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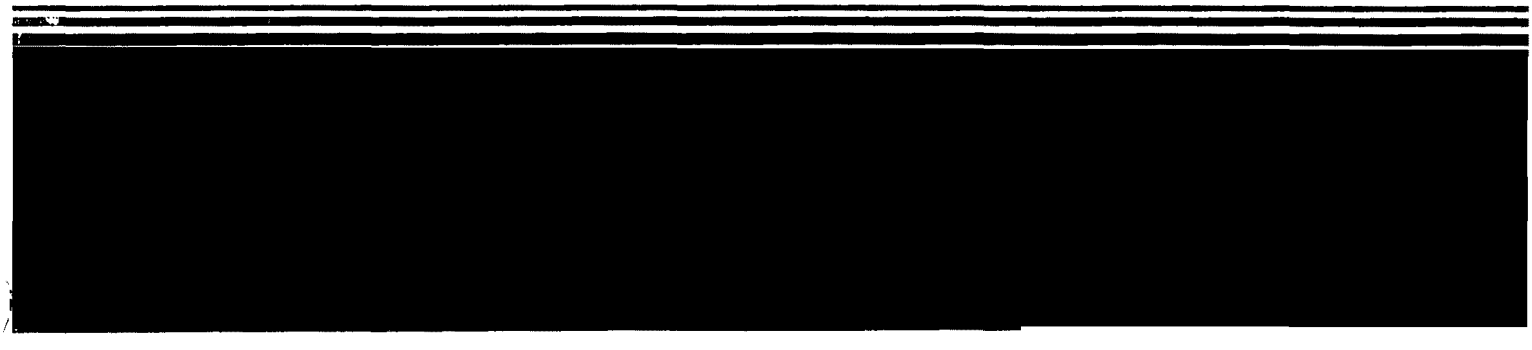
Superfund Record of Decision:

Resolve, MA



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16. ABSTRACT

The Re-Solve, Inc. site is a former waste chemical reclamation facility situated on six-acres of land in North Dartmouth, Massachusetts. Bounded by wetlands to the north and east, the land surrounding the site is predominantly zoned for single family residential use. All residences obtain their water from private wells located on their property. The Copicut River, located about 500 feet from the site, has been designated for the protection and propagation of fish, other aquatic life, wildlife and primary and secondary contact recreation. Between 1956 and 1980, Re-Solve, Inc. handled a variety of hazardous materials including solvents, waste oils, organic liquids and solids, acids, alkalies, inorganic liquids and solids and PCBS. Residues from the distillation tower, liquid sludge waste, impure solvents and burnt tires were disposed of in four onsite unlined lagoons. The lagoon contents were burned periodically to reduce the VOC content. An oil waste that accumulated at the bottom of the degreaser distillation still was disposed of on one portion of the site through landfarming. This oil waste was also spread throughout the site to control dust. Cooling water from the distillation tower was discharged to a shallow, onsite lagoon. In 1974 the Massachusetts Division of Water Pollution Control issued Re-Solve, Inc. a license to collect and dispose of hazardous waste. In December 1980 the Massachusetts Division of Hazardous Waste agreed to accept Re-Solve's offer to surrender its disposal license on
(See Attached Sheet)

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Record of Decision

Remedial Alternative Selection

Site Name and Location

Re-Solve, Inc. Site
North Dartmouth, Massachusetts

Statement of Purpose

This Decision Document represents the selected remedial action for this site 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 (SARA), and to the extent practicable, the National Contingency Plan (NCP); 40 CFR Part 300 et seq., 47 Federal Register 31180 (July 16, 1982), as amended.

The Commonwealth of Massachusetts has concurred on the selected remedy and determined, through a detailed evaluation, that the selected remedy is consistent with M.G.L. ch. 21E.

Statement of Basis

This decision is based on the administrative record which was developed in accordance with Section 113(k) of CERCLA and which is available for public review at the information repositories (index attached). The attached index identifies the items which comprise the administrative record upon which the selection of a remedial action is based.

Description of the Selected Remedy

The selected remedy for the Re-Solve, Inc. site is a comprehensive approach for site remediation which includes both a source control and management of migration component.

The source control component entails:

- Excavation of 22,500 cubic yards of PCB contaminated soils located in the unsaturated zone and treatment on-site in a mobile dechlorination facility. The health-based cleanup level for on-site soils contaminated with PCBs is 25 ppm. This cleanup level corresponds to a 10^{-5} cancer risk level. Soils will be treated in the dechlorination facility to a level of 25 ppm PCBs and then placed back on-sit

- Excavation of 3000 cubic yards of PCB contaminated sediments located in wetland resource areas to the north and east of the site and treatment on-site in the mobile dechlorination facility. The cleanup level for PCB contaminated sediments is 1 ppm. Achievement of the target cleanup level will require the disturbance and temporary loss of areas classified as wetlands. The unavoidable impacts to these resource areas will be mitigated to the maximum extent possible and following such activities, a wetland restoration program will be implemented.

- Dechlorination is an innovative technology which has been proven to be effective in the treatment of PCB contaminated soils on the bench-scale and pilot-scale level. However, it will be necessary to conduct pilot-scale studies to determine the implementability of this technology on a full-scale level. If dechlorination, based on the results of the pilot-scale studies is determined not to be implementable at the Re-Solve site, EPA will select on-site incineration as the principal treatment technology for this component of the selected remedy.

- It is estimated that it will take two (2) years to treat 25,500 cubic yards of PCB contaminated soils and sediments. This estimate is for construction/operation time only, and does not include the time for design, bidding and awarding of the construction contract.

The management of migration component will be implemented upon completion of the source control component. This component entails:

- Active restoration of the overburden and bedrock aquifers contaminated with volatile organic compounds (VOCs) using on-site treatment involving air stripping and carbon adsorption. Groundwater will be treated to reduce contaminants to levels which result in an excess cancer risk of 1×10^{-5}, assuming additivity. EPA estimates that this target remediation level can be achieved within 10 years.

- EPA has determined that it is technically infeasible to remediate PCBs located in the saturated zone soil matrix <u>on-site</u> and ensure that the resultant concentration in groundwater would attain a level that is equivalent to a 10^{-5} cancer risk level. However, treatment of VOCs will render the PCBs relatively immobile, thus restricting contamination to the waste management area, only. Since PCBs will be present in groundwater in excess of the health-based cleanup level upon completion of groundwater remediation, it will be necessary to implement institutional controls on groundwater use within the waste management boundary.

The estimated present worth cost for the source control component is $9,237,000 and the groundwater remediation component is $10,674,000. The total estimated cost for the selected remedy for the Re-Solve, Inc. site is $19,911,000.

Declaration

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the statutory preference for treatment that permanently and significantly reduces the volume, toxicity and mobility of the hazardous substances pollutants and contaminants, as a principal element. Finally, it is determined that this remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

9/24/87
Date

Michael R. Deland
Regional Administrator, EPA Region I

ROD Decision Summary

Re-Solve, Inc. Superfund Site

North Dartmouth, Massachusetts

September 24, 1987

U.S. Environmental Protection Agency

Region I

Boston, Massachusetts

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ROD Decision Summary

Re-Solve, Inc.

North Dartmouth, Massachusetts

I. Site Name, Location and Description

The Re-Solve, Inc. site ("the site") is a former waste chemical reclamation facility situated on a six acre parcel of land in the southeastern Massachusetts town of North Dartmouth. As shown in Figure C-1, the site is located approximately two miles north of Interstate Highway 195 and Reed Road Interchange on the east side of North Hixville Road. The site is bounded by wetlands to the north and east and a pine and mixed hardwood forested area to the south and west. An Algonquin Gas Pipeline right-of-way abuts the eastern boundary of the site.

The land surrounding the Re-Solve site is predominately zoned for single family residential use, with required lot sizes of 40,000 square feet or larger. Two auto salvage yards are located on North Hixville Road, 500 feet and 300 feet respectively to the north-northwest of the site. A former gravel pit located to the northwest has been closed and revegetated. To the northeast of the site approximately 180 acres are owned by the Rod and Gun Club of New Bedford. This land is used by the club for hunting (rabbits and pheasants are stocked by the club), fishing, and target shooting. Part of the acreage is also used in conjunction with a forestry management program. Twenty-five acres of land immediately south of the site bordering the Algonquin Gas Pipeline right-of-way and the Copicut River are held by the Dartmouth Natural Resource Trust.

A town forest is located about two miles south of the site, adjacent to Interstate Highway 195. No rare or endangered species, plants or animals have been reported within a two mile radius of the site.

According to the 1980 Massachusetts Census, North Dartmouth has an area of about 62 square miles and a population of approximately 26,000. The 1980 population represents an increase of approximately 17 percent over the 1975 population of 21,600 persons. Based on the 1980 census, approximately 114 people live within a one half mile radius of the site, and approximately 326 people live within a one mile radius of the site. Two residences are located within 150 yards of the site, one to the northwest and the other to the southwest, and six other residences are found along North Hixville Road within one quarter mile of the site.

All residences in the area obtain their water from private wells located on their property.

The Copicut River, classified as Class B by the Commonwealth of Massachusetts, is located about 500 feet directly east of the site. Class B waters are designated for protection and propagation of fish, other aquatic life, and wildlife and for primary and secondary contact recreation.

The Copicut River drains directly into Cornell Pond, approximately one quarter of a mile down river from the site. Cornell Pond is popular for sport fishing with horn pout, perch, and pickerel the common species. Outflow from Cornell Pond merges with Shingle Island River which then flows into Noquochoke Lake, located about two miles downstream of Cornell Pond (see Figure C-1). Noquochoke Lake is highly enriched with nutrients and stratifies in the summer months, so that sufficient levels of dissolved oxygen may not be present to support a healthy aquatic community.

A summary of local climatological data shows that annual precipitation averages 41 inches in Dartmouth, with most annual totals within 14 percent of the normal. Average monthly precipitation ranges from 2.2 inches to 4.1 inches. Temperatures range from an average low of 32 degrees Fahrenheit on January 1 to about 72 degrees Fahrenheit on July 1.

II. Site History

Re-Solve, Inc. operated as a waste chemical reclamation facility for 24 years until its closure in 1980. A variety of hazardous materials were handled at the Re-Solve site including solvents, waste oils, organic liquids and solids, acids, alkalies, inorganic liquids and solids and PCBs. Historically, the operators disposed of the hazardous byproducts from the distillation process in two ways. The residues from the distillation tower, liquid sludge waste and impure solvents were disposed of in four unlined lagoons on-site. The lagoon contents were burned periodically to reduce the volatile organic content. An oil waste that accumulated at the bottom of the degreaser distillation still was disposed of on one portion of the site through a method known as landfarming. This oil waste was also spread throughout the site to control dust. Cooling water from the distillation tower was discharged to a shallow on-site lagoon in the eastern portion of the site. It is alleged that residues from burned tires were also disposed of in the lagoons.

In 1974, the Massachusetts Division of Water Pollution Control issued Re-Solve, Inc. a license to collect and dispose of hazardous waste. On October 21, 1980, Re-Solve offered to surrender its disposal license. On December 23, 1980, the Massachusetts Division of Hazardous Waste agreed to accept Re-Solve's offer, on the condition that all hazardous waste be removed from the site. Inspection and monitoring of the site by the State at the time showed that no migration of contaminants was occurring from the four lagoons and that vehicle inspection and manifest requirements were adhered to for off-site disposal of drum and tank wastes.

In the following months, there was little evidence of responsive activity on the part of Re-Solve, Inc. and in March of 1981, the Massachusetts Attorney General's Office became involved. Later in 1981, all drums and other debris, including buildings on the site, were removed from the site by Re-Solve, Inc. Following this, the site, with the exception of the slab foundations and loading and unloading pads, was covered with an unknown amount of sand. These activities occurred under the direction of the present site owner. The contents of the four on-site lagoons were not removed.

On June 19, 1981, the Massachusetts Department of Environmental Quality Engineering (MA DEQE) submitted a request to EPA that the Re-Solve, Inc. site be placed on the Superfund National Priorities List (NPL). In October of 1981, EPA released an interim NPL list of 115 priority hazardous waste sites. The Re-Solve site was on the list, thus becoming eligible for federal assistance as part of the Superfund program. On December 30, 1982, the Re-Solve site was placed on EPA's proposed NPL. At the time, it was ranked as number 156 of a total of 418 hazardous waste sites. In September of 1983, the Re-Solve Inc site was placed on the Final NPL. On July 16, 1982, EPA published a Remedial Action Master Plan (RAMP) for the site. The primary purpose of the RAMP was to assess the available site data and identify the type, scope,

sequence, and schedule of remedial projects which would be appropriate at the site.

A Remedial Investigation and Feasibility Study (RI/FS), initiated in the fall of 1982 and completed in June of 1983, was conducted to assess the extent of on-site source contamination and evaluate remedial alternatives. The sampling program conducted as part of the RI provided chemical analyses for air, surface water, groundwater, soil, lagoon wastes and sediment samples.

Indications of contaminated areas and waste types identified in previous studies were also verified in the 1983 RI/FS. The study identified the following four areas, as shown in Figure C-2, as contaminant sources:

(1) Four unlined lagoons in northern part of site.

PCB content was found to vary significantly with depth in the lagoons but was generally greater than 500 ppm. Other contaminants found in the lagoon waste, at concentrations in excess of 5000 ppm, include isophorone, ethylbenzene, toluene, o-xylene, and various phthalates.

(2) Filled cooling water pond at the eastern boundary of the site.

Prior to being filled in 1981, MA DEQE (October, 1980) sampled the active cooling pond water and found high concentrations of methylene chloride (1.45 ppm), acetone (1.5 ppm), trichloroethylene (860 ppb), methylethyl ketone (780 ppb), and other organics at less than 100 ppb.

(3) Areas of oil spreading in the western and southwestern portions of the site.

Waste oil was deposited for many years in the areas along the western boundary of the site just south of the access road entrance. The upper zone was modified by plowing or discing of wastes into the soil. Surface soil samples were found to contain PCB concentrations ranging from 15,000 to 52,000 ppm. Soil boring samples also collected in this area indicated subsurface concentrations of PCB from 4 to over 200,000 ppm. Other organics, including phenols, trichlorobenzene, and bis(2-ethylhexyl)phthalate, were also detected at high concentrations.

(4) Foundations and concrete pads associated with structures which had existed on-site at one time ("structural remnants") and contaminated soils ("hot spots").

The 1983 study identified the on-site contamination source as approximately 3,100 cubic yards of lagoon wastes and 3,900 cubic yards of contaminated soil. Based on a review of analytical data from 35 monitoring wells, it was postulated that the extent of

groundwater contamination was bounded by the Copicut River and Carol's Brook.

In June of 1983, EPA proposed a source control remedial action that included excavation of 7000 cubic yards of contaminated lagoon waste and soil with PCB concentrations greater than 50 ppm, treatment (waste stabilization/fixation process) on-site and encapsulation. Based on an evaluation of comments received during the public comment period, EPA modified its recommended remedial action. The selected remedial action was for the excavation of 7000 cubic yards of source material (i.e. four waste lagoon areas, oil spreading area and other "hot spots"), treatment and transportation to an off-site disposal facility, and encapsulation of the site. A Record of Decision describing this remedial action was approved on July 1, 1983.

Through an interagency agreement, EPA contracted with the Corps of Engineers (US COE) to perform the design and construction of the selected remedy. During remedial design, the quantity of waste requiring disposal was increased to a total of 15,000 cubic yards. The US COE completed the design and in November, 1983 initiated the bidding procedures for the selection of a subcontractor to carry out the remedy. The awarding of the subcontract to CECOS Environmental Inc. was delayed five months due to a bid protest by a third party, but construction on-site did begin in July of 1984. Delays leading to shutdown of the project occurred when EPA Region I was informed that, due to regulatory requirements, only specific wastes from the Re-Solve facility were acceptable for disposal at CECOS facilities in Region II and Region V. Ultimately, soil from the four lagoons plus the soil mixed with it was sent to a CECOS facility in Ohio. All other soils went to a CECOS facility in Niagara Falls, New York.

Near the completion of the excavation of 15,000 cubic yards of soils, additional site investigation studies were conducted to evaluate the effectiveness of the remedial action. This work consisted of 48 on-site shallow soil borings and a series of 5 test pits. These studies indicated that extensive PCB contamination at concentrations greater than 50 ppm still existed in on-site soils to a depth of 10 feet below seasonal low groundwater. The US COE so informed EPA in April of 1985. At that point, the remedial action contract was terminated and a Supplemental RI was initiated to determine the further extent of on-site residual contamination in soils. Encapsulation of the site did not occur.

Concurrent with the US COE activity on-site, EPA had initiated an Off-site RI/FS in September of 1983 to assess the extent of contamination that had migrated beyond the boundaries of the site.

The final draft of that RI was completed in February of 1985. Results from the off-site investigation as well as the on-site RI/FS (1983) and other pertinent data and information developed during the conduct of on-site work were used to analyze the

limits of off-site contamination and to evaluate potential remedial measures.

The four major sources of contamination (Figure C-2) identified in the on-site RI/FS (1983) were confirmed by the analyses obtained from the installation of 45 groundwater monitoring wells at 25 locations, surface water and sediment sampling, soil borings, test pit excavations and lagoon depth probing and analyses. Based on samples taken from these media during the on-site RI(1983) and again in 1984 during the off-site RI (1985) the following were concluded:

- Contaminants are leaching from the intermediate depths of the lagoons where there has been no effective sealing of the side slopes. This leaching process provides a source of both on-site and off-site contamination of the groundwater and soils. In addition, during periods of high precipitation the lagoons would overflow, thus contaminating the sediments in the wetlands north of the site and the unnamed tributary.

- The unlined cooling water pond is acting as a continuous source of groundwater contamination. Precipitation and/or run-off entering this area causes contaminants to seep into the groundwater and then flow laterally in a southeasterly direction from the site towards the Copicut River and Cornell Pond.

- At test pits installed in the oil spreading area along the western boundary of the site in this area, the water table was observed to intersect the zone of high PCB concentrations. Oils were noted floating on the water which had accumulated in one test pit as well as in soils in the upper eight inches.

The results of the off-site RI (1985) indicated that the site is acting as a continuous source of contamination and that off-site contamination emanating from the Re-Solve site impacts upon groundwater, surface water and sediment.

The results of an extensive groundwater sampling program conducted in May, 1983 and January, 1984 are presented in Figures C-3 and C-4. These data clearly indicate a southeastward movement of the contaminant plume in both the overburden and bedrock aquifers. The area of groundwater contamination in the overburden aquifer is approximately bounded on the south and east by Carol's Brook and the Copicut River, but contamination in the bedrock does extend beyond these two surface water bodies. The bedrock contamination east of the Copicut River appears due to localized effects, while the bedrock contamination south of Carol's Brook indicates that this brook is acting as only a partial hydrologic barrier.

The Copicut River, Carol's Brook, the unnamed tributary and Cornell Pond are the primary surface waters in the vicinity of the Re-Solve site. The highest levels of surface water contamination were detected in the unnamed tributary and the Copicut River. Progressively decreasing concentrations of volatile organics were detected downstream from the site in Cornell Pond and the Copicut River.

The principal off-site locations containing elevated levels of PCBs in sediments are shown in Figure C-5. These areas predominate in the wetland area north of the site, and the unnamed tributary to the west. PCBs were not detected in the sediments of Cornell Pond but a concentration of 1.7 ppm was observed in the sediment of the Copicut River downstream of its confluence with Carol's Brook. It appears that sediment transport mechanisms are slowly dispersing fine grained sediments, along with adsorbed PCBs, downstream.

In April 1985, the off-site FS for the site was nearing completion when EPA was informed by the US COE of the extent of contamination that still existed on-site. As part of the development of alternatives in the off-site FS, it had been assumed that the source removal activity on-site would be completed and that the on-site cap would be already in place. Due to the discovery of additional contamination, the cap was not installed and EPA elected to conduct a Supplemental RI to determine the nature and extant of contamination in on-site soils and to supplement information presented in the off-site RI. It was determined that, upon completion of a Supplemental RI, a comprehensive FS would be developed for both source control and management of migration.

Current Status

The Supplemental RI was initiated in September of 1985 and completed in February of 1987. An extensive soil boring investigation was conducted to determine the nature and extent of contamination in soils. This program consisted of a total of 56 borings, 44 of which were on-site, and 12 of which were off-site. Fifty percent of the on-site boreholes extended to bedrock. Each boring included continuous split-spoon sampling with samples being collected at approximately two foot intervals. These samples were then analyzed for PCB and volatile organics and other Hazardous Substance List (HSL) compounds.

Total Volatile Organics

Samples collected during the soil boring program were analyzed for total volatile organics (TVO). The analyses show that, depending on the depth and location of the sample, contamination ranges from lows of 1-100 ppb to highs of 10-1,000 ppm. Figures C-6 and C-7 illustrate these data by delineating areas of significant contamination at various depths. For presentation purposes, levels greater than 50 ppm and greater than 10 ppm of TVO in soil were selected to represent areas of contamination. These areas are not

intended to represent the limits of contamination, but rather the location of possible source areas. There is a total of approximately 31,000 cubic yards (c.y.) soils contaminated with TVO greater than 10 ppm, 20,000 of that being saturated (below groundwater) and 11,000 being unsaturated (above groundwater).

PCB

Data representing the extent of PCB contamination greater than 50 ppm and greater than 10 ppm are presented in Figures C-8 and C-9.

These data represent a similar pattern to that shown on Figures C-6 and C-7 for the total volatile organic compounds, indicating several distinct source areas. These figures show that, in relative terms, the PCB contamination is located in the same source areas as the TVO contamination and is generally more widespread than TVO contamination. Approximately 61,000 c.y. of soil is contaminated with PCBs greater than 10 ppm, 37,000 c.y. being saturated and 24,000 being unsaturated.

Data Summary

Analysis of the soil boring program on the Re-Solve Site indicated the existence of four distinctive source areas or "hot spots" These areas were similar for both the total volatile organics and PCBs, as illustrated in Figures C-6 through C-9, and are identified as follows:

- Former Lagoon Area
- Oil Spreading Area
- Cooling Pond Area
- Smaller Localized Areas ("hot spots")

A primary area of concern is located in the northwest quadrant surrounding observation well SB-25. A review of the past site history at this location reveals that this area was the site of the waste oil spreading operation. The soil boring results in this area indicate high levels of total volatile organic contamination (2,666 ppm in SB-25N). In addition, PCB levels in the 500 ppm range, penetrating through the overburden down twenty feet to bedrock, were found in SB-25N.

It is unusual for PCB compounds to be highly mobile due to low solubility of the PCB constituent in water. However, the migration of PCB compounds in groundwater at the Re-Solve site is dramatically increased due to the presence of various organic solvents such as hexane, carbon tetrachloride, benzene, methylene chloride and acetone. PCB compounds form complexes with, and dissolve in, such compounds, thus increasing the mobility of PCBs in groundwater[1]. Carbon tetrachloride and methylene chloride have greater specific gravities than water, so PCBs dissolved in these compounds could migrate downward in the aquifer. In addition, long term surface loading of waste oils at a high rate caused extensive mounding of these contaminants and subsequent downward migration to lower sections of the overburden aquifer.

The second locality of high soil contamination is the former site of the waste lagoons situated in the northern section of the site. An analysis of the soil borings at the SB-30S location shows high levels of the following organic compounds:

- Methylene chloride
- 2-Butanone (MEK)
- Trans-1,2-Dichloroethylene
- Trichloroethylene
- 4-Methyl-2-Pentanone
- Tetrachloroethylene
- Toluene

The concentration and depths of penetration of these contaminants demonstrate that this area is also a substantial source of groundwater contamination.

The third area of concern is the location of the former cooling pond. The numerous soil borings at this locale show significant concentrations of various organics, particularly acetone and 2-butanone (MEK).

Other areas of soil contamination, so-called "hot spots," are situated in the vicinity of the former septic system and the low drainage areas on the pipeline right-of-way. The soil boring data exhibit low levels of PCBs and high levels of acetone, methylene chloride, 2-butanone (MEK), trichloroethylene, 4-methyl-2-pentanone and tetrachloroethane.

Groundwater

Extensive excavation at locations across the site during the 1983 remedial action removed substantial portions of the contaminated soil matrix. However, a significant quantity of source material still remains, resulting in widespread contamination of on-site groundwater from volatile organics and extractable organics. Groundwater flow is from the site area (east of North Hixville Road) to the east and southeast towards the Copicut River and the unnamed tributary. The contaminants are found downgradient in both the overburden and bedrock aquifers as well as the surface waters.

The overburden at the site consists of rather permeable sands and gravels ranging in thickness from less than 10 ft to about 28 ft at one location. Generally, but with some exceptions, a till layer is found in contact with the bedrock and below the surficial sands and gravels. The thickness of the till layer over the study area is variable, ranging from 0 to over 25 ft. Numerous large boulders, up to 5 ft in diameter, are present in the overburden at the site. These are primarily found in the till layer, but they are also present in the overlying permeable sands and gravels. Monitoring wells installed in the upper sands and gravels were capable of being pumped at some locations at rates of up to 10 to 14 gallons per minute (gpm). Slug test data shows transmissivities ranging from 100 to 176 ft^2/day.

Groundwater contours for November, 1985 and July, 1986 respectively are presented in Figures C-10 and C-11. These contours indicate that approximately 90-95 percent of the groundwater from the site which discharges to the surface water system enters either the unnamed tributary that bounds the site to the northeast or the Copicut River. Surface water flow data collected as part of the Supplemental RI shows that during high water table conditions, most of the groundwater is intercepted by the unnamed tributary. A small portion of the groundwater outflow to the surface water may discharge to Carol's Brook, but this is minimal. With a lower groundwater table, groundwater does not discharge to the unnamed tributary, but enters the Copicut River directly.

Historical groundwater contaminant plume data are presented in Table C-1. The groundwater contaminant plume in the overburden and bedrock aquifers are shown in Figures C-12 and C-13, respectively.

Groundwater sampling at 16 observation well locations, primarily at on-site and immediate off-site locations, indicated PCB contamination ranging from 4 ppb to 1200 ppb in unfiltered groundwater during the November and December 1985 sampling events. However, PCBs are relatively insoluble in water with a range of 2.5 ppb - 15 ppb solubility. The existence of high levels of PCBs in groundwater samples at the locations tested is, to a great extent, believed attributable to PCBs adhering to silt and suspended solids sampled with the unfiltered groundwater samples. To verify this, a second sampling was conducted in July of 1986. Groundwater samples were filtered through a 0.45 micron standard filter for organic analyses to determine if the PCB contaminants detected were, in fact, adsorbed onto silt and soil particles.

The July 1986 sampling of filtered groundwater at ten of the observation well locations showed PCBs at three of the observation wells as indicated below. The remaining seven wells did not indicate the presence of PCBs in groundwater.

Observation Well	Total PCB Concentration (ppb)	
	Nov/Dec.1985 (unfiltered)	July 1986 (filtered)
SW	5.5	1.4
OW-SB-25S	1160	52
OW-SB-34S	6	9.7

This information indicated that PCB oils at OW-SB-25S are present in groundwater at levels higher than the 15 ppb maximum solubility. The presence of other volatile organic compounds in which PCBs are soluble increases the presence of PCBs in the groundwater. Soil borings and groundwater samples at the SB-25S location indicate high concentrations of volatile organics and PCB contaminants at depths throughout the thickness of the overburden aquifer. The overburden contaminant migration plume is almost

entirely discharging into the unnamed tributary and the Copicut River as indicated by the lack of, or low levels of, contamination in overburden observation wells east of the Copicut River. In addition, the pattern of surface water contamination found in the Copicut River and unnamed tributary supports the conclusion that the overburden aquifer is largely discharging into the unnamed tributary and Copicut River. The unnamed tributary appears to be a receptor of contaminant groundwater outflows and exhibits consistent contaminant concentrations in the 2-3 ppm total volatile organic range at its downstream portion. The Copicut River is also a primary receptor of contaminant outflow, exhibiting consistent contaminant levels of approximately 100 ppb downstream of the site before the confluence with the unnamed tributary.

Contaminants in the bedrock aquifer have migrated under surface water to the eastern side of the Copicut River and south of Carol's Brook, as illustrated in Figure C-13. As evidenced by drilling operations at some locations across the study area from the 1985 Off-site RI and boring logs from the Supplemental RI, bedrock at some locations is extensively fractured. Groundwater in the fractured bedrock aquifer flows in a similar direction to that of the overburden aquifer. Contaminants in the bedrock groundwater discharge to the Copicut River. Contaminant migration east of the Copicut may occur during the transient conditions of high water table conditions which causes short-term downward vertical gradients. However, the Copicut River soon recovers and discharge to the Copicut continues. These short-term reversals of flow do not seem to be significant enough for contamination to flow past the Copicut River. Further, a more recently installed off-site cluster of monitoring wells does not exhibit any contamination in either the overburden or bedrock aquifers, indicating that the contaminant plume has not migrated to that downgradient area.

As indicated in these groundwater analyses, contaminant flow in the overburden aquifer is primarily towards the Copicut River. Some of the contaminants have higher specific gravities than water. This fact, in combination with precipitation recharge, contaminant recharge rates, and possible seasonal downward gradients in the contaminated sandy soils, can cause a downward migration of contaminants in the overburden aquifer.

Sediments

The highest concentrations of PCBs in sediments were found in the wetland north of the lagoon area and in the unnamed tributary. Lower levels were found in Carol's Brook, the Copicut River, Cornell Pond and downstream to above the confluence of the Copicut River and the Shingle Island River. Phthalates were found in the wetland area as well. Other volatile organic contaminants were found in sediments from all of the above areas, as well as the Shingle Island River.

Fish sampling was conducted at two stations downstream of the Re-Solve site to determine if PCBs were bioaccumulating in aquatic life. One composite sample, consisting of redfin pickerel and American eel, taken from the Copicut River sampling station, was found to contain 20 ppm PCBs. Because eels generally have higher levels of PCBs than other species in the same water, it is likely that the greater portion of the 20 ppm PCBs was contributed by the eel rather than the redfin pickerel. The other seven fish samples had less than 2 ppm PCBs.

The action level established by the Federal Food and Drug Administration indicating that fish is safe for consumption is 2 ppm PCBs. In August, 1986, EPA, MA DEQE and the Massachusetts Department of Public Health (MA DPH) issued an advisory alerting the public that eels caught in the Copicut River should not be consumed. EPA, MA DEQE and MA DPH posted warning signs, in both English and Portuguese, along the Copicut River and the site vicinity, warning against consumption of eels.

Residential Wells

EPA sampled fifty-six residential wells located both upgradient and downgradient of the site, to determine if site contamination was impacting the quality of drinking water in the area. Of the fifty-six wells, fourteen wells were found to be contaminated with low levels of organic compounds and four were found to contain lead in excess of EPA's Primary Drinking Water Standard. Residential wells that contained organic compounds that are categorized as potential carcinogens were re-sampled by EPA. None of the original contaminants found in the first sampling round were detected in two subsequent sampling rounds. The current quality of drinking water in residential wells located in the vicinity of the site is not considered to have been noticeably affected by contaminants originating from the site.

Although lead was detected in on-site soils, EPA does not attribute the lead detected in these wells to the site. The primary reason for this determination is that these wells are located both upgradient and downgradient to the site and therefore, there is no hydrogeologic connection between the site and all of the wells. Elevated lead levels are commonly due to naturally occurring lead in soil, corrosion of lead piping and connections, residues from lead paint or a combination of these and other sources.

Risk Assessment

The Baseline Risk Assessment was conducted to assess the potential risks to human health and freshwater aquatic life associated with exposure to contaminants from the Re-Solve site in the absence of remediation. A subset of eight of the more than 50 chemicals detected at the Re-Solve site in soils, sediments, groundwater and surface water were selected for detailed evaluation of potential human health risks. PCB-contaminated sediments were considered to pose the greatest environmental risks at the Re-Solve site. Consequently, PCBs were selected for detailed

evaluation with respect to their effects on freshwater aquatic life. Several exposure pathways under both present and future site use conditions were evaluated, and the potential risks associated with these pathways were estimated.

Under present site use conditions, five pathways for human exposure and one pathway for aquatic life exposure were evaluated. The relevant pathways for human exposure were: direct contact with on- and off-site soils and subsequent absorption of contaminants through the skin, or as a result of incidental soil ingestion; inhalation of volatile organic compounds released from on-site soils and surface water; inhalation of particulate matter released from on-site soils; dermal contact with surface water and subsequent contaminant absorption; and human ingestion of fish. The exposure pathway considered to be of most concern to aquatic life was exposure to water in direct contact with sediments contaminated with PCBs.

Under potential site development conditions (i.e., development as a residential area), four exposure scenarios were evaluated: ingestion of on-site groundwater; direct contact with on-site soils; and inhalation of volatile organic compounds and particulate matter released from on-site soils.

The potential human health risks estimated under present site use conditions are summarized in Table C-2. Potential risks were estimated for children who may occasionally play in the soils at or near the Re-Solve site. Exposures and risks were evaluated for all the human health indicator chemicals detected in the soils. Exposure to the potentially carcinogenic human health indicator chemicals found in the on-site surface soils may result in potential upper bound incremental lifetime cancer risks of 6×10^{-8} for the average case and 4×10^{-5} for the plausible maximum case. Incremental lifetime cancer risks posed by exposures to off-site surface soils could be as high as 5×10^{-8} under average exposure conditions and 8×10^{-5} under plausible maximum exposure conditions. The compounds contributing most to these risks were PCBs. The estimated exposures to the non-carcinogenic indicator chemicals in both on- and off-site soils were below chronic intake levels of concern.

The potential risks associated with inhalation of volatile organic compounds and particulate matter released from the soils at the Re-Solve site were evaluated. The incremental lifetime cancer risks associated with the inhalation of volatiles released from soils may be as high as 9×10^{-9} for the average exposure conditions and 1×10^{-6} for the plausible maximum exposure conditions. Exposure to chemicals present in suspended particulate matter were associated with upper bound lifetime cancer risks of 8×10^{-11} for the average exposure scenario and 7×10^{-8} for the plausible maximum exposure scenario. The risks from inhaling particulate matter were associated with the inhalation of PCBs. Exposure to volatile organic compounds released from the Copicut River was evaluated. These exposures were estimated to result in excess lifetime

cancer risks of up to $2x10^{-7}$ for the average exposure scenario and $5x10^{-6}$ for the plausible maximum exposure scenario. The estimated exposures to the non-carcinogenic indicator chemicals released from both soils and surface water were below the chronic intake levels of concern.

The potential risks to individuals who may occasionally wade in the Copicut River adjacent to the Re-Solve site area and have dermal contact with contaminants in the river were assessed. The incremental lifetime cancer risks may be as much as $9x10^{-9}$ under average exposure conditions and $1x10^{-6}$ under plausible maximum exposure conditions. Dermal contact with the non-carcinogenic indicator chemicals detected in the Copicut River and the unnamed tributary was estimated to result in exposures well below the human health reference doses.

The potential risks associated with ingestion of PCB-contaminated fish were also evaluated. For an individual assumed to regularly ingest American eels caught near the site, incremental lifetime cancer risks were estimated to range from $7x10^{-4}$ to $8x10^{-3}$ under average and plausible maximum exposure scenarios, respectively. The excess lifetime cancer risks associated with ingestion of other less contaminated fish species were estimated to range from $4x10^{-4}$ to $7x10^{-6}$.

If the site were developed in the future (i.e., as a residential area), excess risks would be associated with each of the hypothetical pathways considered: ingestion of on-site groundwater, ingestion of and direct dermal contact with contaminated soils, and inhalation of volatile compounds and particulate matter released from contaminated on-site soils. The potential human health risks associated with exposures under future site use conditions are summarized in Table C-3.

Based on a comparison with standards and guidelines for drinking water and the quantitative risk assessment (Supplemental RI, 1987), the contaminants in groundwater at the site would pose significant risks if unfiltered drinking water was obtained from an on-site well. The average and maximum unfiltered sample concentrations for the human health indicator chemicals were compared with standards and guidelines for drinking water as shown in Table C-4. The geometric mean contaminant concentrations for unfiltered groundwater at the site exceeded the MCLs for lead, trichloroethylene and vinyl chloride and exceeded the proposed MCLG for cadmium.

For each chemical except arsenic, the maximum unfiltered concentrations exceeded the standards and proposed values shown in Table C-4. Results for a set of filtered groundwater samples are also provided in Table C-4. The inorganic compounds were detected less frequently in the filtered samples than in the unfiltered samples, suggesting that they are predominantly associated with suspended sediment in groundwater.

The concentrations of the selected indicator chemicals measured in on-site unfiltered groundwater samples were used to evaluate the potential risks associated with ingestion of groundwater. The incremental lifetime cancer risks for ingestion of the human health indicator chemicals ranged from $4x10^{-3}$ to $5x10^{-1}$ under average and plausible maximum exposure conditions, respectively. These risks were primarily attributable to the ingestion of vinyl chloride. Chronic ingestion of the non-carcinogens; cadmium, trans-1,2-dichloroethylene, and lead at the levels measured in unfiltered on-site groundwater would also pose a hazard to potential well-water users.

For an individual assumed to incidentally ingest and have dermal contact with on-site soils under the future site development scenario, the estimated average and plausible maximum exposure conditions were associated with incremental lifetime cancer risks of $1x10^{-7}$ and $3x10^{-2}$, respectively. Exposure to PCBs in soils accounted for the major portion of the estimated risks. For the non-carcinogenic indicator chemicals, chronic incidental ingestion of cadmium and lead under the plausible maximum exposure conditions could also pose risks to human health.

Inhalation of volatile organic compounds released from the Re-Solve site soils under future site use conditions was estimated to result in incremental upper bound lifetime cancer risks of $3x10^{-5}$ and $3x10^{-4}$ for the average and plausible maximum exposure scenarios, respectively. Inhalation of chemicals adsorbed to suspended particulate matter was estimated to result in excess upper bound lifetime cancer risks of $3x10^{-7}$ for the average exposure case and $2x10^{-5}$ for the maximum exposure case. Inhalation exposures to non-carcinogenic indicator chemicals were estimated to be below chronic intake levels of concern.

Finally, PCB contaminated sediments near the Re-Solve site are likely to adversely affect sediment-dwelling organisms and may also impact animals at higher trophic levels that depend on the Re-Solve site area as a habitat.

III Enforcement

In 1983, EPA obtained copies of the Re-Solve, Inc. business files. Based upon a review of these files, EPA identified 270 Potential Responsible Parties (PRPs) and sent a combination notice/information request letter to each PRP during May/June of 1983. Besides notifying each PRP of their potential liability in relation to the site, EPA requested that each PRP submit all records pertaining to business transactions with Re-Solve, Inc. Following the receipt of information request responses, EPA narrowed the list of PRPs to 240 and developed a comprehensive volumetric ranking list.

In 1983, EPA initiated negotiations with the PRPs for past costs and performance of the recommended remedy identified in the on-site RI/FS. The preferred remedy was for the excavation of sources of contamination (i.e., four waste lagoon areas, oil spreading area and other "hot spots"), treatment and transportation to an off-site disposal facility and encapsulation of the site. Negotiations ceased when EPA informed the generators' committee of EPA's increased estimate of the amount of soil requiring excavation. EPA then proceeded to use the Superfund Trust Fund to perform the remedy.

On May 3, 1985, EPA held a meeting with the PRP negotiating committee to discuss the off-site RI/FS. At the onset of the meeting, EPA informed the PRPs that further additional contamination had been discovered on-site. EPA indicated it would terminate the construction contract with the COE, it would not encapsulate the site and a Supplemental RI would be performed to determine the extent of contamination. As a result of this information, negotiations ceased.

During the performance of the remedial work for the Supplemental RI and the development of the FS, EPA conducted briefings for the PRPs.

In March of 1987, following release of the Supplemental RI, EPA discussed the FS development strategy for the site with the PRPs. In June of 1987, immediately prior to release of the Agency's Proposed Plan for site remediation, EPA met with the PRPs and a representative of the Town of Dartmouth and discussed that plan. Finally, during the public comment period, EPA met with the PRP's technical sub-committee and discussed technical issues. As a result of this meeting, the Agency provided the PRPs with additional technical information to clarify certain studies and calculations presented in the FS. Further negotiations with the PRPs will be held following issuance of this ROD.

IV. Community Relations

Throughout the implementation of the source control remedial action and the conduct of the RI/FS, EPA promoted a cooperative working relationship with the town of Dartmouth by communicating relevant information to the Hazardous Waste Coordinator for the Town on a regular basis. In addition, the Hazardous Waste Coordinator attended technical meetings held between EPA and the PRPs Technical Sub-committee.

On March 11, 1987, EPA held a public meeting to discuss the project schedule, the findings of the RI and the preliminary list of remedial alternatives under development in the FS. The public was primarily concerned with the quality of drinking water in the area and PCB contaminated fish. EPA informed the public that the elevated lead detected in certain wells was not attributable to the site and that those persons affected should coordinate with MA DEQE. Overall, the drinking water in the area is of acceptable quality. EPA also re-emphasized the need for public participation in the remedy selection process.

During the development of the FS, the Westport River Defense Fund (WRDF) and a local citizens group, Precinct One North Dartmouth (P.O.N.D.) worked cooperatively to form a Citizen's Advisory Committee (CAC) for the site. EPA and MA DEQE assisted in the organization of the CAC and met with the group during the remedy selection process. During this meeting, EPA and MA DEQE assured the group that they would be available to meet during the design and construction phase.

The FS for the site was released to the public for review and comment on June 2, 1987. Consistent with Section 117 of CERCLA, EPA published a preferred remedial action document on June 17, 1987 describing the Agency's proposed plan for site remediation.

Release of the document initiated a 21 day public comment period during which the public was given an opportunity to submit comments on the proposed plan and the FS. The comment period was scheduled to close on July 7, 1987.

EPA held a public information meeting to discuss the proposed plan and FS on June 23, 1987. During the meeting, the public requested EPA to extend the public comment period. In response to both oral and written requests by members of the public and the PRPs, EPA extended the public comment period to July 31, 1987.

A public meeting was held on July 1, 1987, allowing the public the opportunity to enter oral comments into the record. These comments were recorded in a transcript which is part of the Administrative Record for the site. Written and oral comments and EPA's responses are included in the Responsiveness Summary.

A number of commenters (the Sierra Club, Town of Dartmouth, Re-Solve Citizen's Advisory Committee (CAC), and Westport River

Defense Fund, (WRDF)) supported EPA's choice of dechlorination with groundwater treatment as the preferred alternative for the Re-Solve site. Several commenters (the Sierra Club, WRDF) noted that Region I deserves commendation in deciding on an innovative technology. The Sierra Club also supported the identification of incineration as the backup option.

Citizens and the Town of Dartmouth expressed interest in being kept appraised of any new information EPA receives on the dechlorination process. In addition, the public would like the opportunity to review and discuss the results of the pilot-study.

V. Alternatives Evaluation

A. Introduction

On October 17, 1986, the President signed into law the Superfund Amendments and Reauthorization Act of 1986 (SARA) amending the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and enacting certain additional provisions. Prior to SARA's enactment, actions taken in response to releases of hazardous substances were conducted in accordance with the revised National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300 dated November 20, 1985. Generally, the purpose of the NCP is to effectuate the response powers and responsibilities created by CERCLA. In accordance with Section 105 of CERCLA as amended by SARA, the existing NCP is being revised to reflect the additional provisions of SARA.

While the existing NCP and the standards and procedures established by SARA overlap in many areas, there also exist some differences between the two. Section 121 of SARA, for example, added certain new clean-up objectives to CERCLA. In the interim, until the NCP is republished, the procedures and standards employed by the Agency in responding to releases of hazardous substances, pollutants, and contaminants are to comply with section 121 of CERCLA and, to the maximum extent practicable, the existing NCP.

SARA retained the original CERCLA mandate to conduct protective and cost-effective remedial actions. Remedial actions. as defined by 300.68(a)(1) of the NCP are those responses to releases that are consistent with a permanent remedy to protect or minimize the release of hazardous substances or pollutants or contaminants so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment.

In formulating a remedy, CERCLA now requires the Agency to place heightened emphasis on risk reduction through destruction or treatment of hazardous waste. Section 121 of establishes a statutory preference for remedies that permanently and significantly reduce the volume, toxicity and mobility of hazardous wastes over remedies that do not use such treatment. Section 121 also requires that EPA select a remedy that is protective of human health and the environment, is cost-effective and that utilizes permanent solutions and alternative treatment technologies, to the maximum extent practicable. Furthermore, section 121 requires that, upon completion, remedies must attain applicable or relevant and appropriate Federal and State requirements (ARARs) unless specified waivers are granted.

In accordance with CERCLA and the NCP, therefore, the primary remedial response objectives for Superfund remedial actions are:

- prevent or mitigate further releases of contaminants to surrounding environmental media;

- eliminate or minimize the threat posed to public health or welfare or the environment;
- reduce the volume, toxicity or mobility of hazardous waste through the use of treatment technologies; and
- utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

Following the establishment of remedial objectives, the next issue becomes establishing the appropriate procedures. Again, the Agency must address the NCP and the procedures set up in CERCLA.

Section 300.68 of the NCP, in conjunction with the EPA guidance document entitled "Guidance on Feasibility Studies Under CERCLA," sets forth the remedial alternative development and remedy selection process. This process consists of seven steps:

(1) Identify the nature and extent of contamination and threat presented by the release (§ 300.68(e)(2));

(2) Identify general response objectives for site remediation;

(3) Identify and screen remedial technologies potentially applicable to wastes and site conditions;

(4) Develop alternatives to achieve site-specific response objectives (§ 300.68(f));

(5) Initial screening of alternatives (§ 300.68(g));

(6) Detailed analysis of alternatives (§ 300.68(h)); and

(7) Selection of remedy (§ 300.68(i)).

Both CERCLA and the NCP require first the identification of the nature and extent of contamination at the site. Beyond the initial site characterization section 121 retains the basic framework for the remedial alternatives development and remedy selection process enacted through the NCP, but each phase must be modified to reflect the provisions of CERCLA.

The nature and extent of contamination and the threat presented by the release at the Re-Solve site was documented in the Remedial Investigation for the site and presented as part of the discussion on Site History. A discussion of how CERCLA affects each particular phase of the remedy selection process (Steps 2-7) follows.

B. Response Objectives

Consistent with the NCP, remedial response objectives for the Re-Solve site were developed for source control measures, which

address source areas of contamination, and management of migration measures, which address media or areas that have been impacted by the migration of contaminants away from the source area.

The Remedial Investigation identified four sources of contamination at the site. These sources are the soils in the vicinity of the former lagoon area, the cooling pond area, the oil spreading area and localized areas which include the contaminated sediments located in the wetlands north of the site and the unnamed tributary. On-site areas with PCB contamination above 10 ppm consist of 24,000 cubic yards (c.y.) of unsaturated soil and 37,000 c.y. of saturated soil. The wetlands and the unnamed tributary have 3,000 c.y. of contaminated sediments above 1.0 ppm PCB. The total volume of such source material is 64,000 c.y. The average surface soil contamination level for PCBs is 140 ppm. The wetlands and unnamed tributary have an average surface PCB contamination of 24 ppm. (Handling of contaminated liquids resulting from dewatering and treatment of soils and sediments are included in the management of migration alternatives for groundwater).

The remedial response objectives for source control measures include:

- Prevent or mitigate the continued release of hazardous substances, pollutants and contaminants to the overburden and bedrock groundwater aquifers and to the wetlands, the unnamed tributary, Copicut River and Cornell Pond.
- Reduce risks to human health associated with direct contact with contaminants in surface and sub-surface soils and sediments.
- Reduce risks to freshwater aquatic life associated with contact with PCB contaminated sediments and subsequent bioaccumulation. Freshwater aquatic life include both sediment dwelling organisms and those at higher trophic levels.
- Reduce the volume, toxicity or mobility of hazardous substances, pollutants and contaminants.

The Remedial Investigation also determined that the four source areas have contaminated on and off-site groundwater and off-site surface water. Remediation of contaminated groundwater is necessary to address surface water contamination, since the source of contamination in surface water bodies is groundwater discharge. Treatment of groundwater would include treating contaminated liquids resulting from dewatering and treatment of on-site source soils. In addition, it is known, based on the previous remedial action undertaken at the site, that extensive on-site activity may result in increased airborne contamination. The remedial response objectives for the management of migration measures include:

- Reduce risks to human health associated with dermal contact and subsequent absorption with surface water, ingestion of groundwater and inhalation of volatiles released from groundwater and surface water.

- Eliminate or minimize the threat posed to public health and the environment from the current and potential future extent of contaminant migration in groundwater and surface water.

- Maintain air quality at protective levels for on-site workers and the public during site remediation.

C. Technology Development and Screening

General response actions, identified as response categories in the FS, represent a group or class of responses that could potentially meet the remedial objectives. Technologies identified for each response category were screened based on waste-limiting (waste characteristics that limit the effectiveness or feasibility of a technology) and site-limiting (site characteristics such as high groundwater levels that preclude the use of certain technologies) factors unique to the Re-Solve site, and the level of technical development for each technology. Section 3 of the FS report details this process.

Table C-5 summarizes the general response categories and the applicable technology screening for source control and management of migration.

Technologies which emerged from this screening process were combined into source control and management of migration alternatives. This process is detailed in Section 3 of the FS.

D. Development of Alternatives and Initial Screening of Alternatives

Section 300.68(f)(1) of the NCP requires that, to the extent that it is both possible and appropriate, at least one remedial alternative shall be developed as part of the Feasibility Study in each of the following categories:

- Alternatives for treatment or disposal at an off-site facility as appropriate.

- Alternatives that attain applicable or relevant and appropriate Federal public health and environmental requirements.

- As appropriate, alternatives that exceed applicable or relevant and appropriate Federal public health and environmental requirements.

- As appropriate, alternatives that do not attain applicable or relevant and appropriate Federal public health and environmental requirements but that will reduce the likelihood of present or future threat from hazardous substances and that provide significant protection to public health and welfare and the environment. This must include an alternative that closely approaches the level of protection provided by alternatives that attain applicable or relevant and appropriate requirements.

- No action alternative.

This screening of alternatives must also comply with the requirements of section 121 of CERCLA. Of most importance, section 121(d) codifies the CERCLA Compliance Policy. First published as an appendix to the preamble of the NCP, this policy requires that Superfund remedial actions attain applicable or relevant and appropriate requirements (ARARS) of other Federal statutes. While Section 300.68 (f) of the NCP specifically refers to ARARs in regard to the Development of Alternatives, section 121 incorporates this requirement into the statute while adding the provision that remedial actions also attain State requirements that are more stringent than Federal requirements, to the extent they are also applicable or relevant and appropriate and are identified to EPA in a timely manner. Further, the new statutory requirements and preference for treatment that reduces the volume, toxicity or mobility of hazardous waste, modify the process by which alternatives are developed.

In accordance with CERCLA, and to the extent practicable, the NCP, treatment alternatives were developed for the Re-Solve site ranging from an alternative that, to the degree possible, would eliminate the need for long-term management (including monitoring) at the site to alternatives involving treatment that would reduce the volume, toxicity or mobility of the hazardous substances as their principal element. The alternatives arrayed along the scale vary mainly in the degree to which they rely on long-term management of treatment residuals or low-concentration wastes.

In addition to the range of treatment alternatives, a containment option involving little or no treatment and a no action alternative were developed. Alternatives developed and considered for initial screening at the Re-Solve site are:

Source Control

SC-1	No Action
SC-2	On-Site Thermal Destruction
SC-3	Soil Washing
SC-4	Dechlorination
SC-5	Composting
SC-6	Immobilization
SC-7	In-Situ Biodegradation

Source Control

SC-8	In-Situ Soil Flushing
SC-9	Encapsulation
SC-10	On-Site RCRA/TSCA Landfill
SC-11	Sediment Capping
SC-12	Sediment Removal And Treatment
SC-13	Off-Site RCRA/TSCA Landfill
SC-14	Off-Site Incineration

Management of Migration

MOM-1	No Action (with monitoring)
MOM-2	On-Site Treatment, as follows:
MOM-2A	Precipitation/Heated Influent Air Stripping/Filtration
MOM-2B	Precipitation/Filtration/Carbon Adsorption
MOM-2C	Precipitation/Air Stripping/Filtration/ Carbon Adsorption
MOM-2D	Precipitation/Air Stripping/Biodegradation/ Filtration/Carbon Adsorption
MOM-3	Off-site treatment at a RCRA Treatment/Storage/ Disposal (TSD) Facility
MOM-4	Pretreatment (Air Stripping) and Disposal Off-site at a Publically Owned Treatment Works (POTW)

The purpose of the initial screening step is to reduce the number of alternatives for further detailed analysis while preserving a range of options. The range of alternatives developed for source control and management of migration were subject to an initial screening using the criteria listed in 300.68 (g)(1), (2) and (3) of the NCP. Even if an alternative does not pass the initial screening under the NCP, consistent with section 121 (b)(2) an alternative may be carried through the screening process if it involves an innovative technology and there is a reasonable belief that it offers a potential for better treatment performance or implementability, or fewer or less adverse impacts than other available approaches or lower costs than demonstrated technologies.

The results of the initial screening process are described in detail in Section 3 of the FS. The initial screening process eliminated the following alternatives based upon the specified deficiencies for the reason(s) indicated:

Source Control

SC-3 Soil Washing

- 300.68(g)(3); alternative does not effectively contribute to the protection of public health and welfare and the environment.

SC-5 Composting

- 300.68(g)(2); alternative is not feasible for the location nor does it represent a reliable means of addressing the problem. Technically ineffective and not feasible based on site characteristics.

- 300.68(g)(2); adverse environmental impacts. Volume of material would double or triple.

SC-6 Immobilization

- 300.68(g)(2); technically ineffective for site contaminants.

- 300.68(g)(3); alternative does not effectively contribute to the protection of public health and the environment.

SC-7 In-Situ Biodegration

- 300.68(g)(2); technically ineffective and not feasible for the location and conditions of the release.

SC-8 In-Situ Soil Flushing

- 300.68(g)(2); not feasible based on location and conditions of the release and does not meet acceptable engineering practices for reliability.

- 300.68(g)(3); questionable effectiveness and adverse environmental impacts.

SC-9 Encapsulation

- 300.68(g)(3); does not effectively contribute to the protection of public health and welfare and the environment.

As individual specific alternatives, SC-7, SC-8 and SC-9 would not provide adequate levels of remediation. However, because of the extensive excavation of contaminated soils and associated technical limitations, potential health risks and costs required for other source control alternatives, these three technologies were grouped together as a single remedial alternative for detailed analysis, to be referred to as SC-7, In-Situ Treatment.

SC-10 On-Site RCRA/TSCA Landfill

- 300.68(g)(2); technically infeasible for the location and conditions of the release and not a reliable means of addressing the problem.

- 300.68(g)(3); questionable effectiveness.

SC-11 Sediment Capping

- 300.68(g)(3); questionable effectiveness and significant adverse effects and very limited environmental benefits.

SC-13 Off-Site RCRA/TSCA Landfill

- 300.68(g)(1); No substantially greater public health and environmental benefits at a greater cost than other source control alternatives. Limited availability and limited capacity.

Management of Migration

MOM-2 On-Site Treatment

MOM-2B On-Site Treatment by Precipitation/Filtration/Carbon Adsorption

- 300.68(g)(1); no substantially greater public health and environmental benefits at a greater cost than other on-site treatment.

- 300.68(g)(3); questionable effectiveness.

MOM-2D On-Site Treatment by Precipitation/Air Stripping/ Biodegradation/Filtration/ Carbon Adsorption.

- 300.68(g)(1); no substantially greater public health and environmental benefits at a greater cost than other on-site treatment.

MOM-3 Off-Site RCRA TSD Facility

- 300.68(g)(1); no substantially greater public health or environmental benefits with greater costs.

A summary of the comparison screening for source control and management of migration alternatives can be seen in Tables C-6 and C-7, respectively.

Consistent with the NCP, a No Action alternative for both source control and management of migration was carried into the detailed analysis to provide a basis for comparison to the other alternatives although it would probably not achieve the requirements of section 121 of CERCLA. In addition, a containment option, SC-9, Encapsulation, was retained for detailed analysis as a component of the comprehensive In-Situ Treatment alternative.

Tables C-8 and C-9 summarize the alternatives that were retained for a more detailed evaluation.

E. Detailed Analysis of Alternatives

The alternatives evaluated during detailed review and screening include both source control and management of migration alternatives:

Source Control

SC-1	No Action
SC-2	On-Site Thermal Destruction
SC-4	Dechlorination
SC-7	In-Situ Soil Treatment 2
	SC-7a Encapsulation
	SC-7b Encapsulation with In-Situ Soil Flushing
	SC-7c Encapsulation, In-Situ Soil Flushing and Source Material Treatment
SC-14	Off-Site Incineration

Management of Migration

MOM-1	No Action
MOM-2	On-Site Treatment
	MOM-2a Heated Influent Air Stripping
	MOM-2c Carbon Adsorption
MOM-4	Pre-treatment and Disposal at a POTW

A detailed analysis of the five (5) source control and three (3) management of migration alternatives was conducted consistent with section 121 of CERCLA and, to the maximum extent practicable, 40 C.F.R. § 300.68(h) of the NCP.

The evaluation criteria cited in section 121(b)(1)(A-G) are:

(A) the long-term uncertainties associated with land diposal;

(B) the goals, objectives and requirements of the Solid Waste Disposal Act;

(C) the persistence, toxicity, mobility and propensity to

bioaccumulate of such hazardous substances and their constituents;

(D) short- and long-term potential for adverse health effects from human exposure;

(E) long-term maintenance costs;

(F) potential for future remedial action costs if the alternative remedial action in question were to fail; and

(G) the potential threat to human health and the environment associated with excavation, transportation and re-disposal or containment.

For alternatives where treatment is the principal component of the alternative, several of the section 121 (b)(1) factors are not relevant since treatment will destroy the contaminants, or reduce them to protective levels. The following section 121(b)(1) factors do not have significance when evaluating treatment alternatives since treatment eliminates landfilling:

(A) the long-term uncertainties associated with land disposal; and

(E) long-term maintenance costs

Furthermore, by considering as factors, section 121(b)(1)(A)and(C) inherently the Agency incorporates section 121(b)(1)(B), thereby meeting goals, objectives and requirement of the Solid Waste Disposal Act.

The potential for future remedial action costs, if the alternative remedial action in question were to fail, (section 121(b)(1)(F)) is an important evaluation factor for alternatives that require long-term maintenance and monitoring. This factor was used when evaluating land disposal alternatives. The inability of a treatment technology to obtain its performance goals (i.e. fail) would most probably result in selection of a different remedial action or a change in performance goals; hence the potential costs associated with failure of a treatment technology were not evaluated for each such alternative. Potential failure of a technology may, though, be incorporated into a selected remedy in the event that the remedy is innovative and has not been proven on a full-scale level or in similar situations.

The initial screening occurs under the requirement of section 121. Following a review of the section 121 factors, the Agency considers the NCP factors in screening. The evaluation criteria cited in 40 C.F.R. 300.68(h) of the NCP are:

(1) Detailed cost estimation, including operation and maintenanc costs, and distribution of costs over time;

(2) Evaluation in terms of engineering implementation, reliability, and constructability;

(3) An assessment of the extent to which the alternative is expected to effectively prevent, mitigate, or minimize threats to, and provide adequate protection of, public health and welfare and the environment. This includes an evaluation of the extent to which the alternative attains or exceeds applicable or relevant and appropriate federal public health and environmental requirements. Where the analysis determines that federal public health and environmental requirements are not applicable or relevant and appropriate, the analysis, as appropriate, evaluates the risks of the various exposure levels projected or remaining after implementation of the alternative under consideration;

(4) An analysis of whether recycle/reuse, waste minimization, waste biodegration, or destruction, or other advanced, innovative, or alternative technologies is appropriate to reliably minimize present or future threats to public health or welfare or the environment;

(5) An analysis of any adverse environmental impacts, methods for mitigating these impacts, and costs of mitigation.

The Agency's primary mandate, however is to meet the requirements of section 121; alternatives undergoing detailed analysis will be evaluated in terms of the section 121 (b)(1) (A-G) factors. Where it was determined that an alternative is consistent with the NCP, the alternative was further evaluated using the appropriate 40 C.F.R. 300.68(h) factors.

Source control and management of migration alternatives are evaluated in detail in Section 4 of the FS.

SC-1 and MOM-1 No Action

For the purposes of the detailed evaluation, the no action alternative for source control (SC-1) and management of migration (MOM-1) were combined and evaluated as a comprehensive no action alternative.

The no action alternative for the Re-Solve site consists of undertaking minimal actions to limit the potential risks posed by the site to public health and the environment. These actions include fencing the perimeter of the site, posting warning signs on the fence and in the area of the unnamed tributary, Copicut River and Cornell Pond, grading the site towards the wetlands and unnamed tributary; loaming and seeding to control dust and implementing a multi-media monitoring program. The monitoring program includes air, groundwater and surface water sampling. Air samples would be taken during revegetation and grading operations, as well as necessary control measures, to ensure that on-site operations

do not pose health risks to on-site workers and nearby residents. The groundwater, surface water and sediment monitoring program would extend for thirty (30) years after the closure of the site. This program would include sampling of both the overburden and bedrock aquifers as well as surface water and sediments in the wetlands, the unnamed tributary, Copicut River and Cornell Pond on a regular basis.

The no action alternative does not meet the goals, objectives and requirements of the Solid Waste Disposal Act. Specifically, this alternative does not assure long-term containment of the hazardous wastes at the site and, therefore, does not preclude the need for future corrective action.

Further, the no action alternative would not permanently and significantly reduce the volume, toxicity or mobility of the hazardous wastes at the site. PCBs are both probable human carcinogens and chemically stable compounds that are able to persist in the environment for long periods. PCBs can significantly bioaccumulate and concentrate in the fatty tissues of all organisms. If left untreated, as proposed in the no action alternative, PCBs in sediments will continue to act as a source of contamination with subsequent bioaccumulation for benthic organisms and organisms at higher trophic levels. In addition, precipitation at the site would continue to leach mobile contaminants such as VOCs from the source areas into groundwater. The FS estimates it would take 175 to 400 years for contaminant levels in source areas and groundwater to be reduced, through natural attenuation and biodegradation processes, to levels that are protective of human health and the environment. PCBs, in both the unsaturated and saturated zones would remain at current levels indefinitely. Over this period of time, contaminated groundwater would continue to discharge to the unnamed tributary and Copicut River and migrate away from the site via surface water.

Fencing the site under the no action alternative would reduce the risks posed to public health from direct contact with on-site soils, but would not mitigate the risks posed from direct contact with off-site soils and sediments.

The fence and ground cover can easily and rapidly be installed at the site and a low level of effort is required to maintain the integrity of the fencing and ground cover over its 30 year life. Operation and maintenance would include fence repair and replacement of the fence in 15 years and implementation of the multi-media monitoring program.

Furthermore, the no action alternative does not attain Federal and State applicable or relevant and appropriate public health and environmental requirements. Specifically, it does not comply with the Resource Conservation and Recovery Act (RCRA) 40 C.F.R. Part 264, Subparts G (Closure and Post Closure), K (Surface Impoundment Regulations), L (Waste Piles) and N (Landfills) and Executive Order 11990 (Wetlands).

The estimated capitol cost for the no action alternative is $178,000. The annual operation and maintenance (O & M) cost is estimated to be $152,000. The present worth for the no action alternative, assuming a 10 percent discount rate, is estimated to be $1,640,000.

SC-2 On-Site Thermal Destruction

The On-site Thermal Destruction alternative entails excavation of 64,000 cubic yards of PCB contaminated soils and sediments (61,000 c.y. of soil > 10 ppm and 3,000 c.y. sediments > 1 ppm) and treatment on-site in a mobile incineration system. This volume was selected for engineering purposes only and may vary depending upon the soil cleanup level selected for the site. The soil boring program conducted as part of the Supplemental RI indicated that the bulk of the PCB contaminated soils are located in the northwest portion of the site. In this area, PCBs at levels greater than 10 ppm were found in soils overlying bedrock, approximately 20 feet below the water table.

Treatment of the 64,000 cubic yards of contaminated soils and sediments will require extensive on-site handling and processing of soils throughout the site. In an effort to mitigate the potential offsite migration of contaminated fugitive dust and odors, the method of excavation will be restricted to sheet piled vertical cuts. When excavating below the water table, it will be necessary to pump the enclosed area. The purpose of this approach is to reduce open air removal of contaminated soil, and thus, limit potential emissions. Additionally, these emissions can be controlled by a number of methods, including enclosure of the work areas and emission suppression techniques such as foam or water spray method for dust control.[3]

Implementation of this alternative also requires excavation of PCB-contaminated sediments and relocation on-site for subsequent treatment in a mobile incineration system.[4] For the purposes of this evaluation, it is estimated that it will be necessary to excavate and treat approximately 3000 cubic yards of PCB contaminated sediment containing $\geq$ 1 ppm PCB. (As noted earlier, this volume is included in the total volume of 64,000 cubic yards and may change depending on the sediment cleanup level selected for the site). These sediments are located in areas classified as wetlands, based on National Wetlands Inventory (NWI) mapping as well as site visits to confirm wetland boundaries. Most of the area, which includes the wetlands north of the site and the unnamed tributary, is characterized as a palustrine forested (red maple) or palustrine scrub shrub. Excavation in these areas, therefore, will result in unavoidable impacts and disturbance to wetland resource areas. Such impacts may include the destruction of vegetation and the loss of certain plant and animal species. Impacts to the fauna and flora will be mitigated to the maximum extent possible. All excavation activities will be conducted during dry weather periods and excavated areas will be isolated by means of erosion and sedimentation control devices

to limit the resuspension and downstream transport of contaminated material. Following the excavation activities, all disturbed areas will be restored to their approximate original condition including any necessary revegetation.

Three potentially applicable thermal treatment technologies were presented in the FS for detoxification of the contaminated soils and sediments. These technologies are rotary kiln incineration, infrared processing and circulating fluidized bed incineration. All are currently available as mobile systems for on-site hazardous waste treatment. These three technologies offer different capabilities for the wide range of contaminants encountered at CERCLA sites. While rotary kiln incineration handles the broadest range of volatile types and forms, infrared processing and fluidized bed incineration consume less air and offer advantages in pollution control, residual disposal and cost. All three technologies have been proven at least on a pilot-scale, to be effective in destroying PCBs in soils similiar to those found at the site.

The evaluation of the On-site Thermal Destruction alternative indicates that such treatment of 64,000 cubic yards of contaminated soils and sediments will permanently and significantly reduce the volume, toxicity and mobility of the hazardous wastes present at the site. The analytical screening of the soil samples at Re-Solve, Inc. reveal high levels of both PCBs and volatile organic compounds. To comply with 40 C.F.R. §761.70 of TSCA, a selected incineration system must demonstrate a 99.9999 percent destruction and removal (DRE) efficiency of PCBs. If the thermal destruction alternative is selected, a trial burn would be conducted or required by 40 C.F.R. § 761.70 to determine if the incinerator achieves the requirements of TSCA. All systems generate residual/effluent streams; ash, decontaminated soils, scrubber water or blowdown and fuel gases.

During the trial burn, the Agency will identify the waste constituents in the site-specific residual/effluent stream and determine the appropriate manner in which to dispose of such residuals. The intent is to place decontaminated soils back on-site. Residuals remaining on-site of after treatment would be those soils contaminated with PCBs at levels less than 10 ppm PCB and low levels of volatile organic compounds, and sediment with less than 1 ppm PCB.

Treatment of the PCB contaminated sediments will permanently and significantly reduce the risks to benthic organisms and organisms at higher trophic levels associated with contact with such sediments and subsequent bioaccumulation.

An air monitoring program will be implemented during the performance of this alternative to monitor risks to on-site workers and nearby residents. Mitigative measures, such as those discussed previously, will be taken during excavation to control emissions. The incinerator stack emissions will be closely monitored to ensure that levels are in compliance with RCRA and TSCA. Treatment of PCB contaminated soils will reduce the risks posed to public

health from direct contact. In addition, the construction and operation of the incinerator will generate some noise and traffic impacts for local residents. Truck traffic to and from the site will increase, but the increase is not anticipated to be unreasonable.

It is estimated that the length of operation will be approximately two (2) years. The length of operation, though, may change dependent on the cleanup level selected, which, in turn determines the volume of contaminated soils that will be processed. Following completion of this alternative, the site will be graded, loamed and seeded.

Although mobile incineration systems are commercially marketed, there may be delays in getting a system on-site due to the present limited capacity in the industry. Even though EPA anticipates an increase in production in the future, there may be a problem with availability. Mobile incinerators are presently being used at various CERCLA sites and appear to be technologically reliable based on data from full- and pilot-scale studies.

The On-site Thermal Destruction alternative attains all Federal and State applicable or relevant and appropriate requirements. Specifically, this alternative will attain requirements under TSCA which apply to PCB incineration, and RCRA requirements for incineration of other organic compounds. All work conducted in areas classified as wetlands will be in accordance with the following ARARs[5]:

- U.S. EPA Policy Guidance Memorandum of Floodplains and Wetland Assessments for CERCLA Actions;
- Executive Orders 11988 and 11990;
- Federal Register 40 C.F.R Part 230, 404(b), December 24, 1980; and
- Massachusetts Wetland Protection Act and Regulations (310 C.M.R. 10.00 et. seq.).

The cost analysis was based on rough cost estimates solicited from three companies offering incineration services. Based on these estimates, a median value of $300/cubic yard was used for calculation of incineration costs. The estimated capital cost for this alternative is $21,315,400. The annual operation and maintenance (O&M) cost for this alternative in estimated to be $5,778,000. The estimated present worth for treatment of 64,000 cubic yards of PCB contaminiated soils and sediments, assuming a 10 percent discount rate, is $31,347,000.

A sensitivity analysis was conducted to determine how total project costs change relative to different cleanup levels and volume of treated soil. Costs were examined for six scenarios. The total volume of contaminated material to be excavated, treated

and disposed of was 13,000 c.y., 22,000 c.y., 28,000 c.y., 48,000 c.y., 56,000 c.y. and 64,000 c.y. The total project costs, presented in Figure C-14, are the present worth value of the capital costs and operation and maintenance through the period of implementation.

SC-4 Dechlorination

The Dechlorination alternative entails excavation of 64,000 cubic yards of contaminated soils and sediments and treatment on-site in a mobile dechlorination unit.[6] Potassium/polyethylene glycol (KPEG) dechlorination is a soil treatment process suitable for treating large volumes of soil contaminated at low to moderate levels (1 to 10,000 ppm) of chlorinated organics such as PCBs. Higher concentrations of PCBs can be treated but reagent costs increase significantly. The KPEG dechlorination process rapidly dechlorinates aromatic halides (this includes chlorobenzenes, chlorophenols, dioxins, PCBs and other halogenated ring compounds). The process, shown in Figure C-15, is similar to a soil washing system, with a reagent-soil contacting step followed by a multi-step water rinse process.

The evaluation of the Dechlorination alternative indicates that treatment of 64,000 cubic yards of contaminated soils and sediments will permanently and significantly reduce the volume, toxicity or mobility of the hazardous wastes present at the site. The dechlorination process is primarily for the treatment of chlorinate organics such as PCBs. Bench-scale testing of the dechlorination process was conducted to determine its effectivness in treating PCB contaminated soils. The initial concentration of soil samples taken from the site were 3000 ppm PCB on average. The dechlorination reaction reduced the PCB concentration to less than 1 ppm, demonstrating that the process is effective for treatment of Re-Solve soils.

In addition to PCBs, the Re-Solve soils are also contaminated with other organic compounds. Results of the bench-scale study indicate that dechlorination is effective in removing a percentage of these compounds. In the process, contaminated soil is mixed with a reagent mixture and heated to 150° C. Heating to 150° C significantly increases the reaction rates for dechlorination and boils off the water and many volatile organics held within the soil. The volatile organics, in turn, are captured in vapor phase carbon. When the carbon is spent, it is disposed of off-site in accordance with RCRA. The bench-scale study did not determine the concentration and percentage of organic compounds remaining in soils. Following treatment, the intent is to place the treated soils on-site.

The degree to which such residual soils will require additional treatment and/or management will be determined in a pilot-scale test, if dechlorination is selected as the final remedial action. The dechlorination process also produces various residuals and sidestreams such a spent reagent and contaminated wash water.

Characterization of the reaction byproducts was beyond the scope of the bench-scale study and would have involved a great deal of analytical chemistry.

However, because the major goal of the dechlorination process is to convert materials that are harmful to living organisms to materials that are harmless, EPA's Hazardous Waste Engineering Research Laboratory (HWERL) in Duluth, Minnesota conducted bioassay tests to determine the effects of the reaction byproducts on living organisms. Such tests included: mutagenicity assays, toxicity studies and bioaccumulation/bioconcentration tests. These bioassays indicated that the byproducts produced between the reagents and the pollutants studied (including TCDD) do not bioaccumulate or bioconcentrate. Further, they do not cause mutagenicity nor are they toxic to aquatic organisms or mammals. In any event, it will be necessary to characterize these sidestreams during the pilot-scale test to determine the proper manner in which to dispose of these byproducts.

An air monitoring program will be implemented during the performance of this alternative to reduce risks to on-site workers and nearby residents. Mitigative measures, such as those discussed in the evaluation of alternative SC-2, will be taken during excavation to control emissions. Dechlorination systems are considered relatively safe, and because the reactions occur within a closed system, the risks to nearby residents from the process itself are minimal. Other impacts associated with construction and operation of the facility are similar to that of alternative SC-2 (i.e., noise, truck traffic). This alternative will effectively reduce the risks posed to public health from direct contact with PCB contaminated soils. The risks posed to public health from direct contact with organic compounds present in soils following treatment is expected to be minimal.

It is estimated that the length of operation will be approximately three (3) years. The length of operation may change dependent on cleanup level selected for the site. Following completion of this alternative, the site will be graded, loamed and seeded.

The reliability of this alternative on a full-scale level remains unproven. Current data are only available for bench-scale and limited pilot study tests. While the feasibility of the process has been established, problems can be expected during scale-up to full-scale operation. EPA is aware of one company that is planning on building a full-scale dechlorination unit using heavy industrial equipment by the spring of 1988. In 1985 EPA Region II selected dechlorination as the remedial action for the Wide Beach Superfund site, and that project is now in the design phase. EPA anticipates that additional companies will acquire the capability to design and construct dechlorination units in the future.

The Dechlorination alternative attains all Federal and State applicable or relevant and appropriate requirements. Specifically, shipment of any residuals off-site for disposal will be in

accordance with RCRA and DOT regulations 49 C.F.R 171-179 and 387. In addition, final closure and post closure activities will be consistent with RCRA 40 C.F.R. Part 264 Subpart G (Closure and Post Closure).

The cost analysis was based on information provided by the Galson Research Corporation for treatment of various site volumes. These unit costs were then incorporated into the capital cost and operation and maintenance costs. The estimated capital cost for this alternative is $8,187,400. The annual operation and maintenance (O&M) cost is estimated to be $3,558,500. The estimated present worth for treatment of 64,000 cubic yards of PCB contaminated soils and sediments, assuming a 10 percent discount rate, is $17,038,000.

A sensitivity analysis was conducted to determine how total project costs change relative to different cleanup levels and volume of treated soil. Costs were examined for six scenarios. In the analysis, the total volume of contaminated materials to be excavated, treated and disposed of was 13,000 c.y., 22,000 c.y., 28,000 c.y., 48,000 c.y., 56,000 c.y. and 64,000 c.y. The total project costs, presented in Figure C-16, are the present worth value of the capital costs and operation and maintenance through the period of implementation.

SC-7c Encapsulation, In-situ Soil Flushing and Source Material Treatment

Alternative SC-7c is comprised of three individual component technologies. The first component, encapsulation, provides for the in-situ containment of the contaminated soils. A soil bentonite wall consisting of a screened soil mixture with 6-8 percent bentonite at a 30-inch thickness and 10^{-7} cm/sec permeability, will be constructed around the perimeter of the site. The wall will extend from the surface and be keyed into the underlying bedrock. Once the wall is completed, all contaminated soils found outside the perimeter, including wetland sediments, will be placed inside the wall for further treatment.

Concurrent with the construction of a soil-bentonite wall, the source material treatment component will be implemented. This component entails excavation and destruction of specific areas exhibiting concentrations of PCBs in excess of 500 ppm. The estimated volume of PCB-contaminated source materials at concentrations in excess of 500 ppm is 9000 cubic yards. This volume of source material would be treated using one of the three destruction technologies undergoing detailed evaluation; SC-2 On-site Thermal Destruction, SC-4 Dechlorination and SC-14 Off-site Incineration. For the purposes of this analysis, the costs are based on off-site incineration of 9000 cubic yards of source material. Following completion of the excavation and treatment of source material and construction of the soil-bentonite wall, the site surface will be graded and capped with 18 inches of gravel.

The final component, in-situ soil flushing, provides for an internal closed-loop recirculation system in the form of a soil flushing process to extract the volatile organic and PCB contamination from the existing soil matrix. The focus of the treatment operation is to remove the VOCs and a percentage of the PCBs from the soil matrix and thus eliminate the migration of the residual PCB compounds. The recirculation process flushes the contamination from the soil column and then removes the PCBs from the flushing agent in an on-site treatment process. Groundwater from within the containment wall mixed with 1-2 percent surfactant would serve as the flushing agent.

Since a large portion of the site exhibits PCB contamination of varying concentrations, and the majority of this contamination is in the saturated zone, this alternative was developed using individual components that could effectively control or treat the various waste types. The encapsulation component provides for the installation of a structure or hydraulic containment system that surrounds the existing contaminated groundwater plume. The removal of highly contaminated soils would ultimately reduce the total volume of contamination and eliminate the higher concentration PCBs that may not be effectively treated by the in-situ soil flushing process. The in-situ treatment process may not be effective in reducing the concentration of PCBs in those soils deep in the saturated zone.

The evaluation of alternative SC-7c indicates that this alternative is not capable of assuring the long-term containment of the hazardous wastes at the site and, therefore, will continue to pose risks to human health and the environment. Also, the questionable reliability of this alternative does not preclude the need for future remedial action.

This alternative does, to a degree, reduce the volume, toxicity or mobility of the hazardous wastes present at the site. The soil-bentonite wall is effective in reducing the mobility of certain contaminants, but is less effective over extended periods of time, in containing the highly mobile volatile organics. Volatile organic compounds have already entered the overburden and bedrock aquifer system and migrated beyond the site boundary. Installation of a containment wall will not effectively inhibit the continued migration of contaminants from the source to the bedrock aquifer system, especially if bedrock is highly fractured. In such cases, it is difficult to assume an adequate tie between the slurry wall and the bedrock.

The treatment component of this alternative will provide for the permanent destruction of 9000 cubic yards of PCB-contaminated soils. Detailed evaluations of the three destruction technologies (i.e. SC-2 On-Site Thermal Destruction; SC-4 Dechlorination; SC-14 Off-site Incineration) are described elsewhere in this document.

Bench-scale studies were conducted to determine the effectiveness of the flushing agent in removing volatile organics and PCBs from the soil matrix. The results indicated that the flushing agent was effective in removing the volatile organic contaminant fraction, but, reduction of the concentration of PCBs was less significant. Although the effectiveness of the in-situ soil flushing process is enhanced by the excavation and treatment of the highly contaminated source material, it is limited by many potential factors. A major concern is channeling of the soil flushing agent during in-situ treatment, thereby preventing direct contact between cleaning agent and contaminated soils. The bench-scale study found that variable soil conditions at the site will result in inconsistent flushing. Other limiting factors are listed in Section 4 of the FS. Since the in-situ soil treatment component is innovative, supplemental bench-scale and pilot-scale studies would be required.

Overall, this alternative will reduce the total volume of PCB contaminated soils by 9000 cubic yards. It appears that the volume and mobility of the volatile organics will be reduced over time, but PCB contaminated soils remaining on-site will have to be managed appropriately. For this reason, it will be necessary to implement a long-term monitoring and operation and maintenance program.

This alternative poses some of the hazards associated with on-site excavation of contaminated soils. Mitigative measures, such as those discussed in the evaluation of alternative SC-2, will be taken to control emmissions during excavation. The advantage, though, is that a much lesser volume of contaminated soil would be excavated than with other alternatives.

Placement of a gravel cap over the site and consolidation of all waste material, including contaminated sediments, on-site does reduce the risks posed to human health from direct contact with soils as well as the risks posed to benthic organisms and higher aquatic life. But, because this alternative may not be effective in controlling the release of contaminants into the bedrock aquifer, human and environmental receptors may continue to be at risk in the future.

Assuming a PCB clean-up level of 500 ppm will be achieved through evaluation, and a 50% removal of the residual PCBs remaining in on-site soils, the estimated operation period is forty (40) years. The engineering technology required to physically construct and operate a closed loop recirculation system is available, but the bench-scale study raised several unknowns relative to its effectiveness in field applications. The implementability and constructability of this alternative would have to be further defined during a pilot study.

This alternative attains all Federal and State applicable or relevant and appropriate public health and environmental require-

ments. Specifically, this alternative would be conducted in accordance with RCRA 40 C.F.R. Part 264 Subpart G (Closure and Post-Closure), Subpart N (Landfills) and Subpart F (Releases from Solid Waste Management Units). If source material is treated in an on-site or off-site incinerator, this alternative will attain the appropriate requirements under TSCA, which apply to PCB incineration, and RCRA, which regulates incineration of other organic compounds. All hazardous wastes transported off-site would be in accordance with DOT regulations 49 C.F.R. 171-179 and 387. The capital cost for this alternative includes construction of a soil-bentonite slurry wall, an in-situ recirculation/flushing system and off-site incineration of 9,000 cy PCB contaminated soils. The estimated capital cost for this alternative is $33,882,000. The annual operation and maintenance (O&M) cost for this alternative is $1,598,000. The estimated present worth for treatment of 9,000 cubic yards of contaminated source material in an off-site incinerator and operating an in-situ soil flushing system for forty (40) years, assuming a 10 percent discount rate, is $49,600,000.

SC-14 Off-site Thermal Destruction

The Off-site Thermal Destruction alternative entails excavation of 64,000 cubic yards of PCB contaminated soils and sediments and treatment in an off-site incineration facility.[7] Soil characteristics will be determined to ensure appropriate methods of handling, transportation and disposal. All excavated material will be containerized for shipment and all vehicles used for transportation will be carefully loaded, secured and decontaminated to ensure that residual contamination is not transferred from the site to public areas. The off-site facility must be capable of accepting soil with high levels of volatiles, extractables, including PCBs, and low to medium levels of metals. Final restoration will be achieved through backfilling the site with clean fill, grading, loaming and seeding.

The evaluation of alternative SC-14 indicates that it will permanently and significantly reduce the volume, toxicity and mobility of the hazardous wastes at the site.

In accordance with 40 CFR §761.70 of TSCA, PCB incinerators are required to have a destruction and removal efficiency (DRE) of 99.9999 percent. Incineration is a proven and reliable method of treating PCB contaminated wastes. Residuals that will remain on-site following treatment will be soils contaminated with PCBs at a concentration below 10 ppm and sediments with PCB concentrations less than 1 ppm (or the health-based cleanup standard selected for the site). Minimal long-term management will be required following the implementation of this alternative.

An air monitoring program will be implemented during the performance of this alternative to reduce risks to on-site workers and nearby residents. Mitigative measures such as those discussed in the evaluation of alternative SC-2, will be taken during excavation

to control emissions. Excavated soils waiting to be transported off-site will be contained and covered to reduce fugitive emission of VOCs and contaminated particulate matter. The principal risks to human health and the environment are associated with the transportation of the contaminated soils to the off-site disposal facility. Truck traffic to and from the site will increase dramatically during the implementation of the alternative. It will take approximately 4000 18 wheel trucks to transport 64,000 cubic yards of material to the off-site treatment facility and an equal number of trucks to haul in backfill.

Safety measures will need to be taken to prevent spills on highways and contamination of the Fall River Reservoir, which is located along the truck route.

It is estimated that the length of operation will be approximately two (2) years. This period of performance is dependent on two factors: the cleanup level selected for the site which directly impacts the volume of contaminated soils that must be processed; and locating a hazardous waste management facility which will accept the entire quantity of PCB-contaminated soil (64,000 cubic yards). At present, there are only three facilities that will accept PCB-contaminated soils for incineration and these will only accept small quantities at a time. Hence, large volumes would require a phased delivery schedule.

The off-site treatment alternative attains all Federal and State applicable or relevant and appropriate public health and environmental requirements. Specifically, this alternative is in compliance with 40 C.F.R. §761 of TSCA, and RCRA 40 C.F.R. Part 264 Subpart G (Closure and Post-Closure) and Subpart O (Incinerators). The transport of contaminated soils off-site to the treatment facility will comply with RCRA 40 C.F.R. Parts 262, 263, 264 and 265 and DOT regulations 49 C.F.R. Parts 171-179 and 387. Further, in acordance with CERCLA 121(d)(3), the selected off-site facility must be in compliance with section 3004 and 3005 of the Solid Waste Disposal Act (or, where applicable, in compliance with the Toxic Substances Control Act or other applicable Federal laws) and applicable State requirements.

The cost analysis represents costs for excavation, removal, and incineration of all contaminated material (64,000 c.y.). Unit costs for incineration were based on estimates provided by waste management facilities. The estimated capital cost for this alternative is $212,627,000. The annual operation and maintenance (O&M) cost, which includes the monitoring program that will be conducted throughout the entire operation period, is estimated to be $561,636. The estimated present worth for the treatment of 64,000 cubic yards of PCB contaminated soils in an off-site incinerator, assuming a 10 percent discount rate, is $213,595,000.

A sensitivity analysis was conducted to determine how total project costs change relative to different cleanup levels and volume of treated soil. Costs were examined for six scenarios.

The total volume of contaminated material to be excavated, treated and disposed of was 13,000 c.y., 22,000 c.y., 28,000 c.y., 48,000 c.y., 56,000 c.y. and 64,000 c.y. The total project costs, presented in Figure C-17, are the present worth value of the capital costs and operation and maintenance through the period of implementation.

MOM-1 No Action

This alternative is discussed earlier, combined with alternative SC-1 No Action.

MOM-2 On-site Treatment

On-site treatment of groundwater entails extracting contaminated groundwater from both the overburden and bedrock aquifers, treating it on-site using clarification, filtration, air stripping and/or carbon adsorption (See MOM-2A and 2C for an evaluation of these two technologies) and discharging it back to the groundwater. A small portion of the effluent, approximately 5 to 10 gallons per minute (gpm), will be discharged to the surface water to maintain groundwater flow towards the contaminated zone. The discharge to the surface water will receive advanced treatment to ensure protection of freshwater aquatic life and the environment. Figure C-18 depicts a generalized flow chart for the treatment process.

The projected remediation of the groundwater involves installation of extraction wells in both the overburden and bedrock aquifers and the construction of recharge infiltration galleries. The bedrock groundwater extraction wells will be installed at the same time as the overburden wells. Short-term periods of pumping (up to a week in duration) should be carried out for test purposes upon installation of the system and at a second time prior to initiation of full-time operation. In conjunction with the extraction and recharge closed loop system, the groundwater would be passed through an appropriate treatment system before recharging into the aquifer.

In order to capture and extract the areal expense of the contaminant plume in the relatively shallow saturated overburden aquifer without causing induced infiltration from the adjacent surface water bodies, a series of overburden wells, pumping at withdrawal rates of no more than 5 gpm for each well, is projected. Initial calculations indicate that eight (8) to twelve (12) extraction wells will be required to provide effective contaminant capture.

The recharge of treated groundwater into the aquifer at specified locations will flush and desorb contaminants from the pore water contained within the soil matrix. Siting the recharge infiltration galleries is critical relative to the influence of the recharge mounding effects on the capture zones of the extraction well field. A preliminary groundwater computer model using the USGS MODFLOW program was used to assist in locating the possible configurations of extraction and recharge wells that would provide

optimum extraction and flushing of the contaminated groundwater. In order to capture the contaminant plume in the bedrock aquifer, three (3) or four (4) extraction wells in the shallow bedrock will be located along the center line of the bedrock plume. Four additional wells will be located at the periphery of the high contamination plume in the bedrock (See Figure C-13 TVO Concentrations: Bedrock Aquifer). Pumping rates will be 2 gpm or less from each well or approximately one-third of the adopted extraction rate for the overburden extraction system.

Maximum groundwater extraction and recharge rates are limited by the hydraulic conductivity of the aquifer material. Single well pump tests over short time periods indicate a groundwater extraction and recharge system at an approximate maximum pumping rate of 40 gpm is feasible. This pumping rate, combined with a 15-20 percent discharge to the Copicut River and the remaining treated water recharged to the aquifer, would allow for approximately 1.6 pore water flushes per year. Prior to the design phase of this project, a full-scale pumping and recharge test program will be necessary to provide additional information on any potential modifications to this concept.

The groundwater at the site is contaminated with volatile organics, heavy metals, PCBs and other extractable organics. The concentrations and frequencies of contaminants detected in the groundwater are presented on Table C-10. Of the organic compounds present in the groundwater, those which are semi-volatile and highly water soluble such as acetone, methyl ethyl ketone and methyl isobutyl ketone, are not effectively removed by conventional air stripping or activated carbon processes. However, preheating the influent in the air stripping process will enhance volatilization of these compounds, thus increasing their overall removal.

There are two groundwater treatment alternatives, MOM-2A Heated Air Stripping and MOM-2C Carbon Adsorption, which will undergo detailed evaluation. Many of the unit processes such as metals removal, neutralization and gravity sand filter, are the same for each alternative. The primary difference between the two alternatives is that MOM-2A focuses on the removal of ketones and other volatile organics through the use of heated air stripping with no carbon adsorption whereas MOM-2C emphasizes the removal of volatile organics but not ketones, through the use of conventional air stripping and carbon adsorption. Prior to implementation of either of the two on-site treatment alternatives, it will be necessary to conduct treatability studies to determine the effectiveness of each alternative on the site-specific waste stream (i.e. contaminated groundwater). The design criteria for these two alternatives are presented in Table C-11. A detailed discussion on the unit processes that are similar for each alternative is presented in Section 4 of the FS.

MOM-2A Heated Influent Air Stripping

Alternative MOM-2A utilizes heated influent air stripping to remove volatile organics and ketones from the groundwater. The

air stripping units would consist of packed towers filled with plastic packing media such as polypropylene pall rings or tellevettes. Air would be blown countercurrent to the liquid flow. In this process, the influent water and the air are preheated to about 150° F. This temperature increases the vapor pressure, resulting in an increase in the removal of organics such as ketones. One air stripper will have sufficient capacity to treat the entire plant flow. The second unit will normally handle the 10 gpm stream for surface discharge. It will also serve as the standby unit in case the first needs repairs.

The emissions from the air strippers will be treated with a catalytic burner. Heat will be removed to preheat the air stream into the burner as well as the air stripper water and air influent streams. Vapor phase activated carbon is not recommended for controlling ketones since ketones break down easily in the presence of carbon and may ignite.

The 10 gpm effluent will be polished to obtain very low levels of metals and organics in order to protect freshwater aquatic life in the Copicut River, particularly under low stream flow conditions. The first stage in polishing will be a 0.2 micron rated microfilter that will reduce the effluent metal concentration. An advanced metal removal reagent (i.e. insoluble starch xanthate or sodium di-thiocarbonate) will be added prior to passing the effluent through the microfilter to aid in metals removal. The microfilter effluent will be further treated with a carbon canister (2000 lb) for removal of organics.[8]

Figure C-19 shows the specific technologies and unit processes for alternative MOM-2A.

The evaluation of this alternative indicates that it will permanently and significantly reduce the volume, toxicity and mobility of the hazardous wastes present in groundwater. Air stripping is a proven technology for removal of volatile organics and is one of the most frequently used treatment technologies due to its relative low cost and high efficiency. With an air flow to water ratio of 150 to 1 (volume basis), removal of volatile organics in the 95-99+ percent range is possible. Application of heat to the air stripping process to remove ketones has also been proven in the field and treatment of the off-gas using a catalytic burner is a common practice in the organic chemical industry. Active restoration of the aquifer will also reduce the mobility of volatile organics in groundwater and surface water. Volatile organics increase the solubility of other contaminants in groundwater, such as PCBs. Removal of the volatiles and other organic compounds from the groundwater will decrease the solubility and mobility of the PCBs. At the completion of this remedial alternative, there may be residual PCB contamination on-site but these compounds will be relatively immobile.

The reactor/clarifier process will produce a metal hydroxide sludge that will require proper disposal at a RCRA approved hazardous waste disposal facility. It is estimated that one drum of the metal sludge per day, at approximately 45 percent solids, will be produced and require disposal.

During the performance of this alternative, a multi-media monitoring program would be implemented to monitor the exposure to on-site workers and nearby residents. Groundwater and surface water will also be sampled on a regular basis to monitor the effectiveness of the treatment system. A short-term benefit of this alternative is that it will mitigate the off-site migration of contaminated groundwater, thus reducing the risks posed to public health and the environment. A long-term benefit is that the groundwater will be remediated to levels that are protective of human health and the environment.

The implementation of this alternative requires assembling a treatment system for a projected life of 25 years. The actual operation period depends on the cleanup level selected by the Agency. For the purposes of this analysis, it is assumed that the project life for this alternative is ten (10) years based on laboratory leaching studies and the results of the fate and transport modeling.

The MOM-2A alternative will attain all Federal and State applicable or relevant and appropriate public health and environmental requirements. Specifically, this alternative complies with RCRA 40 C.F.R. Part 264 Subpart F (Groundwater Protection), the Clean Water Act (PL92-500) - NPDES Permitting and National Ambient Air Quality Standards. If applicable, the disposal of metal sludges off-site and/or spent carbon will be in accordance with RCRA 40 C.F.R. Parts 262 and 263 and DOT regulations 49 C.F.R. Parts 171-179 and 387.

The cost analysis was based on information from vendors and cost estimating files. The estimated capital cost for this alternative is $3,473,000. The annual operation and maintenance (O&M) is estimated to be $565,000. The estimated present worth for ten (10) years of operation, assuming a 10 percent discount rate, is $6,945,000.

MOM-2C Carbon Adsorption

Alternative MOM-2C utilizes air stripping and carbon adsorption to remove volatiles and other organic compounds from the contaminated groundwater. A description of the air stripping process was presented in the evaluation of alternative MOM-2A. Under alternative MOM-2C, the air strippers, working under ambient conditions, will only provide for the partial removal of ketones.

The emissions from the air strippers, therefore, will be treated with vapor phase activated carbon since ketones will not be present in significant quantities.

Granular activated carbon would be used in the treatment process to remove the organic compounds remaining after air stripping. Air stripping would be utilized to treat the bulk of contamination in groundwater to low levels. Carbon adsorption would be used as a polishing step to further reduce the contaminants in groundwater to the selected cleanup level. The activated carbon system consists of two upflow fluidized bed type contactors arranged in parallel. One bed will have sufficient capacity to treat the entire plant flow. The contactors will contain 5000 pounds of carbon each and provide an empty bed contact time of one hour, excluding the bed expansion volume. The second carbon bed will normally be used to treat only the 10 gpm waste stream for surface discharge. If the first carbon bed needs servicing, the second will be a standby unit.

The effluent polishing system was previously described in the evaluation of alternative MOM-2A. Figure C-20 shows the specific technologies and unit processes for alternative MOM-2C.

An evaluation of alternative MOM-2C indicates that this alternative and alternative MOM-2A rate similarly against the evaluation criteria. The evaluation of MOM-2C, therefore, will focus on the key differences between the two on-site treatment alternatives in relation to the evaluation criteria. Unless otherwise noted, the benefits and/or limitations of MOM-2C will be the same as those described in the evaluation of MOM-2A.

Alternative MOM-2C will permanently and significantly reduce the volume, toxicity and mobility of the hazardous wastes present in groundwater. This alternative, though, is not specifically designed for the treatability of ketones. Ketones, although found at high concentrations, are not widespread throughout the site. Treatability studies and additional laboratory studies would have to be conducted to determine if the concentration of ketones in the effluent pose a risk to human health and the environment. Also studies will be conducted to determine if ketone removal may take place due to natural biodegradation when the effluent is recharged into the aquifer. The use of vapor phase activated carbon for adsorption of organics in the air is a common practice in the electronics and organic chemical industry and has been used at other CERCLA sites. This unit process is expected to achieve a 90-95 percent volatile organic removal in the air stripping tower exhaust.

In MOM-2C, activated carbon adsorption is added to the treatment facility to achieve a higher effluent quality, thus resulting in a shorter period of performance. Activated carbon beds will also handle shock loads and adsorb higher molecular weight organics, thus increasing this alternative's reliability. This unit process is a proven technology with a long history of successful operation in the municipal and industrial wastewater treatment fields. Activated carbon is effective in removing organic compounds and partially effective (40-70 percent removal efficiencies) in removing inorganic compounds.

The implementation of this alternative requires assembling a treatment system for a project life of 25 years. The actual operation period depends on the cleanup level selected by the Agency. For the purpose of this evaluation, it is assumed that the project life for this alternative will be ten (10) years. The cost analysis for this alternative was based on information from vendors and cost estimating files. The estimated capital cost for alternative MOM 2C is $4,401,500. The annual operation and maintenance (O&M) cost is estimated to be $693,000. The estimated present worth for ten (10) years of operation, assuming a 10 percent discount rate, is $8,659,292.

MOM-4 Pretreatment and Disposal at POTW

Alternative MOM-4 entails extracting contaminated groundwater from the overburden and bedrock aquifers, treating it on-site with precipitation and air stripping and transporting it off-site via a pipeline to a local POTW for final treatment. Coagulation and precipitation are used to remove metals in a clarifier and ambient air stripping will be used to reduce volatile organic compounds. The treated effluent from the air stripping tower will be sampled once a day to assure compliance with the treatment plant's pretreatment standards. The effluent will be collected in a sump and pumped to a POTW in the proximate area. Following treatment at the POTW, the effluent is then returned to the site via a second pipeline for recharge into the groundwater aquifer. Figure C-21 presents an overall system flow diagram for alternative MOM-4.

The evaluation of this alternative indicates that it will permanently and significantly reduce the volume, toxicity and mobility of the hazardous wastes present in groundwater. The on-site unit processes for this alternative, precipitation/coagulation and air stripping, were previously discussed as part of the evaluation of MOM-2A and MOM-2C. The proposed system, though, may not be MOM-2A effective in reducing metals and organic compounds to levels that attain the specific pretreatment requirements of the selected POTW. If this is the case, activated carbon adsorption may have to be added to meet the pretreatment requirements. Prior to implementation of this alternative, a treatability study would need to be conducted to determine of this alternative can attain the relevant pretreatment requirements.

The short- and long-term public health benefits and the magnitude of risk reduction are similiar to that of the on-site treatment alternatives, MOM-2A and MOM-2C. Also, the multi-media sampling program described in the evaluation of MOM-2A is inherent to this alternative.

The implementability of this alternative is dependent on the acceptance and availability of a POTW. The contaminated groundwater at the Re-Solve site contains a wide range of contaminants, including PCBs. If the selected POTW is not permitted to treat specific contaminants, then the permit would have to be revised. In addition, the increased flow and/or waste stream may require that the POTW undergo structural modifications.

The useful life of the on-site treatment equipment is 25 years. The actual operation period depends on the cleanup level selected by the Agency. For the purposes of this evaluation, it is assumed that the project life is ten (10) years.

Alternative MOM-4 attains all Federal and State applicable or relevant and approriate public health and environmental requirements. Specifically, this alternative will be in compliance with RCRA Parts 262, 263 and 264 Subpart F (Groundwater Protection), CWA Sections 306 and 307 (Federal Pretreatment Requirements for discharge to a POTW) and National Ambient Air Quality Standards.

The estimated capital cost for this alternative is $2,890,000. The annual operation and maintence (O&M) cost is estimated to be $294,000. The estimated present worth, assuming a 10 percent discount rate, is $4,696,000.

VI Selection of Remedy

A. Description of the Selected Remedy

The remedial action selected for implementation at the Re-Solve site is consistent with the Comprehensive Environmantal Response, Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Contingency Plan.

The selected remedial action is a comprehensive approach for site remediation which includes both a source control and management of migration component. Both components are necessary in order to achieve the response objectives established for site remediation and the governing legal requirements.

1. Scope and Function of the Selected Remedy

Source Control

The source control component entails excavation of 22,500 cubic yards of PCB contaminated soils located in the unsaturated zone and treatment in an on-site mobile dechlorination facility. The estimated volume of contaminated soils is based on a clean-up standard of 25 ppm PCB. In addition to on-site soils, this component entails excavation of 3000 cubic yards of PCB contaminated sediments located in the wetlands north of the site and the unnamed tributary and treatment on-site in the dechlorination facility. The estimated volume of contaminated sediments is based on a clean-up standard of 1 ppm PCB. The total volume, therefore, of PCB contaminated soils and sediments undergoing treatment on-site in the mobile dechlorination facility is 25,500 cubic yards. It is estimated that it will take two (2) years to implement the source control component.

Implementation of this remedial action requires extensive on-site handling and processing of contaminated soils throughout the site. Figure C-22 illustrates the proposed site layout for implementation of the source control component. An administration trailer, a laboratory trailer and storage and processing facilities in addition to the dechlorination facility will be located on-site. The space available at the site for the operations area and the support area is limited because the site is surrounded by wetlands to the north and east, an Algonquin Gas Pipeline right-of-way and various surface water bodies. It will be necessary, therefore, to utilize the parcel of land adjacent to the site along North Hixville Road in order to implement this remedy.

The contaminated soils undergoing treatment are located in the unsaturated zone. The unsaturated zone at the site is defined as that area from the surface elevation to the seasonal low groundwater table which, based on data gathered during the RI and field observations made during the conduct of the RI and the source control remedial action, is estimated to be elevation 85.

However, the unsaturated zone and thus the seasonal low groundwater elevation will be further defined during design of the selected remedy.

Figure C-23 and C-24 present the areal and vertical extent of PCB contamination greater than or equal to 25 ppm in unsaturated zone soils, respectively. These Figures thus represent the limits of excavation for the source control component.

The soils in the unsaturated zone, generally categorized as fine sands and silts, are contaminated with both volatile organics and PCBs. A concern of the residents in the area is the off-site migration of airborne volatile organics and fugitive dust contaminated with PCBs during conduct of the remedy. In an effort to mitigate the off-site migration of contaminants, the method of excavation will be restricted to sheet piling vertical cuts. The design of this method will reduce open air removal of contaminated soils and thus, limit the potential for emissions. Additionally, emissions suppression techniques such as foam and water spray may be used to control odor and dust.

The contaminated sediments are located in areas classified as wetlands. Excavation in the wetland north of the site and the unnamed tributary will result in unavoidable impacts and disturbance to wetland resource areas. Such impacts may include the destruction of vegetation, the loss of indigenous species and the migration of PCBs downstream. It is imperative, therefore, that the impacts to the flora and fauna be minimized to the maximum extent practicable, and that the disturbed areas be restored to their original conditions.

In an effort to mitigate impacts to the wetland areas, remediation will be conducted during the seasonal low water periods (typically late summer, early fall in Massachusetts). At other periods of the year, the wetlands area north of the site discharges to the unnamed tributary which, in turn, discharges to the Copicut River. Both areas are also on occasion inundated by groundwater. But during the seasonal low groundwater period, the ground water-surface water interaction is substantially reduced. The water level in the wetland is not high enough to overcome natural barriers and discharge to the unnamed tributary. The groundwater table is also so low that groundwater passes under the unnamed tributary and discharges to the Copicut River. The unnamed tributary is normally dry during this period. It is feasible, therefore, to isolate the wetlands north of the site and limit the resuspension and downstream transport of PCB contaminated material while excavating PCB contaminated sediments. In addition, PCB contaminated sediments can be exacavated from the unnamed tributary with minimal impact on the environment during this same time period. During excavation of PCB contaminated sediments, though, downstream monitoring of surface water will be conducted to ensure that transport is not occurring.

Upon completion of the remedial activities in the wetland areas, a wetland restoration program will be implemented. Altered

wetland areas will be restored to their prior condition. The restoration program will be developed during design of the selected remedy. This program will identify the factors which are key to a successful restoration of the altered wetland. Factors may include, but not necessarily be limited to, replacing and regrading hydric soils, provisions for hydraulic control and provisions for vegetative reestablishment, including transplanting, seeding or some combination thereof.

The dechlorination process, discussed and evaluated as part of alternative SC-4 in the Feasibility Study, is a soil treatment process suitable for treating large volumes of soils contaminated at low to moderate levels of chlorinated organics, such as PCBs. The 25,500 cubic yards of contaminated soils and sediments will be treated to a level of 25 ppm PCB. EPA recognizes that a percentage of the 3000 c.y. of PCB contaminated sediment has a concentration less than 25 ppm. However, contaminated sediments at different PCB concentrations will be comingled during excavation and stockpiling, thus necessitating treatment of the entire volume to 25 ppm PCB. This treatment level constitutes the health based clean-up standard selected for PCB in unsaturated zone soils. Each batch will be tested following treatment to ensure attainment of the health based clean-up standard prior to being used to backfill the site. Following treatment of the 25,500 cubic yards of PCB contaminated soils and sediments and placement back on-site, the site will be covered with 18 inches of gravel. This does not constitute final site closure, but is necessary for the implementation of the management of migration component.

The on-site soils are also contaminated with other organic compounds such as volatile organics. The areal extent of contamination is similar for both PCBs and volatile organic compounds. Excavation of the PCB source areas in the unsaturated zone, primarily in the northwest quadrant near SB-25, will also significantly reduce the mass of VOCs contributing to groundwater contamination. Bench-scale studies on Re-Solve soils indicated that the dechlorination process was effective in removing a percentage of the organic compounds in soils, but complete destruction of such organic compounds by dechlorination does not appear feasible. Therefore, the residual organic compounds will undergo further treatment, after being placed back on-site, as part of the management of migration component.

Dechlorination is an innovative technology that has undergone extensive testing on a laboratory scale level. The process has also been the subject of extensive research at EPA's Hazardous Waste Engineering Research Laboratory (HWERL) in Cincinnati, Ohio. HWERL, in coordination with EPA Region II, recently completed a pilot scale study at the GE Moreau Superfund Site in South Glens Falls, New York using a 40 gallon reactor. Preliminary results indicate that the process was successful in reducing PCB levels in soils from approximately 7000 ppm to 10 ppm. HWERL and its contractor, Galson Research Corporation, are planning to conduct

additional pilot studies, using a 40 gallon reactor and a two cubic yard reactor, in the future to further refine the process.

Prior to implementation of the full-scale process at the site, it will be necessary to conduct a pilot study to ascertain the implementability of dechlorination on a full-scale level. In addition, the pilot study will yield information on the percent reduction of other organic compounds in the Re-Solve soils, and volume and types of residuals and byproducts produced from the reaction.

If dechlorination is determined not to be implementable at the site, based on the results of the pilot study, on-site incineration will be used as the source control treatment technology. On-site mobile incineration was discussed and evaluated as part of alternative SC-2. Mobile incineration has been proven on both the pilot- and full-scale level and has been utilized at private and Superfund sites to treat wastes similar to those found at Re-Solve. Prior to full-scale implementation, a trial burn will be conducted to demonstrate that the mobile incinerator can achieve a 99.9999 percent destruction and removal efficiency for PCBs. Residuals and side streams will also be evaluated during the trial burn. Treated soils will be placed back on-site and the site will be covered with 18 inches of gravel. All other component processes of the source control component would remain the same.

Air monitoring will be conducted during excavation activities. Sampling stations will be located at the perimeter of the site and the air will be sampled for VOCs, PCB in vapor phase and metal and PCB particulates.

Management of Migration

The management of migration component consists of a recirculation, pump, treat and flush system. This component will be implemented following completion of the source control remedial action.

Contaminated groundwater will be extracted from both the overburden and bedrock aquifers and treated on-site using alternative MOM-2c Precipitation/Air Stripping/Activated Carbon/Filtration. The treated groundwater will be discharged back into the aquifer via a distribution system. The soils within these areas will be flushed by this process, thus reducing the level of volatile organic compounds.

Groundwater will be treated to reduce contaminants to levels which result in an excess cancer risk of 1×10^{-5}. In this calculation, it was assumed that the chemicals in the groundwater may interact in an additive manner. The estimated period of time required to achieve the remediation level is 10 years, during which time the aquifer will be flushed an estimated 13-16 times (assuming 1.6 flushes per year). Flushing of the aquifer will reduce the level of residual organic compounds in the unsaturated zone to

an estimated 1 ppm total volatile organics. However, completion of the groundwater remediation component will be dependent on the achievement of the target remediation levels for selected indicator compounds in groundwater rather than soil cleanup levels for total volatile organics. EPA believes that, upon achievement of the remediation level in groundwater, the soils in both the saturated and unsaturated zone will be sufficiently clean to be protective of human health and the environment. This alternative was outlined in detail in the FS and summarized in the Alternatives Evaluation section of this document (MOM-2C).

Prior to implementation of this remedy, it will be necessary to conduct additional field studies which will include a full-scale pump test/performance test and a pilot treatability study. The purpose of the full-scale pump test is to determine the maximum groundwater pumping and recharge rates, locations of extraction wells and recharge trenches or wells. A treatability study will be conducted to assess the effectiveness of alternative MOM-2C in treating the contaminated groundwater at the site. Specifically, the air stripping efficiency for semi-volatiles such as ketones will be determined. Ketones, although not widespread on-site, are found in high concentrations in areas. If it is determined that ambient air stripping is not effective in reducing the concentration of ketones to levels that are protective of human health, heated air stripping will be substituted for ambient air stripping. The emissions from the heated air stripper would then be treated with a catalytic burner instead of vapor phase carbon. The other component processes of alternative MOM-2C would still be the same.

Performance monitoring will be implemented consistent with RCRA § 264.100(d), which requires the establishment of a monitoring program to assess the effectiveness of the remedial alternative. Residual water (effluent) contamination from the air stripping process will be monitored during the groundwater treatment operation.

Groundwater and surface water will be monitored on a quarterly basis during implementation of the remedy at base flow which is defined as a period following two days of no rain. Downgradient monitoring wells and residential wells will be used to monitor the groundwater quality; surface waters in the vicinity of the site will be sampled to monitor the levels and extent of contamination. In addition, fish sampling will be conducted at stations downstream of the site.

Further, monitoring of wetlands will be conducted during active restoration of the groundwater to ensure that extraction of groundwater does not detrimentally impact the wetlands. If negative impacts are observed, the rate of groundwater removal will be decreased to the point that the wetland areas are not adversely impacted.

Upon completion of the groundwater remediation component, the site will be graded and covered with one foot of loam and seeding. In accordance with section 121(c) of CERCLA, the site shall be evaluated every five (5) years to assure that the remedy is protective and that the hazardous waste remaining on-site do not pose a threat to human health and the environment.

Cost Analysis

Detailed cost estimates were developed for both the source control and management of migration components of the comprehensive remedial action. Dechlorination and incineration costs were based on treatment of 25,500 cubic yards of PCB contaminated soils and sediment. The cost for alternative MOM-2C is based on 10 years of operation and includes costs for additional field studies such as a pump test and treatability study. All costs were estimated with expected accuracy of -30 to +50 percent in accordance with EPA Guidance on Feasibility Studies Under CERCLA. The cost estimate for dechlorination includes an additional 10 percent contingency because dechlorination is a new and innovative technology and, as such, requires that a contingency be provided during scale-up to accommodate variable sidestream process requirements.

The present worth for dechlorination is $9,237,000. The capital cost and operation and maintenance (O&M) costs are presented in Tables C-12 and C-13, respectively.

If incineration is substituted for dechlorination, the present worth for incineration would be $16,963,000. The capital cost and operation and maintenance (O&M) costs are presented in Tables C-14 and C-15, respectively.

The present worth for alternative MOM-2C is $10,674,000. The capital cost and operation and maintenance (O&M) costs are presented in Tables C-16 and C-17, respectively.

The total present worth for the selected remedial action for the Re-Solve, Inc. site is $19,911,000.

2. Performance Goals

a. Source Control

Soils

PCBs are the most significant component of the soil contamination at the Re-Solve site.

A range of soil cleanup goals for the Re-Solve site was developed based on the potential for PCB-contaminated soils to cause adverse human health effects.[9] The cleanup levels are developed for several different exposure scenarios based on potential human exposures to contaminated soils by direct contact. The estimated

cleanup levels for each exposure scenario assumed surface exposure to contaminated soil (i.e., not covered by clean soil). Individuals who come into contact with contaminated surface soils may be exposed as a result of dermal contact, with subsequent absorption of chemicals across the gastrointestinal tract lining.

The exposure scenarios addressed in this document are identical to those evaluated in the Public Health Evaluation (PHE) for the Re-Solve site. These exposure scenarios reflect both current site use and hypothetical future site use, and each includes an average and a plausible maximum exposure case. In this context, "current use" refers to trespassing whereas "future use" refers to redevelopment of the site for a hypothetical residence. At present, site use consists solely of use by trespassers. Future use might include residential use, inasmuch as there are residences in the area and zoning is residential.

The equation used to calculate soil cleanup concentrations for various exposure scenarios and levels of risk is identical to that presented in the Re-Solve site PHE except that the equation is rearranged to solve for the soil concentration:

$$\text{soil cleanup concent.} = \frac{(\text{risk}) \times \left(\frac{\text{body weight}}{\text{(kg)}}\right) \times \left(\frac{\text{lifetime}}{\text{(70 yrs)}}\right) \times (365\ \text{days/yr})}{\left(\text{potency factor (mg/kg/day)}^{-1}\right) \times \left(\left[\text{soil contact rate (g/visit)} \times \text{convers. factor (kg/10}^{3}\text{g)} \times \text{dermal absorp. factor}\right] + \left[\text{soil ingest. rate (mg/visit)} \times \text{convers. factor (kg/10}^{6}\text{mg)} \times \text{ingest. absorp. factor}\right]\right) \times \left(\frac{\text{visits}}{\text{per yr}}\right) \times \left(\text{total yrs visited}\right)}$$

This equation takes into account the amount of soil contacted and ingested as a result of each visit to the site, the extent of PCB absorption across the skin and the gastrointestinal tract lining, and the frequency and duration of exposure (i.e., visits per year, and total years site is visited). By substituting into the above equation average case estimates for soil contact rate, skin absorption factor, soil ingestion rate, ingestion absorption factor, number of site visits per year, and number of years the site is visited, a PCB soil cleanup level based on average exposure conditions can be derived for a specified level of cancer risk. Similarly, by substituting in maximum exposure case estimates, cleanup levels based on maximum exposure conditions can be derived. In either case, the potency factor for PCBs, 4.34 $(mg/kg/day)^{-1}$, is an upperbound estimate, and therefore even the average exposure scenario results in a conservative cleanup number.

In applying this approach to estimate health-based soil cleanup levels, it is important to recognize the uncertainties inherent in it. The three major sources of uncertainty are associated with (1) the cancer potency factor for PCBs, (2) the value of each exposure parameter, and (3) the overall set of exposure assumptions used to derive a cleanup level. These uncertainties are discussed in detail in Section 4 of the FS.

Table C-18 presents the estimated soil PCB cleanup levels for a range of lifetime cancer risks from 10^{-4} to 10^{-7} and a range of exposure scenarios for the Re-Solve site. These cleanup levels have been derived specifically for the Re-Solve site and are based on a particular set of exposure assumptions designed to approximately reflect average and plausible maximum exposure conditions for this site. In general, the assumptions that have been applied in estimating cleanup levels are conservative.

The cancer potency factor for PCBs, in particular, is very conservative, representing the 95% upper bound cancer potency. Many of the exposure assumptions are discussed in the Re-Solve site PHE. As a result, the cleanup levels shown in Table C-18 are unlikely to result in cancer risks higher than the indicated level, but may result in risks which are considerably lower.

The source control component of the selected remedial action entails excavation and treatment of soils contaminated with PCBs at concentrations of 25 ppm or greater and located in the unsaturated zone. All of the exposure scenarios are limited to potential dermal exposure to the unsaturated zone soils. This cleanup level corresponds to a 10^{-5} risk level for the average case under future site use conditions. (The cleanup level presented on Table C-18 is 30 ppm. As part of the discussion on the development of soil cleanup levels in the FS, EPA discussed some of the uncertainty in the cancer potency factor and exposure parameters used to estimate cleanup levels through the use of significant figures. Because several of the soil contact rates and years visited have only one significant figure, the final cleanup level can have one or, at most, two significant figures. By convention, the 30 ppm cleanup level is understood to be between 25 ppm and 35 ppm. Due to the uncertainty associated with the approach used to estimate cleanup levels, EPA has selected 25 ppm as being representative of a 10^{-5} risk level).

EPA is establishing its cleanup goal solely for PCBs in the unsaturated zone (i.e. above the groundwater table) because it is not reasonable to assume contact with soils below the groundwater table would occur.

Sediments

Three routes of exposure to PCBs in sediments were considered in the development of the cleanup criteria for sediments near the Re-Solve site. The first exposure pathway is the direct contact between benthic organisms and PCBs in sediments. The second pathway is the exposure of aquatic organisms in the water column to PCBs emitted into the water from the sediments. The third pathway is the exposure of predators, including terrestrial organisms, to PCBs that have bioacculumlated through food chains to higher trophic levels.

The first pathway exposure of benthic organisms by direct contact was addressed by reviewing the literature to identify sediment

PCB concentrations that have been associated with adverse impacts on benthic organisms. Although there are few data for freshwater systems, some information is available addressing sediment toxicity to saltwater benthic organisms. The sediment quality triad for example, was used to derive a target PCB concentration in the Puget Sound based on sediment bioassays, sediment chemistry and bottom fish histopathology.[10] Using this method, the authors concluded that minimal biological effects would be expected at PCB sediment concentrations of 0.1 ppm with significant effects expected at sediment concentrations greater than 0.8 ppm. The apparent effects threshold (AET) approach identifies concentrations of chemicals in sediments that are associated (at p - 0.05) with biological effects including reduction of benthic community diversity and toxic effects to amphipods in a bioassay.[11] PCB sediment concentrations associated with effects using these methods ranged from 0.13 to 2.5 ppm.

Based on the potential effects to benthic organisam, sediment PCB concentrations in the range of 0.1 to 2.5 ppm were investigated further. Water concentrations corresponding to this range of sediment concentrations were estimated using a sediment model based on work of Thibodaux[12] and used by EPA to model tetrachlorodibenzo-p-dioxin (TCDD) in sediment and water.[13] The similarity in physicochemical properties between PCBs and TCDD indicates that this approach should be valid. The model assumes that volatilization is the primary fate process of PCBs in water (i.e., photolysis, hydrolysis, and oxidation are negligible) and included site-specific parameters for the fraction of organic carbon in sediments, the depth of the water body, the average wind speed and the width of the water body. It includes terms for mass transfer of PCBs from the sediment to the water, through the water column, and form the water to the air and considers PCBs partitioning from the organic matter to pore water. Assuming sediment concentrations ranging from 0.1 to 2.5 ppm, concentrations in the water of the wetland were estimated to range from 1.9×10^{-8} to 4.9×10^{-7} ppb. These concentrations are all below the Ambient Water Quality Criteria (AWQC) for PCBs of 0.014 ppb.[14]

Bioaccumulation through the food chain was assessed using the WASTOX model.[15] Fish species collected near the site during the RI included perch, brown bullhead, chain and redfin pickerel, and American eel. The WASTOX model has been used successfuly to predict PCB residues in Lake Michigan trout and kepone residues in striped bass in the James River but has not, however, been applied to most the species of concern at the Re-Solve site.

In addition, the model requires some very specific biological information on species being modelled, including feeding habits respiration rates and growth rates. Hence, the results of this modelling effort were only used to provide a rough estimate of potential residues in fish. Further, it is difficult to know what criteria residue value would be appropriate to compare estimated residues to. The FDA tolerance limit of 2 ppm is not based solely on health-based concerns. In order to estimate a

health-based residue level, However consumption habits and the possible yield of the water bodies must be known. In the absence site-specific consumption data, estimated residue concentrations were compared to the FDA tolerance limit of 2 ppm.

Residues were estimated based on PCB sediment concentrations of the wetland, of 0.1 to 2.5 ppm. For the purposes of the model, sediment concentrations in the Copicut were also considered in this range. This latter assumption is supported by sediment data gathered during the RI, where PCB concentrations ranged from 0.2 to 2.7 ppm in the Copicut River and Carol's Brook. Based on these assumptions, residues in the perch were estimated to range from 0.02 to 6.0 ppm; bullhead from 0.01 to 2.3 ppm; and American eel from 0.05 to 13.0 ppm. These results of the model indicate that at the upper end of the investigated range, PCB residues in fish may exceed the FDA tolerance limit. It should be noted that of these four organisms, only the American eel would be expected to enter the wetland, and the chances of this occuring are not known. Other fish species can be exposed to residues in sediments of the wetland and unnamed tributatary by water transport, sediment transport and also possibly by the movement of food organisms into the river.

In selecting the PCB sediment cleanup level for the site, EPA considered the following factors: The range of PCB sediment concentrations (0.13 ppm to 2.5 ppm) associated with adverse impacts to benthic organisms; location and concentration of PCB contamination, and; adverse environmental impacts. Based on an evaluation of these factors, EPA is selecting a cleanup level of 1 ppm for PCB contaminated sediments located in the wetlands north of the site and the unnamed tributary. These contaminants will be excavated and treated in the on-site dechlorination facility.

b. Management of Migration

Target concentrations for groundwater remediation were developed in a manner consistent with EPA's Superfund Public Health Evaluation Manual (OERR 1986). The first step in the process was to review and modify the list of indicator chemicals selected for assessing baseline risk (Public Health Evaluation, Re-Solve Supplemental RI,1987) based on chemical class and treatability. Secondly, the list of chemicals found in groundwater were reviewed, also taking into account chemical class and treatability, to determine if additional chemicals should be considered in the design of the alternative.

The indicator chemicals identified as part of the baseline risk assessment were:

Lead
Polychlorinated Biphenyls (PCBs)
Tetrachloroethylene
Trichloroethylene
Trans-1,2-Dichloroethylene
Vinyl Chloride

This list of indicator compounds can be organized into chemical class. This list is comprised of an inorganic compound (lead), a chlorinated organic compound (PCBs) and volatile organic compounds (tetrachloroethylene, trichloroethylene, trans-1,2-dichloroethylene and vinyl chloride). Further, individual chemicals in each chemical class can be classified as carcinogens and non-carcinogens.

Based on a review of the list of all chemicals found in groundwater at the site, additional chemicals were identified for inclusion as indicator chemicals. These chemicals and their respective chemical class are; acetone, methyl ethyl ketone and methyl isobutyl ketone (ketones) and methylene chloride (volatile organic compound).

Target concentrations were developed for each class of compounds. Within each class, some chemicals may be more difficult to treat than others or may pose a greater risk to public health. These more persistent or greater risk chemicals were considered in the design of the alternative.

Ketone Indicators

Ketones are semivolatile compounds which are not effectively treated by aeration or granular activated carbon. A pilot study will be conducted to determine if heated air stripping should be utilized to reduce the concentration of ketones in groundwater to levels that are protective of human health. A final determination will be made during design of the alternative.

Inorganic Indicators

Lead is a non-carcinogenic inorganic compound with a maximum contaminant level (MCL) of 50 ppb. (MCLs are standards developed under the Safe Drinking Water Act (SDWA) for public water supplies. These standards are based on health, technological and economic feasibility). This MCL, though, is currently undergoing revision. The new proposed MCLG for lead is 20 ppb. EPA is selecting 50 ppb as the target remediation level for lead in groundwater. But, if the proposed MCLG undergoing review and comment is adopted as either a proposed or final MCL prior to the initiation of the groundwater treatment component, the cleanup standard for lead will be the more stringent standard.

VOC Indicators

The majority of the indicator chemicals are volatile organic compounds. Trichloroethylene, tetrachloroethylene, vinyl chloride and methylene chloride are known as suspected human carcinogens whereas trans-1,2-dichloroethylene is a non-carcinogen. The chemicals within this class that are the more persistent and which pose the greatest threat to public health will be used in the design of the alternative.

Based on this criteria, EPA concludes that trichloroethylene (TCE), tetrachloroethylene (PCE) and methylene chloride are the appropriate VOC indicator chemicals for the Re-Solve site.

EPA believes that a target level for groundwater remediation for volatile organics of 5 ppb each for TCE, PCE and methylene chloride will provide adequate protection of public health and the environment. The final MCL for TCE is 5 ppb. The proposed MCL for PCE is still under development, but it is reasonable to assume that the same regulatory approach can be taken for PCE as TCE since these two compounds have the following similarities: weights of evidence for carcinogenicity, practical quantification level; and treatment efficiency. The concentration of methylene chloride corresponding to a 10^{-6} risk level is 5 ppb.

The incremental lifetime cancer risk associated with ingestion of TCE, PCE and methylene chloride at 5 ppb each in groundwater is approximately 1×10^{-5}, assuming additivity. The individual and total risk level associated with a 5 ppb concentration for each of the contaminants is presented in the following table:

Compound	Risk Associated With A 5 ppb Concentration
Trichloroethylene	7×10^{-6}
Tetrachloroethylene	2×10^{-6}
Methylene Chloride	1×10^{-6}
Total	10×10^{-6}
	$= 1 \times 10^{-5}$

Since TCE, PCE and methylene chloride were not present at the same concentrations in groundwater, they may not appear at the same relative concentrations after groundwater treatment. Risks from exposure to groundwater from these three chemicals will depend on their relative ratio. EPA believes that a target concentration of 5 ppb for each chemical is sufficiently protective.

Vinyl Chloride is a potent carcinogen with a final MCL of 2 ppb. It was not included in the calculation of the overall risk associated with the groundwater following remediation because the treatment process will reduce the concentration of vinyl chloride to a level well below the MCL. The effectiveness of aeration in treating a chemical can be measured by the compound's Henry's Law Constant. Generally, the removal of a contaminant by aeration increases with the Henry's Law Constant. The Henry's Law Constant for vinyl chloride is 359,000, which, relative to other volatile organic compounds, is extremely high. This, coupled with an adequate air to water ratio (150:1) in the aeration process should result in near total removal of vinyl chloride during treatment.

Trans-1,2-dichloroethylene was another volatile organic not involved in the calculation. This compound is a non-carcinogen with a proposed MCLG of 70 ppb. The aeration process will also sufficiently reduce the levels detected in groundwater to below

the proposed MCLG. Treatment to 5 ppb for TCE, PCE and methylene chloride is expected to reduce other compounds identified in groundwater to non-detectable levels. However, in the event that other compounds are at detectable levels upon meeting the TCE, PCE and methylene chloride target cleanup levels for groundwater, it will be necessary to determine the overall risk associated with all compounds detected. A determination will be made by EPA upon achieving 5 ppb for TCE, PCE and methylene chloride in groundwater as to whether the aquifer cleanup has satisfied remedial objectives and to assure that water quality is adequately protective of human health and the environment.

PCB Indicator

Both PCBs and VOCs are found at high concentrations in the saturated zone at the site. Each class of chemicals has distinct characteristics. VOCs are highly soluble in groundwater, whereas PCBs are inherently insoluble and have a tendency to adsorb onto soils The solubility of PCBs, though, is enhanced in the presence of VOCs and appears to increase as the concentration of VOCs increase. High concentrations of VOCs at the site cause PCBs to desorb from saturated soils and dissolve in groundwater. This is supported by the fact that PCBs were detected in filtered groundwater samples at levels higher than the normal 15 ppb maximum solubility. As expected, VOCs were also detected at high concentrations in the same samples.

Once in solution, PCBs migrate in groundwater, but at a slower rate than VOCs. The migration rate of PCBs is determined by the VOC concentrations in the soil matrix. High VOC concentrations, such as those presently found at the site, will cause PCBs to migrate an estimated 10 feet in 15 years. On the other hand, if VOC concentrations are reduced to the target remediation levels selected for groundwater, PCB migration will decrease to about 10 feet in 1200 years.

The selected remedial action entails treatment of PCB contaminated soils in the unsaturated zone and active restoration of the groundwater to a 1×10^{-5} risk level. Significant concentrations of PCBs will remain on-site in the saturated zone, but VOCs, other organic compounds and metals will be reduced to the target remediation levels for groundwater treatment. The reduction of contaminant levels, specifically VOCs, will reduce the solubility and mobility of PCBs in groundwater.

However, PCBs will still be present at low concentrations in on-site groundwater. Assuming even distribution of the PCB mass in the waste management area, which is defined as the area within the existing fence line, the estimated solubility of PCBs in the interstitial pore water is 10 to 15 ppb. This concentration is far in excess of 0.08 ppb, the health based cleanup level for a 10^{-5} cancer risk for PCBs. This contamination will be limited to the waste management area only. Eventhough PCBs may desorb from saturated zone soils and solubilize in groundwater, PCBs have a chemical tendency to adsorb onto the next available and

less contaminated soil particle because the soil-water partitioning coefficient for PCBs favors soils. In addition, the time period that PCBs are in solution is very low, thereby inhibiting migration. As mentioned previously, the expected migration of PCBs in groundwater at detectable levels would be 10 feet in 1200 years, assuming that volatile organic compounds in groundwater are remediated to target cleanup levels. Therefore, while low level PCB contamination may be present in groundwater on-site following groundwater remediation, for all practical purposes they will not migrate.

In order to attain a PCB level of 0.08 ppb, the health based cleanup level, in groundwater everywhere on-site, PCBs in the saturated zone would have to be reduced to a concentration of 0.15 ppm. This would require the excavation and treatment of an additional 70,000 cubic yards of PCB contaminated soils in the saturated zone. Because excavation in the saturated zone is exceedingly difficult technically, and is quite costly, the Agency has reviewed the question of whether such excavation is necessary for a protective remedy.

The public health evaluation indicated that remediation of the PCBs in the saturated zone is not necessary to protect against dermal exposure and the only remaining potential exposure pathway to PCBs is ingestion of groundwater.

Due to the ubiquitous nature of the PCBs at the site and the presence of PCB contamination in the saturated zone, EPA believes it is technically infeasible to attain this level of cleanup with any confidence that the water quality on-site would attain, or remain at, acceptable levels over time. The PCBs in the saturated zone will not migrate off-site because of their low mobility in groundwater. Thus, the PCBs in the saturated zone will remain on-site.

Further, work in the saturated zone is complicated by the constant presence of water, which makes it exceedingly difficult to remove all of the PCB contaminated soil. As a result, the Agency cannot assure that excavation of the unsaturated zone would actually result in the attainment of the specified cleanup levels for PCBs in on-site groundwater.

Upon completion of the selected remedial action, PCBs will be present in groundwater on-site in excess of the health based cleanup level for a 10^{-5} cancer risk. However, these levels will only be found within the waste management area, which should not restrict the placement of a drinking water well immediately outside the boundary of the waste management area.

The target remediation level for TCE, PCE and methylene chloride will be achieved at all points on the waste management boundary. This compliance point varies between 200 and 250 feet from the center of the plume, (i.e. point of exposure) which is located in the center of the waste management area. The final location of the compliance point will be determined during design of the

remedial action. For the purposes of this analysis, EPA is assuming that the compliance point is located 200 feet downgradient from the center of mass of the plume.

EPA developed a fate and transport model to simulate the groundwater extraction at the Re-Solve site. This is an iterative technique where for each day, the model calculates the mass and concentration of contaminants remaining in groundwater as a function of the mass of contaminants removed from groundwater due to pumping, and the mass of contaminants entering the groundwater due to leaching from the source soils. The leaching rate constant was derived experimentally.

The model was run in a scenario where the unsaturated zone soils (22,500 cubic yards) were excavated and treated on-site in the mobile dechlorination facility and subsequently placed back on-site. It was assumed that treatment would result in an 80 to 90 percent reduction of the mass of VOCs in the unsaturated zone.

A sensitivity analysis was also done on the leaching rate constant (determined by data from the lab columm study conducted as part of the FS) to determine how the model is affected by this parameter. Results indicated that this model was very sensitive to this parameter and a change in this leaching rate constant by as little as a factor of two or three can dramatically change the predicted time of cleanup.

The fate and transport model was modified to calculate cleanup time with and without the hydrolysis mechanism, using the hydrolysis half-life of tetrachloroethylene (PCE) as the decay rate. Due to the nature of the model, this additional mechanism did not greatly decrease the cleanup times, although it did reduce them.

This probably occurs because the leaching from soil into the water is the rate limiting step, and therefore the hydrolysis of the contaminants in the water does not drastically reduce the time to cleanup the site.

A second model which was developed for the site, a groundwater flow model, and was used to estimate the number of aquifer volumes necessary to flush contaminants and the associated treatment time in order to achieve the target remediation level for PCE in a source well placed on-site in the center of the plume. PCE was selected as the indicator compound for this analysis because its lower vapor pressure and solubility compared to other indicator compounds is such that its natural transport away from source areas is slower than other volatile organics. Further, PCE comprises 12.34 percent of the mass of total volatile organics (TVO) in the saturated zone.

A third model, the Soil Contaminant Evaluation Methodology (SOCEM), was used to determine the relationship between residual levels of contaminants in the source area and the resultant concentrations further downgradient. The SOCEM model was used to determine the allowable concentration of PCE and TVO in a source well located

in the center of the plume, given that the target remediation level for PCE at the point of compliance is 5 ppb. The number of contaminated aquifer volumes and extraction/treatment time were adjusted to reflect the distance from the source well to the point of compliance.

Based on the results of these modeling efforts, an estimated 16 aquifer volumes will have to be pumped and treated over a period of 10 years to attain the target remediation levels at the point of compliance (i.e. 5 ppb each for TCE, PCE and methylene chloride). These estimates are based on a pumping rate of 40 gallons per minute which would allow for approximately 1.6 flushes per year. The resulting concentration for PCE and TVOs in a source well located in the center of the plume on-site would be an estimated 24 ppb and 200 ppb, respectively.

Presently, the highest concentration of TVOs in groundwater on-site is 200 ppm. Treatment of groundwater to 200 ppb on-site represents a 99 percent reduction in the concentration of TVOs.

During remediation of groundwater at the site, the unsaturated zone soils will be flooded and both unsaturated and saturated zone soils will be flushed approximately 16 times over 10 years. EPA estimates that the concentration of TVOs in soils on-site will be reduced to 1 ppm. This concentration will not however, be used as a basis for achievement of the groundwater remediation goals. Groundwater remediation will be determined based on attainment of the target cleanup levels for the selected indicator compounds at the point of compliance, the waste management boundary.

B. Statutory Determinations

CERCLA as amended by SARA requires the Agency to select remedial actions, to be carried out under section 104 of CERCLA or secured under section 106 of CERCLA, which are in accordance with section 121 of CERCLA and, to the extent practicable, the NCP. Accordingly, the selected remedy presented herein is consistent with CERCLA including the cleanup standards in section 121, and to the extent practicable, the NCP.

Under its legal authorities, EPA's primary responsibility at CERCLA sites is to undertake remedial actions that are protective of human health and the environment. In addition, section 121 of CERCLA provides a number of factors and procedures for the Agency to consider and follow in selecting remedies.

First, section 121(b) creates a strong statutory preference for remedial actions that utilize treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants or contaminants as a principal element. The statute prescribes that, in choosing a final remedy, the Agency must select a remedial action that is cost effective and uses permanent solutions and alternative treatment technologies

or resource recovery technologies. In addition, EPA may select an alternative remedial action meeting the objectives of section 121 whether or not such action has been achieved in practice at any other facility or site that has similar characteristics.

Further, section 121(d) provides that EPA's remedial action, when complete, must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws.

1. Protectiveness

a. Source Control

EPA has determined that the 25 ppm cleanup level for PCBs in soils is protective of human health and the environment based upon a number of reasonable and valid (albeit conservative) assumptions. First, the Agency has assumed that the site has considerable potential for future residential development. Should such development occur, in the absence of remediation, an individual might well be exposed to contaminated soils in the unsaturated zone.

The site is presently zoned for single family residential and agricultural use. Currently the area surrounding the site is undergoing extensive residential development. New housing developments have gone in along Hixville Road, Old Fall River Road and Reed Road. Indeed one adjacent property owner has requested a permit to build a residence on the property. Thus, the area is under development pressure and EPA has reasonably assumed in its exposure analysis that individuals would seek to develop the Re-solve site and the immediately surrounding property.

Note that the site might be used even if drinking water wells cannot be drilled on the property. The owners of the Dartmouth Landing Trust, a subdivision presently under construction and located one and one-half miles south of the site, between Hixville Road and Reed Road, plan to extend a waterline to provide public water. Such a waterline might be proposed for the Re-Solve site. Further, the land might be used for recreational purposes or for agricultural purposes without the necessity of a drinking water well on the property.

The 25 ppm cleanup level is associated with an excess cancer risk of no greater than 10^{-5}. It is likely that the true risk is considerably lower, as conservative exposure assumptions were used in the calculation. Also, as part of final site closure, the site will be covered with one foot of loam and seeding. This final cover, although not permanent, will further inhibit the threat posed from direct contact with soils, thereby further lower the risk.

EPA also believes that the 1 ppm PCB cleanup level for sediments located in the wetland north of the site and the unnamed tributary

is protective of human health and the environment (i.e. benthic organisms, aquatic organisms and organisms at higher trophic levels). The selection of this cleanup level was a risk management decision in which the following information was considered: the protectiveness of a 1 ppm PCB cleanup level for the three pathways of exposure discussed previously; the overall protectiveness, and; adverse environmental impacts. The protectiveness of the 1 ppm PCB cleanup level on each pathway of exposure is:

Benthic Organisms

As discussed previously concentrations below 1 ppm have been associated with adverse effects in benthic organisms in saltwater systems. Although similar studies have not been conducted in freshwater systems, there is no information to suggest that freshwater organisms are less sensitive to PCBs than saltwater organisms. Of the freshwater organisms that have been tested using PCBs in water, amphipods (Gammarus pseudolimnaeus) and midges (Tanytarsus dissimilis) appear to be particularly sensitive to PCBs. For example, the 7-day LC_{50} for G. pseudolimnaeus was 5 ppb, and for pupae of T. dissimilis, a 3 week LC_{50} of 0.45 ppb has been reported. These organisms or closely related organisms would be expected to occur near the Re-Solve site. Assuming that freshwater benthic organisms are at least as sensitive to PCBs as saltwater benthic organisms, a sediment PCB concentration of 1 ppm would be protective of some but not all adverse effects of the chemical on benthic organisms.

Aquatic Organisms

The AWQC for PCBs of 0.014 ppb is based on this predation of fish by mink, and not on the toxicity of PCBs to aquatic organisms. Eleven life-cycle or partial life-cycle tests are available for 3 invertebrate and 2 freshwater fish species; chronic values ranged from 0.2 to 15 ppb. Hence, the AWQC of 0.014 ppb is protective of the aquatic species tested and also may be protective of predators. Assuming a sediment concentration of 1 ppm, the water column of the wetland was estimated to contain 1.9×10^{-7} ppb, which is below the AWQC of 0.014 ppb.

Higher Trophic Levels

As discussed previously, the biomagnification of PCB residues through the food chain was evaluated by using the WASTOX model. Assuming a sediment concentration of 1 ppm residues in fish were estimated to range from 0.2 to 5.0 ppm and hence may exceed the FDA tolerance limit. As previously noted, the chances of fish entering the wetland are probably low, but fish in other water bodies near the wetland may be exposed to PCBs from the wetland through transport by water, sediment and prey organisms. It should also be noted that American eels and amphibians such as frogs appear to be particularly efficient ammulators of PCBs. The food chain model used may underestimate PCB residues in these species.

EPA recognizes that the 1 ppm PCB cleanup level may not offer full protection for all pathways of exposure. However, EPA's final decision was not based solely on protectiveness, but also involved the consideration of the adverse environmental impacts posed by various levels of remediation and the location of such remedial activities.

First, cleaning up PCB contaminated sediments to a more protective level (i.e. 100 ppb) would most likely result in no adverse effects on benthic organisms and the resultant residues in fish would probably not exceed the FDA tolerance limit, but, in order to achieve this level of protection, it would be necessary to disturb significant wetland resource areas, almost twice the area that will be disturbed to achieve the 1 ppm cleanup level. EPA does not believe that a lower cleanup level is warranted considering the increased disturbance of wetland resource areas and subsequent loss of flora and fauna.

EPA also considered cleaning sediments to a less protective level (i.e. 2.5 ppm), but rejected this cleanup level because it would not be protective of any of the three pathways of exposure. Finally, PCBs were detected at levels greater than 1 ppm in the Copicut River and Cornell Pond, but EPA has chosen not to remediate these areas because of the potential adverse environmental impacts. The wetland and the unnamed tributary can be isolated from the Copicut River during the seasonal low groundwater period. Mitigative measures can be implemented during excavation of these sediments to minimize downstream migration of PCBs. Remediation (i.e. excavation) in the Copicut River and Cornell Pond, however, will most likely result in the increased bioavailability of PCBs[17] and downstream migration of PCBs adsorbed to sediments.

Instead of excavating PCB contaminated sediment at levels greater than 1 ppm in the Copicut River and Cornell Pond, and thereby potentially magnifying the problem, EPA will monitor the fish in the area.

b. Management of Migration

The Agency's decision to restore the groundwater at the Re-Solve site boundaries to a cancer risk level of 1×10^{-5} was based on several factors. First, EPA considered the Agency's Groundwater Protection Strategy (GWPS) (Office of Groundwater Protection August, 1984). The GWPS provides guidance concerning how different groundwaters throughout the country should be classified and to what extent cleaning up a particular groundwater is appropriate, given where it fits into the classification scheme. EPA also considered the Agency's draft Guidance on Remedial Actions for Contaminated Groundwater At Superfund Sites. (October, 1986). This guidance directs the Agency to consider a $10^{-4} - 10^{-7}$ range of risk levels in selecting the appropriate risk level for the groundwater at the site.

The policy under the GWPS establishes groundwater protection goals based on "the highest beneficial uses to which groundwater having significant water resources value can presently or potentially be put." Guidelines for protection of aquifers are differentially based, relative to characteristics of vulnerability, use and value. Under the classification scheme, the groundwater at the Re-Solve site is Class II groundwater. This groundwater is considered to be a current drinking water source since groundwater is used for drinking water within a two mile radius (i.e. classification review area).

EPA believes that active restoration of the groundwater is appropriate for the site. Presently, the residents in the area obtain their groundwater from both the overburden and bedrock aquifer systems. Contamination in the bedrock aquifer has migrated beyond the Copicut River and Carol's Brook and could potentially impact the quality of drinking water in the residential wells located in the vicinity of the site. As noted above, the owner of the property adjacent to the site along North Hixville Road has commenced proceedings (i.e. to obtain local permits) necessary for the placement of a home on the property. This property in question was the location of a former residence which obtained drinking water from a shallow on-site overburden well.

Finally, it is reasonable to assume that a residence could be placed on or near the site following remediation. As mentioned previously, source soils will be remediated to levels that are protective of human health and the environment. Under these circumstances, groundwater obtained from every point outside the waste management area could be used for drinking water purposes.

Consistent with the draft Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites and EPA's Superfund Public Health Evaluation Manual, EPA evaluated a risk range of 10^{-4} to 10^{-7} individual lifetime cancer risks for carcinogens in selecting a risk level for groundwater. In selecting the appropriate risk level for the site and the rate of restoration, EPA considered the following major factors:

1. Site and groundwater characteristics;
2. Cost, reliability, speed and technical feasibility of groundwater response actions;
3. Anticipated future need for the groundwater;
4. Potential for spreading of the contaminant plume; and
5. Effectiveness and reliability of institutional controls.

EPA selected a 1×10^{-5} risk level for all groundwater outside the waste management area because this groundwater is presently used for drinking water purposes. EPA applied drinking water

standards (MCLs) in establishing the appropriate cleanup level for the site. EPA believes that MCLs are protective of human health.[16] As the legally enforceable standards under the Safe Drinking Water Act, MCLs determine the level of water quality that is acceptable for consumption by people who obtain their drinking water from public water supplies. MCLs or an equivalent level of protection (as discussed earlier, this level of protection corresponds to a 10^{-5} cancer risk) were used to calculate the level of residual risk posed by consumption of groundwater following completion of the remedial action. EPA considers a 1×10^{-5} risk level to be adequately protective of human health.

For several reasons, EPA rejects a level of 10^{-4}. First, this is a Class II aquifer which is presently being used as a drinking water source. EPA anticipates that the area surrounding the site will continue to be developed for residential use, thus increasing the future need of this aquifer. Given the hydrogeologic uncertainties at the site, and the lack of an alternative water supply system in the area, EPA does not believe a 10^{-4} level would leave an adequate margin for error as groundwater use expands.

Secondly, section 121 of CERCLA requires that Superfund response actions must attain applicable or relevant and appropriate requirements. MCLs under the Safe Drinking Water Act are ARAR's for site remediation. If groundwater is remediated to a 10^{-4} risk level, the residual concentrations of individual contaminants at the point of compliance would be in excess of their MCLs.

EPA also rejects 10^{-6} and 10^{-7} risk levels. First, the population in the area has not historically been exposed to potentially hazardous levels of contaminants for an extended period of time. Results from residential well sampling conducted as part of the Supplemental RI concluded that the drinking water from existing wells in the vicinity of the site was of acceptable quality. Secondly, due to the complex nature of the fractured bedrock aquifer system and the high concentrations of a wide variety of contaminants in groundwater, the technical feasibility of remediating groundwater to a level in excess of 10^{-5} may be limited. It should also be noted that remediation of the groundwater to the 10^{-5} level represents a 99 percent reduction from existing levels.

The aquifer characteristics and level of contaminants in groundwater limit the rate of restoration. At a maximum pumping rate of 40 pgm, the groundwater can be restored to a 1×10^{-5} risk level within 10 years. A higher pumping rate will only induce water from adjacent surface water bodies and will not restore the groundwater more rapidly.

2. Consistency with Other Environmental Laws

Environmental laws which are applicable or relevant and appropriate to the recommended source control and management of migration

alternatives at the Re-Solve site are:

- Resource Conservation and Recovery Act (RCRA)
- Clean Water Act
- Safe Drinking Water Act
- Executive Order 11990 (Protection of Wetlands)
- Toxic Substances Control Act (TSCA)
- The Clean Air Act

As specified in the Alternatives Evaluation Section, the selected remedy is expected to comply with The above laws.

The Resource Conservation and Recovery Act (RCRA) closure regulations require closure by removal of waste, waste residues and contaminated subsoils which is equivalent to closure as a surface impoundment or waste pile (40 C.F.R. 264 Supbart K and L); or closure as a landfill by capping and appropriate post-closure care (40 C.F.R. 264 Subpart N). The proposed remediation at the Re-Solve site attains the general RCRA closure performance standards as specified in 40 C.F.R. § 264.111:

The owner or operator must close the facility in a manner that:

(a) Minimizes the need for further maintenance;

(b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and

(c) Complies with the closure requirements of Subpart G including, but not limited to, the requirements of § 264.178, 264.197, 264.228, 264.258, 264.280, 264.310 and 264.351.

The proposed remediation attains the general RCRA performance goals by utilizing the relevant and appropriate sections of closure by removal and closure by capping. Excavation and treatment of PCB contaminated soils above 25 ppm will result in the removal of a large majority of wastes and waste residues and it will prevent the direct contact threat from those contaminants. The management of migration pump and treat option will minimize and eliminate to the extent necessary the migration of contaminants from the site. The gravel cover, loam, seeding and restriction of on-site groundwater use will provide the necessary long-term protection for public health and the environment.

The proposed remediation utilizes the relevant and appropriate requirements of closure by removal and closure by capping. EPA feels that closure by removal and treatment of PCBs and groundwater, attains the goals of RCRA closure by minimizing the direct contact

threat and minimizing the migration of contaminants. To ensure protection of public health and the environment, EPA believes that minimal post-closure care (including, but not limited to, gravel cover, loam, seeding, monitoring and institutional controls) is required and that the relevant and appropriate RCRA post-closure requirements are attained.

Regarding management of migration measures, the specific relevant Federal regulations are the RCRA Groundwater Protection requirements (40 C.F.R. 264 Subpart F), the Clean Water Act and the Safe Drinking Water Act. The groundwater protection regulations require the setting of groundwater protection standards which must be protective of public health and the environment. The target levels of PCE, TCE and methylene chloride are site-specific levels that the Agency has determined will adequately protect public health and the environment. The remediation will attempt to achieve these levels downgradient at the point of compliance. The point of compliance is based on the extent of PCB contamination at depth.

A groundwater monitoring system will be implemented consistent with 40 C.F.R. § 264.100(d) to determine the effectiveness of the groundwater remediation system.

The remediation of groundwater is consistent with the U.S. EPA Groundwater Protection Strategy (GWPS), which classifies the aquifer at Re-Solve as Class IIA (current usage) and requires the restoration of these aquifers. This remediation program would also be consistent with the Commonwealth of Massachusetts Groundwater Protection rules and regulations.

As discused earlier, EPA believes that it is technically infeasible to reduce PCB levels in groundwater within the waste management area to an acceptable risk level for use as a drinking water supply. Because of this, drinking water standards established under the Safe Drinking Water Act (SDWA) are not relevant and appropriate requirements within the waste management area. PCBs are not present, however, in groundwater beyond the waste management area. Hence, that groundwater can be restored to permit its use as a drinking water supply and MCLs, established under the SDWA, are relevant and appropriate and will be attained.

Excavation, filling and restoration of the wetlands will comply with the technical intent of Executive Order 11990 - Protection of Wetlands, the Clean Water Act § 404(b)(1) guidelines and the State Wetland Protection Act (310 CMR 10.00). The excavation will be performed to minimize the destruction of the wetlands. The remedial action contains components to restore the wetlands which may result in the improvement of the beneficial values of the wetlands. The restoration of the wetlands after excavation will be performed consistent with the 404(b)(1) guidelines, and with EPA and State review of the design of the mitigation measures. The Agency feels it is necessary to perform the excavation to adequately protect public health and the environment.

EPA does not consider the TSCA PCB Spill Cleanup Policy (April 2, 1987) as an ARAR for the site. This policy is prospective in nature and establishes what EPA considers to be adequate cleanup for the majority of situations when PCB contamination occurs during activities regulated under TSCA. It is clearly stated that existing spills are excluded from the scope of the policy.

Under the TSCA Disposal Requirements (40 C.F.R. § 761), EPA considers the criteria detailed in 40 C.F.R. 761.70, pertaining to thermal destruction, to be applicable for site remediation. If incineration is selected as the source control treatment technology, treatment and disposal of the 25,500 cubic yards of the PCB waste will be in accordance with these criteria.

EPA does not consider the 50 ppm regulatory threshold to be an ARAR or a cleanup standard for the site. The establishment of this regulatory limit was based on economic and administrative considerations as well as human health and the environment. As such, on a site-specific basis, it does not necesarily achieve the objective of section 121 of CERCLA. Instead, in this case EPA developed health-based cleanup standards for the site based upon a risk assessment.

Further, EPA does not consider the performance requirements for alternative treatment methods for destroying PCBs (40 C.F.R. § 761.60) to be an ARAR for the site. Forty C.F.R. § 761.60 requires that alternative treatment methods achieve a level of performance equivalent to § 761.60 incinerators or high efficiency boilers. The Agency, though, has determined that the level of performance for chemical dechlorination (APEG), a method used to detoxify PCB mixtures in transformer fluids, is 2 ppm PCBs. This clearly is not equivalent to the level of performance of § 761.60 incinerators or high efficiency boilers. Therefore, the performance level for dechlorination will be 25 ppm PCBs, the site-specific health-based cleanup standard determined to be protective of human health. Treating excavated soils to a health-based cleanup standard using an alternative treatment method is consistent with the intent of CERCLA.

During the excavation and treatment of PCB contaminated soils, and during the groundwater treatment, air emissions will be monitored and all relevant Federal and State standards will be attained. Specifically, the National Ambient Air Quality Standards (NAAQS) for particulate matter (PM_{10}) will be met through the specified techniques for excavation activities. An overview of State ARARs can be found in Appendix A.

3. Cost Effectiveness and Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable.

The source soils at the Re-Solve site are highly contaminated with PCBs and VOCs. PCBs, the primary contaminant in the unsaturated zone, are probable human carcinogens and extremely persistent in

the environment. The sediments in the wetland north of the site and the unnamed tributary are also contaminated with PCBs. One composite sample of redfin pickerel and American eel was found to be contaminated with PCBs in excess of the Food and Drug Administration's tolerance level of 2 ppm.

On-site soils are acting as a continuous source of contamination for the groundwater. Groundwater in both the overburden and bedrock aquifer systems is primarily contaminated with VOCs. Some of the VOCs are carcinogens or suspected carcinogens.

Contaminants in the overburden aquifer are predominantly discharging to adjacent surface waters and in turn, migrating away from the site. Residual contamination in the bedrock system has migrated beyond the boundaries of the site.

Dechlorination is an alternative treatment technology that will provide a permanent solution to the PCB problem at the site. Treatment of the PCB contaminated soils in the unsaturated zone to 25 ppm will reduce the risks posed to human health from direct contact with on-site soils by significantly reducing the volume and toxicity of the contaminants. This soil treatment process will also provide the added benefit of treating a percentage of the VOCs in the unsaturated zone, thus assisting in the cleanup of groundwater by eliminating a significant source of contamination to the groundwater.

Excavation of PCB contaminated sediments above 1 ppm PCB and treatment on-site will also reduce the risks posed to freshwater aquatic life associated with contact with these sediments and subsequent bioaccummulation. Freshwater aquatic life include both sediment dwelling organisms and those at higher trophic levels.

In comparison to on-site thermal destruction (incineration), dechlorination is more cost-effective while providing a similar level of reliability and protectiveness. The primary difference between the two treatment alternatives is that dechlorination is proven in the bench-scale level while incineration has been proven on a pilot-scale and full-scale level. However, selection of dechlorination is consistent with section 121(b)(2) which allows EPA to select an innovative technology, whether or not such technology has been achieved in practice at any other facility or site. Dechlorination is also preferred by the public and the Commonwealth of Massachusetts over incineration.

Active restoration of the groundwater will be accomplished using the best demonstrated available technology for treatment of groundwater. The final unit processes will be determined following completion of the treatability studies scheduled to be conducted during remedial design.

Treatment of the groundwater will permanently and significantly reduce the volume, toxicity and mobility of the volatile organics

as well as reduce the mobility of the PCBs present in the saturated zone soil matrix. Restoration of the aquifer to a 1×10^{-5} risk level will permit the groundwater beyond the waste management area boundary to be used for drinking water purposes in the future. However, EPA will require that institutional controls restricting groundwater use be implemented following completion of the remedial action. Institutional controls will be required only for the area within the waste management boundary.

Further, restoration of the groundwater will eliminate the threat posed to public health and the environment from the current and future extent of contaminant migration in groundwater and surface water.

The selected groundwater remediation alternative (MOM-2C) is more costly than the other two treatment alternatives evaluated earlier, MOM-2A Heated Influent Air Stripping and MOM-4 Pretreatment and Disposal at a POTW. However alternatives MOM-2A and MOM-4 alone are not effective in reducing the concentration of contaminants to the target cleanup levels in a time period equivalent to MOM-2C. The high levels of TVO in groundwater (200 ppm TVO) necessitates the use of carbon adsorption to achieve a 99 percent reduction in contaminant levels within 10 years of operation.

In contrast, the no action alternative is not an appropriate remedy. First, such a remedy would be unreliable and of questionable effectiveness in terms of protecting human health. Second, such a remedy would be totally ineffective in terms of protecting the environment. Third, such a remedy does not comply with relevant and appropriate requirements. Finally, no action is exactly what Congress did not intend to encourage in creating a strong statutory preference for remedies that destroy wastes.

In addition, the containment option is not an appropriate remedy because, over the long-term, there are no guarantees that such containment will remain effective. Further, containment will not remove the soil contamination; leaching of these contaminants into the groundwater, particularly the VOCs, would continue, although at a reduced rate compared to present, unremediated conditions. Failing to treat the groundwater would render the groundwater in the vicinity of the site unusable for drinking water for a substantial period of time. The groundwater would also continue to act as a source of contamination to off-site surface waters.

Based on information contained in the Administrative Record for the Re-Solve site, the Agency considers that the selected remedial action is consistent with section 121 of CERCLA and utilizes treatment which permanently and significantly reduces the volume, toxicity and mobility of the hazardous substances at the site as a principal element. Further, the remedial action is protective of human health and the environment, cost-effective and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

C. Evaluation of Selected Remedy vs Other Alternatives

The July 24, 1987 memorandum from the Assistant Administrator for the Office of Solid Waste and Emergency Response entitled "Additional Interim Guidance for FY'87 Record of Decision" establishes nine evaluation criteria which are to be used to explain the rationale for selecting the chosen alternative.

Certain of these criteria are mandated by CERCLA; others derive from the current NCP and existing RI/FS and ROD guidances.

As described earlier, an initial screening of alternatives was conducted using the process contained in the current NCP. This approval was deemed acceptable because CERCLA requirements are either equal to or more stringent than those in the NCP. Hence, screening on the basis of the current NCP would not eliminate alternatives that would be acceptable under CERCLA. That screening process resulted in identification of 5 source control and 3 management of migration alternatives. Certain features of these alternatives were then selected as components of the final remedy described earlier. A comparison of the final remedy with these alternatives was conducted, based upon the nine (9) evaluation criteria. The results are as follows:

1. Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA, as amended by SARA, requires that remedial actions comply with requirements or standards under Federal and State environmental laws. The requirements that must be complied with are those that are applicable or relevant and appropriate to the hazardous substances, pollutants, or contaminants that remain on-site.

All of the alternatives, with the exception of those for No-Action (SC-1 and MOM-1), will meet all Federal and State ARARs. Pilot studies will be required for the dechlorination process to identify the chemical constitutents of the byproducts (i.e., sidestreams) and to determine the degree of future management. If it is determined that the residuals from the dechlorination process must be disposed of off-site, shipment of such residuals will be in accordance with RCRA and DOT requirements. Trial burns will be conducted to meet RCRA and TSCA requirements for those alternatives utilizing thermal destruction, and analysis of residuals will be conducted to determine necessary management.

The selected remedy meets all Federal and State ARARs. Because of the innovative nature of dechlorination technology, the ROD calls for additional pilot-scale evaluation to assess the implementability of this technology on a large scale and the effectiveness in VOC reduction. If such studies show that dechlorination cannot be implemented to meet ARARs, the remedy will be modified to provide on-site incineration as a substitute technology.

All alternatives, except no action, as well as the selected remedy, do require identical work in wetlands areas. Adequate steps can be taken to minimize any system impacts on the wetlands, and all alternatives include mitigative steps to comply with wetlands requirements.

2. Reduction of Volume, Toxicity, or Mobility

This evaluation criteria relates to the performance of a technology or remedial alternative in terms of eliminating or controlling risks posed by the volume, toxicity or mobility of hazardous substances.

The selected remedy will result in the treatment of 25,500 c.y. of soil and sediment contaminated primarily with PCBs and volatile organics. Preliminary results from a bench-scale studies on Re-Solve soils and pilot-scale study in Region II indicate that dechlorination will be successful in reducing PCB levels. Bench-scale tests on Re-Solve soils, however, indicate uncertainty about the extent of reduction of other organic compounds.

The pilot studies necessary to scale up the PCB dechlorination process will also be used to assess the degree of attendant VOC reduction. If the degree of VOC reduction is inadequate to allow the groundwater pump and treat system to achieve its goal within the estimated 10 year timeframe, various means of pre- or post-treatment of soils will be investigated to provide further, adequate VOC reduction. If such reduction cannot be achieved, the remedy calls for substitution of on-site mobile incineration, a proven technology for destruction of both PCBs and organics.

Groundwater treatment called for in the selected remedy, as well as in several alternatives evaluated for consideration of management of migration, will reduce the volume of hazardous organic substances in the groundwater (99 percent reduction). Reduction of organic levels will, in turn, render the PCBs in the saturated zone soil matrix relatively immobile.

A pilot treatability study will be conducted to evaluate the effectiveness of air stripping to remove semi-volatiles, such as ketones. If needed, heated air stripping will be incorporated into the final groundwater treatment train to assure adequate removal of ketones.

3. Short-Term Effectiveness

Short-term effectiveness measures how well an alternative is expected to perform, the time to achieve performance and the potential adverse impacts of its implementation.

The source control component of the selected remedy requires excavation and treatment by dechlorination of 25,500 c.y. of PCB contaminated soil and sediment. Implementation will require an estimated 2 years, exclusive of design, bidding and award time. Excavation could result in the release of airborne volatile

organics and PCB contaminated fugitive dust. To mitigate this, excavation will be restricted to sheet piling vertical cuts. Additional suppressant techniques, such as foam or water spray, may also be needed. Air monitoring will be conducted at the perimeter of the site for VOC, PCB vapor and PCB particulates.

Excavation of sediment in the wetlands will result in unavoidable impacts and disturbances to wetland resource areas which may include destruction of vegetation, loss of indigenous species and downstream migration of PCBs. To minimize such impacts, remediation would be restricted to seasonal low water periods (late summer-early fall). This constraint will require careful scheduling of the project to avoid downtime while waiting for such low water periods.

Because dechlorination is an innovative technology and is currently being implemented on a pilot-scale level, there may be delays in project implementation if the number of full-scale units are limited.

The management of migration component of the selected remedy is alternative MOM-2C, Precipitation/Air Stripping/Activated Carbon/ Filtration. This component will take an estimated 10 years to complete. Prior to implementation, however, a full-scale performance test and pilot treatability study will be needed to determine the maximum groundwater pumping and recharge rates and other design criteria and to verify effectiveness of the treatment train for removal of ketones. Heated air stripping, a component of (alternative MOM-2A), may be required if so indicated by the pilot treatability study. Air, groundwater, surface water and wetlands monitoring will be required during operation to assure no adverse impact to health or the environment and to monitor the effectiveness of the treatment system. If negative impacts are observed, pumping rates may be reduced to assure extraction of groundwater does not detrimentally impact wetlands.

The no-action alternative (SC-1 and MOM-1) could be implemented quickly with minimal impact on health and the environment. The operation and maintenance period for the alternative, though, including fencing, grading, seeding and implementing a long-term monitoring program, would be greater than for other alternatives. Air monitoring would be required during revegetation and grading to ensure that levels do not pose risk to on-site workers and nearby residents. Thus, this alternative requires monitoring for at least 30 years. Reduction of contaminant levels in soils and groundwater to levels protective of human health and the environment by natural attenuation could take as long as 400 years.

Both the on-site and off-site Thermal Destruction/Incineration source control alternatives require excavation of contaminated soils and emission controls as indicated for the selected alternative. Both on- and off-site incineration are proper, effective technologies. On-site incineration will take 3 years to implement, off-site an estimated 2 years. However, off-site incineration could be faced with extensive delays due to the limited commercial incinerator capacity nationwide. Further, off-site incineration will result

in greatly increased truck traffic to and from the site. As many as 4000 18 wheel truckloads of contaminated soil would be transported away, and an equal number would be required to haul clean backfill to the site. Safety measures would be needed to prevent spills on highways and prevent contamination of the Fall River Reservoir, which is located along the truck route.

Mobile incineration systems are commercially available, but there may be delays in securing a system due to the current limited capacity in the industry. EPA anticipates increased availability in the future, but this is unknown at the moment. A test burn would be conducted prior to operation to assure the effectiveness of the selected technology on Re-Solve soils, and both stack and ambient air monitoring would be conducted to ensure protection of public health on- and off-site.

Source control alternative SC-7c (Encapsulation, In-Situ Soil Flushing and Source Material Treatment) calls for construction of a soil bentonite slurry wall, excavation and destruction by one of the source control technologies of a lesser volume of soil and sediment, and soil flushing of the remaining soils. Construction of a slurry wall at depths found at Re-Solve could be implemented quickly, but may not be effective due to problems with sealing joints in fractured bedrock. The required soil excavation will raise the same concern as other source control alternatives, but due to the greatly reduced volume, should be more easily monitored and controlled. Impact upon the wetlands would be the same. In-situ soil flushing will require bench-scale and pilot-scale tests to verify its effectiveness. This alternative could require operation for as long as 40 years to achieve the remediation goals.

4. Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence addresses the long-term protection and reliability an alternative affords.

With the exception of the no-action alternative, each of the alternatives, including the selected remedy, should provide equivalent protection of public health and the environment, because each can be designed to achieve the remediation goals established for the site. None of the alternatives result in complete destruction or removal of all waste, so each would require a review every five years, as mandated by CERCLA section 121(c).

The no action alternative would not be permanent, effective or reliable since contaminants would continue to move from soil into groundwater and on into the surrounding environment. The monitoring program would track, but not control, such movement. Fences, warning signs and similar barriers to limit exposure would require periodic public awareness efforts to monitor effectiveness.

The use of a slurry wall, to contain water, as part of source control alternative SC-7c may not be reliable in the long-term. Leaching, either, under the wall or through the wall itself, as a result of long-term contact between the wall and certain

mobile organic compounds, may release contaminants into the environment. Although bench- and pilot-scale studies would be conducted as part of design, there is some question as to the long-term reduction in PCB levels that would be attainable through this technology.

Both on-site and off-site Thermal Destruction/Incineration would be effective, permanent and reliable alternatives, to the extent that the contaminants in the soils would be destroyed. Similarly, all of the groundwater treatment technologies considered would result in effective and permanent destruction of contaminants. All show the same difficulty with reliability in that all require design of a groundwater extraction system that would result in all contaminants being processed through the treatment train. It is possible that some contaminated groundwater hot spots would escape extraction and treatment and remain in the environment.

The selected remedy shares these problems in common with the other alternatives. If design studies indicate a concern about the effectiveness of dechlorination, incineration would be substituted. The remaining element, however, should be as effective and reliable as the other alternatives.

5. Implementability

Implementability considerations address how easy or difficult, feasible or infeasible it would be to carry out a given alternativ from design through construction and operation and maintenance. The implementability of an alternative is evaluated in terms of technical and administrative feasibility, and availability of needed goods and services. The alternatives evaluated here are all technically feasible. However, there are some minor implementation problems associated with each of the alternatives.

The use of innovative technologies in the selected remedy (i.e., dechlorination) and soil flushing in source control alternative SC-7c are dependent on the outcome of needed pilot and/or bench-scale studies. Both concepts, however, would rely on readily available chemicals and equipment. EPA is aware of one company that is planning to build a full-scale dechlorination unit by the spring of 1988.

Off-site Incineration, SC-14, will be dependent upon adequate capacity at a commercial RCRA/TSCA incinerator, and upon the availability of facilities in compliance with all regulatory requirements, as required by section 121 of CERCLA and EPA's Off-site Policy. At present, there are only three facilities that will accept PCB-contaminated soils for incineration and these will only accept small quantities. Therefore, the large volume involved at Re-Solve would require a phased delivery schedule.

On-Site Thermal Destruction, SC-2, would utilize a mobile incineration system. Such systems are now commercially available and there are no anticipated difficulties in obtaining the

appropriate equipment. It should be noted, however, that full scale operation of such transportable units at hazardous waste sites has been limited, and units have experienced extended periods of downtime.

The on-site groundwater treatment system proposed in alternatives MOM-2a and MOM-2c, as well as in the selected remedy, are standard technologies and should be readily available.

Alternative MOM-4, which calls for pretreatment and disposal of contaminated groundwater at a POTW, would be subject to permit requirements, both for the discharge to the POTW and for the POTW effluent itself. Extensive modification of the existing POTW could be required to satisfy such requirements. Thus, EPA's ability to implement this alternative is highly questionable.

6. State Acceptance

The State acceptance addresses the concern and degree of support that the State government has expressed regarding the remedial alternative being evaluated.

The Commonwealth of Massachusetts has reviewed the various alternatives and has indicated its concurrence with the selected remedy.

7. Community Acceptance

This evaluation criteria addresses the degree to which members of the local community support the remedial alternatives being evaluated.

During the public comment period on EPA's Proposed Plan, a number of commentors (Sierra Club, Town of Dartmouth, Re-Solve Citizens' Advisory Committee, and Westport River Defense Fund) supported EPA's choice of dechlorination and groundwater treatment for the Re-Solve site. The Sierra Club also supported incineration as the backup option.

The local community has reservations about potential air emissions from excavation and handling activities and strongly favors stringent air monitoring and the use of mitigative measures to control any unavoidable emissions.

8. Cost

Costs are evaluated in terms of remedial action costs and replacement costs.

The present worth cost for the source control component of the selected remedial action is based on treatment of 25,500 c.y. of PCB contaminated soils and sediments to a level of 25 ppm PCB. EPA estimates that it will take two (2) years to treat this volume by dechlorination. The estimated present worth cost is $9,237,000.

Included in this cost estimate is an additional 10 percent contingency. This is included because dechlorination is a new and innovative technology and as such, requires that a contingency be provided during scale-up to accommodate variable sidestream process requirements.

By comparison, the estimated present worth cost to treat the same volume by on-site incineration, over a two(2) year period, is $16,963,000. The cost/c.y. estimate used to derive this present worth estimate is $400/c.y. This cost/c.y. estimate is for capital cost and operation and maintenance and does not include costs for excavation and management of residuals.

The estimated present worth cost for off-site incineration of 25,500 c.y. of PCB contaminated soils and sediments is $80,000,000. This estimate could be subject to change, though, depending on the availability of an off-site facility.

For both the no action alternative and alternative SC-7c, studies would have to be performed every five years to ensure the continued effectiveness of the containment component.

As part of the selected remedy, groundwater would be treated to reduce contaminants to levels which will result in an excess cancer risk of $1X\ 10^{-5}$, assuming additivity. The estimated period of time to achieve this level of remediation is 10 years. The estimated present worth cost of the groundwater remediation component (MOM-2C) of the selected remedy is $10,674,000.

The selected groundwater remediation alternative is more costly than the other two treatment alternatives evaluated earlier, MOM-2A, Heated Influent Air Stripping and MOM-4, Pretreatment and Disposal at a POTW. Alternatives MOM-2A and MOM-4 alone are not effective in reducing the concentrations of contaminants in groundwater to the target remediation levels in a time period equivalent to MOM-2C. The high level of contamination in groundwater necessitates the use of carbon adsorption near the end of the remediation period, to ensure attainment of the target cleanup levels.

9. Overall Protection of Human Health and the Environment

Protection of human health and the environment is the central mandate of CERCLA as amended by SARA. Protection is achieved by reducing threats to acceptable levels and taking appropriate action to ensure that, in the future, there will be no unacceptable risks to human health and the environment through any exposure pathways.

All alternatives that underwent detailed analysis in this ROD provide, to some degree, protection of human health and the environment. However, the selected remedy, on-site dechlorination of 25,500 c.y. of PCB contaminated soils and sediments to a treatment level of 25 ppm PCB and remediation of groundwater to an excess cancer risk of 1 X 10-5, provides the highest degree of protection.

Dechlorination, although innnovative, is a treatment process that has been demonstrated on a pilot-scale level to be effective in reducing PCBs in soils to levels that are protective of human health and the environment. Excavation and treatment of PCB contaminated soils and sediments, at concentrations greater than 25 ppm and 1 ppm, respectively, will reduce the volume and toxicity of the hazardous substances at the site.

On-site incineration would offer a similar level of protection as that of dechlorination. The primary difference between the two, excluding cost, is that dechlorination is a closed system (i.e. no emissions from the unit) and incineration produces air emissions. It would be necessary to monitor air emissions from the incinerator during operation to ensure that the levels do not pose a risk to on-site workers and nearby residents.

Alternative SC-14 Off-site Incineration would offer a similar degree of protectiveness on-site, but during implementation noise and truck traffic in the area would increase significantly. In addition, the potential threat of an accident during transport of materials places the drinking water supply of Fall River in danger.

Alternative SC-7C would have the least problems during the remedial action implementation phase and would reduce the risks posed to human health and the environment from direct contact. But, this alternative would not significantly reduce the volume, toxicity and mobility of hazardous substances present at the site. Leaching of these contaminants into groundwater, particularly the VOCs, would continue, although at a reduced rate compared to the present unremediated conditions. Further, over the long-tern, the effectiveness of containment is in question.

The groundwater treatment process represents the best demonstrated available technology for the treatment of the on-site contaminants. Pilot studies will be conducted prior to implementation of the remedy to determine the appropriate unit process that will be used to remediate groundwater. Treatment of groundwater will permantly and significantly reduce the volume, toxicity and mobility of the volatile organics as well as reduce the mobility of the PCBs present in the saturated zone soil matrix.

In contrast, alternative MOM-4 is protective and effective in reducing contaminant levels, but the availability of an off-site POTW to accept the effluent remains uncertain.

Conclusion

Based on information available to evaluate the five (5) source control and three (3) management of migration alternatives against the nine (9) criteria, EPA has concluded that the selected remedy is protective of human health, attains all applicable or relevant and appropriate requirements and is cost-effective. Additionally, because the selected remedy employs dechlorination and on-site treatment of groundwater to eliminate the principal threats at the site (i.e. PCBs in soils/sediments and VOCs in groundwater), this

remedy also satisfies CERCLA's preference for remedies which employ treatment as their principal element to reduce the volume, toxicity or moblity of hazardous substances at the site.

Although this remedy will require measures to control possible risks related to its construction and operation, the Agency's analysis indicates that all of these risks can be satisfactorily controlled. Additionally, any short-term risks appear heavily outweighed by the long-term effectiveness and permanence this remedy will provide. The Agency believes this remedy for this site avoids the long-term uncertainties associated with land disposal, provides a permanent solution and utilizes alternative treatment technologies to the maximum extent practicable.

VII State Role

The role of the Commonwealth of Massachusetts in this Federal lead site is multiple. The State reviews documents to determine if they are in compliance with applicable or relevant and appropriate State environmental laws and provides comments on all EPA funded studies at the site.

The Commonwealth of Massachusetts concurs with the selected remedy for the Re-Solve, Inc. site located in North Dartmouth, Massachusetts. A copy of the Commonwealth's evaluation of the selected remedy's consistency with M.G.L. ch. 21E, as amended in November, 1986, and declaration of concurrence is in Appendix B.

The Commonwealth of Massachusetts will provide:

- 10 percent of the capital cost of the selected remedy;
- 10 percent of the operation and maintenance costs throughout the implementation of the remedy; and
- Cost for long-term monitoring and other activities following completion of the selected remedy.

END NOTES

1. Environmental Protection Agency (EPA). 1980. Ambient Water Quality Criteria for Polychlorinated Biphenyls. Office of Water Regulations and Standards, Criteria and Standards Division, Washington, D.C. EPA 440/5-80-088.

2. This alternative represents the combination of several treatment/handling technologies. The technologies, as individual processes, would not treat the contamination to a level comparable as that of the other proposed alternatives. As opposed to screening out these technologies from further evaluation,the SC-7 In-Situ Soil Treatment alternative has been divided into three sub-alternatives. This provides for each sub-alternative to progressively build on the level of effectiveness provided by a lower level sub-alternative. For the purposes of the ROD, SC-7c; Encapsulation, In-Situ Soil Flushing and source Material Treatment will undergo detailed analysis.

3. Excavation of 64,000 cubic yards of PCB contaminated soils and sediments and associated costs are inherent to all source control alternatives containing treatment as a principal element (i.e., SC-4 Dechlorination and SC-14 Off-site Incineration). A lesser volume of contaminated soils and sediments is treated in alternative SC-7c, but the same excavation techniques described herein shall be utilized.

4. Remediation of PCB contaminated sediments in wetland areas and associated costs are inherent to all source control alternatives. Alternative SC-12, Sediment Removal and Treatment, was the only alternative for the treatment of PCB contaminated sediments that emerged from the initial screening step and was incorporated as a component alternative for each source control alternative.

5. These Federal and State public health and environmental requirements pertaining to remediation of PCB contaminated sediments are also applicable or relevant and appropriate for all source control alternatives, SC-4, SC-7c and SC-14.

6. Refer to the evaluation of alternative SC-2, On-site Thermal Destruction, for a more detailed discussion on the method for excavation of contaminated soils and sediments at the Re-Solve, Inc. site.

7. Ibid.

8. The effluent polishing system described as part of this alternative is the same for alternative MOM-2C Carbon Adsorption.

9. The approach used to develop the range of cleanup goals for the Re-Solve, Inc. site is consistent with EPA Guidance entitled Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup, prepared by the Exposure Assessment Group, Office of Health and Environmental Assessment, May 1986.

END NOTES (Cont'd)

10. Long, E.R., and Chapman, P.M. 1985. A sediment quality triad: Measures of sediment contamination, toxicity and infaunal community composition in Puget Sound. Mar. Pollut. Bull. 16:405-415. Chapman, P.M. 1986. Sediment quality criteria from the sediment quality triad: An example. Environ. Toxicol. Chem. 5:965-976.

11. Tetra Tech. 1986. Development of Sediment Quality Value for Puget Sound. Final Report. Prepared for Resource Planning Associates under U.S. Army Corps of Engineers, Seattle District, for the Puget Sound Dredged Disposal Analysis and Puget Sound estuary Programs. September 1986. 128 p.p. and appendices.

12. Thibodeaux, L.J., Reible, D.D., and Fang, C.S. 1986. Transport of Chemical Contaminants in the Marine Environment Originating from Bottom Deposits -- A Vignette Model. In "Pollutants in a Multimedia Environment," Ed. by Y. Cohen. Plenum Publishing Co., New York.

13. Environmental Protection Agency (EPA). 1987. Review and Development of Methodologies for Estimating Exposure to Dioxin. The Exposure Assessment Group. Office of Health and Environmental Assessment. Office of Research and Development. January 1987.

14. Environmental Protection Agency (EPA). 1980. Ambient Water Quality Criteria for Polychlorinated Biphenyls. r

15. Connolly, J.P., and Thomann,R.V. 1986. WASTOX, A Framework for Modeling the Fate of Toxic Chemicals in Aquatic Environments. Part 2: Food Chain. Prepared for EPA Environmental Research Laboratories at Gulf Breeze and Duluth.

16. Letter from Lee M. Thomas, Administrator, U.S. EPA to Honorable James J. Florio, House of Representatives, regarding the Agency's implementation of the Superfund Amendments and Reauthorization Act of 1986 (SARA).

17. Rice, Clifford P. and White, David S. 1987. PCB Availability Assessment of River Dredging Using Caged Clams and Fish. Environmental Toxicol. Chem. 6:259-274.

Appendices

APPENDIX A

Applicable or Relevant and Appropriate Requirements for the Commonwealth of Massachusetts

S. Russell Sylva
Commissioner
(617) 292-5851

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Hazardous Waste
One Winter Street, Boston, Mass. 02108

August 31, 1987

Linda Murphy, Chief
Massachusetts Waste Management Branch
U.S. Environmental Protection Agency
J.F. Kennedy Federal Building
Boston, MA 02203

Dear Ms. Murphy:

The Department of Environmental Quality Engineering (the Department) has reviewed the June 1987 Draft Feasibility Study (FS) for the ReSolve Federal Superfund Site in Dartmouth, Massachusetts. The purpose of this letter is to identify the Deparment's "applicable or relevant and appropriate standards, limitations, criteria, and requirements" (ARARs) for the site. A preliminary list of the Department's ARARs was given to EPA in early 1987 and included in the draft FS on Table 2-1. The Department requests that the list of State Requlations be updated to include Table I attached to this letter.

The Department understands that for work conducted on-site, substantive requirements of these regulations are ARARs and not the procedural/administrative requirements (i.e., Federal, State, and Local permits) of the regulations.

In an attempt to provide information on each item listed in Table I, a short summary stating the authority and purpose for each regulation is included in Table II. The summaries in Table II demonstrate that standards, requirements, or criteria in the regulations are promulgated under State environmental laws.

The Department has reviewed the alternatives described in the draft FS. Table III presents the Department's determination of ARARs associated with environmental media impacted by activities for each alternative separately discussed in Section 4 of the draft FS.

Section 121(a) and (b) of CERCLA, as amended by SARA, establish requirements for the degree of cleanup for remedial actions at Federal Superfund sites. In addition to other criteria, the amendments require that remedial actions on-site shall attain Federal ARARs and more stringent State ARARs. Table IV includes the list of the more stringent State ARARs for the ReSolve site.

In addition to the ARARs listed in Table IV, the Department's review of draft design plans and specifications for the selected remedial action will identify conditions necessary to mitigate the impact of the construction project to the environment. Conditions identified during the Department's review of the project should be included in the specifications for the project. All pollution control systems are required by law to be approved by the Department.

Finally, all Superfund sites are subject to M.G.L. c. 21E. Chapter 21E is the State's general statutory authority with respect to regulating releases of hazardous materials and oil and therefore can not be waived through the ARAR process.

The Department, pursuant to M.G.L. c. 21E, must recommend an approach for the site that is consistent with the statute. Pursuant to M.G.L. c. 21E, the selection of a permanent remedy is the goal for cleanup of disposal sites. Under § 3A(q) of Chapter 21E a "permanent solution" is a measure or combination of measures that, at a minimum, will attain a level of control for each contaminant at and around the site so that no contaminant of concern will present a significant or otherwise unacceptable risk of damage to health, safety, public welfare, or the environment. The statute also requires that where feasible, measures must reduce contaminants to a "level that would exist in the absence of the disposal site of concern." An evaluation of EPA's recommended selected alternative for the site to determine compliance with the requirement of M.G.L. c. 21E is underway. It is anticipated that a final determination will be made by September 10, 1987.

This list is the Department's first comprehensive attempt to establish a list of ARARs under the SARA amendments. I understand this may also be one of the first such compliations EPA Region I has received from the New England States. As such we look forward to working with you on any questions you may have. For additional information please contact Robert Bois at 292-5833.

Very truly yours,

Edmond Benoit, Deputy Director
Office of Incident Response

EB/lgw
Attachments

cc: Willard Pope, OGC
Robert Donovan, SERO
Richard Cavagnero, EPA
Bruce Maillet, DAQC
William Gaughan, DWPC
Pat Deis, DWS
Gary Clayton, Wetlands/Waterways

TABLE I

State Regulations*

1. 105 CMR Department Public Health

   (a) 105 CMR 670.000, "Right to Know"

2. 301 CMR Executive Office of Environmental Affairs

   (a) 301 CMR 11.00, Massachusetts Environmental Policy Act Regulations

3. 310 CMR Department of Environmental Quality Engineering Regulations

   (a) 310 CMR 6.00, Ambient Air Quality Standards for the Commonwealth of Massachusetts

   (b) 310 CMR 7.00, Air Pollution Control

   (c) 310 CMR 9.00, Administration of Waterways Licenses

   (d) 310 CMR 10.00, Wetlands Protection

   (e) 310 CMR 19.00, Disposal of Solid Waste by Sanitary Landfill

   (f) 310 CMR 22.00, Drinking Water Regulations

   (g) 310 CMR 27.00, Underground Water Source Protection

   (h) 310 CMR 30.00, Hazardous Waste Regulations

   (i) 310 CMR 33.00, Implementation of M.G.L. c. 111F, Employee and Community "Right to Know"

4. 314 CMR Massachusetts Water Pollution Control Regulations

   (a) 314 CMR 3.00, Surface Water Discharge Permit Program

   (b) 314 CMR 4.00, Surface Water Quality Standards

   (c) 314 CMR 5.00, Groundwater Discharge Permit Program

   (d) 314 CMR 6.00, Groundwater Quality Standards

   (e) 314 CMR 7.00, Sewer System Extension and Connection Permit Program

(f) 314 CMR 9.00, Certification for Dredging, Dredging Material Disposal, and Filling in Waters

(g) 314 CMR 12.00, Operation and Maintenance and Pretreatment Standards for Waste Water, Treatment Works, and Indirect Discharges

5. 441 CMR Department of Labor and Industries

(a) 441 CMR 21.00, Worker "Right to Know"

* Applicable statutes are listed in Table II

TABLE II

Authority and Purpose

1(a) 105 CMR 670.000 regulations are adopted by the Department of Public Health pursuant to the authority granted it by M.G.L. c. 111F, § 2. The regulations establishes the Massachusetts Substance List and amendments of regulated substances, trade secrets and research lab exemptions. The goal of the regulations is to protect public health by providing and encouraging the greatest possible transmission of health and safety information concerning toxic and hazardous substances.

2(a) 301 CMR 11.00 regulations govern the implementation of the Massachusetts Environmental Policy Act, M.G.L. c. 30, §§ 62-62H. These regulations provide a substantive basis to use all feasible means or measures to avoid or minimize adverse environmental impact in compliance with environmental standards for decisions made in compliance with M.G.L. c. 30, § 61.

3(a) 310 CMR 6.00 regulations are adopted by the Department pursuant to the authority granted it by M.G.L. c. 111, § 142(d). The regulations set primary and secondary air quality standards for certain pollutants.

3(b) 310 CMR 7.00 regulations adopted by the Department pursuant to the authority granted it by M.G.L. c. 111, §§ 142(a)-142(j) and M.G.L. c. 21C, §§ 4 and 6. The purpose of the regulations are to prevent the occurence of conditions of air pollution where such do not exist and to facilitate the abatement of conditions of air pollution where and when such occur.

3(c) 310 CMR 9.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 21A, § 2 to implement M.G.L. c. 91, §§ 1-63 and M.G.L. c. 21A, §§ 2, 4, 8, and 14. The regulations establish procedures, criteria and standards for the uniform and coordinated administration of the provision of M.G.L. c. 91, work (dredging etc.) that takes place in a waterway (stream, river).

3(d) 310 CMR 10.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 131, § 40. The regulations establish procedures, criteria, and standards for work in a wetland (dredging, altering, etc.) subject to the protection under M.G.L. c. 131, § 40.

3(e) 310 CMR 19.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 111, § 150A. The regulations establish rules and requirements for solid waste disposal facilities.

3(f) 310 CMR 22.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 111, § 160. The regulations establish standards and requirements deemed necessary to prevent pollution and to assure the sanitary protection of water used as sources of public water supply and to ensure the delivery of fit and pure water to all consumers.

3(g) 310 CMR 27.00 regulation are adopted by the Department pusuant to the authority granted it under M.G.L. c. 111, § 160; c. 21, § 27. The regulations govern any underground injection of hazardous wastes, of fluids used

for extraction of minerals, oil, and energy and certain other fluids with potential to contaminate groundwater in order to protect underground sources of drinking water.

3(h) 310 CMR 30.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 21C, §§ 4 and 6 and M.G.L. c. 21E, § 6. The regulations establish rules and requirements for the generation, storage, collection, transportation, treatment, disposal, use, reuse, and recycling of hazardous materials, in Massachusetts under M.G.L. c. 21C, and M.G.L. c. 21E.

3(i) 310 CMR 33.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 111F. The regulations establish rules and requirements for the dissemination of information related to toxic and hazardous substances to the public.

4(a) 314 CMR 3.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 21, §§ 27 and 43. The regulations establish requirements for discharges of pollutants to surface waters of the Commonwealth. In addition to regulating these discharges, M.G.L. c. 21, § 43 also requires the Department to regulate the outlets of such discharges and any treatment works associated with these discharges.

4(b) 314 CMR 4.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 21, §§ 27(5), 27(6), and 27(12). The regulations establish Surface Water Quality Standards to meet the goal of entrancing the quality and value of the resources of the Commonwealth.

4(c) 314 CMR 5.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 21, §§ 27 and 43. The regulations establish requirements for discharges of pollutants to the groundwaters of the Commonwealth. In addition to regulating these discharges, M.G.L. c. 21, § 43 requires the Department to regulate the outlet for such discharges and any treatment works associated with these discharges to assure that these waters are protected for their highest potential use.

4(d) 314 CMR 6.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 21 §§ 27(5), 27(6), 27(12). The regulations establish Groundwater Quality Standards. These standards consist of groundwater classifications, which designate and assign the uses for which the various groundwaters of the Commonwealth shall be maintained and protected; water quality criteria necessary to sustain the designated uses; and regulations necessary to achieve the designated uses or maintain the existing groundwater quality.

4(e) 314 CMR 7.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 21, §§ 27 and 43. The regulations establish a program whereby sewer systems, extensions and connections are regulated and permitted.

4(f) 314 CMR 9.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 21, § 27(12). The regulations establish procedures, criteria, and standards for the uniform and coordinated administration of water quality certification of dredging and dredged material disposal and filling projects in the waters of the Commonwealth.

4(g) 314 CMR 12.00 regulations as adopted by the Department pursuant to the authority granted it under M.G.L. c. 21, §§ 27(9), 27(12) and 34. The regulations establish reqirements that insure the proper operaiton and maintenance of wastewater facilities and sewer systems within the Commonwealth.

5(a) 441 CMR 21.00 regulations are adopted by the Department pursuant to the authority granted it under M.G.L. c. 111F. The regulations establish requirements for worker "Right to Know".

TABLE III

Activity/ARARs

Activity	Regulation
Dredging	105 CMR 670.000 "Right to Know" Implemented by DPH.
	310 CMR 9.00 Administration of Waterways Licences
	310 CMR 10.00 Wetland Protection
	310 CMR 30.00 Hazardous Waste Regulations
	310 CMR 33.00 Implmentation of M.G.L. c. 111F, Employee and Community "Right to Know"
	314 CMR 3.00 Surface Water Discharge Permit Program
	314 CMR 9.00 Certification for dredging, dredging material disposal and filling in waters
	441 CMR 21.00 "Right to Know" Implemented by DLI.
Groundwater capture/treatment system with effluent discharge to surface water	310 CMR 10.00 Wetlands protection
	105 CMR 670.000 "Right to Know" Implemented by DPH.
	310 CMR 6.00 Ambient Air Quality Standards for the Commonwealth of Massachusetts
	310 CMR 7.00 Air Pollution Control
	310 CMR 30.00 Hazardous Waste Regulations
	310 CMR 33.00 Implementation of M.G.L. c. 111F, Employee and Community "Right to know"
	314 CMR 3.00 Surface Water Discharge Permit Program

	314 CMR 4.00 Surface Water Discharge Quality Standards
	314 CMR 7.00 Sewer Extension and Connection Permit Program
	314 CMR 12.00 Operation and Maintenance and Pre-treatment Standards for Waste Water, Treatment Works and Indirect Discharges
	441 CMR 21.00 "Right to Know" Implemented by DLI
Groundwater discharge to Public Owned Treatment Works (POTW)	314 CMR 3.00 Surface Water Discharge Permit Program
	314 CMR 4.00 Surface Water Quality Standards
	314 CMR 7.00 Sewer System Extension and Connection Permit Program
Groundwater capture/treatment system with effluent discharge to the ground	105 CMR 670.000 "Right to Know" Implemented by DPH
	310 CMR 10.00 Wetlands Protection
	310 CMR 6.00 Ambient Air Quality Standard for the Commonwealth of Massachusetts
	310 CMR 7.00 Air Pollution Control
	310 CMR 27.00 Underground Source Protection
	310 CMR 30.00 Hazardous Waste Regulations
	310 CMR 33.00 Implementation of M.G.L. c. 111F, Employee and Community "Right to Know"
	314 CMR 5.00 Groundwater Discharge Permit Program
	314 CMR 6.00 Groundwater Quality Standards

	314 CMR 12.00 Operation and Maintenance and Pre-treatment Standards for Waste Water, Treatment Works and Indirect Discharge
	441 CMR 21.00 "Right to Know" Implemented by DLI
Incineration	105 CMR 670.000 "Right ot Know" Implemented by DPH
	310 CMR 6.00 Ambient Air Quality Standards for the Commonwealth of Massachusetts
	310 CMR 7.00 Air Pollution Control
	310 CMR 30.00 Hazardous Waste Regulations
	310 CMR 33.00 Implementation of M.G.L. c. 111F, Employee and Community "Right to Know"
	441 CMR 21.00 "Right to Know" Implemented by DLI
Dechlorination	105 CMR 670.000 "Right to Know" Implemented by DPH
	310 CMR 6.00 Ambient Air Quality Standard for the Commonwealth of Massachusetts
	310 CMR 7.00 Air Pollution Control
	310 CMR 30.00 Hazardous Waste Regulations
	310 CMR 33.00 Implementation of M.G.L. c. 111F, Employee and Community "Right to Know"
	441 CMR 21.00 "Right to Know" Implemented by DLI
Containment	105 CMR 670.000 "Right to Know" Implemented by DPH
	310 CMR 10.00 Wetlands Protection

	310 CMR 30.00 Hazardous Waste Regulations
	310 CMR 33.00 Implmentation of M.G.L. c. 111F Employee and Community "Right to Know"
	441 CMR 21.00 "Right to Know" Implemented by DLI
Excavation/Off-site Disposal	105 CMR 670.000 "Right to Know" Implemented by DPH
	310 C,R 7.00 Air Pollution Control
	310 CMR 10.00 Wetlands Protection
	310 CMR 30.00 Hazardous Waste Regulations
	310 CMR 33.00 Implementation of M.G.L. c. 111F Employee and Community "Right to Know"
	441 CMR 21.00 "Right to Know" Implemented by DLI

TABLE IV

More Stringent State Requirements
for the ReSolve Site

This list is not an exclusive list

State Requirement	Standard, Requirement, Guideline Criteria, and Limitation
1. Air Quality Control	
(a)310 CMR 7.00 Air Pollution Control 310 CMR 7.01	Establishes guidelines for levels of air pollution.
2. Wetland	
(a)310 CMR 10.00 Wetland 310 CMR 10.54(4)	Requires any work on the bank of a water body, not impair: the physical stability of the bank; the water carrying capacity of the bank; the ground water and surface water quality; and the capacity of the bank to provide breeding habitat, escape cover and food for fisheries.
(b)310 CMR 10.55(4)	Prohibits over 5000 square feet of loss (dredge, fill, etc.) of bordering vegetated wetland, and requires at least 1:1 replication of any lost area within two growing seasons.
(c)310 CMR 10.56	Requires any work within land under water bodies or waterways (ponds and streams), to not impair: the water carrying capacity of any defined channel; the ground and surface water quality; and the capacity of the land to provide breeding habitat, escape cover and food for fisheries.
(d)310 CMR 10.57(4)	Requires "compensatory storage" to be provided for any work that will cause an increase in the horizontal extent and level of flood waters at peak flows.
(e)310 CMR 10.57	Establishes the standards for a Variance from any of the standards contained in 310 CMR 10.54 - 10.57. For the project to qualify for a Variance: there must be no reasonable conditions or alternatives that would allow the project to proceed in compliance with the regulations;

(e)310 CMR 10.57 (Cont.)	mitigating measures (such as full replication of all impaired wetland areas) be included in the project to contribute to the protection of the interest of the Act; and the work must be necessary to accomodatean overriding public interest.
3. Water Supply (a)310 CMR 22.00 Drinking Water	Department's Office of Research and Standards Drinking Water Guidelines for 10 organic compounds; MA Maximum Contaminant Level for Sodium.
(b)310 CMR 27.00 Undergrond Water Source Protection	Classification Program.
4. Hazardous Waste (a)310 CMR 30.00 Hazardous Waste 310 CMR 30.131	Waste with PCBs above 50 ppm is regulated as hazardous waste.
(b)310 CMR 30.620 Landfills 310 CMR 30.622	Must have double liner with leak detection system/collection (no exemptions).
310 CMR 30.623, 624	Requires demonstration of waste/liner compatability and monitoring and inspection.
310 CMR 30.628	No exceptions. Provision also for PAHs.
310 CMR 30.629	Disposal of liquids in landfills are prohibited.
(c)310 CMR 30.630 Special Requirements 310 CMR 30.630(5)	Disposal of Containers of hazardous Waste in other Containters (e.g., lab packs) is prohibited.
(d)310 CMR 30.640 Waste Piles 310 CMR 30.646	Includes provisions for PAHs as an acutely hazardous waste.
(e)310 CMR 30.690 Tank Systems 310 CMR 30.696	Minor differences corresponding to tank design requirements.
310 CMR 30.698	General performance standard only.
310 CMR 30.697(1) and (2)	State regulations include polyaromatic hydrocarbons (PAHs).

5. Water Pollution Control	
(a) 314 CMR 3.00 Surface Water Discharge Permit Program 314 CMR 3.16 (2) and (3)	Incorporates Standards from 4.02
(b) 314 CMR 4.00 Surface Water Quality Standards 314 CMR 4.02 314 CMR 4.03 (4) A.1, (4) A.2 314 CMR 4.04	Requires additional Standards Minimum Water Quality Criteria Antidegradation Provisions
(c) 314 CMR 5.00 Groundwater Discharge Permit Program	No similar Federal Program. Groundwater classification.
314 CMR 5.10	MCL, Health Advisories used as Standards. For chemcials with no such standard, acceptable levels will be risk based.
(d) 314 CMR 6.00 Groundwater Quality Standards 314 CMR 6.06	Minimum Groundwater Qualtiy Criteria.
(e) 314 CMR 7.00 Sewer System Extension and Connection Permit Program	State Program

APPENDIX B

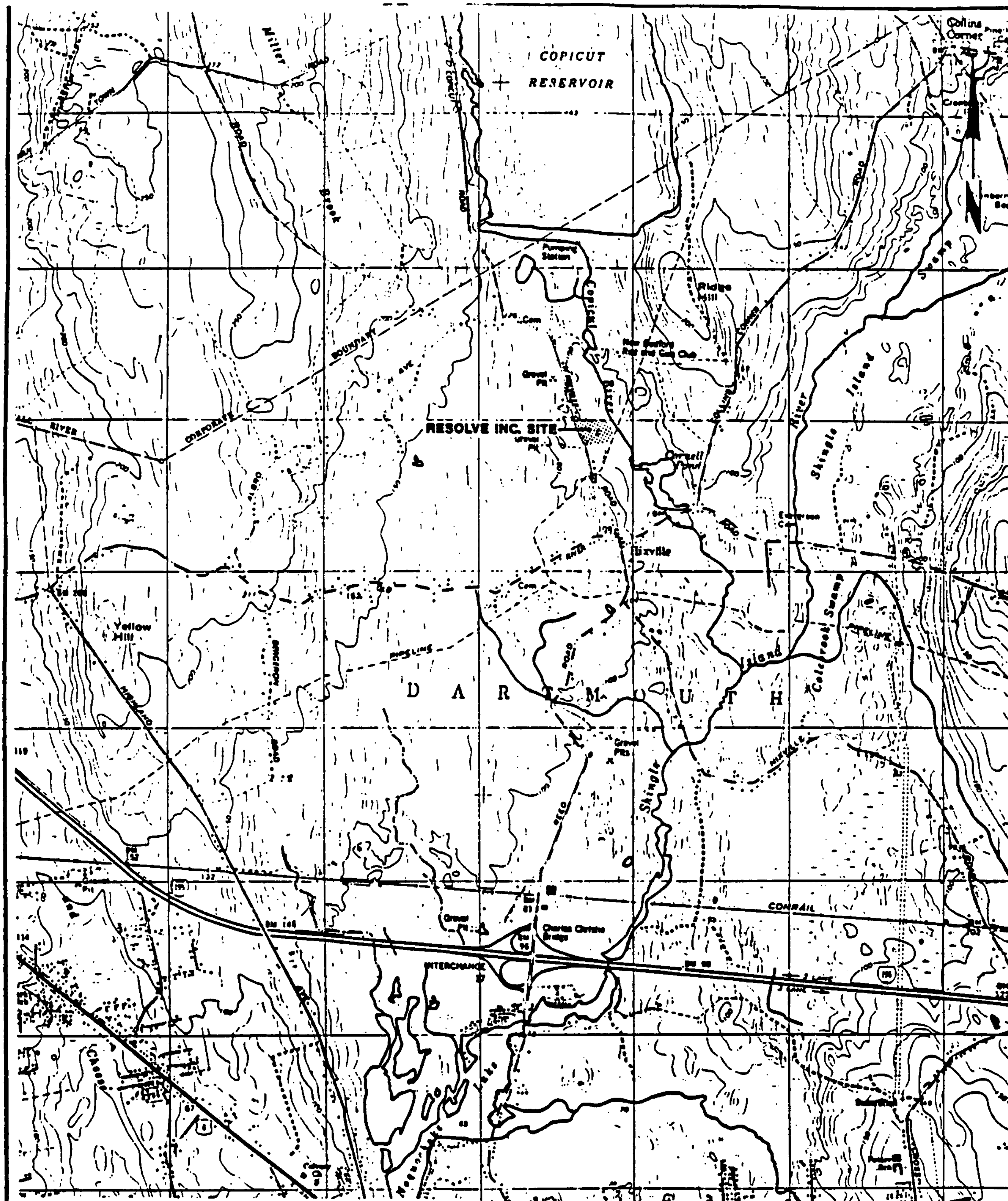
State Evaluation and Concurrence Memorandum

APPENDIX C

Data Base - Figures and Tables

FIGURES

FIGURES (cont'd)



SOURCE: U.S.G.S. FALL RIVER EAST QUADRANGLE

RESOLVE INC. SITE

NORTH DARTHMOUTH, MASSACHUSETTS

RECORD OF DECISION

SEPTEMBER 1987

FIGURE C-1

SITE LOCATION

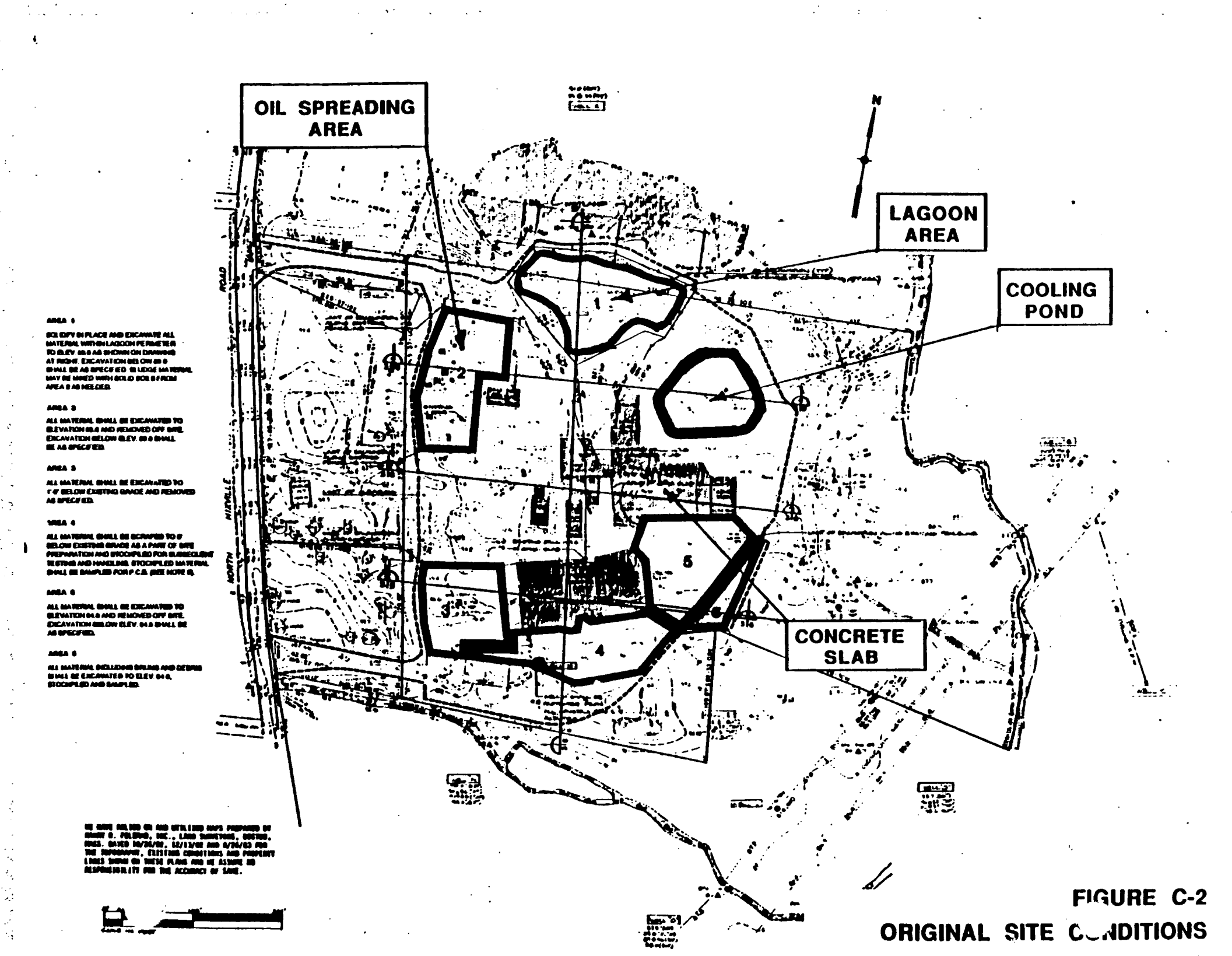
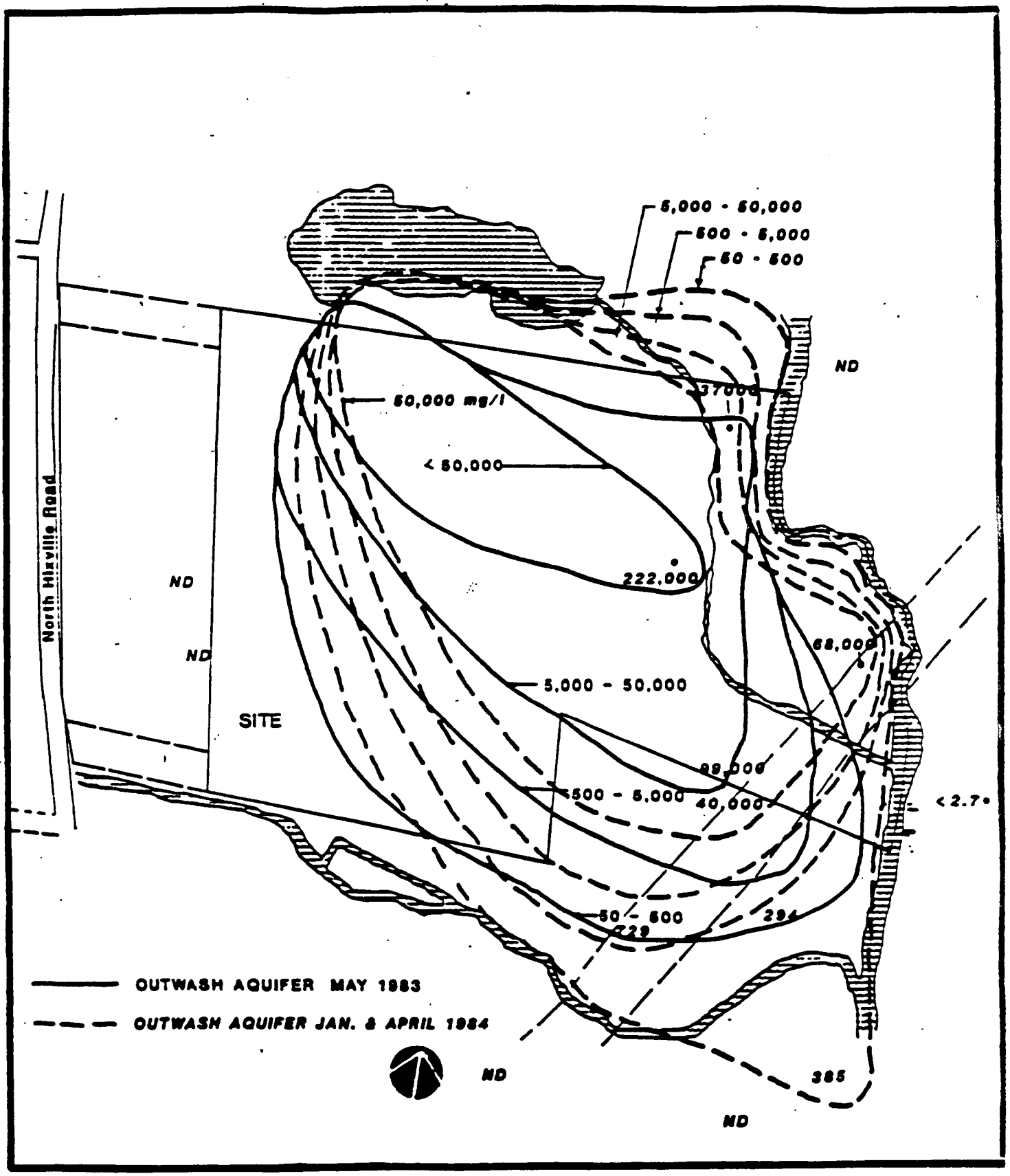
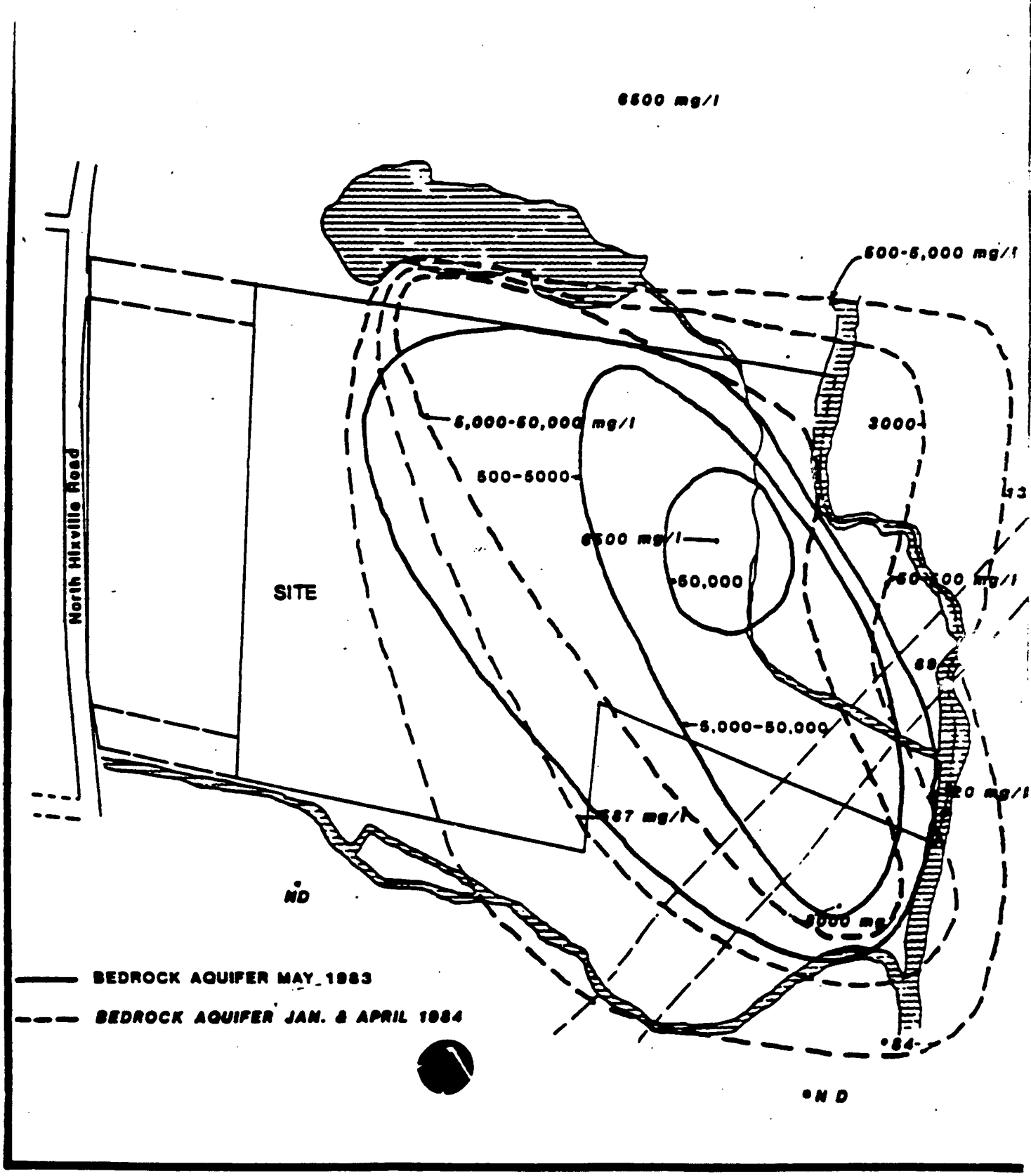


FIGURE C-2
ORIGINAL SITE CONDITIONS



RESOLVE SITE
Dartmouth, Massachusetts
Record of Decision
September 1987

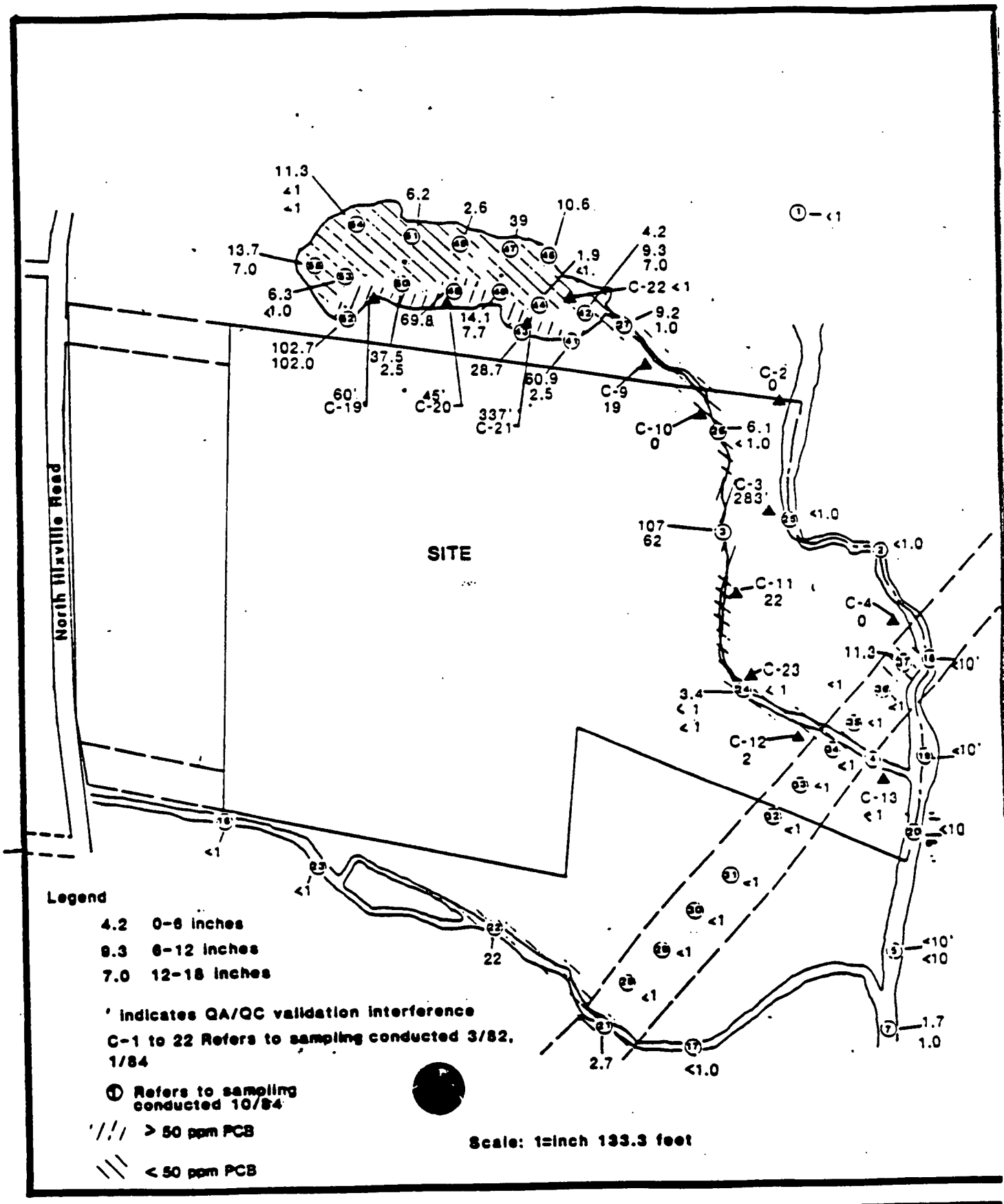
FIGURE C-3
TOTAL VOLATILE ORGANICS CONCENTRATION IN THE OVERBURDEN AQUIFER



RESOLVE SITE
Dartmouth, Massachusetts
Record of Decision
September 1987

FIGURE C-4

TOTAL VOLATILE ORGANICS CONCENTRATION IN THE BEDROCK AQUIFER



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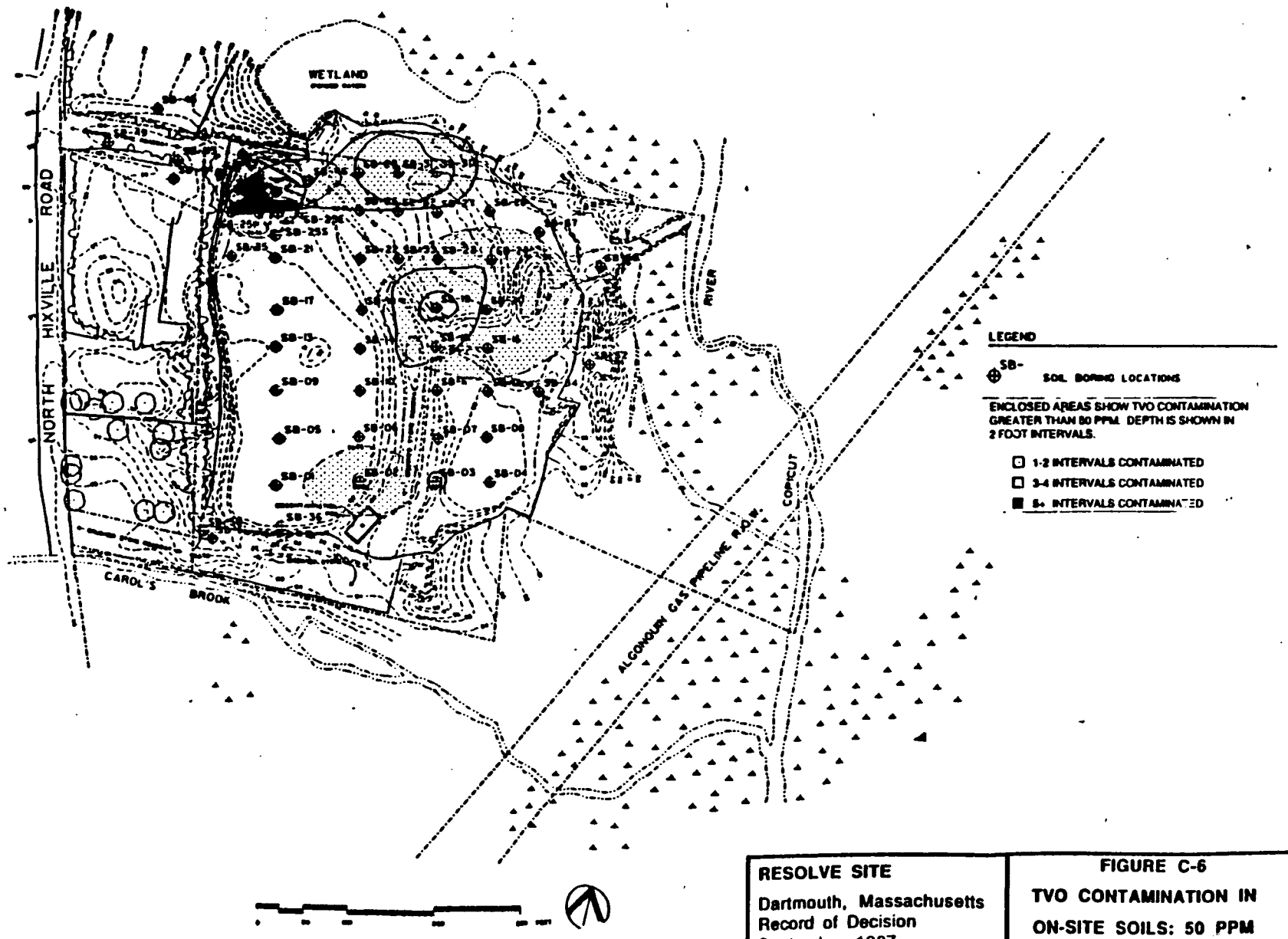
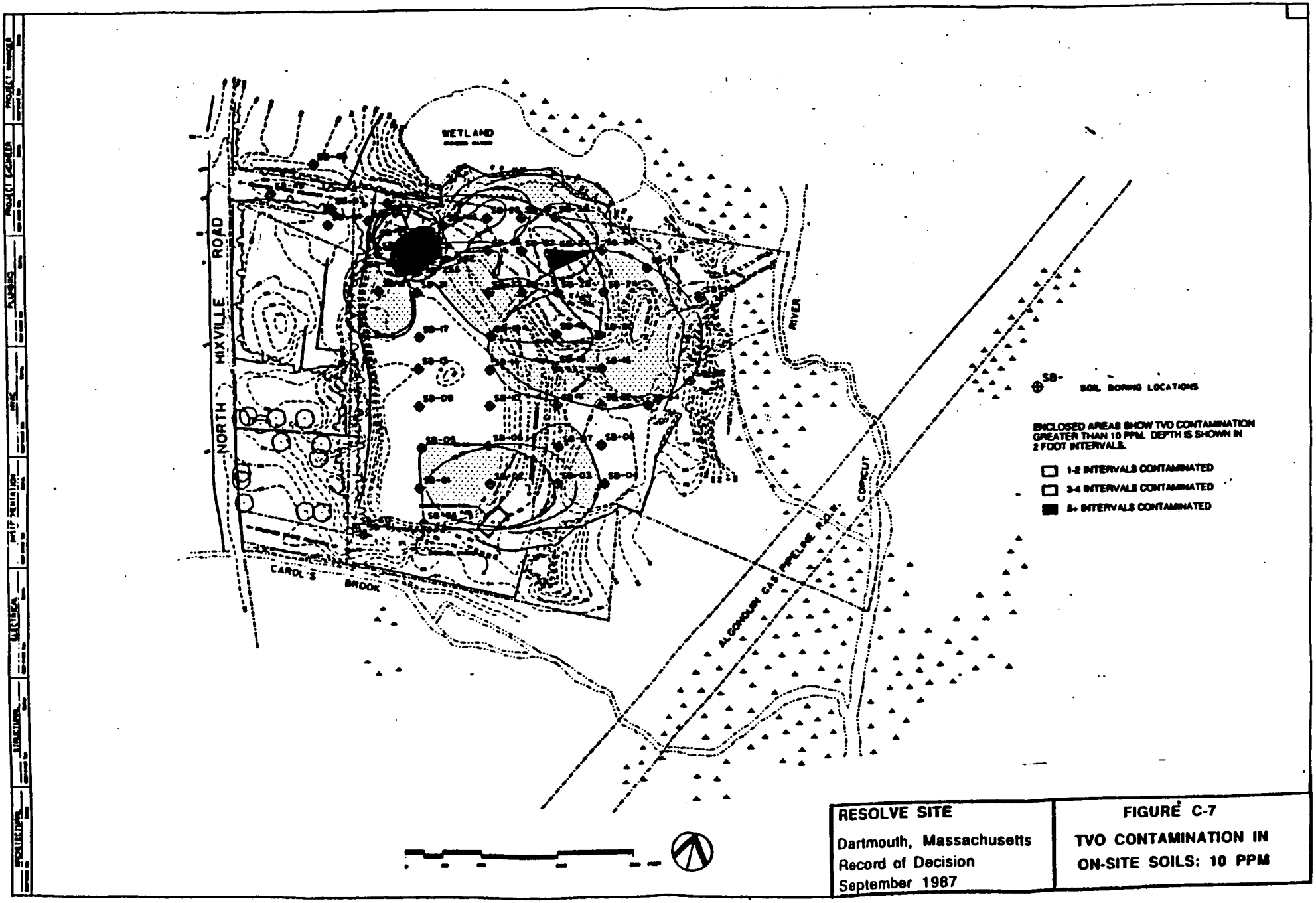
September 1987

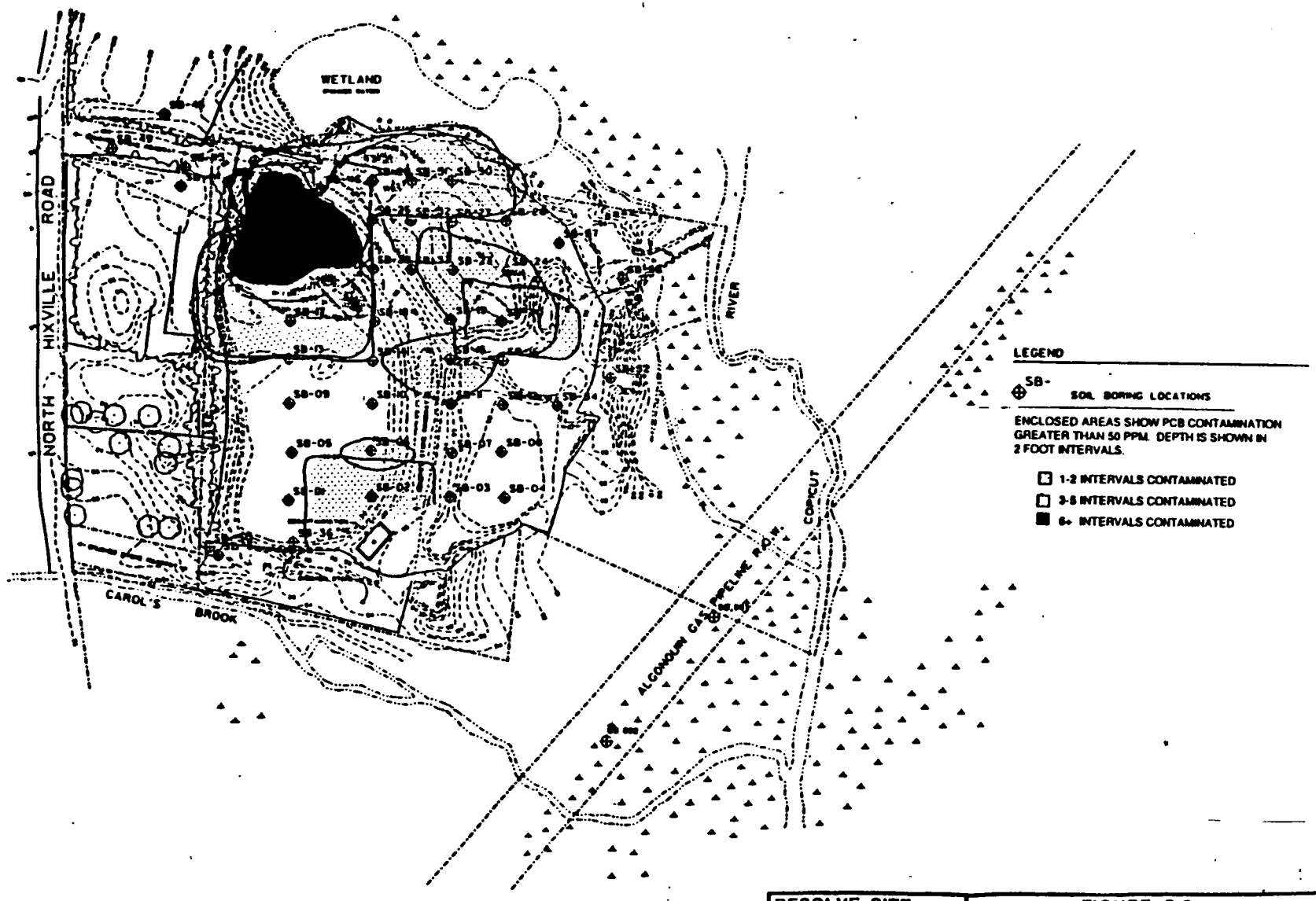
FIGURE C-5

PCBs IN SEDIMENT



RESOLVE SITE Dartmouth, Massachusetts Record of Decision September 1987	**FIGURE C-6** **TVO CONTAMINATION IN ON-SITE SOILS: 50 PPM**


WETLAND
NORTH HIXVILLE ROAD
CAROL'S BROOK
ALGONQUIN GAS PIPELINE ROW
CIRCUIT
RIVER
SB- SOIL BORING LOCATIONS
ENCLOSED AREAS SHOW TVO CONTAMINATION GREATER THAN 10 PPM. DEPTH IS SHOWN IN 2 FOOT INTERVALS.
1-2 INTERVALS CONTAMINATED
3-4 INTERVALS CONTAMINATED
5+ INTERVALS CONTAMINATED
RESOLVE SITE
Dartmouth, Massachusetts
Record of Decision
September 1987
FIGURE C-7
TVO CONTAMINATION IN ON-SITE SOILS: 10 PPM



RESOLVE SITE Dartmouth, Massachusetts Record of Decision September 1987	**FIGURE C-8** **PCB CONTAMINATION IN ON-SITE SOILS: 50 PPM**

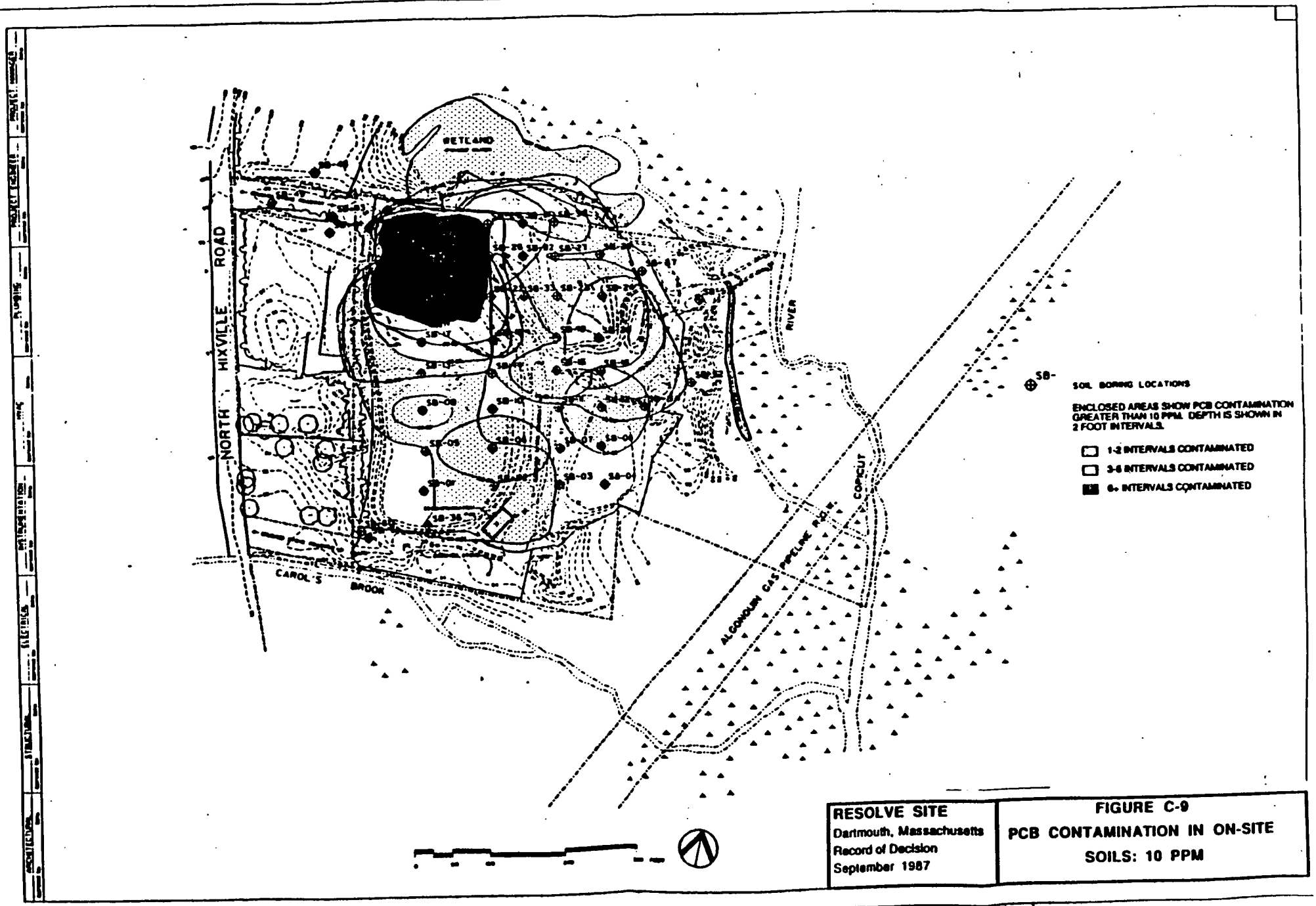


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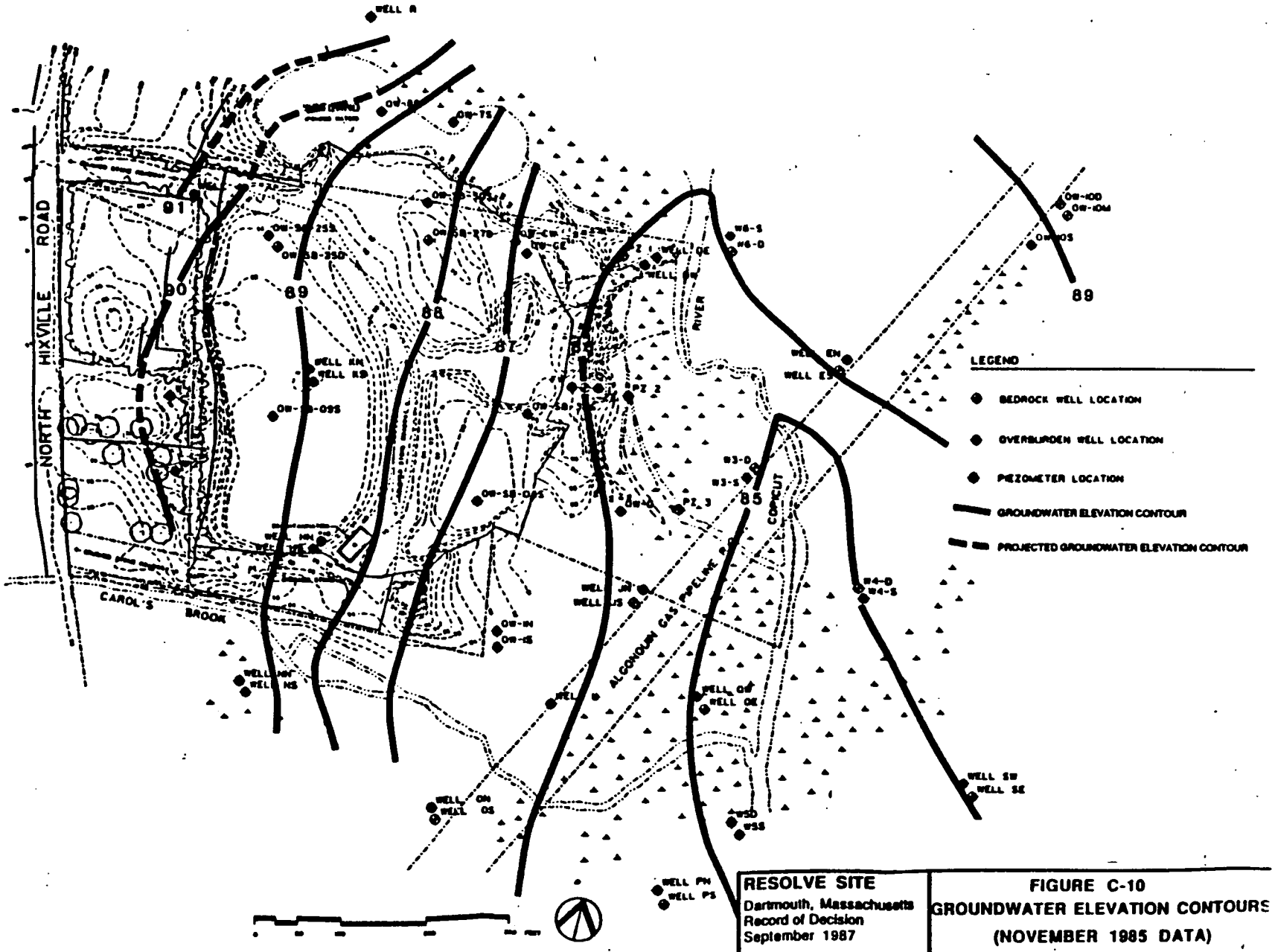
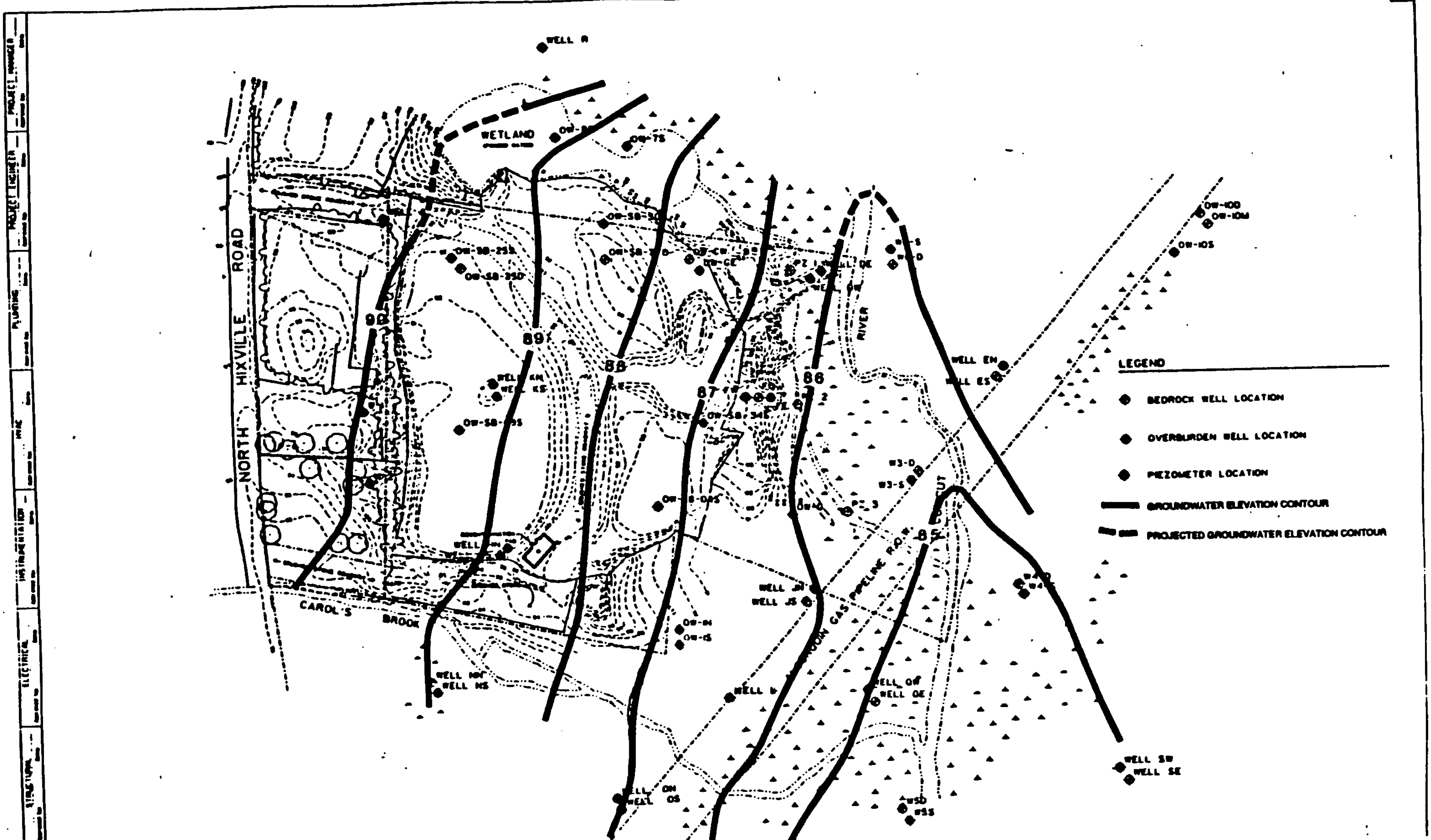
FIGURE C-9
PCB CONTAMINATION IN ON-SITE SOILS: 10 PPM


NORTH HIXVILLE ROAD
CAROL'S BROOK
ALGONQUIN GAS PIPELINE
COPICUT
RIVER
WELL A
WELL SW
WELL SE
WELL SN
WELL SS
WELL NW
WELL NE
WELL NN
WELL NS
WELL ON
WELL OS
WELL PN
WELL PS
LEGEND
BEDROCK WELL LOCATION
OVERBURDEN WELL LOCATION
PIEZOMETER LOCATION
GROUNDWATER ELEVATION CONTOUR
PROJECTED GROUNDWATER ELEVATION CONTOUR
RESOLVE SITE
Dartmouth, Massachusetts
Record of Decision
September 1987
FIGURE C-10
GROUNDWATER ELEVATION CONTOURS
(NOVEMBER 1985 DATA)



RESOLVE SITE
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FIGURE C-11
GROUNDWATER ELEVATION CONTOURS
(JULY 1986 DATA)

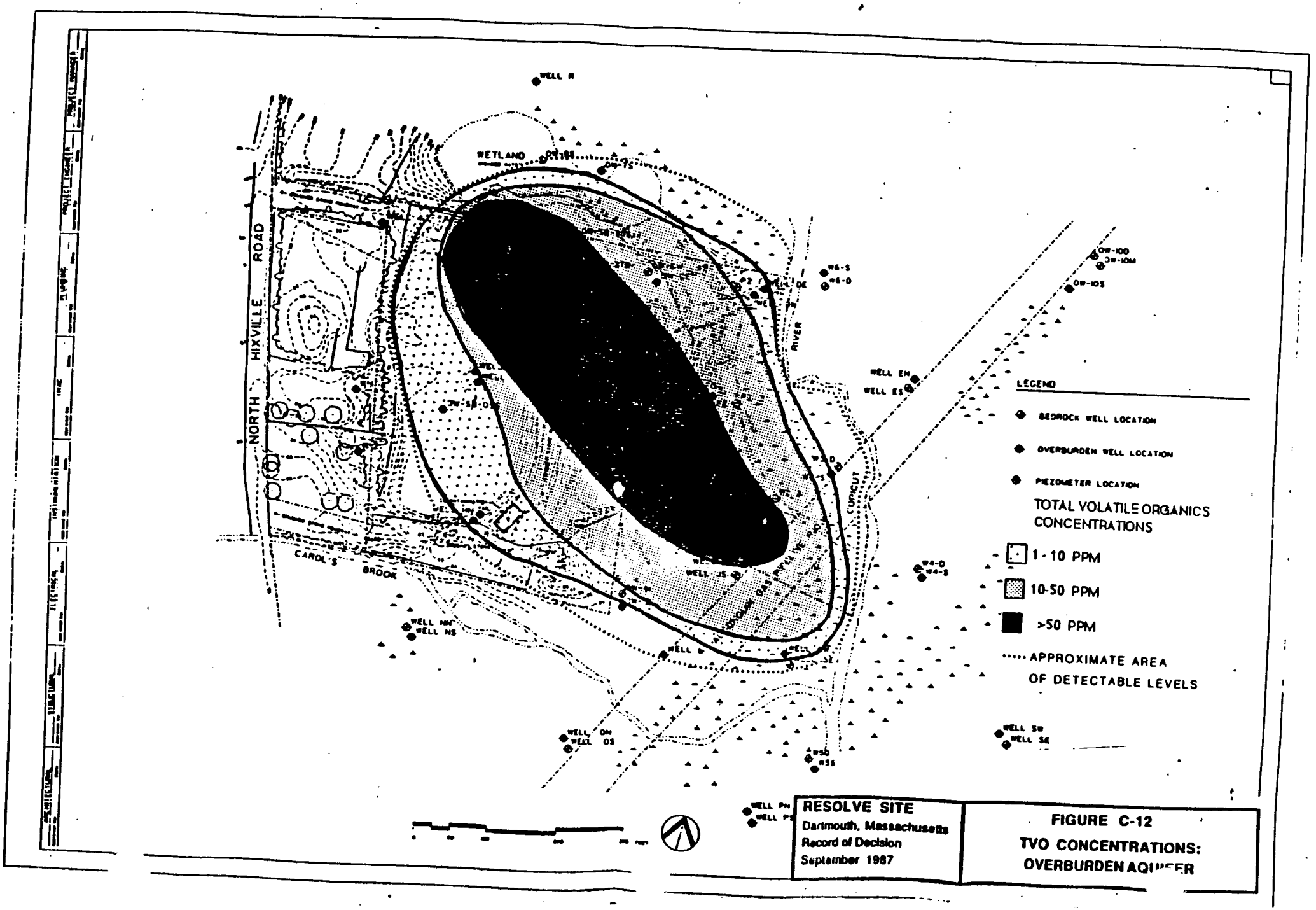
WELL R
WETLAND
OW-7S
NORTH HIXVILLE ROAD
RIVER
W6-S
W6-D
OW-10D
OW-10M
OW-10S
WELL EN
WELL ES
CAROL'S BROOK
WELL NW
WELL NS
WELL JS
WELL JD
W4-D
W4-S
WELL ON
WELL OS
W5D
W5S
WELL SW
WELL SE
WELL PN
WELL PS
LEGEND
BEDROCK WELL LOCATION
OVERBURDEN WELL LOCATION
PIEZOMETER LOCATION
TOTAL VOLATILE ORGANICS CONCENTRATIONS
1 - 10 PPM
10-50 PPM
>50 PPM
APPROXIMATE AREA OF DETECTABLE LEVELS
RESOLVE SITE
Dartmouth, Massachusetts
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FIGURE C-12
TVO CONCENTRATIONS:
OVERBURDEN AQUIFER

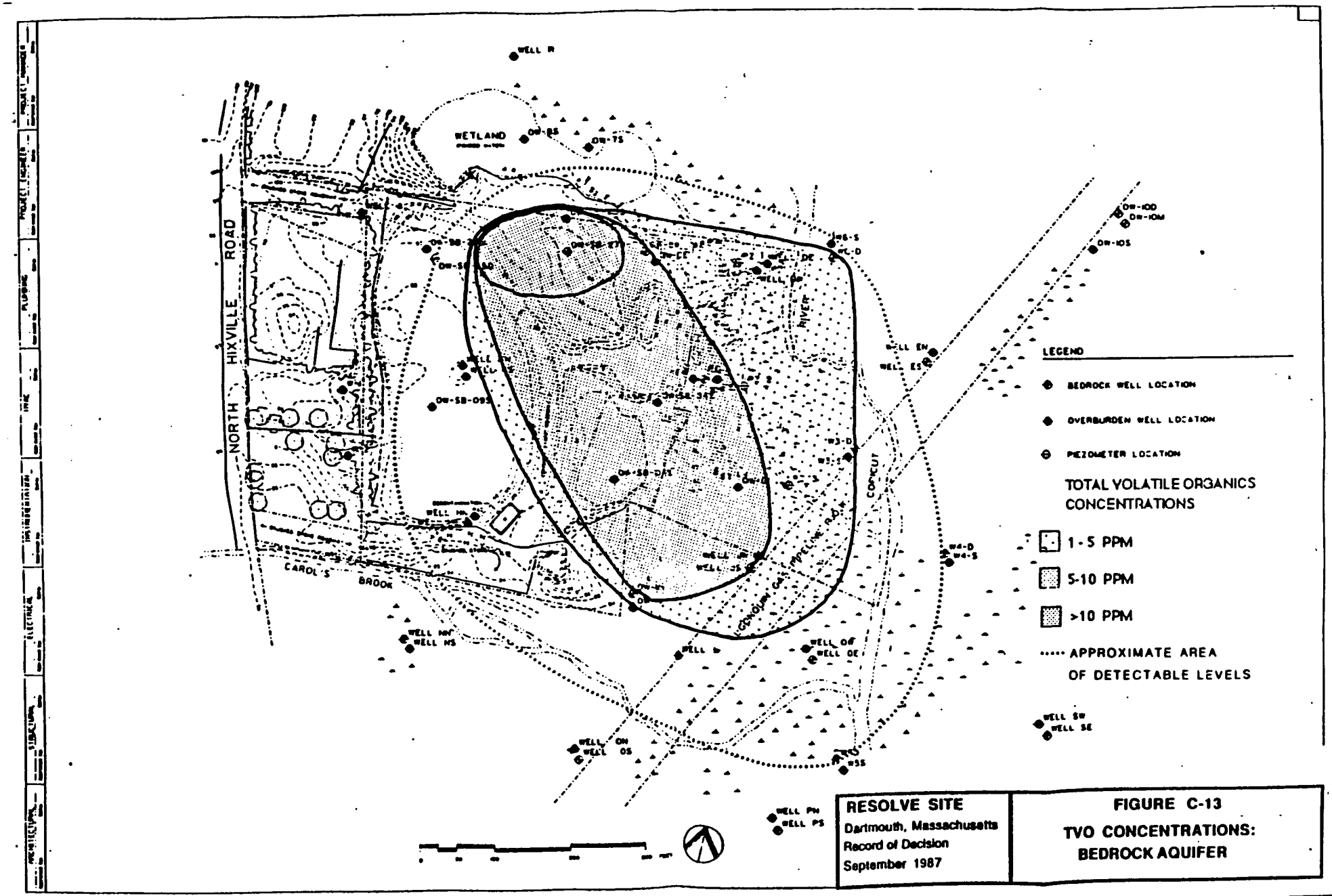
NORTH HIXVILLE ROAD
WETLAND
CAROL'S BROOK
CONOJUM GAS PIPELINE R.O.W.
CONCUT
RIVER
LEGEND
BEDROCK WELL LOCATION
OVERBURDEN WELL LOCATION
PIEZOMETER LOCATION
TOTAL VOLATILE ORGANICS CONCENTRATIONS
1 - 5 PPM
5-10 PPM
>10 PPM
APPROXIMATE AREA OF DETECTABLE LEVELS
RESOLVE SITE
Dartmouth, Massachusetts
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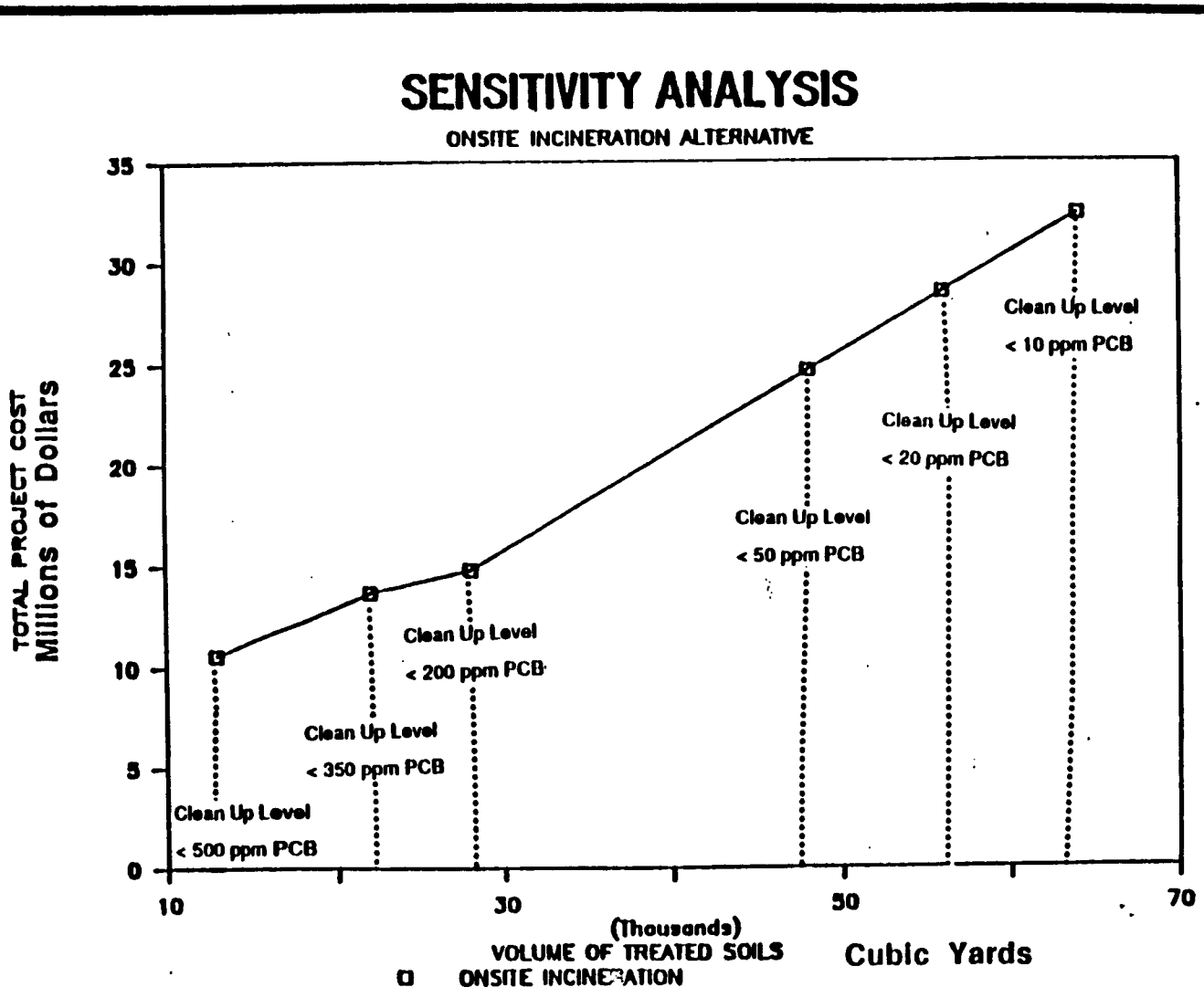
FIGURE C-13
TVO CONCENTRATIONS:
BEDROCK AQUIFER



RESOLVE SITE
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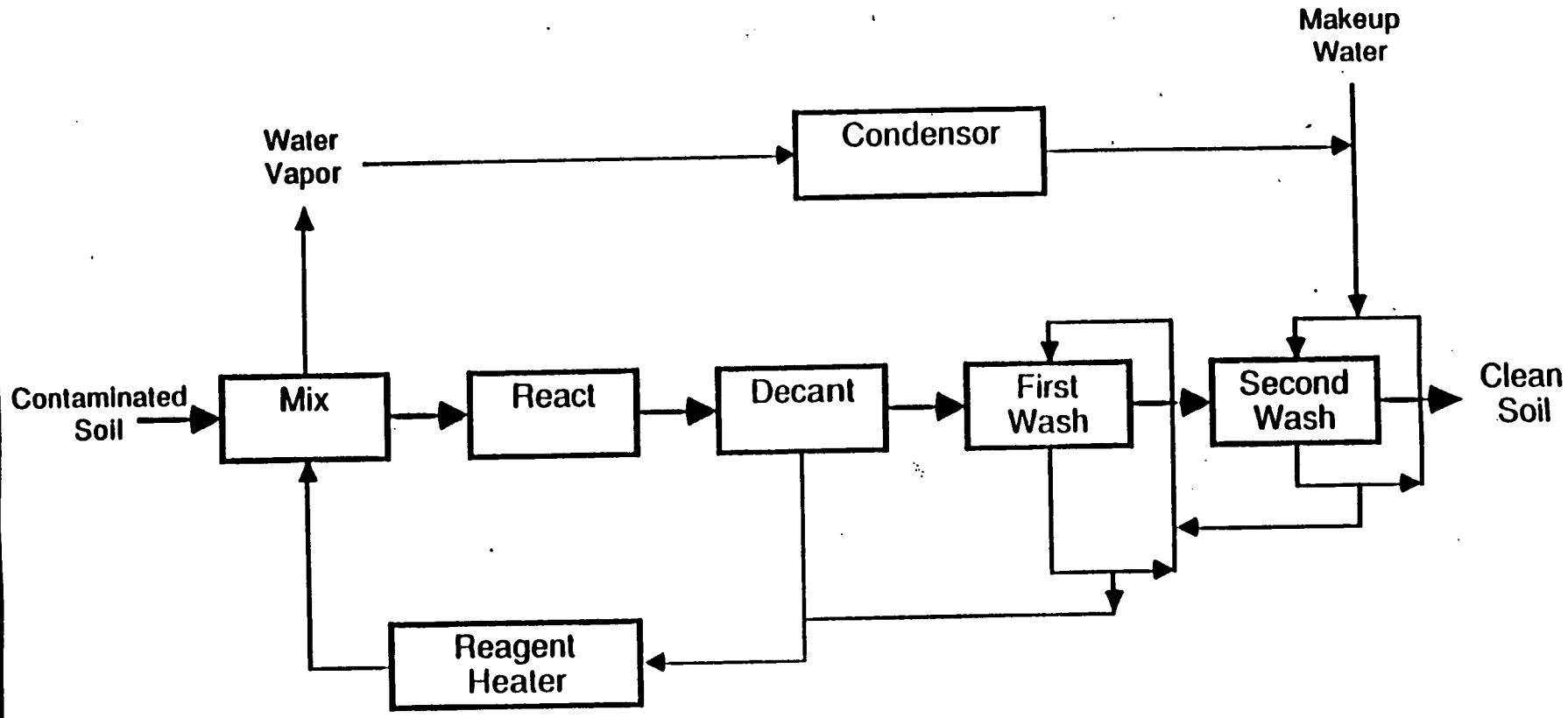
FIGURE C-14
ON-SITE INCINERATION ALTERNATIVE
SENSITIVITY ANALYSIS



RESOLVE SITE
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FIGURE C-15
DECHLORINATION PROCESS
FLOW DIAGRAM

SENSITIVITY ANALYSIS

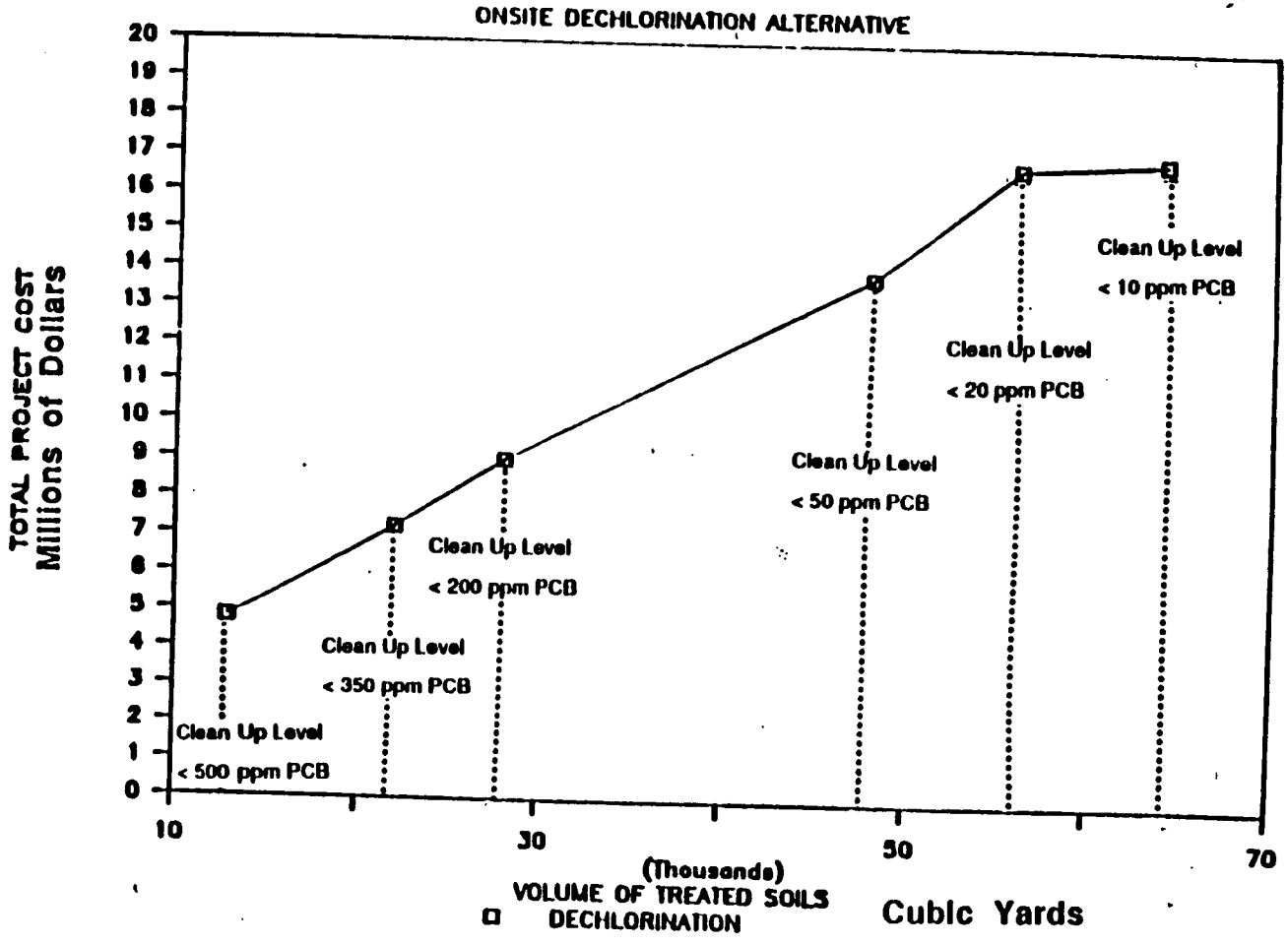

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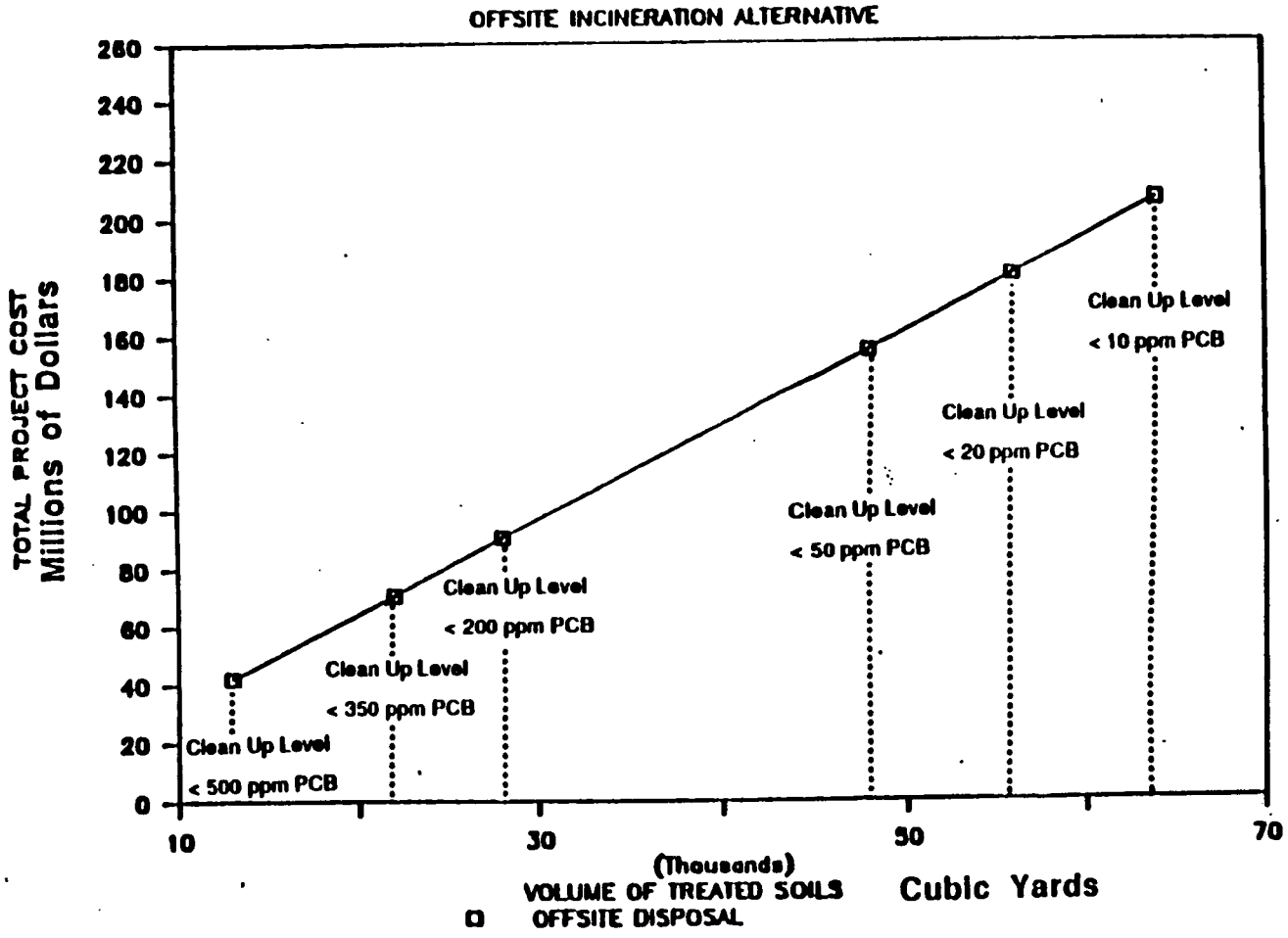
FIGURE C-16
DECHLORINATION ALTERNATIVE
SENSITIVITY ANALYSIS

SENSITIVITY ANALYSIS



RESOLVE SITE
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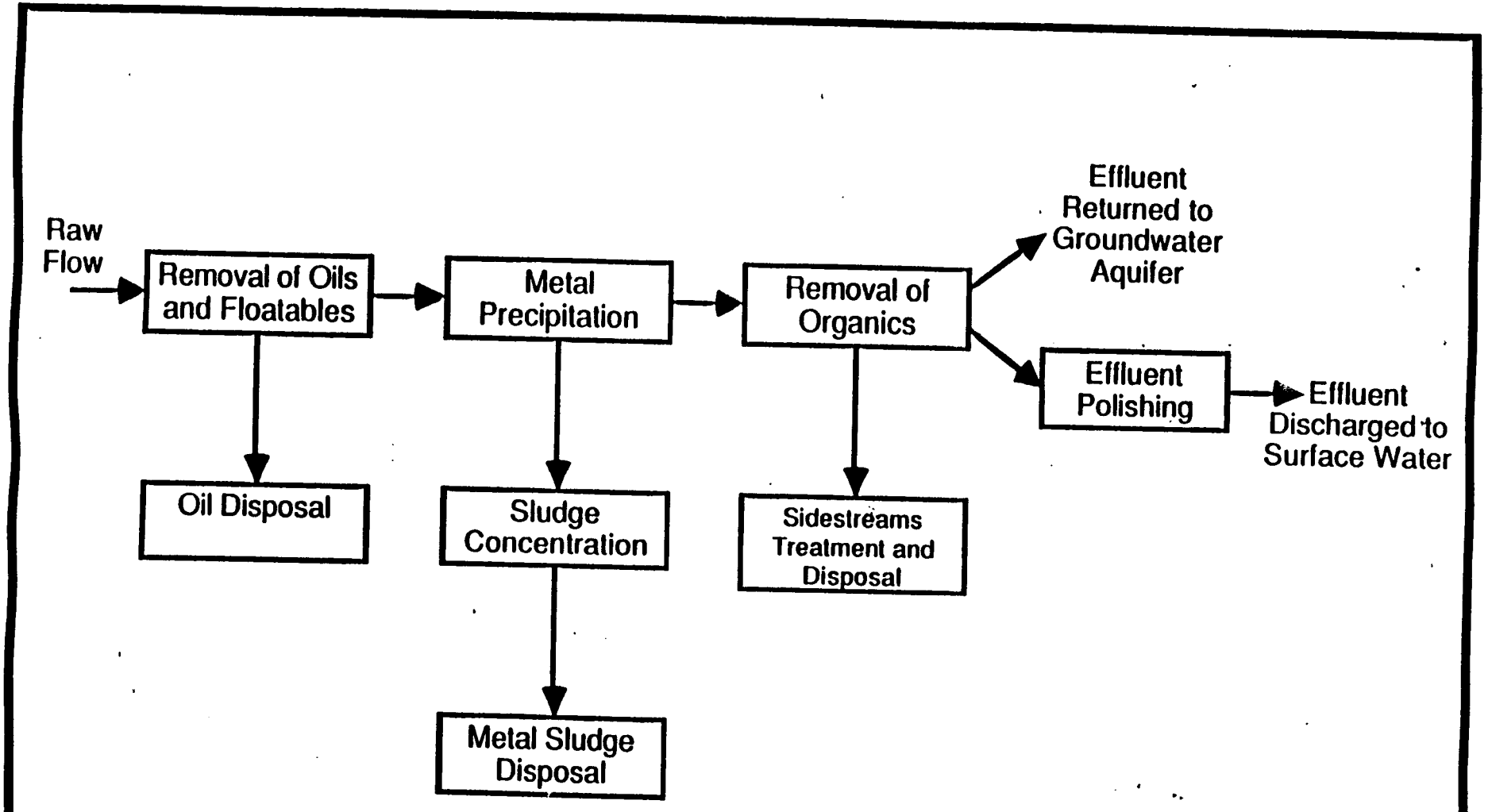
FIGURE C-17
OFF-SITE INCINERATION ALTERNATIVE
SENSITIVITY ANALYSIS



RESOLVE SITE
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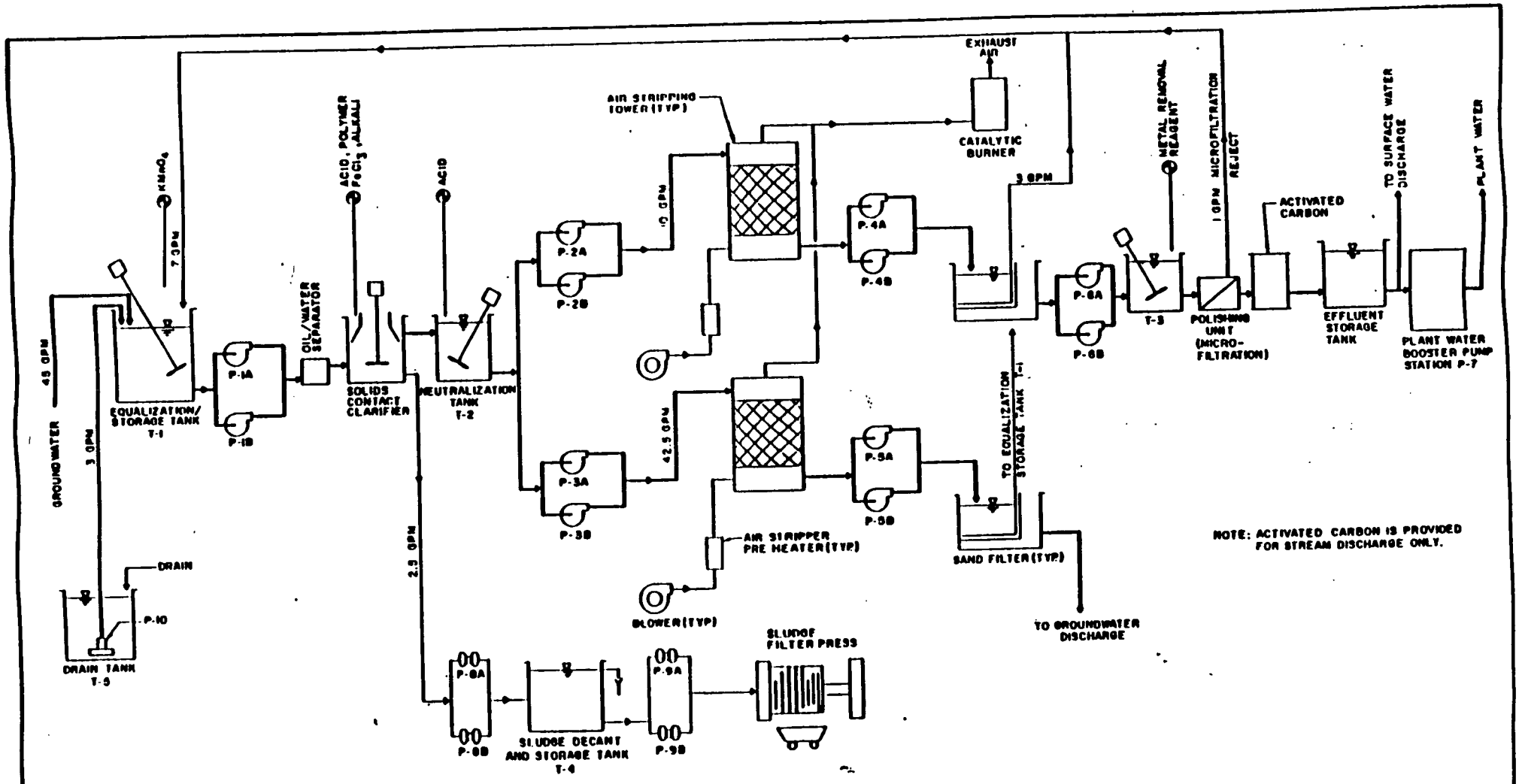
FIGURE C-18
GENERAL FLOW CHART FOR GROUNDWATER TREATM[illegible]T



RESOLVE SITE
DARTMOUTH, MASSACHUSETTS
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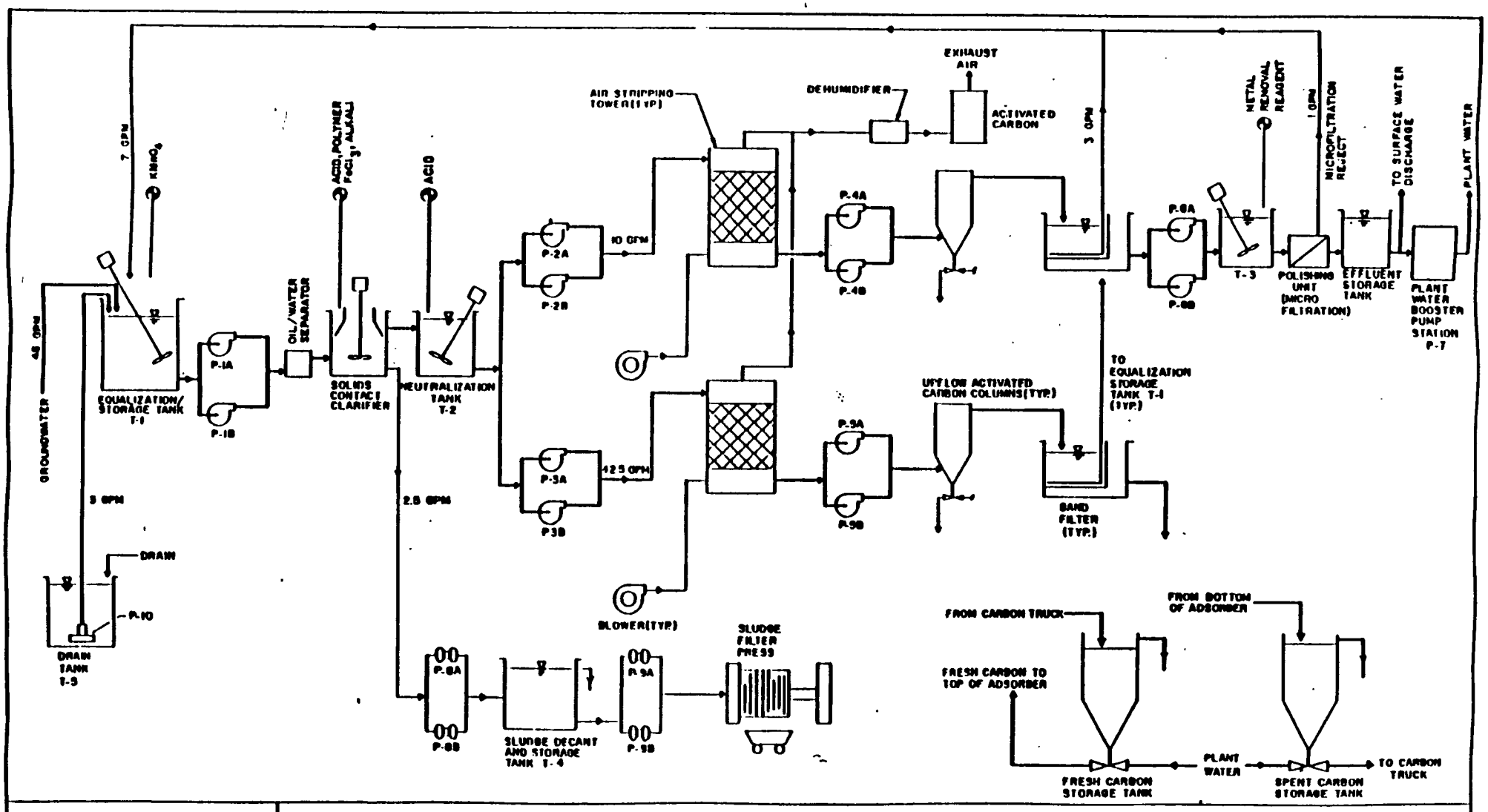
ALTERNATIVE MOM-2A
HEATED INFLUENT AIR STRIPPING
FIGURE C-19



RESOLVE SITE
DARTMOUTH, MASSACHUSETTS
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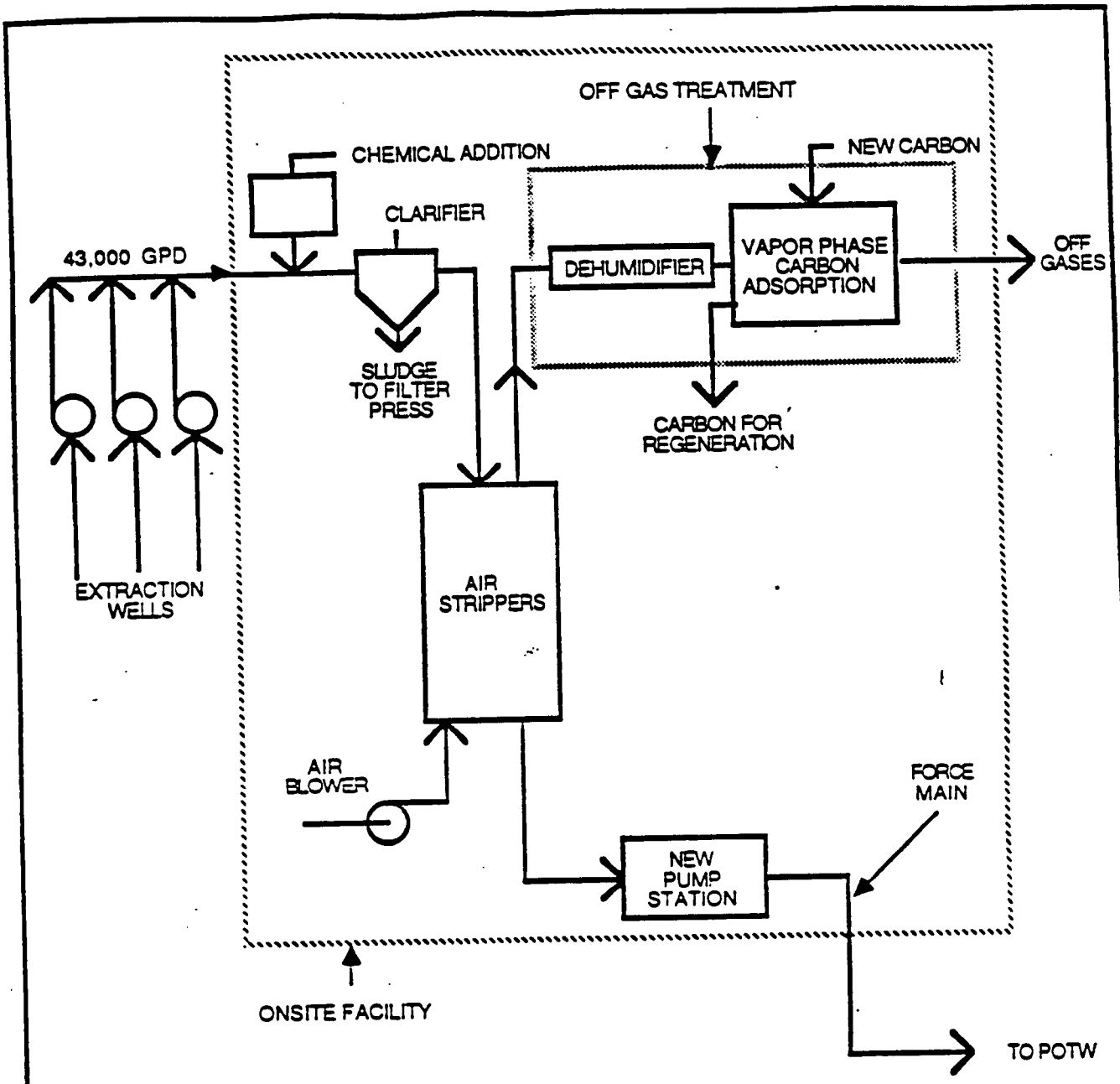
ALTERNATIVE MOM- 2C
ACTIVATED CARBON

FIGURE C-20



RESOLVE SITE
DARTMOUTH, MASSACHUSETTS
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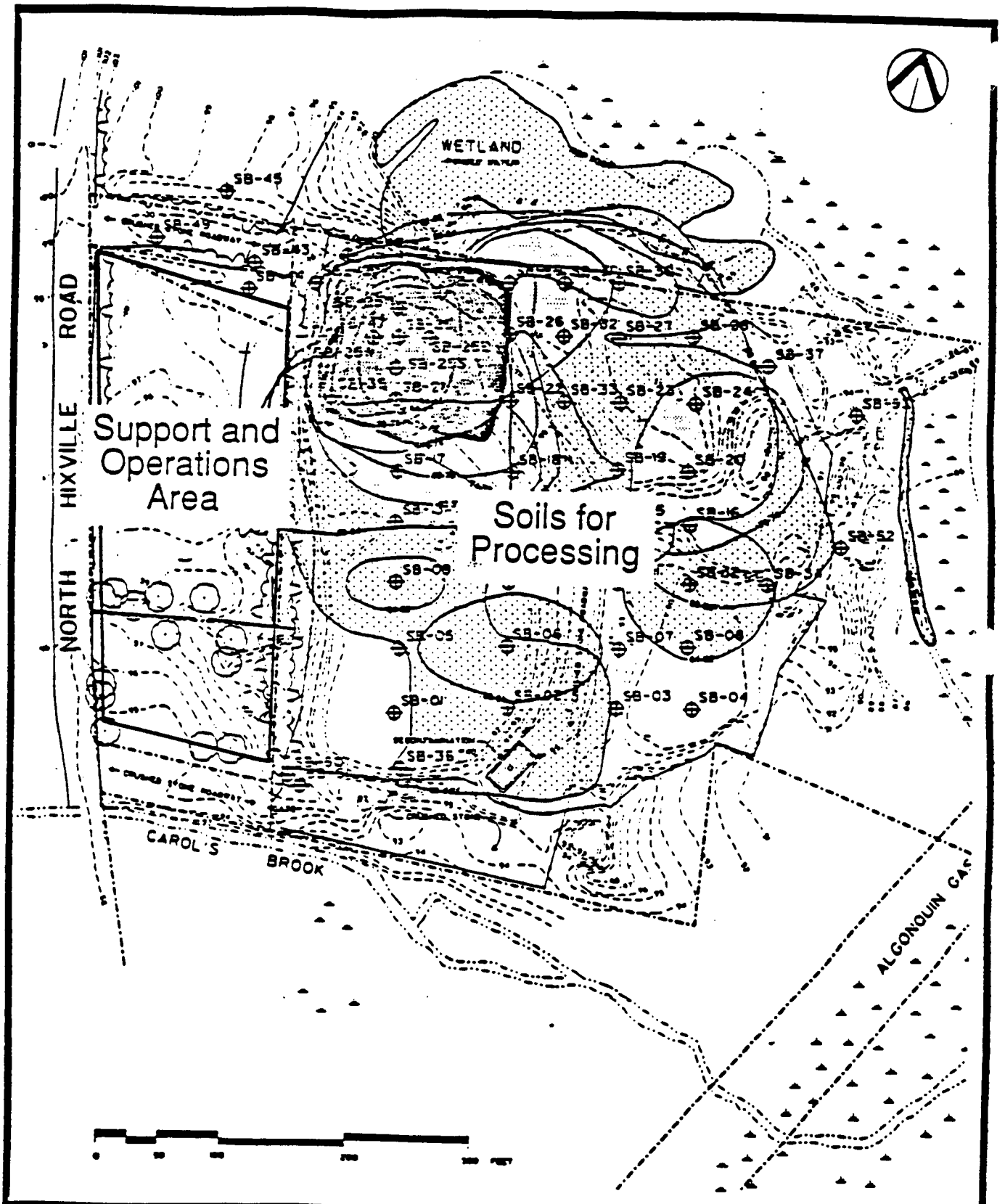
FIGURE C-21
ALTERNATIVE MOM-4
PRETREATMENT AND DISPOSAL AT POTW



RESOLVE SITE
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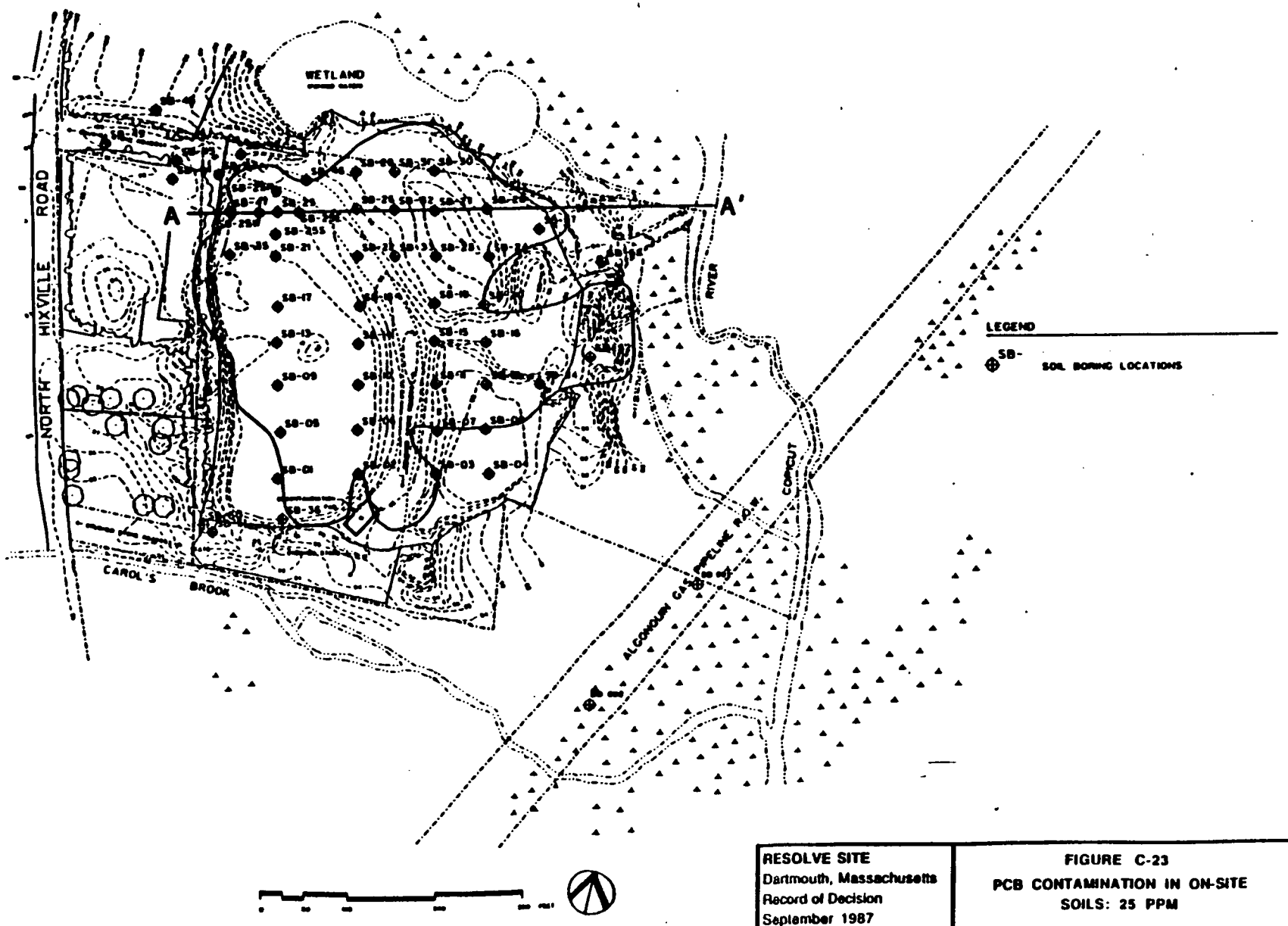
FIGURE C-2.
PROPOSED SITE LAYOUT



RESOLVE SITE Dartmouth, Massachusetts Record of Decision September 1987	**FIGURE C-23** **PCB CONTAMINATION IN ON-SITE SOILS: 25 PPM**

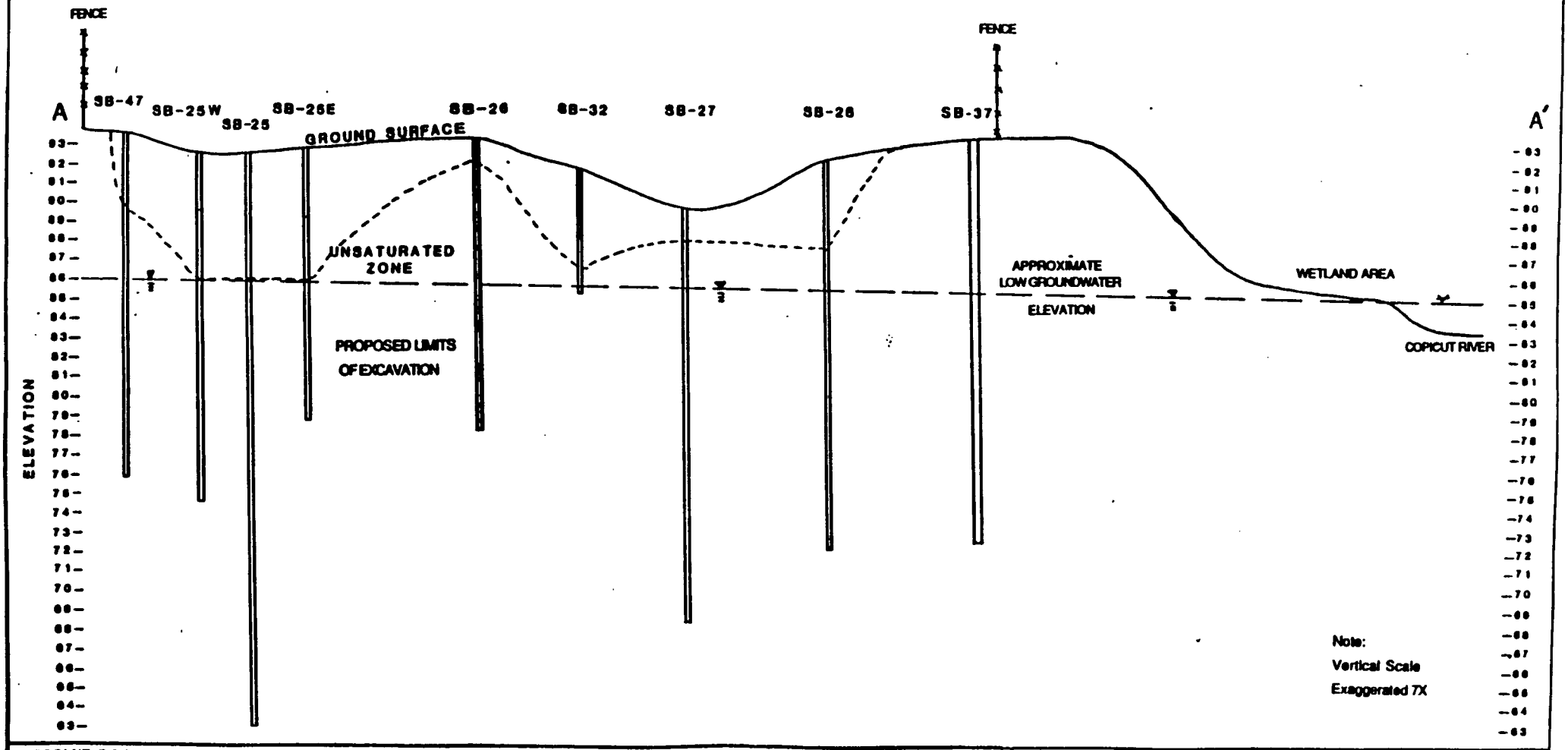


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FIGURE C-24
PCB CONTAMINATION IN ON-SITE SOILS: 25 PPM
CROSS-SECTION A-A'

TABLES

TABLES (cont'd)

TABLE C-1

HISTORICAL GROUNDWATER CONTAMINANT

PLUME DATA

Observation Wells	Total Volatile Organics			Tetrachloroethylene			Trans-1-2-dichloroethene			Trichloroethylene			Vinyl Chloride			Methylene Chloride			Toluene		
	83	84	85	83	84	85	83	84	85	83	84	85	83	84	85	83	84	85	83	84	85
A										6,500						68,000			91,000		
BE	1,622,500																				
BC	85,540						1,400			860						16,000			62,000		
CW	19,342		50,020	350		240	2,200		7,400	3,000		300			5,400				8,500		16,000
DE	43,070	37,010	19,940					6,000	2,500					2,600	2,800	8			200	26,000	6,600
DW	1,003	2,995	13				93	74	2		21		17		1,100	550			15,000		
EN	106						10	13		65											
FW	82,283		43,671		11,000	14,000	14,000	36,000		35,000	2,200	25,000	300			330			150		
FE	111,902	222,000	214,770	14,000		1,600	380		83,000	35,000		50,000	14		8,000	19,000		16,000	6,800		9,000
G	1,953	109,000	41,870			790	12,000	94,000	19,000			9,200			2,500					15,000	3,000
HN	1,953		1,382	1,300		830			2			130									
HS	1,701		3,724			170			1,500			900	1,700		1,000						
IS	637		5,174			36	1,600		280			23	1,700		2,700				610		1,300
JN	71,220	99,000	64,550				47,000	4,900	4,900					5,000	7,100			1,400	64,000	39,000	33,000
KN	137		351	53		31	8		120	34		180			20				40		
KS	445		1,776	220		410	17		310	95		960			1	27					
L	228	729	51				10		1			6	23	470	20	32			13	150	
MS	11															35					
MW	57															19					
OW	19																				
QW	7,200	8,050	4,228												420				6,200	6,800	2,400
R																23			8		
SW	31																				
W1	*			*			*			*			*								
W2	*			*			*			*			*								
W3S	*	64,944	221	*	61		*	43,500	59	*	224		*	4,570	140		83			4,340	
W4S	*			*				*		*	3		*								
W4D	*	14	83	*	2	8	*	3	3	*	14	73	*								
W5S	*		99	*	5		*	5	6	*	5	14	*	202	21		5				
W6S	*	330		*																	

TABLE C-1
(cont'd)

HISTORICAL GROUNDWATER CONTAMINANT

PLUME DATA

Observation Wells	Total Volatile Organics			Tetrachloroethylene			Trans-1-2-dichloroethene			Trichloroethylene			Vinyl Chloride			Methylene Chloride			Toluene		
	83	84	85	83	84	85	83	84	85	83	84	85	83	84	85	83	84	85	83	84	85
OW-07	*	*	510	*	*		*	*	510	*	*		*	*							
OW-08	*	*	330	*	*		*	*	330	*	*		*	*							
OW-09S	*	*		*	*		*	*		*	*		*	*							
OW-10S	*	*		*	*		*	*		*	*		*	*							
OW-11S	*	*		*	*		*	*		*	*		*	*				10			
SB-04S	*	*	205,000	*	*	8,000	*	*	32,000	*	*	23,000	*	*				7,000			13,000
SB-09S	*	*	95	*	*	15	*	*	27	*	*	53	*	*							
SB-34S	*	*	17,005	*	*	5,400	*	*		*	*	7,900	*	*							705
SB-25S	*	*	105,000	*	*		*	*	7,000	*	*	27,000	*	*							
SB-30S	*	*	57,060	*	*	2,100	*	*	16,000	*	*	4,100	*	*				1,400			16,000

* Well did not exist at time of sampling.

+ Wells removed after 1983 sampling.

TABLE C-1
(cont'd)

HISTORICAL GROUNDWATER CONTAMINANT PLUME DATA

Observation Wells	Total Volatile Organics			Tetrachloroethylene			Trans-1-2-dichloroethene			Trichloroethylene			Vinyl Chloride			Methylene Chloride			Toluene		
	83	84	85	83	84	85	83	84	85	83	84	85	83	84	85	83	84	85	83	84	85
BW	1,400	+	+		+	+	600	+	+		+	+	800	+	+						
CE	2,133		5,316			87	2,900		2,200	850		360			540						890
ES		13																			
FC	6,390	6,449	6,129		3,200	2,200		26	600	2,000	69,000	2,400		10	35				190	9	71
IN	3,910	581	481			23	41	93	41		42	6		190	330	26			130	48	
JS	4,801	40,000	4,820				1,900	9,000	280					1,100	3,300		4,400		2,300	27,000	
MW	57															35					
OS	79															45					
PS	19											6				19					
QE	915	303	487				8	5	9				16	40	310	39			100	72	
SE	50															41					
W3D	*	49		*	49		*	5		*	5		*				5				
W4D	*	14	87	*	2	8	*	3	3	*	14	73	*								
W5D	*	64	46	*			*	18	18	*	5	11	*	10	15		5				
W6D	*		2,840	*	340	340	*	23		*	2,000	2,100	*							1	
OW-09M	*	*		*	*		*	*		*	*		*	*							
OW-09D	*	*		*	*		*	*		*	*		*	*							
OW-10M	*	*		*	*		*	*		*	*		*	*							
OW-10D	*	*		*	*		*	*		*	*		*	*							
OW-11M	*	*		*	*		*	*		*	*		*	*							
OW-11D	*	*		*	*		*	*		*	*		*	*							
SB-25D	*	*	506	*	*	3.4	*	*	290	*	*	210	*	*							
SB-27D	*	*	44,920	*	*	8,900	*	*	6,800	*	*	26,000	*	*				600			2.2

* Well did not exist at time of sampling.

+ Wells removed after 1983 sampling.

TABLE C-2

SUMMARY OF RISK ASSESSMENT RESULTS FOR HUMAN EXPOSURE
TO RESOLVE SITE CONTAMINANTS

(Present Site Use)

Present Site Use Exposure Pathway	Total Excess Upper Bound Lifetime Cancer Risk	Hazard Index for Non-carcinogenic Effects
Direct contact with on-site soils		
Average case	6×10^{-8}	<1
Plausible maximum case	4×10^{-5}[b]	<1
Direct contact with off-site soils		
Average case	5×10^{-8}	<1
Plausible maximum case	8×10^{-5}[b]	<1
Inhalation of VOCs[a] released from on-site soils		
Average case	9×10^{-9}	NE
Plausible maximum case	1×10^{-6}[b]	NE
Inhalation of particulate matter released from on-site soils		
Average case	8×10^{-11}	<1
Plausible maximum case	7×10^{-8}	<1
Dermal contact with surface water		
Average case	9×10^{-9}	<1
Plausible maximum case	1×10^{-6}[b]	<1
Inhalation of VOCs released from surface water		
Average case	2×10^{-7}	<1
Plausible maximum case	5×10^{-6}[b]	<1
Ingestion of fish		
Average case	7×10^{-4}[b] (eel consumption)[c]	NE
Plausible maximum case	8×10^{-3}[b] (eel conumption)[c]	NE

NE = not estimated.

[a] VOC = volatile organic compound

[b] Note that excess cancer risks greater than 1×10^{-6} may be unacceptable.

[c] For ingestion of fish species other than eels, total excess lifetime cancer risks would range from 7×10^{-6} for the average case to 4×10^{-4} for the plausible maximum case.

TABLE C-3

SUMMARY OF RISK ASSESSMENT RESULTS FOR HUMAN EXPOSURE TO RESOLVE SITE CONTAMINANTS

(Future Site Use)

Future Site Use Exposure Pathway	Total Excess Upper Bound Lifetime Cancer Risk	Hazard Index for Effects
Ingestion of on-site groundwater		
Average case	4×10^{-3}[b]	4[c]
Plausible maximum case	5×10^{-1}[b]	410[c]
Direct contact with soils		
Average case	1×10^{-7}	<1
Plausible maximum case	3×10^{-2}[b]	12[c]
Inhalation of VOCs[a] released from on-site soils		
Average case	3×10^{-5}[b]	NE
Plausible maximum case	3×10^{-4}[b]	NE
Inhalation of particulate matter released from on-site soils		
Average case	3×10^{-7}	<1
Plausible maximum case	2×10^{-5}[b]	<1

NE = not estimated.

[a] VOC = volatile organic compound.

[b] Note that excess cancer risks greater than 1×10^{-6} may be unacceptable.

[c] These scenarios may pose unacceptable health risks.

TABLE C-4

COMPARISON OF CONCENTRATIONS OF INDICATOR CHEMICALS IN ON-SITE GROUNDWATER

(Future Site Use)

Chemical	Unfiltered Data[a]			Filtered Data		
	Frequency[b]	Geometric Mean Concentration (ppb)[c]	Maximum Concentration (ppb)	Frequency[b]	Maximum Concentration (ppb)	MCL or Proposed Value (ppb)
Arsenic	15/22	<10[d]	24	0/9	ND[e]	50(50[f])
Cadmium	11/22	9	724	1/9	6.4	10(5[f])
Lead	16/22	38	1,120	2/9	14J	50(20[f])
Tetrachloro-ethylene	17/22	157	14,000J[h]	5/9	18,000	5[g]
Trichloroethylene	19/22	527	50,000J	6/9	22,000	1[g]
Vinyl Chloride	10/22	47	8,000J	1/9	3,300	70[f]
trans-1,2-Dichloroethylene	17/22	411	83,000J	7/9	79,000	

[a] The groundwater samples used to assess risks were unfiltered when analyzed. Use of these concentrations may overestimate risks associated with ingestion of drinking water from an on-site well. PCB data were not included in this data summary because many of the reported groundwater concentrations exceeded the aqueous solubilities for PCBs.

[b] Number of samples in which contaminant was detected divided by the total number of valid samples.

[c] Samples in which contaminants were not detected were included in calculating average (geometric mean) concentrations by using a value of one-half the EPA contract laboratory detection limits.

[d] Less than the EPA CLP detection limit given.

[e] ND = not detected at a detection limit of approximately 10 ppb.

[f] Proposed MCLG.

[g] Proposed MCL.

[h] J = estimated value.

TABLE C-5

PRELIMINARY REMEDIAL TECHNOLOGY SCREENING

Remedial Technologies Applicable for Consideration	Applicability/Comments	Remedial Technologies Technically Feasible
No Action		No Action
Site Security	Fencing source areas	Site Security
Monitoring	Groundwater, surface water, sediments and air	Monitoring
Diversion/Collection/Containment		Diversion/Collection/Containment
Slurry Walls	Prevent groundwater migration within site and toward off-site	Slurry Walls
Vibrating Beam	Similar to slurry wall	Vibrating Beam
Grout Walls	Due to inherent toxicity of grouts themselves, relative low quality product	
Sheet Piling	Not permanent solution, possible as a construction technique	Sheet Piling (temporary)
Bottom Seal Grouting	Technology not well developed	
Block Displacement Grouting	Technology not well developed	
Groundwater Interceptor Trench	May be applicable to reroute groundwater around the site	Groundwater Interceptor Trench
Collector Wells	Not a practical technique in permeable soils	
Floating Covers	Could be used as temporary safety measure during work on site. Not recommended as a permanent measure	Floating Covers (temporary)
Cover Materials	Not proven as reliable long-term measure	

TABLE C-5
(Continued)

PRELIMINARY REMEDIAL TECHNOLOGY SCREENING

Remedial Technologies Applicable for Consideration	Applicability/Comments	Remedial Technologies Technically Feasible
Surface Sealing	Possible leaching control measure for soils and sediments	Surface Sealing
Capping	Applicable to reduce further infiltration of precipitation technology well developed	Capping
Dikes and Berms	Possible short-term control measure	Dikes and Berms (temporary)
Levees and Floodwalls	Site not located in flood hazard zone	
Bench Terraces and Drainage Bench	Not applicable, no very steep slopes	
Channels and Waterways	Possible temporary measure during on-site construction and excavation	Channels and Waterways (temporary)
Chutes and Downpipes	Not applicable, no steep slopes	
Seepage Basins and Ditches	Possible to use to reroute surface water to protect cap and to recharge treated groundwater	Seepage Basins and Ditches
Retention Basins	Requires large areas of land, large amounts of sand and silt not a problem	
Cofferdams	May be used during cleanup or in conjunction with sediment removal	Cofferdams
Grading	Used with capping, land-filling and excavation	Grading
Revegetation	Used with capping, land-filling and excavation	Revegetation

TABLE C-5
(Continued)

PRELIMINARY REMEDIAL TECHNOLOGY SCREENING

Remedial Technologies Applicable for Consideration	Applicability/Comments	Remedial Technologies Technically Feasible
Dust Control	Used when removing source materials	Dust Control (temporary)
Removal		Removal
Excavation/Dredging	Removal of sediments and soils, difficult below water table	Excavation
Injection/Extraction Wells	Used to extract groundwater from bedrock (deep wells) and overburden	Injection/Extraction Wells
Immobilization Technologies		Immobilization Treatment
Cement and Silicate Based Fixatives/Self-Cementation	Questionable success with organics matrix due to new TCLP leaching procedure	Fixation/Cementation
Thermoplastics	May increase subsequent options. Some solvents and greases cause asphalt to soften. Some oxidizers can cause explosions.	Thermoplastics
Thermosets/Polymerization	Incompatable wastes, such as organics, reduce chances of good results	
Surface Macro-encapsulation	Not a well developed technology	
Grouting	Soil and sediment stabilization	Grouting
Absorbents	Not permanent treatment and increases amount of material to be disposed of	
Vitrification	Information available through SITE Program	Vitrification

TABLE C-5
(Continued)

PRELIMINARY REMEDIAL TECHNOLOGY SCREENING

Remedial Technologies Applicable for Consideration	Applicability/Comments	Remedial Technologies Technically Feasible
Artificial Ground Freezing	Not as a permanent treatment, but could be used as part of excavation	Artificial Ground Freezing (temporary)
In-Situ Heating	Not a well developed technology	
Separation Technologies		
Precipitation/Coagulation/ Flocculation	May be useful in treatment for removal of inorganics and some oils, requires disposal of sludge	Precipitation/Coagulation/ Flocculation
Sedimentation/Clarification/ Gravity Thickening	May be used for removal of sediments and in conjunction with precipitation or biological treatment. Oil/ water separators can be used for removal of extractables, requires disposal of sludge	Sedimentation/Clarification/ Gravity Thickening
Centrifugation	Separates suspended and colloidal solids, used for industrial hazardous waste treatment	Centrifugation
Filtration	Sludge and backwash water may require further treatment	Filtration
Dewatering Lagoon	Not suitable for volatile toxics or areas with high water table	
Thermal Dewatering Units	May require emission controls, no mobile units exist	Thermal Dewatering Units
Classification	May be used as preliminary treatment to remove large debris from medium to be treated and concentrate waste, soils, or sediments	Classification

TABLE C-5
(Continued)

PRELIMINARY REMEDIAL TECHNOLOGY SCREENING

Remedial Technologies Applicable for Consideration	Applicability/Comments	Remedial Technologies Technically Feasible
Carbon Adsorption	May be used in form of liquid or vapor phase contactor (the latter in conjunction with air stripping)	Carbon Adsorption
Permeable Bed Treatment	Not applicable because of limited life of carbon, likelihood of clogging and desorption, and fractures in bedrock may result in groundwater bypassing treatment	
Powdered Activated Carbon	May be a method of groundwater treatment	Powdered Activated Carbon
Ion Exchange	May be used for removal of inorganics, but only after pretreatment to reduce concentrations of oils and organics	Ion Exchange
Resin Adsorption	Not applicable with very heterogeneous wastes	Resin Adsorption
Air Stripping	Can be used to strip volatiles from wastes	Air Stripping
Steam Stripping	May be used to strip soluble organics as well as volatiles from wastes	Steam Stripping
Distillation	Not applicable to removal of poorly defined feed streams; concentrations of contaminants are low	
Evaporation	Technique for dewatering soils and sediments; VOC removal	Evaporation
Dissolved Air Flotation	May be used to strip volatile organics while removing extractable oily wastes	Dissolved Air Flotation

TABLE C-5
(Continued)

PRELIMINARY REMEDIAL TECHNOLOGY SCREENING

Remedial Technologies Applicable for Consideration	Applicability/Comments	Remedial Technologies Technically Feasible
Freeze Crystallization	Not a well-developed technology for hazardous wastes	
Solvent Extraction	Not a technology to be used when there are many compounds	Solvent Extraction
Soil Flushing	May be used for removing extractables from soils	Soil Flushing
Coalescers	May be used to remove extractable compounds	Coalescers
Mechanical Aeration	May be used as on-site treatment to strip volatiles from the soil	Mechanical Aeration
Reverse Osmosis	Applicable if preceeded by a process to remove oils and larger molecules, such as ultrafiltration	Reverse Osmosis
Ultrafiltration	May be used to remove some of the higher molecular weight contaminants	Ultrafiltration
Electrodialysis	Not applicable because waste does not have high concentrations of salts and ionic species	
Detoxification Treatment		Detoxification Treatment
Aerobic Biodegradation	May be applicable because proven effective on most contaminants. Most notable exception is tetrachloroethylene	Aerobic Biodegradation
Anaerobic Biodegradation	May be applicable, especially in conjunction with aerobic treatment	Anaerobic Biodegradation

TABLE C-5
(Continued)

PRELIMINARY REMEDIAL TECHNOLOGY SCREENING

Remedial Technologies Applicable for Consideration	Applicability/Comments	Remedial Technologies Technically Feasible
Composting	May be applicable to soils and sediments containing extractables and PCBs	Composting
Land Treatment/Spray Irrigation	Not applicable to treatment of volatiles; on-site land area limited; groundwater high in much of the area	
Recirculation Systems	Effective in treating soils and groundwater especially in combination with aerobic biodegradation	Recirculation Systems
Enzymatic Degradation	Not a well developed technology for hazardous wastes	
Dechlorination	PCB reduction proven, mobile units available	Dechlorination (pilot plants available)
Ultraviolet/Ozonation	Effective in reducing PCBs; primarily an off-site treatment	Ultraviolet/Ozonation
Oxidation	Potentially toxic byproducts could worsen groundwater contamination	
Chemical Reduction	Not a well developed technology for use with soils and groundwater	
Neutralization	May be applicable to neutralize effluents from metals precipitation process	Neutralization
Chlorolysis/Chlorinolysis	Not demonstrated for hazardous wastes	
Hydrolysis/Electrolysis	Not a well developed treatment technology	

TABLE C-5
(Continued)

PRELIMINARY REMEDIAL TECHNOLOGY SCREENING

Remedial Technologies Applicable for Consideration	Applicability/Comments	Remedial Technologies Technically Feasible
Thermal Destruction	May be used to destroy organics and PCBs in soils and sediments	Thermal Destruction
On-Site Storage		On-Site Storage
Waste Pile	May be applicable as temporary storage for removed soils and sediments	Waste Pile (temporary)
Storage Vault	May be applicable as short-term storage prior to hauling	Storage Vault (temporary)
Storage Bins	Not applicable for large quantities of waste	
Storage Bags	Not applicable for large quantities of waste	
Tank/Drum Storage	Applicable for short-term storage of groundwater pending off-site transportation	Tank/Drum Storage (temporary)
Surface Impoundment	Implementation difficult with high water table	Surface Impoundment
On-Site Disposal		On-Site Disposal
RCRA Landfill		RCRA Landfill
Deep Well Injection	Containment over time not assured	Not Applicable in New England
NPDES Discharge	May be suitable for treated water	NPDES Discharge
Off-Site Disposal		Off-Site Disposal
RCRA Landfill		RCRA Landfill

TABLE C-5
(Continued)

PRELIMINARY REMEDIAL TECHNOLOGY SCREENING

Remedial Technologies Applicable for Consideration	Applicability/Comments	Remedial Technologies Technically Feasible
Treatment, Storage, Disposal (TSD) Facilities	May be applicable for a large number of wastes	TSD Facilities
Municipal Wastewater Treatment Facility	May require pretreatment	Municipal Wastewater Treatment Facility
Resource Recovery Facility	Usually not for hazardous waste	

TABLE C-6

SUMMARY OF COMPARISON SCREENING SOURCE CONTROL

Remedial Alternative	Total Project Costs Total Present Worth	Project Implementation Period	Environmental and Public Health Considerations	Comparison Findings
No Action				
SC-1 No Action (with fencing)	$1,640,000	30 yrs	1. Eliminate access to contaminated soil source areas by fencing 2. Allows continued release of contaminants to the groundwater, prolongs period of poor groundwater 3. Restricts future use of the site in vicinity of soil source areas	This alternative has been retained for detailed development to provide a basis for comparison to other alternatives as stipulated in NCP.
On-Site Treatment				
SC-2 Thermal Destruction	$31,347,000	5 yrs	1. as above 4. Unimpeded future use of site 5. Eliminates risk from spills associated with transport of contaminated soils 6. Mitigates potential for offsite migration of soils and contaminated groundwater after treatment is completed 7. Potential release of air emissions due to treatment process. Other potential releases include excavation, i.e., dust generation, volatilization of contaminants, and soil erosion resulting in surface water impacts to wetlands	Remedial Alternatives SC-2 and SC-4 were retained for detailed development since they provide environmental benefits for the treatment of contaminated soil. Also, they have high contaminants removal efficiency.

TABLE C-6

SUMMARY OF COMPARISON SCREENING SOURCE CONTROL

Remedial Alternative	Total Project Costs Total Present Worth	Project Implementation Period	Environmental and Public Health Considerations	Comparison Findings
SC-3 Soil Washing	$12,800,000	4 yrs	1. 4,5,6,7 as SC-2 8. Generation of residuals after treatment requiring handling or disposal	Remedial Alternative SC-3 was screened out because it does not have high removal efficiency as SC-2 and SC-4. The cost effectiveness of disposal and treatability of its residuals are questionable too.
SC-4 Dechlorination	$17,038,000	3 yrs	1. 4,5,6,7 as SC-2 8. Generation of residuals after treatment requiring handling or disposal	SC-4 should be selected before the others, if treatability study data for both soil and residuals substantiates an adequate performance.
SC-5 Composting	$18,850,000	10 yrs	1. 4,5,6,7 and 8 as SC-2 9. Potential release of air emissions due to treatment process is higher than other onsite treatment alternatives 10. Requiring large space 11. Performance is affected by weather	SC-5 was screened out because it requires large operating space, and the performance is affected by cold weather.

TABLE C-6

SUMMARY OF COMPARISON SCREENING SOURCE CONTROL

Remedial Alternative	Total Project Costs Total Present Worth	Project Implementation Period	Environmental and Public Health Considerations	Comparison Findings
SC-6 Immobilization/ Chemical Fixation	$15,600,000	2 yrs	1. 4,5,6,7 as SC-2 12. Waste volume increases after treatment requiring additional handling or disposal 13. Limited success with solvents and PCBs	SC-6 was screened out because of its limited success with solvents and PCBs.
In-situ Treatment				
SC-7 Containment/ In-situ Biodegradation	$2,500,000	11 yrs	1. as SC-1 14. Reduction or elimination of contaminants in soil source resulting in an acceleration of groundwater cleanup due to reduction in leaching of contaminants to groundwater 15. Metamorphosis of hazardous nature of soil source areas without problems associated with excavation/removal	Remedial Alternatives SC-7 and SC-8 were retained for detailed development since they provide environmental benefits for the treatment of contaminated soil with order of magnitude costs less than the others (SC-7 only).
SC-8 Containment/ In-situ Soil Flushing	$27,000,000	15 yrs	1. as SC-1 14. as SC-7 4,5,8 as SC-4 15. as SC-7	However, treatability studies are to be conducted to substantiate the adequate performances. SC-7 and SC-8 are combined after the preliminary screening to incorporate detailed consideration

TABLE C-6

SUMMARY OF COMPARISON SCREENING SOURCE CONTROL

Remedial Alternative	Total Project Costs Total Present Worth	Project Implementation Period	Environmental and Public Health Considerations	Comparison Findings
On-Site Containment				
SC-9 Encapsulation	$2,900,000	30 yrs Construction Period 8 Months	1. as SC-1 16. Reduction or prevention of infiltration into soil source areas resulting in groundwater contamination 17. Contaminated soils remaining on-site may cause future release of contaminants 18. Restricted use of the site due to existence of the hazardous wastes	SC-9 was screened out as an individual independent treatment process because of potential release of contaminants in the future. However, it was considered as a component of a combined process.
SC-10 RCRA/TSCA Landfill	$4,900,000	30 yrs Construction Period 12 Months	1. as SC-1 8. Requires leachate disposal or treatment 18. as SC-9	SC-10 was screened out because it did not meet SARA requirements.
Sediment Treatment				
SC-11 Sediment Capping	$260,000	30 yrs Construction Period 6 Months	1. Eliminates access to wetland and unnamed tributary areas by capping 2. as SC-1 3. as SC-1 16. as SC-9	SC-11 was screened out because of potential release of contaminants in future.

TABLE C-6

SUMMARY OF COMPARISON SCREENING SOURCE CONTROL

Remedial Alternative	Total Project Costs Total Present Worth	Project Implementation Period	Environmental and Public Health Considerations	Comparison Findings
			17. as SC-9	
SC-12 Sedimentation Removal and Treatment	$180,000	Implementation Period 4 Months (additional time only)	4. as SC-2 6. as SC-2 7. as SC-2	SC-12 was not considered as an individual independent treatment process but a component of a combined process.
Off-Site Treatment				
SC-13 RCRA/TSCA Landfill	$27,000,000	18 Months	1. as SC-1 7. as SC-2 19. Potential for releases and safety problems due to extensive handling and transportation	SC-13 was screened out because of the current land ban regulations.
SC-14 Incineration	$213,605,000	18 Months	1. as SC-1 7. as SC-2 19. as SC-13 20. High cost is due to the legal restrictions to land disposal	SC-14 was retained for detailed development since it provides more environmental benefit and institutional acceptance than an off-site landfill.

TABLE C-7

SUMMARY OF COMPARISON SCREENING MANAGEMENT OF MIGRATION

Remedial Alternative	Total Project Costs Total Present Worth	Project Implementation Period	Environmental and Public Health Considerations	Comparison Findings
No Action				
MOM-1 No Action	$910,000	30 yrs	1. Groundwater will cleanup in 175-400 yrs as a result of natural processes 2. Includes monitoring to detect off-site contamination that could threaten the nearby residential areas 3. Requires institutional controls restricting the use of the aquifer 4. Does not offer a permanent solution such as treatment	This alternative was retained for detailed development to provide a basis for comparison to other alternatives as stipulated in NCP. However, this alternative is considered as a component of SC-1.
On-Site Treatment				
MOM-2A Precipitation/ Heated Air Stripping /Filtration	$6,945,000	10 yrs	2. as MOM-1 3. as MOM-1 5. May accelerate the cleanup of groundwater 6. Does not restrict future site use controls 7. Removes ketones from the groundwater	This alternative was screened out by comparison with MOM-2C because of the low removal efficiency of other organics.

TABLE C-7

SUMMARY OF COMPARISON SCREENING MANAGEMENT OF MIGRATION

Remedial Alternative	Total Project Costs Total Present Worth	Project Implementation Period	Environmental and Public Health Considerations	Comparison Findings
MOM-2B Precipitation/ Filtration/Carbon Adsorption	$8,250,000	10 yrs	2. as MOM-1 3. as MOM-1 5. as MOM-2A 6. as MOM-2A 7. Does not effectively remove VOCs	This alternative was screened out by comparision with MOM-2C because of the low VOC removal efficiency.
MOM-2C Precipitation/ Air Stripping/ Filtration/Carbon Adsorption	$8,250,000	10 yrs	2. as MOM-1 3. as MOM-1 5. as MOM-2A 6. as MOM-2A	This alternative has been retained for detailed development because it provides more environmental benefit and better groundwater quality than the others.
MOM-2D Precipitation/ Air Stripping/ Biodegradation/ Filtration/Carbon Adsorption	$10,800,000	10 yrs	2. as MOM-1 3. as MOM-1 5. as MOM-2A 6. as MOM-2A	This alternative has been screened out by comparison with MOM-2C because it provides no additional environmental benefit but requires operational involvement and extra costs.

TABLE C-7
SUMMARY OF COMPARISON SCREENING MANAGEMENT OF MIGRATION

Remedial Alternative	Total Project Costs Total Present Worth	Project Implementation Period	Environmental and Public Health Considerations	Comparison Findings
Off-Site Disposal				
MOM-3 RCRA TSD Facility	$17,300,000	2 yrs	6. as MOM-2A 8. Offers a permanent solution to the groundwater contamination 9. Potential for releases and safety problems due to extensive handling and transportation 10. Performance and implementability depend on the availability and acceptance of TSD facility	This alternative has been screened out because of high costs and less dependability.
Off-Site Treatment				
MOM-4 Pretreatment/ Pumping to Wastewater Treatment Plant	$1,806,000	3 yrs	6. as MOM-2A 8. Offers a permanent solution to the groundwater contamination 10. Performance and implementability are dependent on the availability and acceptance of wastewater treatment	This alternative has been retained for detailed development because of its effectiveness and practicality.

TABLE C-8

SUMMARY OF SOURCE CONTROL ALTERNATIVES SCREENING

Alternatives Screened in this Section	Alternatives Eliminated Detailed Development	Alternatives Retained
SC-1 No Action		SC-1 No Action
On-Site Treatment		
SC-2 Thermal Destruction		SC-2 Thermal Destruction
SC-3 Soil Washing	SC-3 Soil Washing	
SC-4 Dechlorination		SC-4 Dechlorination
SC-5 Composting	SC-5 Composting	
SC-6 Immobilization/ Chemical Fixation	SC-6 Immobilization/ Chemical Fixation	
In-Situ Treatment		
SC-7 In-Situ Biodegradation	SC-7 In-Situ Biodegradation	SC-7 In-Situ Soil Treatment*
SC-8 In-Situ Soil Flushing	SC-8 In-Situ Soil Flushing	
On-Site Containment		
SC-9 Encapsulation	SC-9 Encapsulation	
SC-10 RCRA Landfill	SC-10 RCRA/TSCA Landfill	
Sediment Treatment		
SC-11 Sediment Capping	SC-11 Sediment Capping	
SC-12 Sediment Removal and Treatment		SC-12 Sediment Removal and Treatment
Off-Site Treatment		
SC-13 RCRA Landfilling	SC-13 RCRA/TSCA Landfilling	
SC-14 Incineration		SC-14 Incineration including sediment removal and treatment

*SC-7 In-Situ Soils Treatment includes containment with a slurry wall or sheet piling folloved by in-situ biodegradation and soil flushing in a phased approach.

TABLE C-9

SUMMARY OF MANAGEMENT OF MIGRATION ALTERNATIVES SCREENING

Alternatives Screened	Alternatives Eliminated	Alternatives Retained
MOM-1 No Action		MOM-1 No Action, however retained as part of SC-1 not as a separate alternative
On-Site Treatment		
MOM-2A Precipitation/ Heated Influent Air Stripping/Filtration		MOM-2A Precipitation/Heated Influent Air Stripping/ Filtration
MOM-2B Precipitation/ Filtration/Carbon Adsorption	MOM-2B Precipitation/ Filtration/Carbon Adsorption	
MOM-2C Precipitation/ Air Stripping/ Filtration/ Carbon Adsorption		MOM-2C Precipitation/Air Stripping/Filtration/ Carbon Adsorption
MOM-2D Precipitation/Air Stripping/Biodegradation/ Filtration/Carbon Adsorption	MOM-2D Precipitation/Air Stripping/Biodegradation/ Filtration/Carbon Adsorption	
Off-Site Disposal		
MOM-3 RCRA TSD Facility	MOM-3 RCRA TSD Facility	
Off-Site Treatment		
MOM-4 On-Site Pretreatment/ Pumping to Wastewater Treatment Plant		MOM-4 On-Site Pretreatment/ Pumping to Wastewater Treatment Plant

TABLE C-10

CONCENTRATION RANGES AND FREQUENCY OF

VOLATILE COMPOUNDS IN THE RESOLVE SITE GROUNDWATER

Volatile Compounds	Concentration Range[a] (ppb)	Frequency[b]
Acetone	11-37,000	8/27
1,1-Dichloroethane	7-3,700	9/27
1,1-Dichloroethylene	29-1,000	5/27
trans-1,2-Dichloroethylene	1-83,000	23/27
Tetrachloroethylene	3-14,000	18/27
Toluene	2.2-33,000	13/27
Total Xylenes	21-6,700	13/27
1,1,1-Trichloroethane	6-35,000	13/27
Trichloroethylene	6-50,000	20/27
Vinyl Chloride	1-8,000	15/27
Methylene Chloride	600-16,000	5/27
Ethylbenzene	1-1,300	12/27
Methyl ethyl ketone	10-62,000	8/27
Methyl isobutyl ketone	40-6,800	7/27
Extractable Compounds		
1,2,4-Trichlorobenzene	1-230	16/27
Polychlorinated biphenyls (PCBs)[c]	4-1,200	8/27
Inorganic Compounds[c]		
Arsenic	5-148	16/27
Chromium	13-221	22/27
Cadmium	5-724	13/27
Iron	1,740-293,000	26/27
Magnesium	706-27,200	27/27
Manganese	236-20,700	26/27
Lead	13-479	18/27

[a]Number of samples in which contaminant was detected by the total number of samples.

[b]Data obtained from the Remedial Investigation Report by Camp Dresser & McKee, February, 1987.

[c]Data obtained from the unfiltered samples.

TABLE C-11

DESIGN CRITERIA FOR GROUNDWATER TREATMENT SYSTEMS
(Design based on 45 gpm flow plus 25% sidestream circulation)

I.	GENERAL DESIGN BASIS	
	Operation	24 hr/day, 12 mo/year
	Influent Flow Rate	45 gpm (65,000 gpd)
II.	UNIT PROCESSES	
1.	Equalization/Storage Tank	
	Number of Units	1
	Influent Flow	55 gpm
	Equalization (wet volume)	2 hours
	Storage (dry volume)	4 hours
	Total Volume with Freeboard	20,000 gal
2.	Oil Separator	
	Number of Units	1
	Influent Flow	55 gpm
	Max. Effluent Oil and Grease	10 mg/l
3.	Solids Contact Clarifier	
	Number of Units	1
	Influent Flow	55 gpm
	Surface Loading Rate	500 gpd/sf (0.35 gpm/sf)
	Net Settling Area	130 sf
	Flocculation, Detention Time	15 minutes
	Diameter	14 feet
4.	Neutralization Tank	
	Number of Units	1
	Influent Flow	53 gpm
	Detention Time	15 minutes
	Volume with Freeboard	1000 gal
5.	Air Strippers (GW-2A)	
	Number of Units	2 (one operating, one standby)
	Influent Design Flow	53 gpm
	Air to Water Ratio (vol)	100 to 1
	Blower Air Flow	750 cfm
	Tover Diameter (minimum)	3 feet

TABLE C-11 (CONT'D)

DESIGN CRITERIA FOR GROUNDWATER TREATMENT SYSTEMS
(Design based on 45 gpm flow plus 25% sidestream circulation)

6.	Air Strippers (GW-2C)	
	Number of Towers	2 (one operating, one standby)
	Influent Design Flow	53 gpm
	Air to Water Ratio (vol)	150 to 1
	Blower Air Flow	1,100 cfm
	Tower Diameter (minimum)	4 feet
7.	Vapor Phase Activated Carbon	
	Number of Units	2 (one operating, one standby)
	Inlet Air Flow	750 or 1100 cfm
	Carbon Quantity per Unit	10,000 lb.
8.	Activated Carbon (GW-2C)	
	Number of Units	2 (one operating, one standby)
	Influent Design Flow	53 gpm
	Total EBCT/Unit	60 minutes
	Contactor Dimensions	7 ft. dia. x 12 ft. high
	Carbon Load per Unit (min)	5000 lb.
	Fresh Carbon Storage Tank Capacity	10,000 lb.
	Spent Carbon Storage Tank Capacity	10,000 lb.
9.	Activated Carbon Canister (GW-2A)	
	Number of Canisters	2 (one operating, one standby)
	Influent Design Flow	10 gpm
	Total EBCT/canister	60 minutes
	Volume	600 gallons
	Type of Filter	Downflow
10.	Sand Filter	
	Number of Units	2 (one operating, one standby)
	Influent Design Flow	53 gpm
	Type of Filter	Gravity, Downflow
	Surface Loading Rate	2 gpm/sp
	Filter Area/Unit	25 SF

TABLE C-11 (CONT'D)

DESIGN CRITERIA FOR GROUNDWATER TREATMENT SYSTEMS
(Design based on 45 gpm flow plus 25% sidestream circulation)

11.	Sludge Filter Press	
	Number of Units	1
	Capacity	10 CF
	Cycles per day	1
	Sludge at 40% Solids	750 lb/day
	Sludge, Dry Solids	300 lb/day
12.	Sludge Holding Tank	
	Number of Units	1
	Volume	3000 gallons
13.	Reaction Tank (Polishing)	
	Number of Units	1
	Influent Flow	10 gpm
	Detention Time	15 minutes
	Volume with Freeboard	200 gallons
14.	Microfiltration Unit	
	Number of Units	1
	Influent Flow	10 gpm
	Filter Flux	600 gpd/SF
	Filter Area	24 SF
15.	Effluent Storage Tank	
	Number of Units	1
	Volume	10,000 gallons

TABLE C-12

CAPITAL COSTS FOR DECHLORINATION
OF 25,000 C.Y. OF PCB
CONTAMINATED SOILS AND SEDIMENTS

1)	Excavation with Sheet Piling	$ 475,000
2)	Operations Area	356,400
3)	Treatment Process	3,654,000
4)	Replacement of Soils	112,500
5)	Loam	580,000
6)	Seed	9,000
7)	Monitoring Equipment	50,000
	Subtotal	$5,236,900
	Pilot (10%)	524,000
	Engineering (15%)	786,000
	Contingency (15%)	786,000
	TOTAL	$7,332,900

TABLE C-13

OPERATION AND MAINTENANCE AND PRESENT WORTH COST
FOR DECHLORINATION OF 25,000 CY OF PCB
CONTAMINATED SOILS AND SEDIMENTS

1)	Personnel	$ 30,000
2)	Personal Protection Equipment	10,000
3)	Reagent	122,000
4)	Waste Disposal	122,000
5)	Field Labor	154,000
6)	Office Support	35,000
7)	Fuel Costs	25,000
8)	Deprivation	70,000
9)	Maintenance	100,000
10)	Travel	10,000
11)	Side-Stream Treatment	419,000
		$1,097,000

Present Value (10%) for 2 years

$1,097,000 x 1.736 = $1,904,400

Total

$1,904,400 + $7,332,900 = $9,237,000

TABLE C-14

CAPITAL COSTS FOR INCINERATION OF
25,000 CY OF PCB CONTAMINATED SOILS AND SEDIMENTS

1)	Excavation with sheet piling	$ 475,000
2)	Operations Area	356,400
3)	Treatment Process	6,875,000
4)	Replacement of Soils	112,500
5)	Loam 1'	580,000
6)	Seed	9,000
7)	Monitoring Equipment	50,000
	Subtotal	$ 8,457,900
	Pilot (10%)	846,000
	Engineering (15%)	1,269,000
	Contingency (15%)	1,269,000
	TOTAL	$11,841,900

TABLE C-15

OPERATION AND MAINTENANCE AND PRESENT WORTH COST FOR INCINERATION OF 25,000 CY OF PCB CONTAMINATED SOILS AND SEDIMENTS

1)	Equipment	$ 650,000
2)	Labor	775,000
3)	Fuel	775,000
4)	Electricity	200,000
5)	Process Water	5,000
6)	Wastewater Disposal	110,000
7)	Caustics	110,000
8)	Oversized Debris Removal	30,000
9)	Laboratory	295,000
	TOTAL	$2,950,000

Present Value (10%)

$2,950,000 x 1.736 = $5,121,000

$5,121,000 + $11,841,900 = $16,963,000

TABLE C-16

CAPITAL COSTS FOR
ALTERNATIVE MOM-2C PRECIPITATION AIR STRIPPING/
FILTRATION/CARBON ADSORPTION

		Alternative 2C
1)	Collection System	$ 175,000
2)	Extraction/Recharge Wells	340,000
3)	Groundwater Storage Tank	315,000
4)	Process Equipment including groundwater treatment work, sludge devatering facility, carbon system and pumps and piping for the treatment facilities	1,830,000
5)	Site Preparation	55,000
6)	Site Work	285,000
7)	Electrical Work	94,000
8)	Instrumentation	66,000
9)	Building	300,000
	Subtotal	3,460,000
	Pilot Study (10%)	346,000
	Engineering and Administration (15%)	519,000
	Contingencies (15%)	519,000
10)	Long-term Sampling and Maintenance	$1,571,720
TOTAL		$6,416,000

TABLE C-17

OPERATION AND MAINTENANCE COSTS
AND PRESENT WORTH COST FOR ALTERNATIVE MOM-2C
PRECIPATION/AIR STRIPPING/FILTRATION/CARBON ADSORPTION

Operation and Maintenance

	Alternative 2C
Personnel	$179,000
Maintenance	113,000
Power	140,000
Sample and Analyses	75,000
Carbon and Analyses	61,000
Carbon Regeneration	125,000
	$693,000

Present Worth

Project Costs for 10 years operation, at 10% interest rate, P/A = 6.144

Alternative 2C - Precipitation/Air Stripping/ Filtration/Carbon Adsorption

$6,416,000 + ($693,000 x 6.144) = $10,674,000

TABLE C-18

CALCULATION OF SOIL PCB CLEAN-UP LEVELS FOR THE RESOLVE SITE

Direct Contact With Soils (Dermal and Ingestion)	Soil Concentrations Associated with Levels of Excess Cancer Risk (mg/kg)				Exposure Assumptions						
	10-4	10-5	10-6	10-7	Soil Contact Rate (g/visit)	Dermal Absorption Factor	Incidental Ingestion Rate (mg/visit)	Ingestion Absorption Factor	Visits Per Year	Total Years Visited	Body Weight (kg)
Present Site Use (Trespassing):											
Average Case	20,000	2,000	200	20	1	0.01	20	0.35	10	5	30
Plausible Maximum Case	200	20	2	0.2	5	0.05	100	0.50	50	5	30
Future Site Use (Residential):											
Average Case	300	30	3	0.3	1	0.01	20	0.35	100	70	70
Plausible Maximum Case	10	1.0	0.1	0.01	5	0.05	100	0.50	200	70	70
PCB potency factor:	4.34 (mg/kg/day)-1										

FINAL RESPONSIVENESS SUMMARY

Re-Solve, Inc. Superfund Site
North Dartmouth, Massachusetts

EPA Work Assignment No.: 140-1L18
REM II Document Control No.: 243-R11-OP-FBVT-1

PREPARED FOR
U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I
BOSTON, MASSACHUSETTS

Prepared by the REM II Project Team under EPA Contract No. 68-01-6939

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Preface

The U.S. Environmental Protection Agency (EPA) recently held a public comment period for interested parties to comment on EPA's June, 1987 draft Feasibility Study (FS) and preferred alternative for the Re-Solve site. The FS examines and evaluates various options or remedial alternatives for addressing contamination at the site. At the time of the public comment period, EPA had announced its preferred remedy for the cleanup of the Re-Solve site.

The purpose of this responsiveness summary is to document EPA responses to the comments and questions raised during the public comment period. All of the comments summarized in this document will be factored into EPA's final decision of the preferred alternative for cleanup of the Re-Solve site.

This responsiveness summary is divided into the following sections:

I. Responsiveness Summary Overview - This section briefly outlines the proposed remedial alternatives as presented in EPA's draft FS, including the preferred alternative.

II. Background on Community Involvement and Concerns - This section provides a brief history of community interests and concerns regarding the Re-Solve site.

III. Summary Of Comments Received During the Public Comment Period and EPA Responses to These Comments - This section summarizes both written and oral comments received during the public comment period and provides EPA responses to these comments. Part I summarizes public comments and EPA responses, and Part II summarizes comments from potentially responsible parties (PRPs) and EPA responses. These comments are organized by subject area.

IV. Remaining Concerns - This section describes concerns that were not directly addressed during the RI/FS. EPA needs to address these concerns during the design and implementation of the remedial alternative.

Attachment A - This attachment includes a list of the community relations activities conducted at the Re-Solve site during EPA's remedial site program.

I. RESPONSIVENESS SUMMARY OVERVIEW

A. Proposed Alternatives and Preferred Alternative

The draft FS describes several remedial alternatives that are judged by EPA to be the most effective for dealing with the contamination found at the Re-Solve site. The remedial alternatives are organized into two categories: (1) source control and (2) management of migration. The purpose of source control remedial alternatives is to address areas of both soil and sediment contamination at the site. The draft Feasibility Study evaluated four options for addressing contaminated soils and sediments (i.e., source control) at the Re-Solve site. These were:

(1) on-site incineration;

(2) off-site incineration;

(3) on-site dechlorination; and

(4) dechlorination or incineration of highly contaminated soils, construction of a containment wall around the site, and in-place treatment of the remaining contaminated soils.

In addition, the FS evaluated two options for addressing contaminated ground water (i.e., management of migration). These were:

(1) extracting ground water and treating it in an on-site facility; and

(2) extracting ground water, pre-treating it, and piping it to an off-site waste water treatment plant.

EPA's preferred alternative consists of both a source control and management of migration component. The preferred alternative consists of excavation of PCB-contaminated soils and sediments, and treatment in an on-site mobile dechlorination facility. In addition, contaminated ground water will be pumped and treated by means of an air stripping unit and carbon adsorption to remove volatile organic compounds (VOCs). PCB contaminated sediments with PCBs at concentrations of 1mg/kg or greater will be excavated and treated on site in the dechlorination facility.

B. Public Comments on the Remedial Alternatives

Six parties submitted formal written comments to EPA during the public comment period: the Sierra Club, Ecova Corporation, the Town of Dartmouth, the Re-Solve Citizen's Advisory Committee (CAC), the Westport River Defense Fund (WRDF), and the Re-Solve Generators Committee that represents the potentially responsible parties (PRPs). Comments were submitted on behalf of the Re-Solve Generators Committee by (1) ERT; (2) Goodwin, Proctor & Hoar; and (3) Nutter, McClennan & Fish. In addition, a number of comments were received at the public hearing.

In general, the commenters (except the PRPs) supported the choice of the dechlorination and the ground-water treatment alternative but were concerned about the byproducts and effectiveness of dechlorination, air emissions resulting from dechlorination, and PCB mobility and contamination of the aquifer as a result of flushing the groundwater.

PRPs commented that EPA incorrectly applied the SARA requirements for ARARs, "Applicable and Relevant and Appropriate Environmental and Public Health Requirements". ARARs are the Federal and State environmental and health standards that are used to develop the appropriate level of cleanup at Superfund sites. PRPs argued that the ARARs used to develop the cleanup standards for the Re-Solve site should have been the RCRA closure standards for hazardous waste landfills or surface impoundments, as opposed to the Safe Drinking Water Act standards and other requirements. The PRPs also disagreed with EPA's decision to select cleanup standards that would permit future residential use of the site. In addition, the PRPs raised questions about cost estimates, risks of the preferred alternative, and the consistency of assumptions and methodology used in the FS and the Public Health Evaluation.

II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

Potential ground water and surface water contamination have been the principle concerns of the Re-Solve community since the early 1980s. Contamination of fish and wildlife has been a more recent concern. By 1982, the Re-Solve site had been placed on the NPL making it eligible for Superfund monies. The Re-Solve, Inc. site operated as a solvent reclamation facility for 24 years. Sludge-like residues from recycling were disposed of in four unlined lagoons at the site. In addition, cooling water from the processes was discharged to a shallow on-site pond. EPA found high concentrations of hazardous waste materials in these areas such as PCBs, solvents, acids and organic liquids and solids. Although contamination was not detected in private drinking water wells near the site during this initial phase, the community felt it was only a matter of time before the contamination migrated to private wells.

By June 1983, EPA had identified the source of on-site contamination as lagoon wastes and soil contaminated with organic compounds, and EPA removed 15,000 cubic yards of this waste. Further PCB contamination of soil was detected at this time, and a Supplemental RI was undertaken. The Supplemental RI also investigated contamination in off-site soils, sediments, surface water and ground water. One major community concern after completion of the Supplemental RI was the elevated lead levels found in residential wells. EPA concluded that the lead levels were not attributable to the Re-Solve site. Residents continue to be concerned about potential contamination of drinking water and contamination of fish and wildlife. EPA has told citizens that the current quality of drinking water in private wells in the vicinity of the site is considered acceptable. Although PCB contamination found in local fish (other than American eels) was below the Food and Drug Administration standard of 2 parts per million (ppm), citizens were concerned that EPA had not sampled other local game such as racoons.

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

This responsiveness summary addresses both oral and written comments received by EPA concerning the draft Feasibility Study and Preferred Alternative Document for the Re-Solve, Inc. Superfund site. The comment period was held from June 11, 1987 to July 7, 1987 and then extended to July 31, 1987 at the request of several commenters. A public hearing was held at Dartmouth Town Hall on July 1, 1987 as an opportunity for the public and other interested parties to present oral comments to EPA. These comments are recorded in a transcript of the hearing which is available at the information repositories and at the EPA Region I office in Boston, Massachusetts. EPA also received written comments on the draft FS.

The written and oral comments from the public are summarized and organized into the following six categories: (A) remedial alternative preferences, (B) technical concerns regarding remedial alternatives, (C) community relations and public participation, (D) costs and funding issues, (E) enforcement, and (F) miscellaneous. Comments from potentially responsible parties are organized into the following two categories: (A) PRP comments on the Public Health Evaluation; and (B) PRP comments on the FS and Preferred Alternative. EPA responses are provided for each comment, or set of like comments.

Before the start of the public comment period, EPA issued a press release and a fact sheet describing its preferred alternative for the Re-Solve site. In addition, EPA provided a summary of the preferred alternative in the Friday June 19, 1987 edition of the New Bedford Standard Times. The preferred alternative consists of both a source control and management of migration component. Specifically, the preferred remedy entails excavation of PCB-contaminated soils and sediments, and treatment in an on-site mobile dechlorination facility. In addition, contaminated ground water will be pumped and treated with an air stripping unit and carbon adsorption to remove volatile organic compounds (VOCs).

Part I. PUBLIC COMMENTS, EXCLUDING PRP COMMENTS

A. REMEDIAL ALTERNATIVE PREFERENCES

A number of commenters (the Sierra Club, Town of Dartmouth, Re-Solve Citizen's Advisory Committee (CAC), and Westport River Defense Fund, (WRDF)) supported EPA's choice of dechlorination with ground-water treatment as the preferred alternative for the Re-Solve site. Several commenters (the Sierra Club, WRDF) noted that Region I deserves commendation in deciding on an innovative technology. The Sierra Club also supported the identification of incineration as the backup option. Comments regarding the various alternatives discussed in the Feasibility Study are summarized below.

1. Source Control

a. Comment:

The Sierra Club noted that if the backup option of incineration has to be used, the choice of type of incinerator will be important. The commenter noted that the Feasibility Study describes three methods --rotary kiln, infrared, and fluidized bed -- but does not identify EPA's preferred method or relate cost estimates to incineration method. The commenter stated that in view of the fact that there may be greater air quality benefits and cost benefits associated with particular options, EPA should provide more detailed information to the public if it appears likely that incineration will be used.

EPA Response:

Upon completion of the pilot-scale study for dechlorination, EPA will discuss the results at a public information meeting to be held in Dartmouth, Massachusetts. If the backup option, incineration, is selected to treat the PCB-contaminated soils and sediments, EPA will provide additional information on each method of incineration presented in the Feasibility Study.

2. Management of Migration

a. Comment:

One commenter (Ecova) referred to "the technical and economic advantages of biological treatment" over the proposed carbon polishing or air stripping at elevated temperatures. The commenter proposed that the destruction of organic compounds accomplished by a biological process and much lower operating costs may make biological degradation a more acceptable technique to accomplish removal of soluble organic contaminants from the groundwater.

EPA Response:

Bioremediation technologies were evaluated in the FS and screened out because the uncertainties associated with these "emerging" technologies were greater than dechlorination and other innovative technologies. The problems associated with bioremediation are:

1. Maintenance of the proper environment for the micro-organism populations;

2. High energy requirement to breakdown large complex molecules such as PCBs. This translates into longer retention times to complete the reaction;

3. Mass transfer is greatly reduced without agitation by a reactor, thus reducing the speed and effectiveness of the reaction;

4. Variable soil conditions of the site may result in inconsistent flushing, limiting direct contact between micro-organisms and contaminants (PCBs), and;

5. Large areas of land would be needed if bioremediation were implemented using a landfarming technique. As stated in the FS and the ROD, the land surrounding the Re-Solve site is predominantly wetland resource areas, thus limiting the implementability of certain technologies requiring large areas of land.

6. The deep penetration of PCB in the vicinity of SB-25 makes it increasingly difficult to maintain an environment suitable for bioremediation (i.e. adequate supply of oxygen, nitrogen and/or methane).

If dechlorination does not prove to be implementable at the Re-Solve site, EPA does not consider it logical to evaluate a less developed and less implementable technology, such as bioremediation. Rather, the Agency will evaluate a technology that is further along in the developmental process so that cleanup at the site can be initiated in a timely manner.

B. TECHNICAL CONCERNS REGARDING REMEDIAL ALTERNATIVES

1. Source Control

a. Pilot Study

i. Comment

Both the Westport River Defense Fund and the Sierra Club pointed out that during the pilot tests at the site, EPA should take every

possible precaution to avoid adverse impacts on the surrounding neighborhood and environment.

EPA Response:

EPA will develop a site-specific workplan, health and safety plan and project operations plan for all pilot studies and additional field work conducted during the remedial design. These documents will be available for public review at the information repositories. As part of any field studies that will entail excavation and treatment (i.e., dechlorination), an air monitoring program will be implemented to prevent adverse impacts to on-site workers and nearby residents.

ii. Comment:

The Sierra Club asked whether EPA had identified any specific criteria by which to evaluate the pilot testing of dechlorination, and to determine if dechlorination will be used. In addition, the Sierra Club suggested that EPA quickly proceed with the pilot study so that the backup option can be brought on line in a speedy fashion if unanticipated problems arise in the pilot testing.

EPA Response:

Specific evaluation criteria to be used to assess whether dechlorination can be implemented effectively will include, but not necessarily be limited to, the following:

1. Identification of the specific chemical components of the reaction byproducts (i.e., sidestream);
2. Volume and concentration of the sidestream;
3. Pretreatment/treatment requirements for disposal of the sidestream and associated costs;
4. Effectiveness of different reagents in the process;
5. Process time;
6. Percent reduction of total organics in soils; and
7. Overall project cost.

EPA will be negotiating with the PRPs for recovery of past costs incurred by the government and the conduct of the remedial design and remedial action during the winter of 1988. EPA anticipates that the pilot study on the dechlorination process will be conducted during the spring/summer of 1988.

iii. Comment:

Two commenters (the Sierra Club and the Town of Dartmouth) were concerned about the byproducts of the dechlorination process. The Sierra Club advised that, during the pilot study, EPA should assess the production of residuals, their toxicity level, the amount produced, and the facilities necessary for their disposal. In addition, the Sierra Club suggested that potential problems related to disposal of residuals from the dechlorination process be compared to those associated with the different methods of incineration of this waste material.

EPA Response:

EPA will identify the specific chemical components of the reaction byproducts of the dechlorination process as well as estimated volumes during the pilot study. As discussed in the ROD, EPA's Hazardous Waste Engineering Research Laboratory (HWERL) in Duluth, Minnesota recently completed bioconcentration/bioaccumulation, mutagenicity, and toxicity tests on the byproducts of the dechlorination process. These tests concluded that the byproducts did not bioaccumulate, did not cause mutagenicity, nor were they toxic to aquatic organisms. EPA will assess the need to conduct additional toxicity tests on the byproducts during design. In addition, EPA will determine the proper manner in which to dispose of these byproducts during design.

As mentioned previously, one of the evaluation criteria will be the additional management of the byproducts from the dechlorination process. If disposal of the byproducts proves to be both difficult and costly, thus impacting the implementability of the technology, EPA may conduct a comparative analysis of the disposal of the residuals for both dechlorination and incineration.

iv. Comment:

The Sierra Club urged that the results of the pilot study should be fully evaluated before going on with dechlorination. In addition, the Town of Dartmouth and the Re-Solve CAC urged that all data that is currently being gathered on sites being treated with the dechlorination process should be available for review prior to the start of the pilot study at the Re-Solve site. Further, the Re-Solve CAC stated that data from the pilot study at the Re-Solve site should be made available for review (a public hearing) before continuing with the dechlorination process.

EPA Response:

As mentioned previously, a workplan will be developed for the pilot study. Included in the workplan will be all data relevant to the

dechlorination process. EPA will discuss the status of dechlorination and the results of the pilot study during a public information meeting during the conduct of remedial design.

v. Comment:

One commenter asked about the size of the pilot study. Another commenter asked when the pilot study would begin.

EPA Response:

EPA antipicates using a (2) cubic yard pilot unit, the same unit that is to be used at the Wide Beach Superfund site in South Glens Falls, New York. EPA plans on conducting the pilot study during the Spring/Summer of 1988.

b. Cleanup Levels

i. Comment:

The Sierra Club commented that EPA's proposed cleanup level of 30 mg/kg concentration of PCBs in on-site soils in the saturated zone is identified with a risk factor of 10^{-5} and an "average case" scenario for "direct contact with soils".*

The Sierra Club pointed out that the "plausible maximum case" scenario identified a concentration of 1.0 mg/kg for the same level of risk. The Sierra Club recommended that EPA take into account the "plausible maximum case" rather than the "average case". In addition, the Sierra Club stated that the FS does not contain volume estimates that would correspond to more stringent cleanup levels beyond the graph presented in Figure 4-2. Sierra Club requested that EPA provide numerical estimates of these volumes and any corresponding adjustments in cleanup costs that would result if the "maximum plausible case" were used. The Town of Dartmouth Conservation Commission argued that the proposed 30 mg/kg cleanup level for PCB-contaminated soils and the corresponding risk level of 10^{-5} should be weighed against a target level of 20 mg/kg and the associated risk level in order to reduce public health risks at or adjacent to the Re-Solve site.

EPA Response:

Based upon a number of reasonable and valid (albeit conservative) assumptions, EPA considers the average case under future site use conditions to be protective of human health and the environment.

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* The Westport River Defense Fund (WRDF) supported these comments of the Sierra Club by reference.

The estimated volume of PCB-contaminated soils located in the unsaturated zone greater than or equal to a concentration of 1 ppm is 30,000 cubic yards. The estimated total project cost to treat 30,000 cubic yards of PCB-contaminated soils to a cleanup level of 1 ppm is $11.25 million. EPA has selected a cleanup level of 25 ppm for PCBs in soils. A target level of 25 ppm PCBs would still correspond to a 10^{-5} risk level. The rationale for EPA's PCB cleanup standard for soils is presented in more detail in Section VI(B)(1) of the Record of Decision (ROD).

ii. Comment:

The Sierra Club questioned the reliability of the bench-scale studies in predicting the interrelationship of PCBs and volatile organic compounds (VOCs). Specifically, the Sierra Club was concerned that the FS uses a numerical correlation between the concentration of VOCs and PCB mobility that is based on the bench-scale studies. The commenter stated that if there is sufficient uncertainty, the proposed PCB cleanup concentration levels may not be sufficient to guarantee permanent immobility of the PCBs to be left on site.

EPA Response:

The mobility of PCBs in the groundwater is dependent on the VOC concentration in the soil matrix. Results from EPA's bench-scale study and calculations made using available literature on the subject indicate that reducing VOCs to the levels selected in the ROD should render the PCBs relatively immobile. Please refer to Section VI (A)(2) of the ROD for a more detailed discussion on PCB-VOC interaction.

iii. Comment:

The Sierra Club (and WRDF by reference) remarked that the FS does not compare the length of treatment time required to achieve levels of cleanup for the dechlorination and the incineration alternatives. It questioned whether one or the other would result in a significantly faster cleanup, and if so, whether the time savings would significantly affect additional off-site migration that may occur.

EPA Response:

EPA estimates that the time of operation for both dechlorination and incineration of 25,500 cubic yards of PCB-contaminated soils and sediments would be the same. The period of operation is estimated to be 24 months.

c. Air Emissions

i. Comment:

Three commenters had remarks concerning potential air emissions from dechlorination. The Sierra Club (and WRDF by reference) questioned whether VOCs will be released to the environment during the dechlorination process. The Re-Solve CAC reported that previous experience has shown that during the excavation process, the escape of VOCs will be a problem. It questioned what measures will be employed to control the emissions, and whether an enclosure will be used above the 15' by 15' area being treated and, if not, why not.

EPA Response:

The dechlorination process is a closed system. VOCs released during the reaction step will be captured in vapor phase carbon and disposed of properly. Mitgative measures such as those discussed in Section VI(A)(1) of the ROD and the evaluation of alternative SC-2 will be implemented during the excavation activities. EPA is proposing to use emission suppression techniques such as foam or water spray to control odor and dust during excavation. These techniques are more effective and more easily implemented than constructing an enclosure over the excavation.

ii. Comment:

One commenter was concerned with the possibility of air emissions if the backup option of incineration is used and asked how long the process would take.

EPA Response:

In accordance with Section 761.70 of the Toxic Substances Control Act (TSCA), incineration systems must demonstrate a 99.9999 percent destruction and removal efficiency for PCBs. If incineration is selected, a trial burn will be conducted to determine if the incinerator achieves the requirements of TSCA. Further, air emissions from the incinerator will not exceed any Federal or State applicable or relevant and appropriate environmental requirements. EPA estimates that it would take approximately 24 months to incinerate 25,500 cubic yards of PCB-contaminated soils and sediments.

d. Requests for Data

i. Comment:

A representative of the Dartmouth Board of Health noted that the proposed dechlorination process has worked successfully on various

chlorinated compounds, but that it is not clear whether or not this method will work specifically on PCBs.

EPA Response:

Bench-scale testing of the dechlorination process was conducted as part of the FS using soil samples from the Re-Solve site. These samples contained PCBs at 3000 ppm. The dechlorination process was effective in reducing the PCB concentration to less than 1 ppm. Refer to Section 4 of the FS for additional information and data. More recently, a pilot-scale study was completed at the GE Moreau Superfund site using a 40 gallon reactor. Preliminary results indicate that the dechlorination process was successful in reducing the PCB levels in soils from approximately 7000 ppm to 10 ppm.

The specific byproducts from the dechlorination of the PCB-contaminated soils obtained from the Re-Solve site were not identified as part of the bench-scale study. EPA plans on identifying the specific byproducts as part of the pilot-scale study. However, there is no possibility that dioxins will be a byproduct of the dechlorination of PCBs.

e. Other

i. Comment:

A citizen was concerned that if after treatment, EPA finds that it cannot use the soil as backfill, then the timing of cleanup may be delayed, and the price of cleanup may increase.

EPA Response:

EPA selected a target treatment level of 25 ppm for PCB-contaminated soils. This is equivalent to the health-based cleanup standard for the site. Using the dechlorination process, EPA will treat the contaminated soil for a predetermined period of time (treament time will be determined in the pilot study). Following treatment, EPA will sample the batch to determine if the 25 ppm target level has been attained. If the level has been attained, the soil will be used to backfill excavated areas of the site. If the target level has not been attained, the batch will undergo further treatment until the cleanup level is reached so that the treated soil can be used as backfill. This process should not impact the time or cost of the remedial action.

ii. Comment:

Several commenters asked for clarification regarding optional pre-treatment of unsaturated on-site soil.

EPA Response:

During design of the remedial alternative, EPA will conduct treatability studies to determine if pre-treatment of soils will be undertaken. If pre-treatment proves to be cost effective, then the Agency may decide to pursue this option.

iii. Comment:

One person at the public hearing asked whether the flushing of the aquifer will admit PCBs into the aquifer.

EPA Response:

The ground-water treatment system consists of a recirculation system that will draw water in, treat it, and distribute it over the site so that through continuous washing, the soils will be cleansed. Because PCBs are relatively insoluble, they are not expected to be washed off the soils as readily as soluble organic compounds, such as volatile organic compounds (VOCs). The removal of VOCs from the soil and ground water should cause the PCBs to remain in the soil, and thus limit the possibility of ground water contamination.

2. Management of Migration

a. Ground-Water Contamination and Monitoring

i. Comment:

The Town of Dartmouth urged that, in conjunction with any on-site treatment of ground water, a rigorous residential well monitoring program be implemented to detect any migration of contaminants. The Town of Dartmouth suggested that EPA consider the extension of public water supplies to the area adjacent to the Re-Solve site if any migration of contaminants is detected in residential wells.

EPA Response:

Select downgradient residential wells and monitoring wells will be monitored during the ground-water restoration program. If the site related contaminants are detected in such residential wells at levels that are a risk to human health, the Agency will undertake corrective action that may include the provision of bottled water or an alternate water supply.

ii. Comment:

The Sierra Club expressed concern that the Feasibility Study does not examine the question of potential contamination of downgradient

bedrock wells. It questioned to what extent contaminant migration through bedrock can be predicted and whether, in EPA's opinion, this is a serious concern.

EPA Response:

Determining flow direction in a fractured media is very difficult. Ground water will follow fracture pathways in response to potential head changes. In the case of the Re-Solve site, the Copicut River and adjacent wetlands creates a large drain or ground water discharge area for flow on both sides to seek. This is evident by piezometric head data from the site which indicated upward vertical gradients and comparisons to similar basins in New England. There is no question that there is contamination in bedrock, but EPA believes that it discharges to the Copicut River and adjacent wetlands and therefore, does not pose a threat to downgradient users.

iii. Comment:

The Re-Solve site CAC had several questions regarding the management of migration phase of the Feasibility Study, as well as several requests for data. Its questions and suggestions included the following:

- Ground water pumping and treatment should not be started until the horizontal distribution of all of the contaminants are well defined. The CAC suggested that other wells be drilled down to the bedrock but not into it.

- The CAC would like to see more testing to determine if there are separate phases of dense non-aqueous liquids on top of the bedrock and/or on top of semi-permeable silt or clay layers above the bedrock?

- The CAC stated that, considering that the Feasibility Study is based on 1983 data, it would like to see a continuum of the data up to the point of the final cleanup.

EPA Response:

The horizontal and vertical distribution of contaminants were studied extensively as part of the RI through the installation of 45 monitoring wells. EPA feels that it has a good understanding of the dissolved phase of the plume. In addition, 56 soil borings were installed as part of the RI and samples were taken every two feet and analysed for PCBs and total volatile organics (TVO). This represents one of the most extensive soil boring investigations conducted to date in Region 1. The results of this investigation does not indicate the presence of non-aqueous phase liquids. This determination was based on residual concentration of TVOs in soils.

Finally, the FS is not based on 1983 data. Ground-water sampling data from as recently as July 1986 were used to characterize the extent of contamination in the overburden and bedrock aquifers and in the development of remedial alternatives.

c. Schedule

i. Comment:

Two commenters had remarks concerning the schedule of the management of migration phase of the cleanup of the Re-Solve site. The Town of Dartmouth stated that in order to limit migration of contaminants, EPA should consider immediately implementing ground-water treatment. The Re-Solve CAC urged that any lack of experience with the dechlorination process should not be allowed to delay the startup of ground-water treatment. It argued that since VOCs are responsible for the mobility of the PCBs, their early treatment will contribute to control of both problems.

EPA Response:

During design of the remedial action, EPA will conduct pilot-scale studies on the dechlorination process as well as the ground-water treatment processes. The pilot study on dechlorination, therefore, should not delay the implmentation of the remedy. Secondly, treatment of PCB-contaminated source soils will also result in a percent reduction of the VOCs. If the mass of VOCs in the unsaturated zone go untreated, a longer period of time will be required to restore the aquifer to the target cleanup levels. Finally, if the management of migration component is implemented prior to the source control component, PCB-contaminated sediments will continue to act as a source of contamination for an additional 10 years or more.

d. Wetlands

i. Comment:

The Sierra Club (and WRDF by reference) and the Town of Dartmouth were both concerned with the effects of the remedial action on wetlands. The Sierra Club asked whether the "replaced" wetlands will be contiguous to the ones that will be altered or destroyed. It asked whether "replacement" refers to regeneration or enlargement of an existing wetland system, or to an attempt to "create" new wetlands. The Dartmouth Conservation Commission supported the proposed cleanup levels for sediments in the wetlands because of the possibility of continued migration of contaminants downgradient. However, the Town argued, the methodology for working in and adjacent to the wetlands should be scrutinized to avoid further contamination and disruption in the wetland area. The Town made the

following suggestions:

- contaminated wetlands should be isolated with a physical barrier (silt fence and/or berm) or flow patterns should be redirected; and

- contaminated wetlands should be excavated immediately and stock-piled in an upland area.

EPA Response:

The selected remedial action entails excavation of 3000 cubic yards of PCB-contaminated sediments in the wetlands north of the site and the unnamed tributary. Mitigative measures that will be undertaken during the conduct of these activities are discussed in detail in Section VI(A) of the ROD. These activities will result in the temporary loss of wetland areas. Upon completion of the remedial activities, a wetland restoration program will be implemented involving the in-kind replacement of wetlands.

In order for EPA to "excavate" the PCB-contaminated sediments "immediately and stockpile them in an upland area", EPA would have to conduct a removal action at the site. A removal action requires that the contaminants pose an imminent and substantial danger to public health and welfare (see Section 104 of CERCLA). EPA does not believe that the PCB contamination in the wetlands qualifies for removal activity, or that removal activity is appropriate.

C. COMMUNITY RELATIONS AND PUBLIC PARTICIPATION

i. Comment:

One commenter (WRDF) stated that EPA should place greater emphasis on notifying the public of the existence of the site, and that warning signs should be posted about the fish and surface water contamination. It was suggested that all area realtors be sent copies of all bulletins and notices on the site.

EPA Response:

In the summer of 1986, EPA posted warning signs in the vicinity of the site alerting the public against consumption of American eels. As needed, these signs will be replaced. Secondly, EPA has developed an extensive mailing list of interested persons in the community surrounding the site, and EPA welcomes any new additions to this list.

ii. Comment:

The Re-Solve CAC asked if there would be ongoing communication with members of the public to inform them of the progress of the cleanup.

EPA Response:

The community relations activities will continue after the Record of Decision has been signed. EPA will continue to hold public meetings, and issue fact sheets to inform the public of events going on at the site throughout the implementation of the remedial action. EPA continually updates its mailing lists, so that interested members of the community can receive information directly.

D. COST AND FUNDING ISSUES

i. Comment:

The Sierra Club commented that it assumes the State of Massachusetts will pay operation and maintenance costs unless and until responsible parties agree to pay these costs. The Sierra Club questioned whether EPA has done any analysis of what effect the excavation and treatment of greater volumes of soils would have on the long-term operation and maintenance costs associated with ground-water treatment.

EPA Response:

The Commonwealth of Massachusetts will provide 10% of the capital costs and operation and maintenance costs throughout the implementation of the remedy. Secondly, EPA conducted a limited analysis of the effects that treatment of different volumes of soils would have on the rate of restoration of the aquifer. This analysis is presented in the technical memorandum entitled "Re-Solve Aquifer Flushing Technical Memorandum" which is included as part of the Administrative Record for the site.

E. ENFORCEMENT

i. Comment:

Several commenters asked about the status of the negotiations with potentially responsible parties to recover past and future costs.

EPA Response:

Following the issuance of a Record of Decision (ROD), EPA will negotiate with the responsible parties for recovery of past costs

incurred by the Government and for conduct of the remedial design and remedial action described in the Record of Decision (ROD).

F. MISCELLANEOUS

Miscellaneous comments included those regarding the cleanup schedule, site access, the extension of the comment period deadline, EPA oversight of the remedial action, and qualifications of on-site personnel.

a. Cleanup Schedule

i. Comment:

The WRDF expressed concern that the cleanup begin in advance of the projected earliest start date of 1989. It noted that the citizens have been dealing with the problem longer than necessary, as a result of a failed cleanup attempt at the site in 1983.

EPA Response:

First, EPA is required to negotiate with the PRPs for recovery of costs incurred by the government and for conduct of the remedial design/remedial action. If negotiations fail, EPA can then implement the remedy using the Superfund Trust Fund. EPA anticipates that the design of the remedial action will be initiated, by either EPA or the PRPs, in the Spring of 1988. Remedial design normally takes 9 to 12 months to complete. Spring of 1989, therefore, is the earliest possible date that the selected remedial action could be initiated at the site.
Secondly, the first remedial action conducted from July of 1984 to July of 1985 was successful in permanently and significantly reducing the volume and toxicity of PCB-contaminated source material at the site.

ii. Comment:

One citizen was concerned that, since the dechlorination process is still in the pilot stage, in several years EPA may find it made a mistake choosing dechlorination as an alternative, and thus cleanup of the site will be delayed even more. The citizen suggested choosing an "accomplished process."

EPA Response:

EPA will evaluate the implementability of dechlorination through the conduct of the pilot study prior to final selection of the source control treatment technology. The conduct of a pilot study will not delay the initiation of the remedial action at the site.

b. Site Access

i. Comment:

The Town of Dartmouth requested that EPA address short-term and long-term access to the Re-Solve site and surrounding areas.

EPA Response:

As part of the remedial design of the alternative, EPA will initiate enforcement agreements and/or actions to ensure short-term and long-term access to the Re-Solve site.

c. Extension of Comment Period/ Request for Meeting with EPA

i. Comment:

The Re-Solve CAC requested an extension of the comment period deadline, and requested to meet with EPA to discuss issues regarding the site and how the CAC can be of help in the cleanup process.

EPA Response:

In response to the commenter's request, EPA extended the public comment period until July 31, 1987. In addition, EPA and MA DEQE met with the CAC on July 15, 1987 to discuss the role of the CAC in the remedy selection process, the alternatives presented in the FS and the Proposed Cleanup Plan.

d. Remedial Action Oversight

i. Comment:

Several commenters expressed concern that careful monitoring of on-site activities be conducted. WRDF urged that EPA carefully monitor the contractors responsible for the work. The Dartmouth Conservation Commission requested that the Army Corps of Engineers be actively involved in the implementation and monitoring of the cleanup process. Commenters were concerned both with who would be overseeing the cleanup, and who would be enforcing applicable regulatory standards.

EPA Response:

In terms of oversight, if EPA is funding the cleanup, EPA may either enter into an interagency agreement with the Corp of Engineers to conduct the design and oversee the construction of the remedial activities or EPA may enter into an agreement with a private contractor. In either case, an EPA official would be present during the implementation of the remedial action. If the PRPs agree to

perform the remedial action, they will hire their own contractor to perform the work, and EPA will carefully oversee this work. In summary, the EPA will be present at all times, whether private sector or government money is spent, to ensure that the remedial activities are conducted consistent with the Record of Decision.

e. **Qualifications of On-site Personnel**

i. Comment:

One commenter at the public hearing was concerned about the qualifications of the people working on site.

EPA Response:

The qualifications sought for on-site personnel will be determined during the design of the selected remedial action. EPA assures that only qualified people will be involved in the implementation of the remedial action.

PART II. COMMENTS FROM POTENTIALLY RESPONSIBLE PARTIES

INTRODUCTION

The following section summarizes written comments submitted by and on behalf of the Re-Solve Generators Committee (Committee), and provides EPA responses to these comments. The Committee represents potentially responsible parties (PRPs) at the Re-Solve site. Comments were submitted on behalf of the Committee by (1) ERT (Draft Feasibility Study and EPA Preferred Alternative) (July 31, 1987), referred to as the "ERT Review Comments"; (2) Goodwin, Proctor & Hoar (ARARs) (May 21, 1987); (3) Nutter, McClennan & Fish (Additional Comments on FS and Preferred Alternative) (July 31, 1987).

A summary of ERT comments and EPA's responses appear below. Any additional comments by Goodwin, Proctor & Hoar are also included below. For the most part, the Goodwin, Proctor and Hoar comments are reiterated in the ERT comments. Comments similar to those in the ERT document are cross-referenced to avoid duplication of comments and responses. Also included in this section are the comments submitted by Nutter, McClennan and Fish with a point-by-point response by EPA to these comments.

The Goodwin, Proctor and Hoar comments were originally submitted to EPA Region I on May 21, 1987, prior to the initiation of the public comment period. These comments were resubmitted on July 7, 1987 to Lee M. Thomas, Administrator, U.S. EPA. Winston S. Porter, Assistant Administrator, Office of Solid Waste and Emergency Response, U.S. EPA, responded to these comments on behalf of Mr. Thomas in a letter dated August 13, 1987. This response is included as part of the Administrative Record for the site.

EPA's response to an information request from ERT (July 14) is contained in a letter dated July 23, 1987. This EPA letter, responding to cost and design data requests, is included as part of the Administrative Record for the site.

A. PRP COMMENTS ON THE PUBLIC HEALTH EVALUATION

1. Technical Comments on The Public Health Evaluation

a. Selection of Chemicals for Assessment

i. Comment:

Section 8.2 of the report is of considerable importance because decisions made in this section essentially drive the Public Health Evaluation (PHE) performed by Camp Dresser & McKee (CDM). It is critical to subsequent sections of the report because all present and future site risks estimated in the report are based upon the indicator chemicals selected in this section. One apparent deviation we have noted from EPA protocol concerns the use of non-detectable sample values. This is contrary to the intent of the EPA document "Superfund Public Health Evaluation Manual." On p. 24 of this manual the use of non-detect values is discussed and we quote "... the mean should generally be calculated based on samples where the chemical was detected, not including samples below the detection limits." And in a subsequent sentence, "Be sure to be consistent for all chemicals within the medium so that the selection process is not biased." On page 25 of this manual a sample calculation sheet is provided, and zero was used for each sample in which the chemical in question was not detected.

The CDM method for selecting Indicator Chemicals used a geometric mean that incorporated every sample taken at this site. Because each chemical was not found in every sample taken at this site, CDM assumed that all non-detectable values should be treated as though they were equivalent to one-half of the detection limit for that particular chemical (p. 8-3). This approach adds considerable bias to the indicator scores from which site indicator chemicals are to be selected. One problem associated with the methodology is that the geometric mean tends to generate a mean value that is closer to the values most often reported. The addition of values for samples originally reported as non-detectable for a chemical drives the mean value CDM has calculated towards the detection limit value. As each chemical may have a different detection limit, the mean for each chemical is driven towards different minimal values under the CDM method.

A second problem is that the CDM method generates a mean value that is highly influenced by the number of samples actually reporting non-detectable values. As the number of non-detects varies for each chemical, the "adjustment" that is made towards the detection limit by this method varies for each chemical.

EPA Response:

The Superfund Public Health Evaluation Manual (PHE) was developed by EPA to provide guidance in conducting Superfund site PHEs. EPA did not intend that the PHE manual be treated as the only approach for conducting PHEs and, in fact, few PHEs rely exclusively on the PHE manual approach. With respect to detection limits, it is standard practice to consider samples in which the contaminant was detected along with samples in which the contaminant was not detected in calculating a mean value. EPA has specifically recommended that half of the detection limit value be used in calculating means for hazardous waste sites (EP, Exposure Assessment Methodologies for Hazardous Waste Sites, May 1984). The use of zeros for non-detects in calculating the mean may bias the mean estimate downwards whereas use of the reported detection limit in calculating the mean may bias the mean upwards.

b. Human Health Risk Assessment/Potential Development of the Re-Solve Site

i. Comment:

Section 8-30-31, as written, makes no real attempt to discuss the uncertainties inherent to this particular risk assessment; instead, it provides only a short, generic discussion of those factors that typically add uncertainty to all endangerment assessments. CDM has made no attempt to discuss: 1) the uncertainties associated with their approach for selecting indicator chemicals, and how this uncertainty affects the outcome of the risk assessment, 2) the shortcomings of the exposure assessment, 3) the limitations of the sampling data, and 4) they made no attempt to identify those components of the risk assessment (i.e. variables in specific equations) that may alter the perceived risk estimates that have been provided in this document.

EPA Response:

The uncertainties associated with the selection of indicator chemicals may result in an underestimate of risk (by less than 1 order of magnitude) since not all chemicals present at the site were quantitatively evaluated in the risk assessment. There are many uncertainties associated with the exposure assessment, and most of the assumptions used to compensate for these uncertainties may overestimate risks (in most cases by less than 1 order of magnitude). These conservative assumptions include assuming that the frequency of exposure and contact rates with environmental media are constant throughout the period of exposure. The sampling

data used to calculate uncertainties are associated with the limited number of samples used for several exposure pathways (4 for on-site surface soil, 6 for off-site surface soil, 3 for on-site VOC air concentrations, 1 composite fish sample from the Copicut River). The uncertainty in the sample data may result in either over- or under-estimation of potential risks (probably by less than 1 order of magnitude).

ii. Comment:

How can a sample be both an off-site and an on-site sample? A comparison of the listed on- and off-site surface soil samples shows that CDM used SB-47, SB-50 SB-52, and SB-53 as on-site surface soil samples. Yet three of these are actually off-site samples, so that only one on-site surface sample was actually used. It would appear that a major limitation and uncertainty of this PHE is the inadequate number of surface soil samples collected during the remedial investigation. (See ERT review comments #49 and #51). It would be better to consider all soil samples for the purposes of calculating exposures. This would produce an apparent geometric mean of 0.310 ppm for PCBs (p. 8-12, 8-79 based on CDM's method of calculation).

EPA Response:

There are a total of seven surface soil samples collected during the RI. Among these only one (SB47) was collected "on site". However, for the purposes of developing exposure point concentrations, it is desirable to roughly characterize an "average" and a "plausible maximum" level of on-site contamination, and such a characterization should rely on more than one sample if possible. Three of the surface soil samples (SB50, SB52, SB53) were located just outside of the site's fence and thus were formally "off-site" samples. However, these samples were located close enough to on-site areas to characterize potential on-site levels of contamination and so they were used in estimating exposure point concentrations both off and on site.

Certainly more surface soil samples would have been useful.

iii. Comment:

The possible number of times a child may visit a site is open to considerable debate. As previously noted (See ERT Review comment #53), it is highly unlikely that a fence erected at this site would be knocked down and remain down for any

extended period of time. Moreover, children are in school during every month of the year except June, July and August and even during the summer a small child is more likely to play near home. In addition, the ground may be wet, snow-covered or frozen a considerably portion of the year in Massachusetts. All of these factors would act to decrease the number of times a child is likely to gain access to the site. Thus the maximum number of visits per year (50) selected by CDM seems unrealistically high. Given the fact that very few people live near the site (p. 2-1), 25 visits might be considered a better maximal number.

EPA Response:

It is important to understand that a PHE evaluates the "no action alternative," i.e., no institutional controls on the future use and development of the site. It is with this mandate in mind that the exposure pathways and scenarios are developed. Thus, we agree that the plausibility of the exposure scenarios should be considered. But under the no action alternative, it is in fact quite possible that a child might trespass onto the site area 10 times per year for a period of 5 years (see Table 8-10). In addition the PHE focuses on the potential heath risks to the individual as well as to the population. Thus, it was not considered unlikely that one child living near the site might trespass onto the site 50 times per year for the maximum plausible case. This corresponds, for example, to 3 days per week for the 3 summer months (36 days) plus 1 day per week for 2 months in the spring and fall (16 days).

iv. Comment:

The estimates of dermal soil adsorption are exaggerated. CDM recognizes that others have typically used values for the surface area of exposed skin that are smaller than the values which CDM finally selects. Thus, CDM fails to recognize that children will not soil both upper and lower surfaces of the hands, nor will they soil their arms to the same extent as their hands. For this reason, the 1700 cm^2 area provided by Hawley (1985) and cited by CDM would have been a more reasonable number to select.

EPA Response:

The exposed surface area estimates were based on a published EPA report and were conservatively developed for use in the PHE. Had a 1700 cm^2 surface area been used, however, the risks for this pathway would have been reduced by a factor of 0.63 for the average case and 0.50 for the plausible maximum case.

v. Comment:

CDM generates Table 8-10 (p. 8-36) using only the highest soil exposure rate (1.5 mg/cm^2) and only the highest surface area (for a 15 year old). A more plausible estimate for the average exposure scenario would be an average soil deposition rate and a much smaller surface area. In addition, the ingestion of soil (pica) is not practiced by children this age and should be omitted from Table 8-10.

EPA Response:

The average soil contact rate of 1 g/visit was calculated using the lower soil exposure rate and the lower surface area estimate (0.5 mg/cm^2 - 1.3 g/visit), not the higher exposure rate and surface area estimate as suggested in the comment. The soil ingestion rates in Table 8-10 are not applicable to children with pica, in contrast to the comment (see Appendix C of the PHE).

vi. Comment:

CDM applies the TCDD soil bioavailability data of Poiger and Schlatter (1980) to PCBs. Why then does CDM inflate the dermal absorption from a range of 0.3-3% to 1-5%? There is no justification for this change and CDM should adjust its number and calculations accordingly.

EPA Response:

The dermal absorption estimates of 1-5% were conservatively rounded off based on Poiger and Schlatter's (1980) results. The use of the 1-5% number rather than the 0.3-3% numbers could result in overestimates of risks by less than a factor of 2.

vii. Comment:

The equation listed on page 8-39 describing the amount of chemical a person absorbs dermally or ingests during each visit to the site is incorrect. The second half of the equation will not yield a number for a chemical in units of milligrams, therefore it can not be added to the number generated in the first half of the equation. As this number is then used to calculate the risks posed by visiting the site, it is not clear whether the risks posed in Table 8-12 (p. 8-42) are also incorrect.

EPA Response:

The last portion of the equation presented on p. 8-39 (in brackets) estimates the amount of soil contacted and ingested

in kg. The remainder of the equation estimates the amount of chemical exposure in mg by taking into account the contaminant concentration in soil (in mg/kg) and, for VOCs, the potential for volatilization. This equation is not incorrect as stated in the comment; apparently the units of the parameters used in the equation were incorrectly interpreted by the commenter.

viii. Comment:

The calculation that CDM has used to estimate the average lifetime exposure to site contaminants is incorrect. The average body weight over the life span of an individual is the appropriate weight to be used, not the weight they were when they were exposed. Thus, it would appear that risks listed in Table 8-12 are 2.33 times higher than they should be if only this mistake is considered.

EPA Response:

The average daily lifetime exposure is derived by estimating the average dose over the exposure period in mg/kg body weight, using the average body weight of the child over the exposure period (30 kg), and then dividing by the number of days in a 70-year lifetime. Thus, the equation on p. 8-40 is not incorrect.

ix. Comment

Given the number of errors in CDM's equation (p. 8-41, Table 8-11), a more realistic PCB soil exposure should be calculated. If one uses the 625 cm^2 of exposed skin that Hawley (1985) lists for a 6 year old, adopts CDM's 1% absorption rate, and then calculates the average lifetime exposure, the value would actually be 5.9×10^{-10} mg/kg/day for the average case. As more accurate exposure estimates than those calculated by CDM indicate that other CDM exposure variables are too high, it appears that CDM's exposure estimate is too high and by at least two orders of magnitude. For this reason, it would seem that better exposure estimates and a recalculation of the risks listed in Table 8-12 should be performed.

EPA Response:

As noted in the responses to comments vii. and viii. above, the equations used to calculate average daily lifetime doses associated with direct soil contact are correct. Also, as noted in the response to comment vi., the dermal absorption numbers may only slightly overestimate the risks by less than a factor of 2.

x. Comments:

There is no basis for the assumption listed under (d) (see p. 8-44, Table 8-13), i.e. that the maximum concentration is one order of magnitude higher than the mean value. This statement appears to be one that even CDM agrees with for on page 8-45 CDM states "...the selected exposure point concentrations could potentially either underestimate or, more likely, overestimate actual average VOC air levels." Methods should have been developed for extrapolating VOC air concentrations under different meteorological conditions rather than assuming it is ten-fold greater under worst case conditions.

EPA Response:

There is possibly as much as one order of magnitude uncertainty in the use of the VOC and particulate matter data in estimating inhalation exposure point concentrations. However, exposure point concentrations that could be estimated by applying soil volatilization and fugitive dust models in conjunction with air dispersion models would have at least as much or more uncertainty than that in the measured data. Therefore, the measured data were used in Section 8. The uncertainties involved in using such data are noted in Section 8.4.3 and 8.4.4. It should be recognized that there are many uncertainties involved in conducting a PHE and thus the purpose of the PHE is not to precisely define human health risks but rather, to the extent possible based on the available data, provide estimates of the potential for risks to human health. Since the inhalation of contaminants from the Re-Solve site was considered to be a potential pathway of concern, the potential risks associated with this pathway were estimated, but the uncertainties in using either modeled or measured data were seriously considered in developing an approach for evaluating this pathway. In addition, the decision to increase measured VOC air levels to reflect potential worst-case conditions was based on information provided in the peer-reviewed scientific literature indicating that VOC emissions may increase substantially under dry, hot conditions relative to wet, cool conditions.

xi. Comment:

CDM has failed to use a consistent exposure scenario for each route of exposure. Dermal exposure was calculated on 10 visits per 5 years; inhalation exposure was based on 10 visits per year (for only 30 minutes) for 30-64 years. This divergence of exposure scenarios is not justifiable and is used to exaggerate the inhalation exposure to a level above that occurring under the first exposure scenario.

EPA Response:

The direct contact exposure scenario was derived for an individual assumed to trespass onto the site area and engage in activities that would result in contact with and exposure to contaminated soils. The inhalation exposure scenario was derived for an individual assumed to pass through or next to the site area during which time contact (i.e. inhalation) would occur. The direct contact scenario was limited to a child because adults would not be expected to trespass onto the site and engage in activities resulting in soil exposures. The inhalation exposure scenario could not be limited to a child only because adults could walk next to the site, thus exposures over a longer time period were evaluated for this pathway (30-64 years). Considering the significant differences in the exposure pathways and the factors likely to affect the possibility of exposures, different exposure scenarios were not only justifiable but also required.

xii. Comment:

There is no basis for assuming that particulate levels might be as high as 400 mg/m3. Ambient particulate concentrations are normally considered to be no higher than 70 mg/m3.

EPA Response:

For the plausible maximum exposure case, the particulate matter level was not assumed to be as high as 400 mg/m^3 as stated in the comment. It was assumed to be 0.4 mg/m^3. This estimate is well within background particulate matter levels in Rhode Island.

xii. Comment:

Site dusts will be comprised of both on-site and off-site particulates, so the level of exposure has been overstated by CDM, a fact that they admit.

EPA Response:

See response to comment x. above.

xiv. Comment:

CDM assumed that all particulates were respirable, an overestimation of the actual percentage of particulates that are respirable.

EPA Response:

Because there were not site-specific particle size distribution data, it was conservatively assumed for the PHE

that all suspended particulate matter originating from the site was respirable. If only half of the suspended particles were respirable, however, the risks would be reduced by only a factor of 2, and thus would remain of the same order of magnitude shown in Table 8-17.

xv. Comment:

CDM assumes that the high concentrations found in the unnamed tributary are representative of those found in the Copicut River. As this is unlikely to be true due to dilution caused by the size of the river, this overestimation of potential exposures should not be used.

EPA Response:

The maximum plausible case scenario was developed to provide an indication of the upper bounds of the potential risks associated with dermal contact with surface water to assist the decision-maker responsible for developing remedial alternatives for the site. Thus the concentrations in the unnamed tributary were conservatively used to characterize potential worst-case conditions in surface water under low flow conditions (i.e. low dilution capacity).

xvi. Comment:

The numbers CDM has used for the average and maximal contact with the site via wading clearly overstate the potential problem. Given that upstream portions of the river are also accessible in this area, and the fact that the numbers CDM used reflect a person's use of swimming pools, lakes, etc., the potential contact time with water near the site should be reduced accordingly.

EPA Response:

The parameters used to describe contact with surface water were not overly conservative. They assumed that a child could possibly wade a total of either 7 or 12 times per year for a 5 year period. Considering the absence of information indicating that children do NOT wade in the Copicut River or other surface water adjacent to the site, these assumptions were considered reasonable. In addition, it should be kept in mind that PHEs can be used to provide an indication of potential risks, not to precisely quantify risk. Thus the exposure parameters used in this scenario were developed to provide an indication of the potential risks.

xvii. Comment:

CDM is once again being inconsistent in their approach to exposure. The PCB water concentrations for dermal absorption of chemical while wading (Table 8-18, p. 8-55) ranged from 0.52-1.2 ppb with a mean value of 0.53 ppb based on 2/15 samples with detectable levels. These same PCB concentrations now range from ND-1.2 ppb with a mean value of less than 0.5 ppb using 2/11 samples.

EPA Response:

The approach adopted is consistent with the exposure scenarios being evaluated and, as mentioned in the response to comment xi. above, different exposure pathways require pathway-specific development of exposure parameters. In order to evaluate dermal exposures due to wading in the site area, all surface water samples summarized in Table 8-1 and presented again in Table 8-18 were used. In order to evaluate inhalation exposures to VOCs, emissions from the Copicut River were modeled as a line source. A subset of surface water samples was used to characterize potential VOC concentrations in the river.

xviii. Comment

CDM's tendency to estimate the exposure upon a single sample which was taken from a species (eel) that is not a popular sport fish is not justified. In fact, none of the fish species listed on this page are species generally considered edible or prime game species. All tissue samples except the eel sample are below the current FDA guideline of 2 ppm. So, even though it is highly unlikely that an individual would use this area for sport fishing, it is also highly unlikely that their catch would contain fish exceeding the allowable FDA limit.

EPA Response:

It is true that one composite sample of redfin pickerel and American eel was used in the maximum exposure scenario. However, due to the effects of compositing it is likely that one of the fish included in the composite had PCB levels higher than 20 ppm. Furthermore, the highest detected concentrations were consistently used to characterize the maximum exposure scenarios. Thus, the selection of the composite sample (see Table 8-26) for use in exposure Scenario I is entirely consistent with the exposure assessment methodology applied throughout Section 8.

It is true that more fish samples collected from more locations would better characterize potential PCB levels.

It would be helpful to compare background PCB levels with the measured data to determine whether PCBs in fish tissues are site-related. However, given the widespread site-related presence of PCBs in sediments in the site area, it is likely that resident fish will accumulate some site-related PCBs in their tissues and not likely that PCBs in resident fish tissues are completely unrelated to the site.

For the purposes of evaluating the potential risks associated with the ingestion of fish containing PCBs, both a comparison to standards and a risk assessment was considered useful. Furthermore, the FDA PCB limit in fish may be changed to 1 ppm in the near future.

xix. Comment:

The exposure scenario developed by CDM is unrealistic. The exposures apparently stem from an individual living in a house constructed on this site. In addition to the points previously noted (see ERT Review comment #59) the following assumptions are considered to be gross exaggerations:

- The exposure scenarios ignore the fact that if developed, the site will probably be vegetated and that a grass lawn will greatly reduce contact with site soils.

- The portion of the person's skin that is exposed for this scenario is too high given variations in weather and dress that occur during the year.

- The adsorption factor for PCBs that CDM uses is too high.

- Adults do not practice pica, and the accidental ingestion of soils is unrealistic given normal hygienic practices (i.e. washing soiled hands before eating).

- The environmental half-life of each chemical was ignored. Even it if was assumed that the half-life of these chemicals was as long as 5 years, the soil and water levels would undergo 14 half-lives during the life span of an individual. The effect of this constant degradation would be to reduce the average exposure/risk by a factor of about 100.

EPA Response:

The purpose of the PHE, as mentioned already, is to evaluate the no action alternative. If no remedial actions were taken at the site, and considering that the site is in a residential area, it cannot be ruled out that at some point in the future the site could be developed for a residence.

Under these conditions, the fact that this is not likely to occur does not guarantee that it WILL NOT occur. Furthermore, it is clearly stated in Section 8.5 that the future site use scenarios are hypothetical.

It is entirely possible that an individual may live at their residence for 70 years. Not all individuals in the United States migrate to another residence over a lifetime.

The assumptions that were applied are standard EPA assumptions for evaluating inhalation exposures. In addition, the soil ingestions rates do not assume that adults or children have pica. See response to comment v. above.

2. PCB Toxicology

a. Comment:

It is a misconception that all PCBs are alike. In fact, there are 209 different varieties of PCBs, and they have very distinct properties. Only certain ones - by no means, all - are arguably toxic to certain laboratory animals under experimental conditions. The toxicity of those congeners has never been demonstrated to occur in the environment. Indeed, at most, only individuals exposed to heavy doses of PCBs in the work place have reacted negatively to the exposure by contracting chloracne. Epidemiological studies, including the "Final Report of Greater New Bedford, PCB Health Effects Study" just released by the Massachusetts Department of Public Health, do not demonstrate that PCBs are toxic to humans, certainly not at the concentrations that are found in the environment, including at the Re-Solve site. In this regard, we direct the attention of the EPA to the substantial body of literature that has been collected on toxicology and epidemiology, and, in particular to the writings of Renate Kimbrough, formerly of the Center for Disease Control and now with the EPA. For example, in an article entitled "Laboratory and Human Studies on Polychlorinated Biphenyls (PCBs) and Related Compounds, 59 Environmental Health Perspectives", 99, 104 (1985), Dr. Kimbrough says:

> In humans, no adequate studies have been conducted to judge whether long-term exposure to PCB is associated with cancer, nor have any reports been published which have properly studied reproductive outcomes of highly exposed females.

And in a more recent article entitled "Human Health Effects of PCBs and PBBs", 1987, (Ann. Rev. Pharmacol. Toxicol. 1987, 27:87-111) Dr. Kimbrough concludes as follows at 106:

> In conclusion, various toxic effects of PBBs and PCBs have been described in laboratory animals. In humans, acute poisoning outbreaks have only occurred following exposure to a combination of PCBs and PCDFs. When humans were exposed only to PCBs or PBBs, the only observed acute effects have been generally minor. So far, no significant chronic health effects have been causally associated with exposure to PCBs or PBBs."

Dr. Edward Emmett of Johns Hopkins has been identified by the United States as an expert in the epidemiology of PCBs. In a recent publication of the Johns Hopkins School of Hygiene and Public Health, the following appears:

> Not all of the 209 kinds of PCBs have the same detrimental effects on health.
>
> "Based on cellular and biochemical studies, we know that not all PCBs are the same and that while some are quite hazardous, others are relatively harmless," he says.
>
> To date, laboratory tests on animal cells have shown that some kinds of PCBs are highly toxic, while others are not toxic at all. But in order to gauge an individual's exposure to the compounds, scientists traditionally have counted all the PCBs present, treating them as if they each had the same effects.
>
> "This is a poor way to assess the toxicity of a material," Emmett says. In a continuing study, he is determining which individual PCBs seem to be most toxic to man.

In addition, we submit that the literature does not establish that PCBs are toxic to non-human life in the doses to which an animal might be exposed in the Re-Solve environment.

There simply is no credible evidence that PCB exposure in the environment has or will cause any toxic effect to any animal, including man, whether through direct contact or via the food chain. The analyses that formed the basis for the ban of PCBs and the establishment of the FDA Tolerance Level of PCBs were mainly laboratory experiments with PCBs of a type that are not necessarily those found in the environment at all, and certainly not in the quantities that are found in the environment.

EPA Response:

A detailed toxicity profile for PCBs is provided in Appendix A of the PHE and a detailed environmental toxicity profile is provided in Appendix B. These profiles discuss the range of toxicity

information available on PCBs. Although there is, and undoubtedly will continue to be, some disagreement over the potential human health and environmental effects of each congener in the PCB mixture, EPA has developed an approach for evaluating the potential human health risks associated with exposure to PCB mixtures which relies on the use of cancer potency factors.

The ambient water quality criteria for PCBs (0.014 ppb) is below the CLP detection limits for PCBs (0.5 and 1 ppb), and therefore the only way to assess this pathway was through modeling. In Section 8.6, the uncertainties in the partitioning model applied were clearly discussed. However, this model was considered adequate for evaluating the potential risks to freshwater aquatic life.

B. PRP COMMENTS ON THE FS AND PREFERRED ALTERNATIVE

1. Misapplication of ARARs

Comment:

The EPA misapplies SARA's requirement that "Applicable or Relevant and Appropriate Environmental and Public Health Requirements" (ARARs) be met at the site. The proper role for ARARs is in developing the appropriate level of cleanup, not in determining the suitability of various technologies to meet the cleanup level. As discussed in the comments submitted by the Generators Committee on May 21, 1987, the ARARs relevant and appropriate to the Re-Solve site are the interim status closure standards for surface impoundments and land treatment facilities promulgated under RCRA. The site should therefore be closed under interim status rules.

EPA Response:

The Committee appears to have some misperceptions about the proper role of ARARs in the remedy selection process.

Once EPA has developed remedial action alternatives for a site, it identifies the appropriate action - specific ARARs for each alternatives. Each alternative is then evaluated by the remedy selection criteria set forth in CERCLA Section 121, and EPA selects

a remedy that best meets all of the criteria. In contrast, the mere existence of potential action - specific ARARs, such as those for landfill closure, do not determine the selection of remedy.

Further, the Committee indicates that the proper ARARs for the Re-Solve sites are the 40 CFR Part 265 requirements for closure of an interim status land disposal facility. EPA has made it clear that the 40 CFR Part 265 interim status regulations will generally not be applicable or relevant and appropriate to CERCLA response actions. This is explained in the 1985 National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 50 Fed. Reg. 47912 at 47918, November 20, 1985. The NCP preamble states that although the Subtitle C regulations differ according to whether a hazardous waste facility has a RCRA permit or is in interim status, CERCLA remedies will nonetheless have to comply with the more stringent Part 264 requirements for permitted facilities.

The RCRA part 265 "interim status" standards were enacted to be broadly applicable to large numbers of facilities and vast amounts of hazardous waste. They were designed to be bare minimum standards so that the Agency could concentrate on developing more stringent technical based final (permitting) standards. In promulgating the part 265 requirements, the Agency stated that the interim standards are not the final answer to the long-term environmental problems caused by hazardous waste disposal. Nevertheless, EPA felt that through the use of generally applicable requirements (i.e. manifest system, recordkeeping, reporting, closure, water analysis, training, inspection and contingency plan requirements) EPA would begin to bring under control environmentally disastrous practices. (F.R. Vol. 45, No. 98, May 1980, p. 33157).

EPA believes that, in determining ARARs at CERCLA sites, the RCRA Part 264 standards should be used. The Part 264 standards were designed to be the final (permitting) standards that should be attained by all facilities within a reasonable time frame. The Part 264 standards represent the ultimate RCRA compliance standards and are consistent with CERCLA's goals of long-term protection of public health and welfare and the environment (F.R. Vol. 40, No. 224, November 20, 1985, p. 47918).

The past waste disposal practices at the Re-Solve site were not performed according to RCRA design and operational requirements for any type of facility. The RCRA regulations define disposal as the discharge, deposit, injection, dumping, spilling, leaking or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters. A disposal facility in RCRA is defined as a facility in which hazardous waste is

intentionally placed into or on any land or water, and at which waste will remain after closure. EPA believes that the past disposal activities at Re-Solve constitute land disposal, and the actual disposal unit employed at Re-Solve closely resembles the definition of a surface impoundment. EPA believes, however, that only the Agency has discretion to determine which RCRA requirements are relevant and appropriate on a site-specific basis.

The Committee also stated in their comments submitted on May 21, 1987, that the "application of the interim status landfill closure standard appears consistent with, and indeed mandated by, the criteria of SARA Section 121". However, Section 121 of CERCLA does not mandate compliance with any particular set of ARARs. Instead, Section 121(b)(1) articulates a preference for the selection of remedial actions in which treatment permanently and significantly reduces the volume, toxicity or mobility of hazardous substances. In assessing various permanent solutions, EPA must specifically address the long-term effectiveness of the different alternatives. EPA shall, at a minimum, take into account the Section 121(b)(A-G) factors.

Congress prescribes that in choosing its final remedy, EPA must select a remedial action that uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

Region I believes that the Section 121(b) factors are utilized in the evaluation in the Re-Solve FS and that the long-term effectiveness of land disposal would not be adequately protective at the Re-Solve site nor does it meet the statutory preference for treatment. The Alternatives Evaluation Section of the ROD includes a summary of how the Section 121(b) factors were evaluated in the FS.

2. Residential Land Use

Comment:

The FS and Preferred Alternative are based on the assumption that the site must be returned to a condition suitable for unrestricted residential development. Such an assumption is overly conservative and not reasonable. It is also inconsistent with the RCRA closure standards which are the ARARs for the site. Other land uses (e.g. conservation land) are more appropriate and consistent with both the provisions of SARA, RCRA and existing land use.

EPA Response:

EPA's use of a conservative exposure scenario which assumes on-site exposure, including possible dermal contact with subsequent absorption and ingestion by children, is well founded in EPA's

Office of Research and Development's (ROD) May, 1986 guidance on PCB advisory levels, "Development of Advisory Levels for Polychlorinated Biphenyls Cleanup". This guidance document constitutes an advisory that is to be considered in determining the appropriate extent of cleanup at CERCLA sites. EPA notes that it provided a partial list of such "to be considered (TBC)" documents as an Appendix to the preamble of the 1985 NCP (see 50 F.R. 47946). According to the ROD advisory level guidance, it is entirely appropriate to consider a plausible maximum case that includes the possibility of direct human exposure to PCBs present at the site.

Further, there is no continuing industrial presence at or in the vicinity of the site. The site itself is zoned for single family residential and agricultural uses. The area surrounding the site, also zoned single family residential, is undergoing rapid development. There are two residences located within 150 yards of the site and eight within a quarter mile. A 70-unit residential development is being constructed one-and-one-half miles south of the site.

EPA believes that there is a potential for the site, and surrounding property, to be developed in the future despite its previous use. Recently, the owner of the property adjacent to the site along North Hixville Road initiated the permitting procedures for placement of a residence on the property. More importantly, the land appears to be in current use by the owner. A trailer was recently observed on the property, indicating that a person is temporarily residing there.

3. Institutional Controls

Comment:

Without explanation or discussion, the FS fails to address or consider institutional controls (e.g. deed restrictions) in conjunction with other methods as a way of limiting and controlling site use. Such controls can be an effective mechanism for ensuring attainment of cleanup objectives and should be considered. These controls are also a requirement of RCRA interim status closure rules.

EPA Response:

EPA believes that the selected remedy outlined in the ROD will meet CERCLA's preference for permanence and treatment and that the intent of the RCRA closure requirements will be met by the treatment of PCB contaminated soils and sediments and ground water treatment.

Section 121(b) of CERCLA states that the selection of a remedial action be protective of human health and the environment, be cost effective, and utilize permanent solutions and alternative treatment technologies. EPA does not believe that limits on site access and

the use of institutional controls are permanent remedies to protect human health and the environment.

Further, EPA believes that the congressional directives in CERCLA discourage the use of institutional controls when such controls are not used in conjunction with a remedy that permanently and significantly reduces the volume, toxicity and mobility of hazardous substances, pollutants and contaminants.

EPA does consider that institutional controls may be appropriate under certain circumstances. One such circumstance is present at the Re-Solve site. PCBs are present in the saturated zone soil matrix and resultant concentrations in on-site ground water are in excess of the 10^{-5} cancer risk level for the compound. EPA has determined that it is technically infeasible to restore the ground water within the waste management boundary. This will necessitate the use of institutional controls (i.e. ground water use restrictions) for the area within the waste management boundary.

The decision to use institutional controls for ground water was arrived at following an analysis of the technical feasibility of restoring ground water on site. The Agency does not consider institutional controls appropriate for the entire site remediation, since institutional controls alone will not satisfy the requirements of Section 121.

4. Potential Risks of Preferred Alternative

Comment:

The remedial activities associated with the Preferred Alternative contain several elements (e.g. wetlands destruction, on site incineration) that introduce new human health and environmental risks. These new risks have not been evaluated or compared to those of other alternatives.

EPA Response:

The Agency's analysis of the short-term risks associated with the implementation of the preferred alternative indicates that all of these risks can be satisfactorily controlled. Additionally, any short-term risks appear heavily outweighed by the long-term effectiveness and permanence the remedy would offer.

Furthermore, the final remedy selected for the site will be protective of human health and the environment, will be cost-effective, and will utilize permanent solutions and alternative treatment technologies to the maximum extent practicable and will attain Federal and State ARARs. Remedies that are not selected will be ruled out based on the evaluation criteria, not the short-term risks associated with implementation of the remedy.

If incineration is included as a component of the selected remedy, EPA will conduct a trial burn on site to determine if the incinerator achieves the requirements of TSCA and RCRA. TSCA requires that a selected incineration system must demonstrate a 99.9999 percent destruction and removal efficiency (DRE) of PCBs. Nevertheless, air emissions from the incinerator stack would be monitored during operation. If air emission levels exceed the monitoring parameters established during the trial burn, the unit will be shut down, thereby minimizing any short-term risks to on-site workers and nearby residents.

At the Re-Solve site, EPA expects the air emissions from an incinerator to attain all Federal and State ARARS. This is primarily because the metal content in on-site soils is low, especially the metals that tend to vaporize (i.e, mercury and lead).

EPA believes that by virtue of the TSCA and RCRA requirements, the potential risks posed by incineration are minimal. Therefore, incineration could be chosen as the primary treatment technology without a complete reevaluation of all other appropriate alternatives.

As mentioned previously, and contrary to what is stated on page 4-49, paragraph 4 of the FS, the heavy metal content in the Re-Solve soils is low. This statement is supported by the data obtained from the soil boring program conducted as part of the Supplemental RI. Because the potential for delisting the ash will depend on the heavy metal content, EPA does not anticipate that there will be a problem with delisting these residuals. For this reason, EPA's cost estimate for incineration assumed that the treated soils would be delisted and placed back on site.

If, for some reason, the treated soils could not be delisted, the cost for incineration would increase. However, this would also be true for other source control alternatives which involve the delisting of treated soils and placement back on-site.

5. 1 ppm PCB Criterion

Comment:

The cleanup cirterion of 1 ppm PCB, applied to wetlands and stream sediments, is not explained and apparently has no firm scientific basis. Consequently there is no firm basis for the extent of the action proposed by the Preferred Alternative in the wetlands and unnamed tributary. In addition, given the recent findings in the New Bedford Health Study, it is apparent that selective capping of the sediments in the unnamed tributary and banning fish consumption would accomplish the same public health goals with less disruption.

EPA Response:

Three routes of exposure to PCBs in sediments were considered in the development of cleanup criteria for sediments near the Re-solve site. The exposure pathways examined were: first, direct contact between benthic organisms and PCBs in sediments; second, exposure of aquatic organisms in the water column to PCBs emitted into the water from the sediments; and third, the exposure of predators, including terrestrial organisms, to PCBs that have bioaccumulated through food chains to higher trophic levels. The results of the analysis on these three pathways of exposure are presented in Section VI of the ROD.

In selecting the PCB sediment cleanup level for the site, EPA considered the following factors: the range of PCB sediment concentrations (0.13 ppm to 2.5 ppm) associated with adverse impacts to benthic organisms; location and concentration of PCB contamination; and adverse environmental impacts. Based on an evaluation of these factors, EPA selected a cleanup level of 1 ppm for PCB contaminated sediments located in the wetlands north of the site and the unnamed tributary.

EPA evaluated sediment capping as an alternative in the FS for the Re-Solve site. This alternative was screened out because of its questionable effectiveness. The structural integrity of a cap is unlikely to be maintained over time due to soil expansion, settling and erosion which may, in turn, result in the release of contaminants.

6. Misapplication of "Permanent" Remedies

Comment:

First, the FS incorrectly applies the SARA preference for selection of so-called "permanent" remedies to the evaluation of "permanent" remedies. Second, the FS applies an improperly narrow definition of "permanent" remedy, incorrectly equating a "permanent" remedy to only those that immediately destroy hazardous constituents. As a result, the FS incorrectly eliminates from detailed consideration those alternatives, such as capping with ground-water renovation, which permanently reduce the mobility and volume of hazardous substances and which are more cost-effective than the alternatives considered by EPA.

EPA Response:

Section 121(b)(1) of SARA states that the "remedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants and contaminants as a principal element are to be preferred over

remedial actions not involving such treatment." It is evident that there is a statutory preference for treatment and that the use of treatment technologies (including destruction) or resource recovery technologies is one way of achieving permanence. Conversely, capping is not a permanent remedy nor does it involve treatment as a principal element.

Capping merely separates waste from surface contact with humans, animals, and plants. Capping may slow the mobility of hazardous substances, but it does not reduce the volume of hazardous substance (except for leachate), nor does it reduce the toxicity of hazardous waste.

7. Combining Source Control and Management of Migration Alternatives

Comment:

The FS fails to consider possible combinations of source control and management of migration alternatives, thereby unfairly eliminating alternatives such as capping and ground-water renovation which, when taken together, are equally effective as other alternatives.

EPA Response:

The purpose of the Feasibility Study is to present a range of alternatives that have been developed, screened and evaluated consistent with the procedures set forth in CERCLA as amended by SARA, the existing NCP and other guidance. EPA then considers, as part of the remedy selection process, the possible combinations of alternatives that satisfy the statutory requirements presented in Section 121(b)(1) in the course of making the final remedy selection.

8. Improper and Inconsistent Screening Process

Comment:

The PRPs commented that the alternatives screening process in the FS was inconsistent and contained inaccurate information.

EPA Response:

The statement on page 3-69, paragraph 2 of the FS is inaccurate. Off-site incineration was retained for detailed evaluation because EPA felt it was necessary to retain at least one off-site disposal alternative, independent of the associated costs.

Biological treatment was screened out because EPA determined that the technology was less implementable and less effective in treating

the site-specific waste than other treatment technologies. EPA gathered information from outside the Agency and determined that bioremediation is less developed as a technology than dechlorination. Experts in the field (Camp Dresser McKee - CDM) that are currently running either bench-scale or pilot-scale bioremediation studies informed EPA that while the results from bioremediation are promising, the technology is far from being implementable in the field. EPA received estimates indicating that it may take more than 5 years to be able to implement bioremediation in the field. In addition, in-situ bioremediation below a depth of one to two feet has shown little promise to date in the bench-scale and pilot-scale studies. The remedy at the Re-Solve site will require excavation to approximately five feet (see also response to comment #11).

9. Soil Excavation Volumes

Comment:

No explanation or backup is provided to show what volumes of soils would be excavated. The location of PCBs in soil across the site have already been shown to be plotted incorrectly in the RI. If the limits of contamination are the same as those shown in the RI, the volume estimates used in the FS are not accurate and the cost estimates developed are also not correct.

EPA Response:

In a letter to EPA dated July 14, 1987, the Committee's technical contractor, ERT, requested additional information regarding the Re-Solve draft Feasibility Study. The following information was requested:

- cost and design data associated with the caps included in alternatives SC-7a and SC-7b.
- backup information for costs presented for carbon usage with the water treatment; and
- site plans or descriptions outlining the excavation limits presented in the preferred alternative document.

EPA provided ERT with such information in a letter dated July 23, 1987, one week before the close of the public comment period. EPA believes that ERT had adequate time to comment on this information during the comment period and an opportunity to submit supplementary comments on this matter after the close of the public comment is not justified.

10. Wetlands Restoration

Comment:

The FS and Preferred Alternative assume that destruction of the existing wetlands is warranted. However, eventual restoration of the wetlands may not be feasible and, if feasible, is likely to be less successful and more costly than estimated in the FS.

EPA Response:

Excavation in the wetland north of the site and the unnamed tributary will result in unavoidable impacts and disturbance to wetland resource areas. Such impacts may include the destruction of vegetation, the loss of indigenous species and the migration of PCBs downstream.

All excavation activities would be conducted during dry weather periods and excavated areas would be isolated by means of erosion and sedimentation control devices to limit the resuspension and downstream transport of contaminated material. Downstream monitoring should also be conducted during excavation. EPA considers that these measures will adequately mitigate any potential risks posed by downstream migration of PCB contaminated sediments.

In its preferred alternative, EPA did not assume that wetland restoration could be achieved by simply backfilling the excavation to its original elevation and then allowing revegetation to occur naturally. In fact, upon completion of the remedial activities in the wetland areas, a wetland restoration program would be implemented. Altered wetland areas would be restored to their prior condition. This program would identify the factors which are key to a successful restoration of the altered wetland. Factors would include, but not necessarily be limited to, replacing and regarding hydric soils, provisions for hydraulic control and provisions for vegetative reestablishment, including transplanting, seeding or some combination thereof.

Cost estimates for the wetlands restoration program were based on estimates solicited from vendors and the cost of conducting similar work in the Region.

Further, the reference to Sweeden's Swamp is completely irrelevant, taken out of context and has no bearing on the case at hand.

11. Dechlorination and Emerging Technologies

Comment:

The discussions of the dechlorination technology in the FS and the Preferred Alternative do not adequately address the technological uncertainty of application of a full-scale unit to soils containing

PCBs. The cost estimates associated with this application appear unrealistically low. Also, other emerging technologies (e.g., bioremediation) are as well developed technologically as dechlorination and may be less costly. Consequently, more consideration should have been given to these in the FS evaluation, and pilot studies of these technologies should be included as part of the Preferred Alternative.

EPA Response:

The uncertainties of the operation of the dechlorination technology on a full-scale level is discussed in the reliability and implementability/constructability sections on page 4-69 of the Feasibility Study. In addition, Figure 4-6 in the FS describes and presents the development history of this technology. Further analysis of the implementability of this technology at the Re-Solve site is presented in the Alternatives Evaluation section of the ROD.

The cost estimates presented in the Preferred Alternative and the FS were based on information provided by Galson Research Corporation, the only vendor to date that is developing this technology for treatment of soils. Furthermore, contingencies were added to the cost estimates to account for uncertainties associated with implementability of this technology on a full-scale level. Cost estimates will be revised based on information and data obtained from the pilot study.

Bioremediation technologies were evaluated in the FS and screened out because the uncertainties associated with these "emerging" technologies were greater than dechlorination and other innovative technologies. The problems associated with bioremediation are:

1. Maintenance of the proper environment for the micro-organism populations;

2. High energy requirement to break down large complex molecules such as PCBs. This translates into longer retention times to complete the reaction;

3. Without agitation provided by a reactor, mass transfer is greatly reduced, thus reducing the speed and effectiveness of the reaction;

4. Variable soil conditions of the site may result in inconsistent flushing, thereby limiting direct contact between micro-organisms and contaminants (PCBs), and;

5. If bioremediation was implemented using landfarming technique, large areas of land would be needed to set up and maintain these plots. As stated in the FS and the ROD, the land surrounding the Re-Solve site is predominantly wetland resource areas, thus, limiting the implementability of certain technologies requiring large areas of land, including bioremediation.

Further, the deep penetration of PCBs in the vicinity of SB-25, makes it increasingly difficult to maintain an environment suitable for bioremediation (i.e. adequate supply of oxygen, nitrogen and/or methane).

If dechlorination does not prove to be implementable at the Re-Solve site, EPA does not consider it appropriate to evaluate a less developed and less implementable technology, such as bioremediation. Rather, the Agency will evaluate a technology that is further along in the developmental process so that cleanup at the site can be initiated in a timely manner.

12. Cost Effectiveness

Comment:

While cost estimates are provided in the FS, there is not specific discussion or apparent consideration of cost-effectiveness in either the FS or for the Preferred Alternative as required by the National Contingency Plan. Documentation is needed to indicate how EPA considered cost-effectiveness in evaluating the various alternatives and arriving at the Preferred Alternative.

EPA Response:

The Agency's first statutory obligation is to select a remedy that meets the requirements of CERCLA as amended by SARA. If two alternatives are determine to be equally effective in meeting the statutory requirements, EPA will select the least costly remedy. A discussion on cost-effectiveness is presented in Section VI(B) of the ROD.

13. Costs

Comment:

The costs of the Preferred Alternative are probably substantially underestimated:

- Wetlands restoration (if achievable) will take more effort and cost more than estimated by EPA.

- Ground water renovation will take an estimated 40 years not 10 years, increasing costs from $8.7 million to $11.4 million.

- Soil dechlorination will be more costly for a full-scale unit than estimated by the supplier (and EPA) on the basis of pilot studies at other locations.

Knowing the actual potential costs of remediation (not just relative costs) is important to a fair evaluation of alternatives and selection of a Preferred Alternative.

EPA Response:

The Committee's comments on the costs for wetlands restoration and dechlorination were responded to by the Agency in responses number ten (10) and eleven (11) respectively. The Committee's comment on ground water renovation is responded to in response number fifteen (15), Ground water.

14. Disorganized and Confusing Cost Information

Comment:

The PRPs commented that the FS contained disorganized confusing and inaccurate cost information.

EPA Response:

EPA acknowledges that some of the costs cited in the Feasibility Study have some mathematical errors. These errors have been corrected and the new costs (i.e. MOM-2C and MOM-4) are presented in the Alternatives Evaluation Section of the ROD.

The confusion between vendor information and cost estimates are due to format differences in cost estimating. EPA's Guidance on Remedial Investigations and Feasibility Studies requires that costs be presented in the format used in the FS. Information from vendors, therefore, must be reconfigured into the required format. Further, when vendor information is contardictory or suspect, EPA modifies these costs.

15. Ground Water

Comment:

The Committee raised several concerns about the application and coordination of methodologies and techniques used to predict the rate and effectiveness of ground-water remediation. The Committee commented that the FS greatly underestimated the time required to restore the aquifer.

EPA Response:

EPA conducted an analysis of the flushing rate and rate of restoration of ground water, assuming excavation of a known volume of VOC-contaminated on-site soils and using an experimentally-derived leaching rate constant, to determine the estimated time period

necessary to achieve the target remediation level ($1x10^{-5}$ cancer risk level) at all points on the waste management boundary. (Refer to Section IV B of the Re-Solve Record of Decision for more detail). This analysis is presented in a document entitled "Re-Solve Aquifer Flushing Technical Memo," (Technical Memo) which is included as part of the Administrative Record.

Four separate models were used in the analysis to derive the aquifer flushing rate and the rate of restoration of the ground water. A geohydrologic model was used to obtain the maximum pumping rate and flushing rate for the aquifer. Based on this modeling effort, EPA estimated a pumping rate of 40 gallons per minute which translates into 1.6 aquifer flushes per year.

A second model, a fate and transport model, was used to simulate ground-water extraction at the Re-Solve site. This is an iterative technique for which each day, the model calculates the mass and concentration of contaminants remaining in ground water as a function of the mass of contaminants removed from ground water due to pumping, and the mass of contaminants entering the ground water due to leaching from the source soils.

The model assumes excavation of known quantities of PCB-contaminated soil. As indicated in the Supplemental RI, the areal extent of PCB contamination and VOC contamination in on-site soils is similar. Thus, excavation of PCB-contaminated soils in the unsaturated zone (22,500 cy) will also result in the reduction of the mass of VOCs which are acting as a source of ground-water contamination. Excavation of soils contaminated with PCBs and VOCs in the unsaturated zone above the seasonal low ground water table (approximated to be elevation 85 feet) will result in attainment of the target remediation level within 10 years. In contrast, if the source soils in the unsaturated zone go untreated, EPA estimates that aquifer restoration would take approximately 20 years.

Removal of the mass of VOC source material in the unsaturated zone will thereby reduce the quantity of contaminants available for long-term desorption from the soil matrix into ground water. The rate of restoration of ground water, presented in ROD and the Technical Memo, supercede preliminary estimates developed from the equilibrium partitioning coefficient.

The leaching rate constant was derived experimentally through the conduct of a laboratory column leaching study (as presented in Appendices B and D of the Re-Solve FS). This leaching rate was used in the mathematical model to project the duration of the pump and treat system. A sensitivity analysis was also done on the leaching rate constant to determine how the model is affected by this parameter. Results indicated that this model was very sensitive to this parameter and a change in this leaching rate constant by as little as a factor of two or three can dramatically change the predicted time of cleanup.

A third model developed for the site, a ground-water flow model, was used to estimate the number of aquifer volumes necessary to flush contaminants and the associated treatment time to achieve the target remediation level for TCE and PCE in a source well placed on site in the center of the plume. TCE and PCE respectively compose 27.9% and 12.3% of the total VOC concentration in the contaminant plume. PCE, though, was used as the indicator compound for the analysis because its lower vapor pressure and solubility compared to other indicator compounds is such that its natural transport away from the source area is slower than other volatile organics.

A final model, the Soil Contaminant Evaluation Methodology (SOEEM) was used to determine the allowable concentration of PCE in a source well located in the center of the plume, given that the target remediation level for PCE at the point of compliance (i.e. the waste management boundary) is 5 ppb.

Based on the results of these modeling efforts, an estimated 16 aquifer volumes will have to be pumped and treated over a period of 10 years to attain the target remediation level (i.e., $1x10^{-5}$ cancer risk level) at the point of compliance.

In regard to an abbreviated aquifer remediation time period due to hydrolysis chemical degradation of compounds present at the Re-Solve site, Appendix B of the FS states "hydrolysis will not be a major factor contributing to the degradation of the contaminants at the Re-Solve site since the contamination is largely composed of the slower degrading compounds". In addition, due to the time period required for aquifer remediation, hydrolysis will not be a significant factor in reducing the rate of remediation.

Overburden and Bedrock Wells

Wells installed for the pump and treat system will serve to extract ground water for treatment, and monitor elevations and gradients of ground water. Three bedrock wells will be installed at suspected high contaminant zones in the bedrock. Initially, these bedrock wells will act as monitoring wells to determine contaminant levels in the bedrock and vertical hydraulic gradients between the bedrock and the overburden. If upward vertical hydraulic gradients and decreases in ground-water contamination in the bedrock are not exhibited during an extended time period operation of the overburden pumping system, then the bedrock monitoring wells will be pumped at low volumes in order to remediate the bedrock aquifer.

Private Wells

Regarding private wells in the vicinity of the Re-Solve site, EPA agrees that the statement on page 3-34 of the FS is not correct. The residential well sampling program indicated that the current quality of drinking water in residential wells located in the vicinity of the Re-Solve site has not been noticeably affected by contaminants originating from the site.

IV. REMAINING PUBLIC CONCERNS

There were several issues and concerns raised during the responsiveness summary that EPA will address during the remedial design and remedial action. These issues and concerns include the following:

(1) Contamination of Fish and Wildlife: Residents continue to be concerned about the quality of fish and wildlife in areas around the Re-Solve site. As stated in the ROD, fish will be sampled at downgradient stations during the remedial action.

(2) Contamination of Residential Wells: Residents continue to be concerned about the contamination of private drinking water wells around the Re-Solve site. During the remedial action, select downgradient monitoring wells and residential wells will be sampled to assess the efficiency of the ground water restoration program.

(3) Provision of Remedial Design Information: There is considerable concern that new information gathered prior to the remedial action be available for public review and comment. Particular areas of interest are: results of the dechlorination pilot project; plans for restoring wetland areas following excavation; additional ground water remediation analysis (e.g. soil column experiments); and other information, such as cost estimates, that may be generated during the remedial design. EPA will continue to meet periodically with interested parties during the remedial design to discuss new information and design plans. In additon, an informational public meeting will be held when the design is near completion.

ATTACHMENT A

COMMUNITY RELATIONS ACTIVITIES CONDUCTED AT THE RE-SOLVE SITE

Community relations activities conducted at the Re-Solve site to date have included:

- EPA prepared a community relations plan in July 1982 that outlined community relations activities to be conducted during the RI/FS;
- EPA held a public meeting with town officials in June 1983 to discuss the on-site RI/FS and its preferred alternative for the site;
- In response to public comments, EPA modified its preferred alternative. The selected source control remedial action entailed excavation, treatment, and disposal of PCB-contaminated soils and sludges at an off-site disposal facility and encapsulation of the site;
- EPA held a public meeting at the 95% design phase to discuss the source control remedial action and to solicit public comment;
- During construction of the source control remedial action, EPA held weekly press conferences at the site;
- EPA established information repositories in the site community;
- In August 1986, EPA, MA DEQE, and the Massachusetts Department of Health posted warning signs around the Copicut River warning against the consumption of American eels;
- In March 1987, EPA held a public meeting at the Southworth Library in Dartmouth to discuss the results of the Supplemental Remedial Investigation;
- During the development of the FS, the Westport River Defense Fund and a local citizens group, Precinct One North Dartmouth (P.O.N.D.) worked cooperatively to form a Citizen's Advisory Committee (CAC) for the site. EPA and MA DEQE assisted in the organization of the CAC and met with the group during the remedial alternative selection process;
- In June 1987, EPA held a public meeting at the Dartmouth Town Hall to discuss the Feasibility Study Report and the preferred alternative;
- In July 1987, EPA held a public hearing at the Dartmouth Town Hall to accept oral comments on the Feasibility Study and the preferred

alternative and to answer additional questions. Transcripts of this hearing are available at the EPA Region I office in Boston, and at the information repositories located in the site community; and;

- In response to requests from the public, EPA allowed an extension of the public comment period. The comment period lasted from June 11 until July 31, 1987.