Record of Decision
Barkhamsted - New Hartford Landfill
Superfund Site
Barkhamsted, CT

September 28, 2001

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DECLARATION FOR THE RECORD OF DECISION

A. SITE NAME AND LOCATION

Barkhamsted-New Hartford Landfill
Barkhamsted, Connecticut
CERCLIS ID # CTD980732333

B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Barkhamsted-New Hartford Landfill, in Barkhamsted, Connecticut, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 USC § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended. The Director of the Office of Site Remediation and Restoration (OSRR) has been delegated the authority to approve this Record of Decision.

This decision was based on the Administrative Record, which has been developed in accordance with Section 113 (k) of CERCLA, and which is available for review at the Beardsley & Memorial Library in Winstead, Connecticut and at the United States Environmental Protection Agency (USEPA) Region 1 OSRR Records Center in Boston, Massachusetts. The Administrative Record Index (Appendix E to the ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The State of Connecticut concurs with the Selected Remedy.

C. ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

D. DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for the Barkhamsted-New Hartford Landfill Site, which involves the restoration of contaminated groundwater by monitored natural attenuation (MNA). Institutional controls will be used to restrict the future use of the Site and prevent ingestion and dermal contact with groundwater. Groundwater contamination at the Site, which includes volatile and semi-volatile organic compounds, and low concentrations of metals, constitutes a low-level threat. As a result of previous actions at the Site, groundwater is the only medium requiring remedial action. All source materials and principal threats have been

addressed under the previous action. It is anticipated that the selected remedy is the final site remedy.

The selected remedy is a comprehensive approach for this operable unit that addresses all current and potential future risks caused by groundwater contamination. Specifically, this remedial action includes the plume of contaminated groundwater beneath and downgradient of the Barkhamsted-New Hartford landfill. The remedial measures will allow for restoration of the Site groundwater to cleanup levels. Remediation of the contaminant source was addressed in a previous action.

Previous actions at the Site, conducted as a Non-time Critical Removal Action (NTCRA) lead by the Connecticut Department of Environmental Protection (CTDEP) addressed source materials and principal threat wastes. The selected response action addresses the remaining low-level threat wastes at the Site by treating the wastes via naturally occurring, in-situ processes (natural attenuation) to achieve the cleanup levels.

The major components of this remedy are:

1. Remediation of groundwater to cleanup levels by natural attenuation involving naturally occurring in-situ processes; natural attenuation is expected to last approximately sixteen years before groundwater will meet applicable standards;

2. Installation of groundwater monitoring wells in the down-gradient part of the plume;

3. Institutional Controls to prevent ingestion and contact with contaminated groundwater. Institutional controls for this Site include environmental land use restrictions on present and future uses, and groundwater use restrictions;

4. A public education program involving informational meetings and/or mailings to discuss potential Site hazards;

5. Long Term Monitoring of groundwater, surface water, and sediment to evaluate changes over time and to evaluate the success of the remedial action; and

6. Five-year Review.

E. STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

Upon completion of this remedy, hazardous substances will remain on-site under the

landfill cap and will limit use of the property. For all other areas of the site, upon completion of this remedy to clean up groundwater, no hazardous substances will remain on-site above levels that prevent unlimited use or unrestricted exposure. However, prior to reaching the groundwater clean up goals, groundwater and / or land use restrictions are necessary. This remedy will require greater than five years to achieve its clean up goals; therefore, pursuant to CERCLA section 121(c) and as provided in the current guidance on Five Year Reviews (OSWER Directive 9355.7-03B-P, Comprehensive Five-Year Review Guidance, June 2001), USEPA must conduct policy five-year reviews. Therefore, the first five-year review will be completed five years from the date of the Preliminary Close Out Report (PCOR) and subsequent review will be conducted in five year intervals until cleanup levels are achieved.

F. ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

1.	Chemicals of concern (COCs) and their respective concentrations	page. no. 29
2.	Baseline risk represented by the COCs	page. no. 28
3.	Cleanup levels established for COCs and the basis for the levels	page. no. 65
4.	Current and future land and ground-water use assumptions used in the baseline risk assessment and ROD	page. no. 31
5.	Land and groundwater use that will be available at the Site as a result of the selected remedy	page. no. 64
6.	Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected	page. no. 63
7.	Decisive factor(s) that led to selecting the remedy	page. no. 61

G. AUTHORIZING SIGNATURES

This ROD documents the selected remedy for groundwater at the Barkhamsted-New Hartford Landfill. This remedy was selected by USEPA with concurrence of the Connecticut Department of Environmental Protection.

U.S. Environmental Protection Agency

By: Patricia L. Meaney Date: 9/28/01

Patricia L. Meaney, Director
Office of Site Remediation and Restoration, Region 1

A. SITE, LOCATION AND BRIEF DESCRIPTION

The Barkhamsted-New Hartford Landfill, CERCLIS ID # CTD980732333, is located adjacent to and southwest of Route 44 within the Towns of Barkhamsted and New Hartford, Connecticut. The Potentially Responsible Parties group has been the lead entity for Site activities.

The Site is on a 97.8 acre parcel of land on the northern slope of a hill within the Farmington River Valley in the north central portion of Connecticut, approximately 20 miles northwest of Hartford. The Site is bordered on the northeast by the Barkhamsted Town Garage facility. The remainder of the parcel is bounded by a combination of developed and undeveloped private property. Residences with private drinking wells border the site. A portion of the Site was used as a landfill, owned and operated by the Regional Refuse Disposal District #1 (RRDD#1). The Site previously operated as a landfill, and in 1998 a landfill cap and leachate collection system, surrounded by a fence, were constructed as a Non-Time Critical Removal Action (NTCRA) under CERCLA (see Action Memorandum dated January 19, 1996).

A more complete description of the Site can be found in Section 2 of the Remedial Investigation Report (O'Brien & Gere, 1996).

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

The Barkhamsted Site was utilized for the disposal of solid waste between April 1974 and August 1988. After August 1988, the landfill was utilized only for the disposal of bulky and non-processible waste with the exception of a period during November and December 1988 when the Connecticut Resources Recovery Authority (CRRA) Mid-Connecticut Waste to Energy Plant was inoperable. Recycling activities were conducted at the Site since it was opened. The following table provides a chronology of events at the Site since the formation of RRDD#1:

Date	Activity at the Site
September 1970	RRDD#1 was formed.
September 1972	RRDD#1 received CTDEP solid waste permit #005-2L.
September 1972	RRDD#1 purchased the Barkhamsted property from the Town of Barkhamsted.
January 1974	Modification to the RRDD#1 solid waste permit was issued.

Date	Activity at the Site
April 1974	The landfill became operational.
1974 - 1979	Problems were reported regarding a lack of daily cover material.
1970s	Operation of chemical pit which received oily sludge with metal grindings and degreasers.
April 1974 - August 1988	Barkhamsted Site was utilized for the disposal of solid waste.
1980	CTDEP inspection of the Site.
1981	USEPA conducted a preliminary assessment for the Site.
March 1981	RRDD#1 was requested by the CTDEP to eliminate hazardous waste from the facility.
July 1981	CTDEP formally approved metal grinding waste for disposal at RRDD#1.
1983	Two complaints were received concerning the presence of a large number of drums at the landfill.
April 1983	CTDEP requested that twenty-five drums be relocated from the vicinity of the oak tree northwest of the landfill building to a paved area on-site.
November 1983	Thirty drums were found near the scrap metal area north of the toe of the landfill and northwest of the landfill garage.
December 1983	A modification to the landfill operating permit was issued.
1984	Requirement for a new metal grindings cell. Metal grindings were stored on Site in 55-gallon drums.
September 1986	CTDEP acknowledged the handling of both waste oil and batteries for recycling.
1987	USEPA conducted a Site inspection.
November - December 1988	Disposal of solid waste at the Site because CRRA mid-Connecticut Waste to Energy Plant was inoperable.
August 1988 - October 1993	Disposal of bulky and non-processible waste only.

Date	Activity at the Site
1988	CTDEP document states that one half of the barrels received at the Site contained unspecified amounts of chlorinated hydrocarbons or methyl-ethyl-ketone.
October 1989	Barkhamsted Site listed on NPL
February 1990	A minor amendment was granted to the RRDD#1 solid waste permit allowing the landfill to accept dewatered sludge from the Winstead Publicly Owned Treatment Works (POTW).
November 1992	RRDD#1 implements landfill closure. CTDEP Minor Amendment (to Permit # SW-0005-2L) revises water quality monitoring plan.
October 1993	RRDD#1 stops accepting waste for on-site disposal.
January 1995	CTDEP approves landfill closure.
1998	NTCRA is completed.

On February 27, 1990, a minor amendment was granted to the RRDD#1 solid waste permit allowing the landfill to accept dewatered sludge from the Winstead Publicly Owned Treatment Works (POTW). The sewage sludge was brought to the Site and incorporated into the landfill cover material.

Industrial wastes, including metal grinding waste, oily sludge with metal grindings and degreasers, barrels containing unspecified amounts of chlorinated hydrocarbons and methyl-ethyl-ketone, and keratin (a food processing waste) were accepted at the Site. Dry metal grinding waste was reportedly utilized on Site roads and incorporated into the landfill daily cover. CTDEP records state that an industrial waste pit was operated at the Site during the first year of landfill operation (Fuss & O'Neill, 1991b).

Landfill closure was implemented in November 1992 in accordance with the Landfill Closure Plan (Fuss & O'Neill 1992). In addition, water quality monitoring was revised in accordance with a minor amendment to Permit No. SW-0005-2L. RRDD#1 ceased accepting wastes for on-site disposal in October 1993. Final landfill closure was approved by CTDEP in January 1995.

A more detailed description of the Site history can be found in Section 1.2 of the Remedial Investigation Report.

2. History of Federal and State Investigations and Removal and Remedial Actions

In 1981, the USEPA conducted a preliminary assessment for the Site Study Area based on a 1980 CTDEP inspection, and recommended that an inspection take place. USEPA's inspection reported that a groundwater sample collected and analyzed prior to the inspection contained total xylene (92 ppb), toluene (870 ppb), 1,1-dichloroethane (86 ppb), 4-methyl-2-pentanone (1700 ppb), and vinyl chloride (170 ppb). In addition, the inspection reported that industrial oily metal grinding sludges disposed of at the Site contained cadmium, chromium, copper, lead, manganese, nickel and zinc. Leachate from the landfill was observed discharging into the Unnamed Brook during this inspection.

Pursuant to Section 105(8)(b) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Barkhamsted Site was proposed for inclusion on the National Priorities List (NPL) on June 21, 1988 (53 FR 23988). The Barkhamsted Site was listed on the NPL on October 5, 1989 (NPL final rule update #6, 54 FR 41015).

In 1990, a state Administrative Order No. 666 was issued by CTDEP. This Administrative Order required RRDD#1 to: 1) investigate the waste materials and disposal activities on Site; 2) determine the potential impact of such activities or such waste on human health both on Site and off Site; 3) determine the existing and potential extent and degree of soil, groundwater, and surface water pollution; and 4) identify potential impacts of polluted groundwater and surface water on public and private drinking water supplies. A Scope of Study was prepared and implemented on behalf of RRDD#1 to satisfy the requirements of the CTDEP Order. The results of the investigation were presented in the RRDD#1 Landfill Site Investigation Report by Fuss & O'Neill, December 1991 (Fuss & O'Neill, 1991b).

A CERCLA Administrative Order on Consent (Docket No. I-91-1128) to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Site Study Area to the Barkhamsted Site Potentially Responsible Party (PRP) Group, by the USEPA, with the concurrence of the State of Connecticut, became effective on October 4, 1991. During December 1991 and January 1992, the PRPs performed a Limited Field Investigation (LFI) at the Site Study Area pursuant to an LFI Work Plan approved by USEPA in December 1991. The purpose of the LFI was to produce a focused Work Plan for the RI. The results of the LFI are presented in the RI Work Plan, which received conditional approval from the USEPA effective October 1, 1992.

The field work conducted pursuant to the approved RI Work Plan was performed between October 1992 and October 1993. The results of the investigation are presented in the RI Report (O'Brien & Gere Engineers, Inc., February 1996) approved by USEPA on March 7, 1996.

In April 1994, the PRPs prepared and submitted an Engineering Evaluation/Cost Analysis (EE/CA) for removal actions to be implemented as a NTCRA. As part of the NTCRA the USEPA presumptive remedy for CERCLA municipal landfill sites, including a cap, would be implemented. The final EE/CA Report (O'Brien & Gere 1994) was submitted to the USEPA on September 22, 1994 and approved by the Agency on September 26, 1994. Based on the report, the USEPA prepared an Action Memorandum dated January 19, 1996 to document approval of

the NTCRA (Appendix 1-1). USEPA and CTDEP executed an enforcement agreement, dated August 22, 1996, so that CTDEP could oversee the NTCRA with the legislature providing funding to the CTDEP to implement the action. CTDEP and RRDD#1 subsequently entered into Consent Order #SRD-072 requiring RRDD#1 to design and implement the NTCRA approved by the Action Memorandum.

In September 1996, a draft *Conceptual Design Report* (O'Brien & Gere 1996b) was submitted to the CTDEP. Comments on the draft *Conceptual Design Report* were received from the CTDEP by copy of a letter dated October 31, 1996. Responses to the CTDEP comments were provided by the PRPs in a letter dated November 22, 1996.

In accordance with Section B.1.e of the Consent Order (#SRD-072), RRDD#1 prepared the Remedial Action Plan (O'Brien & Gere Engineers, Inc., April 1997) for the NTCRA to be completed at the Barkhamsted Site. The Remedial Action Plan, Technical Specifications, Contract Drawings, and the Subsurface Investigations document represent the Final Remedial Design for the Site.

The NTCRA included the following major components:

- Relocation of contaminated soil, sediment, and refuse to within the limits of the area to be capped
- Installation of a leachate collection system
- Installation of a 15,000-gallon double-walled underground leachate storage tank and associated appurtenances
- Capping of the landfill with a low-permeability capping system
- Relocation of an existing stream
- Vertical extension of active groundwater monitoring wells located within the limits of the capped area, and abandonment of monitoring wells no longer being used
- Site restoration
- Installation of perimeter security fencing
- Institutional controls for protection of the landfill cap

3. History of CERCLA Enforcement Activities

On May 21, 1991, USEPA notified approximately thirty-nine parties of their potential

liability because they either owned or operated the facility, generated hazardous wastes that were shipped to the facility, arranged for the disposal of hazardous wastes at the facility, or transported hazardous wastes to the facility. Negotiations commenced with these potentially responsible parties (PRPs) within 60 days of USEPA notification regarding the settlement of the PRPs' liability at the Site.

The PRPs formed a steering committee and substantial negotiations have taken place. On October 4, 1991, an Administrative Order on Consent was signed. Under this agreement, twenty-three members of the PRP group agreed to develop the RI/FS. The FS was submitted for public comment in June of 2001 and will be considered final upon the execution of this Record of Decision.

The PRPs have been active in the remedy selection process for this Site. The PRP group has publicly endorsed USEPA's proposed plan for remedial action.

C. COMMUNITY PARTICIPATION

Throughout the Site's history, community concern and involvement has varied. Since completion of the landfill cap under the NTCRA, community interest has been at a low level. The USEPA and CTDEP have kept the community and other interested parties apprized of Site activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach efforts.

- In June 1991, the USEPA published a fact sheet to describe the PRP search process and to provide basic information about the Superfund program and the history of the Barkhamsted - New Hartford Landfill Site.
- In October 1991, USEPA awarded a Technical Assistance Grant to an existing local community group, Barkhamsted Residents Acting to Conserve the Environment (BRACE).
- In December 1991, USEPA conducted community interviews in preparation for a Community Relations Plan.
- In April 1992, USEPA released a Community Relations Plan that outlined a program to address community concerns and keep citizens informed about and involved in remedial activities.
- In September 1992, USEPA published a fact sheet to describe plans for the Remedial Investigation and Feasibility Study and to also provide an update on the enforcement process.

- In 1994, USEPA made the administrative record available for public review at USEPA's offices in Boston and at the Beardsley & Memorial Library, 690 Main Street, Winstead, Connecticut. This is the primary information repository for local residents and will be kept up to date by USEPA.

- In December 1994, USEPA published a fact sheet to describe the proposed action and technical alternatives evaluated in the Engineering Evaluation / Cost Analysis, and to announce a public meeting.

- On December 14, 1994, USEPA held an informational meeting at the Barkhamsted Elementary School to describe the proposed action and technical alternatives evaluated in the Environmental Engineering / Cost Analysis.

- On January 11, 1995, USEPA held a formal public hearing to solicit public input on the proposed landfill capping interim action. The public comment period was extended by 15 days and resulted in a 45 day comment period, December 15, 1994 through January 30, 1995.

- In July 1997, the Connecticut Department of Public Health published a fact sheet to summarize the findings of the Public Health Assessment completed in March, 1997.

- In March 1998, USEPA published a fact sheet and held a public information meeting to describe upcoming construction activity and schedules for the NTCRA landfill work.

- In March 1999, USEPA published a fact sheet to provide an update of Site construction activity completed to date, and the schedule for activity during 1999.

- In March 2000, USEPA published a fact sheet to describe the alternatives being evaluated in the Feasibility Study and to describe the nine CERCLA criteria and the public participation process to follow the Feasibility Study.

- During the week of June 21, 2001 USEPA published a notice and brief analysis of the Proposed Plan in The Register Citizen and made the plan available to the public at the Beardsley & Memorial Library.

- USEPA community involvement staff canvassed the local residents, going door to door during March 1998 prior to the public meeting and again in June 2001 prior to the Proposed Plan public comment period to solicit any new community concerns or questions about the Site.

- From June 21, 2001 to July 20, 2001, the Agency held a 30 day public comment period to accept public comment on the alternatives presented in the FS and the Proposed Plan and on any other documents previously released to the public.

- On June 20, 2001, USEPA held an informational meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan to a broader community audience than those that had already been involved at the Site. At this meeting, representatives from USEPA and CTDEP answered questions from the public.

- On July 18, 2001, the Agency held a public hearing to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting and the comments and the Agency's response to comments are included in the Responsiveness Summary which is part of this ROD.

D. SCOPE AND ROLE OF RESPONSE ACTION

The response action contained in this ROD is the final Site remedy and is intended to address fully the threats to human health and the environment posed by the conditions at this Site. This is the first and only operable unit for the Barkhamsted-New Hartford Landfill Site. The selected remedy, selected after evaluating four management migration alternatives, combines management of migration with source control (NTCRA) to obtain a comprehensive approach for Site remediation. In summary, the remedy provides for the restoration of the contaminated groundwater beneath and downgradient of the landfill by natural attenuation to cleanup levels after approximately sixteen years. Institutional controls will be implemented to control Site use, and environmental monitoring will be implemented to evaluate the success of the cleanup and provide information for the five year reviews. A public education program, involving informational meetings and/or mailings, will be implemented to discuss potential Site hazards.

The NTCRA previously addressed Site source materials. The NTCRA, which involved the relocation of contaminated soil and refuse to within the limits of the area to be capped, installation of a leachate collection system, capping of the landfill with a low-permeability capping system, and relocation of an existing stream, was completed in 1998. The source materials addressed by the NTCRA constituted the principal threat contaminants at the Site.

The principal and low-level threats that this ROD addresses are summarized in the following tables:

Principal Threats	**Medium**	**Contaminant(s)**	**Action To Be Taken**
None	None	None	None

Low-Level Threats	Medium	Contaminant(s)	Action To Be Taken
Groundwater	Groundwater	VOCs SVOCs inorganics	Natural attenuation

In summary, the response action contained in this ROD addresses the remaining threats to human health and the environment posed by the Site. This remedy represents the final remedy anticipated for the Site.

E. SITE CHARACTERISTICS

This section summarizes information obtained as part of the RI/FS activities at the Site. A Conceptual Site Model (CSM) is first presented. The CSM is a three-dimensional "picture" of Site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. It documents current and potential future Site conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors.

Following the CSM, descriptions of the investigative and analytical strategies that were employed during the RI/FS process are presented, along with a synopsis of the results of those investigations. The nature and extent of contamination are summarized for all affected media at the Site, although this remedy applies only to Site groundwater.

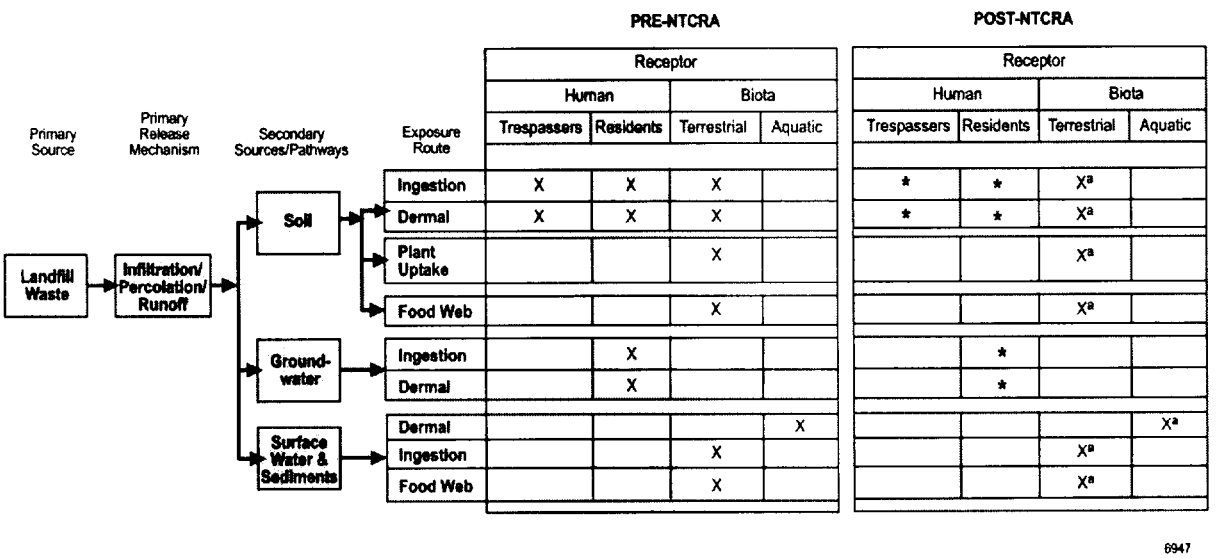
Conceptual Site Model

The landfilled wastes are the source of contamination at the Site. During its period of operation, wastes deposited in the landfill reportedly included metal grinding waste and oily sludge and degreasers.

A drum crushing operation also operated at the landfill, and barrels of chlorinated hydrocarbons and methyl ethyl ketone were reportedly accepted. The means by which contaminants were released to the soil are not known, but possibilities include direct disposal of liquids; leakage of liquids from containers; and disposal of wastes containing liquid or solid contaminants in direct contact with the soil. Some of the contaminants became dissolved in infiltrating precipitation and were transported down into the overburden and bedrock aquifers. A portion of the infiltrating precipitation did not percolate to the water table but instead flowed laterally on poorly permeable layers until it emerged as seeps on the sides of the landfill. Contaminated water from the seeps, as well as contaminated runoff from the landfill surface,

either infiltrated the ground or flowed off into surface waters. Due either to contaminated surface water or to contaminated groundwater discharging to the surface water, some sediments in the surface water bodies also became contaminated.

The risk assessment and response action for the groundwater are based on this CSM. The risk assessment was prepared prior to implementation of the NTCRA in 1995. Subsequent to implementation of the NTCRA, the USEPA conducted a risk screening in order to update Site risks. Figure 1, the CSM, details Site risks both before and subsequent to the implementation of the NTCRA. The response actions detailed in this ROD are based on post-NTCRA risks.



* Exposure prevented by capping or institutional controls

Xa Exposure only to media outside of cap

Figure 1

FIGURE BARKHAMSTED LANDFILL CONCEPTUAL SITE MODEL

General Site Characteristics

The Site is on a 97.8-acre parcel of land (Figure 2) on the northern slope of a hill within the Farmington River Valley, in the north central portion of Connecticut. It is surrounded primarily by mixed hardwood and conifer forests. There is one surface water body, the Unnamed Brook, which originates south of the Site and flows north along the west side of the landfill area. Once beyond the landfill, the brook curves to the northeast and flows under Route 44, where it

enters the Farmington River flood plain and a series of small beaver ponds. It eventually flows into the Farmington River, 0.25 miles southeast of the Site.

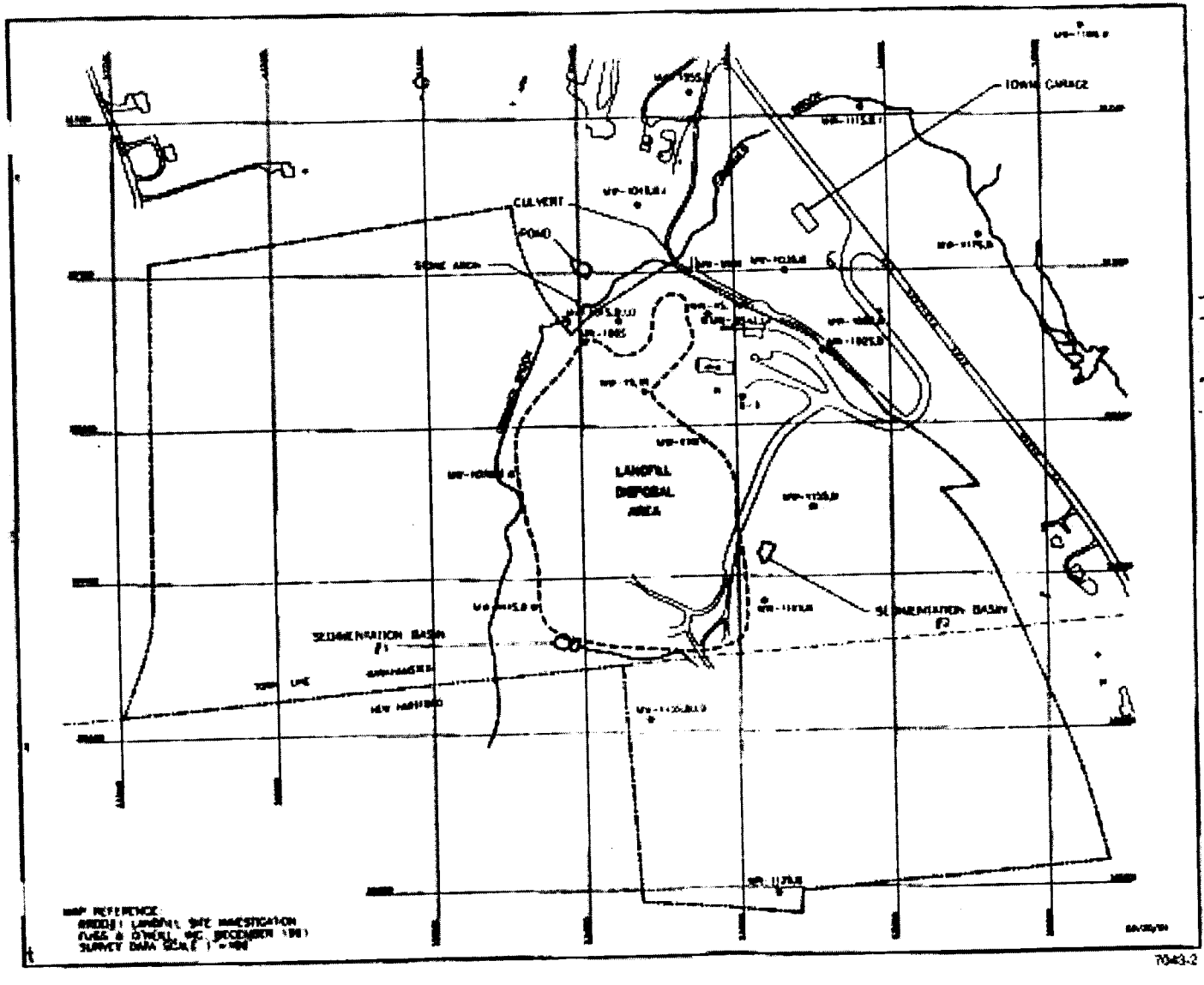
The Site is bordered on the northeast by the Barkhamsted Town Garage facility. The remainder of the parcel is bounded by a combination of developed and undeveloped private property. Residences with private drinking wells border the Site. There are no known areas of archaeological or historical importance. A portion of the Site was used as a landfill. Other areas of the property contain a transfer station, a recycling area, a maintenance and office building, and dense woods. Activities included analysis of samples of soil, groundwater, surface water, sediment, and air at and around the Site. Each medium that was investigated during the RI is discussed separately below.

Soil

During the RI, soil samples were collected both to determine the nature and extent of contamination and to conduct a risk assessment. The strategy for these investigations was to first identify, both within and beyond the limits of the contiguous landfill, potential source areas and areas for further investigation. Geophysical surveys and a soil gas sampling program were then performed within the selected areas to identify specific locations of potential contamination.

Following the preliminary investigations in the subareas of the Site, 24 surface soil samples were collected to support the risk assessment. Soil samples were collected within the limits of refuse, around the perimeter of the landfill, at up gradient (background) locations, and in a residential area along US Route 44. These samples were collected from a depth of 0 to 1 foot and were analyzed for Target Compound List/Target Analyte List (TCL/TAL) volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PCBs/pesticides, and inorganics. Grain-size analyses were also conducted on the samples. Laboratory analytical results are presented in the RI Report (O'Brien & Gere, 1996). Generally, VOCs and PCBs/pesticides were found at trace levels or not detected in the surface soil samples. SVOCs were detected, but at concentrations below the standards of the Connecticut Remediation Regulations. Inorganics, or metals, were detected at concentrations up to two to three times greater than background in several areas. In one area where metal grindings were handled, the metals concentrations were up to two orders of magnitude higher than background.

Soil borings were drilled at 32 locations to define the nature and extent of soil contamination. The borings were located within the limits of refuse, around the perimeter of the landfill, and at up gradient (background) locations. The locations of the borings, like those of the surface soil samples, were based on the results of the geophysical surveys and the soil gas sampling program. Soil samples were collected continuously to the water table, to naturally-occurring soil, or to a depth of 10 feet in most cases. The soil samples were screened in the field, and at least one sample per boring was analyzed for TCL/TAL VOCs, SVOCs, PCBs/pesticides, and inorganics. The occurrence of VOCs, SVOCs, and inorganics were found to be highly correlated with the presence of waste. The occurrence of PCBs/pesticides was very limited. Based on the results of the soil boring program, the boundary denoting the limits of refuse was



LEGEND

RESCO PROPERTY LINE

TOWN LINE

MONITORING WELL LOCATION

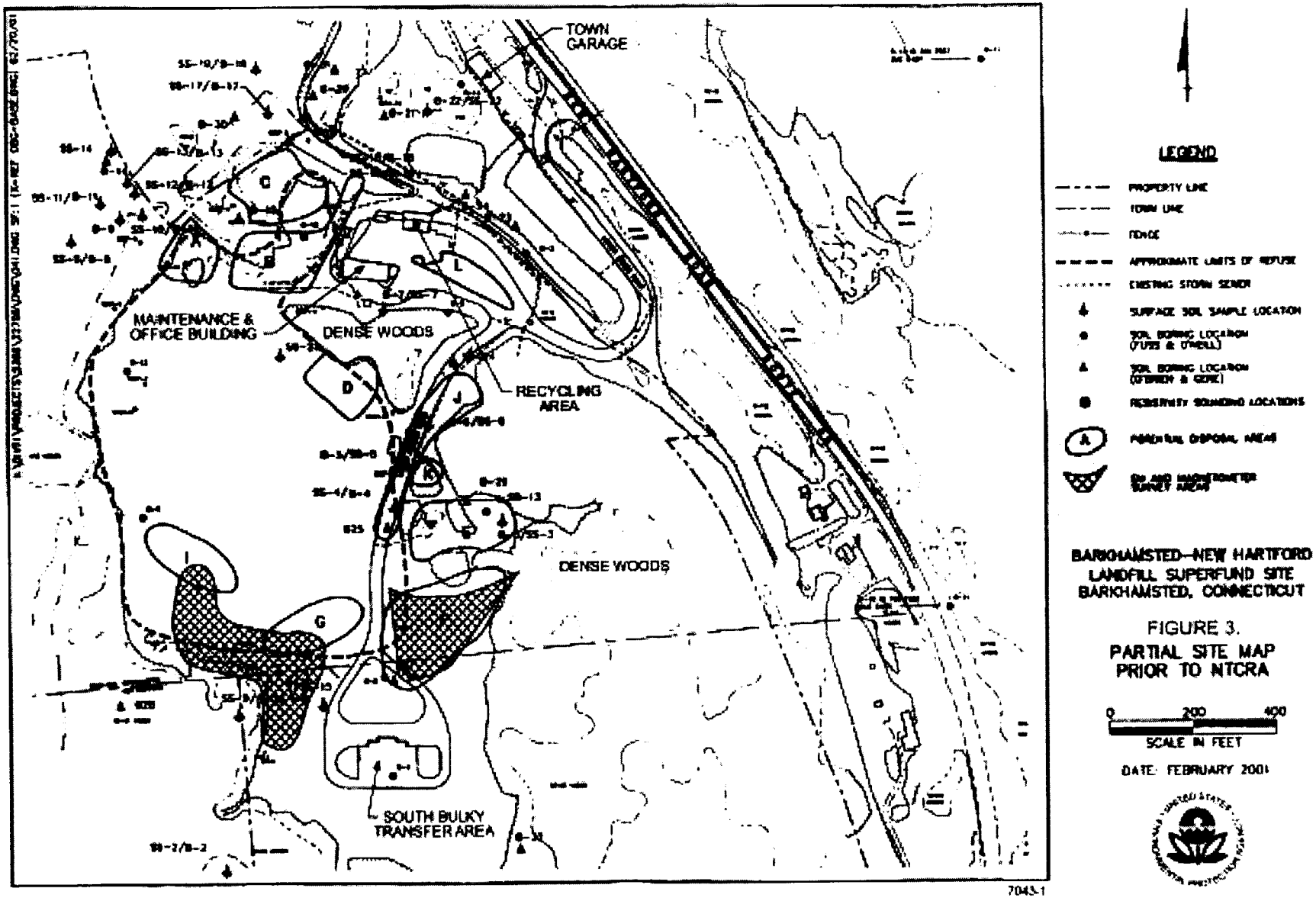
LIMITS OF REFUSE

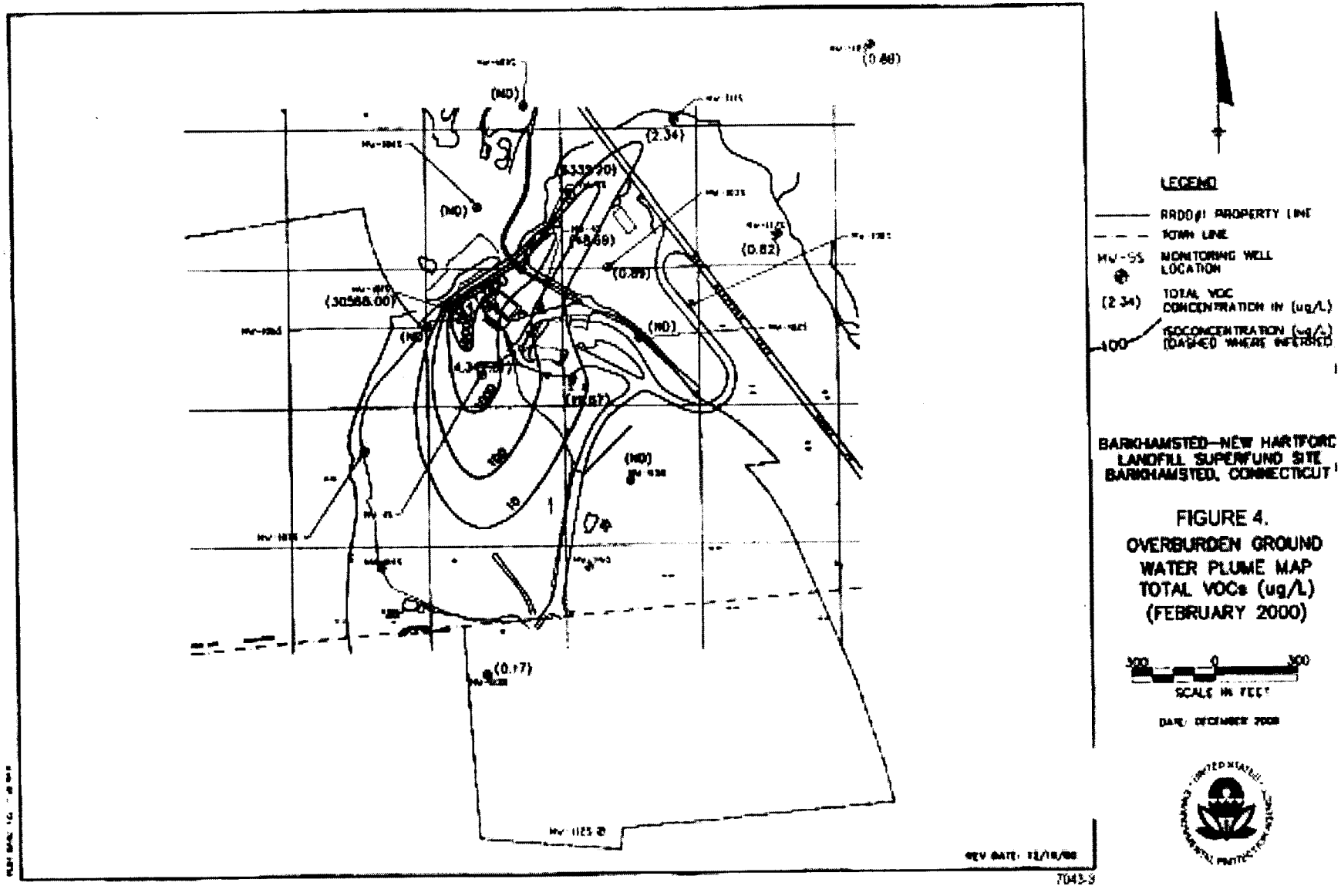
BARKHAMSTED–NEW HARTFORD
LANDFILL SUPERFUND SITE
BARKHAMSTED, CONNECTICUT

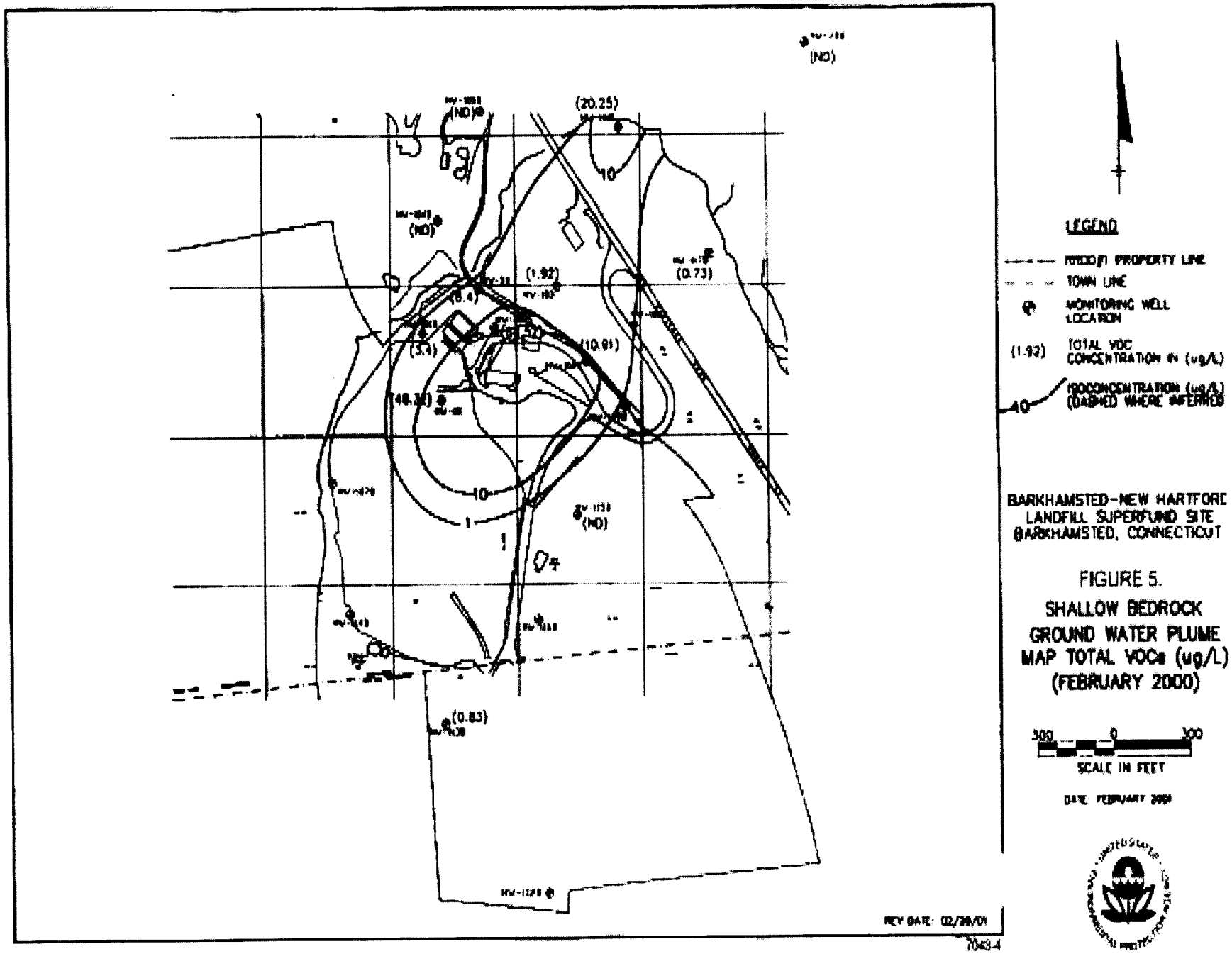
FIGURE 2.
SITE MAP

300 150 0 300

APPROX SCALE IN FEET


TOWN GARAGE
MAINTENANCE & OFFICE BUILDING
DENSE WOODS
RECYCLING AREA
DENSE WOODS
SOUTH BULKY TRANSFER AREA
LEGEND
PROPERTY LINE
TOWN LINE
FENCE
APPROXIMATE LIMITS OF REFUSE
EXISTING STORM SEWER
SURFACE SOIL SAMPLE LOCATION
SOIL BORING LOCATION (FUSS & O'NEILL)
SOIL BORING LOCATION (O'BRIEN & GERE)
RESISTIVITY SOUNDING LOCATIONS
POTENTIAL DISPOSAL AREAS
GAS AND GROUNDWATER SURVEY AREA
BARKHAMSTED–NEW HARTFORD LANDFILL SUPERFUND SITE BARKHAMSTED, CONNECTICUT
FIGURE 3.
PARTIAL SITE MAP PRIOR TO NTCRA
0
200
400
SCALE IN FEET
DATE: FEBRUARY 2001
7043-1


(0.68)
(ND)
(2.34)
(ND)
(0.82)
(0.89)
(ND)
(ND)
(0.17)
LEGEND
PROPERTY LINE
TOWN LINE
MW-55 MONITORING WELL LOCATION
(2.34) TOTAL VOC CONCENTRATION IN (ug/L)
100 ISOCONCENTRATION (ug/L) (DASHED WHERE INFERRED)
BARKHAMSTED—NEW HARTFORD LANDFILL SUPERFUND SITE BARKHAMSTED, CONNECTICUT
FIGURE 4.
OVERBURDEN GROUND WATER PLUME MAP TOTAL VOCs (ug/L) (FEBRUARY 2000)
300 0 300
SCALE IN FEET
DATE: DECEMBER 2000
7043-9


(ND)
(20.25)
(ND)
(1.92)
(0.73)
(10.91)
(ND)
(0.83)
LEGEND
PROPERTY LINE
TOWN LINE
MONITORING WELL LOCATION
(1.92) TOTAL VOC CONCENTRATION IN (ug/L)
10 VOC CONCENTRATION (ug/L) (DASHED WHERE INFERRED
BARKHAMSTED-NEW HARTFORD LANDFILL SUPERFUND SITE BARKHAMSTED, CONNECTICUT
FIGURE 5.
SHALLOW BEDROCK GROUND WATER PLUME MAP TOTAL VOCs (ug/L) (FEBRUARY 2000)
300 0 300
SCALE IN FEET
DATE FEBRUARY 2000
REV DATE: 02/28/01
7043-4

adjusted in some places.

The final investigation related to delineation of the sources of contamination was the excavation of 29 test pits to define the limits of refuse around the landfill periphery. The limits of refuse, based on visual observation of subsurface materials, were staked at each test pit and subsequently surveyed. The limits defined by the test pits correlated well with the information developed during the other investigative activities.

Contaminants of concern (COCs) were selected from the constituents detected in the soil based upon the unacceptable risk posed by the contaminant. The COCs identified in soil included VOCs, SVOCs, and inorganics.

Groundwater

Prior to the RI, 31 monitoring wells had been installed at the Site to sample groundwater and monitor water levels. An additional 22 monitoring wells were installed during the RI. In order to characterize the vertical extent of contamination, wells were installed in the overburden and at three depths in the bedrock: shallow, intermediate, and deep. In most cases, the wells were installed as multi-depth clusters and were located up gradient, cross-gradient, and downgradient of the landfill.

Hydraulic conductivity testing of the overburden and bedrock aquifers was conducted during and after the installation of the new wells. The test results for the overburden indicated hydraulic conductivities ranging from 0.1 to 7.5 ft/day. The ranges of values for the shallow and intermediate bedrock were similar, ranging from 0.001 to 43 ft/day. One test in the deep bedrock yielded a value of 0.002 ft/day.

Two rounds of samples were collected from the monitoring wells during the RI. All of the wells were sampled in the first round, and all but three clusters were sampled in the second round. Samples were analyzed for TCL/TAL VOCs, SVOCs, PCBs/pesticides, and inorganics. The groundwater was found to contain numerous contaminants including acetone, 2-butanone, toluene, trichloroethene, 4-methylphenol, 2,4-dimethylphenol, 2-methylphenol, phenol, and a number of metals.

Since the completion of the RI, four additional rounds of groundwater sampling have been conducted. Not all of the original RI wells have been sampled in the subsequent rounds, since some wells were abandoned during the NTCRA. Most recently, samples were collected in December 1999 and February 2000 to update the risk assessment, to confirm the extent of the plume, and to estimate the extent to which natural attenuation is occurring. This more recent sampling has shown that the concentrations of most contaminants in the groundwater have declined since the RI. A notable exception is toluene, the concentration of which rose significantly in two overburden monitoring wells close to the landfill. During the RI, the plume of contaminated groundwater was found to migrate predominantly in the overburden and the shallow bedrock aquifers to the north and northeast of the landfill. Although monitoring wells in

the intermediate and deep bedrock also contained contaminants at the time of the RI, the levels of contamination have been substantially lower in more recent sampling rounds. There are no NAPLs (non-aqueous phase liquids) known to be present at the Site.

The plume of contaminated groundwater flows out from beneath the northeastern side of the landfill. Some of the plume discharges to the Unnamed Brook, while the remainder migrates in a northeasterly direction (subparallel to the brook) beyond Route 44 and into the flood plain of the Farmington River. The plume is generally about 300 feet wide in the overburden (Figure 4) downgradient of the landfill and somewhat wider in the shallow bedrock (Figure 5). Since the bulk of the plume migrates within the overburden and the shallow bedrock aquifers, the vertical extent of the plume is generally between 10 and 50 feet below the ground surface. Lesser concentrations of contaminants occur in wells in the deep bedrock aquifer, at depths of about 200 feet.

Along the path of the plume, the overburden aquifer is generally 10 to 20 feet thick and consists of glacial till and the overlying ice-contact deposits. The overburden aquifer is unconfined. At its most downgradient extent, the plume migrates into glacial outwash deposits that underlie the Farmington River valley. The outwash deposits are about 40 to 50 feet thick in the vicinity of the plume.

The bedrock at the Site is predominantly micaceous schist with thin beds of amphibolite and pegmatite intrusions. The designation "shallow" bedrock generally refers to the upper 10 to 20 feet.

In the vicinity of the landfill, vertical gradients at multi-well clusters indicate the potential for downward flow of groundwater. Conversely, along the Unnamed Brook north of the landfill and in the Farmington River valley, vertical gradients are upward.

Prior to the implementation of the NTCRA, the origin of the groundwater contamination at the Site was precipitation that infiltrated through the landfill cover and dissolved contaminants as it percolated downward through the waste. The RI also indicates that, due to groundwater mounding within the landfill, some of the contamination originated from waste that lay within a zone of saturation. Since the capping of the landfill, infiltration of precipitation has been largely eliminated along with that source of groundwater contamination.

In addition to the monitoring wells, ten domestic water supply wells to the north and east of the Site were sampled one time during the RI. The samples from these wells were analyzed for the same parameters as the monitoring wells. These 10 wells were a subset of a large number of water supply wells that were identified during a groundwater users survey that extended one mile from the Site. The wells were selected from the larger group based on their position relative to the landfill and the direction of groundwater movement in the bedrock aquifer. No contaminants related to the Site were detected at concentrations above the applicable standards in the domestic supply wells.

COCs for groundwater include 14 VOCs, four SVOCs, and four inorganics. The COCs

were selected from the constituents detected in groundwater based on the unacceptable risks that those contaminants present.

COCs have migrated off-Site in the groundwater system within both the overburden and the bedrock aquifers, so ingestion of water from wells that intercept the plume is a potential subsurface route of human exposure. Residential and institutional properties that surround the Site obtain their water from individual supply wells. No currently active drinking water wells are known to be affected by contaminants from the Site. However, if public or private water supply wells were installed within or near the plume in the future, contaminants from the Site could affect them.

WINTRAN, an analytical two-dimensional groundwater flow and transport model, was used during the Feasibility Study to simulate the fate and transport of COCs at the Site. Separate models were used for the overburden and bedrock aquifers. In both models, the groundwater flow portion of the WINTRAN model was used to simulate steady-state flow between a constant head source and sink. The Unnamed Brook could not be included because the model could not be calibrated with that feature in the simulations; therefore, it was assumed that no groundwater discharges to surface water.

The transport portion of the model incorporated the effects of advection, dispersion, retardation, and contaminant degradation. Two COCs for the groundwater, 4-methylphenol and 2-butanone, were simulated. Since these compounds are present in high concentrations in the plume and are fairly soluble in water, the cleanup times for these compounds represent conservative estimates of the time for remediation of all groundwater COCs. The source of these contaminants was simulated with low-rate injection wells in the landfill area. The assumption was made that, when the landfill was capped, the source of contaminants was eliminated. Based on trends in the groundwater monitoring data through the RI/FS period, fairly high rates of contaminant degradation were projected by the model calibration. However, due to the uncertainties that are associated with contaminant transport modeling, the predicted cleanup times must be considered estimates. The uncertainties in the model predictions arise from the inability to simulate the complex physical and chemical heterogeneities of the aquifer/plume system and the limited water quality data for calibration.

Leachate Seeps

A number of leachate seeps had been located at the Site during pre-RI investigations. During the RI, a survey of the Site was conducted to identify all potential seeps. Twelve seeps were found, most of which had an ultimate discharge point of the Unnamed Brook.

Samples of the discharge from the seeps were collected on two occasions during the RI. All 12 seeps were sampled in the first round, but only nine were sampled in the second. The samples were analyzed for TCL/TAL VOCs, SVOCs, PCBs/pesticides, and inorganics in most cases. The contaminants detected at the highest concentrations include acetone, 2-butanone, toluene, 4-methyl-2-pentanone, phenol, 4-methylphenol, and a number of metals including iron,

aluminum, and manganese. The leachate seeps were determined to be directly affecting water quality in the Unnamed Brook.

Since the capping of the landfill, infiltration of precipitation has been largely eliminated. It is expected that the seeps will eventually dry up and cease to be a source of surface water contamination because infiltrating precipitation would have been the source of water for any perched zones of saturation within the landfill.

Surface Water

Surface water samples were collected twice during the RI. Sixteen locations for samples were designated, upstream, downstream, and proximal to the landfill; however, in each sampling round, one sample was omitted. Most of the locations sampled were in the Unnamed Brook, except two that were in the sedimentation basins for the landfill. Samples were analyzed for TCL/TAL VOCs, SVOCs, PCBs/pesticides, and inorganics in most cases. Downstream surface water samples contained generally low concentrations of Site-related VOCs and SVOCs; however, metals were found to represent the most significant impact of the landfill on surface water.

Recent sampling (December 1999, February 2000), conducted since the implementation of the NTCRA, demonstrates that no constituents exceed the surface water criteria identified in the ecological risk assessment.

Sediment

Sediment samples were collected at locations where surface water samples and leachate seep samples were collected. The sediment samples at the surface water sample locations were collected twice during the RI, at all 16 locations in the first round and at 14 locations in the second round. Samples were analyzed for TCL/TAL VOCs, SVOCs, PCBs/pesticides, and inorganics in most cases. The sediment samples were also analyzed for grain-size distribution. Downstream sediment samples contained generally few VOCs, numerous SVOCs, low concentrations of several pesticides, and metals at concentrations that were up to an order of magnitude above background results.

Sediment samples were also collected at locations where leachate seep samples were collected. The sediment samples at the leachate seep sample locations were collected on two occasions during the RI, at three locations in the first round and at three different locations in the second round. Samples were analyzed for TCL/TAL VOCs, SVOCs, PCBs/pesticides, and inorganics in most cases. The sediment samples were also analyzed for grain-size distribution. Numerous VOCs, SVOCs, pesticides, and metals were detected in the leachate seep sediment samples.

During the performance of the NTCRA, an approximate 340-ft reach of the Unnamed Brook on the west side of the landfill was relocated, with the former section of the brook being

filled and covered with soil. Additionally, sediments were excavated from an approximate 70-ft reach of the brook near the northwest corner of the landfill, and placed beneath the cap during the NTCRA construction.

Air

During the RI, air samples were collected to evaluate whether Site-related residues were being transported from the Site in the air. Seven air sampling stations were established, including locations within the limits of refuse, around the perimeter of the landfill, and at two residential properties adjacent to the Site. The strategy for these investigations was to collect samples prior to and during the conduct of invasive Site investigation activities. Samples were collected continuously over a period of about 8 hours on four dates, two prior to and two during episodes of monitoring well drilling. Wind speed and direction, temperature, and atmospheric pressure data were also collected.

The samples were analyzed for TCL/TAL VOCs, SVOCs, and, at one of the seven stations, for respirable particulates. The results were compared to Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). Since these standards are developed for repeated exposures in industrial settings, they were considered conservative for evaluating community health issues at the Site.

For all sampling events, the detected VOCs and SVOCs were present at concentrations at least 100 times less than the PELs and TLVs. The average particulate concentrations were also below the standards.

Principal Threats

Principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. Wastes generally considered to be principal threats are liquid, mobile and/or highly-toxic source material. All principal threats have been addressed by the NTCRA and, therefore, are not discussed further.

Low-Level Threats

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that are generally considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or groundwater, low leachability contaminants or low toxicity source material. The low-level threats remaining on-site include the contaminants remaining in Site

groundwater, including VOCs, SVOCs, and metals. A low level threat to invertebrates in the Unnamed Brook may also remain due to barium and manganese in the sediments.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The current land uses at the Site include the closed landfill, a transfer station, a recycling area, a maintenance and office building, and dense woods. Land use in areas adjacent to and surrounding the Site currently include the Barkhamsted Town Garage facility to the northeast; a Connecticut Department of Transportation facility to the north; residential properties to the northwest; residential and commercial properties farther to the north and directly east along Route 44; and primarily undeveloped wooded land to the west and south. Based on the zoning and the groundwater use and value determination, the reasonably anticipated future uses of the Site, the adjacent land, and the surrounding areas are the same as the current uses.

Groundwater is the sole water supply for homes and businesses in the vicinity of the Site and would need to be used by any future development in the area. These homes and businesses extract groundwater from private individual wells since no public water system exists in the immediate vicinity of the Site.

Groundwater beneath the landfill and in the surrounding area is classified as GA. The GA classification signifies that the groundwater is presumed to be of natural quality and suitable for drinking without treatment. The State's policy for GA groundwater is to maintain or restore all groundwater in such areas to its natural quality. Connecticut's Water Quality Standards are an important element of Connecticut's USEPA-endorsed Core Comprehensive State Groundwater Protection Program. The groundwater classifications assigned under these standards have been derived through careful consideration of many of the same factors addressed in USEPA's *Groundwater Use and Value Determination Guidance*. A hierarchy of designated uses is included for each groundwater classification.

In addition to the assigned groundwater classification, a Ground Water Use and Value Determination for the Barkhamsted-New Hartford Landfill was prepared by the Bureau of Water Management of the Permitting, Enforcement & Remediation Division, Federal Remediation Program, CTDEP. The evaluation resulted in the assignment of an overall Use and Value of Medium to the groundwater in the review area surrounding the Site.

A highly productive stratified drift aquifer is located in the valley of the Farmington River West Branch, just east of the Site. To the southeast of the Site, this aquifer supplies water to two wells of the New Hartford Water Company. Contaminated groundwater from the Site reaches this aquifer, although there is no evidence that any public or private water supply wells have been affected except those at the landfill itself and the nearby Barkhamsted Highway Department garage. The well at the landfill was completed in bedrock and extended to a depth of 160 feet below grade. No records were available regarding the highway department well.

Any future public water supplies developed in this area would most likely rely on the stratified drift aquifer. However, the plume does not represent a significant threat to such potential wells. This conclusion is based on two factors. First, the plume reaches the stratified drift aquifer, but is not significantly impacting the aquifer. The plume undergoes some attenuation before entering the stratified drift aquifer. Secondly, the area of the plume comprises a small fraction of the total recharge area of the stratified drift aquifer, so the plume is significantly diluted once it enters the stratified drift.

Groundwater from the Site provides significant base flow to the Unnamed brook and is a minor component of the hydrologic budget of the West Branch Farmington River and associated wetlands. Significant wetlands are not associated with the Unnamed brook, and it does not provide significant wildlife habitat. In contrast, the Farmington River is a valuable ecological resource. It has also been designated by the U.S. Department of the Interior as a Wild and Scenic River. Since groundwater from the Site provides only a small component of the flow in the Farmington River, the contamination is not expected to impact the ecological functions and values of the river. No watersheds for public surface water supplies are affected by the Site.

G. SUMMARY OF SITE RISKS

A baseline risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The public health risk assessment followed a four step process: 1) hazard identification, which identified those hazardous substances which, given the specifics of the Site were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates. A summary of those aspects of the human health risk assessment which support the need for remedial action is discussed below followed by a summary of the environmental risk assessment.

1. Human Health Risk Assessment

Of the media evaluated in the human health risk assessment (peripheral soil, groundwater, seep water and brook surface water/sediment), only future groundwater exposure posed an unacceptable risk. Of the 56 chemicals detected in the groundwater plume at the Site during the December 1999 and February 2000 sampling rounds, 22 were selected for evaluation in the human health risk assessment as chemicals of concern (COCs). The COCs were selected to represent potential Site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment and can be found in Table 1-3 of the FS. These chemicals were identified in the FS as presenting a significant current or future risk and are

referred to as the COCs in this ROD and summarized in Table 1. This Table contains the exposure point concentrations used to evaluate the reasonable maximum exposure scenario (RME) in the baseline risk assessment for the COCs. Estimates of average or central tendency exposure concentrations for the chemicals of concern and all chemicals of potential concern can be found Appendix 1-4 of the FS and in Risk Screening for Groundwater, Surface Water and Seeps at the Barkhamsted-New Hartford Landfill Superfund Site, USEPA April 2000 (USEPA, 2000).

Table 1
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration (Maximum Concentration)	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
Ingestion of and dermal contact with ground-water	arsenic	5	22	ug/l	18	0.022	mg/l	Max
	chromium (total)	10	222	ug/l	17	0.22	mg/l	Max
	lead	3	42	ug/l	19	0.042	mg/l	Max
	manganese	60	8,100	ug/l	56	8.1	mg/l	Max
	acetone	1.4	18,000	ug/l	17	18	mg/l	Max
	benzene	0.15	17	ug/l	38	0.017	mg/l	Max
	2-butanone	4.7	37,000	ug/l	4	37	mg/l	Max
	1,2-dichloroethane	0.15	4.4	ug/l	28	0.004	mg/l	Max
	1,2-dichloropropane	0.13	2.2	ug/l	21	0.002	mg/l	Max
	chloroethane	0.24	18	ug/l	30	0.016	mg/l	Max
	chloroform	0.11	0.43	ug/l	3	0.0004	mg/l	Max
	chloromethane	0.21	2.3	ug/l	8	0.002	mg/l	Max
	dibromochloro-methane	0.78	0.78	ug/l	1	0.00078	mg/l	Max
	4-methyl-2-pentanone	0.4	2,200	ug/l	9	2.2	mg/l	Max
	methylene chloride	0.29	110	ug/l	18	0.11	mg/l	Max
	toluene	0.1	23,000	ug/l	35	23	mg/l	Max

Table 1
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration (Maximum Concentration)	Exposure Point Concentration Units	Statistical Measure
		Min	Max					
	trichloroethene	0.12	43	ug/l	23	0.004	mg/l	Max
	vinyl chloride	0.17	19	ug/l	7	0.0019	mg/l	Max
	bis(2ethyl hexyl) phthalate	2.3	65	ug/l	14	0.065	mg/l	Max
	1,4-dichlorobenzene	2.8	4.3	ug/l	2	0.004	mg/l	Max
	2,4-dimethylphenol	6.4	2,200	ug/l	25	2.2	mg/l	Max
	4-Methylphenol	2.3	51,000	ug/l	10	51	mg/l	Max

Key

ug/l: micrograms per liter or parts per billion
95% UCL: 95% Upper Confidence Limit
MAX: Maximum Average Concentration

The table presents the chemicals of concern (COCs) and exposure point concentration for each of the COCs detected in groundwater (*i.e.*, the concentration that will be used to estimate the exposure and risk from each COC in the groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the exposure point concentration (EPC), and how the EPC was derived.

Potential human health effects associated with exposure to the COCs were estimated quantitatively or qualitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the Site. The following is a brief summary of just the exposure pathways that were found to present a significant risk. All other risks have been addressed by the NTCRA. A more thorough description of all exposure pathways evaluated in the risk assessment including estimates for an average exposure scenario, can be found in Section 2.1 of the Human Health Risk Assessment (HHRA) and on page 3 of the USEPA Risk Screening for Groundwater, Surface Water and Seeps (April 18, 2000).

Exposure Assessment

For contaminated groundwater, it was assumed that a resident would ingest 2 liters of water per day for 350days/yr for 30 years. For the Reasonable Maximum Exposure Scenario (RME), concentrations of each contaminant in each well are averaged over the two sampling rounds and the maximum average of all wells for a particular chemical was included as the exposure point concentration in the risk screen. Oral and dermal exposures were assessed.

Risk Characterization

Excess lifetime cancer risks were determined for each exposure pathway by multiplying a daily intake level with the chemical specific cancer potency factor. Cancer potency factors have been developed by USEPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g. 1 x 10^{-6} for 1/1,000,000) and indicate (using this example), that an average individual is not likely to have greater than a one in a million chance of developing cancer over 70 years as a result of Site-related exposure (as defined) to the compound at the stated concentration. All risks estimated represent an "excess lifetime cancer risk" - or the additional cancer risk on top of that which we all face from other causes such as cigarette smoke or exposure to ultraviolet radiation from the sun. The chance of an individual developing cancer from all other (non-Site related) causes has been estimated to be as high as one in three. USEPA's generally acceptable risk range for Site related exposure is 10^{-4} to 10^{-6}. Current USEPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. A summary of the cancer toxicity data relevant to the chemicals of concern is presented in Table 2.

Table 2
Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
arsenic	1.5	1.5	$[(mg/kg)/day]^{-1}$	A	IRIS	4/01/01
1,4-dichlorobenzene	.024	.024	$[(mg/kg)/day]^{-1}$	C	HEAST	FY '97
benzene	.029	.029	$[(mg/kg)/day]^{-1}$	A	IRIS	4/01/01
1,2-dichloroethane	.091	.091	$[(mg/kg)/day]^{-1}$	B2	IRIS	4/01/01
1,2-dichloropropane	.068	.068	$[(mg/kg)/day]^{-1}$	B2	HEAST	FY '97
chloroethane	.0029	.0029	$[(mg/kg)/day]^{-1}$	B2	NCEA	4/01/01
chloroform	.0061	.0061	$[(mg/kg)/day]^{-1}$	B2	IRIS	4/01/01

Table 2
Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
chloromethane	.013	.013	$[(mg/kg)/day]^{-1}$	C	HEAST	FY '97
dibromochloro-methane	.084	.084	$[(mg/kg)/day]^{-1}$	C	IRIS	4/01/01
methylene chloride	.0075	.0075	$[(mg/kg)/day]^{-1}$	B2	IRIS	4/01/01
trichloroethene	.011	.011	$[(mg/kg)/day]^{-1}$	B2	NCEA	4/01/01
vinyl chloride	1.9	1.9	$[(mg/kg)/day]^{-1}$	A	IRIS	4/01/01
bis(2-ethyl hexyl) phthalate	.014	.014	$[(mg/kg)/day]^{-1}$	B2	IRIS	4/01/01

Key
-: No information available
IRIS: Integrated Risk Information System, U.S. EPA
HEAST: Health Effects Assessment Summary Tables
NCEA: National Center for Environmental Assessment

USEPA GROUP:
A - Human Carcinogen

B2 - Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen

Summary of Toxicity Assessment

This table provides carcinogenic risk information which is relevant to the contaminants of concern in groundwater. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in the assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustment is not necessary for the chemicals evaluated at this Site. Therefore, the same values presented above were used as the dermal carcinogenic slope factors for these contaminants.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake level by the reference dose (RfD) or other suitable benchmark. Reference doses have been developed by USEPA and they represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. A HQ $\leq$ 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that

chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) within or across those media to which the same individual may reasonably be exposed. A HI $\leq$ 1 indicates that toxic noncarcinogenic effects are unlikely. A summary of the noncarcinogenic toxicity data relevant to the chemicals of concern is presented in Table 3.

Table 3
Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty /Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/ YY)
arsenic	Chronic	0.0003	mg/kg-day	0.0003	mg/kg-day	Skin	3	IRIS	4/01/01
chromium	Chronic	0.003 (Cr VI)	mg/kg-day	0.003 (Cr VI)	mg/kg-day	----	900	IRIS	4/01/01
manganese	Chronic	0.024	mg/kg-day	0.024	mg/kg-day	CNS	1	IRIS	4/01/01
acetone	Chronic	0.1	mg/kg-day	0.1	mg/kg-day	Liver/ Kidney	1000	IRIS	4/01/01
benzene	Chronic	0.003	mg/kg-day	0.003	mg/kg-day	----	3000	NCEA	3/94
2-butanone	Chronic	0.6	mg/kg-day	0.6	mg/kg-day	Develop-mental	3000	IRIS	4/01/01
1,2-dichloro-ethane	Chronic	0.03	mg/kg-day	0.03	mg/kg-day	----	1000	NCEA	6/97
1,2-dichloro-propane	Chronic	0.0011	mg/kg-day	0.0011	mg/kg-day	Respirato ry	300	IRIS	4/01/01
chloroethane	Chronic	0.4	mg/kg-day	0.4	mg/kg-day	----	1000	NCEA	7/96
chloroform	Chronic	0.01	mg/kg-day	0.01	mg/kg-day	Liver	1000	IRIS	4/01/01
dibromochlor omethane	Chronic	0.02	mg/kg-day	0.02	mg/kg-day	Kidney	1000	IRIS	4/01/01
4-methyl-2-pentanone	Chronic	0.08	mg/kg-day	0.08	mg/kg-day	Liver/ Kidney	3000	HEAST	FY '97
methylene chloride	Chronic	0.06	Mg/kg-day	0.06	mg/kg-day	Liver	100	IRIS	4/01/01
toluene	Chronic	0.2	mg/kg-day	0.2	mg/kg-day	Liver/ Kidney	1000	IRIS	4/01/01
trichloroethen e	Chronic	0.006	mg/kg-day	0.006	mg/kg-day	Liver/ Kidney	3000	NCEA	2/95

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty /Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/ YY)
bis(2-ethylhexyl)-phthalate	Chronic	0.02	mg/kg-day	0.02	mg/kg-day	Liver	1000	IRIS	4/01/01
1,4-dichloro-benzene	Chronic	0.03	mg/kg-day	0.03	mg/kg-day	----	300	NCEA	5/94
2,4-dimethyl-phenol	Chronic	0.02	mg/kg-day	0.02	mg/kg-day	Blood	3000	IRIS	4/01/01
4-methyl-phenol	Chronic	0.005	mg/kg-day	0.005	mg/kg-day	CNS	1000	HEAST	FY '97

Summary of Toxicity Assessment

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in groundwater. All of the COCs have toxicity data indicating their potential for adverse non-carcinogenic health effects in humans.

Tables 4 and 5 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in groundwater evaluated to reflect present and potential future ingestion and dermal contact with groundwater by area residents corresponding to the reasonable maximum exposure (RME) scenario. Only those exposure pathways deemed relevant to the remedy being proposed are presented in this ROD. Readers are referred to USEPA's Risk Screening for Groundwater, Surface Water and Seeps for the Barkhamsted-New Hartford Landfill Superfund Site (April, 2000) for a more comprehensive risk summary of all exposure pathways evaluated for all chemicals of potential concern and for estimates of the central tendency risk.

Table 4

Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk		
				Ingestion	Dermal	Exposure Routes Total
Ground-water	Ground-water	Aquifer - Tap Water	arsenic	4.0×10^{-4}	2.0×10^{-6}	4.0×10^{-4}
		Aquifer - Tap Water	1,4-dichlorobenzene	1.2×10^{-6}	8.0×10^{-7}	2.0×10^{-6}
		Aquifer - Tap Water	benzene	5.9×10^{-6}	9.1×10^{-7}	6.8×10^{-6}
		Aquifer - Tap Water	1,2-dichloroethane	4.4×10^{-6}	2.2×10^{-7}	4.6×10^{-6}
		Aquifer - Tap Water	1,2-dichloropropane	1.6×10^{-6}	1.6×10^{-7}	1.8×10^{-6}
		Aquifer - Tap Water	chloroethane	5.6×10^{-7}	3.3×10^{-8}	5.9×10^{-7}

Click here to go to Section 2 of the Decision Summary