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Superfund
Record of Decision:

Silresim Chemical, MA

50272-101

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 4.5-acre Silresim Chemical site is a former chemical waste reclamation facility in Lowell, Massachusetts. Land use in the area is predominantly industrial, although residential areas are located to the south, east, and northeast with the closest residences approximately 300 to 500 feet from the site. The nearby residences obtain their drinking water from a municipal water supply. From 1971 to 1977, Silresim Chemical Corporation (SCC) used the site for a chemical waste reclamation facility. The facility's primary operations included recycling and reclaiming various chemicals and consolidating waste for offsite disposal. The facility handled approximately 3 million gallons of waste per year including halogenated solvents, oily wastes, alcohols, metal sludge, and plating and pesticide wastes. From 1977 to 1978, SCC abandoned the facility, leaving approximately 1 million gallons of hazardous waste onsite in bulk tanks and nearly 30,000 decaying drums. State investigations revealed evidence of numerous spills, leakage of drums, discharges to nearby sewers, and run-off to adjacent property. A number of EPA and State investigations revealed contamination of soil and ground water. From 1978 to 1982, the State constructed a fence, removed liquid waste in onsite drums and tanks, and constructed berms and absorbent-filled

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Silresim Chemical, MA
First Remedial Action - Final
Contaminated Media: soil, gw
Key Contaminants: VOCs (benzene, TCE, toluene, xylenes), other organics (dioxin, PAHs, PCBs, phenols), and metals (arsenic, chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 280
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(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

trenches. From 1983 to 1984, EPA removed all onsite structures, extended the fence, and placed a clay cap over the site. This Record of Decision (ROD) addresses both onsite and offsite soil and ground water contamination. The primary contaminants of concern affecting the soil and ground water are VOCs including benzene, TCE, toluene, and xylenes; other organics including dioxin, PAHs, PCBs, and phenols; and metals including arsenic, chromium, and lead.

The selected remedial action for this site includes constructing additional perimeter fencing; placing a low-permeability temporary cover over areas of contaminated offsite soil; extending and repairing the existing cap as required; conducting in-situ vacuum/vapor extraction of approximately 137,000 cubic yards of contaminated soil; excavating and stabilizing any soil with residual contamination after treatment with vapor extraction, followed by onsite disposal; backfilling excavated areas with clean fill; installing a RCRA Subtitle C cap over the stabilized soil; pumping and pretreatment of ground water using a phase separation tank to separate non-aqueous phase liquids (NAPLs), followed by chemical addition, flocculation, precipitation, and filtration to remove metals; offsite disposal of NAPLs and residuals from the metals removal process; treating residual ground water using air stripping of heated influent, thermal oxidation, and aqueous phase carbon adsorption, followed by offsite discharge of the treated ground water to the municipal sewer system or onsite discharge to surface water; conducting long-term soil, surface water, and ground water monitoring; and implementing institutional controls including deed, ground water, and land use restrictions The estimated present worth cost for this remedial action is $22,300,000, which includes a present worth O&M cost of $9,263,000.

<u>PERFORMANCE STANDARDS OR GOALS</u>: Chemical-specific unsaturated soil clean-up goals are based on leachability modeling and include among others benzene 4 ug/kg, dioxin 1 ug/kg, PAHs 10,000 ug/kg, PCBs 2,300 ug/kg, phenol 5,300 ug/kg, toluene 2,700 ug/kg, TCE 6 ug/kg, and xylenes 22,000 ug/kg. Chemical-specific surficial soil clean-up goals are based on risk assessments, background levels, and EPA policy and include among others arsenic 21,000 ug/kg (background), benzene 15,000 ug/kg (risk), dioxin 1 ug/kg (policy), lead 500,000 ug/kg (policy), PAHs (total) 29,000 ug/kg (background), PCBs 1,000 ug/kg (policy), and TCE 40,000 ug/kg (risk). Chemical-specific interim ground water clean-up goals are based on MCLs, MCLGs, proposed MCLs (pMCLs), reference doses, and EPA policy and include among others arsenic 50 ug/l (MCL), benzene 5 ug/l (MCL), chromium 100 ug/l (MCLG), dioxin $5x10^{-8}$ ug/l (pMCL), lead 15 ug/l (policy), PAHs 0.2 ug/l (pMCL), PCBs 0.5 ug/l (MCL), phenol 21,000 ug/l (reference dose), TCE 5 ug/l (MCL), toluene 1,000 ug/l (MCLG), and xylenes 10,000 ug/l (MCLG). EPA will conduct a risk assessment of residual ground water contamination to determine final ground water clean-up goals.

RECORD OF DECISION SUMMARY

SILRESIM SITE
LOWELL, MASSACHUSETTS

SEPTEMBER 19, 1991

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

DECLARATION FOR THE RECORD OF DECISION

SILRESIM SITE
LOWELL, MASSACHUSETTS

STATEMENT OF PURPOSE

This decision document represents the selected remedial action for the Silresim Site, in Lowell, Massachusetts, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP); 40 CFR Part 300 et seq., as amended. The Regional Administrator has been delegated the authority to approve this Record of Decision.

The Commonwealth of Massachusetts has concurred on the selected remedy.

STATEMENT OF BASIS

This decision is based on the Administrative Record which has been developed in accordance with Section 113 (k) of CERCLA and which is available for public review at the Pollard Memorial Library in Lowell, Massachusetts and at the Region I Waste Management Division Records Center in Boston, Massachusetts. The Administrative Record Index (Appendix F to the ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in the ROD, may present an imminent and substantial endangerment to human health or public welfare or to the environment.

DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for the Silresim Site, which includes both source control and management of migration components to obtain a comprehensive remedy.

The major components of the selected source control remedy include:

* In situ vacuum/vapor extraction of contaminated soil to remove volatile organic compounds (VOCs);
* Excavation of soil with residual contamination and further treatment using stabilization;
* Disposal of stabilized soil on Site;
* Installation of a Resource Conservation and Recovery Act (RCRA) Subtitle C cap over the stabilized soil; and
* Institutional Controls.

The major components of the selected management of migration remedy include:

* Extraction of contaminated groundwater from the overburden and shallow bedrock using extraction wells;
* Pretreatment of contaminated groundwater using a phase separation tank to separate non-aqueous phase liquids (NAPLs), and metals precipitation/filtration to remove metals;
* Treatment of contaminated groundwater using air stripping of a heated influent, thermal oxidation and aqueous phase carbon adsorption; and
* Institutional controls.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate for this remedial action and is cost-effective. This remedy satisfies the statutory preference for remedies that utilize treatment as a principal element to reduce the toxicity, mobility, or volume of hazardous substances. In addition, this remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

As this remedy will result in hazardous substances remaining on Site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Sept. 19 1991
Date:

Julie Belaga
Regional Administrator
U.S. EPA, Region I

RECORD OF DECISION
SILRESIM SITE

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RECORD OF DECISION SUMMARY
SILRESIM SUPERFUND SITE
SEPTEMBER 19, 1991

I. SITE NAME, LOCATION AND DESCRIPTION

This Record of Decision (ROD) is for the cleanup of the Silresim Superfund Site (the Site) in Lowell, Massachusetts. The Silresim Site is located at 86 Tanner Street in an industrial area of Lowell, Massachusetts, just south of the Central Business district (**Figure 1, Appendix A**). The Site is defined by the extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action. The original facility (Silresim Chemical Corporation) consisted of approximately 4.5 acres; however, the extent of contamination includes approximately 16 acres (bound by the extent of groundwater contamination). The 4.5 acre Silresim property is bordered by the Lowell Iron and Steel Company to the north, the B & M railroad yard and tracks to the east/northeast, and an automobile salvage yard to the south, and Tanner Street to the west. Residential areas are located south, east, and northeast of the Silresim property, with the closest residences located on Canada, Main, and Maple Streets, roughly 300 to 500 feet from the Silresim property boundary. River Meadow Brook lies approximately 400 feet west of the Silresim property boundary (**Figure 2, Appendix A**).

No buildings or permanent structures currently exist on the Silresim property, which is enclosed by an eight-foot high chainlink fence. Most of the land surface within the fence is covered with a clay cap, with the exception of the northeast corner which is covered with crushed stone. Crushed stone also has been placed on runoff areas along the northern and southern perimeter of the Silresim property to prevent direct contact with contaminated soils.

A more complete description of the Site can be found in the Silresim Remedial Investigation report at pages 16 through 20 (March 1990).

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Response History and Land Use

i. Response History

From 1971 through 1977, the Silresim Chemical Corporation operated a chemical waste reclamation facility on the Site. The facility's primary operations included recycling and reclaiming various chemicals and consolidating wastes for off-site disposal. The Massachusetts Division of Water Pollution Control (DWPC) granted the Silresim Chemical Corporation facility a hazardous waste collection and disposal permit in 1973. Wastes were accepted at the facility in drums, tank trucks, railroad tanker cars, and other containers. These substances included halogenated solvents, oily wastes, alcohols, plating wastes, metal sludges and pesticide wastes. Although exact figures do not exist, it is estimated that the facility handled approximately 3 million gallons of waste per year.

Between 1973 and 1975, DWPC cited Silresim for numerous permit violations as the volume of waste received exceeded the facility's capacity. In 1976, DWPC initiated efforts to close the facility because of the increased number of permit violations and the deteriorating condition of the Site. DWPC subsequently issued modifications to the company's permit, modifications that were lifted after DWPC imposed a compliance schedule to clean up the Site and improve operations.

The Silresim Chemical Corporation filed for bankruptcy in late 1977 and abandoned the facility in January 1978, leaving approximately one million gallons of hazardous materials on Site in drums and bulk tanks, including almost 30,000 decaying drums covering virtually all open areas of the facility. Subsequent investigations revealed that the facility had been poorly maintained and revealed evidence of numerous spills, leakage of drums, discharges to Lowell sewers, and runoff to adjacent property.

From 1978 to 1982, the Massachusetts Division of Water Pollution Control (DWPC was the original regulator of hazardous waste in Massachusetts prior to the Department of Environmental Quality Engineering, which is now the Massachusetts Department of Environmental Protection) secured the Silresim facility and minimized immediate threats to public health and the environment. The DWPC constructed a Site fence, hired a 24-hour guard, removed liquid wastes in the on-site drums and above-ground tanks, constructed berms and absorbent-filled trenches to reduce the spread of waste through surface runoff, and conducted studies of the Site soils and groundwater.

In 1982, EPA proposed the Site to the National Priorities List (NPL) for long-term cleanup. The Silresim Site became a final listing on the NPL in 1983. Between the spring of 1983 and December 1984, EPA removed all structures remaining on the Site, extended the fence, and placed a clay cap over the Site. The Massachusetts Department of Environmental Protection has been and is currently responsible for regular operation and maintenance of the Site, which includes maintaining the cap, fence and postings.

A more complete history of the Site can be found in the Remedial Investigation Report at pages 3 through 12.

ii. Land Use

The Site and its surrounding areas have been used for industrial activities since the early 1900's. From 1916 to 1971, several petroleum companies used the Silresim property as an oil and fuel storage depot. The Lowell Iron and Steel Company/Scannell Boiler Works is located just north of the Silresim property. Lowell Used Auto Parts operates an auto salvage yard just south of Silresim. The parcel just east/northeast of the Site is used for railroad activities. Various other industries, as described in the Remedial Investigation Report, are located along Tanner Street.

River Meadow Brook, which has been channeled and filled in the past, and the Lowell Connector are located to the west of the Site. River Meadow Brook runs north to northeast about 400 feet west of the Site. It is classified by the Massachusetts Division of Water Pollution Control as a Class B Stream and is therefore designated for the uses of protection and propagation of fish, other aquatic life and wildlife, and for primary and secondary contact recreation. However, the water quality from upstream of the Silresim Site to the Concord River does not comply with Class B standards. The Brook is affected by upstream industrial discharge unrelated to contaminant plumes from Silresim. The banks are of marginal value to wildlife and aquatic biota due to anthropogenic changes to the stream course and banks, the upstream discharges, and general urban, paved and altered environments adjacent to the stream bank. The potential use of the Brook for recreational activities appears to be limited due to physical characteristics, degraded conditions and observed dumping of trash and debris.

The land southeast of the Site, beyond the railroad property, is being developed as industrial/commercial condominiums. East Pond, a small surface water body is located about 300 feet to the east of the Silresim property. It is filled at its southern end and its banks are completely denuded of trees. The entire perimeter of this small water body is physically disturbed. The State of Massachusetts has not classified East Pond, however, it could be used for recreational activities such as swimming and rafting. The pond is small and shallow during the summer months and recreational use is expected to be infrequent and of short duration.

A multi-family residence is located about 300 feet southwest of the southern boundary of the Site, on Main Street. The Ayer City residential district of south central Lowell is situated just south of this residence, roughly 400 feet and further from the Silresim property boundary. A second residential area is located approximately 1,000 feet north of the Site.

The City of Lowell obtains its water supply from the Merrimack River. The intake is located approximately 3.5 miles upstream of the confluence of the Merrimack and Concord Rivers. The aquifer below the Site is classified by the Federal Government and the Commonwealth of Massachusetts as a Class IIB and I aquifer, respectively. However, groundwater is not being used for drinking water supply purposes in the Silresim area. The closest identified groundwater use is at the Lowell Car Wash at the corner of Tanner and Plain Streets. Groundwater was being used for car washing operations at this location, but employees of the Lowell Car Wash recently stated that use of this well has been terminated. City-supplied water is being utilized for drinking.

B. Enforcement History

During July, August and September of 1983, EPA notified approximately 325 parties who had: owned or operated the facility; generated wastes that were shipped to the facility; arranged for the disposal of wastes at the facility; or transported wastes to the facility, that they were potentially liable with respect to the Site. Negotiations commenced with these potentially responsible parties (PRPs) in 1984 regarding the settlement of the PRP's liability at the Site.

On July 12, 1985, EPA issued an Administrative Order by Consent to the Silresim Site Trust, a group of approximately 200 Potentially Responsible Parties (PRPs), who agreed to undertake a Remedial Investigation and Feasibility Study (RI/FS) to investigate site conditions and to evaluate potential cleanup alternatives which would address contamination at the Silresim Site. In addition, in 1990 EPA entered into an administrative agreement with over 200 PRPs for the past costs incurred at this Site for EPA removal and enforcement activities.

The PRPs have been active in the remedy selection process for this Site. During the public comment period the PRPs submitted written comments which are included in the Administrative Record and which are responded to by EPA in the Responsiveness Summary (**Appendix E**).

III. COMMUNITY PARTICIPATION

Throughout the Site's history, community concern and involvement has been sporadic. During the early 1980's community concern and involvement was high when groundwater, soil and air quality data became available. However, in recent years indicators of local interest have decreased significantly. EPA and the Massachusetts Department of Environmental Protection (DEP) have kept the community and other interested parties informed of Site activities and involved in the decision-making process through informational meetings, fact sheets, press releases, public meetings, and a publicly accessible Site file in the Pollard Memorial Library in Lowell. In 1983 and 1984, EPA and DEP operated an information hot-line and participated in regular meetings of a group called the Silresim Task Force which was designed to improve communications between federal, state, and local officials, and the citizens.

In September 1985, EPA released a community relations plan which outlined a program to address community concerns and keep citizens informed and involved in the remedial activities. In response to a petition from a local environmental organization (the Ayer City Homeowners Chapter of the Greater Lowell Environmental Campaign), DEP designated the Silresim Site as a Public Involvement Plan site in 1988. DEP developed the plan jointly with EPA so that federal and state community relations efforts would not be duplicated. The resulting joint Community Relations Plan/Public Involvement Plan was finalized in June 1991.

EPA has held numerous informational meetings since the Site's listing on the NPL. For example, on April 26, 1990, EPA held an informational meeting to discuss the results of the Remedial Investigation. On June 19, 1991, EPA held a meeting to describe the cleanup alternatives presented in the Feasibility Study, and to present EPA's Proposed Plan. During both of these meetings EPA answered questions from the public. A 30-day public comment period beginning June 20, 1991 was extended an additional thirty days to August 19, 1991 to accept public comment on the alternatives presented in the Feasibility Study, the Proposed Plan and on any other documents previously released to the public. On July 10, 1991, EPA held an informal public hearing to accept any oral comments. A transcript of this hearing, and EPA's response to the comments are included in the attached Responsiveness Summary (**Appendix E**). A more complete list of community relations activities can be found in Attachment A to the Responsiveness Summary.

EPA published a notice with a brief analysis of the Proposed Plan in the Lowell Sun on June 8, 1991 and made the plan available to the public at EPA's offices in Boston and at the Pollard Memorial Library in Lowell on June 19, 1991. On June 19, 1991, EPA also made the updated Administrative Record available for public review at EPA's offices at 90 Canal Street in Boston and at the Pollard Memorial Library in Lowell, Massachusetts.

This decision document presents the selected remedial action at this Site, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the National Contingency Plan. The decision for this Site is based on the Administrative Record.

IV. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The selected remedy was developed by combining different source control and management of migration components to obtain a comprehensive approach for Site remediation. In summary, the remedy calls for in situ vacuum/vapor extraction of approximately 137,000 cubic yards of contaminated soil. Following this treatment, soil with residual contamination will be further treated using a stabilization process. The stabilized soil will be disposed of on Site under an impermeable cap meeting federal requirements. The remedy also includes active restoration of the overburden and bedrock aquifers by pumping the contaminated groundwater and treating it by air stripping.

This remedial action will address the following potential risks to human health and the environment posed by the Site and resulting from:

1) Dermal absorption and incidental ingestion of contaminants in surficial soils;

2) Ingestion of groundwater;

3) Inhalation of volatile organic compounds (VOCs) from groundwater seepage inside buildings at Lowell Iron and Steel and nearby residential basements;

4) Inhalation of VOCs from vents on the Silresim property;

5) Direct contact with contaminants in surface water in the East Pond, River Meadow Brook, and Concord River; and

6) The continued release of contaminants from unsaturated soils to groundwater.

V. SUMMARY OF SITE CHARACTERISTICS

Chapter One of the Feasibility Study contains an overview of the Remedial Investigation. In addition to the Remedial Investigation prepared by the Silresim Site Trust, EPA has prepared an addendum, referred to as the Supplemental Remedial Investigation Report dated June, 1991. The supplement was developed to address data gaps related to the geologic and hydrogeologic conditions at the Site. The significant findings of the Remedial Investigation and Supplemental Remedial Investigation are summarized below:

A. General

The field investigation of the Remedial Investigation (RI) was conducted between 1985 and 1990. The RI assessed the type and extent of contaminants present at the Site and included a risk assessment, which evaluated the potential impacts upon human health and the environment posed by Site conditions. The RI provided baseline data required to evaluate potential cleanup actions. Principal RI field activities included the collection and analysis of samples of groundwater, soil, sediment, surface water, and air. These analyses identified approximately 100 individual contaminants in on-site groundwater and soils. Primary among them were volatile organic compounds (VOCs). In addition, metals, polychlorinated biphenyls (PCBs), herbicides, pesticides, and dioxin were identified.

The field investigation of the Supplemental Remedial Investigation was conducted during the fall and winter of 1990/1991. The objectives were to further determine the extent and distribution of dense non-aqueous phase liquid (DNAPL) in the shallow overburden and bedrock, and the hydraulic properties of bedrock at the Site.

The following sub-sections summarize the findings of both investigations:

B. Geology and Hydrogeology

The study area is underlain by fine-grained glacial outwash deposits ranging from less than 20 to more than 100 feet thick. These soil deposits consist predominantly of layered silty-sands and silts of lacustrine deposition. These deposits are, on average, more than 80 feet in thickness directly below the Silresim property. Underlying the lacustrine silts and sands are thin discontinuous layers of galacial till (ablation and lodgement till) that form a veneer along the bedrock surface. Bedrock below the property consists of gneiss that is moderately fractured and faulted. Bedrock topography at the Site is dominated by a buried valley that trends east-west under the Site.

The lacustrine silts and sands are a common proglacial feature of the region. These deposits are characterized by layering in the upper 5 to 20 feet of overburden. The layering consists of alternating 1/8 to 1/4 inch thick clay and one-inch thick sand layers. Hydraulic conductivities for these lacustrine outwash deposits range betwee 0.1 to 3.0 feet per day **(Figure 3, Appendix A)**.

The depth to groundwater at the Site and in the local area is appoximately 6 to 10 feet below the ground surface or the bottom of the clay cap over the Silresim property. The regional groundwater flow is north and west toward River Meadow Brook. River Meadow Brook drains to the Concord River, which then joins the Merrimack River. Approximately 40 percent of groundwater flow from the Site infiltrates into the 84-inch diameter 100-year-old brick interceptor sewer just north of the Silresim property. Smaller quantities of flow discharge to branch sewers on Canada, Tanner, and Maple Streets, with the balance (about 1 gallon per minute) flowing to River Meadow Brook. The effects of the sewer lines, coupled with low hydraulic conductivities of soils beneath the Silresim property, have resulted in the mounding of groundwater beneath the Silresim property and radial groundwater flow. Total groundwater flow leaving the Site is estimated to be approximately 3 gallons per minute (gpm).

Average horizontal groundwater transport velocities have been estimated to be approximately 85 feet/year in the upper portion of the overburden. Transport velocities in the lower portions are believed to be significantly lower. Observed downward vertical gradients beneath the Site are apparently occurring due to groundwater mounding. Downward vertical flow of groundwater is limited by layering of higher and lower permeability sediments. Therefore, actual vertical flow is substantially less than horizontal flow.

C. Groundwater

Volatile organic compounds (VOCs) were the predominant groundwater contaminants identified. VOCs were detected in overburden groundwater and in the bedrock. The groundwater flow patterns cause the plume to extend northwest to an interceptor sewer and southeast toward Maple Street. Movement of this plume to the southwest and northeast is less extensive. Much of the contaminated groundwater infiltrates into sewers, with the remainder moving toward River Meadow Brook **(Figure 4, Appendix A)**. Approximately 70 groundwater wells were installed and monitored to develop the conceptual groundwater flow patterns for the Site **(Figure 5, Appendix A)**.

Approximately 70 different organic compounds were detected by sampling and analyzing groundwater at the Site, with VOCs representing the highest concentrations. In the center of the plume, total VOC concentrations up to 6,000 ppm (parts per million or mg/l) have been detected. The most frequently encountered VOCs include trichloroethene (TCE), methylene chloride, acetone, benzene, and 1,2-dichloroethane. The highest observed concentrations occurred both on and directly north of the Silresim property, within the upper 40 feet of the aquifer/water table at monitoring wells MW-309, MW-405, and MW-404. Maximum concentrations of individual VOCs detected in late 1988 in well MW-405B, which is located in the center of the plume, were as follows:

CONTAMINANT	CONCENTRATION (ppm)
Benzene	450
1,2-dichloroethane	1,300
Methylene chloride	1,000
Styrene	650
Tetrachloroethene	300
1,1,1-trichloroethane	1,300
Trichloroethene	1,600

Elevated contaminant concentrations also occurred up to 120 feet below the ground surface. In recent years, increased VOC levels have been measured in the groundwater southeast of the Site, where the highest levels (in the 100 ppm range) were found 20 to 30 feet below ground surface.

While highest observed VOC levels generally occur within 10 feet of the water table near the Silresim property, some wells further to the northwest (MW-407, 408 & 105) and southeast (MW-502) indicate that the highest VOC levels occur at intermediate depths, about 15 to 20 feet below the water table. This is believed to result from a combination of downward hydraulic gradients and recharge from precipitation. The presence of slightly more permeable zones in the overburden deposits may also influence migration in these areas.

Although VOCs were detected most frequently and showed the highest relative concentrations, semi-volatile organic compounds (extractable organics) were also detected in the groundwater. The concentrations of total extractable compounds in groundwater on and just north of the Silresim property typically ranged from 0.1 ppm to 40 ppm. In general, data indicate only limited migration of these constituents. Isophorone and 1,2-dichlorobenzene were the most frequently detected extractable organics, followed by benzoic acid and phenol. Dioxins were not detected in the groundwater.

Elevated metals concentrations were found to be erratically distributed in groundwater on the Silresim property. Isolated areas were identified including high chromium (1.3 ppm at MW-404, 0.97 ppm at MW-406); nickel (2.2 ppm at MW-404, 0.29 ppm at MW-405, 0.51 ppm at MW-406); and zinc (37 ppm at MW-404, 2.7 ppm at MW-406, and 1.9 ppm at MW-309). Slightly elevated arsenic concentrations (0.039 to 0.06 ppm) were found in groundwater at MW-408, MW-407, MW-101, MW-404, and MW-403. Iron was detected in almost all groundwater samples at concentrations up to 268 ppm.

Dense non-aqueous phase liquid (DNAPL) has been detected in the shallow overburden and shallow bedrock at two locations (MW-309, MW-405) near the north-central border of the Silresim property. The DNAPL analyzed consisted primarily of trichloroethene, tetrachloroethene, and 1,1,1-trichloroethane.

Although regional and local hydrogeology primarily governs the migration and distribution of dissolved contaminants at the Site, local stratigraphy may have controlled the downward vertical migration of DNAPLs. Data show that thin clay and silty-clay layers, which may act as retarding layers for DNAPL, are found throughout the upper zone of lacustrine silt and sand deposits in the top five to twenty feet of overburden. The lower zone of the overburden includes the weathered bedrock-sediment interface and the shallow bedrock. Although existing analytical data regarding the presence of DNAPL are limited, its presence below these clay layers suggests that the clay did not restrict DNAPL from the deeper overburden (**Figure 5, Appendix A**).

D. Soil

In evaluating the nature and extent of soil contamination and its potential impacts within the study area, two distinct soil zones have been defined. Surficial soils are those soils exposed at ground surface and extending to a depth of 1 foot below ground surface. Soils deeper than 1 foot below ground surface and above the water table are referred to as unsaturated zone soils. This distinction is made in order to discuss differences in the sources, types, and extent of contamination and differences in potential exposure scenarios.

i. Surficial Soils

Most of the Silresim property is covered with gravel and clay, therefore, the surficial soil sampling program addressed those soils outside the Silresim perimeter fence. Contamination in the surficial soils beyond the edges of the clay cap has been documented in primarily five areas (**Figure 2, Appendix A**). Certain portions of the eastern perimeter were found to contain elevated levels of some metals, along with other contaminants. Elevated concentrations of PCBs, certain metals, and trichlorobenzene were found in samples collected from the southeast corner, while VOCs were the predominant contaminants identified on the former Arrow Carrier property just south of the Silresim property. Limited areas of the Lowell Iron and Steel property were found to contain elevated levels of PCBs, VOCs, PAHs, bis(2-ethylhexyl)phthalate and lead. Detectable levels of certain dioxin and furan isomers were also found on the Lowell Iron and Steel property. PCBs, VOCs, PAHs, and certain metals were found in the northeast corner. Specific concentrations detected in each of these areas are listed below:

1. Along the eastern perimeter of the Silresim property, on the Boston and Maine railroad grade, elevated levels of mercury (0.2 to 116 ppm), chromium (35 to 973 ppm), and arsenic (53 to 600 ppm) were

detected. VOC analysis in this area indicated that the majority of samples had non-detectable to trace levels of total VOCs (up to 2.7 ppm TCE). PCBs were detected at levels ranging from 0.02 to 0.14 ppm.

2. In the Southeastern corner of the Silresim property, dioxins, furans, PCBs, metals and organics were detected. Total toxic equivalence concentrations (TTEC) for dioxins and furans ranged from 0.00004 to 0.007 ppm. PCB Aroclor 1221 was detected as high as 1,500 ppm. Elevated levels of metals were detected, including mercury (63 ppm) and arsenic (640 ppm). VOCs in this zone were typically less than 0.7 ppm, and extractable organics such as 1,2,4-trichlorobenzene were detected as high as 110 ppm.

3. In the area just south of the Silresim property (former Arrow Carrier lot) VOCs are the most significant surficial soil contaminants. Total VOCs were detected as high as 210 ppm based on the results of a screening survey. Arsenic, mercury and chromium concentrations were detected at 17.4 ppm, 5.73 ppm and 1870 ppm respectively. PCBs were detected at low levels (less than 0.1 ppm). PAHs and phthalates were consistently found at concentrations ranging from 0.2 to 3.2 ppm. In addition, 752 ppm of 1,2-dichlorobenzene and 278 ppm of 1,4-dichlorobenzene were reported.

4. On the Lowell Iron and Steel property, north of the Silresim property, elevated levels of PCBs, PAHs, phthalates, dioxins, furans and lead were detected in surficial soils. Total VOC concentrations were detected as high as 46.7 ppm but were otherwise generally less than 0.5 ppm. Total lead detected ranged from 526 to 7,850 ppm. Total PAH and phthalates concentrations were as high as 2,255 ppm and 35 ppm, respectively. PCB Aroclor 1254 was detected as high as 4.6 ppm and total toxic equivalence concentrations for the dioxins and furans were less than 0.0003 ppm.

5. In the northeast corner, PAH compounds totaling 13.2 ppm were detected. Total VOC levels were less than 0.1 ppm and PCB Aroclor 1254 was found in two samples at concentrations less than 1 ppm. Elevated levels of chromium (5,000 ppm) and slightly elevated levels of arsenic (55 ppm) were observed.

ii. Unsaturated Soils

The contaminants within the unsaturated zone at the Site are primarily VOCs, although concentrations of extractable organics, metals, and dioxins also occur sporadically (85 constituents were detected). The highest concentrations are in the general vicinity of the clay-capped area. Elevated VOC levels in this zone extend from the base of the cap fill down to the saturated zone (6 to 10 feet below surface grade). Within this zone, VOC levels exceed 1,000 ppm at a number of locations. The highest observed concentrations were detected in the north central and central portions of the cap (as high as 6,400 ppm of tetrachloroethene in the C-9 test boring).

Total VOC levels in the unsaturated soil across the Site generally range from 100 to 1,000 ppm. The lowest levels were detected underlying the northeast and northwest corners of the Silresim property and to the southeast and northeast off the Silresim property.

The most commonly detected extractable compounds included phthalates, PAHs, and chlorinated benzene. Maximum reported concentrations of these were in the 10 to 500 ppm range. The only pesticides detected in more than one sample were aldrin, lindane (Gamma BHC), Beta BHC, and 4,4-DDD, reported at concentrations of 0.01 to 14 ppm in less than 10 percent of the samples analyzed. Herbicides were detected during an earlier investigation (Perkins Jordan, 1981) at levels between 0.25 and 7.5 ppm of 2,4-D and 2,4,5-TP. PCBs were detected at concentrations ranging from 0.03 to 65 ppm.

Arsenic, chromium, copper, lead, mercury, and zinc were detected sporadically in the unsaturated zone soils. In general, the elevated levels of arsenic (36 to 125 ppm) and mercury (5.5 to 19 ppm) were found along the eastern perimeter of the Silresim property. Typically, average concentrations of metals reported in unsaturated soils were within the ranges for natural soils.

The total toxic equivalent 2,3,7,8-TCDD (dioxins) concentrations exceeded one part per billion (1.96 to 10.42 ppb) at three locations near the central and eastern portions of the Silresim property.

E. Surface Water and Sediments

i. River Meadow Brook

Results from the most recent sampling event (Oct. 1989), as well as earlier sampling, show that there is no consistent pattern of contamination in the water or sediments of River Meadow Brook attributable to the Site. The highest levels of cadmium, chromium, copper and zinc in sediments were found upstream of the Site. Extractable organic compounds including dichlorobenzene and phenol, ranging in concentrations from 0.1 to 1.8 ppm, were detected in the sediments. Levels of copper and zinc were similar in upstream and downstream samples. VOCs including trichloroethene, toluene and tetrachloroethene were found in the surface water at low levels (primarily single parts per billion) during both sampling events. PCBs were not detected in the water, but PCB Aroclor 1254 and 1260 have been found at low levels (less than 0.5 ppm) in two downstream sediment samples. Additionally, cyanide was detected at levels below 1 ppm in both the surface water and sediment samples, upstream and downstream.

In general, significant concentration variations between upstream and downstream samples were not noted. Existing groundwater samples collected between the Silresim property and the Brook indicated that the contaminant plume has not yet reached the Brook; therefore the detected contaminants are likely to be the result of other sources, such as other area industries. There are two major discharges to the Brook upstream of Silresim. Additionally, there are automobile junkyards and fuel storage facilities along the Brook.

ii. East Pond

Although surface water samples collected from East Pond indicated no contamination, samples of Pond sediments taken closest to the Site contained low levels (1 to 20 ppb) of eight VOCs. Metals concentrations fell within expected background ranges. Concentrations of extractable organics ranged from 0.1 to 1.8 ppm in a sediment sample; PAHs were the primary constituents observed. Because the detected substances are components of the Silresim plume, it is suspected that they reached East Pond as a result of groundwater flow from the Site.

F. Air

Two air monitoring programs were conducted during the Remedial Investigation. From 1985 through November 1986, the air vents in the clay cap covering the Silresim property were sampled to characterize VOCs in the vent emissions. Additionally, an indoor air sampling program was conducted at Lowell Iron & Steel's facilities in October and December 1988.

The sampling results from the air vents indicate that vent number 4 contained the highest concentrations of target compounds as compared to other vents. The most abundant compounds in that vent were 1,1,1-trichloroethane (564 ppm), and trichloroethene (377 ppm). The concentrations of other target compounds in vent number 4 ranged from below the detection limit to 83.5 ppm. In the remaining vents, the relative concentrations of target compounds were similar to those in vent number 4, but total concentrations were lower. (It should be noted that air flow rates from the vents were below measurable levels suggesting no significant potential for off-site migration).

Ten individual VOCs were found in basement air in the Lowell Iron & Steel operations (warehouse) facility, typically at levels below 2 ppb based on an 8-hour average concentration. Specific compounds detected included halogenated VOCs (1,1,1-trichloroethane, carbon tetrachloride, trichloroethene, tetrachloroethene and trichlorofluoromethane), aromatics (benzene, toluene, ethylbenzene and xylenes) and acetone. The primary contaminants, based on relative concentrations, were acetone, 1,1,1-Trichloroethane, toluene and xylenes.

Fourteen VOCs were reported in the basement air of the Lowell Iron and Steel's administrative building. Specific constituents detected included the 10 VOCs listed above as well as 1,1-dichloroethene, methylene chloride, 1,1-dichloroethane and chloroform. Eight-hour average concentrations for individual compounds ranged from 0.1 to 6.4 ppb, except for methylene chloride which was reported at a concentration of approximately 71 ppb. The sump from which these samples were collected is reportedly connected to the neighboring 84-inch diameter interceptor sewer. It should be noted that based on a review of groundwater data adjacent to the administrative building, it is unlikely that the elevated levels of methylene chloride are a result of the Silresim plume (the sump is reportedly connected to the 84-inch diameter interceptor sewer adjacent to Lowell Iron and Steel).

G. Environmental and Wildlife Habitat

The primary environmental receptors in the study area are River Meadow Brook, East Pond and the B & M Railroad area. All three are urbanized, altered, and geographically limited environments. None of these provide a high level of valuable wildlife habitat as described under Massachusetts Wildlife Habitat Policy Guidance. The low vegetative diversity, simple biological community structure, and frequent presence of opportunistic species indicate that these are disrupted environments of minimal value as wildlife or aquatic habitat.

River Meadow Brook near the Site is severely impacted by upstream industrial discharge. The stretch of Brook in this area meets little of the descriptive criteria which guides State regulatory policy concerning wildlife habitat. The Brook and associated banks are of marginal value to wildlife and aquatic biota due to anthropogenic changes to the stream course and banks, upstream industrial effects on water quality (does not meet Class B standards), and the general urban, paved, and altered environment adjacent to the stream bank. Vegetative structural diversity is low, and the observed high suspended load in the water makes the presence of freshwater clams or mussels unlikely. The trees are generally too young and small to provide cavities for shelter of small animals or bird nests. Most portions of the Brook have steep banks, and little vegetation overhangs them to provide cover or perches. The bushes and saplings do not supply fallen logs or debris extending into the Brook.

East pond has no observable surface inlet or outlet and is filled at its southern end and completely denuded of trees all around its banks. The entire perimeter of this small pond is physically disturbed and has few characteristics ascribed to valuable wildlife habitat. There is no shrub or canopy cover, no overhanging branches and little structural diversity. The banks are dominated by nearly monospecific stands of Purple Loosestrife, an opportunistic species which thrives in disturbed environments.

The B & M Railroad area is a mixed grassland and woodlot habitat. The woodlot is dominated by Aspen, a pioneer species, which indicates recent physical disturbance in the area. Locally, the trees may support small bird populations, and the grassland may support rodent populations and serve as an occasional feeding area for carnivorous birds. The habitat is not extensive enough, however, to provide breeding habitat for such species. The area is surrounded by urban development, residential development, railroad corridors, and pavement, and is not large or vegetatively diverse enough to support large wildlife populations.

A complete discussion of Site characteristics can be found in Chapters 4 through 6 of the Remedial Investigation Report at Pages 21 to 90.

VI. SUMMARY OF SITE RISKS

A Risk Assessment (RA) was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site. The Risk Assessment followed a four step process: contaminant identification (which identified those hazardous substances which, given the specifics of the Site were of significant concern); exposure assessment (which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure);

TABLE 1
SILRESIM SITE
CONTAMINANTS OF CONCERN

Contaminants of Concern	Groundwater/ Surface Water	Soils	Vent Emissions	Indoor Air
Acetone				X
Arsenic	X	X		
Benzene	X	X	X	X
Bis(2-ethylhexyl)phthalate	X	X		
2-Butanone	X			
Carbon Tetrachloride	X		X	X
Chlorobenzene	X	X		
Chloroform	X	X	X	X
Chromium	X	X		
Copper		X		
1,1-Dichloroethane			X	X
1,2-Dichloroethane	X	X	X	
1,1-Dichloroethene	X	X	X	X
1,2-Dichloroethene			X	
Dioxins		X		
Ethylbenzene				X
Lead		X		
Methylene Chloride	X	X	X	X
Mercury		X		
Nickel	X			
PAHs		X		
PCBs		X		
Phenol	X			
Selenium		X		
Styrene		X		
Tetrachloroethene			X	X
1,1,2,2-Tetrachloroethane	X	X		
Toluene	X	X		X
1,2,4-Trichlorobenzene	X	X		
1,1,1-Trichloroethane	X	X	X	X
Trichloroethene	X	X	X	X
Trichlorofloromethane				X
Xylenes				X

toxicity assessment (which considered the types and magnitude of adverse human and environmental effects associated with exposure to hazardous substances); and risk characterization (which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic and environmental risks). The results of the public health risk assessment for the Silresim Site are discussed below.

Table I (above) lists the contaminants of concern for each medium. The Remedial Investigation Report presents detailed information regarding the concentrations and frequency of detection for each indicator substance in each medium.

There were 33 contaminants of concern selected for evaluation in the Risk Assessment. These contaminants constitute a representative subset of the more than 102 contaminants identified at the Site during the Remedial Investigation. The 33 contaminants of concern were selected to represent potential site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. A summary of the health effects of each of the contaminants of concern can be found in Section 7.22, pages 95 to 102, of the Risk Assessment in the March, 1990 Remedial Investigation (RI) report.

Potential human health effects associated with exposure to the contaminants of concern were estimated quantitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on present and potential future land uses. For each pathway evaluated, a more-likely and a reasonable worst-case exposure scenario was developed. Unless otherwise specified, the more-likely case scenario corresponds to the risks computed based on the average concentration of contaminants detected in the particular medium, and the worst-case risk scenario corresponds to the maximum concentrations per medium. Evaluations were based on an integrated model of site contaminant characteristics and the locations and activities of identified receptor populations. For those exposure scenarios for which a source of contamination, potential receptors, and a route for exposure exists, a quantitative evaluation was completed. Exposure scenarios that do not meet these criteria are discussed in qualitative terms. The following is a brief summary of the exposure pathways evaluated. A more thorough description can be found in Section 7.33, pages 109 to 118, of the RI Risk Assessment.

A. Current and Future Potential Exposure Pathways

i. Soils

Exposure to Soils Under the Cap: A majority of the total contaminant mass associated with the Site is contained in the soils directly under the clay cap. In January 1978, a chain-link fence was installed around the Silresim property, limiting direct access onto the property. In January 1983, the Silresim property was graded, a clay cap averaging 14 inches in thickness was then placed over a layer of gravel, and the fence was extended to a height of 8 feet. Ten PVC vents, extending 5 feet above the cap were installed as part of the cap. In addition, crushed stone was placed over areas of surficial soil adjacent to the southeast and northeast sections of the Site. The purpose of these temporary remedial responses was to limit direct access to contaminated soils and to minimize the release of VOC and particulate matter into the air.

Although the clay cap supports vegetative growth and is regularly maintained, portions of its surface are noticeably cracked and eroded. The presence of the fence minimizes the accessibility of Silresim property to children and trespassers, and therefore to minimize the direct exposure to soil under present conditions. Additionally, the gravel cover in the fenced northeast and and southeast corners minimizes the potential for exposure.

A potential impact on air quality from VOCs released from unsaturated soils may exist under the current conditions. VOCs may be released into the air through cracks in the clay cap, although quantitative measurements of the extent of the releases were not conducted. Instead an evaluation of air quality impacts from emissions from vents located on the Site was performed in the Risk Assessment using an advection-dispersion model. Although detectable levels of VOCs were indicated in the vents, no measurable flow was detected, which would suggest no adverse risk due to VOC emissions from the vents. However, variable climatic conditions may lead to changes in flow rates from the vents and contaminant emissions may increase. Under these conditions, residents located downwind from the Silresim property may be impacted by VOCs released from the vents. Potential exposures to emissions from vents have been evaluated based on the results of the dispersion model using assumed flow rates and levels of compounds reported inside the vents. It was assumed that an off-site resident may inhale contaminated air for 70 years.

Under future conditions, the further disturbance of the clay cap and failure of the surrounding fence may create a source for direct exposure to soils. Neighborhood children playing on the Silresim property are the most likely receptors. The potential routes for exposure for this group are direct contact with soils and incidental ingestion of soils. This risk has been quantified using present case contaminant concentrations detected in the unsaturated soils under the cap. Dermal contact and incidental ingestion of soils was evaluated for a school-aged child aged 5-18 years who may be exposed 20 days per year for 14 years. The amount of soils ingested was assumed to be 0.1 gm/day and the soil was assumed to cover the arms and hands.

<u>Exposure to Soils Off the Silresim Property:</u> Five areas located immediately outside the Silresim fence have been found to contain elevated levels of several chemicals. These areas include the eastern

perimeter (B & M Railroad property); the southeast corner; the former Arrow Carrier property south of the fence; the Lowell Iron & Steel property north of the Silresim property; and the northeast corner. As discussed earlier, portions of areas adjacent to the southeast and northeast sides of the Site are covered with crushed stone to prevent direct contact.

The contaminants in these soils may present a current threat to human health through direct contact, inhalation of VOCs released from the soil, and from inhalation of particulates carrying contaminants. Inadvertent ingestion of small amounts of uncovered contaminated soil by workers from adjacent businesses, children playing near these areas, joggers and motorbike riders could potentially occur. Therefore, an evaluation has been completed of the potential exposures and risks associated with incidental ingestion of and direct contact with surficial soils (upper one foot of soil) off the Silresim property.

At each area outside the Silresim fence, incidental ingestion of 0.1 gm/day contaminated soils was assumed for a child aged 5-18 years, 120 days per year for 14 years. Dermal absorption of contaminated soil at each location was also assumed for a child aged 5-18, 120 days per year for 14 years. In addition, for adult employees at Lowell Iron and Steel, a dermal exposure scenario was developed corresponding to contact with the arms and hands for 10 days each year for 20 years.

<u>ii. Groundwater</u>

<u>Drinking Water Supply Wells:</u> Groundwater in the area is not currently being used as a drinking water source because public water is provided to the area. Therefore, only future use of the groundwater as a drinking water supply was evaluated as a potential exposure pathway. The aquifer below the Site is classified by the Federal Government and the Commonwealth of Massachusetts as a Class IIB and I aquifer, respectively. Groundwaters assigned to these classes are defined as being fresh waters found in the saturated zone of unconsolidated deposits or consolidated rock and bedrock, and are designated as a source of potable water supply.

The installation of private drinking water wells in residential areas underlain by contaminated groundwater, could create a potential exposure and therefore a risk. The results of the solute transport analysis indicate that the groundwater plume is not likely to reach the vicinity of the Robinson Street residential neighborhood located north of the Site; however, contaminants in groundwater may reach the four residential streets to the south of the Site in the future.

Under the potential future condition that groundwater may be used as a drinking water source in the vicinity of the Site, the exposures to contaminants may potentially occur through ingestion, dermal absorption, or inhalation of vapors. For the ingestion of contaminated groundwater, it was presumed that an adult may ingest 2 liters of undiluted water per day for 70 years. The current maximum and average concentrations detected in groundwater at the Site were used for the worst-case and more-likely case ingestion exposure scenarios, respectively.

Basement Seepage: Groundwater flow originating at the Site may impact residences and industries through the seepage of water into basements and indirectly through the volatilization of compounds through soils which are saturated with contaminated groundwater. The inhalation of vapors released from the water leaking into basements is expected to be the primary route of exposure if this condition occurs. In addition, receptors may be exposed to contamination through direct contact with basement soils, resulting from infiltration of groundwater.

Lowell Iron and Steel property is presently located within the boundaries of the contaminated groundwater plume. The basement areas of their storage/operating building are frequented by employees on a daily basis for variable durations. Their basement is partially earthen and has been known to flood. Therefore, inhalation of contaminated air by Lowell Iron and Steel employees is a current potential exposure. For this exposure scenario it was presumed that the seepage would be undiluted groundwater based on the solute transport model (worst-case) and from detected concentrations in an adjacent well (more-likely case). The worst-case exposure estimate was calculated based on an adult employee who may be exposed to contaminated air 3 hours per day, 10 days per year, for 20 years, while the more-likely case assumed 1.5 hours of exposure 5 days per year for 5 years. For dermal contact with contaminated soils inside Lowell Iron and Steel's storage facility, it was assumed that the arms and hands of an employee may be exposed for 3 hours per day to contaminated soils for similar durations.

Residential basement seepage was not considered a current potential exposure pathway because existing data indicates that the contaminated plume does not extend to the residential areas. However, in the future, the plume may reach residences to the south of the Site. For future basement seepage into the nearest residential dwelling, it was presumed that a resident may be exposed to contaminated air 1 hour a day for 70 years for the worst-case scenario, and .5 hours per day, 5 days per year for 70 years for the more-likely case scenario. These exposure scenarios also assumed that the seepage would be undiluted groundwater based on the solute transport model (worst-case) and from actual concentrations in an adjacent well (more-likely).

The sewer lines in the vicinity of the Site have been found to influence groundwater flow patterns and to act as interceptors of groundwater originating from the Site. The 84-inch diameter sewer line appears to receive most of the primary groundwater flow. Based on a solute transport analysis, maximum total VOC concentrations discharging to the sewer were calculated. Although it is expected that VOCs in the sewerage would experience significant reduction through aeration or removal with solids, the potential inhalation by residents downwind and in close proximity to the Duck Island sewerage treatment facility was calculated as a future exposure based on modelled concentrations. It was presumed that an individual may be exposed to 20 cubic meters per day of contaminated air continuously for 70 years.

iii. Surface Waters

River Meadow Brook and Concord River: River Meadow Brook has been assigned a class B status by the Commonwealth of Massachusetts, and is therefore designated for the uses of protection and propagation of fish, other aquatic life and wildlife, and for primary and secondary contact recreation. In the future, the Silresim groundwater plume may reach the Brook. Although the potential use of the Brook in the vicinity of the Site for recreational purposes is unlikely due to the physical characteristics and degraded conditions, dermal contact with and ingestion of contaminated water from River Meadow Brook, has been evaluated. For incidental ingestion of contaminated Brook water, it has been presumed as part of the worst-case scenario that children aged 5-18 may ingest 0.05 liters of water, 3 days per year for 14 years. For dermal absorption, it has been assumed as part of the worst-case scenario that a child may be completely immersed in the Brook for a total of 2 hours per day, 2 days per year for 14 years.

Additionally, the potential future environmental impacts on the surface water of River Meadow Brook and Concord River were evaluated. Specifically, a qualitative comparison of predicted concentrations (using solute transport model) of indicator substances in the brook to freshwater aquatic life was evaluated. The comparison was based on predicted concentrations under low-flow (worst-case) and average flow (more-likely case) in River Meadow Brook and Concord River. This comparison assumes that organisms in the Rivers are exposed under similar conditions and respond similarly to organisms for which Federal Water Quality Criteria (FWQC) were established.

River Meadow Brook ultimately flows to the Concord River which is also a Class B river. Although the contaminants entering River Meadow Brook would be attenuated in concentration before impacting Concord River, future exposure through dermal absorption and incidental ingestion could occur and was therefore evaluated. The exposure assumptions for incidental ingestion and dermal absorption of contaminated water in Concord River are the same as those listed above for River Meadow Brook.

East Pond: East Pond has not been classified by the Commonwealth of Massachusetts. However, it could potentially be used for recreational activities such as swimming and rafting. The Pond is small and shallow during the summer months and recreational use is expected to be infrequent and of short duration.

Although the Silresim plume appears to have only minimally affected the sediment and surface waters of East Pond, a solute transport analysis has predicted that it will in the future. Therefore the risks associated with incidental ingestion and dermal absorption of contaminated surface water from East Pond were quantified based on predicted future concentrations from the transport model. The worst-case exposure assumptions for the incidental ingestion of surface water for East Pond are the same as those listed above for River Meadow Brook and Concord River except the frequency of exposure was presumed to be 15 days per year. For dermal absorption, it was assumed that a child may be completely immersed in the Pond 2 hours per day, 15 days per year for 14 years as part of the worst-case exposure.

The potential future environmental impacts from the surface water in East Pond were evaluated. Specifically, a qualitative comparison of predicted concentrations (based on the solute transport model) of indicator substances in the Pond to freshwater aquatic life was evaluated. The comparison was based on the predicted low flow concentrations entering into East Pond. This comparison assumes that organisms in the Pond are exposed under similar conditions and respond similarly to organisms for which WQC were established.

B. Risk Characterization

Excess lifetime cancer risks were determined for each exposure pathway by multiplying the exposure level with the chemical specific cancer potency factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is very unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g. 1×10^{-6} for 1/1,000,000) and indicate (using this example), that an individual is not likely to have greater than a one in a million chance of developing cancer over 70 years as a result of site-related exposure. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances.

The hazard quotient was also calculated for each pathway as EPA's measure of the potential for non-carcinogenic health effects. The hazard quotient is calculated by dividing the exposure level by the reference dose (RfD) or other suitable benchmark for non-carcinogenic health effects. Reference doses have been developed by EPA to protect sensitive individuals over the course of a lifetime and they reflect a daily exposure level that is likely to be without an appreciable risk of an adverse health effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. The hazard quotient is often expressed as a single value (e.g. 0.3) indicating the ratio of the stated exposure as defined to the reference dose value (in this example, the exposure as characterized is approximately one third of an acceptable exposure level for the given compound). The hazard quotient is only considered additive for compounds that have the same or similar toxic endpoints (for example: the hazard quotient for a compound known to produce liver damage should not be added to a second whose toxic endpoint is kidney damage). The resulting sum is referred to as the hazard index.

Table 5, found in Appendix B of this ROD, summarizes the adverse human health effects for the exposure pathways identified in the previous section. Risks have been evaluated in the context of risk management criteria utilized by EPA. Paraphrasing the National Contingency Plan, an acceptable excess upper bound lifetime cancer risk is one which falls within the range of 10^{-4} and 10^{-6}. For the non-carcinogenic effects, a hazard index less than one generally indicates an acceptable exposure level. A qualitative discussion of the risks is provided below:

i. Summary of Current Potential Risks

Exposures to surficial soils beyond the Silresim property fence were evaluated for five distinct areas. Risks calculated for all five of these areas were comparable for noncarcinogenic effects, with cumulative hazard indices under the worst-case and more-likely scenarios being less than one, except for the south corner ($3 \times 10^{+1}$) as a result of dioxins and PCBs, and Lowell Iron & Steel (1.8) due to lead under the worst-case scenario.

Under the worst-case cancer risk scenario the cumulative risk estimates for the dermal contact and ingestion of soils at the B & M Railroad property, southeast corner, and Lowell Iron & Steel property exceed the 10^{-4} to 10^{-6} acceptable cancer risk range. The cumulative risk estimate for each area was 2×10^{-4}, 3×10^{-3}, and 8×10^{-4}, respectively. None of the cancer or non-cancer risk projections for the ingestion of and dermal contact with soils from any of the five areas exceeded EPA's acceptable risk values under the more-likely case exposure scenarios. The cancer risks for each of the five areas beyond the Silresim fence is attributable almost entirely to the presence of arsenic and carcinogenic PAHs, with the exception being in the southeast corner and at Lowell Iron and Steel where PCBs and dioxins presented the most signigicant risk.

For the basement seepage scenario at Lowell Iron and Steel, the cancer risk estimate under a worst-case scenario for the inhalation pathway is 1×10^{-1}. This risk was due in large part to an array of VOCs detected in groundwater, including 1,2-dichloroethane and trichloroethene. Under the more-likely scenario, the cancer risk estimate was 4×10^{-6}. The risk from inhalation exposures in the basement of Lowell Iron and Steel during a dry period is considerably lower for this scenario, based on measured concentrations. Under the worst-case assumptions, the hazard index is significantly less than 1 (1×10^{-2}) and the cancer risk is 2×10^{-5}.

Possible exposures to airborne VOC emissions from the cap vents were quantitatively evaluated at the nearest residential receptors assuming a continuous lifetime of exposure. The worst-case cumulative cancer risk estimate is 1×10^{-5} while the more-likely case excess cancer risk estimate fell below the acceptable risk range of 10^{-4} to 10^{-6}. 1,1-dichloroethene and trichloroethene are the major contributors to this risk estimate.

ii. Summary of Future Potential Risks

Presuming no further substantial remedial activities, it was assumed that both the fence and cap will occasionally be simultaneously impaired which could lead to exposure to contaminated soil on the Silresim property. The ingestion of and direct contact with soil on the Silresim property by children were evaluated assuming worst-case and more-likely case scenarios. Under both scenarios, hazard indices were less than one for exposure through ingestion of soil and the cumulative cancer risk estimates did not exceed the acceptable risk range. The worst-case cumulative hazard index and cancer risk estimate for dermal contact with soil on the Silresim property slightly exceeded the benchmarks of 1 and 1×10^{-4}, respectively. Dioxin, cPAHs and arsenic were three of the major contributors to these risk projections. More-likely case risk projections were within or below acceptable levels for cancer and non-cancer endpoints.

Risk associated with the future ingestion of Site groundwater has been evaluated under a worst-case and a more-likely case scenario and both were found to exceed the acceptable risk levels for carcinogenic and non-carcinogenic endpoints. Projected cancer risks for both the more-likely and the worst-case scenarios were in excess of 1×10^{-2}. Maximum concentrations of nearly all indicator substances exceeded their respective MCLs including, carbon tetrachloride, 1,2-dichloroethane, tetrachloroethene, trichloroethene and benzene. The hazard quotients under each scenario were found to exceed one for most indicator substances.

A portion of the Site groundwater plume has been projected to move beneath the nearest residence south of the Site in the future. The characterization of non-carcinogenic and carcinogenic risk which may result from inhalation of volatile contaminants in basements under a worst-case scenario yielded a cumulative hazard index of approximately one and a cumulative excess cancer risk estimate of 2×10^{-2}. Under a more-likely scenario based on modelled concentrations the calculated cumulative hazard index was less than one and the cancer risk estimate slightly greater than 10^{-5}. The main contributors to these risk estimates were VOCs including 1,2-dichloroethane and TCE which were detected in groundwater.

For the evaluation of volatilization of Site chemicals from sewage entering the Duck Island Wastewater Treatment Plant and the resulting impact to the nearest neighborhood, a simple advection/dispersion model was used to project ambient VOC concentrations. For both the more-likely and worst-case scenarios, hazard indices and incremental lifetime cancer risk estimates were less than one and 10^{-6}, respectively.

For exposures related to contact with surface waters of River Meadow Brook, East Pond, and the Concord River, only the excess cancer risk attributable to dermal contact with surface water in East Pond based on projected concentrations exceeded 10^{-4}, at 1×10^{-3} and 3×10^{-4} for the worst-case and more-likely case scenarios, respectively. The major contributers to these risk estimates included VOCs such as 1,2-dichloroethane and 1,1-

dichloroethene. All other cancer risk estimates for surface water bodies fell within or below the acceptable risk range. Similarly, for the non-cancer endpoints, dermal contact with East Pond surface water was projected to present the greatest risk. Carbon tetrachloride was projected to exceed its reference dose as part of the evaluation of both the worst-case and more-likely case chronic exposure scenarios.

iii. Summary of Potential Environmental Risks

An Environmental Risk Assessment was conducted as well to determine the effects that Site contaminants could pose to the surrounding environment. Three potential environmental receptors near the Site were evaluated, including River Meadow Brook, East Pond, and the B & M railroad area. It was determined that none of these three areas exhibit the characteristics which describe valuable wildlife habitat in Massachusetts. They are not structurally diverse, are often dominated by opportunistic species, surrounded by urban and industrial land, and are obviously degraded as wildlife or aquatic habitat by activities unrelated to the Silresim Site. No endangered species have been identified at the Site.

The potential environmental threat to aquatic life from the future discharge of contaminated groundwater into East Pond, River Meadow Brook and the Concord River was evaluated. Surface water quality expected in the future was qualitatively compared to the predicted concentrations of indicator substances in each water body. The predicted concentrations for ten indicator substances in the three surface waters were less than the respective Water Quality Criteria (WQC) under both the worst-case and more-likely case scenarios. WQC were not available for two of the indicator substances (2-butanone, methylene chloride). It should be noted that detectable levels of VOCs could reach River Meadow Brook within about nine years given a starting date of 1990.

Based on the findings of this evaluation, it was not necessary to identify response objectives to mitigate threats to the environment. However, the response objectives developed for public health exposure to soils and groundwater would provide adequate protection to the environment.

iv. Conclusion

In summary and as presented in **Table 5 in Appendix B** of this document, cumulative incremental lifetime cancer risk estimates were calculated to be greater than 10^{-4} for the following worst-case exposure pathways:

* Ingestion and dermal absorption of soils on B & M Railroad property (arsenic); southeast corner (dioxins, PCBs, and arsenic); and Lowell Iron & Steel property (carcinogenic PAHs);

* Inhalation exposures at Lowell Iron & Steel operational facility from groundwater seepage into a basement (VOCs);

* Future dermal absorption of soil from the unsaturated zone on the Silresim property (VOCs and semi-VOCs);

* Future ingestion of groundwater as a drinking water supply (organic and inorganic compounds);

* Future inhalation exposure at a residential receptor near North Main Street from groundwater seepage into a basement (VOCs); and

* Future, dermal absorption of surface water from East Pond (VOCs).

Cumulative hazard indices calculated for the evaluated exposure pathways were generally less than one. However, several pathways were noted to have instances in which an observed or projected concentration for a given compound was predicted to exceed an acceptable value (usually a reference dose) when worst-case exposure assumptions were used. These pathways include a subset of the pathways listed above found to pose unacceptable cancer risks.

Maximum concentrations of all groundwater indicator substances exceeded the applicable regulatory standard set or proposed under the Safe Drinking Water Act - Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs), except for dioxin, which were not detected in the groundwater, and PAHs detected in low concentrations only.

In terms of the environmental assessment, it was determined that none of the three environmental receptors (East Pond, River Meadow Brook/Concord River, B & M) exhibit the characteristics which describe valuable wildlife habitat in Massachusetts. The predicted concentrations for ten indicator substances in the three surface water bodies were less than the respective WQC under both the worst-case and more-likely case scenarios.

It should be noted that the findings of the Silresim Risk Assessment were dependent on numerous assumptions and subject to many uncertainties inherent in the risk assessment process. The findings are not an absolute characterization of actual risk, but rather serve to highlight potential sources of risk at the Site. Although the range of uncertainties have not been quantified, the use of conservative assumptions and parameters throughout the assessment would be expected to err on the side of protection of human health and the environment.

Consequently, actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health and the environment. Specifically an imminent and substantial threat to public health could result from the contaminated soils, surface waters, air, and groundwater in proximity to the Site.

For a complete explanation of risks posed by contamination at the Silresim Site, please refer to the Risk Assessment presented in Section 7.0 of the

Silresim RI report, which is available at the information repositories.

VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

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

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives were developed to aid in the development and screening of alternatives. These remedial action objectives were developed to mitigate existing and future potential threats to human health and the environment. These response objectives were:

1. Prevent direct contact and incidental ingestion exposure to contaminated surficial soils at the Site (located on and off the Silresim property);

2. Prevent future migration of contaminated groundwater to a hypothetical water supply well, thereby reducing risks from ingestion of contaminated drinking water;

3. Prevent contaminated groundwater discharge to surface waters, thereby reducing risks from dermal absorption and ingestion exposures to contaminated surface water and sediments; and

4. Prevent contaminated groundwater flow toward buildings, thereby reducing risks from inhalation exposures.

B. Technology and Alternative Development and Screening

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

With respect to source control, the RI/FS developed a range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing to the degree possible the need for long term management. This range also included alternatives that treat the principal threats posed by the Site but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; and a no action/limited action alternative that involves no treatement but provides limited protection through engineering or institutional controls.

With respect to ground water response action, the RI/FS developed a limited number of remedial alternatives that seek to attain site specific remediation levels using different technologies; and a no action alternative.

As discussed in Chapter 5 of the Feasibility Study, the RI/FS identified, assessed and screened technologies based on implementability, effectiveness, and cost. These technologies were combined into source control (SC) and management of migration (MM) alternatives. Chapter 6 of the Feasibility Study presented the remedial alternatives developed by combining the technologies identified in the previous screening process with the categories identified in Section 300.430(e) (3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated and screened in Chapters 8 and 9 of the Feasibility Study.

In summary, of the 15 source control and 5 management of migration remedial alternatives screened, 9 of the source control and 4 of the management of migration alternatives were retained for detailed analysis. **Tables 6 and 7 in Appendix B** identify the alternatives that were retained through the screening process, as well as those that were eliminated from further consideration.

VIII. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each alternative retained for detailed analysis. A detailed assessment of each alternative can be found in Tables 11-11 and 12-6 of the Feasibility Study.

A. Source Control (SC) Alternatives Analyzed

The Source Control alternatives that underwent detailed analysis for Silresim include:

SC-1:	No-Action/Minimal Action
SC-2:	Cover System On and Off the Silresim Property
SC-3:	Vacuum/Vapor Extraction and Cap on the Silresim Property
SC-4	Vacuum/Vapor Extraction, Stabilization and Cap on the Silresim Property
SC-6	Thermal Desorption, Stabilization and Cap on the Silresim Property
SC-10	Incineration, Stabilization and Cap on the Silresim property
SC-11	Vacuum/Vapor Extraction, Incineration, Stabilization and Cap on the Silresim Property
SC-14	Vacuum/Vapor Extraction, Solvent Extraction, Stabilization and Cap on the Silresim Property
SC-15	Vacuum/Vapor Extraction, Solvent Extraction, Stabilization, Off-Site Disposal and Cap on the Silresim Property

1. **SC-1 No-Action/Minimal Action**

This alternative was evaluated in detail in the FS to serve as a baseline for comparison with the other remedial alternatives under consideration. Under this alternative, contaminated soil would remain on-site and no contaminants would be removed, treated or destroyed. SC-1 would include measures to prevent exposure and to restrict access to the Site.

Because access to areas of soil contamination outside of the existing perimeter fence is unrestricted, an extension of the perimeter fence and paving or placement of crushed stone over contaminated areas would be conducted. New sections of fence would encircle the contaminated soil zones near the east side, the northeast corner, and the southeast corner of the Site. After the additional fencing is installed, the existing cap would be extended into the newly-fenced areas. Capping of these soils would further reduce direct contact exposures to surficial soils. Additionally, eroded areas of the existing cap would be repaired and regularly maintained.

A public education program would be initiated to inform the public about potential hazards at the Site. The program would include public meetings, presentations, local newspaper articles, and direct mailings to public agencies, utilities, businesses and residences near the Site.

Institutional controls would include access, deed and land use restrictions. These controls would be pursued through legal channels to restrict or prevent the potential use of contaminated areas. Access restrictions could include laws providing for levying of fines against trespassers. Deed and land use restrictions would limit future uses of the Site, and would require appropriate permits, supervision, and health and safety procedures for any intrusive work done on Site.

Any monitoring wells within proposed work areas not intended for use in long-term monitoring would be decommissioned. Wells in proposed work areas intended for long-term monitoring would be extended or protected as necessary.

Long-term monitoring would record and allow evaluation of trends in contaminant concentration. Monitoring would consist of sampling and analyses of soil at selected locations at five-year intervals.

The 1986 CERCLA amendments require that conditions be reviewed every five years at NPL sites where wastes remain on site. As alternative SC-1 would result in wastes remaining on Site, this five-year review process would be mandatory. All data obtained in this monitoring program would be evaluated in the five-year reviews. The reviews would consider all relevant data and determine if additional remedial actions are necessary.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: One Year
ESTIMATED TIME FOR OPERATION: One Year
ESTIMATED CAPITAL COST: $564,000
ESTIMATED O & M (Present Worth): $485,000
ESTIMATED TOTAL COST (Present worth): $1,050,000

2. **SC-2 Cap On and Off the Silresim Property**

Under this alternative, all soils contaminated above the cleanup levels would be covered with a low-permeability cap conforming to Resource Conservation and Recovery Act (RCRA) Subtitle C standards (the existing cap on the Silresim property would be upgraded). Contaminated soil would remain on Site, and no contaminants would be removed, treated, or destroyed. The cap would prevent direct contact with contaminants in surficial soils, minimize inhalation exposure, and limit rainwater infiltration and therefore contaminant migration in the groundwater.

Fence construction, posting of the Site, public education programs, decommissioning of wells, and institutional controls would be implemented as described under Alternative SC-1.

Under this alternative, the existing cap (including the crushed stone cap in the northeast corner of the Site) would be upgraded to conform to RCRA standards. The upgraded cap would, at a minimum, consist of at least 3 feet of low permeability ($\leq 10^{-7}$ cm/sec) soil liner including: 6 inches of sand bedding covered by a synthetic liner, 1 foot of drainage layer soil, filter fabric, 2 feet of final cover, and seed and mulch. Final cap grades in all areas would be from 3 percent to 33 percent.

Under this alternative, the cap would be extended over a significantly larger area than under alternative SC-1. The proposed areal extent of the cap includes any area where soil contaminant concentrations have been observed in excess of the target cleanup goals. These areas would have to be prepared appropriately so that the cap could be constructed. Site preparation activities may include Site grading and removal of debris, fences, scrap vehicles, etc.

Construction of the fence and the RCRA cap would be accomplished using common, well-demonstrated construction practices. Numerous RCRA cap installations are already in place, and standard construction procedures exist for the installation of all components. Construction of a RCRA cap outside of the current Silresim fence would involve coordination with the adjacent property owners. Easements and access to adjacent property areas would have to be obtained (true for all alternatives considered).

Implementation of this alternative would not be likely to result in significant additional environmental impacts, because no contaminants would be removed, treated or destroyed. Adequate control measures would be instituted to reduce VOC and dust emissions. Some disturbance to adjacent properties to be capped would occur, but these are not areas of significan environmental sensitivity.

It is estimated that all components of Alternative SC-2 would be implemented within two years after the completion of remedial design.

Because contaminated materials would remain on Site, long-term monitoring and five-year reviews would be implemented as described under Alternative SC-1. All data obtained in the monitoring program would be evaluated in the five-year reviews to determine if additional remedial actions are necessary.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: One Year
ESTIMATED TIME FOR OPERATION: Two years
ESTIMATED CAPITAL COST: $4,900,000
ESTIMATED O & M (Present Worth): $468,000
ESTIMATED TOTAL COST (Present worth): $5,370,000

3. **SC-3 In Situ Vacuum/Vapor Extraction and Cap**

This alternative involves in situ vacuum/vapor extraction to remove primarily VOCs (and potentially semi-VOCs) from the unsaturated soils. Following the remediation of soil to cleanup levels for VOCs, soil outside of the current Silresim fence exceeding cleanup levels for non-VOCs would be excavated and consolidated on the Silresim property under a final RCRA Subitle C cap. The areas off of the Silresim property would be backfilled with clean fill.

The RCRA cap would be implemented as described under Alternative SC-2. However, under this alternative, the extent of the RCRA cap would not be as large as that proposed under SC-2 because contaminated soil outside of the Silresim fence would be treated or removed. Approximately 137,000 cubic yards of contaminated soils would be treated by a vacuum/vapor extraction system using wells and/or trenches. Vacuum/vapor extraction is a process which removes VOCs from unsaturated soils by using vacuum pumps or blowers to induce air flow towards a trench or a network of extraction wells. VOCs from soil and water desorb into this air stream for further treatment prior to release to the atmosphere.

To enhance the effectiveness of vacuum/vapor extraction and to reduce direct contact exposures, the existing clay cap would be extended and upgraded as discussed above under alternative SC-1. Areas off of the Silresim property to be treated using vacuum/vapor extraction would be covered with a low-permeability cover. This interim cover will induce a radial air flow through the soil and prevent vertical short circuiting of air flow in the vicinity of each extraction trench or well during the period of operation of the vacuum/vapor extraction system.

A treatability study was performed to evaluate the effectiveness of vacuum/vapor extraction on Silresim Site soils (test results are presented in Appendix F of the RI). Results of the test showed that VOC cleanup levels can be attained for most target compounds. The results of the treatability testing, along with information on soil characteristics obtained during the RI, were used as input for a two-dimensional soil gas flow model to assess the time required to attain cleanup levels with various well/trench spacings. Preliminary results indicate that close well spacings would be required to provide acceptable cleanup times. Trenches would allow somewhat wider spacing (18 trenches of varying length, with a nominal spacing of 45 feet), and increased effectiveness in achieving goals in heterogeneous soils. Trenches would be installed to the water table, to depths up to 14 feet (due to dewatering to lower the water table).

The estimated times to achieve VOC cleanup levels for the soils at the Site are:

- approximately three years for the gravel fill on the Silresim property which is part of the existing cap (placed in 1984).
- approximately five years for the cinder and miscellaneous fill material throughout the Site.
- approximately 30 years for the natural sandy silts throughout the Site.

The results of the treatability study indicate that vacuum/vapor extraction would provide relatively short-term reduction of VOC concentrations in the fill layers, but would need to be undertaken for a longer term to achieve cleanup levels in the lower-permeability natural soils.

Waste streams from vacuum/vapor extraction include a VOC-contaminated vapor stream and collected condensate. Off-gas treatment by fume incineration (thermal oxidation) with scrubbing would be employed for the vapor stream. Collected condensate from the vacuum/vapor extraction system and aqueous wastes from the scrubber could be either treated on Site and discharged or shipped off Site for treatment.

Following vacuum/vapor extraction, approximately 3,000 cubic yards of soil off of the Silresim property still contaminated with non-VOC's and inorganic compounds would be excavated and consolidated with appoximately 15,000 cubic yards of soil on the Silresim property. A final RCRA Subtitle C cap as described above under alternative SC-2 would be installed over the contaminated soil located primarily on the Silresim property (also onto limited areas just northeast and southeast of the property).

The aboveground spatial requirements of this alternative are relatively small, consisting primarily of a building to house the vacuum/vapor extraction equipment. Use of areas off of the Silresim property may be required if soils are to be stockpiled before placement under the RCRA cap. Similar to SC-2, construction of a portion of the RCRA cap into areas off of the Silresim property would involve coordination with the adjacent property owners.

Potential adverse environmental impacts that may result from excavation activities at the Site include erosion of contaminated soil, generation of contaminated stormwater runoff, and VOC emissions to the atmosphere. Drainage and erosion control structures (e.g., stacked hay bales and silt fences) would be placed prior to excavation to reduce the potential for environmental threats. Stacked hay bales and silt fences, if properly emplaced, are established and reliable means of drainage and erosion control. Disturbed vegetation areas would be revegetated following the completion of remediation activities.

VOC emissions would be reduced by the application of vapor suppressing foams, or the erection of domes or air sealed "tents" over work areas. Exhaust air from the domes or vents would be treated to remove VOCs prior to discharge. Releases of particulate matter during excavations would be controlled by the application of water sprays, dust suppressant chemicals (e.g., calcium chloride), and/or specialized excavation equipment (e.g., caisson augers). These control measures are likely to be reliable in reducing most emissions from small-scale excavation activities, such as those proposed for the vacuum/vapor extraction systems under Alternatives SC-3, SC-4, SC-11, SC-14 and SC-15.

This alternative would reduce potential risks for direct contact and inhalation exposures by vacuum extraction of VOC-contaminated soils, and the excavation and placement of soils with concentrations of other constituents above cleanup levels under the RCRA cap. This alternative would also reduce potential human and environmental risks associated with the migration of contaminants in groundwater by removing VOCs from unsaturated-zone soils, and by the limitation of infiltration and therefore leachability of contaminants into groundwater.

Because contaminated materials would remain on Site (i.e., heavier organics and metals), long-term monitoring and five-year reviews would be implemented as discussed under Alternative SC-1. Additionally, fencing and posting signs at the Site, institutional controls, public education programs and access restrictions would be instituted as described under alternative SC-1. Data obtained in the monitoring program would be evaluated in the five-year reviews, and the need for further remedial actions would be assessed.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: 30 years
ESTIMATED CAPITAL COST: $7,272,000
ESTIMATED O & M (Present Worth): $1,745,000
ESTIMATED TOTAL COST (Present worth): $9,020,000

4. SC-4 In Situ Vacuum/Vapor Extraction, Stabilization and Cap

Alternative SC-4 involves treating unsaturated-zone soils by in situ vacuum/vapor extraction for removal of VOCs, followed by excavation and stabilization/solidification of soils exceeding cleanup levels for non-VOCs, followed by on-site containment of treated soils under a RCRA Subtitle C cap. Excavation would be performed only for those unsaturated-zone soils exceeding cleanup levels for non-VOCs. Removal of VOCs prior to excavation and further treatment reduces the volume of soils to be excavated, and reduces health risks associated with VOC emissions during excavation.

As described above, approximately 137,000 cubic yards of contaminated soil on and off the Silresim property would be subject to vacuum/vapor extraction. Following an estimated 5 years of vacuum/vapor extraction, approximately 18,000 cubic yards of soil contaminated with non-VOCs and inorganic compounds (metals) above cleanup levels, would be excavated, stabilized and permanently disposed of on the Silresim property. Stabilization is a process by which the waste is either converted into a more chemically stable form or to a more solid form by mixing it with a binding material such as cement. This process is intended to reduce the waste solubility, mobility and/or toxicity and to limit the potential for contaminant migration into the groundwater by reducing the exposed surface area. Because stabilization involves the addition of reagents to the soils to be treated, the volume of soil would be expected to increase by 20 to 60 percent. The excavated areas off of the Silresim property would be backfilled with clean fill.

Following stabilization, the RCRA Subtitle C cap would be constructed over the stabilized material primarily on the Silresim property as described above under SC-2.

It is estimated that all components of Alternative SC-4 would be implemented within seven years after the completion of remedial design, although approximately 30 years would be required to achieve cleanup levels in the natural soils. This assumes that cleanup levels for VOCs in soils to be excavated and stabilized are reached in approximately five years, that stabilization would be implemented within one-half year (assuming a production rate of 180 cubic yards per day), and that the cap would be constructed in approximately one and one-half years. As with Alternative SC-3, cleanup levels for VOCs in the natural soils would be attained in approximately 30 years.

Most of the Site area is expected to require excavation. Although some portions of the Site would be available for siting of equipment, facilities, and stockpiles, some areas off of the Silresim property may be necessary (property access/easements). It appears likely that available space would exist on the Silresim property for longer-term facilities such as the treatment building(s), so that areas off of the Silresim property could be used mainly for the stockpiling of soils and stabilization operations.

This alternative would reduce potential risks for direct contact and inhalation exposures by vacuum/vapor extraction of VOC-contaminated soils, by stabilization of soils with concentrations of other constituents above cleanup levels, and by placement of stabilized soils under a RCRA Subtitle C cap. This alternative would also reduce potential human and environmental risks associated with the migration of contaminants in groundwater by removing unsaturated-zone VOCs, by significantly reducing the leachability of semi-VOCs, PCBs, metals and potentially dioxins through stabilization, and by reducing infiltration through the placement of a RCRA cap.

Potential adverse environmental impacts associated with excavation and stabilization activities were discussed under alternative SC-3. Proposed impact controls include established and reliable means of drainage, erosion and emissions controls. VOC emissions generated during the operation of the vacuum extraction system would be controlled by a fume incinerator with a scrubbing system. This system is an established and reliable means of VOC emission control.

Because contaminated materials would remain on Site in a stabilized form, long-term monitoring and five-year reviews would be implemented as described under alternative SC-1. Additionally, fencing and posting signs at the Site, institutional controls, public education programs and access restrictions would be instituted as described under alternative SC-1. Data obtained in the monitoring program would be evaluated in the five-year reviews to determine if further remedial actions are required.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: 30 years

ESTIMATED CAPITAL COST: $8,637,000
ESTIMATED O & M (Present Worth): $1,986,000
ESTIMATED TOTAL COST (Present worth): $10,620,000

5. **SC-6 Thermal Desorption, Stabilization and Cap**

Alternative SC-6 includes excavating soil with concentrations of VOCs, semi-VOCs, dioxins, metals and PCBs above cleanup levels. These soils would be treated using thermal desorption, and replaced on Site under a RCRA Subtitle C cap. The ability of thermal desorption to achieve cleanup levels at the Silresim Site (particularly those for PCBs and dioxins) has not been demonstrated; therefore, laboratory and/or pilot testing would be required during the Remedial Design stage. Thermal desorption does not destroy or stabilize metals. Metals may be present in a more leachable form after treatment. Treated soils that exceed TCLP limits or cleanup levels would be stabilized prior to disposal within the limits of the cap located primarily on the Silresim property.

Under this alternative, approximately 50,000 cubic yards of soils off of the Silresim property and approximately 87,000 cubic yards on the Silresim property would be excavated and treated using thermal desorption. Thermal desorption is a process similar to incineration, except lower temperatures are used. Contaminants are stripped or driven off heated soils, and are either burned in a secondary combustion chamber and scrubbed to reduce acid gas and particulate emissions, or are separated from the gas stream by condensing, quenching, and/or absorbing in a scrubber solution for further treatment. Scrubber water would be treated either on Site or shipped off Site for treatment.

Prior to treatment with thermal desorption, crushing/shredding of soil clods and screening of large objects (e.g., scrap metal, rocks, etc.) would be performed. This can result in a loss of volatile organic compounds and particulates directly to the atmosphere, and provisions for containment and control of emissions within the excavation and soils handling areas would be required. To reduce these emissions, aggressive measures would be taken. These measures would include the application of vapor suppressing foams and/or the erection of massive domes or air-sealed "tents" over work areas. After treatment, soils would be tested to see if cleanup levels are exceeded. Clean fill would be used to backfill off-site excavations.

A bench or pilot-scale study with Site soils would be necessary to assess thermal desorption operating parameters (i.e., temperature, pollution control and auxiliary fuel requirements) and to assess removal efficiency for contaminants of concern, especially PAHs, PCBs and dioxins. It should be noted that soil moisture is typically the major factor in energy consumption and treatment time for thermal desorption. Moist soils such as those at Silresim will require a higher energy input and treatment time than drier soils.

Following thermal desorption, soil still contaminated above target cleanup levels would be stabilized according to the methods described above under alternative SC-4. The stabilized mass would be disposed of primarily on the Silresim property and capped with a RCRA cap (constructed as described above under alternative SC-2).

The major constructability issue involved in this alternative is the substantial excavation of contaminated soils. The area to be excavated includes all of the Silresim property and substantial areas outside of the Silresim fence. To allow room for soil stockpiles, thermal desorption and stabilization equipment, and other facilities, it is likely that access to areas outside of the Silresim property will need to be obtained.

It is estimated that all components of SC-6 would be implemented within eight years after the completion of remedial design. Thermal desorption production rates typically range from 75 to 100 cubic yards per day for soils with VOCs and low molecular weight semi-VOCs. Longer residence times would be necessary for heavier organics. Therefore, lower production rates would be required. At a rate of 60 cubic yards per day, thermal desorption would take approximately six years to treat 137,000 cubic yards of soil. Stabilization would be implemented within approximately one-half year. Installation of the cap would take approximately one and one-half years.

This alternative would reduce potential risks for direct contact and inhalation exposures through the treatment of VOCs and semi-VOCs present in soils at levels above cleanup levels. Reductions in PCBs and dioxin concentrations are uncertain; therefore, the magnitude of residual risks due to these compounds cannot be evaluated until further testing is completed. This alternative would also reduce potential human and environmental risks associated with the migration of these contaminants to groundwater through the treatment of contaminated subsurface soils and the limitation of infiltration, and therefore leachability, of contaminants into groundwater. Although metals will not be affected by the thermal desorption process, risks associated with direct contact of metals in soils and potential leaching into groundwater would be reduced by stabilization prior to capping.

Potential adverse environmental impacts that may result from excavation activities at the Site are discussed above under alternative SC-3. Proposed impact controls include established and reliable means of drainage and erosion control. The emissions control measures may be less reliable for completely controlling emissions from the large-scale excavation efforts proposed under this alternative. VOC emissions generated during the operation of the thermal desorption system would be controlled by the secondary combustion chamber and the scrubbing system. This system is an established and reliable means of VOC emission control.

Because contaminated materials would remain on Site, long-term monitoring and five-year reviews would be implemented as described under alternative SC-2. Additionally, fencing and posting signs at the Site, institutional controls, public education programs and access restrictions would be instituted as described under alternative SC-1. All data obtained in this monitoring program would be evaluated in the five-year reviews to determine if further remedial actions are required.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: 8 years
ESTIMATED CAPITAL COST: $50,307,000
ESTIMATED O & M (Present Worth): $947,000
ESTIMATED TOTAL COST (Present worth): $51,250,000

6. **SC-10 On-Site Incineration, Stabilization and Cap**

Alternative SC-10 would treat contaminated soils by excavation and on-site incineration. Incinerated soils with residual contamination above target cleanup goals would be stabilized and disposed of on Site under a RCRA Subtitle C cap.

Again, approximately 137,000 cubic yards of soil both on and off the Silresim property would be excavated and incinerated. Incineration is the controlled destruction of organic matter (VOCs, semi-VOCs, and heavier organics such as PCBs and dioxin) that results in the reduction in volume and toxicity of contaminated soils, liquids, and gases. On-site incinerators can be installed on a permanent basis; however, mobile units are typically used for shorter-term projects. Incinerators generally use either a rotary kiln, circulating bed, or infrared system, each of which are described in more detail in Chapter 5 of the Silresim FS.

All incineration systems produce three types of effluents: combustion gases, ash, and scrubber water. Air pollution control equipment would be required to meet emission limits for combustion gases, which typically contain hydrochloric acid and particulates. Scrubber water from the air pollution control devices is neutralized using a solution of sodium hydroxide, which precipitates as a salt. The scrubber water is generally a low volume stream and can be treated together with wastewater generated from other site activities, such as groundwater extraction and dewatering operations. Incinerator ash contains metals; these metals typically oxidize as a result of the high temperatures and presence of excess air in the combustion chamber and may be hazardous. The ash would be stabilized prior to disposal.

This alternative involves excavating contaminated soils and transporting them to an on-site incinerator. Before incineration, the soils would be prepared by crushing, grinding, screening, and/or drying. Similar to alternative SC-6, some form of VOC and particulate emissions control would be required during these operations. The effectiveness of incineration at the Silresim Site would require a pilot study (test burns).

Following incineration, soils would be tested to see if cleanup levels have been met. Approximately 6,000 cubic yards of soil still exceeding cleanup

levels would be stabilized according to the method described above under alternative SC-4, assuming that only metals-contaminated soils would require this treatment. The stabilized mass would be disposed of primarily on the Silresim property under a RCRA Subtitle C cap. Excavations off of the Silresim property would be backfilled with clean fill.
It is estimated that all components of Alternative SC-10 would be implemented within eight years after the completion of remedial design. This assumes that excavation and incineration activities would be completed in approximately six years (assuming a treatment rate of 100 tons per day), that stabilization would be implemented within the next one-half year (assuming some overlap between incineration and stabilization activities), and the cap would be installed in the next one and one-half years.

Most of the Site area would require excavation. Although some portions of the Silresim property would be available for siting of equipment, facilities, and stockpiles, use of areas outside of the Silresim property would be necessary. Available space would exist on the Silresim property for longer-term facilities such as the treatment building(s), so that areas off of the Silresim property would be required for the incineration and stabilization portions of the project.

This alternative would reduce potential risks for direct contact and inhalation exposures through the treatment of VOCs, semi-VOCs, dioxins, and PCBs present in soils at levels above cleanup levels. Although metals would not be removed or destroyed by the incineration process, direct contact and leaching related risks would be prevented through stabilizatio and capping. This alternative would also reduce potential human and environmental risks associated with contaminant migration into groundwater.

Potential adverse environmental impacts that might result from excavation activities at the Site are discussed under alternative SC-3 and SC-6. Proposed impact controls include established and reliable means of drainage and erosion control. The emissions control measures may be less reliable for completely controlling emissions from the large-scale excavation efforts proposed under this alternative. VOC and particulate emissions during the operation of the incinerator would be controlled by off-gas treatment and a scrubbing system.

Because contaminated materials would remain on-site, long-term monitoring and five-year reviews would be implemented as described under alternative SC-1. Additionally, fencing and posting signs at the Site, institutional controls, public education programs and access restrictions would be instituted as described under alternative SC-1. All data obtained in this monitoring program would be evaluated in the five-year reviews to determine if further remedial actions are required.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: 8 years
ESTIMATED CAPITAL COST: $53,879,000
ESTIMATED O & M (Present Worth): $956,000

ESTIMATED TOTAL COST (Present worth): $54,840,000

7. **SC-11 In Situ Vacuum/Vapor Extraction, Incineration, Stabilization and Cap**

Under this alternative, approximately 137,000 cubic yards of contaminated soil would be remediated on Site by in situ vacuum/vapor extraction as described under alternative SC-3. Vacuum/vapor extraction would be used to reduce the volume of soils requiring incineration by remediating VOC-contaminated soils in situ. After acceptable VOC concentrations in soil have been achieved through vacuum/vapor extraction, soils having concentrations of semi-VOCs, PCBs, and dioxins above cleanup levels (approximately 18,000 cubic yards) would be excavated and incinerated as described above under alternative SC-10. Following incineration, approximately 6,000 cubic yards of incinerated soil with metals and other contaminants above cleanup levels would be stabilized and disposed of primarily on the Silresim property under a RCRA subtitle C cap (constructed as described under alternative SC-2).

Treatment residuals include a contaminated air stream and scrubber waters from both the incineration process and the vacuum/vapor extraction system. Contaminated air would be subjected to off-gas treatment and scrubbed to reduce acid gas and particulate emissions. Scrubber water would be treated either on Site, or shipped off Site for treatment. Although contaminant concentrations in the scrubber water are likely to be high, quantities should be relatively low.

Like alternative SC-10, most of the Site area is expected to require excavation, but to a lesser extent. Although some portions of the Silresim property would be available for siting of equipment, facilities, and stockpiles, use of areas off of the Silresim property would be necessary. Available space would exist on the Silresim property for longer-term facilities such as the treatment building(s), so that areas off of the Silresim property would be required for the incineration and stabilization portions of the project.

It is estimated that all components of alternative SC-11 would be implemented within eight years after the completion of remedial design, although approximately 30 years would be required to achieve cleanup levels for VOCs in the natural soils. This assumes that VOC cleanup levels for the materials to be excavated would be reached in approximately five years, that incineration would be completed in approximately one year (assuming a production rate of 100 tons per day), that stabilization would be implemented within the next one-half year (assuming a production rate of 180 cubic yards per day), and the cap would be installed in the next one and one-half years.

This alternative would reduce potential risks for direct contact and inhalation exposures through the vacuum/vapor extraction of VOCs, and the incineration of heavier organic target compounds, such as PAHs, dioxins and

PCBs. Although metals will not be affected by vacuum extraction or incineration, risks associated with direct contact of metals in soils and potential leaching into and migration in groundwater will be reduced by stabilization prior to capping. This alternative would also reduce potential human and environmental risks associated with the migration of these contaminants in groundwater.

The environmental impacts and controls are similar to those described under alternatives SC-4 and SC-6; VOC and particulate emissions during the operation of the incinerator and vacuum/vapor extraction system would be controlled by off-gas treatment including a scrubbing system.

Because contaminated materials would remain on Site, long-term monitoring and five-year reviews would be implemented as described under alternative SC-2. Fencing and posting signs at the Site, institutional controls, public education programs and access restrictions would be instituted as described under alternative SC-1. All data obtained in this monitoring program would be evaluated in the five-year reviews to determine if further remedial actions are required.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: 30 years
ESTIMATED CAPITAL COST: $15,182,000
ESTIMATED O & M (Present Worth): $2,040,000
ESTIMATED TOTAL COST (Present worth): $17,220,000

8. **SC-14 Vacuum/Vapor Extraction, Solvent Extraction, Stabilization, and Cap**

Alternative SC-14 is similar to SC-11, except that solvent extraction would be performed instead of incineration. Approximately 137,000 cubic yards of unsaturated VOC-contaminated soils would be treated in situ for VOCs using vacuum/vapor extraction. Following vacuum/vapor extraction, 18,000 cubic yards of soil exceeding the cleanup levels for non-VOCs and inorganics would be excavated and treated using solvent extraction. Following solvent extraction, 6,000 cubic yards of soil would be stabilized, assuming that only metals contaminated soils would require this treatment.

Solvent extraction is a technology which consists of using a solvent to extract organic compounds and metals from soils. Solvent extraction systems using triethylamine (TEA) or liquid propane to remove PCBs and other organic compounds are available and in service.

Separate phase extracted organics from the solvent extraction process would either be destroyed on Site in a small liquid injection incinerator, or temporarily stored on Site until permitted off-site incineration capacity becomes available. Process wastewaters would contain some contaminants, and would be treated at an off-site facility or in the groundwater treatment system.

Performance data from system manufacturers indicate that residual PCB concentrations in soils were less than 1 mg/kg (the PCB cleanup level for the Silresim Site) in 2 of 14 test cases. Residual PCB concentrations appeared to show little dependence on initial PCB concentrations; rather, soil characteristics appear to be a major factor in process performance. Removal efficiencies exceeded 98.5 percent (the efficiency that would be required at the Silresim Site for the maximum observed PCB concentration of 65 mg/kg) in 10 of the 14 cases, which suggests that the cleanup level may be achievable. However, bench-scale study of this technology would be necessary to verify that the PCB cleanup level can be achieved.

Bench-scale testing would also be used to assess the effect of the reported high concentrations of styrene on the solvent extraction process. The latter compound may be of concern because easily-polymerized materials interfere with solvent extraction by "competing" with the solvent for organic molecules. The cinder fill materials at the Site may also present similar problems.

Following solvent extraction, 6,000 cubic yards of soil with contaminants above cleanup levels (metals) would be stabilized and redeposited on the Silresim property under a RCRA Subtitle C cap as described above under alternatives SC-4 and SC-2, respectively.

All components of Alternative SC-14 would be implemented within eight years after the completion of remedial design, although approximately 30 years would be required to achieve cleanup levels in the natural soils. This assumes that VOC cleanup levels for the materials to be excavated would be reached in approximately five years, that solvent extraction would be completed in approximately one year (assuming a production rate of 100 tons per day), that stabilization would be implemented within the next one-half year (assuming a production rate of 180 cubic yards per day), and the cap would be installed in the next one and one-half years. As with Alternative SC-3, cleanup levels for VOCs in the natural soils would be attained in approximately 30 years.

This alternative would reduce potential risks for direct contact and inhalation exposures through the vacuum/vapor extraction of VOCs, and solvent extraction of heavier organic target compounds such as semi-VOCs, including PAHs. However, residual concentrations of PCBs and dioxins may be above cleanup levels. Risks associated with direct contact of metals in soils and potential leaching and migration in groundwater would be reduced by stabilization prior to capping. This alternative would also reduce potential human and environmental risks associated with the migration of these contaminants in groundwater.

The potential adverse environmental impacts and controls are similar to those described under alternative SC-3; VOC emissions during the operation of the vacuum/vapor extraction system would be controlled by fume incineration with scrubbing. Fugitive emissions from the solvent extraction and stabilization systems would be monitored, and actions taken as necessary.

Because contaminated materials would remain on Site, long-term monitoring and five-year reviews would be implemented as described under alternative SC-2. Fencing and posting signs at the Site, institutional controls, public education programs and access restrictions would be instituted as described under alternative SC-1. All data obtained in this monitoring program would be evaluated in the five-year reviews to determine if further remedial actions are required.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: 30 years
ESTIMATED CAPITAL COST: $9,991,000
ESTIMATED O & M (Present Worth): $854,000
ESTIMATED TOTAL COST (Present worth): $10,850,000

9. **SC-15 Vacuum/Vapor Extraction, Solvent Extraction, Stabilization, Off-Site Disposal**

This alternative is similar to alternative SC-14, except that treated soils would be disposed of off Site. This alternative includes vacuum/vapor extraction of approximately 137,000 cubic yards of soil to remove VOCs, followed by excavation and solvent extraction of 18,000 cubic yards of soil to reduce concentrations of semi-VOCs and PAHs to below cleanup levels. Removal of VOCs prior to excavation and further treatment reduces the volume of soils to be excavated, and reduces health risks associated with VOC emissions during excavation. Soils exceeding cleanup levels for metals alone (6,000 cubic yards) would be stabilized as described under alternative SC-4. Stabilized soils would be disposed of at a location off Site. Excavations would be backfilled with clean fill, and covered with a RCRA Subtitle C cap (constructed as described under alternative SC-2).

This alternative involves the removal and transportation of large volumes of soil off Site to a RCRA-permitted landfill. Soils would need to be excavated, staged, and shipped off-site in accordance with U.S. Department of Transportation (DOT) and RCRA regulations. Staging of soils would be simpler if off-site stabilization were chosen because no dedicated area would be required for this process, and the volume of soil to be handled and shipped would drop significantly (by approximately one-third). The amount of soils to be sent off Site would be large, and locating a RCRA-permitted landfill which accepts dioxin contaminated waste and could guarantee capacity may not be feasible. Currently, there are no licensed facilities in the United States that are available to accept dioxin contaminated soil. The solvent extraction process may not reduce dioxin concentrations below the proposed cleanup level of 0.001 mg/kg. If no dioxin disposal facilities can be located, dioxin-contaminated soils would be reconsolidated on Site, stabilized, and covered with a RCRA cap.

The estimated timeframe to meet the objectives is essentially the same as that discussed under alternative SC-14; all components of Alternative SC-15 would be implemented within approximately 30 years after the completion of remedial design.

Metals would not be treated under this alternative, but would be converted to a less-mobile form. This alternative would reduce exposure risks associated with inhalation exposures and direct contact and ingestion of unsaturated-zone and surficial soils, and limit rainwater infiltration and therefore contaminant migration in groundwater.

The potential adverse environmental impacts and controls are similar to those described under Alternatives SC-3; VOC emissions during the operation of the vacuum/vapor extraction system would be controlled by fume incineration with scrubbing. Fugitive emissions from solvent extraction and stabilization systems would be monitored, and actions taken as necessary. Off-site disposal operations and facilities would conform to DOT and RCRA regulations.

Because contaminated materials would remain on Site during the period that the vacuum/vapor extraction system is in operation, a monitoring program and five-year reviews would be implemented as described under Alternative SC-2. Fencing and posting signs at the Site, institutional controls, public education programs and access restrictions would be instituted as described under Alternative SC-1. All data obtained in the monitoring program would be evaluated in the five-year reviews to determine if further remedial actions are required.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: 30 years
ESTIMATED CAPITAL COST: $17,765,000
ESTIMATED O & M (Present Worth): $854,000
ESTIMATED TOTAL COST (Present worth): $18,620,000

B. Management of Migration (MM) Alternatives Analyzed

Management of migration alternatives address contaminants that have migrated from the original source of contamination. At the Silresim Site, contaminants have migrated from the Silresim property into groundwater primarily northwest toward River Meadow Brook and southeast toward Maple Street (flow is not limited to these directions, however). The Management of Migration alternatives evaluated for the Site include the following alternatives:

MM-1: No Action/Minimal Action

MM-2: Groundwater Extraction, Metals Pretreatment, Air Stripping, Aqueous Phase Carbon Adsorption, Vapor Phase Carbon Adsorption or Thermal Oxidation

MM-3: Groundwater Extraction, Metals Pretreatment, Steam Stripping, Aqueous Phase Carbon Adsorption, and Vapor Phase

Carbon Adsorption or Thermal Oxidation

MM-4: Groundwater Extraction, Metals Pretreatment, UV/Chemical Oxidation, Vapor Phase Carbon Adsorption or Thermal Oxidation

i. Groundwater Extraction and Treatment

The principal objectives of groundwater remedial action are to eliminate or minimize, to the maximum extent practicable, the threat posed to the public health, welfare, and the environment by the current extent of contaminated groundwater, and meet Federal and State drinking water quality standards (ARARs) to return the aquifer to its beneficial uses. The estimated time to achieve interim cleanup levels is contingent on aquifer characteristics, contaminant characteristics, plume mass and areas of extraction. EPA is unable to reliably predict when cleanup levels at the points of compliance can be achieved. However, it is anticipated that cleanup levels at the point of compliance will be achieved in no less than thirty years.

Alternative's MM-2, MM-3, and MM-4 each include a groundwater extraction and treatment system, and a system for discharge of treated water. The groundwater extraction system would collect contaminated groundwater from the aquifer and move the groundwater to the surface for treatment. The treatment system would consist of a series of treatment processes to reduce the concentrations of contaminants requiring removal. The discharge system would consist of a means to deliver the treated water back to the aquifer, to the City of Lowell sewer system or to River Meadow Brook.

For each of the groundwater extraction and treatment alternatives groundwater extraction wells would be installed in the overburden and shallow bedrock, strategically located to intercept groundwater contamination migrating toward vulnerable receptors (basements, East Pond, River Meadow Brook). The extraction system would be designed to maximize contaminant recovery rates. The estimated maximum total flow rate from all the wells for each alternative is approximately 25 gallons per minute (gpm). Potential short-term impacts to the wetlands of East Pond during the installation of a potential extraction well would be minimized by drainage and erosion control measures, including stacked hay bales and silt fences. These controls, when properly emplaced, are reliable means of drainage and erosion control.

Gravity separation of contaminated water from non-aqueous phase contaminants such as floating product and DNAPL would be accomplished using a tank sized to allow gravity separation of aqueous and non-aqueous phase contaminants at the design flow rate. Floating product would be skimmed from the surface; dense non-aqueous phase contaminants would be removed from the bottom of the tank. The remaining aqueous stream would flow by gravity into the iron/manganese removal system.

A pretreatment step would be necessary to remove iron and manganese prior to primary treatment to reduce clogging of the system and reduce iron and manganese concentrations to within discharge limits. As indicated in the RI, iron concentrations up to 268 mg/l and manganese concentrations up to 12.3 mg/l have been observed in Silresim groundwater. These concentrations indicate that iron/manganese removal is required to reduce clogging of treatment equipment. Some incidental removal of metals other than iron and manganese is expected to occur during treatment. Potential systems considered for iron/manganese removal included chemical precipitation/filtration and ion exchange. Chemical precipitation removes dissolved metals by precipitating them as hydroxides or sulfides. A subsequent filtration step would remove additional solids not removed by the clarifier. The ion exchange process removes dissolved metal contaminants by passing contaminated groundwater through a fixed bed packed with ion exchange resin(s).

The following three methods of disposal for treated groundwater were discussed and compared in the FS:

- On-site groundwater recharge.
- Discharge to the City of Lowell's Duck Island Treatment Plant via sanitary sewer lines.
- Discharge to River Meadow Brook through an existing storm drain or a specially-constructed drain line.

The first of these three options involves construction of a series of recharge trenches to allow treated water to seep back into the soils at the Site. While the construction of a recharge system may be possible at the Silresim Site, this would be least practical due primarily to the low permeability and heterogeneity of on-site soils which make recharge technically difficult. Additionally, recharge would tend to increase hydraulic gradients at the Site, which may increase the off-site flow of contaminated groundwater.

Discharge to River Meadow Brook would involve construction of buried piping from the on-site treatment building to either the Brook, which at its closest point is approximately 400 feet from the Site boundary, or to a storm drain that flows to the brook. If discharge to River Meadow Brook is adopted, a NPDES permit would have to be obtained. Discharge limitations would likely be imposed on many of the contaminants found in Site groundwater, and additional parameters such as pH and total suspended solids (TSS). Imposed standards for organic compounds may be as stringent as drinking water standards, while TSS standards are typically 20 to 30 mg/l. Toxicity standards similar to those proposed for the Duck Island facility may also be imposed.

Discharge to the City of Lowell's sanitary sewer system, which flows to the Duck Island Wastewater Treatment Facility (POTW) would involve the construction of a connecting pipe from the groundwater treatment building to a nearby (existing) sewer line with available capacity to handle the expected flow. This connection would probably be made to the Tanner Street sewer near the present Site gate. Discharges would have to conform to the sewer use ordinances, which include a TTO (Total Toxic Organics) standard of 2.13 mg/l, and may include toxicity-based standards. All state and federal requirements for discharge to sewers and to the POTW would be met.

The final decision regarding the discharge location will be made during the design phase of the project, based upon results of the pre-design activities.

1. **MM-1 No-Action/Minimal Action**

This alternative is intended to include the minimal actions that must be taken at the Site to reduce potential risks to the public. This alternative, as required by CERCLA, is used as a basis of comparison for evaluating other proposed management of migration alternatives. MM-1 consists of restricting the use of groundwater on Site, and monitoring of groundwater both on and off Site. Education programs would inform the public about potential hazards associated with Site groundwater. Institutional controls would be implemented to restrict or prevent the potential use of contaminated groundwater. A long-term groundwater monitoring program would be instituted for a period of at least 30 years to evaluate changes in study area conditions over time. As required under the 1986 CERCLA amendments, five-year reviews would be conducted because wastes would remain on Site.

Education programs would inform local agencies, utilities, and the public about potential hazards at the Site. The programs would include public meetings, presentations, local newspaper articles, and direct mailings to businesses and residences located near the Site.

Institutional controls would include access, deed and land use restrictions. These controls would be pursued through legal channels to restrict or prevent the potential use of contaminated groundwater. Land use/deed restrictions would include the addition of water use restriction clauses to property deeds in areas of known groundwater contamination.

Long-term monitoring would record and allow evaluation of trends in contaminant concentration and extent of contaminant migration. Monitoring would consist of sampling and analyses of surface water, groundwater, and downgradient sewers. Surface water samples, and samples from the downgradient sewer would be collected. Groundwater samples would also be collected from multiple selected, existing monitoring wells. Samples would be analyzed for the Target Compound List (TCL) volatile organic compounds during each sampling round, and for the other TCL organics and Target Analyte List (TAL) inorganics.

No treatment of groundwater contaminants would be implemented in this alternative; therefore, the risks associated with the potential exposures to groundwater as identified in the RI would not be permanently mitigated.

The institutional controls included in this alternative would be implemented within approximately one year.

The 1986 CERCLA amendments require that conditions be reviewed every five years at NPL sites where wastes remain on site. As Alternative MM-1 would result in wastes remaining on Site, this five year review process would be mandatory. All data obtained in the monitoring program would be evaluated in the five-year reviews. These reviews would consider all relevant data and determine if additional remedial actions are necessary.

Implementation of this alternative would not be expected to result in any additional environmental impacts, since no contaminants would be removed, treated or destroyed.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 1 year
ESTIMATED TIME FOR OPERATION: 1 year
ESTIMATED CAPITAL COST: $64,000
ESTIMATED O & M (Present Worth): $416,000
ESTIMATED TOTAL COST (Present worth): $480,000

2. **MM-2 Groundwater Extraction, Metals Pretreatment, Air Stripping, Aqueous Phase Carbon Adsorption and Vapor Phase Carbon Adsorption or Thermal Oxidation**

This alternative would remove both inorganic and organic groundwater contaminants by gravity separation, metals pretreatment, air stripping, vapor phase carbon adsorption or thermal oxidation and liquid phase carbon adsorption. Groundwater would be pumped to a settling tank where non-aqueous phase materials (e.g. floating product and DNAPL) would be separated and shipped off Site for reclamation or incineration. The aqueous stream would be directed to a metals removal process. After metals removal, the groundwater would be heated and pumped to the air stripper. Organic compounds would be removed by air stripping and liquid phase carbon adsorption. Secondary waste management would be required for off Site disposal of some contaminants. The treated water would be discharged to one of the three discharge options discussed above which will be determined during the remedial design phase.

Air stripping would be accomplished using either a counter-current air stripping tower or a tray aerator. A stripping tower consists of a vertical tower filled with packing material. Contaminated water flows downward through the packing material while air is forced upward through the tower by a blower. The large surface area of the packing material improves contact of contaminated water with the flowing air. Contaminated air exits the top of the tower, and is directed to subsequent treatment to remove volatilized organics. Tray aerators operate on the same principle as a packed tower, but differ substantially in construction. The unit consists of stacked, perforated trays across which water flows while air is bubbled through from beneath the trays.

To increase the air stripper removal efficiency, the groundwater influent would be heated prior to air stripping. Heating would be accomplished by using steam or other heating methods. Heating of influent results in more efficient stripping and thus reduces the organic loading on the liquid-phase carbon adsorbers. Volatilized organics from the air stripper would be removed by either vapor-phase carbon adsorption or thermal oxidation. The thermal oxidation unit would require an auxiliary fuel source to incinerate the volatile emissions, and a scrubbing system to remove acid gasses. Because of the presence of ketones in groundwater, the use of vapor-phase carbon is a less desirable technology at Silresim. The high heat of adsorption of ketones can result in unacceptable temperature increases and/or carbon bed fires.

An aqueous-phase carbon adsorption unit would be used to remove organic contaminants not removed by the air stripper. Compounds not efficiently removed in the air stripper would tend to be either heavier molecular weight compounds (e.g., PAHs) or highly soluble compounds (e.g., ketones). Carbon adsorption removes organics by collecting them on the surfaces of granules of activated carbon.

Secondary waste management would be required for off-site disposal of non-aqueous phases from gravity separation (e.g., DNAPL, floating product), residues from the metals removal process (e.g. metals hydroxide sludge from chemical precipitation), and the off-site regeneration or disposal of spent carbon. Since hazardous materials would be transported off Site, DOT and RCRA regulations for the transportation of such materials would be applicable and must be met.

The groundwater extraction and treatment system could be designed, constructed, and started up in a period of approximately two to three years. As discussed above, the extraction and treatment system would be expected to function as a long-term remediation system.

Public education programs, institutional restrictions, long-term monitoring, and five-year reviews would be implemented as described above under Alternative MM-1.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: Long-term Remediation
ESTIMATED CAPITAL COST: $4,405,000
ESTIMATED O & M (Present Worth): $7,277,000
ESTIMATED TOTAL COST (Present worth): $11,680,000

3. **MM-3 Groundwater Extraction, Metals Pretreatment, Steam Stripping, Aqueous Phase Carbon Adsorption, and Vapor Phase Carbon Adsorption or Thermal Oxidation**

This alternative is essentially the same as MM-2 detailed above, with the substitution of steam stripping for air stripping. As with Alternative MM-2, groundwater would be pumped to a settling tank where non-aqueous phase liquids (NAPL) would be separated and shipped off-site for reclamation or incineration. Following pretreatment to remove metals from the groundwater, the groundwater would be treated using steam stripping. Steam stripping uses steam, instead of air, to remove contaminants from the groundwater. The contaminated vapor from the steam stripper is condensed then collected and separated in a tank. The non-aqueous phase product, containing high concentrations of contaminants, would be removed and shipped to an off-site facility for disposal or reclamation. The aqueous phase may be recycled through the air stripper. The treated water would be discharged to one of the three discharge options discussed above, which will be determined during the remedial design phase.

Steam stripping uses a vertical column into which groundwater is fed from the top while steam, provided from an on-site boiler, is injected from the bottom. The column contains packing material or a series of perforated plates to increase the contact between the steam and the groundwater. The vapor from the steam stripper is condensed in a water-cooled heat exchanger, and collected in a tank to allow separation into immiscible product phases and aqueous phases. (Very soluble compounds such as acetone will not form a separate phase.) The aqueous phase, containing high concentrations of stripped compounds, may be either treated, disposed of, or recycled back into the treatment system. If the condensate has unacceptable concentrations of ketones (e.g., acetone), recycling into the treatment system may not be viable.

Aqueous-phase carbon adsorption, as described under Alternative MM-2, would be used to remove additional organic contaminants not removed by the stripper.

Secondary waste management would be required for off-site disposal of non-aqueous phases from gravity separation, residues from the metals removal process (e.g. metals hydroxide sludge from chemical precipitation), treatment or disposal of the aqueous phase condensate (if it cannot be recycled into the treatment process), recycling or disposal of recovered product condensate, and the regeneration or disposal of spent carbon. Volatilized contaminants from the pretreatment systems (phase seperator and metals pretreatment) would either be removed by vapor-phase carbon adsorption or a thermal oxidizer. Since hazardous materials would be transported off Site, DOT and RCRA regulations for the transportation of such materials must be met.

The groundwater extraction and treatment system could be designed, constructed, and started up in a period of approximately two to three years. As discussed above, the extraction system would be expected to function as a long-term remediation system.

Public education programs, institutional restrictions, long-term monitoring, and five-year reviews would be implemented as described above under Alternative MM-1.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: Long-term Remediation
ESTIMATED CAPITAL COST: $4,405,000
ESTIMATED O & M (Present Worth): $7,914,000
ESTIMATED TOTAL COST (Present worth): $12,320,000

4. **MM-4 Groundwater Extraction, Metals Pretreatment, UV/Chemical Oxidation, and Vapor Phase Carbon Adsorption or Thermal Oxidation**

Similar to Alternatives MM-2 and MM-3, groundwater would be pumped to a settling tank where NAPL materials would be separated and shipped off Site for treatment. Following pretreatment to remove metals from the groundwater, the groundwater would be treated using ultraviolet (UV)/oxidation to remove the VOCs. UV/oxidation is a treatment which involves the destruction of dissolved organic compounds using ultraviolet light in combination with strong chemical oxidizing agents (ozone or hydrogen peroxide). The treated water would be discharged to one of the three discharge options discussed above to be determined during the remedial design phase.

UV/chemical oxidation would be used to destroy organic contaminants. Available UV/chemical oxidation systems use either hydrogen peroxide or ozone, or both. Either hydrogen peroxide or ozone alone will oxidize organics; however, oxidation rates are significantly increased by using UV light in conjunction with these oxidants. UV light enhances the oxidation process by transforming hydrogen peroxide and ozone into hydroxyl radicals, which are more powerful oxidants than hydrogen peroxide or ozone. UV light also reportedly excites organic molecules to higher, less-stable energy levels, making them more susceptible to oxidation. If the oxidation reaction is carried to completion, the end products from oxidation of non-chlorinated hydrocarbons are carbon dioxide and water. Chlorinated hydrocarbons would also produce hydrochloric acid and/or inorganic chlorides. If the oxidation reaction is not carried to completion, then organic compounds remain.

UV/chemical oxidation processes preferentially destroy more easily oxidized compounds such as vinyl chloride and trichloroethene. Compounds that are harder to destroy require more residence time in the oxidation chamber. These compounds include trichloroethene, dichloroethane, methylene chloride, carbon tetrachloride, and ketones (e.g., acetone). In general, saturated hydrocarbons are more difficult to oxidize than compounds with double or triple bonds. Also, several compounds and constituents interfere with UV/chemical oxidation. Carbonates interfere by consuming oxidants, resulting in higher chemical and/or ozone production costs. Iron and manganese precipitates, oil and grease, and suspended solids coat the UV lamps, reducing UV light transmittance. All UV/chemical oxidation systems require periodic cleaning and replacement of UV lamps.

The use of ozone would require an on-site ozone generator, a relatively high capital cost item. Hydrogen peroxide offers lower capital costs but higher annual costs. The benefits of using ozone improve with higher operating lifetimes. Systems using ozone typically leave residual ozone in the effluent from the oxidation chamber. Release of ozone is unacceptable because it is a priority pollutant. Ozone systems thus require a decomposer, such as a fixed-bed catalytic decomposer, to convert ozone to oxygen. The decomposer is vented to the atmosphere. Hydrogen peroxide does not present these problems, but it is a potentially dangerous chemical that must be handled with care.

Secondary waste management would be required for off-site disposal of non-aqueous phases from gravity separation, residues from the metals removal process (e.g. metals hydroxide sludge from chemical precipitation). Volatilized contaminants from the pretreatment systems (phase seperator and metals pretreatment) would either be removed by vapor-phase carbon adsorption or a thermal oxidizer. Since hazardous materials would be transported off-site, DOT and RCRA regulations for the transportation of such materials would be applicable and must be met.

The groundwater extraction and treatment system could be designed, constructed, and started up in a period of approximately two to three years. As discussed above, the extraction system would be expected to function as a long-term remediation system.

Public education programs, institutional restrictions, long-term monitoring, and five-year reviews would be implemented as described above under alternative MM-1.

ESTIMATED TIME FOR DESIGN AND CONSTRUCTION: 2 to 3 years
ESTIMATED TIME FOR OPERATION: Long-term Remediation
ESTIMATED CAPITAL COST: $4,866,000
ESTIMATED O & M (Present Worth): $6,570,000
ESTIMATED TOTAL COST (Present worth): $11,440,000

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

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

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a site remedy. These criteria and their definitions are as follows:

Threshold Criteria

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

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

2. **Compliance with applicable or relevant and appropriate requirements (ARARS)** addresses whether or not a remedy will meet all of the ARARs of other Federal and State environmental laws and/or provide grounds for invoking a waiver.

Primary Balancing Criteria

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

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

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

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

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

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

Modifying Criteria

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

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

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

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted.

The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis.

A. COMPARISON OF SOURCE CONTROL (SC) ALTERNATIVES

1. Overall Protection of Human Health and the Environment

Each of the alternatives except for SC-1 and SC-2 use technologies that will be protective of human health and the environment by treating the soil to reduce the principal threats (i.e, VOCs) found at the Site, and/or preventing exposure through containment mechanisms. In most cases the mobility, toxicity and volume of contaminants will be reduced.

Alternatives SC-10 and SC-11 would provide the most permanent protection of human health and environment. Under each of these alternatives, essentially all contaminants but metals would be eliminated; and the metals would be stabilized and capped. Although PCB and dioxin cleanup levels may not be met in alternatives SC-6, SC-14, and SC-15, the overall permanent protection of these alternatives would be expected to be only slightly less than with alternatives SC-10 and SC-11. Alternative SC-4 and SC-3 would offer slightly less permanent protection than those mentioned above, because they do not permanently eliminate heavier organics and some semi-VOCs, although they are similarly protective because they reduce exposures to those constituents. Under SC-4, the residual contaminants would be stabilized to provide for added protection against potential inhalation, ingestion, direct contact and leaching related exposure risks. Alternatives SC-1 and SC-2, the no action and cap alternatives, would provide the least amount of overall protection.

2. Compliance with ARARs

A list of ARARs is found in Section X, as well as in **Appendix C**.

Chemical-Specific. There are no federal or state regulations that specify concentration limits for contaminants detected in soil at the Silresim Site. Federal and State requirements for ambient air emissions (Federal Clean Air Act and Massachusetts Air Pollution Control Regulations) generated from soil treatment systems associated with alternatives SC-3 through SC-15 would be met utilizing proper control mechanisms.

Location-Specific. If activities related to the source control portion of the remedy were to occur within a 100-foot buffer zone of the two wetland areas at Silresim (East Pond and River Meadow Brook), the requirements of the Massachusetts Wetlands Protection Act and the Massachusetts Hazardous Waste Siting Regulations would be met.

Action-Specific. Each of the activities and technologies implemented under the source control alternatives SC-1 through SC-15 would be designed and implemented to meet corresponding action-specific ARARs.

3. Long-Term Effectiveness and Permanence

Magnitude of Residual Risk. Alternative SC-15 would result in the least residual risk at the Site because treated soils would be disposed of off Site (if feasible). Although alternatives employing incineration (SC-10 and SC-11) would result in marginally higher residual risk than SC-15, because some waste (metals) would be disposed of on Site, essentially all organics would be destroyed. Alternatives employing thermal desorption or solvent extraction with on Site disposal (SC-6 and SC-14) may result in a higher residual risk than SC-10, SC-11 and SC-15, because dioxins and PCBs may be present above cleanup levels. Alternatives employing vacuum/vapor extraction as the only organic removal component (SC-3 and SC-4) result in slightly higher residual risk than those listed above because dioxins, PCBs, and some semi-VOCs will remain on Site above cleanup levels, however, both would provide protection against direct contact and inhalation exposures to the residual contamination. SC-4 would afford greater long-term protection than SC-3 because it would additionally include stabilization to prevent migration of the residual contaminants to the groundwater. Alternatives involving no treatment (SC-2 and SC-1) result in the highest residual risks. Of these two alternatives, SC-2 offers lower direct contact and inhalation risks, and reduced contaminant migration as a result of the RCRA Subtitle C cap.

All alternatives except SC-15 include the disposal of some waste on Site. Stabilization is a component in all alternatives, except SC-1, SC-2, and SC-3, to reduce the mobility and toxicity of the residual contaminants. Therefore each of these 6 alternatives would provide essentially equal protection against all potential long-term exposure risks.

Adequacy of Controls. Alternatives SC-4 through SC-15 employ stabilization, a RCRA Subtitle C cap, a Site fence, and institutional controls to manage residual contamination. These alternatives offer the most adequate controls. Alternatives SC-3, SC-2, and SC-1 do not employ stabilization. Furthermore, alternative SC-1 employs a non-RCRA cap, offering a less adequate control than SC-2.

Reliability of Controls. Because stabilized soils protected by a RCRA cap offer the most reliable control of residual materials left on Site, alternatives SC-4 through SC-14 are the most reliable in this respect. Alternative SC-15 is unreliable because there are no known facilities that currently accept dioxin contaminated waste. Alternatives SC-1 through SC-3 offer less reliable controls, with SC-1 being the least reliable because a non-RCRA cap is used.

4. Reduction in Toxicity, Mobility, and Volume Through Treatment

Alternatives employing incineration (SC-10 and SC-11) appear to offer the greatest reductions in toxicity, mobility and volume because of the demonstrated effectiveness and removal efficiency of incineration with VOCs, semi-VOCs, PAHs, PCBs and dioxins.

Alternatives employing solvent extraction and thermal desorption (SC-14, SC-15, and SC-6) appear to comprise the next level of TMV reduction, destroying or removing VOCs, semi-VOCs, and PAHs. Some PCB removal would be expected with these technologies, but cleanup levels may not be achieved. Bench and/or pilot scale testing would be required for both technologies to evaluate their effectiveness with dioxins, since neither are proven technologies for treatment of dioxins.

Alternative SC-4 offers VOC removal and immobilization of heavier organics and metals by stabilization treatment. Although little removal of heavier organics results from this alternative, it should be noted that VOCs comprise the bulk of contamination at the Site.

Only alternative SC-15 offers a volume reduction of metals as a result of off-site disposal. SC-3 through SC-14 utilize stabilization which would substantially reduce the mobility and toxicity of metals.

Alternative SC-3 offers VOC removal but no treatment for heavier organics or metals. Alternatives SC-2 and SC-1 offer only minimal reductions in mobility of contaminants, and would not satisfy the statutory preference for alternatives employing treatment as a principal element.

5. Short-Term Effectiveness

Protection of Community. Implementation of alternative SC-1 (no-action) would not result in additional risks to the community because no contaminants would be removed, treated or destroyed. Implementation of alternative SC-2 would result in minimal risks to the public, because a limited amount of soils may be exposed during cap construction operations and grading.

Alternatives SC-3 through SC-15 involve excavation and treatment activities that could result in potential exposure to the community through direct contact and inhalation. In alternatives SC-4, SC-11, SC-14 and SC-15, excavation activities are performed subsequent to vacuum/vapor extraction, so that volumes of soil to be excavated and direct contact and inhalation exposures are reduced because VOCs are destroyed prior to excavation.

Alternatives SC-6 and SC-10 appear to pose the greatest risk to the community during implementation in that large volumes of VOC contaminated soils would be excavated and the reliability of emissions controls is low. Implementation of alternative SC-15 could pose additional public health exposures due to the off-site transport and disposal of contaminants (if an off-site facility for the disposal of dioxin waste can be utilized).

Protection of Workers. Implementation of alternative SC-1 would result in the lowest short-term risks to workers, since minimal actions will be taken and no contaminants would be removed, treated or destroyed. Implementation of alternative SC-2 should result in minimal risks to the workers, because a limited amount of soils may be exposed during cap construction operations and grading.

Alternatives SC-3 through SC-15 involve excavation and treatment activities that may result in potential exposure to the workers through direct contact and inhalation. Alternatives SC-3, SC-4, SC-11, SC-14 and SC-15 require trench excavation for the vacuum/vapor extraction system. In the latter four alternatives, further excavation and treatment activities are also required; however, direct contact and inhalation exposures and any resulting risks would be reduced because of the prior reduction in VOC concentrations. Alternatives SC-6 and SC-10 appear to pose the greatest risk to workers in that large excavation efforts in VOC-contaminated soils would be required. Alternative SC-15 may pose additional worker exposures due to the off-site transport and disposal of contaminants.

Environmental Impacts. The implementation of alternative SC-1 should not result in environmental impacts. Disturbance of vegetated areas should be the only environmental impacts associated with alternative SC-2. Potential adverse environmental impacts may result from alternatives SC-3 through SC-15 from excavation activities, including soil erosion, generation of stormwater runoff, and VOC and dust emissions. However, measures for drainage, erosion and emissions controls are expected to be reliable. Emissions controls for large-scale excavation efforts are expected to be less reliable.

Additional low-level emissions may result from the operation of on Site extraction and treatment systems. Each of the proposed emissions control systems are reliable. Alternatives employing large-scale incineration or thermal desorption (SC-6 and SC-10) probably pose the largest risk of air emissions. Differences in the degree of potential environmental impacts will be dependent on the amount of materials excavated and treated. Alternative SC-15 may pose additional environmental risk due to the off Site transport and disposal of contaminants.

Estimated Time to Achieve Objectives. Alternative SC-1 has the shortest estimated implementation time (one year), followed by SC-2 (two years). Alternatives SC-10 and SC-6 have estimated implementation times of approximately eight years. Alternatives SC-3 and SC-4 have estimated implementation times of two and one-half and seven years, respectively, but they require approximately 30 years to achieve VOC cleanup levels in natural soils. Alternatives SC-11, SC-14, and SC-15 require approximately eight years to implement, but also require approximately 30 years to achieve cleanup levels in natural soils.

6. Implementability

Technical Feasibility

Construction and Operation. Alternative SC-1 offers the fewest constructability concerns. Alternative SC-2 involves a larger construction effort than SC-1, but constructability concerns are minor. Alternatives SC-3, SC-4, SC-11, SC-14, and SC-15 employ vacuum/vapor extraction. Extraction trenches could be up to 14 feet deep, presenting potential construction problems. Alternatives SC-6 and SC-10 involve major excavations in highly VOC-contaminated soils which could pose major constructability problems, particularly with the large-scale application of VOC emissions controls, and the location of treatment equipment and facilities. Treatment equipment would have to be either located on the Silresim property and moved at least once during the course of the project, or located off the property, outside the areas to be excavated. The latter option would involve obtaining easements or acquiring adjacent properties.

Reliability of Technology. Alternatives SC-1 and SC-2 employ the simplest technologies, and pose few reliability concerns. Vacuum/vapor extraction (alternatives SC-3, SC-4, SC-11, SC-14, and SC-15) offers a reliable technology for VOC removal, but little or no reliability for the removal of PAHs, PCBs, dioxins, or metals. Stabilization (alternatives SC-4 through SC-15) offers a reliable means of reducing mobility of metals and potentially heavier organics such as PCBs. Thermal desorption (alternative SC-6) offers high reliability for VOCs and only limited reliability for the removal of PCBs and dioxins. Data is also lacking on the effectiveness of thermal desorption in moist soils. Solvent extraction (alternative SC-14 and SC-15) has been shown to be a reliable technology for the removal of PCBs (but not for dioxins).

Ease of Undertaking Additional Remedial Action. Alternative SC-1 provides the least impediment to future remedial action. All other alternatives employ a RCRA Subtitle C cap which would require greater effort to remove than the existing cap. Alternatives employing vacuum/vapor extraction (alternatives SC-3, SC-4, SC-11, SC-14, and SC-15) may require repair, replacement, or abandonment of the extraction piping. Alternatives employing on-site disposal of stabilized soil (SC-4 through SC-14) could offer potential difficulties because of the hardened soil masses that would be produced.

Monitoring Considerations. Alternative SC-1 presents no impediments to future monitoring. All other alternatives present minor problems involved with maintaining integrity of the RCRA cap during and after soil sampling operations. Alternatives employing or potentially employing stabilization (SC-4 through SC-15) may make soil sampling somewhat more difficult if hardened soil masses require coring equipment.

Administrative Feasibility

All alternatives would require coordination between EPA, DEP, the City of Lowell, and adjacent property owners. Rights-of-way may be required for work in or near railroad property. Alternatives involving or potentially involving the treatment or disposal of process waste (SC-3 through SC-15) would be required to comply with applicable EPA, Department of Transportation, and State DEP regulations. None of these issues are anticipated to present major administrative feasibility problems. The only major feasibility issue is in locating an off Site facility for the disposal of dioxin contaminated waste associated with SC-15.

Availability of Services and Materials

Alternatives SC-1 (Minimal/No Action), SC-2 (On-site Cover System) and SC-3 (On-site Vacuum/Vapor Extraction) use readily available services and materials. All other alternatives require advance scheduling of treatment equipment for stabilization, thermal desorption, incineration, and/or solvent extraction. Stabilization (SC-4 through SC-15) is relatively widely available. On-site incineration (SC-10 and SC-11) is somewhat less available, and thermal desorption and solvent extraction are the least available. Alternative SC-15 presents major concerns associated with the availability of off-site disposal capacity for large volumes of treated soils, and for soils with residual dioxin concentrations above 0.001 mg/kg.

7. Cost

The estimated present worth value of each Source Control alternative is listed below. It should be noted that these costs are estimates made during the Feasibility Study that are expected to provide accuracy of +50 percent to -30 percent.

	Capital Costs	O & M	Present Worth
SC-1	$564,000	$485,000	$1,050,000
SC-2	$4,997,000	$391,000	$5,390,000
SC-3	$7,409,000	$1,745,000	$9,150,000
SC-4	$8,637,000	$1,986,000	$10,620,000
SC-6	$50,444,000	$947,000	$51,390,000
SC-10	$54,016,000	$956,000	$54,970,000

SC-11	$15,294,000	$2,040,000	$17,330,000
SC-14	$10,085,000	$854,000	$10,940,000
SC-15	$17,862,000	$854,000	$18,720,000

8. State Acceptance

The Commonwealth of Massachusetts through the Department of Environmental Protection (MA DEP) concurs with the selection of (SC-4) in situ vacuum/vapor extraction, stabilization and a RCRA cap as the source control alternative for the Silresim Site.

The DEP provided a number of comments on the Proposed Plan and Feasibility Study to assist EPA in evaluating State acceptance of the selected remedy. They provided a list of Applicable, Relevant and Appropriate Requirements (ARARs) for the selected remedy, including chemical, location and action-specific ARARs. DEP indicated that the Proposed Plan appeared to be consistent with the definition contained in the Massachusetts Contingency Plan for a temporary solution. They also indicated their support for the waiver of the bottom landfill liner specification of the Toxic Substance and Control Act (TSCA), by recognizing that the selected remedy will be protective of human health and the environment to exposures to PCBs.

Among DEP's comments on the Proposed Plan, they recommended that wells rather than trenches be further evaluated for use associated with the vacuum extraction system, due to a reduction in air emissions from excavating soil with volatile organic compounds. They recommended the use of a dome or sealed tent to reduce VOC emissions from the soil to be temporarily stockpiled during the implementation of the remedy. Also, DEP indicated that emissions testing would be required by them prior to and during the implementation of the remedy, and that a follow-up risk assessment should be performed once remedial activities have been completed to ensure the protection of human health and the environment.

9. Community Acceptance

Varied comments were received from residents and members of the business community living near the Site, State officials, and the Silresim Potentially Responsible Parties regarding the content of the Feasibility Study and cleanup of the Silresim Site. The comments received during the public comment period on the Proposed Plan and FS are summarized in the attached document entitled "The Responsiveness Summary" (**Appendix E**). In addition, the comments are summarized below.

Three residents presented comments at the public hearing on July 10, 1991. One resident expressed a concern for the level of air emissions associated with the preferred treatment systems. One resident favored an alternative which would include incineration, as a method to cleanup the Site in a shorter period of time than the preferred remedy. Another resident commented that a follow-up health study be performed that specifically tracked the health status of people who have moved out of the residential neighborhoods adjacent to the Site. An adjacent property and business owner indicated in writing their support for the remedy, yet, they expressed their concern for impacts it will have on the use of their property.

The Massachusetts Department of Public Health (DPH) expressed their support for the preferred alternative. However, DPH indicated their concern for the health of residences closest to the Site. Due to the potential for seepage of groundwater into the basements of these homes, they suggested that the affected residents be informed of the potential exposures and that additional data be gathered to better assess these exposures. DPH also expressed their concern that the Lowell Car Wash in the vicinity of the Site, who have used groundwater to wash cars, may become affected in the future. They recommend collecting more data on their well and the geography in the area. Additionally, they mirrored one of the residents concerns regarding potential air emissions during implementation of the remedy.

A group of the Potentially Responsible Parties have raised numerous technical and legal concerns that support waiving drinking water standards (Maximum Contaminant Levels, MCLs) at the Site, changing the point of compliance for meeting cleanup levels for groundwater to River Meadow Brook, and selected less stringent cleanup levels for soils. Although they believe that the selected cleanup remedy is sound and cost effective, they do not believe that it is technically feasible, or appropriate, to remediate the aquifer at the selected point of compliance to drinking water standards. They believe that containment of the plume is a more appropriate alternative. Additionally, the PRPs believe that EPA has not taken into account the background levels of contaminants found in the area or EPA's current Risk Assessment guidance which would raise the cleanup levels to be met.

B. COMPARISON OF MANAGEMENT OF MIGRATION (MM) ALTERNATIVES

1. Overall Protection of Human Health and the Environment

Alternatives MM-2, MM-3 and MM-4 would provide equal overall protection of human health and the environment, either by reducing contaminants to MCLs/MCLGs or other health based standards, or through a combination of mass reduction, institutional controls and/or engineering controls. In either case, potential exposure risks associated with direct contact, ingestion and inhalation of contaminants in groundwater, surface water and air would be significantly reduced.

Alternative MM-1 would offer minimal protection of human health and the environment by limiting future use and development of the affected groundwater resources through institutional controls.

2. Compliance with ARARs

Action-specific. Each of the activities and treatment technologies implemented under the management of migration alternatives would be designed and implemented to meet corresponding action-specific ARARs.

Chemical-specific. The design of alternatives MM-2, MM-3, and MM-4 would be as a long-term remediation strategy. Actual times required to restore groundwater to cleanup levels are not possible to predict with any degree of reliability. Federal and State drinking water standards may either be attained or waived on the grounds of technical impracticability. Since these alternatives will control the migration of groundwater off of the Silresim property, chemical-specific ARARs and TBCs for groundwater, surface water, and air would be met at the compliance points.

At the completion of alternative MM-1, no chemical-specific ARARs would be met, since no removal, treatment or destruction of contaminants would occur.

Location-specific. The only location-specific ARARs identified are the Massachusetts Wetlands Protection Act and the Massachusetts Hazardous Waste Facility Site regulations which would regulate activities within a 100-foot buffer of the two wetland areas at Silresim: East Pond and River Meadow Brook. If any activities such as the installation of extraction wells were to take place within this buffer zone, they would be designed and implemented to meet this ARAR.

3. Long-Term Effectiveness

Magnitude of Residual Risk. Alternatives MM-2 through MM-4 offer a reduction in risks associated with residual contamination by using groundwater extraction to control the migration of contaminated groundwater. The groundwater extraction/treatment system would be effective in mitigating risks, by meeting interim cleanup levels associated with exposures to: groundwater at the edge of the RCRA cap (compliance point), surface water, and air.

Alternative MM-1 would result in the highest potential risks, since no treatment of groundwater would be implemented and risks would be controlled only by institutional measures.

Adequacy and Reliability of Controls. Alternatives MM-2 through MM-4 employ groundwater extraction as the controlling measure for residual contamination. If properly designed, operated, and maintained, a groundwater extraction system would be an adequate and reliable means of controlling further off-site migration. Alternative MM-1 offers reliable but potentially inadequate controls. All alternatives include groundwater monitoring to assess long-term effectiveness.

4. Reduction in Toxicity, Mobility, and Volume Through Treatment

Alternatives MM-2 through MM-4 would reduce the mobility of contaminated groundwater by use of a groundwater extraction system. These alternatives also use groundwater treatment to reduce the toxicity of groundwater through removal of organic contaminants. Each of these alternatives provide comparable removal efficiencies. Reductions in contaminant volume result in each of these alternatives through the various treatment technologies employed. The extent of these reductions depends on the treatment of residuals and on the extent of the oxidation reactions in alternative MM-4. Alternative MM-1 results in no reductions in toxicity, mobility and volume.

5. Short-Term Effectiveness

Protection of Community. Implementation of alternative MM-1 would not result in additional risks to the community, since no contaminants would be removed, treated or destroyed. Alternatives MM-2, MM-3 and MM-4 would result in similar, minimal risks to the community associated with the excavation of soils, emissions from the treatment units, and off-site transportation of materials.

Protection of Workers. Alternative MM-1 would result in the lowest risks to workers, since minimal actions will be taken and no contaminants would be removed, treated or destroyed. Alternatives MM-2, MM-3 and MM-4 would result in similar risks to workers performing excavation activities and operation of treatment equipment.

Environmental Impacts. Implementation of alternative MM-1 would not be expected to result in environmental impacts, since no contaminants would be removed, treated or destroyed. Alternatives MM-2, MM-3 and MM-4 would result in similar, minimal impacts to the environment as a result of excavation and extraction well installation activities.

Estimated Time to Achieve Objectives. Alternative MM-1 involves institutional controls which could be implemented in approximately one year. Alternatives MM-2 through MM-4 involve groundwater extraction and treatment, which could be designed, constructed, and started up in approximately two to three years. The extraction system for these alternatives would be expected to function as a long-term remediation system to reduce further migration and meet cleanup levels at the compliance points. EPA cannot reliably predict when cleanup levels can be achieved at this Site, however, it is anticipated that it will not be less than thirty years from implementation.

6. Implementability

Technical Feasibility

Construction and Operation. Alternative MM-1 includes little or no construction. Alternatives MM-2 through MM-4 would use standard construction equipment and practices, presenting no major constructability issues. Alternative MM-1 includes groundwater monitoring as the only major operating component. Alternatives MM-2 through MM-4 also include monitoring. Operation and maintenance efforts for these three options are anticipated to be comparable.

Reliability of Technology. Alternative MM-1 uses relatively simple monitoring procedures. Alternative MM-2 appears to have high reliability based on its successful long-term use at a similar Superfund site (the Gilson Road Site in Nashua, New Hampshire). Alternative MM-4 uses UV/chemical oxidation, which has been successfully demonstrated in short-term testing. The steam stripping technology employed for alternative MM-3 has not been as widely used as other groundwater treatment techniques.

Ease of Undertaking Additional Remedial Action. Alternative MM-1 presents no impediments to future remedial actions. Alternatives MM-2 through MM-4 would present problems if future actions required removal or relocation of major portions of the extraction and/or treatment systems.

Monitoring Considerations. Alternatives MM-1 through MM-4 present no major impediments to future monitoring.

Administrative Feasibility

Alternative MM-1 would require cooperation between the City of Lowell, the DEP, and the EPA for monitoring efforts and data analysis. Alternatives MM-2 through MM-4 require greater efforts, and also require compliance with sewer use ordinances for discharge to the Duck Island treatment facility should that be the discharge option determined during the remedial design phase.

Availability of Services and Materials

Alternative MM-1 would use widely-available monitoring equipment. Alternatives MM-2 through MM-4 also require services and materials for groundwater extraction and treatment, most of which are widely available. Alternative MM-2 (air stripping) appears to use the most widely-available equipment, followed by alternative MM-3 (steam stripping) and MM-4 (UV/chemical oxidation).

7. Cost

The estimated present worth value of each management of migration alternative is listed below. It should be noted that these costs are estimates made during the Feasibility Study that are expected to provide accuracy of +50 percent to -30 percent.

	Capital Costs	O & M	Present Worth
MM-1	$64,000	$416,000	$480,000

MM-2	$4,405,000	$7,277,000	$11,680,000
MM-3	$4,405,000	$7,914,000	$12,320,000
MM-4	$4,866,000	$6,570,000	$11,440,000

8. State Acceptance

The Massachusetts Department of Environmental Protection (MA DEP) concurs with the selection of an air stripper (MM-2), aqueous phase carbon adsorption and thermal oxidation as the management of migration alternative for the Silresim Site.

In DEP's comments to EPA on the Proposed Plan, they recommended that alternative MM-4 be further evaluated due to the high carbon usage rates reported for the selected remedy (MM-2) in the Feasibility Study. Also, DEP indicated that emissions testing would be required prior to and during the implementation of the remedy, and that a follow-up risk assessment should be performed once remedial activities have been completed to ensure the protection of human health and the environment.

9. Community Acceptance

The comments received during the public comment period on the Proposed Plan and FS are summarized in the attached document entitled "The Responsiveness Summary" (**Appendix E**). Please see the Comparison of Source Control Alternatives, Community Acceptance, above for an additional summary of the comments submitted to EPA by the public.

X. THE SELECTED REMEDY

The remedy selected for the Silresim Site includes Source Control alternative SC-4 and Management of Migration alternative MM-2 to address all contamination at the Site. A detailed description of the cleanup levels and the selected remedy is presented below.

A. Cleanup Levels

i. Interim Groundwater Cleanup Levels

Interim cleanup levels have been established in groundwater for all contaminants of concern identified in the baseline risk assessment found to pose an unacceptable risk to either human health or the environment. Interim cleanup levels have been set based on the appropriate ARARs (e.g., Drinking Water Maximum Contaminant Level Goals (MCLGs) and MCLs) if available, or other suitable criteria described below. Periodic assessments of the protection afforded by remedial actions will be made as the remedy is being implemented and at the completion of the remedial action. At the time that all groundwater ARARs identified in the ROD and newly promulgated ARARs or modified ARARs which call into question the protectiveness of the remedy have been achieved, a risk assessment shall be performed on the residual groundwater contamination. This risk assessment of the residual groundwater contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by exposure to Site groundwater. If the risks are not within EPA's risk management goal for carcinogens and non-carcinogens, then the remedial action will continue until protective levels are attained, or the remedy is otherwise deemed protective. These final protective cleanup levels shall be performance standards for this ROD.

Because the aquifer at and beyond the compliance boundary is classified as a Class IIB aquifer under the Federal Groundwater Protection Strategy and Class I by the Commonwealth of Massachusetts, a potential source of drinking water, MCLs and non-zero MCLGs established under the Safe Drinking Water Act are ARARs.

Interim cleanup levels for known and probable carcinogenic compounds (Class A & B) have been set at the appropriate MCL, as the MCLGs for these groups of compounds are zero. Interim cleanup levels for the Class C (possible carcinogens) have been set at the non-zero MCLGs. In the absence of a MCLG, a MCL or a proposed drinking water standard or other suitable criteria to be considered (i.e., health advisory, state standard), a cleanup level was derived for carcinogenic effects based on a 10^{-6} excess cancer risk level considering the ingestion of ground water and practical quantitation limits. Interim cleanup levels for compounds in groundwater exhibiting non-carcinogenic effects and for which there is no evidence of carcinogenicity or which have not been classified as to their carcinogenic potential, have been set at the MCLG. In the absence of an MCLG, cleanup levels for non-carcinogenic effects have been set at a level thought to be without appreciable risk of an adverse effect when exposure occurs over a lifetime (hazard quotient = 1).

All groundwater ARARs identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy, must be met at the completion of the remedial action at the point of compliance. These levels will be obtained at and beyond the edge of the final RCRA Subtitle C cap which will be installed as part of the Source Control action (approximately the existing fence line or Silresim property boundary). The installation of a final cover over the residual contamination left on the Silresim property limits its potential future uses, such as a drinking water source.

TABLE 2
SILRESIM SITE
INTERIM GROUND WATER CLEANUP LEVELS

Carcinogenic Contaminants of Concern	Cleanup Level (ppb)	Basis	Level of Risk
Arsenic	50	MCL	2E-04[b]
Benzene	5	MCL	4E-06
Bis(2-ethylhexyl)phthalate	4	pMCL[a]	2E-06
Carbon Tetrachloride	5	MCL	2E-05
Chloroform	100	MCL	2E-05
1,1-Dichloroethene	7	MCL	1E-04
1,2-Dichloroethane	5	MCL	1E-05
1,2-Dichloropropane[i]	5	MCL	1E-05
Dioxin[h]	5E-08	pMCL[c]	2E-04
Hexachlorobenzene[i]	1	pMCL	5E-05
Methylene Chloride	5	pMCL	1E-06
PAHs (B(a)P)[h]	.2	pMCL	7E-05
PCBs[h]	.5	MCL	1E-04
Styrene[h]	100	MCLG[d]	9E-05
1,1,2,2-Tetrachloroethane	5	PQL[f]	3E-05
1,1,2-Trichloroethane[i]	5	pMCL	8E-06
Trichloroethene	5	MCL	2E-06
		SUM	**9E-04**

Non-carcinogenic Contaminants of Concern	Cleanup Level (ppb)	Basis	Target Endpoint of Toxicity	Hazard Quotient
2-Butanone	350	GWS[g]	fetotoxicity	0.2
Cadmium[i]	5	MCLG	kidney	0.3
Chlorobenzene	100	MCLG	liver/kidney	0.2
Chromium (trivalent)	100	MCLG	liver	0.003
Copper[i]	1,300	pMCLG[e]	stomach	1.0
1,2-Dichlorobenzene[i]	600	MCLG	liver	0.2
Trans-1,2-Dichloroethene[i]	100	MCLG	liver	0.2
Ethylbenzene[i]	700	MCLG	liver/kidney	0.2
Lead	15	policy	CNS	[k]
Nickel	100	pMCLG[e]	liver/kidney	0.2
Phenol	21,000	RfD[j]	fetal bdy wt	1.0
Selenium	50	MCLG	hair/nails	0.5
Toluene	1,000	MCLG	lvr/kdny	0.2
1,2,4-Trichlorobenzene	9	pMCLG	liver	0.2
1,1,1-Trichloroethane	200	MCLG	liver	0.06
Xylenes[i]	10,000	MCLG	bdy wt/hyper	0.2

HAZARD INDEX SUM	
liver	1.2
Kidney	0.9
Body Weight	1.4

a- Maximum Contaminant Level

b - The cleanup level for arsenic in groundwater has been set at the MCL of 50 ppb. The carcinogenic risk posed by arsenic at 50 ppb in groundwater will approximate 2 in 1,000. However, in light of recent studies indicating that many skin tumors arising from oral exposure to arsenic are non-lethal and in light of the possibility that the dose-response curve for the skin cancers may be sublinear (in which case the cancer potency factor used to generate risk estimates will be overstated), it is Agency policy to manage these risks downward by as much as a factor of ten. As a result, the carcinogenic risks for arsenic at this Site have been managed as if they were 2 in 10,000. (See EPA memorandum, "Recommended Agency Policy on the Carcinogenic Risk Associated with the Ingestion of Inorganic Arsenic" dated June 21, 1988.)

c - Proposed Maximum Contaminant Level

d - Maximum Contaminant Level Goal

e - Proposed Maximum Contaminant Level Goal

f - Practical Quantitation Limit

g - Massachusetts Groundwater Standard, 314 CMR 6.07

h - Additional groundwater indicator substance, which has the potential to leach into groundwater.

i - Additional groundwater indicator substance based on Site groundwater exceeding either an MCL, pMCL, MCLG or a pMCLG.

j - Reference Dose - Concentration corresponding to a reference dose.

k - A hazard quotient is not available for lead as EPA has not issued a reference dose for this compound. The cleanup level for lead comes from a June 1990 memorandum from Henry Longest and Bruce Diamond to Patrick Tobin.

While these cleanup levels are consistent with ARARs (and suitable TBC criteria) for groundwater, a cumulative risk that could be posed by these compounds may exceed EPA's acceptable risk range for remedial action. Consequently, these levels are considered to be interim cleanup levels for groundwater. Thus, when all groundwater ARARs identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been attained, a risk assessment will be performed on residual groundwater contamination to determine whether the remedial action is protective. Remedial actions shall continue until protective concentrations of residual contamination have been achieved or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

Although the goal of this remedial action is to restore the groundwater to its beneficial uses which are federal and state drinking water standards (MCLs), and EPA and the Commonwealth of Massachusetts believe that the selected remedy will achieve this goal, studies suggest that it may not be possible to achieve these standards throughout the area of attainment within a reasonable period of time. Groundwater contamination may be especially persistent in the immediate vicinity of the contaminant source, where concentratons are relatively high and DNAPL has been detected. The practicability of achieving cleanup levels throughout the Site cannot be determined until the extraction system has been implemented and plume response monitored over time.

If the selected remedy cannot meet the cleanup levels (i.e., MCLs) following a reasonable period of system operation, contingency measures and goals may be considered by EPA for replacement. These measures and goals would be considered if they are protective of human health and the environment, but are technically practicable under the corresponding circumstances.

For alternate contingency measures and levels to be considered by EPA, the following condition would need to be satisfied: contaminant levels have ceased to decline over time, and are remaining constant at some statistically significant level above health-based goals in portions of the aquifer outside of the compliance points. If it is determined on the basis of the preceding criteria and the system performance data that portions of the aquifer cannot be restored to their beneficial use, any or all of the following contingency measures will occur as a modification of the existing system: (a) institutional controls will be maintained to prevent access to groundwater that remains above health-based levels; (b) ARARs will be waived for those portions of the aquifer based on the technical impracticability of achieving further contaminant reduction; and (c) continued pumping will be required as a long-term gradient control, or containment measure.

The decision to invoke any or all of these measures may be made by EPA during a future review, following a reasonable period of operation of the selected remedy. If it is determined on the basis of the stated criteria, that MCLs/MCLGs or other health-based ARARs cannot be achieved at the Site, a waiver of ARARs will be invoked, which will be accompanied by an Explanation of Significant Difference (ESD) or an amendment to the Record of Decision.

ii. **Soil Cleanup Levels**

Cleanup levels for soils were developed to reduce risks associated with two potential exposure scenarios. The first of these scenarios is the potential ingestion of contaminated groundwater resulting from the leaching of contaminants from unsaturated-zone soils into groundwater and the transport of these contaminants to a receptor. The second is the potential direct contact exposure to surficial soils in five areas off the Silresim property and to unsaturated zone soils on the Silresim property (if the cap were degraded and the fence removed).

Unsaturated Soils

Soil cleanup levels were developed for unsaturated-zone soils to meet the response objective of protecting human health from the ingestion of groundwater contaminated by soils. (The unsaturated zone includes all soil from one foot below ground surface to the water table, following dewatering associated with the selected remedy). Cleanup levels for indicator substances in unsaturated soils were based on the analysis of compounds leaching from unsaturated-zone soils into the groundwater system and to a hypothetical water supply well on the Silresim property.

It should be noted that the compliance point for groundwater (at the edge of the RCRA Subtitle C cap) does not alter EPA's determination that cleanup levels for the unsaturated zone soils be based upon a hypothetical water supply located on the Silresim property. The flow and dilution of contaminants from the center of the Silresim property to its edge is negligible.

The MacKay partitioning model was utilized to calculate cleanup levels for indicator substances identified for soils in the unsaturated zone. ARARs for the groundwater (i.e., MCLs) were used as inputs into the leaching model. In the absence of an ARAR, the level corresponding to a 10^{-6} risk level (for carcinogens) or a hazard quotient of one (non-carcinogenic effects) was utilized. It should be noted that inorganics selected as indicator substances in the baseline risk assessment were not evaluated in the leaching analyses due to low solubility and absorptive properties; the potential for these compounds to leach from soils at significant concentrations is limited. Consequently, inorganics are viewed as presenting a risk primarily from the ingestion and direct contact of soils and are therefore addressed in the following section (surficial soil cleanup levels).

TABLE 3
SILRESIM SITE
UNSATURATED SOIL CLEANUP LEVELS

Carcinogenic Contaminants of Concern	Soil Cleanup Level (ppb)	Basis for Model Input	Level of Residual GW Risk
Volatile Organic Compounds			
Benzene	4	MCL	4E-06
Carbon Tetrachloride	5	MCL	2E-05
Chloroform	40	MCL	2E-05
1,1-Dichloroethene	5	MCL	1E-04
1,2-Dichloroethane	1	MCL	1E-05
Methylene Chloride	1	pMCL	1E-06
Styrene	170	MCLG	9E-05
1,1,2,2-Tetrachloroethane	6	PQL	3E-05
1,1,2-Trichloroethane	3	pMCL	8E-06
Trichloroethene	6	MCL	2E-06
Others			
Bis(2-ethylhexyl)phthalate	300	pMCL	2E-06
1,2-Dichloropropane	3	MCL	1E-05
Dioxin	1	pMCL	2E-04
Hexachlorobenzene	34	pMCL	5E-05
PAHs (carcinogenic)	10,000	pMCL	7E-05
PCBs	2,300	MCL	1E-04
		SUM	**7E-04**

Non-carcinogenic Contaminants of Concern	Cleanup Level(ppb)	Basis for Model Input	Target Endpoint of Toxicity	Residual GW Hazard Quotient
Volatile Organic Compounds				
chlorobenzene	300	MCLG	lvr/kdny	0.2
Trans-1,2-Dichlorothene	67	MCLG	liver	0.2
1,1,1-Trichloroethane	300	PQL	liver	0.06
Others				
1,2-Dichlorobenzene	8,900	MCLG	liver	0.2
1,2,4-Trichlorobenzene	720	pMCLG	liver	0.2
Ethylbenzene	6,800	MCLG	lvr/kdny	0.2
Phenol	5,300	RfD	body wt	1.0
Toluene	2,700	MCLG	lvr/kdny	0.2
2-Butanone	60	GWS	fetotox	0.2
Xylenes	22,000	MCLG	bdy-wt/hyper	0.2

SUM HAZARD INDEX	
Liver:	1.2
Kidney:	0.6
Body Weight:	1.2

NOTE

a - Specific soil quantitation limits are highly matrix dependent. As such, cleanup levels listed above are subject to the limits of quantitation.

Rfd - Reference Dose

For those soil indicator compounds identified above as volatile organic compounds (VOCs), cleanup levels must be met throughout the contaminated unsaturated zone (defined as one foot below ground surface to the water table following dewatering associated with the remedy) at the Site. For the remaining indicator compounds, unsaturated cleanup levels must be met at and beyond the point of compliance (at and beyond the edge of the final RCRA Subtitle C cap).

The remedial action includes vacuum/vapor extraction of all contaminated soils exceeding cleanup levels to enhance mass removal of VOCs at the Site. The cleanup levels for the remaining indicator substances will be met at the point of compliance through excavation, stabilization and disposal under a final RCRA cap. Areas of excavation off of the Silresim property will be backfilled with clean soil. Therefore, cleanup levels for all of the unsaturated soil indicator compounds will be met. The RCRA cap, stabilization and long-term maintenance will prevent exposure to unsaturated soils and minimize the mobility to groundwater of the residual waste left on Site.

iii. **Surficial Soils**

Cleanup levels for surficial soils were developed to reduce risks associated with direct contact and ingestion exposures to contaminated soils in five areas off the Silresim property and to soils on the Silresim property, if the cap and fence were removed. No ARARs were available for the indicator substances in soils, therefore, health-based levels (concentrations corresponding to a 10^{-6} excess cancer risk level or a hazard quotient of 1.0) were derived and other potential cleanup criteria were compiled.

Health-based cleanup levels were developed for soil indicator substances that were found to pose a risk in excess of 10^{-6} or a hazard quotient of 1.0 when evaluated under a worst-case scenario in the baseline risk assessment. This included seven VOCs, dioxins (as 2,3,7,8-TCDD equivalents), PCBs, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), phenol and six inorganics.

Cleanup levels were derived for direct contact exposure including dermal absorption and incidental ingestion by an older child/adult who may come into contact with these areas. These levels were based on exposure assumptions under a more-likely case scenario as developed in the FS. The specific methodology used to calculate health-based cleanup levels is presented in Appendix B of the RI.

Cleanup levels for two indicator substances are based on average background concencentrations identified in surficial soils at the Silresim Site. Although the risk-based cleanup levels for PAHs and arsenic were calculated to be more stringent than their average background levels, background values are being utilized as the cleanup levels resulting from the

TABLE 4
SILRESIM SITE
SURFICIAL SOIL CLEANUP LEVELS

Carcinogenic Contaminants of Concern	Soil Cleanup Level (ppb)	Basis	Level of Risk
Volatile Organic Compounds			
Benzene	15,000	risk	1E-06
1,1-Dichloroethene	720	risk	1E-06
1,2-Dichloroethane	4,800	risk	1E-06
Methylene Chloride	58,000	risk	1E-06
Styrene	14,000	risk	1E-06
1,1,2,2-Tetrachloroethane	2,200	risk	1E-06
Trichloroethene	40,000	risk	1E-06
Others			
Arsenic	21,000	background	7E-07[a]
Dioxin	1	policy	4E-05
PAHs (carcinogenic)	11,000	background	6E-05
PAHs (total)	29,000	background	6E-05[b]
PCBs	1,000	policy	2E-06
		SUM	**1E-04**[b]

Non-carcinogenic Contaminant of Concern	Cleanup Level (ppb)	Basis for Model Input	Target Endpoint of Toxicity	Hazard Quotient
Lead	500,000	policy	CNS	[c]

a - Recent studies indicate that many skin tumors arising from oral exposure to arsenic are non-lethal and that the dose-response curve for the skin cancers may be sublinear (in which case the cancer potency factor used to generate risk estimates will be overstated). It is Agency policy to manage these risks downward by as much as a factor of ten. As a result, the carcinogenic risk for arsenic at this Site has been managed as if it were 7×10^{-7}. (See EPA memorandum, "Recommended Agency Policy on the Carcinogenic Risk Associated with the Ingestion of Inorganic Arsenic" dated June 21, 1988.)

b - Total PAH risk is based on the cleanup level of 11,000 for carcinogenic PAHs. Therefore the risk of 6E-05 has only been incorporated once to the sum total risk estimate.

c - The cleanup level for lead is based on OSWER Directive 9355.4-02, "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites" (9/7/89).

detection of these compounds at elevated levels outside of the areas suspected to be contaminated by surface run-off from the Silresim facility. Because Silresim cannot be strictly implicated as the only source of these constituents, it is acceptable to consider local background concentrations for PAHs and arsenic (See Section 3.20 in the FS for more detail).

The cleanup level assigned for PCBs is based on guidance established under the Federal Toxic Substance Control Act (TSCA). TSCA has issued a remediation goal of 1 ppm for PCBs at Superfund Sites where land use is residential in nature (exposures occur to residents). This level is considered by EPA to be protective of human health and the environment.

Five of the surficial soil cleanup levels designated in the Proposed Plan have been eliminated, including: chromium, copper, mercury, phenol and selenium. Based on further review and consideration of the data presented in the RI/FS it was determined that none of the exposure pathways for each of these compounds exceeded EPA's acceptable risk level. Chromium, copper, mercury, phenol and selenium are non-carcinogenic compounds. The non-carcinogenic risk posed by each compound, under each exposure pathway considered, fell below a hazard quotient of one. Therefore, EPA has omitted chromium, copper, mercury, phenol and selenium from the list of cleanup levels to be met in surficial soils at the Site.

For those indicator compounds identified above as volatile organic compounds (VOCs), cleanup levels must be met in all surficial soils. For the remaining compounds, cleanup levels must be met at and beyond the point of compliance (the edge of the final RCRA cap). For soils on the Silresim property, surficial soil cleanup levels for VOCs will also apply as a result of the future exposure scenarios (cap and fence removed). The more stringent of the two cleanup levels for each VOC will apply.

Again, the remedial action includes vacuum/vapor extraction of all contaminated soils, which will enable the target cleanup levels to be met both on and off the Silresim property for VOCs only. The cleanup levels for the remaining indicator substances will be met at the point of compliance through excavation, stabilization and disposal under a final RCRA cap. The areas of excavations outside the Silresim property will be backfilled with clean fill. The construction and maintenance of the RCRA cap will prevent exposure to contaminated soils on the Silresim property. Cleanup levels in surficial soils attain EPA's risk management goal for remedial actions (carcinogenic risk level between 10^{-4} and 10^{-6}).

iv. Other Cleanup Levels

Because cleanup levels for soil and groundwater will be met, it is unnecessary to set cleanup levels for indicator substances associated with 1) surface waters and sediments of East Pond, River Meadow Brook and Concord River, 2) indoor air of Lowell Iron and Steel company and the nearest residential building, and 3) ambient air. Each of these exposure pathways are directly associated with the migration of contaminants in either the groundwater or soil media for which cleanup levels are established. EPA has determined that by meeting the cleanup levels for both the soil and groundwater media, all risks associated with the migration of contaminated groundwater or VOCs should be reduced. However, a final risk assessment of residuals will address these concerns at a future date.

B. Description of Remedial Components

i. Source Control

The source control portion of the remedy will involve the following major components (**Figure 6, Appendix A**):

1. Post signs at the Site, construct additional perimeter fence and maintain the existing fence;
2. Implement public education programs and institutional controls;
3. Perform pilot test of vacuum/vapor extraction system to optimize final design;
4. Construct the vacuum/vapor extraction system;
5. Place low-permeability temporary cover over areas of contaminated soil off the Silresim property;
6. Extend and repair cap on the Silresim property as required;
7. Start-up and operate vacuum/vapor extraction system until acceptable VOC concentrations in soil are reached;
8. Perform additional bench-scale and/or pilot scale stabilization/solidification studies;
9. Strip and stockpile existing clay cap and gravel;
10. Excavate and stockpile all soils requiring stabilization;
11. Backfill areas outside of Silresim property with clean fill;
12. Stabilize contaminated soils;
13. Perform confirmatory TCLP analyses;
14. Place treated soil under RCRA cap;
15. Upgrade existing cap to conform to RCRA Subtitle C standards; and
16. Perform long-term monitoring and five-year reviews.

The first stage of the source control remediation will include the construction of additional fencing outside the limits of the existing perimeter fence to prevent potential direct contact exposures with contaminated surficial soil. The Site would be posted by placing clearly labeled signs on the fence. Additionally a public education program to inform the public about potential hazards at the Site (via public meetings, press releases, direct mailings etc.), and institutional controls, including access, deed and land use restrictions, to prevent the potential use of contaminated areas would be established.

In situ vacuum/vapor extraction (also known as soil venting) will be utilized to remove VOCs from approximately 137,000 cubic yards of unsaturated-zone and surficial soils (**Figure 7, Appendix A**). Vacuum/vapor extraction is a process which removes VOCs from unsaturated soils by using vacuum pumps or blowers to induce air flow towards a trench or a network of extraction wells. VOCs from soil and water desorb into this air stream for further treatment prior to discharge. Semi-volatiles and PCBs may also volatilize to a limited extent.

Soil gas probes, placed at varying distances from extraction wells or trenches, are used to obtain vapor samples to assess the performance of the system. Vacuum extraction systems are typically operated until observed concentrations fall below target levels. The zone of influence of the extraction system is monitored with manometers using the same boreholes as the soil gas probes.

Trenches and potentially wells will be used for vacuum/vapor extraction. The reliability and effectiveness of in situ systems has been well demonstrated at many sites across the country, including a SITE (Superfund Innovative Technology Evaluation) demonstration at Groveland, Massachusetts.

A bench scale treatability study was performed to evaluate the effectiveness of vacuum/vapor extraction on Silresim Site soils (test results are presented in Appendix F of the RI). Results of the test showed that VOC cleanup levels can be attained for most target compounds after the exchange of approximately 10,000 pore volumes.

The results of the treatability testing, along with information on soil characteristics obtained during the RI, were used as input to a two-dimensional soil gas flow model to assess the time required to attain cleanup levels with various well/trench spacings. Preliminary results indicate that close well spacings will be required to provide acceptable cleanup times. Trenches will allow somewhat wider spacing (approximately 18 trenches of varying length, with a nominal spacing of 45 feet), and increased effectiveness in achieving cleanup levels in heterogeneous soils. Trenches will be installed to the water table, to depths up to 14 feet.

The estimated times to achieve VOC cleanup levels for the soils at the Site are:

- approximately three years for the gravel fill on the Silresim property which is part of the existing cap (placed in 1984).
- approximately five years for the cinder and miscellaneous fill material throughout the Site.
- approximately 30 years for the natural sandy silts throughout the Site.

The results of the treatability study indicate that vacuum/vapor extraction will provide relatively short-term reduction of VOC concentrations in the fill layers, but would need to be undertaken for a longer term to achieve cleanup levels in the lower-permeability natural soils. A vacuum/vapor extraction pilot-scale test will be necessary to further evaluate its effectiveness and efficiency at the Site and to more closely estimate costs (e.g., costs associated with spacing/location of extraction wells/trenches, manifold and vacuum blower, and off-gas control requirements).

Vapor extraction trenches and/or wells will be installed in the unsaturated zone, and manifolded to vacuum pump(s) or blowers with a thermal oxidizer or fume incinerator (air pollution control). Using the selected groundwater extraction system (MM-2), the water table will be lowered by an additional 6 feet to increase the depth of the unsaturated zone (process known as dewatering). The groundwater extraction and treatment system will precede the source control portion of the remedy by 6 to 12 months to perform dewatering. The dewatering effluent would be treated by the groundwater treatment system.

As discussed above, excavation of a series of trenches across the Site will be necessary to install the vacuum/vapor extraction piping system. It is estimated that they will be approximately 18 inches wide, 14 feet deep (to the groundwater table), and at 45 foot intervals (**Figure 7, Appendix A**). Trenches would be partially backfilled with crushed stone wrapped in geotextile, then completely backfilled with excavated soil and/or clay. **Figure 8 in Appendix A** shows a typical section of an extraction or air inlet trench. (Excavation will begin after the groundwater level is depressed to steady state conditions. The groundwater extraction system will be designed to achieve this depression in approximately six to twelve months).

The final determination of the number, depth, and locations of the trenches and wells associated with the vacuum/vapor extraction system will be finalized during the remedial design phase. These design details can be provided through the initial pilot-testing of a full scale unit. Periodic review and modification of the design, construction, maintenance, and operation of the soil vacuum/vapor extraction system will be necessary. A frequency for reviewing the progress of the systems for meeting the goals and design criteria will be established during the design phase.

During excavation, soil erosion will be controlled through the use of silt fences, hay bales, shallow drainage ditches and/or grading. Shallow drainage ditches will be constructed where necessary to facilitate drainage of storm water away from the immediate work area, allowing excavation and backfilling to be performed in areas free of standing water.

Following the construction of drainage and erosion control structures, clearing and grubbing would be performed in areas where vegetation exists. Any monitoring wells not intended for long-term monitoring will be decommissioned, and wells intended for long-term monitoring would be extended and capped at an elevation above finish grade.

Stockpile areas would be prepared as necessary within the existing cap area to temporarily store excavated soils from the trenches. The stockpile area would be graded to shed stormwater, and would conform to all applicable RCRA and TSCA specifications. Prior to placement of soil in the stockpile area, a double layer of 6-mil polyethylene plastic sheeting will be placed over the ground surface. Haybales and silt fencing will be placed around the perimeter of the stockpile area to reduce losses of stockpiled soils. A separate stockpile area will be maintained for clay cap material excavated from the existing cap. Following stockpiling, approximately 1,500 to 1,750 cubic yards of soil excavated from trenches would be treated by vacuum/vapor extraction along with the other in situ soils by placing them under a cap extension in the northeast corner of the Silresim property, described below.

During excavations, control mechanisms will be taken to prevent VOCs and contaminated particulates from escaping to the atmosphere. Available techniques to control releases of particulate matter during excavation may include water and chemical (e.g., calcium chloride) application to the soils, run-off controls, specialized excavation equipment (e.g., caisson augers) and equipment decontamination. Techniques are available to reduce the release of VOCs during excavation; however, these techniques are less proven and generally more complex than particulate controls. These include the application of vapor suppressing foams, or the erection of domes or air-sealed "tents" over work areas. Exhaust air from the domes or vents would be treated to remove VOCs prior to discharge. The decision of which control measures are necessary will be made during the remedial design stage, however, the best demonstrated control technologies will be utilized in conformance with the Clean Air Act.

Following the installation of the vacuum/vapor extraction piping, the existing clay cap on the Site will be extended and upgraded. This will be done to enhance the effectiveness of vacuum/vapor extraction and to reduce direct contact exposures. The existing cap was constructed by U.S. EPA contractors as part of the 1984 Interim Remedial Measure. The cap consists of approximately 14 inches of low permeability clay placed over 6 to 36 inches of sand and gravel. Any areas of the cap that may be eroded due to stormwater runoff will be repaired to the standards of the existing cap. Areas off of the Silresim property to be treated using vacuum/vapor extraction will be covered with a low-permeability cover. This interim cover is intended to provide a barrier to air flow during the period of operation of the vacuum/vapor extraction system.

The contaminated air stream from the vacuum/vapor extraction system will be treated using a thermal oxidizer or fume incinerator to control the emissions of VOCs. The thermal oxidation unit would include a scrubbing system to remove acid gases. The treated air will meet all federal and state emissions standards prior to being released to the atmosphere. Collected condensate from the vacuum/vapor extraction system and aqueous wastes from the thermal oxidizer (scrubber) will be either treated on Site or shipped off Site for treatment. Following vacuum/vapor extraction to remove the VOCs, approximately 18,000 cubic yards of soil at the Site (on and off of the Silresim property), contaminated with non-VOCs and inorganic compounds, will be excavated and stabilized (**Figure 9, Appendix A**). Stabilization is a waste treatment process designed to accomplish one or more of the following purposes: (1) reduce waste solubility, mobility and toxicity; (2) improve handling characteristics; and (3) limit the potential for migration by reducing the exposed surface area. It is the conversion of a waste to a more chemically stable form or to a more solid form by the addition of a binding material, such as cement.

Several stabilization processes are commercially available for use with hazardous wastes. Although many are proprietary, most are cement, lime, or thermoplastic-based. Cement-based methods involve mixing contaminated solids with a cement, such as Portland cement. The resulting high pH material neutralizes acids and causes many metals to form less soluble compounds. Lime-based methods are similar to those using cement, but produce a less durable product. Thermoplastic methods involve drying, followed by mixing with a heated, petroleum- or plastic-based material (usually asphalt, although polyolefins have been used). It should be noted that nearly all stabilization processes involve the addition of materials to the waste, and thus increase the total waste volume (not mass of hazardous constituents). Volume increases usually range from 20 to 60 percent.

Implementation generally involves soil excavation; mixing occurs at the ground surface or in an above ground vessel. Because VOCs will have been stripped out of the soil via the vacuum/vapor extraction system prior to excavation, it is expected that only minimal controls during excavation and processing will be necessary to prevent additional volatilization. It should be noted that, Occupational Safety and Health Administration (OSHA) general industry and health and safety requirements for the performance of excavation and transportation activities, including trench excavation requirements will be met during the remedial design and remedial action.

The soil to be stabilized, and the overlying clay and gravel, will be excavated and stockpiled separately according to the methods described above. Stabilization will be implemented using a mobile treatment plant. Excavated areas outside of the Silresim property will be backfilled with clean fill. TCLP analyses would be performed on treated soils to confirm the effectiveness of the treatment prior to final disposal on the Silresim property.

During the remedial design phase, additional soil samples will be collected to refine the volume of soil to be treated in the northern portion of the Site. In 1990, the northern portion of the Site was regraded by the owners of the property. Therefore, pre-design work will include analysis of samples collected north of the Silresim property for all surficial soil and unsaturated soil indicator substances (see Tables 7 & 8 above).

All stabilized soil will be disposed of under a cap conforming to RCRA Subtitle C standards located primarily on the Silresim property. Due to the estimated volume of stabilized soil to be disposed of, the area of the cap is likely to exceed the limits of the existing fence on the Silresim property. It is expected, therefore, that the RCRA cap will extend beyond the existing fence just northeast, east and southeast of the Silresim property. Access to some or all of this property may have to be acquired. Site preparation activities for cap construction will include grading and removal of debris, fences, scrap vehicles, etc.

The cap design will be consistent with the State and Federal closure requirements for a RCRA facility. At a minimum, the cap will consist of a multi-layer system composed of a vegetative topsoil layer and a subsurface drainage layer overlying a low-permeability barrier of clay and synthetic liner material. The details of the materials of construction and the thickness of the layers will be established during the remedial design phase.

It is estimated that all components of this remedy will be implemented within seven years after the completion of remedial design, although approximately 30 years would be required to achieve cleanup levels in the natural soils at the Site. This assumes that cleanup levels for VOCs in soils to be excavated and stabilized are reached in approximately five years, that stabilization will be implemented within one-half year (assuming a production rate of 180 cubic yards per day), and that the cap would be constructed in approximately one and one-half years.

Because contaminated materials would remain on Site in stabilized form, long-term monitoring and five-year reviews would need to be implemented. The 1986 CERCLA amendments require that conditions be reviewed every five years at NPL sites where wastes remain on Site. All data obtained in the monitoring program would be evaluated in the five-year reviews. These reviews will consider all relevant data and determine if additional remedial actions are necessary.

ii. Management of Migration

The Management of Migration portion of the remedial alternative will include the following major components (**Figure 10, Appendix A**):

1. Implement public education programs;
2. Implement institutional restrictions on future water use;
3. Install groundwater extraction wells, pumping equipment and associated piping;
4. Install treatment equipment, building, and discharge piping;
5. Start-up and operate extraction, treatment, and discharge systems;
6. Dispose of non-aqueous phase contaminants and secondary wastes generated during the operation of the treatment process; and
7. Perform long-term monitoring and five-year reviews.

Public education programs and institutional restrictions would primarily be implemented as described above under the source control portion of the remedy. In terms of institutional controls, water use restriction clauses would be added to property deeds in areas of known groundwater contamination.

As discussed in the section on cleanup levels, the aquifer at the Site is a Federal Class IIB water body and Massachusetts Class I water body, which is a potential source of drinking water. Therefore, MCLs and non-zero MCLGs established under the Safe Drinking Water Act are ARARs to be met at the points of compliance, which EPA has set at the edge of the RCRA cap, approximately shown on **Figure 9 in Appendix A**. Since groundwater ARARs are currently exceeded at the points of compliance and the risk to human health significantly exceeds EPA's acceptable risk range in this area, active groundwater treatment is required to meet and sustain groundwater ARARs.

The groundwater extraction system will consist of numerous conventional extraction wells, located in both the overburden and bedrock aquifers within the contaminated groundwater plume to maximize groundwater extraction rates. It is estimated, for cost purposes only, that an aggressive extraction scheme will include at least 9 shallow (about 25 to 40 feet deep) wells, 5 moderate depth (50 to 60 feet) wells, 4 deep overburden (60 to 70 feet) wells, and 5 shallow bedrock (20 to 30 feet into bedrock) wells.

The extraction system will be designed to halt further migration of contaminated groundwater toward identified receptors (basements, River Meadow Brook, East Pond), capture as much of the contaminant plume as possible, and achieve drawdowns across the Site in support of the source control remedy. Extraction well locations will be selected, in part, especially to intercept groundwater contamination migrating toward vulnerable receptors such as industrial and residential basements, East Pond and River Meadow Brook.

It is estimated that, on average, each extraction well will contribute between 0.2 to 2 gallons per minute (gpm) of flow, yielding a total estimated flow of about 25 gpm. (Potential yields of bedrock wells can only be roughly estimated at this point). To better refine estimates of well flows, a pump test will be conducted during the remedial design phase.

It is noted that selected deep overburden and shallow bedrock extraction wells will be located within the zone of suspected DNAPL contamination. Siting extraction wells in this zone will provide dewatering to facilitate soil vapor extraction, enhance containment of dissolved phase contamination, and enhance mass removal rates. EPA believes the benefits of siting extraction wells in this zone outweigh the potential risk of mobilizing DNAPL to greater depths during well drilling. Special precautions will be taken during the bedrock well installations to minimize the potential for introducing additional DNAPL into the bedrock. The specific number and locations of extraction wells targeting DNAPL contamination will be finalized during the remedial design phase, following an additional groundwater sampling effort to assess current plume conditions.

Following groundwater extraction, the water will be pumped to a phase separation settlement tank, where gravity separation of contaminated water from non-aqueous phase contaminants, such as floating product and DNAPL, would occur. The tank will be designed to allow gravity separation of aqueous and non-aqueous phase contaminants at the design flow rate. Floating product will be skimmed from the surface; dense non-aqueous phase contaminants will be removed from the bottom of the tank. The remaining aqueous stream will flow by gravity into the iron/manganese removal system.

Removal of iron and manganese will be required prior to air stripping to reduce clogging of the air stripper and reduce iron and manganese concentrations to within discharge limits. As indicated in the RI, iron concentrations up to 268 mg/l (ppm) and manganese concentrations up to 12.3 mg/l have been observed in Silresim groundwater. These concentrations indicate that iron/manganese removal is required to reduce clogging of treatment equipment. Metals other than iron and manganese exist at average concentrations less than likely effluent limits, and therefore may not require removal. However, some incidental removal of metals other than iron and manganese will occur during treatment.

A chemical precipitation/filtration unit will be utilized to remove the metals. Chemical precipitation removes dissolved metals by precipitating them as hydroxides or sulfides. Adjustment of pH may be used to maximize removal of desired metals. Chemical precipitation/filtration equipment will consist of chemical storage tanks, a chemical mixing tank, a flocculation tank, and a clarifier. A chemical precipitant would be added to the contaminated groundwater in the mixing tank. Dissolved metals, primarily iron and manganese, will be converted to insoluble forms by reaction with the precipitant. Flocculation will be used to agglomerate precipitates and other solids into settleable particles. The resulting solids will be settled out in the clarifier, possibly after addition of settling aids such as polymers. A subsequent filtration step will remove additional solids not removed by the clarifier. Each tank will require some form of VOC emissions control such as fume hoods or tank covers with vents.

Air stripping will be accomplished using either a counter-current air stripping tower or a tray aerator. This decision will be made during the design stage. A stripping tower consists of a vertical tower filled with packing material. Contaminated water flows downward through the packing material while air is forced upward through the tower by a blower. The large surface area of the packing material improves contact of contaminated water with the flowing air. Contaminated air exits the top of the tower, and is directed to subsequent treatment to remove volatilized organics. Tray aerators operate on the same principle as a packed tower, but differ substantially in construction. The unit consists of stacked, perforated trays across which water flows while air is bubbled through from beneath the trays.

Prior to air stripping, the influent will be heated. Air stripper removal efficiencies can be increased by heating the influent groundwater prior to air stripping. Heating will be accomplished by using either steam or another heating method (to be decided during the design phase). Heating of influent results in more efficient stripping and thus reduces the organic loading on the liquid-phase carbon adsorbers.

Volatilized organics from the air stripper will be destroyed by thermal oxidation. The thermal oxidation unit will require an auxiliary fuel source to incinerate the volatile emissions, and a scrubbing system to remove acid gasses. This thermal oxidation unit will be utilized for the vapor streams of both the groundwater treatment system and vacuum/vapor extraction system employed as part of a source control portion of the remedy. This system satisfies a specification of the Clean Air Act to utilize the best demonstrated control technology to minimize VOC emissions. Occupational Safety and Health Administration (OSHA) general industry and health and safety requirements specifying Permisssible Exposure Limits and other safety and health requirements during implementation will be met.

Following on-site treatment, the treated water will preferably be discharged to the City of Lowell's sanitary sewer system, which flows to the Duck Island Wastewater Treatment Facility (this will be determined during the remedial design phase). If this facility is able to be utilized, a connecting pipe will be constructed from the groundwater treatment building to a nearby (existing) sewer line with available capacity to handle the expected flow. Discharges will conform to the sewer use ordinances (which include a TTO (Total Toxic Organics) standard of 2.13 mg/l, and may include toxicity-based standards). The Duck Island treatment plant discharges treated water to the Merrimack River under an existing National Pollutant Discharge Elimination System (NPDES) permit.

If the Duck Island Wastewater Treatment Facility is unable to be utilized, the groundwater will be discharged to River Meadow Brook (this will be determined during the remedial design phase). Discharge to River Meadow Brook will involve construction of buried piping from the on-site treatment building to either the Brook, which at its closest point is approximately 400 feet from the Site boundary, or to a storm drain that flows to the Brook. It is likely that the new pipeline would cross both public land (e.g., Tanner Street) and private land. Easements will be required from the affected parties. A gravity piping system shall be installed from the treatment building to the drainage system installed on Site by EPA in 1984. If discharge to River Meadow Brook is selected, a NPDES permit will be obtained.

Secondary waste management would be required for off-site disposal of non-aqueous phases from gravity separation (e.g., DNAPL, floating product), and residues from the metals removal process (e.g., metals hydroxide sludge from chemical precipitation).

As stated above under the Cleanup Levels section, EPA is unable to reliably predict when cleanup levels at the points of compliance can be achieved. The combination of high concentrations of contaminants in the groundwater, expected low groundwater extraction rates due to low permeability of aquifer materials, and the existence of DNAPL prevent a reliable estimation. EPA does, however, believe that achieving cleanup levels at the points of compliance will take in excess of thirty years given the current conditions at the Site and state of technology.

EPA believes that long-term groundwater remediation for the Silresim Site is reasonable given the serious potential exposure risks posed by the continued migration of the plume to nearby receptors (residential basements, East Pond, River Meadow Brook, potential drinking water wells, etc.). Therefore, the groundwater extraction and treatment system will be implemented to meet interim cleanup levels in the shortest time possible.

Periodic review and modification of the design, construction, operation, maintenance and monitoring of the groundwater extraction and treatment system will be necessary. If the performances of the systems are not meeting the design criteria, adjustment or modification may be necessary. These adjustments or modifications may include relocating or adding extraction wells or alternating pumping rates. Switching from continuous pumping to pulsed pumping may improve the efficiency of contaminant recovery and should be evaluated and necessary modifications undertaken. Should new information regarding the extraction and treatment technology become available, it will be evaluated and applied as appropriate.

As described above under the source control portion of the remedy, when waste remains on Site long-term monitoring is required to record and allow evaluation of trends in contaminant concentration and extent of contaminant migration. Monitoring will consist of sampling and analyses of surface water, groundwater, and downgradient sewers.

As part of the long-term monitoring program, additional groundwater monitoring wells may be needed to further define the lateral extent and depth of contamination in the plume. Additional groundwater sampling and analyses would be required for the indicator substances during remedial design to update water quality data from the RI and on a regular basis throughout the remediation. Specific wells and analytical parameters may be added or deleted depending on sampling results and observed trends. Additionally, surface waters of East Pond and River Meadow Brook, and basement air from neighboring residential and industrial buildings may need to be sampled periodically to evaluate the migration of groundwater to those receptors.

Again, to the extent required by law, EPA will review the Site at least once every five years after the initiation of remedial action at the Site if any hazardous substances, pollutants or contaminants remain at the Site, to assure that the remedial action continues to protect human health and the environment. EPA will also evaluate risk posed by the Site at the completion of the remedial action (i.e., before the Site is proposed for deletion from the NPL).

XI. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Silresim Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains ARARs and is cost effective. The selected remedy also satisfies the statutory preference for treatment which permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element. Additionally, the selected remedy utilizes alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

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

The remedy at this Site will permanently reduce the risks posed to human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls, and institutional controls; more specifically the vacuum/vapor extraction, stabilization and capping of contaminated soils, and the collection and treatment of contaminated groundwater at the edge of the RCRA Subtitle C cap will reduce the risks posed to human health and the environment. The stabilized waste deposited on the Silresim property will remain in place. Potential direct contact and ingestion of contaminated soil, and inhalation of volatilized organics from the soil will be eliminated through treatment and capping. Continued migration of contaminants to surface water, sediments, and basement air will be eliminated as a result of the groundwater extraction and treatment system, thus effectively reducing exposure risks.

The remedial actions, as proposed, will be protective of human health and the environment. Vacuum/vapor extraction will permanently reduce the toxicity, mobility and volume of VOCs, and some semi-VOCs, which constitute the primary contaminants at the Site. Stabilizing and capping the residual contaminants in soil will significantly reduce further migration (leaching) of those contaminants into the groundwater. Treatment of groundwater will also reduce the toxicity, mobility and volume of contaminants in the groundwater; treatment will retard the migration of the contaminated plume and halt further contamination of the aquifer. Extraction and treatment will continue until contaminant concentrations are deemed to be protective of human health and the environment. A long-term monitoring program will ensure the remedy remains protective of human health and the environment.

Again, the final groundwater cleanup levels will be determined as the result of a risk assessment performed on residual groundwater contamination after all interim cleanup levels have been met. Unless the resultant cumulative risk is within the 10^{-4} to 10^{-6} incremental risk range and the cumulative hazard index for similar target endpoints is below the specified level of concern, remedial actions shall continue, until protective levels are attained. Finally, implementation of the selected remedy will not pose unacceptable short-term risks or cross-media impacts since the technologies are proven and will be field tested to reduce operational risks, and special engineering precautions will be used to minimize potential for air releases of contaminants.

B. The Selected Remedy Attains ARARs

This remedy will attain all applicable or relevant and appropriate federal and state requirements that apply to the Site. Substantive portions of environmental laws from which ARARs for the selected remedial action are derived, and the specific ARARs include (among others) those listed below.

Appendix D of this ROD contains a table of all ARARs identified for this Site and whether they are applicable, relevant and appropriate or to be considered. Within the table is also presented a brief synopsis of the requirements and the action to be taken to meet them.

i. **Chemical Specific**

Massachusetts Groundwater Quality Standards - Applicable

- Standards include Groundwater Classification; Water Quality Criteria to Sustain the Designated Uses; and Regulations to Achieve Uses and Maintain Groundwater Quality - 314 CMR 6.00.

Massachusetts Air Pollution Control Regulations - Applicable

- 310 CMR 7.01, 7.02 (2)(a), 7.06, 7.09, 7.10, and 7.18

Massachusetts Operation and Maintenance and Pretreatment Standards for Waste Water, Treatment Works, and Indirect Discharges, 314 CMR 12.00 - Applicable

Massachusetts Surface Water Discharge Permit Requirements - Relevant and Appropriate

- Regulates discharges to surface waters and any treatment works associated with discharges. Applicable if groundwater is discharged to River Meadow Brook - 314 CMR 3.00.

Federal Safe Drinking Water Act (SDWA) - Relevant and Appropriate

- National Primary Drinking Water Regulations (NPDWR) 40 CFR 141.
- Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLG).

Massachusetts Drinking Water Regulations - Relevant and Appropriate

- Massachusetts Maximum Contaminant Levels (MMCLs).
- MMCLs for compounds detected at the Silresim Site are Federal MCLs Adopted by DEP - 310 CMR 22.00.

Clean Air Act (CAA) - Relevant and Appropriate

- National Ambient Air Quality Standards (NAAQS) for Total Suspended Particulates (during excavations) - 40 CFR Part 50.

- NAAQS for Hazardous Air Pollutants such as NO_x, SO_2, CO, Lead, and Mercury - 40 CFR 1 to 99.

Massachusetts Ambient Air Quality Standards, 310 CMR 6.00 - Relevant and Appropriate

Massachusetts Prevention and/or Abatement of Air Pollution 310 CMR 8.00 - Relevant and Appropriate

ii. <u>**Location Specific**</u>

Massachusetts Wetlands Protection Act (WPA) Regulations - Applicable

- 100 foot buffer zone of wetlands (East Pond, River Meadow Brook) is regulated under WPA - 310 CMR 10.00.

Massachusetts Hazardous Waste Facility Siting Regulations - Relevant and Appropriate

- Provides substantive requirements for the siting of hazardous waste facilities - 990 CMR 1.00

iii. <u>**Action Specific**</u>

Clean Water Act (CWA) - Applicable

- National Pollution Discharge Elimination System (NPDES)
  A NPDES permit is required if treated groundwater were discharged off-site to the surface waters of River Meadow Brook - 40 CFR 107, 171.1 to 171.5.

Massachusetts Air Pollution Control Regulations - Applicable

- 310 CMR 7.01, 7.02 (2)(a), 7.06, 7.09, 7.10, and 7.18

Toxic Substances Control Act (TSCA) - Applicable

- Regulates the Disposal and Storage of PCBs.

Massachusetts Operation and Maintenance and Pretreatment Standards for Waste Water, Treatment Works, and Indirect Discharges, 314 CMR 12.00 - Applicable

Massachusetts Surface Water Quality Standards - Applicable

- Regulations recommend the use of Federal Ambient Water Quality Criteria (FAWQCs) to establish water quality for toxic pollutants. Applicable if groundwater is discharged to River Meadow Brook - 314 CMR 4.04 and 314 CMR 4.06(2).

Massachusetts Operation and Maintenance and Pretreatment Standards for Wastewater Treatment Works and Indirect Discharge - 314 CMR 12.00

Massachusetts Hazardous Waste Regulations, 310 CMR 30.00

- These regulations are consistent with RCRA and provide for the identification, handling, transport, and record keeping of hazardous waste.

- 310 CMR 30.500, 30.561, 30.590, 30.610 - 30.633, 30.640, 30.660 are relevant and appropriate requirements

- 310 CMR 6.80 and 310.690 are applicable.

Clean Air Act (CAA) - Relevant and Appropriate

- National Ambient Air Quality Standards (NAAQS) for Total Suspended Particulates (during excavations) - 40 CFR Part 50.

- NAAQS for Hazardous Air Pollutants such as NO_x, SO_2, CO, Lead, and Mercury - 40 CFR 1 to 99.

- Utilize Best Demonstrated Control Technologies for emissions.

Massachusetts Ambient Air Quality Standards, 310 CMR 6.00 - Relevant and Appropriate

Massachusetts Prevention and/or Abatement of Air Pollution 310 CMR 8.00 - Relevant and Appropriate

Resource Conservation and Recovery Act - Relevant and Appropriate

- RCRA Subtitle C, 40 CFR 260 - Regulates the Generation, Transport, Excavation, Storage, Treatment and Disposal of Hazardous Waste.

- General RCRA Part 264 requirements that are relevant and appropriate to this remedial action involving on-site treatment, storage and disposal of hazardous waste include standards for preparedness and prevention (Subpart C); contingency plan and emergency procedures (Subpart D); groundwater protection (Subpart F); closure and post-closure requirements (Subpart G); and landfills (cap).

RCRA 40 CFR 268 - Land Disposal Restrictions.

Massachusetts Surface Water Discharge Permit Requirements - Relevant and Appropriate

- Regulates discharges to surface waters and any treatment works associated with discharges. Applicable if groundwater is discharged to River Meadow Brook - 314 CMR 3.00.

Massachusetts Public Health Regulations, 105 CMR 670 - Relevant and Appropriate

Massachusetts "Right to Know" Regulations, 310 CMR 33.00 and 554 CMR 21.00 - Relevant and Appropriate

A discussion of why these requirements are applicable or relevant and appropriate may be found in the FS Report at pages 22 to 33.

The following policies, criteria, and guidance (among others) will also be considered (TBCs) during the implementation of the remedial action:

To Be Considered

Federal Safe Drinking Water Act (SDWA)

- Proposed Maximum Contaminant Levels (pMCLs) and Proposed Maximum Contaminant Level Goals (pMCLGs) under NPDWR-40 CFR 141.

American Conference of Governmental Industrial Hygienists (ACGIH)

- Threshold Limit Value (TLV), Time Weighted Average (TWA) and Short-Term Exposure Limit (STELs) for basement air of Lowell Iron and Steel.

Clean Water Act (CWA) - Federal Ambient Water Quality Criteria (FAWQCs).
EPA Reference Doses (RfD) - For Noncarcinogens.
EPA Lifetime Health Advisories - Office of Drinking Water.
EPA Risk Specific Doses - For Carcinogens.
EPA Directive for Lead - OSWER Directive 9355.4-02.
Agency for Toxic Substances and Disease Registry (ATSDR), dioxins
Massachusetts Allowable Ambient Limits (AALs) and Threshold Effects Exposure Limits (TELs).
Massachusetts Office of Research and Standards Drinking Water Guidelines (ORSGLs).

i(a). Chemical Specific

Federal and State Drinking Water Standards

The groundwater aquifer at and beyond the compliance boundary is classified as Class IIB under the Federal Groundwater Protection Strategy and Class I by the Commonwealth of Massachusetts, which is a source of potable water. While Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) promulgated under the Federal Safe Drinking Water Act are not applicable to groundwater, they are relevant and appropriate to groundwater cleanup because the groundwater may be used as a drinking water source. In addition, the NCP requires that usable groundwater be restored to their beneficial uses whenever practicable. See 40 CFR 300.430(a)(iii)(F).

Massachusetts groundwater quality standards for Class I groundwater issued in 314 CMR 6.00 are applicable requirements for the Silresim Site. The state drinking water standards that are relevant and appropriate for groundwater as a potential drinking water supply are the Massachusetts Maximum Contaminant Levels (MMCLs) issued under 310 CMR 22.00. MMCLs for compounds detected at the Silresim Site are federal MCLs and MCLGs adopted by DEP.

In addition to the Federal and State regulatory standards and guidelines for drinking water and groundwater, risk-based criteria are to be considered. These criteria include concentrations derived from EPA Reference Doses (RfDs) and risk-specific doses based on Carcinogenic Potency Factors (CPFs) and standard exposure assumptions for the ingestion of drinking water.

This remedy will attain these ARARs as well as those identified in **Appendix D**, and will comply with those regulations which have been identified as TBCs by meeting the groundwater cleanup levels at the compliance points through the groundwater treatment system. Removing the VOCs from the soil, stabilizing the residual contaminants in soil and capping of the Site will further reduce the volume of leachate generated. The soil and groundwater treatment systems will reduce levels of contamination at the Site to the interim cleanup levels identified in this ROD. Treated groundwater will also meet Federal standards, State criteria for drinking water, and the discharge requirements to either the POTW or River Meadow Brook which include Massachusetts Surface Water Discharge Permit Requirements (314 CMR 3.00), and Massachusetts Surface Water Quality Standards (314 CMR 4.04, 314 CMR 4.06(2)). If the treated groundwater is discharged to River Meadow Brook, the applicable requirements of the Massachusetts Certification for Dredging, Dredged Materials, Disposal and Filling in Waters of the Commonwealth will be met (314 CMR 9.00).

Federal and State Air Quality Standards

Federal Primary and Secondary National Ambient Air Quality Standards (NAAQS) under the Clean Air Act (CAA) exist for emissions of sulfur oxides, carbon monoxide, ozone, nitrogen oxides, lead and particulate matter. Silresim is located in a non-attainment area for ozone and carbon monoxide. Generation of fugitive dusts and air emissions from soil excavation and treatment facilities (air stripper and vacuum extraction systems) are subject to NAAQS. Maximum achievable control technologies will be utilized to promote and maintain public health and welfare.

Massachusetts air regulations include Ambient Air Quality Standards (310 CMR 6.00), Air Pollution Control Regulations (310 CMR 7.00) and requirements for the Abatement of Episodic and Incidental Air Pollution Emergencies (310 CMR 8.00). Certain provisions of 310 CMR 7.00 which require the best available emissions controls and specify ambient air quality standards are applicable and will be met. The remaining State standards for fugitive emissions from excavation, and emissions from treatment equipment associated with this remedy are relevant and appropriate, and the substantive requirements will be met.

These Federal and State air standards will guide mitigation measures designed to control the release of fugitive dust and particulate matter during excavations at the Site as well as limit VOC emissions from the vacuum/vapor extraction and air stripper treatment systems at the Site.

For the evaluation of volatiles released from groundwater seepage in the Lowell Iron & Steel building, occupational criteria, namely Threshold Limit Values (TLVs), are criteria To-Be-Considered. TLVs refer to airborne concentrations of substances, and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. TLVs are recommendations issued by the American Conference of Governmental Industrial Hygienists (ACGIH) and are used as guidelines in the control of potential occupational health hazards.

Given the nature of potential exposures at Lowell Iron & Steel and the definition of the TLVs, the TLV Short Term Limits (TLV-STL) are relevant criteria for evaluating short-term exposures that may occur when volatiles are released from basement seepage during sporadic flooding events. The TLV Time Weighted Average (TLV-TWA) is relevant for assessing long-term exposures during dry periods when volatiles may be released into the basement on a chronic basis. Through the treatment of soil and groundwater at the Site, relevant TLVs will be met.

ii(a). Location Specific

River Meadow Brook and East Pond are wetlands under the Massachusetts Wetlands Protection Act (WPA) Regulations (310 CMR 10.00). While the Silresim Site lies outside of the 100-foot buffer zone under jurisdiction of the WPA for both of these wetlands, portions of the groundwater contaminant plume are within the buffer zone of East Pond. Activities associated with management of migration (groundwater extraction well installations, discharge line construction, etc.) within the 100-foot buffer zone are subject to the applicable requirements of the WPA and will be met.

iii(a). Action Specific

Federal Primary and Secondary National Ambient Air Quality Standards (NAAQS) under the Clean Air Act (CAA) and Massachusetts air pollution regulations (310 CMR 6.00-8.00) are also action specific ARARs. The discussion of these requirements is found above under section i(a), Chemical Specific ARARs.

These Federal and State air standards will guide mitigation measures designed to control the release of fugitive dust and particulate matter during excavations at the Site as well as limit VOC emissions from the vacuum/vapor extraction and air stripper treatment systems at the Site.

Under the Clean Water Act (CWA), the National Pollution Discharge Elimination System (NPDES) permit requirements for point-source discharges are relevant and appropriate if treated groundwater is discharged to River Meadow Brook. These requirements include compliance with technology-based standards, water quality criteria, discharge monitoring systems and records maintenance. Federal water quality standards will be complied with. In addition, CWA regulations governing CERCLA wastewater discharge to a POTW are applicable. Discharges to the Duck Island Treatment Plant and pretreatment standards for discharges will be met (if POTW discharge is selected during remedial design).

Discharges to surface waters of Massachusetts and the outlets for such discharges and any treatment works associated with these discharges are regulated. These regulations include the Massachusetts Surface Water Discharge Permit Requirements (314 CMR 3.00), Massachusetts Surface Water Quality Standards (314 CMR 4.04, 314 CMR 4.06(2)) and Massachusetts Certification for Dredging, Dredged Materials, Disposal and Filling in Waters of the Commonwealth (314 CMR 9.00). As discussed above under Chemical Specific ARARs, these regulations are ARARs and will be met through treatment and proper controls on the remedial components.

RCRA regulations are relevant and appropriate to the source control and management of migration portions of the remedy. The portions of RCRA Subtitle C that are relevant and appropriate to on-site treatment, storage or disposal include preparedness and prevention (Subpart C); contingency plan and emergency procedures (Subpart D); groundwater protection (Subpart F); closure and post-closure requirements (Subpart G); waste piles (Subpart L); and landfills (Subpart N). Massachusetts Hazardous Waste Regulations that pertain to above ground storage conainers and tanks used to treat or store hazardous waste is applicable and will be met (310 CMR 30.680 and 30.690). Additional Massachusetts Hazardous Waste Regulations that pertain to handling, storage, treatment and disposal of hazardous waste on-site are relevant and appropriate requirements and will be met through proper design and implementation of the remedial components. The off-site treatment and disposal of wastes generated from the soil and groundwater treatment systems at this Site must meet all Federal and State requirements (administrative requirements are not ARARs, however, the substantive requirements must be met). Because the Massachusetts Hazardous Waste Program is authorized to administer the RCRA regulations listed above, the state regulations will be the operative requirements to be met.

The Land Disposal Restrictions (40 CFR 268) of Hazardous and Solid Waste Amendments of RCRA apply to characteristic RCRA hazardous waste at the Site. Under source control, LDRs are triggered because soil contaminated with RCRA characteristic waste will be excavated, treated above ground in a stabilization unit and disposed of on the Silresim Site within one area of contamination. EPA has determined that following treatment, LDRs for RCRA hazardous substances at the Site will be met. However, the final determination will be made following treatment of the soil to determine whether the regulated levels have been met and the remedy is in compliance with LDRs. The comprehensive analysis of LDRs for each of the alternatives considered in the detailed analysis is embodied in a separate report titled "Final Assessment of LDRs; Silresim Site" dated June 6, 1991 which is in the Adminstrative Record.

The PCB Disposal Requirements promulgated under TSCA are applicable to the remedy because the selected remedy involves storage and disposal of soils contaminated with PCBs in excess of 50 ppm. Under the Disposal Requirements, soils and sediments contaminated with PCBs may be disposed of in an incinerator meeting the standards of 40 CFR Section 761.69 or a landfill meeting the requirements of 40 CFR Section 761.75. Under the provisions of 40 CFR Section 761.75(c)(4), the EPA Regional Administrator may waive one or more of the specified landfill requirements upon finding that the requirement is not necessary to protect against an unreasonable risk of injury to human health or the environment from PCBs. In this case, placement of soils with PCBs, which have been stabilized, under a RCRA cap will provide a permanent and protective remedy that satisfies the requirements of the Part 761 landfill regulations. Long-term monitoring of groundwater wells will also be instituted, as required by the chemical waste landfill regulations.

The Regional Administrator is excercising the waiver authority contained within the TSCA regulations at 40 CFR Section 761.75(c)(4), and is waiving certain requirements of the chemical waste landfill regulations. The provisions to be waived require construction of chemical waste landfills in certain low permeable clay conditions [Section 761.75(b)(1)], the use of a synthetic membrane liner [Section 761.75(b)(1)], and that the bottom of the landfill be 50 feet above the histroic high water table [Section 761.75(b)(3)].

The Regional Administrator hereby determines that, for the following reasons, the requirements of 40 CFR Sections 761.75(b)(1), and (3) are not necessary to protect against an unreasonable risk of injury to human health or the environment from PCBs in this case. Among the primary reasons that the waived specifications are not necessary is the low frequency of detection and concentrations of PCBs detected in Site soils. PCBs are not the primary threat at this Site. Although there were a limited number of samples analyzed with PCBs over 50 ppm, the majority had concentrations below 1 ppm and at non-detectable levels. In contrast, the landfill requirements that are waived are designed to protect against the risk from disposal of PCBs at levels no lower than 50 ppm. The specifications regarding liners, soil conditions and depth to groundwater were designed to protect against the risks that high levels of PCBs will migrate into groundwater or be released to air or surface water.

Low permeability clay conditions, a synthetic membrane liner for the underlying substrate, and 50 foot soil barrier to the water table are unnecessary requirements at this Site to prevent migration of PCBs. The soil will be stabilized and disposed of on Site in excavated areas within the upper portion of the unsaturated zone. Disposal of stabilized and capped waste in this zone will minimize the hydraulic connection between the treated soils and groundwater and subsequent migration of PCBs in groundwater. Furthermore, given the low mobility of PCBs in stabilized soils, migration of PCBs to groundwater would be minimal.

This remedy will also comply with the storage requirements of the PCB Disposal Regulations by the construction of a temporary storage area meeting the standards of 40 CFR Section 761.65.

C. The Selected Remedial Action is Cost-Effective

In the Agency's judgment, the selected remedy is cost effective, i.e., the remedy affords overall effectiveness proportional to its costs. In selecting this remedy, once EPA identified alternatives that are protective of human health and the environment and that attain, or as appropriate, waive ARARs, EPA evaluated the overall effectiveness of each alternative by assessing the relevant three criteria: long term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short term effectiveness, in combination. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs.

Of the eight alternatives evaluated and considered protective (SC-2 through SC-15), SC-2, SC-3, SC-14, and the selected remedy (SC-4), have the most cost-effective components. Whereas SC-2 meets ARARs and is considered reasonably protective against exposures such as direct contact and ingestion of soil, it is the least protective of the eight because none of the contaminants are eliminated, reduced or stabilized; therefore the costs are least effective for the level of protection. Although SC-3 is reasonably protective in that VOCs, which are the primary threat at the Site, are eliminated and the remaining constituents are capped, it is only marginally less expensive than the selected remedy and is not as protective because it does not include stabilization for the remaining compounds; therefore, it is not considered as cost effective as SC-4. SC-14 provides more permanent protection than SC-4 because solvent extraction would eliminate additional extractable and heavier organics, however, they both include stabilization and a cap and are therefore equally protective of direct contact, ingestion and leaching related exposures. Logistical/implementability concerns related to the addition of an added treatment system, and concerns related to the effectiveness of solvent extraction to treat PCBs and dioxins make SC-14 less reliable and therefore less cost-effective proportionate to the selected remedy.

The short-term inhalation risks associated with alternatives that include large-scale excavations (SC-6 and SC-10) prior to VOC treatment, and the very high costs of thermal treatments in proportion to the added long-term protection to human health and the environment are not considered proportionately cost-effective. Although the alternatives that include thermal desorption or incineration (including SC-11) reduce or eliminate extractable and heavier organics, the selected remedy provides adequate protection against all potential exposures to those contaminants by stabilizing and capping the residual waste at a much reduced cost (a detailed cost estimate for the selected source control remedy (SC-4) is provided in **Table 8 of Appendix B**).

All three of the alternatives that include groundwater extraction and treatment attain ARARs and are protective. Steam stripping (MM-3) is slightly more expensive than the selected remedial alternative (MM-2) and MM-4. Although the selected remedy is comparable in cost to MM-4, which includes a UV/chemical oxidation treatment system, air stripping with a heated influent (MM-2) is more widely available and tested for sites with a similar waste stream, and therefore considered more reliable and proportionately cost-effective.

All three alternatives include the estimated costs of an extraction system and a pretreatment process to separate non-aqueous phase liquids and remove metals. The final details of the extraction system will be known upon completion of the pump test during predesign activities. Although extraction costs may therefore change, the cost of extraction would be the same for each groundwater alternative (a detailed cost estimate for the selected management of migration remedy (MM-4) is provided in **Table 9 of Appendix B**).

The least expensive alternative, MM-1, the no-action alternative, does not meet ARARs since it would not reduce the concentration of contaminants found in the groundwater to drinking water standards and is not considered protective of human health and the environment.

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

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

Each of the source control alternatives meets its corresponding ARARs. Because alternatives SC-4 through SC-15 each include stabilization, a RCRA Subtitle C cap, a Site fence, and institutional controls to manage residual contaminants, they all offer good protection against the principle exposure risks including direct contact and ingestion of soil, inhalation of VOC emissions, and risks associated with the migration of residual contaminants into groundwater.

Whereas SC-15 offers the most permanent protection on-site because treated soils would be disposed of off-site, it is unreliable as a result of the uncertainty of securing a facility to accept dioxin and PCB contaminated waste, and poses potential serious short-term risks related to the transport of wastes off Site. SC-6, SC-10 and SC-11 offer the next most permanent protection in the shortest time period due to the removal of extractable and heavier organics; however, the short-term risks associated with large scale excavations (SC-6 & SC-10) are considerably higher than those alternatives that strip the VOCs off prior to major excavation; are considerably more costly than the others compared to the added level of permanent protection offered; and pose serious implementation issues (spatial requirements are greater than the others). SC-14 offers more permanent protection than the selected remedy because it too treats the extractable and heavier organics to cleanup levels; however, the inclusion of an additional treatment process adds an extra measure of difficulty associated with implementation than compared to the selected alternative. Although alternatives SC-6 through SC-15 may offer more permanent protection, they are not any more protective than the selected remedy which prevents exposures to the remaining contaminants.

The selected remedial alternative and SC-3 employ the most readily available services and materials, including in situ vacuum/vapor extraction, stabilization (SC-4 only) and a cap. Vacuum/vapor extraction is reliable for removal of VOCs which are the principle threat at the Site, and stabilization combined with a cap is the most reliable means of migration control for residual materials (particularly metals). Both stabilization and capping effectively reduce exposure risks to the contaminants remaining on-site. SC-1 and SC-2 offer little permanent protection because no contaminants are reduced or eliminated. SC-1 is least protective in the long-term because it does not employ a RCRA cap as SC-2 does. Although alternatives SC-6 through SC-15 offer greater reductions in toxicity, mobility and volume of extractables and heavier organics, the selected alternative provides an effective barrier (containment) against exposures to those constituents and is therefore more proportionately cost-effective.

MM-1 would not meet ARARs and would not reduce the toxicity, mobility and volume of contaminants at the Site and is therefore not protective of human health and the environment. The selected management of migration alternative (MM-2) was chosen because of the long-term effectiveness and permanence and ability to reduce toxicity, mobility and volume of contaminants through capture and treatment. Additionally, it was chosen because the components are all well proven, reliable, readily available and easily implementable. Although MM-2, MM-3 and MM-4 would be equally effective in meeting ARARs for approximately the same cost (MM-3 slightly more), and each includes institutional controls to be protective of human health in the short term, MM-3 and MM-4 are generally less proven and available technologies. Unlike MM-2, the use of steam stripping (MM-3), would require a licensed boiler operator to be on hand at all times (operation and maintenance costs could be potentially higher in the long-term).

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

The principal element of the selected source control portion of the remedy is in situ treatment of VOCs in soils via vacuum/vapor extraction and subsequent stabilization and capping of residual contaminants. The principle element of the selected management of migration portion of the remedy is groundwater extraction and treatment utilizing air stripping. These elements address the primary threat at the Site, contamination of soil and groundwater. The selected remedy satisfies the statutory preference for treatment as a principal element by: permanently reducing the volume of VOCs and some semi-VOCs; reducing the mobility of the remaining organics and metals in the soil; and aggressively extracting and treating contaminated groundwater which poses a potential threat through its migration and discharge to nearby basements, River Meadow Brook, East Pond, and to a future potential drinking water supply.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES

EPA presented a Proposed Plan (preferred alternative) for remediation of the Site on June 6, 1991. The source control portion of the preferred alternative included in situ vacuum/vapor extraction, stabilization and a RCRA Subtitle C cap. The management of migration portion of the preferred alternative included groundwater extraction, gravity separation of non-aqueous phase liquids, chemical precipitation/filtration of metals and suspended solids, air stripping, aqueous phase carbon adsorption and thermal oxidation. No significant changes from the Proposed Plan have been made to the selected remedies as detailed in the Record of Decision. Minor changes include the correction of accounting errors in the estimated cost of the selected remedy. These corrections reduced the total cost of the selected remedy by $130,000.

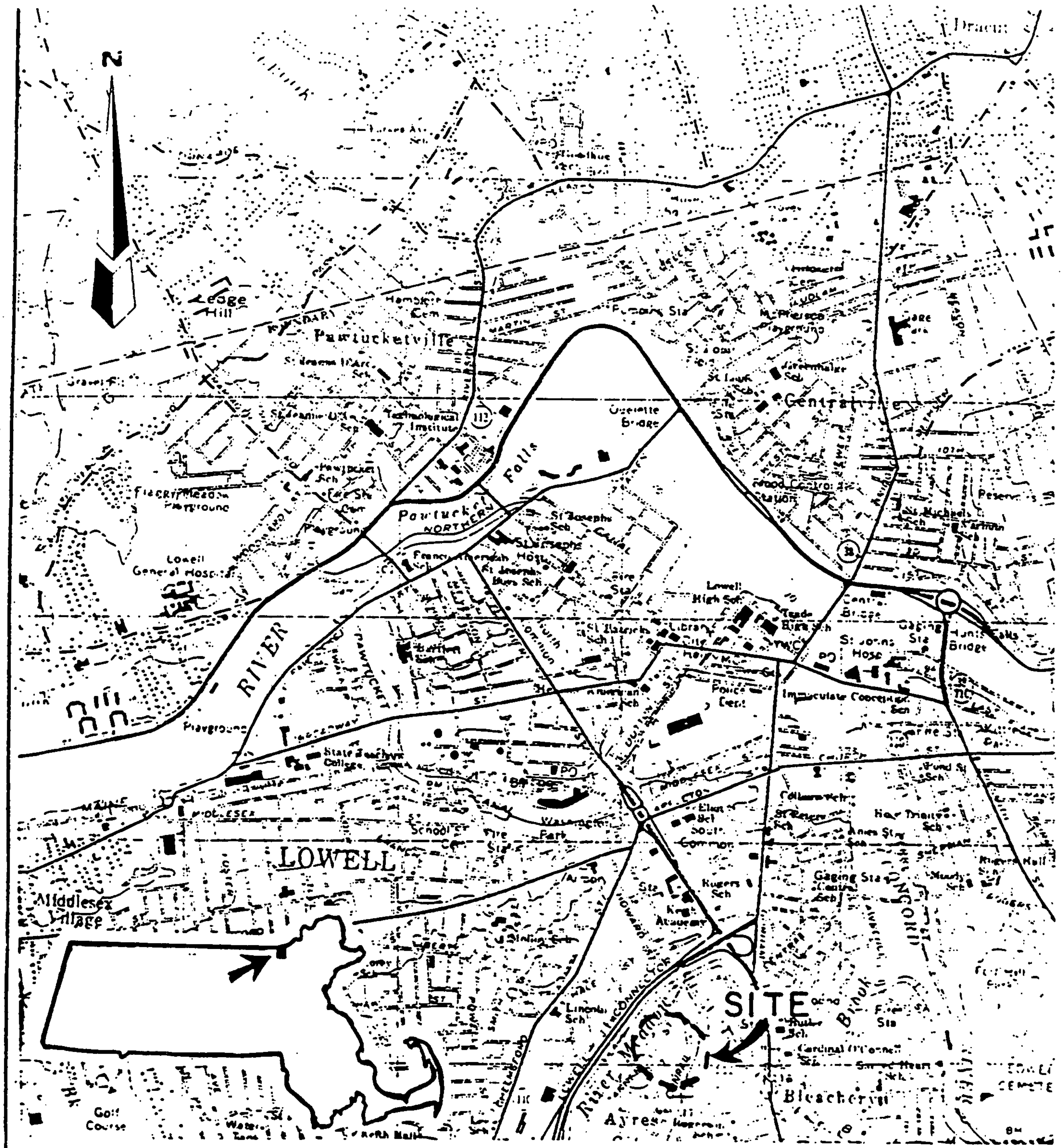
It should be noted that some discrepancies in analysis exist among documents in the Administrative Record, but that this Record of Decision represents EPA's final position with regard to these discrepancies. This position was reached after carefully reviewing and considering all information presented to EPA. Any discrepancies noted would not affect EPA's decision on the remedy.

XIII. STATE ROLE

The Commonwealth of Massachusetts, Department of Environmental Protection has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the Remedial Investigation, Risk Assessment and Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental laws and regulations. Massachusetts concurs with the selected remedy for the Silresim Site. A copy of the declaration of concurrence is attached as **Appendix D.**

APPENDIX A

FIGURES

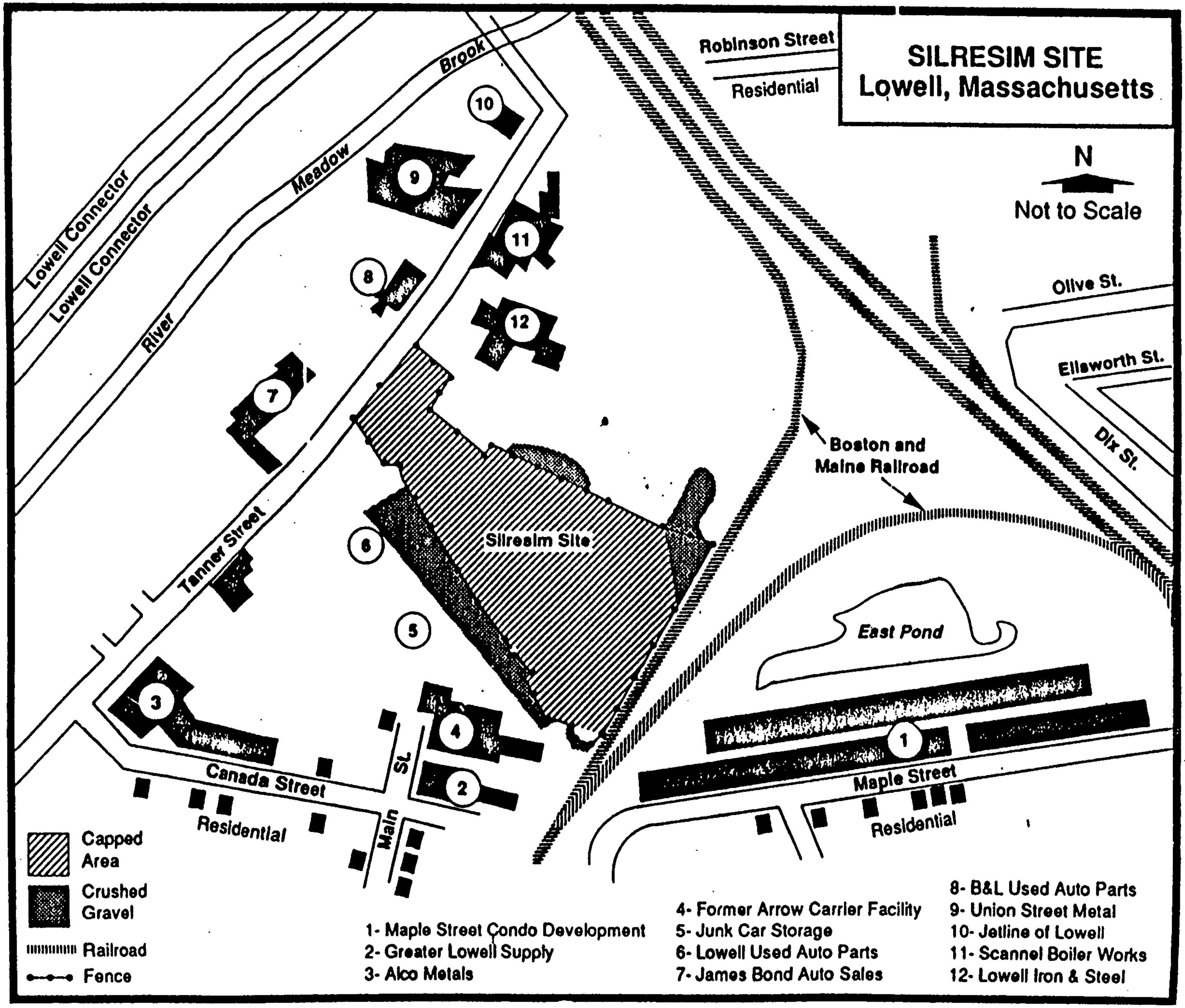


0' 1000 2000' 4000'

FROM USGS LOWELL, MASS. – N.H.
QUADRANGLE MAP (1970)

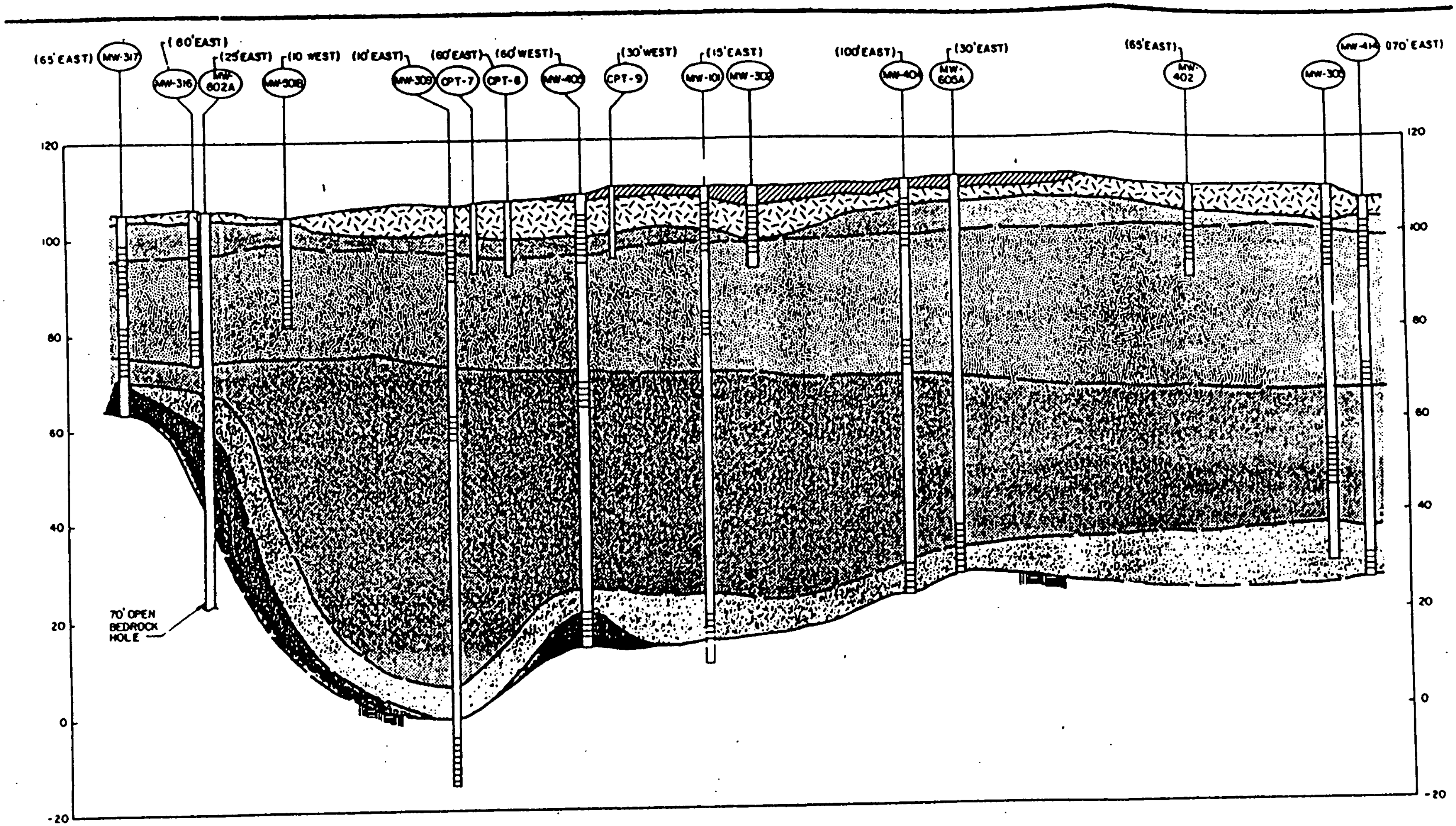
	SILRESIM SITE LOWELL, MASS.	LOCUS PLAN FIGURE 1

POOR QUALITY ORIGINAL



SILRESIM SITE
Lowell, Massachusetts
N
Not to Scale
Robinson Street
Residential
Lowell Connector
Lowell Connector
River
Meadow
Brook
Tanner Street
Olive St.
Ellsworth St.
Dix St.
Boston and Maine Railroad
Silresim Site
East Pond
Canada Street
Main St.
Maple Street
Residential
Residential
1
2
3
4
5
6
7
8
9
10
11
12
Capped Area
Crushed Gravel
Railroad
Fence
1- Maple Street Condo Development
2- Greater Lowell Supply
3- Alco Metals
4- Former Arrow Carrier Facility
5- Junk Car Storage
6- Lowell Used Auto Parts
7- James Bond Auto Sales
8- B&L Used Auto Parts
9- Union Street Metal
10- Jetline of Lowell
11- Scannel Boiler Works
12- Lowell Iron & Steel

FI…RE 2



NOTE: CPT HOLES WERE TEMPORARY

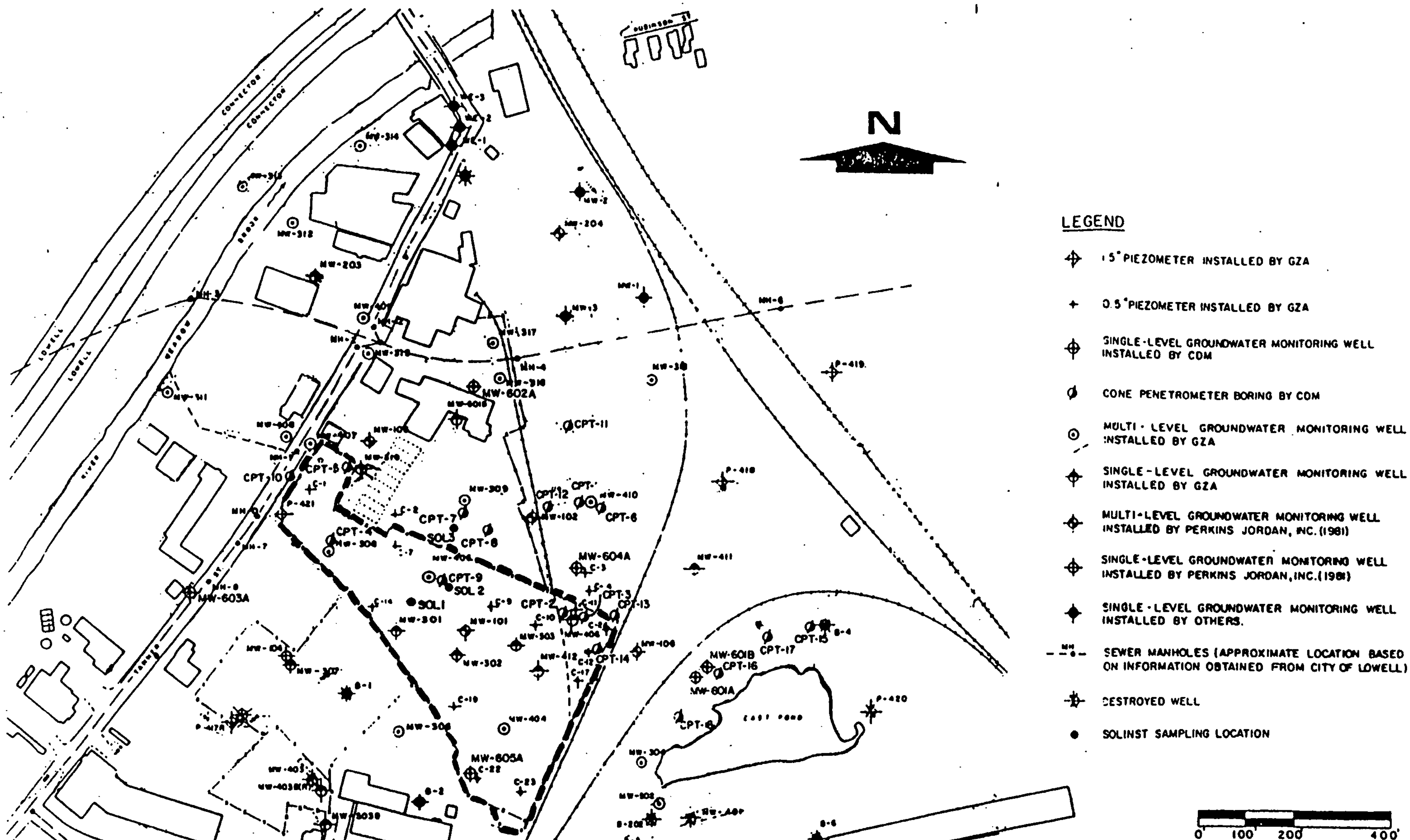
LEGEND

- CLAY CAP
- FILL
- LACUSTRINE SILT AND SAND
- LACUSTRINE SILT AND SAND WITH SILTY - CLAY LAYERS
- ABLATION TILL
- LODGEMENT TILL
- BEDROCK
- CONTACTS (DASHED WHERE INFERRED)

HOR. 100 0 100
VERT. 20 0 20
FEET

SILRESIM SITE
LOWELL, MASSACHUSETTS

FIGURE 3



SILRESIM SITE
LOWELL, MASSACHUSETTS

SITE PLAN

1991

FIGURE 4

POOR QUALITY ORIGINAL

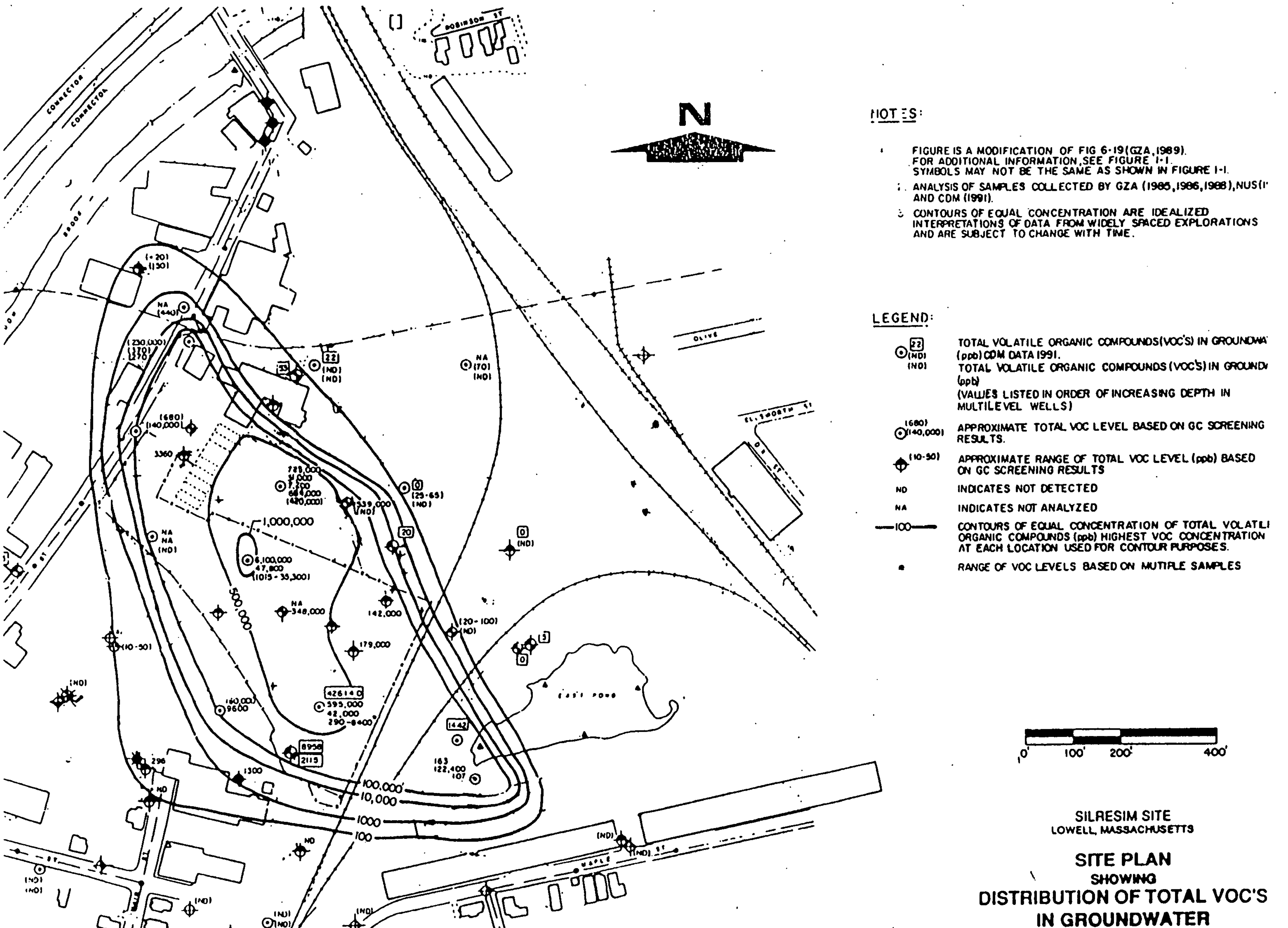
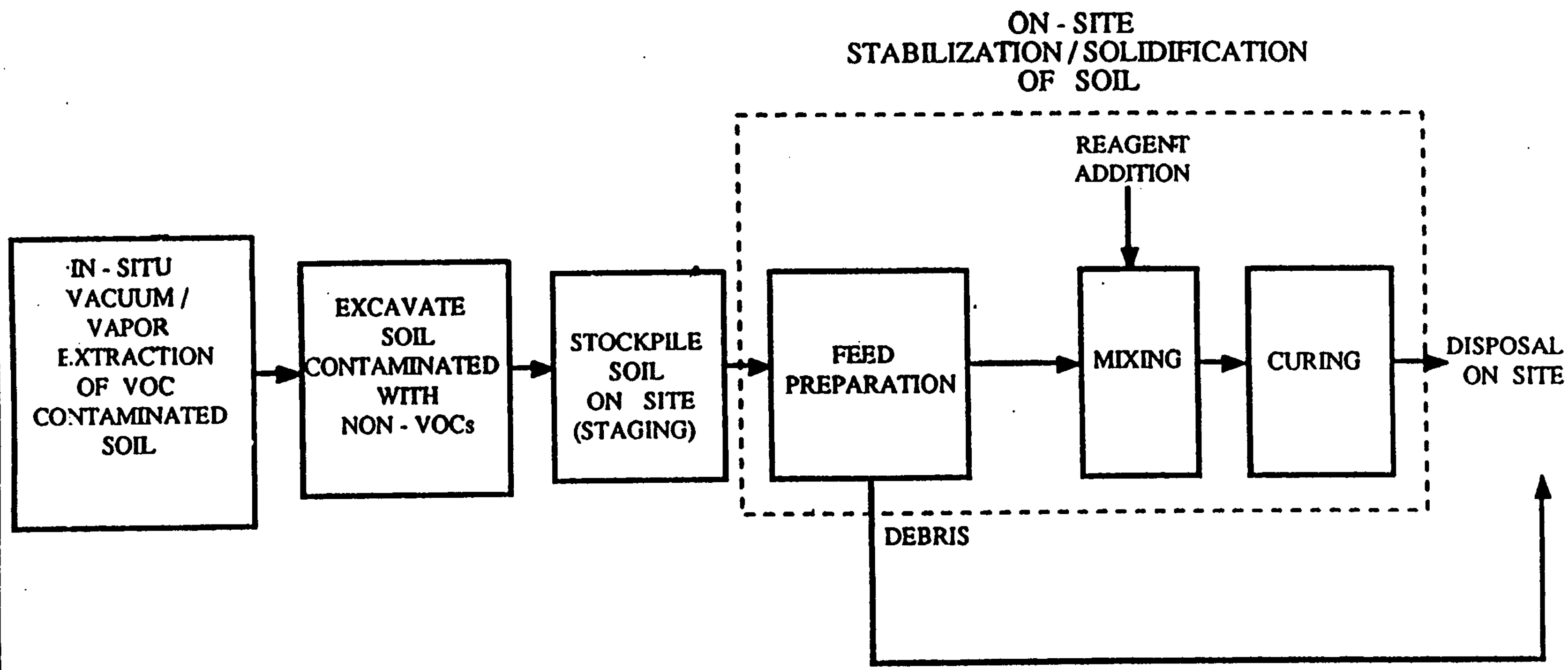

N
NOTES:
FIGURE IS A MODIFICATION OF FIG 6-19 (GZA, 1989). FOR ADDITIONAL INFORMATION, SEE FIGURE 1-1. SYMBOLS MAY NOT BE THE SAME AS SHOWN IN FIGURE 1-1.
ANALYSIS OF SAMPLES COLLECTED BY GZA (1985, 1986, 1988), NUS AND CDM (1991).
CONTOURS OF EQUAL CONCENTRATION ARE IDEALIZED INTERPRETATIONS OF DATA FROM WIDELY SPACED EXPLORATIONS AND ARE SUBJECT TO CHANGE WITH TIME.
LEGEND:
TOTAL VOLATILE ORGANIC COMPOUNDS (VOC'S) IN GROUNDWA (ppb) CDM DATA 1991.
TOTAL VOLATILE ORGANIC COMPOUNDS (VOC'S) IN GROUND (ppb)
(VALUES LISTED IN ORDER OF INCREASING DEPTH IN MULTILEVEL WELLS)
APPROXIMATE TOTAL VOC LEVEL BASED ON GC SCREENING RESULTS.
APPROXIMATE RANGE OF TOTAL VOC LEVEL (ppb) BASED ON GC SCREENING RESULTS
ND INDICATES NOT DETECTED
NA INDICATES NOT ANALYZED
CONTOURS OF EQUAL CONCENTRATION OF TOTAL VOLATILE ORGANIC COMPOUNDS (ppb) HIGHEST VOC CONCENTRATION AT EACH LOCATION USED FOR CONTOUR PURPOSES.
RANGE OF VOC LEVELS BASED ON MUTIPLE SAMPLES
0' 100' 200' 400'
1,000,000
500,000
100,000
10,000
1000
100
6,100,000
47,800
(1015 - 35,300)
EAST POND
SILRESIM SITE
LOWELL, MASSACHUSETTS
SITE PLAN SHOWING DISTRIBUTION OF TOTAL VOC'S IN GROUNDWATER

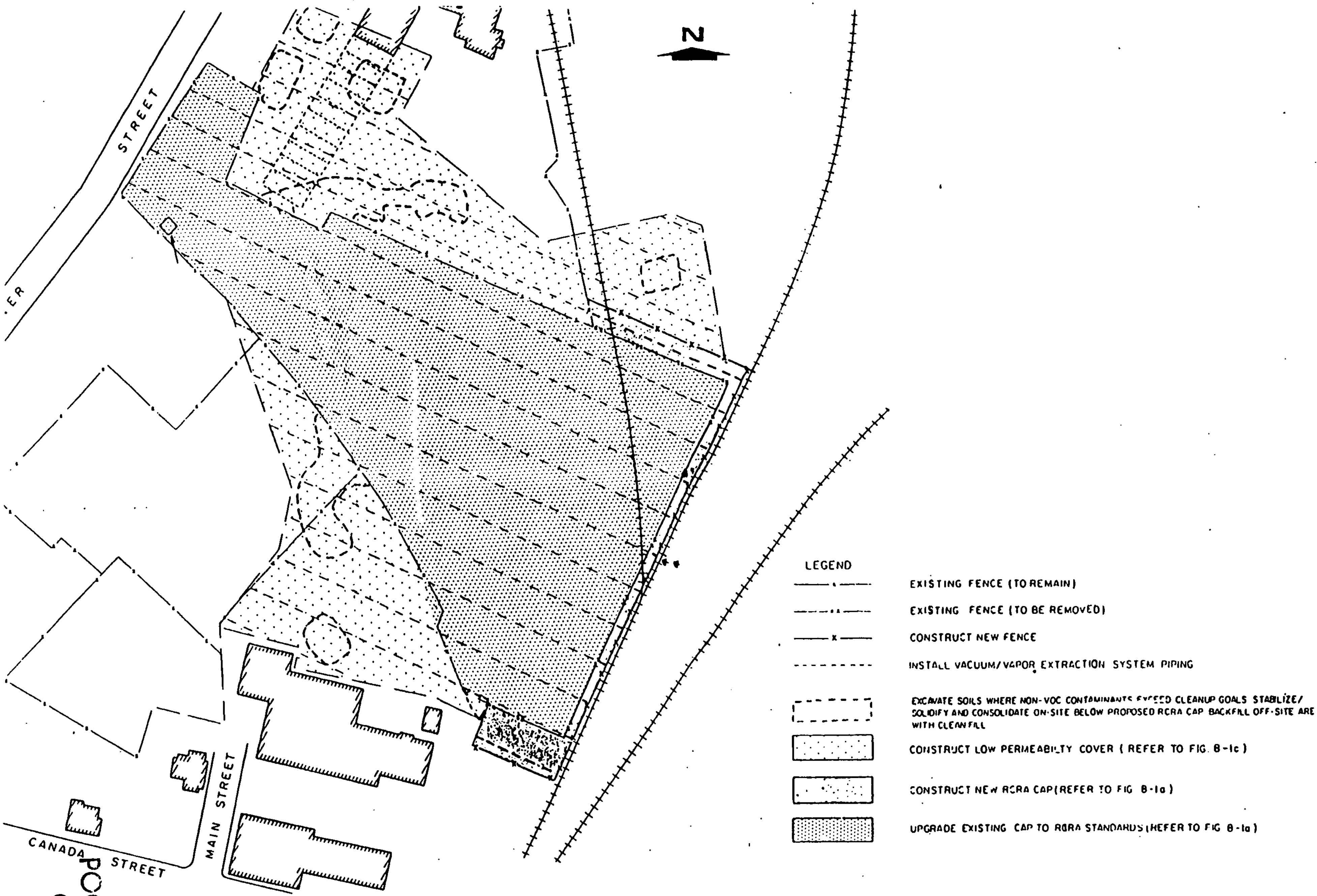
FIGURE 5



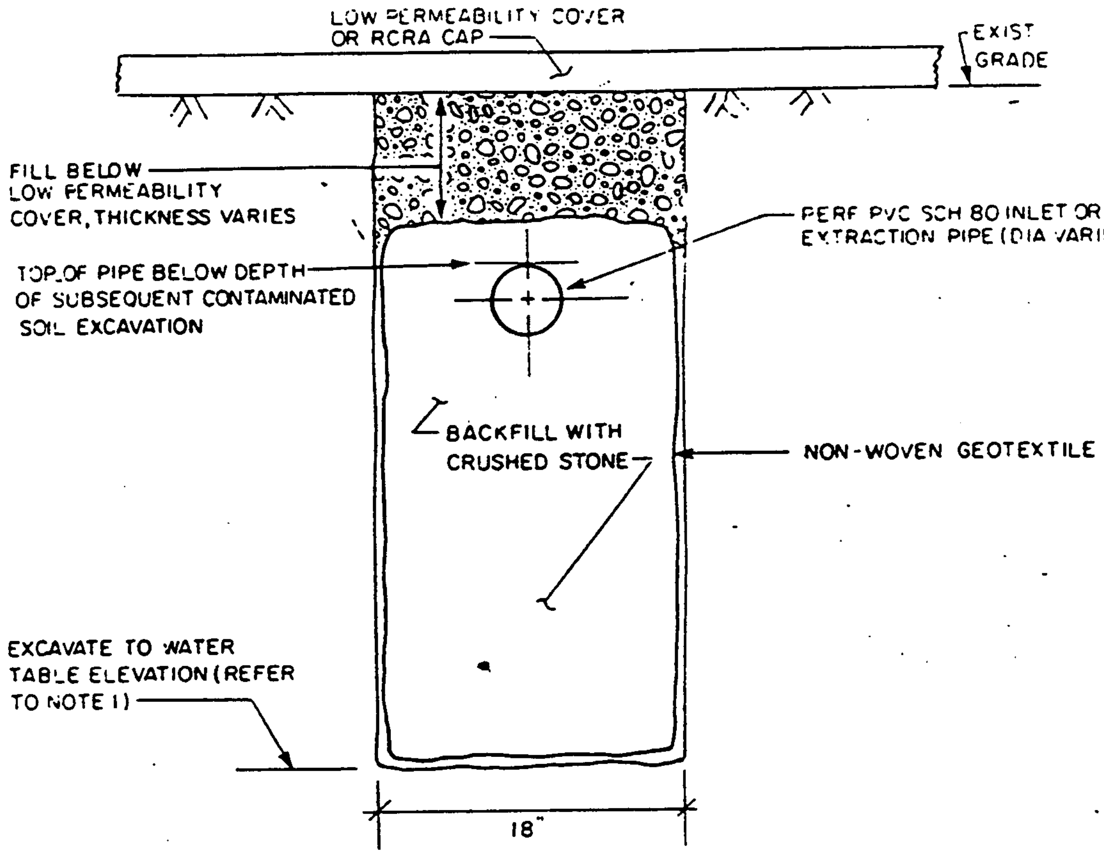
SILRESIM SITE
LOWELL, MASS

CONCEPTUAL BLOCK
FLOW DIAGRAM
REMEDIAL ALTERNATVE
SC -4

FIGURE 6



SILRESIM SITE LOWELL, MASS.	SITE PLAN - ALTERNATIVE SC-4 **VACUUM/VAPOR EXTRACTION** 1991 FIGURE 7

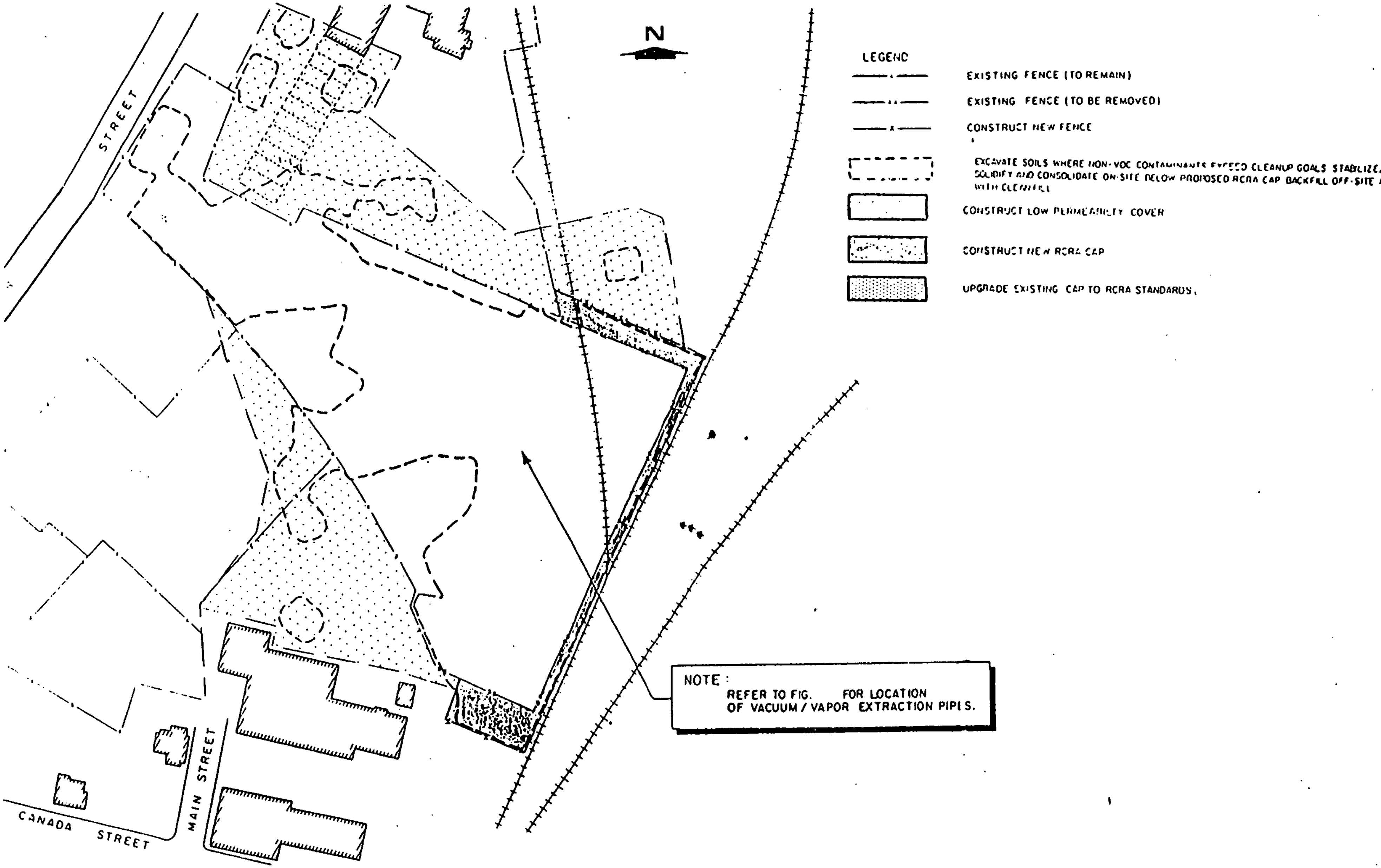


NOTE:

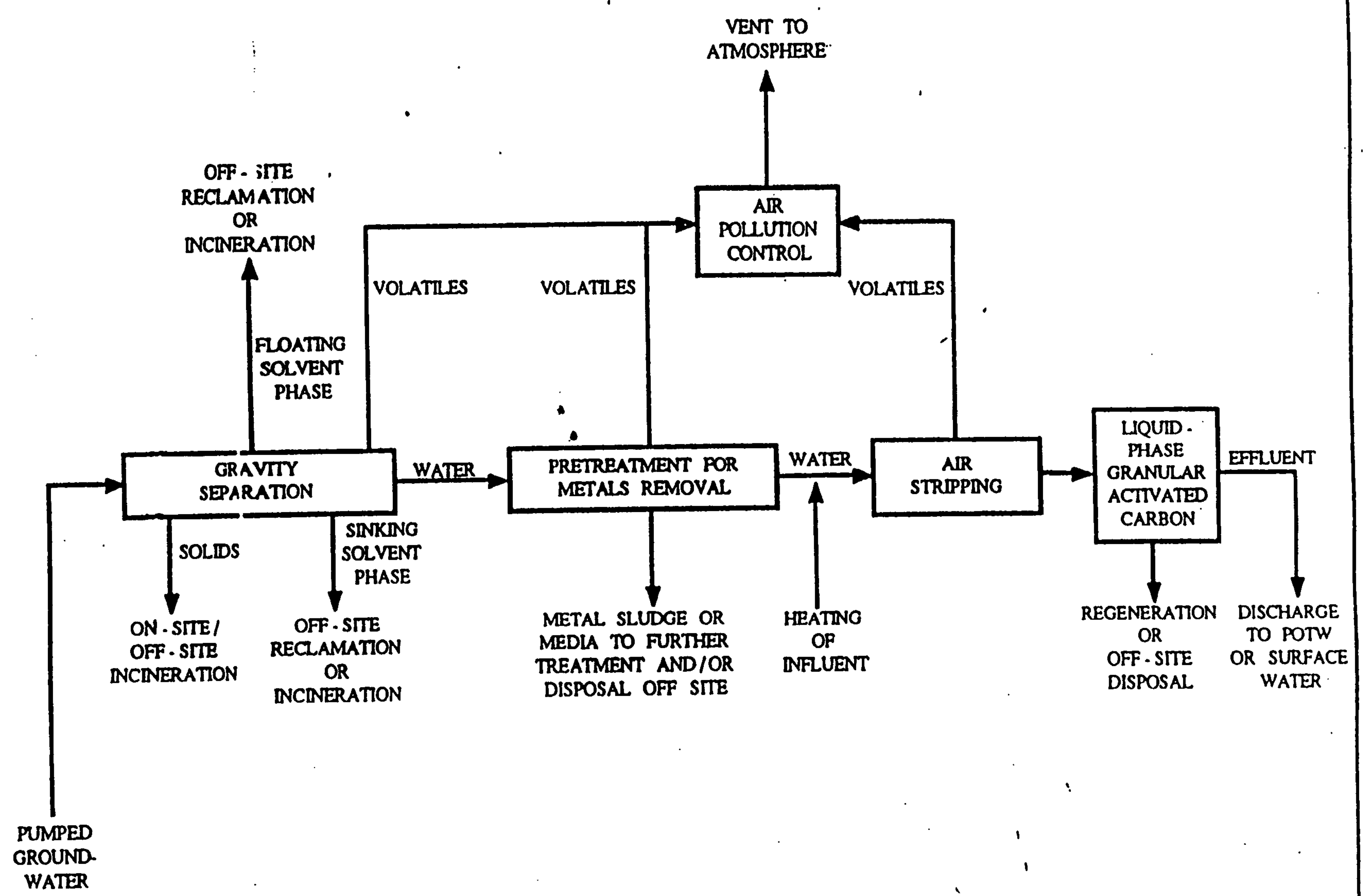
1) WATER TABLE ELEVATIONS TO BE DETERMINED IN THE FIELD BASED ON DEPTH AT WHICH SATURATED SOIL IS ENCOUNTERED.

N.T.S.

SILRESIM SITE LOWELL, MASS.	CONCEPTUAL CROSS SECT OF VACUUM/VAPOR EXTRACTION TRENCH FIGURE 8



SILRESIM SITE LOWELL, MASS.	SITE PLAN - ALTERNATIVE SC-4 VACUUM/VAPOR EXTRACTION STABILIZATION/SOLIDIFICATION AND DISPOSAL ON-SITE FIGURE 9



SILRESIM SITE
LOWELL, MASS

CONCEPTUAL BLOCK FLOW DIAGRAM
REMEDIAL ALTERNATIVE MM-2

FIGURE NO.10

APPENDIX B

TABLES

TABLE 1
SILRESIM SITE
CONTAMINANTS OF CONCERN

Contaminants of Concern	Groundwater/ Surface Water	Soils	Vent Emissions	Indoor Air
Acetone				X
Arsenic	X	X		
Benzene	X	X	X	X
Bis(2-ethylhexyl)phthalate	X	X		
2-Butanone	X			
Carbon Tetrachloride	X		X	X
Chlorobenzene	X	X		
Chloroform	X	X	X	X
Chromium	X	X		
Copper		X		
1,1-Dichloroethane			X	X
1,2-Dichloroethane	X	X	X	
1,1-Dichloroethene	X	X	X	X
1,2-Dichloroethene			X	
Dioxins		X		
Ethylbenzene				X
Lead		X		
Methylene Chloride	X	X	X	X
Mercury		X		
Nickel	X			
PAHs		X		
PCBs		X		
Phenol	X			
Selenium		X		
Styrene		X		
Tetrachloroethene			X	X
1,1,2,2-Tetrachloroethane	X	X		
Toluene	X	X		X
1,2,4-Trichlorobenzene	X	X		
1,1,1-Trichloroethane	X	X	X	X
Trichloroethene	X	X	X	X
Trichlorofloromethane				X
Xylenes				X

TABLE 2
SILRESIM SITE
INTERIM GROUND WATER CLEANUP LEVELS

Carcinogenic Contaminants of Concern	Cleanup Level (ppb)	Basis	Level of Risk
Arsenic	50	MCL	2E-04[b]
Benzene	5	MCL	4E-06
Bis(2-ethylhexyl)phthalate	4	pMCL[a]	2E-06
Carbon Tetrachloride	5	MCL	2E-05
Chloroform	100	MCL	2E-05
1,1-Dichloroethene	7	MCL	1E-04
1,2-Dichloroethane	5	MCL	1E-05
1,2-Dichloropropane[i]	5	MCL	1E-05
Dioxin[h]	5E-08	pMCL[c]	2E-04
Hexachlorobenzene[i]	1	pMCL	5E-05
Methylene Chloride	5	pMCL	1E-06
PAHs (B(a)P)[h]	.2	pMCL	7E-05
PCBs[h]	.5	MCL	1E-04
Styrene[h]	100	MCLG[d]	9E-05
1,1,2,2-Tetrachloroethane	5	PQL[f]	3E-05
1,1,2-Trichloroethane[i]	5	pMCL	8E-06
Trichloroethene	5	MCL	2E-06
		SUM	9E-04

Non-carcinogenic Contaminants of Concern	Cleanup Level (ppb)	Basis	Target Endpoint of Toxicity	Hazard Quotient
2-Butanone	350	GWS[g]	fetotoxicity	0.2
Cadmium[i]	5	MCLG	kidney	0.3
Chlorobenzene	100	MCLG	liver/kidney	0.2
Chromium (trivalent)	100	MCLG	liver	0.003
Copper[i]	1,300	pMCLG[e]	stomach	1.0
1,2-Dichlorobenzene[i]	600	MCLG	liver	0.2
Trans-1,2-Dichloroethene[i]	100	MCLG	liver	0.2
Ethylbenzene[i]	700	MCLG	liver/kidney	0.2
Lead	15	policy	CNS	[k]
Nickel	100	pMCLG[e]	liver/kidney	0.2
Phenol	21,000	RfD[j]	fetal bdy wt	1.0
Selenium	50	MCLG	hair/nails	0.5
Toluene	1,000	MCLG	lvr/kdny	0.2
1,2,4-Trichlorobenzene	9	pMCLG	liver	0.2
1,1,1-Trichloroethane	200	MCLG	liver	0.06
Xylenes[i]	10,000	MCLG	bdy wt/hyper	0.2

HAZARD INDEX SUM	
liver	1.2
Kidney	0.9
Body Weight	1.4

TABLE 2

a- Maximum Contaminant Level

b - The cleanup level for arsenic in groundwater has been set at the MCL of 50 ppb. The carcinogenic risk posed by arsenic at 50 ppb in groundwater will approximate 2 in 1,000. However, in light of recent studies indicating that many skin tumors arising from oral exposure to arsenic are non-lethal and in light of the possibility that the dose-response curve for the skin cancers may be sublinear (in which case the cancer potency factor used to generate risk estimates will be overstated), it is Agency policy to manage these risks downward by as much as a factor of ten. As a result, the carcinogenic risks for arsenic at this Site have been managed as if they were 2 in 10,000. (See EPA memorandum, "Recommended Agency Policy on the Carcinogenic Risk Associated with the Ingestion of Inorganic Arsenic" dated June 21, 1988.)

c - Proposed Maximum Contaminant Level

d - Maximum Contaminant Level Goal

e - Proposed Maximum Contaminant Level Goal

f - Practical Quantitation Limit

g - Massachusetts Groundwater Standard, 314 CMR 6.07

h - Additional groundwater indicator substance, which has the potential to leach into groundwater.

i - Additional groundwater indicator substance based on Site groundwater exceeding either an MCL, pMCL, MCLG or a pMCLG.

j - Reference Dose - Concentration corresponding to a reference dose.

k - A hazard quotient is not available for lead as EPA has not issued a reference dose for this compound. The cleanup level for lead comes from a June 1990 memorandum from Henry Longest and Bruce Diamond to Patrick Tobin.

TABLE 3
SILRESIM SITE
UNSATURATED SOIL CLEANUP LEVELS

Carcinogenic Contaminants of Concern	Soil Cleanup Level (ppb)	Basis for Model Input	Level of Residual GW Risk
Volatile Organic Compounds			
Benzene	4	MCL	4E-06
Carbon Tetrachloride	5	MCL	2E-05
Chloroform	40	MCL	2E-05
1,1-Dichloroethene	5	MCL	1E-04
1,2-Dichloroethane	1	MCL	1E-05
Methylene Chloride	1	pMCL	1E-06
Styrene	170	MCLG	9E-05
1,1,2,2-Tetrachloroethane	6	PQL	3E-05
1,1,2-Trichloroethane	3	pMCL	8E-06
Trichloroethene	6	MCL	2E-06
Others			
Bis(2-ethylhexyl)phthalate	300	pMCL	2E-06
1,2-Dichloropropane	3	MCL	1E-05
Dioxin	1	pMCL	2E-04
Hexachlorobenzene	34	pMCL	5E-05
PAHs (carcinogenic)	10,000	pMCL	7E-05
PCBs	2,300	MCL	1E-04
		SUM	**7E-04**

Non-carcinogenic Contaminants of Concern	Cleanup Level (ppb)	Basis for Model Input	Target Endpoint of Toxicity	Residual GW Hazard Quotient
Volatile Organic Compounds				
chlorobenzene	300	MCLG	lvr/kdny	0.2
Trans-1,2-Dichlorothene	67	MCLG	liver	0.2
1,1,1-Trichloroethane	300	PQL	liver	0.06
Others				
1,2-Dichlorobenzene	8,900	MCLG	liver	0.2
1,2,4-Trichlorobenzene	720	pMCLG	liver	0.2
Ethylbenzene	6,800	MCLG	lvr/kdny	0.2
Phenol	5,300	RfD	body wt	1.0
Toluene	2,700	MCLG	lvr/kdny	0.2
2-Butanone	60	GWS	fetotox	0.2
Xylenes	22,000	MCLG	bdy-wt/hyper	0.2

SUM HAZARD INDEX

Liver:	1.2
Kidney:	0.6
Body Weight:	1.2

NOTE

a - Specific soil quantitation limits are highly matrix dependent. As such, cleanup levels listed above are subject to the limits of quantitation.

Rfd - Reference Dose

TABLE 4
SILRESIM SITE
SURFICIAL SOIL CLEANUP LEVELS

Carcinogenic Contaminants of Concern	Soil Cleanup Level (ppb)	Basis	Level of Risk
Volatile Organic Compounds			
Benzene	15,000	risk	1E-06
1,1-Dichloroethene	720	risk	1E-06
1,2-Dichloroethane	4,800	risk	1E-06
Methylene Chloride	58,000	risk	1E-06
Styrene	14,000	risk	1E-06
1,1,2,2-Tetrachloroethane	2,200	risk	1E-06
Trichloroethene	40,000	risk	1E-06
Others			
Arsenic	21,000	background	7E-07[a]
Dioxin	1	policy	4E-05
PAHs (carcinogenic)	11,000	background	6E-05
PAHs (total)	29,000	background	6E-05[b]
PCBs	1,000	policy	2E-06
		SUM	1E-04[b]

Non-carcinogenic Contaminant of Concern	Cleanup Level (ppb)	Basis for Model Input	Target Endpoint of Toxicity	Hazard Quotient
Lead	500,000	policy	CNS	[c]

a - Recent studies indicate that many skin tumors arising from oral exposure to arsenic are non-lethal and that the dose-response curve for the skin cancers may be sublinear (in which case the cancer potency factor used to generate risk estimates will be overstated). It is Agency policy to manage these risks downward by as much as a factor of ten. As a result, the carcinogenic risk for arsenic at this Site has been managed as if it were 7×10^{-7}. (See EPA memorandum, "Recommended Agency Policy on the Carcinogenic Risk Associated with the Ingestion of Inorganic Arsenic" dated June 21, 1988.)

b - Total PAH risk is based on the cleanup level of 11,000 for carcinogenic PAHs. Therefore the risk of 6E-05 has only been incorporated once to the sum total risk estimate.

c - The cleanup level for lead is based on OSWER Directive 9355.4-02, "Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites" (9/7/89).

TABLE 5
SILRESIM SITE
SUMMARY OF HAZARD INDICES AND CANCER RISK ESTIMATES

EXPOSURE PATHWAYS	WORST-CASE			MORE-LIKELY CASE		
	CUMULATIVE HAZARD INDEX (acute)	CUMULATIVE HAZARD INDEX (chronic)	CUMULATIVE CANCER RISK	CUMULATIVE HAZARD INDEX (acute)	CUMULATIVE HAZARD INDEX (chronic)	CUMULATIVE CANCER RISK
PRESENT CONDITIONS						
Off-site Surficial Soils						
Former Arrow Carrier Property						
Incidental Ingestion	--	1.1E-01	6.1E-06	--	5.8E-03	1.0E-06
Dermal Absorption	--	1.5E-03	8.0E-06	--	4.2E-04	2.0E-06
		1.1E-01	1.4E-05		6.2E-03	3.0E-06
B & M Railroad Area						
Incidental Ingestion	--	9.0E-01	1.5E-04	--	2.8E-02	6.2E-06
Dermal Absorption	--	1.5E-03	2.9E-05	--	3.0E-04	1.1E-05
		9.0E-01	1.8E-04		2.8E-02	1.7E-05
Southeastern Corner						
Incidental Ingestion	--	6.9E+00	8.0E-04	--	6.4E-02	1.4E-05
Dermal Absorption	--	2.2E+01	2.4E-03	--	1.6E-01	3.3E-05
		2.9E+01	3.2E-03		2.2E-01	4.7E-05
Lowell Iron & Steel Property						
Incidental Ingestion	--	1.5E+00	1.7E-04	--	2.3E-02	2.6E-06
Dermal Absorption	--	2.7E-01	5.9E-04	--	7.2E-02	1.4E-05
		1.8E+00	7.6E-04		9.5E-02	1.7E-05
Dermal Absorption -- Employees	1.9E-02	2.1E-02	6.6E-05	3.8E-03	5.6E-03	3.9E-07
Northeastern Corner						
Incidental Ingestion	--	1.2E-01	1.5E-05	--	2.5E-02	3.5E-06
Dermal Absorption	--	3.3E-03	7.5E-06	--	7.5E-04	4.9E-06
		1.2E-01	2.3E-05		2.6E-02	8.4E-06
Lowell Iron & Steel Basement Seepage						
Inhalation						
Groundwater Seepage	1.4E+02	1.8E+01	1.0E-01	1.2E-02	1.6E-03	4.2E-06
Indoor Air	8.5E-02	1.4E-02	1.5E-05	4.2E-02	3.5E-03	9.3E-07
Direct Contact	--	--	1.1E-05	--	--	--
	1.4E+02	1.8E+01	1.0E-01	5.4E-02	5.1E-03	5.1E-06
On-site Vent Emissions						
Inhalation	--	5.9E-03	4.4E-05	--	5.2E-05	7.8E-07

Table 5

SILRESIM SITE
SUMMARY OF HAZARD INDICES AND CANCER RISK ESTIMATES

EXPOSURE PATHWAYS	WORST-CASE			MORE-LIKELY CASE		
	CUMULATIVE HAZARD INDEX (acute)	CUMULATIVE HAZARD INDEX (chronic)	CUMULATIVE CANCER RISK	CUMULATIVE HAZARD INDEX (acute)	CUMULATIVE HAZARD INDEX (chronic)	CUMULATIVE CANCER RISK
FUTURE CONDITIONS						
On-site Unsaturated Zone Soils						
Incidental Ingestion	7.1E-01	5.3E-01	4.0E-05	2.0E-02	5.8E-03	3.4E-07
Dermal Absorption	1.0E+00	1.7E+00	1.9E-04	5.1E-03	3.6E-02	1.8E-06
	1.7E+00	2.2E+00	2.3E-04	2.5E-02	4.2E-02	2.1E-06
Groundwater as Drinking Water Supply						
Ingestion	—	5.7E+03	5.1E+00	—	1.5E+01	9.8E-03
N. Main Street Residence Basement Seepage						
Inhalation	7.6E+00	1.2E+00	1.7E-02	9.2E-02	1.3E-02	1.5E-05
Sewage Treatment Plant Emissions						
Inhalation	—	1.5E-05	3.6E-07	—	5.1E-06	1.2E-07
Surface Waters						
River Meadow Brook						
Ingestion	7.7E-03	2.6E-04	5.7E-08	2.1E-04	2.5E-06	5.1E-10
Dermal Absorption	1.7E+00	3.9E-02	6.5E-06	2.3E-02	2.8E-04	5.7E-08
	1.7E+00	3.9E-02	6.6E-06	2.3E-02	2.8E-04	5.8E-08
East Pond						
Ingestion	1.1E+00	3.9E-02	8.1E-06	1.1E+00	1.3E-02	2.7E-06
Dermal Absorption	2.4E+02	5.9E+00	1.2E-03	1.2E+02	1.5E+00	3.0E-04
	2.4E+02	5.9E+00	1.2E-03	1.2E+02	1.5E+00	3.0E-04
Concord River						
Ingestion	2.8E-04	4.9E-05	1.0E-08	1.4E-05	1.2E-06	2.4E-10
Dermal Absorption	6.0E-02	1.1E-02	2.3E-06	1.5E-03	1.3E-04	2.6E-08
	6.0E-02	1.1E-02	2.3E-06	1.5E-03	1.3E-04	2.6E-08

TABLE 6

SILRESIM SITE

SUMMARY OF THE INITIAL SCREENING OF SOURCE CONTROL REMEDIAL ALTERNATIVES

Potential Source Control Alternative		Major Components	Retained for Detailed Analysis	Eliminated from Further Consideration
SC-1	Minimal/No Action	1) Site Access Restriction 2) Public Education 3) Monitoring/Reporting 4) Repair and Extend Cover	X	
SC-2	On-Site and Off-Site Cover System	1) Expansion/Upgrade of Cover 2) Site Access Restriction 3) Public Education 4) Monitoring/Reporting	X	
SC-3	Vacuum/Vapor Extraction	1) In Situ Vapor Extraction with Dewatering 2) Soils Consolidation On-Site 3) Expansion/Upgrade of Cover 4) Site Access Restriction 5) Public Education 6) Monitoring/Reporting	X	
SC-4	Vacuum/Vapor Extraction, Stabilization/Solidification, and Disposal On Site	1) In Situ Vapor Extraction with Dewatering 2) Excavation 3) Stabilization/Solidification 4) On-Site Disposal 5) Site Access Restriction 6) Monitoring/Reporting	X	

TABLE 6 (CONT'D)

Potential Source Control Alternative		Major Components	Retained for Detailed Analysis	Eliminated from Further Consideration
SC-5	Vacuum/Vapor Extraction and Off-Site Disposal	1) In Situ Vapor Extraction with Dewatering 2) Excavation 3) Stabilization/Solidification (if necessary) 4) Off-Site Disposal* 5) On-Site Reconsolidation/RCRA Cover for Dioxin Contaminated Soils* 6) Site Access Restriction* 7) Monitoring/Reporting*		X
SC-6	Thermal Desorption and Disposal On Site	1) Excavation 2) Thermal Desorption 3) Stabilization/Solidification (if necessary) 4) On-Site Disposal 5) Site Access Restriction 6) Monitoring/Reporting	X	
SC-7	Thermal Desorption and Off-Site Disposal	1) Excavation 2) Thermal Desorption 3) Stabilization/Solidification (if necessary) 4) Off-Site RCRA Landfill* 5) On-Site Reconsolidation/RCRA Cover for Dioxin Contaminated Soils* 6) Site Access Restriction* 7) Monitoring/Reporting		X

TABLE 6 (CONT'D)

Potential Source Control Alternative	Major Components	Retained for Detailed Analysis	Eliminated from Further Consideration
SC-8 Vacuum/Vapor Extraction, Thermal Desorption, and on-site Disposal	1) In Situ Vapor Extraction with Dewatering 2) Excavation 3) Thermal Desorption 4) Stabilization/Solidification (if necessary) 5) On-Site Disposal 6) Site Access Restriction 7) Monitoring/Reporting		X
SC-9 Vacuum/Vapor Extraction and Thermal Desorption On-Site, and Off-Site Disposal	1) In Situ Vapor Extraction with Dewatering 2) Excavation 3) Thermal Desorption 4) Stabilization/Solidification (if necessary) 5) Off-Site RCRA Landfill* 6) On-Site Reconsolidation/RCRA Cover for Dioxin Contaminated Soils* 7) Site Access Restriction* 8) Monitoring/Reporting*		X
SC-10 Incineration and Disposal On-Site	1) Excavation 2) On-Site Incineration 3) Stabilization/Solidification (if necessary) 4) On-Site Disposal 5) Site Access Restriction 6) Monitoring/Reporting	X	

TABLE 6 (CONT'D)

Potential Source Control Alternative	Major Components	Retained for Detailed Analysis	Eliminated from Further Consideration
SC-11 Vacuum/Vapor Extraction, Incineration, and Disposal On Site	1) In Situ Vapor Extraction with Dewatering 2) Excavation 3) On-Site Incineration 4) Stabilization/Solidification (if necessary) 5) On-Site Disposal 6) Site Access Restriction 7) Monitoring/Reporting	X	
SC-12 Off-Site Incineration	1) Excavation 3) Off-Site Incineration* 4) Stabilization/Solidification (if necessary)* 5) Off-Site RCRA Landfill* 6) On-Site Reconsolidation/RCRA Cover for Dioxin Contaminated Soils* 7) Site Access Restriction* 8) Monitoring/Reporting		X
SC-13 Vacuum/Vapor Extraction and Off-Site Incineration	1) In Situ Vapor Extraction with Dewatering 2) Excavation 3) On-Site Incineration* 4) Stabilization/Solidification (if necessary)* 5) Off-Site RCRA Landfill* 6) On-Site Reconsolidation/RCRA Cover for Dioxin Contaminated Soils* 7) Monitoring/Reporting*		X

TABLE 6 (CONT'D)

Potential Source Control Alternative	Major Components	Retained for Detailed Analysis	Eliminated from Further Consideration
SC-14 Vacuum/Vapor Extraction, Solvent Extraction, and Disposal On Site	1) In Situ Vapor Extraction with Dewatering 2) Excavation 3) Solvent Extraction # 4) Stabilization/Solidification (if necessary) 5) On-Site Disposal 6) Site Access Restriction 7) Monitoring/Reporting	X	
SC-15 Vacuum/Vapor Extraction and Solvent Extraction On Site, and Off-Site Disposal	1) In Situ Vapor Extraction with Dewatering 2) Excavation 3) Solvent Extraction # 4) Stabilization/Solidification (if necessary) 5) Off Site RCRA Landfill	X	

Notes:

1. "*" indicates that these steps would be dependent upon whether or not off-site disposal facilities could be located for dioxin contaminated soils.

2. "#" indicates that the solvent extraction process would include the on-site destruction of the dioxin-containing solvent.

TABLE 7

SILRESIM SITE

SUMMARY OF THE INITIAL SCREENING OF MANAGEMENT OF MIGRATION REMEDIAL ALTERNATIVES

Potential Management of Migration Alternative	Major Components*	Retained for Detailed Analysis	Eliminated from Further Consideration
MM-1 Minimal/No Action	1) Deed/Land Use Restrictions 2) Public Education 3) Monitoring/Reporting	X	
MM-2 Pump and Treat Metals Pretreatment, Air Stripping, and Carbon Adsorption	1) Groundwater Extraction 2) Separation of Non-Aqueous Phases 3) Metals Pretreatment 4) Air Stripping 5) Liquid-Phase Carbon Adsorption 6) Discharge to POTW or Surface Water	X	
MM-3 Pump and Treat by Metals Pretreatment, Steam Stripping, and Carbon Adsorption	1) Groundwater Extraction 2) Separation on Non-Aqeous Phases 3) Metals Pretreatment 4) Steam Stripping 5) Liquid-Phase Carbon Adsorption 6) Discharge to POTW or Surface Water	X	

TABLE 7 (CONT'D)

Potential Management of Migration Alternative	Major Components*	Retained for Detailed Analysis	Eliminated from Further Consideration
MM-4 Pump and Treat by Metals Pretreatment and UV and Chemical Oxidation	1) Groundwater Extraction 2) Separation of Non-Aqueous Phases 3) Metals Pretreatment 4) UV/Chemical Oxidation 6) Discharge to POTW or Surface Water	X	
MM-5 Pump and Treat Off Site	1) Groundwater Extraction 2) Collection 3) Transportation 4) Off-Site Treatment		X

Note:

1. Off-gases from unit operations would be sent to either a vapor-phase carbon adsorption unit or a fume incinerator for control of VOCs.

SILRESIM SITE
TABLE 8
CAPITAL AND O&M COST ESTIMATE
ALTERNATIVE SC-4: VACUUM/VAPOR EXTRACTION, STABILIZATION, AND DISPOSAL ON SITE

Cost Component	Est. Quantity		Unit Cost	Capital Cost (1)	Annual O&M	Present Worth O&M/Replacement 30 years, 10%
I. INSTITUTIONAL ACTIONS						
1. Deed Restrictions				$5,000	-	-
2. Public Education Programs				$40,000		
3. Off-Site Property Use	1	AC	$50,000	$37,000 (3)		
4. Acquisition of Property	4	AC	$50,000	$200,000		
5. Site Security					$87,600(2)	$426,000
Subtotal:				$276,000		$426,000
II. GENERAL & SITE PREPARATION						
1. Site Fencing	875	LF	$13	$11,000	$3,700	$35,000
2. General Site Preparation		LS		$105,000		
2. Site Preparation for Venting		LS		$50,000		
3. VOC Emissions Control				$100,000		
4. Extend & Repair Existing Cap		LS		$87,000	$21,400 (2)	$93,000
5. Site Preparation for Stabilization/Solidification		LS		$84,000 (3)		
6. Strip & Stockpile Existing Cap	7000	CY	$17	$119,000 (3)		
7. Construct RCRA Cap	180000	SF	$10	$1,016,000 (7)	$21,400 (5)	$109,000
8. Restore Off-Site Areas		LS		$28,000 (7)		
9. Reveg./Repave Off-Site Areas	2	AC	$25,000	$28,000 (7)		
10. Additional Soil Analyses				$50,000		
Subtotal:				$1,678,000		$237,000
III. VACUUM/VAPOR EXTRACTION TREATMENT COSTS						
1. Pilot Testing		LS		$139,000		
2. Excavation/Stockpiling Soil from Trenches & Off-Site Areas	17500	CY	$21	$368,000		
3. Pipe Installation	8640	FT	$25	$216,000		
4. Trench Backfill	14400	CY	$10	$144,000		
5. Temporary Cap	2200	SY	$16	$35,000		
6. Equipment Purchase & Installation		LS		$775,000		
7. Construct Treatment Equipment Housing		LS		$50,000		
8. Startup & Debug				$50,000		
9. Operation & Maintenance					$50,000	$471,000
10. Sampling and Analyses					$54,000	$509,000
11. Excess Soil Handling	15000	CY	$6	$90,000		
Subtotal:				$1,867,000		$980,000

TABLE 8

IV. STABILIZATION/SOLIDIFICATION TREATMENT COSTS						
1. Treatability Study				$40,000		
2. Excavate/Stockpile Soil	18200	CY	$21	$237,000 (3)		
3. Treatment Cost	30000	TN	$42	$782,000 (3)		
4. Sampling and Analyses	18200	CY	$4	$45,000 (3)		
5. Monitoring during Treatment		LS		$60,000 (3)		
6. Backfill Treated Soil	18200	CY	$10	$113,000 (3)		
Subtotal:				$1,277,000		$0
V. RESIDUALS HANDLING						
1. Off-Site Disposal of Aqueous Waste (If Required)					$20,000	$189,000
Subtotal:				$0		$189,000
VI. LONG TERM MONITORING & REVIEW						
1. Monitoring & Inspections (6)					$50,000 (4)	$77,000
2. Five Year Reviews					$50,000 (4)	$77,000
Subtotal:				$0		$154,000
CONSTRUCTION SUBTOTAL				$5,098,000		$1,986,000
1. Health and Safety	10%			$510,000		
2. Bid Contingency	10%			$510,000		
3. Scope Contingency	20%			$1,020,000		
CONSTRUCTION TOTAL				$7,138,000		
1. Services During Construction	10%			$714,000		
TOTAL IMPLEMENTATION COST				$7,852,000		
1. Engineering and Design	10%			$785,000		
TOTAL CAPITAL COSTS				$8,637,000		
TOTAL PRESENT WORTH OF ALTERNATIVE:						$10,620,000

NOTES:
1. Capital costs are incurred in year 0 unless otherwise stated. Capital costs for alternatives where treatment technologies do not occur in year 0 represent present worth costs using a discount rate of 10%.
2. Cost is incurred annually for years 1 through 6.
3. Capital cost incurred in year 5.
4. Cost is incurred in years 5, 10, 15, 20, 25 and 30.
5. Cost is incurred annually for years 7 through 30.
6. Soils only. Groundwater monitoring covered under MM alternatives.
7. Cost is incurred in year 6.

TABLE 9

SILRESIM SITE

ALTERNATIVE MM-2: PUMP & TREAT ON-SITE BY
METALS PRETREATMENT, AIR STRIPPING & CARBON ADSORPTION

Cost Component	Est. Quantity	Unit Cost	Capital Cost (1)	Annual O&M	Present Worth O&M/Replacement 30 years, 10%
NSTITUTIONAL ACTIONS					
. Deed Restrictions			$5,000		-
:. Public Education Programs			$40,000		-
Subtotal:			$45,000		$0
GENERAL & SITE PREPARATION					
. Mob/Demob & Site Prep		LS	$50,000		
.. Housing & Utilities		LS	$113,000		
Subtotal:			$163,000		$0
GROUNDWATER EXTRACTION SYSTEM					
. Installation of Wells		LS	$280,000	$20,000	$189,000
.. Well Vaults & Subsurface Piping		LS	$166,000		
. Equipment Purchase & Installation		LS	$96,000	$20,000	$189,000
Subtotal:			$542,000		$378,000
TREATMENT SYSTEM					
. Gravity Separator		LS	$40,000	$2,500	$24,000
.. Fe/Mn Removal System		LS	$100,000	$20,000	$189,000
. Air Stripper with Influent Heater		LS	$450,000	$75,000	$707,000
. Fume Incinerator		LS	$200,000	$35,000	$330,000
. Aqueous Activated Carbon		LS	$100,000	$300,000	$2,828,000
. Process Piping, Valves, Instrumentation, etc.		LS	$510,000	$20,000	$189,000
'. Operating Labor				$180,000	$1,697,000
:. Startup		LS	$40,000		
'. Laboratory Equipment		LS	$30,000	$5,000	$47,000
Subtotal:			$1,470,000		$6,011,000
DISCHARGE SYSTEM					
.. Sewer Connection	150	LF $160	$24,000	$20,000	$189,000
Subtotal:			$24,000		$189,000
RESIDUALS HANDLING					
. Off-Site Disposal				$30,000	$283,000
Subtotal:			$0		$283,000
. LONG TERM MONITORING & REVIEW					
'. Monitoring & Inspections (3)				$36,000	$339,000
2. Five Year Reviews				$50,000 (2)	$77,000
3. Additional Analyses			$36,000		
Subtotal:			$36,000		$416,000

TABLE 9

CONSTRUCTION SUBTOTAL		$2,280,000	$7,277,000
1. Health and Safety	10%	$228,000	
2. Bid Contingency	10%	$228,000	
3. Scope Contingency	20%	$456,000	
CONSTRUCTION TOTAL		$3,192,000	
1. Services During Construction	15%	$479,000	
TOTAL IMPLEMENTATION COST		$3,671,000	
1. Engineering and Design	20%	$734,000	
TOTAL CAPITAL COSTS		$4,405,000	
TOTAL PRESENT WORTH OF ALTERNATIVE:			$11,680,000

NOTES: 1. Capital costs are incurred in Year 0 unless otherwise stated.
2. Takes place every five years.
3. Groundwater only. Soil monitoring is covered in SC alternatives.

TABLE 7

SILRESIM SITE

SUMMARY OF THE INITIAL SCREENING OF MANAGEMENT OF MIGRATION REMEDIAL ALTERNATIVES

Potential Management of Migration Alternative	Major Components*	Retained for Detailed Analysis	Eliminated from Further Consideration
MM-1 Minimal/No Action	1) Deed/Land Use Restrictions 2) Public Education 3) Monitoring/Reporting	X	
MM-2 Pump and Treat Metals Pretreatment, Air Stripping, and Carbon Adsorption	1) Groundwater Extraction 2) Separation of Non-Aqueous Phases 3) Metals Pretreatment 4) Air Stripping 5) Liquid-Phase Carbon Adsorption 6) Discharge to POTW or Surface Water	X	
MM-3 Pump and Treat by Metals Pretreatment, Steam Stripping, and Carbon Adsorption	1) Groundwater Extraction 2) Separation on Non-Aqeous Phases 3) Metals Pretreatment 4) Steam Stripping 5) Liquid-Phase Carbon Adsorption 6) Discharge to POTW or Surface Water	X	

TABLE 7 (CONT'D)

Potential Management of Migration Alternative	Major Components*	Retained for Detailed Analysis	Eliminated from Further Consideration
MM-4 Pump and Treat by Metals Pretreatment and UV and Chemical Oxidation	1) Groundwater Extraction 2) Separation of Non-Aqueous Phases 3) Metals Pretreatment 4) UV/Chemical Oxidation 6) Discharge to POTW or Surface Water	X	
MM-5 Pump and Treat Off Site	1) Groundwater Extraction 2) Collection 3) Transportation 4) Off-Site Treatment		X

Note:

1. Off-gases from unit operations would be sent to either a vapor-phase carbon adsorption unit or a fume incinerator for control of VOCs.

SILRESIM SITE
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ALTERNATIVE SC-4: VACUUM/VAPOR EXTRACTION, STABILIZATION, AND DISPOSAL ON SITE

Cost Component	Est. Quantity		Unit Cost	Capital Cost (1)	Annual O&M	Present Worth O&M/Replacement 30 years, 10%
I. INSTITUTIONAL ACTIONS						
1. Deed Restrictions				$5,000		-
2. Public Education Programs				$40,000	-	
3. Off-Site Property Use	1	AC	$50,000	$37,000 (3)		
4. Acquisition of Property	4	AC	$50,000	$200,000		
5. Site Security					$87,600(2)	$426,000
Subtotal:				$276,000		$426,000
II. GENERAL & SITE PREPARATION						
1. Site Fencing	875	LF	$13	$11,000	$3,700	$35,000
2. General Site Preparation		LS		$105,000		
2. Site Preparation for Venting		LS		$50,000		
3. VOC Emissions Control				$100,000		
4. Extend & Repair Existing Cap		LS		$87,000	$21,400 (2)	$93,000
5. Site Preparation for Stabilization/Solidification		LS		$84,000 (3)		
6. Strip & Stockpile Existing Cap	7000	CY	$17	$119,000 (3)		
7. Construct RCRA Cap	180000	SF	$10	$1,016,000 (7)	$21,400 (5)	$109,00
8. Restore Off-Site Areas		LS		$28,000 (7)		
9. Reveg./Repave Off-Site Areas	2	AC	$25,000	$28,000 (7)		
10. Additional Soil Analyses				$50,000		
Subtotal:				$1,678,000		$237,000
III. VACUUM/VAPOR EXTRACTION TREATMENT COSTS						
1. Pilot Testing		LS		$139,000		
2. Excavation/Stockpiling Soil from Trenches & Off-Site Areas	17500	CY	$21	$368,000		
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6. Equipment Purchase & Installation		LS		$775,000		
7. Construct Treatment Equipment Housing		LS		$50,000		
8. Startup & Debug				$50,000		
9. Operation & Maintenance					$50,000	$471,000
10. Sampling and Analyses					$54,000	$509,000
11. Excess Soil Handling	15000	CY	$6	$90,000		
Subtotal:				$1,867,000		$980,000

TABLE 8

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1. Treatability Study		$40,000		
2. Excavate/Stockpile Soil	18200 CY $21	$237,000 (3)		
3. Treatment Cost	30000 TN $42	$782,000 (3)		
4. Sampling and Analyses	18200 CY $4	$45,000 (3)		
5. Monitoring during Treatment	LS	$60,000 (3)		
6. Backfill Treated Soil	18200 CY $10	$113,000 (3)		
Subtotal:		$1,277,000		$0
V. RESIDUALS HANDLING				
1. Off-Site Disposal of Aqueous Waste (If Required)			$20,000	$189,000
Subtotal:		$0		$189,000
VI. LONG TERM MONITORING & REVIEW				
1. Monitoring & Inspections (6)			$50,000 (4)	$77,000
2. Five Year Reviews			$50,000 (4)	$77,000
Subtotal:		$0		$154,000
CONSTRUCTION SUBTOTAL		$5,098,000		$1,986,000
1. Health and Safety	10%	$510,000		
2. Bid Contingency	10%	$510,000		
3. Scope Contingency	20%	$1,020,000		
CONSTRUCTION TOTAL		$7,138,000		
1. Services During Construction	10%	$714,000		
TOTAL IMPLEMENTATION COST		$7,852,000		
1. Engineering and Design	10%	$785,000		
TOTAL CAPITAL COSTS		$8,637,000		
TOTAL PRESENT WORTH OF ALTERNATIVE:				$10,620,000

NOTES: 1. Capital costs are incurred in year 0 unless otherwise stated.
Capital costs for alternatives where treatment technologies do not occur in year 0 represent present worth costs using a discount rate of 10%.
2. Cost is incurred annually for years 1 through 6.
3. Capital cost incurred in year 5.
4. Cost is incurred in years 5, 10, 15, 20, 25 and 30.
5. Cost is incurred annually for years 7 through 30.
6. Soils only. Groundwater monitoring covered under MM alternatives.
7. Cost is incurred in year 6.

TABLE 9

SILRESIM SITE

ALTERNATIVE MM-2: PUMP & TREAT ON-SITE BY
METALS PRETREATMENT, AIR STRIPPING & CARBON ADSORPTION

Cost Component	Est. Quantity	Unit Cost	Capital Cost (1)	Annual O&M	Present Worth O&M/Replacement 30 years, 10%
I. INSTITUTIONAL ACTIONS					
1. Deed Restrictions			$5,000		
2. Public Education Programs			$40,000		
Subtotal:			$45,000		$0
II. GENERAL & SITE PREPARATION					
1. Mob/Demob & Site Prep	LS		$50,000		
2. Housing & Utilities	LS		$113,000		
Subtotal:			$163,000		$0
III. GROUNDWATER EXTRACTION SYSTEM					
1. Installation of Wells	LS		$280,000	$20,000	$189,000
2. Well Vaults & Subsurface Piping	LS		$166,000		
3. Equipment Purchase & Installation	LS		$96,000	$20,000	$189,000
Subtotal:			$542,000		$378,000
IV. TREATMENT SYSTEM					
1. Gravity Separator	LS		$40,000	$2,500	$24,000
2. Fe/Mn Removal System	LS		$100,000	$20,000	$189,000
3. Air Stripper with Influent Heater	LS		$450,000	$75,000	$707,000
4. Fume Incinerator	LS		$200,000	$35,000	$330,000
5. Aqueous Activated Carbon	LS		$100,000	$300,000	$2,828,000
6. Process Piping, Valves, Instrumentation, etc.	LS		$510,000	$20,000	$189,000
7. Operating Labor				$180,000	$1,697,000
8. Startup	LS		$40,000		
9. Laboratory Equipment	LS		$30,000	$5,000	$47,000
Subtotal:			$1,470,000		$6,011,000
V. DISCHARGE SYSTEM					
1. Sewer Connection	150 LF	$160	$24,000	$20,000	$189,000
Subtotal:			$24,000		$189,000
VI. RESIDUALS HANDLING					
1. Off-Site Disposal				$30,000	$283,000
Subtotal:			$0		$283,000
VII. LONG TERM MONITORING & REVIEW					
1. Monitoring & Inspections (3)	—			$36,000	$339,000
2. Five Year Reviews				$50,000 (2)	$77,000
3. Additional Analyses			$36,000		
Subtotal:			$36,000		$416,000

TABLE 9

CONSTRUCTION SUBTOTAL		$2,280,000	$7,277,000
1. Health and Safety	10%	$228,000	
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CONSTRUCTION TOTAL		$3,192,000	
1. Services During Construction	15%	$479,000	
TOTAL IMPLEMENTATION COST		$3,671,000	
1. Engineering and Design	20%	$734,000	
TOTAL CAPITAL COSTS		$4,405,000	
TOTAL PRESENT WORTH OF ALTERNATIVE:			$11,680,000

NOTES: 1. Capital costs are incurred in Year 0 unless otherwise stated.
2. Takes place every five years.
3. Groundwater only. Soil monitoring is covered in SC alternatives.

APPENDIX C

ARARS TABLES

Chemical-Specific ARARs, Criteria, Advisories, and Guidance

Medium	Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Groundwater	Federal Safe Drinking Water Act (SDWA) National Primary Drinking Water Regulations (NPDWR) — 40 CFR 141	Relevant and Appropriate	Maximum Contaminant Levels (MCLs) are enforceable standards that are applicable to drinking water supplies. MCLs are relevant and appropriate for groundwater that may be a potential source of drinking water.	Groundwater at and beyond the point of compliance will attain MCLs at the completion of the remedy (or will be waived on the grounds of technical impracticability). These levels will be attained by the capture and treatment of contaminated groundwater in the plume.
	Federal-RCRA-MCLs — 40 CFR Part 264.94	Relevant and Appropriate	MCLs have been adopted as part of RCRA groundwater protection standards. These standards are equal to MCLS established under NPDWR, SDWA.	Groundwater at and beyond the point of compliance will attain MCLs at the completion of the remedy (or will be waived on the grounds of technical impracticability). These levels will be attained by the capture and treatment of contaminated groundwater in the plume.
	Massachusetts Groundwater Quality Standards — 314 CMR 6.00	Applicable	These standards consist of groundwater classifications, which designate and assign uses for which groundwater shall be maintained and protected; water quality criteria necessary to sustain the designated uses; and regulations to achieve the designated uses or maintain the existing groundwater quality.	Massachusetts groundwater quality standards for Class I groundwater will be met at the compliance point (or be waived on the grounds of technical impracticability). These standards will be met by the capture and treatment of contaminated groundwater in the plume.

Chemical-Specific ARARs, Criteria, Advisories, and Guidance
(cont'd)

Medium	Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Groundwater (cont'd)	Massachusetts Drinking Water Regulations — 310 CMR 22.00	Relevant and Appropriate	Massachusetts Drinking Water Regulations include Massachusetts Maximum Contaminant Levels (MMCLs). If MMCLs are more stringent they will supersede federal MCLs.	MMCLs for compounds detected at Silresim are federal MCLs adopted by MA DEP and will be met at the compliance points (or waived). These levels will be met by the capture and treatment of contaminated groundwater in the plume.
	Federal SDWA, NPDWR — 40 CFR 141	To Be Considered	Proposed MCLs may become potential ARARs, when promulgated, and are considered in the absence of MCLs	Proposed MCLs will be attained at the point of compliance (or be waived on the grounds of technical impracticability) at the completion of the remedy. These standards will be met by the capture and treatment of contaminated groundwater in the plume.
	EPA Reference Doses (RfD) for Noncarcinogens	To Be Considered	Reference doses and standard exposure assumptions for body weight and daily drinking water ingestion rate are used to derive cleanup goals protective of noncarcinogenic effects.	EPA Reference Doses will be met at and beyond the compliance point (or be waived based on technical impracticability).
	EPA Lifetime Health Advisories (HAs), Office of Drinking Water	To Be Considered	Nonregulatory concentration limits for contaminants in drinking water that are considered protective of adverse non-carcinogenic health effects over a lifetime.	Lifetime HAs will be met at and beyond the compliance point (or be waived based on technical impracticability).

Chemical-Specific ARARs, Criteria, Advisories, and Guidance
(cont'd)

Medium	Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Groundwater (cont'd)	SDWA Maximum Contaminant Level Goals (MCLGs) and proposed MCLGs	To Be Considered	MCLGs are set with a margin of safety at levels that would result in no known or anticipated adverse health effects over a lifetime.	Non-zero MCLGs and proposed MCLGs will be met at and beyond the compliance point (or be waived based on technical impracticability).
	Massachusetts Office of Research and Standards Drinking Water Guidelines (ORSGLs)	To Be Considered	Guidance for chemicals other than those with MMCLs in drinking water.	When other federal and state standards are not available, ORSGL standards will be met at and beyond the compliance point (or be waived based on technical impracticability).
Surface Water	Massachusetts Surface Water Discharge Permit Requirements — 314 CMR 3.00	Relevant and Appropriate	Standards regulate discharges of pollutants to surface waters, outlets for such discharges and any treatment works associated with these discharges.	Groundwater will be extracted and treated in conformance with Massachusetts surface water discharge permit requirements.
	Massachusetts Operation and Maintenance and Pretreatment Standards for Wastewater Treatment Works and Indirect Discharge — 314 CMR 12.00	Applicable	Regulations to ensure proper operation and maintenance of wastewater treatment facilities and sewer systems within the Commonwealth.	Remedial activities will comply with all provisions of this regulation.
	Federal Clean Water Act (CWA) — Federal Ambient Water Quality Criteria (FAWQC)	To Be Considered	FAWQC are non-regulatory concentrations for the protection of aquatic life, and of human health from water ingestion and fish consumption.	Groundwater will be extracted and treated to prevent exceedance of these criteria.

Chemical-Specific ARARs, Criteria, Advisories, and Guidance
(cont'd)

Medium	Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Air	Massachusetts Ambient Air Quality Standards — 310 CMR 6.00	Relevant and Appropriate	Regulations specify primary and secondary ambient air quality standards to protect public health and welfare for certain pollutants.	Mitigative measures will be taken to control fugitive dust released during excavation and construction activities. A thermal oxidizer will be used to control air emissions from the groundwater and soil treatment systems.
	Massachusetts Air Pollution Control Regulations — 310 CMR 7.01 and 7.02(2)(a)	Applicable	Regulations pertain to the prevention of emissions in excess of Massachusetts or national ambient air quality standards or in excess of emission limitations in those regulations.	A thermal oxidizer will be used as the best available control technology to control air emissions from the groundwater and soil treatment systems. Mitigative measures will be taken to control emissions from excavation activities.
	310 CMR 7.06	Applicable	Regulations specify requirements to prevent visible emissions, not to exceed the criteria set forth in the regulations.	Adequate controls will be utilized to meet these requirements.
	310 CMR 7.09	Applicable	Regulations specify requirements to prevent dust and odors — generated during remedial actions — which contribute to air pollution.	Adequate controls will be utilized to meet these requirements.
	310 CMR 7.10	Applicable	Regulations specify requirements on construction equipment to suppress sound. Massachusetts DEP policy requires that the site perimeter noise levels not exceed 10 decibels above ambient noise levels.	Mitigative measures will be used to reduce noise levels to below the regulated level.

Chemical-Specific ARARs, Criteria, Advisories, and Guidance
(cont'd)

Medium	Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Air (cont'd)	Massachusetts Air Pollution Control Regulations (cont'd) — 310 CMR 7.18	Applicable	Regulations specify requirements on emissions over 100 tons per year.	A thermal oxidizer will be used as the best available control technology to control air emissions from the groundwater and soil treatment systems. Mitigative measures will be taken to control emissions from excavation activities.
	Massachusetts Prevention and/or Abatement of Air Pollution Episode and Air Pollution Incident Emergencies 310 CMR 8.00	Relevant and Appropriate	Regulations specify requirements to prevent ambient air contaminant concentrations of any location from reaching levels which would constitute significant harm or imminent and substantial endangerment to public health.	Mitigative measures will be taken to control fugitive dust released during excavation and construction activities. A thermal oxidizer will be used to control air emissions from the groundwater and soil treatment systems.
	Clean Air Act (CAA) NAAQS for Total Suspended Particulates — 40 CFR 50	Relevant and Appropriate	Regulation specifies maximum primary and secondary 24-hour concentrations. Fugitive dust emissions from site excavation must be below a 24-hour average of 150 $\mu g/m^3$ for particles having a mean diameter of 10 microns or less.	Fugitive dust emissions will be controlled during excavation and construction activities to maintain concentration below these levels.
	NAAQS for Hazardous Air Pollutants — 40 CFR 1 to 99	Relevant and Appropriate	Regulations specify amounts of emissions for pollutants such as NO_x, SO_2, CO, lead, mercury, and particulates for stationary sources.	Proper design considerations will be implemented to control emissions from groundwater and soil treatments as appropriate.

Chemical-Specific ARARs, Criteria, Advisories, and Guidance
(cont'd)

Medium	Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Air (cont'd)	American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLVs), Time Weighted Average (TWAs), and Short-Term Exposure Limit (STELs)	To Be Considered	TLVs are issued as criteria for controlling air quality for occupational settings. STELs are fifteen minute time-weighted concentrations. TWAs are based on an 8-hour per day, 40-hour work week.	TLV-TWAs and TLV-STELs will be met in the basement of Lowell Iron and Steel's operational facility through the capture and treatment of contaminated groundwater in the northern plume.
	Massachusetts Allowable Ambient Limits (AALs) and Threshold Effects Exposure Limits (TELs)	To Be Considered	Chemical-specific ambient air limits based on health data.	TELs and AALs will be met at the Duck Island sewerage treatment plant and neighboring residential area (if selected as the groundwater discharge location) through the capture and treatment of groundwater prior to discharge. These standards will also be met on-site through soil and groundwater treatment.
Soil	EPA Directive for PCBs (OSWER Directive 9355.4-01)	To Be Considered	Guidance on remedial action for Superfund Sites with PCB contamination recommends a soil action level of 1 mg/kg for residential land use and 10 to 25 mg/kg for industrial land use.	All soil with PCBs above the recommended levels will be excavated, stabilized, and capped on-site to prevent exposure.
	EPA Directive for Lead (OSWER Directive 9355.4-02)	To Be Considered	Interim guidance on establishing soil lead cleanup levels of Superfund Sites recommends a concentration of total lead of 500 to 1,000 mg/kg.	All soil with lead above the recommended levels will be excavated, stabilized, and capped on-site to prevent exposure.

Chemical-Specific ARARs, Criteria, Advisories, and Guidance
(cont'd)

Medium	Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Soil (cont'd)	EPA Reference Doses (RfD) for Noncarcinogens	To Be Considered	Reference doses and standard exposure assumptions for body weight and daily soil contact and ingestion rates are used to derive concentration of compound protective of noncarcinogenic effects.	EPA Reference Doses for some Silresim indicator compounds (VOCs, some semi-VOCs) will be met through vacuum extraction treatment of the soil. All soil with levels of the remaining target compounds exceeding the RfDs will be excavated, stabilized, and capped on-site within the point of compliance.
	Agency for Toxic Substances and Disease Registry (ATSDR) Recommendation for Dioxins	To Be Considered	A level for residential soils contaminated with dioxins (as 2,3,7,8-TCDD equivalents) of 0.001 mg/kg is recommended.	All soil with levels of dioxin exceeding 1 ppb outside of the point of compliance will be excavated, stabilized, and capped on-site to prevent exposure.

Location-Specific ARARs, Criteria, Advisories, and Guidance

Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Massachusetts Wetland Protection Act (WPA) Regulations — 310 CMR 10.00	Applicable	These regulations include standards on dredging, filling, altering, or polluting inland wetlands. Work within 100 feet of a wetland is regulated under these requirements.	All work, including installation of groundwater monitoring wells, to be performed within the 100-foot buffer zone will be done in accordance with these regulations.
Massachusetts Hazardous Waste Facility Siting Regulations — 990 CMR 1.00	Relevant and Appropriate	Requirements for the expeditious and safe siting of hazardous waste facilities in the Commonwealth, which include controls on the construction, operation, and maintenance of new facilities for storage treatment or disposal of hazardous waste.	Any remedial activities to occur within the 100-foot buffer zone of East Pond will meet these requirements.

Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Federal			
Clean Air Act (CAA) NAAQS for Total Suspended Particulates — 40 CFR 50	Relevant and Appropriate	Regulation specifies maximum primary and secondary 24-hour concentrations. Fugitive dust emissions from site excavation must be below a 24-hour average of 150 $\mu g/m^3$ for particles having a mean diameter of 10 microns or less.	Fugitive dust emissions will be controlled during excavation and construction activities to maintain concentration below these levels.
NAAQS for Hazardous Air Pollutants — 40 CFR 1 to 99	Relevant and Appropriate	Regulations specify amounts of emissions for pollutants such as NO_x, SO_2, CO, lead, mercury, and particulates for stationary sources.	Proper design considerations will be implemented to control emissions from groundwater and soil treatments as appropriate.
Clean Water Act (CWA) National Pollution Discharge Elimination System (NPDES) — 40 CFR 122 and 125	Applicable	Regulations for discharges into public surface waters.	If River Meadow Brook is selected as the discharge location for treated groundwater, the requirements of the NPDES program will be met, including the effluent standards, monitoring and testing, and standard and special conditions for discharge. Discharges to the Duck Island treatment plant will also meet the substantive and administrative provisions of NPDES, if selected.
General Pretreatment Regulations for Existing and New Sources of Pollution — 40 CFR 403	Applicable	Regulations for discharges of pollutants to POTW and specification of pretreatment standards for these discharges.	Requirements for discharges to Duck Island Treatment Plant and pretreatment standards for discharges will be met if the POTW is selected for discharge of treated groundwater.

Action-Specific Potential ARARs and Criteria to be Considered (TBCs)
(cont'd)

Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Fish and Wildlife Coordination Act — 16 USC 661	Applicable	Requires the notification of the appropriate State agency exercising jurisdiction over Wildlife Resources and U.S. Fish and Wildlife Service when undertaking any Federal action that modifies any body of water or affects fish and wildlife.	If treated groundwater is discharged to River Meadow Brook, it will be done so as to minimize adverse impacts on fish and wildlife, and Federal and State agencies listed in this statute will be notified and consulted during remedial design if any adverse impacts are anticipated.
Resource Conservation and Recovery Act (RCRA) Subtitle C, 40 CFR 260	Relevant and Appropriate	RCRA regulates the generation, transport, storage, treatment and disposal of hazardous waste.	All excavation, storage, treatment, and disposal activities will be designed and implemented in accordance with the RCRA regulations.
40 CFR 264 Subpart C — Preparedness and Prevention (40 CFR 264.30-264.37)	Relevant and Appropriate	Requirements to minimize the possibility of fires, explosions, and unplanned releases of waste during design, construction, and operation of TSD facilities.	Safety and communication equipment will be installed at the site; local authorities will be familiarized with site operations and construction activities will be conducted to prevent any type of spillage or contaminated runoff from leaving the site.
Subpart D — Contingency Plan and Emergency Procedures (40 CFR 264.50-264.56)	Relevant and Appropriate	Requirements for emergency procedures such as explosions and fires, including a contingency plan identifying procedures to be followed.	Plans will be developed and implemented during site work, including implementation of site remedies and long-term monitoring activities. Copies of the plans will be kept on site.

Action-Specific Potential ARARs and Criteria to be Considered (TBCs)
(cont'd)

Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
40 CFR 264 (cont'd)			
Subpart F — Groundwater Protection (40 CFR 264.90-264.101)	Relevant and Appropriate	Requirements for groundwater monitoring program for the site.	A groundwater monitoring program will be designed, installed, and implemented to evaluate and measure groundwater contamination at and beyond the point of compliance, will meet the substantive standards of this regulation.
Subpart G — Closure and Post-Closure (40 CFR 264.110-264.120)	Relevant and Appropriate	Requirement for closure and post-closure of hazardous waste facilities.	Treated soils will be monitored to ensure that they can be disposed of on site without further treatment. A post-closure monitoring program will be implemented.
Subpart L — Waste Piles (40 CFR 264.250-264.259)	Relevant and Appropriate	Regulations for the storage and treatment of hazardous waste in piles, including protection from precipitation, surface runoff, and wind erosion.	Drainage and erosion control structures will be placed prior to excavation. Excavated soils will be stored in compliance with all substantive provisions of this regulation.
Subpart N — Landfills (40 CFR 264.300-264.317)	Relevant and Appropriate	Design and construction requirements for placement of a cap over waste.	The cap will be designed and constructed to conform to RCRA standards to primarily eliminate direct contact and reduce infiltration of rainwater. The cap and surrounding area will be graded to control run-on and run-off.
40 CFR 268 Land Disposal Restrictions	Relevant and Appropriate	Regulations specify requirements for disposal of hazardous waste.	LDRs for RCRA hazardous substances at the site will be met through soil treatment. To ensure that LDRs have been met, the soil will be tested following treatment.

Action-Specific Potential ARARs and Criteria to be Considered (TBCs)
(cont'd)

Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Toxic Substances Control Act (TSCA) — 40 CFR 761	Applicable	Establishes treatment requirements, including incineration and disposal for PCB-contaminated materials, including soils.	TSCA disposal requirements for PCBs will be met by waiving certain requirements of the chemical waste landfill regulations. Provisions to be waived are sections 761.75(b)(1), construction of a landfill in low permeable clay conditions; 761.75(b)(2), use of a synthetic membrane liner; and 761.75(b)(3), the bottom of the landfill being 50 feet above the historic high water table. EPA has determined that the excavation, stabilization, and capping of PCB-contaminated soil will provide a permanent and protective remedy that satisfies the part 761 landfill requirements.
State Massachusetts Ambient Air Quality Standards — 310 CMR 6.00	Relevant and Appropriate	Regulations specify primary and secondary ambient air quality standards to protect public health and welfare for certain pollutants.	Mitigative measures will be taken to control fugitive dust released during excavation and construction activities. A thermal oxidizer will be used to control air emissions from the groundwater and soil treatment systems.
Massachusetts Air Pollution Control Regulations — 310 CMR 7.01 and 7.02(2)(a)	Applicable	Regulations pertain to the prevention of emissions in excess of Massachusetts or national ambient air quality standards or in excess of emission limitations in those regulations.	A thermal oxidizer will be used as the best available control technology to control air emissions from the groundwater and soil treatment systems. Mitigative measures will be taken to control emissions from excavation activities.

Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Massachusetts Air Pollution Control Regulations (cont'd)			
310 CMR 7.06	Applicable	Regulations specify requirements to prevent visible emissions, not to exceed the criteria set forth in the regulations.	Adequate controls will be utilized to meet these requirements.
310 CMR 7.09	Applicable	Regulations specify requirements to prevent dust and odors — generated during remedial actions — which contribute to air pollution.	Adequate controls will be utilized to meet these requirements.
310 CMR 7.10	Applicable	Regulations specify requirements on construction equipment to suppress sound.	Mitigative measures will be used to reduce noise levels to below the regulated level.
310 CMR 7.18	Applicable	Regulations specify requirements on emissions over 100 tons per year.	A thermal oxidizer will be used as the best available control technology to control air emissions from the groundwater and soil treatment systems. Mitigative measures will be taken to control emissions from excavation activities.
Massachusetts Prevention and/or Abatement of Air Pollution Episode and Air Pollution Incident Emergencies — 310 CMR 8.00	Relevant and Appropriate	Regulations specify requirements to prevent ambient air contaminant concentrations of any location from reaching levels which would constitute significant harm or imminent and substantial endangerment to public health.	Mitigative measures will be taken to control fugitive dust released during excavation and construction activities. A thermal oxidizer will be used to control air emissions from the groundwater and soil treatment systems.
Policy, *Controls of Volatile Organic Compound (VOC) Emissions from Air Strippers which are used to treat Contaminated Groundwater*	To Be Considered	Requirements which specify the use of a vapor phase granular activated carbon on air emissions.	Adequate controls will be utilized to meet these requirements.

Action-Specific Potential ARARs and Criteria to be Considered (TBCs)
(cont'd)

Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Massachusetts Hazardous Waste Regulations — 310 CMR 30.00		Regulations for handling, storage treatment, disposal, and recordkeeping at hazardous waste facilities.	Substantive requirements of all relevant and appropriate Massachusetts requirements will be met through proper design and implementation.
310 CMR 30.500 and 30.561	Relevant and Appropriate	Requirements specifically pertaining to the construction and long-term operation of a treatment system.	
310 CMR 30.580	Relevant and Appropriate	Requirements specifically pertaining to on-site treatment or long-term storage of hazardous waste.	
310 CMR 30.590	Relevant and Appropriate	Requirements specifically pertaining to monitoring, maintenance, and security of wastes left on-site following treatment.	
310 CMR 30.620 to 30.633	Relevant and Appropriate	Requirements specifically pertaining to the cap for RCRA closure.	
310 CMR 30.640	Relevant and Appropriate	Requirements for the construction and operation and closure of waste piles.	
310 CMR 30.660	Relevant and Appropriate	Requirements for the protection of groundwater appropriate to hazardous waste treatment units.	
310 CMR 30.680 and 30.690	Applicable	Requirements that pertain to above ground storage containers and tanks used to treat or store hazardous waste.	All tanks and containers used on-site will meet the applicable requirements.
Massachusetts RIGHT TO KNOW — 105 CMR 670.00	Relevant and Appropriate	Requirements for the transmission of health and safety information to the public and workers concerning toxic and hazardous substances.	Appropriate notification requirements will be met.
Massachusetts RIGHT TO KNOW — 554 CMR 21.00	Relevant and Appropriate	Requirements for the disclosure of information regarding toxic and hazardous substances to DEP and workers.	Appropriate notification requirements will be met.
Massachusetts Hazardous Waste Activity Notification — 310 CMR 33.00)	Relevant and Appropriate	Regulations establish rules and requirements for the distribution of information related to toxic and hazardous substances to the public.	Appropriate notification requirements will be followed.

Action-Specific Potential ARARs and Criteria to be Considered (TBCs)

(cont'd)

Requirement	Status	Summary of Requirement	Action to be Taken to Attain Requirement
Massachusetts Surface Water Discharge Permit Requirements — 314 CMR 3.00	Relevant and Appropriate	Standards regulate discharges of pollutants to surface waters, outlets for such discharges and any treatment works associated with these discharges.	Groundwater will be extracted and treated in conformance with Massachusetts surface water discharge permit requirements.
Massachusetts Surface Water Quality Standards — 314 CMR 4.04	Applicable	Requirements for the antidegradation of surface waters. These provide for control of eutrophication and establish discharge criteria.	If River Meadow Brook is selected as the discharge location, the water will be treated to meet these standards.
314 CMR 4.06(2)	Applicable	Requirements for the antidegradation of unlisted surface water bodies.	If River Meadow Brook is selected as the discharge location, the water will be treated to meet the applicable standards.
Massachusetts Certification for Dredging, Dredged Material Disposal and Filling in Waters — 314 CMR 9.00	Applicable	Requirements for the uniform and coordinated administration of dredging and dredged material disposal and filling projects in the waters of the Commonwealth.	If River Meadow Brook is selected as the discharge point for treated groundwater, certification will be acquired.
Massachusetts Operation and Maintenance and Pretreatment Standards for Wastewater Treatment Works and Indirect Discharge — 314 CMR 12.00	Applicable	Regulations to ensure proper operation and maintenance of wastewater treatment facilities and sewer systems within the Commonwealth.	Remedial activities will comply with all provisions of this regulation.
Federal Clean Water Act (CWA) — Federal Ambient Water Quality Criteria (FAWQC)	To Be Considered	FAWQC are non-regulatory concentrations for the protection of aquatic life, and of human health from water ingestion and fish consumption.	Groundwater will be extracted and treated to prevent exceedance of these criteria.

APPENDIX D

MASSACHUSETTS LETTER OF CONCURRENCE

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection
Bureau of Waste Site Cleanup
One Winter Street, Boston, Massachusetts 02108

Daniel S. Greenbaum
Commissioner

James C. Colman
Assistant Commissioner

Julie Belaga
Regional Administrator
U.S. Environmental Protection Agency
JFK Federal Building
Boston, MA 02203

September 19, 1991

RE: State Concurrence with Record of Decision for the Silresim Federal Superfund Site ID #3-0352

Dear Ms. Belaga:

The Department of Environmental Protection (the Department) has reviewed the preferred remedial alternative recommended by the U.S. EPA for source control and management of migration measures at the Silresim Federal Superfund Site in Lowell, Massachusetts. The Department concurs with the choice of remediation selected.

This remedial action addresses the contaminated soils and groundwater and comprises the following components:

1.) Source Control Alternative
 - vacuum/vapor extraction of contaminated soils,
 - stabilization of the residual contaminated soils and
 - disposal on-site under a RCRA cap
2.) Management of Migration Alternative
 - air stripping of the contaminated groundwater

Because contaminated material will remain on the Site, the use of institutional controls will be necessary. The chosen remedial action will only achieve a temporary solution as defined by the Massachusetts Contingency Plan (MCP). A long-term monitoring program will ensure that the remedy remains protective of human health and the environment.

The EPA will perform a risk assessment on the residual groundwater contamination remaining after project completion to determine whether the remedial action has been effective. Remedial actions will continue until protective levels are attained.

The Department generally identifies the MCP as an applicable requirement for sites in Massachusetts while reserving the right to argue that Chapter 21E constitutes an independent enforcement authority that is not subject to the waiver provisions of CERCLA section 121 (d)(4). The Department identifies the MCP and Chapter 21E as applicable requirements, within the meaning of CERCLA, for the Silresim Superfund Site.

The Department has reviewed the ARARs identified for the Commonwealth and it appears the proposed remedy meets all ARARs. The Department will continue to evaluate the ARARs as remedial design progresses and during implementation and operation of the remedy.

The Department looks forward to working with the EPA in designing and implementing the preferred alternative. If you have any questions or require additional information, please contact Evelyn Tapani at 556-1125.

Very truly yours,

Daniel S. Greenbaum,
Commissioner
Massachusetts Department of
Environmental Protection

cc:

James C. Colman, Assistant Commissioner
Madeline Snow, Division Director
Helen Waldorf, Section Chief
Evelyn Tapani, Project Manager
Richard Chalpin, Regional Engineer
Steve Winslow, Esquire

APPENDIX E

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

SILRESIM SUPERFUND SITE

LOWELL, MASSACHUSETTS

September 19, 1991

U.S. Environmental Protection Agency

Region I

SILRESIM SUPERFUND SITE
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Preface

The U.S. Environmental Protection Agency (EPA) held a 60-day public comment period from June 20, 1991 to August 19, 1991 (due to a hurricane on August 19, the comment period was extended one day to August 20) to provide an opportunity for the public to comment on the Remedial Investigation (RI), Feasibility Study (FS), the Proposed Plan and other documents developed for the Silresim Superfund Site in Lowell, Massachusetts (the Site). The FS examined and evaluated various options, called remedial alternatives, to address contamination at the Site. EPA made a preliminary recommendation of its Preferred Alternative for Site remediation in the Proposed Plan issued on June 19, 1991 before the start of the comment period. All documents on which the preferred remedy selection was based have been placed in the Administrative Record for public review. The Administrative Record is a collection of all the documents considered by EPA to select the remedy for the Site. It is available at the EPA Records Center at 90 Canal Street in Boston, Massachusetts and at the Pollard Memorial Library on Merrimack Street in Lowell, Massachusetts prior to the public comment period.

The purpose of this Responsiveness Summary is to document EPA responses to the questions and comments raised during the public comment period. EPA has considered all of the comments in this document before selecting a final remedial alternative to address contamination at the Site.

The Responsiveness Summary is organized into the following sections:

I. **Overview of Remedial Alternatives Considered in the Feasibility Study and Proposed Plan, including the Preferred Alternative** - This section briefly outlines the remedial alternatives evaluated in the FS and the Proposed Plan, including EPA's Preferred Alternative.

II. **Site History and Background on Community Involvement and Concerns** - This section provides a brief Site history and a general overview of community interests and concerns regarding the Site.

III. **Summary of Comments Received During the Public Comment Period and EPA Responses** - This section summarizes and provides EPA's responses to the oral and written comments received from the public during the public comment period. In Part I of this Section, the comments received from citizens are presented. Part II summarizes comments received by State officials. Part III summarizes comments from the Potentially Responsible Parties (PRPs).

In addition, two attachments are included in this Responsiveness Summary. Attachment A provides a chronology of community relations activities at the Site. Attachment B contains a copy of the transcript from the informal public hearing held on July 10, 1991 in Lowell, Massachusetts. The comments submitted during the public comment period are available in the Administrative Record for the Silresim Site.

I. OVERVIEW OF REMEDIAL ALTERNATIVES CONSIDERED IN THE FEASIBILITY STUDY AND PROPOSED PLAN

Using the information gathered during the Remedial Investigation (RI), EPA identified several objectives for the cleanup of the Silresim Superfund Site. The primary cleanup objective is to reduce the risks to human health and the environment posed by exposure to the source contamination on-site and to groundwater contamination that has already or may in the future migrate off-site. Cleanup levels for groundwater and soil are set at levels that EPA considers to be protective of human health and the environment.

After identifying the cleanup objectives, EPA developed and evaluated potential cleanup alternatives, called remedial alternatives. The FS describes the remedial alternatives considered to address the contaminants of concern and the pathways in which they pose a threat. The FS also describes the criteria EPA used to narrow the range of alternatives to 9 potential source control (SC) remedial alternatives and 4 potential management of migration (MM) remedial alternatives.

The 9 source control remedial alternatives considered are:

SC-1: Minimal/No Action

SC-2: RCRA Cap

SC-3: Vacuum/Vapor Extraction, RCRA Cap

SC-4: Vacuum/Vapor Extraction, Stabilization and Disposal On-Site

SC-6: Thermal Desorption, Stabilization, RCRA Cap

SC-10: Incineration, Stabilization, RCRA Cap

SC-11: Vacuum/Vapor Extraction, Incineration, Stabilization and RCRA Cap

SC-14: Vacuum/Vapor Extraction, Solvent Extraction, Stabilization, and RCRA Cap

SC-15: Vacuum/Vapor Extraction, Solvent Extraction, Stabilization, Off-Site Disposal, RCRA Cap

The 4 management of migration remedial alternatives are:

MM-1: Minimal/No Action

MM-2: Pump and Treat On-Site by Metals Pretreatment, Air Stripping, and Carbon Adsorption

MM-3: Pump and Treat On-Site by Metals Pretreatment, Steam Stripping, and Carbon Adsorption

MM-4: Pump and Treat On-Site by Metals Pretreatment and UV/Chemical Oxidation

The preferred alternative selected by EPA to address Site contamination includes a combination of technologies to address contaminated soil and groundwater at the Site. The preferred Source Control alternative (SC-4) includes in-situ vacuum/vapor extraction of contaminated soil, excavation and stabilization of soil with residual contamination, and disposal of stabilized materials on-site under an impermeable Resource Conservation and Recovery Act (RCRA) Cap. The preferred groundwater treatment alternative (MM-2) includes extraction and treatment of contaminated groundwater utilizing air stripping as the primary treatment component. During remedial design, EPA will determine whether the treated contaminated groundwater will be discharged to the Duck Island Sewage Treatment Facility (POTW) or to River Meadow Brook. In addition, the cleanup plan will rely on institutional controls to prevent any use of groundwater until contaminant concentrations have decreased to safe levels. A long-term monitoring program will also be implemented during pre-design and will continue until EPA determines that the remedy is protective.

After a careful review of the comments made during the public comment period, EPA documented the selected remedy in the Record of Decision. The selected remedy shows no significant changes from the preferred alternative. All of the remedial alternatives considered for implementation at this Site can be found in the Record of Decision Summary, the Proposed Plan and the Feasibility Study.

II. SITE HISTORY AND BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

The Silresim Site is a five-acre abandoned chemical waste recycling facility, located at 865 Tanner Street in Lowell, Massachusetts. The Site and its surrounding areas have been used for industrial activities since the early 1900's, including an oil and fuel storage depot from 1916 to 1971. From 1971 through 1977, the Silresim Chemical Corporation operated a chemical waste reclamation facility on the Site.

The Silresim Chemical Corporation filed for bankruptcy in late 1977, after receiving numerous notices of permit violations from the Massachusetts Division of Water Pollution Control during the mid-1970's. In 1978, the Silresim Chemical Corporation abandoned the Site, leaving approximately one million gallons of hazardous materials on-site in drums and bulk tanks.

From 1978 to 1982, the Massachusetts Department of Environmental Quality Engineering (DEQE, now the Massachusetts Department of Environmental Protection) secured the Site and took steps to minimize immediate threats to public health and the environment, which included the construction of a Site fence, provisions for 24-hour security, removal of liquid wastes in on-site drums and above-ground tanks, and actions to prevent the further migration of contamination.

In 1982, EPA placed the Site on the National Priorities List, making it eligible for Federal action under the Superfund Law. Between the Spring of 1983 and December 1984, EPA removed all structures remaining on the Site, extended the fence, and placed a temporary clay cap over the Site. On July 12, 1985, EPA issued an Administrative Order by Consent to the Silresim Site Trust, a group of parties deemed potentially responsible for contamination at the Site, who agreed to undertake a Remedial Investigation/Feasibility Study to determine the nature and extent of contamination and evaluate potential cleanup alternatives which would address contamination at the Silresim Site.

Throughout the Site's history, community concern and involvement have been sporadic. During the early 1980's community concern and involvement was high when groundwater, soil and air quality data became available. Several citizens groups were established to address Site issues. These groups and other members of the Lowell community participated actively in early developments at the Site. However, in recent years indicators of local interest have decreased significantly.

EPA and the Massachusetts Department of Environmental Protection (DEP) have kept the community and other interested parties informed of Site activities and involved in the decision-making process through informational meetings, fact sheets, press releases, public meetings, and a publicly accessible Site file in the Pollard Memorial Library in Lowell. In 1983 and 1984, EPA and DEP operated an information hot-line and participated in regular meetings of a group called the Silresim Task Force, which was designed to improve communications between federal, state, and local officials, and the citizens.

During September 1985, EPA released a community relations plan which outlined a program to address community concerns and keep citizens informed of and involved in remedial activities. In response to a petition from a local environmental organization (the Ayer City Homeowners Chapter of the Greater Lowell Environmental Campaign), DEP designated the Silresim Site as a Public Involvement Plan (PIP) site in 1988. DEP developed the plan jointly with EPA so that federal and state community relations efforts would not be duplicated. The resulting joint Community Relations Plan/Public Involvement Plan was finalized in June 1991.

EPA has held numerous informational meetings since the Site's listing on the NPL. For example, on April 26, 1990, EPA held an informational meeting to discuss the results of the Remedial Investigation. On June 19, 1991, EPA held a meeting to describe the cleanup alternatives presented in the Feasibility Study, and to present EPA's Proposed Plan. During both of these meetings EPA answered questions from the public. Those in attendance at these meetings included local area residents, State and local officials, representatives from EPA, and representatives from companies interested in the Site activities and cleanup decisions. Summaries of these informational meetings can be found in the Administrative Record at the Pollard Memorial Library in Lowell.

The 30 day public comment period on the alternatives presented in the Feasibility Study, the Proposed Plan and on any other documents previously released to the public that began on June 20, 1991 and was extended an additional thirty days to August 19, 1991 (due to a hurricane on August 19, the comment period was extended one day to August 20). On July 10, 1991, EPA held an informal public hearing to accept any oral comments. The transcript from this meeting is included as Attachment B to this Responsiveness Summary. The comments made at this hearing and EPA's response to the comments are included in Section III of this Responsiveness Summary.

EPA has prepared Site fact sheets and distributed them to recipients on the Site mailing list and at public meetings. These fact sheets included a Superfund Program fact sheet in April, 1990 and a Proposed Plan fact sheet in June, 1991. EPA has issued other press releases regarding Site developments and public meetings throughout the Site's history.

III. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA RESPONSES

This Responsiveness Summary addresses comments received by EPA during the public comment period. Three citizens of Lowell addressed EPA's Preferred Alternative during the public hearing on July 10, 1991. Four sets of written comments were received by EPA during the public comment period including: local businesses, the Massachusetts Department of Public Health, the Massachusetts Department of Environmental Protection and the Silresim PRP group.

Part I - Citizens

Comment 1: One commenter requested that the public comment period be extended for an additional 30 days. The commenter stated that 30 days is not a sufficient period considering the extensive nature of the Proposed Plan and given the potential health impacts that the remedy may have to a community of 800 families. The commenter stated that more details should have been provided in the Proposed Plan, specifically concerning the type and concentrations of air emissions from the preferred treatment systems.

EPA Response: The public comment period was extended an additional 30 days on July 16 pursuant to the formal verbal and written request made by Norine Brodeur, dated July 10, 1991. The comment period ended August 19, 1991 (due to a hurricane, an aditional day was granted, extending the comment period to August 20, 1991).

The Proposed Plan is intended to provide a brief summary of all of the alternatives studied in the Detailed Analysis phase of the Feasibility Study and of EPA's preferred cleanup alternative. The Proposed Plan is a conceptual plan and is intended to solicit public concerns and comments prior to EPA's final remedial selection. Following EPA's consideration of public comments on the preferred alternative and the others analyzed, EPA records its decision in greater detail in the Record of Decision. If EPA were to get into a great deal of specificity on all of the alternatives under consideration in the Proposed Plan, the Superfund process would be unnecessarily prolonged.

Although certain unknowns exist during the public comment period, such as what the exact air emissions would be from excavations and treatment, EPA does identify whether the alternatives would be protective of human health and whether state and federal requirements (such as those of the Clean Air Act) would be achieved by the remedy based on the information provided in the Feasibility Study. The Remedial Design phase is the phase during which technical drawings and specifications are developed for the subsequent Remedial Action. During the design phase, field studies are performed that include actual on-site treatment systems to test their effectiveness and to determine what the contaminant concentrations are in system emissions. Unfortunately, EPA cannot determine exactly what the effluent levels will be from a treatment system until the system is designed and implemented. Prior to this phase, estimates are made to determine whether available controls will meet the appropriate health based standards/limits.

In addition to the remedy meeting state and federal standards for treatment emissions, a health and safety plan will be developed to protect workers on-site and people in the surrounding area during implementation of the remedy. Air monitoring will be also required to ensure that allowable levels of contaminants are not exceeded.

Comment 2: One commenter stated that incineration should have been considered and selected as the most permanent remedy at the Site. The commenter is concerned that a cap will not prevent the rainwater from infiltrating into the soil around the cap and that leaching of contaminants from the soil into the groundwater and migrating off-site will still occur. The commenter stated that the cost of incineration is justified in permanently mitigating the problem.

EPA Response: Incineration was considered for the Silresim Site in two of the nine final Source Control alternatives (SC-10 and SC-11). SC-10 called primarily for excavation and incineration of all soil exceeding cleanup levels for indicator substances (except for inorganics) at the Site. SC-11 called for in-situ vacuum/vapor extraction of volatile organic compounds (VOCs), and subsequent incineration of soil contaminated with semi-VOCs and heavier organics such as PCBs and dioxins. EPA acknowledges this resident's concern regarding the importance of permanently eliminating all the waste at the Site; however, EPA has determined that neither of these alternatives would yield results that are proportionate to the selected remedy in terms of their overall protectiveness, implementability, effectiveness and cost.

Section 121(b)(1) of CERCLA presents several factors that EPA is required to consider at a minimum in its assessment of alternatives. Building upon these specific statutory mandates, the National Contingency Plan articulates nine evaluation criteria to be used in assessing the individual remedial alternatives. A detailed analysis is performed on the alternatives using the nine evaluation criteria in order to select a site remedy. A summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria is found in Section IX of the attached Record of Decision.

Although SC-10 and SC-11 would have provided more permanent protection by reducing the concentrations of most contaminants at the Site (with the exception of metals), the selected remedy will provide the same level of protection for less money by reducing the principal threats at the Site (volatile organic compounds) and by preventing exposure to the remaining contaminants left on

Site through stabilization and capping. Alternative's SC-10 and SC-11 also would require a final cap, as residual contaminants would remain on Site. Even though incineration would reduce the concentrations of heavier organics such as PCBs and dioxins, these constituents are found less frequently, in lower relative concentrations. They are less soluble and therefore less likely to leach into the groundwater. The selected remedy also calls for stabilization to bind the residual contaminants and a cap to increase the long-term effectiveness of stabilization and prevent exposures.

Unlike with the selected remedy or SC-11, excavation of 137,000 cubic yards of VOC contaminated soil down to the water table would be necessary prior to incineration to implement SC-10. Although there are controls for minimizing air emissions due to VOCs, the potential short-term risks (8 years to incinerate) to site workers and the community are considerably higher than those associated with the selected alternative. Additionally, incineration would result in higher air emissions, even with controls, than the selected alternative.

EPA has also determined that the technical feasibility of excavating a very large volume of soil (SC-10) poses major construction problems, including large-scale application of VOC emissions control and the location of treatment equipment and facilities. Treatment equipment would have to be located either on the Silresim property and moved at least once during the course of the project, or located off the property outside the areas to be excavated.

In conclusion, in situ vacuum/vapor extraction, stabilization and a cap will be protective of human health and the environment and reduce the toxicity, mobility and volume of contaminants at the Site at a considerably lower cost than either SC-10 or SC-11. Although SC-10 would complete the job in one-third less time than the selected source control alternative, the short-term risks are considered higher and the construction problems greater in comparison.

[It should be noted to the commenter that incineration applies only to unsaturated (dry) soil. Incineration will not reduce the level of contamination that currently exists in the groundwater. It is technically infeasible to incinerate the contaminated groundwater plume.]

<u>Comment 3:</u> One commenter stated that a follow-up health study should be performed on those residents with physical ailments that have moved out of the Silresim area.

<u>EPA Response:</u> EPA does not prepare health assessments in association with Superfund Sites. The Centers for Disease Control (Agency for Toxic Substances and Disease Registry) in

cooperation with the Massachusetts Department of Public Health are responsible for evaluating potential health risks associated with Superfund Sites. Please refer to Suzanne Simon with the Agency for Toxic Substances and Disease Registry, at (617) 223-5526 for information regarding Silresim health studies.

Comment 4: The Lowell Iron & Steel Company and Scannell Boiler Works at 50 Tanner St. (adjacent to the Silresim property) expressed support for EPA's objectives for cleaning up the Site, but expressed concern for the impact current Site conditions have on their health and the impact that the preferred alternative may have on their businesses. Company representatives stated that implementation of the proposed remedial alternative will require long-term and unrestricted access to, and use of, their properties which may cause their businesses to close. They have requested that EPA actively persuade the PRPs to resolve the problem by working with Lowell Iron and Steel representatives immediately.

EPA Response: Since the release of contaminants at the former Silresim Chemical Company during the 1970's, the contaminants have migrated beyond the original limits of this property. The contaminants have primarily migrated via 1) surface runoff to the soil of the abutting properties, 2) leaching into and with the groundwater, and 3) into the air.

EPA and the Centers for Disease Control, Agency for Toxic Substance and Disease Registry, use current Site conditions to determine what potential exposure risks are posed by the Site and whether there is an imminent and substantial endangerment to human health (and what actions are necessary). If Site conditions change, additional exposure pathways may be created. As previously stated in written correspondence to the principals of Lowell Iron and Steel Company and Scannell Boiler Works, a portion of their property, which is north of the Silresim property, is contaminated and includes as part of the Silresim Superfund Site. Therefore, EPA is concerned that use of that property in a manner that differs from the assumptions made in the Remedial Investigation, prior to implementation of the remedy described in the Record of Decision, may present an additional exposure risk. Additionally, EPA's need for unrestricted access for the purpose of sampling and other pre-design activities prior to the implementation of the remedy is essential.

EPA realizes that ownership of property included in a Superfund site, or part of one, is burdensome and has the potential to restrict use of that property. However, EPA's first responsibility is to the overall protection of human health and the environment. In order to mitigate the risks that the Silresim Site poses to the public and environment, remedial action is required. Unfortunately, the action requires long-term unrestricted access to the abutting property to meet the cleanup levels set forth in the Record of Decision.

Although it is premature to identify whether a settlement will be reached with the Potentially Responsible Parties (PRPs) at the Site, EPA is hopeful that negotiations for performance of the remedial action will be fruitful. EPA wants a fair resolution for all parties affected by the Site, including the abutting property owners. EPA is currently considering this matter, and has urged the PRPs to do the same and open the lines of communication with all involved to ensure a speedy and equitable resolution.

Part II - State Officials

Written comments were received from the Massachusetts Department of Public Health (DPH) and the Department of Environmental Protection (DEP). Where the same or similar comments have been given by both Departments they have been grouped together for the purpose of providing a complete response. The comments are organized in the following categories: A) Human Health and Community Concerns; B) Feasibility Study C) Preferred Alternative; D) Applicable or Relevant and Appropriate Requirements (ARARs); E) General Comments.

A. Human Health/Community Concerns

Comment 1: In letters submitted during the public comment period, the Massachusetts Department of Environmental Protection (DEP) and Department of Public Health (DPH) expressed concern about public health, if contaminants should seep into and volatilize within the basement of the closest residence to the Site on North Main Street. DPH representatives indicated that, in such a case, exposure to residents (especially children) could occur through ingestion, absorption, and/or inhalation. They recommended that EPA notify the potentially affected residents of exposure possibilities. DPH also recommended that EPA gather more information regarding depth of the basement, type of basement floor, foundation type, and the extent of past seepage of groundwater into the basement.

EPA Response: EPA shares the Department of Public Health and the Department of Environmental Protection's concern regarding potential basement seepage of contaminated groundwater into the nearest residence to the Site. Sampling and analysis data from the Remedial Investigation had previously indicated that the contaminated groundwater plume did not extend to the house closest to the Site's southern perimeter. However, the plume is slowly migrating and, until the remedy is implemented, poses potential exposure risks related to potential seepage of contaminants into the basements of residential dwellings closest to the Site.

In order to document the nature and extent of the groundwater plume in this area, EPA recently (August, 1991) collected additional groundwater and surface water/sediment samples south and southeast of the Site. Groundwater samples were collected from existing wells and piezometers located on Main Street, Canada Street and Maple Street. Additionally, surface water and sediment samples were collected from East Pond.

The results of this sampling and analysis will be used to evaluate changes in the current identification of exposure risks posed by the Site. These samples are currently being analyzed. Once this data is available, the Agency for Toxic Substances and Disease Registry (ATSDR) will review the data to determine if there are any potential health risks and/or make a recommendation of additional actions necessary to be protective of human health. This data will also be made available to residents who may be potentially affected, and will become part of the Silresim Administrative Record, located at the Lowell Public Library and at EPA's offices in Boston. The closest resident on North Main Street, as well as other residents located in the vicinity of Silresim, are on EPA's mailing list which means that they should have been receiving EPA mailings related to the Silresim Site, which include the Remedial Investigation Fact Sheet, meeting notices, notices of sampling efforts, notice of the availability of the Silresim Administrative Record, the updated EPA/DEP Community Relations Plan, and the Proposed Plan.

A decision regarding the need for more information regarding the construction of basements and occurrences of seepage into the nearest basements will be made following EPA's review of the validated data from the recent sampling event.

Comment 2: The Massachusetts Department of Public Health stated their concern for the use of a well at a car wash located approximately 2,000 feet from the Site. The car wash allegedly utilizes groundwater for its operations. The Department is concerned that if the contaminated plume were to reach the car wash, there would be a potential future exposure pathway by inhalation and absorption of VOCs. Although the FS indicates that well yields are expected to be very low in the Silresim area, the Department is not convinced that the well yields are too low to prevent future use for industrial or residential purposes and suggests that EPA gather more information regarding the physical nature of the well and surrounding area at the car wash.

EPA Response: It is true that the estimated water yield from a hypothetical drinking water well is very low due to the physical nature of the aquifer at and near the Silresim Site. However, this factor alone would not prevent the installation of a well in the Site area for the purpose of yielding drinking water.

The well at the car wash 2,000 feet away from the Silresim Site is reportedly no longer being utilized for the purpose of cleaning vehicles. The future potential exposures of inhalation, dermal contact and ingestion of contaminated groundwater at the car wash were not evaluated because the exposures were not believed to be reasonable. The Silresim plume is moving at an exceptionally slow rate. In the past 15 years the plume has only migrated 400 feet away from the Site. The forthcoming remedial action is expected to curtail plume migration, and therefore be protective of the nearest receptors to the Site, as well as those further away such as the Lowell Car Wash.

It should be noted, however, that ingestion of contaminated water at a future hypothetical water supply well on the Site was evaluated in the baseline risk assessment in the Remedial Investigation as a worst-case scenario. Superfund risk assessments are used primarily to determine the necessity of remedial actions at sites and to develop target cleanup levels. Sampling and analysis data from the Remedial Investigation is reviewed by the Centers for Disease Control (Agency for Toxic Substances and Disease Registry) to determine if there is any imminent and substantial endangerment to human health and what interim measures are necessary to be protective. If no remedial action were to be taken at Silresim, and the plume were to migrate to the Lowell Car Wash (or to any other utilized groundwater well), certainly institutional controls such as well restrictions would be maintained to ensure protection against exposure to Site contaminants.

For the reasons described above, EPA does not believe that it is necessary to collect additional information regarding the well at Lowell Car Wash.

Comment 3: The Massachusetts Department of Public Health recommended that EPA pay particular attention to air emissions, controls and monitoring while implementing remedial action at the Site. The Department recommended EPA give careful scrutiny to air emissions, controls and monitoring, and potential problems associated with any off-site transportation of hazardous waste. The Department stressed these recommendations to ensure that nearby residents were confident about the health and safety procedures to be exercised during the remedial activities.

EPA Response 3: The remedial action at Silresim includes a number of activities and processes that call for controls of air emissions that could otherwise pose a threat to human health and the environment. As stated in the attached Record of Decision, air emissions controls and monitoring will be undertaken in compliance with all applicable or relevant and appropriate federal and state requirements. Although the nature of the specific emissions is not yet known, and will not be known until the source control and management of migration systems have been designed and implemented, it is projected that controls can and will reduce the contaminant concentrations to meet federal and state specifications for the protection of human health and the environment. A monitoring program will be designed and implemented to ensure that all emissions standards are met and that Site workers and the community are protected.

During the remedial design stage of the project, a health and safety plan is implemented prior to conducting any work at the Site. All potential exposures are accounted for with planned protective response measures. In addition to controls for air emissions, design specifications are included for the proper handling of all wastes to be shipped off-site for further treatment. Furthermore, shipment of waste off Site for further treatment will be undertaken in compliance with all federal and state requirements.

Again, the specifics of air emissions controls and monitoring are addressed fully in the remedial design phase, as opposed to the Record of Decision. All design documents and data generated as a result of design activities are releasable to the public. During remedial design, EPA will be more than happy to respond to public concern regarding the remedy by discussing the specifics of any design deliverable or data.

Comment 4: The Massachusetts Department of Environmental Protection recommended that a risk assessment on the remaining residual contamination be completed following completion of remedial activities, to ensure remedial actions are protective of human health and the environment.

EPA Response: EPA agrees with DEP that a risk assessment should be performed on the remaining residual contamination following the completion of remedial activities; to ensure the protection of human health and the environment. This provision is found in Chapter X of the ROD, in the section on Cleanup Levels.

B. Feasibility Study

Comment 5: The DEP indicated that off-site disposal of dioxin-contaminated soil was mentioned several times in the Feasibility Study. To the Department's knowledge, however, no licensed facility exists which accepts dioxin-contaminated soil. The Department further indicated that the Record of Decision should address this issue.

EPA Response: The only alternative in the Feasibility Study which includes disposal of dioxin contaminated waste at an off-site hazardous waste facility is Source Control Alternative 15 (SC-15). The difficulty of finding a licensed facility to accept contaminated waste is noted in both the FS and ROD. The FS states in the detailed analysis of SC-15, that "There are currently no facilities in the United States that will accept dioxin-contaminated materials, and only one company [Rollins Environmental Services (TX), Inc.] that has submitted a permit application to EPA for consideration." The selected remedy does not include off-site disposal of dioxin-contaminated waste.

Comment 6: The DEP pointed out that the use of water sprays and dust suppressant chemicals, mentioned in the Feasibility Study, are meant to control particulate emissions, not VOC emissions.

EPA Response: DEP's comment is correct. Mechanisms to control releases of particulate matter during excavation may include water and chemical (e.g., calcium chloride) application to the soils, run-off controls, specialized excavation equipment (e.g., caisson augers) and equipment decontamination. Mechanisms to control the release of VOCs during excavation include the application of vapor suppressing foams, or the erection of domes or air-sealed "tents" over work areas. Exhaust air from the domes or vents would be treated to remove VOCs prior to discharge.

Comment 7: Based on DEP's review of the Feasibility Study, they noted that their Department continues to conduct scheduled operation and maintenance at the Site (maintaining the cap fence and sign postings). Additionally, they noted that the cap has been seeded and does support vegetation.

EPA Response: EPA has noted in the ROD that the DEP continues to conduct scheduled operation and maintenance at the Site, including maintenance of the clay cap, fence and sign postings, and that the cap does support vegetation and has been seeded with clover.

C. Preferred Alternative

Comment 8: The Massachusetts Department of Environmental Protection suggested that EPA further evaluate Alternative MM-4, which includes chemical oxidation. The Department stated that Alternative MM-4 requires less secondary waste management and appears to be more effective in removing ketones and methyl chloride than the preferred alternative (MM-2).

EPA Response: EPA further considered Management of Migration Alternative 4 which includes chemical oxidation as its primary treatment component. EPA remains confident that Management of Migration Alternative 2, which includes air stripping with a heated influent, is the most appropriate alternative for addressing groundwater contamination at the Site.

Unlike with MM-4, a required component of the selected groundwater treatment system (MM-2) is aqueous-phase carbon adsorption to remove contaminants not removed by the air stripper. The treatability study conducted during the Feasibility Study for aqueous-phase carbon adsorption assumed ambient temperature air stripping. The selected remedy includes heating the influent prior to air stripping which will significantly increase the removal of ketones and other less volatile compounds in the effluent for subsequent carbon treatment. Therefore, carbon usage will be greatly reduced from the 930 pounds per day maximum usage rate (less than half) calculated pursuant to the treatability study. This carbon will either be regenerated in place or be shipped off-site for regeneration and re-use at the Site.

Although EPA considers the level of secondary waste management for each alternative in their evaluation of alternatives, there are other criteria considered in the evaluation. The National Contingency Plan articulates nine evaluation criteria to be used in assessing each of the remedial alternatives considered by EPA for selection. Of the alternatives that attain ARARs, are protective of human health and the environment, and utilize permanent solutions and treatment technologies to the maximum extent practicable, EPA must determine which one provides the best balance of trade-offs in terms of the nine evaluation criteria.

EPA has determined that Alternative MM-2 will provide the best balance of trade-offs among the alternatives evaluated. EPA believes that each of the components of the selected remedy are well proven, reliable, readily available and easily implementable at the Silresim Site. Although MM-2, MM-3 and MM-4 would be equally effective in meeting ARARs, and are comparable in cost (given the costs are rough estimates), and include institutional controls to be protective of human health in the short term, MM-3 and MM-4 are generally less proven and available technologies.

Chemical oxidation, the primary component of MM-4, is an innovative technology which has been proven successful for the destruction of low levels of volatile organic compounds with little air emissions. However, the application of the chemical oxidation process at Silresim may require high dosages of chemicals (ozone or hydrogen peroxide at a potential ratio of oxidant to contaminants from 5:1 to 10:1), flow recirculation and/or long residence time in order to treat the high concentration and types of compounds found at the Site. This would significantly increase the cost of the treatment. Decreasing the amount of ozone or hydrogen peroxide could result in incomplete oxidation, which would create organic byproducts in the effluent which may not meet discharge standards (total organic carbon). Additional treatment of the water may be required.

Air stripping is a physical process, whereby the parent contaminants are transferred from the aqueous phase to the vapor phase for further treatment. The UV/Oxidation process although reduces the parent contaminants, may result in undefined oxidation byproducts. These intermediate compounds have a tendency to be more water soluble and less adsorbable by carbon, wherease the remaining compounds in the effluent from air stripping can be removed more readily by the aqueous carbon.

Chemical oxidation cannot easily treat compounds such as ketones and aliphatic and saturated compounds, which do not readily oxidize. As stated above, residence times would be longer and/or the groundwater would have to be recirculated through the system which would increase energy consumption. This will also result in an increase in the temperature of the effluent stream. Based on the high concentrations of contaminants found in the groundwater at the Silresim Site and assuming a water temperature increase of approximately 5 degrees fahrenheit per minute retention time in the reactor, an increase of 60-100 degrees fahrenheit in the effluent stream could be expected. This stream would therefore require further treatment prior to discharge. Additionally, the pretreatment system for inorganic contaminants, biological growth and naturally occurring chemicals may have to be more extensive and effective (than for air stripping) to prevent scaling or deposits that precipitate on the ultra-violet (UV) lamps. The estimated life span of the UV lamps is approximately 3 months, but the lamps may require maintenance as often as every few weeks. Scaling of the UV lamps appears to be a serious obstacle to implementation of the UV/Oxidation technology. The precipitate which forms on the lamps prevents the transmittance of UV light to the contaminated water resulting in variable system performance.

A summary of the comparison of each alternative's strengths and weaknesses is found in Section IX of the ROD, and EPA's rationale for selecting MM-2 is expressed in Section XI of the ROD.

<u>Comment 9:</u> The Massachusetts Department of Environmental Protection stated that its Division of Air Quality Control requires emissions testing prior to and during the initial excavation of the vacuum/vapor extraction system trenches so that the presence and concentration of odorous and toxic elements can be detected.

<u>EPA Response:</u> Emissions testing will be conducted during excavation of the trenches for the vacuum/vapor extraction system to ensure protection of human health and the environment.

<u>Comment 10:</u> The DEP suggested that extraction wells rather than trenches be utilized for the vacuum/vapor extraction system to reduce the potential emissions of VOCs.

EPA Response: In reference to the selected vacuum/vapor extraction system for remediation of soil contamination at the Site, EPA agrees with DEP that the use of extraction wells (to extract contaminants from the soil for aboveground treatment) is preferable to trenches. However, it is expected that trenches, in addition to extraction wells, will be necessary to meet soil cleanup levels within a reasonable period of time. Because the majority of soil at Silresim to be remediated consist of silts and fine sands, trenches and extraction wells provide the most practical and cost effective means of meeting soil cleanup levels at the Site. The final determination of the number, depth, and location of the trenches and wells associated with the vacuum/vapor extraction system will be finalized during the remedial design phase.

Comment 11: The estimated volume of soil to be excavated and stockpiled on-site from the vacuum/vapor extraction trenches is approximately 1,750 cubic yards. Because of the anticipated high levels of VOC emissions, the DEP recommended using a dome or air sealed tent to protect the immediate area from emissions originating at the Site.

EPA Response: Contaminated soil excavated from the trenches will be deposited and covered with a clay cap on the Silresim property (in the northeast corner) and treated via the vacuum/vapor extraction system. To control the release of volatile organic compounds during excavation and stockpiling, techniques such as the application of vapor suppressing foams, or the erection of domes or air-sealed "tents" over work areas will be utilized. If domes are used, exhaust air from the domes or vents will be treated to remove VOCs prior to discharge.

EPA recognizes DEP's view that, based on the anticipated VOC levels, a dome or air sealed tent is the preferable control mechanism. However, this is a design level issue, not an issue to be handled in the ROD. The decision of which control measures are necessary will be made during the remedial design stage.

Comment 12: The DEP asked that the ROD provide clarification of the handling and disposal of stabilized soil. They specifically were looking for clarification on whether the stabilized soil will be stored on-site, tested for leaching and then permanently disposed of under a cap.

EPA Response: EPA has clarified that the stabilized soil will be disposed of on-site, following a leaching test to determine the effectiveness of the stabilization treatment to prevent leaching of the contaminants. Following stabilization of the contaminated soil, it will be disposed of in the existing capped area and permanently covered with a RCRA cap.

Comment 13: The vacuum/vapor extraction system is expected to remediate soil in the upper half of the unsaturated zone, prior to excavation, stabilization and disposal of those soils on-site under a final cap. Given that the vacuum/vapor extraction system is expected to operate for a total of 30 years, DEP requested that EPA clarify where excavated soils will be stored during this period and how maintenance of the extraction system will be accomplished, given the placement of stabilized soil and a RCRA cap over the Site.

EPA Response: Once the soil in approximately the upper half of the unsaturated zone meets the target cleanup levels for volatile organic compounds (approximately 5 years), soil which exceeds the target cleanup levels for the remaining indicator substances will be stabilized and then placed on the Silresim Site for final disposal. The installation of a RCRA cap over the stabilized soil will occur following the completion of stabilization. The vacuum extraction system will continue to operate after the stabilization and cap are complete.

The operation of the vacuum/vapor extraction system under stabilized soil is feasible and no major difficulties are anticipated. It is possible that some removal of the system for repair or replacement will be required. However, it is a relatively simple matter to keep the stabilized soil off the top of the trenches. Therefore, no limitations were indicated in the ROD. Specifications of the maintenance of the vacuum/vapor extraction system will be accounted for in the remedial design phase of this project.

Comment 14: The DEP expressed concern about the introduction of dense non-aqueous phase liquid (DNAPL) to bedrock and asked EPA to require contractors to provide details in the project design about measuring the possibility of this type of introduction.

EPA Response: Selected deep overburden and shallow bedrock extraction wells will be located within the zone of suspected DNAPL contamination. Siting extraction wells in this zone will provide dewatering to facilitate soil vapor extraction, enhance containment of dissolved phase contamination, and enhance mass removal rates. EPA believes the benefits of siting extraction wells in this zone outweigh the potential risk of mobilizing DNAPL to greater depths during well drilling. Special precautions will be taken during the rock well installations to minimize the potential for introducing additional DNAPL to the bedrock. The specific number and locations of extraction wells targeting DNAPL contamination will be finalized during the remedial design phase. This has been noted in the ROD.

Comment 15: The DEP indicated that National Pollution Discharge Elimination System (NPDES) permits are written based on water quality based limits, which can be more stringent than Maximum

Contaminant Levels (MCLs, the selected cleanup levels for groundwater treatment). The DEP urged EPA to consult the Quality Criteria for Water (1986, as amended).

EPA Response: The state water quality limits associated with NPDES permits are currently more stringent than MCLs primarily for metals. The selected remedy includes metals precipitation/filtration. If River Meadow Brook is selected as the discharge location, the groundwater treatment system is expected to reduce the concentrations of metals below water quality based NPDES limits. However, pilot testing of the groundwater treatment system will be necessary to insure that the NPDES limits will be met.

D. ARARs

Comment 16: During the public comment period the Massachusetts Department of Environmental Protection submitted a list of State ARARS to supplement those identified in the Feasibility Study. In a follow-up letter to EPA, DEP further refined their list of ARARs. The Department indicated that the lists were not comprehensive, but that it would be useful to EPA in evaluating the "State Acceptance" criterion required in the National Contingency Plan (NCP). The ARARs include Chapter 21E/Massachusetts Contingency Plan (MCP). Chapter 21E of the Massachusetts General Law establishes the MCP as an independent enforcement authority, which is not subject to the waiver provisions of CERCLA (Superfund Act) Section 121(d)(4). This provides for potentially more stringent standards than those set forth in the National Contingency Plan, and is considered by DEP to be applicable to the Silresim Site.

EPA Response: EPA considered DEP's identification of State ARARs potentially suitable to the Silresim Site, and have included each of the ARARs identified in their refined list in the ROD (listed in Appendix C of this ROD), with the exception of Chapter 21E/Massachusetts Contingency Plan (MCP).

Chapter 21E and the MCP are state analogues to CERCLA and the National Contingency Plan, respectively. CERCLA specifically authorizes the President to carry out response actions and requires the promulgation of a National Contingency Plan for selection of response actions, to which the President must adhere. (42 U.S.C Sections 9604(a), 9605, 9607(a)(4)(A).) Congress established a federal program that sets nationwide priorities for site cleanups and consistent national rules for selection of cleanup actions. The states may promulgate legally enforceable environmental standards (i.e., ARARs) which federal cleanups must meet. The states may enact and exercise their own statutory authorities to conduct cleanups using their own preferred risk assessment methodologies and contingency plans. The states may not, however, impose those contingency plans on the President and EPA. To do so would be contrary to the requirements of CERCLA.

Neither Chapter 21E nor the MCP is a legally enforceable environmental standard that would qualify as an ARAR. Chapter 21E authorizes DEP to undertake response actions in much the same way that CERCLA authorizes the President to do so. The only articulated standard for cleanup actions is "a level of control... such that no... substance of concern will present a significant or otherwise unacceptable risk of damage to health, safety, public welfare, or the environment." M.G.L. c. 21E Section 3A. This states a general goal, but it falls short of the specificity required to be a "promulgated standard, requirement, criteria, or limitation." 42 U.S.C. Section 9621(d)(2)(A)(ii). "General goals that merely express legislative intent about desired outcomes or conditions but are non-binding are not ARARs," nor could they be absent some objective standard to define whether they are met. 55 Federal Register 8746.

The "no... significant or otherwise unacceptable risk" language of Chapter 21E, analogous to the "protective of human health and the environment" language of CERCLA, is a guiding principle to be given site-specific content by reference to other binding statutory or regulatory requirements, rather than itself being an ARAR. Indeed, this cleanup goal is so general that even if "no... significant or otherwise unacceptable risk" could be considered a standard, Chapter 21E would still not be an ARAR because there is no way to determine whether it is "more stringent than" the comparable federal standard of "protective" remedies. 42 U.S.C. Section 9621(d)(2)(A)(ii).

The Massachusetts Contingency Plan (MCP), DEP's regulation that guides implementation of the Chapter 21E authority, also fails to meet CERCLA's definition of ARARs. The MCP, like its federal analogue, contains no specific "standard, requirement, criteria, or limitation," but instead prescribes a process for remedial decision making. DEP must follow the MCP's procedure for assessing risk, but the MCP leaves selection of the ultimate cleanup level and remedial strategy to DEP's discretion. See, e.g., 310 C.M.R. Section 40.543(3)(g)3.a (use of excess lifetime cancer risk as "guideline" for remedial decisions). Thus the MCP itself does not provide objective, enforceable standards that could serve as ARARs and mandate specified cleanup levels.

To consider the MCP an ARAR would produce an anomalous results. Were that the case, EPA would have to disregard its own properly promulgated procedures in favor of the Commonwealth's, and defer to the Commonwealth's discretionary judgment of what risks were "acceptable" at a particular Site. Such a result would contravene Congressional intent, as evidenced by the precise elaboration of state ARARs and the President's authority to promulgate the National Contingency Plan, 42 U.S.C. Sections 9621(d)(2)(A), 9605, and would frustrate CERCLA's paramount goal of expeditious and efficacious site cleanups. See NCP preamble, 55 Federal Register at 8689 ("Requiring the Superfund program to comply with both the administrative requirements of CERCLA and the administrative or other non-substantive requirements of other laws would be unnecessary, duplicative and would delay Superfund activities.") Therefore, the MCP, 310 CMR 40.00, is not considered an ARAR at this Site.

Comment 17: The DEP stated that they support EPA's proposal to waive the bottom liner specifications of the Federal Toxic Substance and Control Act (TSCA) disposal requirements for polychlorinated biphenyls (PCBs), recognizing that the remedial actions proposed would be protective of human health and the environment from exposures to PCBs.

EPA Response: In addition to the liner specification of the TSCA PCB disposal requirements, EPA has determined that two additional provisions are not necessary to be protective of human health and the environment from exposures to PCBs. The PCB Disposal Requirements promulgated under TSCA are applicable to the remedy because the selected remedy involves storage and disposal of soils contaminated with PCBs in excess of 50 ppm. Under the Disposal Requirements, soils and sediments contaminated with PCBs may be disposed of in an incinerator meeting the standards of 40 CFR Section 761.69 or a landfill meeting the requirements of 40 CFR Section 761.75. Under the provisions of 40 CFR Section 761.75(c)(4), the EPA Regional Administrator may waive one or more of the specified landfill requirements upon finding that the requirement is not necessary to protect against an unreasonable risk of injury to health or the environment from PCBs.

In the case of the Silresim Site, placement of soils with PCBs, which have been stabilized, under a RCRA cap, will provide a permanent and protective remedy that satisfies the requirements of the Part 761 landfill regulations. Long-term monitoring of groundwater wells will also be instituted, as required by the chemical waste landfill regulations.

The Regional Administrator is exercising the waiver authority contained within the TSCA regulations at 40 CFR Section 761.75(c)(4) and is waiving certain requirements of the chemical waste landfill regulations. The provisions to be waived require construction of chemical waste landfills in certain low permeable clay conditions [Section 761.75(b)(1)], the use of a synthetic membrane liner [Section 761.75(b)(1)], and that the bottom of the landfill be 50 feet above the historic high water table [Section 761.75(b)(3)].

The Regional Administrator hereby determines that, for the following reasons, the requirements of 40 CFR Sections

761.75(b)(1), and (3) are not necessary to protect against an unreasonable risk of injury to health or the environment from PCBs in this case. Among the primary reasons that the waived specifications are not necessary is the low frequency of detection and concentrations of PCBs detected in Site soils. PCBs are not the primary threat at this Site. Although there were a limited number of samples analyzed with PCBs over 50 ppm, the majority had concentrations below 1 ppm and at non-detectable levels. In contrast, the landfill requirements that are waived are designed to protect against the risk from disposal of PCBs at levels no lower than 50 ppm. The specifications regarding liners, soil conditions and depth to groundwater were designed to protect against the risks that high levels of PCBs will migrate into groundwater or be released to air or surface water.

Low permeability clay conditions, a synthetic membrane liner for the underlying substrate, and 50 foot soil barrier to the water table are unnecessary requirements at this Site to prevent migration of PCBs. The soil will be stabilized and disposed of on Site in excavated areas within the upper portion of the unsaturated zone. Disposal of stabilized and capped waste in this zone will minimize the hydraulic connection between the treated soils and groundwater and subsequent migration of PCBs in groundwater. Furthermore, given the low mobility of PCBs in stabilized soils, migration of PCBs to groundwater would be minimal.

E. General Comments

Comment 18: The DEP suggested that EPA redefine the Site. The Department indicated that under the Massachusetts Contingency Plan (MCP), the term "on-site" is interpreted to include the areal extent of the contamination and all related areas in close proximity to the contamination necessary for the implementation of the remedy.

EPA Response: EPA agrees with the DEP's definition of the Silresim Site. In conformance with the definition of "On-site" in the National Contingency Plan (NCP), the Silresim Site (the "Site") is defined by the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action. This is stated in Section I, page 1, of the Record of Decision.

Comment 19: The DEP indicated that the definition of "halogenated" in the glossary of the Proposed Plan is erroneous.

EPA Response: The correct definition of a "halogenated hydrocarbon" is "one of a group of halogen derivatives of organic hydrogen and carbon-containing compounds; the group includes monohalogen compounds and polyhalogen compounds that contain the same or different halogen atoms." "Halogenation" is a chemical process or reaction in which a halogen element is introduced into a substance, generally by the use of the element itself. Both of these definitions came from the McGraw-Hill Dictionary of Chemical Terms.

Part III - Potentially Responsible Parties (PRPs)

One set of written comments were received from a group of Silresim PRPs, known as the Silresim Site Generators Committee (the "Committee").

In brief, the main comments of the Committee were: (1) EPA identification of federal and state drinking water standards (MCLs) are inappropriate cleanup levels for the Site; (2) EPA failed to consider EPA's March 25, 1991 Risk Assessment guidance which would have resulted in less stringent cleanup goals for soil; (3) EPA's selected compliance point for meeting MCLs (edge of RCRA cap) is unnecessary and should have alternately been identified as River Meadow Brook; (4) meeting MCLs at the Site is technically infeasible within a reasonable time period; (5) use of average background levels as soil cleanup levels for some indicator compounds is inappropriate; (6) cleanup levels should be based on River Meadow Brook as the groundwater receptor location, and not the edge of the RCRA cap; (7) the selected remedy should be flexible.

Comment 1: It is inappropriate to base groundwater and soil cleanup goals on Maximum Contaminant Levels (MCLs), which are drinking water standards established under state and federal drinking water laws. The Committee stated that these goals are flawed because the Site is located in an industrial area, the groundwater is not currently used as a drinking water source, there are no private wells being utilized in the area, the suspected well yields are low, and the existence of DNAPL will prevent the attainment of these goals. The Committee cited the ROD for the Sullivans Ledge Site where DNAPL was recognized as a limiting factor to attaining MCLs. Additionally, the Committee stated that Massachusetts regulations limit use of the Site for a water well because of the proximity of other sources of contamination.

EPA Response: EPA disagrees that the selection of Maximum Contaminant Levels (MCLs), which are drinking water standards established under state and federal drinking water laws, is inappropriate for the Silresim Site. The aquifer at the Site is classified as a Class IIB aquifer under the Federal Groundwater Protection Strategy and Class I by the Commonwealth of Massachusetts. These classifications mean that the groundwater is potentially a source of drinking water and other beneficial uses. At sites where groundwater is or may be used for drinking water, MCLs set under the Safe Drinking Water Act or more stringent promulgated State standards are generally applicable or relevant and appropriate standards (ARARs).

It is within EPA's authority to determine ARARs at the Site and to determine cleanup levels necessary to attain those ARARs. With respect to achieving drinking water standards in the aquifer, the NCP, in 40 CFR Part 300, provides that it is the policy of EPA's Superfund program to use EPA's Groundwater Protection Strategy as guidance in determining the appropriate remediation for contaminated groundwater at CERCLA site. The aquifer at Silresim is a valuable resource both under EPA's Guidelines for Groundwater Classification and under the State classification for groundwater. Although the groundwater presently is not being utilized as a drinking water source and is not suitable for direct human consumption without treatment due to chemical contaminants or land use impacts, the goal of the state and federal governments is to restore potential sources of drinking water to drinking water quality and for other beneficial uses.

EPA recognizes that the area in the immediate vicinity of the Silresim Site is industrial (industries which could be adversely affecting the groundwater) and that the availability of a public water supply generally averts the aquifer from use as a drinking water supply. However, the edge of the Silresim contaminated plume is currently at the closest residential neighborhood and is continuing to migrate further away from the original Site. Despite the suspected low water yield in the Site area due to the local geology, private water wells (abandoned due to the current affordable public water supply) were once utilized in this neighborhood. It is not infeasible or inconceivable that private wells could, once again, be installed within the Silresim plume in the future for the purpose of drinking water or other uses.

The PRPs have stated that "...Massachusetts regulations preclude use of the Site for a water well because of the proximity of other sources of contamination." This statement is correct only insofar as a permit for a <u>public</u> water supply is concerned. A public water supply well would not be permitted, however, there are no restrictions on private use of the aquifer (especially for industrial or non-potable use). Only the local Board of Health would have jurisdiction on private supply for individual homes. EPA has determined that the risk of drinking groundwater from the Silresim contaminated plume, either now or in the future, poses an unacceptable risk and supports remediation of the aquifer to drinking water standards.

EPA recognizes the potential difficulties associated with meeting drinking water standards at the Site due to the existence of high concentrations of contaminants and dense non-aqueous phase liquid in the overburden and fractured bedrock, and the suspected low groundwater extraction rates due to low permeability of aquifer materials. However, the uncertainties associated with the degree of effectiveness that the selected soil and groundwater treatment systems will afford prevent EPA from concluding that ARARs or an alternate set of stringent and protective standards is infeasible at this Site.

The PRPs have requested that less stringent cleanup levels be selected based on exposure pathways more realistic than drinking water. Although the goal of this remedial action is to restore the groundwater to its beneficial uses which are federal and state drinking water standards (MCLs), and EPA and the Commonwealth of Massachusetts currently believe that the selected remedy could potentially achieve this goal, EPA recognizes the PRPs concerns and the current studies that suggest that it may not be possible to achieve these standards throughout the area of attainment within a reasonable period of time for the reasons stated above. The practicality of achieving cleanup levels throughout the Site cannot be determined until the extraction system has been implemented and plume response monitored over time.

EPA has stated in the ROD that if the selected remedy cannot meet the cleanup levels (i.e. MCLs) following a reasonable period of system operation, contingency measures and goals may be considered for replacement. These measures and goals would be considered if they are protective of human health and the environment, but are technically practicable under the corresponding circumstances.

For alternate contingency measures and goals to be considered by EPA, the following condition would need to be satisfied: contaminant levels have ceased to decline over time, and are remaining constant at some statistically significant levels above health-based goals in portions of the aquifer outside of the compliance points. If it is determined on the basis of the preceding criteria and the system performance data that portions of the aquifer cannot be restored to their beneficial use, any or all of the following contingency measures will occur as a modification of the existing system: (a) institutional controls will be maintained to prevent access to groundwater that maintains above health-based levels; (b) ARARs will be waived for those portions of the aquifer based on the technical impracticability of achieving further contaminant reduction; (c) continued pumping will be required as a long-term gradient control or containment measure.

The decision to invoke any or all of these measures may be made by EPA during a future periodic review, following a reasonable period of operation of the selected remedy. The remedial decision referenced in the Committee's comments for the Sullivans Ledge Site in New Bedford, Massachusetts, and the decision for the Silresim Site were based upon individual site circumstances and factors. While the circumstances at the Sullivans Ledge Site may be similar to those at the Silresim Site, there are differences that warrant individual consideration (i.e, whether MCLs are ARARs). EPA's remedy selection process does not require an evaluation of how other CERCLA sites have met the statutory requirements and compare to the site at issue.

Comment 2: EPA failed to consider the Agency's March 25, 1991 Risk Assessment guidance. The Committee stated that under this revised guidance document, cleanup levels for volatile organic compounds (VOCs) and phenol would be less stringent than those reported in the Proposed Plan. The Committee further suggested that this guidance and the preamble to the National Contingency Plan (NCP) both support the conclusion that the Site should be classified as commercial/industrial. This classification would result in less stringent cleanup levels proposed by EPA. Additionally, they recommended using action levels identified for soil under EPA's RCRA corrective action program.

EPA Response: With respect to the March 25, 1991 EPA guidance, officially entitled, Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Supplemental Guidance "Standard Default Exposure Factors" Interim Final, and its relevance to the derivation of cleanup levels for soils, there are some key points to consider. First, as the guidance indicates, "the exposure factors presented in this document are generally considered most appropriate and should be used in baseline risk assessments unless alternate or site-specific values can be clearly justified by supporting data". Guidance on calculating risk-based cleanup levels is still in the developmental phase. The relevance of the March 25, 1991 guidance to the derivation of risk based cleanup levels, if any, has not officially been made.

Secondly, even if the above mentioned guidance is eventually endorsed by EPA in the derivation of cleanup levels (it is an interim guidance), Region I policy is to adopt the new exposure parameters outlined in the March 25 guidance only if it is deemed appropriate. Within Region I, these exposure assumptions were to be considered for all baseline risk assessments initiated after March of 1991. The baseline risk assessment for Silresim was completed in March of 1990. EPA determined that it was neither appropriate nor necessary to generate another revision of the baseline risk assessment to accommodate this guidance. Similarly, the development of cleanup levels in the Feasibility Study occurred primarily during 1990, again, before the issuance of this guidance. In order to avoid any further delays to this project, EPA has committed to the use of exposure assumptions used in the baseline risk assessment and in drafts of the Feasibility Study. The Risk Assessment and cleanup levels developed for this Site have been reviewed by EPA and are believed to be appropriate.

Regarding the claim that surficial soil cleanup levels derived using the March 25, 1991 guidance would be less stringent for VOCs and phenols than those ultimately selected, EPA is unable to substantiate this claim. In fact, EPA believes that use of the March 25, 1991 guidance would have led to more stringent soil cleanup levels for every compound. For example, the key assumptions used in the Feasibility Study and March 25, 1991 guidance are as follows:

	Feasibility Study	03/25/91 Guidance
Frequency of Exposure -	60 days per year	350 days per year
Duration of Exposure -	70 years	30 years
Net -	4,200 days	10,500 days

Because of the greater exposure under the new guidance, any cleanup level derived using these factors in soils would be more conservative than those selected at this Site.

With regard to the Committee's belief that the Site should be classified as commercial/industrial for exposure assessments utilized for establishing cleanup levels at the Site, consistent with the March 25, 1991 guidance and preamble to the NCP, EPA has assumed that land use for the Silresim property is commercial/industrial. However, EPA has also assumed that the land immediately adjacent to the Site is "residential" because there are known exposure pathways to neighboring residents. The March 25, 1991 guidance states that "residential exposure scenarios and assumptions should be used whenever there are or may be occupied residences on or adjacent to the Site. Because the exposure parameters corresponding to a residential exposure scenario generally result in a higher potential exposure than a commercial/industrial scenario, the residential exposure parameters were used to develop cleanup levels.

The Feasibility Study (Appendix B, Table B-3) includes the assumptions that were used in deriving risks and cleanup levels for direct contact and ingestion of soil at the Site. The age attributed to the receptor population is 5-70 years, to reflect a realistic trespassing scenario by a neighboring resident (the 1-5 year old population which is known to have the greatest soil ingestion rate was excluded). Where a "resident" is identified in the FS as the exposed population (Table B-3 and elsewhere in the FS) this resident is considered by EPA to be a "neighboring" resident to the Silresim Site. EPA believes that surficial soil cleanup levels, based on direct contact and ingestion of soils, have been derived consistent with land use considerations put forth in the NCP and the March 25, 1991 guidance and reflective of actual exposure pathways.

Lastly, with respect to the use of RCRA corrective action levels for soils, per the July 27, 1990 Federal Register, these values 1) represent only proposed levels and are not promulgated standards, 2) are not based on site-specific assumptions and do not reflect the risks posed by contaminants at Silresim, and 3) were not initially intended to be consistent with CERCLA (Subpart S is currently being developed to be consistent with CERCLA).

Comment 3: Designation of the edge of the RCRA cap (roughly approximated by the Silresim property boundary) as the point of compliance for meeting groundwater cleanup levels is unnecessary because of the unlikelihood that groundwater at the Site will be utilized as a drinking water supply (as contended in comment # 1). The Committee believes that River Meadow Brook is the most appropriate and reasonable compliance point for meeting groundwater cleanup levels, and as an input parameter to the leaching model used for developing unsaturated soil cleanup levels (attached to their comments was a list of recommended cleanup values for both media). The Committee believes that exposures related to basement seepage of contaminated groundwater can be mitigated by utilizing source control measures.

EPA Response: As discussed by EPA under Response 1, Part III, above, the aquifer at the Site is classified as a Class IIB aquifer under the Federal Groundwater Protection Strategy and Class I by the Commonwealth of Massachusetts and is therefore a potential source of drinking water and other beneficial uses. At sites where groundwater is or may be used for drinking water, MCLs set under the Safe Drinking Water Act or more stringent promulgated State standards are generally applicable or relevant and appropriate standards (ARARs). Although the groundwater presently is not being utilized as a drinking water source, the goal of the state and federal governments is to restore potential sources of drinking water to drinking water quality.

The PRPs have requested that less stringent cleanup levels be selected based on exposure pathways more realistic than drinking water. The Risk Assessment detailed in the Remedial Investigation clearly supports the need for stringent cleanup levels and an aggressive remedy to be protective of all exposures posed by the contaminated groundwater. EPA has determined that River Meadow Brook is not an appropriate point of compliance for meeting groundwater cleanup levels and as an input parameter to the leaching model used for developing unsaturated soil cleanup levels, because it is not protective of human health and the environment and does not meet Applicable or Relevant and Appropriate Requirements (ARARs) identified for this Site.

The current and future potential exposures which exceed EPA's acceptable risk range of 10^{-4} and 10^{-6} include ingestion of contaminated groundwater if used as a drinking water source, inhalation of vapors inside residential and industrial basements due to groundwater seepage, and direct contact and dermal absorption of surface waters of East Pond. The point of compliance identified in the Feasibility Study as River Meadow Brook represents a broad perimeter that extends beyond the current and future potential exposures of concern. These exposures are <u>inside</u> this point of compliance, suggested for use by the Committee. The cleanup levels proposed by the Committee, based on this compliance point, are not considered protective of the exposure risks identified above. The source control portion of the remedy alone would not "handle" these exposures as contended by the Committee.

EPA has determined that cleanup levels will be met and based upon the edge of the RCRA cap to insure adequate protection of human health and the environment and to meet ARARs. The final RCRA cap will limit this area from its potential future uses (i.e., drinking water supply). The cleanup levels recommended by the Committee will not be utilized.

<u>Comment 4:</u> The technical feasibility of achieving designated groundwater cleanup goals within a reasonable period of time is uncertain due to the presence of DNAPL, high concentrations of dissolved contaminants, and the low permeability of soils at the Site. The Committee believes that many of the cleanup goals will not be reached within 100 years. Referencing the NCP and decisions made at the Nyanza Superfund Site in Ashland, Massachusetts and the Sullivan's Ledge Superfund Site in New Bedford, Massachusetts, the Committee believes either MCLs should be waived and the remedy should essentially operate as a containment system or the remedy should be considered interim. The Committee believes that a containment system will be protective of human health and the environment and reduce costs.

<u>EPA Response:</u> As stated above under Comment 1, Part III, EPA recognizes the potential difficulties associated with meeting drinking water standards at the Site due to high dissolved contaminant concentrations and DNAPL in the aquifer and low groundwater extraction rates resulting from low permeable aquifer materials. However, the uncertainties associated with the degree of effectiveness which the selected remedy will afford prevent EPA from concluding that it is infeasible to meet groundwater ARARs within a period of time considered reasonable for this Site.

The Committee does not believe that all of the cleanup levels can be reached within a 100 year time frame. This is an unsubstantiated estimate. There is currently no reliable estimate for the period of time necessary to meet the established cleanup objectives. EPA believes that the infeasibility of achieving cleanup levels throughout the Site cannot and should not be determined until the remedy has been implemented and plume response monitored over time. The Risk Assessment, detailed in the Remedial Investigation clearly supports the need for stringent cleanup levels and an aggressive remedy in order to be protective of all exposures posed by the contaminated groundwater. EPA believes that selection of a remedy for the purpose of plume containment would not facilitate the design and implementation of an aggressive groundwater treatment alternative, and may not be adequately protective of human health and the environment.

Although the goal of this remedial action is to restore the groundwater to its beneficial uses, which are federal and state drinking water standards (MCLs), EPA does recognize the Committee's concerns and the current studies that suggest that it may not be possible to achieve these standards throughout the area of attainment within a reasonable period of time for the reasons stated above. Subsequently, EPA has stated in the ROD that if the selected remedy cannot meet the selected cleanup levels following a reasonable period of system operation, contingency measures and goals may be considered for replacement. These measures and goals would be considered if they are still protective of human health and the environment, but are technically practicable under the corresponding circumstances.

As stated previously in EPA's response to Comment 1, Part III, the remedial decision made at each Superfund Site is based on an individual set of circumstances and factors. The decisions made at the sites referenced in the Committee's comments, specifically the Nyanza Site in Ashland, Massachusetts, and the Sullivan's Ledge Site in New Bedford, Massachusetts, are immaterial to the decision made at the Silresim Site. While the circumstances at the Nyanza Site and Sullivans Ledge Site may be similar to those at the Silresim Site, there are differences that warrant individual consideration. EPA's remedy selection process does not require an evaluation of how other CERCLA sites have met the statutory requirements and compare to the site at issue.

Unlike the Nyanza Site and the Sullivan's Ledge Site, EPA does not believe that the criteria necessary to waive groundwater ARARs have been satisfied at the Silresim Site. Therefore, at periodic intervals during implementation of the selected remedy, EPA will review the treatment system for its effectiveness and feasibility in meeting the cleanup objectives. Following a reasonable period of system operation, EPA may deterimine that alternative cleanup levels are warranted for this Site.

Comment 5: The Committee believes that it is innapropriate to set cleanup levels for such compounds as arsenic, mercury and polycyclic aromatic hydrocarbons (PAHs) at the average background concentrations detected in the Site area. The Committee does not believe that these constituents are related to Silresim operations and that establishment of such cleanup levels is contrary to the provisions of the Superfund law. Therefore, at a minimum, the upperbound background values should be selected to avoid remediation of soil not contaminated by Silresim.

EPA Response: EPA does not believe that the available data regarding arsenic, mercury and polycyclic aromatic hydrocarbons (PAHs) detected at the Site (both on and off the Silresim property) substantiate the Committee's claim that these compounds are unrelated to previous hazardous waste activities at Silresim. The Silresim Chemical Corporation accepted a wide range of mixed hazardous waste. The hazardous constituents found on the Silresim property and in adjacent runoff areas are considered by EPA to be Silresim-related contaminants.

Soil samples were collected in the Silresim area, specifically to characterize local background values for various metals and PAHs suspected of being elevated due to the urban environment. Levels of these metals and PAHs in various locations around the Site were found to be elevated. However, EPA does not believe that this information precludes the detection of these compounds on the Silresim Site from being related to Silresim hazardous waste activities. However, EPA believes that because Silresim cannot be strictly implicated as the only source of these constituents, it is acceptable to consider local background concentrations in the determination of cleanup levels for Site remediation.

Two sets of background values for various indicator compounds are presented in the Feasibility Study, including actual sampling data from the Site and a range of values reported in literature for soils in the eastern United States. EPA believes that, where the use of background values is warranted for consideration in determining soil cleanup levels, Site-specific local values are preferable to literature-based regional values. EPA selected the average concentrations of background soil data for the Site as the cleanup levels for arsenic, mercury, selenium, phenol and PAHs in surficial soils.

Of the five indicator substances listed above, EPA has determined that soil cleanup levels for mercury, phenol and selenium are unnecessary. EPA has also determined that the soil cleanup levels for chromium and copper are unnecessary. Based on further review and consideration of the data presented in the RI/FS, it was determined that the exposure pathways for each of these compounds did not exceed EPA's acceptable risk level. Chromium, copper, mercury, phenol and selenium are non-carcinogenic compounds. The non-carcinogenic risks posed by each of these compounds, under each exposure pathway considered, fell below a hazard quotient of one. Therefore, EPA has omitted chromium, copper, mercury, phenol and selenium from the list of cleanup levels to be met in surficial soils at the Site.

Unlike the compounds listed above, the risk associated with direct contact and ingestion of PAHs and arsenic in soil do exceed EPA's acceptable risk range, essentially because they are carcinogens (cPAHs). The health-based risk levels derived in the FS for cPAHs and arsenic are 0.31 mg/kg and 2.9 mg/kg (parts per million), respectively. The average background values for cPAHs and arsenic are 11 mg/kg and 21 mg/kg, respectively. EPA believes that the average local background values selected for arsenic and cPAHs will be adequately protective of human health and the environment and is therefore an acceptable alternative cleanup level. EPA does not agree that the upper bound background values detected outside the Site for PAHs and arsenic are appropriate or protective standards.

Comment 6: The Committee referred EPA to an earlier draft of a discrete segment of the Feasibility Study, known as the Development of Alternatives or FS-2. This report contains a list of groundwater and soil cleanup levels that were based on River Meadow Brook as the point of compliance. These levels are less stringent than those selected by EPA, which are based on the edge of the RCRA as the compliance point. The Committee believes that River Meadow Brook is the appropriate point of compliance for meeting groundwater cleanup levels and for use in determining unsaturated soil cleanup levels. Attached to the Committee's comments is a list of refined cleanup levels for soil and groundwater based on River Meadow Brook as the compliance point. The Committee has requested that EPA adopt these alternate cleanup levels.

EPA Response: Please refer to EPA's response to Comments 1 and 3, Part III, above. For the reasons provided above in the previous responses, EPA has determined that River Meadow Brook is not the appropriate point of compliance for meeting groundwater cleanup levels and as an input parameter to the leaching model used for developing unsaturated soil cleanup levels. EPA has determined that groundwater cleanup goals will be met at the edge of the RCRA cap to ensure adequate protection of human health and the environment and to meet applicable and relevant and appropriate requirements for this Site. Therefore, the cleanup levels recommended by the Committee will not be utilized.

Comment 7: The Committee requested that EPA provide for flexibility in its cleanup plan so that innovative and cooperative water and energy saving measures could be adopted during the remedial phase. The Committee specifically noted the utilization of a cogeneration plant being developed adjacent to the Site for use in the selected groundwater extraction and treatment system.

EPA Response: The Record of Decision is fairly specific in terms of the selected treatment components to be utilized and the potential discharge locations for treated groundwater. The Feasibility Study evaluated three potential locations for the discharge of treated groundwater. EPA has determined based on the evaluation provided in the FS that the discharge location will be either to the Duck Island Sewage Treatment facility (POTW) or to River Meadow Brook. This decision will be made during the remedial design phase of the project. The groundwater treatment system calls for air stripping of a heated influent. The most appropriate means of heating the influent will also be decided upon during the remedial design phase.

ATTACHMENT A

CHRONOLOGY OF COMMUNITY RELATIONS ACTIVITIES AT THE SILRESIM SITE

-- 1982-83	the Silresim Site was placed on the National Priorities List (NPL)
-- 1983-1984	EPA and DEP operate an information hotline and participate in regular meetings of the Silresim Task Force
-- 3/30/83	EPA announces that industrial facilities are emmitting unacceptable levels of VOCs in the vicinity of the Silresim site
-- 5/26/83	EPA announces construction of a fence around the Site
-- 6/7/83	EPA announces a cost-share agreement with the Commonwealth of Massachuesetts to perform interim remedies and conduct studies at the Site
-- 6/28/83	EPA holds an informational public meeting to present operating plans for removal of buildings and construction of a cap at the Site
-- 8/8/83	EPA announces start of work on removing buildings
-- 11/17/83	EPA announces start of work on temporary clay cap
-- 1/18/84	EPA holds public meeting to provide an update on schedule for cap construction
-- 3/15/85	EPA announces public comment period on Remedial Investigation work plans
-- 6/6/85	EPA announces agreement with the Silresim Trust to perform the Remedial Investigation and Feasibility Study (RI/FS) at the Site
-- 9/85	EPA announces availability of the Site Community Relations Plan
-- 10/16/85	EPA holds public meeting on plans for Site studies
-- 5/6/86	EPA holds public meeting on progess and plans of Site studies
-- 7/9/86	EPA holds public meeting on progess and plans of Site studies

-- 10/14/86	EPA announces additional field studies (Phase II)
-- 12/12/86	EPA announces presence of trace levels of dioxin in soils just outside Site fence
-- 12/21/87	EPA confirms presence of low levels of dioxin at Site
-- 5/88	EPA announces that Ayer City Homeowners Association has issued a Letter of Intent to apply for a Technical Assistance Grant (TAG) at the site
-- 10/88	EPA issues a fact sheet providing updates on Site activities
-- 11/88	DEP receives a petition requesting that DEP designate Silresim a "Public Priority Site"
-- 5/3/89	DEP designates Silresim as a Public Involvement Plan (PIP) Site
-- 6/22/89	EPA announces that the TAG grant is still available
-- 9/27/89	EPA announces availability of the Administrative Record
-- 3/27/90	EPA announces 2 administrative agreements with over 200 parties for $3.4 million
-- 4/90	EPA issues a fact sheet on the Superfund program
-- 4/26/90	EPA holds public meeting on results of the Remedial Investigation studies at the Site
-- 11/7/90	EPA announces additional soil and ground water sampling at the Site
-- 6/91	DEP and EPA issue a joint Public Involvement Plan/Community Relations Plan for the Site
-- 6/91	EPA issues a fact sheet on the Site Proposed Plan
-- 6/19/91	EPA holds public meeting to explain cleanup alternatives, including EPA's preferred alternative
-- 6/20/91	Public comment period on the Proposed Plan and other documents begins
-- 7/10/91	EPA holds informal public hearing to accept oral

ATTACHMENT B

TRANSCRIPT

United States Environmental Protection Agency

Public Hearing
Silresim Superfund Site
Proposed Remedial Action Plan

Smith Baker Center
Lowell, Massachusetts
July 10, 1991

UNITED STATES OF AMERICA
ENVIRONMENTAL PROTECTION AGENCY

IN THE MATTER OF:

PROPOSED PLAN
SILRESIM SUPERFUND SITE
LOWELL, MASSACHUSETTS

BEFORE: Margaret Leshen, Section Chief
Leslie McVickar, Remedial Project Manager

Smith Baker Center
400 Merrimack Street
Lowell, Massachusetts
Wednesday, July 10, 1991
7:15 p.m.

M.A. TOROSIAN & ASSOCIATES, INC.

P R O C E E D I N G

MS. LESHEN: Good evening and welcome. This is the Silresim Superfund Site public hearing and I'm Margaret Leshen, the Section Chief of the Superfund Section at the EPA. I'm here to chair this session and I want to welcome everyone.

Before we get started, I'm going to explain exactly how this evening is going to be run. It is an informal public hearing and as such we do have these microphones around the room so that our court transcriber can record what is happening this evening.

If you intend to make a comment during the evening, when we open the actual and formal hearing, I'm going to ask you to get a card or sheet from Sharon, our community relations person, so that we can actually call your name out and record your name for the record.

Before we begin the informal

hearing part, Leslie McVickar, the Project Manager, is going to make an informal presentation about the proposed plan and then we will take formal comments and then we will close the meeting. If there is time, we will answer questions.

Tonight's meeting is to take comments on the Proposed Plan and the Feasibility Study. We want to ensure that you're commenting on all the alternatives that were presented in the Feasibility Study and the Proposed Plan.

As you know, we opened the public comment period on June 20th and it runs through July 19th. After this evening, you will have time to submit your written comments to our office in Boston as long as they come in to Leslie McVickar before July 19th.

All the comments that we receive this evening, as well as the comments that we receive in writing before July 19th, will be responded to in writing in a document called the Responsiveness Summary that will be attached to a Record of Decision at the Site and a Record of Decision will make a decision on the remedial action that will take place at the site.

As I said, we have Leslie McVickar, the EPA Project Manager, with us this evening. We have Evelyn Tapani who is the state Project Manager with us and Doug Fine, the state community relations contact, as well as Ann Fox from the Mass Department of Health.

Does anyone have any questions on how we are going to run this meeting? If not, I'm going to ask Leslie to make a short presentation about the Proposed Plan.

MS. McVICKAR: The United States Environmental Protection Agency has proposed a cleanup plan, referred to as the preferred alternative, to address contamination at the Silresim

Superfund Site in Lowell, Massachusetts. The preferred alternative is EPA's preliminary selection of a remedy and may be altered based upon comments or new information received during the current public comment period which would significantly affect EPA's evaluation of the alternatives.

EPA's preferred cleanup plan includes a combination of technologies to address contaminated soil and groundwater at Silresim. The first phase of the proposed remedy is to address soil contamination which would involve in-situ vacuum/vapor extraction of 137,000 cubic yards of soil on and off the Silresim property to reduce the concentrations of volatile organic compounds to protective levels.

MS. LESHEN: We have a little competition.

MS. McVICKAR: Then, soils exceeding the cleanup goals for the remaining contaminants of concern would be excavated and treated utilizing a treatment known as stabilization, which would bind the contaminants in the soil together, thereby reducing the potential for these contaminants to leach into the groundwater. Final disposition of the stabilized contaminated soil would be primarily on the Silresim property under a permanent multi-layer cap meeting federal specifications.

The preferred alternative to address the contaminated groundwater would include a system to extract and treat groundwater from the contaminated plume to meet target cleanup goals at the Silresim property boundary. Groundwater would be extracted from numerous extraction wells and initially be pumped to a phase separation settlement tank to separate the dense non-aqueous phase liquid from the water. Groundwater would then be treated for removal of metals utilizing chemical precipitation/filtration. Following chemical precipitation, the groundwater would be heated and treated using an air stripper to remove the organic compounds from the water. The contaminated air stream would be treated using thermal oxidation, and the remaining contaminated groundwater would subsequently pass through units of granulated activated carbon, known as carbon adsorption, before being discharged to the Duck Island sewage treatment facility. If this facility could not be used, the treated groundwater will be discharged to nearby River Meadow Brook.

If public comment and additional information cause the EPA to alter their evaluation of the preferred alternative or of the other alternatives considered in the Feasibility Study, EPA could modify the preferred plan or select another alternative.

There were eight other Source Control alternatives and three other Management of Migration alternatives considerd for selection in the Feasibility Study. I will briefly outline each of these, beginning with Source Control, before concluding.

Source Control Plan number 1 is the no action alternative under which no remedial action of the contaminated soils would occur. Under this alternative the only activities would include additional perimeter fencing of the site, posting warning signs, an extension of the existing cap into newly fenced areas and institutional controls.

Source Control alternative number 2 calls for a cover system over contaminated soil exceeding target cleanup levels both on and off the Silresim property. The existing cap would be upgraded and extended to comply with federal requirements.

Alternative number 3 calls for in-situ vacuum/vapor extraction to remove primarily volatile organic compounds, followed by excavation of soils contaminated with non-volatile organics and final disposition on the Silresim property under a cap.

Alternative number 6 calls for on-site treatment of the contaminated soil utilizing thermal desorption. Soils with residual contamination exceeding target cleanup goals would be stabilized, to bind the contaminants with the soil, and disposed of on the Silresim property under a final cap.

Source Control alternative number 10 includes on-site incineration of all soil contaminated above target cleanup goals, followed by stabilization and final disposition of the stabilized material under a cap on the Silresim property.

Alternative number 11 includes

in-situ vacuum/vapor extraction of all soils with concentrations exceeding target cleanup goals for volatile organic compounds, followed by incineration of residual soil still contaminated with non-volatile organics. Folowing incineration, the remaining contaminated soil would be stabilized and disposed of on the Silresim property under a final cap.

Source Control alternative number 14 includes in-situ vacuum/vapor extraction, followed by solvent extraction to remove residual organic compounds. Following solvent extraction, soil which still exceeds target cleanup goals would be stabilized and disposed of under a final cap on the Silresim property.

Final Source Control alternative, number 15, is nearly identical to number 14. The sole difference is that the remaining contaminated soil, following solvent extraction, would be stabilized and disposed of at a licensed facility off-site. The Silresim property would still, however, be capped.

Management of Migration alternative number 1 does not include treatment of the contaminated groundwater. This alternative would include only institutional controls to restrict the use of groundwater at the site and a long-term groundwater monitoring program.

Management of migration alternative number 3 is similar to the preferred groundwater alternative, with the substitution of steam stripping for air stripping. The groundwater would be extracted and initially pumped to a settling tank to remove dense non-aqueous phase liquids. The groundwater would then be treated to remove metals using chemical precipitation, and then pumped to a steam stripper to separate the volatile organic compounds from the water. The residual contaminated air would be treated using carbon adsorption or a thermal oxidizer. The residual contaminated water would be further treated using carbon adsorption. The treated water would then be discharged to the Duck Island treatment facility or to River Meadow Brook.

The final Management of Migration alternative, number 4, is also a pump and treat alternative. Following the pre-treatment units to separate dense non-aqueous phase liquid and metals from the groundwater, it would be treated using ultraviolet chemical oxidation to remove the organic compounds. Either carbon adsorption or thermal oxidation would be used to control emissions of volatile organic compounds. The treated water would then be dischargd to the Duck Island treatment facility or to River Meadow Brook.

MS. LESHEN: Thank you, Leslie.

I would like to call the first person that would like to make a comment. Norine Brodeur.

MS. BRODEUR: I would like to make a formal request that you extend the comment period for 30 days. I think that the extens is extremely important. I know that the study has been ongoing for 10 years. I don't feel as though 30 days is too much to ask. I would expect that the responsible parties would say it is another delay that would be our fault and we have been accused of that and worse. After 10 years, however, I don't think that 30 days is too much to ask. This particular plan is very extensive, very intricate and as a community people we have to weigh and look at this plan and say what is best for our community. What is at risk is the health of 800 families. If we make the wrong decision because we only have

30 days, that would be unfortunate to say the least.

I feel as though everybody has worked very, very hard and you feel comfortable with this. I don't. I think that it is a big risk. I don't think the community knows enough to evaluate it. We have tried to contact people to see if anyone would look at this information for us for free because we have no funds and they will not. It is an extensive job. It takes an awful lot of time to review the amount of material that has come out about the site and what kind of alternatives you are looking at. We hope that in the next 30 days that we might get lucky and find someone. Maybe we won't. But I don't think that it is too much to ask to give us the opportunity. We still see a lot of sickness in the neighborhood. We hear about new things and the old things. We are very, very concerned that if we go forward without knowing all the details of the Proposed Plan, what kind of emissions, for instance, what will be the result, we don't know. We are not sure, you know, and that's why it is so important.

So again, my main concern is time. It has taken 10 years to get to this point and another 30 days won't make any difference unless we get the help we need and then it may make all the difference to us. Thank you.

MS. LESHEN: Thank you. Would anyone like to make a comment? I have received at this point no further formal requests for additional comment but I understand there were some people considering making a comment in the audience.

We are going to need to have your name.

MR. WILLETT: Ray Willett.

MS. LESHEN: Ray Willett.

MR. WILLETT: You have all

kinds of alternatives here but you do not have one that is the ultimate that says, seal, it is all done.

Now, a cap is being put on these places to keep the rainwater, they say, from going down there. It is like an umbrella but all around these, these sites, the rain is going into the soil and it gets into there.

Now, there is a system. I believe it was about four years ago they had a meeting, a meeting on Smith Street and there was one vendor that had an incinerator to move onsite. That could burn the soil right in, dirt and all, and pile it up and when it went through, it went right back and now you have sterile soil. Now, you don't have to bother with that any more. Every one of your alternatives eventually is going to lead into problems again.

Now, you say that is going to be awful expensive. But, what does it cost already to take and clean that site and that's not the end? Now, you want to do more. Now, somebody says for about two years. Now, that is nothing. That's no good. We want forever. The problems are there. I know that at one time it was referenced that, well, that would be our job at that time. There are jobs for everybody. There are many, many sites around this country that would be moving around and doing your job but I think that you should complete the job where you are so that there will be no more problems.

MS. LESHEN: Thank you.

MS. WELCOME: Most of the questions that I have already have been answered at a previous meeting.

MS. LESHEN: Would anyone else that is present now that would like to make a comment into the record?

(Pause)

MS. LESHEN: As I'm closing the

hearing, I would like to go into exactly what is going to go on from here. The people are encouraged to submit written comments to our office at this point in time by July 19th. Leslie and I are not empowered to extend the comment period here and now on the spot. If there is an extension, it will be published in the newspaper and people will be notified. But I would urge you to work on your comments for that day.

As I stated earlier, all the comments received tonight, as well as the ones received in writing during the comment period, will be responded to in the Responsiveness Summary which we attach to the Record of Decision. All of the information and the Feasibility Study and the Proposed Plan which is all information that you should be referring to when you are commenting are available at the Lowell Library as well as our office in Boston.

Any time people can call Leslie with questions but we urge you to submit your comments in writing. I would like to ask for one more time if there is anyone that would like to make a comment into the record?

MS. WELCOME: My name is Ann Welcome.

MS. LESHEN: I think she needs you to talk to the mike. She is recording as well.

MS. WELCOME: I would like to -- I would like to know to what extent a follow-up is being done health-wise for people who have moved out of the Silresim area and still have physical problems. I think that follow-up is of the utmost importance.

MS. LESHEN: Hearing no objections, I'm going to close the hearing and that means no further comments will be responded to from this evening in the responsiveness summary. No one is changing their mind?

MS. BRODEUR: Anything written, you will respond to?

MS. LESHEN: Right.

(Pause)

MS. LESHEN: Okay. Then we will close the record. Thank you very much.

(Whereupon, the hearing concluded at 7:30 p.m.)

COMMONWEALTH OF MASSACHUSETTS

MIDDLESEX, SS.

I, Marybeth Coldwell, Registered Professional Reporter, do hereby certify that the aforegoing pages, 1 through 21, in the matter of the Silresim Superfund Site have been accurately recorded and transcribed to the best of my knowledge, skill and ability.

Marybeth Coldwell, RPR

APPENDIX F

ADMINISTRATIVE RECORD INDEX

Silresim Chemical Corp.

NPL Site
Administrative Record

Index

Compiled: September 13, 1989
Updated: April 25, 1990
Updated: June 19, 1991
ROD Signed: September 19, 1991

Prepared for

Region I
Waste Management Division
U.S. Environmental Protection Agency

With Assistance from

AMERICAN MANAGEMENT SYSTEMS, INC.
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Introduction

This document is the Index to the Administrative Record for the Silresim Chemical Corp. National Priorities List (NPL) site. Section I of the Index cites site-specific documents, and Section II cites guidance documents used by EPA staff in selecting a response action at the site. Additional guidance documents that EPA staff may have consulted in selecting a response action are available through EPA's Region I office.

The Administrative Record is available for public review at EPA's Region I Office in Boston, Massachusetts, and at the Pollard Memorial Library, 401 Merrimack Street, Lowell, Massachusetts 01850. Questions concerning the Administrative Record should be addressed to the EPA Region I Remedial Project Manager.

The Administrative Record is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Section I

Site-Specific Documents

ADMINISTRATIVE RECORD INDEX

for the

Silresim Chemical Corp. NPL Site

1.0 Pre-Remedial

1.2 Preliminary Assessment

1. "Potential Hazardous Waste Site - Identification and Preliminary Assessment" Form, EPA Region I (July 3, 1980).
2. "Potential Hazardous Waste Site - Tentative Disposition" Form, EPA Region I (July 3, 1980).

1.3 Site Inspection

1. "Potential Hazardous Waste Site - Site Inspection Report" Form, EPA Region I (July 3, 1980).
2. "Potential Hazardous Waste Site - Site Inspection Report" Form, EPA Region I (May 18, 1982).

1.18 FIT Technical Direction Documents (TDDs) and Associated Records

1. "Final Report: Analysis of Hazardous Waste Mismanagement Incident in Lowell, Massachusetts," Fred C. Hart Associates, Inc. (June 12, 1978).
2. Memorandum from Paul F. Clay, NUS Corporation to Merrill S. Hohman, EPA Region I (March 29, 1983) with attached "Internal Draft Report - Silresim Air Monitoring," NUS Corporation. Concerning purpose and transmittal of attached report.
3. Memorandum from Mark E. Brickell, NUS Corporation to John F. Hackler and Barbara H. Ikalainen, EPA Region I (May 10, 1983) with attached "Analysis of Silresim Samples," NUS Corporation (March 30, 1983 through May 16, 1983). Concerning perimeter soil sampling, sampling of wells, and remedial measures.
4. Memorandum from Mark E. Brickell, NUS Corporation to EPA Personnel (June 22, 1983). Concerning results of analysis of purgeable and extractable priority pollutants taken at the Arrow Carrier and Menends Investment Realty Property.
5. Letter from Mark E. Brickell, NUS Corporation to John Scannell, Scannell Boiler Works (June 24, 1983) with attached sampling location maps. Concerning results of soil contamination screenings on Scannell Boiler Works property.
6. Letter from Mark E. Brickell, NUS Corporation to Phillip Nyman (Attorney for Wright Leasing and Realty) (June 24, 1983) with attached sampling location maps. Concerning results of soil contamination screenings in the Wright Leasing and Realty parking lot.
7. "Sampling Methodology," EPA Region I with attached sampling locations maps. Concerning soil sampling surveys performed during March and April 1983, and on June 13, 1983 through June 16, 1983.

2.0 Removal Response

2.1 Correspondence

1. Letter from John P. Lehman, EPA Headquarters to Chris Johnson, Silresim Chemical Corporation (October 31, 1974). Concerning attached memorandum and draft resume of vital statistics regarding waste treatment and disposal operations at the Silresim Chemical Corporation.
2. Letter from Thomas C. McMahon, Commonwealth of Massachusetts Division of Water Pollution Control to Daniel K. Moon, EPA Region I (December 27, 1977). Concerning a list of prioritized tasks for site analysis.
3. Letter from Paul G. Keough, EPA Region I to William X. Wall, Member of the Commonwealth of Massachusetts State Senate (February 2, 1978). Concerning information on site activities.
4. Memorandum from Thomas C. McMahon, Commonwealth of Massachusetts Division of Water Pollution Control to David Standley, Commonwealth of Massachusetts Department of Environmental Quality Engineering (March 8, 1978). Concerning the status of the Silresim Chemical Corporation as of March 8, 1978.
5. Letter from Thomas C. McMahon, Commonwealth of Massachusetts Division of Water Pollution Control to William Adams, EPA Region I (April 10, 1978). Concerning a request for assistance with water sample analysis.
6. Letter from William Adams, EPA Region I to Thomas C. McMahon, Commonwealth of Massachusetts Division of Water Pollution Control (April 27, 1978). Concerning assistance in identifying organic chemicals.
7. Letter from Thomas C. McMahon, Commonwealth of Massachusetts Division of Water Pollution Control to Charles D. Lincoln, EPA Region I (August 8, 1978). Concerning a request for initiation of immediate defensive actions.
8. Letter from Charles D. Lincoln, EPA Region I to Thomas C. McMahon, Commonwealth of Massachusetts Division of Water Pollution Control (August 18, 1978). Concerning the immediate initiation of defense actions.
9. Memorandum from Hans Bonne, Commonwealth of Massachusetts Division of Water Pollution Control to Members of the Task Force on Silresim (November 20, 1978). Concerning initiation of cleanup operations.
10. Telephone Notes between Richard C. Boynton, EPA Region I and Glen Gilmore, Commonwealth of Massachusetts Division of Water Pollution Control (January 4, 1979). Concerning update of site cleanup.
11. Trip Report on a Visit to Silresim Chemical Corp., Janet DiBiasio, EPA Region I and Peter Schneider, NERCOM (February 15, 1979). Concerning observation of cleanup operations as of February 1, 1979.
12. Meeting Notes, Public Meeting for the Silresim Chemical Corp. Site, EPA Region I, Commonwealth of Massachusetts Department of Environmental Quality Engineering (June 23, 1981). Concerning public demands for sampling at the site.

2.2 Removal Response Reports

1. "Hazardous Waste Cleanup: Silresim Site in Lowell, Massachusetts," The MITRE Corporation for the Commonwealth of Massachusetts Division of Water Pollution Control (June 1979).

2.3 Sampling and Analysis Data

The Sampling and Analysis Data for the Removal Response may be reviewed, by appointment only, at EPA Region I, Boston, Massachusetts.

2.4 Pollution Reports (POLREPs)

1. POLREP 2, EPA Region I (June 30, 1983).
2. POLREP 3, EPA Region I (July 13, 1983).
3. POLREP 4, EPA Region I (August 4, 1983).
4. POLREP 4, EPA Region I (September 2, 1983).
5. POLREP 1, EPA Region I (June 25, 1986).
6. POLREP 2 and Final, EPA Region I (August 25, 1986).
7. POLREP 1, EPA Region I (December 15, 1986).

2.9 Action Memoranda

1. Memorandum from William N. Hedeman Jr., EPA Headquarters to Lee M. Thomas, EPA Headquarters (June 10, 1983). Concerning implementation of initial remedial measures including removal of structures, installation of fencing and signs, and site cap.
2. Memorandum from Katherine E. Daly, EPA Region I to Michael R. Deland, EPA Region I (April 28, 1986). Concerning completion of removal activities and reparation of a chain link fence.

3.0 Remedial Investigation (RI)

3.1 Correspondence

1. Letter from J. Elliott Thomas Jr., EPA Region I to John D. Tewhey, Jordan Gorrill Associates (January 24, 1983). Concerning results and QA package from soil taken at Silresim.
2. Memorandum from EPA Region I Health Effects Study Group to Merrill S. Hohman, EPA Region I (April 1, 1983). Concerning conclusions reached from the March 14, 1983 through March 23, 1983 air monitoring study.
3. Letter from Barbara H. Ikalainen, EPA Region I to Phillip Nyman (Attorney for Wright Leasing and Realty) (June 21, 1983). Concerning transmittal of the Remedial Action Master Plan.
4. Letter from Barbara H. Ikalainen, EPA Region I to John Scannell, Scannell Boiler Works (June 21, 1983). Concerning transmittal of the Remedial Action Master Plan for the Silresim Site.
5. Letter from Peter J. Aucella, City of Lowell Division of Planning and Development to David M. Webster, EPA Region I (April 2, 1985). Concerning request that issues surrounding potential development at Silresim Site be addressed in the Remedial Investigation/Feasibility Study Work Plan.
6. Letter from David M. Webster, EPA Region I to Norine Danley, Ayer City Homeowners and Renters Association and Massachusetts Fair Share (June 3, 1985). Concerning reopening of comment period and other questions surrounding the Remedial Investigation/Feasibility Study Work Plan.
7. Letter from John R. Moebes, EPA Region I to Peter J. Aucella, City of Lowell Division of Planning and Development (June 5, 1985). Concerning response to letter of April 2, 1985 regarding upcoming Remedial Investigation/Feasibility Study issues.
8. GCA Corporation Attendance List, Remedial Investigation/Feasibility Study Kickoff Meeting for the Silresim Chemical Corp. Site (July 11, 1985).
9. Meeting Notes, Remedial Investigation/Feasibility Study Kickoff Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (July 19, 1985). Concerning the RI/FS process and overview.
10. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (August 7, 1985). Concerning planning of the RI/FS.

3.1 Correspondence (cont'd.)

11. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (September 17, 1985). Concerning various plans in the RI/FS.
12. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (October 23, 1985). Concerning Project Operations Plans.
13. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (November 5, 1985). Concerning RI/FS progress.
14. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (December 11, 1985). Concerning the RI/FS work plan.
15. Letter from Heather M. Ford, EPA Region I to James K. Rogers, Silresim Site Trust (December 16, 1985). Concerning the December RI/FS Oversight and Planning meeting.
16. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (January 13, 1986). Concerning RI/FS progress.
17. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (February 4, 1986). Concerning site sampling and progress.
18. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (March 7, 1986). Concerning progress and deliverable dates.
19. Letter from Philip L. Scannell, Dennis Scannell, and John P. Scannell, Scannell Development Group to E. Michael Thomas, EPA Region I (March 13, 1986) with attached print of proposed buildings. Concerning construction plans, excavation, and moving fill.
20. Letter from James K. Rogers, Silresim Site Trust to David M. Webster, EPA Region I (April 18, 1986). Concerning deliverable delays.
21. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (April 24, 1986). Concerning site progress.
22. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (May 14, 1986). Concerning QA/QC of sampling procedures and progress.
23. Letter from Richard J. Chalpin, Commonwealth of Massachusetts Department of Environmental Quality Engineering to Norine Brodeur, Ayer City Homeowners and Renters Association (May 30, 1986). Concerning answers to questions about the state's role in the Silresim Remedial Investigation/Feasibility Study.
24. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (June 20, 1986). Concerning site progress.
25. Draft Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting and Public Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (July 14, 1986). Concerning citizens issues, and site progress and plans.
26. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (August 11, 1986). Concerning sampling and site progress.
27. Meeting Notes, Remedial Investigation/Feasibility Study Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, GCA Corporation and EPA Region I (September 9, 1986). Concerning sampling and site progress.

3.1 Correspondence (cont'd.)

28. Letter from Joel Balmat, EPA Region I to James K. Rogers, Silresim Site Trust (October 20, 1986). Concerning conditional approval of proposed vent sampling plan.
29. Letter from Joel Balmat, EPA Region I to Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. (October 20, 1986). Concerning monthly groundwater monitoring.
30. Meeting Notes, Final Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, Alliance Technologies Corporation and EPA Region I (November 24, 1986). Concerning overview of field activities and deliverables.
31. Final Draft Meeting Notes, Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, Alliance Technologies Corporation and EPA Region I (December 15, 1986). Concerning overview and oversight of field activities.
32. Final Version Meeting Notes, Monthly Oversight and Planning Meeting for the Silresim Chemical Corp. Site, Alliance Technologies Corporation and EPA Region I (March 4, 1987). Concerning dioxin in soils, overview of field activities, and deliverables.
33. Transcript, EPA Region I and Goldberg-Zoino & Associates, Inc. Remedial Investigation Review Meeting, Camp Dresser & McKee Inc. (May 27, 1987).
34. Letter from Margaret J. Leshen, EPA Region I to James K. Rogers, Silresim Site Trust (May 17, 1988). Concerning scheduling of events necessary for continuation of the Silresim Superfund Project.
35. Letter from Leslie McVickar, EPA Region I to Philip L. Scannell Jr., Lowell Iron and Steel Corp. (June 16, 1988). Concerning soil sampling data and health risk material.
36. Meeting Notes, Remedial Investigation/Feasibility Study Technical Oversight and Planning Meeting, EPA Region I (November 18, 1988). Concerning field studies, air sampling, and the RI/FS.
37. Letter from Leslie McVickar, EPA Region I to Kenneth Carr, U.S. Department of the Interior Fish and Wildlife Division (December 27, 1988). Concerning transmittal of the March 1987 "Draft - Remedial Investigation Report," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
38. Letter from Leslie McVickar, EPA Region I to Philip L. Scannell Jr., Lowell Iron and Steel Company (March 16, 1989). Concerning soils analytical data, summary tables and well screening results.
39. Letter from James K. Rogers, Silresim Site Trust to Leslie McVickar, EPA Region I (March 23, 1989). Concerning revised schedule for the Remedial Investigation.
40. Letter from Leslie McVickar, EPA Region I to Kenneth Carr, U.S. Department of the Interior Fish and Wildlife Division (April 18, 1989). Concerning transmittal of the April 1989 "Revised Draft Report - Remedial Investigation - Volumes I through VIII," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
41. Memorandum from Deirdre Menoyo, Goodwin, Procter & Hoar (Attorney for Silresim Site Trust) to E. Michael Thomas, EPA Region I, Leslie McVickar, EPA Region I, Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. and Silresim Trustees (July 12, 1989). Concerning the Dense Non-Aqueous Phase Liquid (DNAPL) article by Allan Feenstra and John A. Cherry.
42. Letter from James K. Rogers, Silresim Site Trust to Leslie McVickar, EPA Region I (January 16, 1990). Concerning the Silresim DNAPL Investigation.
43. Letter from Merrill S. Hohman, EPA Region I to James K. Rogers, Silresim Site Trust (February 27, 1990). Concerning site RI/FS issues.
44. Memorandum from William Holden, CDM Federal Programs Corporation to File (March 27, 1990). Concerning field oversight activities at the site.
45. "Presentation to the U.S. Environmental Protection Agency Region I," Guy C. Patrick, Golder Associates Ltd. (August 14, 1990).

3.1 Correspondence (cont'd.)

46. Letter from Leslie McVickar, EPA Region I to James K. Rogers, Silresim Site Trust (August 22, 1990). Concerning the DNAPL Investigation.
47. Letter from James K. Rogers, Silresim Site Trust to Leslie McVickar, EPA Region I (August 29, 1990). Concerning the DNAPL Investigation.
48. Letter from RuthAnn Sherman, EPA Region I to Susan M. Cooke, Goodwin, Procter & Hoar (Attorney for Silresim Site Trust) (September 7, 1990). Concerning notification that EPA has approved the March 1990 Final Draft Remedial Investigation for the site.
49. Letter from Susan M. Cooke, Goodwin, Procter & Hoar (Attorney for Silresim Site Trust) to RuthAnn Sherman, EPA Region I (October 23, 1990). Concerning the attached "Comments on DNAPL Investigatory Program at the Silresim Superfund Site," John A. Cherry and Guy C. Patrick (October 22, 1990).
50. Letter from Leslie McVickar and RuthAnn Sherman, EPA Region I to Susan M. Cooke, Goodwin, Procter & Hoar (Attorney for Silresim Site Trust) (November 8, 1990). Concerning the DNAPL Investigation.
51. Memorandum from J. Pickens, Camp Dresser & McKee Inc. to Addressees (November 28, 1990). Concerning the Cone Penetration Testing (CPT) program activities at the site.
52. Memorandum from J. Pickens, Camp Dresser & McKee Inc. to Addressees (December 7, 1990). Concerning the CPT program activities at the site.
53. Letter from James P. Cassidy Jr. (Attorney for Ralph Tucci) to EPA Region I and Commonwealth of Massachusetts Department of Environmental Protection (January 21, 1991). Concerning request for sampling data.
54. Letter from James P. Cassidy Jr. (Attorney for Ralph Tucci) to Merrill S. Hohman, EPA Region I (May 7, 1991). Concerning request for future sampling data.
55. Letter from Leslie McVickar, EPA Region I to James P. Cassidy Jr. (Attorney for Ralph Tucci) (May 22, 1991). Concerning Mr. Cassidy's request for sampling data.
56. Letter from Leslie McVickar, EPA Region I to James P. Bond, Tanner Street Businessmen's Group (July 26, 1991). Concerning transmittal of the March 1990 "Final Draft Report - Remedial Investigation - Volumes I-III," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.

3.2 Sampling and Analysis Data

1. Letter from Richard L. Fortin, Perkins Jordan, Inc. to J. Elliot Thomas Jr., EPA Region I (January 10, 1983). Concerning the transmittal of attached Boring Logs, New England Boring Contractors, Inc. (December 8, 1982 through December 13, 1982), Field Inspection Boring Logs, E.C. Jordan Co. (December 8, 1982 through December 14, 1982), and Boring and Monitoring Well Locations Map of the Silresim Chemical Corp. Site.
2. Air Sampling Locations Maps and Corresponding Data (March 14, 1983 through March 23, 1983).
3. "Draft - Silresim Air Monitoring - Silresim Chemical Corporation," NUS Corporation (August 10, 1984).
4. Memorandum from Mark E. Brickell, NUS Corporation to David M. Webster, EPA Region I (August 1, 1985) with attachments. Concerning Silresim CLP Analytical Data from soil samples taken on June 29, 1983 outside of existing fence line.
5. Memorandum from Mark E. Brickell, NUS Corporation to David M. Webster, EPA Region I (August 1, 1985). Concerning Silresim CLP Analytical Data from soil samples taken on April 27, 1983 outside of existing fence line.
6. Memorandum from Mark E. Brickell, NUS Corporation to David M. Webster, EPA Region I (August 1, 1985). Concerning Silresim groundwater monitoring.

3.2 Sampling and Analysis Data (cont'd.)

7. Letter from Matthew West for Lawrence Feldman, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trustees (March 10, 1986). Concerning attached laboratory report from initial round of groundwater samples at the Silresim site.
8. Letter from Lawrence Feldman, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trust (April 1, 1986). Concerning gas chromatograph screening results.
9. Letter from Claire G. Quadri for Charles A. Lindberg and Lawrence Feldman, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trustees (May 1, 1986). Concerning transmittal of attached "Volatile Organic Analysis Data Time History of Concentrations of Chemical Compounds," Goldberg-Zoino & Associates, Inc. (December 2, 1981 through December 4, 1985).
10. Letter from Lawrence Feldman, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trust (May 22, 1986). Concerning PCB contamination of surficial soils.
11. Letter from John E. Ayres, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trustees (May 30, 1986). Concerning the transmittal of attached outline of a proposed air vent sorbent tube sampling program for the Silresim site.
12. Letter from Lawrence Feldman, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trust (May 30, 1986). Concerning transmittal of chemical analyses completed by Roy F. Weston, Inc. during Parts II and III of the Silresim Remedial Investigation.
13. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to Nancy Bettinger, Commonwealth of Massachusetts Department of Environmental Quality Engineering (May 30, 1986). Concerning transmittal of attached subsurface profile sketches and water level data sheets.
14. Memorandum from Charles Moulton, GCA Corporation to Thomas Spittler, EPA Region I (July 7, 1986). Concerning Organic Data Validation Case No. 5870, IT Analytical Services.
15. Memorandum from Michael Jasinski, GCA Corporation to Nancy Piligian and David M. Webster, EPA Region I and Rosemary Ellersick, GCA Corporation (July 8, 1986). Concerning transmittal of attached memos reporting on Organic Validation Cases No. 5304 - Compuchem Labs, No. 5304 - Chemtech Consulting, No. 5629 - Hittman Ebasco, Inc., No. 5629 - Aquatec, Inc. (July 7, 1986).
16. Memorandum from Charles A. Lindberg and William R. Beloff for John E. Ayres, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trust (July 9, 1986). Concerning the contents and transmittal of attached results of surficial soil PCB analyses completed by Roy F. Weston, Inc. and Cambridge Analytical Associates, Inc.
17. Memorandum from Nancy Bettinger, Commonwealth of Massachusetts Department of Environmental Quality Engineering to Richard J. Chalpin, Commonwealth of Massachusetts Department of Environmental Quality Engineering (August 19, 1986) with attached "Analysis of Water Samples from MSF - Lowell - Silresim," ERT for Wehran Engineering (August 15, 1986). Concerning chemical analysis results for samples collected from sewers in the vicinity of the Silresim site.
18. Letter from James Okun, Goldberg-Zoino & Associates, Inc. to Joel Balmat, EPA Region I (November 3, 1986). Concerning transmittal of chromatography for the Silresim Air Vent Study.
19. Letter from Marie M. Studer, Cambridge Analytical Associates to Linda Boynton, EPA Headquarters (November 4, 1986). Concerning transmittal of attached sample data package for Case No. 6483 (Inorganics Analysis) for the Silresim site.

3.2 Sampling and Analysis Data (cont'd.)

20. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trust (November 6, 1986). Concerning transmittal of attached draft preliminary results of groundwater screening and revision of proposed Phase II groundwater sampling plan.
21. Memorandum from Peter R. Kahn, EPA Region I to Joel Balmat, EPA Region I (November 19, 1986). Concerning air vent sampling field performance audit at Silresim site.
22. Meeting Notes, November 14, 1986 Silresim Remedial Investigation/Phase Two Groundwater Sampling Meeting, EPA Region I (November 19, 1986) with attached draft groundwater sampling data. Concerning additional sampling of specific monitoring wells.
23. Letter from Joel Balmat, EPA Region I to Richard Boyle, Transit Construction Company (November 26, 1986). Concerning transmittal of attached analytical results of sampling activities on the Transit Construction Company property.
24. Letter from Emily C. Carfioli, Roy F. Weston, Inc. to Claire G. Quadri, Goldberg-Zoino & Associates, Inc. (December 4, 1986). Concerning transmittal of attached sampling and analysis data summaries.
25. Letter from Emily C. Carfioli, Roy F. Weston, Inc. to Claire G. Quadri, Goldberg-Zoino & Associates, Inc. (December 6, 1986). Concerning transmittal of attached volatile organic analysis data and summary sheet for dioxin samples.
26. Memorandum from Elio Goffi, EPA Region I to Nancy Barmakian, EPA Region I (January 8, 1987). Concerning data validation for Silresim Case No. 2606A.
27. Letter from Claire G. Quadri, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trust (January 15, 1987). Concerning transmittal of attached preliminary dioxin results.
28. "Silresim Phase II Split Samples" Data, GCA Corporation and Alliance Technologies Corporation (February 12, 1987).
29. "Work/QA Plan Short Form - Silresim Chemical Corp. Site," EPA Region I (June 3, 1987).
30. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to Joel Balmat, EPA Region I (July 1, 1987). Concerning transmittal of attached "Silresim Water Levels," (April 10, 1987).
31. Memorandum from James Ward, EPA Region I to Gary Lipson, EPA Region I (August 12, 1987). Concerning Silresim soil sampling.
32. Memorandum from Gary Lipson, EPA Region I to Joel Balmat, EPA Region I (August 24, 1987). Concerning sampling at Silresim Site.
33. Memorandum from Elio Goffi, EPA Region I to Nancy Papoulias, EPA Region I (November 11, 1987). Concerning attached Silresim Site Case No. 3012-A.
34. Letter Report from John Walker for Karen L. Stone, Camp Dresser & McKee Inc. to Nancy Barmakian, EPA Region I (December 10, 1987). Concerning Case No. 8129 - Four Low Level Soil Samples AH828-AH831 - Scannell Property.
35. Memorandum from S.R. Gates, Camp Dresser & McKee Inc. to Margaret J. Leshen, EPA Region I (February 16, 1988). Concerning transmittal of attached Silresim - Scannell property soil sampling.
36. Memorandum from Margaret J. Leshen, EPA Region I to File (February 18, 1988). Concerning soil sample locations at Scannell property.
37. Memorandum from Karen L. Stone, Camp Dresser & McKee Inc. to Nancy Barmakian, EPA Region I (February 19, 1988). Concerning case 8129, organic data validation, and corrections to letter report of December 10, 1987.

3.2 Sampling and Analysis Data (cont'd.)

38. Letter Report from Karen L. Stone, Camp Dresser & McKee Inc. to Margaret J. Leshen, EPA Region I (February 22, 1988) with attached Letter Report from Karen L. Stone, Camp Dresser & McKee Inc. to Nancy Barmakian, EPA Region I (February 19, 1988). Concerning explanation of Data Qualifiers for Validated Organic and Inorganic Data - Case 8129, as an addendum to letter report of December 10, 1987.
39. Memorandum from Peter R. Kahn, EPA Region I to Leslie McVickar, EPA Region I (October 3, 1988). Concerning the transmittal of attached revised "Indoor Air Toxics Study Work Plan - Lowell Iron and Steel, Co.," EPA Region I (September 1988).
40. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to Leslie McVickar, EPA Region I (October 20, 1988). Concerning surficial soil sampling.
41. Memorandum from Peter R. Kahn, EPA Region I to Leslie McVickar, EPA Region I (November 4, 1988). Concerning transmittal of attached final "Indoor Air Toxics Sampling Results - Lowell Iron and Steel Company," EPA Region I (October 1988).
42. "Certificate of Laboratory Analysis," Camp Dresser & McKee Inc. (November 9, 1988). Concerning Silresim samples collected October 12, 1988.
43. Memorandum from Peter R. Kahn, EPA Region I to Leslie McVickar, EPA Region I (November 30, 1988). Concerning the transmittal of attached "Indoor Air Toxics Study Work Plan - Administration Building - Lowell Iron and Steel Company," EPA Region I (November 1988).
44. "Case Report," TMS Analytical Services Inc. (December 5, 1988). Concerning case 4246A with attached:
    A. Letter from Mary Ann Becker, Lucy B. Guzman, and Joseph D. Mastone, Roy F. Weston, Inc. to Dennis P. Gagne, EPA Region I (January 26, 1989). Concerning the review and evaluation of attached dioxin/furan package submitted by TMS Analytical Services Inc.
    B. Memorandum from Leslie McVickar, EPA Region I to Debra Szaro, EPA Region I (February 21, 1989). Concerning request for review of dioxin samples.
    C. Letter from Dan Delinger, TMS Analytical Services, Inc. to Elio Goffi, EPA Region I (March 23, 1989). Concerning explanation of discrepancy of data.
    D. Memorandum from Elio Goffi, EPA Region I to Leslie McVickar, EPA Region I (April 4, 1989). Concerning independent audit of data package from Roy F. Weston, Inc.
45. Memorandum from Peter R. Kahn, EPA Region I to Leslie McVickar, EPA Region I (January 31, 1989). Concerning the transmittal of "Indoor Air Toxics Sampling Results - Administration Building - Lowell Iron and Steel Company," EPA Region I (January 1989).
46. Letter from Stacy Sabol, Goldberg-Zoino & Associates, Inc. to Leslie McVickar, EPA Region I (February 16, 1989). Concerning draft groundwater analytical summary tables for samples taken in the fall of 1988.
47. Letter from Charles A. Lindberg, Goldberg, Zoino & Associates, Inc. to James K. Rogers, Silresim Site Trust (March 8, 1989). Concerning attached Final Status Report on Fall 1988 Soil Samples.
48. Letter from Charles A. Lindberg, Goldberg, Zoino & Associates, Inc. to James K. Rogers, Silresim Site Trust (March 10, 1989). Concerning attached tables on field activities.
49. Memorandum from William R. Swanson, Camp Dresser & McKee Inc. to Leslie McVickar, EPA Region I (April 3, 1989). Concerning summary table for split soil sampling and potentially responsible party results.

3.2 Sampling and Analysis Data (cont'd.)

The records cited in entry numbers 50 through 71 may be reviewed, by appointment only, at EPA Region I, Boston, Massachusetts.

50. Letter from John D. Tewhey, Perkins Jordan, Inc. to J. Elliott Thomas Jr., EPA Region I (February 11, 1983). Concerning the attached analyses of 15 soil samples from the Lowell area.
51. "Inorganics Traffic Report" Forms and "Organics Traffic Report" Forms Package, EPA Region I (December 4, 1985).
52. "Inorganics Traffic Report" Forms and "Organics Traffic Report" Forms Package, EPA Region I (February 26, 1986 through November 13, 1986).
53. Letter from Carter P. Nulton, Roy F. Weston, Inc. to Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. (February 28, 1986). Concerning data reports of January 27, 1986 (metals, VOAs and BNAs) and January 28, 1986 (TCDD).
54. Letter from Matthew West for Lawrence Feldman, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trustees (March 10, 1986). Concerning transmittal of attached laboratory report from initial round of groundwater samples at the Silresim site.
55. Memorandum from Michael Jasinski, GCA Corporation to David M. Webster, EPA Region I (July 7, 1986). Concerning transmittal of copies of all GCA Corporation sample results and accompanying split sample results.
56. "Organic Analysis Data Sheet" Forms, Aquatec, Inc. (October 11, 1986 through November 26, 1986). Concerning organics analysis results from Phase II surficial soil sampling at Silresim site.
57. "Inorganics Traffic Report" Forms and "Organics Traffic Report" Forms Package, EPA Region I (October 24, 1986 through October 28, 1986).
58. "Inorganics Traffic Report" Forms and "Organics Traffic Report" Forms Package, EPA Region I (November 20, 1986 through November 21, 1986).
59. "Initial Calibration Summary," (November 25, 1986). Concerning dioxin.
60. Letter from Elio Goffi, EPA Region I to Nancy Barmakian, EPA Region I (January 8, 1987). Concerning attached data validation for Silresim Case No. 2626A.
61. "Inorganics Traffic Report" Forms and "Organics Traffic Report" Forms Package, EPA Region I (January 15, 1987).
62. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to the Silresim Site Trust (February 2, 1987). Concerning transmittal of draft analytical results (samples taken from November through December 1987) from soil and groundwater sampling rounds conducted at the Silresim site.
63. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to Joel Balmat, EPA Region I (February 10, 1987). Concerning transmittal of attached revised data summary and full QA/QC package for dioxin analyses of samples SS-16 and SS-17.
64. Letter from Benjamin Rice, Alliance Technologies Corporation to Joel Balmat, EPA Region I (March 4, 1987). Concerning content and transmittal of attached data validation of Phase Two test pit samples - Case No. 6572.
65. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to Joel Balmat, EPA Region I (March 6, 1987). Concerning the transmittal of attached QA/QC packages for samples SS-16, 17, and 18, and samples SS-6, 7, 8, 10, 11, and 14.
66. "Technical Report for USEPA - Volumes 1, 2, and 3," Environmental Testing and Certification Corp. (June 1987). Concerning 3 volumes of raw dioxin data.
67. Letter from Robert F. Smith for Harry J. Klann, Environmental Testing and Certification Corp. to Nancy Barmakian, EPA Region I (August 11, 1987). Concerning addendum to "Technical Report for USEPA - Volumes 1, 2, and 3," Environmental Testing and Certification Corp. (June 1987).

3.2 Sampling and Analysis Data (cont'd.)

68. Letter from Lewis Pillis, Centec Analytical Services, Inc. to Wayne Wirtanen, EPA Region I (October 9, 1987). Concerning transmittal of attached inorganic analyses data package for Case No. 8129.
69. "Regional Review of Organic Contract Laboratory Data Package," NUS Corporation (December 10, 1987). Concerning Case No. 8129 - Scannell Property.
70. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to James K. Rogers, Silresim Site Trust (January 4, 1989). Concerning attached soil and groundwater data.
71. "Data Validation for the Organic Fraction of Case 10725," Versar, Inc. (February 14, 1989). Concerning Fall 1988 split sampling results from Camp Dresser & McKee Inc.

3.4 Interim Deliverables

1. "Preliminary Draft - Remedial Action Master Plan," Camp Dresser & McKee Inc. (January 10, 1983).
2. "Remedial Action Master Plan," Camp Dresser & McKee Inc. (April 1983).
3. Draft "Remedial Action Operating Plan," EPA Region I (June 1983).
4. Draft "Project Operations Plan" - Deliverable 1, Updated with Revisions 1 and 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (August 22, 1985).
5. Draft "Project Operations Plan - Volume I," Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (October 1985).
6. Draft "Project Operations Plan - Volume II" - Revision 1, Updated with Revisions 1 and 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (October 1985).
7. Draft - "Phase One Sampling Plan" - Deliverable 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (December 1985).
8. Final - "Project Operations Plans - Volume I" - Deliverable 1, Revision 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (January 1986).
9. Final - "Project Operations Plans - Volume II" - Deliverable 1, Revision 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (January 1986).
10. "Use of Barcad Instruments for Groundwater Monitoring," Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (January 1986).
11. "Phase One Sampling Plan" - Deliverable 2, Revision 1, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (February 1986).
12. Letter from John E. Ayres, Goldberg-Zoino & Associates, Inc. to Silresim Site Trustees (May 30, 1986). Concerning transmittal of the outline of a proposed air vent sorbent tube sampling program for the Silresim site (Deliverable - 4).
13. "Preliminary Results - Phase I Sampling" - Deliverable 3, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (May 1986).
14. "Phase Two Sampling Plan" - Deliverable 4, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (June 1986).
15. "Phase Two Sampling Plan" - Revised Deliverable 4, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (August 1986).
16. Letter from Charles A. Lindberg for Lawrence Feldman, Goldberg-Zoino & Associates, Inc. to Silresim Site Trust (October 1, 1986). Concerning proposed "Phase II Groundwater Sampling and Analysis Plan" for the Silresim site (expands on section 3.50 of Deliverable 4).
17. Letter Report from Charles A. Lindberg for Lawrence Feldman, Goldberg-Zoino & Associates, Inc. to Silresim Site Trustees (October 10, 1986). Concerning protocol for vent air sampling.
18. "Phase Two Sampling Plan" - Revised Deliverable 4, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (November 1986).

3.4 Interim Deliverables (cont'd.)

19. "Preliminary Results - Phase Two Sampling" - Deliverable 5, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (December 1986).
20. "Site-Specific Health and Safety Plan - Remedial Investigation Addendum - Silresim Site," Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (October 1988).
21. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to James K. Rogers, Silresim Site Trust (December 29, 1988). Concerning transmittal of attached addenda to Remedial Investigation Work Plans.
22. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to James K. Rogers, Silresim Site Trust (May 25, 1990). Concerning the attached map and "Seismic Refraction Survey," Weston Geophysical Corporation for Goldberg-Zoino & Associates, Inc. (April 1990).
23. Letter from William R. Swanson, CDM Federal Programs Corporation to Leslie McVickar, EPA Region I (September 6, 1990). Concerning the attached "Health and Safety Plan," CDM Federal Programs Corporation (September 5, 1990).

Comments

24. Comments Dated January 19, 1983 from Thomas F. McLoughlin, Commonwealth of Massachusetts Department of Environmental Quality Engineering on the January 10, 1983 "Preliminary Draft - Remedial Action Master Plan," Camp Dresser & McKee Inc.
25. Comments Dated January 25, 1983 from Norine Danley, Lowell Fair Share on the January 10, 1983 "Preliminary Draft - Remedial Action Master Plan," Camp Dresser & McKee Inc.
26. Comments Dated March 4, 1983 from Thomas F. McLoughlin, Commonwealth of Massachusetts Department of Environmental Quality Engineering on the January 10, 1983 "Preliminary Draft - Remedial Action Master Plan," Camp Dresser & McKee Inc.
27. Comments Dated April 22, 1983 from Thomas F. McLoughlin, Commonwealth of Massachusetts Department of Environmental Quality Engineering on the April 1983 "Remedial Action Master Plan," Camp Dresser & McKee Inc.
28. Comments Dated July 12, 1983 from Bruce Maillet, Commonwealth of Massachusetts Department of Environmental Quality Engineering on the June 1983 Draft "Remedial Action Operating Plan," EPA Region I.
29. Comments Dated July 12, 1983 from Wesley E. Straub, U.S. Department of Health and Human Services on the June 1983 Draft "Remedial Action Operating Plan," EPA Region I.
30. Comments Dated September 3, 1985 from Philip Gschwend, Massachusetts Institute of Technology Department of Civil Engineering on the August 22, 1985 Draft "Project Operations Plan" - Deliverable 1, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
31. Comments Dated September 4, 1985 from Phyllis Robey, Lowell Fair Share on the August 22, 1985 Draft "Project Operations Plan" - Deliverable 1, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees with attached "Proposal for a Technical Assistance Grant."
32. Comments Dated September 24, 1985 from David M. Webster, EPA Region I on the August 22, 1985 Draft "Project Operations Plan" - Deliverable 1, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
33. Letter from David M. Webster, EPA Region I to James K. Rogers, Silresim Site Trust (October 8, 1985). Concerning transmittal of attached Comments Dated October 1, 1985 from Charles Porfert, EPA Region I on the August 22, 1985 Draft "Project Operations Plan" - Deliverable 1, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.

3.4 Interim Deliverables (cont'd.)

Comments

34. Letter from Heather M. Ford, EPA Region I to James K. Rogers, Silresim Site Trust (November 18, 1985) with attached Comments from EPA Region I on the August 22, 1985 Draft "Project Operations Plan" - Deliverable 1, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees. Concerning conditional approval of the "Project Operations Plan" - Deliverable 1, Revision 1, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees (October 1985).
35. Comments Dated January 10, 1986 from David M. Webster, EPA Region I on the December 1985 Draft - "Phase One Sampling Plan" - Deliverable 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
36. Comments Dated January 15, 1986 from James Thomas, Robert Clemens, and Michael Jasinski, GCA Corporation on the December 1985 Draft - "Phase One Sampling Plan" - Deliverable 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees with attached "A Laboratory Evaluation of Ground Water Sampling Mechanisms," M.J. Barcelona, J.A. Helfrich, E.E. Garske, and J.P. Gibb.
37. Comments Dated January 21, 1986 from Julio C. Olimpio, U.S. Department of the Interior Geological Survey Water Resources Division on the December 1985 Draft - "Phase One Sampling Plan" - Deliverable 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
38. Comments Dated January 28, 1986 from Heather M. Ford, EPA Region I on the December 1985 Draft - "Phase One Sampling Plan" - Deliverable 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
39. Comments Dated February 6, 1986 from Heather M. Ford, EPA Region I on the December 1985 Draft - "Phase One Sampling Plan" - Deliverable 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
40. Comments and Approval Dated February 24, 1986 from Heather M. Ford, EPA Region I on the December 1985 Draft - "Phase One Sampling Plan" - Deliverable 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
41. Comments Dated February 28, 1986 from Philip Gschwend, Massachusetts Institute of Technology Department of Civil Engineering on the December 1985 Draft - "Phase One Sampling Plan" - Deliverable 2, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
42. Comments and Approval Dated May 13, 1986 from David M. Webster, EPA Region I on the May 1986 "Preliminary Results - Phase I Sampling" - Deliverable 3, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
43. Comments Dated June 23, 1986 from Richard J. Chalpin, Commonwealth of Massachusetts Department of Environmental Quality Engineering on the May 1986 "Preliminary Results - Phase I Sampling" - Deliverable 3, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
44. Comments Dated July 10, 1986 from Philip Gschwend, Massachusetts Institute of Technology Department of Civil Engineering on the June 1986 "Phase Two Sampling Plan" - Deliverable 4, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
45. Comments Dated July 21, 1986 from Richard J. Chalpin, Commonwealth of Massachusetts Department of Environmental Quality Engineering on the June 1986 "Phase Two Sampling Plan" - Deliverable 4, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
46. Draft Comments Dated August 4, 1986 on the June 1986 "Phase Two Sampling Plan" - Deliverable 4, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
47. Comments Dated August 13, 1986 from David M. Webster, EPA Region I on the June 1986 "Phase Two Sampling Plan" - Deliverable 4, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.

3.4 Interim Deliverables (cont'd.)

Comments

48. Comments and Conditional Approval Dated September 18, 1986 from David M. Webster, EPA Region I on the August 1986 "Phase Two Sampling Plan" - Revised Deliverable 4, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
49. Comments Dated October 16, 1986 from Peter R. Kahn, EPA Region I on the October 10, 1986 Letter Report Concerning Protocol for Vent Air Sampling, Goldberg-Zoino & Associates, Inc.
50. Comments and EPA Conditional Approval Dated October 20, 1986 from Joel Balmat, EPA Region I on the October 10, 1986 Letter Report Concerning Protocol for Vent Air Sampling, Goldberg-Zoino & Associates, Inc.
51. Comments Dated November 21, 1986 from David M. Webster, EPA Region I on the "Phase Two Sampling Plan" - Revised Deliverable - 4, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.
52. Comments and Approval Dated February 2, 1987 from Heather M. Ford, EPA Region I on the December 1986 "Preliminary Results - Phase Two Sampling" - Deliverable 5, Goldberg-Zoino & Associates, Inc. for Silresim Site Trustees.

Responses to Comments

53. Response Dated March 9, 1983 from Merrill S. Hohman, EPA Region I on the January 25, 1983 Comments from Norine Danley, Lowell Fair Share.
54. Response Dated November 27, 1985 from James K. Rogers, Silresim Site Trust and John E. Ayres, Goldberg-Zoino & Associates, Inc. to the November 18, 1985 Letter from Heather M. Ford, EPA Region I.
55. Response Dated December 20, 1985 from Heather M. Ford, EPA Region I to the November 27, 1985 Response from James K. Rogers, Silresim Site Trust and John E. Ayres, Goldberg-Zoino & Associates, Inc.
56. Response Dated January 22, 1986 from John E. Ayres, Goldberg-Zoino & Associates, Inc. to the January 10, 1986 Comments from David M. Webster, EPA Region I.
57. Response Dated May 30, 1986 from Lawrence Feldman, Goldberg-Zoino & Associates, Inc. to the May 13, 1986 Comments and Approval from David M. Webster, EPA Region I.

3.6 Remedial Investigation (RI) Reports

1. "Draft - Remedial Investigation Report - Volume I" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1987).
2. "Draft - Remedial Investigation Report - Volume II" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1987).
3. "Draft - Remedial Investigation Report - Volume III" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1987).
4. "Draft - Remedial Investigation Report - Volume IV" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1987).
5. "Draft - Remedial Investigation Report - Revised Chapters 5, 6, and 7," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (September 30, 1988).
6. "Revised Draft Report - Remedial Investigation - Volume I," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (April 1989).
7. "Revised Draft Report - Remedial Investigation - Volume II - Tables," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (April 1989).
8. "Revised Draft Report - Remedial Investigation - Volume III," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (April 1989).

3.6 Remedial Investigation (RI) Reports (cont'd.)

9. "Revised Draft Report - Remedial Investigation - Volume IV - Appendices A-F," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (April 1989).
10. "Revised Draft Report - Remedial Investigation - Volume V - Appendices G-J," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (April 1989).
11. "Revised Draft Report - Remedial Investigation - Volume VI - Appendices K-M," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (April 1989).
12. "Revised Draft Report - Remedial Investigation - Volume VII - Appendices N-O," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (April 1989).
13. "Revised Draft Report - Remedial Investigation - Volume VIII - Appendices P-R," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (April 1989).
14. "Revised Draft Report - Remedial Investigation - Volume I," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (September 1989).
15. "Revised Draft Report - Remedial Investigation - Volume II," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (September 1989).
16. "Revised Draft Report - Remedial Investigation - Volume III," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (September 1989).
17. "Final Draft Report - Remedial Investigation - Volume I," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1990).
18. "Final Draft Report - Remedial Investigation - Volume II," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1990).
19. "Final Draft Report - Remedial Investigation - Volume III," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1990).
20. "Final Draft Report - Remedial Investigation - Volume IV," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1990).
21. "Final Draft Report - Remedial Investigation - Volume V," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1990).
22. "Final Draft Report - Remedial Investigation - Volume VI," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1990).
23. "Final Draft Report - Remedial Investigation - Volume VII," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1990).
24. "Final Draft Report - Remedial Investigation - Volume VIII," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (March 1990).
25. "Final Draft Remedial Investigation Addendum - Volume I," CDM Federal Programs Corporation (June 1991).
26. "Final Draft Remedial Investigation Addendum - Volume II," CDM Federal Programs Corporation (June 1991).

Comments

27. Comments Dated April 16, 1987 from Lawrence Feldman for Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. on the March 1987 "Draft - Remedial Investigation Report" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
28. Comments Dated April 28, 1987 from Dodie Brownlee, Commonwealth of Massachusetts Department of Environmental Quality Engineering on the March 1987 "Draft - Remedial Investigation Report" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
29. Comments Dated April 29, 1987 from Philip Gschwend, Massachusetts Institute of Technology Department of Civil Engineering on the March 1987 "Draft - Remedial Investigation Report" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
30. Comments Dated May 18, 1987 from Richard J. Chalpin, Commonwealth of Massachusetts Department of Environmental Quality Engineering on the March 1987 "Draft - Remedial Investigation Report" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.

3.6 Remedial Investigation (RI) Reports (cont'd.)

Comments

31. Final Draft Comments Dated August 21, 1987 from Joel Balmat, EPA Region I on the March 1987 "Draft - Remedial Investigation Report" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
32. Comments Dated September 30, 1987 from Margaret J. Leshen, EPA Region I on the March 1987 "Draft - Remedial Investigation Report" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
33. Comments Dated December 7, 1988 from Leslie McVickar, EPA Region I on the September 30, 1988 "Draft - Remedial Investigation Report - Revised Chapters 5, 6, and 7," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
34. Comments from Phillip L. Scannell Jr., Scannell Boiler Works on the March 1987 "Draft - Remedial Investigation Report" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
35. Comments from Ayer City Homeowners Association on the March 1987 "Draft - Remedial Investigation Report" - Deliverable 6, Goldberg-Zoino & Associates, Inc. for Silresim Site Trust .
36. Corrections Dated May 22, 1989 from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. on the April 1989 "Revised Draft Report - Remedial Investigation," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
37. Comments Dated June 16, 1989 from Leslie McVickar, EPA Region I on the April 1989 "Revised Draft Report - Remedial Investigation," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
38. Comments Dated June 30, 1989 from Leslie McVickar, EPA Region I on the April 1989 "Revised Draft Report - Remedial Investigation," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust with the attached:
    A. Comments Dated May 15, 1989 from Kenneth Finkelstein, U.S. Department of Commerce National Oceanic and Atmospheric Administration on the April 1989 "Revised Draft Report - Remedial Investigation," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust with attached Comments Dated August 13, 1987 from Kenneth Finkelstein for Lawrence E. Keister, U.S. Department of Commerce National Oceanic and Atmospheric Administration on the March 1987 "Draft - Remedial Investigation Report," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
    B. Comments Dated May 25, 1989 from Robert Adler, EPA Region I on the April 1989 "Revised Draft Report - Remedial Investigation," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
    C. Memorandum from Boyd Allen, Commonwealth of Massachusetts Department of Environmental Quality Engineering to Helen Waldorf, Commonwealth of Massachusetts Department of Environmental Quality Engineering (June 20, 1988). Concerning Superfund sites and Class III designation.
    D. Memorandum from Robert Adler, EPA Region I to Jane Downing, EPA Region I (February 17, 1989). Concerning ground water classification and ARAR compliance at the Sullivan's Ledge Superfund Site.
    E. "Massachusetts Drinking Water Standards and Guidelines," Commonwealth of Massachusetts Department of Environmental Quality Engineering (March 1989).
39. Comments Dated December 13, 1989 from Leslie McVickar, EPA Region I on the September 1989 "Revised Draft Report - Remedial Investigation," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust with the attached Comments Dated October 10, 1989 from Kenneth Carr, U.S. Department of the Interior Fish and Wildlife Division on the September 1989 "Revised Draft Report - Remedial Investigation," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.

3.6 Remedial Investigation (RI) Reports (cont'd.)

Responses to Comments

40. Response Dated June 16, 1987 from Joel Balmat, EPA Region I to Comments from Phillip L. Scannell, Jr., Scannell Boiler Works.
41. Response Dated November 4, 1987 from Charles A. Lindberg and John E. Ayres, Goldberg-Zoino & Associates, Inc. to the September 30, 1987 Comments from Margaret J. Leshen, EPA Region I.
42. Response Dated March 2, 1990 from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to the December 13, 1989 Comments from Leslie McVickar, EPA Region I.

3.7 Work Plans and Progress Reports

1. "Work Plan - Remedial Investigation/Feasibility Study of Alternatives," NUS Corporation (September 1983).
2. "Work Plan for an RI/FS of the Silresim Site," Goldberg-Zoino & Associates, Inc. and Roy F. Weston, Inc. (April 1984).
3 "Remedial Investigation/Feasibility Study - RI/FS - Work Plan," Camp Dresser & McKee Inc. (February 11, 1985).
4. "Remedial Investigation/Feasibility Study - RI/FS - Work Plan - Appendix B," Camp Dresser & McKee Inc. (February 11, 1985).
5. Trip Report on a Visit to Silresim Site, Peter Hall, GCA Corporation (March 3, 1986). Concerning technical oversight of Goldberg-Zoino & Associates, Inc.'s sampling activities.
6. Cross-Reference: Memorandum from Peter R. Kahn, EPA Region I to Leslie McVickar, EPA Region I (October 3, 1988). Concerning the transmittal of attached revised "Indoor Air Toxics Study Work Plan - Lowell Iron and Steel, Co.," EPA Region I (September 1988) [Filed and cited as entry number 39 in 3.2 Sampling and Analysis Data].
7. Cross-Reference: Memorandum from Peter R. Kahn, EPA Region I to Leslie McVickar, EPA Region I (November 30, 1988). Concerning the transmittal of attached "Indoor Air Toxics Study Work Plan - Administration Building - Lowell Iron and Steel Company," EPA Region I (November 1988) [Filed and cited as entry number 43 in 3.2 Sampling and Analysis Data].
8. "Trip Report, Soil Sample Collection at the Silresim Superfund Site, December 26-28, 1990," CDM Federal Programs Corporation (March 5, 1991).
9. Letter from William Holden, CDM Federal Programs Corporation to Leslie McVickar, EPA Region I (April 16, 1991). Concerning the attached "Trip Report, Groundwater Sample Collection at the Silresim Superfund Site, February 4-8, 1991."

Comments

10. Comments Dated May 10, 1985 from James C. Colman, Commonwealth of Massachusetts Department of Environmental Quality Engineering on the February 11, 1985 "Remedial Investigation/Feasibility Study - Work Plan," Camp Dresser & McKee Inc.
11. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to James K. Rogers, Silresim Site Trust (October 7, 1988) with attached Comments from Leslie McVickar, EPA Region I on the August 1988 "Silresim Remedial Investigation Additional Sampling Work Plan," and attached "Silresim Remedial Investigation - Revised Addendum Work Plan," Goldberg-Zoino & Associates, Inc. (October 1988).

3.9 Health Assessments

1. Memorandum from Christine J. Spadafor, EPA Region I to Leslie Carothers, EPA Region I (July 27, 1982). Concerning health surveys and health investigations for hazardous waste sites in Region I.
2. Memorandum from Georgi A. Jones, U.S. Department of Health and Human Services Public Health Service Centers for Disease Control to John Figler, EPA Region I (October 27, 1982). Concerning a review of Silresim Superfund site.
3. Memorandum from Chester L. Tate Jr. and Thomas K. Welty, Department of Health and Human Services Public Health Service Centers for Disease Control to Assistant Director for Program, U.S. Department of Health and Human Services Public Health Service Centers for Disease Control (June 30, 1983). Concerning attachments regarding issue of temporary relocation of residents during structural demolition and clay capping.
4. "Silresim Area Health Study - Report of Findings - Executive Summary," Center for Survey Research, University of Massachusetts-Boston and Boston University School of Public Health for Commonwealth of Massachusetts Department of Environmental Quality Engineering (November 22, 1983).
5. Comments from Ayer City Homeowners and Renters Association on the November 22, 1983 "Silresim Area Health Study - Report of Findings - Executive Summary," Center for Survey Research, University of Massachusetts-Boston and Boston University School of Public Health for Commonwealth of Massachusetts Department of Environmental Quality Engineering.
6. Memorandum from Marilyn R. DiSirio, U.S. Department of Health and Human Services Public Health Service Agency for Toxic Substances and Disease Registry to Joel Balmat, EPA Region I (January 12, 1986). Concerning recommendation to fence or temporarily cover contaminated area to protect the public health.
7. Memorandum from David Fornez Jr. for Jeffrey A. Lybarger, U.S. Department of Health and Human Services Public Health Service Agency for Toxic Substances and Disease Registry to Marilyn R. DiSirio, U.S. Department of Health and Human Services Public Health Service Agency for Toxic Substances and Disease Registry (August 8, 1986). Concerning recommendation for additional soil sampling to define perimeter of contamination and extend restricted area.
8. Memorandum from Louise A. House, U.S. Department of Health and Human Services Public Health Service Agency for Toxic Substances and Disease Registry to Ira Leighton, EPA Region I (December 10, 1987). Concerning issue of immediate removal action.
9. Memorandum from Louise A. House, U.S. Department of Health & Human Services Public Health Service Agency for Toxic Substances and Disease Registry to Leslie McVickar, EPA Region I (March 5, 1989). Concerning health consultation on indoor air samples at the Silresim site and Lowell Iron and Steel Company.
10. Letter from John B. Miles Jr., U.S. Department of Labor Occupational Safety and Health Administration to Leslie McVickar, EPA Region I (March 8, 1989). Concerning review of indoor air samples.
11. Letter from Leslie McVickar, EPA Region I to Philip L. Scannell Jr., Lowell Iron and Steel Company (March 16, 1989). Concerning transmittal of attached ATSDR and OSHA Health Assessment for Indoor Air Samples taken October 5, 1988 and December 6, 1988.

4.0 Feasibility Study (FS)

4.1 Correspondence

1. Letter from RuthAnn Sherman, EPA Region I to Susan M. Cooke, Goodwin, Procter & Hoar (Attorney for Silresim Site Trust) (October 3, 1990). Concerning the site MCP Risk Assessment Addendum.
2. Letter from Leslie McVickar, EPA Region I to Evelyn Tapani, Commonwealth of Massachusetts Department of Environmental Protection (February 12, 1991). Concerning the state's need to respond to EPA comments on the December 1990 "Draft Deliverable FS-3 Detailed Analysis of Alternatives," Goldberg-Zoino & Associates for Silresim Site Trust.
3. Letter from Evelyn Tapani, Commonwealth of Massachusetts Department of Environmental Protection to James K. Rogers, Silresim Site Trust (April 17, 1991). Concerning Notice of Response Action requiring compliance to implement a remedial action at the site.
4. Letter from Leslie McVickar, EPA Region I to Evelyn Tapani, Commonwealth of Massachusetts Department of Environmental Protection (May 2, 1991). Concerning transmittal of the May 1991 "Draft Feasibility Study Report," GZA GeoEnvironmental, Inc. for Silresim Site Trust and request for comments.
5. Letter from Leslie McVickar, EPA Region I to Evelyn Tapani, Massachusetts Department of Environmental Protection (May 16, 1991). Concerning transmittal of the "First Draft Silresim Proposed Plan" and request for comments.
6. Letter from Evelyn Tapani, Commonwealth of Massachusetts Department of Environmental Protection to Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. (May 31, 1991). Concerning completion of the MCP risk assessment addendum.
7. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to Evelyn Tapani, Commonwealth of Massachusetts Department of Environmental Protection (June 7, 1991). Concerning completion of the MCP risk assessment addendum.
8. Letter from RuthAnn Sherman, EPA Region I to Susan M. Cooke, Goodwin, Procter & Hoar (Attorney for Silresim Site Trust) (June 27, 1991). Concerning approval of the June 1991 "Final Draft Feasibility Study Report - Volumes I-IV," GZA GeoEnvironmental, Inc. for Silresim Site Trust.

4.2 Sampling and Analysis Data

1. Letter from James K. Rogers, Silresim Site Trust to Leslie McVickar, EPA Region I (September 11, 1989). Concerning request by the National Oceanic and Atmospheric Administration (NOAA) for additional water and surface samples with attached:
   A. "Proposed Additional Sampling River Meadow Brook," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
   B. "Proposed Surface Water/Sediment Sampling Location Plan," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (August 1989).
2. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to James K. Rogers, Silresim Site Trust (February 5, 1990). Concerning transmittal of the attached sampling results from River Meadow Brook.
3. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates to James K. Rogers, Silresim Site Trust (November 8, 1990). Concerning the status of the soil treatability studies.
4. Letter from Mei Ching Tse and Anita C. Rigassio, Camp Dresser & McKee, Inc. to Dennis P. Gagne, EPA Region I (July 16, 1991). Concerning results of water samples.

4.2 Sampling and Analysis Data (cont'd.)

5. Letter from Mei Ching Tse and Anita C. Rigassio, Camp Dresser & McKee, Inc. to Dennis P. Gagne, EPA Region I (July 17, 1991). Concerning results of water and soil samples.

Comments

6. Comments Dated February 15, 1990 from Kenneth Finkelstein, U.S. Department of Commerce National Oceanic and Atmospheric Administration on the results of the"Proposed Additional Sampling River Meadow Brook," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.

4.3 Scopes of Work

1. "Work Plan for Silresim DNAPL Investigation -- Feasibility Addendum, Volume I -- Technical Scope of Work ," CDM Federal Programs Corporation (June 1990).
2. "Attachment I - Technical Memorandum - Scope of Work - Additional Sampling for Feasibility Study Addendum," CDM Federal Programs Corporation (June 1991).

4.4 Interim Deliverables

Reports

1. "Development of Remedial Alternatives - Deliverable FS-1," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (December 1988).
2. "Alternatives Array Document," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (August 1989).
3. "Deliverable FS-2 - Remedial Alternatives Screening," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (November 1989).
4. "Revised Deliverable FS-2 Remedial Alternatives Screening," Goldberg-Zoino & Associates for Silresim Site Trust (July 1990).
5. "Draft Deliverable FS-3 Detailed Analysis of Alternatives - Volume I," Goldberg-Zoino & Associates for Silresim Site Trust (December 1990).
6. "Draft Deliverable FS-3 Detailed Analysis of Alternatives - Volume II," Goldberg-Zoino & Associates for Silresim Site Trust (December 1990).
7. "Draft Deliverable FS-3 Detailed Analysis of Alternatives - Volume III," Goldberg-Zoino & Associates for Silresim Site Trust (December 1990).
8. "Draft - Massachusetts Contingency Plan Risk Assessment Addendum," GZA GeoEnvironmental, Inc. for Commonwealth of Massachusetts on behalf of Silresim Site Trust (June 1991).

Comments

9. Comments Dated January 18, 1989 from Leslie McVickar, EPA Region I on the December 1988 "Development of Remedial Alternatives - Deliverable FS-1," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
10. Comments Dated February 1, 1990 from Leslie McVickar, EPA Region I on the November 1989 "Deliverable FS-2 - Remedial Alternatives Screening," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
11. Letter from Leslie McVickar, EPA Region I to James K. Rogers, Silresim Site Trust (May 22, 1990). Concerning the submittal of Revised Deliverable FS-2.
12. Comments Dated July 13, 1990 from Charles A. Lindberg, Goldberg-Zoino & Associates on the July 1990 "Revised Deliverable FS-2 Remedial Alternatives Screening," Goldberg-Zoino & Associates for Silresim Site Trust.

4.4 Interim Deliverables (cont'd.)

13. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates to James K. Rogers, Silresim Site Trust (August 1, 1990). Concerning errors in the Revised Deliverable FS-2 Remedial Alternatives Screening.

Comments

14. Comments Dated September 11, 1990 from Leslie McVickar, EPA Region I on the July 1990 "Revised Deliverable FS-2 Remedial Alternatives Screening," Goldberg-Zoino & Associates for Silresim Site Trust.
15. Comments Dated February 11, 1991 from Leslie McVickar, EPA Region I on the "Draft Deliverable FS-3 Detailed Analysis of Alternatives," Goldberg-Zoino & Associates for Silresim Site Trust.
16. Comments Dated April 3, 1991 from Leslie McVickar, EPA Region I on the December 1990 "Draft Deliverable FS-3 Detailed Analysis of Alternatives," Goldberg-Zoino & Associates for Silresim Site Trust.

Responses to Comments

17. Letter from James K. Rogers, Silresim Site Trust to Leslie McVickar, EPA Region I (February 27, 1991). Concerning late response to EPA's Draft Comments on the December 1990 "Draft Deliverable FS-3 Detailed Analysis of Alternatives," Goldberg-Zoino & Associates for Silresim Site Trust.
18. Response Dated March 5, 1991 from Charles A. Lindberg, Goldberg-Zoino & Associates on the February 11, 1991 Comments from Leslie McVickar, EPA Region I.
19. Response Dated May 1, 1991 from Charles A. Lindberg, Goldberg-Zoino & Associates on the February 11, 1991 and April 3, 1991 Comments from Leslie McVickar, EPA Region I.

4.5 Applicable or Relevant and Appropriate Requirements (ARARs)

1. Cross-Reference: Letter from M. Gretchen Muench, EPA Region I to Donald Nagle Commonwealth of Massachusetts Department of Environmental Protection (April 12, 1991). Concerning the attached:
    A. Letter from William Walsh-Rogalski, EPA Region I to Peter R. Bronson, Commonwealth of Massachusetts Department of Environmental Protection (January 3, 1991). Concerning transmittal of portions of the brief filed concerning the F.T. Rose Disposal Pit site.
    B. Letter from William Walsh-Rogalski, EPA Region I to Peter R. Bronson, Commonwealth of Massachusetts Department of Environmental Protection (January 9, 1991). Concerning the attached portions of the F.T. Rose Disposal Pit site brief [Filed and cited as entry number 5 in 9.1 Correspondence].
2. Cross-Reference: Letter from Peter R. Bronson, Commonwealth of Massachusetts Department of Environmental Protection to William Walsh-Rogalski, EPA Region I (April 22, 1991). Concerning identifying the Massachusetts Contingency Plan (MCP) in the ARAR process [Filed and cited as entry number 6 in 9.1 Correspondence].
3. "Final Assessment of LDR's," CDM Federal Programs Corporation (June 6, 1991).
4. Cross-Reference: "Draft - Massachusetts Contingency Plan Risk Assessment Addendum," GZA GeoEnvironmental, Inc. for Commonwealth of Massachusetts on behalf of Silresim Site Trust (June 1991) [Filed and cited as entry number 8 in 4.4 Interim Deliverables].

4.6 Feasibility Study (FS) Reports

Reports

1. "Draft Feasibility Study Report - Volume I," GZA GeoEnvironmental, Inc. for Silresim Site Trust (May 1991).
2. "Draft Feasibility Study Report - Volume II," GZA GeoEnvironmental, Inc. for Silresim Site Trust (May 1991).
3. "Draft Feasibility Study Report - Volume III," GZA GeoEnvironmental, Inc. for Silresim Site Trust (May 1991).
4. "Draft Feasibility Study Report - Volume IV," GZA GeoEnvironmental, Inc. for Silresim Site Trust (May 1991).
5. "Final Draft Feasibility Study Report - Volume I," GZA GeoEnvironmental, Inc. for Silresim Site Trust (June 1991).
6. "Final Draft Feasibility Study Report - Volume II," GZA GeoEnvironmental, Inc. for Silresim Site Trust (June 1991).
7. "Final Draft Feasibility Study Report - Volume III," GZA GeoEnvironmental, Inc. for Silresim Site Trust (June 1991).
8. "Final Draft Feasibility Study Report - Volume IV," GZA GeoEnvironmental, Inc. for Silresim Site Trust (June 1991).

Comments

9. Comments Dated June 3, 1991 from Leslie McVickar, EPA Region I on the May 1991"Draft Feasibility Study Report (FS-IV)," GZA GeoEnvironmental, Inc. for Silresim Site Trust.

Comments on the Feasibility Study received by EPA Region I during the formal public comment period are filed and cited in 5.3 Responsive Summaries.

4.7 Work Plans and Progress Reports

1. Draft - "Work Plan - Silresim Feasibility Study," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (August 1988).
2. "Revised Work Plan - Silresim Feasibility Study," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (October 1988).
3. "Final Work Plan - Silresim Feasibility Study," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (January 1989).
4. Letter from James K. Rogers, Silresim Site Trust to Leslie McVickar, EPA Region I (August 30, 1989). Concerning the attached "Treatability Studies Work Plan," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (August 31, 1989).
5. Letter from Charles A. Lindberg, Goldberg-Zoino & Associates, Inc. to James K. Rogers, Silresim Site Trust (November 29, 1989) with the attached "Proposed Exploration Location Plan," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust (August 1989). Concerning a revised work plan for geophysical studies at the site.

Comments

6. Comments Dated November 18, 1988 from Leslie McVickar, EPA Region I on the October 1988 "Revised Work Plan - Silresim Feasibility Study," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
7. Comments Dated October 17, 1989 from Leslie McVickar, EPA Region I on the August 31, 1989 "Treatability Studies Work Plan," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.

4.7 Work Plans and Progress Reports (cont'd.)

Comments

8. Comments Dated November 8, 1989 from Leslie McVickar, EPA Region I on the August 31, 1989 "Treatability Studies Work Plan," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.

4.9 Proposed Plans for Selected Remedial Action

1. "EPA Proposes Cleanup Plan for Silresim Superfund Site," EPA Region I (June 1991).

Comments

Comments on the Proposed Plan received by EPA Region I during the formal public comment period are filed and cited in 5.3 Responsiveness Summaries.

5.0 Record of Decision (ROD)

5.3 Responsiveness Summaries

1. Cross-Reference: Responsiveness Summary, EPA Region I (September 19, 1991) [Filed and included as Appendix E in entry number 1 in 5.4 Record of Decision (ROD)].
2. Cross-Reference: Transcript, Public Meeting Summary, EPA Region I (June 10, 1991) [Filed and included as Exhibit A in entry number 1 in 5.4 Record of Decision (ROD)].

The following citations indicate written comments received by EPA Region I during the formal public comment period.

3. Comments Dated June 28, 1991 from Anne T. Fox, Commonwealth of Massachusetts Department of Public Health on the June 1991 "EPA Proposes Cleanup Plan for Silresim Superfund Site," EPA Region I.
4. Letter from Norine Brodeur to EPA Region I (July 10, 1991). Concerning a request for an extension of time on the public comment period.
5. Comments Dated August 6, 1991 from John P. Scannell Jr., Scannell Boiler Works Co., Inc. and Philip L. Scannell III, Lowell Iron & Steel Co., Inc. on the June 1991 "EPA Proposes Cleanup Plan for Silresim Superfund Site," EPA Region I.
6. Comments Dated August 19, 1991 from Evelyn Tapani and Helen Waldorf, Commonwealth of Massachusetts Department of Environmental Protection on the June 1991 "EPA Proposes Cleanup Plan for Silresim Superfund Site," EPA Region I.
7. Comments Dated August 20, 1991 from Susan M. Cooke, Goodwin, Procter & Hoar (Attorney for Silresim Site Trust) on the June 1991 "EPA Proposes Cleanup Plan for Silresim Superfund Site," EPA Region I.
8. Cross-Reference: Letter from Helen Waldorf, Commonwealth of Massachusetts Department of Environmental Protection to Leslie McVickar, EPA Region I (September 13, 1991). Concerning clarification of state ARARs [Filed and cited as entry number number 7 in 9.1 Correspondence].

5.4 Record of Decision (ROD)

1. Record of Decision, EPA Region I (September 19, 1991).

9.0 State Coordination

9.1 Correspondence

1. Letter from Kenneth A. Hagg, Commonwealth of Massachusetts Department of Environmental Quality Engineering to Thomas Spittler, EPA Region I (August 2, 1982). Concerning a request for assistance from EPA in analyzing air samples.
2. Letter from Michael R. Deland, EPA Region I to Gerald E. St. Hilaire, Commonwealth of Massachusetts Executive Office of Communities and Development (April 1985). Concerning notification of proposed Superfund project.
3. Letter from Gerald E. St. Hilaire, Commonwealth of Massachusetts Executive Office of Communities and Development to David M. Webster, EPA Region I (May 30, 1985). Concerning review of EPA proposal for a remedial investigation and feasibility study at Silresim Chemical Corp.
4. Letter from Marcia J. Berger, Commonwealth of Massachusetts Department of Environmental Quality Engineering to James K. Rogers, Silresim Site Trust (May 30, 1986). Concerning update on conditions at the Silresim site and explain recommended interim capital improvements.
5. Letter from M. Gretchen Muench, EPA Region I to Donald Nagle Commonwealth of Massachusetts Department of Environmental Protection (April 12, 1991). Concerning the attached:
   A. Letter from William Walsh-Rogalski, EPA Region I to Peter R. Bronson, Commonwealth of Massachusetts Department of Environmental Protection (January 3, 1991). Concerning transmittal of portions of the brief filed concerning the F.T. Rose Disposal Pit site.
   B. Letter from William Walsh-Rogalski, EPA Region I to Peter R. Bronson, Commonwealth of Massachusetts Department of Environmental Protection (January 9, 1991). Concerning the attached portions of the F.T. Rose Disposal Pit site brief.
6. Letter from Peter R. Bronson, Commonwealth of Massachusetts Department of Environmental Protection to William Walsh-Rogalski, EPA Region I (April 22, 1991). Concerning identifying the Massachusetts Contingency Plan (MCP) in the ARAR process.
7. Letter from Helen Waldorf, Commonwealth of Massachusetts Department of Environmental Protection to Leslie McVickar, EPA Region I (September 13, 1991). Concerning clarification of state ARARs.

10.0 Enforcement

10.1 Correspondence

1. Memorandum from Patrick A. Parenteau, EPA Region I to E. Michael Thomas, EPA Region I (November 13, 1984). Concerning telephone conversation with Norine Danley regarding availability of work plan for public review.

10.7 EPA Administrative Orders

1. Administrative Order, In the Matter of The Trustees of the Silresim Site Trust, Silresim Site Trust, Respondents, Docket No. I-85-1083 (July 12, 1985).
2. Memorandum from Harley F. Laing, EPA Region I to Julie Belaga, EPA Region I (June 8, 1990). Concerning Amendment to Silresim Site Trust Agreement.
3. Memorandum from Harley F. Laing and Merrill S. Hohman, EPA Region I to Julie Belaga, EPA Region I (July 16, 1990). Concerning approval of the Amendment to Silresim Site Trust Agreement.
4. Memorandum from Harley F. Laing, EPA Region I to Julie Belaga, EPA Region I (June 4, 1991). Concerning approval of the Amendment to Silresim Site Trust Agreement.
5. Letter from RuthAnn Sherman, EPA Region I to Susan M. Cooke, Goodwin, Procter & Hoar (Attorney for Silresim Trust Site) (June 7, 1991). Concerning the attached Approval of Amendment to Silresim Site Trust Agreement.

11.0 Potentially Responsible Party (PRP)

11.1 PRP Lists

1. "Listing of Potentially Responsible Parties at CERCLA Sites," EPA Headquarters (December 23, 1986).

11.5 Site Level - General Correspondence

1. Letter from Merrill S. Hohman, EPA Region I to Addressees (April 15, 1983). Concerning notification of potential liability.
2. Letter from Anthony D. Cortese, Commonwealth of Massachusetts Department of Environmental Quality Engineering (August 22, 1983). Concerning notification of potential liability.
3. Letter from Merrill S. Hohman, EPA Region I (August 22, 1983) to attached Mailing List (dated October 4, 1983). Concerning notification of potential liability.
4. Memorandum from Daniel Sandhaus, NUS Corporation to E. Michael Thomas, EPA Region I (September 13, 1983) with attached master notification letter. Concerning Silresim notification letters sent out September 6, 1983.
5. Memorandum from Daniel Sandhaus, NUS Corporation to E. Michael Thomas, EPA Region I (September 13, 1983) with attached master notification letter. Concerning Silresim notification letters sent out September 8, 1983.
6. Memorandum from Daniel Sandhaus, NUS Corporation to E. Michael Thomas, EPA Region I (September 13, 1983) with attached master notification letter. Concerning Silresim notification letters sent out September 9, 1983.
7. Memorandum from Daniel Sandhaus, NUS Corporation to E. Michael Thomas, EPA Region I (September 13, 1983) with attached master notification letter. Concerning Silresim notification letters sent out September 13, 1983.
8. Memorandum from Daniel Sandhaus, NUS Corporation to E. Michael Thomas, EPA Region I (September 14, 1983) with attached master notification letter. Concerning Silresim notification letters sent out September 14, 1983.

11.5 Site Level - General Correspondence (cont'd.)

9. Letter from Heather M. Ford, EPA Region I to James K. Rogers, Silresim Site Trustees (June 24, 1986). Concerning change in EPA project coordinator from Heather M. Ford to David M. Webster.
10. Letter from Merrill S. Hohman, EPA Region I to attached Mailing List. Concerning notification of potential liability.

13.0 Community Relations

13.1 Correspondence

1. "Ayers City Fair Share/Silresim Cleanup Committee - Demand Sheet," Lowell Fair Share (July 22, 1981).
2. "Fair Share's Neighborhood Health & Safety Issue Request List," Massachusetts Fair Share (June 17, 1982).
3. Memorandum from EPA Region I to File (August 2, 1982). Concerning City of Lowell Superfund Contact.
4. Telephone Notes Between Barbara H. Ikalainen, EPA Region I and Norine Danley Brodeur, Lowell Fair Share (August 25, 1982). Concerning upcoming Silresim Task Force Meeting.
5. Letter from Michael S. Dukakis, Governor of the Commonwealth of Massachusetts to Norine Danley, Lowell Fair Share (September 10, 1982). Concerning future plans for Silresim.
6. Telephone Notes Between E. Michael Thomas, EPA Region I and Margo Vickers, Public Interest Economics (September 16, 1982). Concerning contract between EPA and Public Interest Economics.
7. Letter from Daniel W. Dubner, Medical Associates to Whom It May Concern (March 16, 1983). Concerning Danley family relocation away from Silresim waste site, with attached:
   A. Letter from Michael A. Gilchrist, Medical Associates to Mr. and Mrs. Robert Brand (October 26, 1982). Concerning Brand family relocation from present address.
   B. Letter from Alan T. Kent, Dr.'s Kent and Weisfeldt, Inc. to Whom It May Concern (March 17, 1983). Concerning relocation of Janet Brand from Silresim Superfund site.
   C. Memorandum from Georgi A. Jones, U.S. Department of Health and Human Services Public Health Service Centers for Disease Control to John Figler, EPA Region I (October 27, 1982). Concerning review of Silresim Superfund site.
   D. "News Release," Massachusetts Department of Environmental Quality Engineering (September 14, 1982). Concerning selection of Boston University School of Public Health to conduct health study of residents living near Silresim Superfund site.
   E. Memorandum from Christine J. Spadafor, EPA Region I to Leslie Carothers, EPA Region I (July 27, 1982). Concerning health surveys and health investigations for hazardous waste sites in Region I.
   F. Telephone Notes Between Christine J. Spadafor, EPA Region I and Mary Ann Fraelich, EPA Headquarters (July 14, 1982). Concerning Silresim health evaluation by CDC.
8. Meeting Agenda, Silresim Task Force (April 6, 1983). Concerning schedule of events at task force meeting.
9. Letter from Lester A. Sutton, EPA Region I to Norine Danley (May 6, 1983). Concerning progress at the Silresim site.
10. Meeting Notes, John F. Hackler, Barbara H. Ikalainen and David Pickman, EPA Region I and Silresim Task Force. (May 11, 1983). Concerning discussion of EPA's expected activities at the Silresim site.

13.1 Correspondence (cont'd.)

11. Telephone Notes Between Barbara H. Ikalainen, EPA Region I and Norine Danley (May 16, 1983). Concerning request for proposals.
12. Letter from John F. Hackler, EPA Region I to John F. O'Dowd, Boston & Maine (May 17, 1983). Concerning soil sample screening analysis on B & M property.
13. Letter from Barbara H. Ikalainen, EPA Region I to Mr. and Mrs. Allan Danley (May 18, 1983) with attached "Press Release - Fair Share: Health and Safety Should Come First In Silresim RAMP." Concerning response to requests outlined in May 11, 1983 Lowell Fair Share press release.
14. "Contingency Relocation Plan" (July 6, 1983).
15. Memorandum from Mark E. Brickell, NUS Corporation to Barbara H. Ikalainen, EPA Region I (July 7, 1983). Concerning transmittal of attached:
    A. Letter from Mark E. Brickell, NUS Corporation to Norine Danley, Massachusetts Fair Share (June 28, 1983). Concerning FIT team field work.
    B. Letter from Mark E. Brickell, NUS Corporation to William L. Strigler, (June 28, 1983). Concerning FIT team field work.
    C. Letter from Mark E. Brickell, NUS Corporation to Norine Danley, Massachusetts Fair Share (June 28, 1983). Concerning sampling on Scannell Boiler Works property.
    D. Letter from Mark E. Brickell, NUS Corporation to Lawrence B. Boyd, Boston & Maine Corporation (June 28, 1983). Concerning surface soil sampling on properties adjacent to the Silresim Chemical site.
    E. Letter from Mark E. Brickell, NUS Corporation to John F. O'Dowd, Boston & Maine Corporation (June 28, 1983). Concerning surface soil sampling on properties adjacent to the Silresim Chemical site.
    F. Letter from Mark E. Brickell, NUS Corporation to Norine Danley, Massachusetts Fair Share (June 28, 1983). Concerning surface soil sampling on properties adjacent to the Silresim Chemical site.
    G. Letter from Mark E. Brickell, NUS Corporation to Norine Danley, Massachusetts Fair Share (June 28, 1983). Concerning soil contamination investigation of the Wright Leasing and Realty parking lot.
    H. Memorandum from Paul F. Clay, NUS Corporation to Norine Danley, Lowell Fair Share (June 29, 1983). Concerning the final report on the air monitoring study.
16. Letter from Barbara H. Ikalainen, EPA Region I to Allan Danley, Lowell Fair Share (July 21, 1983). Concerning response to points made in Fair Share handout from July 12, 1983 public meeting.
17. Letter from David Pickman, EPA Region I to Steve Starrod (August 8, 1983). Concerning response to call made on the Silresim information hotline.
18. Letter from William H. Foege, U.S. Department of Health and Human Services Centers for Disease Control to Norine Danley, Lowell Fair Share (August 26, 1983). Concerning review of proposed remedial plan for the Silresim site.
19. "Silresim Superfund Site - Recommended Remedial Measures," National Toxics Campaign for the Ayer city residents (October 1983).
20. Telephone Notes Between John Figler, EPA Region I and Georgi A. Jones, U.S. Department of Health and Human Services Public Health Service Centers for Disease Control (January 17, 1984). Concerning Silresim health study.
21. Letter from Adam Parker, Lowell Fair Share (January 27, 1984). Concerning transmittal of Steve Lester's analysis of hydrogeological study.
22. "Hotline Update," EPA Region I (January 27, 1984). Concerning update for the weeks of January 23 and 30, 1984.
23. "Hotline Update," EPA Region I (February 13, 1984). Concerning update for the month of February.

13.1 Correspondence (cont'd.)

24. Letter from Merrill S. Hohman, EPA Region I to Phyllis Robey (February 16, 1984). Concerning response to issues raised at the February 5, 1984 National Campaign Against Toxic Hazards conference.
25. Meeting Notes, Citizens Meeting with AA for External Affairs (September 1984). Concerning action to be taken at Silresim.
26. Letter from Debra Prybyla, EPA Region I to Mr. and Mrs. Allan Danley (December 17, 1984). Concerning public participation throughout the RI/FS phase.
27. Letter from Debra Prybyla, EPA Region I to Norine Danley (January 16, 1985). Concerning response to information request.
28. Letter from Richard T. Leighton, EPA Region I to Barry Pollack, Technology Investment Trust (February 14, 1985). Concerning summary of telephone conversations relating to property at 108 Tanner Street.
29. Letter from James P. Bond, Tanner Street Businessmen's Group to EPA Region I (March 20, 1985). Concerning test boring requirements.
30. Memorandum to File, EPA Region I (March 25, 1985). Concerning requests made by Norine Danley.
31. "Silresim Superfund Site - Summary of Plans for Studies of the Site," EPA Region I (March 1985).
32. "Silresim Superfund Site - Summary of Plans for Studies of the Site," EPA Region I (April 1985).
33. Memorandum from David M. Webster, EPA Region I to Brooke Cook, EPA Region I (May 17, 1985). Concerning April 29, 1985 Silresim public meeting.
34. Letter from John R. Moebes, EPA Region I to Peter J. Aucella, City of Lowell (May 22, 1985). Concerning potential future site uses of the Silresim site.
35. Letter from David M. Webster, EPA Region I to Norine Danley, Ayer City Homeowners and Renters Association and Massachusetts Fair Share (June 3, 1985). Concerning response to requests made regarding the work plan for the RI/FS.
36. Letter from Patricia L. Meaney for Merrill S. Hohman, EPA Region I to Norine Danley, Fair Share (June 28, 1985). Concerning response to request for information.
37. Letter from Phyllis Robey, Lowell Fair Share to David M. Webster, EPA Region I (September 18, 1985). Concerning transmittal of proposal to PRPs.
38. Letter from David M. Webster, EPA Region I to George Kokoliadis (October 2, 1985). Concerning transmittal of fact sheet.
39. Letter from Merrill S. Hohman, EPA Region I to Norine Danley, Ayer City Homeowners & Renters Association and Lowell Fair Share (October 15, 1985). Concerning denial of requested funds.
40. Letter from David M. Webster, EPA Region I to Norine Brodeur, (February 21, 1986). Concerning measures taken to include citizen participation in the RI/FS process.
41. Letter from Norine Brodeur, Ayer City Homeowners & Renters Association to David M. Webster, EPA Region I (March 3, 1986). Concerning the Community Relations, Health and Safety, and Sampling Plans for the Silresim site.
42. Meeting Notes, EPA Region I and Commonwealth of Massachusetts, Department of Environmental Quality Engineering (March 17, 1986). Concerning public relations and the Site Safety Plan.
43. Telephone Notes Between David M. Webster, EPA Region I and David Pickman, EPA Region I (April 23, 1986). Concerning list of citizen concerns.
44. Letter from David Pickman, EPA Region I to Norine Brodeur, Ayer City Homeowners & Renters Association (April 24, 1986). Concerning response to earlier questions.
45. Memorandum to David M. Webster, EPA Region I (April 1986). Concerning directions to May 6, 1986 public meeting.

13.1 Correspondence (cont'd.)

46. Letter from Phyllis Robey to Michael R. Deland, EPA Region I (June 4, 1986). Concerning videotaping of public meetings.
47. Letter from J. Winston Porter, EPA Headquarters to William McDonald (June 23, 1986). Concerning support of Region I's policy regarding videotaping of Superfund project management meetings.
48. Letter from Merrill S. Hohman, EPA Region I to Norine Brodeur, Ayer City Homeowners & Renters Association (June 26, 1986). Concerning response to request letters.
49. Letter from David M. Webster, EPA Region I to Phyllis Robey (July 2, 1986). Concerning decision not to videotape May 22, 1986 meeting.
50. Letter from Joel Balmat, EPA Region I to Norine Danley Brodeur, Ayer City Homeowners & Renters Association (February 4, 1987) with attached Letter from Norine Danley Brodeur, Ayer City Homeowners & Renters Association to Joel Balmat, EPA Region I (January 21, 1987). Concerning response to request to expand oversight contract of Alliance Technologies Corporation.
51. Meeting Agenda, Ayer City Homeowners Association (March 2, 1987). Concerning New England Regional Educational Conference on Hazardous Waste.
52. Letter from Philip L. Scannell Jr., Scannell Boiler Works to Merrill S. Hohman, EPA Region I (July 8, 1987). Concerning the remedial investigation report conducted by Goldberg-Zoino & Associates, Inc.
53. Letter from James A. Thompson Jr., Pepe & Hazard (Attorney for Scannell Boiler Works) to E. Michael Thomas, EPA Region I (November 16, 1987). Concerning request for all sampling and monitoring results from EPA regarding Scannell Boiler Works property.
54. Letter from Nancy Papoulias, EPA Region I to Philip L. Scannell Jr., Scannell Boiler Works. Concerning results of soil samples collected on Scannell property.
55. Letter from Merrill S. Hohman, EPA Region I to Philip L. Scannell Jr., Scannell Boiler Works. Concerning response to letter dated July 8, 1987 regarding sampling activities on Scannell property.
56. "Silresim Demands," Ayer City Homeowners & Renters Association.
57. Letter from Norine Danley Brodeur, Ayer City Homeowners Association to Joel Balmat, EPA Region I. Concerning off-site PCB levels, attached map of desired monitoring wells, and questions.
58. Letter from David M. Ozonoff and Mary Ellen Colten, Center for Survey Research to Residents of Lowell. Concerning scientific sample for health study.
59. Letter from David M. Ozonoff and Mary Ellen Colten, Center for Survey Research to Residents of Lowell. Concerning participation in health study.
60. "Silresim Update for Ayer City Residents," Lowell Fair Share.
61. "The Most Immediate and Important Technical Solutions for the Initial Remedial (Cleanup and Protection) Measures at Silresim," Richard C. Bird Jr. for Ayer City Residents.
62. List of Demands, Lowell Fair Share. Concerning list of five demands to improve EPA's temporary cleanup plan for Silresim.
63. "Why Are We Upset About The EPA's Latest Plans For Silresim?" Ayer City Homeowners Association and Lowell Fair Share. Concerning list of reasons why action on Silresim should begin immediately.
64. Letter from Michael R. Deland, EPA Region I to Phyllis Robey, Massachusetts Fair Share. Concerning response to previous issues.
65. "Notice to Residents," Barbara H. Ikalainen, EPA Region I. Concerning transmittal of attached "Summary of Safety Precautions In Operating Plan for Remedial Action at Silresim Site.
66. Letter from Norine Danley, Lowell Fair Share to E. Michael Thomas, EPA Region I. Concerning delay in cleanup of Silresim Site.

13.1 Correspondence (cont'd.)

67. Set of Silresim Hotline Messages including:
    A. Revised Tape Message, David Pickman, EPA Region I (May 16, 1983).
    B. "Report on EPA Operations at Silresim Chemical Waste Site" (August 31, 1983).
    C. "Report on Information Line (Also to News Media)" (September 9, 1983).
    D. Tape Message, Michael R. Deland, EPA Region I (September 13, 1983).
    E. Tape Message, David Pickman, EPA Region I (September 27, 1983).
    F. Tape Message, Richard T. Leighton, EPA Region I (November 15, 1983).
    G. Tape Message, Richard T. Leighton, EPA Region I (November 28, 1983).
    H. Tape Message, Richard T. Leighton, EPA Region I (January 10, 1984).
    I. Tape Message, Richard T. Leighton, EPA Region I (April 13, 1984).
68. Letter from Norine Danley Brodeur, Ayer City Homeowners Association to Merrill S. Hohman, EPA Region I. Concerning response to requests for the residents of Ayer City.

13.2 Community Relations Plans

1. "Community Relations Plan - Silresim Chemical Corporation." (September 1985).
2. "Draft Public Involvement Plan/Community Relations Plan," Commonwealth of Massachusetts Department of Environmental Protection (April 1991).
3. "Final Public Involvement Plan/Community Relations Plan," Commonwealth of Massachusetts Department of Environmental Protection (June 1991).

Comments

4. Comments Dated March 1986 from Ayer City Homeowners on the September 1985 "Community Relations Plan - Silresim Chemical Corporation."

13.3 News Clippings/Press Releases

News Clippings

1. "Major Field Study Scheduled at Silresim Chemical Plant," The Sun - Lowell, MA (February 16, 1978).
2. "Claims Toluene Still Being Dumped in City Sewer System," The Sun - Lowell, MA (March 14, 1978).
3. "The Headache of Hazardous Waste," The Boston Sunday Globe - Boston, MA (June 18, 1978).
4. "EPA Tests at Silresim Site Asked by Tsongas," The Sun - Lowell, MA (August 18, 1978).
5. "Suspect, 17, Charged in Lowell Fire, Blast," The Boston Evening Globe - Boston, MA (August 21, 1978).
6. "Fire in Lowell Razes Chemical Storehouse," The Boston Globe - Boston, MA (August 21, 1978).
7. "The Lesson From Lowell," The Boston Globe - Boston, MA (August 25, 1978).
8. "Poison Chemicals: Where Do We Dump Them?," The Boston Herald - Boston, MA (September 6, 1978).
9. "EPA Regulations Would Govern Chemical Disposal," The Sun - Lowell, MA (December 14, 1978).
10. "Chemicals' Effects Difficult to Measure," The Sun - Lowell, MA (July 14, 1982).
11. "Does Fair Share Play Fair?," The Sun - Lowell, MA (July 15, 1982).
12. "Silresim Founder Says He's a Victim too," The Sun - Lowell, MA (July 16, 1982).

13.3 News Clippings/Press Releases (cont'd.)

News Clippings

13. "Silresim Health Study Consultant to be Picked," The Sun - Lowell, MA (September 12, 1982).
14. "Silresim," The Sun - Lowell, MA (October 16, 1982).
15. "Study No Surprise to Plant's Neighbors," The Boston Globe - Boston, MA (January 21, 1983).
16. "Report Spurs Fears About Air Near Silresim," The Sun - Lowell, MA (March 6, 1983).
17. "This is Not Massachusetts, This is Toxichusetts," The Item - Wakefield, MA (March 8, 1983).
18. "State Officials Ask EPA to Conduct Air Tests," The Daily Times and Chronicle - Woburn, MA (March 8, 1983).
19. "Senate OKs Hazwaste Fund...," The Transcript - North Adams, MA (March 8, 1983).
20. "$25-Million Cleanup Gets Senate Nod," The News - Milford, MA (March 8, 1983).
21. "EPA to Recheck Lowell Toxic Site," The News - Newburyport, MA (March 9, 1983).
22. "Dump's Neighbors Blast EPA," (March 10, 1983).
23. "Relocation Aid Urged for Mass. Residents," The Patriot Ledger - Quincy, MA (March 11, 1983).
24. "Report Finds Water Safe Near Silresim," The Sun - Lowell, MA (March 13, 1983).
25. "Air Tests Get Underway," The Sun - Lowell, MA (March 14, 1983).
26. "Tests Explore Health Threat," The Gazette - Haverhill, MA (March 15, 1983).
27. "Tests Begin at Lowell Waste Site," The Boston Globe - Boston, MA (March 15, 1983)
28. "Dumping," The Harvard Independent - Harvard University, Cambridge, MA (March 17, 1983).
29. "Air Test Finds Pollutants - But They're not From Silresim," The Sun - Lowell, MA (March 18, 1983).
30. "Pollutants From Lowell Firm at 'Nuisance' Levels," The Sun - Lowell, MA (March 21, 1983).
31. "Ayers City Leaders Need More Convincing," The Sun - Lowell, MA (March 22, 1983).
32. "Dukakis Signs Superfund Bill at Toxic Waste Dump," The Standard Times - New Bedford, MA (March 25, 1983).
33. "Dukakis Approves 'Superfund' of $25m for Hazardous Waste," The Boston Globe - Boston, MA (March 25, 1983).
34. "State Gets Toxic Waste Law," The Chronicle and Times - Reading, MA (March 25, 1983).
35. "Majilite Moves to Reduce Odors Near Silresim Site," The Sun - Lowell, MA (March 26, 1983).
36. "Silresim Editorial False, Misleading," The Sun - Lowell, MA (March 31, 1983).
37. "Silresim Tests Find 'Normal Urban Air'," The Sun - Lowell, MA (March 31, 1983).
38. "State Orders Toxic Cleanup," The Boston Herald - Boston, MA (April 5, 1983).
39. "2 Lowell Firms Told to Cut Use of Chemical," The Patriot Ledger - Quincy, MA (April 5, 1983).
40. "An End to the Silresim Story ...?," The Sun - Lowell, MA (April 7, 1983).
41. "EPA May Cap Silresim," The Sun - Lowell, MA (April 7, 1983).
42. "Focus of Health Study Now Shifts to Account for New Air Problems," The Sun - Lowell, MA (April 8, 1983).

13.3 News Clippings/Press Releases (cont'd.)

News Clippings

43. "EPA Approves Fence to Surround Silresim," The Sun - Lowell, MA (May 27, 1983).
44. "Some Relocations to be Considered," The Sun - Lowell, MA (June 22, 1983).
45. "Silresim Cleanup Delayed Two Weeks," The Sun - Lowell, MA (July 29, 1983).
46. "State Settles Suit Against Silresim, Bank," The Sun - Lowell, MA (August 25, 1983).
47. "Tank Finding Taken in Stride," The Sun - Lowell, MA (September 9, 1983).
48. "Dump Cleanup to Begin," The Greenfield Recorder - Greenfield, MA (September 14, 1983).
49. "Workers Clean Out Silresim Waste Tank," The Sun - Lowell, MA (September 15, 1983).
50. "Firms Must Pay for Waste Cleanup," The Boston Globe - Boston, MA (September 22, 1983).
51. "Work Delayed on Installation of Clay Cap on Silresim Site," The Sun - Lowell, MA (December 12, 1983).
52. "Higher Rate of Ills Near Toxic Site," The Boston Globe - Boston, MA (January 20, 1984) with attached letter from David Pickman, EPA Region I to Chris Chinlund, The Boston Globe (January 20, 1984).
53. "Feds Plan to Make Clean Silresim Sweep," The Sun - Lowell, MA (January 26, 1984).
54. "The Silresim Settlement," The Boston Business Journal - Boston, MA (April 9-16, 1984).
55. "Toxic Waste Victims Evoke Tears, Support," The Sun - Lowell, MA (April 12, 1984).
56. "Firm Begins to Lay Cap Over Silresim Waste Site," The Sun - Lowell, MA (April 30, 1984).
57. "Toxic Waste Dumps Suspected of Affecting Health of Neighbors," The Washington Post - Washington D.C. (May 27, 1984).
58. "Fair Share Head Joins Group Pushing for Silresim Cleanup," The Sun - Lowell, MA (July 3, 1984).
59. "Water, Toxic Waste Key '85 Issues: EPA," The Sun - Lowell, MA (December 28, 1984).
60. "EPA Seeks Comment About Silresim," The Sun - Lowell, MA (March 18, 1985).
61. "How to Track Down Toxins," Newsweek Magazine (May 6, 1985).
62. "Firms Agree to Fund Silresim Site Study," The Sun - Lowell, MA (June 6, 1985).
63. "Lowell Clean-up," Fitchburg Leominster Sentinel & Enterprise - Fitchburg, MA (June 7, 1985).
64. "Group Seeks EPA Funds to Treat Lead Paint Homes," The Sun - Lowell, MA (June 12, 1985).
65. "Soil Contamination in Ayers City Threatening Neighborhood: Residents," The Sun - Lowell, MA (July 21, 1986).
66. "EPA Seeking Buried Waste at Silresim," The Sun - Lowell, MA (November 13, 1986).
67. "EPA Still Testing Toxic Waste Site," The Gloucester Daily Times - Gloucester, MA (November 14, 1986).
68. "Dioxin Found Near Old Waste Site; EPA to Cover Contaminated Soil," The Boston Globe - Boston, MA (December 13, 1986).
69. "Dioxin Found Near Silresim Site," The Sun - Lowell, MA (December 13, 1986).
70. "Waste Site to be Covered," The Lawrence Eagle Tribune - Lawrence, MA (December 14, 1986).

13.3 News Clippings/Press Releases (cont'd.)

News Clippings

71. "Dioxin-Contaminated Soil at Silresim to be Covered," The Sun - Lowell, MA (December 16, 1986).
72. "Wrong Sand Delivery Delays Covering Dioxin," The Sun - Lowell, MA (December 17, 1986).
73. "EPA Returns to Lay Cover Over Contaminated Soil," The Sun - Lowell, MA (December 18, 1986).
74. "Test Results Due on Dioxin at Silresim," The Sunday Sun - Lowell, MA (December 21, 1986).
75. "EPA Takes New Round of Silresim Soil Tests," (June 5, 1987).
76. "The United States Environmental Protection Agency Announces The Availability Of The Administrative Record For The Silresim Superfund Site In Lowell, Massachusetts," The Sun - Lowell, Massachusetts (September 27, 1989).
77. "Residents Want a Timetable for Silresim Cleanup," The Sun - Lowell, MA (April 26, 1990).
78. "EPA Extends Time for Public Input on Silresim Cleanup," The Sun - Lowell, MA (July 16, 1991).
79. "EPA Butt of Lowell Wrath," The Boston Herald - Boston, MA.
80. "Congressmen Start Waste Inquiry Amid Poisons, Stench and Decay," The New York Times - New York.
81. "EPA Downplays Toxic 'Hot Spot'."
82. "Neighborhood Group Charges Chemicals Filtering into Rivers," The Sun - Lowell, MA.
83. "Atkins Calls for Expanded Role in Waste Site Cleanup Program," The Sun - Lowell, MA.
84. "Arrow Parking Area Contaminated," The Sun - Lowell, MA.
85. "Silresim Team Divided on How to Close the Site," The Sun - Lowell, MA.
86. "Visit by EPA Chief Unlikely."

Press Releases

87. "News Release," Commonwealth of Massachusetts Department of Environmental Quality Engineering (April 23, 1982). Concerning a newly-formed task force meeting on April 27, 1982.
88. "Environmental News Release," EPA Region I (July 23, 1982). Concerning announcement of eligibility for action under Superfund.
89. "Statement - Selection of New Superfund Sites," Anne M. Gorsuch, EPA Headquarters (July 23, 1982).
90. "News Release," Commonwealth of Massachusetts Department of Environmental Quality Engineering (September 14, 1982). Concerning selection of Boston University School of Public Health to conduct a comprehensive health study.
91. "News Release," Commonwealth of Massachusetts Department of Environmental Quality Engineering (October 13, 1982). Concerning the results of the Silresim air monitoring study.
92. "Draft Press Release" EPA Region I (April 1, 1983). Concerning announcement of findings of the Health Effect Study Group reviewing air quality data from Silresim Site.
93. "News Release," Commonwealth of Massachusetts Department of Environmental Quality Engineering (April 4, 1983). Concerning Administrative Orders issued against two Lowell firms.
94. "Environmental News Release," EPA Region I (May 26, 1983). Concerning construction of a new security fence at the Silresim site.

13.3 News Clippings/Press Releases (cont'd.)

Press Releases

95. "New England Newswatch," WBZ - TV (September 9, 1983). Concerning the discovery of a two tons of sludge in a 20,000 gallon tank at the Silresim site.
96. "News Release - Lowell Health Study Released Today," Commonwealth of Massachusetts Department of Public Health and Commonwealth of Massachusetts Department of Environmental Quality Engineering (January 19, 1984).
97. "Environmental News Release," EPA Region I (January 25, 1984). Concerning announcement of a January 18, 1984 public meeting of the Silresim Task Force.
98. "Lowell Hazardous Waste Firm Faces License Revocation," Commonwealth of Massachusetts Department of Environmental Quality Engineering (May 3, 1984).
99. "Report on EPA Operations at Silresim Superfund Site," EPA Region I (May 1984). Concerning installation of a temporary clay cap.
100. "EPA Seeks Public Comment on Plans for Study at Silresim Superfund Site," EPA Region I (March 15, 1985).
101. "EPA Environmental News - Public Meeting to Explain Plans for Studies at Silresim Superfund Site," EPA Region I (April 19, 1985).
102. "EPA Environmental News - EPA Signs Agreement on Silresim Superfund Site," EPA Region I (June 6, 1985).
103. "New England Newswatch," WCVB - TV (July 21, 1986). Concerning a hot spot at the Silresim site.
104. "New England Newswatch," WCVB - TV (December 12, 1986). Concerning discovery of new area of dioxin contamination outside Silresim site's fence.
105. "EPA Environmental News - EPA to Conduct Additional Soil Sampling for Dioxin," EPA Region I (June 2, 1987).
106. "Environmental News - EPA Recovers $3.4 Million at Silresim Superfund Site," EPA Region I (March 27, 1990).
107. "Environmental News - EPA Announces Public Meeting to Discuss Results of Study on Silresim Superfund Site," EPA Region I (April 13, 1990).
108. "Environmental News - EPA to Collect Additional Data at Silresim Superfund Site," EPA Region I (November 7, 1990).
109. "Notice of Document Availability," Commonwealth of Massachusetts Department of Environmental Protection (April 10, 1991). Concerning "Draft Public Involvement Plan/Community Relations Plan."
110. Public Meeting Notice, Massachusetts Department of Environmental Protection. Concerning public meeting to be held April 24, 1991.
111. "Environmental News - EPA Announces $22.5 Million Proposed Cleanup Plan for the Silresim Superfund Site," EPA Region I (June 6, 1991).
112. "Environmental News - EPA Extends Public Comment Period on Proposed Cleanup Plan for Silresim Superfund Site," EPA Region I (July 16, 1991).
113. "Environmental News Release," EPA Region I. Concerning industrial emissions of volatile organic chemicals at unacceptable levels in the vicinity of the Silresim site.
114. "For Immediate Release," EPA Region I. Concerning possibility of installing a temporary cap on the Silresim site.

13.4 Public Meetings

1. Cross-Reference: Meeting Notes, Public Meeting for the Silresim Chemical Corp. Site, EPA Region I and Commonwealth of Massachusetts Department of Environmental Quality Engineering (June 23, 1981). Concerning public demands regarding sampling studies at the site [Filed and cited as entry number 12 in 2.1 Correspondence].
2. "Air Study Inadequacy," Lowell Fair Share (November 10, 1982).

13.4 Public Meetings (cont'd.)

3. EPA Region I Attendance List, Operating Plan Public Meeting for the Silresim Chemical Corp. Site (June 13, 1983).
4. "Summary of Silresim Task Force Meeting - Lowell, Massachusetts," EPA Region I, January 25, 1984.
5. Ayer City Homeowners and Renters Association Meeting Agenda (April 29, 1985) with attached:
   A. "Silresim Demands," Ayer City Homeowners and Renters Association (April 29, 1985).
   B. "Demands for the Kyan Street Site," Ayer City Homeowners and Renters Association (April 29, 1985).
   C. "Summary of Plans for Studies of the Site," EPA Region I (April 1985).
6. Memorandum from David M. Webster, EPA Region I to Brooke Cook, EPA Region I (April 29, 1985). Concerning EPA responses to demands made by the Ayer City Homeowners and Renters Association at April 29, 1985 public meeting.
7. Meeting Notes, Public Meeting for the Silresim Chemical Corp. Site, EPA Region I (October 16, 1985).
8. Memorandum from EPA Region I to File (May 6, 1986). Concerning outline for the May 6, 1986 public meeting.
9. National Campaign Against Toxic Hazards, Massachusetts Fair Share, and Ayer City Homeowners and Renters Association Meeting Agenda (June 30, 1987) with attached:
   A. "Superfund Alternatives for Managing Hazardous Waste," EPA Headquarters (Fall 1986).
   B. Letter from Joseph H. Kenny, Terra Vac Inc. to Thomas Spittler, EPA Region I (December 28, 1985) with attached "Vacuum: Defense System for Ground Water VOC Contamination."
10. EPA Region I Meeting Summary, Public Meeting for the Silresim Site (April 25, 1990).
11. EPA Region I Meeting Summary, Public Meeting for the Silresim Site (June 19, 1991).

13.5 Fact Sheets

1. "Silresim Fact Sheet," Commonwealth of Massachusetts Department of Environmental Quality Engineering (December 4, 1978 through June 7, 1979).
2. "Do we have an immediate crisis at the Silresim site?!!," Massachusetts Fair Share (March 9, 1983). Concerning results of air monitoring work commissioned by the Commonwealth of Massachusetts.
3. "Silresim Update - Hazardous Waste Cleanup Report - Ayer City Fair Share," Lowell Fair Share (May 9, 1983). Concerning a Silresim Task Force Meeting scheduled for May 11, 1983.
4. "Report on EPA Operations at Silresim Chemical Waste Site," EPA Region I (August 12, 1983). Concerning initiation of dismantling work at site.
5. "Report on EPA Operations at Silresim Chemical Waste Site," EPA Region I (August 22, 1983). Concerning continuation of dismantling work and site monitoring.
6. "Report on EPA Operations at Silresim Chemical Waste Site," EPA Region I (August 31, 1983). Concerning dismantling work and equipment preparatory to the laying of a temporary cap.
7. "Report on EPA Operations at Silresim Chemical Waste Site," EPA Region I (September 8, 1983). Concerning anticipated completion of dismantling.
8. Memorandum from David M. Webster, EPA Region I to Heather M. Ford, Richard T. Leighton, Debra Prybyla, E. Michael Thomas, and Pam Hill, EPA Region I (February 14, 1985). Concerning attached Fact Sheet for informal and formal public meetings.

13.5 Fact Sheets (cont'd.)

9. "Silresim Superfund Site - Summary of Plans for Studies of the Site," EPA Region I (March 1985).
10. "Fact Sheet - Summary of Enforcement Activities" with attached "Chronology," Commonwealth of Massachusetts Department of Environmental Quality Engineering.

13.7 Technical Assistance Grants

1. Letter from Norine Danley, Ayer City Homeowners and Renters Association (July 1985). Concerning request for assistance.
2. Memorandum from David M. Webster, EPA Region I to Heather M. Ford, EPA Region I (July 22, 1985). Concerning request for $100,000 from citizens' groups in Lowell.
3. Memorandum from Heather M. Ford, EPA Region I to Merrill S. Hohman, EPA Region I (August 15, 1985). Concerning proper channels for Technical Assistance Grant requests.
4. Letter from James K. Rogers, Silresim Site Trust to Phyllis Robey, Lowell Fair Share (October 14, 1985). Concerning request of a Technical Assistance Grant from the Silresim Site Trustees.
5. Letter from Merrill S. Hohman, EPA Region I to Norine Danley, Ayer City Homeowners Association and Lowell Fair Share (October 15, 1985). Concerning Superfund statutes for grants to private citizens or groups.
6. Telegram from Norine Danley Brodeur, Ayer City Homeowners and Renters Association to Michael R. Deland, EPA Region I (December 9, 1986). Concerning request for Technical Assistance Grant of $50,000 and a waiver of the 20% matching of funds.
7. Letter from J. Winston Porter, EPA Headquarters to Norine Danley Brodeur, Ayer City Homeowners and Renters Association (January 27, 1987). Concerning explanation of the initiation of the Technical Assistance program pursuant to SARA.
8. Letter from Chris Jendras, EPA Region I to Interested Citizen (March 31, 1988). Concerning approval of regulations for Technical Assistance Grants.
9. Letter from Norine Brodeur, Greater Lowell Environmental Campaign to Mary H. Grealish, EPA Region I (April 13, 1988). Concerning request for Technical Assistance Grant and waiver on matching funds.
10. Letter from M.J. Gonsalves, Northern Tanner Street Business Association to Mary H. Grealish, EPA Region I (May 6, 1988). Concerning request for technical assistance.
11. Letter from Mary H. Grealish, EPA Region I to Norine Brodeur, Ayer City Homeowners Association (May 12, 1988). Concerning Federal regulations for obtaining a grant.
12. Letter from Mary H. Grealish, EPA Region I to M.J. Gonsalves, Northern Tanner Street Business Association (May 20, 1988). Concerning forming a coalition with other potential applicants.
13. Letter from Mary H. Grealish, EPA Region I to James P. Bond, Tanner Street Businessmen's Group (June 9, 1988). Concerning reply to attached letter from James P. Bond.
14. Letter from Mary H. Grealish, EPA Region I to James P. Bond, Tanner Street Businessmen's Group (June 23, 1988). Concerning enclosure of copy of "The Citizens' Guidance Manual for the Technical Assistance Grant Program."
15. Letter from Mary H. Grealish, EPA Region I to Norine Brodeur, Ayer City Homeowners Association (June 23, 1988). Concerning reply to attached letter, enclosure of a grant application package, and a copy of "The Citizens' Guidance Manual for the Technical Assistance Grant Program."

13.7 Technical Assistance Grants (cont'd.)

16. Letter from Mary H. Grealish, EPA Region I to M.J. Gonsalves, Northern Tanner Street Business Association (June 23, 1988). Concerning enclosure of copy of "The Citizens' Guidance Manual for the Technical Assistance Grant Program."
17. Letter from James P. Bond, Tanner Street Businessmen's Group to Mary H. Grealish, EPA Region I (June 26, 1988). Concerning withdrawal of Letter of Intent.
18. Letter from Norine Brodeur Routhier, Greater Lowell Environmental Campaign to Mary H. Grealish, EPA Region I (July 19, 1988). Concerning request for extension of time for application.
19. Letter from Mary H. Grealish, EPA Region I to Norine Brodeur Routhier, Ayer City Homeowners Association (July 26, 1988). Concerning response to request for extension of time for application.
20. Letter from Mary H. Grealish, EPA Region I to Norine Brodeur Routhier, Ayer City Homeowners Association (August 11, 1988). Concerning availability of application to the public.
21. Letter from Mary H. Grealish, EPA Region I to Norine Brodeur Routhier, Ayer City Homeowners Association (December 6, 1988). Concerning preliminary review of application.
22. Letter from Mary H. Grealish, EPA Region I to Norine Brodeur Routhier, Ayer City Homeowners Association (March 27, 1989). Concerning response to issues raised in December 6, 1988 letter.

14.0 Congressional Relations

14.1 Correspondence

1. Letter from Alex Kidaloski for Paul E. Tsongas, Member of the U.S. House of Representatives to Dennis Huebner, EPA Region I (September 28, 1977). Concerning attached letter from Gerry Tremblay, Silresim Chemical Corp. to Alex Kidaloski, Aide to Congressman Paul E. Tsongas.
2. Letter from Daniel K. Moon, EPA Region I to Alex Kidaloski for Paul E. Tsongas, Member of the U.S. House of Representatives (November 1, 1977). Concerning the Silresim Chemical Corporation's request for information on potential liquid waste generators.
3. Cross-Reference: Letter from Paul G. Keough, EPA Region I to William X. Wall, Member of the Commonwealth of Massachusetts State Senate (February 2, 1978). Concerning information on activities at the Silresim Chemical Corporation site [Filed and cited as entry number 3 in 2.1 Correspondence].
4. Letter from Congressman Paul E. Tsongas, Member of the U.S. House of Representatives to Douglas N. Costle, EPA Headquarters (August 15, 1978). Concerning expediting the clean-up of Silresim Chemical Corporation facility.
5. Letter from Thomas C. Jorling, EPA Region I to Edward M. Kennedy, Member of the U.S. Senate (August 2, 1979). Concerning attached letter from Michael E. McLaughlin, County of Middlesex Office of the County Commissioners to James E. Carter, President of the United States.
6. Letter from Edward M. Kennedy and Paul E. Tsongas, Members of the U.S. Senate, and James M. Shannon, Member of the U.S. House of Representatives to John Hernandez, EPA Region I (March 10, 1983). Concerning air monitoring studies at Silresim Superfund site.
7. Letter from Paul E. Tsongas, Member of the U.S. Senate to Lester A. Sutton, EPA Region I (April 6, 1983). Concerning air monitoring studies at Silresim site.

14.1 Correspondence (cont'd.)

8. Letter from Lester A. Sutton, EPA Region I to Paul E. Tsongas, Member of the U.S. Senate (May 16, 1983). Concerning response to letter regarding air monitoring studies at the Silresim Chemical Corporation Site.
9. Letter from Paul G. Keough, EPA Region I to Paul E. Tsongas, Member of the U.S. Senate (June 7, 1983). Concerning EPA efforts in protecting the public health in Lowell, Massachusetts.
10. Letter from Paul E. Tsongas, Member of the U.S. Senate to Dr. Vernon N. Houk, U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry (July 15, 1983). Concerning the visit to Silresim Site in Lowell, Massachusetts by Houk's staff.
11. Memorandum from Betsy Horne, EPA Region I to David M. Webster, EPA Region I (August 12, 1985) with attached attendance list and meeting notes. Concerning briefing on Superfund sites in Congressman Atkins' District.
12. Telephone Notes Between David M. Webster, EPA Region I and Kathi Anderson for Edward M. Kennedy, Member of the U.S. Senate (April 22, 1986). Concerning Silresim site activities and upcoming public meeting.
13. Telephone Notes Between David M. Webster, EPA Region I and Stan Rosenberg for Chester Atkins, Member of the U.S. House of Representatives (May 1, 1986). Concerning public meeting scheduled on May 6, 1986.
14. Memorandum to David M. Webster, EPA Region I. Concerning preliminary meeting of city officials and members of the public.

16.0 Natural Resource Trustee

16.1 Correspondence

1. Letter from Kenneth Finkelstein, U.S. Department of Commerce National Oceanic and Atmospheric Administration to EPA Region I (March 8, 1988). Concerning procedure for requesting a Covenant Not to Sue (release from liability) for natural resources.
2. Cross-Reference: Letter from Leslie McVickar, EPA Region I to Kenneth Carr, U.S. Department of the Interior Fish and Wildlife Division (December 27, 1988). Concerning transmittal of the March 1987 "Draft - Remedial Investigation Report," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust [Filed and cited as entry number 37 in 3.1 Correspondence].
3. Cross-Reference: Letter from Leslie McVickar, EPA Region I to Kenneth Carr, U.S. Department of the Interior Fish and Wildlife Division (April 18, 1989). Concerning transmittal of the April 1989 "Revised Draft Report - Remedial Investigation - Volumes I through VIII," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust [Filed and cited as entry number 40 in 3.1 Correspondence].
4. Telephone Notes Between Leslie McVickar, EPA Region I and James Mikolaities, U.S. Department of the Interior Fish and Wildlife Division (May 12, 1989). Concerning review of the April 1989 "Revised Draft Report - Remedial Investigation - Volume I," Goldberg-Zoino & Associates, Inc. for Silresim Site Trust.
5. Letter from Kenneth Finkelstein, U.S. Department of Commerce National Oceanic and Atmospheric Administration to EPA Region I (May 24, 1989). Concerning procedures for notifying the NOAA trustee and request for a Covenant Not to Sue (release from liability) for natural resources.

16.5 Technical Issue Papers

1. Letter from Bruce Blanchard, U.S. Department of the Interior to Gene Lucero, EPA Headquarters (February 24, 1984). Concerning a preliminary natural resources survey.

17.0 Site Management Records

17.1 Correspondence

1. Letter from Susan M. Cooke, Goodwin, Procter & Hoar (Attorney for Silresim Site Trust) to RuthAnn Sherman, EPA Region I (June 6, 1990). Concerning information on monitoring wells.
2. Letter from Susan M. Cooke, Goodwin, Procter & Hoar (Attorney for Silresim Site Trust) to RuthAnn Sherman, EPA Region I (June 19, 1990). Concerning summary of outstanding issues.

17.2 Access Records

1. Letter from James A. Thompson Jr., Pepe & Hazard (Attorney for the Scannell families) to Leslie McVickar, EPA Region I (March 14, 1990). Concerning Scannell property adjacent to the site.
2. Letter from Timothy M. Conway, EPA Region I to James A. Thompson Jr., Pepe & Hazard (Attorney for the Scannell families) (March 29, 1990). Concerning Scannell property adjacent to the site.
3. Letter from James A. Thompson Jr., Pepe & Hazard (Attorney for the Scannell families) to Timothy M. Conway, EPA Region I (April 13, 1990). Concerning Scannell property adjacent to the site.
4. Letter from RuthAnn Sherman, EPA Region I to James A. Thompson Jr., Pepe & Hazard (Attorney for the Scannell families) (June 25, 1990). Concerning Scannell property adjacent to the site.
5. Letter from James A. Thompson Jr., Pepe & Hazard (Attorney for the Scannell families) to RuthAnn Sherman, EPA Region I (August 10, 1990). Concerning consent for access to property.
6. "Consent for Access to Property," EPA Region I (September 7, 1990). Concerning the Lowell Iron & Steel Company.
7. Letter from Merrill S. Hohman, EPA Region I to William L. Stigler, Lowell Used Auto Parts (September 17, 1990). Concerning request for access to property.
8. Letter from Merrill S. Hohman, EPA Region I to Donald Doubleday, Lowell Department of Public Works (September 17, 1990). Concerning request for access to property.
9. Letter from Merrill S. Hohman, EPA Region I to Daniel T. Sullivan (September 17, 1990). Concerning request for access to property.
10. Letter from Merrill S. Hohman, EPA Region I to Arthur Hammer, Mill City Investments, Inc. (September 17, 1990). Concerning request for access to property.
11. Letter from Merrill S. Hohman, EPA Region I to David Anderson, Boston and Maine Corporation (September 17, 1990). Concerning request for access to property.
12. Letter from Merrill S. Hohman, EPA Region I to Robert P. Betty and Joan M. Betty (October 24, 1990). Concerning request for access to property.
13. Letter from Merrill S. Hohman, EPA Region I to Ralph Tucci, Lowell Used Auto Parts, Inc. (October 24, 1990). Concerning request for access to property.
14. Letter from Leslie McVickar, EPA Region I to Philip L. Scannell III (November 8, 1990). Concerning request for access to property.
15. Letter from Leslie McVickar, EPA Region I to Robert P. Betty and Joan M. Betty (November 14, 1990). Concerning request for access to property.
16. Letter from Merrill S. Hohman, EPA Region I to Ralph Tucci, Lowell Used Auto Parts, Inc. (November 14, 1990). Concerning request for access to property.
17. Letter from Merrill S. Hohman, EPA Region I to Anthony O'Neill, Mill City Investments (May 2, 1991). Concerning request for access to property.

17.2 Access Records (cont'd.)

18. Letter from Leslie McVickar, EPA Region I to Philip L. Scannell III, Lowell Iron and Steel Company (May 2, 1991). Concerning transmittal of the combined Commonwealth of Massachusetts Department of Environmental Protection Public Involvement Plan and the Community Relations Plan.
19. Letter from Merrill S. Hohman, EPA Region I to Ralph Tucci, Lowell Used Auto Parts, Inc. (May 2, 1991). Concerning request for access to property.
20. Letter from Merrill S. Hohman, EPA Region I to Philip L. Scannell, III, Dennis Scannell and John P. Scannell, Lowell Iron and Steel Company (June 5, 1991). Concerning request for access to property.
21. Letter from Merrill S. Hohman, EPA Region I to Anthony Dinapoli, L'Energia Incorporated (June 6, 1991). Concerning request for access to property.
22. Letter from Leslie McVickar, EPA Region I to John Scannell, Lowell Iron and Steel Company and Anthony DiNapoli, L'Energia Corporation (June 14, 1991). Concerning protective abandonment of monitoring wells at the site.
23. Letter from Leslie McVickar, EPA Region I to Ralph Tucci, Lowell Used Auto Parts, Inc. (August 5, 1991). Concerning schedule for groundwater sampling on Mr. Tucci's property.
24. Letter from Leslie McVickar, EPA Region I to Anthony O'Neill, Mill City Investments (August 5, 1991). Concerning schedule for groundwater sampling on Mr. O'Neill's property.

17.4 Site Photographs/Maps

1. Index of 20 Rolls of Photographs of the Silresim Initial Remedial Measure (IRM), NUS Corporation (December 16, 1983 to December 11, 1984).

The records cited in entry numbers 2 through 7 may be reviewed, by appointment only, at EPA Region I, Boston, Massachusetts.

2. As-Built Plans for Silresim Site Clay Cap, NUS Corporation (July 12, 1985).
3. Map of Property In Lowell, Massachusetts at Wye Leading to Lowell Secondary Track, Boston and Maine Corporation (September 23, 1985).
4. 20 Rolls of Photographs of the Silresim Initial Remedial Measure (IRM), NUS Corporation (December 16, 1983 to December 11, 1984).
5. "Site Analysis - Silresim Site - Volume 1," U.S. EPA (August 1989).
6. "Site Analysis - Silresim Site - Volume 2," U.S. EPA (August 1989).
7. Aerial Photographs and Slides of the Silresim Site.

17.5 Site Descriptions/Chronologies

1. "Status Report - Silresim Chemical Corporation Hazardous Waste Problem," Commonwealth of Massachusetts Department of Environmental Quality Engineering (August 21, 1978).
2. "Format for Inventory of Disposal Sites Where Hazardous Waste Threatens Public Health," Commonwealth of Massachusetts Department of Environmental Quality Engineering (October 1978).
3. "Massachusetts Water Quality Task Force," Commonwealth of Massachusetts Department of Environmental Quality Engineering (September 1979). Concerning the discovery of Silresim Waste Site.
4. "Site Cleanups Continue," Commonwealth of Massachusetts Department of Environmental Quality Engineering (October 11, 1981). Concerning removal cleanup progress.
5. "Silresim Chemical Corporation," EPA Region I (September 1982). Concerning the history of Silresim Chemical Corporation.
6. Memorandum from EPA Region I to File (April 15, 1983 through September 15, 1983). Concerning Silresim activity and cost timeline.

17.5 Site Descriptions/Chronologies (cont'd.)

7. Memorandum from EPA Region I to File (May 11, 1983). Concerning timeline of cleanup activity at Silresim site presented at the May 11, 1983 Task Force meeting.
8. "Summary of Recent Events," EPA Region I (September 30, 1987 through January 9, 1988).
9. "The Silresim Superfund Site Historical Summary," EPA Region I. (September 7, 1988). Concerning the historical events related to the Silresim Superfund Site's creation and cleanup.
10. "Site Cleanup: Silresim Chemical (MA)," Richard T. Leighton, EPA Region I. Concerning Silresim as a case study.
11. "Summary of Silresim." Concerning the events and problems related to the site.

17.7 Reference Documents

1. "Volatilization of Organic Compounds from Shallow Phreatic Aquifers," June Anne Swallow, Massachusetts Institute of Technology (August 1983).
2. "Determination of 2,3,7,8-TCDD in Soil and Sediment," EPA Region VII (September 1983).
3. "Draft - Report on TCDD Sampling Methods," Daniel J. Harris, EPA Region VII (December 1, 1983).
4. "Assessment of Health Risk from Exposure to Contaminated Soil," John K. Hawley, New York State Department of Health Bureau of Toxic Substance Assessment (May 10, 1985).
5. "Special Analytical Services," EPA Region IV (October 9, 1986).
6. "Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxins and -Dibenzofurans (CDDs and CDFs)," EPA Headquarters (October 1986).
7. "What Has Gone Wrong?" R. Allan Freeze and John A. Cherry, Ground Water (July/August 1989).
8. "Groundwater Contamination: Pump-and-Treat Remediation," Douglas M. Mackay and John A. Cherry, Environmental Science Technology, Vol. 23 No. 6 (1989).
9. Memorandum from Richard Willey, EPA Region I to Carl DeLoi, EPA Region I (February 15, 1991). Concerning topics discussed during meeting with John A. Cherry and EPA Headquarters personnel on February 5, 1991 with attached meeting attendance list.
10. "Measurement of Hydraulic Conductivity Distributions -- A Manual of Practice," Fred J. Molz, Oktay Guven, and Joel G. Melville, Auburn University.
11. "The Cone Penetration Test for Environmental Investigations," Tony A. Kiefer, Technica, Ltd.
12. "Risk Assessment for Pentachlorophenol and Dioxin/Furan in Chehalis, Washington," Patricia C. Storm and David Tetta.
13. "Determination of Airborne Volatile Nitrogen Compounds Using Four Independent Techniques," NUS Corporation.
14. "Assessing Health Risks from Contaminated Soils," Barbara D. Beck, EPA Region I.

17.8 State and Local Technical Records

1. "Silresim Cleanup" (December 4, 1978 through June 7, 1979).
2. Memorandum from John J. O'Brien, EPA Region I to William A. Simmons, Commonwealth of Massachusetts Department of Environmental Quality Engineering (July 28, 1981). Concerning contract for Phases III of Silresim cleanup operation.
3. "Hydrogeologic Investigation," Perkins Jordan, Inc. (February 26, 1982).

17.8 State and Local Technical Records (cont'd.)

4. "Remedial Action Study," Perkins Jordan, Inc. (April 27, 1982).
5. "Remedial Action Study Addendum," Perkins Jordan, Inc. (July 26, 1982).
6. Comments Dated July 26, 1982 from Stephen U. Lester, Citizen's Clearinghouse for Hazardous Wastes, Inc. on the February 26, 1982 "Hydrogeological Investigation," and the April 27, 1982 "Remedial Action Study," Perkins Jordan, Inc.
7. "Preliminary Evaluation of the Silresim Air Monitoring Study," Commonwealth of Massachusetts Department of Environmental Quality Engineering (October 13, 1982).
8. Draft "Field Investigation of Silresim Chemical Waste Site and Surrounding Neighborhood," TRC Environmental Consultants, Inc. (November 23, 1982).
9. "Addendum - Hydrogeologic Investigation," Perkins Jordan, Inc. (March 8, 1983).
10. "Tanner Street Industrial Park, Lowell, Massachusetts," The Geotechnical Group, Inc. (July 1985).

18.0 Initial Remedial Measure

18.1 Correspondence

1. Memorandum from E. Dennis Escher, NUS Corporation to Patrick C. Falvey, NUS Corporation (March 1, 1983). Concerning Silresim Chemical Corporation IRM assignment.
2. Trip Report on a Visit to Silresim Chemical Corporation Site, EPA Region I, Camp, Dresser & McKee Inc., and NUS Corporation (March 7, 1983). Concerning development of work plan, demolition, and capping construction specifications for an IRM.
3. Memorandum from Health Effects Study Group, EPA Region I to Merrill S. Hohman, EPA Region I through John R. Moebes, EPA Region I (April 1, 1983). Concerning the conclusions of the Lowell Air Monitoring Study conducted March 14, 1983 through March 23, 1983.
4. Letter from Thomas F. McLoughlin, Commonwealth of Massachusetts Department of Environmental Quality Engineering to Merrill S. Hohman, EPA Region I (April 15, 1983). Concerning the agreement between EPA Region I and DEQE regarding future actions at the Silresim site.
5. Meeting Agenda, EPA Region I (June 13, 1983). Concerning Silresim Operating Plan meeting.
6. Letter from Thomas F. McLoughlin for Anthony D. Cortese, Commonwealth of Massachusetts Department of Environmental Quality Engineering to Paul G. Keough, EPA Region I (June 22, 1983). Concerning a credit audit for cost-sharing under CERCLA.
7. Telephone Notes Between Larry Giarrizzo, Commonwealth of Massachusetts Department of Environmental Quality Engineering and James Plunkett, NUS Corporation (June 28, 1983). Concerning state regulations and restrictions existing in the development of a sedimentation basin in conjunction with remedial actions.
8. Memorandum from John F. Hackler, EPA Region I to Silresim Working Committee (June 30, 1983). Concerning Draft Operating Plan for the Silresim Site.
9. Memorandum from James Plunkett, NUS Corporation to Patrick C. Falvey, NUS Corporation (June 30, 1983). Concerning utilities potentially affected by the Silresim Remedial Action.

18.1 Correspondence (cont'd.)

10. Memorandum from John Figler, U.S. Department of Health and Human Services Centers for Disease Control to John R. Moebes, EPA Region I (July 7, 1983). Concerning Centers for Disease Control position on Silresim with attached:
    A. Draft "Notice to Residents," Barbara H. Ikalainen, EPA Region I (July 1983). Concerning attached summary operating plan.
    B. "Summary of Safety Precautions in Operating Plan for Remedial Action at Silresim Site, Lowell, MA," EPA Region I (July 1983).
11. Memorandum from George D. Gardner, NUS Corporation to File (July 11, 1983). Concerning a meeting with Barbara H. Ikalainen regarding work plan for the IRM.
12. Memorandum from John F. Hackler, EPA Region I to Edward Taylor, EPA Region I (July 13, 1983). Concerning a Request for Analytical Services in Support of the Initial Remedial Measures to be performed at the Silresim Hazardous Waste Site.
13. "Notice to Residents," Barbara H. Ikalainen, EPA Region I to Residents (July 14, 1983). Concerning attached "Summary of Safety Precautions in Operating Plan for Remedial Action at Silresim Site, Lowell, MA."
14. Memorandum from P. Goldstein, NUS Corporation to E. Dennis Escher and R.A. Burns, NUS Corporation (July 25, 1983). Concerning verbal authorization received for IRM construction at Silresim.
15. Memorandum from Patrick C. Falvey, NUS Corporation to File (August 1, 1983). Concerning a meeting with Barbara H. Ikalainen, E. Michael Thomas, and David Pitman, EPA Region I.
16. Memorandum from Barbara H. Ikalainen, EPA Region I to William Kaschak, EPA Headquarters (August 19, 1983). Concerning approval of NUS Corporation work plan for the IRM.
17. Letter from Gary F. Smith, NUS Corporation to Mr. Grant, D.T. Grant Company, Inc. (September 7, 1983) Concerning discrepancies and problem areas following an inspection of site work.
18. Memorandum from Patrick C. Falvey, NUS Corporation to Mark E. Brickell, NUS Corporation (September 7, 1983). Concerning meeting with Silresim subcontractors.
19. Memorandum from Patrick C. Falvey, NUS Corporation to E. Dennis Escher and Gary F. Smith, NUS Corporation (September 8, 1983). Concerning hazardous waste fluids collected at Silresim Site.
20. "Conference Report Number 1," C.J. Mabardy Inc. and NUS Corporation (November 9, 1983). Concerning site progress and personnel safety.
21. "Conference Report Number 2," EPA Region I and NUS Corporation (November 10, 1983). Concerning site progress.
22. Meeting Agenda, EPA Region I (November 10, 1983). Concerning subcontract award, hotline, and IRM progress.
23. Letter from Patrick C. Falvey, NUS Corporation to Robert Hamel, Colonial Gas Energy Systems (December 7, 1983). Concerning interference of a 6" gas line with new sewer line.
24. Memorandum from George D. Gardner, NUS Corporation to E. Dennis Escher, D. Threlfall, and D.R. Brenneman, NUS Corporation (January 18, 1984). Concerning a series of meetings at EPA Region I.
25. Memorandum from Patrick C. Falvey, NUS Corporation to P. Goldstein, E. Dennis Escher, D. Threlfall, George D. Gardner, and W. Bell, NUS Corporation (January 19, 1984). Concerning dismantling and capping of site, and shutdown of project.
26. Letter from Patrick C. Falvey, NUS Corporation to Richard T. Leighton, EPA Region I (March 2, 1984). Concerning attached letter regarding cessation of construction activities on the Silresim site due to inclement weather.

18.1 Correspondence (cont'd.)

27. Letter from Patrick C. Falvey, NUS Corporation to Raymond E. Hamwey, C.J. Mabardy Inc. (March 29, 1984). Concerning the formal notification to reactivate construction activities at Silresim Site.
28. Memorandum from William D. Trimbath, NUS Corporation to File (May 7, 1984). Concerning status of construction at the site.
29. Letter from William D. Trimbath, NUS Corporation to Richard T. Leighton, EPA Region I (May 14, 1984). Concerning transmittal of minutes of May 7, 1984 meeting.
30. Letter from Mark E. Brickell, NUS Corporation to Gino Palmacci, Massachusetts Bay Transit Authority (July 6, 1984). Concerning a request for permission to use MBTA owned land in Readville, Massachusetts.
31. Memorandum from John George, NUS Corporation to George D. Gardner and Patrick C. Falvey, NUS Corporation (August 21, 1984). Concerning measures to prevent erosion of site cap.
32. Letter from William D. Trimbath, NUS Corporation to Raymond Hamway, C.J. Mabardy Inc. (September 25, 1984). Concerning calculations of clay compacted in place at the Silresim job site.
33. Memorandum from Debra Prybyla, EPA Region I to Richard T. Leighton, EPA Region I (January 3, 1985). Concerning property damages to B & L Used Auto Parts.
34. Letter from Patrick C. Falvey and Donald Senovich, NUS Corporation to Richard T. Leighton, EPA Region I (March 21, 1985), Concerning the sale of equipment and tankage stored on James G. Grant Company's property with attached "Equipment Inventory List."
35. Letter from Patrick C. Falvey and George Latulippe, NUS Corporation to Richard T. Leighton, EPA Region I (May 10, 1985). Concerning approval to proceed with the sale of equipment and tankage.
36. Telephone Notes Between EPA Region I and Marcia J. Berger, Commonwealth of Massachusetts Department of Environmental Quality Engineering (January 29, 1986). Concerning depressions in the cap at Silresim Site.
37. Telephone Notes Between David M. Webster, EPA Region I and Patrick C. Falvey, NUS Corporation (February 3, 1986). Concerning delegating correction of fence problems to Camp Dresser & McKee or EPA Region I FIT Office.
38. Letter from Patrick C. Falvey, NUS Corporation to David M. Webster, EPA Region I (February 4, 1986). Concerning transmittal of sample drawing and specifications for fencing.
39. Memorandum from David M. Webster, EPA Region I to File (April 30, 1986). Concerning a trip report to Silresim Site to inspect fence problem.
40. Memorandum from David M. Webster, EPA Region I to File (May 28, 1986). Concerning emergency action regarding PCB contaminated soil near Silresim site.
41. "Engineering, Procurement & Construction Schedule," NUS Corporation.

18.2 Sampling and Analysis Data

1. "Interim Draft Report Overview," NUS Corporation (March 29, 1983).
2. Letter from Paul F. Clay and Anthony J. DeMarco, NUS Corporation to Thomas Powers, Commonwealth of Massachusetts Department of Environmental Quality Engineering (May 16, 1983). Concerning attached Ambient Air Sampling Data.
3. Soil and Monitoring Well Samples, NUS Corporation (May 16, 1983 through July 11, 1984).
4. Letter from Paul F. Clay, NUS Corporation to Thomas Powers, Commonwealth of Massachusetts Department of Environmental Quality Engineering (June 2, 1983). Concerning attached ambient air sampling data.

18.2 Sampling and Analysis Data (cont'd.)

5. "Portable Chromatography Analysis," NUS Corporation (June 17, 1983).
6. "Air Monitoring Data Silresim HWS," NUS Corporation (June 24, 1983 through July 7, 1983).
7. Memorandum from John F. Hackler, EPA Region I to Edward Taylor, EPA Region I with attached sampling maps and plans (July 13, 1983). Concerning a request for analytical services in support of the IRM.
8. Memorandum from John M. Panaro, NUS Corporation to Richard T. Leighton, EPA Region I (September 29, 1983). Concerning the final report of the Silresim Air Monitoring Project.

18.4 Initial Remedial Measure (IRM) Reports

1. "Specification for Chain-Link Fence," NUS Corporation (May 26, 1983).
2. Cross-Reference: Draft "Remedial Action Operating Plan," EPA Region I (June 1983) [Filed and cited as entry number 3 in 3.4 Interim Deliverables].
3. "Silresim Magnetometer Survey," NUS Corporation (February 10, 1984).

18.5 Work Plans and Progress Reports

1. Letter from Thomas R. Sheckells, EPA Headquarters to Noel Urban, U. S. Army Corps of Engineers (April 29, 1983). Concerning attached "Technical Assistance Amendment Form IAG Number 3A425."
2. Progress Report, NUS Corporation (June 17, 1983).
3. Trip Report on a Visit to the Silresim Site Pertaining to Air Analysis, John M. Panaro, NUS Corporation (June 22, 1983).
4. Letter from Barbara H. Ikalainen, EPA Region I to George D. Gardner, NUS Corporation (July 13, 1983). Concerning review of Work Plan dated June 1983.
5. Memorandum from Barbara H. Ikalainen, EPA Region I to William Kaschak, EPA Headquarters (August 19, 1983). Concerning approval of NUS Corporation Work Plan.
6. "Work Plan - Initial Remedial Measures," NUS Corporation (September 1983).
7. Progress Report, NUS Corporation (October 1983).
8. Work Plan, NUS Corporation (November 15, 1983).
9. Progress Report, NUS Corporation (November 18, 1983).
10. Progress Report, NUS Corporation (November 1983).
11. Trip Report on a Visit to the Silresim Site, George D. Gardner, NUS Corporation (December 15, 1983).
12. Progress Report, NUS Corporation (December 1983).
13. Progress Report, NUS Corporation (January 11, 1984).
14. Trip Report on a Visit to the Silresim Site, George D. Gardner, NUS Corporation (January 19, 1984).
15. Trip Report on a Visit to Silresim Site, Charles D. Wilder, NUS Corporation (April 26, 1984) with attached letters of recommendation from Inland Pollution Control, Inc.
16. Trip Report on a Visit to Silresim Site, William D. Trimbath, NUS Corporation (May 17, 1984).
17. Trip Report on a Visit to Silresim Site, William D. Trimbath, NUS Corporation (May 21, 1984).
18. Progress Report, NUS Corporation (May 22, 1984).
19. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (May 25, 1984).
20. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (May 29, 1984).
21. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (June 6, 1984).

18.5 Work Plans and Progress Reports (cont'd.)

22. Progress Report, NUS Corporation (June 8, 1984).
23. Progress Report, NUS Corporation (June 14, 1984).
24. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (June 19, 1984).
25. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (July 11, 1984).
26. Progress Report, NUS Corporation (July 16, 1984).
27. Progress Report, NUS Corporation (July 26, 1984).
28. Progress Report, NUS Corporation (August 10, 1984).
29. Progress Report, NUS Corporation (September 5, 1984).
30. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (September 9, 1984).
31. Progress Report, NUS Corporation (September 10, 1984).
32. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (September 19, 1984).
33. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (September 25, 1984).
34. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (September 25, 1984).
35. Progress Report, NUS Corporation (October 9, 1984).
36. Progress Report, NUS Corporation (October 25, 1984).
37. Progress Report, NUS Corporation (November 5, 1984).
38. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (November 26, 1984).
39. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (December 4, 1984).
40. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (January 2, 1985).
41. Trip Report on a Visit to the Silresim Site, William D. Trimbath, NUS Corporation (January 4, 1985).
42. Letter from Donald Senovich, NUS Corporation to Richard T. Leighton, EPA Region I (July 22, 1985). Concerning Work Assignment Amendment Request.
43. Letter from Dennis P. Gagne, EPA Region I to Donald Senovich, NUS Corporation (August 12, 1985). Concerning response to Work Assignment Amendment Request.

18.7 Operations and Maintenance Records

1. Telephone Notes Between Thomas Riley, NUS Corporation and Marcia J. Berger, Commonwealth of Massachusetts Department of Environmental Quality Engineering (June 20, 1985). Concerning catch basin on site cap.
2. Memorandum from Yee Cho, Commonwealth of Massachusetts Department of Environmental Quality Engineering to David M. Webster, EPA Region I (August 19, 1985). Concerning transfer of funding for operations and maintenance activities.
3. Memorandum from Marcia J. Berger, Commonwealth of Massachusetts Department of Environmental Quality Engineering to Nancy Bettinger, Commonwealth of Massachusetts Department of Environmental Quality Engineering (August 23, 1985). Concerning project manager status for operation and maintenance activities.
4. Memorandum from Marcia J. Berger, Commonwealth of Massachusetts Department of Environmental Quality Engineering to Jeff Gould, Commonwealth of Massachusetts Department of Environmental Quality Engineering (November 14, 1985). Concerning proposed operation and maintenance work at Silresim Site.

18.8 Action Memoranda

1. Memorandum from William N. Hedeman Jr., EPA Headquarters to Lee M. Thomas, EPA Region I (June 10, 1983). Concerning a request for authorization to proceed with implementation of Initial Remedial Measures and completion of a Remedial Investigation and Feasibility Study.

Section II

Guidance Documents

GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at EPA Region I, Boston, Massachusetts.

General EPA Guidance Documents

1. U.S. Environmental Protection Agency. Office of Research and Development. Municipal Environmental Research Laboratory. Carbon Adsorption Isotherms for Toxic Organics (EPA-600/8-80-023), April 1980.

2. U.S. Environmental Protection Agency. Office of Water and Waste Management. Evaluating Cover Systems for Solid and Hazardous Waste, 1980.

3. U.S. Environmental Protection Agency. Office of Research and Development. Municipal Environmental Research Laboratory. Handbook for Evaluating Remedial Action Technology Plans (EPA-600/2-83-076), August 1983.

4. U.S. Environmental Protection Agency. Office of Ground-Water Protection. Ground-Water Protection Strategy, August 1984.

5. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response, Office of Emergency and Remedial Response, and Office of Research and Development. Review of In-Place Treatment Techniques for Contaminated Surface Soils - Volume 1: Technical Evaluation (EPA-540/2-84-003a), September 1984.

6. "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Final Rule and Interim Final Rule and Proposed Rule" (40 CFR Part 136), Federal Register, October 26, 1984.

7. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Hazardous Response Support Division. Standard Operating Safety Guides, November 1984.

8. U.S. Environmental Protection Agency. Office of Research and Development. Environmental Research Laboratory. EPA Guide for Minimizing the Adverse Environmental Effects of Cleanup of Uncontrolled Hazardous Waste Sites, (EPA-600/8-85/008), June 1985.

9. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Guidance on Feasibility Studies under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (EPA/540/G-85/003, OSWER Directive 9355.0-05C), June 1985.

10. Memorandum from Gene Lucero to the U.S. Environmental Protection Agency, August 28, 1985 (discussing community relations at Superfund Enforcement sites).

11. U.S. Environmental Protection Agency. Office of Waste Programs Enforcement. The Endangerment Assessment Handbook, August 1985.

12. U.S. Environmental Protection Agency. Office of Waste Programs Enforcement. Toxicology Handbook, August 1985.2. Covers for Uncontrolled Hazardous Waste Sites, September 1985.

13. U.S. Department of Health and Human Services. National Institute for Occupational Safety and Health, and Occupational Safety and Health Administration. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985.

14. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Handbook of Remedial Action at Waste Disposal Sites (EPA/625/6-85/006), October 1985.

15. U.S. Environmental Protection Agency. Hazardous Waste Engineering Research Laboratory. Handbook: Remedial Action at Waste Disposal Sites (Revised) (EPA/625/6-85/006), October 1985.

16. "National Oil and Hazardous Substances Pollution Contingency Plan," Code of Federal Regulations (Title 40, Part 300), 1985.

17. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Community Relations in Superfund: A Handbook (Interim Version) (EPA/HW-6, OSWER Directive 9230.0-3A), March 1986.

18. U.S. Environmental Protection Agency. Office of Health and Environmental Assessment. Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup (OHEA-E-187), May 1986.

19. U.S. Environmental Protection Agency. Hazardous Waste Engineering Research Laboratory. Handbook for Stabilization/Solidification of Hazardous Waste (EPA/540/2-86/001), June 1986.

20. U.S. Environmental Protection Agency. Office of Research and Development. Hazardous Waste Engineering Research Laboratory. Treatment Technology Briefs: Alternatives to Hazardous Waste Landfills (EPA/600/8-86/017), July 1986.

21. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Draft Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites (OSWER Directive 9283.1-2), September 20, 1986.

22. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response and Office of Emergency and Remedial Response. Mobile Treatment Technologies for Superfund Wastes (EPA 540/2-86/003 (f)), September 1986.

23. U.S. Environmental Protection Agency. Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended October 17, 1986.

24. "Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo - p - Dioxins and Dibenzofurans (CDDs and CDFs)," EPA Region I, October 1986.

25. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Draft Guidance on Remedial Actions for Contaminated GroundWater at Superfund Sites (OSWER Directive 9283.1-2), October 1986.

26. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Superfund Public Health Evaluation Manual (OSWER Directive 9285.4-01), November 1986.

27. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Interim Guidance on Superfund Selection of Remedy (OSWER Directive 9355.0-19), December 24, 1986.

28. U.S. Environmental Protection Agency. Office of Research and Development. Hazardous Waste Engineering Research Laboratory. Technology Briefs: Data Requirements for Selecting Remedial Action Technology (EPA/600/2-87/001), January 1987.

29. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Data Quality Objectives for Remedial Response Activities: Development Process (EPA/540/G-87/003), March 1987.

30. "PCB Spill Cleanup Policy" (40 CFR Part 761), Volume 52, Number 63, April 2, 1987.

31. Letter from Lee M. Thomas to James J. Florio, Chairman, Subcommittee on Consumer Protection and Competitiveness, Committee on Energy and Commerce, U.S. House of Representatives, May 21, 1987 (discussing EPA's implementation of the Superfund Amendments and Reauthorization Act of 1986).

32. Memorandum from J. Winston Porter to Addressees ("Regional Administrators, Regions I-X; Regional Counsel, Regions I-X; Director, Waste Management Division, Regions I, IV, V, VII,and VIII; Director, Emergency and Remedial Response Division, Region II; Director, Hazardous Waste Management Division, Regions III and VI; Director, Toxics and Waste Management Division, Region IX; Director, Hazardous Waste Division, Region X; Environmental Services Division Directors, Region I, VI, and VII"), July 9, 1987 (discussing interim guidance on compliance with applicable or relevant and appropriate requirements).

33. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Alternate Concentration Limits Guidance (OSWER Directive 9481.00-6C, EPA/530-SW-87-017) July 1987.

34. U.S. Environmental Protection Agency. Office of Health and Environmental Assessment. A Compendium of Technologies Used in the Treatment of Hazardous Waste (EPA/625/8-87/014), September 1987.

35. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001, OSWER Directive 9355.0-14), December 1987.

36. Record of Decision, Keefe Environmental Services NPL Site, Epping, New Hampshire, EPA Region I, Boston, Massachusetts, March 21, 1988.

37. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response and Office of Emergency and Remedial Response. Draft Guidance on CERCLA Compliance with Other Laws Manual (OSWER Directive 9234.1-01), May 6, 1988.

38. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Superfund Automated Records of Decision System (RODs) User Manual (EPA/540/G-87/005), August 1988.

39. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) Compliance with Other Laws Manual (EPA/540/G-89/006, OSWER Directive 9234.1-01), August 1988.

40. Public Health Risk Evaluation Database (PHRED) User's Manual (two diskettes containing the dBase III+ system are included), September 16, 1988.

41. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Technology Screening Guide for Treatment of CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) Soils and Sludges (EPA 540/2-88/004), September 1988.

42. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (Interim Final) (EPA/540/G-89/004, OSWER Directive 9355.3-01), October 1988.

43. Memorandum from Michael Callahan, U.S. Environmental Protection Agency Office of Health and Environmental Assessment to Henry L. Longest, U.S. Environmental Protection Agency Office of Emergency and Remedial Response, December 6, 1988 (discussing update of PCB clean-up levels).

44. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites (EPA/540/G-88/003, OSWER Directive 9283.1-2), December 1988.

45. U.S. Environmental Protection Agency. Risk Reduction Engineering Laboratory. Technology Evaluation Report SITE Program Demonstration Test, HAZCON Solidification, Douglassville, Pennsylvania, Volume I, (EPA/540/5-89-001a), February 1989.

46. Memorandum from Bill Hanson, U.S. Environmental Protection Agency Site Policy and Guidance Branch to Regional Superfund Branch Chiefs, Regions I-X, April 7, 1989 (discussing PCB Contamination at Superfund Sites).

47. Memorandum from Jonathan Z. Cannon to Regional Administrators, Regions I-X (OSWER Directive 9347.1-0), April 17, 1989 (discussing policy for Superfund compliance with the RCRA land disposal restrictions).

48. U.S. Environmental Protection Agency. Risk Reduction Engineering Laboratory. Technology Evaluation Report: SITE Program Demonstration Test Terra Vac In Situ Vacuum Extraction System Groveland, Massachusetts, Volume I (EPA/540/5-89/003a), April 1989.

49. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. ARARs Q's & A's (OERR 9234.2-01FS), May 1989.

50. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Land Disposal Restrictions: Summary of Requirements, June 1989.

51. U.S. Environmental Protection Agency, Region 1. Supplemental Risk Assessment Guidance for the Superfund Program, (EPA 901/5-89-001), June 1989.

52. Memorandum from Louis F. Gitto, U.S. Environmental Protection Agency Air, Pesticides, and Toxic Management Division, Region I to Merrill S. Hohman, Waste Management Division, Region I (OSWER Directive 9355.0-28), July 12, 1989 (discussing air stripper control guidance).

53. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Risk Assessment Guidance for Superfund, Human Health Evaluation Manual Part A, July 1989.

54. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Superfund LDR Guide #1, Overview of RCRA Land Disposal Restrictions (LDRs) (OSWER Directive 9347.3-01FS), July 1989.

55. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Superfund LDR Guide #2, Complying With the California List Restrictions Under Land Disposal Restrictions (LDRs) (OSWER Directive 9347.3-02FS), July 1989.

56. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Superfund LDR Guide #3, Treatment Standards and Minimum Technology Requirements Under Land Disposal Restrictions (LDRs) (OSWER Directive 9347.3-03FS), July 1989.

57. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Superfund LDR Guide #4, Complying With the Hammer Restrictions Under Land Disposal Restrictions (LDRs) (OSWER Directive: 9347.3-04FS), July 1989.

58. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Superfund LDR Guide #5, Determining When Land Disposal Restrictions (LDRs) Are Applicable to CERCLA Response Actions. (OSWER Directive: 9347.3-05FS), July 1989.

59. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Superfund LDR Guide #6A, Obtaining a Soil and Debris Treatability Variance for Remedial Actions. (OSWER Directive: 9347.3-06FS), July 1989.

60. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Interim Final Guidance on Preparing Superfund Decision Documents (OSWER Directive 9355.3-02), July 1989.

61. "RCRA Regulations," Code of Federal Regulations (Title 40, Part 264), July 1989.

62. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) Compliance with Other Laws Manual - Part II: Clean Air Act and Other Environmental Statutes and State Requirements (EPA/540/G-89/009, OSWER Directive 9234.1-02), August 1989.

63. Memorandum from Henry L. Longest, U.S. Environmental Protection Agency Office of Emergency and Remedial Response to Regional Waste Management Division Directors (OSWER Directive 9355.4-02) September 7, 1989 (discussing soil lead clean-up levels).

64. Record of Decision, So. Municipal Water Supply Well NPL Site, Petersborough, New Hampshire, EPA Region I, Boston, Massachusetts, September 27, 1989.

65. Record of Decision, Kellogg-Deering Well Field NPL Site, Norwalk, Connecticut, EPA Region I, Boston, Massachusetts, September 29, 1989.

66. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. CERCLA Compliance with Other Laws Manual - RCRA ARARs: Focus and Closure Requirements (OSWER Directive 9234.2-04), October 1989.

67. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Ground Water Issue - Performance Evaluation of Pump-and-Treat Remediations (EPA/540/4-89/005), October 1989.

68. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. The Superfund Innovative Technology Evaluation Program: Technology Profiles (EPA/540/5-89/013), November 1989.

69. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. The Feasibility Study: Development and Screening of Remedial Action Alternatives (OSWER Directive 9355.3-01FS3), November 1989.

70. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. CERCLA Compliance with State Requirements. (OSWER Directive 9234.2-05FS), December 1989.

71. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Superfund LDR Guide #7, Determining When Land Disposal Restrictions (LDRs) are Relevant and Appropriate to CERCLA Response Actions. (OSWER Directive 9347.3-08FS), December 1989.

72. U.S. Environmental Protection Agency. Risk Reduction Engineering Laboratory. Technology Evaluation Report: SITE Program Demonstration of the Ultrox International Ultraviolet Radiation/Oxidation Technology (EPA/540/5-89/012), January 1990.

73. U.S. Environmental Protection Agency. Risk Reduction Engineering Laboratory. Handbook on In Situ Treatment of Hazardous Waste-Contaminated Soils (EPA/540/2-90/002), January 1990.

74. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. CERCLA Compliance with Other Laws Manual - CERCLA Compliance with the CWA and SDWA (OSWER Directive 9234.2-06/FS), February 1990.

75. "National Oil and Hazardous Substances Pollution Contingency Plan," Federal Register (Vol. 55, No. 46), March 8, 1990, p. 8666.

76. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. The Feasibility Study: Detailed Analysis of Remedial Action Alternatives (OSWER Directive 9355.3-01FS4), March 1990.

77. "A Field Evaluation of the UV/Oxidation Technology to Treat Contaminated Groundwater," HMC, March/April 1990.

78. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. CERCLA Compliance with Other Laws Manual - Summary of Part II - CAA, TSCA, and Other Statutes (OSWER Directive 9234.2-07/FS), April 1990.

79. Memorandum from Henry L. Longest and Bruce Diamond, U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response to Regional Waste Management Division Directors (OSWER Directive 9203.0-06) June 4, 1990 (concerning Superfund responsiveness summaries).

80. "Protection of Environment," Code of Federal Regulations (Title 40, Parts 190-299), Revised as of July 1, 1990.

81. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. CERCLA Site Discharges to POTWs Guidance Manual (EPA/540/G-90/005), August 1990.

82. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. A Guide on Remedial Actions at Superfund Sites with PCB Contamination (OSWER Directive 9355.4-01/FS), August 1990.

83. U.S. Environmental Protection Agency. Risk Reduction Engineering Laboratory. Guide for Conducting Treatability Studies Under CERCLA: Soil Vapor Extraction, March 1, 1991.

84. Memorandum from Timothy Fields Jr., U.S. Environmental Protection Agency Office of Emergency and Remedial Response to Regional Waste Management Division Directors (OSWER Directive 9285.6-03) March 25, 1991 (discussing standard default exposure factors).

85. Memorandum from Timothy Fields Jr., U.S. Environmental Protection Agency Office of Emergency and Remedial Response to Regional Waste Management Division Directors March 27, 1991 (discussing guidance on key terms used in Superfund).

86. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Guide to Developing Superfund No Action, Interim Action, and Contingency Remedy RODs (OSWER Directive 9355.3-02FS-3), April 1991.

87. U.S. Environmental Protection Agency. Office of Soiid Waste and Emergency Response. Guide to Addressing Pre-ROD and Post-ROD Changes (OSWER Directive 9355.3-02FS-4), April 1991.

88. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Superfund Record of Decision Update (OSWER Directive 9200.5-2161), May 1991.

89. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Superfund Record of Decision Update (OSWER Directive 9200.5-2161), July 1991.

90. U.S. Environmental Protection Agency. Hazardous Waste Engineering Research Laboratory. Evaluation of the B.E.S.T. Solvent Extraction Sludge Treatment Technology: Twenty-Four Hour Test (EPA/600/2-88/051).

91. U.S. Environmental Protection Agency. Impact of the RCRA Land Disposal Restrictions of Superfund Response Actions in Superfund.

92. U.S. Environmental Protection Agency. Hazardous Waste Engineering Research Laboratory. Application of Low-Temperature Thermal Technology to CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) Soils.

93. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Personnel Protection and Safety.