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FIVE-YEAR REVIEW REPORT

**First Five-Year Review Report
for the Barkhamsted-New Hartford Landfill
Barkhamsted-New Hartford, Connecticut**

September 2003

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Region 1
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LIST OF ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
COPC	Contaminants of Potential Concern
CTDEP	Connecticut Department of Environmental Protection
EPA	United States Environmental Protection Agency
ELUR	Environmental Land Use Restriction
FS	Feasibility Study
FSP	Field Sampling Plan
MCLs	Maximum Contaminant Levels
MCLG	Maximum Contaminant Level Goals
MDL	Method Detection Limit
MNA	Monitored Natural Attenuation
NPL	National Priorities List
NTCRA	Non-Time Critical Removal Action
OHM	Oil and/or Hazardous Material
OMM	Operations and Maintenance Manual
OU	Operable Unit
ppm	Parts per million
ppb	Parts per billion
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
PQL	Practical Quantitation Limit
PSD	Performing Settling Defendant
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAO	Response Action Objectives
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SVOCs	Semivolatile organic compounds
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

The remedy selected to address contamination at the Barkhamsted-New Hartford Landfill site (hereinafter referred to as the 'Site'), located in the town of Barkhamsted, Litchfield County, Connecticut was Monitored Natural Attenuation (MNA) of Site groundwater (deemed as the only medium requiring further remediation). This landfill was capped as part of a Non-Time Critical Removal Action (NTCRA) lead by the Connecticut Department of Environmental Protection (CTDEP) to address source materials and principal-threat wastes. The CTDEP approved the landfill closure in January 1998. The Record of Decision (ROD) indicating that MNA was the selected remedy was approved on September 28, 2001 (EPA, 2001b) incorporated the landfill cap into the final remedy. Quarterly sampling of groundwater monitoring wells at the landfill to meet CTDEP requirements has been ongoing. Quarterly sampling of groundwater monitoring wells at the landfill pursuant to the ROD began in April and May of 2003. The trigger for this five-year review was the Record of Decision in 2001, however since the NTCRA (1998) left waste in place, this five-year review was conducted at this time under EPA's discretionary authority.

The assessment of the five-year review found that the remedy is functioning as designed. The immediate threats to human health and the environment have been addressed by capping the landfill. The selected groundwater remedy is MNA. Once the groundwater cleanup goals have been achieved, in approximately 16 years (see O'Brien & Gere Engineers, Inc. 2001a), the groundwater remedy will be protective of human health and the environment. In the interim, exposure pathways that could result in unacceptable risks are being controlled. Environmental Land Use Restrictions (ELURs), which prohibit the installation of drinking water wells, have been placed on the main facility property.

FIVE-YEAR REVIEW SUMMARY FORM (CONT'D)

Issues:

The following issues arose during recent groundwater sampling activities conducted in April and May 2003:

- The discovery of four 55-gallon drums at well MW-111. Two of the drums were rusted and empty. The other two drums contained approximately 2 to 20 gallons of groundwater purge water based on the labeling of the drums. No visual or olfactory evidence of oil and/or hazardous materials (OHM) was encountered within or in the area surrounding the drums. Samples were collected from each drum and analyzed for Volatile Organic Compounds (VOCs) and metals. CTDEP was present during sampling activities. The sample results were consistent with purge water and the drums were removed with the water discharged to the landfill leachate holding tank for later disposal.
- Three groundwater-monitoring wells were deemed as inaccessible and could not be sampled. Inaccessibility was attributed to the following:
 - MW-113I: The well casing was damaged (bent) and would not allow for insertion of the sampling pump.
 - MW-113D: A submersible pump and associated cable (used for previous sampling) were abandoned in the well and could not be removed.
 - MW-4R: An unknown obstruction present at an approximate depth of 12 feet below ground surface (bgs).

Recommendations and Follow-Up Actions:

- Continued monitoring of Site groundwater, potential leachate seeps, soil, surface water and sediment, as required.
- Continue to verify that natural attenuation is occurring.
- Adoption of environmental land use restriction (ELUR) for the properties other than the RRDD#1 facility.
- Continued maintenance of the existing landfill cap cover.
- Repair of damaged wells MW-113I, MW-113D, and MW-4R do not appear necessary at this time, but the potential need for these wells will be evaluated further with new data.
- To more clearly define the extent of the Contaminants of Concern (COCs), EPA recommends that existing additional wells be sampled in future sampling events. The proposed wells to be sampled include wells MW-105S and B, MW-108S and B, MW-109B, MW-117S and B, and MW-118S and B.

FIVE-YEAR REVIEW SUMMARY FORM (CONT'D)

Protectiveness Statement:

The assessment of the five-year review found that the remedy is functioning as designed. The immediate threats have been addressed through the construction, operation, and maintenance of the landfill capping. The groundwater remedy (MNA) is currently protective of human health and the environment as the plume is not expanding, impacting drinking water wells, and people are not drinking the impacted groundwater. In addition, CTDEP has signed the ELURs on the RRDD #1 property and is in the process of signing the other areas impacted by Site related contaminants. ELURs are institutional controls, which prohibit the installation of drinking water wells.

1.0 INTRODUCTION

The purpose of this five-year review is to determine whether the remedy for the Barkhamsted-New Hartford Landfill Superfund Site (Site) is protective of human health and the environment. The methods, findings and conclusions of this review are documented in this first five-year review report. In addition, this report identifies issues encountered during preparation of this five-year review, along with recommendations to address such issues.

The United States Environmental Protection Agency (EPA) must implement five-year reviews pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). CERCLA Section 121(c) states:

If the President selects a remedial action that results in any hazardous substances, pollutants or contaminants remaining at the Site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such Site in accordance with section 9604 [104] or 9606 [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The Agency reported this requirement further in the NCP; part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This is the first five-year review for the Site. The trigger for this five-year review was the Record of Decision in 2001, however, since the Non Time Critical Removal Action (NTCRA) (1998) left waste in place, this five-year review was conducted at this time under EPA's discretionary authority. The five-year review (statutory) is required due to the fact that hazardous substances, pollutants, or contaminants remaining at the Site are above levels that allow for unlimited use and unrestricted exposure. This five-year review has been prepared following guidance provided by EPA (2001a). The EPA Region 1, conducted the five-year review of the remedy implemented at the Site. This review was conducted by the Remedial Project Manager (RPM) for the entire Site from May 1, 2003 to August 28, 2003. This report documents the results of the review.

The selected remedial action to reduce impact of designated COCs to groundwater (deemed as the only medium requiring remediation) is Monitored Natural Attenuation (MNA) of Site groundwater. LFR Levine-Fricke (LFR) was selected as the contractor on behalf of the Potentially Responsible Party (PRP) in February 2003. LFR conducted the initial quarterly groundwater-sampling event, pursuant to the ROD, in April and May 2003 program.

2.0 SITE CHRONOLOGY

The chronology of the Site, including significant events and dates is addressed in Table 1, all of which occurred at one operating unit (OU).

TABLE 1: CHRONOLOGY OF SITE EVENTS

Date (Month/year)	Environmental Issue/Event/milestone
September 1970	Regional Refuse Disposal District No. 1 (RRDD#1) was formed.
September 1972	RRDD#1 received CTDEP soil waste permit #005-2L. The RRDD#1 purchased the Barkhamsted property from the Town of Barkhamsted.
1970's	Operation of chemical pit that received oily sludge with metal grindings and degreasers.
January 1974	Modification to the RRDD# 1 solid waste permit was issued.
April 1974	The landfill became operational.
1974-1979	CTDEP solid waste reports document lack of daily cover material; additional issues include ponding of water on landfill surface and encroachment of brush and bulky waste onto 50-foot buffer zone.
April 1974- August 1988	Barkhamsted landfill Site was used for the disposal of solid waste.
1980	CTDEP inspection of the Site.
1981	EPA conducted a preliminary assessment for the Site.
March 1981	CTDEP requests RRDD#1 to remove hazardous waste from the facility.
July 1981	CTDEP formerly approved disposal of metal grinding waste at Site.
1983	Two complaints received concerning the presence of a large number of drums; CTDEP requests that 25 drums containing suspect motor oil be re-located to a paved area on-Site.
November 1983	Thirty drums discovered near the scrap metal area (north of toe of landfill and NW of garage).
December 16, 1983	A modification to the landfill operating permit was issued.

1984	Requirement for a new metals grindings cell. Metal grindings were stored on Site in 55-gallon drums.
September 1986	CTDEP acknowledges handling of waste oil and batteries for recycling.
March-1987	NUS Corporation conducts Site inspection, on behalf of EPA –Site receives hazard ranking score (HRS) of 52.00, later lowered to 38.05, due to low population density and fact that area served by public water supply.
November – December 1988	Solid waste was disposed at the Site because Connecticut Resources Recovery Authority’s (CRRA) mid-Connecticut “Waste to Energy” Plant was inoperable.
August 1988 – October 1993	Disposal of bulky and non-processible waste only.
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 5, 1989	Barkhamsted Site listed on NPL.
February 1990	Minor amendment was granted to the RRDD#1 solid waste permit allowing landfill to accept dewatered sludge from Winsted’s publicly owned treatment works (POTW).
1990	CTDEP Administrative order to investigate waste materials; determine extent of impact and potential impact to soil, surface water and groundwater.
October 4, 1991	CERCLA Administrative Order to Conduct Remedial Investigation/Feasibility Study (RI/FS) (Docket No. I-91-1128).
Dec 1991-Jan 1992	Limited Field Investigation (LFI) conducted by O’Brien & Gere Engineers, Inc.
December 1991	Scope of Study completed by Fuss & O’Neill per CTDEP Administrative Order No. 666.
November 1992	Landfill closure implemented. CTDEP revise permit # SW-0005-2L to address water quality monitoring plan.
October 1993	Facility ceases acceptance of waste for on-Site disposal.
April 1994	Engineering Evaluation/Cost Analysis (EE/CA) addressing NTCRA completed.
September 26, 1994	EPA enters into enforcement agreement with CTDEP; CTDEP enter into Consent Order with RRDD#1 requiring RRDD#1 to design and implement NTCRA.
October 1994	Landfill cover (2-ft thick) installed.
January 1995	CTDEP approves landfill closure.
February 1996	Remedial Investigation (RI) by O’Brien & Gere Engineers, Inc. (1996).
September 1996	Draft Remedial Action Plan (RAP).
1998	NTCRA completed; implementation of leachate collection system; capping of landfill and Site restoration.

June 2001	Feasibility Study Report, O'Brien & Gere Engineers, Inc. (2001a).
September 28, 2001	EPA Record of Decision (ROD) (EPA, 2001b), and Preliminary Close-Out Report.
November 19, 2002	ELUR public notice; 30-day comment period from 11/19/02 to 12/19/02.
April 30 - May 8, 2003	Sampling of Site groundwater monitoring wells and residential potable water wells.
May 8, 2003	Consent Decree Entered and Signed by US District Court for the District of Connecticut
June 2003	Surface water and sediment sampling. Landfill Cap Inspection.

3.0 BACKGROUND

3.1 Physical Characteristics

The Site is comprised of a 97.8-acre parcel of land located on the northern slope of a hill within the Farmington River Valley, in the north central portion of Connecticut. The Site is a semi-active waste disposal area located in the Towns of Barkhamsted and New Hartford, Litchfield County, Connecticut (a Site Location Map is provide as Figure 1). The capped landfill itself is approximately 13 acres. The Site is abutted to northeast by the Barkhamsted Town Garage facility and in other directions by both developed and undeveloped private properties. This includes residential properties to the east and southeast that use private wells for potable water. The town center of New Hartford lies within a one-mile radius to the south-southeast of the Site. Other areas of the Site property include an active transfer station, recycling area, maintenance and office building, and dense woods comprised primarily of hardwood and conifer trees. A Site Location Map is provided as Figure 1.

3.2 Land and Resource Use

The Site was formerly used as a solid waste landfill with a chemical pit that received oily sludge with metal grindings and degreasers. Waste oil and batteries were handled for recycling. A NTCRA was initiated in 1992 to cap the landfill, which stopped accepting waste for on-Site disposal in October 1993. In January 1998, the CTDEP approved the landfill closure.

The current use of the Site includes an active waste transfer station, recycling area, with a maintenance and office building. The capped landfill is fenced. The current use for the surrounding area is residential, commercial and recreational. The Metropolitan District Commission (MDC) owns undeveloped land along the Farmington River, which is used for recreational purposes, including fishing, swimming and boating.

One surface water body, designated as the "Un-named Brook", originates south of the Site and flows along the western portion of the landfill area. Beyond the landfill, the brook proceeds to the northeast and flows under Route 44, where it enters the Farmington River floodplain and a series of small beaver ponds. The brook eventually flows into the Farmington River, located approximately 0.25 miles southeast of the Site. The Farmington River is a Class B River for recreational fishing and boating.

The groundwater aquifer underlying the Site is currently not used as a drinking water source, but nearby commercial and residential areas use on-Site wells for potable water. Groundwater at the Site is estimated to flow to the northeast. Downgradient of the Site, groundwater flow is more easterly toward the Farmington River. Groundwater contour maps for April 30, 2003 for the overburden and shallow bedrock are included as Figures 2 and 3, respectively.

3.3 History of Contamination

The Barkhamsted landfill was used for the disposal of solid waste between April 1974 and August 1988. The property is owned and operated by the Regional Refuse Disposal District #1 (RRDD#1). RRDD#1 is a corporate entity that was established on May 25, 1970 upon the adoption of its charter by the Towns of Barkhamsted, Colebrook, New Hartford and Winchester. On September 21, 1972, RRDD#1 received a permit from the State of CTDEP approving the establishment of a solid waste disposal area. The Site began operating as a landfill in 1974.

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. In 1998, a landfill cap and leachate collection system, surrounded by a fence, were constructed pursuant to a NTCRA under State authority. Table 1 provides a chronology of major environmental issues, events and milestones at the Site, as documented in the Remedial Investigation (RI) report (O'Brien & Gere Engineers, Inc., 1996) and Feasibility Study (FS) report (O'Brien & Gere Engineers, Inc., 2001a).

Historical wastes accepted at the landfill included the following:

- Municipal solid waste;
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- Industrial wastes, including metal grinding waste, oily sludge with metal grinding and degreasers; barrels containing unspecified amounts of chlorinated hydrocarbons and methyl-ethyl-ketone (MEK) and keratin; and
- Dry metal grinding waste.

3.4 Initial Response

In 1981, EPA conducted a Site inspection, based on previous findings of the CTDEP. EPA's 1981 inspection included collection and analysis of Site groundwater samples. Laboratory analytical results of Site groundwater indicated concentrations of xylenes, toluene, 1,1-dichloroethane (1,1-DCA), 4-methyl-2-pentanone and vinyl chloride (VC). EPA inspection report also indicated the presence of metals at the Site (including cadmium, chromium, copper, lead, manganese, nickel and zinc) attributed to the historical disposal of oily metal grinding sludges. Additionally, during EPA's inspection, leachate was observed to be discharging from the landfill into the Un-named Brook. Pursuant to Section 105(8)(b) of CERCLA, the Site was proposed for inclusion on the National Priorities List (NPL) on June 21, 1988 and was subsequently listed on the NPL on October 5, 1989. Administrative orders were issued by CTDEP (1990) and EPA (1991) to investigate waste materials and disposal activities on the Site, along with the extent of impact to soil, groundwater and surface water.

In 1994, a NTCRA was implemented at the Site, which included re-location of impacted soil and sediment to a paved portion of the Site, along with installation of a leachate collection system and landfill cap. The NTCRA was completed in 1998. A risk assessment was prepared prior to NTCRA implementation to assess post-NTCRA risks to human and ecological receptors. Groundwater was deemed as the only medium requiring additional remediation.

Subsurface investigations conducted from 1992 to 2000 are documented in the RI and FS reports. These investigations indicated the following:

- Soil sampling analytical results indicated concentrations of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs). Table 1-1 of the FS Report (O'Brien & Gere Engineers, Inc., 2001a) identifies contaminants of potential concern (COPCs), including VOCs, SVOCs and inorganics. Soils containing constituents detected at concentrations exceeding applicable or relevant and appropriate criteria were addressed in the NTCRA.
 - Surface water sampling and leachate seep sediment sampling results indicated concentrations of SVOCs, pesticides and PCBs. Sediment samples collected from
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hydrogeologically downgradient locations (to the landfill) and leachate seep sediment samples indicated concentrations of VOCs, SVOCs, metals, pesticides and PCBs.

Prior to the RI, 31 groundwater-monitoring wells were installed at the Site. Twenty-two additional wells were installed during the RI. COCs based on groundwater investigations include 14 VOCs, 4 SVOCs and 4 inorganics. Groundwater sampling conducted since the RI have shown a decreasing trend in most contaminant concentrations, with the exception of toluene, which has increased in concentrations at two wells.

3.5 Basis for Taking Action

Hazardous substances, in concentrations above health-based levels, were identified during the RI/FS. The RI identified COCs that have been released at the Site in each media, which are identified below and also in Table 2. EPA completed a baseline human health risk assessment in February 1996 and updated it in April 2000. Using EPA's risk assessment guidance, potential human health effects associated with exposure to COCs were estimated for various exposure scenarios. Calculated risks for some exposure scenarios fell outside EPA's acceptable range, which formed the basis for the response actions. An ecological risk assessment conducted within the same time period determined that it was not likely that the contaminants found at the Site would cause significant ecological impacts.

The COCs were selected from the constituents detected in groundwater based on the unacceptable risks that these contaminants present. Groundwater was the only medium that poses an unacceptable post-NCTRA risk to human health. Since COCs have migrated in overburden and bedrock groundwater, off-Site impacts are a concern, specifically to nearby potable water supplies. As documented in EPA's Record of Decision (ROD) (EPA, 2001b), the primary objective is restoration of Site groundwater by MNA, which has been designated as the final Site environmental remedy with an expected duration of approximately 16 years. Installation of additional groundwater monitoring wells may be required to fill in data gaps and assess the performance of the MNA. Prior to such well installation, data from temporary sampling locations may be collected at the Site to properly locate new wells.

The only medium that potentially poses an unacceptable post-NTCRA risk to the environment is sediment. Although the actual risk is uncertain, it is likely that decreased leachate, biodegradation of organic contaminants, and natural sedimentation will ameliorate these possible risks. Surface water and sediment sampling is to be conducted to assess this potential risk. Based on surface water sampling conducted in 2000 (subsequent to the NTCRA), there are no known constituents exceeding applicable criteria in surface water, as identified in the ecological risk assessment presented in the FS. Leachate seeps are expected to gradually diminish in discharge volume over time or dry up.

COCs for groundwater, as addressed in the ROD, include the following:

Acetone	
Benzene	Toluene
1,2-dichloroethane	2-Butanone (MEK)
1,2-dichloropropane	4-methyl-2-pentanone
Chloroethane	1,4-dichlorobenzene
Chloroform	Bis(2-ethyl hexyl) phthalate
Chloromethane	2,4-dimethylphenol
Dibromochloromethane	4-methylphenol
Methylene chloride	Arsenic
Trichloroethene (TCE)	Chromium (total)
Vinyl chloride (VC)	Lead
Manganese	Acetone

A complete list of the COC and other compounds analyzed is included in Table 2.

4.0 REMEDIAL ACTIONS

The following discusses initial plans, implementation history and current status of the remedy.

4.1 Remedy Selection and Remedial Action Objectives

The ROD for the Site was signed on September 28, 2001 (EPA, 2001b). MNA is the selected remedial option to reduce groundwater impacts at the Site. Remedial action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate and prevent existing and future potential threats to human health and the environment. The RAOs for the selected remedy for the Site are broken into two categories: groundwater and sediment.

Groundwater

The RAOs for groundwater for human health are as follows:

- Prevent ingestion or dermal contact with groundwater having constituent concentrations exceeding EPA 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.
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- 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.

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, Connecticut Water Quality Standards, or in their absence, a hazard index of 1.

4.1.1 Source Control

The source control was addressed by the NTCRA, which included re-location of impacted soil and sediment to a paved portion of the Site, along with installation of a leachate collection system and landfill cap. During the performance of the NTCRA, an approximate 340-foot reach of the Un-named Brook was relocated on the west side of the landfill, with the former section of the brook being covered with soil. Moreover, sediments were excavated from an approximately 70-foot reach of the brook and placed beneath the cap during the NTCRA construction. The EPA has determined that the landfill cap controls contaminant sources and that no additional actions beyond operation and maintenance of the cap are anticipated during implementation of the final cleanup remedy (MNA, institutional controls).

4.1.2 Management of Migration

The major components of the management of migration remedy selected in the ROD includes:

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

- Five-year reviews.

4.2 Remedy Implementation

In 1992 landfill closure was implemented in accordance with the Landfill Closure Plan (Fuss & O'Neill, 1992). In January 1995 the CTDEP approves the landfill closure. In April 1997, the Remedial Action Plan for the NCTRA was prepared, which included (O'Brien & Gere Engineers, Inc., 1997):

- Relocation of impacted soil, sediment and refuse to within the limits of the area to be capped;
- Installation of a leachate collection system, with a 15,000-gallon underground leachate holding tank;
- Capping of the landfill with a low-permeability capping system;
- Relocation of the Un-named Brook;
- Vertical extension of 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.

In January 1998 the NTCRA was completed. Since then, community involvement activities were conducted. In June 2001 the Feasibility Study (FS) was completed (O'Brien & Gere Engineers, Inc., 2001a). On September 28, 2001, the ROD was signed, which selected MNA as the remedy (EPA, 2001b). A Consent Decree was signed by the PRPs on various dates between September and November 2002 and by government representatives between September 2002 and January 2003, which was entered by the court on May 8, 2003 (United States v. Regional Refuse District No. 1, et al., 2003).

Pursuant to the terms of the Consent Decree, RRDD#1 is performing the RA. In the spring of 2003, RRDD#1 initiated the long-term monitoring of groundwater. Periodic monitoring data continues to be collected in support of restoration of contaminated groundwater via monitored natural attenuation.

MNA remedy provides for both source control and management of groundwater migration. The approximate clean up time frames for the selected remedy is 16 years to reach groundwater cleanup levels. Statutory 5-year reviews will be conducted as long as waste is in place.

4.3 System Operations/Operation and Maintenance (O&M)

RRDD# 1 is conducting the long-term monitoring and maintenance activities at the Site. There are two components to the long-term monitoring and maintenance activities: a.) Source Control, b.) Monitored Natural Attenuation of Groundwater. For the source control, a landfill post-closure Operation and Maintenance Manual (OMM) was completed in October 2001 (O'Brien & Gere Engineers, Inc., 2001b). O&M activities include the following:

- Routine inspection and maintenance of constructed features, including the landfill cap, gas venting system, leachate collection and storage system, surface water runoff facilities, the in-stream sedimentation basin, access roads, groundwater monitoring system and physical Site security;
- Mowing of the cap;
- Performance of a Long-term monitoring program including groundwater, surface water (including seeps) and sediment;
- Response to alarm and unforeseen circumstances;
- Coordination of leachate removal and disposal; and
- Evaluation of O&M and monitoring activities and identification of proposed changes to the OMM or Site procedures/policies that would provide a safer and/or more cost-effective operation.

Visual Site monitoring of the landfill occurs on a routine basis to evaluate evidence of erosion; cap differential settlement; the condition of the perimeter fencing, gates, locks and signs; condition of gas monitoring probes; drainage structures and surrounding property structures. The existing groundwater monitoring wells and immediate surrounding area is reviewed during each sampling event.

To date, the Source Control O&M activities have been ongoing since the capping of the landfill. The MNA sampling activities were initiated in April and May of 2003 with the first quarterly sampling event.

With regard to O&M costs, the following is an approximation of total annual system operations/O&M costs during the period until submission of the next five-year review in September 2008. This cost estimate is different from the cost estimate of the ROD as it included the estimated maintenance cost for the cap, leachate disposal, and reporting to the CTDEP in addition to the ROD estimated cost. The ROD cost estimate addressed only the sampling and monitoring, installation of new wells, with reporting to the EPA.

Table 3: Annual System Operations/O&M Estimated Costs

Dates		Total Cost Estimate rounded to nearest \$1,000
From	To	
5/03	5/04	\$408,000
5/04	5/05	\$374,000
5/05	5/06	\$204,000
5/06	5/07	\$140,000
5/07	5/08	\$150,000

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for the Site.

6.0 FIVE-YEAR REVIEW PROCESS

Tasks completed as part of this review include review of pertinent Site-related documents; an inspection of Site monitoring areas; discussions with RRDD#1, EPA, CTDEP and the community; and a review of Site-specific regulatory and relevant standards. The Site review was led by Byron Mah, the RPM for the EPA, with support from Gilbert Richards of the CTDEP. Sampling and Analysis and technical support was lead by Allen Walker of LFR, the project manager for the PRP group, and included LFR team members with expertise in hydrogeology, MNA, and risk assessment.

6.1 Community Notification and Involvement

As documented in the ROD, the level of community concern and involvement has varied. Since completion of the NTCRA, community interest has been minimal. Provided below is a chronology of public outreach efforts that have occurred since 1998.

Chronology of Public Outreach Efforts Table

March 1998	EPA publishes a fact sheet and holds a public information meeting to describe upcoming construction activity and schedules for the NTCRA landfill work. EPA community involvement staff canvasses the local residents, going door to door prior to the public meeting.
March 1999	EPA publishes a fact sheet to provide an update of Site construction activity completed to date and the schedule for activity during 1999.
March 2000	EPA publishes a fact sheet to describe the alternatives being evaluated in the FS and to describe the nine CERCLA criteria and the public participation process to follow the FS.
Week of June 21, 2001	EPA publishes a notice and brief analysis of the Proposed Plan in The Register Citizen and makes the plan available to the public at the repository – Beardsley Memorial Library.
Prior to week of June 21, 2001	EPA community involvement staff canvasses the local residents, going door to door prior to the public meeting.
June 20, 2001 to July 20, 2001	EPA holds 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.
June 20, 2001	EPA holds an informational meeting to discuss the results of the RI and the cleanup alternatives presented in the FS and to present the EPA's Proposed Plan to a broader community audience than those that had already been involved at the Site. At this meeting, representatives from EPA and CTDEP answered questions from the public.
July 18, 2001	EPA holds a public hearing to discuss the Proposed Plan and to accept any oral comments.
November 19, 2002	ELUR public notice; 30-day comment period from November 19, 2002 to December 19, 2002

On June 17, 2003 a public notice was published in the Register Citizen to announce the five-year review, Site activities, and a June 24, 2003 public open house. A letter stating the same was provided to the local community's chief municipal officers. EPA also sent out a press release regarding the five-year review and other updates to the Site activities. There were no comments received with regards to the protectiveness of the remedy.

6.2 Document Review

Site-related documents reviewed as part of this effort are listed in Table 4. The documents were compared to six aspects of the Site including:

- Basis for the Response Action;
- Implementation of the Response;
- Operation and Maintenance;
- Remedy Performance;
- Legal Documentation; and
- Community Involvement.

6.3 Data Review

Groundwater monitoring pursuant to the ROD was initiated in April and May of 2003. Therefore, only one round of sampling had been conducted at the time of the five-year review, which included the initial sampling for MNA parameters.

Table 5 presents the results of the first round of groundwater sampling at the Site. The table compares the data to applicable state and federal criteria. The data includes VOCs, SVOCs, metals, leachate parameters and the MNA parameters. As this is the first comprehensive sampling event, these results establish the baseline for the MNA sampling. The evaluation of the MNA parameters is further discussed in Section 7 of this report.

Based on the analytical results, LFR prepared figures of the COC concentration for detected COCs. The following figures were prepared:

- Figure 4: Overburden Total VOCs and SVOCs Concentration Map - April 30 - May 8, 2003;
- Figure 5: Overburden Total BTEX Concentration Map - April 30 - May 8, 2003;
- Figure 6: Shallow Bedrock Total VOCs and SVOCs Concentration Map - April 30 - May 8, 2003; and
- Figure 7: Shallow Bedrock Total BTEX Concentration Map - April 30 - May 8, 2003.

A review of these figures indicates that the delineation of the likely plume endpoint to the east was estimated. To more clearly define the extent of the COCs, LFR recommends that existing additional wells be sampled in future sampling events. The proposed wells to be sampled include wells MW-105S and B, MW-108S and B, MW-109B, MW-117S and B, and MW-118S and B.

The initial round of surface water and sediment sampling occurred on August 14, 2003. The results of this sampling were not available for inclusion in this report.

6.4 Site Inspection

A Site inspection was conducted during each the initial sampling event in April and May 2003 as well as on June 24, 2003. EPA and CTDEP performed the Site inspection. This review focused on the condition of the groundwater monitoring wells and their usability for sampling. In addition, a Site review was conducted with Byron Mah of the EPA and Gil Richards of the CTDEP on April 30, 2003.

During the review with the EPA and CTDEP, representatives an off-Site well location (well MW-111) was reviewed and four 55-gallon drums were found at the well head. This well is located in the woods accessible by a dirt road that is blocked at its entrance. The drums were labeled as purge water, but the label was weathered and appeared old. Two of the drums contained liquid and the others did not. The drums were in poor condition as they were rusted with some holes. It was suspected that these drums contained purge water from the initial sampling during the RI or FS. LFR sampled the drums for VOCs and metals. No VOCs were detected and the metals detected were consistent with purge water. Based on these results, the drums were removed by the RRDD#1 with the water placed in the leachate holding tank for disposal.

Regarding the well conditions, three of the wells were unable to be sampled. This included well MW-113I, MW-113D and MW-4R. These wells were damaged as follows:

- MW-113I: the PVC was bent so that sampling equipment could not pass;
- MW-113D: a pump was stuck in the well; and
- MW-4R: there was an obstruction at 12 feet below grade.

The condition of the cap and fence appeared good at the time of the visit.

The landfill cap is also checked by an independent inspector as part of the source control requirements. The latest inspection was June 5, 2003. No significant issues were identified during this inspection. A copy of the inspection checklist is included as Appendix A.

6.5 Interviews

Interviews were conducted with various parties connected to the Site. Carol Jones, a nearby resident, was interviewed on April 30, 2003. No significant problems regarding

the Site were identified during the interview. There were no concerns expressed about the protectiveness of the remedy. She expressed a historical concern about stormwater runoff from the Site to her property, but this was corrected with Site grading. She also expressed that adequate prior notice to sampling be provided.

Jim Hart, the administrator for the Site, did not indicate significant problems regarding the Site. He inquired if it was possible to reuse the leachate water collected in the holding tank, which would be used to water the grass on the landfill cap. To further review this possibility, LFR collected a sample of the leachate water for laboratory analysis and characterization. The potential reuse of this water is being evaluated.

7 TECHNICAL ASSESSMENT

7.1 Is the Remedy functioning as intended by the decision documents?

The review of documents, Applicable, or Relevant, and Appropriate Requirements (ARARs), risk assumptions, and the results of the Site inspection indicate that the remedy is functioning as intended by the ROD. A copy of the ARARs for the Site is attached at Appendix B. The capping of landfill material and collection of leachate have achieved the remedial objectives to minimize the migration of contaminants to groundwater and surface water and prevent direct contact with, or ingestion of, contaminants in soil and sediments. The forthcoming implementation of institutional controls will prevent exposure to contaminated landfill materials.

O&M of the cap and drainage structures has been effective. O&M annual costs are consistent with original estimates and there are no indications of any difficulties with the remedy.

There were no opportunities for system optimization observed during this review. The monitoring well network provides sufficient data to assess the general progress of natural attenuation within the plume, and maintenance of the cap is sufficient to maintain its integrity. To better assess the magnitude and extent of the groundwater plume downgradient of the landfill, additional monitoring locations are planned that include sampling existing monitoring wells and the installation of new monitoring wells.

The institutional controls that are in place (the main facility) include prohibitions on the use or disturbance of groundwater until cleanup levels are achieved, and prohibitions on excavation activities, disturbance of the cap, and any other activities or actions that might interfere with the implemented remedy. The institutional controls that are about to be recorded (Town Property, MDC, and a private property owner) will also have the same prohibitions. These institutional controls, in the form of an ELUR, have been submitted to CTDEP for approval. No activities were observed that would have violated the institutional controls. The cap and the surrounding area were undisturbed, and no new uses of groundwater were observed. The fence around the Site is intact and in good repair. EPA and CTDEP inspected the Cap on June 24, 2003.

7.2 Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of remedy selection still valid?

7.2.1 Changes in Exposure Pathways

The exposure pathways as indicated in the risk assessment and ROD are shown Figure 8. There have been no changes in the physical conditions of the Site since approval of the decision documents. Therefore, no changes in exposure pathways have occurred that would affect the protectiveness of the remedy.

7.2.2 Changes in Toxicity, ARARs, and Other Contaminant Characteristics

Changes in toxicity

Since approval of the decision documents, the EPA or other authority has revised toxicity factors for some of the chemicals of concern. Sources of toxicity factors that were reviewed included EPA's Integrated Risk Information System (IRIS), EPA Health Effects Summary Tables (HEAST), and reports by the EPA National Center for Environmental Assessment (NCEA). Tables 6 summarize the previous and currently applicable toxicity factors for COCs that are carcinogens and non-carcinogens, respectively. The EPA-approved cancer slope factor for benzene has increased by a factor of less than two. The EPA-approved cancer slope factor for vinyl chloride has decreased by about 26 percent. Increases in cancer slope factor indicate a greater potential for carcinogenic action. In addition, the NCEA has proposed an increased cancer slope factor for trichloroethylene, which is currently under review by EPA. The proposed slope factor for TCE is 36 times greater than before. The risk assessment concluded that that 80 percent of the total estimated carcinogenic risk from groundwater exposure was due to arsenic. The agency-recognized toxicity of arsenic has not changed since approval of the decision documents.

Benzene, trichloroethylene, and vinyl chloride contributed 1, 0.1, and 9 percent to the total estimated incremental excess cancer risk from exposure to groundwater, respectively.

The EPA-approved reference dose for manganese has increased by a factor of less than six. The EPA-approved reference dose for benzene has decreased by about 7.5 times. Decreases in reference doses indicate a greater potential for non-carcinogenic effect. In addition, the NCEA has proposed a decreased reference dose for trichloroethene, which is currently under review by EPA. The proposed reference dose for TCE is 20 times less than before.

Conversely, the EPA-approved reference dose for manganese has increased by about 60 times. The reference doses for three chemicals (1,2-dichloroethane, 1,2-dichloropropane, and chloroethane) have been withdrawn from EPA's IRIS database, pending further review by EPA. The risk assessment concluded that 91 percent of the total estimated non-carcinogenic risk from groundwater exposure was from 4-methylphenol. The agency-recognized toxicity of 4-methylphenol has not changed since approval of the decision documents. Benzene, trichloroethylene, and manganese contributed 0.05 percent, 0.0006 percent, and 3 percent to the total estimated incremental excess cancer risk from exposure to groundwater.

Based on a review of these changes in toxicity factors, the overall estimated cancer and non-cancer Site risks, as estimated in the risk assessment, are unlikely to be significantly affected. Moreover, the changes in toxicity factors are unlikely to affect groundwater cleanup levels at the Site. Currently, the most stringent cleanup levels for groundwater (as indicated in the ROD) are dictated by background concentrations for each chemical of concern, rather than by total estimated health risk.

Changes in ARARs, Standards and To Be Considered's

Cleanup levels were established in the ROD for 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 were 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. Groundwater cleanup levels for each chemical of concern is its background concentration, per Connecticut RSRs, Section 22a-133k-3(a). A list of tentative background concentrations was presented in the ROD. During the Remedial Action Phase, EPA in consultation with CTDEP, will determine whether these concentrations represent background for this Site. EPA will only change these values in the ROD if they are necessary pursuant to Section 117(c) of CERCLA. A process often referred to as an Explanation of Significant Differences.

There is one change that has occurred in the ARARs and To Be Considereds (TBCs) since the ROD was signed. Since the ROD was signed, EPA adopted lower Maximum

Concentration Level (MCL) standards for arsenic in groundwater. This changed the standard from 50 ppb to 10 ppb.

The interim groundwater cleanup level, as presented in the ROD, was based on the arsenic standard in drinking water of 50 ug/l established in 1975, by the U.S. Public Health Service standard originally established in 1942. The Safe Drinking Water Act, as amended in 1996, required EPA to review current drinking water standards for arsenic, propose a maximum contaminant level (MCL) for arsenic by January 1, 2000, and issue a final regulation by January, 2001.

EPA published a new standard for arsenic in drinking water of 10 ug/l on January 22, 2001 that would require public water supplies to reduce arsenic to 10 ug/l by 2006. EPA withdrew this standard in March 2001 for review. On May 22, 2001 EPA extended the previous delay of the rule's effective date to February 22, 2002 but did not change the compliance date (2006) for systems.

EPA requested three independent, expert panels to conduct three studies as part of its reassessment of the January 22 rule; the National Research Council undertook an expedited review of EPA's arsenic risk analysis and recent health effects research, the National Drinking Water Advisory Council reassessed the rule's cost, and the Agency's Science Advisory Board reviewed its benefits.

The risks, cost, and benefits reviews are completed. EPA decided that the additional information has reinforced the basis for significant reductions of the standard. On October 31, 2001, EPA affirmed the appropriateness of an MCL or regulatory level of 10 ug/l for arsenic in drinking water in its press release. As required by the Safe Drinking Water Act, a standard of 10 ug/l protects public health based on the best available science and ensures that the cost of the standard is achievable. This arsenic drinking water rule became effective on February 22, 2002 and by January 23, 2006, both community water systems and non-transient, non-community water systems must comply with the new 10 ug/l standard. Additionally, Superfund must also adopt this new standard and treat it as it would any other MCL-based contaminant concentration level in its decision making process for groundwater cleanups.

Therefore, the arsenic cleanup level must be reviewed and a determination made as to whether the remedy remains protective in light of the revised cleanup goals. The ROD's goal of cleaning up arsenic to drinking water levels is unlikely to be met in light of (a) the revised MCL for arsenic (10 ppb), and (b) the current lack of viable cleanup technology for arsenic in groundwater. However, risks to human health can be controlled as long as the groundwater in the immediate vicinity of the contaminated portions of the Site is not used for drinking water.

All other risk based cleanup goals as presented in the ROD remain substantively unchanged.

7.2.3 Expected Progress Towards Meeting RAOs

Groundwater modeling conducted during the FS (O'Brien & Gere Engineers, Inc. 2001a) estimated that natural attenuation would achieve the groundwater cleanup levels in the overburden in approximately 15.6 years, and in the bedrock aquifer in approximately 6 years. These results were obtained by simulating the flow of groundwater and the migration and attenuation of two COCs, 4-methylphenol and 2-butanone. Since these compounds were 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. Based on calibration to 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. Uncertainties in the model predictions arose from the inability to simulate complexities in the aquifer/plume system and the limited water quality data for calibration.

Previous review of historical groundwater quality data indicated that the concentrations of Site-related constituents are either remaining relatively stable, or are decreasing over time. Geochemical evidence that indicated subsurface conditions are amenable for microbially-mediated degradation included the following:

- an abundance of dissolved organic carbon that can be used 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.

Recently, a long-term groundwater-monitoring program was initiated that is designed to assess the progress of natural attenuation over time. The results from the first round of this monitoring program are shown in Table 5. Based on a preliminary review of this recent data, Site-related constituents continue to remain relatively stable, or are decreasing over time. Isoconcentration contour plots for total VOCs and SVOCs and total are shown in Figures 4 through 7. Additional interpretation of these data, including a more detailed evaluation of progress towards meeting RAOs, will occur in future periodic reports, including future five-year Reviews.

7.3 Other information that could call into question the protectiveness of the remedy

There is no other information that calls into question the protectiveness of the remedy.

7.4 Technical Assessment Summary

The review of documents, ARARs, risk assumptions, and the results of the Site inspection indicate that the remedy is functioning as intended by the ROD. The exposure assumptions, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection remain still valid. Some changes in agency-recognized toxicity factors have occurred for selected Site-related chemicals, but these changes have not affected cleanup levels, nor are they expected to significantly affect overall Site risk. Long-term monitoring data indicate that groundwater plume is relatively stable or shrinking, and that acceptable progress is being made towards meeting RAOs.

8 ISSUES

As of the date of this writing, there have been no problems or issues encountered during sampling, other than the inability to collect samples from three Site groundwater monitoring wells (MW-113I, MW-113D, MW-4R), due to damage and/or obstructions. These wells are not critical to assess the performance of MNA at the Site and there is no current plan to replace them.

The other issue encountered during groundwater sampling in April and May 2003 included the discovery of four 55-gallon drums at well MW-111. Two of the drums were rusted and empty. The other two drums contained approximately 2 to 20 gallons of purge water based on the label on the drums. No visual or olfactory evidence of OHM (Oil / hazardous materials) was encountered within or in the area surrounding the drums. Samples were collected from each drum and analyzed for VOCs and metals. CTDEP was present during sampling activities. No VOCs were detected and the metals detected were consistent with purge water. Based on these results, the drums were removed by the RRDD with the water placed in the leachate-holding tank for disposal.

Neither of the issues set forth above affect the protectiveness of the remedy.

9 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Refer to Table 8 for a listing of recommendations and follow-up actions.

10 PROTECTIVENESS STATEMENT

This five-year review has found that the remedy is functioning as designed. The immediate threats to human health and the environment have been addressed by capping the landfill. The selected groundwater remedy is MNA. Once the groundwater cleanup goals have been achieved, in approximately 16 years (see O'Brien & Gere Engineers, Inc. 2001a), the groundwater remedy will be protective of human health and the environment. In the interim, exposure pathways that could result in unacceptable risks are being controlled. Environmental Land Use Restrictions (ELURs), which prohibit the installation of drinking water wells, have been placed on the main facility property.

11 NEXT REVIEW

The due date for the second five-year review is September 15, 2008.

REFERENCES

- Fuss & O'Neill 1992. RRDD#1 Landfill Closure Plan, Barkhamsted CT, September.
- O'Brien & Gere Engineers, Inc. 1996. Remedial Investigation (RI) -Barkhamsted-New Hartford Landfill Superfund Site. February.
- O'Brien & Gere Engineers, Inc. 1997. Remedial Action Plan for Non-Time Critical Removal Action, Barkhamsted-New Hartford Landfill Superfund Site.
- O'Brien & Gere Engineers, Inc. 2001a. Feasibility Study-Barkhamsted-New Hartford Landfill Superfund Site. June.
- O'Brien & Gere Engineers, Inc. 2001b. Operation and Maintenance manual-Barkhamsted Landfill Pleasant Valley, Connecticut Landfill Closure. October.
- State of Connecticut Department of Environmental Protection 1990. Consent Order #SRD-072 between the State of Connecticut and the Regional Refuse Disposal District No. 1.
- United States Environmental Protection Agency (U.S. EPA) 1991. Administrative Order on Consent. Docket #I-91 –1128 between the EPA, the State of Connecticut, and the PRP Group. October 4.
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- United States Environmental Protection Agency (U.S. EPA) 2001b. EPA Superfund Record of Decision: Barkhamsted – New Hartford Landfill, EPA ID: CTD980732333, OU1, Barkhamsted, CT. EPA/OD/R01-01/001, September 28.
- United States of America and State of Connecticut v. Regional Refuse Disposal District No. 1, et al. 2003. Consent Decree, U.S. District Court for the District of Connecticut. May 7.



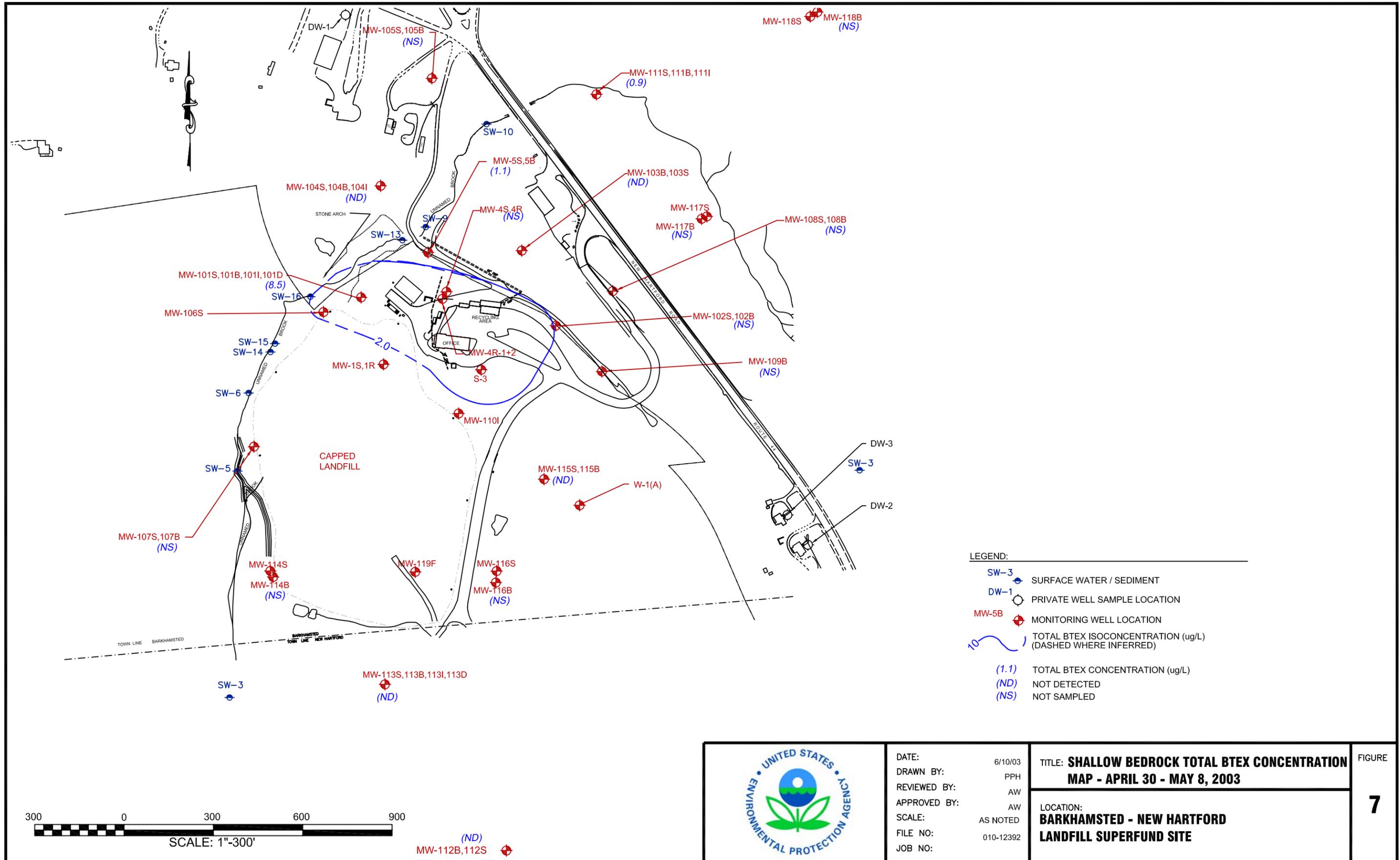
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 APPROVED BY: AW
 SCALE: AS NOTED
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 JOB NO: 010-12392

TITLE:
TOPOGRAPHIC MAP

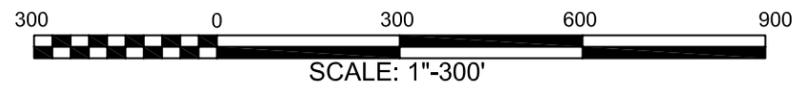
LOCATION:
**BARKHAMSTED - NEW HARTFORD
 LANDFILL SUPERFUND SITE**

FIGURE:

1



- LEGEND:**
- SW-3 SURFACE WATER / SEDIMENT
 - DW-1 PRIVATE WELL SAMPLE LOCATION
 - MW-5B MONITORING WELL LOCATION
 - 10 TOTAL BTEX ISOCONCENTRATION (ug/L) (DASHED WHERE INFERRED)
 - (1.1) TOTAL BTEX CONCENTRATION (ug/L)
 - (ND) NOT DETECTED
 - (NS) NOT SAMPLED



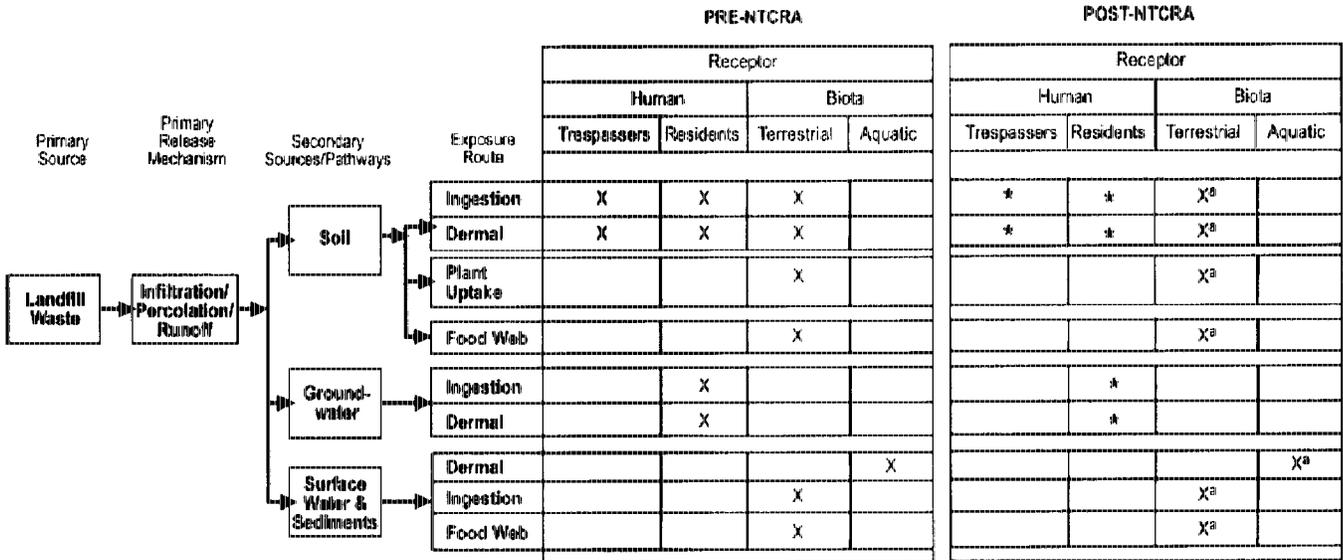
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 DRAWN BY: PPH
 REVIEWED BY: AW
 APPROVED BY: AW
 SCALE: AS NOTED
 FILE NO: 010-12392
 JOB NO:

TITLE: **SHALLOW BEDROCK TOTAL BTEX CONCENTRATION MAP - APRIL 30 - MAY 8, 2003**

LOCATION: **BARKHAMSTED - NEW HARTFORD LANDFILL SUPERFUND SITE**

FIGURE **7**

Figure 8
Potentially complete exposure pathways (from USEPA, 2001)



* Exposure prevented by capping or institutional controls
X^a Exposure only to media outside of cap

TABLE 1 - CHRONOLOGY OF SITE EVENTS

TABLE 2: CONTAMINANTS OF CONCERN AND OTHER TARGET ANALYTES

Medium/Matrix: Groundwater

<i>Benzene</i> ¹	<i>Toluene</i> ¹	Diethyl phthalate ²	Cadmium ²	Carbon disulfide ²
<i>1,2-dichloroethane</i> ¹	Ethylbenzene ²	Di-n-octyl phthalate ²	Calcium ²	Chlorobenzene ²
<i>1,2-dichloropropane</i> ¹	o-Xylene ²	Napthalene ²	Cobalt ²	Cis-1,2-Dichloroethene ²
<i>Chloroethane</i> ¹	p-Xylene ²	Phenol ²	Copper ²	Styrene ²
<i>Chloroform</i> ¹	m-Xylene ²	<i>Arsenic</i> ¹	Iron ²	<i>1,4-dichlorobenzene</i> ¹
<i>Chloromethane</i> ¹	Acetone ²	<i>Chromium (total)</i> ¹	Magnesium ²	1,2-dichlorobenzene ²
<i>Dibromochloromethane</i> ¹	<i>2-Butanone (MEK)</i> ¹	<i>Lead</i> ¹	Mercury ²	<i>Bis(2-ethyl hexyl)</i> <i>phthalate</i> ¹
<i>Methylene chloride</i> ¹	<i>4-methyl-2-pentanone</i> ¹	<i>Manganese</i> ¹	Nickel ²	<i>2,4-dimethylphenol</i> ¹
<i>Trichloroethene (TCE)</i> ¹	1,1,1-Trichloroethane ²	Aluminum ²	Potassium ²	<i>4-methylphenol</i> ¹
<i>Vinyl chloride (VC)</i> ¹	1,1-Dichloroethane ²	Antimony ²	Selenium ²	2-methylnapthalene ²
Tetrachloroethene	2-Hexanone ²	Barium ²	Silver ²	2-methylphenol ²
Trans-1,2-dichloroethene	Bromomethane ²	Beryllium ²	Sodium ²	Benzoic acid ²
Thallium ²	Dissolved ethene ³	Chemical Oxygen Demand (COD) ³	Vanadium ²	Zinc ²
Dissolved hydrogen ³	Ferrous Iron ³	Dissolved methane ³	Nitrite ³	Sulfate ³
Sulfide ³	Nitrate ³	Dissolved ethane ³		

NOTES

¹ Project action limit defined by Clean-Up levels designated in ROD (US EPA 2001b)

² Project action limit defined by Clean-Up levels designated in FS (O'Brien & Gere, 2001a)

³ Monitored Natural Attenuation (MNA) Parameters

Contaminants of Concern (italics) defined in ROD (US EPA 2001b)

TABLE 2: CONTAMINANTS OF CONCERN AND OTHER TARGET ANALYTES
(CONT'D)

Medium/Matrix: Leachate and Groundwater

Alkalinity
Ammonia
Chemical Oxygen
Demand
Specific Conductivity
Hardness (Metals)
pH
Total Sulfate
Chloride
Nitrate
Total Dissolved Solids
Total Suspended Solids

Medium/Matrix: Sediment

Benzo(a)anthracene	Arochlor-1254	Aluminum
Benzo(b)fluoranthene	Gamma-chlordane	Antimony
Benzo(a)pyrene	4, 4'-DDE	Arsenic
Indeno(1,2,3-cd)pyrene	4, 4'-DDT	Barium
Phenanthrene	Endosulfan II	Beryllium
Pyrene	Endrin	Chromium
Cobalt	Lead	Vanadium
Copper	Manganese	Zinc
Iron	Nickel	

Medium/Matrix: Leachate Seeps/Surface Water

Chloromethane	Benzene	Arsenic
1,2-Dichloropropane	Bromodichloromethane	Aluminum
Acetone	Chloroethane	Barium
Carbon disulfide	Chloroform	Copper
Methylene chloride	2,4-Dimethylphenol	Iron
Xylenes	Bis(2-ethylhexyl)phthalate	Cadmium
Phenol	Lead	Zinc
Chlorobenzene	Manganese	Copper
1,1,-Dichloroethane	Zinc	Chromium
Hardness (Metals)	4, 4'-DDE	4, 4'-DDT
Arochlor-1254		

Basis for Response Action

Remedy decision documents, and Federal and State laws and regulations, provide the basis upon which the remedy was selected or modified. The documents in the table below identify the background and goals of the remedy and changes in laws and regulations that may affect the remedy.

DOCUMENT	PURPOSE OF DOCUMENT	USE DURING FIVE-YEAR REVIEW
Remedial Investigation (RI) Barkhamsted-New Hartford Landfill Superfund Site O'Brien & Gere Engineers, Inc. February 1996	Records assessment findings.	Understanding of site conditions. Risk assessment.
Feasibility Study (FS) Report Barkhamsted-New Hartford Landfill Superfund Site O'Brien & Gere Engineers, Inc. June 2001	Reviews various remedial alternatives and ends in selection of remedial action	Selection of remedial action. Background information. Community concerns. Risk assessment.
EPA Superfund Record of Decision (ROD) Barkhamsted-New Hartford Landfill U.S. Environmental Protection Agency (U.S. EPA) September 28, 2001	Records remedial decision.	Background information. Goals for the remedy. Basis for action. Community concerns.
Federal environmental laws and regulations.	Statutory and regulatory requirements.	Changes in standards identified as ARARs in the ROD that provides a basis for cleanup levels/protectiveness of the remedy.
State environmental laws and regulations.	Statutory and regulatory requirements.	More stringent state environmental laws and regulations.

Implementation of the Response

Implementation documents furnish information about design assumptions, design plans or modifications, and documentation of the completion of construction at operable units (OUs) and the Site.

DOCUMENT	PURPOSE OF DOCUMENT	USE DURING FIVE-YEAR REVIEW
Remedial Investigation (RI) Barkhamsted-New Hartford Landfill Superfund Site O'Brien & Gere Engineers, Inc. February 1996	Records assessment findings	Understanding of site conditions. History and status of remedial action.
Feasibility Study (FS) Report Barkhamsted-New Hartford Landfill Superfund Site O'Brien & Gere Engineers, Inc. June 2001	Reviews various remedial alternatives and ends in selection of remedial action.	Selection of remedial action. Background information. History and status of remedial action.
EPA Superfund Record of Decision (ROD) Barkhamsted-New Hartford Landfill U.S. Environmental Protection Agency (U.S. EPA) September 28, 2001	Records remedial decision	Background information. Goals for the remedy. Basis for action. Community concerns.
Operation and Maintenance Manual Barkhamsted Landfill O'Brien & Gere Engineers, Inc. October 2001	Identify O&M activities at landfill and long-term groundwater monitoring program.	Long-term groundwater monitoring requirements. Background information. Construction and design information.

Remedy Performance

Monitoring data progress reports, and performance evaluation reports provide information that can be used to determine whether the remedial action continues to operate and function as designed, and has achieved, or is expected to achieve cleanup levels. The data presented in these documents can also provide trend analysis, which can be used to determine how well the remedy is performing and how long it may take to achieve remediation goals. These reports can also indicate whether monitoring activities are adequate to ensure the effectiveness of the remedy and whether these activities are being conducted.

DOCUMENT	PURPOSE OF DOCUMENT	USE DURING FIVE-YEAR REVIEW
Operation and Maintenance Manual Barkhamsted Landfill O'Brien & Gere Engineers, Inc. October 2001	Identify O&M activities at landfill and long-term groundwater monitoring program.	Long-term groundwater monitoring requirements. Background information.
Quarterly and Annual Monitoring reports Fuss & O'Neill, Inc. Annually to 2003	Results of CTDEP long-term monitoring program. Trend analysis.	Check whether COC are within established criteria. Evaluate progress of cleanup. Trend analysis for COCs, but no MNA data.
Quarterly monitoring data LFR, Inc. April-May 2003 (to be published in future Quarterly and Annual Monitoring reports)	Results of CTDEP and USEPA long-term monitoring program. Trend analysis.	Check whether COC are within established criteria. Evaluate progress of cleanup. Trend analysis for COCs, with MNA data.

Operation and Maintenance

O&M documents describe the ongoing measures at the Site to ensure the remedy remains protective. They provide the structure for the O&M at the Site and confirm that O&M is proceeding as planned.

DOCUMENT	PURPOSE OF DOCUMENT	USE DURING FIVE-YEAR REVIEW
Operation and Maintenance Manual Barkhamsted Landfill O'Brien & Gere Engineers, Inc. (2001a)	Identify O&M activities at landfill and long-term groundwater monitoring program.	Long-term groundwater monitoring requirements. Background information.
Quarterly and Annual Monitoring reports Fuss & O'Neill, Inc. Annually to 2003	Results of CTDEP long-term monitoring program. Document O&M activities and data.	Check whether COC are within established criteria and no unusual trends. Confirm activities are conducted and identify issues.

Legal Documentation

Legal documentation pertinent to the Site may specify responsibilities for conducting remedial actions, implementing institutional and access controls, O&M activities and performing elements of the five-year reviews.

DOCUMENT	PURPOSE OF DOCUMENT	USE DURING FIVE-YEAR REVIEW
Consent Decree Finalized May 7, 2003	Commitments/agreements regarding implementation and operation of the remedy and conduct of studies.	Responsibilities of the PRP for conducting remedial activities at the Site

Community Involvement

The community involvement plan (CIP) will provide a better understanding of the history of community involvement and of other activities at the Site. It will also help to identify community members who may be useful resources during interviews.

DOCUMENT	PURPOSE OF DOCUMENT	USE DURING FIVE-YEAR REVIEW
Feasibility Study (FS) Report Barkhamsted-New Hartford Landfill Superfund Site O'Brien & Gere Engineers, Inc. June 2001	Reviews various remedial alternatives and ends in selection of remedial action	Background information. Community concerns.
EPA Superfund Record of Decision (ROD) Barkhamsted-New Hartford Landfill U.S. Environmental Protection Agency (U.S. EPA) September 28, 2001	Records remedial decision.	Background information. Community concerns.
Community Involvement Plan Draft 2003	Site communication strategy that specifies outreach activities.	Community concerns/issues and identification of appropriate community members for interviews.

TABLE 3 - ANNUAL OPERATIONS/O&M COSTS

TABLE4 – REVIEW OF SITE RELATED DOCUMENTS

Basis for Response Action

Remedy decision documents, and Federal and State laws and regulations, provide the basis upon which the remedy was selected or modified. The documents in the table below identify the background and goals of the remedy and changes in laws and regulations that may affect the remedy.

DOCUMENT	PURPOSE OF DOCUMENT	USE DURING FIVE-YEAR REVIEW
Remedial Investigation (RI) Barkhamsted-New Hartford Landfill Superfund Site O'Brien & Gere Engineers, Inc. February 1996	Records assessment findings.	Understanding of site conditions. Risk assessment.
Feasibility Study (FS) Report Barkhamsted-New Hartford Landfill Superfund Site O'Brien & Gere Engineers, Inc. June 2001	Reviews various remedial alternatives and ends in selection of remedial action	Selection of remedial action. Background information. Community concerns. Risk assessment.
EPA Superfund Record of Decision (ROD) Barkhamsted-New Hartford Landfill U.S. Environmental Protection Agency (U.S. EPA) September 28, 2001	Records remedial decision.	Background information. Goals for the remedy. Basis for action. Community concerns.
Federal environmental laws and regulations.	Statutory and regulatory requirements.	Changes in standards identified as ARARs in the ROD that provides a basis for cleanup levels/protectiveness of the remedy.
State environmental laws and regulations.	Statutory and regulatory requirements.	More stringent state environmental laws and regulations.

Implementation of the Response

Implementation documents furnish information about design assumptions, design plans or modifications, and documentation of the completion of construction at operable units (OUs) and the Site.

DOCUMENT	PURPOSE OF DOCUMENT	USE DURING FIVE-YEAR REVIEW
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EPA Superfund Record of Decision (ROD) Barkhamsted-New Hartford Landfill U.S. Environmental Protection Agency (U.S. EPA) September 28, 2001	Records remedial decision	Background information. Goals for the remedy. Basis for action. Community concerns.
Operation and Maintenance Manual Barkhamsted Landfill O'Brien & Gere Engineers, Inc. October 2001	Identify O&M activities at landfill and long-term groundwater monitoring program.	Long-term groundwater monitoring requirements. Background information. Construction and design information.

Remedy Performance

Monitoring data progress reports, and performance evaluation reports provide information that can be used to determine whether the remedial action continues to operate and function as designed, and has achieved, or is expected to achieve cleanup levels. The data presented in these documents can also provide trend analysis, which can be used to determine how well the remedy is performing and how long it may take to achieve remediation goals. These reports can also indicate whether monitoring activities are adequate to ensure the effectiveness of the remedy and whether these activities are being conducted.

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Community Involvement

The community involvement plan (CIP) will provide a better understanding of the history of community involvement and of other activities at the Site. It will also help to identify community members who may be useful resources during interviews.

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EPA Superfund Record of Decision (ROD) Barkhamsted-New Hartford Landfill U.S. Environmental Protection Agency (U.S. EPA) September 28, 2001	Records remedial decision.	Background information. Community concerns.
Community Involvement Plan Draft 2003	Site communication strategy that specifies outreach activities.	Community concerns/issues and identification of appropriate community members for interviews.

Table 6
Changes in Cancer Toxicity Data

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor in ROD	Current Applicable Oral Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YY)
Arsenic	1.5	same	[(mg/kg)/day] ¹	A	IRIS	06/09/03
1,4-dichlorobenzene	.024	same	[(mg/kg)/day] ¹	C	HEAST	FY '97
Benzene	.029	0.055	[(mg/kg)/day] ¹	A	IRIS	06/09/03
1,2-dichloroethane	.091	same	[(mg/kg)/day] ¹	B2	IRIS	06/09/03
1,2- dichloropropane	.068	same	[(mg/kg)/day] ¹	B2	HEAST	FY '97
Chloroethane	.0029	same	[(mg/kg)/day] ¹	B2	NCEA	07/12/99
Chloroform	.0061	same	[(mg/kg)/day] ¹	B2	IRIS	06/09/03
Chloromethane	.013	same	[(mg/kg)/day] ¹	C	HEAST	FY '97
Dibromochloro-methane	.084	same	[(mg/kg)/day] ¹	C	IRIS	06/09/03
Methylene chloride	.0075	same	[(mg/kg)/day] ¹	B2	IRIS	06/09/03
Trichloroethene	.011	0.4	[(mg/kg)/day] ¹	B1	NCEA	8/01/01

Vinyl chloride	1.9	1.4	[(mg/kg)/day] ¹	A	IRIS	06/09/03
Bis(2-ethyl hexyl) phthalate	.014	same	[(mg/kg)/day] ¹	B2	IRIS	06/09/03
Key Changes since Record of Decision shown in boldface -: 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 that is relevant to the contaminants of concern in groundwater. At the time of writing the risk assessment, slope factors were not available for the dermal route of exposure. Thus, the dermal slope factors used in the assessment were 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.						

**Table 7
Changes in Non-Cancer Toxicity Data**

Pathway: Ingestion, Dermal

Chemical of Concern	Oral RfD Value in ROD	Current Applicable Oral RfD Value	Oral RfD Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source	Date (MM/DD/YY)
arsenic	0.0003	same	mg-kg/day	Skin	3	IRIS	06/09/03
chromium	0.003 (Cr VI)	same	mg-kg/day	----	900	IRIS	06/09/03
manganese	0.024	0.14	mg-kg/day	CNS	1	IRIS	06/09/03
acetone	0.1	same	mg-kg/day	Liver/Kidney	1000	IRIS	06/09/03
benzene	0.003	0.0004	mg-kg/day	----	300	IRIS	06/09/03
2-butanone	0.6	same	mg-kg/day	Developmental	3000	IRIS	06/09/03
1,2-dichloroethane	0.03	none	mg-kg/day	----	---	IRIS	06/09/03
1,2-dichloropropane	0.0011	none	mg-kg/day	---	---	IRIS	06/09/03
chloroethane	0.4	none	mg-kg/day	----	---	NCEA	07/12/99
chloroform	0.01	same	mg-kg/day	Liver	1000	IRIS	06/09/03
Dibromochloromethane	0.02	same	mg-kg/day	Kidney	1000	IRIS	06/09/03
4-methyl-2-pentanone	0.08	same	mg-kg/day	Liver/Kidney	3000	HEAST	FY '97
methylene chloride	0.06	same	mg-kg/day	Liver	100	IRIS	06/09/03
toluene	0.2	same	mg-kg/day	Liver/Kidney	1000	IRIS	06/09/03
trichloroethene	0.006	.0003	mg-kg/day	Liver/Kidney	3000	NCEA	08/01/01
bis(2-ethylhexyl)-phthalate	0.02	same	mg-kg/day	Liver	1000	IRIS	06/09/03
1,4-dichlorobenzene	0.03	---	mg-kg/day	----	---	IRIS	06/09/03

2,4-dimethylphenol	0.02	same	mg-kg/day	Blood	3000	IRIS	06/09/03
4-methylphenol	0.005	same	mg-kg/day	CNS	1000	HEAST	FY '97
Key: Changes since Record of Decision shown in boldface -: 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 non-carcinogenic risk information that 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. All RfD's are based on chronic toxicity. Dermal RfD values used in the risk assessment were extrapolated from oral values.							

2,4-dimethylphenol	0.02	same	mg-kg/day	Blood	3000	IRIS	06/09/03
4-methylphenol	0.005	same	mg-kg/day	CNS	1000	HEAST	FY '97
Key: Changes since Record of Decision shown in boldface -: 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 non-carcinogenic risk information that 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. All RfD's are based on chronic toxicity. Dermal RfD values used in the risk assessment were extrapolated from oral values.							

Table 8: Recommendations and Follow-Up Actions:

Issue	Recommendations and Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Three groundwater monitoring wells (MW113-I, MW113-D and MW4-R) were inaccessible.	Repair of damaged wells MW113-I, MW113-D and MW-4R do not appear necessary at this time, but the potential need for these wells will be evaluated further with new data.	PRP	USEPA; CTDEP	TBD	N	N
Discovery of drums containing suspect purged groundwater	Drums were removed and the contents placed in the leachate holding tank for disposal.	PRP	USEPA; CTDEP	Completed	N	N
More complete assessment of the MNA process between impacted and un-impacted areas.	Install new well couplet to the north of well MW-103 by the Barkhamsted DPW garage.	PRP	USEPA; CTDEP	Completed	N	N
Full delineation of the extent of the groundwater plume to the east.	Sample existing additional wells in future sampling events. The additional wells proposed to be sampled include wells MW-105S and B, MW-108 S and B, MW-109B, MW-117S and B and MW-118S and B.	PRP	USEPA; CTDEP	Completed	N	Y
On-Site ELUR	ELUR with CTDEP for signature, then it will be filed.	PRP	USEPA; CTDEP	Completed	N	Y
Off-Site ELUR	ELUR to be put out for public comment.	PRP	USEPA; CTDEP	December 2003	N	Y