Excerpts from the draft Risk Characterization dated November 24, 2004 by Cambridge Environmental, Inc. for the W.R. Grace & Co. Property in Cambridge, Massachusetts.

The request for electronic copies of Haley & Aldrich reports was declined, so the reports were scanned and proofread by members of Alewife Neighbors, Inc. and the Alewife Study Group to the best of our volunteer abilities. Some sections did not scan well, or were complicated and not scanned because of the proofreading and correction effort. The information presented here is our best attempt to provide access to the information in the reports. Errors in transcription are unintentional. We apologize for omissions you may feel were important. The original documents are available at the North Cambridge and Main branches of the Cambridge Public Libraries and at W. R. Grace & Co., 62 Whittemore Avenue, Cambridge.

8 Characterization of risks to human health

8.1 Exposure assumptions

8.1.1 Common factors

The following common exposure assumptions are used:

$t_{subchronic}$	=	0.5	yr	Subchronic averaging period
$t_{chronic}$	=	7	yr	Chronic averaging period
t_{life}	=	75	yr	Lifetime averaging period
t_{const}	=	2	yr	Period assumed for construction
f_{resp}	=	0.75		Fraction of TSP that is respirable (Section 4.4.1.2)
f_{sub10}	=	0.35		Fraction of TSP that is less than 10 lam in aerodynamic diameter (Section 4.4.1.2)
f_{lung}	=	0.50		Fraction of sub- IO Jim particles that enters the deep lung (the rest is swallowed) (DEP, 2002c)
f_{inh}	=	0.233		f_{sub10}*f_{lung}/f_{resp} the fraction of respirable particles that reaches the deep lung (DEP, 2002c)
f_{ing}	=	0.767		1 - f_{inh} the fraction of respirable particles that is swallowed (DEP, 2002c)

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8.1.2 Current exposure scenarios

8.1.2.1 Adjacent resident

Adjacent residents are assumed to be present adjacent to the site 24 hours/day for a lifctime of 75 years (substantially more than the default values used by DEP). They are exposed to contaminated air and soil throughout that time, with assumed cumulative contact rates substantially higher than the defaults used generally for residential exposure by DEP (see Sections E.1 and E.2). Their distance from contaminated areas in the current scenario is given in Table 6.3 for each contaminant. Their cumulative exposure rates per unit body weight for subchronic, chronic, and lifetime periods, where those exposure rates are derived, and other exposure factors are shown in Table 8.1.

Table 8.1 Exposure rates and factors for the current resident scenario

Exposure parameter	Value	Unit	Derivation
the exposure period	75	yr	Assumption
the fraction of contaminated air breathed during the exposure period	1		Assumption
the fraction of the exposure period exposed to soil contaminated by the site	1		Assumption
s the largest 6-month subchronic cumulative soil ingestion rate	4.63	mg-yr/kg-day	Section E.1
the largest 7-year chronic cumulative soil ingestion rate	42.35	mg-yr/kg-day	Section E.1
the lifetime cumulative soil ingestion rate	100.21	mg-yr/kg-day	Section E.1
the largest 6-month subchronic cumulative den-nal contact rate with soil	29.7	mg-yr/kg-day	Section E.2
the largest 7-year chronic cumulative dermal contact rate with soil	339.8	mg-yr/kg-day	Section E.2
the lifetime cumulative dermal contact rate with soil	1183.7	mg-yr/kg-day	Section E.2
the largest 6-month cumulative inhalation rate	0.315	m^3-yr/kg-day	Section E.3
the largest 7-year cumulative inhalation rate	3.691	m^3-yr/kg-day	Section E.3
the 75-year lifetime cumulative inhalation rate	21.671	m^3-yr/kg-day	Section E.3
the effective time of exposure to vapor during the subchronic period	*0.5*	yr	$f_{res,air}t_{subchronic}$
the effective time of exposure to vapor during the chronic period	7	yr	$f_{res,air}t_{chronic}$
the effective time of exposure to vapor during a lifetime	75	yr	$f_{res,air}t_{life}$

8.1.2.2 Transients

The exposure assumptions for a transient are designed to be adequate to cover transient users of the site, including office visitors, those crossing the site to reach the MBTA station, and trespassers. The transient is assumed to be present on the site for up to 1 hour per day every day for life, with the person breathing 1/24 of their total air intake on site during that time. Soil contact is assumed to be equivalent to residential soil contact I day per week (52 times per year - although actual contact would be limited in winter months by snow cover and frozen soil). This corresponds to fairly heavy use of the site, certainly more extreme than would be expected for transient visitors. Exposure rates and their derivation for the current transient user are shown in Table 8.2.

[table did not scan well]

8.1.2.3 Office workers

[this section skipped]

8.1.3 Future exposure scenarios

8.1.3.1 Adjacent resident

Exposure parameters for the future resident (subscript *const_res)* during construction are similar to those for the current resident (subscript *res*). Adjacent residents are assumed to be present adjacent to the site 24 hours/day for a lifetime of 75 years (substantially more than the default values used by DEP). They are exposed to contaminated air and soil throughout that time, with assumed cumulative contact rates substantially higher than the defaults used generally for residential exposure by DEP (see Sections E.1 and E.2). Their distance from contaminated areas is the smaller of 50 m and the distance in Table 6.3 for the future construction scenario. Their cumulative exposure rates per unit body weight for subchronic, chronic, and lifetime periods, where those exposure rates are derived, and other exposure factors are shown in Table 8.4.

Table 8.4 Exposure rates and factors for the future resident scenario

Exposure parameter	**Value**	**Unit**	**Derivation**
the exposure period	75	yr	Assumption
the fraction of contaminated air breathed during the exposure period	1		Assumption
the fraction of the exposure period exposed to soil contaminated by the site	1		Assumption
the largest 6-month subchronic cumulative			

soil ingestion rate	4.63	mg-yr/kg-day	Section E.1
the largest 7-year chronic cumulative soil ingestion rate	42.35	mg-yr/kg-day	Section E.1
the lifetime cumulative soil ingestion rate	100.21	mg-yr/kg-day	Section E.1
the largest 6-month subchronic cumulative dermal contact rate with soil	29.7	mg-yr/kg-day	Section E.2
the largest 7-year chronic cumulative dermal contact rate with soil	339.8	mg-yr/kg-day	Section E.2
the lifetime cumulative dermal contact rate with soil	1183.7	mg-yr/kg-day	Section E.2
the largest 6-month cumulative inhalation rate	0.315	m yr/kg-day	Section E.3
the largest 7-year cumulative inhalation rate	3.691	m3-yr/kg-day	Section E.3
the 75-year lifetime cumulative inhalation rate	21.671	m3-yr/kg-day	Section E.3
the effective time of exposure to vapor during the subchronic period	0.5	yr	$f_{res,air}t_{subchronic}$
the effective time of exposure to vapor during the chronic period	7	yr	$f_{res,air}t_{chronic}$
the $_{effective}$ time of exposure to vapor during a lifetime	75	yr	$f_{res,air}t_{life}$

8.1.3.2 Transients

[this section skipped, complex table]

8.1.3.3 Office workers

[this section skipped, table]

8.1.3.4 Construction worker

[this section skipped, table]

8.2 Exposure calculations and exposures

[this section skipped, many equations and tables]

8.3 Hazard indexes and risks

From the exposures and doses evaluated in Section 8.2, hazard indexes and risk estimates are computed for each chemical using:

[equations did not scan well]

where the symbols and subscripts have the same meaning as in Section 8.2, except that *type is* restricted to *subchronic and chronic* (for hazard indexes), and the other symbols represent:

Hazard index
Lifetime risk
Reference dose (Section 7)
Reference concentration (Section 7)
Cancer slope factor (Section 7)
Inhalation unit risk (Section 7)
Relative absorption factor (Section 7).

Where a *RAF* is not available, it is assumed to be unity.

The hazard indexes and lifetime risks calculated using the doses and exposures of Section 8.2 are shown in Tables 8.16 through 8.22. All values are shown to 1 significant figure, although the accuracy of the values is probably less than this (see Section 12). The entry NA for a risk value indicates that the carcinogenicity of the compound has not been quantitatively evaluated (by EPA, DEP, or in this Risk Characterization) for the given route of exposure, while NC indicates an evaluation of lack of carcinogenicity for the route of exposure.

The tables also show summary hazard indexes, equal to the sum over chemicals of the hazard indexes and risks, and the summary grand total that is the sum over different routes of exposure. For the construction scenarios, the grand total risk is shown either including or excluding asbestos to indicate the effect of controlling soil movement to prevent asbestos emissions. [34]

The summary grand totals are shown in Table 8.15 for the scenarios explicitly modeled, again rounded to 1 significant figure. For all current scenarios modeled, no summary hazard index exceeds unity and no lifetime risk exceeds the MCP risk limit of 1E-5. For all future scenarios modeled, no sununary hazard index exceeds unity, but all lifetime risks exceed the MCP risk limit of I E-5, indicating the need for mitigation. The summary risk estimates excluding asbestos indicate that sufficient mitigation would be prevention of asbestos release, since all summary lifetime risk estimates then do not exceed the MCP risk limit of 1E-5.

Overestimates for combination scenarios are also shown in Table 8.15. The sum of hazard indexes and lifetime risk estimates for all current (and future non-construction) scenarios necessarily overestimates the risk for a resident who is also a transient and who works as an office worker on the site (or any combination of these scenarios). For this combination

scenario, the sununary hazard index does not exceed unity, and the lifetime risk estimate does not exceed the MCP risk limit.

Combination scenarios for the future construction scenario examined here are the combined resident/transient/office worker, and the resident construction worker. These scenarios are very unlikely and may apply to only one or two individuals, if any. For the former, an overestimate is obtained by summing the sunnnary hazard indexes and lifetime risks for the resident. Both subchronic and chronic hazard indexes do not exceed unity, but the lifetime risk estimate exceeds the MCP risk limit of 1E-5. Again, however, asbestos exposure mitigation is sufficient, to prevent the lifetime risk estimate exceeding the MCP limit.

For the resident construction worker, an overestimate of hazard index and lifetime risk may be obtained by summing the sununary hazard index and lifetime risk estimates for the resident and the construction worker. Once again, both summary subchronic and chronic hazard indexes do not exceed unity, but the lifetime risk estimate exceeds the MCP risk limit of I E-5. Once again also, asbestos exposures mitigation is sufficient to prevent the lifetime risk estimate exceeding the MCP limit.

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[34] Asbestos risk estimates from construction are removed by omitting asbestos risk entirely from the sum, assuming that management methods prevent any emissions of asbestos. Asbestos does not contribute to the hazard indexes. Control of asbestos emissions would also control dust emissions, so would mitigate the effect of other contaminants adsorbed to that dust, but this effect is not evaluated since it is small in every case.

Other combinations of construction worker with transient or office worker would provide overestimates of risks for various permutations of residents, transient, office workers, and transients. However, other such combinations are not useful, since they double-count exposures even more than the combinations just examined.

Table 8.15 Summary grand total hazard index (HI) and lifetime risks for various scenarios				
	Subchronic HI	Chronic HI	Lifetime Risk	Lifetime Risk omitting asbestos
Current scenarios				
Current resident	0.06	0.06	1.E-06	NA
Current transient	0.2	0.2	3.E-06	NA
Current office worker	0.09	0.1	5.E-06	NA
Future scenarios				
Future resident with construction	0.4	0.2	**2.E-04**	1.E-06
Future transient with construction	0.3	0.3	**2.E-05**	3.E-06
Future office worker with construction	0.2	0.1	**8.E-05**	5.E-06
Construction worker	0.9	0.08	**2.E-05**	4.E-07
Combinations				
All current	0.4	0.4	I.E-05	NA
All future non-construction-worker with construction	0.8	0.6	3.E-04	9.E-06
Resident construction worker	1	0.3	3.E-04	I.E-06

Note: Risk estimates that exceed DEP risk guidelines are shown in bold.

8.4 Conclusions

The site poses no significant risk to human health for current conditions. Hazard indices and incremental cancer risks for all receptors are less than DEP's guidelines. The specific conclusions of the human health risk characterization for current conditions are:

- Residents - No significant risk to human health
- Transients - No significant risk to human health
- Office workers - No significant risk to human health
- Utility workers - No significant risk to human health because utilities are not currently located in contaminated areas

The site poses no significant risk to human health for future conditions that do not involve construction or movement of contaminated soil. Hazard indices and incremental cancer risks for all receptors are again less than DEP's guidelines. A condition of significant risk to human health potentially exists due to asbestos exposure during a hypothetical, very large scale construction project. Hazard indices are less than the DEP guideline, but incremental cancer risks exceed the DEP guideline of 1.E-05 (1×10^{-5}). The specific conclusions of the human health risk characterization for future conditions are:

- Residents - Potential significant risk to human health due to the inhalation of asbestos during a large scale construction project. No significant risk to human health in the absence of construction.
- Transients - Potential significant risk to human health due to the inhalation of asbestos during a large scale construction project. No significant risk to human health in the absence of construction.
- Office workers - Potential significant risk to human health due to the inhalation of asbestos during a large scale construction project. No significant risk to human health in the absence of construction.
- Construction workers - Potential significant risk to human health due to the inhalation of asbestos.

8.5 Deviations from DEP default exposure assumptions

In a few instances, the characterization of risks to human health deviates from default DEP models and assumptions. In some cases, deviations from DEP defaults are due to the long history of the site. Some models presented in the risk characterization were developed prior to the issuance of DEP's risk characterization guidance in 1995, and have been peer reviewed. These original models were deemed conservative by that review, and some have been maintained in the risk characterization. In other cases, site-specific data were used in place of DEP defaults to obtain a better estimate of site-specific risks. In all cases, the deviations result in conservative estimates of risk at the Site.

- *Site-specific dust concentrations*

A site-specific residential construction-related dust (TSP) concentration of 21.2 $\mu g/m^3$ is used to estimate risks to adjacent residents during construction work on the site. The derivation of this site-specific dust concentration is based on the dust concentration modeled (Section 4.4.3) to occur at residential locations during construction work, assuming that the on-site PM_{10} dust concentration due to construction is 60 $\mu g/m^3$ (the DEP default value for this situation), adjusted by the fraction of time construction work occurs on the site. A windblown site-related TSP concentration of 7.8 $\mu g/m^3$ is added to the construction-related TSP concentration to obtain a total dust concentration of 29 $\mu g/m^3$ for adjacent residents. The resulting risk estimates for the inhalation pathway (particulates plus asbestos) were a chronic hazard index of 0.0005 and an incremental cancer risk of 2×10^{-4}. The incremental cancer risk was due almost entirely to asbestos, with all other chemicals contributing 1×10^{-8} to the total.

If the DEP default PM_{10} concentration of 60 $\mu g/m^3$ is assumed to exist within residential properties during construction periods, instead of the site-specific value derived in Section 4.4.3, the conclusions of the risk characterization would not change. Risk estimates for this exposure pathway would increase by a factor of about 1.7,[35] but the chronic hazard index and the incremental cancer risk from chemicals other than asbestos would remain negligible, and the incremental cancer risk posed by asbestos would remain greater than DEP's guideline of 1×10^{-5}.

- *Residential soil contact rates*

As discussed in Section 8.1.2.1, 8.1.3.1 and subsequent sections as well as in Appendix E, assumed cumulative soil contact rates for residents and other receptors based on the residential soil contact rates are substantially higher than the defaults used generally for residential exposure by DEP. This is a conservative aspect of the risk characterization and results in higher risk estimates than would be obtained using DEP's default assumptions.

[35] The only difference from Section 4.4.3 would be the omission of the factor 0.52 derived there relating the TSP concentration in residential areas to that on-site during the 8 hours per day of construction.

- *Construction assumptions*

Though individual construction workers are only assumed to be present on the site for six months, the risk characterization assumes a very extensive construction project of two years duration involving extensive excavation and the construction of multiple buildings on the property for the purpose of evaluating risks to nearby receptors. Though such a project was once proposed, it is now exceedingly unl ikely that such a construction project will take place in the foreseeable future. Because the construction project is much more extensive than DEP's recommended six month construction project, consideration of a two year construction project is a conservative aspect of the risk characterization.

- *Emissions models*

The exposure point concentrations for contaminants in air are based on a number of emissions models discussed in Chapter 4. The models used are scientifically defensible and result in conservative estimates of contaminant concentrations to which individuals are likely to be exposed. A peer review (EH&E, 1996) of the models confirmed that they are conservative. For several exposure pathways considered in the risk characterization, DEP has not recommended the use of any specific models, such as for inhalation of windblown dust from a specific area of contaminated soil. While several of the models used are not specifically recommended in DEP guidance, they represent conservative estimates of exposure, as required by the MCP.

- *Office worker exposure duration*

The exposure duration for the office worker is assumed to be 45 years. Exposure as a child resident prior to exposure as an office work is also assumed, by combining the risk estimates for residents and office workers. This is longer than is typically assumed in MCP risk characterizations, but ensures that risk estimates are conservative. Assuming a shorter exposure duration would result in a corresponding decreases in estimated incremental cancer risks for office workers.

9 Characterization of risks to safety

[this section skipped]

10 Characterization of risks to public welfare

A characterization of risks to public welfare is conducted as part of a Method 3 MCP risk characterization. The risk of harm to public welfare is in part characterized by comparing the site average concentrations of contaminants in soil and groundwater to Upper Concentration Limits (UCLs), as described in the MCP. The concentrations of contaminants in hot,spots are also compared to UCLS. Additionally, the existence of nuisance conditions, the unilateral restriction of the use of another person's property, and any monetary or non-pecuniary costs due to the degradation of public or private resources are considered.

10.1 Upper Concentration Limits

Section 310 CMR 40.0996 (1) of the MCP states that an exceedance of UCLs for soil or groundwater indicates the potential for significant risk of harm to public welfare. As demonstrated in Tables 10.1 and 10.2, the site average concentrations of all contaminants in soil and the maximum concentration of each contaminant in groundwater are below their respective UCLs.

10.2 Asbestos

While DEP has not promulgated explicit UCLs for asbestos in soil - there is a default UCL value of 1% that applies to any contaminant for which there is no explicit UCL. Based on the data collected (752 samples were analyzed for asbestos, excluding duplicate samples), no hotspots for asbestos contamination are identifiable, and the site-wide average of measured concentrations of asbestos in soil is lower than 1%.

The EPA data that characterize asbestos in soil within 3 inches of the ground surface demonstrate that asbestos levels in surface soil are consistent with background (ATSDR, 2001). The AUL that will be placed on the site requiring that areas of disturbed soil be covered with clean soil will ensure that significant levels of asbestos will not occur in surface soil in the future. With the AUL in place, no asbestos will spread off-site at levels that could cause nuisance conditions, restrictions on nearby properties, or the degradation of public or private resources.

10.3 Nuisance conditions

No data indicate that significant release-related contamination has spread offsite at levels that could adversely impact property uses in the vicinity of the release.

Potential odors that could arise during soil movement are the primary public welfare issue at the Site. Under current site conditions, no soil disturbing activities are occurring, and odors are unlikely to occur. However, if future conditions involve soil movement in areas containing the highest levels of napthalene, odors could occur.

During the biological treatment field demonstration project, a noticeable odor was generated during the initial filling of the test cell. This odor was noted by the personnel performing simultaneous air monitoring ("It should be noted that during the sampling days, TRC staff observed a mothball odor at the remediation site. This is the indication of the presence of naphthalene," Ambient Monitoring at W.R. Grace Alewife Property, TRC Environmental Consultants, February 1, 1989).

This simultaneous air monitoring showed that 8-hour average naphthalene concentrations were all below the nominal detection limit of 15 [$\mu g/m^3$ (actually, from 8 to 26 $\mu g/m^3$ on different samples) in 24 samples taken on 4 days. The average threshold for detection of odor from naphthalene is about 120 $\mu g/m^3$, and the recognition threshold would be at a concentration a factor 3 to 10 times higher (American Petroleum Institute, 1985; Punter, 1983).[38] In the sample of 35 people used to determine this threshold, the standard deviation of the threshold for individuals was a factor of $x/\div 4.5$, implying that about 15% of the population can be expected to have a detection threshold below $120/4.5 \approx 30$ $\mu g/m^3$, and presumably a recognition threshold between 100 and 300 $\mu g/m^3$. The measurements showing average concentrations below 8 to 26 $\mu g/m^3$ appear initially to contradict the detection by nose on site. The TRC report speculates that the failure of the instrumentation to detect higher concentrations was due to a failure to desorb the naphthalene from the charcoal tubes used to collect it. However, discussion with Samuel Cha of TRC, the project manager responsible for producing the TRC report, indicates that this cannot be the entire story. As required by the NIOSH method from which the sampling protocol was adapted, desorption experiments were performed. These showed 82% desorption at 25 μg per tube, corresponding to an air concentration of 25 $\mu g/m^3$ (the samples used were approximately 1 m^3). If the measurements were compromised, it must have been through a different mechanism, and no such mechanism is apparent or has been suggested.

Further consideration shows that the measurements and odor detections are actually consistent. The peak concentrations (persisting for seconds or less at any point) on the site could have been in the 1000 $\mu g/m^3$ and higher range, while the long term average concentration (measured by the instruments) was undetectable (<15 $\mu g/m^3$). Such peak concentrations would be easily

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[38] The first citation quotes the second as giving 130 $\mu g/m^3$, but converts between ppb and $\mu g/m^3$ with a factor corresponding to a temperature of O°C. We have converted using a factor appropriate for 20°C.

recognizable as naphthalene by most of the population, even though they only lasted for short periods, and some odor would be detectable for longer periods. The odors that were detected during the bioremediation test cell filling are likely to occur during any activity on site that results in large scale earth movement from contaminated areas. Thus any type of excavation activity will give rise to similar odors, especially during the initial phases of the activity when contaminated soil is brought to the surface.

10.4 Conclusion

Based on these factors, the risk characterization concludes that the site poses no significant risk to public welfare for current conditions. Future soil movement in contaminated areas has the potential to result in short-term odors; however, if no soil movement in naphthalenecontaminated areas takes place without appropriate management, the site poses no significant risk to public welfare for future conditions.

11 Characterization of risks to the environment

[chapter skipped]

12 Uncertainties

[chapter skipped]

13 Activity and Use Limitations

The Method 3 risk characterization evaluated risks to human health, safety, public welfare, and the environment for all current site uses and for several anticipated and hypothetical future site uses. The risk characterization did not, however, evaluate risks associated with all potential future site uses (e.g. redevelopment of the site for residential purposes). Furthermore, for a few future scenarios, the risk characterization concluded that the site may pose a significant risk to certain individuals if precautions are not taken to limit exposure. For these reasons, the following restrictions should be placed on the property in an Activity and Use Limitation.

- Residential redevelopment of the site should not occur without further evaluating health risks to future on-site residents. Restricting residential redevelopment of the site prevents future residents from coming into daily contact with higher concentrations of contaminants in soil and air than occur at adjacent residences.

- Any use of the site for activities that result in dermal contact with contaminated areas more than once per week should not occur without further evaluation. For exampld-, - no use of any part of the site as an unpaved sports area should be contemplated without further evaluation.

- Any use of the site for growing foods for human or animal consumption should not occur without further evaluation.

- Any use of the site for schools, nurseries, or other uses that would involve the presence of individuals younger than 18 on the site for periods more than would be expected for . visits to a retail store or mall should not occur without further evaluation.

- Prior to construction of future buildings on the site, the potential for vapor intrusion should be examined, and suitable mitigation measures taken if required to prevent contaminant migration to indoor air.

- All construction projects involving excavation into areas of contaminated soil should require a health and safety plan to limit exposure by construction workers and a soil management plan to limit exposure by others. The soil management plan should ensure that soil containing asbestos or bioaccumulating chemicals does not remain in surface soil subsequent to soil moving activities. Care should also be taken to prevent significant odors from occurring from soil contaminated with naphthalene.

- Individuals younger than 18 should not be permitted on the site for more than an average of one day per week during construction work, and should be prevented from coming into contact with contaminated soil piles (or vapors or dust from such piles) produced during on-site excavation.

- The utilities currently present on the site are not located in contaminated areas; therefore, utility work will not pose a significant risk to workers. The risk

characterization does not, however, evaluate risks to utility workers for future utilities installed in contaminated areas, and concludes that there is the potential for risks to safety from excavations into contaminated soil such as might occur during emergency work on utilities located in contaminated areas. If new underground utilities are installed on the site, contaminated soil that might be excavated during any such emergency work on utilities should be replaced with clean soil. This will prevent potential future risks to health or safety of utility workers.

- Groundwater on the site is not currently used and is categorized GW-3 in areas that are not within 30 feet of an occupied building. GW-3 groundwater is not considered to be a source of drinking water and is not considered as such in the risk characterization. The risk characterization also, however, does not evaluate direct contact with groundwater during construction work. The AUL should specify that the health and safety plan for construction work should prevent any such contact (e.g. by requiring de-watering of excavations). If contaminated groundwater is exposed at the site, adequate measures should be taken to prevent exposure to the groundwater itself and vapors evaporating from the groundwater.

14 Conclusions

An MCP risk characterization was performed to assess risks associated with a release of oil, asbestos, and other hazardous materials at the W.R. Grace & Co. Property (RTN 3-0277). Method 3 was selected as the most appropriate method by which to evaluate risks to human health, safety, public welfare, and the environment. The primary routes of exposure considered in the assessment are incidental ingestion of soil, dermal absorption from soil, inhalation of vapors, and inhalation and ingestion of soil particles and fibers.

14.1 Current conditions

The primary receptors examined for current site conditions were adjacent residents, transient users of the site (e.g. pedestrians, trespassers, and MBTA commuters), office workers on the site, and utility workers. The conclusions of the risk characterization for the Site under current conditions are:

- The site poses no significant risk to human health for current conditions. The total noncancer hazard indexes for adjacent residents, transient users, office workers, and utility workers at existing utilities do not exceed DEP's guideline of unity. Furthermore, the total incremental cancer risk estimates for all receptors do not exceed DEP's guideline of I x I 0-1.

- The site poses no significant risk to safety under current site conditions and during
- emergency utility excavations at existing, identified utilities.

- The site poses no significant risk to public welfare under current conditions. The characterization of risks to public welfare does not identify any nuisance conditions, restrictions on the use of another person's property, or any monetary or non-pecuniary costs due to the degradation of public resources under current conditions.

- The site poses no significant risk to the environment under current conditions. The characterization of risks to the environment finds that potential exposure of environmental receptors to site-related contamination is limited. All contaminant concentrations in groundwater are less than UCLS. No measured surface water concentrations exceed ambient water quality criteria or DEP guidelines. Ambient water quality criteria are unlikely to be exceeded in the future upon groundwater discharge to surface water. Sediment has not been impacted by the contamination from the disposal site.

14.2 Future conditions

The receptors examined under foreseeable and hypothetical future scenarios were adjacent residents, transient users of the site, office workers on the site, utility workers, and construction workers. The conclusions of the risk characterization for the Site for future conditions are:

- The site poses no significant risk to human health for future conditions that do not involve construction or movement of contaminated soil. All non-cancer hazard indices for adjacent residents, transient users, office workers, utility workers, and construction workers are no greater than DEP's guideline of unity, and all total incremental cancer risk estimates are less than DEP's guideline of 1 x 10'.

- A condition of significant risk to human health potentially exists during a hypothetical, very large scale construction project. Non-cancer hazard indices for adjacent residents, transient users, office workers, utility workers, and construction workers are less than the DEP guideline of unity, but incremental cancer risks for all receptors exceed the DEP guideline of I x 10-' because of the potential exposure to asbestos.

- The site poses no significant risk to safety except for future, worst-case, small scale excavation by a construction or utility worker in heavily contaminated areas.

- The site may pose a significant risk to public welfare under foreseeable future conditions. Under foreseeable future use conditions of disturbance to naphthalene contaminated areas of soil, adjacent areas are likely to be affected by odors, potentially a nuisance condition.

- The site poses no significant risk to the environment under future conditions except in circumstances where excavation leaves asbestos or high levels of bioconcentrating contaminants (e.g. naphthalene and other PAHS) at the surface. The characterization of risks to the environment finds that potential exposure of environmental receptors to siterelated contamination is limited. All contaminant concentrations in groundwater are less than UCLS. No measured surface water concentrations exceed DEP guidelines or ambient water quality criteria. Ambient water quality criteria are unlikely to be exceeded in the future upon groundwater discharge to surface water. Sediment has not been impacted by the contamination from the disposal site.