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Five-Year Review Report

Second Five-Year Review Report

for

Hanscom Field/Hanscom Air Force Base Superfund Site

Bedford, Concord, Lexington, Lincoln

Middlesex County, Massachusetts

August 2002

PREPARED BY:

**Environmental Flight
66th Civil Engineering Squadron
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Approved by:

Date:


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SEP 13 2002



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September 23, 2002

Tom Best
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66 SPTG/CEV
Hanscom AFB, MA 01731

Re: *Second Five-Year Review Report for Hanscom Air Force Base*

Dear Mr. Best:

Thank you for the opportunity to review *Five-Year Review Report for Hanscom Field/Hanscom Air Force Base* dated August 2002. Upon review, the EPA concurs with the finding that all remedies as implemented, or in the process of being implemented, by Hanscom are protective of human health and the environment per the protectiveness statements in the Report.

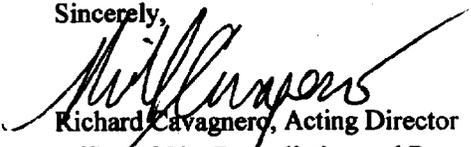
The Report includes reviews for OU's 1, 2, and 3 and is consistent with EPA's *Comprehensive Five Year Review Guidance, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-03B-P* (June 2001). For sites which do not yet have a final remedy in place (OU1 and OU3, Site 21), Hanscom's commitment to pursue the CERCLA cleanup process to a successful conclusion is clear. In the interim, both sites have (or had) interim remedial actions in operation and access is restricted to minimize/control potential threats to human health.

The second five-year review was triggered by the first five-year review on September 30, 1997. Consistent with Section 121(c) of CERCLA and *(OSWER) Directive 9355-03B-P*, the next statutory required five-year review must be finalized prior to September 30, 2007.

EPA concurs with the findings and recommendations in the review. We also acknowledge Hanscom's commitment to operate Boundary Interceptor Well #1 (BIW1) through a final ROD for OU1. From our perspective, this well should be pumped as long as it is withdrawing significant VOC concentrations. If in the future it appears that the extraction system could be secured for remediation of Hanscom confirmed sources, consultation as to who should undertake operation of BIW1 should take place prior to securing it.

Finally, EPA would like to commend you on a comprehensive, detailed review that you performed in house. If you have any questions please contact me at 617-918-1344 or barry.michael@epa.gov.

Sincerely,


Richard Cavagnero, Acting Director
Office of Site Remediation and Restoration

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Five-Year Review Report

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List of Acronyms

1,2-DCE	1,2-dichloroethene
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
ARAR	Applicable or Relevant and Appropriate Requirement
AST	Aboveground Storage Tank
BIW	Boundary Interceptor Well
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cfs	Cubic feet per second
cis	cis-1,2-dichloroethene
COC	Contaminant of Concern
CoE	U.S. Army Corps of Engineers
DEA	Debris Excavation Area
DD	Decision Document
DNAPL	Dense Non-Aqueous Phase Liquid
DoD	Department of Defense
ESC	Electronic Systems Center
EWRA	East Wetland Remediation Area
FAA	Federal Aviation Administration
FS	Feasibility Study
GAC	Granular Activated Carbon
GC	Gas Chromatograph
gpm	gallons per minute
H&A	Haley & Aldrich, Inc.
HI	Hazard Index
IC	Institutional Controls

List of Acronyms – Continued

IROD	Interim Record of Decision
IRP	Installation Restoration Program
IW	Interceptor Well
LNAPL	Light Non-Aqueous Phase Liquid
LTMP	Long Term Monitoring Plan
LUC	Land Use Controls
MA DEP	Massachusetts Department of Environmental Protection
MASSPORT	Massachusetts Port Authority
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
MCP	Massachusetts Contingency Plan
mgd	million gallons per day
MSL	mean sea level
NCP	National Oil and Hazardous Substances Contingency Plan
NFRAP	No Further Response Action Planned
NPL	National Priorities List
O&M	Operation and Maintenance
O,M&M	Operation, Maintenance and Monitoring
ORC	Oxygen Release Compound
OSRR	Office of Site Remediation and Restoration
OU	Operable Unit
OW	Observation Well
PAH	Polynuclear Aromatic Hydrocarbon
ppb	Parts per billion
ppm	Parts per million

List of Acronyms – Continued

PSG	Professional Services Group, Inc.
RA	Remedial action
RAB	Restoration Advisory Board
RAO	Remedial Action Objectives
RAO (MCP)	Response Action Outcome
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCADA	Supervisory control and data acquisition system
SVE	Soil Vapor Extraction
SVOC	Semi-volatile organic compound
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbon
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VER	Vapor Enhanced Recovery
VOC	Volatile organic compound
WWRA	West Wetland Remediation Area

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Executive Summary

This is the second five-year review for the Hanscom Field/Hanscom AFB Superfund Site. The triggering action for this review is the date of the Five-Year Review Report #1, as shown in EPA's WasteLAN database: September 15, 1997. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants are or will be left on site above levels that allow for unlimited use and unrestricted exposure.

The Department of Defense (DoD) initiated its Installation Restoration Program (IRP) concurrently with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (as amended by the Superfund Amendments and Reauthorization Act (SARA) with the overall goal of cleaning up contamination on DoD installations. The USAF began implementing the IRP at Hanscom AFB during the 1980s with initial surveys and records reviews to identify potentially contaminated sites. Subsequently Hanscom AFB, including Hanscom Field, was listed on the USEPA National Priorities List (NPL) in 1994. Of the 22 individual Hanscom AFB IRP sites with known or suspected contamination, 6 with on-going or pending remedial actions have been designated as CERCLA sites and fall under jurisdiction of the United States Environmental Protection Agency (USEPA) and are the subject of this review. These CERCLA sites were grouped into the following three Operable Units (OUs):

Operable Unit 1

- IRP Site 1 Fire Training Area II
- IRP Site 2 Paint Waste Disposal Area
- IRP Site 3 Jet Fuel Residue/Tank Sludge Disposal Area

Operable Unit 2

- IRP Site 4 Sanitary Landfill

Operable Unit 3

- IRP Site 6 Landfill/Former Filter Beds
- IRP Site 21 Unit 1 Petroleum Release Site

The location of these three Operable Units is shown in **Figure 1**.

Pre-NPL Remedial Action Plans for Hanscom Field Sites (IRP Sites 1, 2, 3/5 and 4): In 1985 Haley & Aldrich, Inc. (H&A) was retained to conduct investigations and prepare Remedial Action Plans for IRP Sites 1 through 5 on Hanscom Field. Field investigation of the sites was conducted by H&A in 1985 and 1986. The results of this field work are included in Appendix F of the report entitled *Installation Restoration Program, Phase IV-A, Hanscom AFB Area I*. Based on the results of the field investigation H&A prepared a "Remedial Action Plan" for each site. Following public review of the plans, Hanscom AFB documented selection of each site's Remedial Action Plan in a *Decision Paper, Area 1 (Sites 1-5)* dated April 6, 1988. This Decision Paper was approved by the Base Commander on April 20, 1988. Please note that the Remedial Action Plan entitled IRP Sites 3/5 noted that "... field investigations have failed to indicate that fire training activities or any contamination associated with those activities can be attributed to Site 5." Thus this Remedial Action Plan did not address Site 5 and a "Decision Document for Close-Out" for Site 5, was signed by the Base Commander on 27 September 1991. This Decision Document included the determination "... that there is no basis for the existence of this site." and the declaration that "... the selected remedy is no action and the site is hereby closed-out." Regulatory confirmation of the close out of IRP Site 5 was also subsequently documented in the OU-1 Interim Record of Decision (IROD).

The Remedial Action Plans for IRP Sites 1, 2 and 3 included the removal of drums and/or visibly contaminated soil in 1988; construction of a groundwater collection, treatment and recharge system which commenced operation in 1991; and a long term groundwater and surface water monitoring program. The groundwater collection system included collection trenches at each of the three sites and four (4) boundary interceptor wells along the Hanscom Field/Hanscom AFB northern property boundary with the Town of Bedford's property. The purpose of these wells is to intercept any contamination migrating off the airfield complex through the lower/glacial till and/or bedrock aquifers.

The Remedial Action Plan for IRP Site 2, the former Hanscom AFB municipal landfill, included a low permeable cap, drainage measures and a compensatory wetland completed in 1988 and long-term monitoring program conducted between December 1989 and September 1992.

OU-1/IRP Sites 1, 2 & 3: Following designation of Hanscom Field/Hanscom AFB as a NPL site, USEPA became the lead regulatory agency and IRP Sites 1, 2 and 3 were grouped into Operable Unit 1 to facilitate further response actions. These three sites are confirmed groundwater contamination source areas with some residual soil contamination. Contaminants of Concern (COCs) at OU-1 consist of chlorinated and aromatic volatile organic compounds (VOCs), with the contaminants with highest concentrations being trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE) and vinyl chloride. Dense non-aqueous phase liquid (DNAPL) is known to be present at Site 1 and is suspected to be present in other areas within OU-1. While the extent of the DNAPL is not fully known it is believed to be fully contained and within the capture zone of the existing collection system

IRP Site 1, located at the north end of the airfield was reportedly used from the late 1960s through 1973 for fire training exercises. It is situated in the town of Bedford. Two (2) burn pits were used at this site. Waste oils, solvents, paint thinners, and degreasers were collected from around the base, dumped into pits, ignited, and then extinguished. Occasionally, aircraft wrecks and fuselages were burned in the pits. The size of the pits was estimated to be 15 feet by 20 feet. There is no information indicating that a liner or containment was used at these pits.

IRP Site 2, located in the northeast portion of the airfield, was used for disposing of waste solvents and paint from 1966 to 1972. It is situated in the town of Bedford. Metal plating wastes may also have been disposed in this area from the early 1960s through 1972. During the removal action discussed in the Initial Response section four (4) drum burial pits of various size were found and excavated. There is no information indicating whether any type of liner or containment was used at these pits.

IRP Site 3, located in a triangular area in the western portion of the airfield bounded by Taxiway "Whiskey" to the north, Taxiway "Mike" to the southwest and Runway 5-23 to the southeast. It is situated in the town of Concord. According to the Phase I Records Search, several hundred drums of waste oils and paint wastes were buried at the Jet Fuel Residue Area during the period of 1959 to 1969. Disposal at the Tank Sludge Area, which is located within the same triangular area and to the northwest of the Jet Fuel Residue Area, reportedly occurred during the early 1960's. Because of the close proximity of this site to the Jet Fuel Residue Area, they were discussed and evaluated as one site. During the removal action discussed in the Initial Response section ten (10) drum burial pits of various size were found and excavated. There is no information indicating whether any type of liner or containment was used at these pits.

As stated above, Remedial Action Plans for IRP Sites 1, 2 and 3 were developed and implemented prior to the NPL designation. Subsequently, in 1995, USEPA advised that additional studies were necessary to ensure that these earlier actions fully addressed CERCLA requirements. Using the results of all previous investigations a *Final Ecological Risk Assessment, OU1* (dated January 1999) and a *Focused Feasibility Study, OU1* (dated May 2000) were completed. This effort included groundwater flow and solute transport models, and an evaluation of the soil-to-groundwater contaminant transport pathway for human health risk assessment. Based on these reports and the presence of DNAPL in the bedrock fractures, the Project Team concluded that it was not prudent to select a final remedy at this time since compliance with Applicable or Relevant and Appropriate Requirements (ARARs) would not be attained in the existing groundwater contaminant plume in the short-term. It was determined that an Interim remedial action should be selected/implemented and an *Interim Proposed Plan for Hanscom AFB Operable Unit 1* (dated June

2000) was prepared. The public review of this plan, to include a Public Information Meeting and Public Hearing on June 28, 2000, was completed in July 2000 without comment.

Subsequently an *Interim Record of Decision*, dated November 2000, selecting the remedy for OU1 was signed by the Air Force on January 24, 2001 and by USEPA on February 6, 2001. The Commonwealth of Massachusetts formally concurred with this IROD by letter dated December 27, 2000. The selected interim remedial action for cleaning up OU-1/IRP Sites 1, 2 and 3 includes continued operation of the existing dynamic groundwater collection and treatment system, implementation of institutional controls, and monitoring of groundwater and surface water.

The assessment of this five-year review found that the remedy at OU-1/IRP Sites 1, 2 and 3 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The OU-1 remedy is intended to be an interim remedial action while additional information is gathered to support a final remedy that will be targeted at remediating all or part of the groundwater plume. Current monitoring data indicate that the remedy is functioning as intended and all threats at the site have been addressed through physical (contaminated soil removal, fencing, recharge basins) and institutional controls. Current data indicate that the OU-1 RA has been and continues to be successful in cleaning up the surface water and surface aquifer and in containing/ capturing lower and bedrock aquifer contamination at the boundary. Current data also indicate that concentrations in the off-site plume are declining.

OU-2/IRP Site 4: IRP Site 4 was used as the Hanscom AFB municipal waste landfill from December 1964 until December 1974. The site covers 10.5 acres and is located approximately 1,800 feet southeast of the approach end of Runway 5-23 on Hanscom Field. The landfill is situated predominantly in the town of Lincoln, with a small portion protruding into the bordering town of Concord. Pre-1964 topographic maps of the area indicate that the site was a wetland area associated with Elm Brook. During its active life, the landfill was intended to be primarily for the disposal of solid waste. However, the *Installation Restoration Program Phase I – Records Search* report states that interviews with Base personnel confirmed that dumpsters containing waste from all shops and research laboratories were emptied into the landfill during its 10-year operation. No attempt was made to segregate hazardous materials from nonhazardous materials. The landfill ranges from 10 to 15 feet deep and is estimated to have a volume of 210,000 cubic yards. As discussed above the remedial action constructed in 1988 placed an impervious cap over the area. The area is also bermed with drainage ditches to channel runoff from the capped area to the wetlands. Today the area is grassed open space with a softball field in the southern half.

Following the listing of Hanscom Field/Hanscom AFB on the NPL, USEPA requested that CERCLA Human Health and Ecological Risk Assessments, to include Supplemental Sampling and Analysis, be completed for IRP Site 4. The site was also designated Operable Unit 2 at this time. The additional monitoring was conducted and the CERCLA risk assessments were completed. Subsequently USEPA determined that the Remedial Action completed in 1988 was acceptable as a final remedial action. The Project Team (Hanscom AFB, USEPA & MA DEP Remedial Project Managers) concluded that additional long-term monitoring data was not required but Five-Year Reviews of the remedial action were appropriate. USEPA and Hanscom AFB completed a site inspection in May 1997 and USEPA issued "*Five-Year Review Report #1, Hanscom Air Force Base Superfund Site, Middlesex County, Massachusetts*" dated September 1997. This review concluded "based on the field inspection, and human health and ecological risk assessment, protectiveness of the landfill cap at Site 4 has been demonstrated" however, the review did identify a requirement to remove scrub brush growing in the drainage ditches and on sections of the cap and berms and for a long-term inspection/maintenance program to be instituted. The field work to remove the scrub brush was completed in the spring of 1998 and a long-term inspection and maintenance program has been instituted.

The assessment of this five-year review found that the remedy at OU-2/IRP Site 4 is protective of human health and the environment. The assessment found that the recommendations of the 1st Five-Year Review

have been implemented and that a long-term inspection and maintenance program is in place to ensure continued protectiveness of the remedy. The protectiveness the landfill cap had previously been confirmed by the long-term monitoring conducted between December 1989 and September 1992, Supplemental Sampling and Analysis conducted in 1995 and 1996, the Human Health and Ecological Risk Assessments completed in 1997, and the 1st Five-Year Review conducted in 1997. Quarterly inspections since 1998 confirm that there have been no changes of any kind since the 1st Five-Year Review conducted in 1997 that could affect the protectiveness of the remedy.

OU-3/IRP Site 6: OU-3/IRP Site 6 is approximately 15 acres in area and is located in the northeast portion of Hanscom AFB. It is situated in both the town of Bedford and the town of Lexington. The site is bounded to the north by a former railroad spur, to the northeast by a wetland area and small pond, to the east by a commercial industrial park, to the south by a service road (Hunter Street), and to the west by IRP Site 21 (the former aviation fuel facility). IRP Site 6 consists of three distinct areas: the former filter beds (including the former sludge beds) and two (2) hillside landfill areas; the south landfill (including a suspected ash disposal area and Building 1855 Underground Storage Tank (UST) site); and the west landfill. The former filter bed area is higher than the wetlands to the north and was the location of the original sanitary waste treatment system (used from 1947 until the mid 1950's) for Hanscom AFB. This system, which was abandoned in place when the Base connected to a municipal sanitary waste system, consisted of an Imhoff Tank, Dosing Tank, Filter Beds (six (6) sand filled cells with a concrete berm surrounding each cell) and two (2) sludge beds. Following the abandonment of the treatment system, this area became a disposal site for municipal wastes, construction debris, and clean fill. As a result the filter beds were overlain by approximately 5 to 15 feet of solid waste material. Immediately adjacent to, and to the south of the filter bed area are two (2) hillside landfill areas (south and west). Disposal in these two areas was mainly clean fill and/or construction debris. The south landfill was originally graded into terraces, however, these were obliterated by dumping of clean fill from a building foundation excavation and construction debris in the late 80's/early 90's. The southernmost portion of the south landfill includes a suspected ash disposal area and the former location of an 1,000-gallon No. 2 fuel oil UST on the west side of Building 1855. When the UST tank was removed in 1990, evidence of a petroleum release was found. Building 1855 formerly housed an incinerator and is currently a licensed solid waste transfer station for Hanscom AFB.

The Remedial Investigation (RI) of the site was completed in 1998 and Human Health and Ecological Risk Assessments were completed in 1999. The human health risk assessment revealed that future industrial site workers potentially exposed to compounds of concern in surface soil. Also, future residential groundwater users may be exposed to an unacceptable human health risk that exceeds 10^{-4} (carcinogenic) and $HI > 1$ (noncarcinogenic). In addition, the ecological risk assessment revealed an unacceptable risk to soil invertebrates and animals feeding 100% of the time at the landfill areas (especially the suspected Ash Disposal Area), to benthic and water column organisms in the wetlands, and to the black-crowned night heron from DDT in the wetlands. Based on the RI and risk assessments a *"Focused Feasibility Study, Operable Unit 3, Site 6 – Landfill"* and a *"Proposed Plan for Hanscom AFB Operable Unit 3/Site 6"* were prepared. The public review of the Proposed Plan, to include an Information Meeting and Public Hearing on June 20, 2000, was completed in July 2000 without comment. Subsequently, a *Record of Decision*, dated September 2000, selecting the remedy for OU3/IRP Site 6 was signed by the Air Force on November 14, 2000 and by USEPA on December 5, 2000. The Commonwealth of Massachusetts formally concurred with this Record of Decision (ROD) by letter dated October 16, 2000.

The remedial action for cleaning up OU-3/IRP Site 6 includes containment/pervious capping of three landfill areas, removal of contaminated sediments and landfill debris from adjacent private property and placing of this material within the capped landfill area, long-term monitoring, and institutional controls. In addition, the remedy includes establishment of a groundwater compliance boundary and a Contingency Groundwater Remedy in the event monitoring results show that the remedy is not effective in maintaining groundwater quality outside the compliance boundary. The construction of the final remedy in accordance with the IRP Site 6 ROD was substantially completed in September 2001 and a long-term inspection, maintenance and monitoring program is currently in place.

The assessment of this five-year review found that the remedy at OU-3/IRP Site 6 currently protects human health and the environment in the short-term because construction has been completed and institutional controls have been implemented. However, in order for the remedy to be protective in the long-term, the following actions need to be taken: conduct groundwater, liquid seep and surface water monitoring to confirm that natural flushing and natural attenuation are reducing the size and strength of the contaminant plume within the compliance boundary and that groundwater quality is being met outside the compliance boundary. It is expected that it will take approximately three to five years to collect sufficient data to make a final protectiveness determination. Review of the *Remedial Action Report* confirms that the remedy was constructed in accordance with the Remedial Design and review of December 2001 and March 2002 inspection reports confirms that the remedy remains in place as constructed. Also in December 2001 the post-RA monitoring of the site was initiated with a baseline monitoring round which will be compared to future monitoring results to assess protectiveness.

OU-3/IRP Site 21: IRP Site 21 is an area with groundwater contamination and three separate areas of petroleum products floating on the water table. These areas are technically referred to as light non-aqueous phase liquid (LNAPL) pools. The site is approximately 5 acres in area, situated in the town of Bedford in the northeast portion of Hanscom AFB and adjacent to IRP Site 6. IRP Site 21 is the area of a former aviation fueling facility that was used for storage, off-loading, and dispensing of jet fuel and aviation gasoline from at least 1945 through 1973, and to store and distribute No. 2 fuel oil during the early 1970s. Fuel was stored in aboveground and underground storage tanks, which had associated pump houses and a network of underground piping. This area was also used for the storage of cleaning solvents and other petroleum products (oils and lubricants) associated with aircraft and vehicle maintenance.

Since the discovery of IRP Site 21 in 1990, several interim remedial actions have been conducted and the RI and risk assessments were completed in July 2000. Based on these documents and data gathered during the interim remedial actions, a *“Feasibility Study, Operable Unit 3/ Site 21”* dated June 2001 and *“Proposed Plan for Hanscom AFB Operable Unit 3/Site 21”* dated July 2001 were prepared. The public review of the Proposed Plan, to include a Public Information Meeting and Public Hearing on August 1, 2001, was completed in August 2001 without comment. Subsequently, a *Record of Decision*, dated October 2001 selecting the remedy for OU3/IRP Site 21 was signed by the Air Force on August 20, 2002 and is currently being staffed for USEPA’s signature. The Commonwealth of Massachusetts formally concurred with this ROD by letter dated January 22, 2002.

The construction of the final remedy in accordance with the IRP Site 21 ROD is programmed to commence by September 30, 2002. The selected remedial action for cleaning up OU-3/IRP Site 21 includes three interceptor trenches with passive recovery wells; removal and disposal of petroleum saturated soil encountered during trench construction; enhancement of biodegradation of groundwater contamination by ORC® application in all trenches; a network of active recovery wells connected to an existing treatment system; monitoring; land use controls/institutional controls; and groundwater containment/treatment and vacuum enhanced recovery (VER) contingencies. Pre-RA Monitoring of the site in accordance with the *Final Basewide Quality Assurance Project Plan for Long Term Monitoring at Operable Unit 1 and Operable Unit 3 (Site 6 and 21)* is already underway.

The assessment of this five-year review found that the remedy at OU-3/IRP Site 21 is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. Current monitoring data indicate that water quality of the adjacent Shawsheen River is not being threatened and that there is natural containment of the LNAPL and natural containment/apparent natural attenuation of the groundwater contamination. All threats at the site are currently being addressed through monitoring, land use controls and institutional controls.

Issues: The assessment of this five-year review found only one issue related to current site operations, conditions, or activities that affect current and/or future protectiveness of any of the Hanscom Field/Hanscom AFB remedies. This was a discolored liquid seeping from the former filter bed area of OU-3/IRP Site 6 into the wetland remediation areas. This liquid was analyzed during construction of the RA (August 2001) and found to have concentrations of some metals that exceeded one or more standards. At this time there is insufficient data to determine whether or not this condition affects the current or future protectiveness of the OU-3/IRP Site 6 remedy.

Recommendations and Follow-up Actions: The following are required and suggested improvements to current site operations, activities, remedy, or conditions. Hanscom AFB is responsible for their implementation with regulatory oversight by Massachusetts Department of Environmental Protection (MA DEP) and/or USEPA Region 1.

OU-1/IRP Sites 1, 2 and 3

- Incorporate IROD Institutional Controls in next formal revision of the Hanscom AFB General Plan. Note the base is in the process of contracting with a consultant to update the October 1998 General Plan which identifies the IRP Sites as areas with "Environmental Constraints". The update with the specific OU-1 Institutional Controls listed is planned to be published on/about October 2003.
- Continue efforts to establish Memoranda of Understanding with Massport and the Town of Bedford concerning the OU-1 Institutional Controls with objective of having both documents finalized by December 31, 2002.
- Continue on-going efforts to gather information to support a final OU-1 remedy that will be targeted at remediating all or part of the groundwater plume.
- Continue to share groundwater and surface water monitoring results with Massport, the Town of Bedford, and the Hanscom AFB Restoration Advisory Board (RAB).
- Formally revise the OU-1 Long Term Monitoring Plan in accordance with the recommendations listed in the OU1/IRP Sites 1, 2 and 3 Data Review Section with the objective of having this action finalized by December 31, 2002.
- Continue on-going efforts to find effective measures to reduce source area contamination, especially at IRP Site 1, in order to expedite groundwater cleanup.
- Continue interim cessation of active remediation of the IRP Site 3 source until monitoring indicates that it is still required or until a determination can be made that active remediation is no longer necessary.

OU-2/IRP Site 4

- Continue long-term inspection and maintenance program as recommended in the 1st Five-Year Review Report

OU-3/IRP Site 6

- Incorporate IROD Institutional Controls in next formal revision of the Hanscom AFB General Plan. Note the base is in the process of contracting with a consultant to update the October 1998 General Plan which identifies the IRP Sites as areas with “Environmental Constraints”. The update with the specific OU-1 Institutional Controls listed is planned to be published on/about October 2003.
- Install proposed compliance boundary wells with the objective of having the wells installed prior to September 30, 2002.
- Formally revise the OU-3/IRP Site 6 Long Term Monitoring Plan to add the sampling and analysis of any discolored liquid seeping from the Former Filter Bed into the wetland remediation areas with the objective of having this action finalized by December 31, 2002.

OU-3/IRP Site 21

- Incorporate ROD Land Use Controls/Institutional Controls in next formal revision of the Hanscom AFB General Plan. Note the base is in the process of contracting with a consultant to update the October 1998 General Plan which identifies the IRP Sites as areas with “Environmental Constraints”. The update with the specific OU-1 Institutional Controls listed is planned to be published on/about October 2003.

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Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (from WasteLAN): Hanscom Field/Hanscom AFB		
EPA ID (from WasteLAN): MA 8570024424		
Region: I	State: MA	City/County: Bedford/Middlesex
SITE STATUS		
NPL status: <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deleted <input type="checkbox"/> Other (specify)		
Remediation status (choose all that apply): <input checked="" type="checkbox"/> Under Construction <input checked="" type="checkbox"/> Operating <input checked="" type="checkbox"/> Complete		
Multiple OUs?* <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Construction completion date: ___ / ___ / _____	
Has site been put into reuse? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
REVIEW STATUS		
Lead agency: <input type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input checked="" type="checkbox"/> Other Federal Agency – US Air Force		
Author name: Thomas W. Best		
Author title: Installation Restoration Program Manager	Author affiliation: Hanscom Air Force Base	
Review period:** 01/01/2002 to 08/20/2002		
Date(s) of site inspection: 05/28/2002		
Type of review: <input checked="" type="checkbox"/> Post-SARA <input type="checkbox"/> Pre-SARA <input type="checkbox"/> NPL-Removal only <input type="checkbox"/> Non-NPL Remedial Action Site <input type="checkbox"/> NPL State/Tribe-lead <input type="checkbox"/> Regional Discretion		
Review number: <input type="checkbox"/> 1 (first) <input checked="" type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify)		
Triggering action: <input type="checkbox"/> Actual RA Onsite Construction at OU # _____ <input type="checkbox"/> Actual RA Start at OU# _____ <input type="checkbox"/> Construction Completion <input checked="" type="checkbox"/> Previous Five-Year Review Report <input type="checkbox"/> Other (specify)		
Triggering action date (from WasteLAN): 09/15/1997		
Due date (five years after triggering action date): 09/15/2002		

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]

Five-Year Review Summary Form, cont'd.

Issues: OU-3/IRP Site 6 - Discolored liquid seeping from the former filter bed area into the wetland remediation areas (WWRA & EWRA). This liquid was analyzed during construction of the RA (August 2001) and found to have concentrations of some metals which exceeded AWQC, MCL and/or MCP GW-1 Standards. At this time there is insufficient data to determine whether or not this condition affects the current or future protectiveness of the Site 6 remedy.

Recommendations and Follow-up Actions: Revise the OU-1 and OU-3/IRP Site 6 Long Term Monitoring Plans and continue long-term maintenance of OU-2/IRP Site 4 cap as recommended in the 1st Five-Year Review Report.

Incorporate OU-1 IROD, OU-3/IRP Site 6 and OU-3/IRP Site 21 ROD Land Use Controls/Institutional Controls in next formal revision of the Hanscom AFB General Plan.

Establish Memoranda of Understanding with Massport and the Town of Bedford concerning the OU-1 Institutional Controls and continue to share groundwater and surface water monitoring results with Massport, the Town of Bedford, and the Hanscom AFB Restoration Advisory Board (RAB).

Continue on-going efforts to find effective measures to reduce OU-1 source area contamination, especially at IRP Site 1, in order to expedite groundwater cleanup.

Continue on-going efforts to gathered information to support a final OU-1 remedy that will be targeted at remediating all or part of the groundwater plume.

Continue interim cessation of active remediation of the IRP Site 3 source until monitoring indicates that it is still required or until a determination can be made that active remediation is no longer necessary.

Install proposed OU-3/IRP Site 6 compliance boundary wells.

Protectiveness Statement(s):

OU-1/IRP Sites 1, 2 & 3: The remedy at OU-1 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

OU-2/IRP Site 4: The remedy at OU-2 is protective of human health and the environment.

OU-3/IRP Site 6: The remedy at OU-3/IRP Site 6 currently protects human health and the environment in the short-term because construction has been completed and land use/institutional controls have been implemented. However, in order for the remedy to be protective in the long-term, the following actions need to be taken: conduct groundwater, liquid seep and surface water monitoring to confirm that natural flushing and natural attenuation are reducing the size and strength of the contaminant plume within the compliance boundary and that groundwater quality is being met outside the compliance boundary. It is expected that it will take approximately three to five years to collect sufficient data to make a final protectiveness determination.

OU-3/IRP Site 21: The remedy at OU-3/IRP Site 21 is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

Other Comments: None

Five-Year Review Report

I. Introduction

The purpose of five-year reviews is to determine whether the remedies at a site are protective of human health and the environment or are expected to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

The United States Air Force is preparing this five-year review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 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 judgment of the President that action is appropriate at such site in accordance with section [104] or [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 United States Air Force interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR §300.430(f)(4)(ii) 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.

The United States Air Force has conducted a five-year review of the remedial actions implemented at the Hanscom Field/Hanscom AFB Superfund Site in Bedford, Concord, Lexington and Lincoln, Massachusetts. This review was conducted by the Hanscom Air Force Base Installation Restoration Program Manager from January 2002 through August 2002. This report documents the results of the review.

This is the second five-year review for the Hanscom Field/Hanscom AFB Superfund Site. The triggering action for this review is the date of the Five-Year Review Report #1, as shown in USEPA's WasteLAN database: September 15, 1997. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants are or will be left on site above levels that allow for unlimited use and unrestricted exposure.

II. Site Chronology

Table 1: Chronology of Site Events

Event	Date
Initial discovery of problem or contamination <ul style="list-style-type: none"> - IRP Sites 4 & 6 - IRP Site 2 & 3 - IRP Site 1 - IRP Site 21 	5 June 1981 25 June 1982 April 1983 14 June 1990
Pre-NPL responses <ul style="list-style-type: none"> - Hydrogeologic Investigation of Hanscom Field - Remedial Action Plans for IRP Sites 1 thru 5 - Design of IRP Site 1 Soil Removal - Design of IRP Sites 2 & 3 Drum Removal - Design of IRP Site 4 Soil Cap Old Landfill - IRP Phase II-Confirmation/Quantification-Stage 1 for IRP Sites 6 through 13 - Design of pump & treat system for Sites 1, 2 & 3 - IRP Site 1 Soil Removal - IRP Sites 2 & 3 Soil & Drum Removal - Construction of IRP Site 4 Soil Cap - RI/FS for IRP Sites 6, 8 & 13 - Construction of groundwater collection, treatment and recharge system for IRP Sites 1, 2 & 3 - Long-term Monitoring of IRP Site 4 (7 Rounds) - Long-term Monitoring of IRP Sites 1, 2 and 3/5 - IRP Site 21 Pilot Product Recovery - Operation of groundwater collection, treatment and recharge system for IRP Sites 1, 2 & 3 - Preliminary RI, IRP Site 21 - IRP Site 21 SVE & Groundwater/Product Recovery 	June 1982 – September 1984 September 1985 – May 1988 December 1986 – August 1987 December 1986 – August 1987 December 1986 – August 1987 November 1986 – August 1988 February 1987 – May 1988 September 1987 – August 1988 September 1987 – June 1988 September 1987 – September 1988 September 1987 – June 1992 September 1988 – January 1991 November 1989 – November 1992 November 1990; February – March 1991; August 1991 December 1990 – February 1991 23 April 1991 - present 1992 – March 1994 March 1993 – December 1993
NPL listing	31 May 1994
Removal actions - OU-3/IRP Site 21	September 1995 – Present
Remedial Investigation/Feasibility Study completed <ul style="list-style-type: none"> - OU-2/IRP Site 4 Supplemental Sampling - OU-2/IRP Site 4 Risk Assessments - OU-3/IRP Site 6 Supplemental RI - OU-1 Ecological Risk Assessment - OU-3/IRP Site 21 Remedial Investigation - OU-3/IRP Site 6 Risk Assessments - OU-3/IRP Site 6 Focused Feasibility Study - OU-3/IRP Site 6 Proposed Plan - OU-1 Focused Feasibility Study 	February 1996 April 1997 July 1998 January 1999 April 1999 July 1999 May 2000 May 2000 May 2000

Table 1: Chronology of Site Events

Event	Date
<ul style="list-style-type: none"> - OU-1 Interim Proposed Plan - OU-3/IRP Site 21 Supp. RI & Risk Assessments - OU-3/IRP Site 21 Feasibility Study - OU-3/IRP Site 21 Proposed Plan 	<ul style="list-style-type: none"> June 2000 July 2000 June 2001 July 2001
ROD signature <ul style="list-style-type: none"> - OU-3/IRP Site 6 ROD dated September 2000 - OU-1 IROD dated November 2000 - OU-3/IRP Site 21 ROD dated October 2001 	<ul style="list-style-type: none"> Air Force 14 November 2000 EPA 5 December 2000 Air Force 24 January 2001 EPA 6 February 2001 Air Force 20 August 2002 Pending
ROD Amendments or ESDs	N/a
Enforcement documents (CD, AOC, Unilateral AO)	N/a
Remedial design start <ul style="list-style-type: none"> - OU-1/IRP Sites 1, 2 & 3 - OU-2/IRP Site 4 - OU-3/IRP Site 6 - OU-3/IRP Site 21 	<ul style="list-style-type: none"> Pre-NPL Pre-NPL 27 September 1999 Pending
Remedial design complete <ul style="list-style-type: none"> - OU-1/IRP Sites 1, 2 & 3 - OU-2/IRP Site 4 - OU-3/IRP Site 6 - OU-3/IRP Site 21 	<ul style="list-style-type: none"> Pre-NPL Pre-NPL 13 April 2001 Pending
Superfund State Contract, Cooperative Agreement, or Federal Facility Agreement signature	N/a
Construction dates (start, finish) <ul style="list-style-type: none"> - OU-1/IRP Sites 1, 2 & 3 - OU-2/IRP Site 4 - OU-3/IRP Site 6 - OU-3/IRP Site 21 	<ul style="list-style-type: none"> Pre-NPL Pre-NPL 29 March 2001 - 17 September 2001 Pending
Construction completion date	Upon completion of IRP Site 21
Actual remedial action start <ul style="list-style-type: none"> - OU-1/IRP Sites 1, 2 & 3 - OU-2/IRP Site 4 - OU-3/IRP Site 6 - OU-3/IRP Site 21 	<ul style="list-style-type: none"> Pre-NPL Pre-NPL 18 September 2001 Pending
Final Close-out Report	N/a
Deletion from NPL	N/a
Previous five-year reviews	15 September 1997

III. Background

Physical Characteristics

Hanscom Field/Hanscom AFB is located in the central part of Middlesex County, Massachusetts, approximately 14 miles northwest of downtown Boston and 11.5 miles south of downtown Lowell, Massachusetts. The complex occupies land in the towns of Bedford, Concord, Lexington, and Lincoln (**Figure 1**). Topographically the Hanscom Field/Hanscom AFB area is located in a low-lying basin surrounded by hills. The relatively flat runway portion of Hanscom Field lies in the ancient lake bed of glacial Lake Concord. The ground surface elevation on this former lake bed ranges from 120 to 130 feet above mean sea level (MSL). The hills south of the air base, and Pine Hill to the west, rise to more than 200 feet MSL. Hills north of the airfield area are more subdued, but still rise above 150 feet MSL. Former glacial Lake Concord, and Hanscom AFB on its southern edge, drain to the Shawsheen River, which flows north-northeast from the site to join the Merrimack River approximately 15 miles downstream. The topography and surficial geology of the Hanscom Field/Hanscom AFB area is illustrated in **Figure 2**.

The Department of Defense (DoD) initiated its Installation Restoration Program (IRP) concurrently with CERCLA (as amended by SARA) with the overall goal of cleaning up contamination on DoD installations. The USAF began implementing the IRP at Hanscom AFB during the 1980s with initial surveys and records reviews to identify potentially contaminated sites. Subsequently Hanscom AFB, including Hanscom Field, was listed on the USEPA National Priorities List (NPL) in 1994. Of the 22 individual Hanscom AFB IRP sites with known or suspected contamination, 6 with on-going or pending remedial actions have been designated as CERCLA sites and fall under jurisdiction of the USEPA and are the subject of this review. These CERCLA sites were grouped into the following three operable units:

Operable Unit 1

- IRP Site 1 Fire Training Area II
- IRP Site 2 Paint Waste Disposal Area
- IRP Site 3 Jet Fuel Residue/Tank Sludge Disposal Area

Operable Unit 2

- IRP Site 4 Sanitary Landfill

Operable Unit 3

- IRP Site 6 Landfill/Former Filter Beds
- IRP Site 21 Unit 1 Petroleum Release Site

The location of these three Operable Units is shown in **Figure 1**.

Upon the designation of Hanscom Field/Hanscom AFB as a NPL Site in 1994 USEPA reviewed the listing of all of the IRP sites to identify those not subject to CERCLA because of the CERCLA petroleum exclusion clause. IRP sites identified at this time as non-CERCLA sites included IRP Sites 9, 11, 12, 14, 15, 16, 17, 18. Subsequently, following additional review of site investigation data, IRP Sites 13 and 22 were also determined to be non-CERCLA sites. Please note that non-CERCLA/petroleum sites are regulated by the Massachusetts Contingency Plan (MCP) with regulatory oversight by the Massachusetts Department of Environmental Protection (MA DEP).

There are 16 IRP Sites not covered by this Five-Year Review because they have either been closed-out with regulatory concurrence or are non-CERCLA sites being regulated by the MCP. The status of these 16 sites is as follows:

IRP

<u>Site</u>	<u>Name</u>	<u>Status</u>	<u>Date</u>	<u>Document</u>
5	Fire Training Area I	Closed-out	9/27/1991	AF DD (note 1)
7	Industrial Wastewater Treatment System	Closed-out	1/22/1991	AF DD (note 2)
8	Scott Circle landfill	Closed-out	12/23/1991	AF DD (note 3)
9	Administration Building Jet Fuel Spill	Closed-out	1/22/1991	AF DD
10	Mercury Spill at Building 1128	Closed-out	12/19/1989	AF DD (note 2)
11	Various Fuel Spills on Runways & Taxiways	Closed-out	1/22/1991	AF DD
12	AAFES Service Station Gasoline Leak	Closed-out	1/22/1991	AF DD
13	Motor Pool Gasoline Leak	MCP LTM	1/19/1999	Class C RAO
14	Multi-site UST Investigation	Closed-out	10/19/2000	AF DD
15	Multi-site UST Removal	Closed-out	10/19/2000	AF DD
16	Contamination at Building T-860	Closed-out	9/30/1994	AF DD
17	Contamination at Building 1103	Closed-out	9/30/1993	AF DD
18	Contamination at Building 1102-C	Closed-out	9/30/1993	AF DD
19	Suspected Dump Site	Closed-out	9/30/1994	AF DD (note 2)
20	Suspected Fire Training Area	Closed-out	2/6/2001	OU-1 IROD
22	AAFES Service Station Petroleum Leaks	MCP LTM	8/26/1997	Class C RAO

Note 1 - Closed-out reconfirmed by OU-1 IROD

Note 2 - Closed-out reconfirmed by USEPA letter dated July 5, 2000

Note 3 - Closed-out reconfirmed by USEPA letter dated September 28, 2001

Land and Resource Use

Hanscom AFB is an active base owned and operated by the Federal government through the Department of the USAF. Hanscom AFB is home to the Electronic Systems Center (ESC), a dynamic nucleus of research and development. ESC is the USAF acquisition and development center for world-class command and control systems.

Hanscom Field, located adjacent to and north of the Base, is a civilian airport owned by the Commonwealth of Massachusetts and operated by the Massachusetts Port Authority (MASSPORT) and the Federal Aviation Administration (FAA). However, prior to 1973, the USAF leased the runways and flight line, that are now Hanscom Field, from the Commonwealth and the primary mission of Hanscom AFB was the operational maintenance of fighter aircraft and research and development support.

There are currently no plans to change the existing land use of Hanscom Field/Hanscom AFB in the future.

Groundwater beneath Hanscom Field/Hanscom AFB is not currently used as a drinking water supply, and it is not expected to be so used in the future. Nonetheless, MA DEP has classified groundwater in Hanscom Field/Hanscom AFB as being of "high use and value" and the groundwater in the Town of Bedford has been designated as GW-1 (i.e., as a potential future drinking water supply) under state law by means of a Town of Bedford Aquifer Protection District by-law that was enacted through a process authorized by MA DEP and implemented through the state regulations (MCP). However, MA DEP has classified sections of the area as a Non-Potential Drinking Water Source (Medium Yield). The MCP defines "Non-Potential Drinking Water Source" as, "Those portions of high and medium yield aquifers which may not be considered as areas of groundwater conducive to the locations of public water supplies." The MA DEP groundwater classification map is included as **Figure 3**.

A well inventory was conducted for Hanscom AFB by M&E as part of the Remedial Investigation of IRP Site 6. The objective of the well inventory was to identify and locate all public water supply wells, private drinking water wells, and industrial, irrigation, and monitoring wells within a three-mile radius of Hanscom AFB. Subsequently, in October 2000, officials from Hanscom AFB met with the Director of the Board of

Health in the Town of Bedford to review the location of any wells installed after the M&E survey. These surveys revealed that there are five private wells located within 1.4 miles of the northeastern corner of Hanscom AFB, in Bedford. The two nearest private wells are located 1.2 miles north-northeast, and 1.3 miles northeast of the northeastern corner of Hanscom AFB, respectively. The closest active public wells are the Town of Bedford Shawsheen Road Wellfield located approximately 2.3 miles northeast of the northeastern corner of Hanscom AFB.

OU-1/IRP Sites 1, 2 & 3: OU-1 includes part of Hanscom Field and wetland areas and a beaver pond area to the north/northeast of the airfield known as the Jordan Conservation Area and Hartwell Town Forest which is owned by the Town of Bedford. There are deed restrictions on the Bedford property which limit use to passive and/or active recreation use (per conversation with Ms. Elizabeth Bagdonas/Bedford Conservation Board). There is also a small section of OU-1 which is leased from the Commonwealth by Hanscom AFB and used as a campground and as the site of the central groundwater treatment facility for OU-1. The current Hanscom AFB Base General Plan (master plan) identifies this leased area as "Outdoor Recreation" in both the existing and future Land Use Plans. Potable water for the campground and treatment facility is provided by the Town of Lexington public water distribution system. Wetland B is a mature forested swamp associated with a tributary of the Shawsheen River. Wetland B was delineated and named during the Air Force Comprehensive Ecological Analysis by LEC in 1992-1995 (LEC, 1997). Since the LEC investigations, beaver have dammed the drainage channel resulting in a significant portion of the former wetland becoming inundated. Therefore, the nomenclature of Wetland B/beaver pond has been adopted to represent this mixed habitat.

IRP Site 1, situated in the town of Bedford, is a former Air Force fire training area located on a relatively flat plateau on the southeast side of Hartwell Hill and northwest of Hanscom Field Runway 5-23. The area is slightly higher than the runways and the wetlands to the northeast. This area was reportedly used for fire training from the late 1960s through 1973. Today the area is fenced open space.

IRP Site 2, situated in the town of Bedford, is the site of drum burial pits located on Hanscom Field north of Runway 11-29 and east of Runway 5-23 which were used for disposing of waste solvents and paint from 1966 to 1972. The area is the same elevation as the runways and is slightly higher than the wetlands to the north. Prior to the remedial activities discussed below the site was devoid of most vegetation, possibly because of the sand cap placed over the site following the burial of the drums. Today the area is grassed open space cover by a groundwater recharge system.

IRP Site 3, situated in the town of Concord, is the site of drum burial pits located on Hanscom Field in a triangular area bounded by Taxiway "Whiskey" to the north, Taxiway "Mike" to southwest and Runway 5-23 to the southeast. The area is the same elevation as the runways. Today the area is grassed open space cover by a groundwater recharge system.

OU-2/IRP Site 4: IRP Site 4 is a municipal waste landfill which covers 10.5 acres and is located approximately 1,800 feet southeast of the approach end of Runway 5-23 on Hanscom Field. Pre-1964 topographic maps of the area indicate that the site was a wetland area associated with Elm Brook. As discussed below the remedial action constructed in 1988 placed an impervious cap over the area. The area is also bermed with drainage ditches to channel runoff from the capped area to the wetlands. Today the area is grassed open space with a softball field in the southern half. The landfill is situated predominantly in the town of Lincoln, with a small portion protruding into the bordering town of Concord.

OU-3/IRP Site 6: OU-3/IRP Site 6 is approximately 15 acres in area and is located in the northeast portion of Hanscom AFB. The site is bounded to the north by a former railroad spur, to the northeast by a wetland area and small pond, to the east by a commercial industrial park, to the south by a service road (Hunter Street), and to the west by IRP Site 21, the former aviation storage facility. IRP Site 6 consists of three distinct areas: the former filter beds (including the former sludge beds) and two (2) hillside landfill areas (south and west). The former filter bed area is higher than the wetlands to the north. As discussed below the remedial action constructed in 2001 re-graded and placed a pervious cap over the three landfilled areas of the site.

Today IRP Site 6 is a grassed area which is fenced and locked. An area adjacent to the southeast portion of the site is used as a municipal waste transfer station for all municipal waste produced at Hanscom AFB and a sand and salt storage dome is located adjacent to the southwest corner of the site. Land use in adjacent and surrounding areas in close proximity to the site currently includes an occupied industrial park located to the east of the site, unoccupied wetland areas just north and northeast of the filter bed area, a former railroad spur to the north of the site, and an industrial area of the base to the west of the site. IRP Site 6 is situated in both the town of Bedford and the town of Lexington.

IRP Site 6 is classified in the Hanscom Air Force Base General Plan (master plan) as industrial in both the existing and future Land Use Plans. Based upon this designation there is a potential for future industrial use of the site. However, the General Plan also classifies IRP Site 6 as an area with "Severe Constraints" to ensure that any future change in land use does not increase the risk of exposure to waste/contaminated soils remaining on site and that groundwater within the compliance zone is not used for human consumption.

OU-3/IRP Site 21: OU-3/IRP Site 21 is approximately 5 acres in area, situated in the town of Bedford, in the northeast portion of Hanscom AFB and adjacent to IRP Site 6. IRP Site 21 is the area of a former aviation fueling facility that was used for storage, off-loading, and dispensing of jet fuel and aviation gasoline from at least 1945 through 1973, and to store and distribute No. 2 fuel oil during the early 1970s. Fuel was stored in aboveground and underground storage tanks, which had associated pump houses and a network of underground piping. This area was also used for the storage of cleaning solvents and other petroleum products (oils and lubricants) associated with aircraft and vehicle maintenance.

Today most of the northern half of the site is a controlled/fenced parking area for privately owned recreational vehicles and a controlled/fenced general purpose storage area for bulky items that can be stored in the open. The remainder of the northern half is used as a staging area for contractors working on the base. The southern half of the site includes Building 1823, which is currently used as the base entomology facility; a former aboveground storage tank (AST) area, which is currently used by the Base roads and grounds maintenance organization for equipment and materials storage, wood/brush chipping, and composting; and the access road to Building 1833 (Base maintenance shops), Building 1834 (family housing maintenance shop) and associated vehicle parking areas. The Shawsheen River bounds the site to the north.

The area of IRP Site 21 is classified in the Hanscom Air Force Base General Plan (master plan) as either "Industrial" or "Outdoor Recreational" in both the Current Land and Future Land Use Plans. The General Plan also shows the site with "Environmental Constraints" (because of IRP Site status and proximity to Shawsheen River) and with "Operational Constraints" (due to proximity to Hanscom Field). Through these measures the use of the site is well controlled and managed. There are currently no plans to change the existing use of IRP Site 21 in the future.

History of Contamination

Hanscom AFB's initial action in implementing CERCLA was the submission of *Notification of Hazardous Waste Site* forms to USEPA on 5 June 1981, which identified IRP Sites 4 and 6 as landfilled areas where hazardous waste may have been disposed. Following discussions with long-time employees, this initial notification was amended with the submission of additional *Notification of Hazardous Waste Site* forms to USEPA on 25 June 1982, which identified IRP Sites 2 and 3 as areas sites where hazardous waste may have been disposed. Also, in 1982 IRP actions at Hanscom Field/Hanscom AFB commenced with the conduct of a preliminary investigation of IRP Site 3. Subsequently Roy F. Weston, Inc. was retained by Hanscom AFB to conduct a hydrogeologic investigation at Hanscom Field to assess the potential for past waste disposal activities at Hanscom field to impact the water quality at the Town of Bedford's Hartwell Road wellfield.. This investigation confirmed the existence of contamination at IRP Sites 2 and 3 and also identified contamination in the area designated as IRP Site 1.

In 1984, JRB Associates, Inc. was retained by Hanscom AFB to complete an Installation Assessment/Records Search. The purpose of this investigation was to identify the potential for environmental contamination from past waste management practices, evaluate the probability of contaminant migration, and assess the potential hazard posed by past disposal activities. 5 of the 6 specific sites covered by this Five-Year Review (IRP Sites 1, 2, 3, 4, & 6) were documented in this report.

In June 1990, petroleum product identified as jet fuel (JP-4) was found in a foundation investigation boring for an addition to Building 1823 and in September 1990, during the cleaning of the abandon fuel transfer pipeline, No. 2 fuel oil was released from the end of the former rail tank car unloading header. Also, in December 1990 during the removal of abandoned underground tanks connected to the floor drains of the pump houses (Buildings 1818 and 1828), LNAPL was found in both of the UST excavations. Subsequently, the area of these discoveries was designated IRP Site 21.

OU-1/IRP Sites 1, 2 & 3: OU-1 is an area with groundwater contamination that includes three distinct areas of concern, known as IRP Sites 1, 2, and 3, which are all located on Hanscom Field. These three sites are confirmed groundwater contamination source areas with some residual soil contamination. Contaminants of Concern (COCs) at OU-1 consist of chlorinated and aromatic volatile organic compounds (VOCs), with the contaminants with highest concentrations being trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE) and vinyl chloride. Dense non-aqueous phase liquid (DNAPL) is known to be present at Site 1 and is suspected to be present in other areas within OU-1. While the extent of the DNAPL is not fully known it is believe to be fully contained and within the capture zone of the existing collection system.

IRP Site 1, located at the north end of the airfield was reportedly used from the late 1960s through 1973 for fire training exercises. Two (2) burn pits were used at this site. Waste oils, solvents, paint thinners, and degreasers were collected from around the base, dumped into pits, ignited, and then extinguished. Occasionally, aircraft wrecks and fuselages were burned in the pits. The size of the pits was estimated to be 15 feet by 20 feet (Figure 4). There is no information indicating that a liner or containment was used at these pits.

IRP Site 2, located in the northeast portion of the airfield, was used for disposing of waste solvents and paint from 1966 to 1972. Metal plating wastes may also have been disposed in this area from the early 1960s through 1972. During the removal action discussed in the Initial Response section four (4) drum burial pits of various sizes were found and excavated (**Figure 5**). There is no information indicating whether any type of liner or containment was used at these pits.

IRP Site 3, located in a triangular area in the western portion of the airfield bounded by Taxiway "Whiskey" to the north, Taxiway "Mike" to the southwest and Runway 5-23 to the southeast. According to the Phase I Records Search several hundred drums of waste oils and paint wastes were buried at the Jet Fuel Residue Area during the period of 1959 to 1969. Disposal at the Tank Sludge Area, which is located within the same triangular area and to the northwest of the Jet Fuel Residue Area, reportedly occurred during the early 1960's. Because of the close proximity of this site to the Jet Fuel Residue Area, both areas were discussed and evaluated as one site (**Figure 6**). During the removal action discussed in the Initial Response section ten (10) drum burial pits of various sizes were found and excavated. There is no information indicating whether any type of liner or containment was used at these pits.

OU-2/IRP Site 4: IRP Site 4, located on the southwestern corner of Hanscom Field, was used as the Hanscom AFB municipal waste landfill from December 1964 until December 1974 (**Figure 7**). During its active life, the landfill was intended to be used primarily for the disposal of solid waste. However, the *Installation Restoration Program Phase I – Records Search* report states that interviews with Base personnel confirmed that dumpsters containing waste from all shops and research laboratories were emptied into the landfill during its 10-year operation. No attempt was made to segregate hazardous materials from nonhazardous materials. A review of the 1980 chemical inventory and waste management practices of Hanscom AFB shops and resident research facilities revealed that the following types of compounds and associated empty containers were routinely discarded into dumpsters and disposed of in

the landfill: battery acid; bonding compounds; fuels; medical wastes; inks and paints; mercury; photographic chemicals (developers, fixers, toners); spent acids (HF, H₂SO₄, HCl, HNO₃); and trichloroethene (TCE) and other cleaning solvents. The landfill ranges from 10 to 15 feet deep and is estimated to have a volume of 210,000 cubic yards.

OU-3/IRP Site 6: IRP Site 6, located on the northeastern corner of Hanscom AFB, consists of three distinct areas: the former filter beds (including the former sludge beds); the south landfill (including a suspected ash disposal area and Building 1855 UST site); and the west landfill (Figure 8).

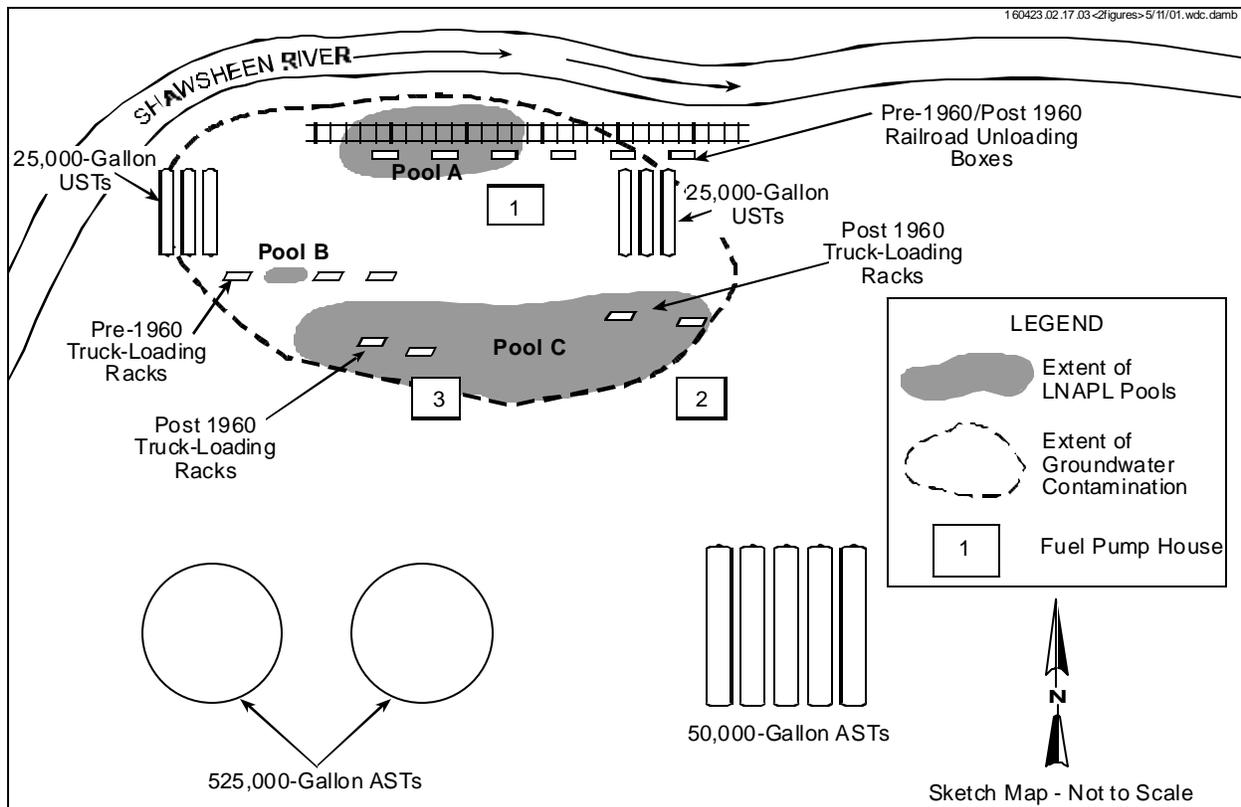
The former filter bed area was the location of the original sanitary waste treatment system (used from 1947 until the mid 1950's) for Hanscom AFB. This system, which was abandoned in place when the Base connected to a municipal sanitary waste system, consisted of an Imhoff Tank, Dosing Tank, Filter Beds (six (6) sand filled cells with a concrete berm surrounding each cell) and two (2) sludge beds. Following the abandonment of the treatment system, this area became a disposal site for municipal wastes, construction debris, and clean fill. The filter beds were overlain by approximately 5 to 15 feet of solid waste material. The *Installation Restoration Program Phase I – Records Search* reports an unauthorized release of 110 gallons of “Bar Kleen” and 80 gallons of “Inhibitor N-101 in the filter bed area in April 1983. These substances are boiler water treatment chemicals. Also reported were two (2) truckloads of No. 2 fuel oil soaked soil being dried on polyethylene sheets and 10-15 empty drums labeled as foaming grease. One drum was on its side and leaking rust colored liquid. Other documented releases included the burying of approximately 200 canisters of DDT in the late 1940's with about three-fourths of these canisters excavated in the early 1970s and transferred off-site. The remaining one-fourth of these canisters was deteriorated and could not be removed. Power line insulators, sod piles, and construction debris were reportedly stored on an abandoned concrete pad. A sign in the southeast corner of the filter bed area indicated that “leaded tank sludge buried here, do not excavate.”

Immediately adjacent to, and to the south of the filter bed area are two (2) hillside landfill areas (south and west). Disposal in these two areas was mainly clean fill and/or construction debris. The south landfill was originally graded into terraces at 160 to 180-foot MSL elevations, however, these were obliterated by dumping of clean fill from a building foundation excavation and construction debris in the late 80's/early 90's. The southernmost portion of the south landfill includes a suspected ash disposal area and the former UST location that was located on the west side of Building 1855. Building 1855 formerly housed an incinerator and is currently a licensed solid waste transfer station for Hanscom AFB. The UST was an 1,000-gallon steel tank used to store No. 2 fuel oil for Building 1855. This tank was installed in 1958 and removed in 1990. When the tank was removed evidence of a petroleum release was found.

OU-3/IRP Site 21: IRP Site 21 is an area with groundwater contamination and three separate areas with petroleum products floating on the water table. These areas are technically referred to as light non-aqueous phase liquid (LNAPL) pools. Several investigations have been conducted to determine what contamination exists, exactly where the contamination is located, and whether or how the contamination is moving. Concentrations of chlorinated VOCs, chlorinated benzenes, benzene, toluene, ethylbenzene, and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH) have been detected in various media at the site. Fortunately, it appears that the LNAPL pools and the groundwater contamination are not migrating and have not adversely impacted the Shawsheen River which is adjacent to the northern edge of the site. The stable nature of the product and dissolved-phase contamination is the result of the fine grained soils at the site which have high adsorptive qualities, and the natural biodegradation of the contaminants. In addition, the vertical migration of the dissolved-phase contamination is confined by a layer of glacial till that underlies the sand and gravel water table aquifer.

The diagram below presents the historical layout of the site. Prior to 1960 the fuel distribution and storage system at IRP Site 21 consisted of a railroad tank car siding where the fuel was unloaded, six 25,000-gallon underground storage tanks (USTs), and truck loading/unloading stations located on the northern portion of the site. Post-1960 the USTs and the truck loading/unloading stations were replaced

by two 525,000-gallon jet fuel and five 50,000-gallon aviation gasoline above-ground storage tanks (ASTs) and new truck loading/unloading stations located on the south side of the site. This post-1960 system also included three pump houses (#1, #2 & #3 in diagram below).



Initial Response

All of the following actions were conducted under the Air Force initiated CERCLA based IRP with the Massachusetts Department of Environmental Protection as the lead regulatory agency.

Remedial Action Plans for Hanscom Field Area 1 (IRP Sites 1, 2, 3/5 and 4): In 1985 Haley & Aldrich, Inc. (H&A) was retained to conduct investigations and prepare Remedial Action Plans for Area 1 on Hanscom Field which included IRP Sites 1 through 5 (**Figure 9**). Field investigation of the sites was conducted by H&A in 1985 and 1986. The results of this field work are included in Appendix F of the report entitled *Installation Restoration Program, Phase IV-A, Hanscom AFB Area I*. Based on the results of the field investigation H&A prepared a "Remedial Action Plan" for each site. Following public review of the plans, Hanscom AFB documented selection of each site's Remedial Action Plan in a *Decision Paper, Area 1 (Sites 1-5)* dated April 6, 1988. This Decision Paper was approved by the Base Commander on April 20, 1988. Please note that the Remedial Action Plan entitled *IRP Sites 3/5* noted that "... field investigations have failed to indicate that fire training activities or any contamination associated with those activities can be attributed to Site 5." Thus this Remedial Action Plan did not address Site 5 and a "Decision Document for Close-Out" for Site 5, was signed by the Base Commander on 27 September 1991. This Decision Document included the determination "... that there is no basis for the existence of this site." and the declaration that "... the selected remedy is no action and the site is hereby closed-out." Regulatory confirmation of the close out of IRP Site 5 was also subsequently documented in the OU-1 Interim Record of Decision (IROD).

The Remedial Action Plans for IRP Sites 1, 2 and 3 included the removal of drums and/or visibly contaminated soil; construction of a groundwater collection, treatment and recharge system; and a long term monitoring program. Also included were four (4) Boundary Interceptor Wells along the Hanscom AFB/Massport northern property boundary with the Town of Bedford's property. The purpose of these wells is to intercept any contamination migrating off the airfield complex through the lower/glacial till and/or bedrock aquifers.

The Remedial Action Plan for IRP Site 2, the former Hanscom AFB municipal landfill, included a low permeable cap, drainage measures, a compensatory wetland and long-term monitoring.

Remedial Action Design for Hanscom Field Area 1 (IRP Sites 1, 2, 3/5 and 4): H&A was also retained to design the remedial actions for IRP Sites 1, 2, 3/5 and 4. This effort commenced in December 1986 and was completed in August 1987.

Remedial Action Construction - IRP Site 1: In September 1987 Enroserv Inc. was awarded a contract for Soil Removal and Site Improvements at IRP Site 1. Field work commenced in the spring of 1988 and was completed in August 1988. There were three areas where visibly contaminated soils were excavated: Burn Pit #1, Burn Pit #1 Runoff Area, and Burn Pit #2 (**Figure 4**). A total of 2,160 tons of visibly contaminated soil was removed and transported to disposal facilities. Post-excavation survey data indicate that excavation depths averaged three to four feet in the two Burn Pits, and one to two feet in the Burn Pit #1 Runoff Area. These areas were backfilled with clean fill material.

Remedial Action Construction - IRP Sites 2 and 3: In September 1987 Hydro-dredge Corporation was awarded a contract for Drum Removal at IRP Sites 2 and 3. Field work commenced in October 1987 and was completed in June 1988. Buried drums were excavated from Sites 2 and 3 in January and February, 1988. The majority of the drums were empty and only 660 gallons of liquids were recovered. Site 2 contained 4 drum excavation pits (**Figure 5**) and Site 3 contained 10 drum excavation pits (**Figure 6**). A total of 1,896 tons of visibly contaminated soil was removed from the pits along with the drums and transported to licensed off-site disposal facilities. The pits were backfilled with the remaining excavated soil and 1,617 tons of clean fill with the intent that any residual contamination would be captured by the groundwater collection trench installed around the perimeter of the site.

Remedial Action Construction - IRP Site 4: In September 1987 WES Construction Corporation was awarded a contract for *Soil Cap Old Landfill* which included a low permeable cap, drainage measures, and a compensatory wetland. Field work commenced in April 1988 and was completed in September 1988 (**Figure 7**).

Remedial Action Construction – Groundwater Collection, Treatment and Recharge System for IRP Sites 1, 2 and 3: In September 1988 R. Zoppo Co., Inc. was awarded a contract to construct a groundwater collection, treatment and recharge system for IRP Sites 1, 2 and 3 (**Figure 10**). Components of the system included:

- central groundwater treatment facility
- underground piping and electrical to and from the treatment facility and remote groundwater collection points
- upper (surface/unconfined) aquifer groundwater collection trenches with pump station at each site
- groundwater recharge basins at IRP Sites 2 and 3
- four boundary interceptor wells (BIWs) aligned along the Hanscom AFB/Massport northern property boundary with the Town of Bedford's property. These wells are constructed to collect groundwater from both the lower and bedrock aquifers.

The contractor received a Notice to Proceed in December 1988 and startup testing of the completed project was conducted between November 1990 and April 1991.

Long-Term Monitoring of IRP Site 4: In 1989 Environmental Resources Management, Inc. was awarded a contract to conduct long-term monitoring of groundwater and surface water at IRP Site 4. A total of seven rounds of sampling were completed between December 1989 and September 1992. Environmental Resources Management's final report for this long-term monitoring was issued in November 1992.

Technical Document to Support No Further Action Planned, IRP Site 4: This document, which was signed by the Electronic System Center Commander on 30 September 1993, states that "A permanent response action solution has been achieved (landfill cap). Groundwater and surface water monitoring has determined that a condition of no significant risk of harm to health, safety, public welfare and the environment foreseeable future exists at the site. thus the selected remedy is the No further Action alternative and the site is hereby closed-out."

Remedial Action Operation – Groundwater Collection, Treatment and Recharge System for IRP Sites 1, 2 and 3: In January 1991 Metcalf & Eddy Services was awarded a contract for the operation and maintenance of the Groundwater Collection, Treatment and Recharge System for IRP Sites 1, 2 and 3. Regular/daily operation of the system was started on 23 April 1991 and on 6 May 1991 the system went to round-the-clock operation (and has continued around-the clock ever since). **Attachment C-1** provides a summary listing of OU-1 Groundwater Collection, Treatment and Recharge System **Key Dates/Milestones**.

Groundwater collected via the collection trenches at IRP Sites 1, 2 and 3 and from the four boundary interceptor wells (BIW-1, BIW-2, BIW-3 & BIW-4) is pumped to the central treatment facility. The maximum flow capacity of the treatment facility is approximately 320 gallons per minute (gpm). The facility location and the approximate alignment of the system piping are shown in **Figure 10**. The groundwater is pumped initially to a 40,000-gallon equalization tank and then through two air stripping towers connected in series to remove the contaminants of concern (VOCs). The water cascades downward through materials (similar to whiffle balls) within the towers while air is blown upward. Contaminants are removed from the groundwater in this process and go into a gaseous phase. The water that leaves the towers, called *effluent*, is sampled and analyzed by a commercial laboratory at least monthly to ensure that it meets regulatory discharge parameters. The treated effluent can be pumped to the recharge basins at Sites 2 and 3, where it is reintroduced to the groundwater and/or discharged to a drainage channel between the treatment plant and the northeast-southwest runway of Hanscom Field. This drainage channel flows to the wetlands in the Bedford Town Forest. The treatment facility also has an off-gas treatment system consisting of 2 granular activated carbon units connected in series which removes the VOCs from the air from the stripping towers before the air is discharged into the atmosphere.

IRP Site 1, 2 & 3 Decision Document No Further Response Action Planned: This document, which was signed by the Base Commander on 9 April 1992, states that "..... This determination is protective of human health and the environment, and attains Federal and State requirements that are applicable or relevant and appropriate, and cost effective. This declaration is to continue operation of a pump and treat system until the groundwater meets acceptable levels."

Long-Term Monitoring of IRP Sites 1, 2 and 3: H&A was also retained to conduct the long term monitoring of IRP Sites 1, 2 and 3. Between January 1986 and October 1988 H&A completed 3 rounds of groundwater monitoring in Operable Unit 1. Round 1 (January & March 1986), Round 2 (September-October 1987) and Round 3 (September-October 1988) were associated with the development of the Remedial Action Plans, the design of the Remedial Actions and to establish a baseline prior to commencement of groundwater treatment. Round 4 (November 1990), Round 5 (February-March 1991) and Round 6 (August 1991) were designed to provide long term monitoring information on the performance of the groundwater treatment facility and the potential off-site migration of groundwater contaminants from Hanscom field. Upon review of the Round 6 data MA DEP requested that the monitoring network be expanded to better access the effectiveness of the pump & treat system. 30 additional monitoring wells were installed prior to further sampling. Subsequently Round 7 (June-July 1994) and Round 8 (November 1994) were completed.

OU-3/IRP Site 21: Previous remedial actions conducted at IRP Site 21 are summarized below.

Table 2: IRP Site 21 Remedial Actions

Date	Authority	Action	Results
1990-1991	MCP Interim Measure/DEP Case No. 3-3315	Passive Recovery System (1 recovery well) for 8 weeks in the vicinity of Building 1823. Contractor: GZA Remediation, Inc.	25 gallons of jet fuel recovered
1993	MCP Interim Measure/DEP Case No. 3-3315	200 Linear Feet of Horizontal Recovery Trench. Operation of Soil Vapor Extraction (SVE) system for 4 months, and Groundwater Recovery/Treatment System for 8 months. Contractor: Zenone, Inc.	1,400 tons of petroleum contaminated soil removed 226,420 gallons of groundwater recovered/treated 62 gallons of petroleum product recovered 185 gallons of SVE solvent recovered
1995 thru Oct 1998	CERCLA Removal Action	9 to 13 Recovery Wells & Zenone's Recovery Trenches. Operation of Soil Vapor Extraction (SVE) and Groundwater Recovery/Treatment System Sep 95 thru Oct 98. Contractor: Kestrel Drilling and Remediation, Inc.	3,191,356 gallons of groundwater recovered/treated 1,451 gallons of petroleum product recovered 1,679 gallons of SVE solvent recovered
1999-2000	CERCLA Removal Action	3 Recovery Wells. Operation Vacuum Enhanced Recovery (VER) System Sep 99 thru Jul 00 Contractor: Arcadis Geraghty & Miller, Inc.	67,730 gallons of groundwater recovered/treated
2000-present	CERCLA Removal Action	Continued Operation of Vacuum Enhanced Recovery (VER) System and groundwater monitoring Contractor: IT Corp	231,408 gallons of groundwater recovered/treated

Long-Term Monitoring of IRP Sites 21: A component of the Removal Action which commenced in September 1995 is the long-term monitoring of groundwater contaminant concentrations and the thickness of the LNAPL in selected IRP Site 21 monitoring and recovery wells. Long-term groundwater sampling rounds have been conducted in April 1996, June 1996, December 1996, March 1997, June 1997, December 1997, April 1998, June 1998, September 1998, April 1999, July 1999, May 2000, October 2000, January 2001, May 2001, October 2001 and May 2002.

Basis for Action

OU-1/IRP Sites 1, 2 and 3: Following Hanscom's designation as a NPL site, USEPA became the lead regulatory agency. The airfield sites were grouped into OU-1 to facilitate further response actions. USEPA also reviewed H&A's Long-term Monitoring Rounds 7 and 8 data and requested that the monitoring network be expanded again to better access the effectiveness of the pump & treat system and to better define the nature and extent of contamination from the airfield (OU-1) sites. 22 additional monitoring wells were installed prior to further sampling.

Subsequently Round 9 (June-July 1996) and Round 10 (May 1997) were completed. During this period CH2M Hill was retained to complete CERCLA Risk Assessments, a Focus Feasibility Study and an Interim Record of Decision (IROD) for OU1. As part of this effort groundwater flow and solute transport

models were developed. These indicated a need for an additional cluster (3) monitoring wells in the Bedford forest northeast of the boundary interceptor wells to confirm the models' projection of the off-site contaminated groundwater plume. Figure 14 presents the *Simulated TCE Plume in the Lower Aquifer in 1997* and Figure 15 presents the *Simulated TCE Plume in the Bedrock Aquifer in 1997*. The new/additional well cluster (B253/B254/B255 on Figure 12) was installed prior to H&A's Round 11 (May 1998). The results of Sampling Round 11 and a summary of all earlier sampling rounds are presented in the Round 11 Sampling Report (H&A, 1998). The Round 11 (and subsequent monitoring) results for the new cluster are consistent with what was projected by the model.

COC concentrations in OU-1 groundwater exceed federal drinking water standards (*i.e.*, MCLs and non-zero MCLGs), state drinking water standards (*i.e.*, MCLs) and state groundwater risk characterization standards (*i.e.*, MCP Method 1 GW-1 standards) at many locations, and that as a result there is an unacceptable risk to human health from groundwater ingestion. The table below presents the highest concentration of a contaminant of concern exceeding MCLs in different areas of OU-1 from the most recent sampling event. The results were determined by the off-site commercial laboratory analysis of samples collected from OU-1 monitoring wells except that on-site gas chromatograph (GC) results are listed where recent laboratory analysis is not available or the GC analysis of a more recent sample from the well had a higher concentration.

Table 3: OU-1 LTMP Most Recent Results

Contaminant (exceeding MCL)	Sample Id/ Location	Maximum Concentration	MCL (Drinking Water Std)	Sampling Date
Site 1 Plume Source Area				
<u>Surface/Lower Aquifer</u>				
Trichloroethene	RAP1-3S	782 ug/L Note 1	5 ug/L	11 April 2002
Cis-1,2-Dichloroethene	RAP1-3S	525 ug/L Note 1	70 ug/L	11 April 2002
<u>Bedrock Aquifer</u>				
Trichloroethene	RAP1-3R	152,600 ug/L Note 1	5 ug/L	12 September 2001
Cis-1,2-Dichloroethene	RAP1-3R	24,250 ug/L Note 1	5 ug/L	12 September 2001
Site 1 Plume on Hanscom Field				
<u>Surface Aquifer</u>				
Vinyl Chloride	RAP 1-6S	4 ug/L	2 ug/L	5 September 2001
<u>Lower Aquifer</u>				
1,1-Dichloroethane	RAP1-6T	79 ug/L	70 ug/L	5 September 2001
1,1-Dichloroethene	RAP1-6T	41 ug/L	7 ug/L	5 September 2001
1,2-Dichloroethane	RAP1-6T	8 ug/L	5 ug/L	5 September 2001
Chloroform	RAP1-6T	17 ug/L	5 ug/L	5 September 2001
Trichloroethene	RAP1-6T	68 ug/L	5 ug/L	5 September 2001
Cis-1,2-Dichloroethene	RAP1-6T	1,870 ug/L	70 ug/L	5 September 2001
Vinyl Chloride	RAP1-6T	656 ug/L	2 ug/L	5 September 2001
<u>Bedrock Aquifer</u>				
1,1Dichloroethane	RAP1-6R	205 ug/L	70 ug/L	5 September 2001
1,1Dichloroethene	RAP1-6R	158 ug/L	7 ug/L	5 September 2001
1,2-Dichloroethane	RAP1-6R	30 ug/L	5 ug/L	5 September 2001
Trichloroethene	RAP1-6R	1,039 ug/L	5 ug/L	5 September 2001
Cis-1,2-Dichloroethene	RAP1-6R	4,537 ug/L	70 ug/L	5 September 2001
Vinyl Chloride	RAP1-6R	1,084 ug/L	2 ug/L	5 September 2001
Site 2 Plume Source Area				
<u>Surface Aquifer</u>				
Trichloroethene	OW 2-4	82 ug/L Note 1	5 ug/L	10 April 2002
Cis-1,2-Dichloroethene	OW 2-4	784 ug/L Note 1	70 ug/L	10 April 2002
<u>Lower Aquifer</u>				
Trichloroethene	B-115	380 ug/L	5 ug/L	5 September 2001
Cis-1,2-Dichloroethene	B-115	986 ug/L	70 ug/L	5 September 2001
Vinyl Chloride	B-115	41 ug/L	2 ug/L	5 September 2001
<u>Bedrock Aquifer</u>				
	No Wells			

Table 3: OU-1 LTMP Most Recent Results

Contaminant (exceeding MCL)	Sample Id/ Location	Maximum Concentration	MCL (Drinking Water Standard)	Sampling Date
Site 1/2 Plume in Campground				
<u>Surface Aquifer</u>				
No Exceedances	All wells			October 2001
<u>Lower Aquifer</u>				
Trichloroethene	B113	41 ug/L Note 1	5 ug/L	5 April 2001
Cis-1,2-Dichloroethene	B113	167 ug/L Note 1	70 ug/L	5 April 2002
<u>Bedrock Aquifer</u>				
	No Wells			
Site 3 Plume Source				
<u>Surface Aquifer</u>				
Trichloroethene	OW 3-11	8 ug/L Note 1	5 ug/L	21 December 2001
<u>Lower Aquifer</u>				
No Exceedances	All wells			January-April 2002
<u>Bedrock Aquifer</u>				
No Exceedances	All wells			January-April 2002
Site 3 Plume on Hanscom Field				
<u>Surface Aquifer</u>				
Trichloroethene	RAP3-3S	43 ug/L	5 ug/L	18 April 2002
<u>Lower Aquifer</u>				
No Exceedances	All wells			January-April 2002
<u>Bedrock Aquifer</u>				
None	All wells			January-April 2002
Off-site/Bedford Forest				
<u>Surface Aquifer</u>				
No Exceedances	All wells			27 November 2001
<u>Lower Aquifer</u>				
Trichloroethene	B248	262 ug/L	5 ug/L	27 November 2001
Cis-1,2-Dichloroethene	B248	154 ug/L	70 ug/L	27 November 2001
<u>Bedrock Aquifer</u>				
Trichloroethene	B-244A	44 ug/L	5 ug/L	27 November 2001
Cis-1,2-Dichloroethene	B-244A	72 ug/L	70 ug/L	27 November 2001
Vinyl Chloride	B-244A	5 ug/L	2 ug/L	27 November 2001

Note 1 – Screening/on-site GC result

OU-2/IRP Site 4: As stated above, a “*Technical Document to Support No Further Action Planned*” for Site 4 was signed by the Commander on 30 September 1993. MA DEP subsequently requested that a risk assessment be completed in order to close-out the site. O'Brien & Gere was retained to complete a MCP Risk Assessment which included supplemental sampling and analysis at IRP Site 4. However, prior to completion of this effort, Hanscom Field/Hanscom AFB was added to the NPL and USEPA requested that CERCLA Human Health and Ecological Risk Assessments be completed instead of the MCP Risk Assessment. The site was also designated Operable Unit 2 at this time. O'Brien & Gere's scope of work was then modified to only include sampling and analysis. Field work was conducted by O'Brien & Gere between December 1994 and April 1995. The results of this field work are included in O'Brien & Gere's Report entitled “*Supplemental Sampling and Environmental Update, Site 4 – Sanitary Landfill*” dated February 1996.

CH2M Hill was retained to complete the CERCLA Human Health and Ecological Risk Assessments. In the process it was determined that some data gaps existed and CH2M Hill conducted additional sampling and analysis. This field work was completed in 1996 and the results provided in CH2M Hill's “*Operable Unit 2 Sampling Report*” dated August 1996. The CERCLA risk assessments were then completed and are found in CH2M Hill's *Baseline Human Health Risk Assessment for Operable Unit 2 (Site 4)* and *Baseline Ecological Risk Assessment for Operable Unit 2 (Site 4)*, both dated April 1997.

Upon review of the above USEPA determined that the Remedial Action completed in 1988 was acceptable as a final remedial action. The Project Team (Hanscom AFB, USEPA & MA DEP Remedial Project Managers) concluded that additional long-term monitoring data was not required but Five-Year Reviews of the remedial action were appropriate. USEPA and Hanscom AFB completed a site inspection in May 1997 and USEPA issued "Five-Year Review Report #1, Hanscom Air Force Base Superfund Site, Middlesex County, Massachusetts" dated September 1997. This review concluded "based on the field inspection, and human health and ecological risk assessment, protectiveness of the landfill cap at Site 4 has been demonstrated" however, the review did identify a requirement to remove scrub brush growing in the drainage ditches and on sections of the cap and berms and for a long-term inspection/maintenance program to be instituted. The field work to remove the scrub brush was completed in the spring of 1998 and a long-term inspection and maintenance program has been instituted.

OU-3/IRP Site 6: The baseline human health risk assessment revealed that future industrial site workers potentially exposed to compounds of concern in surface soil. Also, future residential groundwater users may be exposed to an unacceptable human health risk that exceeds 10^{-4} (carcinogenic) and HI>1 (noncarcinogenic). In addition, the ecological risk assessment revealed an unacceptable risk to soil invertebrates and animals feeding 100% of the time at the landfill areas (especially the suspected Ash Disposal Area), to benthic and water column organisms in the Wetland Z area, and to the black-crowned night heron from DDT in wetland Z.

Media that have been sampled during field investigations include subsurface soil, surface soil, sediments (wetland and stream), surface water, and groundwater. Previous investigations conducted at the site have identified the following potential sources of contamination.

Table 4: OU-3/IRP Site 6 RI Results

Contaminant Type	Medium Affected	Concentration Range	Approximate Areal Extent	Suspected Source
VOCs*	Groundwater – Upper aquifer Groundwater – Lower aquifer	3.0 - 100 ug/L 0.5 – 130 ug/L	Former Filter Beds	Flushing of landfill areas
Pesticides**	Wetland sediment	0.01 – 920 ug/kg	Wetland Z sediment/north of Former Filter Beds	Landfill surface soil erosion, surface water draining from the landfill areas
SVOCs** (including PAHs)	Wetland sediment	10 - 55,000 ug/kg	Wetland Z sediment/north of Former Filter Beds	Landfill surface soil erosion, surface water draining from the landfill areas
SVOCs** (including PAHs)	Groundwater – Upper aquifer	0.27 – 180 ug/L	Former Filter Beds	Flushing of landfill areas
SVOCs** (including PAHs)	Surface soil	0.0035 – 330 mg/kg	Suspected Ash Disposal Area	Landfill debris (source area)
SVOCs** (including PAHs)	Subsurface soil	0.00084 – 12 mg/kg	South Landfill	Landfill debris (source area)
Metals*	Groundwater – Upper aquifer Groundwater – Lower aquifer	14.3 – 117,000 ug/L 22 – 14,400 ug/L	Former Filter Beds	Flushing of landfill areas
Metals*	Surface water	ND – 0.11mg/L	Ponded wetland areas	Flushing of landfill areas, surface water draining from the landfill areas

Notes:

*Human Health Risk Assessment (CH2M HILL, 1999a) exposure concentration data was used for concentration ranges.

**Ecological Risk Assessment (CH2M HILL, 1999b) exposure concentration data was used for concentration ranges.

ND – Non Detect

OU-3/IRP Site 21: COC concentrations in OU-3/IRP Site 21 groundwater exceed federal drinking water standards (*i.e.*, MCLs and non-zero MCLGs), state drinking water standards (*i.e.*, MCLs) and state groundwater risk characterization standards (*i.e.*, MCP Method 1 GW-1 standards), and the human health risk assessment revealed that future construction workers potentially exposed to LNAPL and contaminated groundwater, and future residential groundwater users may be exposed to an unacceptable human health risk that exceeds 10^{-4} (carcinogenic) and $HI > 1$ (noncarcinogenic).

Contaminants detected above MCLs in groundwater during the 1999 Supplemental RI are presented in the Table below by sample location, *i.e.*, beneath LNAPL Pools A, B or C or from the dissolved-phase plume.

Table 5: Contaminants of Concern in Groundwater – OU-3/IRP Site 21

Contaminant (exceeding MCL)	Sample Id/ Location	Maximum Concentration	MCL (Drinking Water Standard)
Source Area (LNAPL Pool A)			
Benzene	MW-10	150 ug/L	5 ug/L
Toluene	MW-10	1800 ug/L	1,000 ug/L
Naphthalene	MW-10	170 ug/L	20 ug/L ¹
Source Area (LNAPL Pool B)			
Naphthalene	ECS-33	73 ug/L	20 ug/L ¹
Source Area (LNAPL Pool C)			
Naphthalene	MWZ-20	120 ug/L	20 ug/L ¹
Groundwater Plume			
1,4-Dichlorobenzene	CH-102	390 ug/L	75 ug/L
1,2-Dichlorobenzene	CH-102	1400 ug/L	600 ug/L
1,2,4-Trichlorobenzene	ECS-31	84 ug/L	70 ug/L
vinyl chloride	ECS-28	37 ug/L	2 ug/L
cis-1,2-Dichloroethene	ECS-28	100 ug/L	70 ug/L
Trichloroethylene	MWZ-7	6 ug/L	5 ug/L
Naphthalene	MWZ-23	33 ug/L	20 ug/L ¹
Benzene	ECS-14R	73 ug/L	5 ug/L
TPH	CH-102	2,900 ug/L	200 ug/L ¹

Notes:

¹ MCP Method 1 GW-1 standard used because no MCL exists.

The ecological risk assessment revealed that, although a risk could not be ruled out for the Shawsheen River, the contamination detected in the river is not related to the releases regulated under CERCLA and actions to address the contamination detected are not included in the remedial action. However, actions to ensure that the site's contaminants are not impacting the Shawsheen River are subject to CERCLA and are included in the remedial action. Also, it should also be noted, that the headwaters of the Shawsheen River, which includes Hanscom AFB and Hanscom Field, are the subject of intensive study through the Massachusetts Watershed Initiative established to ensure Clean Water Act compliance.

IV. Remedial Actions

Remedy Selection - OU-1/IRP Sites 1, 2 and 3

As stated above, Remedial Action Plans for IRP Sites 1, 2 and 3 were developed and implemented prior to the NPL designation. Subsequently, in 1995, USEPA advised that additional studies were necessary to ensure that these earlier actions fully addressed CERCLA requirements. Using the results of all previous investigations CH2M Hill completed a *Final Ecological Risk Assessment, OU1* (dated January 1999) and a *Focused Feasibility Study, OU1* (dated May 2000). This effort included groundwater flow and solute transport models, and an evaluation of the soil-to-groundwater contaminant transport pathway for human health risk assessment. Based on these reports and the presence of DNAPL in the bedrock fractures the Project Team concluded that it was not prudent to select a final remedy at this time since compliance with ARARs would not be attained in the existing groundwater contaminant plume in the short-term. It was determined that an Interim remedial action should be selected/implemented. Subsequently CH2M Hill prepared an *Interim Proposed Plan for Hanscom AFB Operable Unit 1*, dated June 2000. The public review of this plan, to include a Public Information Meeting and Public Hearing on June 28, 2000, was completed in July 2000 without comment.

An *Interim Record of Decision*, dated November 2000, (also prepared by CH2M Hill) selecting the remedy for OU1 was signed by the Air Force on January 24, 2001 and by USEPA on February 6, 2001. The Commonwealth of Massachusetts formally concurred with this IROD by letter dated December 27, 2000.

Remedial action objectives (RAOs) based on the types of contaminants, environmental media of concern, and potential exposure pathways, were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment. The RAOs for the selected remedy for OU-1 are:

- Prevent exposure (via ingestion, inhalation and/or dermal contact) to groundwater containing COC concentrations that exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards).
- Prevent further migration of dissolved-phase COCs in groundwater.
- Prevent discharge of groundwater containing COC concentrations that exceed federal drinking water standards, state drinking water standards and state groundwater risk characterization standards to surface water bodies and wetlands.

A secondary objective of the cleanup activities is to decrease contaminants near the source area and to reduce the size of the off-site dissolved phase plume, *i.e.*, draw back the plume toward the source areas.

The RAOs are meant to reduce the potential exposure of humans to VOCs in groundwater that are present in concentrations that exceed federal and state drinking water standards and state groundwater risk characterization standards and pose an unacceptable risk to human health and the environment. While contaminated soil remedial measures are not stated objectives of this interim remedial action, institutional controls being implemented will also prevent human exposure to residual subsurface soil contamination in the plume source areas which could pose an unacceptable risk to human health.

The selected remedy for OU-1 involves:

- continued operation of the existing dynamic groundwater collection and treatment system,
- implementation of institutional controls, and
- monitoring of groundwater and surface water.

This remedy is expected to effectively contain the migration of groundwater contaminants and is expected to reduce the overall extent of the groundwater plume via a reduction in contaminant mass. This remedy is intended to be an interim remedial action. Additional information will be gathered to support a final remedy that will be targeted at remediating all or part of the groundwater plume. This IROD also acts as the decision document for choosing No Further Action for soils at IRP Sites 5 and 20.

Issuance of this IROD embodied specific determinations made by USEPA's Regional Administrator pursuant to CERCLA. Under section 121(d)(4)(A) of CERCLA, the Regional Administrator concurred with the decision to waive attainment of the following applicable or relevant and appropriate requirements (ARARs) within the groundwater plume on the basis that this action is an interim measure and will become part of a total remedial action that will meet or attain ARARs when it is completed: the federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs), the SDWA Maximum Contaminant Level Goals, the Massachusetts Drinking Water Standards, and the Massachusetts Contingency Plan (MCP) Method 1 GW-1 groundwater standards. Due to the nature of OU-1, full compliance with these requirements will not be attained in the existing groundwater contaminant plume in the short-term. However, pursuant to this IROD, captured groundwater will be treated to below these standards prior to discharge and long-term monitoring of groundwater and surface water will be conducted to track changes in contaminant concentration over time.

Remedy Selection - OU-2/IRP Site 4

A discussed above a remedy for OU-2/IRP Site 4 was selected prior to the listing of Hanscom Field/Hanscom AFB on the NPL with the MA DEP as the lead regulatory agency. The selected remedy was documented in the Remedial Action Plan for the former Hanscom AFB municipal landfill.

Remedy Selection - OU-3/IRP Site 6

Using the results of all previous investigations CH2M Hill completed a *Human Health Risk Assessment, Site 6 of OU3* and the *Ecological Risk Assessment, Site 6 of OU3* both dated July 1999. In addition to finalizing the risk assessments CH2M Hill also prepared a "*Focused Feasibility Study, Operable Unit 3, Site 6 – Landfill*" and "*Proposed Plan for Hanscom AFB Operable Unit 3/Site 6*" both dated May 2000. The public review of Proposed Plan, to include a Public Information Meeting and Public Hearing on June 20, 2000, was completed in July 2000 without comment.

A *Record of Decision*, dated September 2000 (also prepared by CH2M Hill) selecting the remedy for OU3/IRP Site 6 was signed by the Air Force on November 14, 2000 and by USEPA on December 5, 2000. The Commonwealth of Massachusetts formally concurred with this ROD by letter dated October 16, 2000.

Remedial action objectives (RAOs) based on the types of contaminants, environmental media of concern, and potential exposure pathways, were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment. The RAOs for the selected remedy for OU-3/ Site 6 are:

- Prevent exposure to groundwater above health-based criteria (via ingestion, inhalation, and dermal contact) within the landfill and filter bed area.
- Reduce exposure of ecological receptors to Wetland Z sediment contamination.
- Reduce potential exposure of ecological receptors to contaminated surface soils in the landfill/former filter bed area, south landfill, and west landfill.
- Prevent direct contact to surface soils within the landfill source areas (former filter bed area, south landfill, former ash disposal area, and west landfill).
- Minimize erosion of potentially contaminated soil from the former filter bed area into the adjacent pond and wetlands.

The RAOs are meant to reduce the potential exposure of future industrial site workers to PAHs in surface soil at the landfill areas via dermal contact, ingestion, and inhalation that may present a human health risk in excess of 10^{-4} (carcinogenic) and HI >1 (noncarcinogenic) such that the risk attributable to this medium is below 10^{-4} to 10^{-6} (carcinogenic) and has a HI which does not exceed one (noncarcinogenic) and complies with ARARs for the protection of human health and the environment.

In addition, the RAOs are meant to reduce the potential exposure of children and adults to VOCs and inorganics in groundwater via ingestion, dermal contact, and inhalation that may present a human health risk in excess of 10^{-4} (carcinogenic) and HI >1 (noncarcinogenic) such that the risk attributable to this medium is below 10^{-4} to 10^{-6} (carcinogenic) and has a HI which does not exceed one (noncarcinogenic) and complies with ARARs for the protection of human health and the environment.

The RAOs are meant to reduce the potential exposure of soil invertebrates and higher trophic level omnivorous animals to PAHs and inorganics in the landfill soil that are present in concentrations that may result in adverse effects for these receptors. In addition, the RAOs are meant to reduce the potential exposure of benthic organisms and the black-crowned night heron to pesticides in the wetland sediments.

The selected remedy for OU-3/IRP Site 6 consists of:

- containment of three landfill areas,
- removal of contaminated sediments and landfill debris and placing of this material within the capped landfill area,
- long-term monitoring, and
- institutional controls.
- In addition, the remedy includes establishment of a groundwater compliance boundary and a Contingency Groundwater Remedy in the event monitoring results show that the remedy is not effective in maintaining groundwater quality outside the compliance boundary.

An expected outcome of the selected remedy is that the landfill soils and wetland sediments will no longer present an unacceptable risk to future industrial site workers and ecological receptors via dermal contact, ingestion, and inhalation. In combination with natural flushing and natural attenuation, this alternative can be expected to achieve a reduction in the size and strength of the contaminant plume within the compliance boundary. The selected remedy will also provide environmental and ecological benefits such as restoration of the wetlands areas where contaminated sediments are removed.

Remedy Selection - OU-3/IRP Site 21

Using the results of all previous investigations CH2M Hill prepared a *"Feasibility Study, Operable Unit 3/ Site 21"* dated June 2001 and *"Proposed Plan for Hanscom AFB Operable Unit 3/Site 21"* dated July 2001. The public review of Proposed Plan, to include a Public Information Meeting and Public Hearing on August 1, 2001, was completed in August 2001 without comment. A *Record of Decision*, dated October 2001 (also prepared by CH2M Hill) selecting the remedy for OU3/IRP Site 21, was signed by the Air Force on August 20, 2002 and is currently being staffed for USEPA's signature. The Commonwealth of Massachusetts formally concurred with this ROD by letter dated January 22, 2002.

Remedial action objectives (RAOs) based on the types of contaminants, environmental media of concern, and potential exposure pathways, were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment. The RAOs for the selected remedy for OU-3/ Site 21 are:

- Prevent exposure (via ingestion, inhalation and/or dermal contact) to groundwater containing COC concentrations that exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards);
- Prevent discharge to the Shawsheen River of groundwater containing COC concentrations that exceed federal drinking water standards, state drinking water standards and state groundwater risk characterization standards;
- Prevent or minimize further migration of the contaminant plume (dissolved-phase COCs);
- Prevent or minimize further migration of contaminants from source materials (VOCs/LNAPL) to groundwater; and
- Within an acceptable time period (< 100 years), return groundwaters to federal drinking water standards (i.e., MCLs and non-zero MCL goals (MCLGs)), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards).

The principal components of the selected remedial action for cleaning up OU-3/IRP Site 21 include:

- Three (3) interceptor trenches with passive recovery wells, one main trench covering LNAPL Pools A and B near northern boundary of the site and two smaller trenches at hotspot areas within LNAPL Pool C;
- Network of active recovery wells in non-hotspot areas of LNAPL Pool C;
- Enhancement of biodegradation of dissolved-phased contaminants (VOCs and fuel compounds) by ORC® application in all trenches;
- Monitoring;
- Land Use Controls/Institutional Controls; and
- Groundwater Containment/Treatment and VER Contingencies.
- Five-year Reviews

The primary expected outcome of the selected remedy is that the human health risks associated with the contaminated groundwater and LNAPL will be eliminated through the implementation of the selected remedy described above. Petroleum saturated soils will be removed during the installation of the trenches. Residual LNAPL not removed during construction will be contained, captured and removed through a network of active and passive recovery wells. Short term exposure to contaminants will be controlled

through the use of the land use controls (LUCs)/Institutional Controls (ICs). Groundwater monitoring will confirm the effectiveness of the remedy in containing the LNAPL pools and dissolved-phase (VOCs/fuel compounds) groundwater contaminated plume from migrating to the Shawsheen River.

Remedy Implementation - OU-1/IRP Sites 1, 2 and 3

Continued Operation Of The Existing Dynamic Groundwater Collection And Treatment System: As discussed above the remedy for OU-1/IRP Sites 1, 2 and 3 was constructed/implemented prior to the listing of Hanscom Field/Hanscom AFB on the NPL and appropriateness of the remedy was re-confirmed by the OU-1 IROD. However, there have been several alterations of the original groundwater collection, treatment and recharge system since it was placed in operation in April 1991. Significant changes include:

- In 1996 the system was automated which allowed for the reduction in operating staff/unmanned operation and the pump stations at IRP Sites 1, 2 and 3 were upgraded with larger pumps. Subsequently in 1997 variable speed drives were added to these pumps.
- In 1997 an experimental vacuum enhanced recovery (VER) system consisting of four recovery wells was placed in operation in the immediate vicinity of Burn Pit #1 and Burn Pit #1 Runoff Area at Site 1 to accelerate the removal of contaminant mass from the bedrock aquifer at Site 1. Following a successful Demonstration Project, this system was incorporated in the OU-1 remedy.
- In 1997 two additional conventional interceptor wells were placed in operation, one downgradient (southeast) of Site 1 (IW-6) and the other downgradient (north) of Site 2 (IW-5). Also the pump in BIW #1 was replaced with a larger pump.
- In 1999 an additional conventional interceptor well was installed at Site 1 (IW-10) in the center of Burn Pit #2 and the VER system at Site 1 was augmented by the conversion of 3 monitoring wells in the immediate area to conventional interceptor wells (IW-7, IW-8 & IW-9). The groundwater collected by these wells is pumped to the central treatment facility.
- In 2001 the pumps in BIW #3 and BIW #4 were replaced with larger pumps to take advantage of available well yield to increase the amount of contaminant mass being recovered and to enhance the on-site containment and draw back of the off-site plume being provided by the BIWs.
- In August 2001 because the TCE and Cis-1,2-DCE concentrations had declined to near drinking water standards the collection and treatment of groundwater from Site 3 was suspended.

Institutional Controls: Institutional Controls (ICs) instituted and/or pending to establish safeguards that control access to contaminated groundwater and soil are listed below. ICs are formally monitored and results documented by the base environmental office in normal maintenance and/or monitoring reports for the remedial action.

- Hanscom Field has a perimeter fence and access is restricted to authorized personnel. In addition IRP Site 1 is separately fenced. All areas of Hanscom Field are patrolled by MASSPORT personnel.
- Recharge basins constructed on top of the drum burial pit locations at IRP Sites 2 and 3 provide a 4-6 foot physical barrier to the original ground surface. Also the original surface soil at IRP sites 1, 2 and 3 was removed by the 1988 removal actions and replaced by clean backfill. Thus access to any residual subsurface soil contamination is physically restricted.

- Inspections by the Hanscom AFB IRP Manager and frequent inspections (almost daily) Hanscom AFB's remedial action-operations contractor's on-site staff in the course of their OU-1 system operation, maintenance and monitoring duties to verify that untreated groundwater within OU-1 is not being used for any purpose and that there is no unauthorized digging at IRP Sites 1, 2 and 3.
- IRP Sites 1, 2 and 3 are specifically shown in the Hanscom Air Force Base General Plan (master plan) dated October 1998 as areas with "Environmental Constraints", however, the specific OU-1 constraints are not identified. The specific OU-1 groundwater and land use restrictions will be identified in the update of the General Plan which is currently underway and scheduled to be published o/a October 2003.
- The locations of IRP Sites 1, 2 and 3 are noted in Massport's 1995 Generic Environmental Impact Report (GEIR) Update to alert operational personnel, planners, and decision makers of their presence.
- In addition Hanscom AFB is seeking to establish a Memorandum of Understanding with MASSPORT to ensure that untreated groundwater on Hanscom Field is not used for any purpose (human consumption or otherwise) whilst the levels of VOC concentrations in the groundwater are above that which allow for unlimited use and unrestricted exposure and that any digging or excavation at IRP Sites 1, 2 and 3 on Hanscom Field is conducted in accordance with a site specific health and safety plan which addresses the residual subsurface soil contamination.
- Hanscom AFB is also seeking to establish a Memorandum of Understanding with the Town of Bedford to ensure that untreated groundwater in the Bedford Town Forest/Jordan Conservation Area is not used for any purpose (human consumption or otherwise) whilst the levels of VOC concentrations in the groundwater are above that which allow for unlimited use and unrestricted exposure.

Monitoring Of Groundwater And Surface Water: This was initially conducted by H&A (Round 1 in 1985 through Round 11 in 1998) and, since 1999, long-term monitoring of OU-1 has been conducted by Hanscom's remedial action-operations contractor, IT Corporation. Current monitoring is in accordance with the *Final Basewide Quality Assurance Project Plan for Long Term Monitoring at Operable Unit 1 and Operable Unit 3 (Site 6 and 21)* dated September 2001 which was prepared by IT Corporation.

Remedy Implementation - OU-2/IRP Site 4

As discussed above the remedy for OU-2/IRP 4, was constructed/implemented prior to the listing of Hanscom Field/Hanscom AFB on the NPL and the protectiveness of the remedy documented in the 1st Five-Year Review Report.

Remedy Implementation - OU-3/IRP Site 6

Remedial Design/Remedial Construction: The Remedial Design in conformance with the ROD is dated April 2001. This RD was prepared for Hanscom AFB by CH2M Hill. Construction of the remedy was completed via an Air Force Center for Environmental Excellence (AFCEE) contract with IT Corporation. IT Corporation mobilized on-site on 29 May 2001 and field work was substantially complete on September 17, 2001. The *Final Remedial Action Report* dated April 2002 describes the construction of the RA.

The major components of IT's scope of work included:

- Conducting a property line survey to verify the location of the Base property line to the north and east of the Former Filter Bed Area,
- Excavation of the contaminated sediments from two wetland hotspot areas and the placement of this material under the Former Filter Bed Area cap,

- Excavation of the debris extending off the Base property and the placement of this material under the Former Filter Bed Area cap,
- Constructing a permeable cap at the Former Filter Bed Area, South Landfill, and West Landfill,
- Restoring the wetlands in the wetland remediation areas,
- Re-establishment of perimeter and security fencing with signs on each gate, and
- As-built surveys and drawings.

The following work remains and is scheduled to be completed prior to the annual groundwater and surface water sampling event in the Fall of 2002.

- Installation of three monitoring well couplets down gradient from Site 6

Institutional Controls: Institutional Controls (ICs) instituted to prevent groundwater use and to ensure that future land use does not increase the risk of exposure to the waste/contaminated soils and groundwater remaining on the site are listed below. ICs are formally monitored and results documented by the base environmental office in normal maintenance and/or monitoring reports for the remedial action.

a. Fencing with locked gates

b. Signs at each of the 3 vehicle access gates stating:

IRP Site 6

No Digging, No Dumping

Per Order of the Installation Commander

For Additional Information Contact the Environmental Office

781-377-4495/8207/4667

c. Inspections by both the Hanscom AFB IRP Manager and by Hanscom AFB's remedial action-operations contractor's on-site staff in the course of their IRP Site 6 maintenance and monitoring duties to verify the integrity of the cap and that ICs have not been violated; i.e., no drinking water wells installed and no unauthorized digging or dumping.

d. IRP Site 6 is shown in the Hanscom Air Force Base *General Plan* (master plan) as an area of the base with "Environmental Constraints" and base operating procedures (as established by Air Force Instructions) requires that project planning documents (for both new construction and repair projects) be coordinated with the environmental office. Also the *General Plan* categorizes IRP Site 6 as "Industrial" in the *Existing Site Use Plan*, as "Industrial" in the *Future Site Use Plan*, and as "Industrial" in the *Development Zones Plan*.

The above ICs will be enhanced in the near future by amending the General Plan to add the following specific environmental constraints that apply to IRP Site 6 site:

a. No drinking water wells allowed on the site and untreated groundwater recovered from the site cannot be used for any purpose.

b. Any digging, excavation, or dewatering at the site must be approved by the base environmental office in writing and, once approved, be conducted in accordance with conditions established in the approval document and a site specific health and safety plan which addresses the waste/contaminated soils and groundwater remaining on the site.

c. The current land use of the IRP Site 6 area is classified as "industrial" in the General Plan and the actual current land use is "open space". Changes from this "open space" land use of IRP Site 6 must be approved in writing by the base environmental office. Also EPA and MA DEP will be notified for consultation

45 days in advance of proposed land used changes, which are inconsistent with the land use assumptions or land uses described in the ROD.

Long-Term Monitoring: Monitoring has been initiated in accordance with the *Final Basewide Quality Assurance Project Plan for Long Term Monitoring at Operable Unit 1 and Operable Unit 3 (Site 6 and 21)* dated September 2001 which was prepared by IT Corporation. The initial groundwater and surface water sampling event was conducted by IT Corporation in December 2001 to establish baseline conditions subsequent to completion of the RA construction activities.

Groundwater Compliance Boundary: The initial groundwater compliance boundary has been established and is shown on Figure 8 and the initial sampling and analysis of groundwater at the boundary is scheduled for the Fall of 2002. However, as stated above, three additional monitoring well couplets must be completed prior to the sampling event.

Contingency Groundwater Remedy: Not required at this time

Remedy Implementation - OU-3/IRP Site 21

Remedial Design/Remedial Construction: The design and construction of the selected Remedial Action for IRP Site 21 are programmed this fiscal year (FY2002) with field activities anticipated to commence in the fall (2002).

Institutional Controls: Land Use Controls (LUCs)/Institutional Controls (ICs) instituted and/or pending to prevent groundwater use and to ensure that future land use does not increase the risk of exposure to the waste/contaminated soils and groundwater remaining on the site are listed below. LUCs/ICs are formally monitored and results documented by the base environmental office in normal maintenance and/or monitoring reports for the remedial action.

a. Regular inspections by both the Hanscom AFB IRP Manager and by Hanscom AFB's remedial action-operations contractor's on-site staff in the course of their IRP Site 21 monitoring duties to ensure that ICs have not been violated; i.e., no drinking water wells installed and no unauthorized digging.

b. IRP Site 21 is shown in the Hanscom Air Force Base *General Plan* (master plan) as an area of the base with "Environmental Constraints" and base operating procedures as defined by Air Force Instructions requires that project planning documents (for both new construction and repair projects) be coordinated with the environmental office. Also the *General Plan* categorizes IRP Site 21 as part "Industrial" and part "outdoor recreation" in the *Existing Site Use Plan* and in the *Future Site Use Plan*, and as "Industrial" in the *Development Zones Plan*.

The above LUCs/ICs will be enhanced in the near future by amending the General Plan to add the following specific environmental constraints (LUCs/ICs) that apply to IRP Site 21:

a. No drinking water wells allowed on the site and untreated groundwater recovered from the site cannot be used for any purpose.

b. Any digging, excavation, or dewatering at the site must be approved by the base environmental office in writing and, once approved, be conducted in accordance with a site specific health and safety plan which addresses the LNAPL and dissolve-phase groundwater contamination.

c. No changes in the current land use of the site without the written approval of the base environmental office. The current land use is part "industrial" and part "outdoor recreational" (storage of recreational vehicles). Also EPA and MA DEP will be notified for consultation 45 days in advance of

proposed land used changes, which are inconsistent with the land use assumptions or land uses described in the ROD.

Long-Term Monitoring: Monitoring of IRP Site 21 commenced in 1995 as a component of the Removal Action. This was initially conducted by Kestrel/ECS and, since 2001, long-term monitoring of OU-3/IRP Site 21 has been conducted by Hanscom's remedial action-operations contractor, IT Corporation. Current monitoring is in accordance with the *Final Basewide Quality Assurance Project Plan for Long Term Monitoring at Operable Unit 1 and Operable Unit 3 (Site 6 and 21)* dated September 2001 which was prepared by IT Corporation. The most recent Pre-RA groundwater and surface water monitoring and LNAPL measurements were conducted in May 2002.

Groundwater Containment/Treatment and VER Contingencies: Not required at this time

Remedy Implementation Summary

OU-1/IRP Sites 1, 2 & 3

- Continued operation of the existing dynamic groundwater collection and treatment system – implemented
- Institutional controls – implemented, however, revision to Hanscom AFB General Plan and MOUs with Massport and Town of Bedford are pending
- Monitoring of groundwater and surface water – implemented

OU-4/IRP Site 4

- Maintenance of cap – implemented
- Monitoring of groundwater and surface water – no longer required

OU-3/IRP Site 6

- Containment of three landfill areas – implemented
- Removal of contaminated sediments and landfill debris and placing of this material within the capped landfill area - completed
- Institutional controls - implemented, however, revision to Hanscom AFB General Plan is pending
- Long-term monitoring – baseline completed – annual event scheduled for Fall 2002
- Groundwater compliance boundary – new wells scheduled to be installed before annual monitoring in Fall 2002
- Contingency Groundwater Remedy – no requirement at this time

OU-3/IRP Site 21

- Remedy is scheduled for design and construction later this year
- Land Use Controls/Institutional controls - implemented, however, revision to Hanscom AFB General Plan is pending
- Long-term monitoring - implemented
- Groundwater Containment/Treatment and VER Contingencies – no requirement at this time

Remedial Action – Operation OU-1/IRP Sites 1, 2 and 3

As stated above, Metcalf & Eddy Services, Inc. (subsequently acquired by Professional Services Group (PSG)) was contracted via a Corps of Engineers (CoE) service contract to provide operation, maintenance and monitoring support for the remedial action. At the end of May 1996, the original service contract ended, however, PSG was awarded a CoE construction contract to upgrade and automate the collection, treatment and recharge system. PSG continued normal operations of the system during the course of the construction contract which ended in December 1998. Commencing in January 1999, IT Corporation was contracted via an AFCEE remedial action contract to provide operation, maintenance and monitoring support for the OU-1 remedial action. IT continues to provide this support to the present. Of note, Metcalf & Eddy Services, Inc.'s initial system manager and the lead operator have continued to serve in these same 2 positions as O&M responsibility transferred from contractor to contractor providing significant institutional knowledge on the intricacies of the system.

System operations and maintenance (O&M): O&M is conducted in accordance with the O&M Manual entitled *Recovered Groundwater Treatment System O&M Manual*. The O&M Manual was initially prepared by Engineer-Science, Inc., a subcontractor to H&A, in 1991. The manual was revised by IT Corp, a subcontractor to PSG Inc., in 1998 following completion of the system automation and upgrade contract. Under this contract a supervisory control and data acquisition (SCADA) system was installed to control and monitor system operation. The SCADA system includes remote terminal units at the pump stations at IRP Sites 1, 2 and 3 for two-way radio communication with the central control unit at the central treatment facility. Also includes an auto-dialer to notify the operating contractor of major failures during non-duty hours/periods of unattended operation.

The primary activities associated with O&M of the OU-1 Groundwater Collection, Treatment and Recharge System include the following:

- Visual and computer checks of all operational equipment to include remote collection points (pump stations and interceptor wells). Repairs as necessary for proper operation.
- On-site and off-site commercial analysis of treatment systems (central & Site 1 VER) water quality and air quality parameters to ensure compliance with discharge standards.
- Adjustment of controls and computer set points necessary for efficient system operation.
- Scheduled/routine maintenance of equipment.
- On-site re-generation of central system's granular activated carbon units when continuous monitoring device indicates need for such.
- Major maintenance tasks as needed for efficient system operation. Includes replacement of failed pumps, replacement of "consumed" activated carbon in Site 1 VER system and in the central system (when it can no longer be regenerated on-site), pigging of collection system piping, acid cleaning of stripping towers, and cleaning/repacking of stripping towers.
- Disposal of recovered solvent
- Visual checks of doors, gates, and system components to include remote sites for signs of vandalism and/or other unauthorized activity.
- Response to major alarms during non-duty/unattended operation period. Major alarms include steam boiler failure, security alert, process down, high equalization tank level, or fire alarm.

Groundwater Monitoring: As stated above, H&A conducted eight (8) separate groundwater monitoring events of IRP Sites 1, 2 and 3 between January 1986 and November 1994. Though technically after the NPL listing in May 1994, Round 7 (June-July 1994) and (November 1994) were completed with MA DEP oversight. Following the designation of Hanscom Field/Hanscom AFB as a NPL site, USEPA reviewed H&A's Round 7 and 8 data and requested that the monitoring network be expanded again to better access the effectiveness of the pump & treat system and to better define the nature and extent of contamination from the airfield (OU-1) sites. 22 additional monitoring wells were installed prior to further sampling. Subsequently Round 9 (June-July 1996) and Round 10 (May 1997) were completed. During this period CH2M Hill was retained to complete CERCLA Risk Assessments, a Focus Feasibility Study and an IROD

for OU1. As part of this effort groundwater flow and solute transport models were developed. These indicated a need for an additional cluster (3) monitoring wells in the Bedford forest to confirm the models' leading edge of the contaminated groundwater plume. These 3 wells were installed prior to H&A's Round 11 (May 1998).

Following H&A's Round 11 (May 1998), Hanscom AFB developed a long-term monitoring plan (LTMP) for OU-1 and included the implementation of the LTMP in the scope of the existing AFCEE contract with IT Corporation for the operation, maintenance and monitoring of the OU-1 remedial action. IT's responsibility to execute the LTMP commenced in 1999 and continues to the present. The primary activities associated with OU-1's LTMP include the following:

- Annual sampling of selected monitoring wells and one surface water sampling point with analysis for VOCs by an off-site commercial laboratory to confirm the containment and possible reduction of the OU-1 plumes. Also includes 3 wells being monitored for the Town of Bedford and regulators.
- Piezometric levels collected from selected surface aquifer wells quarterly to assess the effectiveness of the collection trenches at Sites 1, 2 and 3, and from all OU-1 wells semi-annually to monitor seasonal trends.
- Monthly sampling of collection points and monitoring wells for screening by the operations and maintenance (O&M) staff using an onsite gas chromatograph (GC). The purpose of this sampling and analysis is for remedial system optimization and to identify trends in VOC levels at groundwater collection points and within the OU-1 plumes. This GC analysis will only quantify the two principal contaminants of concern, TCE and Cis-1,2-DCE.

O&M Costs: The actual costs incurred to date are summarized in Table 6 below. The annual O&M costs estimated in the Remedial Action Plans for IRP Sites 1, 2 and 3 were \$415,000 (Year 1), \$347,000 (Year 2) and \$320,000 for Years 3 to 30. Upon completion of the design, and in preparation of a Request for Proposals from prospective bidders, the following government estimate was prepared:

- Base Year = \$668,192 fixed + unit priced items – total = \$770,764
- Option Year 1 = \$575,547 fixed + unit priced items – total = \$685,026
- Option Year 2 = \$610,201 fixed + unit priced items – total = \$726,560
- Option Year 3 = \$649,366 fixed + unit priced items – total = \$773,237
- Option Year 4 = \$692,749 fixed + unit priced items – total = \$824,569

Table 6: Annual OU-1 Remedial Action-Operations Costs

Start Date	End Date	Basic O&M Cost	LTMP	One-time O&M/ Alterations	Remarks
April 1991	March 1992	\$551,670		\$10,414	Propane & solvent disposal
April 1992	March 1993	\$485,270			
April 1993	March 1994	\$509,534		\$63,475	Acid wash towers; solvent disposal; booster pumps,
April 1994	March 1995	\$535,010		\$137,243	Pigging system; iron bacteria pilot studies
April 1995	March 1996	\$561,760		\$25,599	Solvent & carbon disposal; Clean Site 2 Recharge Pipes, pave around plant
April 1996	December 1996	\$403,425		\$689,844	Automation & upgrades; Drill IWs 5 & 6
January 1997	December 1997	\$342,009		\$164,036	Acid Wash towers; replace BIW-1 power & pump; VFDs for pump stations; IWs 5 & 6 power& pumps; BIW & IW flow meters
January 1998	December 1998	\$281,904		\$58,734	Repack Towers
January 1999	December 1999	\$315,347	\$15,170	\$73,984	Drill IW-10; power/pumps,IWs 7,8, 9 & 10; Y2K upgrades; VER carbon
January 2000	December 2000	\$299,145	\$20,253	\$60,507	Acid wash towers; VER carbon; 2-Bedford Community Garden monitoring wells
January 2001	December 2001	\$316,080	\$16,238	\$31,987	VER Carbon; Permanganate Pilot Study
January 2002	February 2003	\$380,601	\$23,667	\$37,833	14 Months O,M&M, VER & main system carbon, solvent disposal

Please note the above excludes government-furnished electricity and propane costs. These utility costs were estimated to be \$96,000 for FY 2002 (1 Oct 2001 – 30 Sep 2002)

Remedial Action – Operation OU-2/IRP Site 4

The grass on the main cap is cut periodically by Massport and a softball league at no cost to Hanscom AFB. However, the 1st Five-Year Review identified a requirement to remove scrub brush growing in the drainage ditches and on sections of the cap and berms and recommended that a long-term inspection/maintenance program be instituted. The initial field work to remove the scrub brush was completed in the spring of 1998 by PSG, Inc., via a modification to the contract providing operation, maintenance and monitoring support for the on-going OU-1 remedial action. Subsequently, since 1999, the recurring inspection and maintenance of IRP Site 4 has been included in the scope of work of the AFCEE contract with IT Corporation for the operation, maintenance and monitoring support for the on-going Hanscom AFB Remedial Actions. IT's responsibilities for OU-2/IRP Site 4 include:

- Periodic inspections to verify integrity of the cap and to monitor for settlement and slope instability
- Fill and/or seed low and bare areas of landfill cap
- Fill animal burrows on landfill cap
- Cut grass and brush on the berms and on the northwest lobe of the cap outside bermed (main) area of landfill cap
- Remove debris from drainage swales

O&M Costs: The remedy was put in place in 1988 and the annual O&M costs estimated in the Remedial Action Plan for IRP Site 4 for years 3 to 30 was \$19,000. This included both maintenance and monitoring costs. However, following completion of the Human Health and Ecological Risk Assessments and the 1st Five-Year Review, the Project Team (Hanscom AFB, USEPA & MA DEP Remedial Project Managers) concluded that additional long-term monitoring data was not required. Actual maintenance costs incurred since the 1st Five-Year Review are summarized in the following Table 7.

Table 7: Annual OU-2/IRP Site 4 Remedial Action-Operations Costs

Dates		Total Cost
From	To	
October 1997	December 1998	\$5,454
January 1999	December 1999	\$2,933
January 2000	December 2000	\$5,696
January 2001	December 2001	\$4,752
January 2002	February 2003	\$5,000

Remedial Action-Operation OU-3/IRP Site 6

Construction of the Remedial Action for IRP Site 6 was substantially completed in September 2001 and the remedial action-operation phase has commenced. On September 28, 2001, IT Corporation performed an inspection of the West Wetland Remediation Area and East Wetland Remediation Area to establish baseline conditions for future inspections and assessments. The baseline inspection was performed by a qualified wetlands scientist and included the establishment of a transect line through each wetland remediation area, the placement of a 1 m x 1 m quadrant at a reproducible location, an ocular estimation of the ratio of growth to area, photographs of the wetland remediation areas from a reproducible location, and the assessment of the remedial progress.

The IRP Site 6 operation, maintenance and monitoring (O,M&M) Program includes:

- Inspection of fences, gates, signs and permanent survey benchmarks for integrity.
- Inspection of the final cover for bare spots, settling, subsidence, displacement, ponding of water, erosion and unauthorized activity such as digging/excavation and well installation.
- Inspection of Debris Excavation #1 and #2 for bare spots.
- Mowing of grassed areas of the landfill caps at least once per year.
- Fertilizing, seeding, and mulching as required to establish and maintain grass cover.
- Inspection of groundwater monitoring wells for proper functioning.
- Repairs as necessary if an inspection of the landfill cap indicates that corrective action is needed to repair or restore a component of the landfill cap.
- Annual monitoring of wetland ecosystem development in the West and East Wetland Restoration Areas, supervised by a Wetlands Scientist, at the beginning (May) and end (September) of the growing season. To the extent practicable, invasive or nuisance species identified will be removed by hand, or hand spray or wipe treatment with Rodeo® (Monsanto Company).
- Annual long-term groundwater monitoring program in accordance with the Long-term Monitoring Plan (LTMP) for IRP Site 6 in order to evaluate the overall performance of the remedial alternative and to ensure groundwater quality is met outside the compliance boundary.

The frequency of capped areas inspection is quarterly for the first year, biannually for the following four years and annually thereafter, unless conditions noted between or during the annual inspections indicate that more frequent inspections are required.

O, M & M Costs: The annual cost estimated in the ROD for OU-3/IRP Site 6 was \$48,150 which includes \$23,150 for groundwater and surface monitoring. The current working estimate for this site's CY2002 O,M&M contract totals \$56,000, which includes \$44,500 for groundwater and surface monitoring in accordance with the LTMP.

Remedial Action-Operation OU-3/IRP Site 21

There is no current remedial action-operation requirement since the design and construction of the selected remedy is not complete. An O,M&M Plan will be included in the remedial design and the scope of the remedial action construction contract will include post-RA baseline groundwater and surface water sampling and a system shakedown period through March 2003. The annual O,M&M costs estimated in the ROD for OU-3/IRP Site 21 is \$28,000 which includes \$8,000 for groundwater and surface monitoring.

V. Progress Since the Last Five-Year Review

OU-2/IRP Site 4 was the only remedial action covered by the *“Five-Year Review Report #1, Hanscom Air Force Base Superfund Site, Middlesex County, Massachusetts”* dated September 1997. This review concluded “based on the field inspection, and human health and ecological risk assessment, protectiveness of the landfill cap at Site 4 has been demonstrated” however, the review did identify a requirement for maintenance of the site to remove scrub brush growing in the drainage ditches and on sections of the cap. This field work/maintenance was completed in the spring of 1998 by PSG, Inc., via a modification to the contract providing operation, maintenance and monitoring support for the on-going OU-1 remedial action. Subsequently, since 1999, the requirement for routine inspections and required maintenance actions have been included in the scope of work of the AFCEE contract with IT Corporation for the operation, maintenance and monitoring support for the on-going remedial actions. Documentation of the continuing maintenance of the Site 4 remedial action can be found in reports entitled *“Compilation of 4 letter Reports concerning 1999 Quarterly Inspections”*, *“Compilation of 4 letter Reports concerning 2000 Quarterly Inspections”* and *“Compilation of 4 letter Reports concerning 2001 Quarterly Inspections”*.

VI. Five-Year Review Process

Administrative Components

The Second Five-Year Review of Hanscom Field/Hanscom AFB Superfund Site kicked off on 24 January 2002 at a Project Team/Five-Year Review Scoping meeting at Hanscom AFB. Attendees included Michael Barry, US EPA Region 1 RPM, Robert Campbell, outgoing MA DEP RPM, Garry Waldeck, Incoming MA DEP RPM, Michael Quinlan, IT Corp. Project Manager, and Thomas Best, Hanscom AFB Restoration Program Manager. The Air Forces' initial plan was to contract with IT Corporation to conduct the review. Subsequently, Hanscom AFB decided to complete the review "in-house" relying on IT Corp for technical support on a per tasking basis. The Project Team agreed that Hanscom should target to have the "draft" report submitted for comment by the end of June to ensure finalization by the end of September.

Community Involvement

The Hanscom AFB Restoration Advisory Board (RAB) was notified of the Five-Year Review on 30 January 2002. The RAB was advised that the IRP Update presented at this meeting was a preliminary presentation of the review and that the RAB would be kept apprised of progress towards the finalization of the report. On 28 March 2002 minutes of the 30 January 2002 RAB meeting with handouts were sent to all RAB members who did not attend the meeting.

A Memorandum dated May 1, 2002 was sent to officials of the 4 surrounding communities and Massport advising of the conduct of the five-year review and inviting participation.

The Draft-Final Report was placed in the Bedford Town Library and the Hanscom AFB Library and a notice placed in the local papers announcing a July 5th through August 2nd public comment period. No comments were received.

Memorandums dated June 27, 2002 with a copy of the Executive Summary was sent to the RAB mailing list and to officials of the 4 surrounding communities and Massport advising of the public review of the Draft-Final Report and inviting participation. No comments were received.

Document Review

This five-year review consisted of a review of relevant documents including O,M&M records (see **Attachment A**). Applicable groundwater cleanup standards, as listed in the RODs for OU-3 IRP Site 6 and IRP Site 21 and the IROD for OU-1, were reviewed (see **Attachment B**).

Data Review - Operational Data for OU-1 Groundwater Collection, Treatment and Recharge System

General - Since the OU-1 remedial action was not covered by the First Five-Year Review, the operational records from system startup have been reviewed. The major elements of data initially collected concerned the treatment facility's operation and compliance with discharge standards, to include groundwater piezometric data, gallons treated, gallons recharged on-site and/or discharge off-site, and commercial laboratory analytical data for influent, mid-point, and effluent. The OU-1 groundwater treatment system has processed between 100 to 320 gallons per minute since it became operational and, as of 31 December 2001, 1.241 billion gallons of groundwater had been treated. See **Attachment C-1** for a summary listing of OU-1 Groundwater Collection, Treatment and Recharge System **Key Dates/Milestones** and **Attachment C-2** for the **Summary Report of Operations for December 2001** which includes monthly operational data for calendar year 2001.

Gallons Treated – The initial design of the treatment system was to accommodate the following anticipated flows:

- Site 1 Collection Trench - 775 feet long = 10 gpm
- Site 2 Collection Trench - 1,710 feet long = 60 gpm
- Site 3 Collection Trench – 1,970 feet long = 190 gpm
- 4 Boundary Interceptor Wells (15 gpm each) = 60 gpm
- Total = 320 gpm

See **Attachment C-3** for a chart of **gallons treated from 1991 through 2001**. Though the system is designed for 320 gpm operations commenced in 1991 at 238 gpm and flow to the treatment facility steadily decreased to 100+/- gpm by the end of December 1991 where the flow stabilized. The reduction was due to the growth of an iron bacteria in the collection pipes restricting flow from the pump stations to the treatment facility. In an effort to overcome the restriction, booster pumps were added to the 3 pump stations in February 1993. This change initially increased pumping rates to 290+/-, however, the bacterial growth continued and flow rates declined until they stabilized at 200+/- gpm. In June 1994, the collection system piping was modified to allow for the “pigging” (mechanical cleaning) of the lines and rates increased to 270+/- gpm. Subsequently in 1996, a major “alteration” contract automated the system and upgraded the 3 pump stations to provide the capability to pump more from the pump stations than the treatment facility can process. Following the pump upgrades, flow rates averaged between 260 and 280+/- gpm until 2001. Operations in 2001 started at 292 gpm in January and ended at 161 gpm in December. Two factors impacted 2001 performance, the drought conditions being experienced in the region and the cessation of collection from Site 3 in August 2001 which was contributing 105+/- gpm earlier in 2001.

In 1997, a concerted effort to maximize the system’s influent contaminant concentrations was begun. Variable speed drives were added to the 3 sites pump stations, additional interceptor wells (IW-5 and IW-6) collecting from zones of high groundwater concentrations were installed, and flow meters were installed at all BIWs/IWs. Also a vacuum enhanced recovery (VER) demonstration project commenced at the Site 1 Burn Pit #1 and Burn Pit #1 Runoff Area. The following priorities were established to operate the treatment facility as close to the design capacity as possible while maximizing influent contaminant concentrations:

- Priority 1 – Site 1 Collection Trench, Site 1 VER System, 4 BIWs and IWs
- Priority 2 - Site 2 Collection Trench
- Priority 3 - Site 3 Collection Trench

Since 1997, the collection system has also been enhanced by the operation of the Site 1 VER system, additional interceptor wells at Site 1, and larger pumps at BIWs 1, 3 and 4. As a result of these physical and operational concept changes the recent annual operational data in gpm is as follows:

<u>Source</u>		<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>
Site 1 Collection Trench	24.5	19.4	20.5	14.0	
Site 1 VER System		0.9	0.8	1.4	0.6
BIW #1		26.6	21.6	18.3	17.6
BIW #2		7.5	8.2	7.4	7.9
BIW #3		18.4	20.4	18.3	46.2
BIW #4		9.2	10.3	11.3	15.9
IW-5 (Site 2 lower aquifer)		9.1	4.0	1.0	2.8
IW-6 (Site 1 bedrock aquifer)		4.0	3.5	3.7	3.6
IW-7-8-9 (Site 1 bedrock aquifer)	0.0	0.6	0.1	0.0	
IW-10 (Site 1 Burn Pit #2)		0.0	0.2	0.5	0.5
Site 2 Collection Trench		105.9	74.6	79.7	65.6
<u>Site 3 Collection Trench</u>	<u>77.3</u>	<u>99.5</u>	<u>98.1</u>	<u>67.4</u>	
Total		283.5	263.1	260.5	242.3

Hydraulic Influence of System - Groundwater piezometric data has been collected periodically to assess the hydraulic impacts of the collection system and a detailed evaluation of the data was included in H&A's LTMP Reports. Figures 14 through 17 have been extracted from H&A's Round 11 report to present the contoured interpretation of May 1998 groundwater elevations in the surface (unconfined), lower, and bedrock aquifers. Figures 14 and 15 present groundwater elevation contours for the surface aquifer at Sites 1 and 2 and at Site 3, respectively. Figures 16 and 17 present groundwater elevation contours for the lower aquifer and the bedrock aquifer, respectively, across the airfield. The Round 11 report confirmed that operation of the system establishes a capture zone in the surface aquifer at each of the three collection trenches and that a capture zone is established at the boundary in the lower and bedrock aquifers. Also the changes in the collection system since May 1998 that are described in the Remedy Implementation section (increased pumping from BIW #3 and BIW #4) should have enhanced the boundary capture zone.

Influent-Effluent Concentrations/Discharge Compliance – The air stripping towers were designed to handle the following influent concentrations.

TCE	= 45,000 ppb
Trans-1,2-DCE	= 7,500 ppb
1,2-DCA	= 820 ppb
Vinyl Chloride	= 35 ppb

To ensure compliance with discharge ARARs the treatment system's influent, mid-point, and effluent were analyzed for VOCs weekly by a commercial laboratory from startup through the end of 1998 and monthly from the start of 1999 through today. During this time the effluent has **always** met drinking water standards with no detections of any VOCs. See **Attachment C-4** for a chart of **influent TCE concentrations from 1991 through 2001**. As seen in this chart there were wide swings in the TCE concentrations through 1998. This is not unexpected as slugs of contamination are collected and processed, however, the 1991 high of 5,300 ppb was significantly less than expected/provided for by the design. Also obvious is a decreasing trend punctuated by a significant jump up in 1997. The decreasing trend is also not unexpected as the initial pool of dissolved-phase contamination within the collection system's zone of influence is readily collected. This is replaced by "cleaner" groundwater moving into the zone which picks up additional contamination dissolving from that absorbed onto the soil and, over time, the amount absorbed onto the soil decreases resulting in lower and lower concentrations entering the collection system. The 1997 jump up in concentrations reflects the change in operation mechanics/optimization of the collection system discussed above. Prior to 1997 Site 3, per original design, made up the majority of the influent since it physically "yields" more than the other collection points. However, by 1997, in terms of contamination, Site 3 was the least contaminated of the sources and groundwater collected from Site 3 has the effect of diluting the composite influent. Also evident on this Chart is a minor jump up of TCE concentrations at the end of 2001/start of 2002 which reflects the cessation of collection from Site 3 in August 2001.

Effluent Toxicity Testing/Discharge Compliance – In addition to the VOC analysis the treatment system's effluent has been tested quarterly for toxicity. Two species are tested, the daphnid, *Ceriodaphnia dubia*, and the fathead minnow, *Pimephales promelas*. Since the 1991 startup, the effluent has **never** exhibited signs of acute toxicity on either species during the initial 48 hour exposure period **nor** had any chronic effects on the survival of either species during the 7 day exposure period. Periodically this testing has found that the effluent did have observed sublethal, chronic effects on either daphnid reproduction or on minnow growth during the 7 day exposure period. This impact on the daphnid's growth reproduction or on minnow growth is perplexing since there is no apparent reason (water quality parameters appear to be consistent with historical results) and this is may be a lab effect rather than an effluent effect. We will continue to review the historical data and monitor future results to determine if some type of corrective action is required. See **Attachment C-5** for a table summarizing **quarterly effluent toxicity testing results from 1991 through February 2002**.

On-Site Recharge/Off-site Discharge - As discussed above recharge basins were constructed at Site 2 and Site 3 to re-inject the treated groundwater with the objective of maximizing the effectiveness of soil flushing action in removing contaminants absorbed onto the soil. The design was to recharge 250 gpm with the remainder (70 gpm) being discharge to surface waters leaving the site (discharge point is Hanscom Field storm water discharge ditch flowing into Wetland B/beaver pond north of Hanscom field). However, as with the collection system, iron bacteria growth in the recharge pipes restricted flow from the recharge pipes and recharging was stopped at Site 2 in January 1992 and at Site 3 in March 1992.

In 1995, following the cleaning of the recharge pipes at Site 2, a 2-week recharging test was conducted at Site 2. Since then, there has been periodic use of recharging at both Site 2 and 3 as reflected in the following data.

		<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>
Off-site Discharge (gpm)	258.8	263.1	220.2	185.3	
Site 2 Recharge (gpm)		10.1	0	10.4	7.5
<u>Site 3 Recharge (gpm)</u>		<u>14.5</u>	<u>0</u>	<u>29.8</u>	<u>49.5</u>
Total		283.5	263.1	260.5	242.3

The current O&M plan is to recharge at Site 2 at the maximum rate possible and discharge the remainder off-site.

Vacuum Enhanced Recovery System at the Site 1 Burn Pit #1 and Burn Pit #1 Runoff Area. This system consists of 4 recovery wells (RWs #1, #2, #3 & #4) and a trailer mounted recovery and treatment system located at a confirmed dense non-aqueous phase liquid (DNAPL) area (monitoring well RAP1-3R) immediately downgradient of the Site 1 Burn Pit #1 and Burn Pit #1 Runoff Area (**Figure 11**). The 4 wells are installed in a 40-ft square pattern with RAP1-3R in the center of the square. The trailer contains a 15 HP liquid ring vacuum pump to extract vapor and groundwater from the recovery wells, an vapor/liquid phase separator, 2 granular activated carbon (GAC) units in series to treat the recovered vapor, and a pump with flow meter to transfer the recovered liquid to the Site 1 pump station for subsequent treatment by the central groundwater treatment facility. The VER system was initially installed and operated by Arcadis Geraghty & Miller as an AFCEE Technology Demonstration Project conducted in 2 phases; between December 1997 and June 1998 and between October 1998 and April 1999. During the demonstration a total of 707,522 gallons of contaminated groundwater was recovered and processed by the central groundwater treatment facility. It was estimated that during the demonstration periods this system recovered an average of 2.4 pounds of VOCs per day that it operated, 1.4 via the vapor phase and 1.0 via the liquid phase.

Due to the success of the VER demonstration the system was incorporated in the OU-1 remedial action and on 28 April 1999 the system was restarted by IT Corporation. The VER system was operated continuously until 18 June 2001 except for the period between 29 June 1999 and 22 October 1999 when high humidity made it impracticable to meet vapor phase discharge standards. During the period of operation a total of 1,323,232 gallons of contaminated groundwater was recovered. **Attachment C-6** is a table that summarizes the **VER system liquid effluent** concentrations (TCE and Cis-1,2-DCE) for the from the start of the demonstration project and **Attachment C-7** is a chart of the **TCE concentrations**. Please note that, since the VER process transfers VOCs from the liquid phase to the vapor phase, the VER liquid concentrations reflected in the table and chart do not completely reflect the level of contamination being recovered. **Attachment C-8** is a table that summarizes the **VER system's operational data** since the start of regular operations in April 1999 and **Attachment C-9** is a chart of **vapor phase influent** VOC concentrations. Attachment C-9 also includes vapor phase data from the demonstration project. This data shows that, while there are fluctuations, there are no discernable trends. The lack of declining trends is attributed to a large source of DNAPL/adsorbed phase VOC mass **remaining** in the area, even after the significant amount of mass removed by the VER system since December 1997. This conclusion led to the development of the permanganate injection/in-situ oxidation pilot study now under way. In June 2001 operation of the VER system was suspended for the duration of the permanganate pilot study. The objective

of this pilot study is to determine if permanganate injection/in-situ oxidation would be more cost effective in cleaning up this source area than continuing the operation of the VER system. This study is projected to be completed by the fall (2002) at which time a decision will be made as to whether or not VER would be a more cost effective technology than permanganate to eliminate the DNAPL in the area.

Source Areas Contaminant Concentrations - As stated above, data initially collected for the OU-1 remedial action concerned the groundwater treatment facility's operation and compliance with discharge standards and did not include monitoring the contaminant concentration at individual collection sources. In 1997 it was realized that source data was needed to better optimize the OU-1 remedial system and the O&M program was revised to include the monthly analysis of samples collected from each of the 3 pump stations and from each BIW/IW. This analysis is performed by the O&M staff using an on-site gas chromatograph (GC). Note that only the 2 principal contaminants of concern (TCE and Cis-1,2-DCE) are quantified during this on-site analysis. A discussion of this source data follows:

Site 1 Pump Station (see Table/Attachment C-10 and Chart/Attachment C-11). This pump station's effluent is a composite of the discharge from the Site 1 collection trench, BIW #1, BIW #2, IW-6, IW-7/8/9, IW-10, and the Site 1 VER system. These sources, other than the collection trench, are also analyzed separately. The pump station effluent's TCE concentration has decreased significantly, from 1,716 ppb in January 1998 to 218 ppb in March 2002. Cis-1,2-DCE has also decreased from 250 ppb to 55 ppb over the same period. It is noted that, since March 2001, the TCE has settled at a plateau of 300+/- ppb. Also the TCE-CIS ratio has decreased from 8+/- to 4+/-.

Site 2 Pump Station (see Table/Attachment C-10 and Chart/Attachment C-12). This pump station's effluent is a composite of the discharge from the Site 2 collection trench, BIW #3, BIW #4, and IW-5. These sources, other than the collection trench, are also analyzed separately. The pump station effluent's TCE concentration has decreased significantly, from 419 ppb in January 1998 to 124 ppb in March 2002. Cis-1,2-DCE has also decreased from 532 ppb to 197 ppb over the same period. It is noted that the TCE-CIS ratio has gone from usually above 1.0 prior to June 2000 to 0.6 recently.

Site 3 Pump Station (see Table/Attachment C-10 and Chart/Attachment C-13). This pump station's effluent is all from the Site 3 collection trench. However, because the TCE and Cis-1,2-DCE concentrations had declined to near drinking water standards the collection and treatment of groundwater from this site was stopped in August 2001. It is noted that prior to the cessation of pumping from this site the TCE-CIS ratio was usually in the 0.1-0.2 range.

Boundary Interceptor Well # 1 (BIW-1) (see Table/Attachment C-14 and Chart/Attachment C-15). This well is constructed to collect from the lower (glacial till) and bedrock aquifers. Pumping from BIW #1 did not commence when the OU-1 system went on-line in 1991 because the Site 1 pump station was only capable of pumping the discharge from the collection trench. This shortcoming was rectified by a temporary fix in April 1995 and permanently by the pump station upgrade at the end of 1996. Also pump failures in 1996 and twice again in 1997 led to the replacement of the underground electric service to the pump in October 1997. At this time the size of the pump was upgraded from 10+/- gpm to 25+/- gpm. This pump upgrade resulted in a significant step up in TCE concentrations from the 400 ppb range to over 1,000 ppb. Since October 1998, the TCE concentration has declined to a plateau at 150+/- ppb. It is noted that Cis,1-2-DCE concentrations are either below detection levels or at low levels with a TCE-CIS ratio that exceed 10.0.

Boundary Interceptor Well # 2 (BIW-2) (see Table/Attachment C-14 and Chart/Attachment C-16). This well is constructed to collect from the lower (glacial till) and bedrock aquifers. Pumping from BIW #2 did not commence when the OU-1 system went on-line in 1991 because the Site 1 pump station was only capable of pumping the discharge from the collection trench. This shortcoming was rectified by a temporary fix in April 1995 and permanently by the pump station upgrade at the end of 1996. Since March 1997 (when the GC analysis of the pumps effluent commenced), both the TCE and Cis-1,2-DCE concentrations have been on a downward trend and are now very close to drinking water standard. It is

noted that with few exceptions the TCE-CIS ratio has consistently been in the 0.2-0.4+/- range.

Boundary Interceptor Well # 3 (BIW-3) (see **Table/Attachment C-14 and Chart/Attachment C-17**). This well is constructed to collect from the lower (glacial till) and bedrock aquifers. Pumping from BIW #3 did not commence when the OU-1 system went on-line in 1991 and O&M records indicate that sporadic operation of the BIWs commenced in July 1993 and the continuous operation of BIW #3 commenced in 1995. In August 2000, the underground electric service to BIW #3 failed and it was replaced in November 2000. When the pump was restarted it was determined that, due to improper phasing, the pump had previously been operating at less than its capacity. Thus in November 2000, with the proper phasing, the pumping rate increased from 20+/- to 50+/- gpm. Subsequently, in June 2001, the pump failed and was replaced with a larger pump as operational records indicated that BIW #3 would "yield" significantly more than 50 gpm. However, the current pumping rate cannot be accurately determined because it exceeds the calibration range of the flow meter. This flow meter is scheduled to be replaced later this year by one which can accurately record flows in the 50-100 gpm range. Since March 1997 (when the GC analysis of the pumps effluent commenced), both the TCE and Cis-1,2-DCE concentrations have declined significantly, however, a minor step up did occur following the pump upgrade in 2001. It is noted that with few exceptions the TCE-CIS ratio has consistently been in the 4.0+/- range since the start of analysis. Also with few exceptions the Cis-1,2-DCE concentrations have been below drinking water standards.

Boundary Interceptor Well # 4 (BIW-4) (see **Table/Attachment C-18 and Chart/Attachment C-19**). This well is constructed to collect from the lower (glacial till) and bedrock aquifers. Pumping from BIW #4 did not commence when the OU-1 system went on-line in 1991 and O&M records indicate that sporadic operation of the BIWs commenced in July 1993 and the continuous operation of BIW #4 commenced in 1995. Subsequently, in September 2001, the pump was replaced with a larger pump as operational records indicated that BIW #4 would "yield" more than the 10-12 gpm obtained with the original pump. The upgraded BIW #4 pumping rate is now stabilized between 28 and 30 gpm. Since March 1997 (when the GC analysis of the pumps effluent commenced), both the TCE and Cis-1,2-DCE concentrations initially increased, peaked, and are now on a significant downward trend. The TCE peaked at 1,634 ppb in June 1999 and the Cis-1,2-DCE peaked at 1,258 ppb in June 2001. It is noted that a step up similar to that seen at other sources did not occur following the pump upgrade in 2001. Also of note is that the TCE-CIS ratio has declined from the 2.0+/- range at the start of analysis to 0.3 today.

Interceptor Well # 5 (IW-5) (see **Table/Attachment C-18 and Chart/Attachment C-20**). This well, constructed to intercept contamination in the lower (glacial till) aquifer closer to the Site 2 source area, was added to the collection system in August 1997. Unfortunately the pumping capacity of this well has been affected by iron bacteria fouling and its yield has dropped from greater than 10 gpm to less than 1 gpm at times and, since July 2001, has been in the 3 to 5 gpm range. Following startup, both the TCE and Cis-1,2-DCE concentrations rapidly declined to a plateau at 500+/- ppb each. However, since the start of 2002, the Cis-1,2-DCE concentrations have fluctuated between 500 and 1,000 ppb. Also of note is that the TCE-CIS ratio has declined from the +1.0 range at the start of analysis to 0.4 today.

Interceptor Well # 6 (IW-6) (see **Table/Attachment C-18 and Chart/Attachment C-21**). This well, constructed to intercept contamination in the bedrock aquifer closer to the Site 1 source area, was added to the collection system in August 1997. Following startup, both the TCE and Cis-1,2-DCE concentrations rapidly declined to a plateau at 4,000+/- ppb for TCE and 2,000+/- ppb for Cis-1,2-DCE. Also the TCE-CIS ratio has consistently been in the 2.0+/- range.

Interceptor Wells # 7, 8 & 9 (IW-7, 8 & 9) (see **Table/Attachment C-22**). These 3 wells were originally installed as monitoring wells associated with the VER demonstration project and are shown on **Figure 11** as GM-97-M2, GM-97-M3 and GM-97-M4 respectively. In April 1999, following completion of the demonstration project, pumps were installed to maximize recovery from the Site 1 Burn Pit #1 and Burn Pit #1 Runoff Area. However, iron bacteria growth has precluded significant recovery via these wells and the pumps have been operated only sporadically since they were installed. Also, since June 2001 when permanganate injection/in-situ oxidation pilot project commenced at this area, recovery via these wells has

been suspended for the duration of the project. Thus these wells have functioned (and probably will continue to function in the future) more as monitoring wells than as recovery wells. As seen in the Table there was very significant contamination in these wells at the start of monitoring and levels have declined significantly since the start of analysis. This reduction is more likely due to the operation of the Site 1 VER system than the limited recovery via these 3 wells. See the discussion below concerning the VER recovery wells for a more accurate assessment of cleanup progress in the Site 1 Burn Pit #1 and Burn Pit #1 Runoff Area.

Interceptor Well # 10 (IW-10) (see **Table/Attachment C-23 and Chart/Attachment C-24**). This well was added to the collection system in July 1999 and was constructed to intercept contamination in both the overburden and bedrock aquifers. It is located in the center of the Site 1 Burn Pit #2 (see **Figure 4**). Following startup, the TCE concentrations have fluctuated without a discernable trend and the Cis-1,2-DCE concentrations are usually below detection levels. Also due to high levels of silt and clay in the overburden and lack of significant fractures in the bedrock the yield of this well is very low. Consideration is now being given to constructing an interceptor trench in this area to enhance the yield of IW-#10.

VER Wells (RWs 1, 2, 3 & 4) (see **Figure 11, Tables/Attachments C-25 and C-26, and Charts/Attachments C-27 thru 30**). As discussed above, these recovery wells are located in a confirmed DNAPL area. The wells are constructed to principally recover contamination from the bedrock fractures by using a very high vacuum to dewater the wells and volatilize the DNAPL. In order to assess changes in the concentrations of the groundwater being recovered, the VER system is temporarily shut down and samples of the groundwater recharging the wells are obtained and analyzed by the O&M staff using the on-site GC. The tables and charts provide a summary of TCE and Cis-1,2-DCE concentrations for the 4 VER wells from the start of the demonstration project to March 2001. This data shows that, while there are fluctuations, there are discernable declining trends in RW-2 and RW-3. This data also shows a very significant drop in TCE and Cis-1,2-DCE concentrations in each of the 4 VER wells following the commencement of the permanganate injection/in-situ oxidation pilot study in June 2001. While the initial results are quite promising, it is too soon to draw conclusions as to whether or not permanganate injections would be a more cost effective remediation technology for this DNAPL area. This will be addressed in the final pilot study report which is not anticipated prior to the completion of this five-year review. The analytical data collected to date for this source area indicates that progress is being made in reducing the mass of contaminants at Site 1 but that there is still a very significant contaminant mass remaining. As recorded in the table in **Attachment E** (pages 1 & 2) the concentration of TCE in monitoring well RAP1-3R in the center of the box with the RWs at the corners was 1,100,000 ppb in June 1996 and 152,600 ppb in September 2001. This reduction is most likely due to the operation of the Site 1 VER system.

Data Review - OU-1 LTMP Data

As discussed above in earlier sections of this report the long-term monitoring of OU-1 was initiated in January 1986 and an extensive network of monitoring wells has been established to assess groundwater quality in each of the 3 aquifers of concern within OU-1. The OU-1 monitoring points are shown in **Figure 12**. The current LTMP is 2-phased; (1) the annual sampling of selected monitoring wells and a surface water sampling point for analysis of VOCs by an off-site commercial laboratory, and (2) the monthly/quarterly/semi-annually/annually sampling of selected monitoring and the surface water sampling point for analysis of TCE and Cis-1,2-DCE by the O&M staff using an on-site GC. The table at **Attachment D** provides a **historical summary of chemical analytical data** (laboratory VOC analysis) for the monitoring wells and surface water monitoring point in Phase 1 of the LTMP and the table at **Attachment E** provides a **historical summary of all on-site GC analysis**. Charts showing the **long-term trends** in the Cis-1,2-DCE and/or TCE concentrations at OU-1 monitoring points are at **Attachment F**.

Due to the complexity of the OU-1 groundwater contamination the analysis of results is best presented by the following sections of OU-1:

- Surface Water
- Site 1 On-site Plume except Hanscom AFB Campground area
- Site 2 On-site Plume and Hanscom AFB Campground area
- Boundary of Hanscom Field/Hanscom AFB with Town of Bedford
- Off-site/Bedford Town Forest
- Site 3
- Northwest Area

Surface Water The LTMP surface water monitoring point is in the Hanscom Field storm water discharge ditch between Sites 1 and 2. This ditch empties into Wetland B/beaver pond north of Hanscom field. This ditch also receives the groundwater treatment effluent that is not recharged on-site and the surface water monitoring point (RAP1-4SW) is located downstream of the discharge point. As shown in **Attachment F-1** the concentration of Cis-1,2-DCE declined to **below drinking water standards** in November 1990 and has been below 1 ppb since October 1999 and the concentration of TCE declined to **below drinking water standards** in June 1996 and has been below 1 ppb since October 1999. These reductions can be attributed to 2 factors. (1) The Site 1 collection trench is successfully containing surface aquifer contamination at the source area precluding its migration to this downgradient location. (2) Prior to the operation of the BIW's the drainage ditch received discharge from the surface aquifer but with the BIWs operational the hydraulic gradients are changed and the ditch recharges the surface aquifer.

Site 1 On-site Plume except Hanscom AFB Campground area: The Site 1 plume is cigar-shaped, extending in a southeasterly direction from the source areas (burn pits) on Hanscom Field to the vicinity of BIW #3 and BIW #4 in the Hanscom AFB Campground area. The Site 1 plume also co-mingles with the Site 2 plume in the Campground area. It is believed that the Site 1 plume generally follows a trough in the bedrock surface. Contamination has been found in all three aquifers with the greatest concentrations being in the bedrock. Monitoring well **RAP1-3R**, in the center of the VER area is considered to represent the location of the principal source of the Site 1 plume. The historical TCE concentrations (combination of off-site laboratory and on-site GC results) in this well are graphed in **Attachment F-2**. This data indicates that progress towards reducing the Site 1 contaminant source is being made and, as discussed in the VER section above, the reduction in TCE is most likely due to the operation of the Site 1 VER system. However, this data also indicates that a significant amount remains.

The LTMP analytical data indicates that the Site 1 collection trench has been very effective in cleaning up the surface aquifer and, at this time, the groundwater in **all surface aquifer** monitoring wells **downgradient** of the trench **meet** drinking water standards. However, residual surface aquifer contamination above drinking water standards still exists upgradient of the trench (PO1-4SA, RAP1-3S & V-1). The effectiveness of the remedial action in the surface aquifer is best seen by review of the historical TCE concentrations in monitoring well **RAP1-6S** which are graphed in **Attachment F-3**. As shown in this chart the concentration of TCE declined from greater than 1 ppm in September 1988 to below drinking water standards (5 ppb) in October 1999.

The Site 1 collection trench augmented by IW-6 in 1997 has also been effective in cleaning up the lower/glacial till and bedrock aquifers in the immediate vicinity of the trench. The effectiveness of the remedial action in this section of OU-1 is best seen by review of the historical TCE and Cis-1,2-DCE concentrations in monitoring wells **B-103** (lower), **B-237** (bedrock), **B-240** (bedrock) and **RAP1-5R** which are graphed in **Attachments F-4 thru F-7**. Please note that these charts are based on a combination of off-site laboratory and on-site GC results. All of these wells show one or more orders of magnitude reduction in TCE concentrations as reflected below:

B-103 – 30 ppb via lab in July 1994 (1st sampling) and 8 ppb via GC in September 2001
B-237 – 8,600 ppb via lab in June 1996 (1st sampling) and 6 ppb via GC in March 2002
B-240 – 32,000 ppb via lab in June 1996 (1st sampling) and 653 ppb in December 2001 and a
“suspect” bdl via GC in March 2002
RAP1-5R – 48,000 ppb via lab in Feb. 1986 (1st sampling) and 35 ppb via GC in September 2001

The OU-1 remedial action has been less effective in cleaning up the lower/glacial till and bedrock aquifers in the downgradient area between the collection trench/IW-6 and BIW #2 and BIW #4, but a positive impact is evident in monitoring wells **RAP1-6T** and **RAP1-6R** as shown in **Attachment F-3**. You'll note that initially there is an uptrend in the TCE concentrations followed by a downtrend. The TCE concentration peaked in the lower aquifer well in November 1994 and in the bedrock aquifer well between June 1996 and May 1998. These trends are considered to be the result of a “pulling” of the plume from the upgradient/source areas through the RAP1-6 area and on towards the BIWs. You'll also note a very significant drop in the lower aquifer between September 2000 and September 2001. This is considered a “localized” effect of an on-going DoD molasses injection demonstration project being conducted in this section of the Site 1 plume and not indicative of a significant change in the plume concentrations. This conclusion is supported by the **Attachment E** data for lower aquifer monitoring wells **IRZ-2, IRZ-3, IRZ-4** and **IRZ-5** which are immediately downgradient of RAP 1-6T.

Downgradient of the RAP 1-6 area and closer to BIW #2 is the B-241 (surface), B-242 (lower) and B-243 (bedrock) monitoring well cluster. These wells were not installed until 1996 thus conditions in this area prior to then are unknown. In regards to the **lower** and **bedrock** aquifers an impact of the OU-1 remedial action, especially the impact of BIW #2, is quite evident as shown in **Attachment F-8**. Please note that these charts are based on a combination of off-site laboratory and on-site GC results.

Also downgradient of the RAP 1-6 area and closer to BIW #4 is the RAP 2-2 monitoring well cluster (RAP2-1S, RAP2-2T, & RAP2-2R). These wells were originally installed to monitor the IRP Site 2 plume but are now believed to be in the Site 1 plume. In regards to the lower (**RAP2-2T**) and bedrock (**RAP2-2R**) aquifers an impact of the OU-1 remedial action is evident as shown in **Attachment F-9** and **Attachment F-10**. Please note that these charts are based on a combination of off-site laboratory and on-site GC results.

Similar to the RAP1-6 area the TCE initially was in an uptrend and now is in a slight downtrend, however, the Cis-1,2-DCE appears to still be peaking in this area.

In summary LTM data shows that the OU-1 remedial action has significantly reduced the levels of contaminants on the Site 1 on-site plume, however, pockets of high levels still remain at the source area and in the area between the RAP1-6 and RAP2-2 monitoring well clusters.

Site 2 On-site Plume and Hanscom AFB Campground area: At this time the Site 2 plume extends in a northerly/northeasterly direction from the source areas (drum burial pits) on Hanscom Field to the vicinity of BIW #3 and BIW #4 in the Hanscom AFB Campground area. It appears to be leaving the source area in the lower/glacial till aquifer. The Site 2 plume also co-mingles with the Site 1 plume in the Campground area.

The LTMP analytical data indicates that the Site 2 collection trench has been very effective in cleaning up the surface aquifer and, at this time, the groundwater in **all surface aquifer** monitoring wells **downgradient** of the trench in the Hanscom AFB Campground area **meet** drinking water standards. However, residual surface aquifer contamination that is above drinking water standards still exists in the immediate area of the trench (RWF-11 & PO2-1S) and within the perimeter of the trench (Site 2 OWs). Please note that all of these wells are within the capture zone of the collection trench.

The effectiveness of the remedial action in cleaning up the surface aquifer is best seen by review of the historical TCE concentrations in monitoring well **RWF-11** immediately (10 feet) downgradient of the trench. The results of the off-site/commercial laboratory analysis of samples from this well are graphed in **Attachment F-11**. As shown in this chart, the concentration of TCE declined from 36 ppm in October 1987

to below 100 ppb In June 1994. Since then, in October 1999, there was a spike up to higher concentrations followed by a return to 12 ppb in September 2001.

The LTMP analytical data indicates that the Site 2 collection trench augmented by IW-5 in 1997 has also been effective in cleaning up the lower aquifer in the vicinity of the Site 2 source area (drum burial pits). This is confirmed by the LTMP results graphed in **Attachment F-12** for the lower aquifer monitoring well, **B-115**, located in the center of the source area. A very positive impact is also noted at lower aquifer monitoring well **B-109** located downgradient of the source area in the vicinity of the collection trench. As shown in **Attachment F-13**, the concentration of both the TCE and Cis-1,2-DCE has declined significantly since this well was first sampled in 1994 and is currently below drinking water standards. Please note that this chart is based on a combination of off-site laboratory and on-site GC results.

Further downgradient in the Hanscom AFB Campground are surface and lower aquifer monitoring well clusters, B101 (surface)/B108 (lower) and B-107 (surface)/ B113 (lower). These wells were installed in 1994 thus data for the pre-RA and initial RA time period is not available. It is thought that the Site 1 and Site 2 plumes are co-mingled in the lower aquifer in this area and that the LTMP results since 1994 reflect more the impact of BIW #3 and BIW #4 than the Site 2 collection trench augmented by IW-5. As stated above, there is no evidence of contamination in the surface aquifer. The LTMP results for **B108** are graphed in **Attachment F-14** and for **B113** in **Attachment F-15**. Please note that the chart for B-113 is based on a combination of off-site laboratory and on-site GC results. As shown in these charts there appears to be an uptrend developing, especially in Cis-1,2-DCE concentrations. This uptrend may be the result of the increases in the recovery from the lower aquifer via BIW #3, BIW #4 and IW #5. It is noted that groundwater in this area is within the capture zone of BIW #3 and/or BIW #4.

Boundary: The boundary is defined by the four BIWs augmented by monitoring wells located along the boundary. The boundary monitoring wells, listed in order the northwest to southeast, and LTMP Attachment F document numbers are as follows:

RAP1-1T and RAP1-1R (immediately vicinity of BIW #1) -- **Attachment F-16**
PO1-2R (between BIW #1 and BIW#2) -- **Attachment F-17**
RAP1-4S and RAP1-4RA (between BIW #1 and BIW#2) -- **Attachment F-18**
B102 (surface) and **B126** (lower) (immediately vicinity of BIW #2) -- **Attachments F-19 & 20**
PO2-1T and PO2-1RA (immediately vicinity of BIW #4) -- **Attachment F-21**
PO2-2T and PO2-2R (immediately vicinity of BIW #4) -- **Attachment F-22**
RAP2-1T and RAP2-1R (immediately vicinity of BIW #4) -- **Attachment F-23**
RAP2-3S, RAP2-3T and RAP2-3R (between BIW #3 and BIW#4) -- **Attachment F-24 ***

* RAP2-3S and RAP2-3R are not graphed as there have been no LTMP exceedances of MCLs.

Both the LTMP boundary monitoring well data and the LTMP boundary interceptor well data in Attachment C consistently reflect one of two patterns for the contamination in the lower and bedrock aquifers; either a declining trend since the start of data collection or an initial increasing trend followed by a declining trend. Both of these patterns confirm the effectiveness of the four boundary interceptor wells in containing/capturing lower and bedrock aquifer contamination at the boundary. Also the RAP1-1T/PO1-2S/RAP1-4S/B102/RAP2-3S data shows that since 1995 the surface aquifer at the boundary has met drinking water standards.

Of note is the data for RAP1-1T, RAP1-1R and BIW #1 which defined the northwestern end of the Hanscom Field/Hanscom AFB boundary with the Town of Bedford. At this location there is no lacustrine layer to separate the surface from the lower aquifer thus RAP1-1T monitors both aquifers and, except for 5.6 ppb in November 1994, the TCE levels have been and continue to be below drinking water standards. Also as of June 1996 TCE levels in the bedrock in RAP1-1R decreased to 5.5 ppb and have been below drinking water standards ever since. Also Cis-1,2-DCE has always been below detection levels in both of these wells. However, as discussed above significant TCE concentrations (150+/- ppb) continued to be capture by

the nearby BIW#1. This is most likely due to fact that the BIW is much deeper into the bedrock than the monitoring well and is pulling the TCE through deeper fractures than those monitored by RAP1-1R. The total depth of BIW #1 is 95 feet whereas the depth of RAP1-1R is 54.4 feet. The source of the contamination being captured by BIW #1 has never been confirmed. It may be from IRP Site 1, however, the modeling completed as part of the Feasibility Study does not reflect this. Regardless of the source the fact is that the contamination is being captured and Hanscom AFB has no plans to stop recovery by BIW #1 before a "Final" ROD for OU1 is issued and implemented.

Off-site/Bedford Town Forest: The off-site plume in the Bedford Town Forest is monitored by five (5) monitoring well clusters. These wells and their respective LTMP Attachment F document number are as follows:

B-127 (surface) and **B-111** (lower) - approximately 250' north of BIW #4 -- **Attachment F-25**
B244A (bedrock), **B245** (lower), **B246** (surface) – south/west flank of plume approximately 550' northeast of BIW #2 -- **Attachment F-26**
B247 (surface), **B248** (lower), **B249** (bedrock) – center of plume approximately 900' north of BIW #4 -- **Attachment F-27**
B250 (surface), **B251** (lower), **B252** (bedrock) – south/east flank of plume approximately 450' east of BIW #4 -- **Attachment F-28**
B253 (surface), **B254** (lower), **B255** (bedrock) – leading edge of plume approximately 2,000' north of BIW #4 -- **Attachment F-29**

The LTMP monitoring well data indicates that all off-site/Bedford Forest surface aquifer monitoring wells meet drinking water standards and that contamination in the lower aquifer is much more significant than in the bedrock aquifer suggesting that the primary migration pathway is in the lower aquifer. This is consistent with the modeling discussed in the Basis for Action section. In general there are downward concentration trends in the well clusters in the southeast flank (B250, B251 and B252), southwest flank (B244A, B245, B246), and center (B247, B248 and B249) of the off-site plume, and there is a relatively stable concentration near the northeast leading edge of the plume (B253, B254 and B255). This data in conjunction with the LTMP boundary interceptor and monitoring well data indicates that the OU-1 RA has been, and continues to be, successful in containing/capturing lower and bedrock aquifer contamination at the boundary. Also of note is the spike up/down at B-111 and the significant downtrend in the cluster in the center of the off-site plume (B247, B248 and B249) which appears to indicate that the BIW's are also pulling back some of the off-site contamination.

Site 3: Groundwater in the lower and bedrock aquifers at Site 3 has consistently met and continues to meet drinking water standards and, at monitoring wells with positive detections of TCE and/or Cis-1,2-DCE the trend in concentrations has been down. This is confirmed by the LTMP results graphed in **Attachment F-30** for the lower aquifer monitoring well, **B125**, located in the center of the Site 3 source area (drum burial pits) and in **Attachment F-31** for the lower aquifer monitoring well, **B122**, located located downgradient of the source area/collection trench. At both wells the laboratory reported below detections levels for all VOCs in April 2002 samples. Charts are not meaningful for the Site 3 bedrock aquifer monitoring wells because there has been very few detections of VOCs in the LTMP samples.

In regards to the surface aquifer (and as discussed previously) LTMP data shows that the remedial action has been very successful in cleaning up the surface aquifer. As the TCE and Cis-1,2-DCE concentrations were approaching/reaching drinking water standards the collection and treatment of groundwater from IRP Site 3 was stopped in August 2001. The impact/effectiveness of the remedial action is shown in **Attachment F-32** for the surface aquifer monitoring well, **OW3-7**, located in the center of the Site 3 source area (drum burial pits) and in **Attachment F-33** for the surface aquifer monitoring well, **B118**, located downgradient of the collection trench. It is recognized that there may be both residual soil contamination in the historical drum burial pits which may contribute to future groundwater contamination and pockets of contaminated groundwater remaining within the perimeter of the collection trench. In this regard the August 2001 shutdown of the Site 3 groundwater recovery, treatment and recharge is considered

an interim action until future long-term monitoring results confirm that no further active cleanup is required for IRP Site 3. Recommended changes to the LTMP to assess impact of no active remediation at Site 3 are discussed below.

In addition to the Site 3 source area within the perimeter of the collection trench, there are 2 additional areas in the Site 3 area that have had/have significant surface aquifer contamination. One is the location of surface aquifer monitoring well RAP3-3S. This well is downgradient of historical drum burial pit 3J which is not within the perimeter of the Site 3 collection trench. It is approximately 250 feet to the east and is most likely outside of the collection trench's capture zone. LTMP data for **RAP3-3S** is shown in **Attachment F-34**. While this graph shows wide fluctuations, the TCE concentration is on a downtrend. The second area of concern is the location of surface aquifer monitoring well RAP3-4S. A source of the groundwater contamination in this area has never been found and, as at RAP3-3S, this area is considered to be outside the collection trench's capture zone. LTMP data for **RAP3-4S** is shown in **Attachment F-35**. As shown in the graph TCE concentrations peaked in 1990 and, as of November 1999, declined to below the Drinking water standards. Of note the TCE and Cis-1,2-DCE concentrations in the lower aquifer wells at both of these areas of concern (RAP3-3T and RAP 3-4T) have never exceeded drinking water standards. Also of note is that both of these isolated surface aquifer areas of concern are on the upgradient side of Hanscom Field and that natural attenuation/dispersion without active remediation should be protective of human health and the environment.

Northwest Area: Please note that this area was included in the Haley & Aldrich's investigation of Hanscom Field Area to confirm whether or not groundwater contamination was migrating from Hanscom Field towards Elm Brook on the north side of Hartwell Hill. The investigation concluded that it was not and LTMP data confirms that groundwater **throughout the Northwest area has consistently met and continues to meet** drinking water standards.

LTMP Recommended Changes:

The Project Team should review the OU-1 LTMP data with the objective to optimizing the sampling and analysis effort and conserve resources. Consideration should be given to suspending the monitoring of upgradient and other wells which historically have had little to no detections of TCE and/or Cis-1,2-DCE. Also the plan should be adjusted as necessary to assess the impact of the cessation of recovery from IRP Site 3.

Data Review OU-2/IRP Site 4

Since the first Five-Year Review conducted in 1997, OU2/IRP Site 4 has been in a long-term maintenance phase with no requirement for groundwater or surface water monitoring. The first Five-Year Review did identify a requirement for maintenance of the site to remove scrub brush growing in the drainage ditches and on sections of the cap. This maintenance was completed in the spring of 1998. Subsequently, since 1999, quarterly inspections have been routinely performed and maintenance/repairs identified in the inspection have been completed. Review of the quarterly inspection reports confirms that the integrity of the cap is being maintained and that there are no physical changes at the site.

Data Review OU-3/IRP Site 6

As a result of the RA construction activities the RAOs for this site have been substantially achieved and in September 2001 the Site entered the long-term maintenance and monitoring phase. Review of the *Remedial Action Report* confirms that the remedy was constructed in accordance with the Remedial Design and review of December 2001 and March 2002 inspection reports confirms that the remedy remains in place as constructed. Also in December 2001 the post-RA long-term monitoring of the site in accordance with the *Final Basewide Quality Assurance Project Plan for Long Term Monitoring at Operable Unit 1 and Operable Unit 3 (Site 6 and 21)* dated September 2001 was initiated. The OU3/IRP Site 6

monitoring well network is shown in **Figure 8** and IT's *Baseline Groundwater Monitoring Report for Post-RA Monitoring of Operable Unit 3 Site 6 (December 2001 Samples)* dated May 2002 presents the results of this monitoring. Contaminants exceeding standards in the December sampling are presented/ summarized below. It is noted that due to the recent draught/low water table several wells were dry during this sampling event. Also not sampled in December 2001 were the planned new wells and one existing well on the compliance boundary. These are scheduled to be included in the 2002 sampling round. The baseline sampling conducted to date confirms that the most significant contaminant of concern is arsenic.

Table 8 - OU-3/IRP Site 6 Post-RA Monitoring

Contaminant (exceeding MCL)	Monitoring Well Id	Dec 2001 Concentration	MCL (Drinking Water Standard)
Volatile & Semi-Volatile Organic Compounds			
1,4-Dichlorobenzene	MW6-B07	5.41 ug/L	5 ug/L ¹
Trichloroethene	MW6-23	6.1 ug/L	5 ug/L
1,4-Dichlorobenzene	MW6-110U	6.98 ug/L	5 ug/L ¹
Benzene	MW6-110U	6.34 ug/L	5 ug/L
Naphthalene	MW6-110U	25.3 ug/L	20 ug/L
1,4-Dichlorobenzene	MW6-110T	6.1 ug/L	5 ug/L ¹
Benzene	MW6-112U	6.24 ug/L	5 ug/L
Naphthalene	MW6-112U	155 ug/L	20 ug/L
Organochlorine Pesticides			
4,4'-DDD	MW6-114T	0.277 ug/L	0.1 ug/L ¹
Arsenic – Dissolved Phase			
	MW6-B07	48 ug/L	10 ug/L ²
	MW6-B09	26 ug/L	10 ug/L ²
	MW6-B10	21 ug/L	10 ug/L ²
	MW6-11	45 ug/L	10 ug/L ²
	MW6-13	12 ug/L	10 ug/L ²
	MW6-23	62 ug/L	10 ug/L ²
	MW6-25	123 ug/L	10 ug/L ²
	MW6-110T	22 ug/L	10 ug/L ²
Arsenic – Total			
	MW6-B07	47 ug/L	10 ug/L ²
	MW6-B09	28 ug/L	10 ug/L ²
	MW6-B10	27 ug/L	10 ug/L ²
	MW6-11	48 ug/L	10 ug/L ²
	MW6-13	24 ug/L	10 ug/L ²
	MW6-17	19 ug/L	10 ug/L ²
	MW6-21	20 ug/L	10 ug/L ²
	MW6-23	59 ug/L	10 ug/L ²
	MW6-25	145 ug/L	10 ug/L ²
	MW6-110T	21 ug/L	10 ug/L ²
Other Metals–Dissolved Phase			
Barium	MW6-112U	2,028.7 ug/L	2,000 ug/L
Cadmium	MW6-113T	18.1 ug/L	5 ug/L
Nickel	MW6-113T	135.7 ug/L	100 ug/L ¹
Other Metals – Total			
Antimony	MW6-112U	7 ug/L	6 ug/L
Barium	MW6-112U	2,173.2 ug/L	2,000 ug/L
Cadmium	MW6-113T	18.2 ug/L	5 ug/L
Nickel	MW6-113T	134.6 ug/L	100 ug/L ¹

Notes:

¹ MCP Method 1 GW-1 standard used because no MCL exists or MCP standard is lower.

² MCL Lowered from 50 to 10 in 2001.

The *Remedial Action Report* includes the analytical results of the confirmation sampling of the West and East Wetland Remediation Areas (WWRA & EWRA) and Debris Excavation Area #1 (DEA #1) prior to restoration of the areas to document residual levels, if any, of contamination. The results indicated the presence of trace levels of SVOCs and pesticides, all below MCP S-1/GW-1 standards. Also noted during construction activities was a discolored liquid seeping from the Former Filter Bed Area into the wetland remediation areas. Samples were taken from both the WWRA and the EWRA and analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. The results indicated that both samples were below detection levels for pesticides and PCBs and there were some trace levels of VOCs and SVOCs detected but all were below the most restrictive standard. However, in regards to metals there were some exceedences of one or more of the standards in the liquid seeping into the WWRA but no exceedences in the liquid seeping into the EWRA. Positive results of the metals analysis are presented below. Sufficient data is not available at this to determine whether these seeps are the result of construction activities which will not re-occur or are an on-going action which may affect the protectiveness of the remedy. In order to evaluate the impact of these seeps the O,M&M plan will be revised to document presence/non-presence of seeps during inspections and the LTMP will be revised add the sampling and analysis of any liquid seeping from the former filter bed area.

Table 9 - OU-3/IRP Site 6 RA Monitoring - Liquid Seeps from Former Filter Bed Area

METALS	AWQC Standard	MCL (Drinking Water Standard)	MCP GW-1 Standard	WWRA 22 August 2001	EWRA 22 August 2001
Aluminum	None	None	None	160 mg/L	0.4 mg/L
Arsenic	0.15 mg/L	0.001 mg/L	0.05 mg/L	0.27 mg/L	0.008 mg/L
Barium	None	2 mg/L	2 mg/L	1 mg/L	bdl
Calcium	None	None	None	340 mg/L	65 mg/L
Chromium	0.074 mg/L	0.1 mg/L	0.1 mg/L	0.29 mg/L	bdl
Cobalt	None	None	None	0.1 mg/L	bdl
Copper	0.009 mg/L	1.3 mg/L	None	0.41 mg/L	bdl
Iron	None	None	None 0.015	530 mg/L	0.78 mg/L
Lead	0.0025 mg/L	0.015 mg/L	mg/L	0.57 mg/L	bdl
Magnesium	None	None	None	61 mg/L	10 mg/L
Manganese	None	None	None	10 mg/L	29 mg/L
Mercury	0.00077 mg/L	0.002 mg/L	0.002 mg/L	0.0006 mg/L	bdl
Nickel	0.052 mg/L	None	0.1 mg/L	0.28 mg/L	bdl
Potassium	None	None	None	72 mg/L	27 mg/L
Selenium	0.005 mg/L	0.05 mg/L	0.05 mg/L	0.01 mg/L	bdl
Silver	None	None	0.04 mg/L	0.02 mg/L	bdl
Sodium	None	None	None	97 mg/L	32 mg/L
Vanadium	None	None	0.05 mg/L	0.31 mg/L	bdl
Zinc	0.12 mg/L	None	2 mg/L	2.3 mg/L	0.02 mg/L

Notes:

Bold indicates exceedence of one or more standards

AWQC – Ambient Water Quality Criteria (National Water Quality Criteria for Priority Toxic Pollutants – Freshwater Chronic Standards)

bdl – analytical results were below detection levels

Data Review OU-3/IRP Site 21

Since construction of the remedy for OU3/IRP Site 21 is not complete, there is no operation and maintenance data to review. However, as discussed above in earlier sections of this report long-term monitoring data has been collected in conjunction with the remedial investigations and interim remedial actions at the site. The OU3/IRP Site 21 monitoring well network is shown in **Figure 13** and the current LTMP is in 2 stages; pre-RA and post-RA (1) in accordance with the *Final Basewide Quality Assurance Project Plan for Long Term Monitoring at Operable Unit 1 and Operable Unit 3 (Site 6 and 21)* dated

September 2001. The most recent Pre-RA groundwater and surface water monitoring and LNAPL measurements were conducted in May 2002. The Table at **Attachment G** provides a historical **summary of the laboratory analysis** of groundwater samples collected during the pre-RA stage and **Charts showing LTMP trends** for contaminants of concern for selected wells are at **Attachment H**. The Table at **Attachment I** provides a historical **summary of LNAPL measurements**.

Of primary concern in the pre-RA stage is confirmation of the natural containment of the LNAPL and natural containment/apparent natural attenuation of the dissolved-phase plume to ensure that water quality of the adjacent Shawsheen River is not being threatened. Table 10 below summarizes the results of the pre-RA sampling of the Shawsheen River at the stream gauging station immediately downgradient of the site. While there have been sporadic detections of the Site 21 VOC contaminants of concern these detections were well below drinking water standards. Thus it is concluded that neither the LNAPL nor the dissolved-phase plume is adversely impacting the water quality of the Shawsheen River.

Table 10 - OU-3/IRP Site 21- Shawsheen River Stream Gauging Station

Groundwater Plume Contaminants of Concern	25	16 Oct 1997	24 May 2001	11 Oct 2001	9 May 2002	MCL (Drinking Water Standard)
	Nov 1996					
1,4-Dichlorobenzene	bdl	bdl	0.84 µg/L	bdl	bdl	5 µg/L ¹
1,2-Dichlorobenzene	0.5 µg/L	bdl	0.26 µg/L	bdl	bdl	600 µg/L
1,2,4-Trichlorobenzene	bdl	bdl	bdl	bdl	bdl	70 µg/L
vinyl chloride	bdl	bdl	0.11 µg/L	bdl	bdl	2 µg/L
cis-1,2-Dichloroethene	0.9 µg/L	bdl	0.53 µg/L	0.83 µg/L	1.04 µg/L	70 µg/L
Tetrachloroethene	bdl	bdl	bdl	bdl	bdl	5 µg/L
Trichloroethylene	1 µg/L	bdl	0.2 µg/L	0.5 µg/L	0.5 µg/L	5 µg/L
Naphthalene	bdl	bdl	bdl	bdl	bdl	20 µg/L ¹
Benzene	bdl	bdl	bdl	bdl	bdl	5 µg/L

Notes:

¹ MCP Method 1 GW-1 standard used because no MCL exists or MCP standard is lower.

bdl – analytical results were below detection levels

Three monitoring wells, ECS-38, ECS-39 and ECS-40, monitor the groundwater flowing from IRP Site 21 towards the Shawsheen River. Two of these wells (ECS-38 and ECS-39) have had exceedances of drinking water standards, whereas ESC-40 has been consistently near or below the laboratory detection levels for all VOCs. At **ECS-38** there is one VOC contaminant of concern; 1,4-dichlorobenzene. The historical results for this contaminant are graphed in **Attachment H-1**. Please note that the current levels do not exceed the USEPA MCL of 75 ppb but do exceed the more stringent MCP GW-1 standard of 5 ppb. At **ECS-39** there are three VOC contaminants of concern; 1,4-dichlorobenzene, TCE and vinyl chloride. The historical results for these contaminants are graphed in **Attachment H-2**. At this location in recent monitoring events the TCE and vinyl chloride concentrations have met drinking water standards and the 1,2 dichlorobenzene concentration has fluctuated from slightly above the more stringent MCP GW-1 standard of 5 ppb to below the standards. Upgradient of the 3 perimeter wells and downgradient of the LNAPL pools are monitoring wells MWZ-3 and MWZ-4. The historical results for the total BTEX concentration in these wells are graphed in **Attachment H-3** for **MWZ-3** and **Attachment H-4** for **MWZ-4**. Both of these graphs show stable to slight downtrends in the total BTEX concentrations.

A component of the pre-RA LTMP is the checking of wells for LNAPL and measuring its thickness when present. A table summarizing this monitoring is presented in **Attachment I**. Of note is the continued existence of LNAPL in most of the wells which have had measurable LNAPL in the past and the absence of LNAPL in wells with no historical detections which indicates that the LNAPL is not migrating.

Site Inspection

An inspection of the Site was conducted on May 28, 2002, by the Hanscom AFB Installation Restoration Program Manager accompanied by the USEPA and MA DEP Remedial Project Managers for the Hanscom Field/Hanscom AFB NPL Site. The purpose of this inspection was to confirm current land use and to assess the protectiveness of the remedies for OU-1/IRP Sites 1, 2 and 3, OU2/IRP Site 4, OU3/IRP Site 6, and OU3/IRP Site 21. No significant issues were identified and no activities were observed that would indicate that areas with subsurface soil contamination had been excavated or that the groundwater was being used for potable/non-potable purposes.

OU-1/IRP Sites 1, 2 and 3: All 3 sites are within the restricted/fenced perimeter of Hanscom Field which is patrolled by Massport operational and security personnel. IRP Site 1 with the VER system is also fenced to segregate the area from the active airfield and adjacent US Navy property. At IRP Sites 2 and 3 recharge basins are constructed over the drum burial pits which precludes access to any residual subsurface soil contamination. The central treatment facility is fenced with access to it controlled by the Hanscom AFB's remedial action contractor's on-site staff. The storm drainage ditch where the effluent from the treatment system is discharged was checked and no evidence of an adverse impact of the discharge was observed.

OU-2/IRP Site 4: This site is part of Hanscom Field in the Runway 5 Approach but is outside the perimeter fencing of the active part of the airfield. Vehicle access to this area is restricted by locked gates and physical barriers, however, the area is accessible on foot. The capped areas, berms, side slopes, drainage structures were observed in good condition and as constructed in 1988. The maintenance recommendations of the 1st Five-Year Review were found to be fully implemented.

OU-3/IRP Site 6: This site is on Hanscom AFB and access to the base is restricted to authorized personnel. The site is also separately fenced with signs advising that it is an IRP site and that digging and dumping are not authorized. The capped areas, side slopes/toe drains and drainage structures were observed in excellent condition and as constructed in 2001, however, the grass is still not fully established and there is some evidence of winter kill. Also the remediated wetland areas are not fully restored. A five year time frame for this process was projected in the Remedial Design. The seeping of discolored liquid from the north side of the former filter bed area into the wetland restoration areas, as noted in the *Remedial Action Report for Landfill Capping Project at Operable Unit 3 – Site 6*, was observed. As discussed above the LTMP is being modified to include the sampling of this liquid when/if present.

OU-3/IRP Site 21: As with IRP Site 6 this site is on Hanscom AFB and access to the base is restricted to authorized personnel. The "industrial" land use of the Site 21 area was observed to be unchanged, however, the remedial action is not yet in place, thus it could not be inspected. Also Mr. Best reported that on May 8th he had inspected the Shawsheen River and its banks for evidence of petroleum product seeping into river. None was found.

Interviews

Interviews were conducted with various parties connected to the site. During the May inspection, The USEPA and MA DEP RPMs were interviewed. Neither identified any concerns regarding the Hanscom Field/Hanscom AFB NPL Site. Mr. Rich Landry, the Hanscom AFB Remedial Action-Operations contractor's field/on-site manager and his assistant, Mr. Daniel Kelly, were interviewed on May 29th. Neither identified any issues/concerns with the operation, maintenance and monitoring associated with the on-going remedial actions.

VII. Technical Assessment

OU-1/IRP Sites 1, 2 and 3

Question A: Is the remedy functioning as intended by the decision documents?

Remedial Action Performance: The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy is functioning as intended by the IROD. Surface water and groundwater sampling as part of the LTMP confirms that operation of the remediation system has achieved the remedial objectives to minimize the migration of groundwater contaminants and to reduce the contaminant concentrations of groundwater discharges to surface water to below groundwater standards. This monitoring also confirms that the secondary objective to decrease contaminants near the source area and to reduce the size of the off-site dissolved phase plume, i.e., draw back the plume toward the source areas is being met. In addition monitoring indicated that active remediation of the IRP Site 3 source area may no longer be necessary and in August 2001 the Site 3 groundwater recovery, treatment and recharge was suspended. This is considered an interim action until future long-term monitoring results confirm that no further active cleanup is required for IRP Site 3.

System Operations/O&M: Operation and maintenance of the groundwater collection, treatment and recharge system has, on the whole, been extremely effective. The system operates continuously around-the-clock with periodic scheduled/unscheduled shutdowns for maintenance or repairs. The system has consistently operated for greater than 97.5% of possible hours. As a result of capital improvements in 1996 current O&M annual costs are now significantly less than original estimates and there are no indications of any difficulties with the remedy.

Opportunities for Optimization: Starting in 1996 there have been several changes in the system with the objective of optimization and, as indicated above, in keeping with the IROD's primary objective of "... continued operation of the existing **dynamic** groundwater treatment system ..." additional opportunities are being investigated. These include the on-going Permanganate Injection Pilot Study at IRP Site 1 and the in-situ treatment technology being demonstrated in the on-site plume downgradient of IRP Site 1. In addition, following the cessation of collection at IRP Site 3, the treatment system now has excess capacity. Additional recovery wells and/or interceptor trench addressing IRP Site 1 source area and/or downgradient plume are being considered to take advantage of this excess capacity and expedite mass contaminant removal.

Early Indicators of Potential Issues: There have been no frequent equipment breakdowns or changes in operation, maintenance and monitoring data that indicate a potential/developing issue. There are no known issues or problems associated with the OU-1 Remedial Action that could place protectiveness at risk.

Implementation of Institutional Controls and Other Measures: The existence of IRP Sites 1, 2 and 3 is documented in the Hanscom AFB General Plan and in Massport's Generic Environmental Impact Report (GEIR) to alert operational personnel, planners and decision makers to the environmental constraints associated with these areas of Hanscom Field. Access controls are in place and prevent exposure to any residual subsurface soil contamination (e.g., restricted/controlled entry to active airfield, fencing and recharge basins constructed on top of IRP Sites 2 and 3). The human health risks associated with the contaminated groundwater at the site remain, however, this groundwater is not currently used as a drinking water supply, nor is it expected to be so used in the future. MOUs with Massport and the Town of Bedford documenting that they will not authorize the use of the groundwater as a drinking water supply have not yet been put in place but negotiations with each party are underway.

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

Changes in Standards and To Be Considereds: The ARARs listed in the OU-1 IROD that must be met and that have been evaluated are included in **Attachment B-1**. These include federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards); ARARs related to surface water and wetland protection; and ARARs related to groundwater and treatment system monitoring. There have been no changes in these ARARs and no new standards or TBCs identified that affect the protectiveness of the OU-1 remedy.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics: Physical site conditions or the understanding of these conditions have not changed in a way that could affect the protectiveness of the remedy. The land use on or near the site remains un-changed and there are no newly identified contaminants or contaminant sources. Human health or ecological routes of exposure or receptors have not been newly identified or changed in a way that could affect the protectiveness of the remedy. There are no unanticipated toxic byproducts of the remedy not previously addressed by the decision documents.

Changes in Risk Assessment Methods: Standardized risk assessment methodologies have not changed in a way that could affect the protectiveness of the remedy.

Expected Progress Towards Meeting RAOs: The remedy is progressing as expected.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No newly identified ecological risks been found and no weather-related events have affected the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed, the site inspection, and the interviews, the remedy is functioning as intended by the IROD and there have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

OU-2/IRP Site 4

Question A: Is the remedy functioning as intended by the decision documents?

Since the 1st Five-Year Review, the physical site conditions or the understanding of these conditions have not changed in a way that could affect the protectiveness of the remedy. The protectiveness the landfill cap had previously been confirmed by the long-term monitoring conducted between December 1989 and September 1992, Supplemental Sampling and Analysis conducted in 1995 and 1996, the Human Health and Ecological Risk Assessments completed in 1997, and the 1st Five-Year Review conducted in 1997. The 1st Five-Year Review concluded "based on the field inspection, and human health and ecological risk assessment, protectiveness of the landfill cap at Site 4 has been demonstrated". The assessment of this

five-year review found that the recommendations of the 1st Five-Year Review have been implemented and that a long-term inspection and maintenance program is in place to ensure continued protectiveness of the remedy. Quarterly inspections since 1998 confirm that there have been no changes of any kind since the 1st Five-Year Review that could affect the protectiveness of the remedy.

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

The Human Health Risk Assessment concluded that “there are no unacceptable risks associated with exposure to Site 4 media” and the Ecological Risk Assessment concluded that “there are no significant ecological risks associated with Site 4.” There have been no changes to standardized risk assessment methodologies, exposure assumptions, or toxicity data which would affect these risk assessments.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No newly identified ecological risks been found and no weather-related events have affected the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed, the site inspection, and the interviews, the remedy is functioning as intended by the 1988 Remedial Action Plan and there have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessments and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

OU-3/IRP Site 6

Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicates that the remedy appears to be functioning as intended by the ROD. However, since the remedy has been in place for less than 1 year, additional data/time is required to fully address this question and to assess whether or not natural flushing and natural attenuation are achieving the expected reduction in the size and strength of the contaminant plume within the compliance boundary. Also, while the post-RA on-site baseline groundwater monitoring has been completed, the groundwater monitoring of the compliance boundary is still pending/scheduled for later this year. The capping of contaminated soils and removal of contaminated wetland soil has achieved the remedial objectives to prevent direct contact with contaminants in surface soils, to reduce exposure of ecological receptors to contamination, and to minimize erosion of contaminants from the site to the adjacent wetlands and pond. The implementation of institutional controls ensures that future land use does not increase the risk of exposure to the waste/contaminated soil remaining on site and that the groundwater within the compliance zone is not used for human consumption.

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

The ARARs listed in the OU-3/IRP Site 6 ROD are included in **Attachment B-2**. As the remedial work has been completed, most ARARs for soil contamination and construction activities cited in the ROD have been met. ARARs that still must be met at this time and that have been evaluated include the Safe Drinking Water Act (SDWA) (40 CFR 141.11-141.16) from which many of the groundwater cleanup levels

were derived - [Maximum Contaminant Levels (MCLs)]; and ARARs related to post-RA monitoring. There have been no changes in these ARARs and no new standards or TBCs identified that affect the protectiveness of the remedy. Also, the design and construction of the IRP Site 6 remedy addressed/mitigated risks identified in the Human Health and Ecological Risk Assessments and there have been no changes to standardized risk assessment methodologies, exposure assumptions, or toxicity data which would affect these risk assessments. However, the Safe Drinking Water Act (SDWA) was changed in 2001 to lower the arsenic standard from 50 ug/L to 10 ug/L. Since, as discussed earlier in this report, arsenic is the principal contaminant of concern in the on-site groundwater and this change may necessitate adjustment of the groundwater compliance boundary or implementation of the contingency groundwater remedy in the event LTMP monitoring results show that the remedy is not effective in maintaining groundwater quality outside the compliance boundary. Data, collected in accordance with the LTMP for IRP Site 6, will be analyzed by the Project Team as collected to assess whether or not changes are required prior to the completion of the next (3rd) Five-Year Review in 2007.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

As discussed in the Data Review Section discolored liquid was found seeping from the former filter bed area into the wetland remediation areas (WWRA & EWRA) which had concentrations of some metals which exceeded AWQC, MCL and/or MCP GW-1 Standards. Sufficient data is not available at this time to evaluate the impact of these seeps. No weather-related events have affected the protectiveness of the remedy and there is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed, the site inspection, and the interviews, the remedy appears to be functioning as intended by the ROD for OU-3/IRP Site 6, however, additional data/time is required to fully assess this remedy to include the impact of the discolored liquid seeping from the former filter bed area into the wetland remediation areas and the impact of the reduction of the arsenic groundwater standard. Data, collected in accordance with the LTMP for IRP Site 6, will be analyzed by the Project Team as collected to assess whether or not changes are required prior to the completion of the next (3rd) Five-Year Review in 2007. It is noted that there have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. Also there have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessments, and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

OU-3/IRP Site 21

Question A: Is the remedy functioning as intended by the decision documents?

Not applicable as the remedy is not yet in place.

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

The ARARs listed in the OU-3/IRP Site 21 ROD that must be met and that have been evaluated are included in **Attachment B-3**. These include federal drinking water standards (*i.e.*, MCLs and non-zero MCLGs), state drinking water standards (*i.e.*, MCLs) and state groundwater risk characterization standards (*i.e.*, MCP Method 1 GW-1 standards); ARARs related to construction activities; and ARARs related to groundwater and treatment system monitoring. There have been no changes in these ARARs and no new standards or TBCs identified that affect the protectiveness of the OU-1 remedy. The pending design and construction of the selected remedy for IRP Site 21 will address risks identified in the Human Health and Ecological Risk Assessments and there have been no changes to standardized risk assessment

methodologies, exposure assumptions, or toxicity data which would affect these risk assessments.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No newly identified human health or ecological risks have been found and no weather-related events have affected the protectiveness of the selected remedy. There is no other information that calls into question the protectiveness of the selected remedy.

Technical Assessment Summary

According to the data reviewed, the site inspection, and the interviews, the selected remedy, upon implementation, should function as intended by the ROD. There have been no changes in the physical conditions of the site or in the cleanup levels for the contaminants of concern that would affect the protectiveness of the selected/pending remedy. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessments and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the selected/pending remedy. There is no other information that calls into question the protectiveness of the remedy.

VIII. Issues

There are no issues related to current site operations, conditions, or activities that affect current and/or future protectiveness of any of the Hanscom Field/Hanscom AFB remedies except for the following Site 6 condition.

- Discolored liquid seeping from the former filter bed area into the wetland remediation areas (WWRA & EWRA). This liquid was analyzed during the construction of the RA (August 2001) and found to have concentrations of some metals which exceeded AWQC, MCL and/or MCP GW-1 Standards.

At this time there is insufficient data to determine whether or not this condition affects the current or future protectiveness of the Site 6 remedy.

IX. Recommendations and Follow-up Actions

The following are required and suggested improvements to current site operations, activities, remedies, or conditions. Hanscom AFB is responsible for their implementation with regulatory oversight by MA DEP and/or USEPA Region 1.

OU-1/IRP Sites 1, 2 and 3

- Incorporate IROD Institutional Controls in next formal revision of the Hanscom AFB General Plan. Note the base is in the process of contracting with a consultant to update the October 1998 General Plan which identifies the IRP Sites as areas with "Environmental Constraints". The update with the specific OU-1 Institutional Controls listed is planned to be published on/about October 2003.
- Continue efforts to establish Memorandum of Understanding with Massport and the Town of Bedford concerning the OU-1 Institutional Controls with objective of having both documents finalized by December 31, 2002.
- Formally revise the OU-1 Long Term Monitoring Plan in accordance with the recommendations listed in the OU1/IRP Sites 1, 2 and 3 Data Review Section with the objective of having this action finalized by December 31, 2002.
- Continue on-going efforts to find effective measures to reduce source area contamination, especially at IRP Site 1, in order to expedite groundwater cleanup.
- Continue on-going efforts to gather information to support a final OU-1 remedy that will be targeted at remediating all or part of the groundwater plume.
- Continue to share groundwater and surface water monitoring results with Massport, the Town of Bedford, and the Hanscom AFB Restoration Advisory Board (RAB).
- Continue interim cessation of active remediation of the IRP Site 3 source until monitoring indicates that it is still required or until a determination can be made that active remediation is no longer necessary.

OU-2/IRP Site 4

- Continue long-term maintenance of cap as recommended in the 1st Five-Year Review Report

OU-3/IRP Site 6

- Incorporate ROD Institutional Controls in next formal revision of the Hanscom AFB General Plan. Note the Base is in the process of contracting with a consultant to update the October 1998 General Plan which identifies the IRP Sites as areas with "Environmental Constraints". The update with the specific OU-1 Institutional Controls listed is planned to be published on/about October 2003.
- Install proposed OU-3/IRP Site 6 compliance boundary wells with the objective of having the wells installed prior to September 30, 2002.
- Formally revise the OU-3/IRP Site 6 Long Term Monitoring Plan to add the sampling and analysis of the discolored liquid seeping from the Former Filter Bed into the wetland remediation areas with the objective of having this action finalized by December 31, 2002.

OU-3/IRP Site 21

- Incorporate ROD Land Use Controls/Institutional Controls in next formal revision of the Hanscom AFB General Plan. Note the base is in the process of contracting with a consultant to update the October 1998 General Plan which identifies the IRP Sites as areas with “Environmental Constraints”. The update with the specific OU-1 Institutional Controls listed is planned to be published on/about October 2003.

X. Protectiveness Statement(s)

OU-1/IRP Sites 1, 2 & 3

- The remedy at OU-1 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The OU-1 remedy is intended to be an interim remedial action while additional information is gathered to support a final remedy that will be targeted at remediating all or part of the groundwater plume. Current monitoring data indicate that the remedy is functioning as intended and all threats at the site have been addressed through physical (contaminated soil removal, fencing, recharge basins) and institutional controls. Current data indicate that the OU-1 RA has been and continues to be successful in cleaning up the surface water and surface aquifer and in containing/capturing lower and bedrock aquifer contamination at the boundary. Current data also indicate that concentrations in the off-site plume are declining.

OU-2/IRP Site 4

- The remedy at OU-2 is protective of human health and the environment.

The protectiveness the landfill cap at IRP Site 4 was documented in the 1st Five-Year Review and there have been no changes of any kind since 1997 that could affect the protectiveness of the remedy. A long-term inspection and maintenance program is in place to ensure continued protectiveness of the remedy.

OU-3/IRP Site 6

- The remedy at OU-3/IRP Site 6 currently protects human health and the environment in the short-term because construction has been completed and institutional controls have been implemented. However, in order for the remedy to be protective in the long-term, the following actions need to be taken:

Conduct groundwater, liquid seep and surface water monitoring to confirm that natural flushing and natural attenuation are reducing the size and strength of the contaminant plume within the compliance boundary and that groundwater quality is being met outside the compliance boundary.

It is expected that it will take approximately three to five years to collect sufficient data to make a final protectiveness determination

The remedy has been in place less than one-year and a long-term inspection, maintenance and monitoring program is currently in place to evaluate the continued protectiveness of the remedy. Review of the *Remedial Action Report* confirms that the remedy was constructed in accordance with the Remedial Design and review of December 2001 and March 2002 inspection reports confirms that the remedy remains in place as constructed. Also in December 2001 the post-RA monitoring of the site was initiated with a baseline monitoring round which will be compared to future monitoring results to assess protectiveness.

OU-3/IRP Site 21

- The remedy at OU-3/IRP Site 21 is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

Current monitoring data indicate that water quality of the adjacent Shawsheen River is not being threatened and that there is natural containment of the LNAPL and natural containment/apparent natural attenuation of the dissolved-phase plume. All threats at the site are currently being addressed through monitoring, land use controls and institutional controls.

XI. Next Review

The next five-year review for the Hanscom Field/Hanscom AFB Superfund Site should be completed no later than five years following the signature date of this Five-Year Review Report which is anticipated to occur on or before September 15, 2002.