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

September 28, 2001

Record of Decision
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APPENDICES

DECLARATION FOR THE RECORD OF DECISION

A. SITE NAME AND LOCATION

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

B. STATEMENT OF BASIS AND PURPOSE

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

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

The State of Connecticut concurs with the Selected Remedy.

C. ASSESSMENT OF THE SITE

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

D. DESCRIPTION OF THE SELECTED REMEDY

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

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

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

The major components of this remedy are:

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

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

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

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

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

6. Five-year Review.

E. STATUTORY DETERMINATIONS

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

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

F. ROD DATA CERTIFICATION CHECKLIST

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

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

G. AUTHORIZING SIGNATURES

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

U.S. Environmental Protection Agency

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

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

Record of Decision
Part 2: The Decision Summary

A. SITE, LOCATION AND BRIEF DESCRIPTION

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

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

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

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

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

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

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

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

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

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

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

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

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

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

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

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

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

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

In April 1994, the PRPs prepared and submitted an Engineering Evaluation/Cost Analysis (EE/CA) for removal actions to be implemented as a NTCRA. As part of the NTCRA the USEPA presumptive remedy for CERCLA municipal landfill sites, including a cap, would be implemented. The final EE/CA Report (O'Brien & Gere 1994) was submitted to the USEPA on September 22, 1994 and approved by the Agency on September 26, 1994. Based on the report, the USEPA prepared an Action Memorandum dated January 19, 1996 to document approval of the NTCRA (Appendix 1-1). USEPA and CTDEP executed an enforcement agreement, dated August 22, 1996, so that CTDEP could oversee the NTCRA with the legislature providing funding to the CTDEP to implement the action. CTDEP and RRDD#1 subsequently entered into Consent Order #SRD-072 requiring RRDD#1 to design and implement the NTCRA approved by the Action Memorandum.

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

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

The NTCRA included the following major components:

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

3. History of CERCLA Enforcement Activities

On May 21, 1991, USEPA notified approximately thirty-nine parties of their potential liability because they either owned or operated the facility, generated hazardous wastes that were shipped to the facility, arranged for the disposal of hazardous wastes at the facility, or transported hazardous wastes to the facility. Negotiations commenced with these potentially responsible parties (PRPs) within 60 days of USEPA notification regarding the settlement of the PRPs' liability at the Site.

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

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

C. COMMUNITY PARTICIPATION

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

D. SCOPE AND ROLE OF RESPONSE ACTION

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

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

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

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

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

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

E. SITE CHARACTERISTICS

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

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

Conceptual Site Model

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

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

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

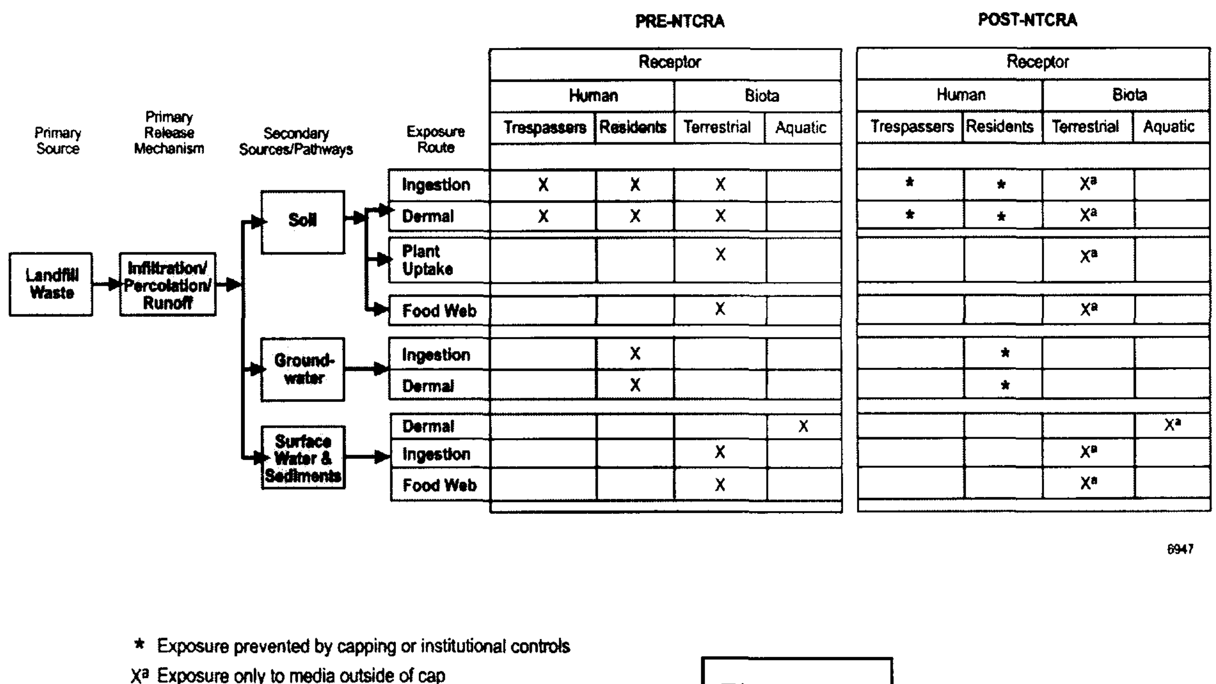


Figure 1

FIGURE BARKHAMSTED LANDFILL CONCEPTUAL SITE MODEL

General Site Characteristics

The Site is on a 97.8-acre parcel of land (Figure 2) on the northern slope of a hill within the Farmington River Valley, in the north central portion of Connecticut. It is surrounded primarily by mixed hardwood and conifer forests. There is one surface water body, the Unnamed Brook, which originates south of the Site and flows north along the west side of the landfill area. Once beyond the landfill, the brook curves to the northeast and flows under Route 44, where it enters the Farmington River flood plain and a series of small beaver ponds. It eventually flows into the Farmington River, 0.25 miles southeast of the Site.

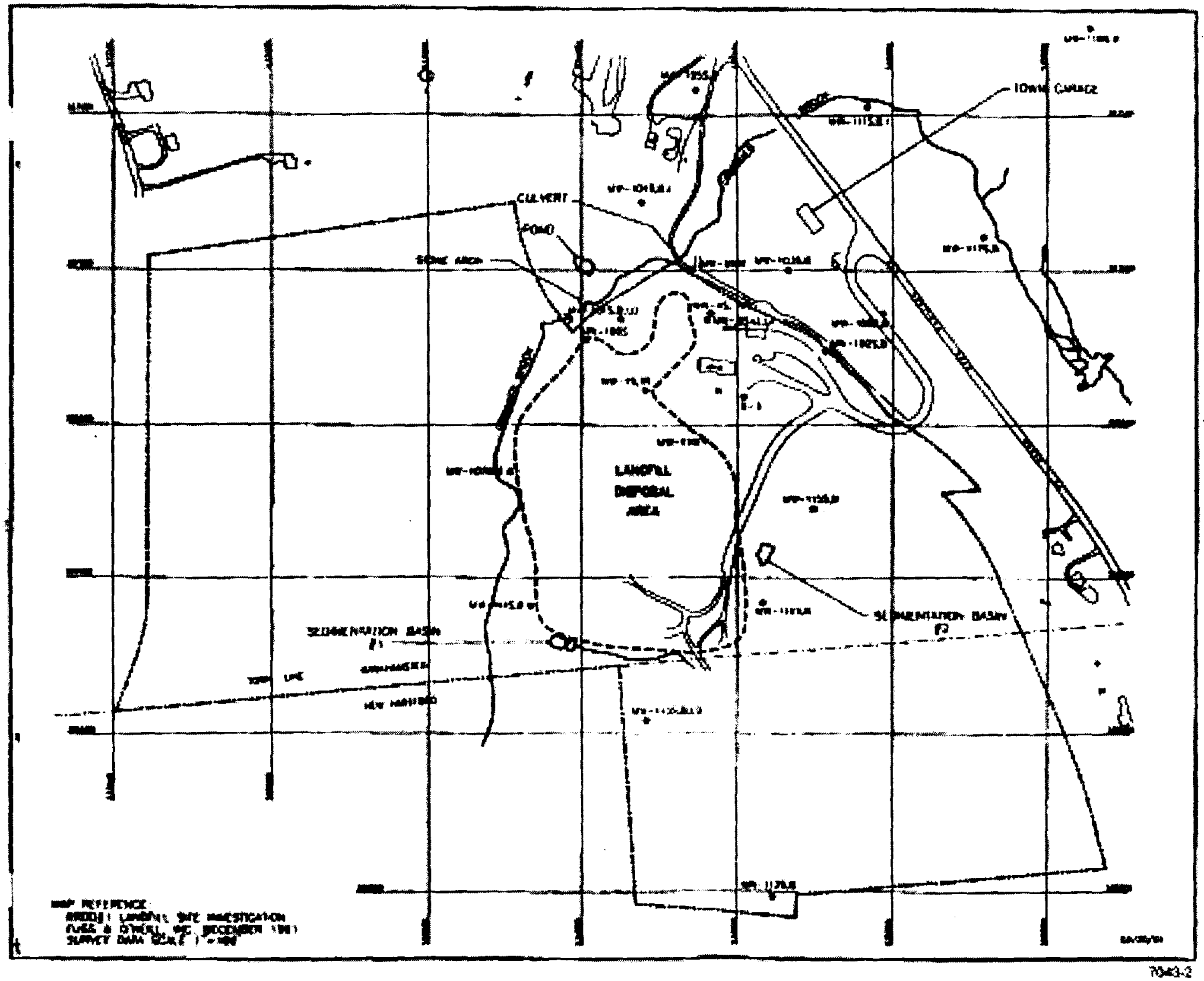
The Site is bordered on the northeast by the Barkhamsted Town Garage facility. The remainder of the parcel is bounded by a combination of developed and undeveloped private property. Residences with private drinking wells border the Site. There are no known areas of archaeological or historical importance.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

Soil

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

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

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



BARKHAMSTED—NEW HARTFORD
LANDFILL SUPERFUND SITE
BARKHAMSTED, CONNECTICUT

FIGURE 2.
SITE MAP

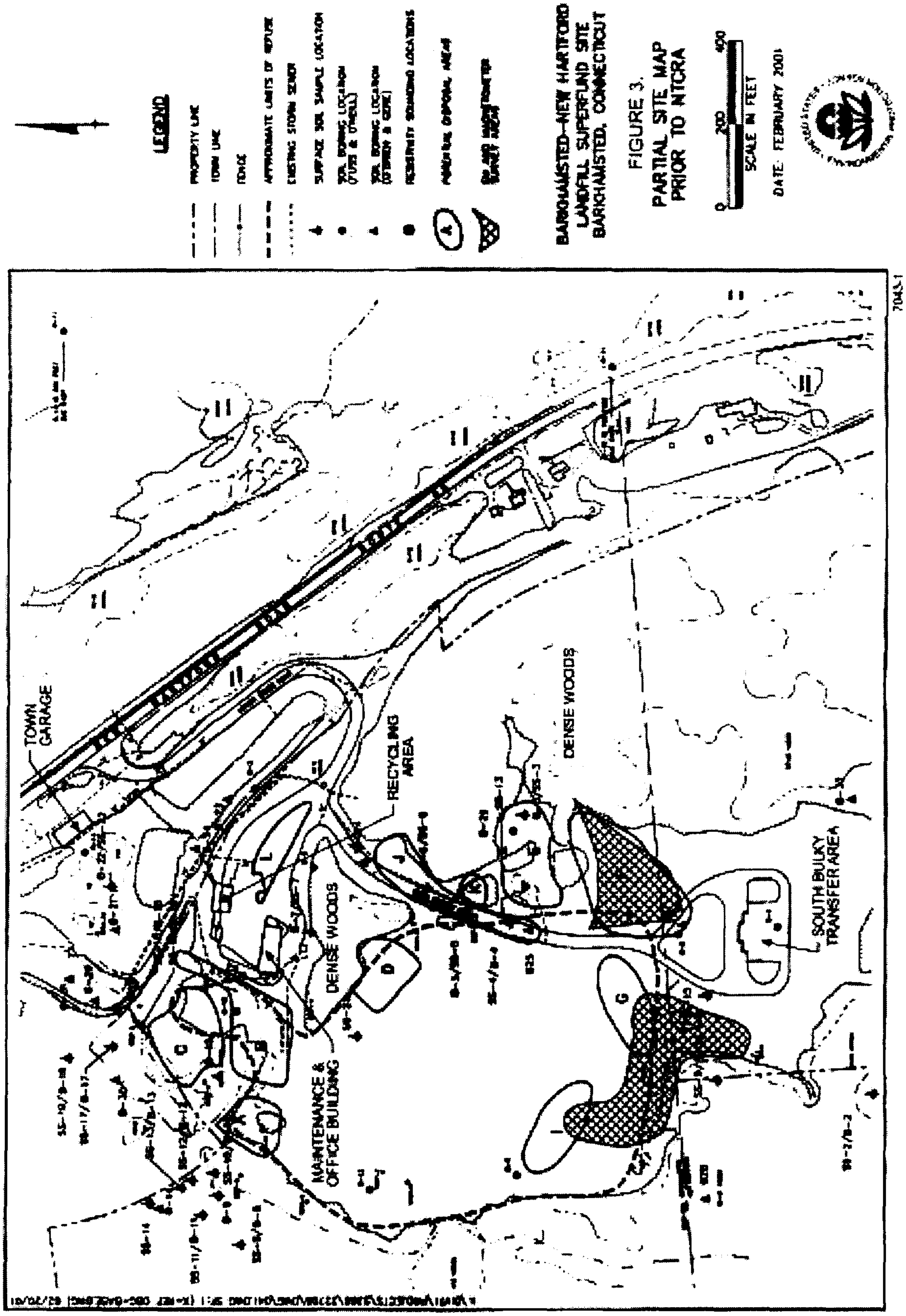
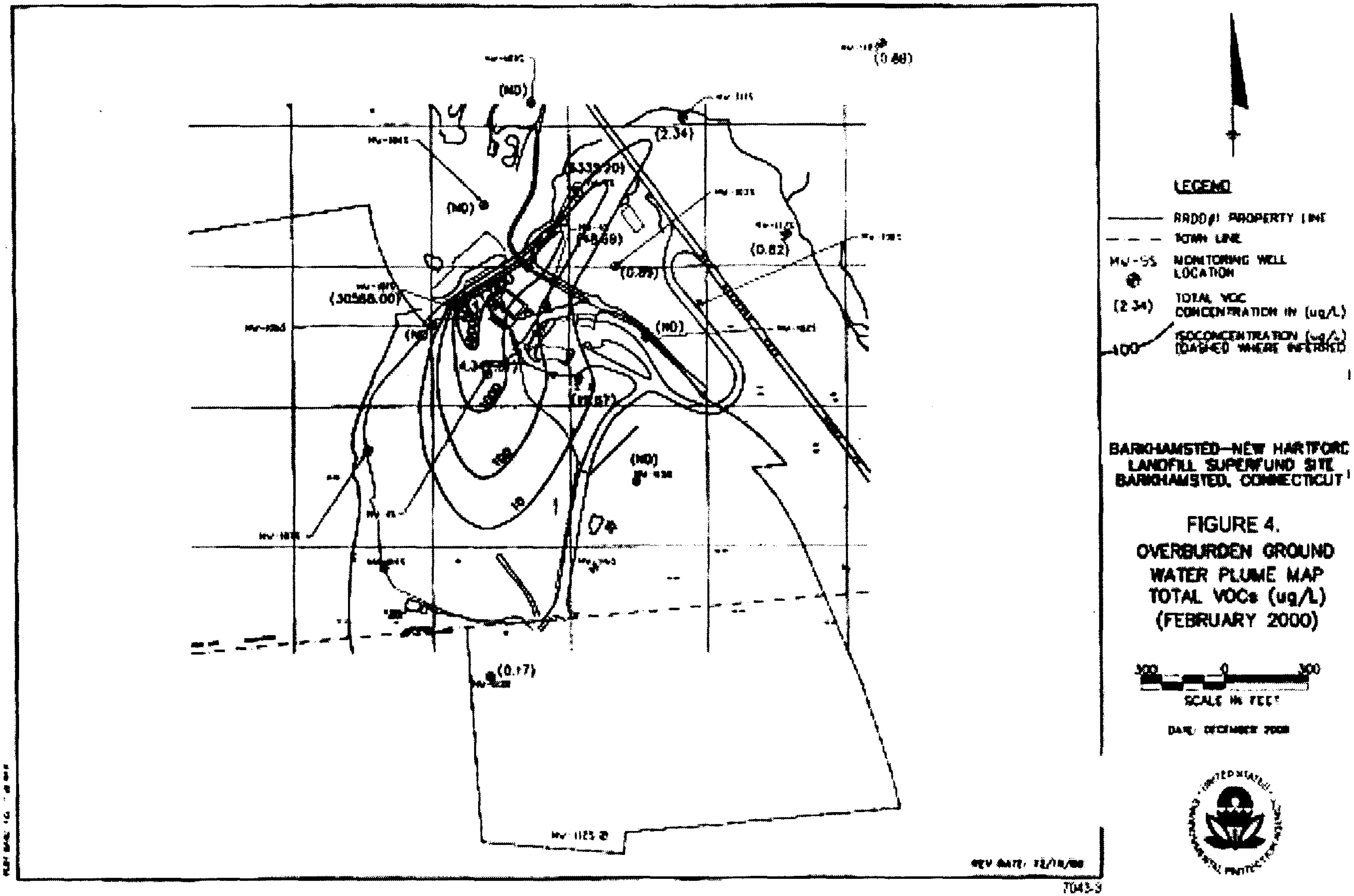
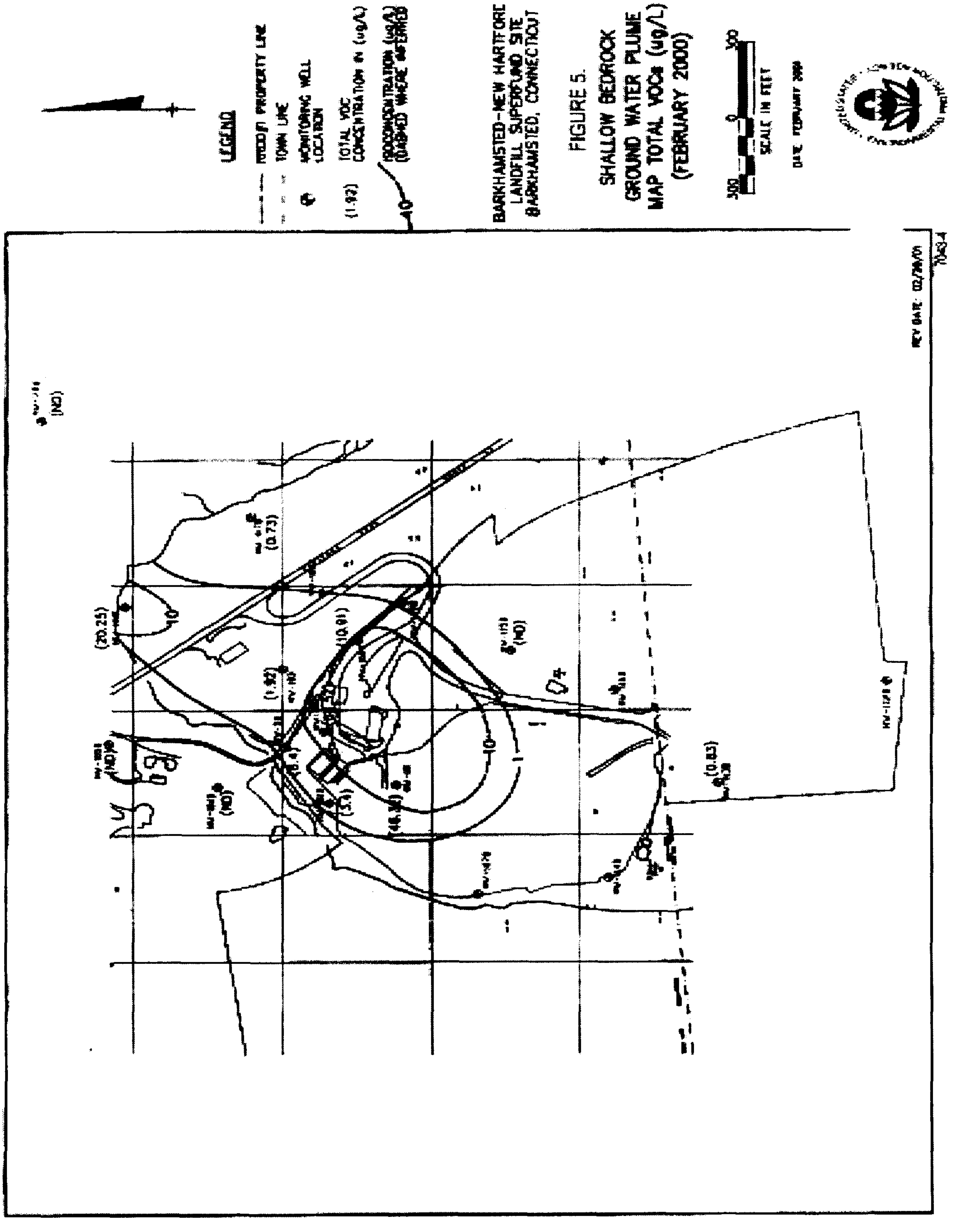


FIGURE 3. PARTIAL SITE MAP PRIOR TO NTCRA


(ND)
(2.34)
(0.82)
(0.88)
(30588.00)
(0.17)
LEGEND
PROPERTY LINE
TOWN LINE
MW-55 MONITORING WELL LOCATION
(2.34) TOTAL VOC CONCENTRATION IN (ug/L)
100 ISOCONCENTRATION (ug/L) (DASHED WHERE INFERRED)
BARKHAMSTED—NEW HARTFORD LANDFILL SUPERFUND SITE BARKHAMSTED, CONNECTICUT
FIGURE 4.
OVERBURDEN GROUND WATER PLUME MAP TOTAL VOCs (ug/L) (FEBRUARY 2000)
SCALE IN FEET
DATE: DECEMBER 2000
7043-3


LEGEND
PROPERTY LINE
TOWN LINE
MONITORING WELL LOCATION
(1.92) TOTAL VOC CONCENTRATION IN (ug/L)
ISOCONCENTRATION (ug/L) (DASHED WHERE INFERRED)
BARKHAMSTED-NEW HARTFORD LANDFILL SUPERFUND SITE
BARKHAMSTED, CONNECTICUT
FIGURE 5.
SHALLOW BEDROCK GROUND WATER PLUME MAP TOTAL VOCs (ug/L) (FEBRUARY 2000)
300 0 300
SCALE IN FEET
(ND)
(0.73)
(20.25)
(0.91)
(1.92)
(11.4)
(3.1)
(46.50)
(0.83)
10
1
REV DATE: 02/26/01

adjusted in some places.

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

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

Groundwater

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

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

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

Since the completion of the RI, four additional rounds of groundwater sampling have been conducted. Not all of the original RI wells have been sampled in the subsequent rounds, since some wells were abandoned during the NTCRA. Most recently, samples were collected in December 1999 and February 2000 to update the risk assessment, to confirm the extent of the plume, and to estimate the extent to which natural attenuation is occurring. This more recent sampling has shown that the concentrations of most contaminants in the groundwater have declined since the RI. A notable exception is toluene, the concentration of which rose significantly in two overburden monitoring wells close to the landfill. During the RI, the plume of contaminated groundwater was found to migrate predominantly in the overburden and the shallow bedrock aquifers to the north and northeast of the landfill. Although monitoring wells in the intermediate and deep bedrock also contained contaminants at the time of the RI, the levels of contamination have been substantially lower in more recent sampling rounds. There are no NAPLs (non-aqueous phase liquids) known to be present at the Site.

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

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

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

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

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

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

COCs for groundwater include 14 VOCs, four SVOCs, and four inorganics. The COCs were selected from the constituents detected in groundwater based on the unacceptable risks that those contaminants present.

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

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

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

Leachate Seeps

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

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

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

Surface Water

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

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

Sediment

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

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

During the performance of the NTCRA, an approximate 340-ft reach of the Unnamed Brook on the west side of the landfill was relocated, with the former section of the brook being filled and covered with soil. Additionally, sediments were excavated from an approximate 70-ft reach of the brook near the northwest corner of the landfill, and placed beneath the cap during the NTCRA construction.

Air

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

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

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

Principal Threats

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

Low-Level Threats

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that are generally considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or groundwater, low leachability contaminants or low toxicity source material. The low-level threats remaining on-site include the contaminants remaining in Site groundwater, including VOCs, SVOCs, and metals. A low level threat to invertebrates in the Unnamed Brook may also remain due to barium and manganese in the sediments.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

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

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

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

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

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

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

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

G. SUMMARY OF SITE RISKS

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

1. Human Health Risk Assessment

Of the media evaluated in the human health risk assessment (peripheral soil, groundwater, seep water and brook surface water/sediment), only future groundwater exposure posed an unacceptable risk. Of the 56 chemicals detected in the groundwater plume at the Site during the December 1999 and February 2000 sampling rounds, 22 were selected for evaluation in the human health risk assessment as chemicals of concern (COCs). The COCs were selected to represent potential Site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment and can be found in Table 1-3 of the FS. These chemicals were identified in the FS as presenting a significant current or future risk and are referred to as the COCs in this ROD and summarized in Table 1. This Table contains the exposure point concentrations used to evaluate the reasonable maximum exposure scenario (RME) in the baseline risk assessment for the COCs. Estimates of average or central tendency exposure concentrations for the chemicals of concern and all chemicals of potential concern can be found Appendix 1-4 of the FS and in Risk Screening for Groundwater, Surface Water and Seeps at the Barkhamsted-New Hartford Landfill Superfund Site, USEPA April 2000 (USEPA, 2000).

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

Scenario Timeframe: *Future*
Medium: Groundwater
Exposure Medium: Groundwater

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

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

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

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

Key

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

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

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

Exposure Assessment

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

Risk Characterization

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

Table 2
Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

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

Table 2
Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

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

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

USEPA GROUP:
A - Human Carcinogen

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

Summary of Toxicity Assessment

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

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake level by the reference dose (RfD) or other suitable benchmark. Reference doses have been developed by USEPA and they represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. A HQ $\leq$ 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) within or across those media to which the same individual may reasonably be exposed. A HI ≤ 1 indicates that toxic noncarcinogenic effects are unlikely. A summary of the noncarcinogenic toxicity data relevant to the chemicals of concern is presented in Table 3.

Table 3
Non-Cancer Toxicity Data Summary

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

Pathway: Ingestion, Dermal

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

Summary of Toxicity Assessment

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

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

Table 4

Characterization Summary - Carcinogens

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

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk		
				Ingestion	Dermal	Exposure Routes Total
Ground-water	Ground-water	Aquifer - Tap Water	arsenic	$4.0x10^{-4}$	$2.0x10^{-6}$	$4.0x10^{-4}$
		Aquifer - Tap Water	1,4-dichlorobenzene	$1.2x10^{-6}$	$8.0x10^{-7}$	$2.0x10^{-6}$
		Aquifer - Tap Water	benzene	$5.9x10^{-6}$	$9.1x10^{-7}$	$6.8x10^{-6}$
		Aquifer - Tap Water	1,2-dichloroethane	$4.4x10^{-6}$	$2.2x10^{-7}$	$4.6x10^{-6}$
		Aquifer - Tap Water	1,2-dichloropropane	$1.6x10^{-6}$	$1.6x10^{-7}$	$1.8x10^{-6}$
		Aquifer - Tap Water	chloroethane	$5.6x10^{-7}$	$3.3x10^{-8}$	$5.9x10^{-7}$

Table 4

Characterization Summary - Carcinogens

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

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk		
				Ingestion	Dermal	Exposure Routes Total
		Aquifer - Tap Water	chloroform	$2.9x10^{-8}$	$2.9x10^{-9}$	$3.2x10^{-8}$
		Aquifer - Tap Water	chloromethane	$3.1x10^{-7}$	$9.1x10^{-9}$	$3.2x10^{-7}$
		Aquifer - Tap Water	dibromochloro-methane	$7.9x10^{-7}$	$6.1x10^{-8}$	$8.5x10^{-7}$
		Aquifer - Tap Water	methylene chloride	$9.9x10^{-6}$	$3.8x10^{-7}$	$1.0x10^{-5}$
		Aquifer - Tap Water	trichloroethene	$5.3x10^{-7}$	$9.0x10^{-8}$	$6.2x10^{-7}$
		Aquifer - Tap Water	vinyl chloride	$4.3x10^{-5}$	$2.3x10^{-6}$	$4.5x10^{-5}$
		Aquifer - Tap Water	bis(2ethyl hexyl) phthalate	$1.1x10^{-5}$	$1.8x10^{-5}$	$2.9x10^{-5}$
					groundwater risk total=	$5.0x10^{-4}$
					Total Risk =	$5.0x10^{-4}$

Key
— : Toxicity criteria are not available to quantitatively address this route of exposure.

Risk Characterization

This table provides risk estimates for the significant routes of exposure. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's exposure to groundwater, as well as the toxicity of the COCs (arsenic, 1,4-dichlorobenzene, benzene, 1,2-Dichloroethane, 1,2-dichloropropane, Chloroethane, chloroform, chloromethane, dibromochloromethane, methylene chloride, trichloroethene, vinyl chloride, bis(2ethyl hexyl) phthalate). The total risk from direct exposure to contaminated groundwater at this Site to a current child resident is estimated to be 5.04 x 10^{-4}. The COC contributing most to this risk level is arsenic.

Table 5

Risk Characterization Summary - Non-Carcinogens

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

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient		
					Ingestion	Dermal	Exposure Routes Total
Ground-water	Ground-water	Aquifer - Tap water	arsenic	Skin	2.0	$1.1x10^{-2}$	2.0
Ground-water	Ground-water	Aquifer - Tap water	chromium	---	2.0	$2.1x10^{-3}$	2.0
Ground-water	Ground-water	Aquifer - Tap water	manganese	CNS	9.1	$1.3x10^{-3}$	9.1
Ground-water	Ground-water	Aquifer - Tap water	acetone	Liver/Kidney	4.9	$2.4x10^{-2}$	4.9
Ground-water	Ground-water	Aquifer - Tap water	benzene	---	$1.5x10^{-1}$	$2.4x10^{-2}$	$1.8x10^{-1}$
Ground-water	Ground-water	Aquifer - Tap water	2-butanone	Developmen-tal	1.7	$1.6x10^{-2}$	1.7
Ground-water	Ground-water	Aquifer - Tap water	1,2-dichloroethane	---	$3.6x10^{-3}$	$1.8x10^{-4}$	$3.8x10^{-3}$
Ground-water	Ground-water	Aquifer - Tap water	1,2-dichloropropane	Respiratory	$4.9x10^{-2}$	$5.1x10^{-3}$	$5.4x10^{-2}$
Ground-water	Ground-water	Aquifer - Tap water	chloroethane	—	$1.1x10^{-3}$	$6.6x10^{-5}$	$1.2x10^{-3}$
Ground-water	Ground-water	Aquifer - Tap water	chloroform	Liver	$1.1x10^{-3}$	$1.1x10^{-4}$	$1.2x10^{-3}$
Ground-water	Ground-water	Aquifer - Tap water	dibromochloromethane	Kidney	$1.1x10^{-3}$	$8.5x10^{-5}$	$1.1x10^{-3}$
Ground-water	Ground-water	Aquifer - Tap water	4-methyl-2-pentanone	Liver/Kidney	$7.4x10^{-1}$	$2.2x10^{-2}$	$7.7x10^{-1}$
Ground-water	Ground-water	Aquifer - Tap water	methylene chloride	Liver	$5.0x10^{-2}$	$2.0x10^{-3}$	$5.2x10^{-2}$
Ground-water	Ground-water	Aquifer - Tap water	toluene	Liver/Kidney	3.1	1.1	4.2
Ground-water	Ground-water	Aquifer - Tap water	trichloroethene	Liver/Kidney	$1.8x10^{-2}$	$3.2x10^{-3}$	$2.1x10^{-2}$
Ground-water	Ground-water	Aquifer - Tap water	bis(2-ethylhexyl) phthalate	Liver	$8.8x10^{-2}$	$1.5x10^{-1}$	$2.4x10^{-1}$
Ground-water	Ground-water	Aquifer - Tap water	1,4-dichlorobenzene	---	$3.6x10^{-3}$	$2.6x10^{-3}$	$6.2x10^{-3}$

Table 5

Risk Characterization Summary - Non-Carcinogens

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

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient		
					Ingestion	Dermal	Exposure Routes Total
Ground-water	Ground-water	Aquifer - Tap water	2,4-dimethylphenol	Blood	3.0	4.2×10^{-1}	3.4
Ground-water	Ground-water	Aquifer - Tap water	4-methylphenol	CNS	275	27	302
						GW Hazard Index Total =	331
						Hazard Index Total =	331
						Skin Hazard Index =	2.0
						Blood Hazard Index =	3.4
						Respiratory Hazard Index =	0.054
						Developmental Hazard Index =	1.7
						CNS Hazard Index =	311
						Liver/Kidney Hazard Index =	9.9

Key

— : Toxicity criteria are not available to quantitatively address this route of exposure.
N/A: Route of exposure is not applicable to this medium.

Risk Characterization

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of hazard quotients) for all routes of exposure. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) greater than 1 indicates the potential for adverse noncancer effects. The estimated HI of 327 indicates that the potential for adverse noncancer effects could occur from exposure to contaminated groundwater containing chromium, manganese, acetone, 2-butanone, toluene, 2,4-dimethylphenol, and 4-methylphenol.

The only medium which poses an unacceptable risk is groundwater. The total cancer risk from dermal and oral exposures via a drinking water scenario is 5×10^{-4}. Eighty percent of the cancer risk is due to arsenic at the maximum concentration of 22 μg/L. This cancer risk estimate is conservative because it assumes that groundwater containing the maximum concentration is actually consumed. If groundwater were to be consumed, it is much more likely that the concentration would be closer to the average concentration. Groundwater in the area is not consumed presently because municipal drinking water is provided. In addition, institutional controls will be instituted to prevent installation of drinking water wells in the future.

According to Review Comments on the "Geochemical Modeling for Assessing Natural Attenuation of Arsenic at the Barkhamstead New Hartford Landfill" Superfund Site, Barkhamstead, CT by Ann Keeley, Ph.D. on March 22, 2001, concentrations of arsenic will decrease over time to 5 μg/L. The cancer risk associated with 22 μg/L arsenic is 4 x 10^{-4}. The cancer risk associated with the other carcinogenic chemicals is 1 x 10^{-4}. Since the modeled future arsenic concentration (5 μg/L) is 4.4 times lower, the future cancer risk of arsenic would be 9.1 x 10^{-5}. If the concentrations of the other carcinogenic chemicals remain the same (which is unlikely and perhaps over represents their exposure), the total future cancer risk would be 1.93 x 10^{-4}. The RI/FS found that the concentrations of these chemicals should reach background levels in about 15 years. Since it is likely that the concentrations of the other carcinogenic chemicals will decrease due to natural attenuation, it is probable that the future cancer risk would be below 1 x 10^{-4}, within USEPA's acceptable risk range of 1 x 10^{-4} to 1 x 10^{-6}. As a result, it is concluded that the future cancer risk will be acceptable even if groundwater was used for drinking water.

The current risks of non-carcinogenic chemicals exceed USEPA's hazard quotients of concern. The hazard indices (HI) which may exceed USEPA's hazard quotient of concern occur for the target endpoints of skin (HI=2.0), blood (HI=3.4), developmental effects (HI=1.7), liver/kidney effects (HI=9.1)and CNS (HI=311). The greatest contributor by far to noncancer risk is 4-methylphenol which is responsible for a HQ of 302 for central nervous system (CNS) effects (Table 5).

Lead in groundwater also exceeds its action level and would exceed USEPA's goal for lead in children's blood. The USEPA's Integrated Exposure and Uptake Biokinetic model was used to evaluate the hazard potential posed by exposure of young children less than 7 years of age as the most sensitive receptor group. This model evaluates exposures to lead from multiple media (i.e. soil/dust, drinking water, diet and air). Model defaults for media concentrations were assumed for all media except for drinking water. The model defaults are based on national background levels of lead in diet, air, dust and soil. The outcome of the model revealed that at the maximum average concentration of lead in any well (42 μg/L), 15.5% of children in the population would have blood lead levels that exceed 10 μg/dL. It is USEPA policy to protect 95% of the sensitive population against blood lead levels in excess of 10 ug/dL blood.

Uncertainty

There is always some imprecision, inaccuracy, and unrepresentativeness in the environmental data used to characterize site risks. The extent to which the data are incomplete is usually quantifiable, but precision, accuracy, and representativeness can only be estimated or described qualitatively. Below is a brief discussion of the major uncertainties associated with the risk assessment for the Site. A more complete discussion can be found in Section 5 of the Baseline Human Health Risk Assessment.

- The data include many measurements flagged with a "J", indicating that the measurement is approximate, or with a "UJ", indicating that the detection limit is approximate. These measurements contribute to the overall uncertainty in the estimate of risks.

- Many contaminants were measured near their detection limits, where the measurement precision is low. Also, with the typical incidence of low-level laboratory contaminants, measured concentrations of many samples were flagged "J" (estimated" wherever observed concentrations were less than the detection limits).

- Some of the low measurements of acetone and 2-butanone may have been either laboratory or sampling contaminants and/or Site contaminants. Due to the presence of related compounds at the Site, this assessment conservatively assumes that detected quantities represent actual Site contamination, not laboratory or sampling artifacts.

- Nitrate, a common landfill contaminant, was not analyzed for in the RI. It is associated with sewage, fertilizer, and general household waste, not specifically with hazardous waste. Non-Contract Laboratory Program (CLP) analyses indicated that nitrates were present above levels of potential health concern, but the quantitative risk assessment did not address risks from nitrate. Therefore, risks may be underestimated for consumption of groundwater directly downgradient of the landfill.

- Use of unfiltered groundwater samples for chemical analysis during the RI may overstate exposures that would actually occur in the event that groundwater directly downgradient of the landfill were to be used as drinking water. Actual water supplies from groundwater are typically less turbid than samples from monitoring wells and would probably have lower concentrations of most metals.

- An important assumption in this assessment is that environmental concentrations of chemicals will remain constant for the foreseeable future. This assumption is made when estimated exposure rates are extended a number of years. A more detailed model might predict the dispersion of contamination and degradation of organic compounds expected to occur with natural attenuation. Unfortunately, this kind of modeling is not very reliable. Uncertainty about the extent of contamination and movement of contaminants toward the nearby residences means that risks to neighborhood residents could be underestimated or overestimated by this assessment.

- Use of maximum values for an upper estimate of exposure is conservative, and may result in overestimation of the risk for the maximally exposed individual. On the other hand, average concentrations are also subject to statistical uncertainty, and may overestimate or underestimate realistic or exposure point concentrations.

<u>Human Health Risk Summary</u>

All human health risks other than those associated with groundwater were addressed as a result of the NTCRA because all exposure pathways except groundwater ingestion were either eliminated or ameliorated to acceptable risk levels by the NTCRA. The only medium that poses an unacceptable human health risk is exposure to groundwater. The total elevated cancer risk from dermal and oral exposures via a drinking water scenario is 5×10^{-4} (e.g. 5 in 10,000 chance of cancer above the normal lifetime chance of cancer of 1 in 3 or 4). Most (80%) of this elevated risk is due to arsenic at a maximum concentration of 22 μg/l. The hazard indices (HI) of contaminants in groundwater which may exceed the hazard quotient of concern (HI=1) occur for non-carcinogenic effects to skin, blood, kidney, fetal development, and the central nervous system. The greatest contributor by far to non-cancer risk is 4-methylphenol which is responsible for a hazard quotient (HQ) of 302 for central nervous system effects. Lead in groundwater also exceeds its action level and would exceed the USEPA's health goal for lead in children's blood under the conservative assumption that children would ingest lead at the maximum average concentration of lead in any well (42 μg/l).

2. Ecological Risk Assessment

RI Baseline Ecological Risk Assessment

The baseline ecological risk assessment in the RI (Metcalf & Eddy, 1996) evaluated ecological risk of chemicals of potential concern (COPCs) in sediment and surface water of the Unnamed Brook and Unnamed Pond, as well as soil in seeps. The ecological risk assessment was limited to locations outside the projected landfill cap using the assumption that seeps would dry out and become soil areas. COPCs are chemicals that have been detected at least once during chemical analysis of samples from a site. There were 59 COPCs in sediment, 32 COPCs in surface water, and 60 COPCs in seep soil, many of which were common to all three media. The maximum concentration of each COPC in each medium was screened against conservative ecological risk-based screening levels for the same medium (surface water, sediment and soil), and those COPCs that exceeded screening levels were selected as Chemicals of Concern (COCs) for further ecological risk assessment. The COCs selected for each medium were presented in Table 3-5 of the baseline ecological risk assessment (Metcalf & Eddy, 1996). The COCs included inorganics, pesticides and PAHs.

The risks of the COCs were evaluated by calculating average and maximum hazard quotients (HQ) for each receptor. The HQ is calculated by dividing the COC concentration or dose at the site by the no-effect or low-effect concentration or dose derived from the scientific literature. The representative receptors included fish, benthic invertebrates, amphibians, mammals (beaver, muskrat, mink, woodchuck, rodents), birds (robin), and soil invertebrates (earthworms). The average and maximum HQs for fish were calculated by dividing the average and maximum COC concentrations in surface water by the USEPA Ambient Water Quality Criteria. The HQ values for benthic invertebrates were calculated by dividing average and maximum COC concentrations in sediment by Lowest Effect Levels (LELs) from the Ontario Ministry of Energy and Environment or other conservative benchmarks. HQ values for mammals and birds were calculated by dividing the estimated dose due to ingestion of soil, sediment or tissue by no-effect or low-effect benchmark doses from the scientific literature.

The baseline ecological risk assessment concluded that: 1) aquatic invertebrate communities in the unnamed brook were at risk from metals, specifically aluminum, manganese, and iron; 2) mink and other semi-aquatic animals were at risk from pesticides in sediment (primarily DDT); and 3) small terrestrial mammals that consume animal tissue (e.g. earthworms) are at risk from the ingestion of chromium in seep soil.

Post-NTCRA Ecological Risk Assessment

Since the completion of the RI and the Baseline Ecological Risk Assessment, RRDD#1 has completed landfill closure under the NTCRA, which included capping of the landfill and installation of a leachate collection system, completed in 1998. During the performance of the NTCRA, an approximate 340-ft reach of the Unnamed Brook on the west side of the landfill (in the vicinity of Leachate Seeps 8 and 13) was relocated, with the former section of the brook being filled and covered with soil. Moreover, sediments were excavated from an approximate 70-ft reach of the brook near the northwest corner of the landfill (roughly between Leachate Seeps 5 and 6), and placed beneath the cap during the NTCRA construction. That excavation was conducted after coordinating with CTDEP to remove the most visually contaminated (iron stained) sediment from the brook.

Monitoring of water in the seeps and surface water of the Unnamed Brook was conducted in November/December, 2000 and February, 2000. In April, 2000 USEPA updated the ecological risk assessment with data from 1999/2000 by estimating risks associated with surface water and seeps. The surface water and seep water data are presented in Tables 6 and 7, respectively.

Post-NTCRA Surface Water

The more recent surface water monitoring data (Table 6) indicates that none of the inorganics that had driven the risk to aquatic organisms prior to the NTCRA exceeded surface water benchmarks after the NTCRA. However, bis(2-ethylhexyl) phthalate and carbon disulfide were detected in surface waters in December, 1999 at concentrations exceeding surface water quality benchmarks, but these were not detected in February, 2000. The concentrations of contaminants detected in surface water in December, 1999 and February, 2000 are compared with benchmark concentrations for aquatic organisms in Table 6. The results show that carbon disulfide and bis(2-ethylhexyl) phthalate exceeded their benchmarks in December, 1999 but not in February, 2000. These results indicate that at the last sampling period in February, 2000 there were no exceedances of surface water benchmarks in the Unnamed Brook, indicating that there is no significant risk of COCs in surface water to aquatic organisms.

Table 6
Chemical Concentrations in Surface Water of Unnamed Brook Before and After NTCRA-Barkhamsted Landfill

			Maximum Concentration (ug/l)			
Chemical of Concern of Concern	**Benchmark (ug/l)**	**Benchmark Source**	**Pre-NTCRA**		**Post-NTCRA**	
			August, 1995	**April, 1997**	**December, 1999**	**February , 2000**
Acetone	1500	(2)	10J	NA	ND	ND
Carbon disulfide	0.92	(2)	NA	NA	**13**	ND
Methylene chloride	2200	(2)	2J	NA	0.67J	ND
2,4-Dimethylphenol	2.4	(5)	8	NA	ND	ND
4-Methylphenol	--	--	16	NA	ND	ND
Bis(2-ethylhexyl) phthalate	3	(2)	ND	NA	**3.9J**	ND
Aluminum	87	(3)	**700**	**500**	ND	ND
Barium	3.9	(1)	ND	ND	ND	ND
Copper	2.7	(4)	ND	ND	ND	ND
Iron	1000	(3)	**8800**	**2100**	1.2	1.9
Lead	0.4	(4)	**3**	ND	ND	ND
Manganese	120	(2)	**250**	**230**	0.25	0.29
Zinc	36.5	(4)	ND	10	ND	ND

1) USEPA, 1996
(2) Suter and Tsao, 1996
(3) National Recommended Ambient Water Quality Criteria (USEPA, 1999)
(4) National Recommended Ambient Water Quality Criteria-adjusted to 25 mg/l hardness (USEPA, 1999)
(5) Rhode Island Ambient Water Quality Criteria (as used in the baseline risk assessment)
NA = Not Analyzed
ND = Not Detected
J = Estimated concentration
-- = Not Available
Values in bold exceed benchmark
Data from Table 3 (USEPA, 2000)

Post-NTCRA Seep Water

Seeps are expected to gradually diminish with the implementation of the NTCRA, until all seeps have been eliminated. As shown in Table 7, chemical concentrations in seep water have decreased since the NTCRA and do not exceed surface water benchmarks in the latest sampling round (February, 2000), except possibly for 2,4-dimethylphenol which had an estimated concentration greater than the benchmark. Nevertheless, 2,4-dimethylphenol was not detectable in surface water of the Unnamed Brook (see Table 6), indicating that seep water is not causing exceedances of aquatic benchmarks in the Unnamed Brook itself where aquatic organisms occur. Aquatic organisms do not occur in the seeps themselves. These trends are expected to continue over time due to the landfill cap and continuing leachate collection. The seeps are expected to become drier as less precipitation infiltrates into the landfill. The ecological risks of seep soil to terrestrial mammals were minimal prior to the NTCRA and will decrease as vegetation becomes established in the seep areas. The results of these analyses will be used to assess the ecological risk over time and determine the need for any future remedial action. In particular, the monitoring data will be addressed as part of the 5-year review for the site.

Table 7
Chemical Concentrations in Surface Water of Seeps Before and After NTCRA-Barkhamsted Landfill

			Maximum Concentration (ug/l)			
	Benchmark	**Benchmark**	**Pre-NTCRA**		**Post-NTCRA**	
Chemical of Concern	(ug/l)	Source	August, 1995	August, 1998	December, 1999	February, 2000
Acetone	1500	(2)	26	NA	1.2J	ND
1,1-Dichloroethane	47	(2)	ND	NA	0.47J	0.64
1,2-Dichloroethane	910	(2)	ND	NA	0.26J	ND
1,2-Dichloropropane	--	--	ND	NA	0.29J	ND
4-Methyl-2-pentanone (MIBK)	170	(2)	ND	NA	0.62J	ND
Benzene	130	(2)	2.1	NA	1.9	1.8
Bromodichloromethane	--	--	ND	NA	0.28J	ND
Carbon disulfide	0.92	(2)	ND	NA	**54J**	ND
Chlorobenzene	54	(2)	2.8	NA	1.3	0.96
Chloroethane	--	--	4.7	NA	1.5J	1.3
Chloroform	28	(2)	ND	NA	1	ND
Chloromethane	--	--	ND	NA	ND	0.43J
Dibromochloromethane	--	--	ND	NA	0.15J	ND
Ethylbenzene	7.3	(2)	0.58	NA	ND	ND
Methylene chloride	2200	(2)	ND	NA	0.36J	ND
Toluene	9.8	(2)	ND	NA	0.21J	0.16J
Xylenes	13	(2)	3.4	NA	2.2	0.79
cis-1,2-Dichloroethene	590	(6)	ND	NA	0.12J	ND
Diethyl phthalate	210	(2)	7.1J	NA	2.6J	ND
2,4-Dimethylphenol	2.4	(5)	**21**	NA	**24**	**5.4J**
Phenol	110	(7)	ND	NA	ND	13
Aluminum	87	(3)	**900**	ND	3.6J	52
Arsenic	150	(3)	5	ND	0.005	0.007
Barium	3.9	(1)	**500**	**300**	0.4	0.4
Cadmium	0.8	(4)	ND	ND	ND	0.001
Chromium	23.8	(3)	20	10	0.01	0.05
Copper	29	(4)	10	ND	ND	0.09
Iron	1000	(3)	**80000**	**42000J**	76	150
Lead	14.7	(4)	ND	ND	ND	0.058
Manganese	120	(2)	**4800**	**5600**	0.25	0.29
Zinc	382	(4)	ND	ND	0.02	0.17

Data from Table 4 (USEPA, 2000)
(1) USEPA, 1996
(2) Suter and Tsao, 1996
(3) National Recommended Ambient Water Quality Criteria (USEPA, 1999)
(4) National Recommended Ambient Water Quality Criteria-adjusted to 25 mg/l hardness (USEPA, 1999)
(5) Rhode Island Ambient Water Quality Criteria (as used in the baseline risk assessment)
(6) Tier II value for 1,3-Dichloropropane used based on structural similarity
(7) AWQC chronic value calculated by the Great Lakes Water Quality Initiative as cited in Suter and Tsao, 1996
NA = Not Analyzed
ND = Not Detected
J = Estimated concentration
-- = Not Available
Values in bold exceed benchmark

Post-NTCRA Sediment

Sediments have not been analyzed in the Unnamed Brook after the completion of the NTCRA. Estimated post-NTCRA average and maximum COC concentrations were calculated by removing the RI data for the samples from areas of the Unnamed Brook that were relocated (SED-5) or excavated (SED-15), followed by re-calculation of the maximum and average concentrations. These re-calculated average and maximum concentrations were compared with updated sediment benchmarks for benthic invertebrates. The results of this comparison are presented in Table 8.

Table 8.
Comparison of Pre- and Post-NTCRA Sediment Concentrations With Benchmarks

	Sediment Concentration (ug/kg)				Sediment Benchmark Concentration (ug/kg)	
	Pre-NTCRA (1)		Post-NTCRA (2)		TEC	PEC
Chemical	Maximum	Average	Maximum	Average	(ug/kg)	(ug/kg)
Benzo(a)pyrene	850	268	850	251	150	1,450
Phenanthrene	730	243	730	255	204	1,170
Pyrene	2,300	402	2,300	436	195	1,520
4,4'-DDE	9.6	3.3	9.6	3.4	3.16	31.3
4,4'-DDT	11	3.4	11	3.3	4.16	62.9
Endosulfan	8.9	3.2	8.9	3.2	5.4(3)	5.4(3)
Endrin	3.8	2.9	3.8	2.8	20 (3)	20(3)
Chlordane	11	2.2	11	2.3	3.24	17.6
Barium	204,000	80,642	204,000	73,190	40,000(4)	40,000(4)
Chromium	66,900	23,952	55,700	22,093	43,400	111,000
Copper	47,900	16,252	47,900	15,988	31,600	149,000
Iron	79,400,000	21,608,750	79,400,000	20,320,500	20,000,000(5)	40,000,000 (6)
Lead	73,700	21,394	73,700	21,838	35,800	128,000
Manganese	9,450,000	1,221,279	9,450,000	1,105,035	460,000 (5)	1,100,000 (6)

Table 8. Comparison of Pre- and Post-NTCRA Sediment Concentrations With Benchmarks						
	Sediment Concentration (ug/kg)				Sediment Benchmark Concentration (ug/kg)	
	Pre-NTCRA (1)		Post-NTCRA (2)		TEC	PEC
Chemical	Maximum	Average	Maximum	Average	(ug/kg)	(ug/kg)
Nickel	35,500	12,208	35,500	11,780	22,800	48,600
Zinc	183,000	48,170	183,000	47,414	121,000	459,000

NA = Not Available
TEC = Threshold Effects Concentration from MacDonald et al (2000)
PEC = Probable Effects Concentration from MacDonald et al (2000)
(1) Data from RI Report (Metcalf & Eddy, 1996)
(2) Concentrations estimated by recalculation after removal of SED-5 and SED-15 from RI database
(3) Sediment Quality Benchmark from USEPA (1996) Ecotox Thresholds. ECO Update. USEPA 540/F-95/038
(4) Benchmark from Table 5-1 in RI Report (Metcalf & Eddy, 1996)
(5) Lowest Effect Level from Ontario Ministry of the Environment
(6) Severe Effect Level from Ontario Ministry of the Environment

Updated sediment benchmarks for aquatic organisms were taken from more recent studies (MacDonald et al 2000; USEPA, 1996). The original RI benchmarks (Table 5-1 of Metcalf & Eddy, 1996) were used if updated benchmarks were unavailable. Two types of benchmarks are represented; no-effect concentrations and probable effect concentrations. No-effect benchmarks include the Threshold Effect Concentration (TEC) from MacDonald et al (2000), the Lowest Effect Level (LEL) from the Ontario Ministry of Environment and Energy (OMEE), and the Sediment Quality Benchmark (SQB) from USEPA (1996). These benchmarks represent concentrations below which adverse effects are unlikely. These benchmarks are compared with maximum contaminant concentrations in screening level ecological risk assessments to screen out chemicals from further concern. It can be concluded that a chemical will not have adverse effects if it does not exceed these type of benchmarks.

The probable effect benchmarks include Probable Effect Concentrations (PEC) from MacDonald et al (2000) and Severe Effect Levels (SELs) from OMEE. These benchmarks represent concentrations above which adverse effects are likely. These benchmarks can be used in a baseline ecological risk assessment to conclude that effects are likely, unless rebutted by more site-specific data such as toxicity tests or benthic population surveys. Generally, the baseline ecological risk assessment concludes that adverse effects are likely only if the average concentration exceeds this type of benchmark.

The results of this analysis (Table 8) indicate that the estimated maximum post-NTCRA sediment concentration of many of the COCs exceeds the no-effect benchmarks, but the average concentrations of only two COCs (barium and manganese) exceed the probable effect benchmarks. As a result, it is concluded that some level of risk might still exist for benthic invertebrates in the Unnamed Brook.

It is likely that the contaminant concentrations in the biotic zone of the Unnamed Brook will decrease in the future due to biodegradation of some of the organic COCs, decreased inputs due to the NTCRA, and covering of stream sediment by natural sedimentation. Over time, these processes should ameliorate the possible risks to benthic invertebrates. As part of the site remedy, the seeps and sediment will be monitored in the future. The results of these analyses can be used to assess the ecological risk during the monitoring period and at the five-year review period.

Post-NTCRA Seep Soils

The primary risk of contaminants in seep soil was associated with ingestion by deer mice of chromium in prey tissue. This risk was calculated based on a food web model that conservatively assumed that the deer mouse diet is 50% animal tissue, that the chromium concentration in tissue was equal to that in soil, that 100% of the diet was obtained from seep areas, and that the reference dose was 2.5 mg/kg/day. Hazard Quotients for the average and maximum exposure cases were 44 and 1128, respectively, for the consumption of chromium in animal tissue. The average exposure case is likely more reflective of actual exposure than the maximum exposure case, and this risk is likely overestimated by one or more orders of magnitude because of the conservative exposure assumptions used in the food web model. In addition, the reference dose used in the model was highly conservative because it assumed that all of the chromium in seep soil was in the more toxic hexavalent form. Since it is likely that most of the chromium in seep soils would be in the less toxic trivalent form, a more appropriate reference dose would be 5466 mg/kg/day, which is the estimated reference dose for white footed mice (Sample et al, 1996) for trivalent chromium. This reference dose is about 2000 times higher so it is probable that the hazard quotient is overestimated by at least 3 orders of magnitude due to this factor alone. Combined with the probability that the mice would probably forage beyond the seep areas for much more of their diet than assumed, it is concluded that the actual risk of seep soil to mice is negligible.

Uncertainty

As discussed previously with human health risk assessment there is always some imprecision, inaccuracy, and unrepresentativeness in the environmental data used to characterize site risks. Many of the human health risk uncertainties described previously apply to ecological risk assessment as well. Conservative assumptions with high levels of uncertainty include the use of estimated data (J values) in the calculation of average concentrations, the assumption that environmental concentrations will remain the same over time, and the use of maximum concentrations as an upper estimate of exposure. In addition, there is great uncertainty concerning the toxicity factors used to estimate risks to the representative receptor organisms. The toxic effects of COCs have not been tested in laboratory studies with the selected receptors, rather, the no-effect doses have been estimated based on laboratory studies with other laboratory species. Additional uncertainty factors associated with ecological risk assessment include uncertainty concerning the assumptions made in food web modeling, including soil-to-prey bioaccumulation factors, foraging areas relative to site exposure areas, proportion of time spent by a receptor species at the site, body weights, ingestion rates, and diet composition.

Ecological Risk Summary

The baseline ecological risk assessment in the RI concluded that: 1) aquatic invertebrate communities in the Unnamed Brook were at risk from metals, specifically aluminum, manganese and iron; 2) mink and other semi-aquatic animals were at risk from pesticides in sediment (primarily DDT); and 3) small mammals that consume animal tissue (e.g. earthworms) are at risk from the ingestion of chromium from organisms that grow in seep soil.

Evaluation of the available post-NTCRA chemical data indicate that the concentrations have decreased significantly in surface water of the Unnamed Brook and in seep water. Risks of chemicals in surface water to aquatic organisms are now acceptable as shown by the absence of benchmark exceedances during the latest monitoring round in February, 2000. Chemical concentrations in seep water have decreased, and are not causing exceedances of aquatic benchmarks in the Unnamed Brook. These trends are expected to continue over time due to the landfill cap and continuing leachate collection. The seeps are expected to become drier as less precipitation infiltrates into the landfill.

Most of the ecological risk of seep soil to terrestrial mammals was associated with chromium in the food web of mice that might eat earthworms in seep soils. Due to the use of highly conservative food web assumptions and toxicity factors, it is probable that the actual risk in seep soils is negligible. The RI ecological risk assessment assumed that all of the chromium was in the more toxic hexavalent form and that the mice would feed only in the seep soil areas. Use of more realistic exposure and toxicity assumptions would result in calculated risks at least three orders of magnitude lower than those estimated in the RI. Any other potential risks of seep soil will decrease as the seeps dry out and vegetation becomes established in the seep areas.

Although sediment in the Unnamed Brook has not been sampled since the NTCRA, it is probable that risks to benthic organisms have decreased due to NTCRA activities (stream relocation and selected excavation, capping and leachate collection), as well as natural sedimentation and attenuation of organic COCs. A comparison of sediment COC concentrations measured prior to the NTCRA with updated sediment benchmarks indicates that there may be limited risk to benthic organisms due to barium and manganese in sediment.

With the completion of the NTCRA cap and leachate collection system, it is anticipated that the sources of contaminants to the Unnamed Brook-leachate seeps and landfill runoff-have been or will be mitigated. Results of sampling conducted in November/December 1999 and February 2000 showed that none of the previously detected COCs (pesticides, metals, SVOCs) were detected. Monitoring of seeps and sediment will be conducted as part of the NTCRA consent order between Connecticut and the PRP group. These data can be used to confirm that ecological risks are continuing to decrease.

With the completion of the NTCRA cap and leachate collection system, it is anticipated that the sources of contaminants to the Unnamed Brook – leachate seeps and landfill runoff – have been or will be mitigated. Results of sampling conducted in November/December 1999 and February 2000 showed that neither of the pesticide contaminants of potential concern (DDE or DDT) were detected in any of the surface water or leachate seep samples collected.

3. Basis for Response Action

The only medium that poses an unacceptable post-NTCRA risk to human health is groundwater. The baseline human health risk assessment revealed that potential exposure of residents to compounds of concern in groundwater via ingestion and dermal exposure may present an unacceptable human health risk. The total cancer risk from dermal and oral exposures via a drinking water scenario is 5×10^{-4}. Eighty percent of the cancer risk is due to arsenic at the maximum concentration of 22 μg/L. The hazard indices (HI) which may exceed EPA's hazard quotient of concern occur for the target endpoints of skin (HI = 2.0), blood (HI = 3.4), developmental effects (HI = 1.7), liver/kidney effects (HI = 9.1), and central nervous system (HI = 311). The greatest contributor by far to noncancer risk is 4-methylphenol which is responsible for a HQ of 302 for central nervous system effects. Lead in groundwater also exceeds its action level and would exceed EPA's maximum blood lead goal for children.

The only medium that potentially poses an unacceptable post-NTCRA risk to the environment is sediment. The baseline ecological risk assessment indicated that no-effect screening level benchmarks for benthic invertebrates were exceeded by many chemicals. However, probable post-NTCRA average concentrations exceeded more realistic effects-based benchmarks only for barium and manganese, suggesting that there may remain some level of risk to benthic invertebrates in the Unnamed Brook. Although the actual risk is uncertain, it is likely that decreased leachate, biodegradation of organic contaminants, and natural sedimentation will ameliorate these possible risks.

Based in the findings of the baseline human health and ecological risk assessments and post-NTCRA risk assessment screening, only groundwater was found to pose a definite future Site risk. Therefore, groundwater is the only focus of this remedial action.

H. REMEDIATION OBJECTIVES

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate prevent existing and future potential threats to human health and the environment. The RAOs for the selected remedy for Barkhamsted New-Hartford Superfund Site are:

Sediment

The RAOs for sediment for environmental protection are as follows:

- Protect benthic invertebrates and mammals ingesting contaminated prey from direct contact with, or ingestion of, sediment having constituent concentrations exceeding a hazard index of 1.

- Prevent releases of constituents from sediments that would result in surface water levels exceeding federal Ambient Water Quality Criteria, CT Water Quality Standards, or in their absence, a hazard index of 1.

Groundwater

Human Health

The RAOs for groundwater identified by USEPA for human health are as follows:

- Prevent the ingestion or dermal contact with groundwater having constituent concentrations exceeding USEPA Safe Drinking Water Act Maximum Contaminant Levels (MCLs), or in their absence, the more stringent of an excess cancer risk of 1×10^{-6} for each substance or a hazard quotient of 1 for each non-carcinogenic substance.

- Restore groundwater beyond the compliance boundary (limits of the landfill) to MCLs or any more stringent CT Remediation Standards (background concentrations), or in their absence, the more stringent of an excess cancer risk of 1×10^{-6} for each substance or a hazard quotient of 1 for each non-carcinogenic substance.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

1. Statutory Requirements/Response Objectives

Under its legal authorities, USEPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that USEPA's remedial action, when complete, must comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that USEPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

2. Technology and Alternative Development and Screening

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for the Site.

The RI/FS developed a limited number of remedial alternatives that attain Site specific remediation levels for Site groundwater within different time frames using different technologies; and a no action alternative.

As discussed in Section 2.4 of the FS, groundwater treatment technology options were identified, assessed and screened based on implementability, effectiveness, and cost. These technologies were combined into management of migration (MM) alternatives. Section 3 of the FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in detail in Sections 4 and 5 of the FS. Four management of migration alternatives were selected for detailed analysis.

J. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each management of migration alternative evaluated.

Management of migration (MM) alternatives address contaminants that have migrated into and with the groundwater from the original source of contamination. At the Site, contaminants have migrated from landfill wastes and contaminated soils into groundwater prior to implementation of the NTCRA. The MM alternatives analyzed for the Site include:

- MM-1 No Action
- MM-2 Management/Natural Attenuation
- MM-3A Collection, Treatment, and Discharge of Groundwater
- MM-3B Collection, Treatment, and Discharge of Groundwater

Each of the four MM alternatives is summarized below. A more complete, detailed presentation of each alternative is found in Section 3 of the FS.

MM-1: No Action

The key component of MM-1: No Action is monitoring of groundwater, surface water (including seeps), and sediment for 5-year reviews.

A No-Action alternative is included in the MM alternatives as required by the NCP (40 C.F.R. § 300.430(e)(6)). The No-Action alternative would include an environmental monitoring program for groundwater, surface water and sediment, to be performed for at least 30 years. Monitoring is part of the No Action alternative as it is necessary to perform the 5-year reviews as required by the NCP (40 C.F.R. § 300.430(f)(ii)). The No Action alternative would not, in and of itself, treat, remove, or actively reduce the potential exposure risk to contaminated groundwater, soil, and/or sediments on-site. This alternative would not include environmental land use restrictions or public education.

Estimated annual O&M cost (monitoring): $16,900
Estimated Present Worth: $242,080 (assuming 30 years at 7% discount rate)

MM-2: Management/Natural Attenuation

The key components of MM-2: Management/Natural Attenuation include:

- Long-term monitoring of groundwater, surface water (including seeps), and sediment
- Restoration of contaminated groundwater via natural attenuation
- Environmental land use restrictions
- Public education program

Long-term monitoring would include the installation of additional monitoring wells and periodic sampling and analysis of the groundwater, surface water, seeps, and sediment to evaluate changes over time. USEPA will determine the location, magnitude, frequency, and extent of all environmental sampling and analysis as necessary. Groundwater sampling would generally be conducted quarterly, although certain wells would be sampled only semiannually or annually. The samples would be analyzed generally for TCL Organics (VOCs and SVOCs) and TAL metals (dissolved and total) and any other compound as necessary. Surface water samples would also generally be collected at the same frequency as groundwater and analyzed for the same parameters as the groundwater plus pesticides. Seeps would be sampled quarterly for the first year and analyzed for the same parameters as the surface water samples. The seep sampling program would then be reviewed and adjusted, if necessary, based on the results from the first year. Sediment sampling and analysis will generally occur on an annual basis for TCL Organics (PCBs/Pesticides, VOCs, SVOCs) and TAL metals. Air sampling would be conducted during the first sampling round. Air samples would be taken from the landfill vents and from four stations, including one at a downwind residence and two at the recycling/maintenance facility work area.

The air samples would be analyzed for VOCs and compared to applicable Federal and state standards. Based on the results of this single air sampling event, recommendations for additional sampling or actions, if necessary, would be made.

Environmental land use restrictions involve placing legal restrictions on present and future uses. Land use restrictions would include use of groundwater for drinking or any other purpose, disturbances of soil on the Site, and construction of buildings on the Site. In general, these land use restrictions would prevent residential use of the Site, prevent contaminated groundwater from being extracted for use, and avoid disturbance of the landfill cap installed under the NTCRA. Additional environmental land use restrictions of down-gradient properties would prohibit the installation of any wells and the use of groundwater for any purpose. Any owner of property interests on the Site shall be required to create binding land use restrictions on their property needed to implement the remedy under applicable federal, state and local standards. On any property outside of the Site where the remedy calls for institutional controls to be implemented, any and all property rights needed to implement legally binding, land use restrictions for the remedy shall be acquired under applicable federal, state, and local standards.

A public education program would be implemented. Informational meetings would be held to inform the community of imminent or completed remedial activities. Mailings would also be used to provide updates on the progress of the cleanup or, if necessary, to discuss potential Site hazards.

The groundwater cleanup levels would be achieved via natural attenuation under this alternative. Natural attenuation processes include advection, dispersion, sorption, dilution, volatilization, geochemical precipitation, bio-degradation, radioactive decay, and chemical or biological stabilization, transformation, or destruction. Groundwater modeling conducted during the FS showed that natural attenuation will achieve the groundwater cleanup levels, in the overburden in approximately 15.6 years and in the bedrock aquifer in approximately 6 years.

An evaluation of natural attenuation was conducted in accordance with USEPA protocols (Wiedemeier, et. al. 1998). Lines of evidence indicate that the organic contaminant plumes in the overburden and shallow bedrock are attenuating naturally. The first line of evidence was applied through evaluation of the historic groundwater analytical data that established decreasing trends in COCs and documented plume stability. The second line of evidence was documented through the collection and analysis of geochemical parameters during the December 1998, November/December 1999, and February 2000 sampling events, and examining those data trends and relationships between the supplies of electron donors and electron acceptors, and the presence of metabolic by-products.

A review of historical groundwater quality data indicates that the concentrations of Site-related constituents are either remaining stable or decreasing over time. Elimination of the source of groundwater contaminants by completion of the NTCRA in November 1998 shows further decreases in contaminant concentrations. Evidence of microbial mediated degradation is supported by the presence of daughter products. Geochemical evidence that indicates subsurface conditions amenable for microbially mediated degradation include the following:

- an abundance of dissolved organic carbon that can be utilized as a carbon source (electron donor) by microbes;
- anaerobic conditions that sustain reductive dechlorination;
- presence of organic compounds that can undergo fermentation reactions (BTEX, ketones) that produce hydrogen, which can be utilized by microbes during reductive dechlorination;
- low concentrations of nitrate that will not suppress the reductive dechlorination pathway;
- low sulfate concentrations within the plume as compared to background suggesting utilization as an electron acceptor;
- some degree of increased chloride concentration in the plume compared to background suggesting dechlorination is occurring;
- some degree of increased alkalinity in the plume compared to background suggesting that the plume is biologically active;
- decreases in oxidation-reduction potential in the plume as compared to background suggesting the plume is biologically active;
- the presence of methane that suggests highly reducing conditions and microbial degradation; and
- groundwater pH ranges that are suitable for microbial populations.

In addition to the lines of evidence, completion of the bioattenuation screening process provides further evidence supporting natural attenuation. The screening process completed for the December 1998, November/December 1999, and February 2000 data consistently indicates that there is adequate to strong evidence that geochemical conditions are amenable to natural attenuation. Natural attenuation is discussed in detail in Section 4.2.2.2. of the FS.

Site conditions with implementation of MM-2 would eventually be consistent with applicable federal and state chemical-specific ARARs once natural attenuation of the ground water in the overburden is achieved in approximately 15.6 years and in the bedrock aquifer in approximately 6 years. The remedy is also consistent with all identified action-specific ARARs listed in Table 4-3B. No location-specific ARARs were identified.

Estimated Capital Cost: $147,000
Estimated Annual O&M Costs: $82,000
Estimated Present Worth: $945,392 to $1,196909 (assuming a range of 16 to 30 years at a discount rate of 7%)
Estimated Time to Reach Remediation Goals: 15.6 years

MM-3A: Collection, Treatment (including air stripping and carbon adsorption) and Discharge of Groundwater

The key components of MM-3A: Collection, Treatment (including air stripping and carbon adsorption) and Discharge of Groundwater include:

- Long-term monitoring of groundwater, surface water (including seeps), and sediment
- Environmental land use restrictions
- Public education program
- Groundwater extraction
- Filtration
- Chemical precipitation
- Neutralization
- Air stripping
- Carbon adsorption
- Discharge of treated groundwater to the Unnamed Brook

The treatment technologies are described in detail in Section 2.4.1. of the FS and are summarized below.

Alternative MM-3A builds upon MM-1 and MM-2 (as it includes the same monitoring, environmental land use restrictions, and public education elements) and also consists of installation of extraction wells; on-site treatment of groundwater collected in the wells via filtration, chemical precipitation, neutralization, air stripping, and carbon adsorption; and discharge of treated groundwater to the Unnamed Brook.

As summarized in Section E of this ROD, Site Characteristics, the nature and extent of contamination in groundwater suggests that VOCs, SVOCs, and metals are the primary COCs. The distribution of impact appears to be primarily in the overburden and shallow bedrock aquifers. However, groundwater in various depths of the overburden and bedrock aquifers has been impacted. Extraction wells (recovery wells) are suitable for extraction of groundwater from shallow and deep overburden or bedrock aquifers. Groundwater modeling (presented in Section 1.2.4 of the FS) was used to evaluate the number, location, and pumping rate of the extraction wells necessary to prevent further migration of the groundwater plume. The modeling showed that installation of seven wells in the overburden zone and seven wells in the shallow bedrock zone will effectively capture the plume. A combined pumping rate of 15.4 gpm would create a sufficient capture zone to intercept the contaminants. Aquifer performance testing would be required to evaluate the actual placement and flow rate of the recovery wells.

The treatment technologies would address the COCs. Filtration would remove precipitated metals and suspended solids. Chemical precipitation involves oxidation and reduction reactions to change the chemical form of a hazardous material to render it less toxic or to change its solubility, stability, or separability, or otherwise change it for handling or disposal purposes. Neutralization is used to eliminate or reduce the reactivity and corrosiveness of contaminated water and/or treated water. The process of pH adjustment is a partial neutralization process which makes the waste stream either more acidic or more alkaline to enhance chemical, biochemical reactions and precipitation. Air stripping is a mass transfer process in which volatile organic contaminants in groundwater are transferred to the gaseous (vapor) phase. Carbon adsorption is a physical treatment process involving adsorption of chemical contaminants onto activated carbon. It involves contacting a liquid or vapor waste stream with the carbon, usually by flow, through a series of packed-bed reactors. The treated water would be discharged to the Unnamed Brook in accordance with the criteria established by state and federal regulations.

This alternative would eventually be consistent with Federal and State ARARs. For MM-3A, groundwater will achieve the cleanup levels in the overburden in approximately 13.2 years and in the bedrock in approximately 4.9 years.

Estimated Capital Cost: $1,514,080
Estimated Annual O&M Costs: $244,800
Estimated Present Worth: $3,673,291 - $4,584,181 (assuming a range of 14 to 30 years at a discount rate of 7%)
Estimated Implementation Time Frame: one year
Estimated Time to Reach Remediation Goals: 14.2 years

MM-3B: Collection, Treatment (including UV oxidation) and Discharge of Groundwater

The key components of MM-3B: Collection, Treatment (including UV oxidation) and Discharge of Groundwater include:

- Long-term monitoring of groundwater, surface water (including seeps), and sediment
- Environmental land use restrictions
- Public education program
- Groundwater extraction
- Filtration
- Chemical precipitation
- Neutralization
- UV oxidation
- Discharge of treated groundwater to the Unnamed Brook

The treatment technologies are described in detail in Section 2.4.1 of the FS and are summarized below.

Alternative MM-3B builds upon MM-1 and MM-2 (as it includes the same monitoring, environmental land use restrictions, and public education elements) and is very similar to MM-3A, with the exception of the use of UV oxidation in lieu of air stripping and carbon adsorption. Ultraviolet (UV) oxidation is a process which utilizes UV radiation in combination with an oxidizer such as hydrogen peroxide or ozone to destroy hazardous chemicals in aqueous solution. The combination of the UV radiation and oxidizer produces a synergistic effect and acts to promote the oxidation of many contaminants into nontoxic forms. This treatment process is most amenable to dissolved organic compounds including halogenated organic and aromatic compounds and has been successful in treating many of the COCs associated with this Site. The treated water would be discharged to the Unnamed Brook in accordance with the criteria established by state and federal regulations.

This alternative would eventually be consistent with Federal and State ARARs. For MM-3B, groundwater will achieve the cleanup levels in the overburden in approximately 13.2 years and in the bedrock in approximately 4.9 years.

Estimated Capital Cost: $1,572,880
Estimated Annual O&M Costs: $245,800
Estimated Present Worth: $3,819,545 - $4,767,071 (assuming a range of 14 to 30 years at a discount rate of 7%)
Estimated Implementation Time Frame: one year
Estimated Time to Reach Remediation Goals: 14.2 years

K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum USEPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a Site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with applicable or relevant and appropriate requirements (ARARs)** addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. **Long-term effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.

5. **Short term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after USEPA has received public comment on the RI/FS and Proposed Plan:

8. **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Tables 4-4a through 4-4g of the FS.

A summary of the comparative analysis is presented below in Table 10. This table presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis. Only those alternatives which satisfied the first two threshold criteria were balanced and modified using the remaining seven criteria.

Table 10: Summary for the Comparative Analysis of Alternatives

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

All of the alternatives, except the no-action alternative (MM-1), are protective of human health and the environment by eliminating, reducing, or controlling risks posed by the Site through natural attenuation or treatment of contaminants, engineering controls, and/or institutional controls. For MM-2, the two-dimensional groundwater model shows that natural attenuation will achieve the cleanup levels in the overburden in approximately 15.6 years and in the bedrock aquifer in approximately 6 years. For MM-3A and MM-3B, groundwater will achieve the cleanup levels in the overburden in approximately 13.2 years and in the bedrock in approximately 4.9 years. Alternatives MM-3A and MM-3B provide only a slight advantage over MM-2 in terms of the time to achieve groundwater criteria. There is no difference in the cleanup time frames between MM-3A and MM-3B.

MM-2, MM-3A, and MM-3B provide better protection than MM-1 since they include environmental land use restrictions and public education that would prevent contact with, and ingestion of, groundwater. MM-2, MM-3A, and MM-3B are considered to be equally protective of human health and the environment because cleanup goals will be met.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial action to be implemented at the Site, the location of the Site, or other circumstances present at the Site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the Site, the remedial action itself, the Site location or other circumstances at the Site, nevertheless address problems or situations sufficiently similar to those encountered at the Site that their use is well-suited to the Site.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

All alternatives had in common the federal and state chemical-specific ARARs. Maximum contaminant levels (MCLs) for several Site contaminants are exceeded in the plume that flows northeast from beneath the landfill in the groundwater system. MM 1 does not meet chemical-specific ARARs because it does not adequately address exceedances of MCLs. Location- and action specific ARARs associated with construction and potential regulatory issues associated with discharge requirements, air emissions, and waste generation, storage and disposal applied to alternatives MM-3A and MM-3B only.

Alternatives MM-3A and MM-3B provide only a slight advantage over MM-2 in terms of the time to achieve the groundwater cleanup levels. There is no difference in the cleanup time frames between MM-3A and MM-3B. Alternatives MM-2, MM-3A, MM-3B would eventually be compliant with the chemical-specific ARARs.

The activities associated with implementation of MM-2, MM-3A, and MM-3B would be performed in a manner compliant with the action-specific ARARs. Alternative MM-3A and MM-3B will meet all applicable federal and state location-specific ARARs for building discharge pipes and discharging water into wetlands and watercourses. Based on the above, only alternatives MM-2, MM-3A, and MM-3B would be compliant with the applicable ARARs or critical To Be Considered Materials (TBCs) for the Site. TBCs are non-promulgated advisories or guidance issued by the federal or state government that are not legally binding and do not have the status of ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk.and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

Each alternative, except the No Action alternative, provides some degree of long-term protectiveness through environmental land use restrictions and public education. Alternatives MM-3A and MM-3B may provide an additional degree of protection through groundwater extraction and treatment.

There are no controls under MM-1 to manage untreated groundwater. Environmental land use restrictions and public education are adequate and reliable in restricting activities resulting in potential ingestion of, or contact with, groundwater for MM-2, MM-3A, and MM-3B. Monitoring activities associated with all four alternatives are adequate and reliable in terms of evaluating changes in the extent and concentrations of the contaminants. The extraction and treatment technologies associated with both MM-3A and MM-3B have been used extensively and have been proven to provide long-term reliability.

The adequacy and suitability of controls for MM-3A, MM-3B, and MM-2 are better than MM-1, since they include use of environmental land use restrictions and public education. MM-2, MM-3A, and MM-3B are equal with respect to the reliability of the management controls.

Five year reviews would be necessary to evaluate the effectiveness of any of these alternatives because hazardous substances would remain on-site in concentrations above health-based levels.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternatives MM-1 and MM-2 do not include treatment as a component of the remedy. Therefore, these alternatives would not actively reduce the toxicity or volume of contamination at the Site. Over time, however, contaminant levels in the existing areas of contamination are expected to decrease through natural attenuation.

The treatment processes associated with MM-3A and MM-3B would generate treatment residuals, however these would be safely handled and properly disposed of according to Federal, state, and local standards.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

Groundwater, surface water and sediment monitoring will not affect the community.

For MM-2, MM-3A, and MM-3B, additional environmental land use restrictions will prohibit installation of wells and use of groundwater. Alternatives MM-3A and MM-3B would pose a minimal increase in potential risk to the community if implemented compared to MM-1 and MM-2. This is due to potential exposure to contaminated fugitive dust and vapors during construction. Risks to samplers of exposure to contaminated groundwater, surface water, and sediment would be associated with the monitoring program for MM-1, MM-2, MM-3A, and MM-3B. Appropriate personal protective equipment would be used during the monitoring activities.

Since alternatives MM-3A and MM-3B involve construction activities, inhalation of dust and vapors, and direct contact with groundwater could cause significantly more risk to workers if MM-3A and MM-3B were implemented than if MM-1 and MM-2 were implemented.

No environmental impacts are identified for implementation of MM-1 and MM-2. Alternatives MM-3A and MM-3B could pose an impact to the environment by contaminant transport during construction. Impacts may be caused by improper off-Site drainage control and dust control measures. There is no expected environmental impact during operation and maintenance of MM-3A and MM-3B.

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Groundwater, surface water, and sediment monitoring associated with MM-1, MM-2, MM-3A, and MM-3B is readily implemented and is reliable to evaluate the Site conditions. For all four alternatives, additional remedial actions (if required) would be easily implemented.

For MM-2, MM-3A, and MM-3B, legal coordination with property owners and town officials would be required to implement the environmental land use restrictions and public education program. On any property outside of the Site where the remedy calls for institutional controls to be implemented, property rights needed to implement legally binding, land use restrictions for the remedy need to be acquired under applicable federal, state, and local standards. Environmental land use restrictions, public education, and groundwater, surface water and sediment monitoring are readily implemented and are reliable.

Installation of recovery wells and construction and operation of the treatment technologies associated with MM-3A and MM-3B are readily implemented and reliable. The effectiveness of MM-3A and MM-3B would be easily monitored as part of the groundwater, surface water, and sediment monitoring program.

Although all of the alternatives presented are feasible, there is significant difference in the implementability of MM-1 and MM-2 versus MM-3A and MM-3B, as the latter two require the installation, operation, and maintenance of treatment equipment for a period of approximately 15 years.

Coordination with agencies other than USEPA and CTDEP would not be required for MM-1. Legal coordination with property owners and the town would be necessary to implement the environmental land use restrictions and public education program for MM-2, MM-3A, MM-3B. Environmental land use restrictions, public education, and monitoring are readily implemented. Permits for off-Site disposal of residual materials and treated groundwater for MM-3A and MM-3B would be required and are easily obtainable.

Cost

The estimated present worth costs for each alternative are presented in ranges. The lower present worth cost is based on the estimated number of years that the alternative will achieve the groundwater cleanup levels in both the overburden and bedrock aquifers. The upper end of the range is based on 30 years in accordance with USEPA Guidance on Conducting RI/FS under CERCLA.

MM-1: $183,405 to $242,080
MM-2: $945,382 to $1,196,909
MM-3A: $3,673,291 to $4,584,181
MM-3B: $3,819,545 to $4,767,071

Alternative MM-1 is the least costly alternative. The cost to implement MM-2 is significantly less than the extraction and treatment alternatives (MM-3A and MM-3B) which are similar to each other. The increase in costs of alternatives MM-3A and MM-3B provide only a slight decrease in the time required to reduce toxicity, mobility, and volume than the other alternatives, based on groundwater modeling results.

State / Support Agency Acceptance

The State of Connecticut has accepted and concurred with this remedy decision. CTDEP provided comments on the Proposed Plan. Details of these comments are found in the Responsiveness Summary. The State is supportive of this remedy.

Community Acceptance

The community is supportive of this remedy. There were no comments made during the comment period.

L. THE SELECTED REMEDY

1. Summary of the Rationale for the Selected Remedy

The selected remedy for the Barkhamsted-New Hartford Landfill is alternative number MM-2 Management/Natural Attenuation. This remedy, which addresses management of migration of contaminated Site groundwater, is the final component of a comprehensive remedy for the Site. The selected remedy addresses the low-level risks posed by Site groundwater. The source and all principal risks were addressed in a previous action.

The major components of this remedy include remediation of groundwater to cleanup levels by natural attenuation after approximately 15.6 years; installation of groundwater monitoring wells; institutional controls; a public education program; long term monitoring of groundwater, surface water, and sediment; and five-year reviews.

2. Description of Remedial Components

The key components of the Selected Remedy, Management/Natural Attenuation, include:

- Long-term monitoring of groundwater, surface water (including seeps), and sediment
- Restoration of contaminated groundwater via natural attenuation
- Environmental land use restrictions
- Public education program
- Five year review

Long-term monitoring would include the installation of additional monitoring wells and periodic sampling and analysis of the groundwater, surface water, and sediment to evaluate changes over time. Once cleanup levels have been met, the groundwater monitoring system will be utilized to collect information to ensure that the cleanup levels are maintained and the remedy is protective. The Connecticut Remediation Standard Regulations (RSRs) require that all substances in the groundwater that are part of a release be remediated to background concentrations. For practical purposes, monitoring of the groundwater from under the landfill will be measured at wells located at the boundary of the landfill for compliance. Compliance with background must be demonstrated in accordance with Section 22a-133k-3(g)(3) of the RSRs, therefore long-term monitoring would continue until cleanup has been demonstrated in accordance with these regulations.

The currently listed background concentrations (see Table 11), based on data from the existing up gradient wells, are considered cleanup levels until additional samples from appropriately located background wells can be collected to establish representative background concentrations in a manner consistent with the RSRs. CTDEP and USEPA agreed to the use of these groundwater cleanup levels with the understanding that background concentrations in groundwater would be adjusted during the remedial design phase.

The groundwater cleanup levels would be achieved via natural attenuation under this alternative. Natural attenuation processes include advection, dispersion, sorption, dilution, volatilization, geochemical precipitation, biodegradation, radioactive decay, and chemical or biological stabilization, transformation, or destruction.

To the extent required by policy, USEPA will review the Site at least once every five years after construction completion, if any hazardous substances, pollutants or contaminants remain at the Site, to assure that the remedial action continues to protect human health and the environment.

The selected remedy may change somewhat as a result of monitoring the remedy. Changes to the remedy described in this ROD will be documented in a technical memorandum in the Administrative Record for the Site, an Explanation of Significant Differences (ESD) or a ROD Amendment, as appropriate.

3. Summary of the Estimated Remedy Costs

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the Monitored Natural Attenuation remedy. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

ITEM	TOTAL COST
Direct Capital Costs	
Monitoring Wells Installation - Overburden	$20.000
Monitoring Wells Installation - Shallow Bedrock	$30.000
Environmental Land Use Restrictions	$5.000
Public Education Program	$20.000
Engineering (20%)	$36.000
Contingency (20%)	$36.000
Total Direct Capital Costs	**$147,000**

Annual Operation & Maintenance Costs		
Sampling Labor/Directs		$30,000
Groundwater, Surface Water & Sediment Analyses		
- Natural attenuation analysis		$8,000
- VOC analysis		$10,000
- SVOC analysis		$12,000
- Metals analysis		$12,000
Groundwater, Surface Water & Sediment Reports		$6,000
Miscellaneous		$1,500
Public Education Program		$2,500
	Total Annual O&M Costs	**$82,000**
Five-Year Review (one-time cost every 5 yrs)	$15,000	$15,000
	Present Worth of Annual O&M Costs for 16 Years (i=7%)	**$798,382**
	Present Worth of Annual O&M Costs for 30 Years (i=7%)	**$1,049,909**
	TOTAL ESTIMATED COST FOR 16 YEARS	**$945,382**
	TOTAL ESTIMATED COST FOR 30 YEARS	**$1,196,909**

4. Expected Outcomes of the Selected Remedy

The primary expected outcome of the selected remedy is that the area downgradient of the landfill will no longer present an unacceptable risk to humans via groundwater and will be suitable for unrestricted use. Approximately 16 years are estimated as the amount of time necessary to achieve the goals consistent with residential use. The expected outcome of the Site itself is to remain as a refuse / recycling / disposal facility, with restricted use of land and groundwater at the landfill itself, unrestricted use in all other areas.

Groundwater Cleanup Levels

Cleanup levels have been established in groundwater for all chemicals of concern identified in the Baseline Risk Assessment found to pose an unacceptable risk to either public health or the environment. Cleanup levels have been set based on the ARARs (e.g., non-zero Drinking Water Maximum Contaminant Level Goals (MCLGs), MCLs, and more stringent State Remediation Standard Regulations) as available, or other suitable criteria described below. Periodic assessments of the protection afforded by remedial actions will be made as the remedy is being implemented and at the completion of the remedial action. At the time that Groundwater Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, and as demonstrated in accordance with Section 22a-133k-3(g)(3) of the Connecticut RSRs, a risk assessment shall be performed on all residual groundwater contamination to determine whether the remedial action is protective. This risk assessment of the residual groundwater contamination shall follow USEPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by all chemicals of concern (including but not limited to the chemicals of concern) via ingestion and dermal contact with groundwater. If, after review of the risk assessment, the remedial action is not determined to be protective by USEPA, the remedial action shall continue until either protective levels are achieved, and are not exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective or is modified. These protective residual levels shall constitute the final cleanup levels for this ROD and shall be considered performance standards for this remedial action.

Because the aquifer at and beyond the compliance boundary for the landfill is a Class IIB aquifer (GA) which is a potential source of drinking water, MCLs and non-zero MCLGs established under the Safe Drinking Water Act and more stringent State standards are ARARs. For practical purposes, a compliance boundary has been established as the wells around the perimeter of the landfill.

In situations where a promulgated State standard is more stringent than values established under the Safe Drinking Water Act, the State standard was used as the cleanup level.

Table 11 summarizes the Cleanup Levels for carcinogenic and non-carcinogenic chemicals of concern identified in groundwater.

Table 11: Groundwater Cleanup Levels*

Carcinogenic Chemical of Concern	Cancer Classification	Cleanup Level (ug/l)	Basis	RME Risk
arsenic	A	5.0	Background Conc.	9.1×10^{-5}
1,4-dichlorobenzene	C	<10.0	Background Conc.	5.0×10^{-6}
Benzene	A	<0.5	Background Conc.	2.0×10^{-7}

1,2-dichloroethane	B2	<0.5	Background Conc.	5.8x10^{-7}
1,2-dichloropropane	B2	<0.5	Background Conc.	4.4x10^{-7}
chloroethane	B2	<1.0	Background Conc.	3.7x10^{-8}
chloroform	B2	<0.5	Background Conc.	4.0x10^{-8}
chloromethane	C	<1.0	Background Conc.	1.6x10^{-7}
dibromochloromethane	C	<0.5	Background Conc.	5.5x10^{-7}
methylene chloride	B2	<2.0	Background Conc.	1.9x10^{-7}
Trichloroethene	B2	<0.5	Background Conc.	7.8x10^{-8}
vinyl chloride	A	<1.0	Background Conc.	2.4x10^{-5}
bis(2-ethyl hexyl) phthalate	B2	<2.0	Background Conc.	8.9x10^{-7}
Sum of Carcinogenic Risk				1.2x10^{-4}

Noncarcinogenic Chemicals of Concern Class D & E	Target Endpoint	Cleanup Level (ug/l)	Basis	RME Hazard Quotient
arsenic	Skin	5.0	Background Conc.	4.5x10^{-1}
chromium	---	50.0	Background Conc.	4.5x10^{-1}
lead	---	3.0	Background Conc.	----
manganese	CNS	50.0	Background Conc.	5.6x10^{-2}
acetone	Liver/Kidney	<10.0	Background Conc.	2.7x10^{-3}
benzene	---	<0.5	Background Conc.	5.2x10^{-3}
2-butanone	Developmental	<10.0	Background Conc.	4.6x10^{-4}
1,2-dichloroethane	—	<0.5	Background Conc.	4.7x10^{-4}
1,2-dichloropropane	Respiratory	<0.5	Background Conc.	1.4x10^{-2}
chloroethane	—	<1.0	Background Conc.	7.2x10^{-5}
chloroform	Liver	<0.5	Background Conc.	1.5x10^{-3}
chloromethane	—	<1.0	Background Conc.	----
dibromochloromethane	Kidney	<0.5	Background Conc.	7.3x10^{-4}
4-methyl-2-pentanone	Liver/Kidney	<5.0	Background Conc.	1.7x10^{-3}
methylene chloride	Liver	<2.0	Background Conc.	9.4x10^{-4}
toluene	Liver/Kidney	<0.5	Background Conc.	9.2x10^{-5}
trichloroethene	Liver/Kidney	<0.5	Background Conc.	2.7x10^{-3}

Noncarcinogenic Chemicals of Concern Class D & E	Target Endpoint	Cleanup Level (ug/l)	Basis	RME Hazard Quotient
vinyl chloride	---	<1.0	Background Conc.	----
bis(2-ethylhexyl)phthalate	Liver	<2.0	Background Conc.	$7.3x10^{-3}$
1,4-dichlorobenzene	---	<10.0	Background Conc.	$1.6x10^{-2}$
2,4-dimethylphenol	Blood	<10.0	Background Conc.	$1.5x10^{-2}$
4-methylphenol	CNS	<10.0	Background Conc.	$5.9x10^{-2}$
			Skin Hazard Index =	$4.5x10^{-1}$
			Blood Hazard Index =	$1.5x10^{-2}$
			Developmental Hazard Index =	$4.6x10^{-4}$
			CNS Hazard Index =	$1.2x10^{-1}$
			Respiratory Hazard Index =	$1.4x10^{-2}$
			Liver/Kidney Hazard Index =	$2.6x10^{-2}$

* The cleanup level established for each chemical is the background concentration, per Connecticut RSRs, Section 22a-133k-3(a). During the RA Phase, USEPA in consultation with CTDEP will determine whether these concentrations represent background for this Site and will change these values, if necessary, through an ESD.

All Groundwater Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy and the protective levels determined as a consequence of the risk assessment of residual contamination, must be met at the completion of the remedial action at the points of compliance. At this Site, Cleanup Levels must be met for the entire Site, as measured at the compliance boundary (edge of the landfill) USEPA has estimated that the Cleanup Levels will be obtained within 16 years of issuance of this ROD.

M. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Barkhamsted-New Hartford Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs and is cost effective. In addition, the selected remedy utilizes permanent solutions to the maximum extent practicable. Practicable alternate treatment technologies or resource recovery technologies were not identified for this remedy. The selected remedy does not satisfy the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element. In balancing the nine criteria, the lack of treatment is outweighed by modeling that shows that the contaminates of concern will be effectively reduced in toxicity through natural attenuation processes after a slightly longer period than would be needed to achieve clean-up requirements through available treatment technologies, at significantly less cost.

1. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this Site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through monitored natural reductions in toxicity, engineering controls and institutional controls. More specifically, groundwater cleanup levels will be achieved through natural attenuation processes. Environmental land use restrictions would prohibit residential use of the Site, use of groundwater for drinking or any other purpose, and avoid disturbance of the landfill cap installed under the NTCRA. Environmental land use restrictions of downgradient properties would prohibit the installation of any wells and use of groundwater for any purpose. Any owner of property interests on the Site shall be required to create binding land use restrictions on their property needed to implement the remedy under applicable Federal, state, and local standards. On any property outside of the Site where the remedy calls for institutional controls to be implemented, any and all property rights needed to implement legally binding, land use restrictions for the remedy shall be acquired under applicable Federal, State, and local standards. A public education program would be implemented to provide the community with information regarding the Site.

The selected remedy will reduce potential human health risk levels such that they do not exceed USEPA's acceptable risk range of 10^{-4} to 10^{-6} for incremental carcinogenic risk and such that the non-carcinogenic hazard is below a level of concern (HI will not exceed 1). It will reduce potential human health risk levels to protective ARARs levels, i.e., the remedy will comply with ARARs and To Be Considered criteria. Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

Groundwater monitoring will be used to determine when the ARAR-based Groundwater Cleanup Levels identified in the ROD, as well as newly promulgated ARARs and modified ARARs that call into question the protectiveness of the remedy, have been achieved and have not been exceeded for a period of three consecutive years. At that time, a risk assessment shall be performed on the residual groundwater contamination to determine whether the remedy is protective. This risk assessment of the residual groundwater contamination shall follow USEPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by ingestion and dermal contact with groundwater. If, after review of the risk assessment, the remedy is not determined to be protective by USEPA, the remedial action shall continue until protective levels are achieved and have not been exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

2. The Selected Remedy Complies With ARARs

The selected remedy will comply with all federal and any more stringent state ARARs that pertain to the Site. In particular, this remedy will comply with the following federal ARARs:

- Safe Drinking Water Act

Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), 40 CFR 141.11-141.16. The SDWA MCLs and non-zero MCLGs are relevant and appropriate because they are the basis for the Cleanup Levels for the Site groundwater, which is a potential future drinking water source.

Safe Drinking Water Act (SDWA) Maximum Contaminant Level Goals (MCLGs), 40 CFR 141.50-141.51. The SDWA MCLG are relevant and appropriate because they are health-based criteria to be considered for drinking water sources. Non-zero MCLGs are to be used as goals when MCLs have not been established.

In addition, the selected remedy will comply with the following more stringent state ARARs:

- State groundwater and surface water standards
- State drinking water standards
- State groundwater remediation regulations

Connecticut Water Quality Standards (C.G.S. Section 22a-426): These standards are applicable because the groundwater classification of the Site is GA, and the state's goal is to restore the groundwater to a quality consistent with its use for drinking water without treatment.

Connecticut Standards for Quality and Adequacy of Public Drinking Water (RCSA Section 19-13-B101 through B102): These regulations are relevant and appropriate because, similar to the federal Safe Drinking Water Act, the regulations have established standards for water quality in private water supply systems and standards for quality of public drinking water.

Connecticut Remediation Standard Regulations (RCSA Section 22a-133K 1 through 3): These regulations are applicable because any substance that is part of a release at a Site must be remediated. Depending on the contaminant of concern, the cleanup standards vary from cleaning up to background concentrations to specific numeric cleanup criteria described in Section 22a-

133k-3(d)(1) and (2).

A discussion of why these requirements are applicable or relevant and appropriate may be found in the FS Report in Tables 4-1, 4-2, and 4-3 of the ROD.

3. The Selected Remedy is Cost-Effective

In the USEPA's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

MATRIX OF COST AND EFFECTIVENESS DATA FOR THE BARKHAMSTED-NEW HARTFORD LANDFILL SUPERFUND SITE

RELEVANT CONSIDERATION FOR COST-EFFECTIVENESS DETERMINATION: (Site characteristics relate to cost-effectiveness criteria)

Alternative	Present Work Cost[1]	Incremental Cost[1]	Long-Term Effectiveness and Permanence	Reduction of TMV Through Treatment	Short-Term Effectiveness
1) MM-1: No Action □	$183,400 to $242,000	———	• No reduction in long-term risk to human health and the environment	• No, reduction of toxicity and volume through natural attenuation	• Small short-term risk to workers implementing site monitoring • Short-term risk to community from potential exposure to contaminated groundwater
2) MM-2: Management/ ■ Natural Attenuation, including institutional controls	$945,400 to $1,196,900	+762,000 to +954,900	• Reduction in long-term risk to human health through public education and land use restrictions	• No, reduction of toxicity and volume through natural attenuation	• Small short-term risk to workers implementing site monitoring • Reduction in short-term risk to community from potential exposure to contaminated groundwater through public education and land use restrictions
3) MM-3A: Collection ■ Treatment (including air stripping and carbon adsorption) and Discharge of Groundwater	$3,673,300 to $4,584,200	+3,027,900 to +3,387,300	• Reduction in long-term risk to human health through public education and land use restrictions	• Reduction in toxicity, mobility, and volume through collection and treatment • Generation of treatment residuals	• Some additional short-term risk to workers, environment, and community due to construction activities • Reduction in short-term risk to community from potential exposure to contaminated groundwater through public education and land use restrictions • Slightly shorter time to achieve remedial goals for groundwater
4) MM-3B: Collection, ■ Treatment (including UV oxidation) and Discharge of Groundwater	$3,819,500 to $4,767,000	+146,200 to +182,800	• Reduction in long-term risk to human health through public education and land use restrictions	• Reduction in toxicity, mobility, and volume through collection and treatment • Generation of treatment residuals	• Some additional short-term risk to workers, environment, and community due to construction activities • Reduction in short-term risk to community from potential exposure to contaminated groundwater through public education and land use restrictions • Slightly shorter time to achieve remedial goals for groundwater

COST-EFFECTIVENESS SUMMARY: *(Summary of individual cost-effectiveness evaluations and relative cost-effectiveness determinations)*

- Alternative 1 is not considered to be cost-effective.
- While Alternatives 2, 3 and 4 are considered to be cost-effective, Alternative 2 provides a potentially greater return on investment.

Key: (1) The estimated present worth costs are presented in ranges. The lower end of the range is based on the estimated cleanup time for that alternative. The high end of the range is based on 30 years, in accordance with USEPA Guidance on Conducting RI/FS under CERCLA

4. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once the Agency identified those alternatives that attain or, as appropriate, waive ARARs and that are protective of human health and the environment, USEPA identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility or volume through treatment; 3) short-term effectiveness; 4) implementability; and 5) cost. The balancing test emphasized long-term effectiveness and permanence and the reduction of toxicity, mobility and volume through treatment; and considered the preference for treatment as a principal element, the bias against off-Site land disposal of untreated waste, and community and state acceptance. The selected remedy provides the best balance of trade-offs among the alternatives.

All of the alternatives, except No Action (MM-1), provide some degree of long-term protectiveness through environmental land use restrictions and public education. Alternatives MM-3A and MM-3B may provide an additional degree of protection through groundwater extraction and treatment. All of the alternatives would address the contaminants of concern by reducing concentrations in the groundwater to the cleanup levels. Although the selected remedy, MM-2, would not employ treatment as a component of the remedy, cleanup levels would be achieved within a reasonable time-frame without generating treatment residuals. Reduction of toxicity, mobility, or volume would be equal for each of the alternatives. While the natural attenuation process in alternative MM-2 does not meet the criteria for reduction of toxicity, mobility, or volume, functionally at this site natural processes are expected to equal or exceed clean-up levels achieved by either of the treatment technologies proposed in alternatives MM-3A or MM-3B. The selected remedy does not involve construction, thereby resulting in no environmental impacts during the implementation of this alternative. Risk to workers during implementation of this remedy would be less than for those alternatives involving construction. All four alternative are easily implemented. The selected remedy was found to be the most cost-effective of the alternatives, except No Action.

5. The Selected Remedy Satisfies the Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element

While the MM-2 natural attenuation alternative does not meet this criteria, modeling shows that natural attenuation is expected to address the primary threat at the Site, contamination of groundwater, as defined by chemical concentrations in excess of drinking water standards and State groundwater remediation standards and groundwater quality criteria. Although active groundwater treatment is not being employed, it has been determined that remediation of the Site groundwater via natural processes, including advection, dispersion, sorption, dilution, volatilization, geochemical precipitation, and biodegradation, will effectively achieve cleanup levels within a time frame similar to other alternatives.

6. Five-Year Reviews of the Selected Remedy are Required.

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

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

USEPA presented a proposed plan for monitored natural attenuation for remediation of the Site on June 20, 2001. The source control was addressed by the NTCRA. The management of migration portion of the preferred alternative included:

- Long-term monitoring of groundwater, surface water (including seeps), and sediment
- Restoration of contaminated groundwater via natural attenuation
- Environmental land use restrictions
- Public education program
- Five year review

USEPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the proposed plan, were necessary.

O. STATE ROLE

The Connecticut Department of Environmental Protection (CTDEP) has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the Remedial Investigation, Risk Assessment and Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. The State of Connecticut concurs with the selected remedy for the Barkhamsted-New Hartford Landfill Superfund Site. A copy of the declaration of concurrence is attached as Appendix A.

BARKHAMSTED-NEW HARTFORD LANDFILL SUPERFUND SITE RESPONSIVENESS SUMMARY

The US Environmental Protection Agency (USEPA) held a 30-day public comment period from June 20 to July 20, 2001, to provide an opportunity for public input on the Remedial Investigation (RI), Feasibility Study (FS), and Proposed Plan to address contamination at the Barkhamsted-New Hartford Landfill Superfund Site in Barkhamsted, CT. The USEPA prepared the Proposed Plan based on the results of the RI and FS and other documents found in the Administrative Record. The RI identified the nature and extent of contamination, and the FS identified the alternatives considered for addressing the contamination. The Proposed Plan, issued on June 18, 2001, presented the USEPA's preferred alternative for the Site. All documents that were used in the USEPA's selection of the preferred alternative were placed in the Administrative Record which is available for public review at the Beardsley & Memorial Library in Winsted, CT, and at USEPA Records Center in Boston, MA.

The purpose of this Responsiveness Summary is to document the USEPA's responses to the questions and comments raised during the public comment period. The USEPA considered all of the comments summarized in this document before selecting the final remedial alternative to address contamination at the site.

This comment period yielded one set of comments from the Connecticut Department of Environmental Protection (CTDEP), the comments follow with a response from USEPA.

In addition, a copy of the transcript from the public hearing held on July 18, 2001 in Barkhamsted, CT is follows this Responsiveness Summary.

Summary of Comments from CTDEP

1. Remedial Action Objectives for Groundwater

In several locations (such as the second bullet point on page 10), the Proposed Plan incorrectly identifies one of the Remedial Action Objectives for groundwater as restoration to federal or state MCLs. The Connecticut Remediation Standard Regulations (RSRs), which are applicable ARARs, require remediation of groundwater to background, not Federal or State MCLs. Please see Section 22a-133k-3(a) of the RSRs, which states "remediation of a groundwater plume in a GA area shall...result in the reduction of each substance therein to a concentration equal to or less than the background concentration of ground water for such substance...."

The Remedial Action Objective for groundwater is more accurately identified on page 64 of the Feasibility Study as "restore ground water beyond the compliance boundary to MCLs, CT Remediation Standards"(meaning background).

USEPA Response:

In the descriptions of the Remedial Action Objectives and the preferred alternative/selected alternative in the ROD document, the Remedial Action Objective for Groundwater is to restore groundwater beyond the compliance boundary (limits of the landfill) to MCLs or any more stringent CT Remediation Standards (background concentrations), or in their absence, the more stringent of an excess cancer risk of 1×10^{-6} for each substance or a hazard quotient of 1 for each non-carcinogenic substance.

2. Groundwater Cleanup Levels - Establishing Background Concentrations for Substances in Groundwater

The Preferred Alternative in the Proposed Plan references "Interim Groundwater Cleanup Levels" (Table 1) as the standards that must be met for a cleanup. The only reference to attaining background concentrations in groundwater is found in a note at the bottom of Table 1 in the Proposed Plan, which states "Note: the interim cleanup level established for each chemical **is the background concentration** (emphasis added). Further information on chemicals of concern can be found in the Feasibility Study."

This single reference to background in a note at the bottom of Table 1 in the Proposed Plan does not reflect the discussions between USEPA and CTDEP last fall on the issue of background concentrations in groundwater. Please refer to a letter from Mary Jane O'Donnell (USEPA) to Elsie Patton (CTDEP) dated 9/25/2000, which contains a Discussion of Background Concentration Limits at the Barkhamsted-New Hartford Landfill Superfund Site. As is reflected in this letter, CTDEP and USEPA agreed that data from the existing up gradient wells (which either have not been sampled an appropriate number of times, have not been not sampled recently or consistently enough, or are in a less than ideal locations) could be used as interim cleanup levels) *until a sufficient number of samples from appropriately located background wells can be collected to establish representative background concentrations in a manner consistent with the RSRs*. CTDEP and USEPA agreed to the use of interim groundwater cleanup levels with the understanding that background concentrations in groundwater would be finalized during the Remedial Design phase (after the ROD). CTDEP still believes that finalizing background concentrations after the ROD is a reasonable and acceptable approach, but is concerned that this approach is not reflected at all in the Proposed Plan.

CTDEP is also concerned that the note at the bottom of Table 1 in the Proposed Plan could be interpreted to infer that background concentrations (consistent with the requirements of the RSRs) have already been established for all of the substances listed, which is not the case.

USEPA Response:

In the description of the preferred alternative/selected alternative in the ROD document, USEPA has stated that Groundwater Cleanup Levels are based on the contaminant background concentrations and that USEPA will verify and determine if the values currently indicated as background, represent background for this site, and that the Groundwater Cleanup Levels will be adjusted if necessary based on sampling during the remedial design phase.

3. Explanation of Interim vs. Final Groundwater Cleanup Levels

In the Proposed Plan, there is no explanation of why **interim** groundwater cleanup levels are being used and how and when final (meaning other than interim) groundwater cleanup levels (e.g. background concentrations acceptable to CTDEP) for some or all of the substances in groundwater will be established. Please refer to the September 25, 2000 letter referenced above for a discussion of the background issue, and the identification of an approach that is acceptable to both USEPA and CTDEP. In the Proposed Plan, the only discussion of any revision of groundwater cleanup levels refers to a final evaluation by USEPA after attainment of the interim cleanup levels in Table 1 has been demonstrated. The Proposed Plan only indicates that the Interim Groundwater Cleanup Levels *may* be updated by USEPA *after groundwater monitoring indicates the Interim Groundwater Cleanup Levels have been reached.* This does not reflect DEP's understanding that Interim Groundwater Cleanup Levels were to used until representative background concentrations could be established by monitoring appropriately located background wells for an appropriate period of time.

USEPA Response:

USEPA, will be setting, groundwater cleanup levels, based on the background determinations to date. USEPA will adjust the background concentration values, where additional monitoring of appropriately located background wells for an appropriate period of time indicate a significant difference in background as necessary.

4. Substances in groundwater which must be remediated

Pursuant to Section 22a-133k-3(a) of the RSRs, remediation of a groundwater plume in a GA area shall "result in the reduction of each substance therein to a concentration equal to or less than the background concentration of ground water for such substance". This requires all substances in groundwater that are part of a release to be remediated to background concentrations, not just those substances listed in Table 1 in the Proposed Plan as Contaminants of Concern (COCs) in groundwater.

USEPA Response:

The description of the preferred alternative/selected alternative in the ROD document, includes a statement that the RSRs require that all substances in groundwater that are part of a release be remediated to background concentrations, that compliance with background must be demonstrated in accordance with Section 22a-133k-3(g)(3) of the RSRs, and that any decision to discontinue groundwater monitoring must be made in accordance with Section 22a-133k-3(g)(3) of the RSRs.

5. Attainment of Proposed Cleanup Levels

Section 22a-133k-3(f) of the RSRs contains specific requirements for demonstrating compliance with background concentrations for groundwater in a GA area. Section 22a-133k-3(g)(3) of the RSRs contains specific requirements for the Discontinuation of Ground Water Monitoring (after completing post-remediation monitoring). It is not clear if the reference to a period of three years of monitoring that shows groundwater concentrations at or below background concentrations (on page 11 of the Proposed Plan) reflects the specific monitoring requirements of the sections of RSRs listed above.

USEPA Response:

In the description of the preferred alternative/selected alternative in the ROD document, USEPA has clarified that the process for establishing background concentrations during Remedial Design. In the section describing the outcome of the remedy in the ROD document, USEPA states that the requirements of section 22a-113k-3(f) and (g) needs to be met. The remedial action objectives require that the groundwater beyond the compliance boundary (limits of the landfill) is restored to MCLs or any more stringent CT Remediation Standards (background concentrations), or in their absence, the more stringent of an excess cancer risk of 1 x 10^{-6} for each substance or a hazard quotient of 1 for each non-carcinogenic substance.

APPENDIX A

CTDEP Letter of Concurrence

STATE OF CONNECTICUT

DEPARTMENT OF ENVIRONMENTAL PROTECTION

79 ELM STREET HARTFORD, CONNECTICUT 06106

PHONE: (860) 424-3001

Arthur J. Rocque, Jr.
Commissioner

September 24, 2001

Ms. Patricia L. Meaney, Director
United States Environmental Protection Agency
Office of Site Remediation and Restoration
JFK Federal Building (HAA)
Boston, MA 02203-2211

Re: State Concurrence with Remedial Action, Barkhamsted-New Hartford Landfill, Barkhamsted, Connecticut

Dear Ms. Meaney:

The Connecticut Department of Environmental Protection (CTDEP) concurs with the remedy selected by the Environmental Protection Agency (EPA) for the Barkhamsted-New Hartford Landfill, Barkhamsted, Connecticut. The selected remedy consists of: 1) Remediation of groundwater by natural attenuation; 2) Installation of groundwater monitoring wells in the downgradient part of the plume; 3) Institutional Controls to protect the integrity of the landfill cap and to prevent ingestion of contaminated groundwater; 4) A public education program; 5) Long term monitoring of groundwater, surface water, and sediment; and 6) Five-year Reviews.

The remedy is described in detail in the proposed plan dated June 2001, and the draft Record of Decision dated September 2001.

Thank you for your cooperation on this project. If you have any questions regarding this project, please contact Sheila Gleason of my staff at (860) 424-3767.

Sincerely,

Arthur J. Rocque, Jr.
Commissioner

AJR:SG

APPENDIX B

REFERENCES

USEPA. 1996. *Ecotox Thresholds*. ECO Update Vol.3. No.2. EPA 540/F-95/038.

USEPA. 1999. *National Recommended Water Quality Criteria-Correction*. USEPA 822-Z-99-001.

USEPA. 2000. *Review and ecological assessment of the November/December 1999 and February 2000 surface water and seep contaminant concentration data for the Barkhamstead/New Hartford Landfill, New Hartford, Connecticut*. USEPA Memorandum dated April 2, 2000 from P. Tyler to C. Pina-Springer.

MacDonald, D. D., C. G. Ingersoll, and T. A. Berger. 2000. *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems*. Arch. Environ. Centime. Toxicol. 39: 20-31.

Metcalf & Eddy, Inc. 1996. *Barkhamstead-New Hartford Landfill Superfund Site Baseline Risk Assessment Part II Ecological Risk Assessment*. January, 1996.

Sample, B. E., D. M. Opresko, and G. W. Suter II. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision*. ES/ER/TM-86/R3. Oak Ridge National Laboratory, Oak Ridge, TN. June 1996.

Suter II, G. W. and C. L. Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*. ES/ER/TM-96/R2. Oak Ridge National Laboratory, Oak Ridge, TN. June, 1996.

Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision. ES/ER/TM-96/R2. Oak Ridge National Laboratory, Oak Ridge, TN.

APPENDIX C

List of Acronyms

List of Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ARAR	Applicable or relevant and appropriate requirement
AWQC	Ambient water quality criteria
BTEX	Benzene, toluene, ethyl benzene, xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
C.G.S	Connecticut General Statute
CNS	Central nervous system
COC	Contaminant of concern
COPC	Contaminant of potential concern
CRRA	Connecticut Resources Recovery Authority
CSM	Conceptual site model
CTDEP	Connecticut Department of Environmental Protection
EPC	Exposure point concentration
ESD	Explanation of Significant Differences
FS	Feasibility study
gpm	Gallons per minute
HEAST	Health Effects Assessment Summary Tables
HHRA	Human health risk assessment
HI	Hazard index
HQ	Hazard quotient
IRIS	Integrated Risk Information System
LEL	Lowest effect level
LFI	Limited field investigation
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal
MIBK	4-methyl-2-pentanone
MM	Management of migration
MNA	Monitored natural attenuation
NAPLs	Non-aqueous phase liquids
NCP	National Oil and Hazardous Substances Contingency Plan (40 CFR Part 300)
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTCRA	Non-time critical removal action
OMEE	Ontario Ministry of Environment and Energy
O&M	Operation and maintenance
OSHA	Occupational Safety and Health Administration
OSRR	Office of Site Remediation and Restoration
OSWER	Office of Solid Waste and Emergency Response
PAHs	Polynuclear aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PEC	Probable effects concentration
pH	Pouvoir hydrogene (expression of acidity/alkalinity)
POTW	Publicly owned treatment works

ppm	Parts per million
PRP	Potentially responsible party
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RCSA	Regulations of Connecticut State Agencies
RfD	Reference dose
RI	Remedial investigation
RME	Reasonable maximum exposure
ROD	Record of Decision
RRDD#1	Regional Refuse Disposal District #1
RSRs	Remediation Standard Regulations
SDWA	Safe Drinking Water Act
SELs	Severe effect levels
SQB	Sediment quality benchmark
SVOC	Semivolatile organic compound
TAL	Target analyte list
TBC	To be considered
TCL	Target compound list
TEC	Threshold effects concentration
TLV	Threshold limit value
UCL	Upper confidence limit
USEPA	United States Environmental Protection Agency
USC	United States Code
UV	Ultraviolet
VOC	Volatile organic compound

APPENDIX D

ARARs Tables

TABLE 4-1b
BARKHAMSTED-NEW HARTFORD LANDFILL SUPERFUND SITE
BARKHAMSTED, CONNECTICUT

POTENTIAL STATE AND FEDERAL LOCATION-SPECIFIC ARARs
ALTERNATIVE MM-2 (Management/Natural Attenuation)

There are no location specific ARARs.

Table 4-2b

BARKHAMSTED-NEW HARTFORD SUPERFUND SITE, BARKHAMSTED, CONNECTICUT
POTENTIAL STATE AND FEDERAL CHEMICAL-SPECIFIC ARARs
ALTERNATIVE MM-2 (Management/Natural Attenuation)

Authority	Requirement	Status	Requirement Synopsis	Action Taken to Meet ARAR
GROUNDWATER				
Federal Requirements	Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) 40 CFR §141.11 - 141.16	Relevant and Appropriate	MCLs have been promulgated for several common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water.	COPCs were compared to MCLs. MCLs were utilized to evaluate the clean-up criteria.
	Maximum Contaminant Level Goals (MCLGs) 40 CFR §141.50-141.51	Relevant and Appropriate	MCLGs are health-based criteria to be considered for drinking water sources. MCLGs are available for several organic and inorganic contaminants. Non-zero MCLGs are to be used as goals when MCLs have not been established.	When MCLs have not been established, non-zero MCLGs in the groundwater will be attained at the compliance boundary. A restriction on use of groundwater within the compliance boundary will be established and an appropriate monitoring program will be conducted until the groundwater concentrations are less than the MCLGs.
State Requirements	Standards for Quality and Adequacy of Public Drinking Water RCSA §19-13-B101 through B102	Relevant and Appropriate	Regulations similar to the Safe Drinking Water Act where by standards for water quality in private water supply systems and standards for quality of public drinking water have been established.	These standards will be compared to federal standards. If the state standards are more stringent than the federal standards, then the state standards will be met by the remedy.

Table 4-2b
BARKHAMSTED-NEW HARTFORD SUPERFUND SITE, BARKHAMSTED, CONNECTICUT
POTENTIAL STATE AND FEDERAL CHEMICAL-SPECIFIC ARARs
ALTERNATIVE MM-2 (Management/Natural Attenuation)

Authority	Requirement	Status	Requirement Synopsis	Action Taken to Meet ARAR
	Remediation Standard Regulations RCSA §22a-133k- 1through 3	Applicable	Substances that are part of a release at a site must be remediated. In some cases, groundwater must be remediated to background concentrations. For other cases, as described in §22a-133k-3(d)(1) and (2), the regulations provide specific numeric clean up criteria for a wide variety of contaminants in groundwater, surface water and soil vapor.	These standards will be compared to federal standards. If the state standards are more stringent than the federal standards, then the state standards will be met by the remedy. Under state standards, all substances in the groundwater plume will be remediated to background concentrations, unless conditions listed in §22a-133k-3(d)(1) and (2) are met.

TABLE 4-3b
BARKHAMSTED-NEW HARTFORD LANDFILL SUPERFUND SITE, BARKHAMSTED, CONNECTICUT
POTENTIAL STATE AND FEDERAL ACTION-SPECIFIC ARARs
ALTERNATIVE MM-2 (Management/Natural Attenuation)

Authority	Requirement	Status	Requirement Synopsis	Action Taken to Meet ARAR
GROUNDWATER				
Clean Water Act, Section 402, National Pollution Discharge Elimination System (NPDES)	33 USC 1342; 40 CFR 122 through 125	Applicable	These standards govern the protection of surface water sources	Standards will be used to evaluate monitoring results for surface water and sediments to determine if further remedial action is required to protect resources.
Hazardous Waste Management: TSDF Standards	RCSA § 22a-449 (c) 104	Applicable	This section establishes standards for treatment, storage, and disposal facilities. The standards of 40 CFR 264 are incorporated by reference.	Any hazardous waste which is temporarily stored of on this site as part of the remedy will be managed in accordance with the requirements of this section.

TABLE 4-3b

BARKHAMSTED-NEW HARTFORD LANDFILL SUPERFUND SITE, BARKHAMSTED, CONNECTICUT

POTENTIAL STATE AND FEDERAL ACTION-SPECIFIC ARARs

ALTERNATIVE MM-2 (Management/Natural Attenuation)

Authority	Requirement	Status	Requirement Synopsis	Action Taken to Meet ARAR
Hazardous Waste Management: Generator and Handler Requirements, Listing and Identification	RCSA § 22a-449(c) 100-101	Applicable	CT is delegated to administrate the federal RCRA statute through its state regulations. These sections establish standards for listing and identification of hazardous waste. The standards of 40 CFR 260-261 are incorporated by reference.	Hazardous waste determinations will be performed on all contaminated material generated during monitoring activities to determine that that levels of regulated constituents do not exceed applicable limits. Any contaminated materials which exceed applicable limits will be managed in accordance with requirements of these regulations, if necessary.
State Requirements	Water Quality Standards CGS §22a-426	Applicable	Connecticut's Water Quality Standards were adopted under this statute. They establish specific numeric criteria, and anti-degradation policies for groundwater and surface water. The groundwater classification of the Site is GA and the state's goal is to restore the groundwater to a quality consistent with its use for drinking without treatment.	Remedial activities will be under taken in a manner which is consistent with the anti-degradation policy in the water quality standards. If any remedial activities occur that are regulated under these provisions, the use of engineering controls and best management practices may be required to prevent or minimize adverse impacts to the waters of the state.
Connecticut	CT Council on Soil and Water Conservation	TBC	Technical and administrative guidance for development, adoption and implementation of erosion and sediment control program.	Guidelines will be followed to protect wetland and aquatic resources. Guidelines for Soil Erosion and Sediment Control

APPENDIX E

Administrative Record Index

Barkhamsted-New Hartford Landfill

NPL Site

Administrative Record
Index

ROD Signed: September, 28 2001

Prepared by
EPA New England
Office of Site Remediation and Restoration

With Assistance from
ASRC Aerospace
6301 Ivy Lane, Suite 300
Greenbelt, MD 20770

Introduction to the Collection

This is the administrative record file for the Barkhamsted-New Hartford Landfill Superfund site, Operable Unit 00, Sitewide, September 2001. The file contains site-specific documents used by EPA staff in selecting a response action at the site. The file is presented in two media: this compact disc and related oversized or non-print documents that are available for review through the EPA New England Superfund Records Center.

PLEASE NOTE:

The administrative record file is available for review at:

EPA New England Superfund Records Center
1 Congress Street, Suite 1100 (HSC)
Boston, MA 02114
(by appointment)
617-918-1440 (phone)
617-918-1223 (fax)

Beardsley Memorial Library
40 Munro Place
Winsted, CT 06098
(860) 379-6043

Questions about this administrative record file should be directed to the EPA New England site manager.

An administrative record file is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

BARKHAMSTED-NEW HARTFORD LANDFILL
ADMINISTRATIVE RECORD FILE
ROD 9/2001

2. REMOVAL RESPONSE

1. MEMO : POLLUTION REPORT (POLREP) NO. 2 AND FINAL.
TO: MARY JANE ODONNELL, US EPA REGION 1
AUTHOR: BYRON MAH, US EPA REGION 1
DOC ID: 24272 07/12/2001 5 PAGES

3. REMEDIAL INVESTIGATION (RI)

1. MEMO : MANUFACTURER'S SPECIFICATIONS FOR THE HORIBA U-22 WATER QUALITY MONITORING SYSTEM (A 11/10/99 FAX COVER SHEET IS ATTACHED).
AUTHOR: FIELD ENVIRONEMENTAL INSTRUMENTS INC
DOC ID: 6842 2 PAGES

2. REPORT: BASELINE RISK ASSESSMENT, PART 1: HUMAN HEALTH RISK ASSESSMENT.
TO: US EPA REGION 1
AUTHOR: METCALF & EDDY INC
DOC ID: 2401 11/01/1995 207 PAGES

3. REPORT: BASELINE RISK ASSESSMENT, PART 2, ECOLOGICAL RISK ASSESSMENT.
TO: US EPA REGION 1
AUTHOR: METCALF & EDDY INC
DOC ID: 6209 01/01/1996 120 PAGES

4. REPORT: REMEDIAL INVESTIGATION (RI) REPORT, VOLUME 1.
TO: BARKHAMSTED PRP GROUP
AUTHOR: OBRIEN & GERE ENGINEERS INC
DOC ID: 2691 02/01/1996 480 PAGES

5. REPORT: REMEDIAL INVESTIGATION (RI) REPORT, VOLUME 2 - APPENDICES A-E.
TO: BARKHAMSTED PRP GROUP
AUTHOR: OBRIEN & GERE ENGINEERS INC
DOC ID: 2405 02/01/1996 308 PAGES

6. REPORT: REMEDIAL INVESTIGATION (RI) REPORT, VOLUME 3 - APPENDICES F-O.
TO: BARKHAMSTED PRP GROUP
AUTHOR: OBRIEN & GERE ENGINEERS INC
DOC ID: 2406 02/01/1996 425 PAGES

7. MEMO : COMMENTS REGARDING THE REVIEW OF THE BASELINE RISK ASSESSMENT PART 2 AND THE SURFACE WATER AND LEACHATE ANALYTICAL SAMPLING ROUNDS.
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: PATTI LYNNE TYLER, US EPA REGION 1
DOC ID: 6831 08/11/1999 2 PAGES

3.REMEDIAL INVESTIGATION (RI) (cont)

8. REPORT: REVIEW OF BASELINE RISK ASSESSMENT PART 2 AND THE SURFACE WATER AND LEACHATE ANALYTICAL SAMPLING ROUNDS.
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: PATTI LYNNE TYLER, US EPA REGION 1
DOC ID: 6832 08/11/1999 8 PAGES

9. MEMO : COMMENTS REGARDING THE REVIEW OF THE DRAFT SAMPLING AND ANALYSIS PLAN.
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: ANN AZADPOUR-KEELEY, US EPA RISK MANAGEMENT RESEARCH LAB
DOC ID: 6843 10/30/1999 3 PAGES

10. REPORT: QUALITY ASSURANCE PROJECT PLAN (QAPP).
AUTHOR: OBRIEN & GERE ENGINEERS INC
DOC ID: 6849 11/01/1999 247 PAGES

11. MEMO : COMMENTS REGARDING THE REVIEW OF THE GROUND-WATER FLOW AND TRANSPORT MODELING RESULTS.
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: ANN AZADPOUR-KEELEY, US EPA RISK MANAGEMENT RESEARCH LAB
DOC ID: 6845 03/01/2000 3 PAGES

12. REPORT: CONFERENCE CALL MEETING NOTES.
DOC ID: 6836 03/20/2000 2 PAGES

13. MEMO : COMMENTS REGARDING THE REVIEW OF THE EVALUATION OF NATURAL ATTENUATION.
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: ANN AZADPOUR-KEELEY, US EPA RISK MANAGEMENT RESEARCH LAB
DOC ID: 6844 04/04/2000 10 PAGES

14. REPORT: COMMENTS REGARDING THE REVIEW AND ECOLOGICAL ASSESSMENT OF THE NOVEMBER/DECEMBER 1999 & FEBRUARY 2000 SURFACE WATER AND SEEP CONTAMINANT CONCENTRATION DATA
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: PATTI LYNNE TYLER, US EPA REGION 1
DOC ID: 6834 04/12/2000 2 PAGES

15. REPORT: REVIEW AND ECOLOGICAL ASSESSMENT OF THE NOVEMBER/DECEMBER 1999 AND FEBRUARY 2000 SURFACE WATER AND SEEP CONTAMINANT CONCENTRATION DATA.
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: PATTI LYNNE TYLER, US EPA REGION 1
DOC ID: 6835 04/12/2000 14 PAGES

3.REMEDIAL INVESTIGATION (RI) (cont)

16. MEMO : HUMAN HEALTH RISK SCREENING ANALYSIS FOR EXPOSURES TO GROUNDWATER, SURFACE WATER AND SEEPS
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: ANN MARIE BURKE, US EPA REGION 1
DOC ID: 6833 04/18/2000 25 PAGES

17. REPORT: HEALTH CONSULTATION, PUBLIC HEALTH IMPLICATIONS OF PRIVATE WELL SAMPLING FROM WELLS NEAR THE BARKHAMSTED-NEW HARTFORD LANDFILL, CERCLIS NO. CTD980732333
AUTHOR: US PUBLIC HEALTH SERVICE/ATSDR
DOC ID: 6837 06/14/2000 10 PAGES

4. FEASIBILITY STUDY (FS)

1. LETTER: UPDATED APPLICABLE OR RELEVANT & APPROPRIATE REQUIREMENTS (ARARS) TABLES FOR THE FEASIBILITY STUDY (FS) (A 03/31/99 COVER LETTER IS ATTACHED)
DOC ID: 6195 19 PAGES

2. MEMO : COMMENTS REGARDING THE STATUS OF THE LANDFILL CAP
TO: SITE FILE
AUTHOR: CAROLYN PINA-SPRINGER, US EPA REGION 1
DOC ID: 6198 04/20/1999 12 PAGES

3. LETTER: COMMENTS TO PRE-FINAL SITE INSPECTION CONDUCTED ON 06/04/1999.
TO: SHEILA GLEASON, CT DEPT OF ENVIRONMENTAL PROTECTION
AUTHOR: CAROLYN PINA-SPRINGER, US EPA REGION 1
DOC ID: 6197 06/21/1999 2 PAGES

4. LETTER: REQUEST FOR REVIEW OF CHANGES TO THE APPLICABLE OR RELEVANT & APPROPRIATE STANDARDS (ARARS) TABLES.
TO: SHEILA GLEASON, CT DEPT OF ENVIRONMENTAL PROTECTION
AUTHOR: CAROLYN PINA-SPRINGER, US EPA REGION 1
DOC ID: 6194 06/25/1999 1 PAGE

5. MEMO : SUMMARY OF THE PRE-FINAL SITE INSPECTION.
TO: SITE FILE
AUTHOR: CAROLYN PINA-SPRINGER, US EPA REGION 1
DOC ID: 6199 07/07/1999 17 PAGES

6. REPORT: DRAFT QUALITY ASSURANCE PROJECT PLAN (QAPP) (A COVER LETTER IS ATTACHED)
TO: BARKHAMSTED PRP GROUP
AUTHOR: OBRIEN & GERE ENGINEERS INC
DOC ID: 6207 10/01/1999 246 PAGES

BARKHAMSTED-NEW HARTFORD LANDFILL
ADMINISTRATIVE RECORD FILE
ROD 9/2001

4.FEASIBILITY STUDY (FS) (cont)

7. MEMO : SUMMARY OF SITE VISIT
TO: SITE FILE
AUTHOR: CAROLYN PINA-SPRINGER, US EPA REGION 1
DOC ID: 6196 11/22/1999 4 PAGES

8. LETTER: COMMENT ON APPLICABLE OR RELEVANT & APPROPRIATE REQUIREMENTS (ARARS) TABLES FOR FEASIBILITY STUDY (FS).
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: SHEILA GLEASON, CT DEPT OF ENVIRONMENTAL PROTECTION
DOC ID: 6193 02/09/2000 2 PAGES

9. REPORT: DRAFT NOVEMBER/DECEMBER 1999 SAMPLING EVENT DATA VALIDATION REPORT (A 03/31/00 COVER LETTER IS ATTACHED)
TO: BARKHAMSTED PRP GROUP
AUTHOR: OBRIEN & GERE ENGINEERS INC
DOC ID: 6206 03/01/2000 312 PAGES

10. REPORT: FEBRUARY 2000 SAMPLING EVENT DATA VALIDATION REPORT
TO: BARKHAMSTED PRP GROUP
AUTHOR: OBRIEN & GERE ENGINEERS INC
DOC ID: 6205 03/01/2000 311 PAGES

11. SAMPLING & ANALYSIS DATA: TABLE 3 - TENTATIVELY IDENTIFIED COMPOUNDS FOR SEMIVOLATILES IN GROUND WATER SAMPLES OBTAINED DURING THE 02/00 SAMPLING EVENT (A 03/23/00 COVER LETTER IS ATTACHED)
AUTHOR: OBRIEN & GERE ENGINEERS INC
DOC ID: 6315 03/01/2000 16 PAGES

12. LETTER: TRANSMITTAL OF THE VALIDATION REPORT FOR 02/2000 SAMPLING EVENT.
TO: CAROLYN PINA-SPRINGER, US EPA REGION 1
AUTHOR: JAMES R HECKATHORNE, OBRIEN & GERE ENGINEERS INC
DOC ID: 6204 03/13/2000 1 PAGE

13. LETTER: RESPONSE TO COMMENTS ON DRAFT APPLICABLE OR RELEVANT & APPROPRIATE REQUIRMENTS (ARARS).
TO: SHEILA GLEASON, CT DEPT OF ENVIRONMENTAL PROTECTION
AUTHOR: CAROLYN PINA-SPRINGER, US EPA REGION 1
DOC ID: 6192 04/10/2000 2 PAGES

14. LETTER: LIST OF CHANGES REQUIRED TO UPDATE THE FEASIBILITY STUDY (FS) & THE APPLICABLE AND RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) TABLES.
TO: RICHARD BELL, TRW INC
AUTHOR: CAROLYN PINA-SPRINGER, US EPA REGION 1
DOC ID: 6191 04/12/2000 22 PAGES

4.FEASIBILITY STUDY (FS) (cont)

15. FACT SHEET: EPA PROPOSES LONG TERM CLEANUP.
AUTHOR: US EPA REGION 1
DOC ID: 19641 06/01/2001 18 PAGES

16. REPORT: FEASIBILITY STUDY, DRAFT (PART 1 OF 2 - TEXT).
TO: US EPA REGION 1
AUTHOR: OBRIEN & GERE ENGINEERS INC
DOC ID: 19715 06/01/2001 299 PAGES

17. REPORT: FEASIBILITY STUDY, DRAFT (PART 2 OF 2 - APPENDICES).
TO: US EPA REGION 1
AUTHOR: O'BRIEN & GERE ENGINEERS INC
DOC ID: 20950 06/01/2001 165 PAGES

5. RECORD OF DECISION (ROD)

1. REPORT: GROUND WATER USE AND VALUE DETERMINATION.
AUTHOR: ARTHUR J ROCQUE, CT DEPT OF ENVIRONMENTAL PROTECTION
DOC ID: 18562 05/03/2001 17 PAGES

2. LETTER: COMMENTS ON THE PROPOSED PLAN.
TO: BYRON MAH, US EPA REGION 1
AUTHOR: SHEILA GLEASON, CT DEPT OF ENVIRONMENTAL PROTECTION
DOC ID: 24269 07/20/2001 3 PAGES

3. LETTER: STATE CONCURRENCE WITH REMEDIAL ACTION.
TO: PATRICIA L MEANEY, US EPA REGION 1
AUTHOR: ARTHUR J ROCQUE, CT DEPT OF ENVIRONMENTAL PROTECTION
DOC ID: 24270 09/24/2001 1 PAGE

4. REPORT: RECORD OF DECISION.
AUTHOR: US EPA REGION 1
DOC ID: 24208 09/28/2001

8. POST REMEDIAL ACTION

1. REPORT: PRELIMINARY CLOSE OUT MEMORANDUM.
AUTHOR: US EPA REGION 1
DOC ID: 24209 09/01/2001 10 PAGES

BARKHAMSTED-NEW HARTFORD LANDFILL
ADMINISTRATIVE RECORD FILE
ROD 9/2001

13. COMMUNITY RELATIONS

1. FACT SHEET: FACT SHEET: COMMUNITY UPDATE
   AUTHOR: US EPA REGION 1
   DOC ID: 5768 03/01/2000 6 PAGES

2. PUBLIC MEETING RECORD: NOTICE OF PUBLIC COMMENT PERIOD.
   AUTHOR: US EPA REGION 1
   DOC ID: 19672 06/01/2001 1 PAGE

3. LETTER: TRANSMITTAL LETTER TO FIELD REPOSITORY ACCOMPANYING THE ADMINISTRATIVE RECORD.
   TO: MARY LEE BULAT, BEARDSLEY MEMORIAL LIBRARY
   AUTHOR: HOLLY INGLIS, US EPA REGION 1
   DOC ID: 19799 06/20/2001 1 PAGE

4. PUBLIC MEETING RECORD: PUBLIC HEARING TRANSCRIPT.
   AUTHOR: FALZARANO COURT REPORTERS
   US EPA REGION 1
   DOC ID: 24207 07/18/2001

17. SITE MANAGEMENT RECORDS

1. FACT SHEET: EPA FACTS ABOUT ACTIVATED CARBON TREATMENT.
   AUTHOR: US EPA HEADQUARTERS
   DOC ID: 6847 06/01/1992 2 PAGES

2. FACT SHEET: EPA FACTS ABOUT AIR STRIPPING.
   AUTHOR: US EPA HEADQUARTERS
   DOC ID: 6848 06/01/1992 2 PAGES

3. FACT SHEET: EPA FACTS ABOUT PUMP-AND-TREAT.
   AUTHOR: US EPA HEADQUARTERS
   DOC ID: 6846 06/01/1992 2 PAGES

4. PHOTOGRAPH: CAP INSTALLATION, SAND LAYER & COMPLETED CAP.
   AUTHOR: US EPA REGION 1
   DOC ID: 6255 11/01/1998 1 PAGE

APPENDIX F

Transcript of the Public Hearing on July 18, 2001

ORIGINAL

PUBLIC HEARING FOR THE
BARKHAMSTED-NEW HARTFORD LANDFILL
SUPERFUND SITE

JULY 18, 2001
7:40 P.M.

Regional Refuse Disposal District No. 1
RRDD No. 1 Office Building
Barkhamsted-New Hartford Landfill
Route 44
Pleasant Valley, Connecticut

FALZARANO COURT REPORTERS
117 N. Saddle Ridge
West Simsbury, CT 06092
860.651.0258

MR. MURPHY: Good evening, everybody. My name's Jim Murphy from the Environmental Protection Agency. I want to welcome everyone to the formal public comment period, public hearing on the Barkhamsted-New Hartford Landfill Super Fund site proposed plan.

We will take comment tonight from any members of the public who are interested in commenting on the plan. We have plans available in the back of the room for anyone who doesn't have one, and on page 8 of the plan, I just want to point out that there is a section about how comments can be made on the plan.

The public comment period was open June 20th, and it's running through this Friday, which is July 20th, 30-day public comment period. EPA will accept formal comments tonight orally or people may present written comments tonight, and we will also accept comments through Friday, either written -- postmarked by Friday -- or via e-mail or fax received in our office by Friday.

Upon completion of the formal public comment period, this Friday, July 20th, EPA will review the public comments and we will respond to them in what's called a responsiveness summary which is a document that is part of the record of decision.

With that, I will also introduce the people from EPA and DEP, and then we can open it up for any public comments.

As I said, I'm Jim Murphy from EPA. On my left is Byron Mah, who is a remedial project manager/environmental engineer for EPA; Mary Jane O'Donnell, supervisory environmental engineer, Office of Site Remediation and Restoration, Connecticut section chief; from DEP there is Christine Lacas and Sheila Gleason.

At this point we will open it up for any comments.

MR. TRICKEY: My name is David Trickey. I'm the co-chairman of the Barkhamstead site PRP Group.

We have worked with EPA and DEP for about ten years now on the RIFS. Our group has approximately 23 members, including the RRDD 1 landfill and a number of private companies and public companies. We have worked closely on the development of the proposed alternative remedies, and on behalf of the PRP Group, I do want to strongly endorse EPA's preferred remedy, the alternative identified as MM-2 in the EPA publication. We feel that it is based on a thorough study, addresses the issues of environmental and human health and safety, and is the preferred alternative for this site.

I really have no comments other than that, unless there are questions.

MR. MURPHY: Thank you, Mr. Trickey.

Any additional comments at this time? Going once. Okay. There being no additional comments, we will formally close the public comment period, and thank you very much for coming.

MR. MAH: The hearing.

MR. MURPHY: The public hearing, the comment period, will go until Friday, as I said. Thank you, Byron. So we are all set on the hearing.

(Time noted: 7:44 p.m.)

CERTIFICATE

I hereby certify that the foregoing 4 pages are a complete and accurate computer-aided transcription of my stenotype notes taken of the Public Hearing for the Barkhamsted-New Hartford Landfill Superfund Site at the Regional Refuse Disposal District No. 1, RRDD No. 1 Office Building, Route 44, Pleasant Valley, Connecticut, on July 18, 2001.

James A. Scally

James A. Scally, RPR, LSR #80