

APPENDIX B
HUMAN HEALTH BACKUP

APPENDIX B-1

**DRAFT BASELINE HUMAN HEALTH
RISK ASSESSMENT ADDENDUM**

Draft Baseline Human Health Risk Assessment Addendum Evaluation of Asbestos-Containing Soils Using Activity-Based Sampling

January 2008

1.0 INTRODUCTION

This report presents an addendum to the Baseline Human Health Risk Assessment (BHHRA) for the Blackburn & Union Privileges Superfund Site (the site) in Walpole, Massachusetts (Science Collaborative, 2007). With regard to soils, the BHHRA concluded that soils in the East of South Street On-Facility area and the Old Railroad and Former Lower Mill Pond area require action due to the presence of elevated levels of polycyclic aromatic hydrocarbons (PAHs), arsenic, and/or trichloroethene (TCE). However, the BHHRA did not address human health risk from exposures to asbestos-containing soils.

EPA issued OSWER Directive Memorandum 9345.4-05 on Aug.10, 2004 entitled “Clarifying Cleanup Goals and Identification of New Assessment Tools for Evaluating Asbestos at Superfund Cleanups”. This BHHRA Addendum presents a risk assessment performed to determine if further response actions are necessary for soils in areas previously remediated to less than a 1% asbestos standard. This BHHRA addendum specifically addresses soils containing less than 1% asbestos by incorporating supplemental asbestos sampling data collected during investigational activities performed by EPA and evaluating those data in compliance with applicable EPA guidance (USEPA, 1986b; USEPA, 1989; USEPA, 1997; USEPA, 2001, USEPA, 2002) and EPA Region 1 Guidance (USEPAReg1, 1994; USEPAReg1, 1995; USEPAReg1, 1999).

The human health risk assessment addendum proceeds in five steps: Hazard Identification, Exposure Assessment, Dose-Response Assessment, Risk Characterization, and Uncertainty Analysis. The Hazard Identification describes the activity-based asbestos sampling data available for the site. The Exposure Assessment identifies potential exposures for both current and future land use at the site, estimates exposure point concentrations, and specifies exposure assumptions for estimating asbestos exposures. The Toxicity Assessment describes the available toxicity values for asbestos and the receptor-specific adjustments to toxicity values made in this assessment. The Risk Characterization summarizes quantitative risk estimates by exposure scenario. The Uncertainty Analysis highlights uncertainties in the risk assessment that one should consider when interpreting and using the results of this assessment.

1.1 Site Description and Background

This section is primarily based on information presented in the Remedial Investigation Report prepared by Sanborn, Head, and Associates, Inc. (SHA, 2007) for the site. The site is located approximately one mile from the center of Walpole, Massachusetts, just south of the intersection of Common Street and South Street. South Street runs through the center of the site in a north/south direction. The Neponset River runs through the southern portion of the site in an

east/west direction. Lewis Pond, present as a result of the dam at West Street, is located approximately 2,000 feet northwest of the site (Figure 1 – Site Vicinity Plan). The site is approximately 22 acres, consisting of 23 parcels of land, some “On-Facility” and some “Off-Facility.” “On-Facility” areas have been the focus of various industrial activities spanning several hundred years, and “Off-Facility” areas have historically been undeveloped or residential lots.

The portion of the site east of South Street consists of On-Facility and Off-Facility areas. The currently occupied Cosmec, Inc. (Cosmec) area (East of South Street On-Facility) is mostly paved and consists of five buildings that currently are used for foundry-related and associated support operations. Peripheral to the Cosmec property is the Old Railroad and Former Lower Mill Pond area, and three residential and one vacant Gleason Court Lots (Off-Facility). The portion of the site west of South Street consists of the Area of Containment (AOC), the West of South Street On-Facility area, and three Off-Facility areas. The West of South Street On-Facility area includes the currently unoccupied former mill building which was used for a number of industrial purposes, including a manufacturer of “multibestos and rubber specialties.” Areas peripheral to the West of South Street On-Facility area and the AOC are mostly residential. Vacant Lot 209, Residential Lot 208, and the Orlando Property residential lot are considered “On-Site” but Off-Facility. Other residential lots along the Neponset River, located west of the site up to and including lots near Lewis Pond (Lot 283, Lot 282, Lot 210, Lot 230, Lot 257, Lot 342, Lot 360) and commercial Lot 350 are considered “Off-Site.”

From the mid- to late-seventeenth century to circa 1891, On-Facility portions of the site were used for a variety of manufacturing purposes, including a sawmill, corn mill, snuff factory, forge, tan yard, and cloth manufacturing; processing of cotton and wool; and manufacturing of mattresses, cotton batting, lamp wicks, and carpet linings. Between circa 1891 and 1915, the site was used for manufacture of tires, rubber goods, and insulating materials. The site was used to manufacture asbestos clutch and brake linings between 1915 and 1935. Subsequently, the site was again used for a variety of manufacturing purposes, including manufacturing of non-woven cotton products, dye flocking of cotton, manufacturing of instant coffee, and rag and paper recycling.

Prior environmental investigations and subsequent remedial actions addressed the presence of asbestos-containing soils on-site. Extensive sampling was carried out between 1986 and 1990 to delineate the extent of asbestos contamination on a site-wide basis. Historical sampling activities conducted to characterize asbestos in soil utilized a detection limit of 1%. Results of the previous sampling were reported as not detected, detected at less than 1%, or at a detected value above 1%. This investigatory effort was followed by design and, in 1992, the implementation of a remedial action at the site pursuant to an Administrative Order by EPA to remove soil with asbestos detected in excess of 1%.

In 1992, asbestos-containing soils were excavated from various areas of the site, including Lots 33-123 and 33-259. Although asbestos was detected in soil samples from limited areas of the site, the asbestos-containing soil on the site (On-Facility) was effectively removed to less than or equal to 1% via analysis by Polarized Light Microscopy (PLM). In Off-Facility residential and

undeveloped lots, asbestos was either not detected, or detected in soil samples at less than 1% (SHA, 2007). Thus, no action was performed in these areas at the time of the removal action.

Excavated soils were consolidated with existing asbestos-containing material south of the former mill building or in a containment cell west of the former mill building. These areas, along with existing asbestos-containing soil to the north of the former mill building, have been designated the AOC. To the south and west of the mill building, the AOC has been capped with six inches of topsoil, placed over 24 inches of sand. To the north, the AOC is covered with asphalt. The AOC is subject to a deed restriction (i.e., future excavation and building construction is restricted); an eight-foot barbed-wire security fence surrounds its perimeter.

During July through September 2006, Metcalf & Eddy (M&E), under contract to EPA, conducted supplemental soil sampling for asbestos at historical sampling locations where previous detects of asbestos were reported at less than 1%. Fifty-two soil samples were collected through the depth of fill from 14 On-Facility borings. Nineteen Off-Facility and six background soil samples were also collected to depths of 2.5 feet below ground surface (bgs). Samples were analyzed for asbestos by PLM by method CARB 435 with a detection limit of 0.25%. Laboratory analysis of On-Facility samples reported that asbestos was not detected in most samples collected. Exceptions noted include an asbestos concentration of 1.75% in the 0.5 to 4 ft bgs interval for boring I-3.5, with visual observations of asbestos reported at less than 0.25% within the intervals above and below this interval. Asbestos was also detected in soil boring M-5.5 at concentrations of 0.25%, 0.5%, and 0.75% in the three most surficial intervals. Visual observation of asbestos was also reported by the laboratory at less than 0.25% in soil borings ME-1 and MA-2.5. Asbestos was not detected in any Off-Facility soil sample collected, nor was it visually observed during the laboratory scan (M&E, 2006/2007).

In order to assess risks at the site in areas previously remediated to levels below a 1% standard, Lockheed Martin Technology Services (Lockheed Martin), under contract to EPA, conducted site-specific activity-based sampling to measure asbestos air concentrations during low intensity (raking) and high intensity (lawn mowing) soil disturbance activities. This BHHRA addendum evaluates the sampling results obtained from the activity-based sampling effort (Lockheed Martin, 2008). The raking activity data are considered applicable to other low intensity activities that may occur at the site (e.g., walking and jogging) while the lawn mowing activity data are considered applicable to other high intensity activities that may occur at the site (e.g., biking, gardening, landscaping, and soil excavation). Table 1 presents the exposure points, receptors, and activities applicable for the site.

2.0 HAZARD IDENTIFICATION

This section summarizes available data for quantifying inhalation risks associated with the release of fugitive dusts from asbestos-containing soils at the site and the selection of contaminants of potential concern (COPCs) for the two activity-based sampling scenarios (raking and lawn mowing). This BHHRA addendum relies on analytical data presented in the Blackburn and Union Privileges Asbestos Activity Based Sampling report (Lockheed Martin, 2008), included as Appendix B-2. Activity-based sampling was conducted in June 2007 to determine exposure of potential receptor populations to respirable asbestos fibers. The following

text summarizes the activity-based sampling event; Appendix B-2 should be consulted for additional details related to this site-specific sampling.

A total of 38 activity-based asbestos air samples were collected from six activity areas (3 raking areas and 3 mowing areas), three background locations, and six perimeter locations during two days of sampling (one day for each activity). Perimeter and background sampling was performed to evaluate whether or not a release from the site or activity had occurred. Perimeter samples were collected from fixed locations sampled three times during each day of sampling (18 total samples) to monitor dust migration upwind, downwind, and crosswind of the activity areas. Background samples were collected at three locations during a ten-hour period for two consecutive days (6 total samples) from locations further from the activity areas, selected to reflect the concentration of asbestos in air for the environmental setting near the site. Perimeter and background samples were collected at breathing height, approximately four feet above ground surface, to mimic exposure during physical activities. Background and perimeter sampling locations are shown in Appendix B-2, Figures 2 and 3, for raking and lawn mowing activities, respectively.

Activity-based samples (raking and lawn mowing) were collected using personal air sampling devices during three 2-hour shifts (raking) and three 90-minute shifts (lawn mowing) on each day of sampling. Each activity sampler wore personal protective equipment and a backpack containing the personal air sampler. Samples were collected using both a high flow rate (~10 liters/min) and low flow rate (~4 liters/min) during both activities, with one duplicate collected each sampling day (14 total samples). Data from personal air samplers were used in the evaluation of human exposure since this sampling method provides a more accurate estimation of exposures occurring during each activity. The activity areas are shown in Appendix B-2, Figures 2 and 3. All air samples were collected at breathing height, approximately 4 to 5 feet above ground surface.

The air samples were analyzed by International Standardization Organization (ISO) Method 10312, *Ambient Air – Determination of Asbestos Fibers: Direct Transfer Transmission Electron Microscopy Method*. For the personal air samples, high flow samples were analyzed first, followed by low flow sample analysis if the high flow samples were overloaded. For the raking activity, high flow samples were not overloaded, therefore, only the high flow samples were analyzed for asbestos fibers with a detection limit of 0.027 structures per cubic centimeter (s/cc). Because all low and high flow samples collected during the lawn mowing activity were overloaded, samples were re-analyzed using ISO Method 13794, *Ambient Air – Determination of Asbestos Fibers: Indirect Transfer Transmission Electron Microscopy Method*, with a detection limit of 0.003 s/cc. As with ISO Method 10312, the laboratory was instructed to read the low flow samples using ISO Method 13794 only if the high flow samples could not be read. Two of the high flow mowing activity samples could be read upon re-analysis. However, the third high flow sample could not be read, requiring analysis of the low flow sample for this area. Therefore, three of the overloaded samples were not analyzed by ISO Method 13794. The results of the analysis for the samples collected during the raking and lawn mowing activities are presented in Appendix B-2, Table 1.

There are different methods to analyze asbestos in soil, sediment, building materials, and air.

Phase Contrast Microscopy (PCM) can be used to determine filter loading and analyze airborne asbestos fibers. PCM can detect different types of fibers but cannot differentiate asbestos fiber types and other non-asbestos fiber types. PCM results are reported as fibers per cubic centimeter of air (f/cc). Transmission Electron Microscopy (TEM) can be used to determine concentration and identification of potential airborne asbestos fibers. The TEM method is more powerful than the PCM method since TEM can also be used to detect asbestos fibers at lower concentrations, distinguish asbestos fiber types, and the size and dimension of each detected fiber. TEM results are reported as structures per cubic centimeter of air (s/cc). Both PCM and TEM methods were used to analyze airborne samples collected at the site. Since the risk assessment model used is based on PCM measurements, only the TEM asbestos fibers that meet the definition of fibers measured by the PCM method are considered for the risk assessment. Those TEM asbestos fibers are called PCM-equivalent and are defined as having a length greater than 5 microns, a width range between 0.25 microns and 3.00 microns in diameter, and an aspect ratio (ratio of length to width) greater than or equal to 3-to-1. The PCM-equivalent fibers are based on fiber dimensions defined by the PCM method.

The following summarizes the available activity-based samples, by area, for each of the activity scenarios:

- Raking Scenario: Raking Area 1 H, Raking Area 2 H, and Raking Area 3 H (plus its field duplicate Raking Area 3 HD)
- Lawn Mowing Scenario: Mowing Area 4 L, Mowing Area 5 H, and Mowing Area 6 H (plus its field duplicate Mowing Area 6 HD)

Available background air samples for each area and activity are summarized below:

- Raking Scenario: Background 1 (Area 1), Background 2 (Area 2), and Background 3 (Area 3)
- Lawn Mowing Scenario: Background 1 (Area 4), Background 2 (Area 5), and Background 3 (Area 6)

Data for the two activity scenarios, including the background data, are summarized in Table 2. The three activity-based samples collected under high flow conditions during the raking activity showed no asbestos structures detected above the detection limit. In addition, no perimeter or background air samples collected during the raking activity showed detectable asbestos fibers. Due to the lack of detectable asbestos structures in air samples collected during the raking activity, asbestos was not selected as a COPC, and no further evaluation has been conducted for raking or other low intensity activities (e.g., walking or jogging) at the site.

In contrast, two of the three activity-based samples collected during the lawn mowing activity showed detections of asbestos structures. Even though none of the background air samples collected during the lawn mowing activity showed detectable asbestos fibers, perimeter samples indicated detectable levels of asbestos fibers in air. Results from perimeter samples were not used to evaluate risk during the activities for the risk assessment since they were collected to document air quality during the sampling events and monitor off-site migration from air sampling pumps at stationary locations. It is also not realistic to use perimeter results since it

would assume that a person stands unmoving at the perimeter location for 2 hours to be exposed to the detected levels while the activities of raking or mowing are being performed. No risk-based screening values are available to use for selecting asbestos as a COPC for the fugitive dust pathway. However, due to the presence of detectable asbestos structures in air samples collected during the lawn mowing activity at levels above background concentrations for mowing locations, asbestos is selected as a COPC for lawn mowing or other high intensity activities (e.g., gardening, excavation, landscaping, or bike riding). Table 2 documents the COPC selection process for the lawn mowing activity.

Data collected from the activity-based sampling event, including the background data, are considered applicable to all areas of the site potentially impacted by asbestos and possibly containing residual levels of asbestos from the 1992 removal event in soil. Activity-based sampling data are considered applicable to exposures during high intensity activities (e.g., excavation, mowing, biking, landscaping, and gardening); background sampling data are considered applicable to site exposures during times when high intensity activities are not occurring. Therefore, the data summarized in Table 2 for the lawn mowing activity and for background have been applied to areas of the site, as identified in Table 1 and Section 3.0, Exposure Assessment. Other soil COPCs evaluated in the 2007 BHHRA (Science Collaborative, 2007) are considered for the purpose of cumulative risk estimation, as discussed in Section 5, Risk Characterization.

3.0 EXPOSURE ASSESSMENT

The exposure assessment evaluates potential exposure of humans to asbestos-impacted soil under current and potential future land use conditions. As part of the Exposure Assessment, exposure point concentrations (EPCs) and exposure profiles are developed. EPCs are concentrations of COPCs to which receptors are reasonably expected to be exposed. Exposure profiles, or scenarios, describe potential receptors, activities through which receptors may be exposed to COPCs, the medium and route through which exposure may occur, and exposure assumptions, describing the frequency and duration of exposure. Exposure assumptions and EPCs are combined to calculate chronic daily exposures, using specific equations. The following sections describe the derivation of EPCs, and the selection of exposure scenarios and exposure assumptions, and the equations used to estimate chronic daily exposures.

This assessment evaluates risk from Reasonable Maximum Exposures (RME), used to estimate high levels of exposure (protective of the 90th or 95th upper percentile of the exposed population), and Central Tendency (CT) exposures, used to estimate average levels of exposure (protective of the 50th percentile, or median, of the exposed population) for all exposure scenarios. The RME is defined as the highest exposure reasonably expected to occur at a site (USEPA, 1989), and is intended to provide a conservative estimate of exposure, well above the average case, that is still within the range of possible exposures. In this assessment, RME levels are estimated by setting exposure time and exposure frequency at the high end of possible values, while setting central tendency exposure time assumptions at half those selected for the RME scenario.

Consistent with the 2007 BHHRA, the CT exposure assumptions are used to calculate a central tendency or average risk for exposure only for scenarios with RME risks that exceed regulatory limits.

3.1 Exposure Point Concentrations

EPCs are presented in Table 3.RME for the reasonable maximum scenario and Table 3.CT for the central tendency scenario. Because the activity-based sampling and background results are assumed to be applicable across the site, EPCs are the same for each exposure point evaluated. EPCs used in this assessment are based on the activity-based air sampling data collected during the lawn mowing activity, and the background data collected during both the raking and lawn mowing activities.

Three activity-based air samples were collected during the single day of lawn mowing performed at the site. One air sample was collected from each of three lawn mowing areas. The lawn mowing areas were small in size (approximately 50 square meters in area) and located in close proximity or adjacent to each other (see Figure 3 in Appendix B-2). Due to the small number of activity-based air samples collected over the small sampling area, the arithmetic mean asbestos air concentration measured during the lawn mowing activity was selected as representative of both the RME and CTE scenarios. The arithmetic mean air concentration (0.00815 f/cc) was calculated by first averaging sample Mowing Area 6 H with its field duplicate (Mowing Area 6 HD), and then averaging the three air samples (Mowing Area 4 L, Mowing Area 5 H and Mowing Area 6 H average), using ½ the reporting limit for the non-detect value associated with sample Mowing Area 5 H.

To calculate an EPC applicable to background exposures (i.e., exposures potentially occurring when high intensity activities are not occurring), the six available background samples were averaged, using ½ the reporting limit for the non-detect values for each background sample. The resulting background EPC is 0.0000933 f/cc.

3.2 Exposure Scenarios

The BHHRA addendum is based on receptors, exposure points, and exposure scenarios quantitatively evaluated in the 2007 BHHRA (Science Collaborative, 2007). Table 1, Selection of Exposure Pathways, presents the rationale for the inclusion of the current and future inhalation of fugitive dust pathway at each exposure area shown in Figure 1. Inhalation of fugitive dusts released from asbestos in soil is the only exposure pathway being evaluated in this BHHRA addendum. Currently, Cosmec occupies the eastern industrial portion of the site (East of South Street On-Facility), so a current site worker is evaluated at this parcel. The former rail bed to the east of Cosmec (Old Railroad and Former Lower Mill Pond Area) and the western unoccupied industrial portion of the site (West of South Street On-Facility) are currently accessible to trespassers. Gleason Court Lots 122, 124 and 125 are residential. The vacant lot to the north of Cosmec (Gleason Court Vacant Lot) is currently accessible to nearby residents who live on Gleason Court. The AOC is considered inaccessible. However, areas peripheral to the AOC and further north and west of the AOC are residential (Residential Lot 208, Lot 283, Lot 282, Lot

210, Lot 230, Lot 257, Orlando Property, Lot 342, and Lot 360) or accessible to trespassers (Vacant Lot 209 and Lot 350).

In the future, all portions of the site may be developed for residential use, except for the AOC. Therefore, exposures to a future resident were evaluated at all locations outside of the AOC, even on some parcels zoned for Limited Manufacturing where unrestricted residential use is not reasonably foreseeable. Likewise, exposures to a future construction worker were evaluated at all locations outside the AOC except for Lots 350 and 360 which are located within a wetland area and are not expected to undergo future development. A future site worker is also evaluated at the East and West of South Street On-Facility areas.

3.3 Exposure Assumptions

The following sections summarize the exposure assumptions applied for each scenario. Exposure assumptions in the BHHRA addendum are consistent with those used in the 2007 BHHRA (Science Collaborative, 2007) or consistent with guidance provided in *Risk Assessment Guidance for Superfund Part A* (USEPA, 1989), *Risk Updates* (USEPAReg1, 1994; USEPAReg1, 1995; USEPAReg1, 1999), and the *Exposure Factors Handbook* (USEPA, 1997).

Exposure parameter values that are used to estimate RME and CT risk for all scenarios are presented in Table 4.RME and Table 4.CT, respectively. No assumptions are provided for exposure duration (total number of years of exposure) since these parameters are accounted for in the toxicity values selected for the receptor-specific evaluation, as discussed in Section 4, Toxicity Assessment.

3.3.1 Current and Future Resident

The current resident may be exposed to asbestos in soil while engaging in high intensity outdoor activities. Lawn mowing, gardening, and biking are selected for evaluation as representative of high intensity activities applicable to a residential scenario. Adults and older children may be exposed while engaging in the applicable high intensity activities. Young children may be exposed while playing in the vicinity of adults and older children performing the activities of interest; infants may be exposed while in the care of an adult or older child engaging in the activities of interest. The current and future resident is assumed to be exposed to asbestos in soil via the inhalation of fugitive dusts released from soil during high intensity activities. Table 1 details the exposure points evaluated for current and future resident exposures.

Residents are conservatively assumed to be present at the site for 350 days/year and 24 hours/day (USEPA, 1997). RME residents are assumed to be exposed to asbestos-containing dusts during mowing (2 hours/day for 22 days/year), gardening (2 hours/day for 22 days/year), and biking (1 hour/day for 22 days/year). CT residents are assumed to be exposed by the same activities as the RME resident and for the same numbers of days/year, but for half the number of hours/day (1 hour/day for lawn mowing, 1 hour/day for gardening, and 0.5 hour/day for biking). For background exposures, RME and CT residents are assumed to be exposed to background concentrations for the remaining 19 and 21.5 hours per day, respectively, of the 22 days that high intensity activities occur. In addition, residents are assumed to be exposed to background

concentrations 24 hours/day during the remaining 328 days of site exposure. The assumptions for exposure time and exposure frequency related to activity and background exposures are based on professional judgment.

3.3.2 Current Trespasser

The current trespasser may be exposed to asbestos in soil while engaging in high intensity outdoor activities. Biking is selected for evaluation as representative of high intensity activities applicable to a trespasser scenario. The current trespasser is assumed to be exposed to asbestos in soil via the inhalation of fugitive dusts released from soil during high intensity activities. Table 1 details the exposure points evaluated for current trespasser exposures.

Consistent with the 2007 BHHRA, trespassers are assumed to be present at the site for 87 days/year (4 days/week for the 5 warmest months of the year). RME trespassers are assumed to be exposed to asbestos-containing dusts during biking for 1 hour/day, 22 days/year. CT trespassers are assumed to be exposed by the same activity as the RME trespasser and for the same number of days/year, but for 0.5 hour/day. For background exposures, RME and CT trespassers are assumed to be exposed to background concentrations for 1 hour and 0.5 hours per day, respectively, on the 22 days that high intensity activities occur, for a total of 2 hours and 1 hour on-site, respectively, for those 22 days. In addition, RME and CT trespassers are assumed to be exposed to background concentrations for 2 hours/day and 1 hour/day, respectively, during the remaining 65 days of on-site exposure. The assumptions for exposure time and exposure frequency related to activity and background exposures are based on professional judgment.

3.3.3 Current and Future Site Worker

The current and future site worker may be exposed to asbestos in soil while engaging in high intensity outdoor activities. Landscaping is selected for evaluation as representative of high intensity activities applicable to a site worker scenario. The current and future site worker is assumed to be exposed to asbestos in soil via the inhalation of fugitive dusts released from soil during high intensity activities. Table 1 details the exposure points evaluated for current and future site worker exposures.

Site workers are assumed to be present at the site 250 days/year, 8 hours/day (USEPA, 1997). RME site workers are assumed to be exposed to asbestos-containing dusts during landscaping for 1 hour/day, 50 days/year. CT site workers are assumed to be exposed by the same activity as the RME site worker and for the same number of days/year, but for 0.5 hours/day. For background exposures, RME and CT site workers are assumed to be exposed to background concentrations for 7 hours and 7.5 hours per day, respectively, on the 50 days that the high intensity activity occurs, for a total of 8 hours of on-site for those 50 days. In addition, site workers are assumed to be exposed to background concentrations for 8 hours/day during the remaining 200 days of exposure. The assumptions for exposure time and exposure frequency related to activity and background exposures are based on professional judgment.

3.3.4 Future Construction Worker

The future construction worker may be exposed to asbestos in soil while engaging in high intensity outdoor activities. Excavation activities are selected for evaluation as representative of high intensity activities applicable to a construction scenario. The future construction worker is assumed to be exposed to asbestos in soil via the inhalation of fugitive dusts released from soil during high intensity activities. Table 1 details the exposure points evaluated for future construction worker exposures.

Consistent with the 2007 BHHRA, construction workers are assumed to be present at the site 156 days/year (6 days/week for 6 months). RME construction workers are assumed to be exposed to asbestos-containing dusts during excavation activities for 8 hours/day, 156 days/year. CT construction workers are assumed to be exposed by the same activity as the RME construction worker and for the same number of days/year, but for 4 hours/day. CT construction workers are also assumed to be exposed to background concentrations for the remaining 4 hours of the work day, for a total of 8 hours of exposure. The assumptions for exposure time and exposure frequency related to activity and background exposures are based on professional judgment.

3.4 Calculation of Chronic Daily Exposure

To estimate the chronic daily exposure received by people exposed to asbestos in fugitive dust, EPCs are combined with assumptions that describe the duration and frequency of exposure. The Chronic Daily Exposure (CDE) for the inhalation exposure pathway is calculated using equations shown in Tables 4.RME and 4.CT. For each receptor, a CDE is calculated by multiplying the applicable air EPC (either that associated with high intensity activity or background conditions) and time-weighting factor (TWF). A TWF is a fraction of lifetime during which exposure occurs. As a unitless value, the TWF is the product of exposure time (ET; hours/day), represented as a fraction of a 24-hour day, and exposure frequency (EF; days/year), represented as a fraction of a 365-day year. Multiple TWFs were calculated for each receptor to account for differences between ET and EF for background and activity-related exposures. For example, three TWFs were calculated for the RME resident (see Table 4.RME). TWF₁ accounts for the high intensity activity exposures that are assumed to occur for a portion of each activity day and year (5/24 hours/day; 22/365 days/year). TWF₂ accounts for the background exposures assumed to occur for the remaining portion of each activity day, when high intensity activity is not occurring (19/24 hours/day; 22/365 days/year). TWF₃ accounts for background exposures on the remaining 328 days when no high intensity activity occurs (24/24 hours/day; 328/365 days/year). CDEs, in units of f/cc, are then combined with toxicity values in units of (f/cc)⁻¹ to generate incremental lifetime cancer risks (ILCRs), as described in Section 5, Risk Characterization.

4.0 TOXICITY ASSESSMENT

The primary purpose of the Toxicity Assessment is to identify the toxicity values used in the evaluation of human cancer risks and non-cancer health effects. These toxicity values are combined with the CDEs of asbestos to calculate inhalation cancer risks and non-cancer health

hazards in the risk characterization step. EPA has developed toxicity values for cancer and non-cancer effects for certain chemicals. The toxicity values for cancer through inhalation are known as unit risks (URs). The toxicity values for non-cancer effects associated with inhalation exposures are known as reference concentrations (RfCs).

Historically, an important distinction between the cancer and non-cancer toxicity values has been that UR were developed assuming a linear dose-response relationship at the low doses associated with environmental exposures in humans (USEPA, 1986a), whereas non-cancer reference concentrations were developed assuming that there was a threshold to the adverse effect. In other words, for a carcinogen, it was assumed that there is a finite risk of a carcinogenic response associated with all exposures, no matter how low. For a non-cancer threshold effect it was assumed that there is a dose below which no adverse effects would be expected.

Toxicity values are used to provide quantitative estimates of the carcinogenic and noncarcinogenic toxicity of COPCs. EPA recommends the following hierarchy of toxicological sources for Superfund Risk Assessments (OSWER Directive 9285.7-53, December 5, 2003):

Tier 1 - EPA's Integrated Risk Information System (IRIS, <http://www.epa.gov/iris>)

Tier 2 - EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs, <http://hhpprtv.ornl.gov/>) – The Office of Research and Development / National Center for Environmental Assessment (NCEA, <http://www.epa.gov/ncea>) / Superfund Health Risk Technical Support Center (STSC) develops PPRTVs on a chemical specific basis as requested by EPA's Superfund program. These values are available upon request through the project USEPA Risk Assessor.

Tier 3 - Other toxicity Values – Includes additional USEPA and non-EPA sources:

- California Environmental Protection Agency (CalEPA) toxicity values (<http://www.oehha.ca.gov/risk/ChemicalDB>)
- The Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs) (<http://www.atsdr.cdc.gov/mrls.html>)
- Health Effects Assessment Summary Tables (HEAST). Annual FY-1997. Office of Research and Development/ Office of Emergency and Remedial Response. OERR 9200.6-303

The most technically defensible toxicity values available, based on EPA guidance and hierarchy, were used to evaluate asbestos in this assessment. The URs used in this assessment are summarized in Table 6. As shown in Table 5, no RfC value is available to evaluate the noncarcinogenic effects associated with inhalation exposures to asbestos. Therefore, only the carcinogenic effects of asbestos inhalation exposures have been quantified.

Carcinogenicity is described in two ways: 1) quantitatively, with URs; and 2) qualitatively with the EPA Weight-of-Evidence classification scheme (A through E) (USEPA, 1986a). The UR is used with exposure information to provide a conservative estimate of the likelihood that an individual will develop cancer as a result of lifetime exposure to a chemical. It is a plausible upper-bound estimate of carcinogenic potency used to calculate cancer risk from exposure to

carcinogens by relating lifetime average contaminant exposures to the incremental probability of an individual developing cancer over a lifetime. The inhalation URs used in the risk assessment are expressed as risk per unit exposure, in units of incremental cancer risk per asbestos fiber per cubic centimeter of air inhaled. Cancer potency is directly proportional to the UR values; the larger the UR, the greater the cancer potency of the compound. In accordance with the EPA 1986 guidelines, URs are calculated assuming there are no threshold levels for carcinogenic effects and that the response increases linearly with dose at low levels, including dose levels encountered in the environment.

Carcinogenicity is also described through the EPA Weight-of-Evidence classification scheme (A through E). The weight-of-evidence evaluation considers available test data, adequacy of studies, types of studies, and observed responses. Chemicals that give rise to cancer or gene mutations are generally classified as follows:

- Group A: Human Carcinogen, sufficient human data
- Group B1: Probable Human Carcinogen, limited human data
- Group B2: Probable Human Carcinogen, sufficient evidence in animals and limited evidence or no evidence in humans
- Group C: Possible Human Carcinogen, limited evidence in animals and limited or no evidence in humans
- Group D: Not Classifiable as to Human Carcinogenicity, insufficient tests for carcinogenesis or mutagenesis are available
- Group E: Evidence of Non-Carcinogenicity in Humans

Using the weight-of-evidence classification scheme, asbestos is classified into Group A, Human Carcinogen.

Guidelines for Carcinogen Risk Assessment (USEPA, 2005a), including supplemental guidance for assessing susceptibility from early-life exposure to carcinogens (USEPA, 2005b) have been developed by EPA to update the 1986 cancer guidelines. The Cancer Guidelines classify human carcinogenic potential as “*Carcinogenic to Humans*,” “*Likely to Be Carcinogenic to Humans*,” “*Suggestive Evidence of Carcinogenic Potential*,” “*Inadequate Information to Assess Carcinogenic Potential*,” and “*Not Likely to Be Carcinogenic to Humans*,” to replace the Weight-of-Evidence alphanumeric categories A through E.

The 2005 Cancer Guidelines also differ from the 1986 guidelines in using straight-line extrapolation from a point of departure near the lower end of the observed range on the dose-response data for carcinogens acting by a non-threshold mode of action and those whose mode of action is unknown, rather than using a mathematical model, the linearized multistage model (LMS), to extrapolate below the observed range (USEPA, 2005a; USEPA, 2005b). However, assessments based on the 1986 guidelines are considered scientifically acceptable for estimating human health risk.

Following the 2003 OSWER hierarchy of toxicological sources for Superfund Risk Assessments, the IRIS UR value of 0.23 (f/cc)^{-1} is used in this risk assessment addendum. This UR value is derived to estimate cumulative excess lung cancer and mesothelioma from a continuous lifetime exposure from birth. However, it is not likely that the receptors of interest would be exposed to

asbestos at the site during their whole lifetime every day of their lives from birth. Besides, studies also show that exposure to asbestos fibers early in life rather than later in life can contribute more to the lifetime estimates of excess cancer risk. Since receptors are likely to be exposed to asbestos for only a portion of their lifetime and at different ages, another approach is used to adjust the asbestos IRIS lifetime UR to account for the age of onset of exposure and various durations of exposure for each receptor. The IRIS lifetime UR value and the adjusted less-than-lifetime UR values are derived based on human epidemiological data presented in the *Airborne Asbestos Health Assessment Update* (USEPA, 1986b). The UR for the trespasser assumes 10 years of exposure from age 5 to age 15. For the site worker UR, 25 years of exposure is assumed from age 20 to age 45. The construction worker UR assumes one year of exposure at age 30, while the resident UR is based on a 30-year exposure duration (from birth to age 30). Table 6 presents these UR values.

5.0 RISK CHARACTERIZATION

The Risk Characterization integrates information developed during the Hazard Identification, Exposure Assessment, and Toxicity Assessment to estimate the risks for each exposure point and receptor. RME risk estimates represent estimates of risk to human health that are above average, but within the range of possible exposures. CT risk estimates provide central tendency or average risks. Consistent with the 2007 BHHRA, CT evaluations are presented only for scenarios with RME cancer risks that are above EPA's cancer risk range (i.e., total cancer risk $> 10^{-4}$), or non-cancer hazards greater than EPA's target organ-specific hazard index limit of 1, as identified in the 2007 BHHRA.

Cancer risks and non-cancer hazards, calculated for soil COPCs other than asbestos in the 2007 BHHRA for the incidental ingestion, dermal contact, and inhalation of fugitive dust pathways, have been re-presented in this BHHRA addendum. The ingestion of homegrown vegetables after uptake of COPCs from soil was also quantified in the BHHRA. However, the risks and hazards associated with soil COPCs through the vegetable intake pathway have not been presented in this addendum due to a risk management decision that this pathway is unlikely to be complete.

To estimate cumulative receptor risks, this BHHRA addendum presents the cancer risks and non-cancer hazards from the BHHRA and sums to those baseline risks the incremental cancer risk associated with asbestos inhalation exposures. Because toxicity values for non-cancer effects are not available for asbestos, the non-cancer hazards presented in this document are the same as those presented in the BHHRA. The BHHRA should be referenced for information related to the calculation of non-cancer hazards and cancer risks for COPCs other than asbestos. The following sections discuss the methodology used to estimate the cancer risk associated with asbestos only.

5.1 Calculation of Asbestos Cancer Risks

The Incremental Lifetime Cancer Risk (ILCR) is defined as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a carcinogenic compound. For asbestos inhalation exposures, the ILCR associated with the Chronic Daily Exposure (CDE)

is the product of the CDE and the inhalation unit risk (UR) for the dust inhalation exposure pathway:

$$ILCR = UR \times CDE$$

Where:

ILCR = Incremental lifetime cancer risk for asbestos (unitless);

UR = Inhalation Unit Risk for asbestos (f/cc)⁻¹; and

CDE = Chronic daily exposure for asbestos (f/cc).

The total cancer risk for each exposure scenario is calculated by summing the risks across all exposure pathways for all COPCs, including asbestos. Cancer risks for children and adults are summed to provide a total receptor cancer risk for the residential scenario.

The EPA cancer risk range identified in the National Contingency Plan (NCP) (USEPA, 1990) is 1 in 1,000,000 (expressed as 10⁻⁶) to 1 in 10,000 (expressed as 10⁻⁴) over the course of a 70-year lifetime. For sites where the cumulative site risk to an individual based on the RME is less than 10⁻⁴, action generally is not warranted unless there are adverse environmental effects (USEPA, 1991). All cancer risk estimates were compared to EPA's cancer risk range.

5.2 Risk Summary

This section summarizes ILCRs for all exposure scenarios evaluated in the BHHRA addendum. In addition, the results of the BHHRA with regards to soil exposures for non-cancer effects are also presented (Science Collaborative, 2007).

Tables 9.1.RME through 9.53.RME summarize risks and hazards for the soil RME scenarios, using the receptor-specific less-than-lifetime URs. A footnote at the bottom of each of these tables provides the cumulative ILCR using the IRIS lifetime UR. CT summaries are provided only for those scenarios with risks or hazards above EPA risk management criteria, as identified in the 2007 BHHRA. Table 10 presents a summary of total receptor risks and hazards by exposure point, and identifies those COPCs that are major contributors to risks and hazards above EPA risk management criteria.

5.2.1 Current Scenarios

Risks and hazards for the current exposure scenarios are provided in Tables 9.1.RME through 9.13.RME for the resident, Tables 9.14.RME through 9.16.RME for the trespasser, and Table 9.17.RME for the site worker. There are no exceedances of EPA's risk range of 10⁻⁶ to 10⁻⁴ or HI limit of 1 for any current RME scenario. Therefore, CT risks and hazards have not been presented.

ILCRs for the current resident range from 4x10⁻⁵ for Lot 208, Lot 282, and Lot 342 to 8x10⁻⁵ for Gleason Court Lot 125 and the Orlando Property. Noncancer hazards for the current resident range from a HI of 0.04 at Gleason Court Lot 124 to a HI of 0.7 at Lot 360. However, the 2007 BHHRA identified lead as presenting an unacceptable hazard to current residents at Lot 257.

ILCRs for the current trespasser range from 3×10^{-6} for Lot 350 to 4×10^{-5} for the Old Railroad and Former Lower Mill Pond area. Noncancer hazards for the current trespasser range from a HI of 0.03 at Lot 350 to a HI of 0.2 at the Old Railroad and Former Lower Mill Pond area.

For the current site worker at the East of South Street On-Facility area, the ILCR is 7×10^{-5} and the HI is 0.02.

5.2.2 Future Scenarios

Risks and hazards for the future exposure scenarios are provided in Tables 9.18.RME through 9.35.RME for the resident, Tables 9.36.RME and 9.37.RME for the site worker, and Tables 9.38.RME through 9.53.RME for the construction worker. There are three exposure points with exceedances of EPA's risk range of 10^{-6} to 10^{-4} and/or HI limit of 1 for the RME resident scenario. CT risks and hazards have been presented consistent with the 2007 BHHRA.

ILCRs for the future resident exceed 10^{-4} for the East of South Street On-Facility area (1×10^{-3}), the West of South Street On-Facility area (2×10^{-4}), and the Old Railroad and Former Lower Mill Pond area (5×10^{-4}). CT ILCRs at these three exposure points and RME ILCRs for the remaining exposure points do not exceed EPA's risk range. ILCRs for the remaining exposure points range from 3×10^{-5} for Vacant Lot 209 to 8×10^{-5} for Gleason Court Lot 125. Noncancer hazards for the future resident exceed the target HI of 1 at the Old Railroad and Former Lower Mill Pond area, with the CT HI at 1 for this exposure point. HIs are less than 1 for the remaining exposure points and vary from a HI of 0.1 at Gleason Court Lot 124, the Orlando Property, Lot 208, and Vacant Lot 209 to a HI of 0.7 at Lot 360. The major risk contributors are identified as asbestos, arsenic, and carcinogenic PAHs. Trichloroethene is also identified as a major risk contributor at the East of South Street On-Facility area. The 2007 BHHRA also identified lead as presenting an unacceptable hazard to future residents at Lot 257.

ILCRs for the future site worker range from 2×10^{-5} for the West of South Street On-Facility area to 1×10^{-4} for the East of South Street On-Facility area. Noncancer hazards for the future site worker range from a HI of 0.02 at the West of South Street On-Facility area to a HI of 0.05 at the East of South Street On-Facility area.

ILCRs for the future construction worker range from 4×10^{-6} for Gleason Court Lots 122, 124, and 125, Gleason Court Vacant Lot, the Orlando Property, Lot 208, Vacant Lot 209, Lot 210, Lot 230, Lot 257, Lot 282, Lot 283, and Lot 342 to 1×10^{-5} for the East of South Street On-Facility and Old Railroad and Former Lower Mill Pond areas. Noncancer hazards for the future construction worker range from a HI of 0.02 at the Orlando Property, Lot 208, and Vacant Lot 209 to a HI of 0.7 at the Old Railroad and Former Lower Mill Pond area.

6.0 UNCERTAINTY SECTION

In general, risk estimates are subject to uncertainties in each step of the assessment. In order to limit the possibility of erroneously concluding that the site poses no unacceptable risks, assumptions are applied in the risk assessment that are more likely to overestimate rather than

underestimate risk. This section identifies those assumptions that tend to result in overestimation of risk, and identifies additional uncertainties that may bias the evaluation toward underestimation of risk.

6.1 Environmental Sampling Design and Collection

Since it is not possible to sample the entire exposure area, one must rely on a set of samples from defined locations to represent the entire exposure area or site. Although this is a source of uncertainty, it is not likely to result in an underestimate of risk because sampling was targeted to areas of the site believed to be representative of the site as a whole. In addition, the activity performed (i.e., mowing) was selected to provide an upper bound of exposures due to its generating high energy and airborne fibers from soil. Such a biased data set is more likely to overestimate risk.

As stated in the Asbestos Activity Based Sampling Report (Lockheed Martin, 2008; Appendix B-2), there were no apparent problems reported from the field collection program that should affect data quality and usability. All PCM-equivalent data were acceptable for use in the BHHRA addendum based on field and laboratory QC. Therefore, there is little uncertainty resulting from sampling error.

6.2 Analytical Techniques and Data Quality

As discussed in the Asbestos Activity Based Sampling Report (Lockheed Martin, 2008; Appendix B-2), overall there were no significant analytical errors that should affect data usability in the BHHRA addendum. Reporting limits (RLs) for asbestos were obtained using the best available technology. Data evaluation indicated that there were minimal data quality issues that could affect data usability. Therefore, there is little uncertainty resulting from laboratory analytical error.

6.3 Reporting limits

There is uncertainty associated with the treatment of non-detected compounds in EPC calculations. It is possible that results reported as “below reporting limit” may actually have been detects. The assessment uses one-half the sample reporting limit in calculating EPCs to address this uncertainty, which may overestimate or underestimate risk associated with these samples. However, given the high degree of data quality identified in the data set, this uncertainty is considered low.

6.4 Selection of Exposure Parameters

There is uncertainty in each exposure factor selected for use in any risk assessment. Some of the exposure assumptions used in the BHHRA addendum were based on professional judgment. To avoid underestimation of exposure, as recommended by EPA guidance, scenarios were evaluated using a Reasonable Maximum Exposure (RME). RME is defined as the highest exposure reasonably expected to occur at a site (USEPA, 1989), and is typically represented by applying 90th to 95th percentile exposure assumptions. The intent of the RME is to provide a conservative

estimate of exposure, well above the average case, that is still within the range of possible exposures. RME levels are estimated by setting exposure time and exposure frequency at the high end of possible values. CT exposure is defined as the average exposure and was achieved by setting exposure time at half the value used for the RME scenario. The CT exposure assumptions are used to calculate a central tendency or average risk for the site for scenarios with RME exceedances of EPA's cancer risk range or hazard index benchmark.

6.5 Asbestos Toxicity Values

Another source of uncertainty in all risk assessments is the uncertainty associated with derivation of the toxicity values. Most toxicity values are developed using data from animal studies where administered doses are high relative to environmental dose levels in order to observe adverse responses. These results are then extrapolated from high dose to low dose and from test animal to sensitive human using assumptions based on empirical data and policy decisions to provide conservative, health protective, toxicity values.

In addition to uncertainties in estimating exposure concentrations, there are also uncertainties regarding the toxicity of asbestos. Asbestos is a generic name given to a group of six different types of fibrous minerals that occur as bundles of fibers naturally in the environment, which fall into two mineral groups, serpentine and amphibole. The most common asbestos type is chrysotile, from the serpentine mineral. The other five asbestos-related minerals (amosite, crocidolite, tremolite, anthophyllite, and actinolite) are amphiboles. Chrysotile asbestos consists of curly fibers, while amphiboles all have rod-like fibers. There is uncertainty concerning differences in the extent of disease caused by different types of asbestos fibers. The amphibole fiber type is believed to be much more toxic than the chrysotile fiber type. Specifically, chrysotile is one tenth as potent as amphiboles toward the induction of lung cancer and one hundredth as potent toward the induction of mesothelioma (USEPA, 2003). These differences are likely due to the varying physical and chemical properties of the different fibers. The bulk of available data indicate that fiber size is the most important determinant of carcinogenic potential.

Since the IRIS lifetime UR value and the adjusted less-than-lifetime UR values are based on airborne measurements for only fibers that are analyzed using the PCM method or meet the PCM-equivalent dimension requirements, it is not possible to distinguish risks from asbestos of different fiber types if they exist at the site. Besides, there is an uncertainty that the actual risks could also include risks from fibers of dimensions other than PCM-equivalent dimension (shorter and thinner fibers than fibers analyzed by PCM) that exist at the site but are not quantified. EPA is currently working on an approach to evaluate risks from exposure to various asbestos fiber types and fiber sizes.

Using the IRIS lifetime UR value would result in higher risks than using the less-than-lifetime UR values (see footnotes for Tables 9.1.RME through 9.53.RME). However, this could overestimate the cancer risks from exposures to asbestos at the site since it would assume that the exposure for a receptor (i.e., trespasser, resident, site worker, and construction worker) occurs during their whole lifetime rather than only a portion of their lifetime. Therefore, the use of less-than-lifetime UR values is considered more appropriate in estimating asbestos excess cancer risks.

Another uncertainty with the asbestos UR values is that while the derivation of both the IRIS value and the adjusted less-than-lifetime values is based on epidemiological data from occupational exposures, they are applied to non-occupational scenarios for the risk assessment. It is very likely that in these occupational studies, workers working directly with mining, milling, manufacturing, transporting, and disposing of asbestos could be exposed to higher levels of asbestos than the receptors being evaluated in the risk assessment. Considering the differences in exposed receptors, exposure duration, and exposure frequency, using of the toxicity values derived from occupational workers could result in an overestimate of the actual risks for receptors at the site.

6.6 Evaluation of Risk from Asbestos

Sources of uncertainty throughout the risk assessment affect risks estimated in the Risk Characterization. Evaluation of risk due to asbestos in soil is subject to a number of uncertainties. One of the biggest challenges is that a standard method does not exist to quantify asbestos fibers in soil. Soil analysis by PLM typically reports asbestos as non-detect below 1 percent and, more recently, attains a detection limit of 0.25 percent. The EPA Region I Method is a modified version of this qualitative method used to identify the type and percent of asbestos in a soil matrix. However, applying asbestos data from this qualitative method to quantify asbestos risk introduces considerable uncertainty to the risk assessment.

To evaluate asbestos air risk, a simple assumption could be made that the visual estimate of the percent asbestos in soil is equal to the percent asbestos in dust released to air, the exposure medium of concern. The correlation between percent asbestos in soil and percent in dust is likely to vary considerably depending on the nature of the soil matrix and how asbestos fibers are associated with the soil matrix. Asbestos fibers can be attached to the soil matrix, be loose, be part of a piece of debris, or anything in between. Therefore, the actual proportion (relative to other dust components) of asbestos in dust may be higher or lower than what is in soil.

To more accurately assess asbestos risk, one approach available is the elutriator Method (Berman and Kolk, 2000), which is used to measure the amount of asbestos released to the air in respirable dust from representative samples of asbestos-contaminated soil. The method specifies soil sampling and analytical protocols for measuring asbestos dust concentrations, which can be used in combination with modeled dust concentrations for dust-generating activities, to quantify risk from inhalation of asbestos in air. However, the asbestos dust concentrations generated in the laboratory may not be representative of real life exposures.

Due to high degree of uncertainty associated with these approaches, activity-based sampling data were gathered to measure asbestos in air during typical soil disturbing activities (raking and lawn mowing) to quantify risk from asbestos in soil. This type of measurement can be applied directly to risk calculations. The direct measurement of asbestos concentrations in air during applicable activities reduces the uncertainty associated with the asbestos risk evaluation.

7.0 REFERENCES

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**TABLE 1
SELECTION OF EXPOSURE PATHWAYS
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM**

**Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Fugitive Dust	Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, 342, and 360; Orlando Property; Gleason Court Vacant Lot	Resident	Adult/Child	Inhalation	Quant	Inhalation of asbestos fibers released into air during mowing, gardening, and biking possible.
			West of South Street On-Facility; Old Railroad and Former Lower Mill Pond Area; Lot 350; Vacant Lot 209	Trespasser	Older Child (7-14 years old)	Inhalation	Quant	Inhalation of asbestos fibers released into air during biking possible.
			East of South Street On-Facility	Site Worker	Adult	Inhalation	Quant	Inhalation of asbestos fibers released into air during landscaping possible.
Future	Soil	Fugitive Dust	East of South Street On-Facility; West of South Street On-Facility; Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, 342, 350, and 360; Orlando Property; Gleason Court Vacant Lot; Vacant Lot 209	Resident	Adult/Child	Inhalation	Quant	Inhalation of asbestos fibers released into air during mowing, gardening, and biking possible.
			East of South Street On-Facility; West of South Street On-Facility; Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, and 342; Orlando Property; Gleason Court Vacant Lot; Vacant Lot 209	Construction Worker	Adult	Inhalation	Quant	Inhalation of asbestos fibers released into air during construction activities possible.
			East of South Street On-Facility; West of South Street On-Facility	Site Worker	Adult	Inhalation	Quant	Inhalation of asbestos fibers released into air during landscaping possible.

**TABLE 2
OCCURENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM**

**Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Current/Future Medium: Soil Exposure Medium: Fugitive Dust
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Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value ⁽⁴⁾	Screening Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection ⁽³⁾
RAKING ⁽¹⁾															
East of South Street On-Facility; West of South Street On-Facility; Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, 342, 350, and 360; Orlando Property; Gleason Court Vacant Lot; Vacant Lot 209	1332-21-4	Asbestos	ND	ND	f/cc	Not Detected	0 / 3	0.00015 - 0.0027	ND	ND (<0.00018 - <0.00019)	N/A			No	NDB
MOWING ⁽²⁾															
East of South Street On-Facility; West of South Street On-Facility; Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, 342, 350, and 360; Orlando Property; Gleason Court Vacant Lot; Vacant Lot 209	1332-21-4	Asbestos	0.0096	0.01335	f/cc	Mowing Area 6 H	2 / 3	0.003	0.01335	ND (<0.00015 - <0.00021)	N/A			Yes	NSV/ABL

(1) Activity-based sampling data available for raking activity are samples Raking Area 1 H, Raking Area 1 L, Raking Area 2 H, Raking Area 2 L, Raking Area 3 H, Raking Area 3 HD, and Raking Area 3 L.
(2) Activity-based sampling data available for mowing activity are samples Mowing Area 4 H, Mowing Area 4 L, Mowing Area 5 H, Mowing Area 5 L, Mowing Area 6 H, Mowing Area 6 HD, and Mowing Area 6 L.
f/cc = fibers per cubic centimeter
ND = Not detected above laboratory detection limit
N/A = Not Available
(3) Rational for Deletion or Selection: NDB = Not detected above laboratory reporting limit or background level
NSV = No screening value available
ABL = Detected above the maximum detected background level
(4) Six background air samples collected during raking/mowing activities are presented in Table 3 of Appendix B-2. These values are considered representative of ambient asbestos air concentrations at the site.

**TABLE 3.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM**

**Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Current/Future Medium: Soil Exposure Medium: Fugitive Dust
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Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
East of South Street On-Facility; West of South Street On-Facility; Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, 342, 350, and 360; Orlando Property; Gleason Court Vacant Lot; Vacant Lot 209	Asbestos (CA _a)	f/cc	0.00815	N/A	0.01335	0.00815	f/cc	Mean	(1)
	Asbestos (CA _{bk})	f/cc	0.0000933	N/A	0.000105	0.0000933	f/cc	Mean	(2)

f/cc = fibers per cubic centimeter

EPC = Exposure Point Concentration

RME = Reasonable Maximum Exposure

N/A = Not applicable due to small number of samples available

CA_a = Concentration of asbestos in air during receptor-specific activities resulting in measurable asbestos fiber release from soil.

CA_{bk} = Concentration of asbestos in ambient air during receptor-specific activities not resulting in measurable asbestos fiber release from soil.

(1) Due to the small number of samples collected over a small area, the mean concentration has been selected as the RME EPC. Half the detection limit was used for the non-detect sample in the calculation of the mean.

(2) Because asbestos was not detected in the background air samples, half the detection limits were used in the calculation of both the mean and maximum concentrations.

TABLE 3.CT
EXPOSURE POINT CONCENTRATION SUMMARY
CENTRAL TENDENCY EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM

Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Fugitive Dust

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
East of South Street On-Facility; West of South Street On-Facility; Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, 342, 350, and 360; Orlando Property; Gleason Court Vacant Lot; Vacant Lot 209	Asbestos (CA _a)	f/cc	0.00815	N/A	0.01335	0.00815	f/cc	Mean	(1)
	Asbestos (CA _{bk})	f/cc	0.0000933	N/A	0.000105	0.0000933	f/cc	Mean	(2)

f/cc = fibers per cubic centimeter

EPC = Exposure Point Concentration

CT = Central Tendency

N/A = Not applicable due to small number of samples available

CA_a = Concentration of asbestos in air during receptor-specific activities resulting in measurable asbestos fiber release from soil.

CA_{bk} = Concentration of asbestos in ambient air during receptor-specific activities not resulting in measurable asbestos fiber release from soil.

(1) Due to the small number of samples collected over a small area, the mean concentration has been selected as the RME EPC. Half the detection limit was used for the non-detect sample in the calculation of the mean.

(2) Because asbestos was not detected in the background air samples, half the detection limits were used in the calculation of both the mean and maximum concentrations.

**TABLE 4.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM**

**Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Fugitive Dust

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name				
Inhalation	Trespasser	Older Child	West of South Street On-Facility; Old Railroad and Former Lower Mill Pond Area; Lot 350; Vacant Lot 209	CA _a	Asbestos Concentration in Air - Activity	See Table 3.RME	f/cc	See Table 3.RME	Chronic Daily Exposure (CDE) (f/cc) = (CA _a x TWF ₁) + CA _{bk} (TWF ₂ + TWF ₃)				
				CA _{bk}	Asbestos Concentration in Air - Background	See Table 3.RME	f/cc	See Table 3.RME					
				ET ₁	Exposure Time - Activity (Biking)	1	hr/day	Professional Judgment					
				ET ₂	Exposure Time - Ambient ₁	1	hr/day	Professional Judgment					
				ET ₃	Exposure Time - Ambient ₂	2	hr/day	Professional Judgment					
				EF ₁	Exposure Frequency - Activity (Biking)	22	days/year	Professional Judgment					
				EF ₂	Exposure Frequency - Ambient ₁	22	days/year	Professional Judgment					
				EF ₃	Exposure Frequency - Ambient ₂	65	days/year	Professional Judgment					
				CF ₁	Conversion Factor	24	hrs/day	--					
	CF ₂	Conversion Factor	365	days/year	--								
	Resident	Adult/Child	East of South Street On-Facility; Gleason Court Vacant Lot; Vacant Lot 209 Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, 342, 350, and 360; Orlando Property; West of South Street On-Facility	CA _a	Asbestos Concentration in Air - Activity	See Table 3.RME	f/cc	See Table 3.RME	Chronic Daily Exposure (CDE) (f/cc) = (CA _a x TWF ₁) + CA _{bk} (TWF ₂ + TWF ₃)				
				CA _{bk}	Asbestos Concentration in Air - Background	See Table 3.RME	f/cc	See Table 3.RME					
				ET ₁	Exposure Time - Activity (Biking, Gardening, Mowing)	5	hr/day	Professional Judgment					
				ET ₂	Exposure Time - Ambient ₁	19	hr/day	Professional Judgment					
				ET ₃	Exposure Time - Ambient ₂	24	hr/day	Professional Judgment					
				EF ₁	Exposure Frequency - Activity (Biking, Gardening, Mowing)	22	days/year	Professional Judgment					
				EF ₂	Exposure Frequency - Ambient ₁	22	days/year	Professional Judgment					
				EF ₃	Exposure Frequency - Ambient ₂	328	days/year	Professional Judgment					
				CF ₁	Conversion Factor	24	hrs/day	--					
				CF ₂	Conversion Factor	365	days/year	--					
				Site Worker	Adult	East of South Street On-Facility; West of South Street On-Facility	CA _a	Asbestos Concentration in Air - Activity		See Table 3.RME	f/cc	See Table 3.RME	Chronic Daily Exposure (CDE) (f/cc) = (CA _a x TWF ₁) + CA _{bk} (TWF ₂ + TWF ₃)
							CA _{bk}	Asbestos Concentration in Air - Background		See Table 3.RME	f/cc	See Table 3.RME	
	ET ₁	Exposure Time - Activity (Landscaping)	1				hr/day	Professional Judgment					
	ET ₂	Exposure Time - Ambient ₁	7				hr/day	Professional Judgment					
	ET ₃	Exposure Time - Ambient ₂	8				hr/day	Professional Judgment					
	EF ₁	Exposure Frequency - Activity (Landscaping)	50				days/year	Professional Judgment					
	EF ₂	Exposure Frequency - Ambient ₁	50				days/year	Professional Judgment					
EF ₃	Exposure Frequency - Ambient ₂	200	days/year				Professional Judgment						
CF ₁	Conversion Factor	24	hrs/day				--						
CF ₂	Conversion Factor	365	days/year	--									
Construction Worker	Adult	East of South Street On-Facility; Gleason Court Vacant Lot; Vacant Lot 209 Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, and 342; Orlando Property; West of South Street On-Facility	CA _a	Asbestos Concentration in Air - Activity	See Table 3.RME	f/cc	See Table 3.RME	Chronic Daily Exposure (CDE) (f/cc) = (CA _a x TWF ₁) + (CA _{bk} x TWF ₂)					
			CA _{bk}	Asbestos Concentration in Air - Background	See Table 3.RME	f/cc	See Table 3.RME						
			ET ₁	Exposure Time - Activity (Excavation)	8	hr/day	Professional Judgment						
			ET ₂	Exposure Time - Ambient ₁	0	hr/day	Professional Judgment						
			EF	Exposure Frequency	156	days/year	Professional Judgment						
			CF ₁	Conversion Factor	24	hrs/day	--						
			CF ₂	Conversion Factor	365	days/year	--						

CA_a = Concentration of asbestos in air during receptor-specific activities resulting in measurable asbestos fiber release from soil.
CA_{bk} = Concentration of asbestos in ambient air during receptor-specific activities not resulting in measurable asbestos fiber release from soil.
Activity - associated with receptor-specific activities resulting in measurable asbestos fiber release from soil
Ambient₁ - associated with other activities not resulting in measurable asbestos fiber release from soil, but occurring on those days when asbestos-releasing activities occur
Ambient₂ - associated with other activities not resulting in measurable asbestos fiber release from soil, and occurring on days when no asbestos-releasing activities occur
ET₁ for resident (5 hours/day) assumes 1 hour of biking, 2 hours of mowing, and 2 hours of gardening
TWF - Time Weighting Factor

**TABLE 4.CT
VALUES USED FOR DAILY INTAKE CALCULATIONS
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM**

**Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Fugitive Dust

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Trespasser	Older Child	West of South Street On-Facility; Old Railroad and Former Lower Mill Pond Area; Lot 350; Vacant Lot 209	CA _a	Asbestos Concentration in Air - Activity	See Table 3.CT	f/cc	See Table 3.CT	Chronic Daily Exposure (CDE) (f/cc) = (CA _a x TWF ₁) + CA _{bk} (TWF ₂ + TWF ₃)
				CA _{bk}	Asbestos Concentration in Air - Background	See Table 3.CT	f/cc	See Table 3.CT	
				ET ₁	Exposure Time - Activity (Biking)	0.5	hr/day	Professional Judgment	
				ET ₂	Exposure Time - Ambient ₁	0.5	hr/day	Professional Judgment	
				ET ₃	Exposure Time - Ambient ₂	1	hr/day	Professional Judgment	
				EF ₁	Exposure Frequency - Activity (Biking)	22	days/year	Professional Judgment	
	EF ₂	Exposure Frequency - Ambient ₁	22	days/year	Professional Judgment				
	EF ₃	Exposure Frequency - Ambient ₂	65	days/year	Professional Judgment				
	CF ₁	Conversion Factor	24	hrs/day	--				
	CF ₂	Conversion Factor	365	days/year	--				
	Resident	Adult/Child	East of South Street On-Facility; Gleason Court Vacant Lot; Vacant Lot 209 Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, 342, 350, and 360; Orlando Property; West of South Street On-Facility	CA _a	Asbestos Concentration in Air - Activity	See Table 3.CT	f/cc	See Table 3.CT	Chronic Daily Exposure (CDE) (f/cc) = (CA _a x TWF ₁) + CA _{bk} (TWF ₂ + TWF ₃)
				CA _{bk}	Asbestos Concentration in Air - Background	See Table 3.CT	f/cc	See Table 3.CT	
ET ₁				Exposure Time - Activity (Biking, Gardening, Mowing)	2.5	hr/day	Professional Judgment		
ET ₂				Exposure Time - Ambient ₁	21.5	hr/day	Professional Judgment		
ET ₃				Exposure Time - Ambient ₂	24	hr/day	Professional Judgment		
EF ₁				Exposure Frequency - Activity (Biking, Gardening, Mowing)	22	days/year	Professional Judgment		
EF ₂	Exposure Frequency - Ambient ₁	22	days/year	Professional Judgment					
EF ₃	Exposure Frequency - Ambient ₂	328	days/year	Professional Judgment					
CF ₁	Conversion Factor	24	hrs/day	--					
CF ₂	Conversion Factor	365	days/year	--					
Site Worker	Adult	East of South Street On-Facility; West of South Street On-Facility	CA _a	Asbestos Concentration in Air - Activity	See Table 3.CT	f/cc	See Table 3.CT	Chronic Daily Exposure (CDE) (f/cc) = (CA _a x TWF ₁) + CA _{bk} (TWF ₂ + TWF ₃)	
			CA _{bk}	Asbestos Concentration in Air - Background	See Table 3.CT	f/cc	See Table 3.CT		
			ET ₁	Exposure Time - Activity (Landscaping)	0.5	hr/day	Professional Judgment		
			ET ₂	Exposure Time - Ambient ₁	7.5	hr/day	Professional Judgment		
			ET ₃	Exposure Time - Ambient ₂	8	hr/day	Professional Judgment		
			EF ₁	Exposure Frequency - Activity (Landscaping)	50	days/year	Professional Judgment		
EF ₂	Exposure Frequency - Ambient ₁	50	days/year	Professional Judgment					
EF ₃	Exposure Frequency - Ambient ₂	200	days/year	Professional Judgment					
CF ₁	Conversion Factor	24	hrs/day	--					
CF ₂	Conversion Factor	365	days/year	--					
Construction Worker	Adult	East of South Street On-Facility; Gleason Court Vacant Lot; Vacant Lot 209 Old Railroad and Former Lower Mill Pond Area; Lots 122, 124, 125, 208, 283, 282, 210, 230, 257, and 342; Orlando Property; West of South Street On-Facility	CA _a	Asbestos Concentration in Air - Activity	See Table 3.CT	f/cc	See Table 3.CT	Chronic Daily Exposure (CDE) (f/cc) = (CA _a x TWF ₁) + (CA _{bk} x TWF ₂)	
			CA _{bk}	Asbestos Concentration in Air - Background	See Table 3.CT	f/cc	See Table 3.CT		
			ET ₁	Exposure Time - Activity (Excavation)	4	hr/day	Professional Judgment		
			ET ₂	Exposure Time - Ambient ₁	4	hr/day	Professional Judgment		
			EF	Exposure Frequency	156	days/year	Professional Judgment		
			CF ₁	Conversion Factor	24	hrs/day	--		
CF ₂	Conversion Factor	365	days/year	--					

CA_a = Concentration of asbestos in air during receptor-specific activities resulting in measurable asbestos fiber release from soil.

CA_{bk} = Concentration of asbestos in ambient air during receptor-specific activities not resulting in measurable asbestos fiber release from soil.

Activity - associated with receptor-specific activities resulting in measurable asbestos fiber release from soil

Ambient₁ - associated with other activities not resulting in measurable asbestos fiber release from soil, but occurring on those days when asbestos-releasing activities occur

Ambient₂ - associated with other activities not resulting in measurable asbestos fiber release from soil, and occurring on days when no asbestos-releasing activities occur

ET₁ for resident (2.5 hours/day) assumes 0.5 hours of biking, 1 hour of mowing, and 1 hour of gardening

TWF - Time Weighting Factor

TABLE 5
NON-CANCER TOXICITY DATA -- INHALATION
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM

Blackburn & Union Privileges Site
Walpole, Massachusetts

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RFC		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RFC : Target Organ(s)	
		Value	Units			Source(s)	Date(s) ⁽¹⁾ (MM/DD/YYYY)
Asbestos	Chronic	NA	NA	NA	NA	NA	January 2008

Notes:

(1) Date indicates when IRIS was last reviewed for the most current toxicity value.

NA = Not Available

IRIS = Integrated Risk Information System

TABLE 6
CANCER TOXICITY DATA - INHALATION
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM

Blackburn & Union Privileges Site
Walpole, Massachusetts

Chemical of Potential Concern	Unit Risk		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Asbestos	0.23	(f/cc) ⁻¹	A	IRIS	January 2008 ⁽¹⁾
Trespasser (ED = 10 years; from age 5 to age 15)	0.071	(f/cc) ⁻¹	A	EPA, 1986	(2)
Site Worker (ED = 25 years; from age 20 to age 45)	0.066	(f/cc) ⁻¹	A	EPA, 1986	(2)
Construction Worker (ED = 1 year; at age 30)	0.003	(f/cc) ⁻¹	A	EPA, 1986	(2)
Resident (ED = 30 years; from birth to age 30)	0.158	(f/cc) ⁻¹	A	EPA, 1986	(2)

Notes:

(1) Date indicates when IRIS was last reviewed for the most current toxicity value.

(2) Exposure duration and less-than-lifetime unit risk values have been used in the evaluation, derived based on information presented in "Airborne Asbestos Health Assessment Update" (EPA, 1986).

(f/cc)⁻¹ = risk per fiber per cubic centimeter

ED = Exposure Duration

IRIS = Integrated Risk Information System

Weight of Evidence/Cancer Guideline Description: A - Human carcinogen

TABLE 9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Gleason Court Lot 122	Benzo(a)pyrene	7.E-06	3.E-06	---	1.E-05	Renal	0.00007	0.00003	---	0.0001			
			Arsenic	1.E-05	1.E-06	---	2.E-05	Integumental; Cardiovascular	0.3	0.02	---	0.3			
			Manganese	---	---	---	---	Neurological	0.02	---	---	0.02			
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04			
	Exposure Point Total				2.E-05	4.E-06	---	3.E-05		0.3	0.02	---	0.3		
	Exposure Medium Total				2.E-05	4.E-06	---	3.E-05		0.3	0.02	---	0.3		
	Fugitive Dust	Gleason Court Lot 122	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---		
Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---			
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---			
Soil Total				2.E-05	4.E-06	3.E-05	6.E-05		0.3	0.02	---	0.3			
Total Risk Across All Media							6.E-05	Total Hazard Across All Media				0.3			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 7E-05

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Gleason Court Lot 124	Benzo(a)pyrene	1.E-05	4.E-06	---	2.E-05	Renal	0.0001	4E-05	---	0.0002
			Benzo(b)fluoranthene	2.E-06	6.E-07	---	2.E-06	Renal	0.0002	6E-05	---	0.0002
			Dibenz(ah)anthracene	1.E-06	5.E-07	---	2.E-06	Renal	0.00001	5E-06	---	0.00002
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04
		Exposure Point Total	1.E-05	5.E-06	---	2.E-05		0.04	0.0001	---	0.04	
	Exposure Medium Total		1.E-05	5.E-06	---	2.E-05		0.04	0.0001	---	0.04	
	Fugitive Dust	Gleason Court Lot 124	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---
			Exposure Point Total	---	---	3.E-05	3.E-05		---	---	---	---
		Exposure Medium Total		---	---	3.E-05	3.E-05		---	---	---	---
	Soil Total			1.E-05	5.E-06	3.E-05	5.E-05		0.04	0.0001	---	0.04
Total Risk Across All Media							5.E-05	Total Hazard Across All Media				0.04

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 6E-05

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Gleason Court Lot 125	Benz(a)anthracene	2.E-06	8.E-07	---	3.E-06	Renal	0.0002	8E-05	---	0.0003			
			Benzo(a)pyrene	3.E-05	9.E-06	---	4.E-05	Renal	0.0003	9E-05	---	0.0003			
			Benzo(b)fluoranthene	3.E-06	1.E-06	---	4.E-06	Renal	0.0003	0.0001	---	0.0004			
			Dibenz(ah)anthracene	2.E-06	8.E-07	---	3.E-06	Renal	0.00002	8E-06	---	0.00003			
			Arsenic	2.E-06	2.E-07	---	2.E-06	Integumental; Cardiovascular	0.04	0.003	---	0.04			
			Manganese	---	---	---	---	Neurological	0.02	---	---	0.02			
			Vanadium	---	---	---	---	Renal	0.03	---	---	0.03			
	Exposure Point Total				4.E-05	1.E-05	---	5.E-05		0.09	0.003	---	0.09		
	Exposure Medium Total				4.E-05	1.E-05	---	5.E-05		0.09	0.003	---	0.09		
	Fugitive Dust	Gleason Court Lot 125	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---		
Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---			
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---			
Soil Total				4.E-05	1.E-05	3.E-05	8.E-05		0.09	0.003	---	0.09			
Total Risk Across All Media				8.E-05				Total Hazard Across All Media				0.09			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 9E-05

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Gleason Court Vacant Lot	Benzo(a)pyrene	5.E-06	2.E-06	---	7.E-06	Renal	0.00005	0.00002	---	0.00007			
			Arsenic	2.E-05	2.E-06	---	2.E-05	Integumental; Cardiovascular	0.4	0.03	---	0.4			
			Manganese	---	---	---	---	Neurological	0.02	---	---	0.02			
			Vanadium	---	---	---	---	Renal	0.03	---	---	0.03			
	Exposure Point Total				2.E-05	4.E-06	---	3.E-05		0.4	0.03	---	0.4		
	Exposure Medium Total				2.E-05	4.E-06	---	3.E-05		0.4	0.03	---	0.4		
	Fugitive Dust	Gleason Court Vacant Lot	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---		
Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---			
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---			
Soil Total				2.E-05	4.E-06	3.E-05	6.E-05		0.4	0.03	---	0.4			
Total Risk Across All Media							6.E-05	Total Hazard Across All Media				0.4			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 7E-05

**TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Orlando Property	Benz(a)anthracene	3.E-06	1.E-06	---	4.E-06	Renal	0.0003	0.0001	---	0.0004	
			Benzo(a)pyrene	2.E-05	9.E-06	---	3.E-05	Renal	0.0002	0.00009	---	0.0003	
			Benzo(b)fluoranthene	3.E-06	1.E-06	---	4.E-06	Renal	0.0003	0.0001	---	0.0004	
			Dibenz(ah)anthracene	1.E-06	5.E-07	---	2.E-06	Renal	0.00001	0.000005	---	0.00002	
			Indeno(1,2,3-cd)pyrene	6.E-07	2.E-07	---	8.E-07	Renal	0.00006	0.00002	---	0.00008	
			Arsenic	3.E-06	3.E-07	---	4.E-06	Integumental; Cardiovascular	0.06	0.005	---	0.07	
			Chromium VI	---	---	---	---	None observed	0.03	---	---	0.03	
			Manganese	---	---	---	---	Neurological	0.03	---	---	0.03	
	Vanadium	---	---	---	---	Renal	0.04	---	---	0.04			
	Exposure Point Total				4.E-05	1.E-05	---	5.E-05		0.2	0.005	---	0.2
	Exposure Medium Total				4.E-05	1.E-05	---	5.E-05		0.2	0.005	---	0.2
	Fugitive Dust	Orlando Property	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
			Exposure Point Total				---	---	3.E-05	3.E-05	---	---	---
Exposure Medium Total				---	---	3.E-05	3.E-05	---	---	---	---		
Soil Total				4.E-05	1.E-05	3.E-05	8.E-05		0.2	0.005	---	0.2	
Total Risk Across All Media							8.E-05	Total Hazard Across All Media					0.2

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 9E-05

**TABLE 9.6.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Lot 208	Benzo(a)pyrene	1.E-06	4.E-07	---	2.E-06	Renal	0.00001	0.000004	---	0.00002			
			Arsenic	3.E-06	3.E-07	---	4.E-06		Integumental; Cardiovascular	0.06	0.005	---	0.07		
			Manganese	---	---	---	---		Neurological	0.02	---	---	0.02		
			Vanadium	---	---	---	---		Renal	0.02	---	---	0.02		
			Cyanide (free)	---	---	---	---		Whole Body; Endocrine; Neurological	0.0009	---	---	0.0009		
	Exposure Point Total				5.E-06	7.E-07	---	5.E-06		0.1	0.005	---	0.1		
	Exposure Medium Total				5.E-06	7.E-07	---	5.E-06		0.1	0.005	---	0.1		
	Fugitive Dust	Lot 208	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---			
			Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---
			Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---
Soil Total				5.E-06	7.E-07	3.E-05	4.E-05		0.1	0.005	---	0.1			
Total Risk Across All Media							4.E-05	Total Hazard Across All Media				0.1			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 5E-05

**TABLE 9.7.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Lot 210	Benzo(a)pyrene	1.E-05	4.E-06	---	2.E-05	Renal	0.0001	0.00004	---	0.0002
			Benzo(b)fluoranthene	1.E-06	5.E-07	---	2.E-06	Renal	0.0001	0.00005	---	0.0002
			Arsenic	4.E-06	3.E-07	---	4.E-06	Integumental; Cardiovascular	0.07	0.006	---	0.07
			Manganese	---	---	---	---	Neurological	0.03	---	---	0.03
			Nickel	---	---	---	---	Whole Body; Hepatic	0.05	---	---	0.05
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04
	Exposure Point Total			2.E-05	5.E-06	---	2.E-05		0.2	0.006	---	0.2
	Exposure Medium Total			2.E-05	5.E-06	---	2.E-05		0.2	0.006	---	0.2
	Fugitive Dust	Lot 210	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---
			Exposure Point Total			---	---	3.E-05	3.E-05		---	---
Exposure Medium Total			---	---	3.E-05	3.E-05		---	---	---		
Soil Total			2.E-05	5.E-06	3.E-05	5.E-05		0.2	0.006	---	0.2	
Total Risk Across All Media							5.E-05	Total Hazard Across All Media				0.2

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 7E-05

TABLE 9.8.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 230	Benzo(a)pyrene	8.E-06	3.E-06	---	1.E-05	Renal	0.00008	0.00003	---	0.0001	
			Arsenic	7.E-06	6.E-07	---	7.E-06		Integumental; Cardiovascular	0.1	0.01	---	0.1
			Vanadium	---	---	---	---		Renal	0.03	---	---	0.03
	Exposure Point Total				1.E-05	3.E-06	---	2.E-05		0.2	0.01	---	0.2
	Exposure Medium Total				1.E-05	3.E-06	---	2.E-05		0.2	0.01	---	0.2
	Fugitive Dust												
		Lot 230	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---	
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				1.E-05	3.E-06	3.E-05	5.E-05		0.2	0.01	---	0.2	
Total Risk Across All Media							5.E-05	Total Hazard Across All Media				0.2	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 6E-05

**TABLE 9.9.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)								
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total				
Soil	Soil	Lot 257	Benz(a)anthracene	1.E-06	5.E-07	---	2.E-06	Renal	0.0001	0.00005	---	0.0002				
			Benzo(a)pyrene	1.E-05	5.E-06	---	2.E-05	Renal	0.0001	0.00005	---	0.0002				
			Benzo(b)fluoranthene	2.E-06	7.E-07	---	3.E-06	Renal	0.0002	0.00007	---	0.0003				
			Dibenz(ah)anthracene	3.E-06	1.E-06	---	4.E-06	Renal	0.00003	0.00001	---	0.00004				
			Indeno(1,2,3-cd)pyrene	1.E-06	5.E-07	---	2.E-06	Renal	0.0001	0.00005	---	0.0002				
			Arsenic	1.E-05	1.E-06	---	1.E-05	Integumental; Cardiovascular	0.2	0.02	---	0.2				
			Chromium VI	---	---	---	---	None observed	0.05	---	---	0.05				
			Manganese	---	---	---	---	Neurological	0.03	---	---	0.03				
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04				
			Exposure Point Total				3.E-05	9.E-06	---	4.E-05		0.3	0.02	---	0.3	
	Exposure Medium Total				3.E-05	9.E-06	---	4.E-05		0.3	0.02	---	0.3			
	Fugitive Dust	Lot 257	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---			
				Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---
				Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---
Soil Total				3.E-05	9.E-06	3.E-05	7.E-05		0.3	0.02	---	0.3				
Total Risk Across All Media							7.E-05	Total Hazard Across All Media				0.3				

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 8E-05

TABLE 9.10.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 282	Benzo(a)pyrene	3.E-06	1.E-06	---	4.E-06	Renal	0.00003	0.00001	---	0.00004	
			Arsenic	9.E-06	8.E-07	---	1.E-05	Integumental; Cardiovascular	0.2	0.01	---	0.2	
			Manganese	---	---	---	---	Neurological	0.03	---	---	0.03	
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04	
	Exposure Point Total				1.E-05	2.E-06	---	1.E-05		0.2	0.01	---	0.2
	Exposure Medium Total				1.E-05	2.E-06	---	1.E-05		0.2	0.01	---	0.2
	Fugitive Dust												
		Lot 282	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---	
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				1.E-05	2.E-06	3.E-05	4.E-05		0.2	0.01	---	0.2	
Total Risk Across All Media							4.E-05	Total Hazard Across All Media					0.2

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 6E-05

TABLE 9.11.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 283	Benz(a)anthracene	1.E-06	5.E-07	---	2.E-06	Renal	0.0001	5E-05	---	0.0002	
			Benzo(a)pyrene	1.E-05	5.E-06	---	2.E-05	Renal	0.0001	5E-05	---	0.0002	
			Benzo(b)fluoranthene	1.E-06	4.E-07	---	2.E-06	Renal	0.0001	4E-05	---	0.0002	
			Dibenz(ah)anthracene	1.E-06	4.E-07	---	1.E-06	Renal	0.00001	4E-06	---	0.00001	
			Arsenic	5.E-06	5.E-07	---	5.E-06	Integumental; Cardiovascular	0.09	0.008	---	0.1	
			Manganese	---	---	---	---	Neurological	0.06	---	---	0.06	
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04	
	Exposure Point Total			2.E-05	7.E-06	---	3.E-05		0.2	0.008	---	0.2	
	Exposure Medium Total			2.E-05	7.E-06	---	3.E-05		0.2	0.008	---	0.2	
	Fugitive Dust	Lot 283	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---
Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---		
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---		
Soil Total			2.E-05	7.E-06	3.E-05	6.E-05		0.2	0.008	---	0.2		
Total Risk Across All Media				6.E-05				Total Hazard Across All Media				0.2	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 7E-05

TABLE 9.12.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Lot 342	Benzo(a)pyrene	2.E-06	7.E-07	---	3.E-06	Renal Integumental; Cardiovascular None observed Renal	0.00002	0.000007	---	0.00002
			Arsenic	6.E-06	5.E-07	---	6.E-06		0.1	0.009	---	0.1
			Chromium VI	---	---	---	---		0.05	---	---	0.05
			Vanadium	---	---	---	---		0.04	---	---	0.04
	Exposure Point Total			8.E-06	1.E-06	---	9.E-06		0.2	0.009	---	0.2
	Exposure Medium Total			8.E-06	1.E-06	---	9.E-06		0.2	0.009	---	0.2
	Fugitive Dust											
		Lot 342	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---
Exposure Point Total			---	---	3.E-05	3.E-05		---	---	---	---	
Exposure Medium Total			---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				8.E-06	1.E-06	3.E-05	4.E-05		0.2	0.009	---	0.2
Total Risk Across All Media							4.E-05	Total Hazard Across All Media				0.2

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 5E-05

TABLE 9.13.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Child and Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 360	Benz(a)anthracene	1.E-06	3.E-07	---	1.E-06	Renal	0.00009	3E-05	---	0.0001	
			Benzo(a)pyrene	8.E-06	3.E-06	---	1.E-05	Renal	0.00008	3E-05	---	0.0001	
			Benzo(b)fluoranthene	1.E-06	4.E-07	---	2.E-06	Renal	0.0001	4E-05	---	0.0002	
			Dibenz(ah)anthracene	2.E-06	6.E-07	---	2.E-06	Renal	0.00002	6E-06	---	0.00002	
			Antimony	---	---	---	---	Whole Body; Hepatic	0.09	---	---	0.09	
			Arsenic	2.E-05	2.E-06	---	2.E-05	Integumental; Cardiovascular	0.3	0.03	---	0.4	
			Chromium VI	---	---	---	---	None observed	0.2	---	---	0.2	
			Vanadium	---	---	---	---	Renal	0.05	---	---	0.05	
	Exposure Point Total				3.E-05	6.E-06	---	4.E-05		0.7	0.03	---	0.7
	Exposure Medium Total				3.E-05	6.E-06	---	4.E-05		0.7	0.03	---	0.7
	Fugitive Dust	Lot 360	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
				Exposure Point Total				---	---	3.E-05	3.E-05	---	---
Exposure Medium Total				---	---	3.E-05	3.E-05	---	---	---			
Soil Total				3.E-05	6.E-06	3.E-05	7.E-05		0.7	0.03	---	0.7	
Total Risk Across All Media				7.E-05				Total Hazard Across All Media					0.7

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 8E-05

Note: 'Whole Body' is included in all Total Target Organ Hazard Indices

Total Cardiovascular HI Across All Media	0.4
Total Hepatic HI Across All Media	0.09
Total Integumental HI Across All Media	0.4
Total Renal HI Across All Media	0.050
Total None observed HI Across All Media	0.2
Total Whole Body HI Across All Media	0.09

TABLE 9.14.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Trespasser
Receptor Age: Older Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	West of South Street On-Facility and Vacant Lot 209	Benz(a)anthracene	2.E-07	1.E-07	---	3.E-07	Renal	0.00007	0.00006	---	0.0001
			Benzo(a)pyrene	2.E-06	1.E-06	---	3.E-06	Renal	0.00008	0.00007	---	0.0001
			Benzo(b)fluoranthene	2.E-07	1.E-07	---	3.E-07	Renal	0.00008	0.00007	---	0.0001
			Chrysene	2.E-09	1.E-09	---	3.E-09	Renal	0.00008	0.00007	---	0.0002
			Dibenz(ah)anthracene	2.E-07	2.E-07	---	3.E-07	Renal	0.000009	0.000007	---	0.00002
			Indeno(1,2,3-cd)pyrene	8.E-08	6.E-08	---	1.E-07	Renal	0.00003	0.00003	---	0.00006
			Arsenic	2.E-06	3.E-07	---	2.E-06	Integumental; Cardiovascular	0.04	0.007	---	0.05
			Manganese	---	---	---	---	Neurological	0.002	---	---	0.002
	Vanadium	---	---	---	---	Renal	0.003	---	---	0.003		
			Exposure Point Total		4.E-06	2.E-06	---	6.E-06		0.04	0.008	---
		Exposure Medium Total		4.E-06	2.E-06	---	6.E-06		0.04	0.008	---	0.05
	Fugitive Dust	West of South Street On-Facility and Vacant Lot 209	Asbestos	---	---	2.E-06	2.E-06	NA	---	---	---	---
		Exposure Point Total		---	---	2.E-06	2.E-06		---	---	---	---
		Exposure Medium Total		---	---	2.E-06	2.E-06		---	---	---	---
Soil Total				4.E-06	2.E-06	2.E-06	8.E-06		0.04	0.008	---	0.05
Total Risk Across All Media							8.E-06	Total Hazard Across All Media				0.05

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 1E-05

TABLE 9.15.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Trespasser
Receptor Age: Older Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Old Railroad and Former Lower Mill Pond Area	Benz(a)anthracene	1.E-06	8.E-07	---	2.E-06	Renal	0.0005	0.0004	---	0.0009			
			Benzo(a)pyrene	8.E-06	7.E-06	---	2.E-05	Renal	0.0004	0.0003	---	0.0007			
			Benzo(b)fluoranthene	1.E-06	1.E-06	---	3.E-06	Renal	0.0006	0.0005	---	0.001			
			Benzo(k)fluoranthene	7.E-08	5.E-08	---	1.E-07	Renal	0.0003	0.0002	---	0.0005			
			Chrysene	1.E-08	9.E-09	---	2.E-08	Renal	0.0005	0.0004	---	0.0009			
			Dibenz(ah)anthracene	2.E-06	1.E-06	---	3.E-06	Renal	0.00007	0.00006	---	0.0001			
			Indeno(1,2,3-cd)pyrene	6.E-07	5.E-07	---	1.E-06	Renal	0.0003	0.0002	---	0.0005			
			Antimony	---	---	---	---	Whole Body; Hepatic	0.005	---	---	0.005			
			Arsenic	8.E-06	2.E-06	---	1.E-05	Integumental; Cardiovascular	0.2	0.03	---	0.2			
			Chromium VI	---	---	---	---	None observed	0.007	---	---	0.007			
			Manganese	---	---	---	---	Neurological	0.003	---	---	0.003			
			Vanadium	---	---	---	---	Renal	0.004	---	---	0.004			
			Exposure Point Total				2.E-05	1.E-05	---	3.E-05		0.2	0.04	---	0.2
			Exposure Medium Total				2.E-05	1.E-05	---	3.E-05		0.2	0.04	---	0.2
Soil	Fugitive Dust	Old Railroad and Former Lower Mill Pond Area	Asbestos	---	---	2.E-06	2.E-06	NA	---	---	---	---			
			Exposure Point Total				---	---	2.E-06	2.E-06		---	---	---	---
			Exposure Medium Total				---	---	2.E-06	2.E-06		---	---	---	---
Soil Total				2.E-05	1.E-05	2.E-06	4.E-05		0.2	0.04	---	0.2			
Total Risk Across All Media							4.E-05	Total Hazard Across All Media				0.2			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 4E-05

TABLE 9.16.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Trespasser
Receptor Age: Older Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 350	Benzo(a)pyrene	7.E-08	6.E-08	---	1.E-07	Renal	0.000003	0.000003	---	0.000006	
			Antimony	---	---	---	---	Whole Body; Hepatic	0.006	---	---	0.006	
			Arsenic	7.E-07	1.E-07	---	9.E-07	Integumental; Cardiovascular	0.02	0.003	---	0.02	
			Vanadium	---	---	---	---	Renal	0.006	---	---	0.006	
			Exposure Point Total	8.E-07	2.E-07	---	1.E-06		0.03	0.003	---	0.03	
	Exposure Medium Total	8.E-07	2.E-07	---	1.E-06		0.03	0.003	---	0.03			
	Fugitive Dust	Lot 350	Asbestos					NA					
					---	---	2.E-06	2.E-06		---	---	---	---
				Exposure Point Total	---	---	2.E-06	2.E-06		---	---	---	---
				Exposure Medium Total	---	---	2.E-06	2.E-06		---	---	---	---
Soil Total				8.E-07	2.E-07	2.E-06	3.E-06		0.03	0.003	---	0.03	
Total Risk Across All Media							3.E-06	Total Hazard Across All Media					0.03

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 6E-06

TABLE 9.17.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Current
Receptor Population: Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient						
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total		
Soil	Soil	East of South Street On-Facility	Trichloroethylene (TCE)	1.E-08	---	---	1.E-08	Hepatic; Renal; Developmental; Immunological	0.0003	---	---	0.0003		
			Benzo(a)anthracene	3.E-06	2.E-06	---	5.E-06		Renal	0.0004	0.0003	---	0.0007	
			Benzo(a)pyrene	2.E-05	2.E-05	---	4.E-05		Renal	0.0003	0.0002	---	0.0005	
			Benzo(b)fluoranthene	3.E-06	2.E-06	---	5.E-06		Renal	0.0003	0.0003	---	0.0006	
			Benzo(k)fluoranthene	1.E-07	1.E-07	---	2.E-07		Renal	0.0002	0.0001	---	0.0003	
			Chrysene	3.E-08	2.E-08	---	5.E-08		Renal	0.0003	0.0003	---	0.0006	
			Dibenz(ah)anthracene	3.E-06	2.E-06	---	5.E-06		Renal	0.00003	3E-05	---	0.00006	
			Indeno(1,2,3-cd)pyrene	1.E-06	1.E-06	---	3.E-06		Renal	0.0002	0.0002	---	0.0003	
			Arsenic	2.E-06	3.E-07	---	2.E-06		Integumental; Cardiovascular	0.01	0.002	---	0.01	
			Exposure Point Total				3.E-05		3.E-05	---	6.E-05	0.01	0.003	---
Exposure Medium Total				3.E-05	3.E-05	---	6.E-05	0.01	0.003	---	0.02			
Soil	Fugitive Dust	East of South Street On-Facility	Asbestos	---	---	4.E-06	4.E-06	NA	---	---	---	---		
			Exposure Point Total				---		---	4.E-06	4.E-06	---	---	---
			Exposure Medium Total				---		---	4.E-06	4.E-06	---	---	---
Soil Total				3.E-05	3.E-05	4.E-06	7.E-05	0.01	0.003	---	0.02			
Total Risk Across All Media							7.E-05	Total Hazard Across All Media			0.02			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 8E-05

Note: Risk estimates shown for TCE are calculated using the upper end of the slope factor range.

TABLE 9.18.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)						
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total		
Soil	Soil	East of South Street On-Facility	Trichloroethylene (TCE)	2.E-06	---	---	2.E-06	Hepatic; Renal; Developmental; Immunological Respiratory Whole Body Renal Renal Renal Renal Renal Renal Renal Whole Body; Hepatic Integumental; Cardiovascular None observed Neurological Immunological Renal Hematological	0.2	---	---	0.2		
			2-Methylnaphthalene	---	---	---	---		0.01	0.005	---	0.02		
			Naphthalene	---	---	---	---		0.006	0.002	---	0.008		
			Benz(a)anthracene	5.E-05	2.E-05	---	7.E-05		0.005	0.002	---	0.007		
			Benzo(a)pyrene	5.E-04	2.E-04	---	7.E-04		0.005	0.002	---	0.007		
			Benzo(b)fluoranthene	6.E-05	2.E-05	---	8.E-05		0.006	0.002	---	0.008		
			Benzo(k)fluoranthene	3.E-06	1.E-06	---	5.E-06		0.003	0.001	---	0.005		
			Chrysene	5.E-07	2.E-07	---	7.E-07		0.005	0.002	---	0.007		
			Dibenz(ah)anthracene	5.E-05	2.E-05	---	6.E-05		0.004	0.002	---	0.006		
			Indeno(1,2,3-cd)pyrene	2.E-05	6.E-06	---	2.E-05		0.002	0.0006	---	0.002		
			Dibenzofuran	---	---	---	---		0.03	0.008	---	0.04		
			Antimony	---	---	---	---		0.03	---	---	0.03		
			Arsenic	4.E-06	4.E-07	---	4.E-06		0.07	0.006	---	0.08		
			Chromium VI	---	---	---	---		0.03	---	---	0.03		
			Manganese	---	---	---	---		0.02	---	---	0.02		
	Mercury	---	---	---	---	0.1	---	---	0.1					
	Vanadium	---	---	---	---	0.04	---	---	0.04					
	Zinc	---	---	---	---	0.03	---	---	0.03					
	Exposure Point Total				7.E-04	2.E-04	---	1.E-03	0.6	0.03	---	0.6		
	Exposure Medium Total				7.E-04	2.E-04	---	1.E-03	0.6	0.03	---	0.6		
Soil	Fugitive Dust	East of South Street On-Facility	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---		
			Exposure Point Total				---		---	3.E-05	3.E-05	---	---	---
			Exposure Medium Total				---		---	3.E-05	3.E-05	---	---	---
Soil Total				7.E-04	2.E-04	3.E-05	1.E-03	0.6	0.03	---	0.6			
Total Risk Across All Media							1.E-03	Total Hazard Across All Media				0.6		

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 1E-03

Note: Risk estimates shown for TCE are calculated using the upper end of the slope factor range.

TABLE 9.18.CT
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
CENTRAL TENDENCY EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)						
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total		
Soil	Soil	East of South Street On-Facility	Trichloroethylene (TCE)	4.E-07	---	---	4.E-07	Hepatic; Renal; Developmental; Immunological Respiratory Whole Body Renal Renal Renal Renal Renal Renal Renal Renal Whole Body; Hepatic Integumental; Cardiovascular None observed Neurological Immunological Renal Hematological	0.08	---	---	0.08		
			2-Methylnaphthalene	---	---	---	---		0.007	0.0009	---	0.007		
			Naphthalene	---	---	---	---		0.003	0.0004	---	0.003		
			Benzo(a)anthracene	9.E-06	1.E-06	---	1.E-05		0.003	0.0004	---	0.003		
			Benzo(a)pyrene	8.E-05	1.E-05	---	9.E-05		0.003	0.0004	---	0.003		
			Benzo(b)fluoranthene	1.E-05	1.E-06	---	1.E-05		0.003	0.0004	---	0.003		
			Benzo(k)fluoranthene	5.E-07	7.E-08	---	6.E-07		0.002	0.0002	---	0.002		
			Chrysene	8.E-08	1.E-08	---	9.E-08		0.003	0.0004	---	0.003		
			Dibenz(ah)anthracene	7.E-06	9.E-07	---	8.E-06		0.0002	3E-05	---	0.0003		
			Indeno(1,2,3-cd)pyrene	3.E-06	3.E-07	---	3.E-06		0.0008	0.0001	---	0.001		
			Dibenzofuran	---	---	---	---		0.01	0.002	---	0.02		
			Antimony	---	---	---	---		0.02	---	---	0.02		
			Arsenic	6.E-07	2.E-08	---	7.E-07		0.04	0.001	---	0.04		
			Chromium VI	---	---	---	---		0.01	---	---	0.01		
			Manganese	---	---	---	---		0.009	---	---	0.009		
			Mercury	---	---	---	---		0.05	---	---	0.05		
			Vanadium	---	---	---	---		0.02	---	---	0.02		
			Zinc	---	---	---	---		0.02	---	---	0.02		
			Exposure Point Total				1.E-04		1.E-05	---	1.E-04	0.3	0.006	---
	Exposure Medium Total				1.E-04	1.E-05	---	1.E-04	0.3	0.006	---	0.3		
Soil	Fugitive Dust	East of South Street On-Facility	Asbestos	---	---	2.E-05	2.E-05	NA	---	---	---	---		
			Exposure Point Total				---		---	2.E-05	2.E-05	---	---	---
			Exposure Medium Total				---		---	2.E-05	2.E-05	---	---	---
Soil Total				1.E-04	1.E-05	2.E-05	1.E-04	0.3	0.006	---	0.3			
Total Risk Across All Media							1.E-04	Total Hazard Across All Media				0.3		

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to

Note: Risk estimates shown for TCE are calculated using the upper end of the slope factor range.

TABLE 9.19.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	West of South Street On-Facility	Benz(a)anthracene	6.E-06	2.E-06	---	8.E-06	Renal	0.0006	0.0002	---	0.0008			
			Benzo(a)pyrene	7.E-05	2.E-05	---	9.E-05	Renal	0.0007	0.0002	---	0.0009			
			Benzo(b)fluoranthene	7.E-06	2.E-06	---	9.E-06	Renal	0.0007	0.0002	---	0.0009			
			Chrysene	7.E-08	3.E-08	---	1.E-07	Renal	0.0007	0.0003	---	0.001			
			Dibenz(ah)anthracene	8.E-06	3.E-06	---	1.E-05	Renal	0.00008	3E-05	---	0.0001			
			Indeno(1,2,3-cd)pyrene	3.E-06	1.E-06	---	4.E-06	Renal	0.0003	0.0001	---	0.0004			
			Arsenic	1.E-05	9.E-07	---	1.E-05	Integumental; Cardiovascular	0.2	0.01	---	0.2			
			Chromium VI	---	---	---	---	None observed	0.02	---	---	0.02			
			Manganese	---	---	---	---	Neurological	0.01	---	---	0.01			
			Mercury	---	---	---	---	Immunological	0.04	---	---	0.04			
	Vanadium	---	---	---	---	Renal	0.02	---	---	0.02					
	Exposure Point Total				1.E-04	3.E-05	---	1.E-04		0.3	0.02	---	0.3		
	Exposure Medium Total				1.E-04	3.E-05	---	1.E-04		0.3	0.02	---	0.3		
	Soil	Fugitive Dust	West of South Street On-Facility	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---		
Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---			
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---			
Soil Total				1.E-04	3.E-05	3.E-05	2.E-04		0.3	0.02	---	0.3			
Total Risk Across All Media							2.E-04	Total Hazard Across All Media				0.3			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 2E-04

TABLE 9.20.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Gleason Court Lot 122	Benzo(a)pyrene	7.E-06	2.E-06	---	9.E-06	Renal	0.00007	0.00002	---	0.00009			
			Arsenic	1.E-05	1.E-06	---	1.E-05	Integumental; Cardiovascular	0.2	0.02	---	0.3			
			Manganese	---	---	---	---	Neurological	0.02	---	---	0.02			
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04			
	Exposure Point Total				2.E-05	4.E-06	---	2.E-05		0.3	0.02	---	0.3		
	Exposure Medium Total				2.E-05	4.E-06	---	2.E-05		0.3	0.02	---	0.3		
	Fugitive Dust	Gleason Court Lot 122	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---		
Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---			
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---			
Soil Total				2.E-05	4.E-06	3.E-05	5.E-05		0.3	0.02	---	0.3			
Total Risk Across All Media							5.E-05	Total Hazard Across All Media				0.3			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 7E-05

TABLE 9.21.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Gleason Court Lot 124	Benzo(a)pyrene	1.E-05	4.E-06	---	1.E-05	Renal	0.0001	4E-05	---	0.0001			
			Benzo(b)fluoranthene	1.E-06	5.E-07	---	2.E-06	Renal	0.0001	5E-05	---	0.0002			
			Dibenz(ah)anthracene	1.E-06	4.E-07	---	2.E-06	Renal	0.00001	4E-06	---	0.00002			
			Arsenic	4.E-06	3.E-07	---	4.E-06	Integumental; Cardiovascular	0.07	0.006	---	0.07			
			Manganese	---	---	---	---	Neurological	0.02	---	---	0.02			
			Vanadium	---	---	---	---	Renal	0.03	---	---	0.03			
	Exposure Point Total				2.E-05	5.E-06	---	2.E-05		0.1	0.006	---	0.1		
	Exposure Medium Total				2.E-05	5.E-06	---	2.E-05		0.1	0.006	---	0.1		
	Fugitive Dust	Gleason Court Lot 124	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---		
				Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---			
Soil Total				2.E-05	5.E-06	3.E-05	5.E-05		0.1	0.006	---	0.1			
Total Risk Across All Media							5.E-05	Total Hazard Across All Media				0.1			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 7E-05

TABLE 9.22.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Gleason Court Lot 125	Benz(a)anthracene	2.E-06	7.E-07	---	3.E-06	Renal	0.0002	7E-05	---	0.0003	
			Benzo(a)pyrene	3.E-05	9.E-06	---	4.E-05	Renal	0.0003	9E-05	---	0.0003	
			Benzo(b)fluoranthene	3.E-06	1.E-06	---	4.E-06	Renal	0.0003	0.0001	---	0.0004	
			Dibenz(ah)anthracene	2.E-06	8.E-07	---	3.E-06	Renal	0.00002	8E-06	---	0.00003	
			Arsenic	8.E-06	8.E-07	---	9.E-06	Integumental; Cardiovascular	0.1	0.01	---	0.2	
			Barium	---	---	---	---	Renal	0.02	---	---	0.02	
			Manganese	---	---	---	---	Neurological	0.03	---	---	0.03	
			Vanadium	---	---	---	---	Renal	0.03	---	---	0.03	
	Exposure Point Total				4.E-05	1.E-05	---	5.E-05		0.2	0.01	---	0.2
	Exposure Medium Total				4.E-05	1.E-05	---	5.E-05		0.2	0.01	---	0.2
Soil	Fugitive Dust	Gleason Court Lot 125	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
			Exposure Point Total				---	---	3.E-05	3.E-05		---	---
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				4.E-05	1.E-05	3.E-05	8.E-05		0.2	0.01	---	0.2	
Total Risk Across All Media							8.E-05		Total Hazard Across All Media			0.2	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to

1E-04

TABLE 9.23.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Gleason Court Vacant Lot	Benzo(a)pyrene	5.E-06	2.E-06	---	7.E-06	Renal	0.00005	0.00002	---	0.00007	
			Arsenic	2.E-05	2.E-06	---	2.E-05	Integumental; Cardiovascular	0.3	0.03	---	0.3	
			Manganese	---	---	---	---	Neurological	0.02	---	---	0.02	
			Vanadium	---	---	---	---	Renal	0.03	---	---	0.03	
	Exposure Point Total				2.E-05	4.E-06	---	3.E-05		0.4	0.03	---	0.4
	Exposure Medium Total				2.E-05	4.E-06	---	3.E-05		0.4	0.03	---	0.4
	Fugitive Dust	Gleason Court Vacant Lot	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---
				Exposure Point Total				---	---	3.E-05	3.E-05		---
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				2.E-05	4.E-06	3.E-05	6.E-05		0.4	0.03	---	0.4	
Total Risk Across All Media							6.E-05	Total Hazard Across All Media				0.4	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 7E-05

TABLE 9.24.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Old Railroad and Former Lower Mill Pond Area	Benzo(a)anthracene	4.E-05	1.E-05	---	5.E-05	Renal	0.004	0.001	---	0.005	
			Benzo(a)pyrene	2.E-04	6.E-05	---	2.E-04	Renal	0.002	0.0006	---	0.002	
			Benzo(b)fluoranthene	3.E-05	1.E-05	---	4.E-05	Renal	0.003	0.001	---	0.004	
			Benzo(k)fluoranthene	1.E-06	4.E-07	---	2.E-06	Renal	0.001	0.0004	---	0.002	
			Chrysene	2.E-07	8.E-08	---	3.E-07	Renal	0.002	0.0008	---	0.003	
			Dibenz(ah)anthracene	4.E-05	1.E-05	---	5.E-05	Renal	0.0004	0.0001	---	0.0005	
			Indeno(1,2,3-cd)pyrene	2.E-05	7.E-06	---	3.E-05	Renal	0.002	0.0007	---	0.003	
			Antimony	---	---	---	---	Whole Body; Hepatic	0.05	---	---	0.05	
			Arsenic	1.E-04	9.E-06	---	1.E-04	Integumental; Cardiovascular	2	0.1	---	2	
			Chromium VI	---	---	---	---	None observed	0.04	---	---	0.04	
	Manganese	---	---	---	---	Neurological	0.02	---	---	0.02			
	Vanadium	---	---	---	---	Renal	0.03	---	---	0.03			
			Exposure Point Total	4.E-04	1.E-04	---	5.E-04		2	0.2	---	2	
			Exposure Medium Total	4.E-04	1.E-04	---	5.E-04		2	0.2	---	2	
		Fugitive Dust	Old Railroad and Former Lower Mill Pond Area	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---
				Exposure Point Total	---	---	3.E-05	3.E-05		---	---	---	
				Exposure Medium Total	---	---	3.E-05	3.E-05		---	---	---	
		Soil Total	4.E-04	1.E-04	3.E-05	5.E-04		2	0.2	---	2		
				Total Risk Across All Media			5.E-04	Total Hazard Across All Media			2		

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 5E-04

Total Cardiovascular HI Across All Media	4
Total Integumental HI Across All Media	4

Note: 'Whole Body' is included in all Total Target Organ Hazard Indices

TABLE 9.24.CT
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
CENTRAL TENDENCY EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)						
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total		
Soil	Soil	Old Railroad and Former Lower Mill Pond Area	Benzo(a)anthracene	6.E-06	7.E-07	---	7.E-06	Renal	0.002	0.0003	---	0.002		
			Benzo(a)pyrene	3.E-05	3.E-06	---	3.E-05	Renal	0.0008	0.0001	---	0.0009		
			Benzo(b)fluoranthene	5.E-06	6.E-07	---	5.E-06	Renal	0.001	0.0002	---	0.002		
			Benzo(k)fluoranthene	2.E-07	3.E-08	---	2.E-07	Renal	0.0006	9E-05	---	0.0007		
			Chrysene	3.E-08	4.E-09	---	4.E-08	Renal	0.001	0.0002	---	0.001		
			Dibenz(ah)anthracene	6.E-06	8.E-07	---	7.E-06	Renal	0.0002	3E-05	---	0.0002		
			Indeno(1,2,3-cd)pyrene	3.E-06	4.E-07	---	4.E-06	Renal	0.001	0.0001	---	0.001		
			Antimony	---	---	---	---	Whole Body; Hepatic	0.03	---	---	0.03		
			Arsenic	2.E-05	5.E-07	---	2.E-05	Integumental; Cardiovascular	0.9	0.03	---	0.9		
			Chromium VI	---	---	---	---	None observed	0.02	---	---	0.02		
	Manganese	---	---	---	---	Neurological	0.01	---	---	0.01				
	Vanadium	---	---	---	---	Renal	0.01	---	---	0.01				
	Exposure Point Total				6.E-05	6.E-06	---	7.E-05		1	0.03	---	1	
	Exposure Medium Total				6.E-05	6.E-06	---	7.E-05		1	0.03	---	1	
	Soil	Fugitive Dust	Old Railroad and Former Lower Mill Pond Area	Asbestos	---	---	2.E-05	2.E-05	NA	---	---	---	---	
Exposure Point Total				---	---	2.E-05	2.E-05	---	---	---	---			
Exposure Medium Total				---	---	2.E-05	2.E-05	---	---	---	---			
Soil Total				6.E-05	6.E-06	2.E-05	9.E-05		1	0.03	---	1		
Total Risk Across All Media				9.E-05				Total Hazard Across All Media					1	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 1E-04

TABLE 9.25.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Orlando Property	Benz(a)anthracene	3.E-06	1.E-06	---	4.E-06	Renal	0.0003	0.0001	---	0.0004	
			Benzo(a)pyrene	2.E-05	8.E-06	---	3.E-05	Renal	0.0002	0.00008	---	0.0003	
			Benzo(b)fluoranthene	3.E-06	1.E-06	---	4.E-06	Renal	0.0003	0.0001	---	0.0004	
			Dibenz(ah)anthracene	9.E-07	3.E-07	---	1.E-06	Renal	0.000009	0.000003	---	0.00001	
			Indeno(1,2,3-cd)pyrene	4.E-07	2.E-07	---	6.E-07	Renal	0.00004	0.00002	---	0.00006	
			Arsenic	3.E-06	3.E-07	---	3.E-06	Integumental; Cardiovascular	0.05	0.004	---	0.06	
			Chromium VI	---	---	---	---	None observed	0.03	---	---	0.03	
			Manganese	---	---	---	---	Neurological	0.03	---	---	0.03	
	Vanadium	---	---	---	---	Renal	0.03	---	---	0.03			
			Exposure Point Total		3.E-05	1.E-05	---	4.E-05			0.1	0.005	---
		Exposure Medium Total		3.E-05	1.E-05	---	4.E-05			0.1	0.005	---	0.1
	Fugitive Dust	Orlando Property	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
			Exposure Point Total	---	---	3.E-05	3.E-05		---	---	---	---	
		Exposure Medium Total		---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				3.E-05	1.E-05	3.E-05	7.E-05		0.1	0.005	---	0.1	
Total Risk Across All Media							7.E-05	Total Hazard Across All Media					0.1

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 9E-05

TABLE 9.26.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Lot 208	Benzo(a)pyrene	1.E-06	4.E-07	---	2.E-06	Renal	0.00001	4E-06	---	0.00002			
			Arsenic	3.E-06	3.E-07	---	4.E-06	Integumental; Cardiovascular	0.06	0.005	---	0.07			
			Manganese	---	---	---	---	Neurological	0.02	---	---	0.02			
			Vanadium	---	---	---	---	Renal	0.02	---	---	0.02			
			Cyanide (free)	---	---	---	---	Whole Body; Endocrine; Neurological	0.0009	---	---	0.0009			
	Exposure Point Total				5.E-06	7.E-07	---	5.E-06		0.1	0.005	---	0.1		
	Exposure Medium Total				5.E-06	7.E-07	---	5.E-06		0.1	0.005	---	0.1		
	Fugitive Dust	Lot 208	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---			
			Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---
			Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---
Soil Total				5.E-06	7.E-07	3.E-05	4.E-05		0.1	0.005	---	0.1			
Total Risk Across All Media							4.E-05		Total Hazard Across All Media				0.1		

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 5E-05

TABLE 9.27.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Vacant Lot 209	Arsenic	3.E-06	3.E-07	---	4.E-06	Integumental; Cardiovascular Neurological Renal	0.06	0.005	---	0.07	
			Manganese	---	---	---	---		0.02	---	---	0.02	
			Vanadium	---	---	---	---		0.04	---	---	0.04	
			Exposure Point Total	3.E-06	3.E-07	---	4.E-06			0.1	0.005	---	0.1
	Exposure Medium Total				3.E-06	3.E-07	---	4.E-06		0.1	0.005	---	0.1
	Fugitive Dust	Vacant Lot 209	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---
				Exposure Point Total	---	---	3.E-05	3.E-05		---	---	---	---
				Exposure Medium Total				---		---	3.E-05	3.E-05	---
Soil Total				3.E-06	3.E-07	3.E-05	3.E-05		0.1	0.005	---	0.1	
Total Risk Across All Media				3.E-05				Total Hazard Across All Media				0.1	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to

5E-05

TABLE 9.28.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 210	Benzo(a)pyrene	1.E-05	4.E-06	---	2.E-05	Renal	0.0001	0.00004	---	0.0002	
			Benzo(b)fluoranthene	1.E-06	5.E-07	---	2.E-06	Renal	0.0001	0.00005	---	0.0002	
			Arsenic	4.E-06	3.E-07	---	4.E-06	Integumental; Cardiovascular	0.07	0.006	---	0.07	
			Manganese	---	---	---	---	Neurological	0.03	---	---	0.03	
			Nickel	---	---	---	---	Whole Body; Hepatic	0.05	---	---	0.05	
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04	
	Exposure Point Total				2.E-05	5.E-06	---	2.E-05		0.2	0.006	---	0.2
	Exposure Medium Total				2.E-05	5.E-06	---	2.E-05		0.2	0.006	---	0.2
	Fugitive Dust	Lot 210	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
			Exposure Point Total				---	---	3.E-05	3.E-05	---	---	---
Exposure Medium Total				---	---	3.E-05	3.E-05	---	---	---	---		
Soil Total				2.E-05	5.E-06	3.E-05	5.E-05		0.2	0.006	---	0.2	
Total Risk Across All Media							5.E-05	Total Hazard Across All Media				0.2	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 7E-05

TABLE 9.29.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 230	Benzo(a)pyrene	8.E-06	3.E-06	---	1.E-05	Renal	0.00008	0.00003	---	0.0001	
			Arsenic	7.E-06	6.E-07	---	7.E-06		Integumental; Cardiovascular	0.1	0.01	---	0.1
			Vanadium	---	---	---	---		Renal	0.03	---	---	0.03
	Exposure Point Total				1.E-05	3.E-06	---	2.E-05		0.2	0.01	---	0.2
	Exposure Medium Total				1.E-05	3.E-06	---	2.E-05		0.2	0.01	---	0.2
	Fugitive Dust	Lot 230	Asbestos		---	---	3.E-05	3.E-05	NA	---	---	---	---
				Exposure Point Total				---		---	3.E-05	3.E-05	---
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				1.E-05	3.E-06	3.E-05	5.E-05		0.2	0.01	---	0.2	
Total Risk Across All Media							5.E-05	Total Hazard Across All Media				0.2	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 6E-05

TABLE 9.30.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Lot 257	Benz(a)anthracene	1.E-06	5.E-07	---	2.E-06	Renal	0.0001	0.00005	---	0.0002			
			Benzo(a)pyrene	1.E-05	5.E-06	---	2.E-05	Renal	0.0001	0.00005	---	0.0002			
			Benzo(b)fluoranthene	2.E-06	7.E-07	---	3.E-06	Renal	0.0002	0.00007	---	0.0003			
			Dibenz(ah)anthracene	3.E-06	1.E-06	---	4.E-06	Renal	0.00003	0.00001	---	0.00004			
			Indeno(1,2,3-cd)pyrene	1.E-06	5.E-07	---	2.E-06	Renal	0.0001	0.00005	---	0.0002			
			Arsenic	1.E-05	1.E-06	---	1.E-05	Integumental; Cardiovascular	0.2	0.02	---	0.2			
			Chromium VI	---	---	---	---	None observed	0.05	---	---	0.05			
			Manganese	---	---	---	---	Neurological	0.03	---	---	0.03			
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04			
			Exposure Point Total				3.E-05	9.E-06	---	4.E-05		0.3	0.02	---	0.3
			Exposure Medium Total				3.E-05	9.E-06	---	4.E-05		0.3	0.02	---	0.3
			Fugitive Dust	Lot 257	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
Exposure Point Total					---	---	3.E-05	3.E-05	---	---	---				
Exposure Medium Total					---	---	3.E-05	3.E-05	---	---	---				
Soil Total				3.E-05	9.E-06	3.E-05	7.E-05		0.3	0.02	---	0.3			
Total Risk Across All Media				7.E-05				Total Hazard Across All Media				0.3			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 8E-05

TABLE 9.31.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 282	Benzo(a)pyrene	3.E-06	1.E-06	---	4.E-06	Renal	0.00003	0.00001	---	0.00004	
			Arsenic	9.E-06	8.E-07	---	1.E-05	Integumental; Cardiovascular	0.2	0.01	---	0.2	
			Manganese	---	---	---	---	Neurological	0.03	---	---	0.03	
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04	
	Exposure Point Total				1.E-05	2.E-06	---	1.E-05		0.2	0.01	---	0.2
	Exposure Medium Total				1.E-05	2.E-06	---	1.E-05		0.2	0.01	---	0.2
	Fugitive Dust	Lot 282	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
			Exposure Point Total				---	---	3.E-05	3.E-05	---	---	---
Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				1.E-05	2.E-06	3.E-05	4.E-05		0.2	0.01	---	0.2	
Total Risk Across All Media							4.E-05	Total Hazard Across All Media					0.2

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 6E-05

TABLE 9.32.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Lot 283	Benz(a)anthracene	1.E-06	5.E-07	---	2.E-06	Renal	0.0001	5E-05	---	0.0002
			Benzo(a)pyrene	1.E-05	5.E-06	---	2.E-05	Renal	0.0001	5E-05	---	0.0002
			Benzo(b)fluoranthene	1.E-06	4.E-07	---	2.E-06	Renal	0.0001	4E-05	---	0.0002
			Dibenz(ah)anthracene	1.E-06	4.E-07	---	1.E-06	Renal	0.00001	4E-06	---	0.00001
			Arsenic	5.E-06	5.E-07	---	5.E-06	Integumental; Cardiovascular	0.09	0.008	---	0.1
			Manganese	---	---	---	---	Neurological	0.06	---	---	0.06
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04
	Exposure Point Total			2.E-05	7.E-06	---	3.E-05		0.2	0.008	---	0.2
	Exposure Medium Total			2.E-05	7.E-06	---	3.E-05		0.2	0.008	---	0.2
	Fugitive Dust	Lot 283	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---
Exposure Point Total			---	---	3.E-05	3.E-05		---	---	---	---	
Exposure Medium Total			---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total			2.E-05	7.E-06	3.E-05	6.E-05		0.2	0.008	---	0.2	
Total Risk Across All Media							6.E-05	Total Hazard Across All Media				0.2

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 7E-05

**TABLE 9.33.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts**

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 342	Benzo(a)pyrene	2.E-06	7.E-07	---	3.E-06	Renal	0.00002	0.000007	---	0.00002	
			Arsenic	6.E-06	5.E-07	---	6.E-06	Integumental; Cardiovascular	0.1	0.009	---	0.1	
			Chromium VI	---	---	---	---	None observed	0.05	---	---	0.05	
			Vanadium	---	---	---	---	Renal	0.04	---	---	0.04	
	Exposure Point Total			8.E-06	1.E-06	---	9.E-06		0.2	0.009	---	0.2	
	Exposure Medium Total			8.E-06	1.E-06	---	9.E-06		0.2	0.009	---	0.2	
	Fugitive Dust		Lot 342	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---
		Exposure Point Total		---	---	3.E-05	3.E-05		---	---	---	---	
		Exposure Medium Total		---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				8.E-06	1.E-06	3.E-05	4.E-05		0.2	0.009	---	0.2	
Total Risk Across All Media							4.E-05	Total Hazard Across All Media					0.2

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 5E-05

TABLE 9.34.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)						
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total		
Soil	Soil	Lot 350	Benzo(a)pyrene	3.E-06	1.E-06	---	4.E-06	Renal	0.00003	0.00001	---	0.00004		
			Antimony	---	---	---	---	Whole Body; Hepatic	0.05	---	---	0.05		
			Arsenic	8.E-06	7.E-07	---	8.E-06	Integumental; Cardiovascular	0.1	0.01	---	0.2		
			Vanadium	---	---	---	---	Renal	0.05	---	---	0.05		
	Exposure Point Total				1.E-05	2.E-06	---	1.E-05		0.2	0.01	---	0.3	
	Exposure Medium Total				1.E-05	2.E-06	---	1.E-05		0.2	0.01	---	0.3	
	Fugitive Dust		Lot 350	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---	
Exposure Point Total					---	---	3.E-05	3.E-05		---	---	---	---	
Exposure Medium Total					---	---	3.E-05	3.E-05		---	---	---	---	
Soil Total				1.E-05	2.E-06	3.E-05	4.E-05		0.2	0.01	---	0.3		
Total Risk Across All Media							4.E-05	Total Hazard Across All Media					0.3	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 6E-05

TABLE 9.35.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk (combined child and adult)				Non-Cancer Hazard Quotient (only child HQs are listed because they are higher than corresponding adult HQs)							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Lot 360	Benz(a)anthracene	1.E-06	3.E-07	---	1.E-06	Renal	0.00009	3E-05	---	0.0001			
			Benzo(a)pyrene	8.E-06	3.E-06	---	1.E-05	Renal	0.00008	3E-05	---	0.0001			
			Benzo(b)fluoranthene	1.E-06	4.E-07	---	2.E-06	Renal	0.0001	4E-05	---	0.0002			
			Dibenz(ah)anthracene	2.E-06	6.E-07	---	2.E-06	Renal	0.00002	6E-06	---	0.00002			
			Antimony	---	---	---	---	Whole Body; Hepatic	0.09	---	---	0.09			
			Arsenic	2.E-05	2.E-06	---	2.E-05	Integumental; Cardiovascular	0.3	0.03	---	0.4			
			Chromium VI	---	---	---	---	None observed	0.2	---	---	0.2			
			Vanadium	---	---	---	---	Renal	0.05	---	---	0.05			
			Exposure Point Total				3.E-05	6.E-06	---	4.E-05		0.7	0.03	---	0.7
			Exposure Medium Total				3.E-05	6.E-06	---	4.E-05		0.7	0.03	---	0.7
Soil	Fugitive Dust	Lot 360	Asbestos	---	---	3.E-05	3.E-05	NA	---	---	---	---			
			Exposure Point Total				---	---	3.E-05	3.E-05		---	---	---	---
			Exposure Medium Total				---	---	3.E-05	3.E-05		---	---	---	---
Soil Total				3.E-05	6.E-06	3.E-05	7.E-05		0.7	0.03	---	0.7			
Total Risk Across All Media							7.E-05	Total Hazard Across All Media				0.7			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 8E-05

Note: 'Whole Body' is included in all Total Target Organ Hazard Indices

Total Cardiovascular HI Across All Media	0.4
Total Hepatic HI Across All Media	0.09
Total Integumental HI Across All Media	0.4
Total Renal HI Across All Media	0.05
Total None observed HI Across All Media	0.2
Total Whole Body HI Across All Media	0.09

TABLE 9.36.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient						
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total		
Soil	Soil	East of South Street On-Facility	Trichloroethylene (TCE)	8.E-07	---	---	8.E-07	Hepatic; Renal; Developmental; Immunological Respiratory Whole Body Renal Renal Renal Renal Renal Renal Renal Whole Body; Hepatic Integumental; Cardiovascular Renal Hematological	0.02	---	---	0.02		
			2-Methylnaphthalene	---	---	---	---		0.001	0.001	---	0.003		
			Naphthalene	---	---	---	---		0.0006	0.0005	---	0.001		
			Benz(a)anthracene	5.E-06	4.E-06	---	8.E-06		0.0006	0.0005	---	0.001		
			Benzo(a)pyrene	4.E-05	4.E-05	---	8.E-05		0.0005	0.0005	---	0.001		
			Benzo(b)fluoranthene	5.E-06	4.E-06	---	9.E-06		0.0006	0.0005	---	0.001		
			Benzo(k)fluoranthene	3.E-07	2.E-07	---	5.E-07		0.0004	0.0003	---	0.0007		
			Chrysene	4.E-08	4.E-08	---	8.E-08		0.0005	0.0005	---	0.001		
			Dibenz(ah)anthracene	4.E-06	3.E-06	---	7.E-06		0.00005	4E-05	---	0.00009		
			Indeno(1,2,3-cd)pyrene	1.E-06	1.E-06	---	3.E-06		0.0002	0.0002	---	0.0003		
			Antimony	---	---	---	---		0.004	---	---	0.004		
			Arsenic	1.E-06	2.E-07	---	1.E-06		0.008	0.002	---	0.009		
			Vanadium	---	---	---	---		0.004	---	---	0.004		
			Zinc	---	---	---	---		0.003	---	---	0.003		
			Exposure Point Total				6.E-05		5.E-05	---	1.E-04	0.04	0.006	---
Exposure Medium Total				6.E-05	5.E-05	---	1.E-04	0.04	0.006	---	0.05			
Soil	Fugitive Dust	East of South Street On-Facility	Asbestos	---	---	4.E-06	4.E-06	NA	---	---	---	---		
			Exposure Point Total				---		---	4.E-06	4.E-06	---	---	---
			Exposure Medium Total				---		---	4.E-06	4.E-06	---	---	---
Soil Total				6.E-05	5.E-05	4.E-06	1.E-04	0.04	0.006	---	0.05			
Total Risk Across All Media							1.E-04	Total Hazard Across All Media			0.05			

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to

Note: Risk estimates shown for TCE are calculated using the upper end of the slope factor range.

TABLE 9.37.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient						
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total		
Soil	Soil	West of South Street On-Facility	Benz(a)anthracene	5.E-07	4.E-07	---	9.E-07	Renal	0.00006	5E-05	---	0.0001		
			Benzo(a)pyrene	6.E-06	5.E-06	---	1.E-05	Renal	0.00007	6E-05	---	0.0001		
			Benzo(b)fluoranthene	5.E-07	5.E-07	---	1.E-06	Renal	0.00007	6E-05	---	0.0001		
			Chrysene	6.E-09	5.E-09	---	1.E-08	Renal	0.00008	7E-05	---	0.0001		
			Dibenz(ah)anthracene	6.E-07	6.E-07	---	1.E-06	Renal	0.000008	7E-06	---	0.00002		
			Indeno(1,2,3-cd)pyrene	2.E-07	2.E-07	---	4.E-07	Renal	0.00003	3E-05	---	0.00006		
			Arsenic	3.E-06	6.E-07	---	4.E-06	Integumental; Cardiovascular	0.02	0.004	---	0.02		
	Exposure Point Total				1.E-05	7.E-06	---	2.E-05		0.02	0.004	---	0.02	
	Exposure Medium Total				1.E-05	7.E-06	---	2.E-05		0.02	0.004	---	0.02	
	Soil	Fugitive Dust	West of South Street On-Facility	Asbestos	---	---	4.E-06	4.E-06	NA	---	---	---	---	
Exposure Point Total				---	---	4.E-06	4.E-06		---	---	---			
Exposure Medium Total				---	---	4.E-06	4.E-06		---	---	---			
Soil Total				1.E-05	7.E-06	4.E-06	2.E-05		0.02	0.004	---	0.02		
Total Risk Across All Media								2.E-05	Total Hazard Across All Media				0.02	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-05

TABLE 9.38.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient									
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total					
Soil	Soil	East of South Street On-Facility	Trichloroethylene (TCE)	1.E-07	---	---	1.E-07	Hepatic; Renal; Developmental; Immunological	0.02	---	---	0.02					
			2-Methylnaphthalene	---	---	---	---		Respiratory	0.005	0.002	---	0.007				
			Naphthalene	---	---	---	---		Whole Body	0.0002	9E-05	---	0.0003				
			Benz(a)anthracene	6.E-07	2.E-07	---	9.E-07		Renal	0.0002	8E-05	---	0.0003				
			Benzo(a)pyrene	6.E-06	2.E-06	---	8.E-06		Renal	0.0002	7E-05	---	0.0003				
			Benzo(b)fluoranthene	7.E-07	3.E-07	---	9.E-07		Renal	0.0002	8E-05	---	0.0003				
			Benzo(k)fluoranthene	4.E-08	1.E-08	---	5.E-08		Renal	0.0001	5E-05	---	0.0002				
			Chrysene	6.E-09	2.E-09	---	8.E-09		Renal	0.0002	7E-05	---	0.0003				
			Dibenz(ah)anthracene	5.E-07	2.E-07	---	7.E-07		Renal	0.00002	6E-06	---	0.00002				
			Indeno(1,2,3-cd)pyrene	2.E-07	8.E-08	---	3.E-07		Renal	0.00006	2E-05	---	0.00009				
			Antimony	---	---	---	---		Whole Body; Hepatic	0.01	---	---	0.01				
			Arsenic	2.E-07	2.E-08	---	2.E-07		Integumental	0.03	0.002	---	0.03				
			Vanadium	---	---	---	---		Renal	0.01	---	---	0.01				
			Zinc	---	---	---	---		Hematological	0.01	---	---	0.01				
			Exposure Point Total				8.E-06		3.E-06	---	1.E-05		0.09	0.005	---	0.1	
			Exposure Medium Total				8.E-06		3.E-06	---	1.E-05		0.09	0.005	---	0.1	
			Dust	Dust	East of South Street On-Facility	Trichloroethylene (TCE)	---		---	3.E-12	3.E-12	Neurological; Hepatic; Endocrine	---	---	5E-09	0.00000005	
						2-Methylnaphthalene	---		---	---	---		Respiratory	---	---	7E-07	0.0000007
						Naphthalene	---		---	---	---		Respiratory	---	---	0.000002	0.000002
	Benz(a)anthracene	---				---	8.E-12	8.E-12	Respiratory	---	---		0.000002	0.000002			
Benzo(a)pyrene	---	---				7.E-11	7.E-11	Respiratory	---	---	0.000002		0.000002				
Benzo(b)fluoranthene	---	---				8.E-12	8.E-12	Respiratory	---	---	0.000002		0.000002				
Benzo(k)fluoranthene	---	---				5.E-13	5.E-13	Respiratory	---	---	0.000001		0.000001				
Chrysene	---	---				7.E-14	7.E-14	Respiratory	---	---	0.000002		0.000002				
Dibenz(ah)anthracene	---	---				6.E-12	6.E-12	Respiratory	---	---	2E-07		0.0000002				
Indeno(1,2,3-cd)pyrene	---	---				2.E-12	2.E-12	Respiratory	---	---	6E-07		0.0000006				
Antimony	---	---				---	---	Respiratory	---	---	9E-07		0.0000009				
Arsenic	---	---				5.E-11	5.E-11		---	---	---		---				
Asbestos	---	---				3.E-06	3.E-06	NA	---	---	---		---				
Exposure Point Total				---	---	3.E-06	3.E-06		---	---	0.00001	0.00001					
Exposure Medium Total				---	---	3.E-06	3.E-06		---	---	0.00001	0.00001					
Soil Total				8.E-06	3.E-06	3.E-06	1.E-05		0.09	0.005	0.00001	0.1					
Total Risk Across All Media				1.E-05				Total Hazard Across All Media				0.1					

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

Note: Risk estimates shown for TCE are calculated using the upper end of the slope factor range.

TABLE 9.39.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	West of South Street On-Facility	Benz(a)anthracene	7.E-08	3.E-08	---	9.E-08	Renal	0.00002	0.000008	---	0.00003
			Benzo(a)pyrene	8.E-07	3.E-07	---	1.E-06	Renal	0.00002	0.00001	---	0.00003
			Benzo(b)fluoranthene	8.E-08	3.E-08	---	1.E-07	Renal	0.00002	0.000009	---	0.00003
			Chrysene	8.E-10	3.E-10	---	1.E-09	Renal	0.00003	0.00001	---	0.00004
			Dibenz(ah)anthracene	9.E-08	3.E-08	---	1.E-07	Renal	0.000003	0.000001	---	0.000004
			Indeno(1,2,3-cd)pyrene	3.E-08	1.E-08	---	5.E-08	Renal	0.00001	0.000004	---	0.00001
			Arsenic	4.E-07	4.E-08	---	4.E-07	Integumental	0.06	0.006	---	0.07
			Exposure Point Total	1.E-06	4.E-07	---	2.E-06		0.06	0.006	---	0.07
	Exposure Medium Total	1.E-06	4.E-07	---	2.E-06		0.06	0.006	---	0.07		
	Dust	West of South Street On-Facility	Benz(a)anthracene	---	---	8.E-13	8.E-13	Respiratory	---	---	0.0000002	0.0000002
			Benzo(a)pyrene	---	---	9.E-12	9.E-12	Respiratory	---	---	0.0000003	0.0000003
			Benzo(b)fluoranthene	---	---	9.E-13	9.E-13	Respiratory	---	---	0.0000002	0.0000002
			Chrysene	---	---	1.E-14	1.E-14	Respiratory	---	---	0.0000003	0.0000003
			Dibenz(ah)anthracene	---	---	1.E-12	1.E-12	Respiratory	---	---	0.00000003	0.00000003
			Indeno(1,2,3-cd)pyrene	---	---	4.E-13	4.E-13	Respiratory	---	---	0.0000001	0.0000001
Arsenic			---	---	1.E-10	1.E-10		---	---	---	---	
Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---			
Exposure Point Total	---	---	3.E-06	3.E-06		---	---	0.000001	0.000001			
Exposure Medium Total	---	---	3.E-06	3.E-06		---	---	0.000001	0.000001			
Soil Total			1.E-06	4.E-07	3.E-06	5.E-06		0.06	0.006	0.000001	0.070001	
				Total Risk Across All Media		5.E-06	Total Hazard Across All Media				0.07	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.40.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Gleason Court Lot 122	Benzo(a)pyrene	8.E-08	3.E-08	---	1.E-07	Renal	0.000003	0.000001	---	0.000004	
			Arsenic	6.E-07	5.E-08	---	6.E-07	Integumental	0.09	0.008	---	0.1	
		Exposure Point Total	6.E-07	8.E-08	---	7.E-07		0.09	0.008	---	0.1		
	Exposure Medium Total	6.E-07	8.E-08	---	7.E-07		0.09	0.008	---	0.1			
	Dust	Gleason Court Lot 122	Benzo(a)pyrene	---	---	1.E-12	1.E-12	Respiratory	---	---	0.00000003	0.00000003	
			Arsenic	---	---	2.E-10	2.E-10		---	---	---	---	
		Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---		
	Exposure Point Total	---	---	3.E-06	3.E-06		---	---	0.00000003	0.00000003			
	Exposure Medium Total	---	---	3.E-06	3.E-06		---	---	0.00000003	0.00000003			
	Soil Total				6.E-07	8.E-08	3.E-06	4.E-06		0.09	0.008	0.00000003	0.1
				Total Risk Across All Media				4.E-06	Total Hazard Across All Media				0.1

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

**TABLE 9.41.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Gleason Court Lot 124	Benzo(a)pyrene	1.E-07	5.E-08	---	2.E-07	Renal	0.000004	0.000001	---	0.000005
			Benzo(b)fluoranthene	2.E-08	6.E-09	---	2.E-08	Renal	0.000005	0.000002	---	0.000007
			Arsenic	2.E-07	1.E-08	---	2.E-07	Integumental	0.02	0.002	---	0.03
			Exposure Point Total	3.E-07	7.E-08	---	4.E-07		0.02	0.002	---	0.03
	Exposure Medium Total			3.E-07	7.E-08	---	4.E-07		0.02	0.002	---	0.03
	Dust	Gleason Court Lot 124	Benzo(a)pyrene	---	---	1.E-12	1.E-12	Respiratory	---	---	0.00000004	0.00000004
			Benzo(b)fluoranthene	---	---	2.E-13	2.E-13	Respiratory	---	---	0.00000005	0.00000005
			Arsenic	---	---	5.E-11	5.E-11		---	---	---	---
			Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---
	Exposure Point Total			---	---	3.E-06	3.E-06		---	---	0.00000009	0.00000009
Exposure Medium Total			---	---	3.E-06	3.E-06		---	---	0.00000009	0.00000009	
Soil Total				3.E-07	7.E-08	3.E-06	4.E-06		0.02	0.002	0.00000009	0.03
Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.03

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

**TABLE 9.42.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Gleason Court Lot 125	Benz(a)anthracene	2.E-08	9.E-09	---	3.E-08	Renal	0.000007	0.000003	---	0.00001
			Benzo(a)pyrene	3.E-07	1.E-07	---	4.E-07	Renal	0.000009	0.000004	---	0.00001
			Benzo(b)fluoranthene	4.E-08	1.E-08	---	5.E-08	Renal	0.00001	0.000004	---	0.00002
			Arsenic	4.E-07	3.E-08	---	4.E-07	Integumental	0.05	0.005	---	0.06
			Exposure Point Total	7.E-07	2.E-07	---	9.E-07		0.05	0.005	---	0.06
	Exposure Medium Total			7.E-07	2.E-07	---	9.E-07		0.05	0.005	---	0.06
	Dust	Gleason Court Lot 125	Benz(a)anthracene	---	---	3.E-13	3.E-13	Respiratory	---	---	0.00000007	0.00000007
			Benzo(a)pyrene	---	---	4.E-12	4.E-12	Respiratory	---	---	0.0000001	0.0000001
			Benzo(b)fluoranthene	---	---	4.E-13	4.E-13	Respiratory	---	---	0.0000001	0.0000001
			Arsenic	---	---	1.E-10	1.E-10		---	---	---	---
			Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---
	Exposure Point Total			---	---	3.E-06	3.E-06		---	---	0.0000003	0.0000003
	Exposure Medium Total			---	---	3.E-06	3.E-06		---	---	0.0000003	0.0000003
	Soil Total				7.E-07	2.E-07	3.E-06	4.E-06		0.05	0.005	0.0000003
Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.06

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

**TABLE 9.43.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts**

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Gleason Court Vacant Lot	Benzo(a)pyrene	6.E-08	2.E-08	---	8.E-08	Renal	0.000002	0.0000008	---	0.000003
			Arsenic	7.E-07	6.E-08	---	8.E-07	Integumental	0.1	0.01	---	0.1
		Exposure Point Total	8.E-07	9.E-08	---	9.E-07		0.1	0.01	---	0.1	
	Exposure Medium Total	8.E-07	9.E-08	---	9.E-07		0.1	0.01	---	0.1		
	Dust	Gleason Court Vacant Lot	Benzo(a)pyrene	---	---	8.E-13	8.E-13	Respiratory	---	---	0.00000002	0.00000002
			Arsenic	---	---	2.E-10	2.E-10		---	---	---	---
			Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---
		Exposure Point Total	---	---	3.E-06	3.E-06		---	---	0.00000002	0.00000002	
	Exposure Medium Total	---	---	3.E-06	3.E-06		---	---	0.00000002	0.00000002		
	Soil Total			8.E-07	9.E-08	3.E-06	4.E-06		0.1	0.01	0.00000002	0.10000002
Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.1

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.44.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient							
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total			
Soil	Soil	Old Railroad and Former Lower Mill Pond Area	Benz(a)anthracene	4.E-07	2.E-07	---	6.E-07	Renal	0.0001	0.00005	---	0.0002			
			Benzo(a)pyrene	2.E-06	7.E-07	---	3.E-06	Renal	0.00006	0.00002	---	0.00008			
			Benzo(b)fluoranthene	3.E-07	1.E-07	---	4.E-07	Renal	0.0001	0.00004	---	0.0001			
			Benzo(k)fluoranthene	1.E-08	5.E-09	---	2.E-08	Renal	0.00004	0.00002	---	0.00006			
			Chrysene	2.E-09	9.E-10	---	3.E-09	Renal	0.00008	0.00003	---	0.0001			
			Dibenz(ah)anthracene	4.E-07	2.E-07	---	6.E-07	Renal	0.00001	0.000006	---	0.00002			
			Indeno(1,2,3-cd)pyrene	2.E-07	9.E-08	---	3.E-07	Renal	0.00007	0.00003	---	0.0001			
			Arsenic	4.E-06	4.E-07	---	5.E-06	Integumental	0.6	0.06	---	0.7			
			Exposure Point Total				7.E-06	2.E-06	---	9.E-06		0.6	0.06	---	0.7
			Exposure Medium Total				7.E-06	2.E-06	---	9.E-06		0.6	0.06	---	0.7
	Dust	Old Railroad and Former Lower Mill Pond Area	Benz(a)anthracene	---	---	5.E-12	5.E-12	Respiratory	---	---	0.000001	0.000001			
			Benzo(a)pyrene	---	---	2.E-11	2.E-11	Respiratory	---	---	0.000006	0.000006			
			Benzo(b)fluoranthene	---	---	4.E-12	4.E-12	Respiratory	---	---	0.000001	0.000001			
			Benzo(k)fluoranthene	---	---	2.E-13	2.E-13	Respiratory	---	---	0.0000005	0.0000005			
			Chrysene	---	---	3.E-14	3.E-14	Respiratory	---	---	0.0000008	0.0000008			
			Dibenz(ah)anthracene	---	---	6.E-12	6.E-12	Respiratory	---	---	0.0000001	0.0000001			
			Indeno(1,2,3-cd)pyrene	---	---	3.E-12	3.E-12	Respiratory	---	---	0.0000007	0.0000007			
			Arsenic	---	---	1.E-09	1.E-09		---	---	---	---			
			Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---			
			Exposure Point Total				---	---	3.E-06	3.E-06		---	---	0.000005	0.000005
Exposure Medium Total				---	---	3.E-06	3.E-06		---	---	0.000005	0.000005			
Soil Total				7.E-06	2.E-06	3.E-06	1.E-05		0.6	0.06	0.000005	0.700005			
Total Risk Across All Media							1.E-05	Total Hazard Across All Media					0.7		

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.45.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Orlando Property	Benz(a)anthracene	3.E-08	1.E-08	---	5.E-08	Renal	0.00001	0.000004	---	0.00001	
			Benzo(a)pyrene	3.E-07	1.E-07	---	4.E-07	Renal	0.000009	0.000003	---	0.00001	
			Benzo(b)fluoranthene	3.E-08	1.E-08	---	4.E-08	Renal	0.00001	0.000004	---	0.00001	
			Indeno(1,2,3-cd)pyrene	5.E-09	2.E-09	---	7.E-09	Renal	0.000002	0.0000006	---	0.000002	
			Arsenic	1.E-07	1.E-08	---	1.E-07	Integumental	0.02	0.002	---	0.02	
			Exposure Point Total	5.E-07	1.E-07	---	6.E-07		0.02	0.002	---	0.02	
	Exposure Medium Total				5.E-07	1.E-07	---	6.E-07		0.02	0.002	---	0.02
	Dust	Orlando Property	Benz(a)anthracene	---	---	4.E-13	4.E-13	Respiratory	---	---	0.0000001	0.0000001	
			Benzo(a)pyrene	---	---	3.E-12	3.E-12	Respiratory	---	---	0.00000009	0.00000009	
			Benzo(b)fluoranthene	---	---	4.E-13	4.E-13	Respiratory	---	---	0.0000001	0.0000001	
			Indeno(1,2,3-cd)pyrene	---	---	6.E-14	6.E-14	Respiratory	---	---	0.00000002	0.00000002	
			Arsenic	---	---	4.E-11	4.E-11		---	---	---	---	
			Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---	
	Exposure Point Total				---	---	3.E-06	3.E-06		---	---	0.0000003	0.0000003
Exposure Medium Total				---	---	3.E-06	3.E-06		---	---	0.0000003	0.0000003	
Soil Total				5.E-07	1.E-07	3.E-06	4.E-06		0.02	0.002	0.0000003	0.0200003	
Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.02	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.46.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Lot 208	Arsenic	1.E-07	1.E-08	---	2.E-07	Integumental	0.02	0.002	---	0.02
		Exposure Point Total		1.E-07	1.E-08	---	2.E-07		0.02	0.002	---	0.02
		Exposure Medium Total		1.E-07	1.E-08	---	2.E-07		0.02	0.002	---	0.02
	Dust	Lot 208	Arsenic	---	---	4.E-11	4.E-11	NA	---	---	---	---
			Asbestos	---	---	3.E-06	3.E-06		---	---	---	---
		Exposure Point Total		---	---	3.E-06	3.E-06		---	---	---	---
	Exposure Medium Total		---	---	3.E-06	3.E-06		---	---	---	---	
	Soil Total				1.E-07	1.E-08	3.E-06	4.E-06		0.02	0.002	0.1
Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.02

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.47.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Vacant Lot 209	Arsenic	1.E-07	1.E-08	---	2.E-07	Integumental	0.02	0.002	---	0.02
		Exposure Point Total		1.E-07	1.E-08	---	2.E-07		0.02	0.002	---	0.02
		Exposure Medium Total		1.E-07	1.E-08	---	2.E-07		0.02	0.002	---	0.02
	Dust	Vacant Lot 209	Arsenic	---	---	4.E-11	4.E-11	NA	---	---	---	---
			Asbestos	---	---	3.E-06	3.E-06		---	---	---	---
			Exposure Point Total		---	---	3.E-06		3.E-06	---	---	---
	Exposure Medium Total		---	---	3.E-06	3.E-06		---	---	---	---	
Soil Total				1.E-07	1.E-08	3.E-06	4.E-06		0.02	0.002	---	0.02
Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.02

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.48.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Lot 210	Benzo(a)pyrene	1.E-07	5.E-08	---	2.E-07	Renal	0.000004	0.000002	---	0.000006
			Benzo(b)fluoranthene	2.E-08	7.E-09	---	2.E-08	Renal	0.000005	0.000002	---	0.000007
			Arsenic	2.E-07	1.E-08	---	2.E-07	Integumental	0.02	0.002	---	0.03
			Exposure Point Total	3.E-07	7.E-08	---	4.E-07		0.02	0.002	---	0.03
	Exposure Medium Total			3.E-07	7.E-08	---	4.E-07		0.02	0.002	---	0.03
	Dust	Lot 210	Benzo(a)pyrene	---	---	2.E-12	2.E-12	Respiratory	---	---	0.00000004	0.00000004
			Benzo(b)fluoranthene	---	---	2.E-13	2.E-13	Respiratory	---	---	0.00000006	0.00000006
			Arsenic	---	---	5.E-11	5.E-11		---	---	---	---
			Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---
			Exposure Point Total	---	---	3.E-06	3.E-06		---	---	0.0000001	0.0000001
Exposure Medium Total			---	---	3.E-06	3.E-06		---	---	0.0000001	0.0000001	
Soil Total				3.E-07	7.E-08	3.E-06	4.E-06		0.02	0.002	0.0000001	0.03
Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.03

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.49.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 230	Benzo(a)pyrene	9.E-08	3.E-08	---	1.E-07	Renal	0.000003	0.000001	---	0.000004	
			Arsenic	3.E-07	3.E-08	---	3.E-07	Integumental	0.05	0.004	---	0.05	
		Exposure Point Total	4.E-07	6.E-08	---	4.E-07		0.05	0.004	---	0.05		
	Exposure Medium Total	4.E-07	6.E-08	---	4.E-07		0.05	0.004	---	0.05			
	Dust	Lot 230	Benzo(a)pyrene	---	---	1.E-12	1.E-12	Respiratory	---	---	0.00000003	0.00000003	
			Arsenic	---	---	9.E-11	9.E-11		---	---	---	---	
		Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---		
	Exposure Point Total	---	---	3.E-06	3.E-06		---	---	0.00000003	0.00000003			
	Exposure Medium Total	---	---	3.E-06	3.E-06		---	---	0.00000003	0.00000003			
	Soil Total				4.E-07	6.E-08	3.E-06	4.E-06		0.05	0.004	0.00000003	0.05
				Total Risk Across All Media				4.E-06	Total Hazard Across All Media				0.05

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.50.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 257	Benz(a)anthracene	2.E-08	6.E-09	---	2.E-08	Renal	0.000005	0.000002	---	0.000007	
			Benzo(a)pyrene	2.E-07	6.E-08	---	2.E-07	Renal	0.000005	0.000002	---	0.000007	
			Benzo(b)fluoranthene	2.E-08	9.E-09	---	3.E-08	Renal	0.000007	0.000003	---	0.00001	
			Indeno(1,2,3-cd)pyrene	2.E-08	6.E-09	---	2.E-08	Renal	0.000005	0.000002	---	0.000007	
			Arsenic	5.E-07	4.E-08	---	5.E-07	Integumental	0.07	0.006	---	0.08	
			Exposure Point Total	7.E-07	1.E-07	---	8.E-07		0.07	0.006	---	0.08	
	Exposure Medium Total				7.E-07	1.E-07	---	8.E-07		0.07	0.006	---	0.08
	Dust	Lot 257	Benz(a)anthracene	---	---	2.E-13	2.E-13	Respiratory	---	---	0.00000005	0.00000005	
			Benzo(a)pyrene	---	---	2.E-12	2.E-12	Respiratory	---	---	0.00000005	0.00000005	
			Benzo(b)fluoranthene	---	---	3.E-13	3.E-13	Respiratory	---	---	0.00000007	0.00000007	
			Indeno(1,2,3-cd)pyrene	---	---	2.E-13	2.E-13	Respiratory	---	---	0.00000005	0.00000005	
			Arsenic	---	---	1.E-10	1.E-10		---	---	---	---	
			Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---	
	Exposure Point Total				---	---	3.E-06	3.E-06		---	---	0.00000002	0.00000002
Exposure Medium Total				---	---	3.E-06	3.E-06		---	---	0.00000002	0.00000002	
Soil Total				7.E-07	1.E-07	3.E-06	4.E-06		0.07	0.006	0.00000002	0.08	
Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.08	

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.51.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential ~	Cancer Risk				Non-Cancer Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total
Soil	Soil	Lot 282	Arsenic	4.E-07	3.E-08	---	4.E-07	Integumental	0.06	0.005	---	0.07
		Exposure Point Total		4.E-07	3.E-08	---	4.E-07		0.06	0.005	---	0.07
		Exposure Medium Total		4.E-07	3.E-08	---	4.E-07		0.06	0.005	---	0.07
	Dust	Lot 282	Arsenic	---	---	1.E-10	1.E-10	NA	---	---	---	---
			Asbestos	---	---	3.E-06	3.E-06		---	---	---	---
		Exposure Point Total		---	---	3.E-06	3.E-06		---	---	---	---
	Exposure Medium Total		---	---	3.E-06	3.E-06		---	---	---	---	
	Soil Total				4.E-07	3.E-08	3.E-06	4.E-06		0.06	0.005	---
Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.07

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.52.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Non-Cancer Hazard Quotient									
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total					
Soil	Soil	Lot 283	Benz(a)anthracene	2.E-08	6.E-09	---	2.E-08	Renal	0.000005	0.000002	---	0.000007					
			Benzo(a)pyrene	2.E-07	6.E-08	---	2.E-07						Renal	0.000005	0.000002	---	0.000007
			Arsenic	2.E-07	2.E-08	---	2.E-07						Integumental	0.03	0.003	---	0.04
			Exposure Point Total	4.E-07	8.E-08	---	5.E-07							0.03	0.003	---	0.04
	Exposure Medium Total		4.E-07	8.E-08	---	5.E-07		0.03	0.003	---	0.04						
	Dust	Lot 283	Benz(a)anthracene	---	---	2.E-13	2.E-13	Respiratory	---	---	0.00000005	0.00000005					
			Benzo(a)pyrene	---	---	2.E-12	2.E-12						Respiratory	---	---	0.00000005	0.00000005
			Arsenic	---	---	6.E-11	6.E-11		---	---	---	---					
			Asbestos	---	---	3.E-06	3.E-06	NA	---	---	---	---					
			Exposure Point Total	---	---	3.E-06	3.E-06		---	---	0.0000001	0.0000001					
Exposure Medium Total		---	---	3.E-06	3.E-06		---	---	0.0000001	0.0000001							
Soil Total				4.E-07	8.E-08	3.E-06	4.E-06		0.03	0.003	0.0000001	0.04					
Total Risk Across All Media							4.E-06	Total Hazard Across All Media					0.04				

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 9.53.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS
REASONABLE MAXIMUM EXPOSURE
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential ~	Cancer Risk				Non-Cancer Hazard Quotient					
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal	Inhalation	Exposure Routes Total	
Soil	Soil	Lot 342	Arsenic	2.E-07	2.E-08	---	3.E-07	Integumental	0.04	0.003	---	0.04	
		Exposure Point Total		2.E-07	2.E-08	---	3.E-07		0.04	0.003	---	0.04	
		Exposure Medium Total		2.E-07	2.E-08	---	3.E-07		0.04	0.003	---	0.04	
	Dust	Lot 342	Arsenic	---	---	7.E-11	7.E-11	NA	---	---	---	---	
			Asbestos	---	---	3.E-06	3.E-06		---	---	---	---	
			Exposure Point Total		---	---	3.E-06		3.E-06	---	---	---	---
		Exposure Medium Total		---	---	3.E-06	3.E-06		---	---	---	---	
	Soil Total				2.E-07	2.E-08	3.E-06	4.E-06		0.04	0.003	---	0.04
	Total Risk Across All Media							4.E-06	Total Hazard Across All Media				0.04

Using the IRIS unit risk for asbestos, the total risk for this receptor would change to 3E-04

TABLE 10
SUMMARY OF RECEPTOR RISKS
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Receptor	Exposure Point	RME or CT	Total Soil Cancer Risks	Total Soil Noncancer Risks	Media > 1E-04 or HI > 1	Major contributors to risk (> 1E-06, HI > 1)
Current Resident	Gleason Court Lot 122	RME	6E-05	3E-01		N/A
	Gleason Court Lot 124	RME	5E-05	4E-02		N/A
	Gleason Court Lot 125	RME	8E-05	9E-02		N/A
	Gleason Court Vacant Lot	RME	6E-05	4E-01		N/A
	Orlando Property	RME	8E-05	2E-01		N/A
	Lot 208	RME	4E-05	1E-01		N/A
	Lot 210	RME	5E-05	2E-01		N/A
	Lot 230	RME	5E-05	2E-01		N/A
	Lot 257	RME	7E-05	3E-01		N/A
	Lot 282	RME	4E-05	2E-01		N/A
	Lot 283	RME	6E-05	2E-01		N/A
	Lot 342	RME	4E-05	2E-01		N/A
	Lot 360	RME	7E-05	7E-01		N/A
Current Trespasser	West of South Street On-Facility and Vacant Lot 209	RME	8E-06	5E-02		N/A
	Old Railroad and Former Lower Mill Pond Area	RME	4E-05	2E-01		N/A
	Lot 350	RME	3E-06	3E-02		N/A
Current Site Worker	East of South Street On-Facility	RME	7E-05	2E-02		N/A
Future Resident	East of South Street On-Facility	RME	1E-03	6E-01	soil	(C) - Asbestos, trichloroethene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic
		CT	1E-04	3E-01		
	West of South Street On-Facility	RME	2E-04	3E-01	soil	(C) - Asbestos, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic
	Gleason Court Lot 122	RME	5E-05	3E-01		N/A
	Gleason Court Lot 124	RME	5E-05	1E-01		N/A
	Gleason Court Lot 125	RME	8E-05	2E-01		N/A
	Gleason Court Vacant Lot	RME	6E-05	4E-01		N/A
	Old Railroad and Former Lower Mill Pond Area	RME	5E-04	2E+00	soil	(C) - Asbestos, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic (NC) - Arsenic
CT		9E-05	1E+00			
Orlando Property	RME	7E-05	1E-01		N/A	
Lot 208	RME	4E-05	1E-01		N/A	

TABLE 10
SUMMARY OF RECEPTOR RISKS
BASELINE HUMAN HEALTH RISK ASSESSMENT ADDENDUM
Blackburn & Union Privileges Site
Walpole, Massachusetts

Receptor	Exposure Point	RME or CT	Total Soil Cancer Risks	Total Soil Noncancer Risks	Media > 1E-04 or HI > 1	Major contributors to risk (> 1E-06, HI > 1)
Future Resident (cont.)	Vacant Lot 209	RME	3E-05	1E-01		N/A
	Lot 210	RME	5E-05	2E-01		N/A
	Lot 230	RME	5E-05	2E-01		N/A
	Lot 257	RME	7E-05	3E-01		N/A
	Lot 282	RME	4E-05	2E-01		N/A
	Lot 283	RME	6E-05	2E-01		N/A
	Lot 342	RME	4E-05	2E-01		N/A
	Lot 350	RME	4E-05	3E-01		N/A
	Lot 360	RME	7E-05	7E-01		N/A
Future Site Worker	East of South Street On-Facility	RME	1E-04	5E-02		N/A
	West of South Street On-Facility	RME	2E-05	2E-02		N/A
Future Const. Worker	East of South Street On-Facility	RME	1E-05	1E-01		N/A
	West of South Street On-Facility	RME	5E-06	7E-02		N/A
	Gleason Court Lot 122	RME	4E-06	1E-01		N/A
	Gleason Court Lot 124	RME	4E-06	3E-02		N/A
	Gleason Court Lot 125	RME	4E-06	6E-02		N/A
	Gleason Court Vacant Lot	RME	4E-06	1E-01		N/A
	Old Railroad and Former Lower Mill Pond Area	RME	1E-05	7E-01		N/A
	Orlando Property	RME	4E-06	2E-02		N/A
	Lot 208	RME	4E-06	2E-02		N/A
	Vacant Lot 209	RME	4E-06	2E-02		N/A
	Lot 210	RME	4E-06	3E-02		N/A
	Lot 230	RME	4E-06	5E-02		N/A
	Lot 257	RME	4E-06	8E-02		N/A
	Lot 282	RME	4E-06	7E-02		N/A
	Lot 283	RME	4E-06	4E-02		N/A
Lot 342	RME	4E-06	4E-02		N/A	

Notes

Bolded values exceed a cancer risk of 1E-04 or a target organ HI of 1.

HI - Hazard Index

RME - Reasonable Maximum Exposure

CT - Central Tendency Exposure

(C) - Carcinogenic Risk

(NC) - Noncarcinogenic Risk

N/A - Not Applicable