric Acid		X		
Naptha	Petroleum Product	X	X		
Nitric Acid		X	X		
Nylon					X
Phenol	Tung Oil	X	X	X	X
Phenol Formaldehyde Copolymer	Synthetic Thermosetting Polymer				X
Phenolic Resin	Condensation of Phenol with Aldehydes				X
Phenolic Resin 424					X
Phenolic Resin 439					X
Phenolic Resin 478					X
Pickle Liquor	Waste Acid Containing Dissolved Metals			X	
Polybutadiene Resin	Synthetic Thermoplastic Polymer				X
Powdered Metals					X
2-Propanone	Acetone	X		X	
Process CNSL		X			X
Raw Cashew Nut Oil		X			X
RC 439	477 Saturant	X			
RC 845					X
Reclaimed City Water		X			
Red Oxide	Iron Oxide		X		
Resin Solution CR04					X
Rinsate Water					X
Rubber	Polyisoprene		X		
Rubber Cement			X		
Sartomer 845					X
Saturant 295E	90% Anacardic Acid; Sulfur Blistering Compound	X			

TABLE 2-1 (cont.)
CHEMICAL COMPOUNDS USED OR HANDLED AT THE RAYMARK FACILITY
REMEDIAL INVESTIGATION
RAYMARK – OU6
STRATFORD, CONNECTICUT

CHEMICAL COMPOUND/MATERIAL	DESCRIPTION	INFORMATION SOURCES			
		No. 1	No. 2	No. 3	No. 4
Saturant 439		X			
Saturant 451		X			X
Saturant 500-3					X
Saturant 500-F					X
Saturant 8240		X			
Saturant 850F					X
Saturant 851					X
Saturant RC 581					X
Scrap Resin	Petroleum and Mineral Spirits	X			
Scrap Saturant					X
#3 Sludge					X
Soap Saturant 850F					X
Solvent 204		X			
Steel			X		X
Steel Wool			X		
Sulfuric Acid	Battery Acid		X		
Tetrachloroethylene	Perchloroethylene (PCE)			X	
Textile Spirits					X
Toluene				X	X
Toluol	Cresol	X	X		
1,1,1-Trichloroethane (TCA)		X	X	X	
Trichloroethylene (TCE)	Trichloroethene			X	
Tung Oil		X			X
Unleaded Gasoline		X			
Varsol	Petroleum Aliphatic Solvents				X
Varsol #18		X			X
Vegetable Oil					X
VMP Naptha	Varnish; Petroleum Spirits	X			
Waste Oil		X			
White Water		X	X		X

Information Sources:
No. 1 - Overall Site Plan, Sheet No. S1 (ELI, 1995).
No. 2 - RCRA Facility Investigation Report, Section 2.0 (ELI, 1995).
No. 3 - RCRA Application, Part A, 8/15/80.
No. 4 - RCRA Application, Part B, 8/15/80.

TABLE 2-2
SUMMARY OF BACKGROUND CONCENTRATIONS IN SOIL
AT LOCATIONS THROUGH STRATFORD
REMEDIAL INVESTIGATION
RAYMARK – OU6
STRATFORD, CONNECTICUT

PARAMETER	FREQUENCY OF DETECTION (1)	AVERAGE CONCENTRATION (2)	
		value	units
Pesticides/PCBs:			
4,4'-DDD	0/35	4.60	µg/kg
4,4'-DDE	12/34	16.7	µg/kg
4,4'-DDT	13/34	29.1	µg/kg
Aldrin	0/36	2.41	µg/kg
alpha-BHC	0/36	2.41	µg/kg
alpha-Chlordane	9/35	4.88	µg/kg
Aroclor-1016	0/37	49.9	µg/kg
Aroclor-1221	0/37	93.0	µg/kg
Aroclor-1232	0/37	47.0	µg/kg
Aroclor-1242	0/37	46.1	µg/kg
Aroclor-1248	0/37	46.1	µg/kg
Aroclor-1254	0/37	46.1	µg/kg
Aroclor-1260	0/37	46.1	µg/kg
Aroclor-1262	0/27	36.8	µg/kg
Aroclor-1268	0/37	46.1	µg/kg
beta-BHC	0/35	2.39	µg/kg
delta-BHC	0/35	2.32	µg/kg
Dieldrin	8/33	13.1	µg/kg
Endosulfan I	3/35	4.52	µg/kg
Endosulfan II	5/36	4.72	µg/kg
Endosulfan Sulfate	0/36	4.69	µg/kg
Endrin	1/36	4.77	µg/kg
Endrin Aldehyde	1/36	4.56	µg/kg
Endrin Ketone	4/35	5.31	µg/kg
gamma-BHC	0/36	2.41	µg/kg
gamma-Chlordane	6/34	2.67	µg/kg
Heptachlor	1/35	2.19	µg/kg
Heptachlor Epoxide	2/35	2.33	µg/kg
Methoxychlor	4/34	22.3	µg/kg
Toxaphene	2/35	236	µg/kg
Metals:			
Aluminum	39/39	12900	mg/kg
Antimony	0/37	2.86	mg/kg
Arsenic	39/39	5.67	mg/kg
Barium	39/39	57.5	mg/kg
Beryllium	34/39	0.719	mg/kg
Cadmium	8/39	0.397	mg/kg
Calcium	39/39	1600	mg/kg
Chromium	39/39	17.0	mg/kg
Cobalt	29/39	6.35	mg/kg
Copper	37/38	28.8	mg/kg
Iron	39/39	16000	mg/kg
Lead	36/39	80.8	mg/kg
Magnesium	39/39	3250	mg/kg

TABLE 2-2 (cont.)
SUMMARY OF BACKGROUND CONCENTRATIONS IN SOIL
AT LOCATIONS THROUGHOUT STRATFORD
REMEDIAL INVESTIGATION
RAYMARK – OU6
STRATFORD, CONNECTICUT

PARAMETER	FREQUENCY OF DETECTION (1)	AVERAGE CONCENTRATION (2)	
		value	units
Manganese	39/39	306	mg/kg
Mercury	25/39	0.111	mg/kg
Nickel	2/39	12.5	mg/kg
Potassium	24/39	961	mg/kg
Selenium	6/39	0.499	mg/kg
Silver	2/39	0.508	mg/kg
Sodium	21/34	76.4	mg/kg
Thallium	0/39	0.368	mg/kg
Vanadium	38/39	34.2	mg/kg
Zinc	39/39	112	mg/kg

Notes:

(1) The locations and numbers of background samples collected were determined in concurrence with EPA. The frequency of detection denotes the number of times the compound/analyte was detected per the total number of samples that were analyzed.

(2) The average background concentrations were calculated as the arithmetic average of the detected concentrations and ½ the detection limits for those compounds/analytes reported as undetected. The detection limits used in the calculation are the sample specific detection limits reported by the laboratory. These detection limits are based on the EPA CLP contract required quantitation limits (CRQLs) for organics, and contract required detection limits (CRDLs) for inorganics, and incorporate any associated sample dilution or solids content factors.

TABLE 4-1
SUMMARY OF RECEPTOR RISKS AND HAZARDS
REMEDIAL INVESTIGATION
RAYMARK-OU6
STRATFORD, CONNECTICUT

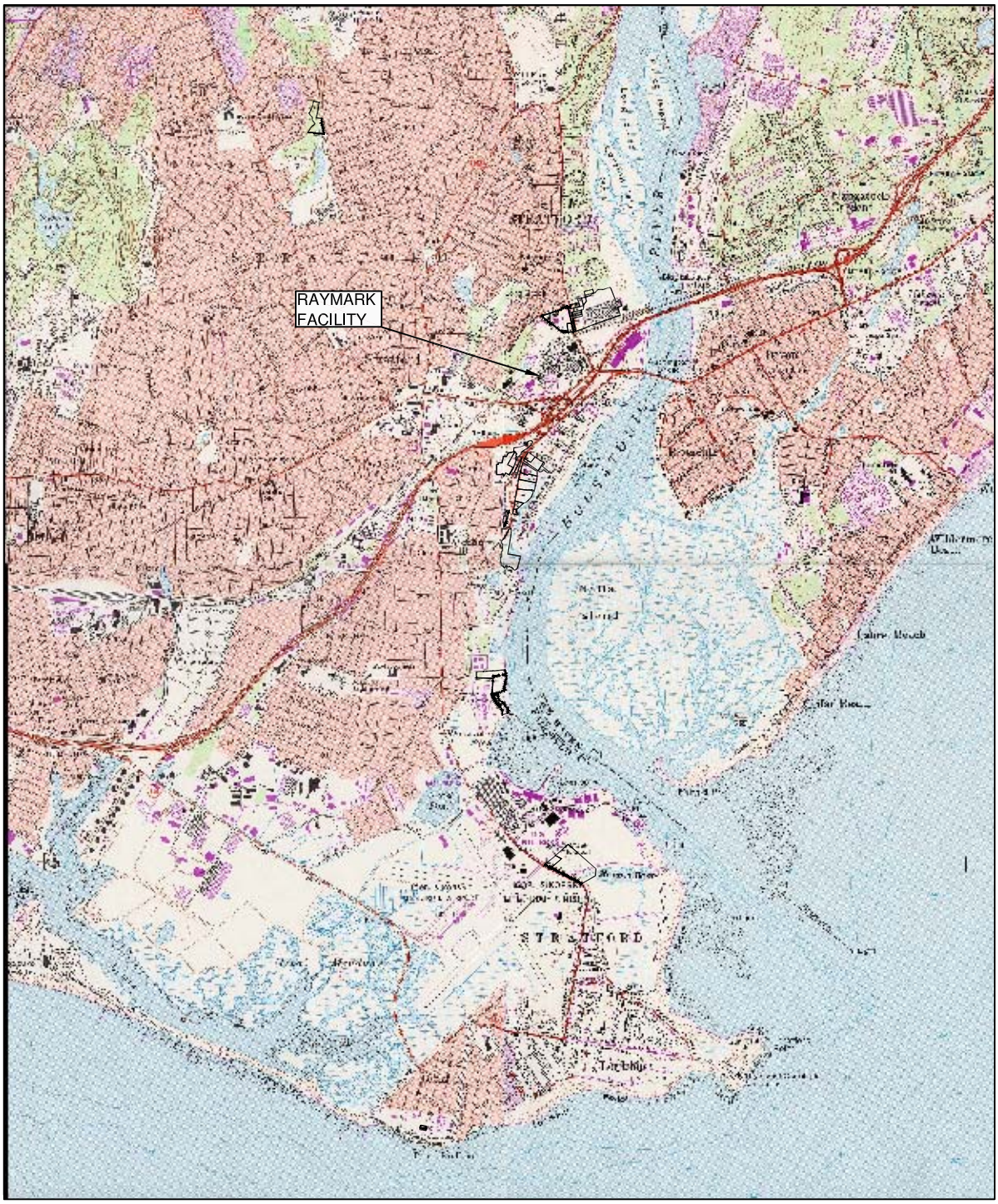
Property	Maximum Asbestos (1)	Lead (2)	Scenario/ Receptor	CR>1E-04 or HI>1	Total Cancer Risks (3)	Total Cancer Risks (4)	Major contributors to cancer risk above 1E-04 (individual cancer risk >1E-06)	Total Noncancer Hazard Index	Major contributors to noncancer Hazard Index (HI>1.0)
Lockwood Avenue Property	50%	0.5-1.2%	Commercial Worker	YES	4.8E-05	7.3E-05	PCBs, Dioxin TEQ, PAHs, Arsenic	2.1	PCBs
Lockwood Avenue Property	50%	2.5%	Recreational Visitor	YES	8.6E-05	1.9E-04	PCBs, Dioxin TEQ, PAHs, Arsenic, Dieldrin	9.2	PCBs, Chromium
200 Ferry Boulevard	25%	0.2-0.6%	Commercial Worker	NE	NE	NE	NE	NE	NE
230 Ferry Boulevard	90%	9 - 12%	Commercial Worker	YES	3.2E-04	1.4E-03	PCBs, Dioxin TEQ, Arsenic, PAHs	7.2	PCBs
250 Ferry Boulevard	90%	17-20%	Commercial Worker	YES	2.9E-04	6.7E-04	PCBs, Dioxin TEQ, PAHs, Arsenic	12	PCBs
280 Ferry Boulevard	90%	57-59%	Commercial Worker	YES	3.3E-04	9.8E-04	PCBs, Dioxin TEQ, PAHs, Arsenic	8.2	PCBs
300 Ferry Boulevard	75%	28-31%	Commercial Worker	YES	2.8E-04	3.6E-04	PCBs, Dioxin TEQ, Arsenic, Benzo(a)pyrene	18	PCBs
Lot behind 326 Ferry Boulevard	60%	2.2-3.9%	Commercial Worker	YES	1.7E-04	3.9E-04	PCBs, Dioxin TEQ, Arsenic, Benzo(a)pyrene	9	PCBs
Vacant Lot at Housatonic Avenue	80%	91%	Future Resident	YES	6.3E-04	3.4E-03	PCBs, Dioxin TEQ, PAHs, Arsenic	20	PCBs
326 Ferry Boulevard	8%	NA	Commercial Worker	NO	2.8E-06	3.4E-06	Benzo(a)pyrene	0.04	NA
576 East Broadway	90%	7.1-9.7%	Commercial Worker	YES	5.0E-04	2.0E-03	PCBs, Dioxin TEQ, Dieldrin, Arsenic, Benzo(a)pyrene	16	PCBs
600 East Broadway	85%	1.0-2.1%	Commercial Worker	YES	4.0E-05	5.9E-05	PCBs, Dioxin TEQ, Arsenic, Benzo(a)pyrene	1.8	PCBs
Vacant DOT lot abutting I-95	40%	0.2-0.7%	Commercial Worker	NO	5.0E-06	6.7E-06	PCBs	0.2	NA
CT Right-of-Way	16%	0.2-0.6%	Commercial Worker	NO	1.8E-06	NA	NA	0.03	NA
CT Right-of-Way - Residential Portion	16%	1.3%	Resident	YES	3.5E-05	4.4E-05	PCBs, Dioxin TEQ, PAHs, Arsenic	2.2	PCBs
304 East Main Street	50%	17-20%	Commercial Worker	YES	3.1E-04	3.6E-04	PCBs, Dioxin TEQ, Arsenic	21	PCBs
340 East Main Street	70%	21-24%	Commercial Worker	NO	1.2E-06	NA	NA	0.08	NA
380 East Main Street	2%	0.2-0.6%	Commercial Worker	NE	NE	NE	NE	NE	NE
250 East Main Street	80%	0.2-0.6%	Commercial Worker	NO	1.8E-07	NA	NA	0.005	NA
DPW Lot	30%	0.2-0.7%	Commercial Worker	NE	NE	NE	NE	NE	NE
251 East Main Street	7%	NA	Commercial Worker	NE	NE	NE	NE	NE	NE
Beacon Point Area	40%	11%	Recreational Visitor	YES	1.1E-04	5.1E-04	PCBs, Dioxin TEQ, PAHs, Arsenic	4.3	PCBs
1 Beacon Point Road	60%	0.5-1.2%	Commercial Worker	NO	8.2E-06	1.6E-05	PCBs, Dioxin TEQ, Benzo(a)pyrene	0.19	NA
Airport Property North of Marine Basin	40%	0.2-0.7%	Commercial Worker	NO	2.1E-05	3.6E-05	PAHs	0.0014	NA
Wooster Park	60%	0.69%	Recreational Visitor	NO	1.6E-05	4.4E-05	PCBs, Dioxin TEQ, Benzo(a)pyrene	0.7	NA
Third Avenue Property	10%	0.16%	Resident	YES	1.5E-05	1.6E-05	PCBs, Benzo(a)pyrene	2.2	PCBs

Notes:

(1) Maximum Detected Asbestos; asbestos-containing material is material containing more than 1 percent asbestos (Appendix A to Subpart M of 40 CFR 61) (EPA, 1990). All properties have asbestos above 1 percent.
(2) Probability that blood lead levels exceed 10 ug/dL; EPA's goal is that no more than 5% of individuals will have blood lead concentrations above 10 ug/dL.
(3) Cancer risks estimated using the dioxin slope factor of 1.5E+5 (mg/kg/d)-1.
(4) Cancer risks estimated using the Draft Dioxin Reassessment recommended dioxin slope factor of 1E+6 $(mg/kg/d)^{-1}$.
NA- Not Applicable
NE- Not evaluated due to insufficient data.
All properties have asbestos above 1 percent.

Lead is above levels of concern, Cancer Risks are above 1E-04, AND/OR Hazard Indices are above 1.
Cancer risks fall in the range of 10^{-4} to 10^{-6}, hazard indices are less than 1, and lead is below levels of concern.
Lead is below levels of concern. Cancer risks are less than 10^{-6} and hazard indices are less than 1 OR cancer risks and hazard indices were not evaluated due to insufficent data.

FIGURES



N

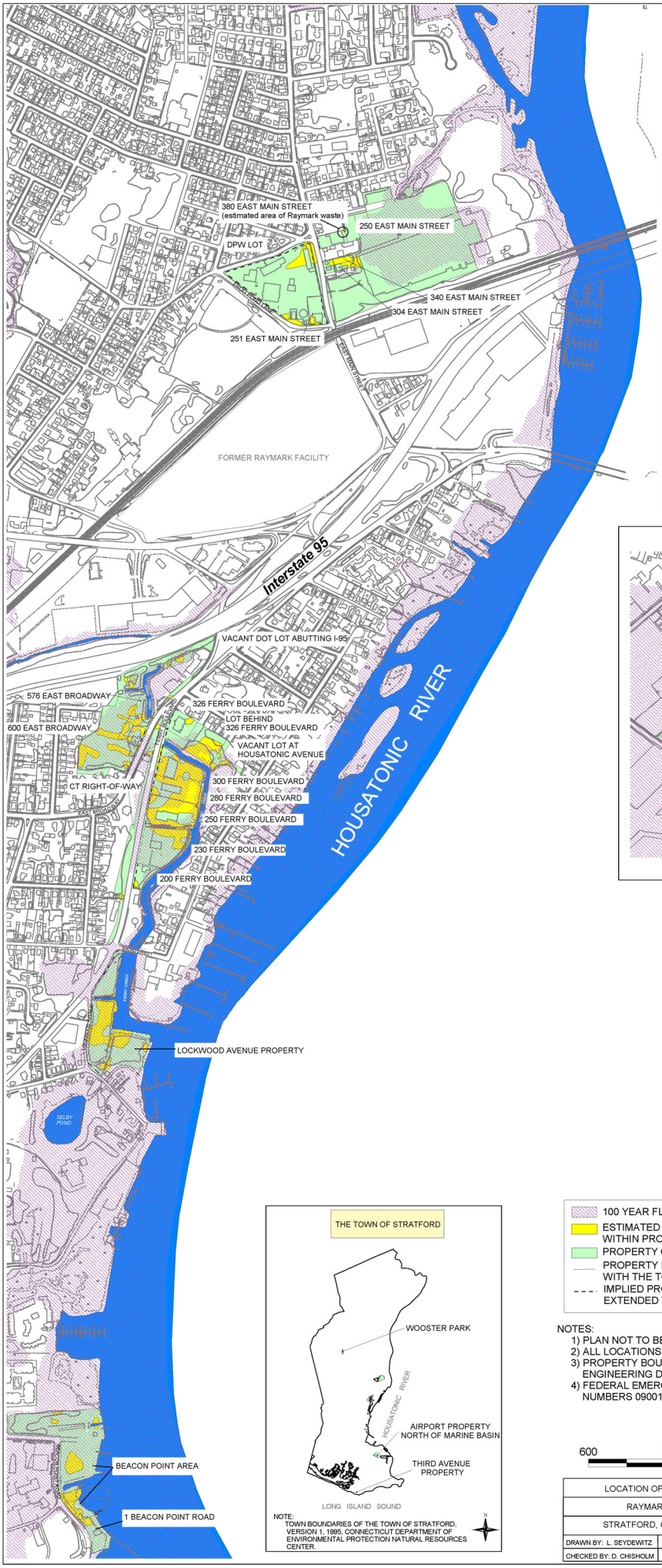
BASEMAP: PORTIONS OF THE FOLLOWING U.S.G.S. QUADRANGLE MAPS: BRIDGEPORT, CONN., 1970 (PHOTOREVISE: 1984) AND MILFORD, CONN., 1960 (PHOTOREVISED: 1984)

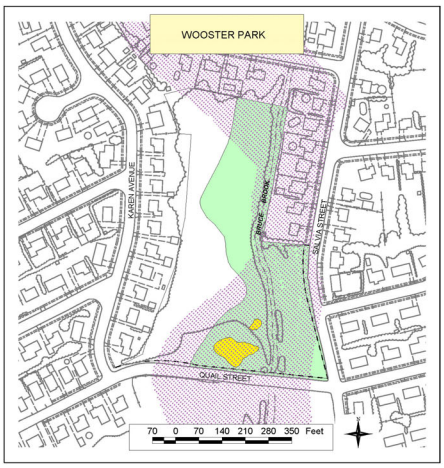
0' GRAPHIC SCALE 4000'

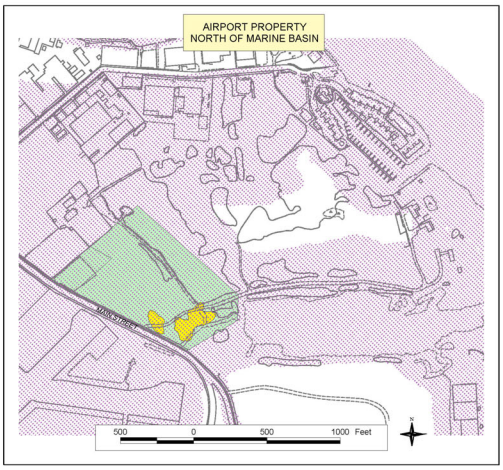
1 INCH = 4000 FEET

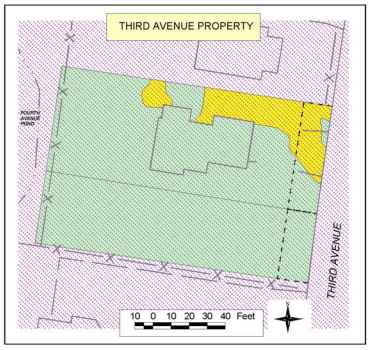
SITE LOCUS	FIGURE 1–1
REMEDIAL INVESTIGATION	TETRA TECH NUS, INC.
RAYMARK – OU6 – STRATFORD, CT	
DRAWN BY: D.W. MACDOUGALL	REV.: 0
CHECKED BY: D. CHISHOLM	DATE: JANUARY 2004
SCALE: 1" = 100'	ACAD NAME: DWG\4106\0900\FIG_1–1.DWG

55 Jonspin Road Wilmington, MA 01887
(978)658–7899









- 100 YEAR FLOOD PLAIN
- ESTIMATED AREA OF RAYMARK WASTE WITHIN PROPERTY OF INTEREST
- PROPERTY OF INTEREST
- PROPERTY BOUNDARY AS RECORDED WITH THE TOWN OF STRATFORD
- IMPLIED PROPERTY BOUNDARY EXTENDED TO ROADWAY

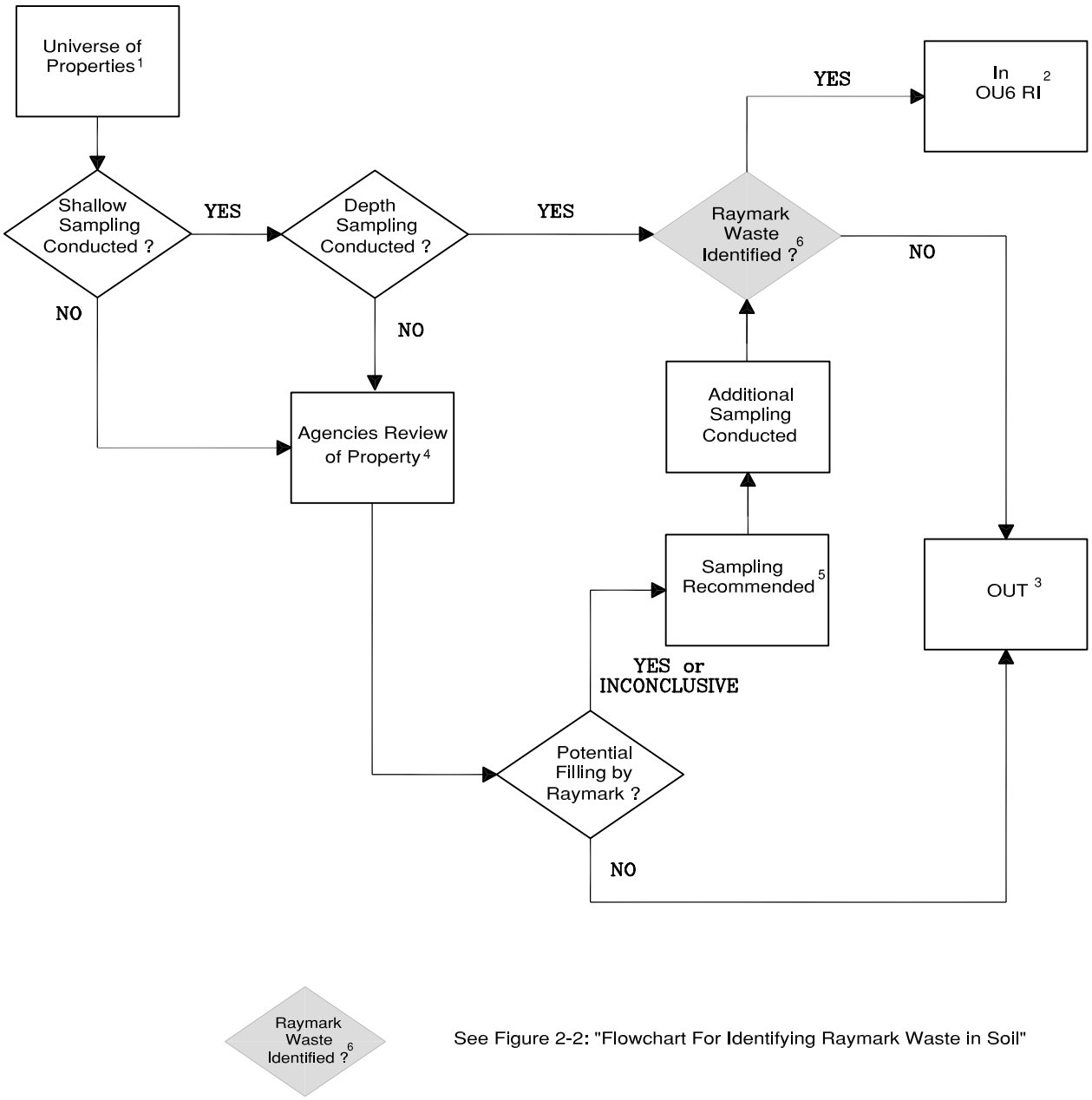
NOTES:
1) PLAN NOT TO BE USED FOR DESIGN
2) ALL LOCATIONS TO BE CONSIDERED APPROXIMATE
3) PROPERTY BOUNDARIES ARE APPROXIMATE BASED ON TOWN OF STRATFORD ENGINEERING DEPARTMENT PLANS
4) FEDERAL EMERGENCY MANAGEMENT AGENCY, Q3 FLOOD DATA, COMMUNITY-PANEL NUMBERS 090016 0001-0004, REVISED JUNE 16, 1992, FEMA, WASHINGTON, D.C.

600 0 600 1200 1800 Feet

N

LOCATION OF PROPERTIES	FIGURE 1-2 (revision 1)
RAYMARK - OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: L. SEYDEWITZ / DATE: APRIL 11, 2005	55 JONSPIN ROAD WILMINGTON, MA 01887
CHECKED BY: D. CHISHOLM / FILE: C:\...\OU5_RI_2003.APR	(978)658-7899

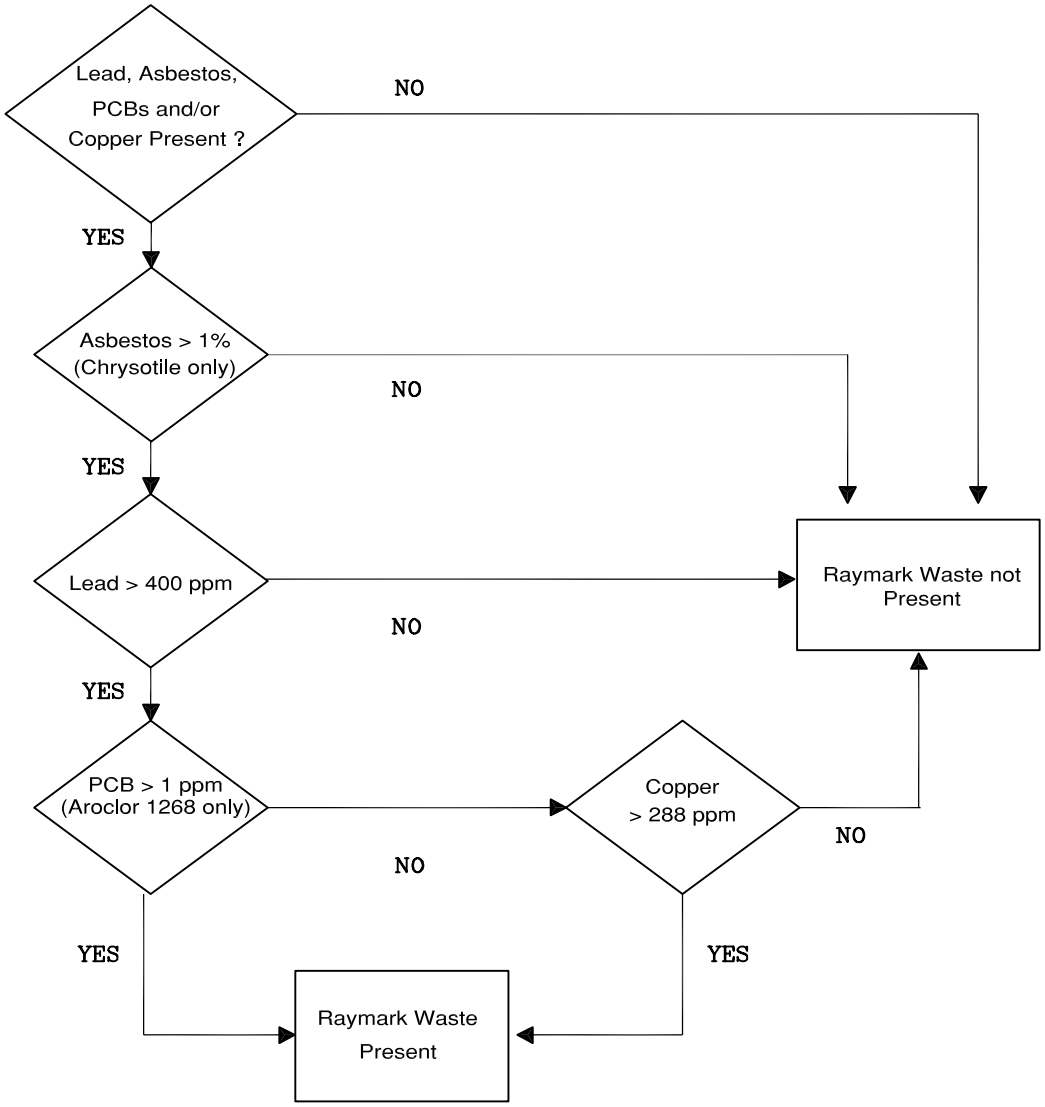
PROPERTY EVALUATION FLOW CHART



See Figure 2-2: "Flowchart For Identifying Raymark Waste in Soil"

PROPERTY EVALUATION FLOW CHART	FIGURE 2–1
RAYMARK – OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: R.G.D. / D.W.M. — DATE: JANUARY 2004	55 Jonspin Road Wilmington, MA 01887
CHECKED BY: H.M. FORD — ACAD NAME: DWG\4106\0900\FIG_2-1.DWG.DWG	(978)658-7899

FLOW CHART FOR IDENTIFYING
RAYMARK WASTE IN SOIL



Notes:
1. All results from a single sample at the same depth interval.

IDENTIFYING RAYMARK WASTE IN SOIL FLOW CHART	FIGURE 2–2
RAYMARK – OU6	TETRA TECH NUS, INC.
STRATFORD, CONNECTICUT	
DRAWN BY: R.G.D. / D.W.M. — DATE: JANUARY 2004	55 Jonspin Road Wilmington, MA 01887 (978)658–7899
CHECKED BY: H.M. FORD — ACAD NAME: DWG\4106\0900\FIG_2–2.DWG	

Identification of Properties[*]

The Universe of Properties[†] evaluated as part of this RI included all properties that had been identified over a 10-year period where there was a potential for Raymark waste to be present (see Figure 2-1). These locations were identified by a number of sources including, but not limited to, officials of the Town of Stratford, Raymark records and/or former employees, historical records, analytical data, and neighbors/citizens. Reasons for identification included, without limitation, knowledge of past filling/disposal activities and locations, property conditions and topography, proximity to the former Raymark Facility, and proximity to areas subject to excavation actions by EPA's Removal Program. Each property was evaluated to determine whether adequate sampling had been previously conducted to evaluate the potential presence of Raymark waste. Both EPA and the CT DEP (the Agencies) participated in these evaluations.

Specifically, if adequate shallow (0-2 feet) and depth (>2 feet) samples had been collected, then an assessment for the presence of Raymark waste was made based on a comparison of the sampling results to the definition of Raymark waste described in Section 2.2. If Raymark waste was identified on the property (that is, if the sampling results met the definition of Raymark waste), then the property was included in the Raymark Operable Unit No. 6 Remedial Investigation Report (OU6 RI[2]). If Raymark waste was not identified, then the property was "out"[3] of the evaluation process and no further action would be needed under Superfund.

If only shallow samples were collected or if no shallow or depth samples had been collected, the Agencies, with input from the town, reviewed the property to determine the potential for Raymark waste to be present in soil on the property. The Agencies'[4] determination of whether or not there was a potential for Raymark waste to be present on a property was based upon a number of factors. These factors included, without limitation, input from Town officials (Town of Stratford, 2002/2003), evidence of past filling/disposal activities and locations, property conditions and topography, analytical data, aerial photography, proximity to the former Raymark Facility, proximity to areas subject to excavation by EPA's Removal Program, and evaluations and recommendations made by the federal Agency for Toxic Substances and Disease Registry

[*] Footnotes in Sections 2.1 and 2.2 reflect points of decisions as shown on Figure 2-4 for identifying Raymark waste.

(ATSDR) and/or the Connecticut Department of Public Health (CT DPH). Further, if a property abutted another property that had either been subject to an EPA removal action or was determined to contain Raymark waste, then that property usually was recommended for shallow and depth sampling particularly if the Raymark waste portion of the removal property abutted it.

If the Agencies determined that there was not a potential for Raymark waste to be present on a property, then the property was considered "out" of the evaluation process and not part of the OU6 RI. If the Agencies determined there was a potential for Raymark waste to be present or if the evidence was inconclusive, then additional sampling was recommended[5]. At the conclusion of such sampling, analytical results were compared to the definition of Raymark waste. If Raymark waste was identified on a property, then the property was included in the OU6 RI. If Raymark waste was not identified on a property, the property was considered "out" of the evaluation process and no further action would be performed under Superfund.

Definition of Raymark Waste

All determinations of the presence or absence of Raymark waste (Raymark Waste Identified[6]) were based on the following definition of Raymark waste: Raymark waste in soil is defined as a single soil sample at the same depth interval containing lead above 400 parts per million (ppm) (milligrams per kilogram (mg/kg)) **and** asbestos (chrysotile only) greater than 1 percent **and either** copper above 288 ppm (mg/kg) **or** polychlorinated biphenyls (PCBs)(Aroclor 1268 only) above 1 ppm (mg/kg). This definition was developed by EPA, in consultation with the CTDEP, and reviewed by the Raymark Advisory Committee's consultant, prior to evaluation of sampling data from properties.

Properties that have soil samples with analytical results meeting the Raymark waste definition, and have not undergone a removal action, or are not included under other operable units as discussed in Section 1.3.3, are presented in this RI Report. A list of these properties is shown on Table 1-1. A Human Health Risk Assessment (HHRA) was performed to estimate potential current and/or future risks to the public from the contaminants detected in soils at each property containing Raymark waste. The results of these evaluations are presented for each property in Section 3.

As shown on Figure 2-2, details of the development of the Raymark waste definition are as follows:

1. **Lead** - Lead was selected as an identifying contaminant of Raymark waste as it was used in the fabrication of various brake and friction materials in the Raymark manufacturing process. Raymark acknowledged in its RCRA "Part A application" that up to 2.5 billion gallons of lead-contaminated waste liquid flowed through its on-site lagoons on an annual basis. The on-site lagoons were routinely dredged and the spoils were disposed of on the facility property and at other locations throughout the town. The soils and sediments on the former Raymark Facility, in particular the on-site lagoons, contained high levels of lead.

   Lead was identified as a contaminant of concern because it appeared in most samples collected during the 1992 – 1994 sampling on the former Raymark Facility

(elevated lead concentrations were found in process waste, imported fill, and native fill – the latter two assumed to be the result of leachate or cross contamination).

In addition, based on the samples collected on the former Raymark Facility and during the 1993 to 1995 removal actions, 400 mg/kg lead was selected by EPA and approved by ATSDR as a conservative permanently protective cleanup level for residential properties. This value was consistent with EPA's 1992 draft *Soil Screening Level Guidance and Revised Interim Soil Lead Guidance* document (EPA, 1992c). This document was later published in July 1994 as *Revised Interim Guidance on Establishing Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (EPA, 1994b). This value was also consistent with the sample data obtained from the former Raymark Facility itself.

Currently, the 400 mg/kg lead standard remains because it meets the new proposed Connecticut Remediation Standard Regulations (CT RSRs) for residential properties. In an effort to differentiate this contaminant from lead paint from a home or business, the presence of lead and asbestos in the same sample will further identify it as Raymark waste.

2. **Asbestos** - Asbestos was selected as an identifying contaminant of Raymark waste by EPA in 1993 because of its dominance in the waste materials from the 1993 to 1995 removal actions and from samples collected at the former Raymark Facility. The one percent definition was set because it meets the National Emission Standards for Hazardous Air Pollutants (NESHAP) definition for an asbestos-containing material (EPA, 1990a). Currently, the Raymark waste definition remains at one percent, identifying the asbestos as chrysotile asbestos.

3. **PCBs** – PCBs were selected as an identifying contaminant of Raymark waste because of their predominance in samples collected at the former Raymark Facility and given that PCBs do not occur naturally in the environment. A concentration of 1 mg/kg total PCB was adopted by EPA for use in previous removal actions since unrestricted exposure to 1 mg/kg or less of total PCBs has been deemed safe by EPA (OSWER Directive: Remedial Actions for Superfund Sites with PCB Contamination) (EPA, 1990b). Based on historical sampling, EPA further believes

that the majority of PCBs at the former Raymark Facility resemble Aroclor 1268 rather than the other PCB Aroclors (including Aroclor 1262 which was also found consistently at the Raymark Facility). As such, EPA has refined the definition of Raymark waste from the general term "total PCBs" to the more descriptive term "Aroclor 1268" as noted below. Samples collected at the former Raymark Facility, and during the 1993 to 1995 removal actions, indicated that PCBs were contained in the waste materials. Using this information, PCBs were selected as an identifying contaminant of Raymark waste. In 1993, the 1 mg/kg total PCB standard was selected based on the OSWER directive from August 1990, *Remedial Actions for Superfund Sites with PCB Contamination* (EPA, 1990b). Pursuant to this guidance, samples from properties collected from 1993 to 1995 with PCBs greater than 1 mg/kg were considered above the action level that is protective of human health in a residential exposure scenario without institutional controls. Currently this standard remains at the 1 mg/kg standard for lead.

Currently, the definition of Raymark waste has been refined to state that the PCBs action level is greater than 1 mg/kg Aroclor 1268, for the reasons described below. Aroclor 1262 was dismissed because it was not considered exclusively unique to the former Raymark Facility samples.

- *Wipe samples, taken within the former Raymark Facility buildings that contained processes that most likely used PCBs, had Aroclor 1268.*

- *Samples collected by former Raymark Facility consultants, from the sediments and soils on the facility property where off-specification process waste was dumped to fill in low spots on the property, indicated Aroclor 1268.*

- *Knowledge that PCB usage was probable in manufacturing processes such as Raymark's (plasticizers in phenolic resins and as wax extenders).*

- *No other known users of 1268 Aroclors have been identified in the area (either to jointly dump materials on the properties throughout Stratford and/or to provide disposal materials to Raymark as imported fill material. EPA*

assumes that any fill materials brought onto the Raymark property would have been from local sources as a cost savings to the company).

- *Samples taken from known Raymark waste disposal areas around Stratford over the past 10 years have indicated Aroclor 1268.*

4. **Copper** - Copper was selected as an identifying contaminant because of its predominance in the Raymark waste from samples collected from the 1993 to 1995 removal actions, and the former Raymark Facility. The 288 mg/kg standard was selected by EPA as the identifying benchmark as it is ten times greater than average background concentrations (see Table 1-3).

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