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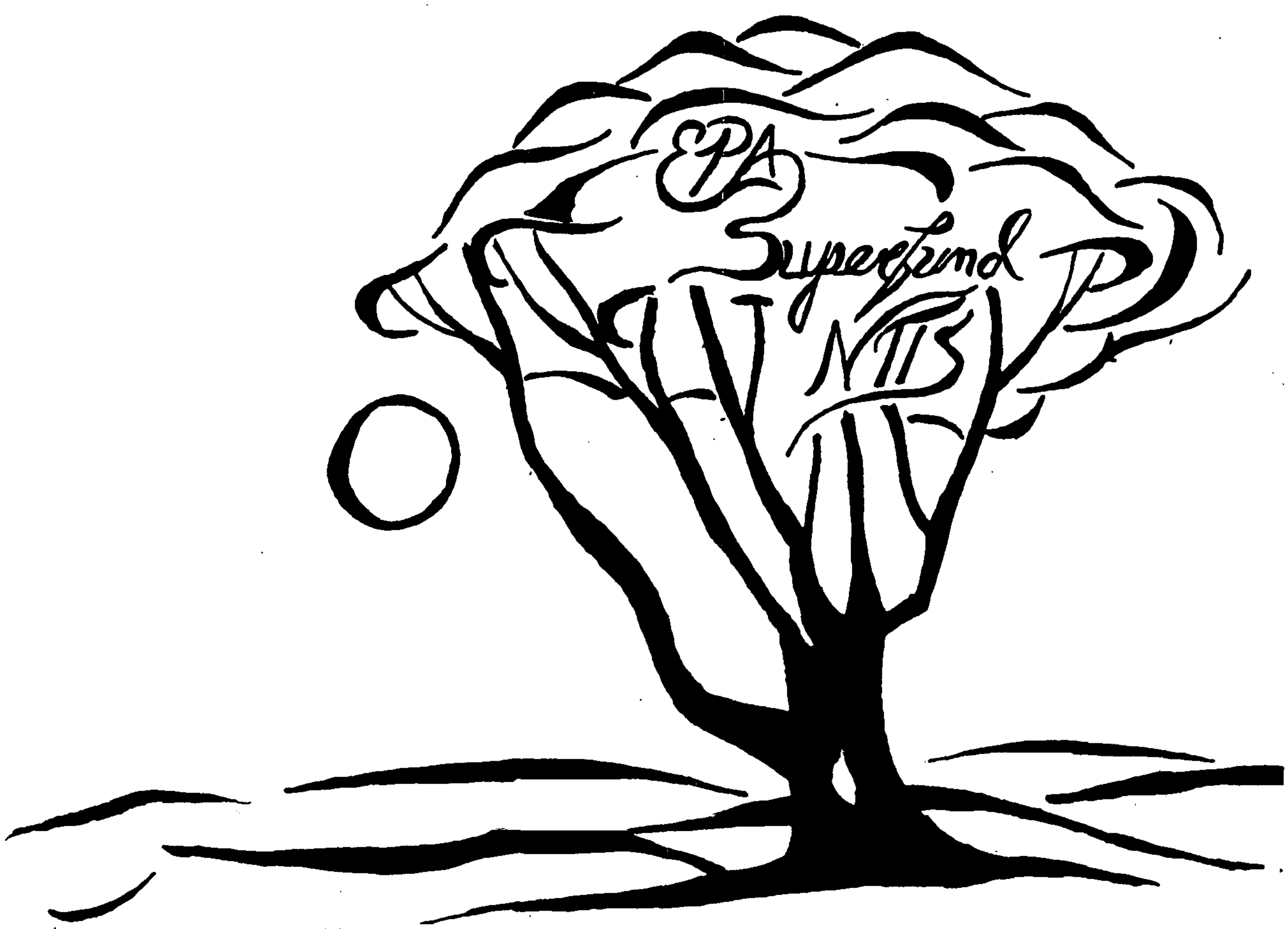
EPA Superfund Record of Decision:

Somersworth Sanitary Landfill Site, Somersworth, NH, 6/21/1994



DECLARATION FOR THE RECORD OF DECISION

Somersworth Sanitary Landfill Superfund Site
Somersworth, New Hampshire

STATEMENT OF PURPOSE

This Decision Document presents the selected remedial action for the Somersworth Sanitary Landfill Superfund Site in Somersworth, New Hampshire, 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), the National Oil and Hazardous Substances Contingency Plan (NCP), and 40 CFR Part 300 et seq., as amended. The Region I Administrator has been delegated the authority to approve this Record of Decision (ROD).

The State of New Hampshire concurs with the selected remedy, including both the preferred alternative and the contingency alternative.

STATEMENT OF BASIS

This decision is based on the Administrative Record which has been developed in accordance with Section 113(k) of CERCLA and which is available for public review at the Somersworth Public Library in Somersworth, New Hampshire, and at the Region I Waste Management Division Records Center at 90 Canal Street, Boston, Massachusetts. The Administrative Record Index (Appendix E to the ROD) identifies the items which comprise the Administrative Record upon which the selection of the remedial action is based.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy for the Somersworth Sanitary Landfill Superfund Site includes both source control and management of migration components to obtain a comprehensive remedy.

The source control remedial measures for the preferred alternative include:

- installation of a treatment wall composed of impermeable barrier sections and innovative, permeable, chemical treatment sections to provide in-situ (in-place), flow-through treatment of contaminated ground water at the landfill waste boundary (the compliance boundary). The barrier sections, sheet piling or slurry walls, will direct contaminated ground water through the treatment sections where detoxification of the VOCs will occur; and

- placement of a permeable cover over the landfill allowing precipitation to flush contamination from the waste area. This cover will remain as long as contaminants continue to leach from the landfill waste and the chemical treatment "wall" is functioning. After cleanup levels have been achieved and can be maintained without use of the treatment "wall," EPA will evaluate an appropriate landfill cover to be installed to close the landfill.

If it is determined that preferred alternative will not meet performance standards, the contingency alternative will be implemented. The source control remedial measures for the contingency alternative include:

- construction of a diversion trench on the upgradient side of the landfill to intercept and divert groundwater around the landfill. To the extent practicable, this diverted groundwater will be used to recharge the downgradient wetlands. A perimeter slurry wall would be completed around the landfill waste. Permeable treatment sections of chemical treatment wall would be removed and replaced by slurry wall material. The final component would be a landfill cover which complies with RCRA C requirements. The purpose of these components is to lower the ground water to below the waste in an attempt to meet interim ground water cleanup levels in the overburden aquifer at the compliance boundary. The ground water levels would be monitored to determine if the water table would be lowered below the waste and ground water quality would be monitored to ensure that overburden ground water will meet interim ground water cleanup levels at the compliance boundary. If either of these conditions cannot be met, then extraction and treatment of overburden ground water from within the slurry wall will be implemented. The remedial design will determine the number, location and pumping rates of each well, as well as, the most appropriate treatment technology and discharge location. On-site treatment and disposal methods and pretreatment and discharge at the Somersworth wastewater treatment facility are the two options which will be evaluated.

The management of migration remedial measures for both the preferred and contingency remedies include:

- installation of a pump in bedrock monitoring well B-12R to extract contaminated ground water. The contaminated ground water will be either discharged onto the landfill to enhance flushing or injected just upgradient of the chemical treatment wall to receive treatment for the preferred alternative or treated with the extracted overburden ground water for the contingency alternative. The need for bedrock ground water extraction wells down gradient of the chemical treatment wall or perimeter slurry wall will be investigated during the design. This investigation will focus on the number, location, and flow rate of the wells; the timing of their installation; and the impacts on the overall ground water cleanup; and

- natural attenuation of contaminated groundwater beyond the compliance boundary to lower contaminant concentrations through physical, chemical and biological processes until groundwater cleanup levels are met. After completion of source remediation, no further contamination will be added to the groundwater at levels which would prevent attainment of the groundwater cleanup levels. It has been estimated that overburden groundwater which has been affected by the landfill will clean itself to the groundwater cleanup levels within approximately fifty-five years after completion of chemical treatment wall or perimeter slurry wall.

Additional measures include:

- institutional controls to ensure that the affected ground water will not be used until ground water cleanup levels have been met. These controls should place further restrictions on development and ground water use in and around the wetland areas, as well as, along Blackwater Road south of the landfill to ensure that new wells are not installed or existing wells are not put back into service. Examples of acceptable institutional controls include use restrictions imposed on deeds, zoning ordinances, and the State of New Hampshire's ground water management zone, among others. As part of this portion of the remedy, a fence will be installed around the landfill to restrict access. The area requiring fencing will be determined during design; and

- a detailed ground water monitoring program to be developed during remedial design. The program will address long-term monitoring of the aquifer and performance monitoring of the chemical treatment wall. At a minimum, the sampling event frequency for the aquifer monitoring will be quarterly for the first three years for at least VOCs. Biannual sampling for other organics and inorganic compounds for that period should be conducted. Inorganic compounds will be sampled using a low flow sampling technique to ensure that the data is representative of the inorganics moving with the ground water.

DECLARATION

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

6/21/94
Date

John P. DeVillars
Regional Administrator
U.S. EPA, Region I

RECORD OF DECISION SUMMARY
SOMERSWORTH SANITARY LANDFILL SUPERFUND SITE

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I. SITE NAME, LOCATION AND DESCRIPTION

The Somersworth Sanitary Landfill Superfund Site (the "Site") is located on the north side of Blackwater Road approximately 300 to 400 feet west of the intersection of Blackwater Road and High Street (State Route 9) and one mile southwest of the center of the city of Somersworth in Strafford County, New hampshire (Figure 1).

The Site includes the approximately twenty-six acre waste disposal area and adjacent wetlands northwest of the former landfill. The City owns the entire landfill area and much of the wetlands. The landfill was operated by the City from the mid-1930's until 1981 when the City began taking wastes to a regional incinerator. From 1981 to the present, in the southwest portion of the landfill, those wastes which can not be incinerated are stockpiled and hauled away. Approximately ten acres of the eastern portion of the landfill have been reclaimed by the City for recreational facilities; tennis and basketball courts, ball fields, and a playground.

Numerous residential properties exist to the north, south and east of the Site, including an apartment building located adjacent to the Site at the northeast corner. A fire station and a National Guard Armory are located just east of the Site.

The landfill is entirely within the Peter's Marsh Brook surface drainage basin. The brook is a tributary to Tate's Brook which flows into the Salmon Falls River, the water supply for both Somersworth and Berwick, Maine. Ground water flows northwesterly towards the brook and discharges to the brook and adjacent wetlands. A decommissioned municipal water supply well (well no. 3) is located approximately 2300 feet north-northwest of the Site.

A more complete description of the Site can be found in the Remedial Investigation Report at pages 1-2 through 2-4 and pages 5-1 through 5-20.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Land Use and Response History

The Somersworth Sanitary Landfill accepted municipal and industrial wastes from the mid-1930's to 1981. The landfill began as a burning dump in the northeast corner of the Site. In 1958 burning was stopped and landfilling began. Natural soils were excavated beyond the working area, the excavation filled with refuse, and covered at the end of each day with the excavated natural, sandy soils. The landfill expanded in a generally westerly direction. The eastern portion of the landfill was not used for disposal after 1975. At that time preparations commenced for a recreational park on that portion of the landfill. The park was completed in late 1978.

In 1981 the City ceased waste disposal operations at the landfill and joined the Lamprey Regional Solid Waste Disposal Cooperative. Waste was thenceforth disposed of at the Cooperative's incinerator in Durham, New Hampshire. With the cessation of landfilling operations, the City installed four ground water monitoring wells near the Site's northern and western boundaries. Samples taken from these wells indicated the presence of volatile organic compound (VOC) contamination. As a result of this and subsequent investigations, the landfill was placed on the National Priority List (NPL) on September 8, 1983.

A more detailed description of the Site history can be found in the Remedial Investigation Report at pages 1-4 to 1-6.

B. Enforcement History

In 1989, the Somersworth Landfill Trust (SLT) was formed by the City of Somersworth and approximately thirty businesses and industries which had an interest in the Site. The SLT voluntarily signed an Administrative Order by Consent with EPA and the State of New Hampshire. By this order, which took effect on April 28, 1989, the SLT agreed to complete limited aspects of the Remedial Investigation and to prepare the Feasibility Study for the Site.

On December 8, 1993, EPA notified thirty-one parties who either owned or operated the facility, generated wastes that were shipped to the facility, arranged for the disposal of wastes at the facility, or transported wastes to the facility of their potential liability with respect to the Site. Many of the parties notified were members of the SLT. A meeting was held with these potentially responsible parties (PRPs) on January 13, 1994, regarding the settlement of the PRPs' liability at the Site.

The PRPs have been active in the remedy selection process for this Site. In addition to having performed the Feasibility Study, technical comments presented by PRPs during the public comment period at a meeting were summarized in writing, and the summary and written comments were included in the Administrative Record.

III. COMMUNITY PARTICIPATION

Throughout the Site's history, community concern and involvement have been increasing as costs of the remedy have become clearer. EPA has kept the community and other interested parties apprised of the Site activities through informational meetings, fact sheets, press releases and public meetings.

The lead agency for the performance of the Remedial Investigation was the New Hampshire Water Supply and Pollution Control Commission (NHWSPCC), the predecessor to the Department of Environmental Services, Waste Management Bureau. During the Remedial Investigation, NHWSPCC addressed community concerns and kept citizens informed about and involved in activities. On December 10, 1984, NHWSPCC held an informational meeting in the Wood School, Somersworth to describe the plans for the Remedial Investigation. On June 21, 1989, NHWSPCC held an informational meeting in the Wood School, Somersworth to discuss the results of the Remedial Investigation and to describe plans for the Feasibility Study.

On December 8, 1993, EPA issued the Proposed Plan and on December 9, 1993, made the administrative record available for public review at EPA's offices in Boston and at the Somersworth Public Library. On December 14, 1993, EPA held an informational meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan. Also during this meeting, the Agency answered questions from the public. From December 15, 1993, through February 14, 1994, the Agency held a public comment period to accept comments on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public. EPA published a notice and brief analysis of the Proposed Plan in Foster's Daily Democrat on December 29, 1993, and announced the time and location of the public hearing. On February 8, 1994, the Agency held an informal public hearing at the Somersworth Vocational Education Center to discuss the Proposed Plan and to accept any oral comments. A transcript of this hearing and the comments, as well as, the Agency's response to comments are included in the attached responsiveness summary.

IV. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The selected remedy was developed by combining components of different source control and management of migration alternatives to obtain a comprehensive approach for Site remediation. In summary, the remedy provides treatment of contaminated overburden and bedrock ground water with flushing of contamination from the source area. This remedial action will address the principal threat to human health and the environment posed by the site: the potential future ingestion of contaminated ground water.

V. SUMMARY OF SITE CHARACTERISTICS

Pages 9 through 24 of the Feasibility Study contain an overview of the Remedial Investigation. The significant findings of the Remedial Investigation are summarized below.

A. Soil

Low levels of VOCs and SVOCs were detected in soil samples collected from within and around the landfill. Inorganic compounds in the soil samples collected from the Site were at or below background levels.

B. Ground Water

Fifty ground water monitoring wells have been installed in geologic test borings to characterize ground water flow and quality. Water level measurements and water quality samples have been taken several times between 1985 and 1992. Data from 1985 through 1987 were presented in the Remedial Investigation. Data from 1989 through 1992 were presented in the Remedial Investigation Data Gathering Report. In addition, a ground water extraction pump test was conducted to further define the hydrology of the Site.

Results of the investigations indicate that approximately fifteen to seventy-five feet of glacial till, sand, and gravel overlie a moderately to highly fractured bedrock. Total ground-water flows across the Site are approximately 200 to 300 gallons per minute (gpm) with about five percent of the flow (ten to fifteen gpm) occurring in the bedrock. The general direction of flow is towards the north-northwest in both the overburden and bedrock aquifers. The bedrock aquifer discharges upward into the overburden aquifer along Peter's Marsh Brook and the wetlands. Landfill waste was found to be below the water table in several borings and test pits.

While no PCB's or pesticides were detected in any sampling rounds, VOCs and inorganic compounds were detected in a ground water plume beneath and down gradient of the landfill, as well as in ground water in an area along Blackwater Road (see Figure 2). Principal contaminants detected during the 1985 through 1987 sampling rounds included: 1,1-dichloroethylene; cis and trans 1,2-dichloroethylene; 1,1-dichloroethane; trichloroethylene; tetrachloroethylene; arsenic; and chromium. Principal contaminants detected during the 1989 through 1992 sampling rounds included: benzene; 1,1-dichloroethylene; cis and trans 1,2-

dichloroethylene; 1,2-dichloroethane; trichloroethylene, tetrachloroethylene, vinyl chloride, arsenic; and chromium. Statistical analysis of the data for arsenic and chromium, as well as for several other metals, has determined that concentrations of metals found in the ground water affected by the landfill are similar to concentrations found outside the affected ground water. Therefore, it appears that the presence of these metals is not related to disposal of hazardous substances at the Site.

The contaminated plume appears to have reached a steady state condition with its furthest extent approximately 1700 feet northwest of the northwest edge of the landfill waste disposal area. However, detections of increased levels of contaminants have occurred in individual monitoring wells occasionally.

C. Surface Water and Sediments

Sediment samples were taken in 1985 and 1986 at several locations in Peter's Marsh Brook upstream and downstream of the landfill. Xylenes (maximum concentration - 130 ppb) were detected at three locations downstream of the landfill. At only one of these stations were other VOCs detected (methylcyclohexane - 200 ppb, toluene - 70 ppb, ethybezene - 20 ppb, and carbon disulfide - 20 ppb). No semi-volatile organic compounds (SVOCs) were detected in any sediment sample. Inorganic analyses showed levels upstream and downstream of the landfill to be at similarly low levels.

Surface water samples taken at the same locations as the sediment samples showed the presence of several VOCs at the same downstream locations as the sediment samples which showed VOCs. The most prevalently detected compound and the compound detected at the highest level was 1,2-dichloroethylene (cis and trans) with a maximum concentration of 25.2 ppb. Other VOCs detected included trichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, benzene, toluene, tetrahydrofuran, and diethyl ether. All were typically detected at less than 5 to 10 ppb. Subsequent sampling done in 1992 in standing water in the wetlands did not result in any VOCs being detected. Inorganic compounds were detected at low levels.

D. Air

Ambient air samples were collected from the four corners of the Site and the center of the Site.

Analysis of these samples indicated that VOCs were present at acceptable levels as specified by the State of New Hampshire.

A complete discussion of site characteristics can be found in the Remedial Investigation Report at pages 7-1 through 7-30 and in the Remedial Investigation Data Gathering Report at pages 10 through 47.

VI. SUMMARY OF SITE RISKS

A Risk Assessment (RA) was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site. The public health risk assessment followed a four step process: 1) contaminant identification, which identified those hazardous substances which, given the specifics of the site were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the site, including carcinogenic and non-carcinogenic risks. The first human health risk assessment was based on data that were collected several years ago (1985 through 1987). Since the nature of the ground water contamination has changed over the years, potential future exposure and risks from ground water were reevaluated utilizing more recent data which were collected between 1989 and 1992 and presented in the Remedial Investigation Data Gathering Report. This risk assessment addressed only the two exposure points identified in the original risk assessment which posed a potential public health risk, consumption of ground water from the area down-gradient from the landfill and from the area along Blackwater Road across from the landfill. The results of this supplementary public health risk assessment for the Somersworth Sanitary Landfill Site are discussed below followed by the conclusions of the environmental risk assessment.

TABLE 1A: SUMMARY OF CONTAMINANTS OF CONCERN IN GROUND WATER IN AREA 4

Contaminants of Concern	Average Concentration (μg/l)	Maximum Concentration (μg/l)	Frequency of Detection
Antimony	19	41	3/15
Arsenic	24	203	18/22
Benzene	6	10	14/33
Beryllium	1[1]	1	4/15
Carbon Disulfide	6	38	7/33
Chlorobenzene	5[1]	5	13/33
1,2-Dichloroethylene (tot.)	177	1200	20/33
1,1-Dichloroethylene	4[1]	4	3/33
Lead	3	29	11/15
Manganese	560	4610	21/22
Methylene Chloride	14	76	15/33
Tetrachloroethylene	13.8	140	13/33
Trichloroethylene	54	370	26/33
Vinyl Chloride	107	1900	26/33

[1] Maximum concentration detected used to represent "average" rather than convention of using one-half the detection to calculate

TABLE 1B: SUMMARY OF CONTAMINANTS OF CONCERN IN GROUND WATER IN AREA 5

Contaminants of Concern	Average Concentration (μg/l)	Maximum Concentration (μg/l)	Frequency of Detection
Benzene	1[1]	1	1/8
1,2-Dichloroethylene (tot.)	39	130	7/8
1,1-Dichloroethylene	2	2	2/8
Manganese	350	848	6/6
Tetrachloroethylene	3.5	4	3/8
Trichloroethylene	1430	6200	4/8
Vinyl Chloride	11	25	5/8

[1] Maximum concentration detected used to represent "average" rather than convention of using one-half the detection to calculate

Fourteen contaminants of concern, listed in tables found in Appendix A of this Record of Decision and Tables 1A and 1B, above, were selected for evaluation in the supplementary risk assessment. These contaminants constitute a representative subset of the more than 60 contaminants identified at the Site during the Remedial Investigation and subsequent Remedial Investigation Data Gathering. The fourteen contaminants of concern were selected to represent potential site related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. A summary of the health effects of each of the contaminants of concern can be found in Appendix A to this Record of Decision.

Potential human health effects associated with exposure to the contaminants of concern were estimated quantitatively or qualitatively through the development of several hypothetical exposure pathways. These pathways were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the Site. Currently, land use northeast and east of the Site and along Blackwater Road south of the Site is residential with public water provided by the City of Somersworth. Open land exists north and west of the Site, much of which contains wetlands. Approximately 2300 feet north and west of the Site is an abandoned municipal water supply well. The potential exists for contaminated ground water to be consumed if either existing or new residences along Blackwater Road south of the Site install wells or if public demand results in a need for use of the aquifer formerly tapped by the abandoned municipal well. The following is a brief summary of the exposure pathways evaluated. A more thorough description can be found in the Remedial Investigation, Section 8, pages 3 through 6.

Five exposure areas were delineated based upon the nature and extent of contamination, geographic location, and land use and exposed populations (Figure 3). Pathways quantitatively evaluated included: ingestion of ground water, two liters per day for seventy years; ingestion and dermal contact with soil by persons ranging in age from two to thirty for fifty to 100 exposures per year; direct contact with surface water for children aged six to fifteen for twenty-four to forty-eight exposures per year; and ingestion of 0.3 kilograms of fish per meal for twelve to twenty four meals per year for sixty-five years. In addition, inhalation of vapors and particulates was qualitatively assessed. For each pathway evaluated, an average and a reasonable maximum exposure estimate was generated corresponding to exposure to the average and the maximum concentration detected in that particular medium. For the supplementary risk assessment, the pathway for ingestion of ground water was evaluated using an exposure frequency of thirty years and an ingestion rate of two liters per day.

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

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

The tables below depict the carcinogenic and non-carcinogenic risk summary for the contaminants of concern in ground water evaluated in the supplementary risk assessment to reflect potential future risks from ingestion corresponding to the average and the reasonable maximum exposure (RME) scenarios for the two exposure points, Area 4 (downgradient wetlands) and Area 5 (Blackwater Road).

CARCINOGENIC RISKS FOR THE POSSIBLE FUTURE INGESTION* OF GROUNDWATER FROM AREA 4

Contaminant of Concern (Class)	Concentration (μg/l) avg	max	Cancer Potency Factor $(mg/kg/day)^{-1}$	Risk Estimate avg	RME
Arsenic (A)	24	203	1.75	$4.8x10^{-4}$	$4.2x10^{-3}$
Benzene (A)	6	10	$2.9x10^{-2}$	$2.1x10^{-6}$	$3.4x10^{-6}$
Beryllium (B2)	1[1]	1	4.3	$7.1x10^{-5}$	$7.1x10^{-5}$
1,1-Dichloroethene (C)	4[1]	4	$6x10^{-1}$	$2.8x10^{-5}$	$2.8x10^{-5}$
Methylene Chloride (B2)	14	76	$7.5x10^{-3}$	$1.2x10^{-6}$	$6.7x10^{-6}$
Tetrachloroethylene (B2)	13.8	140	$5.2x10^{-2}$	$8.4x10^{-6}$	$8.5x10^{-5}$
Trichloroethylene (B2)	54	370	$1.1x10^{-2}$	$7.0x10^{-6}$	$4.8x10^{-5}$
Vinyl Chloride (A)	107	1900	1.9	$2.4x10^{-3}$	$4.2x10^{-2}$
			SUM	$3.0x10^{-3}$	$4.7x10^{-2}$

* Ingestion based on exposure factor of $2.9x10^{-2}$ l/kg/day

1 Maximum concentration detected used to represent "average" rather than convention of using one-half the detection to calculate

NON-CARCINOGENIC RISKS FOR THE POSSIBLE FUTURE INGESTION* OF GROUNDWATER FROM AREA 4

Contaminant of Concern (Class)	Concentration (μg/l) avg	max	Reference Dose (mg/kg/day)	Target Endpoint of Toxicity	Hazard Quotient avg	RME
Antimony (D)	19.2	41.3	0.0004	Blood, Heart	1.3	2.8
Carbon Disulfide	6	38	0.1	Development	.0017	.014
Chlorobenzene (D)	5[1]	5	0.02	Liver	.0068	.0068
1,2-Dichloroethylene (total) (D)	177	1200	0.009	Liver, Kidney	.54	3.7
Lead (B2)	3	29	na		1.4%> cutoff	
Manganese	560	4610	0.005	CNS	3.1	25

* Ingestion based on exposure factor of $2.9x10^{-2}$ l/kg/day

1 Maximum concentration detected used to represent "average" rather than convention of using one-half the detection to calculate

CARCINOGENIC RISKS FOR THE POSSIBLE FUTURE INGESTION* OF GROUNDWATER FROM AREA 5

Contaminant of Concern (Class)	Concentration (µg/l) avg	max	Cancer Potency Factor $(mg/kg/day)^{-1}$	Risk Estimate avg	RME
Benzene (A)	1[1]	1	$2.9x10^{-2}$	$3.4x10^{-7}$	$3.4x10^{-7}$
1,1-Dichloroethene (C)	2	2	$6x10^{-1}$	$1.4x10^{-5}$	$1.4x10^{-5}$
Tetrachloroethylene (B2)	3.5	4	$5.2x10^{-2}$	$2.4x10^{-6}$	$2.4x10^{-6}$
Trichloroethylene (B2)	1430	6200	$1.1x10^{-2}$	$1.8x10^{-4}$	$8.0x10^{-4}$
Vinyl Chloride (A)	11	25	1.9	$2.4x10^{-4}$	$5.6x10^{-4}$
			SUM	$4.4x10^{-4}$	$1.4x10^{-3}$

* Ingestion based on exposure factor of $2.9x10^{-2}$ l/kg/day
1 Maximum concentration detected used to represent "average" rather than convention of using one-half the detection to calculate

NON-CARCINOGENIC RISKS FOR THE POSSIBLE FUTURE INGESTION* OF GROUNDWATER FROM AREA 5

Contaminant of Concern (Class)	Concentration (µg/l) avg	max	Reference Dose (mg/kg/day)	Target Endpoint of Toxicity	Hazard Quotient avg	RME
1,2-Dichloroethylene (total) (D)	39	130	0.009		.12	.4
Manganese	350	848	0.005	CNS	1.9	4.6

* Ingestion based on exposure factor of $2.9x10^{-2}$ l/kg/day

For Area 4 ground water located down-gradient from the landfill, carcinogenic risks fall outside the acceptable risk range of 10^{-4} to 10^{-6} for both the average and reasonable maximum exposure scenarios. Most of this risk is due to arsenic and vinyl chloride. For non-carcinogenic risks, the hazard index slightly exceeded one. The major contributors to the non-carcinogenic effects are antimony, manganese and 1,2-dichloroethylene. For Area 5 ground water located across Blackwater Road from the landfill, carcinogenic risks also fall outside the acceptable risk range of 10^{-4} to 10^{-6} for both the average and reasonable maximum exposure scenarios. Most of this risk is due to trichloroethylene, and vinyl chloride. For non-carcinogenic risk, the hazard index of one was exceeded due to manganese.

In addition, concentrations of several of the compounds exceeded their ARARs, MCLGs or MCLs, in various samples. These compounds and associated

MCLG or MCL include: antimony (6 μg/l), arsenic (50 μg/l), benzene (5 μg/l), 1,2-dichloroethylene (cis-70 μg/l and trans-100 μg/l), lead (action level of 15 μg/l), methylene chloride (5μg/l), tetrachloroethylene (5μg/l), trichloroethylene (5μg/l), and vinyl chloride (2μg/l).

A qualitative environmental risk assessment was performed during the Remedial Investigation and a Wetlands Assessment was conducted during the Feasibility Study. No sensitive plant or animal species were identified in the vicinity of the Site. The conclusion of the environmental risk assessment was that the Site was not likely to pose a risk to aquatic organisms. The wetlands assessment indicated that there have been no apparent adverse impacts to the wetlands.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health and welfare. Therefore, contaminated ground water must be remediated through implementation of the selected remedy.

VII. DEVELOPMENT AND SCREENING OF ALTERNATIVES

A. Statutory Requirements/Response Objectives

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

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

- Prevent ingestion of contaminated ground water by local residents;
- Prevent the public from coming into direct contact with contaminated solid wastes, surface soils, surface water, and sediments;

- Reduce or eliminate migration of contaminants from the solid wastes or soils into ground or surface water;

- Reduce or eliminate off-site migration of contaminants in excess of regulated allowable limits; and

- Ensure that the ground water and surface water have residual contaminant levels that are protective of human health and the environment.

B. Technology and Alternative Development and Screening

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

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

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

As discussed in Chapter 3 of the Feasibility Study, the RI/FS identified, assessed and screened technologies based on implementability, effectiveness, and cost. These technologies were combined into ten comprehensive alternatives. Chapter 4 of the Feasibility Study and the Feasibility Study Addendum presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in Chapter 5 of the Feasibility Study. Table 11 identifies the ten alternatives that were evaluated.

VIII. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each alternative evaluated. A detailed tabular assessment of each alternative can be found in Table 14 of the Feasibility Study (March 1993) with modifications presented in the Feasibility Study Addendum.

Alternative 1: No Action. This alternative was evaluated in the FS to serve as a baseline for all remedial alternatives under consideration. Under this alternative, no action would be taken except for long-term monitoring of ground water near the site on a semi-annual basis. The results of the ground water sampling from ground water monitoring wells would be reviewed to evaluate any changes that occur and to reassess further remedial actions that may be required.

This alternative is primarily a data collection activity; no treatment or containment of the landfill wastes or contaminated ground water would occur, and no effort would be made to reduce the risk of potential human exposure to contamination. It is possible that a reduction in the level of contaminants in the ground water may occur over an extremely long time period due to natural attenuation; however, the length of time needed to attain cleanup levels in ground water cannot be predicted.

Estimated Time for Design and Construction: None
Estimated Capital Cost (1993 Dollars): $0
Estimated Operation and Maintenance Costs (1993 Dollars): $775,500
Estimated Total Cost (1993 Dollars): $775,500

Alternative 2: Limited Action. This alternative is similar to Alternative 1, except in addition to semi-annual ground water monitoring, it would include institutional controls to minimize the potential of exposure to contamination. Institutional controls would include restricting access to the Site by installing a fence around the site, providing an alternate water supply to area residents (if necessary), and placing ground water use restrictions on land surrounding the Site.

This alternative would not include treatment or containment of contamination in the disposal area. Although the Limited Action alternative would reduce the potential risk of human exposure to on-site contaminants, some health risk from uncontained contamination would remain. Contaminated ground water would continue to migrate into the wetland area. As mentioned in Alternative 1, the natural processes of dilution and degradation may decrease the level of contamination over time. However, without treatment or containment, neither the mobility of the contaminants nor the volume of contamination would be reduced.

Estimated Time for Design and Construction: None
Estimated Capital Cost (1993 Dollars): $100,500
Estimated Operation and Maintenance Costs (1993 Dollars): $775,500
Estimated Total Cost (1993 Dollars): $876,000

Alternative 3: Limited Action, Landfill Cover, Extraction of Bedrock Ground Water with Treatment, Ground Water Monitoring. This alternative combines the Limited Action alternative (identified above) with an engineered landfill cover and extraction of ground water from the bedrock at monitoring well B-12R and from a series of wells in the bedrock downgradient of the landfill. The cover would extend across the 26-acre landfill and would consist of a multi-layer design consistent with the requirements of RCRA Subtitle C. The cover would prevent direct contact with contaminated soil and solid wastes and prevent rain water and snow melt from draining through the landfill. Control points to collect and discharge landfill-generated gas would also be installed, if necessary. The surface would be graded to promote surface water runoff which would, in turn, decrease percolation through the landfill and slow the rate of contaminant entry into ground water beneath the landfill. This would subsequently reduce the quantity of contaminants entering the ground water and surface water, but since wastes currently lie below the ground water table, the migration of contaminants would not be stopped completely, thus allowing contamination to continue to enter the wetland areas. The ground water to be pumped from the bedrock would be treated at the POTW as in Alternative 8d.

Estimated Time for Design and Construction: 2 years
Estimated Capital Cost (1993 Dollars): $9,520,700
Estimated Operation and Maintenance Costs (1993 Dollars): $1,297,100
Estimated Total Cost (1993 Dollars): $10,817,800

Alternative 4: Limited Action, Landfill Cover, Enhanced In-Situ Biological Treatment, Natural Attenuation, Bedrock Ground Water Extraction with In-Situ Treatment, and Ground Water Monitoring. This alternative uses enhancement of natural biological processes to treat the contamination flowing through the landfill. Additional, necessary nutrients would be applied to the landfill to hasten the biological degradation processes and naturally detoxify the contaminated ground water entering the wetlands area. In order to accelerate "flushing" of the landfill, ground water extracted from bedrock will be reapplied to the landfill. Also, to maximize "flushing" by precipitation, an impermeable cover will not be placed on the landfill as long as the enhanced biological treatment is functioning.

Estimated Time for Design and Construction: 2 years
Estimated Capital Cost (1993 Dollars): $10,287,700
Estimated Operation and Maintenance Costs (1993 Dollars): $2,535,100
Estimated Total Cost (1993 Dollars): $12,822,800

Alternative 5: Limited Action, Landfill Cover, In-Situ Chemical Treatment Wall and Ground Water Diversion, Ground Water Extraction from Bedrock, and Ground Water Monitoring. The key element of this alternative is the construction of the permeable treatment wall composed of impermeable barrier sections and innovative, permeable, chemical treatment sections to provide in-situ (in-place), flow-through treatment of contaminated ground water at the landfill waste boundary (the compliance boundary). The barrier sections, sheet piling or slurry walls, will divert ground water through the treatment sections where detoxification of VOCs occurs. End products are non-toxic ethenes and ethanes, carbon dioxide, water and chlorides. No residuals are created which require disposal.

The contaminated ground water to be extracted from the bedrock downgradient of the landfill will be pumped at approximately the rate of flow of the bedrock ground water beneath the landfill. An extraction well at monitoring well B-12R will further reduce the amount of contamination in the bedrock ground water. The purpose of collecting this ground water is: 1) to prevent additional contaminants from discharging from the bedrock to the ground water in the vicinity of the wetlands to enable that ground water to naturally clean itself; and 2) to enable achievement of standards at the compliance boundary, the edge of the landfill, in the shortest time practicable, approximately fifty-five years.

In order to accelerate "flushing" of the landfill, ground water extracted from bedrock will be reapplied to the landfill. Also, to maximize "flushing" by precipitation, an impermeable cover will not be placed on the landfill as long as the chemical treatment "wall" is functioning and contaminants are leaching from the landfill waste. After cleanup levels have been achieved and can be maintained without use of the treatment "wall," EPA will evaluate an appropriate landfill cover to be installed to close the landfill. The extraction of the bedrock ground water and the use of the in-situ chemical treatment "wall" will prevent additional contaminants from entering the wetlands area, thus allowing the ground water to clean itself in the shortest time feasible.

Estimated Time for Design and Construction: 3 years
Estimated Capital Cost (1993 Dollars): $12,744,700
Estimated Operations and Maintenance Costs (1993 Dollars): $2,240,100
Estimated Total Cost (1993 Dollars): $14,984,800

Alternatives 6a and 6b: Limited Action, Landfill Cover, Slurry Wall (Partial [6a] or Perimeter [6b]), Natural Attenuation, Bedrock Ground Water Extraction with Treatment, and Ground Water Monitoring. These alternatives would add a partial or a perimeter slurry wall to Alternative 3 in order to more effectively contain the waste by lowering the ground water below the waste thus, minimizing migration of contaminants to the wetlands area ground water. Upgradient ground water diversion would be required to prevent the artificial raising of the ground water when it encounters the slurry wall. This diverted ground water would be recharged into the wetlands to lessen the impacts caused by the interruption of flow.

Estimated Time for Design and Construction: 2 years
Estimated Capital Cost (1993 Dollars): 6a - $11,610,200
6b - $12,434,200
Estimated Operation and Maintenance Costs (1993 Dollars):
6a or 6b - $1,296,600
Estimated Total Cost (1993 Dollars): 6a - $12,906,800
6b - $13,730,800

Alternatives 7a and 7b: Limited Action, Landfill Cover, Bedrock and Overburden Ground Water Extraction With On-Site (7a) or Off-Site (7b) Ground Water Treatment, and Ground Water Monitoring. These alternatives provide the remedial action in Alternative 3 with the addition of extraction of contaminated ground water from the overburden aquifer underlying the landfill. For Alternative 7a, the treated ground water would be discharged on site. Ground water extraction would minimize the migration of landfill-generated contaminants. The on-site treatment system would likely consist of some combination of a metals removal unit, biological waste water treatment unit, or activated carbon adsorption unit. The ground water would be treated at a rate up to 2000 gallons per minute, generating up to 9,600 pounds of waste sludge per day. Actual flows and sludge generation rates would be determined during pre-design studies. The sludge would be properly disposed of at an off-site landfill in accordance with all applicable laws.

The extraction process would dewater between 40 and 190 acres of the downgradient wetlands. To limit this environmental impact for the on-site treatment system, treated water would be discharged downgradient from the extraction location, providing clean ground water to the wetlands. However, significant dewatering would still result. On-site discharge of treated water would also produce a hydraulic barrier that reduces the potential for off-site migration of contaminants.

For the off-site treatment option at the POTW, Alternative 7b, pretreatment might be needed as described in Alternative 8d, below. However, for flows in excess of 485 gpm, major expansion of the POTW would be necessary. In addition, to attempt to lessen the wetland impacts, potable municipal water would have to be recharged to the wetlands since treated ground water would be discharged off-site at the POTW. As with option 7a, significant adverse wetland impacts would still result.

Estimated Time for Design and Construction: 2 years
Estimated Capital Cost (1993 Dollars): 7a - $35,495,700
7b - $21,624,700
Estimated Operation and Maintenance Costs (1993 Dollars):
7a - $25,053,100
7b - $40,753,100
Estimated Total Cost (1993 Dollars): 7a - $60,548,800
7b - $62,377,800

Alternatives 8a and 8b: Limited Action, Landfill Cover, Bedrock and Overburden Ground Water Extraction with On-Site (8a) or Off-Site Ground Water Treatment (8b) and Partial Slurry Wall, and Ground Water Monitoring. These alternatives include the same components as Alternatives 7a and 7b (Limited Action, Landfill Cover, On-Site and Off-Site Ground Water Extraction/Treatment/Discharge) with the addition of a partial slurry wall upgradient from the landfill (8a for on-site treatment and 8b for off-site treatment).

The presence of the partial slurry wall would cause an artificial rise in the ground water table upgradient of the landfill. A drainage system would be installed to prevent this artificial rise in the water table, and to divert water around the buried wastes. The discharge of this diverted water to the wetlands downgradient of the landfill would minimize the impact to the wetlands. However, some impact to the wetlands would remain as a result of the ground water extraction.

The upgradient slurry wall would reduce the amount of ground water entering the landfill area, thereby reducing the amount of water which comes into contact with the wastes. As a result, the ground water extraction rate could be reduced to about 900 gallons per minute and the amount of sludge produced during treatment would be reduced to about 2,900 pounds per day. The sludge would be disposed of at an off-site landfill in accordance with all applicable laws.

Estimated Time for Design and Construction: 2 years
Estimated Capital Cost (1993 Dollars): 8a - $26,016,700
8b - $18,354,700
Estimated Operations and Maintenance Costs (1993 Dollars):
8a - $10,332,100
8b - $16,245,100
Estimated Total Cost (1993 Dollars): 8a - $36,348,800
8b - $34,599,800

Alternatives 8c and 8d: Limited Action, Landfill Cover, Perimeter Slurry Wall with Ground Water Diversion, Overburden Ground Water Extraction within Slurry Wall, Bedrock Ground Water Extraction, On-Site (8c) or Off-Site (8d) Ground Water Treatment and Discharge, and Ground Water Monitoring. These alternatives include the same components as Alternatives 7a and 7b (Limited Action, Landfill Cover, On-Site and Off-Site Ground Water Extraction/Treatment/Discharge) with the addition of a perimeter slurry wall upgradient from the landfill (8c for on-site treatment and 8d for off-site treatment).

For Alternative 8c, the extracted ground water would be conveyed to an on-site wastewater treatment system. This treatment system would include some combination of a metals removal unit, biological waste water treatment unit or activated carbon adsorption unit. Waste sludge generated by the treatment unit, approximately 400 pounds per day, would be properly disposed of at an off-site landfill operating in compliance with all applicable laws. After the extracted ground water is treated on-site, it would be used to recharge the wetlands, as needed. For Alternative 8d, the extracted ground water would be conveyed to the Somersworth POTW through sanitary sewer lines. The integrity of the existing sanitary sewer lines would require verification prior to discharging the extracted ground water. If the extracted ground water does not meet the pretreatment requirements of the Somersworth POTW, a pretreatment system would be required on site. That system would focus primarily on reducing suspended metals and solids. The extracted ground water would then be treated at the Somersworth POTW. It is estimated that the POTW can handle up to about 485 gallons per minute (gpm) of extracted ground water before needing expansion. The estimated bedrock and ground water extracted by implementation of this alternative would be approximately 140 gpm. The actual flow could be lower depending on the ability of the cover and slurry wall to hydraulically isolate the overburden aquifer beneath the landfill. Therefore, it is unlikely that the capacity of the POTW would have to be increased. The POTW-treated ground water would be discharged to the Salmon Falls River.

Estimated Time for Design and Construction: 2 years
Estimated Capital Cost (1993 Dollars): 8c - $16,507,850
8d - $18,393,871
Estimated Operations and Maintenance Costs (1993 Dollars:
8c - $ 3,264,962
8d - $ 2,823,722
Estimated Total Cost (1993 Dollars): 8c - $19,772,812
8d - $21,217,593

Alternative 9: Complete Excavation, Removal, and Off-Site Disposal of Landfilled Waste, Natural Attenuation, Bedrock Ground Water Extraction with Treatment, and Ground Water Monitoring: Alternative 9 involves the excavation and off-site disposal of solid wastes and surface soils present at the site. Extraction and treatment of bedrock ground water would be conducted as in Alternative 3.

This alternative would provide a permanent, low-maintenance measure for source control. However, there are high costs associated with the excavation and off-site disposal due to the long distance to be travelled to reach a RCRA-approved disposal facility and the number of trips that would be required to the landfill. The closest RCRA-approved landfill is 250 miles away, and the estimated number of truck trips is 22,500.

Estimated Time for Design and Construction: 1 year
Estimated Capital Cost (1993 Dollars): $259,705,200
Estimated Operations and Maintenance Costs (1993 Dollars): $630,600
Estimated Total Cost (1993 Dollars): $260,335,800

Alternative 10: Limited Action, Landfill Cover, Excavation and On-Site Reconsolidation of Landfilled Waste, Bedrock Ground Water Extraction with Treatment, and Ground Water Monitoring. This alternative would differ from Alternative 10 in that wastes would be completely removed from below the water table, reconsolidated on-site and placed entirely above the water table, then capped with an impermeable cover which meets RCRA Subtitle C requirements for final closure of hazardous waste sites.

Estimated Time for Design and Construction: 1 year
Estimated Capital Cost (1993 Dollars): $16,338,700
Estimated Operations and Maintenance Costs (1993 Dollars): $1,297,100
Estimated Total Cost (1993 Dollars): $17,635,800

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

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

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

Threshold Criteria

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

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

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

Primary Balancing Criteria

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

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

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

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

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

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

Modifying Criteria

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

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

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

A detailed tabular assessment of each alternative according to the two threshold and five primary balancing criteria can be found in Table 14 of the Feasibility Study.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against those criteria, was conducted. This comparative analysis can be found in the Feasibility Study Addendum.

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

1. Overall Protection of Human Health and the Environment

With the exception of Alternative 1 (the no-action alternative), Alternatives 7a and 7b (overburden ground water extraction with on-site or off-site treatment), and Alternatives 8a and 8b (partial slurry walls and overburden ground water extraction with on-site or off-site treatment), each of the alternatives is protective. Alternative 1 is not protective because it would leave contamination above acceptable levels in the groundwater and the wetlands for an indefinite period of time, without any other measures to prevent exposure. Because Alternatives 7a, 7b, 8a, and 8b would not employ perimeter slurry walls, overburden ground water extraction would result in significant environmental damage to the wetlands due to extensive dewatering which could not be mitigated through recharge of treated effluent or of municipal water. Furthermore, because the pump and treat technology would not remediate the wetland area ground water faster or more effectively than Alternative 1, protective levels of ground water contamination would not be achieved in the foreseeable future. Although otherwise similar to alternative 1, Alternative 2 would achieve protectiveness through promulgation of institutional controls to limit exposures to contaminated media. (The reliability of such controls over the long period of time required under that alternative is, however, a consideration in the evaluation of this alternative under other criteria.) Alternative 3 combines the institutional controls of Alternative 2 with a RCRA Subtitle C cover and pumping and treating of bedrock ground water. The cover positively prevents contact with wastes and minimizes leachate generation to shorten the time until ground water achieves protective levels. The pumping and treating of the bedrock ground water will, also, shorten the time to achieve protective levels so that the length of time that institutional controls must be in place will be shortened, thus their likelihood of being effective is enhanced. In contrast to alternative 7, the low pumping rates anticipated should have no negative impact on the wetland environment. Alternatives 4 and 5 provide protectiveness from the in-situ treatment methods employed which will provide shorter times to achieve protective levels in ground water by enhancing the rate of remediation through enhancement of biodegradation (Alternative 4) or by effectively eliminating contaminant migration continuing into the wetland area by employing the chemical treatment "wall" (Alternative 5). As with the previous alternatives, institutional controls would prevent exposures until cleanup levels are achieved. Alternative 6 achieves protective levels in a manner similar to Alternative 3 and would provide some isolation of the waste through the use of slurry walls and cover (thereby somewhat shortening the time to achieve protective levels of contamination in the ground water). Alternatives 8c and 8d employ pump and treat technologies and perimeter slurry walls to remediate the ground water both in bedrock and overburden aquifers. With appropriate recharge techniques, the impact on wetlands should be minimal. Therefore, Alternatives 8c and 8d (on-site or off-site treatment with a full slurry wall) are protective. Alternative 9 achieves protectiveness by completely removing waste from the Site and relying on institutional controls to prevent ingestion of contaminated ground water. Alternative 10 achieves protectiveness by reconsolidating wastes above the ground water table, under a RCRA Subtitle C cover.

2. Compliance with ARARs

Most alternatives will meet all ARARs, but there are several exceptions. Alternative 2 cannot meet the RCRA Subtitle C closure requirements due to the lack of the required cover and an inability to meet the chemical-specific ARARs (SDWA MCLs) at the compliance boundary (the edge of the landfill) within an acceptable timeframe. Since Alternative 2 provides no active measures to reduce contamination, contaminants will remain in the ground water indefinitely. Alternatives 3 and 6a, which include the requisite cover, would not meet the chemical-specific ARARs at the compliance boundary since contaminants would continue to emanate from the waste located in the ground water. While the cover would reduce leachate production, wastes and associated contamination would remain in the ground water indefinitely. Alternative 6acould not meet the chemical-specific ARARs at the compliance boundary because of the presence of landfill waste in the ground water which would continue to contribute contamination above cleanup levels to the ground water

Alternatives must pass the two threshold criteria to be evaluated using the remaining criteria. Based on the discussion above, the alternatives that may be analyzed under the balancing and modifying criteria are: 4, 5, 6b, 8c, 8d, 9 and 10.

3. Long-Term Effectiveness and Permanence

Alternatives 4 and 5 would maintain protection over the long term since the technologies treat the source of contamination and allow for faster natural attenuation in the wetlands area. Long-term management should be minimal. After the treatment process has been completed, residual risks and the need for further maintenance or exposure control would be minimal. Alternative 6b would require long-term maintenance of the cover, as well as, the upgradient ground water diversion and perimeter slurry wall. Some contaminated ground water would be released to the wetlands since the wastes would be left in place and might not be completely isolated. Alternatives 8c and 8d prevent dewatering of the wetlands by isolating the wetlands through the use of a perimeter slurry wall to allow natural attenuation to occur in the wetland areas. Extraction and treatment within the slurry wall will result in a magnitude of residual risk nearly as low as Alternatives 4 and 5, both of which should more directly address the source of contamination in the landfill and not produce treatment residuals requiring management. Long-term management is more complex than for other alternatives which do not employ the added flows from extraction of overburden ground water. Alternative 9 results in the lowest magnitude of residual risk since all waste is to be removed from the Site. Alternative 10 would lower remaining risk somewhat by removing wastes from the ground water.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 4, 5, 6b, 8c, 8d, 9 and 10 all employ identical extraction systems for bedrock ground water and provide treatment as well. Therefore, all are identical with respect to the degree of reduction of toxicity, mobility, and volume of contaminants in the bedrock ground water. Alternatives 4, 5, 8c and 8d all employ treatment methods to reduce toxicity, mobility, and volume of contamination in the overburden aquifer. The principal difference among these alternatives is that Alternatives 4 and 5 would result in total destruction of the contamination. Alternatives 8c and 8d generate significant amounts of sludge which would require ultimate disposal.

5. Short-Term Effectiveness

This factor involves several considerations, including (a) short term risks to the community during implementation, (b) potential dangers to workers during implementation, (c) potential environmental effects of the remedial action itself during implementation, and (d) the length of time required to achieve cleanup levels.

All alternatives present comparable risks of exposure to contaminated groundwater during the period required to complete the restoration of the groundwater. As noted below, those time frames vary; the alternatives with the shortest time frames thus present the least short-term risk. (The time frame associated with each alternative is indicated below.) The risk is greatest under alternatives 1 and 2 since no capping of the landfill or cleanup of ground water/leachate will take place under these alternatives, and cleanup levels would not be attained in the foreseeable future.

Time frames for achievement of protective levels under the alternatives are projected to be as follows: Alternatives 6b, 8c, and 8d would require about one year to implement and approximately fifty-five years to achieve cleanup goals in the overburden aquifer down-gradient of the edge of the landfill. Alternative 5 would require up to three years to implement and approximately fifty-five years to achieve cleanup goals in the overburden aquifer down-gradient of the edge of the landfill. Alternative 4 would require up to four years to implement and approximately fifty-five years to achieve cleanup goals in the overburden aquifer down-gradient of the edge of the landfill. Alternatives 9 and 10 would require one year to implement and approximately eighty-three years to achieve cleanup goals in the overburden aquifer down-gradient of the edge of the landfill. As a result of the bedrock ground water extraction and treatment systems, it is expected that the bedrock ground water would achieve cleanup goals at least as quickly as the overburden ground water.

With respect to environmental risks, or risks to workers, during implementation, Significant risks to human health and the environment could result from an inadvertent release of contamination during the waste excavation and removal or reconsolidation process which would be utilized in Alternatives 9 or 10. Alternative 9 poses the greatest risk due to the complete excavation and off-site disposal of the landfill wastes. Alternative 10 would be an improvement since wastes will not be disposed of off-site but still would be excavated. Stringent health and safety measures would be required during the implementation of these alternatives to protect construction crews and nearby residents. Minor releases of VOCs and/or particulates may occur during the regrading of the solid wastes and soils prior to the installation of the cover which is utilized in Alternatives 4, 5, 6b, 8c, and 8d, and 10. Dust control measures, the use of interim covers, air monitoring (if necessary), and proper health and safety training would minimize exposures to construction crews and nearby residents. Minimal incidental exposures to workers would be expected for the construction of any of the ground water extraction and treatment systems. Remedial activities are not expected to adversely impact the community during or after implementation. Minimal risks to workers are associated with the construction of the perimeter slurry wall and collection drain utilized in Alternatives 6b, 8c and 8d.

Alternatives 8c and 8d would create minimal impacts on wetlands, since mitigation measures should prove to be effective. Alternative 6b is less harmful since wetland impacts could be nearly completely mitigated. Alternative 10 would have the next highest level of risk to the environment because of the continued migration of contaminated ground water into the wetlands. Alternatives 4, 5, and 9 would have the lowest level of risk to the environment.

6. Implementability

All of the alternatives can be implemented using standard construction methods. The principal difference among alternatives concerns the reliability of the technology. Neither Alternative 4 nor Alternative 5 has been implemented at the scale proposed. The likelihood that technical problems will occur with the delivery system used to provide nutrients to the landfill in Alternative 4 is high. The potential for preferred pathways developing so that portions of the waste do not receive nutrients is likely. For Alternative 5, the mechanisms which occur that detoxify the contamination within the in-situ chemical treatment wall are not well documented or understood. There is also an unknown potential for fouling, plugging and exhaustion of capacity or effectiveness. However, additional remedial actions could easily be undertaken if required. Implementation of Alternative 9 would be difficult from an administrative basis. The ability of a RCRA-approved landfill to handle the large volumes of waste (approximately 450,000 tons) is unknown. In addition, the large number of truck trips necessary to transport the wastes over long distances may create substantial fugitive dust and fuel emissions. Finally, with the large number of trips, the potential exists for a truck traffic accident which could release contaminated material. All other aAlternatives (6b, 8c, 8d, and 10) are roughly equivalent in their implementability.

7. **Cost**

The capital, operation and maintenance, and total cost for each alternative is provided as part of the site description in Section VIII., Description of Alternatives. For comparative purposes, all costs are based upon thirty years of operation of each alternative. The actual costs would differ somewhat based upon the length of time necessary to achieve cleanup levels.

8. **State Acceptance**

The State has reviewed the FS, the Proposed Plan, and this Record of Decision and concurs with the remedy.

9. **Community Acceptance**

Community acceptance of this Proposed Plan has been evaluated based on comments received at the public meetings and during the public comment period. In general, most of the community members who expressed views supported Alternative 5, the innovative technology chosen as the preferred alternative, but did not support the contingency remedy of pump-and-treat. Some community members questioned the innovative technology because of the uncertainties about its effectiveness or implementability. However, overall sentiment in the community is that the No Action or Limited Action alternatives would be more appropriate remedies based upon the public's perception of risk and cost-effectiveness. The Somersworth Landfill Trust, which includes the City of Somersworth stated in its comments that it did not feel that any response action was necessarily warranted, but that if remedial action were to be taken, Alternative 5 should be selected. A further discussion of community concerns is found in the Responsiveness Summary, Appendix B.

<u>Overall comparison of alternatives under above criteria</u>

The NCP requires EPA to select the alternative that meets the threshold criteria of protectiveness and ARAR compliance, and best balances the remaining seven criteria. EPA has concluded that Alternative 5 represents the best balance of the criteria, subject to concerns stemming from its innovative nature. Because of those concerns, EPA has identified a contingent remedy, Alternatives 8c and 8d (to be constructed in stages), which best meet the NCP criteria if Alternative 5 does not prove to be successful.

The basis for selecting these alternatives is as follows. First, EPA may not consider any alternative that fails to achieve one or both of the threshold criteria. Alternatives 1, 7, 8a and 8b were found not to be protective, and Alternatives 2, 3 and 6a were found not to comply with ARARs. Therefore, those alternatives could not be considered further.

In choosing among the remaining alternatives, major concerns included the time frame required to complete the remedial action (which affected both long-term effectiveness and short-term effectiveness), and cost, although other factors affected the selection as well. Alternative 9 was inferior on all relevant considerations: it involved the longest time frame of any alternative (other than alternatives 1 and 2 which were not under consideration), presented significant short term risks, and was vastly more expensive than any other alternative. Alternative 10 was less costly than several other options, while more costly than others, but also had a longer remedial time frame and presented significant short-term risks.

This left Alternatives 4, 5, 6b, 8c and 8d. Among these, Alternatives 6b, 8c and 8d had the shorter time frame and advantages over the others in terms of implementability. However, the time frame is only slightly shorter than under the other options, and Alternatives 8c and 8d are considerably more costly. Alternative 6b is questionable in terms of long-term effectiveness of the slurry wall to maintain hydraulic control to isolate the wastes. Alternatives 8c and 8d rely on pumping the overburden ground water to maintain that control, but at additional cost. Due to cost considerations, EPA looked closely at Alternatives 4 and 5. These two alternatives were similar in terms of time frame, use of treatment, and short-term effectiveness. Alternative 4 was somewhat less expensive; however, significant concerns exist about its implementability. The likelihood that technical problems will occur with the delivery system used to provide nutrients to the landfill in Alternative 4 is high. The potential for preferred pathways developing so that portions of the waste do not receive nutrients is likely. Finally as between these alternatives, community support was much stronger for Alternative 5. Therefore, Alternative 5 was preferable to Alternative 4.

Alternative 5 is significantly cheaper than Alternatives 8c and 8d; however, concerns about its implementability still exist. Therefore, in the overall balancing of alternatives the two approaches are similar. Since there are no current exposures to contaminated groundwater, and exposure is generally unlikely in the very near term, EPA has chosen to proceed with alternative 5 and to proceed with it pending a final decision on its implementability which will be based on the information and experience gained in carrying it out. If it is found not to be implementable, either alternative 8c or 8d will be implemented.

X. THE SELECTED REMEDY

The selected remedy is Alternative 5 with Alternatives 8c or 8d as the contingency remedy if Alternative 5 is determined to be ineffective. Each of these alternatives are comprehensive, including technologies for both source control and management of migration. The remedial components of the selected remedy are described in detail, below.

A. Interim Ground Water Cleanup Levels

Interim cleanup levels have been established in ground water for all contaminants of concern identified in the Baseline Risk Assessment found to pose an unacceptable risk to either public health or the environment. Interim cleanup levels have been set based on the ARARs (e.g., Drinking Water Maximum Contaminant Level Goals [MCLGs] and MCLs) as available, or other suitable criteria described below. Periodic assessments of the protection afforded by remedial actions will be made as the remedy is being implemented and at the completion of the remedial action. At the time that Interim Ground Water Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on the residual ground water contamination to determine whether the remedial action is protective. This risk assessment of the residual ground water contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by ingestion of ground water and inhalation of VOCs from domestic water usage. If, after review of the risk assessment, the remedial action is not determined to be protective by EPA, the remedial action shall continue until either protective levels are achieved, and are not exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

Because the aquifer at and beyond the compliance boundary for the landfill is a Class IIB aquifer (a potential source of drinking water), MCLs and non-zero MCLGs established under the Safe Drinking Water Act are ARARs.

Interim cleanup levels for known, probable, and possible carcinogenic compounds (Classes A, B, and C) have been established to protect against potential carcinogenic effects and to conform with ARARs. Because the MCLGs for Class A & B compounds are set at zero and are thus not suitable for use as interim cleanup levels, MCLs and proposed MCLs have been selected as the interim cleanup levels for these Classes of compounds. Because the MCLGs for the Class C compounds are greater than zero, and can readily be confirmed, MCLGs and proposed MCLGs have been selected as the interim cleanup levels for Class C compounds.

Interim cleanup levels for Class D and E compounds (not classified, and no evidence of carcinogenicity) have been established to protect against potential non-carcinogenic effects and to conform with ARARs. Because the MCLGs for these Classes are greater that zero and can readily be confirmed, MCLGs and proposed MCLGs have been selected as the interim cleanup levels for these classes of compounds.

In situations where a promulgated State standard is more stringent than values established under the Safe Drinking Water Act, the State standard was used as the interim cleanup level. In the absence of an MCLG, an MCL, a proposed MCLG, proposed MCL, State standard, or other suitable criteria to be considered (i.e., health advisory, state guideline) an interim cleanup level was derived for each compound having carcinogenic potential (Classes A, B, and C compounds) based on a 10^{-6} excess cancer risk level per compound considering the ingestion of ground water and inhalation of VOCs from domestic water usage. In the absence of the above standards and criteria, interim cleanup levels for all other compounds (Classes D and E) were established based on a level that represents an acceptable exposure level to which the human population including sensitive subgroups may be exposed without adverse affect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (hazard quotient equals one) considering the ingestion of groundwater and inhalation of VOCs from domestic water usage. If a value described by any of the above methods was not capable of being detected with good precision and accuracy or was below what was deemed to be the background value, then the practical quantification limit or background value was used as appropriate for the Interim Ground Water Cleanup Level.

Table I below summarizes the Interim Cleanup Levels for carcinogenic and non-carcinogenic contaminants of concern identified in ground water.

TABLE I: INTERIM GROUND WATER CLEANUP LEVELS

Carcinogenic Contaminants of Concern (class)	Interim Cleanup Level (µg/l)	Basis	Level of Risk
Benzene (A)	5	MCL	1.7×10^{-6}
1,1-Dichloroethylene (C)	7	MCLG	4.9×10^{-5}
Methylene Chloride (B2)	5	MCL	4.4×10^{-7}
Tetrachloroethylene (B2)	5	MCL	3.1×10^{-6}
Trichloroethylene (B2)	5	MCL	6.5×10^{-7}
Vinyl Chloride (A)	2	MCL	4.5×10^{-5}
		SUM	1.0×10^{-4}

Non-carcinogenic Contaminants of Concern (Class)	Interim Cleanup Level (µg/l)	Basis	Target Endpoint of Toxicity	Hazard Quotient
Dichloroethylene (D)				
Cis-1,2-	70	MCLG	Liver, Kidney	0.19
Trans-1,2-	100	MCLG	Liver, Kidney	0.14
		HI	Liver, Kidney	0.33

These interim cleanup levels are consistent with ARARs or suitable TBC criteria for ground water, attain EPA's risk management goal for remedial actions and are determined by EPA to be protective. However, the true test of protection cannot be made until residual levels are known. Consequently, at the time that Interim Groundwater Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on the residual ground water contamination to determine whether the remedial action is protective. This risk assessment of the residual ground water contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by ingestion of ground water and inhalation of VOCs from domestic water usage. If, after review of the risk assessment the remedial action is not determined to be protective by EPA, the remedial action shall continue until either protective levels are achieved and are not exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

Several metals have been detected sporadically in ground water samples from the Site at concentrations which exceed ARARs and/or which would cause public health risks to be outside of EPA's acceptable risk range of 10^{-4} to 10^{-6} for carcinogenic risks or to exceed a hazard index of one for non-carcinogenic effects. These metals include: antimony, arsenic, beryllium, and manganese. However, statistical analyses have been done on each of these metals and no statistical difference could be seen between the metals data up-gradient and down-gradient of the landfill. This would indicate that the metals are naturally occurring or background and as such no cleanup level will be set. In addition, the samples for metals were obtained using standard techniques which may result in an overestimation of the concentrations of metals in the aquifer. During the long-term ground water monitoring required as an element of the remedy, low-flow sampling techniques will be employed to accurately represent the metals actually moving with the ground water. Based on EPA's experience with these sampling techniques, concentrations are expected to be lower than those presented in the Remedial Investigation and subsequent Remedial Investigation Data Gathering Report. These are the data which will be used in the risk assessment to be conducted on the residual contamination to ensure that the remedy is protective.

All Interim Groundwater Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy and the protective levels determined as a consequence of the risk assessment of residual contamination, must be met at the completion of the remedial action at the points of compliance, the aquifer at and beyond the edge of the landfill (down-gradient of the chemical treatment wall). EPA has estimated that these levels will be obtained within approximately fifty-five years after completion of the source control component.

B. Description of Remedial Components

EPA has selected an innovative, emerging technology involving a permeable, chemical treatment "wall" because of the potential benefits which would be achieved by its use over other alternatives. These benefits include: complete detoxification of VOCs, no residuals requiring treatment or disposal, simple operation, low maintenance, and relatively low costs.

1. <u>In-situ chemical treatment "wall" (Figure 4) and ground water diversion</u>

This is the key element of the remedy, the construction of a treatment wall composed of impermeable barrier sections and innovative, permeable, chemical treatment sections to provide in-situ (in-place), flow-through treatment of contaminated ground water at the landfill waste boundary (the compliance boundary). The barrier sections, sheet piling or slurry walls, will direct contaminated ground water through the treatment sections where detoxification of the VOCs will occur.

Because of the emerging, innovative nature of this technology, the following activities must be accomplished in order to ensure that the remedy is effective:

- collection of additional, necessary hydrogeologic data,
- bench-scale studies to determine the degradation rate of VOCs in site ground water under simulated in-situ conditions, if evaluation of the bench-scale studies indicate the applicability of the technology to the Site,
- installation of an in-situ, pilot-scale chemical treatment wall,
- development of a ground water flow model for evaluation of pilot-scale field results; and if this evaluation continues to demonstrate the applicability of the technology,
- design, installation, and evaluation of the full-scale chemical treatment wall.

EPA will require that all activities up to and including final design be completed within two years. The final design documents will include a detailed monitoring program to assess the effectiveness of the chemical treatment wall.

If, at any time after the construction of the remedy, EPA determines, based upon a review of the data developed during the monitoring program, that the remedy is likely not to be protective or that the remedy's anticipated performance no longer warrants its selection, then the design for the contingency remedy will begin. Upon determining that the selected remedy will not meet performance standards, the contingency remedy will be constructed in two stages with the first stage being evaluated to determine if the next stage of the contingency remedy is needed. As a component of the first stage, a diversion trench will be constructed on the upgradient side of the landfill to intercept and divert groundwater around the landfill. To the extent practicable, this diverted groundwater will be used to recharge the downgradient wetlands. A second component of the first stage would be the completion of a perimeter slurry wall around the landfill waste. Permeable treatment sections of chemical treatment wall would be removed and replaced by slurry wall material. The final component of the first stage would be a landfill cover which complies with RCRA C requirements. The purpose of the components of this stage is to lower the ground water to below the wastes in an attempt to meet interim ground water cleanup levels in the overburden aquifer at the compliance boundary. This stage of the contingency remedy is essentially Alternative 6b, as set forth in the Feasibility Study. The ground water levels would be monitored to determine if the water table would be lowered below the waste and ground water quality would be monitored to ensure that overburden ground water will meet interim ground water cleanup levels at the compliance boundary. If either of these conditions cannot be met, then stage two of the contingency remedy would be implemented. This would consist of the extraction and treatment of overburden ground water from within the slurry wall. The remedial design will determine the number, location and pumping rates of each well, as well as, the most appropriate treatment technology and discharge location. On-site treatment and disposal methods and pretreatment and discharge at the Somersworth wastewater treatment facility are the two options which will be evaluated. Completion of stage two of the contingency remedy would complete all components of Alternative 8c or 8d.

2. <u>Landfill cover</u>

To maximize "flushing" of contaminants from the landfill waste and subsequently through the chemical wall for treatment, a permeable cover allowing precipitation to infiltrate the waste area will be placed on the landfill as long as contaminants continue to leach from the landfill waste and the chemical treatment "wall" is functioning. After cleanup levels have been achieved and can be maintained without use of the treatment "wall," EPA will evaluate an appropriate landfill cover to be installed to close the landfill. The evaluation will be based on the data collected as part of the monitoring program.

If the contingency remedy is implemented, a multi-layer, impermeable cover which meets the requirements of RCRA C will be designed, installed, and maintained over the landfill (Figure 5).

3. Bedrock ground water extraction and treatment

Extraction of bedrock ground water will be done at monitoring well B-12R and down gradient of the chemical treatment wall. A pump will be installed in monitoring well B-12R and the effluent will be piped to the landfill for treatment through the chemical treatment wall. The contaminated ground water will be either discharged onto the landfill to enhance flushing or injected just upgradient of the chemical treatment wall to receive treatment. After installation and operation of this well has begun, its effectiveness in remediating the down-gradient bedrock ground water so that the extent of the bedrock ground water extraction system down gradient of the chemical treatment wall can be determined. The studies required will focus on the number, location, and flow rate of the wells; the timing of their installation; and the impacts on the overall ground water cleanup.

If the contingency remedy is implemented, the extracted bedrock ground water will be treated at the Somersworth Wastewater Treatment Facility or, if the second phase of the contingency is implemented, the bedrock ground water will be treated along with the overburden ground water.

4. Natural attenuation for the wetlands ground water plume

The use of the chemical treatment wall and bedrock ground water extraction will prevent contaminants from continuing to discharge to the wetlands ground water. This will allow the ground water to naturally attenuate in as short a time as practicable, estimated at fifty-five years.

5. Institutional controls to prevent use of contaminated ground water

Potential demands for water during the fifty-five year period prior to achieving ground water cleanup levels make the implementation of institutional controls an important element of the remedy. Therefore, institutional controls will be used to ensure that the affected ground water will not be used until ground water cleanup levels have been met. These controls should place further restrictions on development and ground water use in and around the wetland areas, as well as, along Blackwater Road south of the landfill to ensure that new wells are not installed or existing wells are not put back into service. As part of this portion of the remedy, a fence will be installed around the landfill to restrict access. The area requiring fencing will be determined during design.

6. <u>Ground water monitoring</u>

A detailed ground water monitoring program will be developed during remedial design. The program will address long-term monitoring of the aquifer and performance monitoring of the chemical treatment wall. At a minimum, the sampling event frequency for the aquifer monitoring will be quarterly for the first three years for at least VOCs. Biannual sampling for other organics and inorganic compounds for that period should be conducted. Inorganic compounds will be sampled using a low flow sampling technique to ensure that the data is representative of the inorganics moving with the ground water.

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

XI. STATUTORY DETERMINATIONS

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

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

The remedy at this Site will permanently reduce the risks posed to human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls, and institutional controls; more specifically, for the selected remedy, through the use of an in-situ chemical treatment wall to treat contaminated ground water emanating from the landfill, bedrock ground water extraction and treatment through the chemical treatment wall, and institutional controls to restrict use of contaminated ground water; for the contingency remedy, through isolation of the wastes by an impermeable landfill cover and a perimeter slurry wall, by bedrock ground water extraction and treatment at the Somersworth Wastewater Treatment Facility or on-site, by extraction and treatment of overburden ground water if necessary, and by institutional controls to restrict use of contaminated ground water.

Moreover, the selected remedy and contingency remedy will achieve potential human health risk levels that attain the 10^{-4} to 10^{-6} incremental cancer risk range and a level protective of noncarcinogenic endpoints, and will comply with ARARs and to-be-considered criteria. At the time that the Interim Ground Water Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on the residual ground water contamination to determine whether the remedial action is protective. This risk assessment of the residual ground water contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by ingestion of ground water and inhalation of VOCs from domestic water usage. If, after review of the risk assessment, the remedial action is not determined to be protective by EPA, the remedial action shall continue until protective levels are achieved and have not been exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

B. The Selected Remedy Attains ARARs

This remedy will attain all applicable or relevant and appropriate federal and state requirements that pertain to the Site. Environmental laws from which ARARs for the selected remedial action are derived, and the specific ARARs include:

__Chemical-Specific__

Safe Drinking Water Act (SDWA), 40 CFR 141.50 - 141.62, Maximum Contaminant Level Goals (MCLGs), where greater than zero

Safe Drinking Water Act (SDWA), 40 CFR 141.11-141.16, Maximum Contaminant Levels (MCLs)

Clean Water Act (CWA), Federal Water Quality Criteria (FWQC) for protection of human health

CWA, Federal Water Quality Criteria (FWQC) for protection of aquatic life

New Hampshire Primary Drinking Water Criteria (MCLs and MCLGs) under RSA Ch. 485, promulgated at Env-Ws 316 and 317 (to the extent they are more stringent than MCLs and non-zero MCLGs)

Env-WS 410.05, Ambient Ground Water Quality Standards (to the extent they are more stringent than MCLs and non-zero MCLGs)

Env-WS Part 432, Water Quality Criteria for Protection of Human Health and Protection of Aquatic Life

Location-Specific

CWA Section 404; 40 CFR Part 230; 33 CFR Parts 320-330

RSA 217A NH Native Plant Protection Act

RSA 485-A-17, Dredging and Control of Run-Off; Env-Ws Part 415, Dredging Rules

RSA Ch. 482-A, Fill and Dredge in Wetlands; and Env-Wm 300-400, and 600, Criteria and Conditions for Fill and Dredge in Wetlands

Env-WS 410.26, Ground Water Management Zone

Action-Specific - Alternative 5

Env-Ws 410.24(a) and (b), Criteria for Remedial Action.
NOTE: Other criteria in 410.24, which do not impose distinct requirements but rather are weighed more generally in selecting remedial action plans would not be ARARs.

Env-Ws 410.27, Groundwater Management Permit Compliance Criteria.
NOTE: This provision requires a revised remedial action plan where implementation of an approved plan fails to meet performance standards. At this site, the revised remedial plan will be as specified in the phased contingency remedy described elsewhere in this ROD.

New Hampshire Hazardous Waste Regulations, in so far as they are relevant to the alternative, including in particular:

Env-Wm 353.09 and 353.10, Siting requirements for hazardous waste facilities and variances

Env-Wm 702.08 Environmental and Health Requirements

Env-Wm 702.09 General Design Requirements

Env-Wm 702.11 Ground Water Monitoring

Env-Wm 702.12 Other Monitoring

Env-Wm 708.02 Operation Requirements

Env-Wm 708.03 Technical Requirements

Fugitive Dust Emission Control, NH Admin. Rules, Env-A 1002

Env-Wm 403 Industrial and Municipal Wastewater Discharge Permits

We 604 Abandonment of Wells

Action-Specific - Alternative 8c

Clean Water Act, Discharge of Treatment System Effluent, 40 CFR 122, 40 CFR 125, 40 CFR 131, and 40 CFR 136, National Pollutant Discharge Elimination System

Fugitive Dust Emission Control, NH Admin. Rules, Env-A 1002

RSA 485-A:8 Surface Water Classifications

RSA 485-A:12 Enforcement of Classification

Env-Ws 410.24(a) and (b), Criteria for Remedial Action.
NOTE: Other criteria in 410.24, which do not impose distinct requirements but rather are weighed more generally in selecting remedial action plans would not be ARARs.

Env-Ws 410.27, Groundwater Management Permit Compliance Criteria.

Env-Ws 410.07, 410.09, 410.10 Prohibited Discharge, Groundwater Discharge Zone, Groundwater Discharge Permit Compliance Criteria

Env-Wm 403 Industrial and Municipal Wastewater Discharge Permits

We 604 Abandonment of Wells

New Hampshire Hazardous Waste Regulations, in so far as they are relevant to this alternative, including in particular:

Env-Wm 353.09 and 353.10 Siting requirements for hazardous waste facilities and variances

Env-Wm 702.08 Environmental and Health Requirements

Env-Wm 702.09 General Design Requirements

Env-Wm 702.11 Ground Water Monitoring

Env-Wm 702.12 Other Monitoring

Env-Wm 708.02 Operation Requirements

Env-Wm 708.03 Technical Requirements

Action-Specific - Alternative 8d

Clean Water Act, Discharge of Treatment System Effluent, 40 CFR 122, 40 CFR 125, 40 CFR 131, and 40 CFR 136, National Pollutant Discharge Elimination System

Fugitive Dust Emission Control, NH Admin. Rules, Env-A 1002

Env-Ws 410.07, 410.09, 410.10 Prohibited Discharge, Groundwater Discharge Zone, Groundwater Discharge Permit Compliance Criteria

We 604 Abandonment of Wells

Env-Ws 410.24(a) and (b), Criteria for Remedial Action.
NOTE: Other criteria in 410.24, which do not impose distinct requirements but rather are weighed more generally in selecting remedial action plans would not be ARARs.

Env-Ws 410.27, Groundwater Management Permit Compliance Criteria.

New Hampshire Hazardous Waste Regulations, in so far as they are relevant to this alternative, including in particular:

Env-Wm 353.09 and 353.10 Siting requirements for hazardous waste facilities and variances

Env-Wm 702.08 Environmental and Health Requirements

Env-Wm 702.09 General Design Requirements

Env-Wm 702.11 Ground Water Monitoring

Env-Wm 702.12 Other Monitoring

Env-Wm 708.02 Operation Requirements

Env-Wm 708.03 Technical Requirements

The ARAR Tables, Appendix C, present a more detailed explanation of each ARAR and whether it is applicable or relevant and appropriate as well as other environmental criteria considered.

C. The Selected Remedial Action is Cost-Effective

In the Agency's judgment, the selected remedy is cost-effective, i.e., the remedy affords overall effectiveness proportional to its costs. In selecting this remedy, once EPA identified alternatives that are protective of human health and the environment and that attain, or, as appropriate, waive ARARs, EPA evaluated the overall effectiveness of each alternative by assessing the relevant three criteria--long term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short term effectiveness, in combination. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs. The costs of the selected remedy, Alternative 5, in 1993 dollars are:

Estimated Capital Cost:	$12,744,700
Estimated O & M Costs:	$ 2,240,100
Estimated Total Cost:	$14,984,800

Approximately $9,000,000 of the total costs of the selected remedy reflect costs for the design, construction, and maintenance of a RCRA C landfill cover. However, as stated in Section X.B.2., after cleanup levels have been achieved and can be maintained without use of the chemical treatment "wall," EPA will evaluate an appropriate cover to be installed to close the landfill. A significant cost reduction could be realized.

Should the preferred alternative fail to be protective, the contingency remedy will be implemented, the overall effectiveness of which is proportional to its costs. The costs of the contingency remedies (Alternatives 8c and 8d) are presented below:

	8c	8d
Estimated Capital Cost:	$16,507,350	$18,393,871
Estimated O & M Costs:	$ 3,264,962	$ 2,823,722
Estimated Total Cost:	$19,772,812	$21,217,593

If it is determined that the first stage of the contingency remedy is effective, then the costs would be similar to the costs of Alternative 6b, as presented below:

Estimated Capital Cost:	$12,434,200
Estimated O & M Costs:	$ 1,296,600
Estimated Total Cost:	$13,730,800

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

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

disposal of untreated waste, and community and state acceptance. The selected remedy provides the best balance of trade-offs among the alternatives.

The selected remedy, Alternative 5, provides the best balance among the alternatives that complied with ARARs and were protective. As described in Section IX., Summary of the Comparative Analysis of Alternatives, Alternative 5 and Alternative 4, rank highest among the alternatives for both long-term effectiveness and permanence and reduction of toxicity, mobility or volume through treatment. For short-term effectiveness Alternative 5 ranks among the top four alternatives which met the threshold criteria. It ranks somewhat lower than the top four alternatives (Alternative 6b, 8c, 8d, and 10) on implementability because of its use of an emerging, innovative technology. However, it ranks significantly higher than Alternative 4 which relies on enhanced biological mechanisms to be effective. Alternative 5 ranks in the top two, along with Alternative 4, for lowest costs. The State has supported the selected remedy, including the contingency remedy. Based upon comments received at the public hearing and written comments, the community conditionally supports the selected remedy over all others which meet ARARs and are protective. The primary concern of the community is the cost of any remedial action. Furthermore, Alternative 5 is the remedial action alternative which was most strongly favored by the Somersworth Landfill Trust throughout the development of the Feasibility Study.

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

The principal element of the selected remedy is the in-situ treatment of ground water by a chemical treatment wall. This element addresses the primary threat at the Site, contamination of ground water. The selected remedy satisfies the statutory preference for treatment as a principal element by permanently reducing the toxicity of contaminants in the ground water.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES

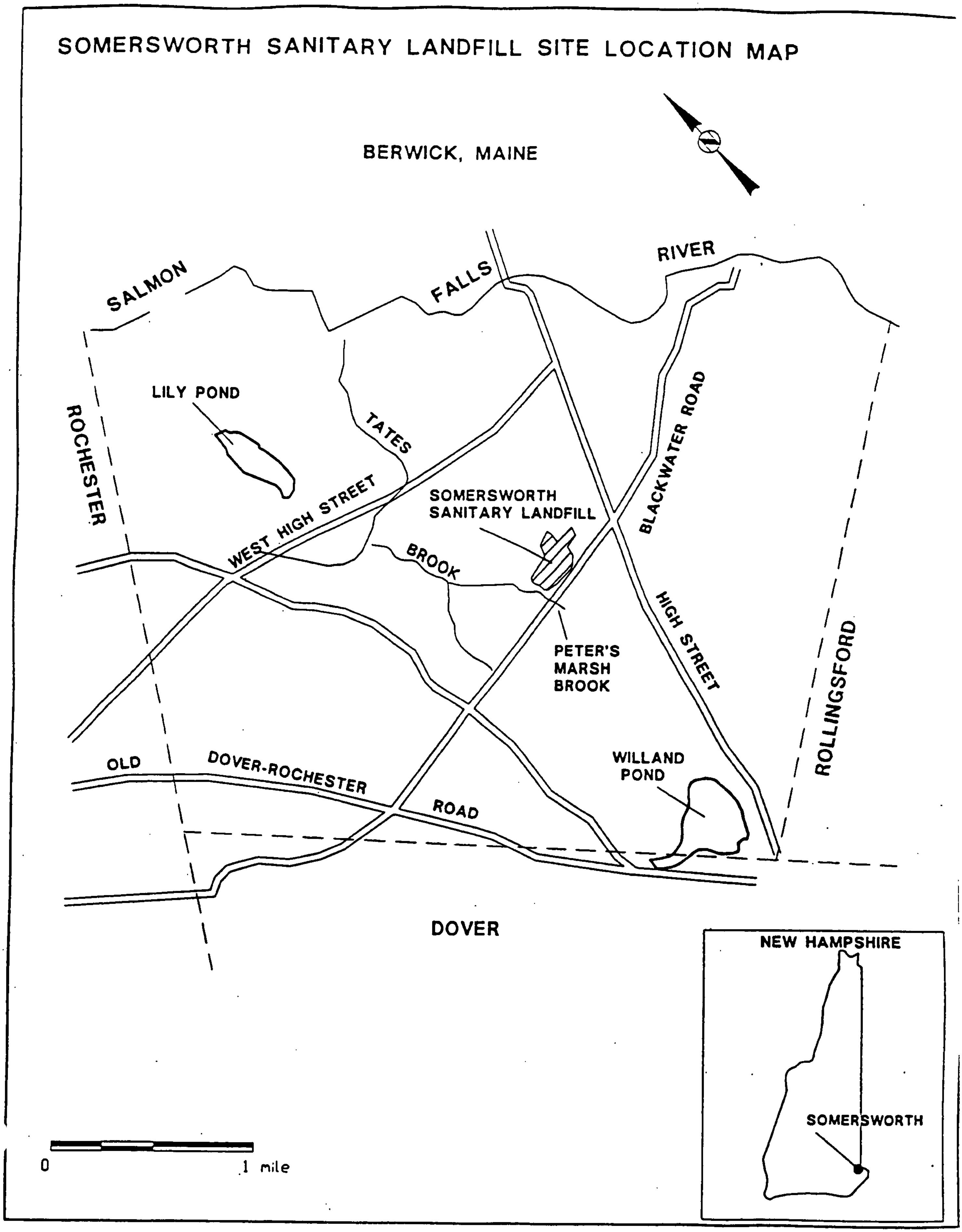
EPA presented a proposed plan (preferred alternative) for remediation of the Site on December 14, 1993. The source control portion of the preferred alternative included an in-situ chemical treatment wall and landfill cover. The management of migration portion of the preferred alternative included natural attenuation and limited bedrock ground water extraction and treatment. A contingency alternative was presented should the preferred alternative prove not to be protective. The contingency alternative included a landfill cover meeting the requirements of RCRA C, a perimeter slurry wall with upgradient ground water diversion and wetland recharge, and overburden and bedrock ground water extraction and treatment. Based upon comments received during the public comment period, EPA, in consultation with the New Hampshire Department of Environmental Services, has determined that the contingency alternative, if implemented, would be constructed in two stages. The first stage would include all components of the original contingency alternative except the overburden ground water extraction and treatment. The goal of this stage would be to lower the ground water below the waste, thereby minimizing or eliminating the production of leachate and the migration of contaminants beyond the compliance boundary above cleanup levels. The need for the second stage, extraction and treatment of overburden ground water within the slurry wall, would be determined based upon an evaluation of the effectiveness of the first stage to minimize leachate production and contaminant migration. Water levels would be monitored to determine if the water table falls below the waste and water quality will be evaluated to determine if ARARs can be attained at the compliance boundary. This change to the contingency alternative could result in potential cost savings that would be realized if pumping and treating the overburden ground water within the slurry wall is not necessary to meet ARARs and to be protective.

XIII. STATE ROLE

The New Hampshire Department of Environmental Services has reviewed the various alternatives and has indicated its support for the selected remedy, including the contingency remedy. The State has also reviewed the Remedial Investigation, Risk Assessment, Feasibility Study, and Feasibility Study Addendum to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental laws and regulations. The State of New Hampshire concurs with the selected remedy for the Somersworth Sanitary Landfill Site. A copy of the declaration of concurrence is attached as Appendix D.

FIGURES

Figure 1


SOMERSWORTH SANITARY LANDFILL SITE LOCATION MAP
BERWICK, MAINE
SALMON
FALLS
RIVER
LILY POND
ROCHESTER
TATES
WEST HIGH STREET
BROOK
SOMERSWORTH
SANITARY LANDFILL
BLACKWATER ROAD
PETER'S
MARSH
BROOK
HIGH STREET
ROLLINGSFORD
WILLAND
POND
OLD
DOVER-ROCHESTER
ROAD
DOVER
NEW HAMPSHIRE
SOMERSWORTH
0
1 mile

SOMERSWORTH SANITARY LANDFILL SITE MAP

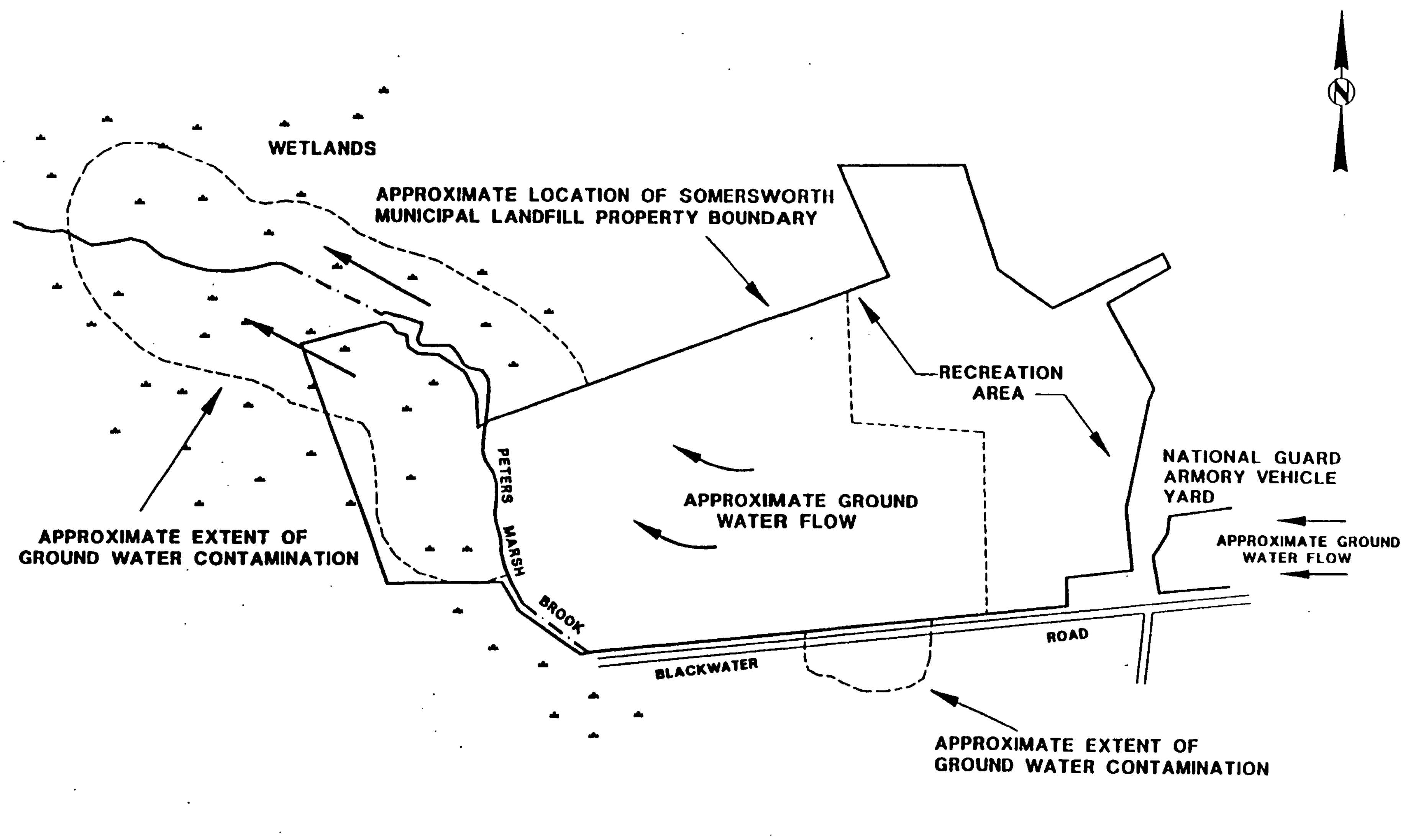
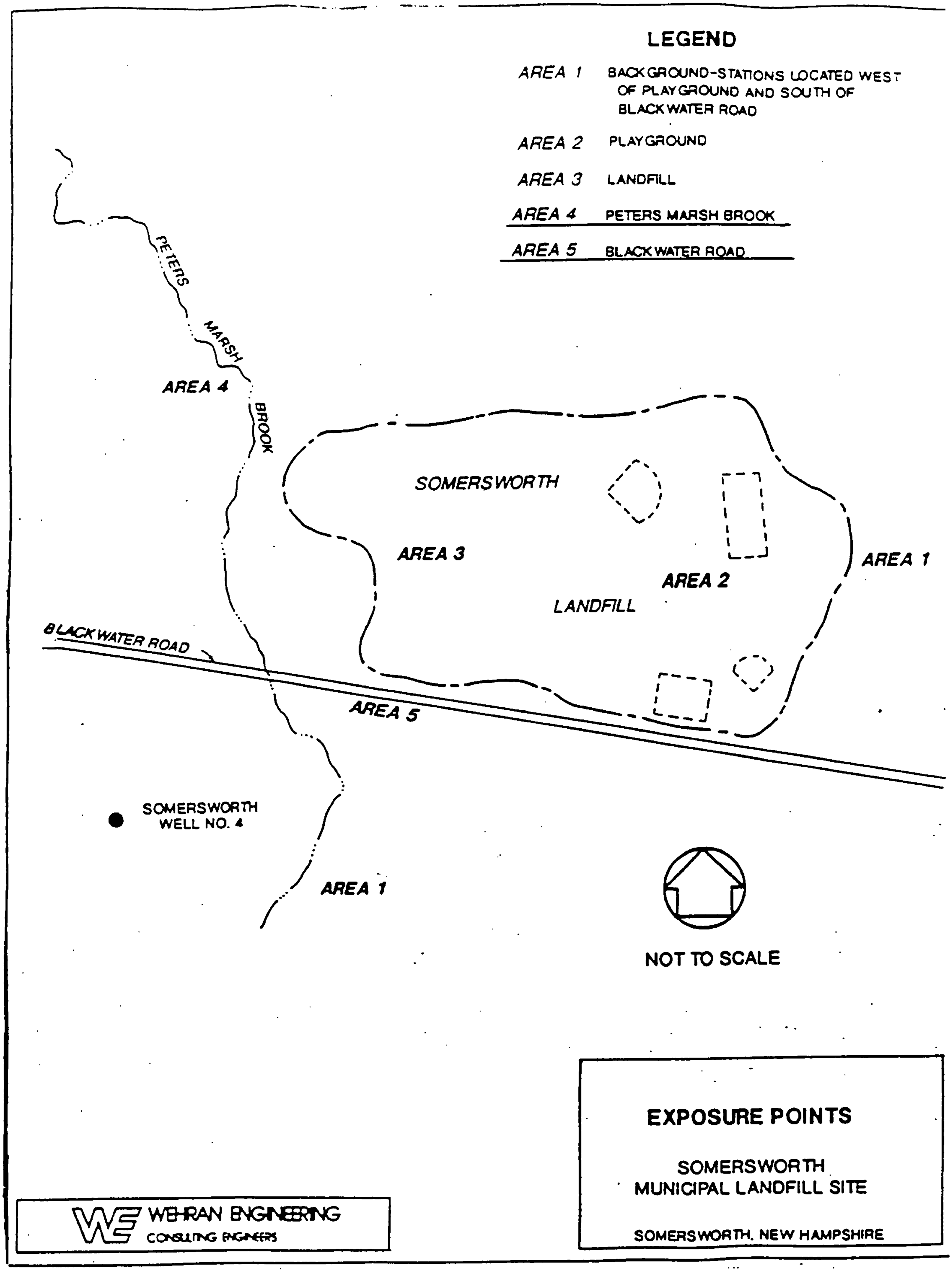
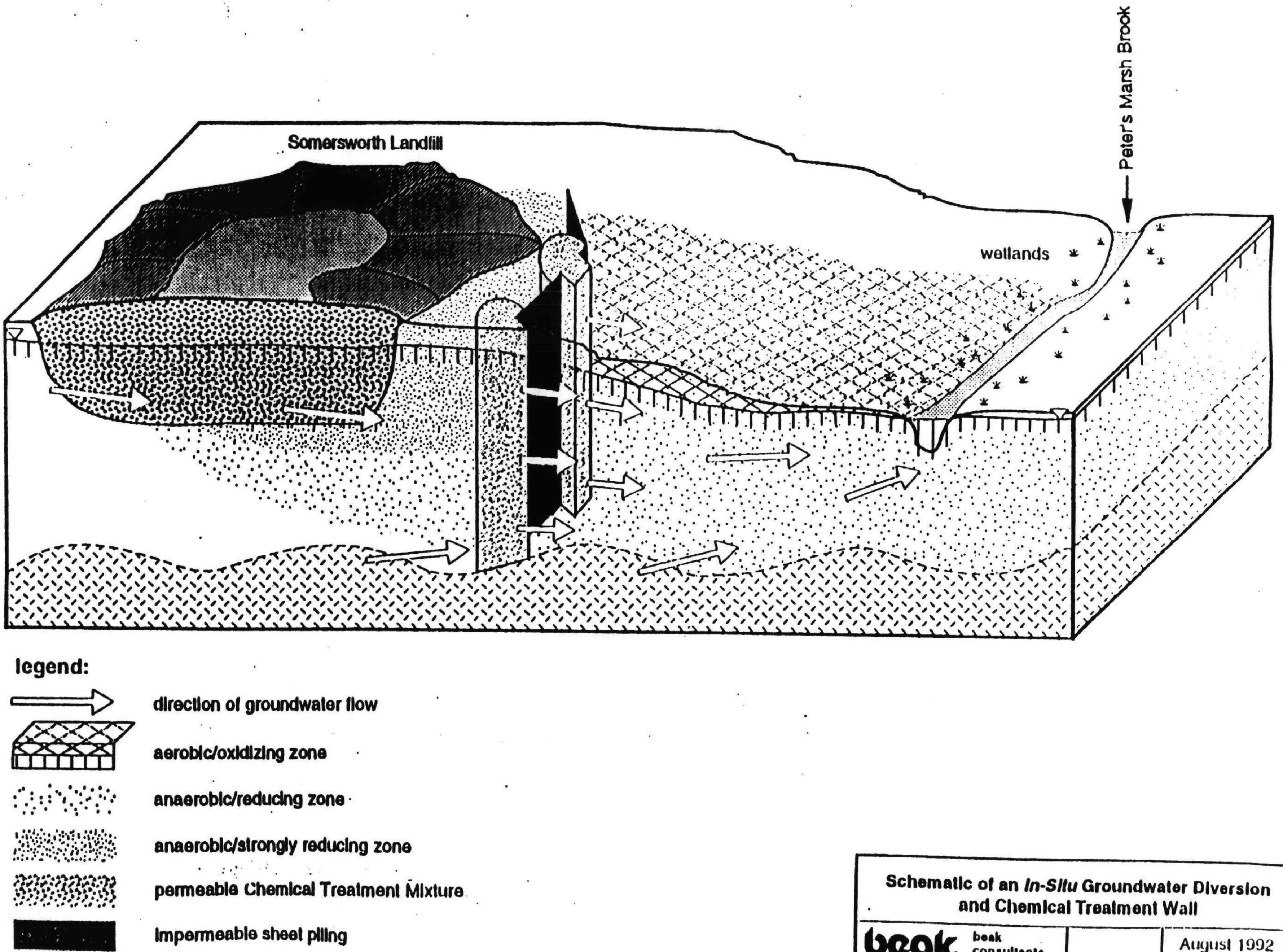


Figure 2


LEGEND
AREA 1 BACKGROUND-STATIONS LOCATED WEST OF PLAYGROUND AND SOUTH OF BLACKWATER ROAD
AREA 2 PLAYGROUND
AREA 3 LANDFILL
AREA 4 PETERS MARSH BROOK
AREA 5 BLACKWATER ROAD
PETERS MARSH BROOK
AREA 4
SOMERSWORTH
AREA 3
LANDFILL
AREA 2
AREA 1
BLACKWATER ROAD
AREA 5
SOMERSWORTH WELL NO. 4
AREA 1
NOT TO SCALE
EXPOSURE POINTS
SOMERSWORTH MUNICIPAL LANDFILL SITE
SOMERSWORTH, NEW HAMPSHIRE
WEHRAN ENGINEERING
CONSULTING ENGINEERS



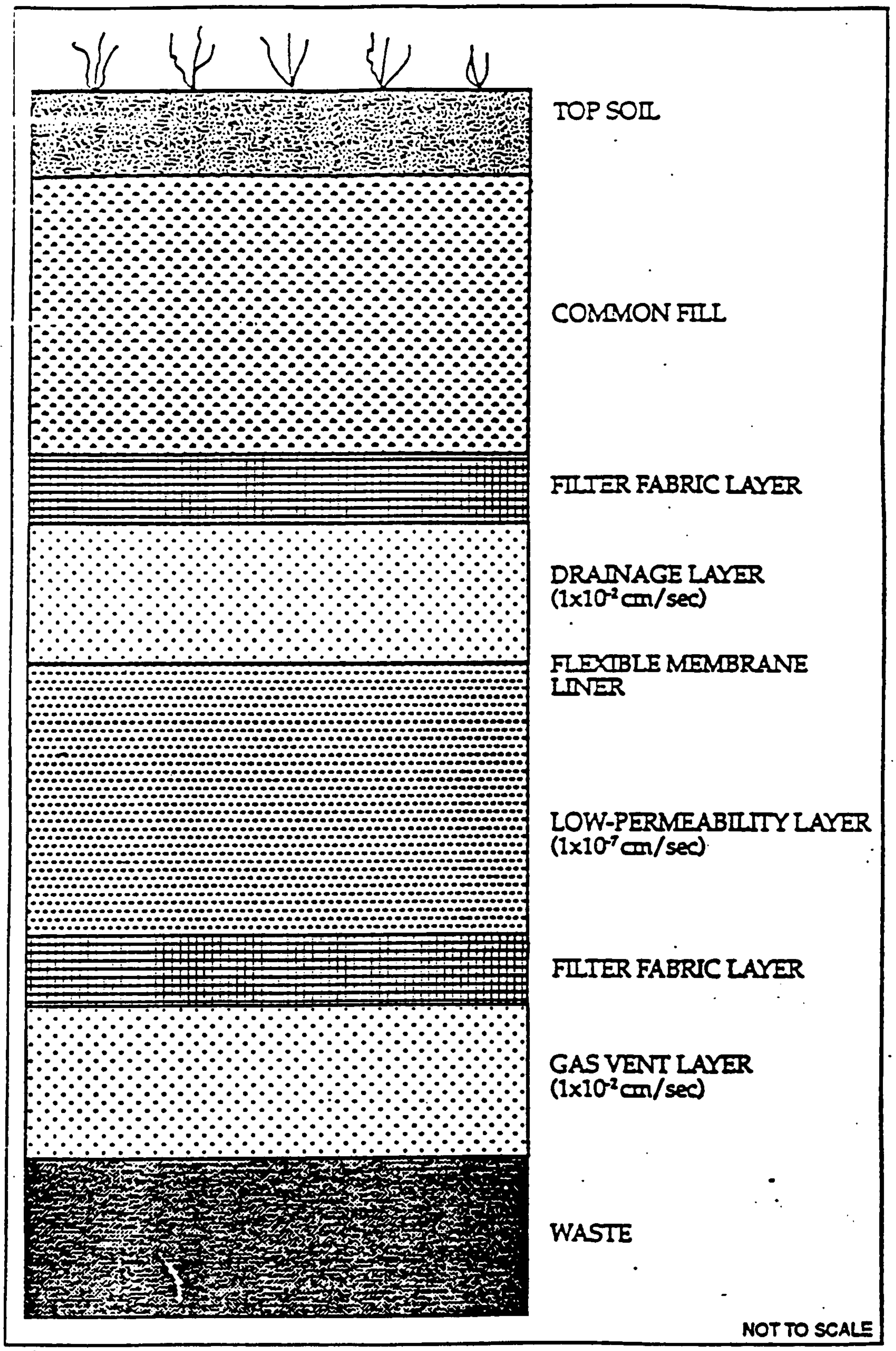
Schematic of an *In-Situ* Groundwater Diversion and Chemical Treatment Wall

beak consultants

August 1992

FIGURE 5

Typical Multi-layer Cap Cross Section



APPENDIX A

Supplemental Risk Assessment

Addendum to the Risk Assessment for Somersworth Municipal Landfill

Somersworth, New Hampshire

June 21, 1994

prepared by Mary Ballew, Environmental Scientist,
for EPA-New England

Table of Contents

I. INTRODUCTION

As part of the Remedial Investigation/Feasibility Study (RI/FS) at Superfund hazardous waste sites, the National Oil and Hazardous Substances Pollution Contingency Plan[1] requires the performance of baseline human health and ecological risk assessments. The purpose of the baseline risk assessment is to determine, in the absence of remediation, whether contaminants identified at the site pose a current or potential risk to human health or the environment. The analysis assists in evaluating whether remediation is necessary.

The purpose of this addendum is to supplement the human health section of an earlier risk assessment[2] based on exposure measurements from 1986. This study examines the risk for two populations near the Somersworth landfill: future residents along Blackwater Road (area 5) and in area 4 (wetlands). The only scenario evaluated herein is the risk to a future resident whom will ingest groundwater from wells in areas 4 and 5. This analysis only uses samples collected from test wells between November 1989 and January 1992.

A. Components of the risk assessment

The risk assessment for human health consists of four components: hazard identification, exposure assessment, toxicity evaluation, and risk characterization. Hazard identification examines the contamination at the site and selects the contaminants of concern (COCs), which are those contaminants likely to pose the greatest risk to human health. The exposure assessment estimates exposures to receptor populations from site-specific data on releases of chemicals. The toxicity evaluation describes the toxicological effects from exposure to each COC and summarizes relevant toxicity criteria. The risk characterization estimates carcinogenic and noncarcinogenic risks by using information from the toxicity evaluation and the exposure assessment. Uncertainty is also evaluated within the risk characterization.

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[1]National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule. 40 CFR part 300, Federal Register, 55(46):8666, 1990.

[2]Wehran Engineers and Scientists and Goldberg-Zoino & Associates, Inc., Remedial Investigation for Somersworth Municipal Landfill, Somersworth, New Hampshire, May 1989.

--- risk addendum for Somersworth June 21, 1994 ---

This addendum to the risk assessment was conducted in accordance with the following EPA guidance:

US EPA Region I Waste Management Division Risk Updates: December, 1992

Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual

———— (Part A) interim final, EPA 540/1/-89, December 1989.

———— Development of Risk-Based Preliminary Remediation Goals (Part B) publication 9285.7-01B, December 1991, PB92-963333.

———— Risk Evaluation of Remedial Alternatives (Part C), publication 9285.7-01C, December 1991, PB92-963334.

Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03 (EPA, March 25, 1991).

Supplemental Guidance to RAGS: Calculating the Concentration Term, (Publication 9285.7-08I, June 22, 1992)

EPA Region I Supplemental Risk Assessment Guidance for the Superfund Program (EPA 901/5-89-001, June 1989).

Final Guidance Data Useability in Risk Assessment (Part A) (publication 9285.7-09A, April 1992, PB92-963356)

Guidance for Data Useability in Risk Assessment (Part B), (publication 9285.7-09B, May 1992, PB92-963362)

Dermal Exposure Assessment: Principles and Applications (EPA 600/8-91/011B, January, 1992)

Air/Superfund National Technical Guidance Study Series, Volumes I, II, III, and IV (EPA 450/1-89-001,002,003,004, July 1989).

Guidelines for:

a. Carcinogen Risk Assessment (51 FR 33992, September 24, 1986);

b. Exposure Assessment Guidelines (57 FR 22887, 1992.)

B. Summary of site description, history and earlier investigations

This section summarizes information available in the report of the remedial investigation; please see this report for further details. The Somersworth Municipal Landfill is located in the central portion of Somersworth, New Hampshire, approximately one mile southwest of the City proper. The approximately 26 acre site is situated entirely on land owned by the City of Somersworth. The City has owned and operated the landfill since 1945. There is little information about the composition of the waste generated and no records from the landfill operation. One industry acknowledged disposing of eighty 35-gallon drums of chemical waste per week[3]. Other industrial wastes included paper, plastic, wood, rags, and leather. Given the contamination at the site, the few records of industrial usage probably underestimate what was disposed at the site. Although the landfill was still active in 1989, the last year reported in the RI, at that time it accepted only those materials that cannot be incinerated. In 1989, these materials were disposed of in the western portions of the landfill (the "stump dump"). The eastern part of the landfill contains a recreational complex with a playground, playing fields, and tennis and basketball courts. To the east and adjacent to the landfill is an apartment complex, National Guard Armory and firehouse. To the south lie several residences and an auto repair shop. To the west about 200 to 300 feet from the landfill lies Peter's Marsh Brook. An associated wetland lies along the western and northern edges of the landfill.

Two water supply wells were located near the landfill; well Number 3 about 2300 ft north-northwest and Number 4 about 800 ft. southwest. Both have been dismantled and sealed because of high metals, inadequate yields, and the risk of contamination from the landfill. Another groundwater production well, residential well RW-2 located immediately south of the landfill, was decommissioned by 1989 (Wehran risk assessment). Groundwater from the landfill is moving in a west-northwesterly direction. There is direct hydraulic communication between the overburden and the heavily fractured bedrock underlying it, so for risk assessment purposes this is a single unconfined aquifer. All surface runoff from the active and inactive portions of the landfill eventually reaches Peter's Marsh Brook. This is a tributary of Tate's Brook which is a tributary of the Salmon Falls River. Both Somersworth, New Hampshire and Berwick, Maine take their drinking water from this river. The intakes on the

[3]The RI did not specify the number of weeks during which this disposal occurred.

river are about 1.5 miles north-northeast of the landfill and about 7.5 miles downstream. The Wehran risk assessment estimated that less than 3% of the concentrations that reach Peter's Marsh Brook would subsequently reach the intakes on the Salmon Falls River.

The Somersworth municipal landfill accepted municipal and industrial refuse for on-site disposal between the mid 1930's and 1981. Local industries include tanneries, bleacheries, shoe manufacturers, and metal finishing operations. Since there is a lack of records at the site, it is not clear which of these industries disposed of waste therein. Groundwater quality studies (initiated in 1980) indicated that the volatile organic compounds (VOC's) leaching from the landfill were contaminating the groundwater under the site. Subsequent investigations documented both inorganic and organic contamination of groundwater and surface water in the area.

The site was listed on EPA's National Priority List (NPL) in accordance with the National Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, commonly referred to as the "Superfund" legislation). The NPL listing triggered remedial investigative activities under the direction of EPA, the first of which was a Remedial Action Master Plan (RAMP) in September 1983. Work on the Remedial Investigation (RI) was initiated by November 1984 by Wehran Engineers and Scientists and the final RI report was submitted by May 1989.

II. HAZARD IDENTIFICATION

A. Data sources, evaluation and statistical analysis

This section describes the data sources and the methods used to statistically analyze, describe, and summarize the data. Canonie Environmental sent EPA-New England a list of wells and contaminants sampled at Somersworth. The State of New Hampshire, which in this case superceeds the EPA Contract Laboratory Program, reviewed the data. This analysis uses samples collected from test wells between November 1989 and January 1992.

Following the terminology of the RI and the earlier risk assessment (see below) we divided the site into two areas of interest. Area 4 is a wetland bordering the landfill and Roger Duwart identified 19 sampling locations in the plume in this area: B-6L[4], B-6R[5], B-8L, B-8R, B-9L, B-9R, OB-2, OB-3, OB-4U[6], OB-4R, OB-5U, OB-5R, OB-6U, OB-6R, OB-16U, OB-16R, OB-17U, OB-17R, OB-18U. Area 4 is downgradient of the landfill according to the EPA-New England hydrologist. Area 5 contains 5 sampling locations: B-12R, B-12L, B-13R, B-13L, B-13WT. Area 5 is not downgradient of the assumed borders of the landfill but according to the EPA-New England hydrologist it is downgradient of one highly contaminated well. It is possible that the landfill extends further than assumed and that this contaminated well is within the real boundaries of the landfill or that there is a second, highly contaminated source of solvents within the landfill. The upper and lower aquifers communicate significantly at Somersworth so I did not separately analyze their risks.

I contacted Steve Stodola at the EPA lab in Lexington and he advised me on how to analyze and interpret the raw data. The data qualifiers are slightly different from those used by EPA-New England. Rejected results did not appear in the data. Data was marked as "not evaluated" (NE), "not reported" (NR), or "not detected"(ND). The State of New Hampshire distinguished between two types of estimated data: (1) an estimate for which the detected concentration of the analyte was higher than the calibration range (E); and (2) an estimate for which the detected concentration of the analyte was below the quantitation limit (J). Following EPA-New England policy[7], estimated data and data without qualifiers was used in the risk assessment. Samples marked with a B meant that the chemical was also found in the laboratory blank. Following EPA policy[8], I used the 5x,10x rule to distinguish true readings of the chemical from false positives caused by contamination. For common laboratory contaminants [9] [10], the sample must have ten times more chemical than the blank to be valid. For all other chemicals, the concentration in the

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[4]"L" refers to a sample taken from the lower part of the upper aquifer

[5]"R" refers to a sample taken from a bedrock well

[6]"U" refers to the upper part of the upper aquifer.

[7]Region 1 Supplement to RAGS, op cit.

[8]RAGS 1989, op cit.

[9] ie., acetone, methyl ethyl ketone, methylene chloride, toluene, and phthalate esters

[10]p.5-16 in Risk Assessment Guidance for Superfund, Vol 1, Human Health Evaluation Manual (Part A) EPA/540/1-89/002 Dec. 1989.

sample must be five times greater than in the blank to be valid. The blank for this comparison was the one collected closest in time to the sample. If the sample failed the 5x,10x rule, then the sample was a nondetect.

All nondetects were set to one half of the detection level and different chemicals had different limits of detection. The nondetects entered into the calculation of an "average case" scenario. In accordance with EPA-New England guidance, this scenario is based on the arithmetic mean of the concentration of contaminants in the plume. Only wells located over or downgradient of the plume entered into this calculation. This approach is currently under review by an EPA workgroup. The "reasonable worst case" exposure scenario is based on the maximum concentration of a chemical measured in a sample. The results of duplicate samples were averaged; however, samples from the same well at different time periods were not averaged.

The Uptake/Biokinetic (UBK) model, version 0.99d, was employed to calculate risks from lead exposures. This model examines exposures for the most sensitive members of the population which the model assumes to be children between the ages of 6 months and 6 years. Lead concentrations in ground water (average only as recommended by EPA) were entered into the model and default parameters were used for the remaining variables.

B. Selection of contaminants of concern

After assembling the data, I used the risk screening table from Region III[11] to exclude from further consideration chemicals with either low toxicity or low concentrations. This narrowed down to 15 contaminants of concern for area four and seven for area five. Table 1 shows the contaminants of concern in each area of the site and the wells with the highest hits at each site. It also shows the number of samples with exceedances of MCLs out of those in which a COC was detected. In area four, the wetlands, contamination appears widespread. Vinyl chloride, manganese, arsenic, benzene, and 1,2-DCE are highest at the edge of the landfill. Antimony, chlorobenzene, cobalt, beryllium, and methylene chloride are highest just outside the landfill. TCE, PCE, 1,1-DCE, lead, and carbon disulfide are highest about 1,000 feet downstream of the landfill in the wetlands. Most of the metals were highest in the bedrock wells and the wells in the lower part of the upper aquifer. Although the contamination extends quite far into the area four wetlands, the largest part

[11]Memorandum from Roy L. Smith, PhD., Senior Toxicologist, Region III EPA to the RBC Table mailing list concerning the risk-based concentration table, third quarter 1993; memo dated July 9, 1993.

of the toxic contamination is less than 1,000 feet away from the landfill. The MCLs or action levels were exceeded for eight contaminants of concern in area 4. The evidence for a true exceedance of MCLs or action levels is weakest for antimony[12], arsenic[13], benzene[14], and lead[15] and strongest for 1,2-dichloroethene, tetrachloroethene, trichloroethene, and vinyl chloride. The evidence for exceedance of MCLs is particularly strong for vinyl chloride (23 samples exceeded the MCL out of 27 samples with detects of vinyl chloride) which chemical also presents the greatest risk at the site. In area five, which is near the residences along Blackwater Road, all but one of the COCs were highest in a bedrock well, B-12, on the edge of the landfill. Most of the few samples collected for 1,2-dichloroethene, trichloroethene, and vinyl chloride exceeded their MCLs (table 1). These are the same chemicals that are major contaminants in area four. The small number of samples collected in this location mean that any analysis based on these numbers is very uncertain; the true concentrations of contaminants could be higher than those represented herein.

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[12]Based on the small number of total detects and the small number of exceedances of MCLs.

[13]Based on the small number of exceedances of MCLs given the large number of samples with detects.

[14]Based on the small number of exceedances of MCLs given the large number of samples where benzene was detected.

[15]Based on the small number of detects of lead and the small number of detects that exceed the action level.

Table 1. Contaminants of concern at Somersworth

contaminant of concern, MCL (ppb)	area 4, wetlands	highest well	area 5, Blackwater Rd	highest well
antimony, 6	>MCL[16], 2/4[17]	B9R[18]	not COC[19]	
arsenic, 50	>MCL, 3/22	OB17U[20]	not COC	
benzene, 5	>MCL, 4/19	OB17U, OB17R	x[21]	B12R
beryllium, 4	x	B6R, B8L[22]	not COC	
carbon disulfide	x	OB5R	not COC	
chlorobenzene	x	B6L	not COC	
1,1-dichloroethene, 7	x	OB6U	x	B12R
1,2-dichloro-ethene, 70	>MCL, 12/31	OB17U	>MCL, 5/7	B12R
lead, AL=15	>AL, 2/7	B8L	not COC	
manganese	x	OB16R	x	B12L
methylene chloride, 5	>MCL, 4/7	OB5R	not COC	
tetrachloro-ethene, 5	>MCL, 6/13	OB6U	x	B12R
trichloro-ethene, 5	>MCL, 18/27	OB6U	>MCL, 4/4	B12R
vinyl chloride, 2	>MCL, 23/27	OB17U	>MCL, 4/5	B12R

[16] >MCL or AL = highest level exceeds MCL or action level.

[17] (# of samples >MCL)/(# of samples with detects).

[18] R = the bedrock aquifer.

[19] not COC = not a contaminant of concern in area 5 because it fails to pass the region III risk screening test.

[20] U= the upper part of the upper aquifer.

[21] x = contaminant present.

[22] L = the lower part of the upper aquifer.

III. EXPOSURE ASSESSMENT

This section evaluates the likelihood, magnitude, and frequency of exposure to the contaminants of concern at the Somersworth site. It identifies the pathways and routes by which receptors may contact contaminants. Exposure assessment includes: (1) characterization of exposure setting which describes the physical setting and identifies potentially exposed populations; (2) identification of exposure pathways which identifies the media of concern and the actual and potential exposure routes; (3) development of exposure scenarios which describes both the present and future scenarios and the exposure parameters; and (4) quantification of exposure which estimates exposure point concentrations and doses. Based on the description of the site in the RI, the physical characteristics of the site were used to assess the pathways by which human receptors may become exposed to site contaminants. Exposure scenarios were developed based on this information and consideration of land use and human behavior patterns. Given that this document is an addendum to an earlier risk assessment[23] and that there is new data only for groundwater, only the groundwater pathway will be evaluated herein. Additional pathways were evaluated in the Wehran risk assessment and the situation at the site has not changed substantially since that analysis. Estimates of exposure doses were calculated for the groundwater exposure pathway considering the future use of the site. In accordance with current EPA-New England guidance, the average-case and reasonable worst-case exposures (maximum contaminant concentrations) were assessed. Values for intake variables (such as consumption rates) were chosen so that the combined effect of all of the values will result in conservative but reasonable estimates. Therefore not all intake variables will represent maximum values.

A. Characterization of exposure setting

The physical characteristics of the site and characteristics of the human population on and near the site were evaluated to determine which parameters might influence exposure to site contaminants and to help identify exposure pathways. The physical setting of the Somersworth site is described in Section I. This section focuses on the actual and potential receptors at the site. Land use as described in the RI was evaluated in assessing the present and potential populations which live, work, or otherwise spend time at or in the area of the Somersworth site. This analysis assesses the likelihood that various groups,

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[23]Wehran Engineers and Scientists, Methuen, MA., and Goldberg-Zoino and Associates, Inc., Manchester,NH., Volume I, Remedial investigation, Somersworth Municipal Landfill, Somersworth, New Hampshire. Prepared for New Hampshire Department of Environmental Services, Waste Management Division, Concord, New Hampshire, May 1989.

including sensitive subpopulations, will be exposed to site contaminants.

1. Receptors under present land use

The Somersworth Municipal Landfill is a 26-acre landfill that received liquid and solid wastes from local industries and residences from the mid-1930's to about 1981. After 1981, landfill operations ceased and the western part of the landfill was used as a "stump dump" for tree stumps, brush, and household appliances. The Somersworth Municipal Landfill is located in a generally urban setting on the outskirts of the city of Somersworth. The site is about one mile southwest of the city center. In 1985 the population of Somersworth was about 11,400. The population of Berwick, Maine on the other side of the Salmon Falls River was about 4,200.

There are residences near the landfill along Blackwater Rd. There are employees at several businesses and a National Guard Armory nearby. The workers, because they spend less time near the landfill, should receive lower exposures to the toxicants than the residents, so this analysis considers the most exposed and sensitive population to be residents. Pedestrian access to the site and the contaminated wetlands is unrestricted. Fishing takes place in Peter's Marsh Brook, however access to the brook and movement through the adjoining the wetlands is difficult. There is heavy seasonal hunting of woodcock and partridge in the wetlands. Vehicular access to the site is possible. Trespassing is likely and there is a possibility of motorcycle access. Trespassers, primarily youths, are the most probable receptors of contaminants present in sediments and surface water from the contaminated wetlands. At present, the western part of the landfill is covered with the "stump dump" and clean fill and the eastern part of landfill is covered with clean fill about 0.5 to 3 feet deep (in the Forest Glades Park); therefore the present hazard to trespassers from the surface soils on the landfill is small. Wehran in 1989 found ponded areas on the playground and the landfill. Water in the ponds or the leaching of contaminants through the fill material to the surface soil in these locations could be a source of exposure to trespassers. Landfill workers are potential receptors of site contaminants but their exposure is less than that of a youth trespasser for all contaminated media but ambient air. It is assumed that the workers will avoid the sediments and surface waters in the wetlands because of their knowledge of contamination there and because they will be busy working. Groundwater in the vicinity is contaminated with the metals manganese and iron. Because of the poor water quality, two public water wells near the landfill and a private well along Blackwater Road are closed. At present no one drinks the groundwater from wells near the landfill.

2. Receptors under future land use

Land immediately south of the Somersworth landfill is currently occupied by residences. There is the possibility of further development in this area along Blackwater Road. At present the houses in the area use town water and the well water, if they tried to use it, is unpleasant because it is contaminated with metals that affect the taste and appearance of the water. At present it is not economical to remove the metals from the water but in the future treating water for metals may become cheaper so that future residents, industries, or even the municipal water plant may decide to use groundwater in the vicinity of the landfill.

There is a possibility of a future risk to trespassers if the soil cover on the site erodes, especially in areas of high human contact such as the playground, playing fields, or motorcycle trails. Also leaching of chemicals through seasonal ponding areas on the playground or landfill may eventually lead to contamination of surface soils in small "hot spots".

B. Identification of exposure pathways

The purpose of this step is to identify complete exposure pathways to be evaluated in the risk assessment. To be complete, a pathway must consist of the following four elements:

- a source and mechanism of chemical release into the environment;
- a transport medium by which the released chemical may reach a receptor (such as groundwater);
- a point of potential contact of the human receptor with the contaminated medium;
- an exposure route (such as ingestion or inhalation)

The sources and mechanisms of chemicals at the site are discussed in section I of this report. Transport media, points of potential contact, and exposure routes are discussed in the Wehran RI report in the chapter on risk assessment. Discussion of the exposure pathways (above) shows that the situation at the site has not changed substantially since the 1989 risk assessment was performed. Although EPA currently uses different guidances and standards for risk assessment, the 1989 risk assessment used the appropriate guidances available at that time. EPA does not require the re-calculation of risks for the site unless there is new information or a change in site conditions since the last assessment.

Since the only media for which there is new information is groundwater and the current risks from groundwater should not change substantially since the last risk assessment[24], this analysis will concentrate only on the risks of ingestion of groundwater by future residents at the site. Also, if there have been any change in risk since 1989, ingestion of groundwater is likely to show the greatest change.

Based on anticipated future use of vicinity ground water, ingestion of groundwater is a potential route of exposure. Future ingestion of groundwater from wells at the boundary of the landfill (especially along Blackwater Road) is considered a viable exposure option. Also, the no-action alternative and some of the proposed treatments for the site do not exclude the possibility of drilling a groundwater well through the landfill or the contaminated wetland in the future. Because the aquifers in the overburden and the highly fractured bedrock are substantially hydraulically connected, exposure to groundwater will be evaluated for both water bearing units together. Exposure to residents via dermal contact with contaminated groundwater was not evaluated quantitatively in the risk assessment because the magnitude of such exposure should be insignificant compared to other groundwater sources. This is due to the short duration of exposure and the low permeability of the skin to contaminants in tap water.[25] The inhalation exposures from the domestic use of groundwater contaminated with VOCs can only be evaluated qualitatively. Quantitatively estimating this exposure source is difficult because the inhalation models of volatilized contaminants during bathing, showering, or cooking or from seepage into basements are highly uncertain and depend on site conditions. It is even more difficult to estimate the exposure of future residents.[26] The residential receptor for future scenarios involving ground water was assumed to be a 70 kg adult. Future residents adjacent to the landfill were assumed to be exposed to groundwater for a period of 30 years which is the 90th percentile for time at a single residence.[27] They were assumed to ingest contaminated waster on a daily basis, except for two weeks spent away from home, which results in 350 days per year of exposure.

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[24]This is because currently groundwater is not being consumed at the site.

[25]Supplemental Risk Assessment Guidance for the Superfund Program, EPA 901/5-89/001, June 1989.

[26]Ibid

[27]Human Health Evaluation Manual, Supplemental Guidance, Standard default exposure factors, interim final, Office of Solid Waste and Emergency Response, March 1991.

The Wehran RI details information about the exposure pathways, exposure points, and receptor populations at the Somersworth Municipal Landfill. This RI considered all of the reasonable pathways, including ingestion of ground water (based on 1986 samples), ingestion of surface soils or dry exposed sediments, dermal contact with surface soils or dry exposed sediments, ingestion of submerged sediments, dermal contact with submerged sediments, dermal contact with surface water from perennial water bodies, and inhalation of air emissions. The additional exposure pathways are adequately covered in the text[28] and tables[29] of this report so they will not be discussed further herein.

C. Quantification of exposure

This section describes the methodology and approach for determining exposure point concentrations of COCs and chemical specific intakes (dose) for the receptors and pathways selected for quantitative analysis. The exposure point concentration is the measured or estimated amount of a chemical in the environmental medium of concern at the point of human contact. Exposure point concentrations were developed for the groundwater pathway based only on recent site sampling data (Chapter II). Conservatively, concentrations at exposure points for future scenarios were assumed to be those measured during field sampling. No dilution or degradation was assumed. The exposure point concentrations for water are expressed in mass per unit volume (milligrams per liter, mg/l). To represent the reasonable maximum exposures, the maximum concentration was used as the exposure point concentration. The average exposure was evaluated using the arithmetic mean concentration. The method of calculating the average was explained in Chapter II. The following equation was used to estimate the exposure dose to humans that would result from the concentration of the contaminant in the sampled groundwater:

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[28]Chapter 8, risk assessment in Volume I, Remedial investigation, Somersworth Municipal Landfill, Somersworth, New Hampshire, Wehran Engineers and Scientists, and Goldberg-Zoino & Associates, Inc, May 1989.

[29]See Table 15 and note Tables 16-21, risk assessment tables in Volume II, Tables, Remedial investigation, Somersworth Municipal Landfill, Somersworth, New Hampshire, Wehran Engineers and Scientists, and Goldberg-Zoino & Associates, Inc, May 1989.

Figure 1. Ingestion of chemicals in drinking water, future residential exposure scenario[30]

$$\text{exposure dose (mg/kgday)} = \frac{C \times IR \times EF \times UC}{BW \times AVG \times 365 \text{ days/yr}}$$

where:

C = groundwater concentration (μg/l)
IR = water ingestion rate (2 l/day)
EF = exposure frequency (350 days/yr)
UC = units conversion (1×10^{-3} mg/μg)
BW = body weight (70 kg for an adult)
AVG = number of years over which the exposure is averaged (70 years for carcinogenic and 30 years for non-carcinogenic effects)

IV. TOXICITY AND DOSE-RESPONSE ASSESSMENT

This section presents scientific evidence of toxicity and reviews the relationship between dose and health effects for each contaminant of concern. Section V., Risk Characterization, uses this information to estimate the carcinogenic and non-carcinogenic risks to a population exposed to the COC's on site.

Sources of toxicity information are EPA's Integrated Risk Information System (IRIS) on-line database and the scientific literature. Toxicity values came from the following sources, in descending order of use:

- IRIS
- Health Effects Assessment Tables (HEAST) and Supplements
- EPA's Environmental Criteria and Assessment Office

Appendix A contains summaries of toxicity information for all of the contaminants of concern. These summaries also include the standards and criteria in effect now for each COC. The inhalation and oral slope factors were used to calculate the carcinogenic risks of the COCs and the RfDs were used to calculate the noncarcinogenic risks (hazard index).

A. Carcinogenic responses

Evaluation of the effects of COCs known or suspected to be carcinogens (EPA classes A, B1, B2) conforms to the most recent EPA policy. Slope factors (also known as cancer potency factors) estimate the risks from cancer. The slope factor is the upper 95% confidence limit of the slope of the dose-response curve and

[30] From Risk assessment guidance for superfund (RAGS), Volume I- Human Health Evaluation Manual (Part A). December 1989.

is extrapolated to low doses. When a slope factor was not available for a COC, the cancer risk was not evaluated quantitatively.

Table 2. The EPA classification for the weight of evidence of carcinogenicity.

cancer class	description of evidence
group A human carcinogen	sufficient evidence exists from epidemiological studies to support a causal association between exposure to a given agent and cancer
group B probable human carcinogen	
B1	limited human evidence and sufficient animal evidence
B2	sufficient animal evidence and no or inadequate human evidence
group C possible human carcinogen	limited animal evidence and no or inadequate human evidence
group D not classifiable as to human carcinogenicity	inadequate animal and human data
group E probable noncarcinogen	evidence of noncarcinogenicity in humans

B. Noncarcinogenic responses

Although lead is a carcinogen (EPA class B2) the calculations for the health risks of lead are based upon noncarcinogenic endpoints. For estimation of the risks from lead in residential areas, EPA requires use of the Uptake/Biokinetic model (UBK model) for lead and EPA-New England uses version 0.99d (May 1994) of the model. The average concentrations of lead in groundwater enters into the model as the concentration of lead in drinking water and the rest of the model uses the default parameters. EPA requires calculation of the risk from lead for the most sensitive population which is assumed to be children between the ages of 6 months and 6 years.

Noncarcinogenic risks other than lead are estimated by analyzing chronic exposures to COCs in relation to chronic reference doses (RfDs). A chronic RfD is an estimate of a daily concentration of a chemical to which the human population can be exposed without experiencing adverse health effects during a lifetime of exposure. The RfD takes into account the presence of sensitive subpopulations in the human population.

Chronic RfDs are derived from the following equation:

eq.1 $$\text{RfD (mg/kgday) or (mg/m3)} = \frac{\text{NOAEL or LOAEL}}{\text{UF*MF}}$$

where:

NOAEL = the "no observable adverse effects level", the chemical dose at which there is no statistically or biologically significant difference in frequency of an adverse effect between exposed and control populations.

LOAEL = the "lowest observable adverse effects level", the lowest dose at which a statistically significant difference in the frequency of an adverse effect exists.

UF = the uncertainty factor, which is included to account for differences among species, variation in human sensitivity, and extrapolations from subchronic to the chronic NOAEL or from the LOAEL to the NOAEL.

MF = the modifying factor, an additional uncertainty factor that accounts for uncertainties in the overall validity of the study and database.

If the oral RfD was not available for a given COC, then the oral exposure pathway was not assessed quantitatively for that COC. Available data on all COCs at Somersworth for chronic and subchronic noncarcinogenic effects is listed in Appendix A. The chronic oral RfDs listed include the appropriate uncertainty and modifying factors. For more information, see the EPA database IRIS.[31]

[31] Integrated Risk Information System (IRIS) on-line database, National Library of Medicine, updated monthly (1994).

V. RISK CHARACTERIZATION

The goal of the risk characterization is to quantify the increased probability of developing cancer or suffering an adverse noncarcinogenic effect as a result of exposure to site contaminants. The future human health risks attributable to the site COC's are discussed in this section. The risk characterization integrates data developed from the exposure assessment and the toxicity and dose-response assessment to derive numerical estimates of carcinogenic and noncarcinogenic risk. Risk from Somersworth site contaminants is assessed for groundwater under "average" and "reasonable maximum exposure" (RME) (maximum detected concentrations) conditions.

A. Methodology

Risk is a function of chemical toxicity and the route and duration of exposure. EPA's cancer slope factors and RfDs, discussed in section D, were used as indicators of toxicity in the risk characterization. The chemical and pathway (water) specific doses calculated in accordance with the method outlined in Figure 1 is used to represent exposure. Summary risk tables are presented within the text of this section. Risks associated with lead exposure were evaluated using the lead Uptake Biokinetic model (UBK), version 0.99d.

Incremental carcinogenic (CA) risk associated with exposure to contaminants is typically calculated according to the following equation:

eq. 2 incremental CA risk = slope factor x dose

where the incremental CA risk represents the probability of developing cancer over a 70-year lifetime from exposure to the toxicants on site.

Cancer risk is unitless and usually expressed in the units of scientific notation. For example, a risk of 1×10^{-6} (or 1E-06) indicates that an individual has one chance in a million (1,000,000) of developing cancer as a result of a lifetime of exposure to toxicants on site. Incremental cancer risk was calculated for each COC for which EPA provides a slope factor using the pathway of the risks to future adult residents from ingesting groundwater. In accordance with EPA policy, the risks from all carcinogenic contaminants were summed within each area to provide total cancer risks for area 4 and area 5. EPA has not identified a single value that represents a significant incremental cancer risk. However, the NCP target risk range for Superfund sites has been set at approximately 10^{-4} to 10^{-6} per environmental medium.[32]

Potential noncarcinogenic effects were evaluated based on a comparison of chemical-specific chronic exposure doses with corresponding protective doses derived from health criteria. The result of this comparison is expressed as the Hazard Quotient (HQ):

eq. 3 Hazard Quotient = Exposure dose/protective dose

A HQ that exceeds unity (one) suggests a greater likelihood of developing an adverse subchronic or chronic toxic effect. However, the uncertainty factors built into the protective dose usually result in overly protective (conservative) dose values. Therefore, the protective dose is likely well below that for which adverse effects will be seen. HQs were calculated for each contaminant for which health criteria are currently available (Tables 3 and 5). The HQs for every contaminant were summed to produce a rough estimate of the risk specific to a given pathway, the Hazard Index (HI). In estimating the HI, potential responses were conservatively assumed to be additive. This procedure gives the best estimate of true risk when the HQs are summed for the same toxic endpoint or target organ; combining across toxic endpoints gives only a crude index or estimate of hazard from the chemical.

B. Risk Summary

An overall summary of the Somersworth site carcinogenic and noncarcinogenic risk from groundwater is presented in Tables 3 to 6. It does not include current risks of ingestion of groundwater because no one is drinking the water at present (see Chapter I). Risks from the site other than those from groundwater are detailed in the Wehran 1989 RI referenced earlier. Risks are calculated separately for area 4 (wetlands) and area 5 (Blackwater Rd) because of differing contaminant exposures to receptor populations that might live in these areas in the future. These tables include cumulative cancer risk values and HIs for the pathway of ingestion of groundwater for adults. They receive exposure in a scenario of future land use of drinking water from wells adjacent to the landfill. Risks specific to a medium, for which the NCP target risk range of 10^{-4} to 10^{-6} applies, can be calculated by summing all pathways for a given medium and receptor. Chemical specific risk values (RfDs and cancer slope factors) are presented in Appendix A.

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[32] 40 CFR Part 300, National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule, Federal Register, 55(46) 8666, 1990

Table 3. Non-carcinogenic risks from ingestion of groundwater by future adult residents adjacent to the Somersworth site, area 4 wetlands

area 4 non-carcinogenic risk compound	foot-notes	MCL (mg/l)	RfD oral mg/kgday	highest conc (mg/l or ppm)	HQ at highest conc	ave. conc (mg/l or ppm)	HQ at average conc	cancer class	systems affected by compound
antimony	a,b,c,d	0.006	0.0004	0.041	**2.8E+00**	0.019	**1.3E+00**	na	blood, heart
carbon disulfide		na	0.1	0.038	1.0E-02	0.006	1.7E-03	na	development
chlorobenzene	e	na	0.02	0.005	6.8E-03	0.005	6.8E-03	D	liver
dichloroethene(1,2-)(total)	f,g	0.07	0.009	1.200	**3.7E+00**	0.177	5.4E-01	D	liver, kidney
lead	h,i	na	na	0.029	not applicable	0.003	1.4% > cutoff	B2	
manganese		na	0.005	4.610	**2.5E+01**	0.560	**3.1E+00**	D	CNS

Table 4. Carcinogenic risks from ingestion of groundwater by future adult residents adjacent to the Somersworth site; area 4 wetlands

area 4 carcinogenic risk compound	footnotes	MCL (mg/l)	EPA cancer class	cancer potency factor 1/(mg/kgday)	highest conc (mg/l)	cancer risk at highest conc	ave conc (mg/l)	cancer risk at ave conc
arsenic	j	0.050	A	1.75	0.203	**4.2E-03**	0.024	**4.8E-04**
benzene		0.005	A	0.029	0.010	3.4E-06	0.006	2.1E-06
beryllium	k	0.004	B2	4.3	0.001	7.1E-05	0.001	7.1E-05
dichloroethene(1,1-)	l	0.007	C	0.6	0.004	2.8E-05	0.004	2.8E-05
methylene chloride		0.005	B2	0.0075	0.076	6.7E-06	0.014	1.2E-06
tetrachloroethene	m	0.005	B2,C	0.052	0.14	8.5E-05	0.0138	8.4E-06
trichloroethene	m	0.005	B2,C	0.011	0.370	4.8E-05	0.054	7.0E-06
vinyl chloride	g,n	0.002	A	1.9	1.900	**4.2E-02**	0.107	**2.4E-03**

SUMMARY OF AREA 4 RISKS	risk at maximum exposure	risk at average exposure
(1) Total cancer risk:	4.7E-02	3.0E-03
(2) total hazard index:	31.8	4.9
(a) blood or circulatory:	2.8	1.3
(b) liver or kidney:	3.7	0.5
(c) CNS:	25	3.1
(3) children with blood lead above 10ug/dl:	not applicable	1.40%

Footnotes for tables three and four:

a. na=not available

b. HQ is hazard quotient.

c. method for calculating hazard quotient:
((conc mg/l * 2 l/day * 350 d/yr * 30 yr)/(30yr * 365d/yr * 70kg BW))/RfD mg/kg/day

d. Risks above 1E-4 or hazard quotients above 1.0 are in bold.

e. The Risk Assessment Guidance for Superfund (RAGS, 1989) recommends against presenting an average concentration that is higher than the maximum sampled at the site; we follow RAGS herein.
When the maximum is close to the detection limit, as in this case, it sometimes occurs that the average, as calculated according to EPA-New England guidance, is greater than the maximum.
Here the average calculated according to guidance is 0.006 mg/l and the risk at this concentration is 7.5E-03.

f. MCL based on the cis isomer which is the most hazardous.

g. RfD for 1,2-dichloroethene and cancer potency factor for vinyl chloride based on heast.

h. Lead has an action level for water of 0.015mg/l.

i. At the average concentration of lead, 1.4% of children in the age group six months to 6 years (which is the most sensitive population) will have blood leads above 10ug/dl.
This is the concentration that the EPA proposes as a screening level for blood lead in children.
EPA's goal is to keep the average blood lead for 95% of children below 10 ug/dl.

j. method for calculating cancer risk:
((conc mg/l * 2 l/day * 350d/yr * 30yr)/(70yr * 365d/yr * 70kg BW))* CPF 1/(mg/kg/day)

k. Here the average calculated according to guidance (see above) is 0.002 mg/l and the risk at this concentration is 8E-05.

l. Here the average calculated according to guidance (see above) is 0.006 mg/l and the risk is 4.2E-05.

m. From EPA ECAO.

n. The average concentration was calculated from all of the wells in the vicinity of the plume.
One half the concentration of the non-detects was substituted wherever there were non-detects.
This procedure is currently under review by EPA.

Table 5. Non-carcinogenic risks from ingestion of groundwater by future adult residents adjacent to the Somersworth site, area 5, Blackwater Rd.

area 5 non-carcinogenic risk compound	foot-notes	MCL	RfD oral mg/kgday	highest conc (mg/l or ppm)	HQ at highest conc	ave. conc (mg/l or ppm)	HQ at average conc	cancer class	target organ
dichloroethene(1,2-)(total)	a,b,c,d,e,f	0.07	0.009	0.13	4.0E-01	0.039	1.2E-01	D	
manganese	g	na	0.005	0.848	**4.6E+00**	0.350	**1.9E+00**	D	CNS

Table 6. Carcinogenic risks from ingestion of groundwater by future adult residents adjacent to the Somersworth site; area 5, Blackwater Rd.

area 5 carcinogenic risk compound	footnotes	MCL (mg/l)	EPA cancer class	cancer potency factor 1/(mg/kgday)	highest conc (mg/l)	cancer risk at highest conc	ave conc (mg/l)	cancer risk at ave conc
benzene	h,i	0.005	A	0.029	0.001	3.4E-07	0.001	3.4E-07
dichloroethene(1,1-)	j	0.007	C	0.6	0.002	1.4E-05	0.002	1.4E-05
tetrachloroethene	k	0.005	B2,C	0.052	0.004	2.4E-06	0.0035	2.1E-06
trichloroethene	k	0.005	B2,C	0.011	6.200	**8.0E-04**	1.430	**1.8E-04**
vinyl chloride	f	0.002	A	1.9	0.025	**5.6E-04**	0.011	**2.4E-04**

SUMMARY OF AREA 5 RISKS	risk at maximum exposure	risk at average exposure
(1) Total cancer risk:	1.4E-03	4.4E-04
(2) total hazard index (CNS):	4.6	1.9

Footnotes for tables five and six:

a. HQ is hazard quotient.
b. method for calculating hazard quotient:
   ((conc mg/l * 2 l/day * 350 d/yr * 30 yr)/(30yr * 365d/yr * 70kg BW))/RfD mg/kg/day
c. The average concentration was calculated from all of the wells in the vicinity of the plume.
   One half the concentration of the non-detects was substituted wherever there were non-detects.
   This procedure is currently under review by EPA.
d. Risks above 1E-4 or hazard quotients above 1.0 are in bold.
e. MCL based on the cis isomer which is the most hazardous.
f. RfD for 1,2-dichloroethene and cancer potency factor for vinyl chloride based on heast.
g. na=not available
h. method for calculating cancer risk:
   ((conc mg/l * 2 l/day * 350d/yr * 30yr)/(70yr * 365d/yr * 70kg BW))* CPF 1/(mg/kg/day)
i. RAGS recommends against presenting an average concentration that is higher than the maximum sampled at the site; we follow RAGS herein. When the maximum is close to the detection limit, as in this case, it sometimes occurs that the average, as calculated according to EPA-New England guidance, is greater than the maximum.
   The average calculated according to guidance is 0.006 mg/l and the risk is 1.9E-06.
j. The average calculated according to guidance is 0.003 mg/l and the risk is 2.4E-05.
k. From EPA ECAO.

--- risk addendum for Somersworth June 21, 1994 ---

1. Qualitative assessment of risk

Most of the contaminants at the site had either RfDs or cancer potency factors from IRIS, HEAST, or the EPA ECAO. The only contaminants that did not are potassium, magnesium, iron, and sodium. EPA does not have standards for potassium or magnesium. Both are essential nutrients for human health, constituents of the human body, and have very low toxicity to humans. Magnesium forms a body burden of about 20 grams in the bone and muscle and the body has mechanisms to maintain a balance of magnesium concentrations in the tissues. At the given concentrations in groundwater, it is unlikely that either potassium or magnesium will represent a risk to future residents near the landfill.

Although sodium is also an essential nutrient, chronic exposure to high doses of sodium in drinking water has been linked to increased blood pressure in humans. High blood pressure that goes untreated for years is associated with circulatory and kidney problems. EPA does not have an RFD or MCL for sodium but has established a drinking water equivalent level (DWEL) for sodium. The DWEL is a lifetime exposure concentration protective of adverse, non-cancer health effects, that assumes all of the exposure to a contaminant is from a drinking water source. The DWEL for sodium is 20 mg/l. About 20 samples from areas four and five exceed the DWEL. One well had 123 mg/l and another had 94 mg/l. This means that the groundwater is too salty to drink safely over the course of a lifetime. It is unclear whether this salt is site related, mobilized by the site, related to snow removal activities, or naturally occurring.

Iron is also an essential nutrient but excess dietary iron can cause chronic iron toxicity.[33] In chronic iron toxicity, iron in the human body increases from a normal level of three to five grams (g) to an abnormal level of 20 to 40 g. It concentrates in the liver, pancreas, spleen, endocrine organs, and heart. Clinical effects from chronic iron toxicity include disturbances in liver function, diabetes mellitus, endocrine disturbances, and cardiovascular effects. EPA has a secondary maximum contaminant level for iron of 0.3 mg/l. The secondary MCL is a recommendation for public water supplies and is based on preventing stains on laundry and odor or taste problems in drinking water. Many samples (22) from areas 4 and 5 exceeded this concentration; the maximum concentration was 74.6 mg/l and several wells exceeded 20 mg/l. The US Public Health Service in 1969 recommended that public water supplies be kept below 0.3

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[33]Casarett and Doull's Toxicology, 3rd edition, Klassen CD, Amdur MO, Doull J, ed. Macmillan 1986, pp 613-14.

mg/l and they did base this recommendation on human health.[34] The exact iron concentration in groundwater that would produce chronic iron toxicity in humans is unclear, but it is probably good to keep the iron levels below 0.3 mg/l. Most of the wells near the landfill exceed this recommended level now so there will be some risk of chronic iron toxicity if future residents ingest the groundwater. If a person was safe from chronic iron toxicity at levels below 0.3 mg/liter, then for a 70 kg man consuming 2 liters of water per day, the person would be safe consuming below 0.00857 mg/kgday. If this were the case, the hazard quotient for iron in the groundwater at Somersworth would be at or below 240. This HQ would make iron the largest noncarcinogenic risk at the site. EPA does not yet have a national policy on the level of iron that is safe for consumption in drinking water; however, some iron ingestion is necessary to prevent anemia in humans.

2. Quantitative assessment of risk

Tables three and four outline the noncarcinogenic and carcinogenic risks for the wetlands in area 4 at the Somersworth municipal landfill. The concentrations of 8 chemicals exceed the maximum contaminant level (MCL): antimony, arsenic, benzene, 1,2-dichloroethene, lead, methylene chloride, tetrachloroethene, trichloroethene, and vinyl chloride. Also, the maximum concentration of lead in the groundwater exceeds the action level for lead in drinking water. Noncarcinogenic hazard indices exceeded unity by more than an order of magnitude for groundwater ingestion by future residents. Manganese represents the greatest hazard with a HQ of thirty one; the total hazard index is about 32. Antimony and 1,2-dichloroethene, that pose the other noncarcinogenic risks, exceed one yet are less than ten. The hazard from ingesting this water is greatest for effects to the central nervous system. The UBK lead model predicts that, at the average concentration of lead, about 1.4% of children ingesting the lead in groundwater in area 4 will develop a blood lead above 10 micrograms per deciliter. The cancer risks in this area are high; the lifetime risk from vinyl chloride alone is 4×10^{-2} or 400 per 10,000 population. This is 100 to 10,000 times the 10^{-4} to 10^{-6} risk level. For each of arsenic, beryllium, and 1,1-dichloroethene, lifetime cancer risk also exceeds 10^{-4}. The risks at the highest concentrations are about an order of magnitude greater than those at the average concentrations; however, even the average risk for arsenic and vinyl chloride

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[34]From the US Public Health Service, Community Water Supply Study: Analysis of National Survey Findings, US Department of Health, Education, and Welfare, Washington, D.C. 1970, as cited in pp.409-411 Casarett and Doull's Toxicology, 2nd ed., Doull J, Klaassen CD, Amdur MO, eds., Macmillan 1980.

exceeds 10^{-4}. The total cancer risk at area 4 is about 5×10^{-2}.

In area 5, where there are residences along Blackwater Road, there are seven contaminants of concern and only three of those exceed the MCL: 1,2-dichloroethene, trichloroethene, and vinyl chloride (Tables 5 and 6). In this area the hazard index, based only on manganese, is five. Lead concentrations measured here are too low to constitute a health risk. For each of trichloroethene and vinyl chloride, lifetime cancer risk exceeds 1×10^{-4}. The total cancer risk is about 2×10^{-2} at Blackwater Road.

C. Discussion of uncertainties

The carcinogenic and noncarcingenic risk estimates presented in this report are not intended to be calculations of absolute risk to individuals who reside adjacent to the Somersworth Municipal Landfill. Uncertainties in underlying data prevent exact determination of risk to receptor populations. The goal of the risk assessment is to provide reasonable, conservative risk estimates to guide decision making. By using standardized methodology guidelines (Chapter I) and standardized EPA default exposure factors, risk assessments for Superfund sites provide a basis for determining whether remediation needs to be considered. Risk is broadly a function of exposure and toxicity. Therefore, uncertainties in characterizing either of these lead to inaccuracy in risk estimates. Also, future land uses and future concentrations of contaminants in an area are uncertain. Given the proximity of the site to the center of the City of Somersworth, this land may be used for residential or industrial purposes in the future. One large uncertainty in exposure at this site results from the small number of wells (5) in area 5. Only one of the wells was highly contaminated and it was uncertain if the contamination in the other wells was from the contaminated one or directly from the landfill. This is also the area which is most likely to receive future development. If exposure is underestimated here, the risks to future adult residents ingesting groundwater from wells in area 5 may be higher than those shown herein.

VI. SUMMARY AND CONCLUSIONS

Thus for both the wetlands in area 4 and Blackwater Road in area 5, the future cancer risks from ingestion of groundwater are hundreds of times higher than the target risk range of the NCP. In area four the lifetime cancer risk is about 5×10^{-2} and in area five about 2×10^{-2}. The hazard indices show toxicity an order of magnitude higher than unity in area 4 and about 5 times unity in area 5. The total hazard index for area four is 32 and for area five is five. The risk from lead exposure is low at area 5 and higher in area 4, where exposure exceeds the action level for lead. Therefore, it seems that the hazard from lead is of concern in area 4 and minimal in area 5. The risk estimates in area 5 are highly uncertain because of the small number (5) of wells in this location and the future risks from ingestion of groundwater in this location could be higher. The qualitative risk assessment shows that future residents that ingest the groundwater may have considerable health risks from salt (sodium chloride) and iron.

VII. Appendix A. TOXICITY SUMMARIES FOR CONTAMINANTS OF CONCERN

This is a summary of toxicity information provided for the benefit of the reader. All of these summaries (except where noted) are based upon information provided to EPA in a work assignment (C01151) by TRC Environmental Corporation for Bennington landfill (4/4/94).

Antimony

Antimony is used: (1) as an alloy constituent in pewter and white metal, (2) in the manufacture of storage battery plates, solder and ammunition; (3) as a fire-retardant in textiles; (4) to dye steel, aluminum, pewter and zinc; (4) as antimony potassium tartrate, used as a medicinal and as a fixative in dyeing. Antimony is naturally present in water bodies as antimony oxide. It sorbs to clays and minerals and should be stable in soils. Antimony primarily affects the lungs upon inhalation and may lead to kidney and liver damage upon ingestion.

Reports from humans and animals suggest that inhalation of about 4 mg/m3 antimony may lead to cardiac dysfunction, injury to heart muscle, and elevated blood pressure. Antimony may cause an increase in spontaneous abortions in pregnant women and reduced weight gain in infants whose mothers were exposed. Antimony is mutagenic. Antimony increased the risk of lung cancer via inhalation for exposed workers and rats but the number of studies is insufficient to characterize it as a carcinogen. The LC_{50} values for Daphnia magna and the fathead minnow range between 9,000 and 22,000 mg/l.

Standards for Antimony

Unclassified by EPA as to carcinogenicity

·oral slope factor	NA
·chronic oral RfD	4 x 10-4 mg/kgday
·MCL	0.006 mg/l
·AWQC	0.088 mg/l, acute (proposed)
	0.030 mg/l, chronic (proposed)

Arsenic

Industrial compounds of arsenic include arsenic disulfide, arsenic pentoxide, arsenic trichloride, arsenic trisulfide, and lead arsenate; the primary form is arsenic trioxide. The last is used in the production of pigments, the manufacture of glass, the printing of textiles, tanning, and the production of anti-fouling paints. Arsenic is quite mobile in the environment but the number of valence states (4) makes it hard to characterize. Arsenic readily bioaccumulates but often biotransforms to methylated arsenicals which are volatile compounds that evaporate from surface waters. It sorbs to clays, iron oxides, and particulate matter. In the absence of sorptive materials arsenic usually leaches into groundwater where it moves easily. Removal of atmospheric arsenic occurs primarily through wet and dry precipitation.

Arsenic absorbs easily into the human body through the gastrointestinal lining. Absorbed arsenic distributes in the nails, hair, bone and skin in humans and metabolizes to methylated arsenicals. Arsenic is acutely toxic to humans and the subacute lethal dose for humans is about 0.6 mg/kgday. Ingestion can cause nausea, vomiting, diarrhea and other gastrointestinal disorders. Chronic exposure may cause tingling or burning sensations in the skin, weakness, loss of body weight, bronchitis, or skin disorders. Children who drank water containing 0.8 mg/l arsenic developed myocardial infarctions and arterial thickenings. Concentrations of arsenic in drinking water of 0.5 mg/l may have caused gangrene in the feet and toes in 0.9% of the exposed population in Taiwan. Arsenic increases the frequency of fetal malformations, is teratogenic, and affects DNA. Arsenic in drinking water increases the risk of skin cancer. Inhalation of arsenicals increases the risk of lung cancer. Rates of bladder, lung, kidney, and colon cancer may also be elevated in a Taiwanese population exposed to arsenic in drinking water. It is difficult to induce cancers in laboratory animals exposed to arsenic. Arsenic is acutely toxic to freshwater and saltwater species and juveniles are the most susceptible (toxicity can occur as low as 40 μg/l.

Standards for Arsenic

EPA class A carcinogen

•oral slope factor:	1.75 $(mg/kgday)^{-1}$			
•chronic oral RfD:	3.0×10^{-4} mg/kgday			
•MCL:	0.05 mg/l			
•AWQC:	acute:	360 μg/l	chronic:	190 μg/l

Benzene

Benzene is a clear, colorless, aromatic hydrocarbon that has a sweet odor; its odor threshold is 2 ppm. It is extremely flammable and volatile. Benzene is widely used in the production of industrial chemicals, such as styrene and phenols, and in the manufacture of rubber, plastic, and inks. Benzene is photo-oxidized rapidly (half-life less than one day) in the atmosphere. Benzene is retained in moist soils and slowly transports into groundwater where it is stable. Benzene is highly lipid soluble and is absorbed via inhalation, ingestion, and dermal contact. It is sequestered in fatty tissue and is detoxified in the liver. Target organs include the bone marrow, CNS, and the respiratory system. Acute exposure to benzene via inhalation can be fatal within minutes. Chronic exposure can cause aplastic anemia, leukopenia, and thrombocytopenia in humans. In rodents, benzene causes an increase in the incidence of tumors, carcinomas, leukemias, and lymphomas that is directly proportional to dose. Benzene causes statistically significant increases in the incidence of leukemia in workers exposed via inhalation. It may also cause lymphatic and hematopoietic cancers in humans. Benzene causes leukemia in dogs and rats.

Standards for Benzene

EPA class A carcinogen

oral slope factor:	2.9×10^{-2} (mg/kgday)$^{-1}$
inhalation slope factor:	2.9×10^{-2} (mg/kgday)$^{-1}$
provisional RfC:	6×10^{-3} mg/m^3 (ECAO 3/25/94)
provisional RfD:	3×10^{-4} mg/kgday (ECAO 1/24/94)
1 to 2 day AIC:	3×10^{-2} mg/m^3 (ECAO 4/14/94)
30 day AIC:	6×10^{-2} mg/m^3 (ECAO 4/14/94)
MCL:	5.0 µg/l

Beryllium

Beryllium is a gray metal that is used as an alloy in numerous industries because of its light weight and high tensile strength. As an alloy it is used in machinery parts, in springs, in non-sparking tools, on airplanes, in drill bits, in watches, and in switch parts. Exposure to beryllium is generally associated with the processes of milling and alloying. Coal combustion and milling releases particulate beryllium into the atmosphere. Atmospheric beryllium deposits in the soil where it sorbs to particulate matter in the relatively insoluble form of beryllium oxide. In surface waters, most beryllium compounds hydrolyze to beryllium hydroxide which sorbs to particulate matter in the water. Beryllium is taken up by the lungs during inhalation and the GI tract during ingestion of water. It accumulates primarily in the skeleton although some collects in the liver and kidneys.

Acute exposures to inhaled beryllium in humans resulted in death from interstitial pneumonitis. Chronic exposure in humans can cause death by inflammation of cells within the alveoli; enlargement of the heart, liver and spleen; cyanosis; and the development of kidney stones. Beryllium increases mutagenicity in hamster and human lymphocyte cells. It is carcinogenic in animals but carcinogenicity has not yet been demonstrated in humans. In rats only 5 ppm beryllium sulfate in drinking water caused an increase in cancerous growths. Intravenous injection caused bone cancer in rabbits and intratracheal injection caused various cancers in the lungs of rats. Beryllium is toxic to freshwater species and may be mildly toxic to saltwater species. The presence of calcium carbonate in the water appears to decrease the toxicity of beryllium. Addition of beryllium salts to the diet of poultry and livestock caused changes in skeletal growth and failure of long bones to develop properly.

Standards for Beryllium

EPA Class B2 carcinogen

oral slope factor:	4.3 $(mg/kgday)^{-1}$
chronic oral RfD:	5×10^{-3} mg/kgday
MCL:	4×10^{-3} mg/l
AWQC:	acute: 130 µg/l (LOEL) chronic: 5.3 µg/l (LOEL)

Carbon Disulfide

Carbon disulfide is a clear, colorless, very flammable and highly volatile liquid that has an ether-like odor when pure and a sulfurous odor when impure. It is used in the manufacture of a variety of products (e.g. rayon, cellophane, carbon tetrachloride, rubber chemicals, flotation devices, ammonium thiocyanate, sodium thiocyanate, xanthogenates, and insecticide) and as a solvent. Carbon disulfide evaporates rapidly (with a half life of 11 minutes) from surface water. Volatilization may be the major escape route from soils as well, although this has not been proven. The gas does not bind to soil particles. Carbon disulfide is rapidly absorbed into the lungs of humans. Carbon disulfide and its metabolites distribute rapidly to body fat and highly perfused tissues in rats but does not appear to bioaccumulate. Carbon disulfide is rapidly excreted via the lungs and urine and its metabolites are excreted more slowly via the urine. Occupational exposure to carbon disulfide is associated with cardiovascular, neurologic, psychologic, immunologic and ocular effects. Rats exposed to high concentrations showed alterations in blood cells; disorientation; hair loss; and destruction of central and peripheral nervous tissue. Other studies in animals showed cardiovascular, hepatic, renal, and gastrointestinal effects. Carbon disulfide may cause resorption of the developing fetus or reduce fetal body weights. It causes testicular damage in male rats. There was an excess of lymphocytic leukemia deaths in rubber workers exposed to multiple solvents, one of which was carbon disulfide. There is evidence of an association between exposure and disease, but because of the number of other confounding exposures to solvents, it is difficult to isolate an effect due to carbon disulfide alone.

Standards for Carbon Disulfide

Unclassified by EPA as to carcinogenicity

·oral slope factor:	NA
·chronic oral RfD:	1×10^{-1} mg/kgday
·MCL:	NA

Chlorobenzene

Chlorobenzene is a colorless liquid with a mild aromatic odor. It is an intermediate in the production of dyes and pesticides and used to manufacture aniline, phenol, and chloronitrobenzene. Chlorobenzene in air degrades slowly by free radical oxidation. Since it is both insoluble and volatile, its release in water results in rapid transfer to air. It binds to soil where it resists biodegradation and migrates slowly to water. Chlorobenzene bioaccumulates in fish, aquatic invertebrates, and algae and metabolizes to other compounds in higher organisms. In rats that had acute inhalation exposures, chlorobenzene collected in fat tissue, liver, and kidney. It is excreted via exhalation and urination. Ingestion of chlorobenzene in beagles showed an increasing response with increasing dose: (1) cellular changes in the liver and bile duct at a moderate dose (55 mg/kgday), and (2) death, loss of body weight, gross liver pathology, kidney damage, GI changes, and effects on the blood and urine at high dose (about 270 mg/kgday). In mice and rats administered chlorobenzene by gavage, low doses (60 or 125 mg/kg) produced liver damage and decreased liver weight; moderate doses (250 mg/kg) caused decreased body weight gain and lesions; and high doses (500 or 750 mg/kg) caused death, lesions in many organs, decreased body weight gain, or altered serum biochemistry. Inhalation studies in animals found little or no effect from chlorobenzene. Chlorobenzene is acutely toxic to fish at levels greater than 25 mg/l and to aquatic invertebrates at levels greater than 10 mg/l.

Standards for Chlorobenzene

EPA class D carcinogen

•oral slope factor:	NA
•chronic oral RfD:	2×10^{-2} mg/kgday
•MCL:	NA

--- risk addendum for Somersworth June 21, 1994 ---

1,1 Dichloroethene

1,1 Dichloroethene (1,1 DCE) is a clear liquid with a sweet smell. It is used in the manufacture of paint, varnish, lacquer, soap, and finish removers; as a solvent; and as a cleaning agent in the dry cleaning industry. 1,1 DCE volatilizes from surface waters and is photo-oxidized in the air. 1,1 DCE will probably absorb to organic materials in surface soil and will volatilize from surface soils with low organic content. It may readily leach from soil and migrate into groundwater. In rats, 1,1 DCE readily absorbs via digestion or inhalation and excretes through exhalation and urination. Oral or inhalation exposure leads to liver or kidney damage in rats, guinea pigs, rabbits, dogs, and monkeys. Mice and rats showed increased DNA alkylation and repair in both liver and kidney; this is a sign of mutagenicity which indicates a potential for carcinogenicity in these organs. Inhalation of 1,1 DCE caused kidney cancer in male mice and mammary tumors in rats. 1,1 DCE is not extremely toxic to freshwater or saltwater organisms; LC50 values (the concentration lethal to 50% of the organisms) range between 80 and 200 mg/l.

Standards for 1,1 Dichloroethene

EPA class C carcinogen

·oral slope factor:	6×10^{-1} (mg/kgday)$^{-1}$
·chronic oral RfD:	9×10^{-3} mg/kgday
·MCL:	7 µg/l

1,2-Dichloroethene

1,2-Dichloroethene(DCE) usually consists of a mixture of 60% cis-DCE and 40% trans-DCE. Each isomer shows different toxic properties. At room temperature, 1,2-dichloroethene is a liquid with a slight acrid, ethereal odor. It is used as a solvent for acetylcellulose, resins, and waxes; to extract rubber, oils, and fats; as a refrigerant; and in the manufacture of pharmaceuticals and artificial pearls.

The half-life of the vapor form of the trans isomer is about one to six days and the cis isomer is even shorter. Volatilization is probably the main means of dispersion from surface soils. Some may be carried back to earth in rainwater. Biodegradation of 1,2-DCE in subsurface soil is probably a slow process so that it probably leaches from these soils into groundwater. One author reported that about half the groundwater in New Jersey was contaminated with the trans form.

Virtually 100% of ingested DCE and 35-50% of inhaled DCE may be absorbed systemically. Ingestion of cis-DCE by rats caused liver toxicity and inhalation of trans-DCE by rats caused damage to the lung and liver. DCE exposure in rats reduced the ability of the animals to detoxify contaminants (inhibits the MFO system) and the cis isomer appeared to produce a stronger effect than the trans. In animals, cis-DCE increased mutations and caused chromosomal mutations in bone marrow. Acute toxicity occurs at 11.6 mg/l in freshwater and 224 mg/l in saltwater aquatic life. Toxicity may occur at lower concentrations with more sensitive species than those tested.

Standards for 1,2-dichloroethene

EPA Class D carcinogen for the cis isomer and no classification for mixed isomers.

chronic oral RfD:	cis:	1 x 10-2 mg/kgday
	trans:	2 x 10-2 mg/kgday
	mixed:	9 x 10-3 mg/kgday
MCL:	cis:	70 µg/l
	trans:	100 µg/l

Lead

Lead and its compounds may enter and contaminate the global environment by natural occurrence or during mining, smelting, processing, and use. Lead consumption increased by 3% for every year between 1962 and 1971 which was largely due to demands for batteries and gasoline additives. Residents may be exposed to lead via paints and plasters, crayons from China, glazes in pottery, lead fumes or ashes from the burning of battery casings, car exhaust in areas where gasoline contains lead, and the use of solder or paint in hobbies. Particulate lead is removed from the atmosphere by wet or dry deposition. Its transport in ground or surface waters depends on its oxidation state. In polluted waters and soils, lead strongly binds to organic materials. However,it is not easily absorbed by living plants.

Adults absorb about 8% of ingested lead and children absorb 50-60%. This rate can be influenced by nutritional status and the presence of or type of food in the stomach. About 35 to 40% of inhaled lead is absorbed by adults and the amount absorbed depends on particle size. In humans hemopoiesis is the most sensitive system affected by lead; as little as 0.4 μg Pb/ml blood in adults decreases the amount of hemoglobin and heme proteins produced. Chronic exposure of rats to 5 mg Pb/l water produced slight effects on the conduction velocity of nerves, blood pressure, and the source of energy in heart muscle (cardiac ATP). Lead exposure during childhood has been linked to deficits in higher mental functions (as measured by IQ and other tests). Occupational exposure to lead during pregnancy increases miscarriages, premature delivery, and early membrane rupture. Lead also produces developmental and mutagenic effects in animals. There is a correlation between sister-chromatid exchange and lead exposure in workers. Lead that composes as little as 1% of the diet (or 3 to 4 mg/day or 500 to 2000 mg/kgday) can yet increase the incidence of renal tumors in rats. Lead nitrate produces chronic toxicity in freshwater crustaceans at as little as 12 μg/l.

Standards for Lead

EPA class B2 carcinogen

There is no RfD or slope factor; EPA requires the use of the UBK model to determine the noncarcinogenic risks of lead; there is no policy on the carcinogenic risks.

Action level:	0.015 mg/l	
AWQC:	acute:	0.083 mg/l
	chronic:	0.0032 mg/l

Manganese

Manganese(Mn) is used as an alloy in steel and iron manufacturing. Manganese compounds are used in the manufacture of batteries, paints, varnishes, dyes, inks, fireworks, fertilizers, and disinfectants. Organic Mn is used as an anti-knock agent in unleaded gasoline in the US and Canada. In the atmosphere, Mn is present as a particulate form and breaks down by photochemical and thermal reactions. It is removed from the atmosphere by wet and dry deposition. The environmental fate of Mn in water is affected by the amount of dissolved oxygen and the acidity of the water. In the presence of dissolved oxygen, Mn forms oxide compounds which either remain suspended or deposit in the sediments. The residence times of these compounds can be as much as 300 years. In soils, the solubility of Mn is increased with low pH and with high concentrations of chlorides, nitrates, or sulfates. Under these conditions, Mn is transported readily and is absorbed rapidly by plants. Also, these conditions often prevail in the leachate from landfills; although the Mn at a site may be naturally occurring, the presence of leachate may increase the solubility of Mn and facilitate its transport or uptake. Absorption of Mn occurs primarily in the gastrointestinal tract and is controlled homeostatically by the amount of Mn already present in the body. Under normal conditions approximately three percent of ingested Mn is absorbed. Small Mn particles deposit in the alveoli and are excreted within four days. About 40 to 70 percent of absorbed Mn is excreted in the feces. Mn appears to be absorbed differently from food than from drinking water, so EPA developed two separate oral RfDs (IRIS 4/94[35]). Mn is an essential nutrient in the human diet. Standard diets from the US, England, and Holland reveal average daily intakes of 2.3 to 8.8 mg Mn/day. Normal intake may be well over 10 mg per day, especially in vegetarian diets. The National Research Council declared that an "adequate and safe" level of intake was 2-5 mg/day for adults. Mn exposed adults in Greece showed a increased frequency of neurobehavioral symptoms that showed a dose-response relationship. Such symptoms included weakness, fatigue, gait disturbances, tremors, and problems with muscle tone. Well water in the high exposure area had 1600 to 2300 $\mu g/l$ Mn versus 3.6 to 14.6 $\mu g/l$ in the low exposure area; symptoms appear at a dose of about 0.06 mg/kgday. Their dietary exposure might have been somewhere between 5 and 15 mg/day; the exact number is unsubstantiated. In Japan, residents consuming large amounts of Mn from water contaminated with battery wastes experienced severe neurobehavioral symptoms of lethargy,

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[35]Since much of the information about the toxicity of manganese involves recent research that was not reflected in the TRC toxicity profiles, much of the information that follows is referenced in IRIS.

increased muscle tonus, tremor, and mental disturbances. The most severe symptoms were seen in the elderly and children appeared unaffected. By retrospective estimation, the water may have contained 28 mg/l of Mn which is an intake of about 0.8 mg/kgday in a 70 kg adult. Studies in rats and Rhesus monkeys support these findings although rats are far less sensitive than humans to the effects of Mn. Neonatal rats show a much greater rate of GI absorption of Mn than rats even a few days older (days 1 to 14 vs day 18). Also, neonates show a greater rate of transfer of Mn from the blood to the brain than do adults. Dieter et al (1992) (see IRIS) says that, because of the greater sensitivity of the young, "if there were a toxicological limit to Mn according to the principles of preventive health care, then it would have to be set at 0.2 mg/l of Mn for infants as a group at risk." The EPA RfD of 0.005 mg/kgday is roughly equivalent to a drinking water standard of 0.2 mg/l. However, at this point there is no MCL for Mn and even 0.2 mg/l may not be sufficient to protect the infant population since the RfD is based on a lack of response in adults at this concentration. Mn appears naturally in several different valence states and many different compounds which may have different absorption rates and toxicities. Manganese depresses reproductive functions in male and female lab animals, and causes impotence, still births and spontaneous abortions in humans. It has mutagenic effects in bacterial and mammalian cells. Manganese compounds, such as Mn chloride, Mn acetylacetonate, and Mn dioxide, increase the incidence of tumors near the site of injection. EPA does not, however, conclude that the same is true for elemental Mn. Inhalation of Mn or Mn compounds by workers at levels typically found in Mn production facilities leads to significant increases in the frequency of neurobehavioral symptoms such as: fatigue; memory, attention and concentration difficulties; nightmares; sweating; sexual dysfunction; lower back pain; joint pain; and noises in the ears. In advanced Mn poisoning at the higher levels found in some workplaces, the symptoms are even more severe (hand tremor, changes in handwriting, loss of balance when turning, difficulty in reaching a fixed point).

Standards for Manganese

EPA Class D Carcinogen		
chronic oral RfD:	**water:**	**5×10^{-3} mg/kgday**
	food:	**1.4×10^{-1}**
chronic inhalation RfC:		**5×10^{-5} mg/m^3**
MCL:		**NA**
AWQC:	**water and fish consumption:**	**0.1 mg/l**
	fish consumption only:	**none**

A criterion for domestic water supplies of 0.05 mg/l should minimize the objectionable qualities of Mn, such as staining of laundry and undesirable taste (Quality Criteria for Water, July 1976, PB-263943).

Methylene Chloride

Methylene chloride is a widely used industrial degreaser and paint remover. It is a low temperature extractant; a solvent for oil, fats, waxes, and cellulose acetate; a flammability depressant in aerosols; and a caffeine extractant for coffee and tea. It leaves surface soils and water primarily through volatilization. In the atmosphere it photo-oxidizes to carbon dioxide, carbon monoxide, and phosgene, or returns to earth via wet and dry deposition. It does not sorb well to soils and does not bioaccumulate. It readily leaches to groundwater.

It is readily inhaled and concentrates in adipose tissue primarily, and in brain, blood, and liver secondarily. In rats doses of 50 mg/kgday resulted in histologic alterations of the liver. Subchronic exposure (to > 100 ppm methylene chloride) of rats produced narcosis and lethargy. In humans, methylene chloride produces irritation of mucus membranes and side effects such as lassitude, loss of appetite, numbness, and light headedness. Acute exposure causes heart arrhythmia and death in humans and liver and kidney damage in lab animals. It is mutagenic in bacterial cells and causes mitotic recombination in yeast cells.

Rats and mice exposed to up to 4000 ppm methylene chloride developed mammary adenomas, fibroadenomas, hepatocellular adenomas, and carcinomas. Female rats exposed to 5 and 250 mg/kgday showed a slight increase in the incidence of hepatocellular carcinomas and neoplastic nodules. Acute toxicity for freshwater species range between 193,000 and 224,000 mg/l and for saltwater species between 256,000 and 331,000 mg/l.

Standards for Methylene Chloride

EPA Class B2 Carcinogen

oral slope factor:	7.5×10^{-3} (mg/kgday)$^{-1}$
chronic oral RfD:	6×10^{-2} mg/kgday
MCL:	5 μg/l

Tetrachloroethene

Tetrachloroethene, often called perchloroethylene (PCE), is a clear liquid with an odor similar to that of ether. It is used as a dry-cleaning solvent; a degreaser; a fumigant; a chemical intermediate; and medically as a anthelmintic. It volatilizes rapidly when released to surface waters and soils. In the atmosphere it interacts with hydroxyl radicals to produce carbon monoxide, carbon dioxide, and hydrogen chloride. It adsorbs to the organic material in soil, however in soils with low organic content tetrachloroethene leaches into and transports readily in groundwater. It degrades slowly in groundwater where it can remain for months or years. In water in degrades to vinyl chloride and dichloroethene.

Tetrachloroethene distributes mainly to fatty tissues and at much lower concentrations in the blood and liver of humans. Only four percent of the tetrachloroethene absorbed by humans is metabolized. Absorbed tetrachloroethene is excreted via the lungs and its metabolites are excreted via the urine at a half life of 144 hours. When taken orally it is absorbed via the GI lining and this transport is facilitated by fats and oils.

Chronic exposure in humans effects the CNS, mucous membranes, eyes, and skin. Acute exposure can cause unconsciousness, dizziness, or vertigo and can be fatal at massive doses. In rats and mice, it causes toxicity to kidney and liver tissue. It causes fetal resorption and skeletal abnormalities in rats and mice. Tetrachloroethene causes cancer, often liver cancer, in rats and mice. Dry cleaning workers exposed to PCE, carbon tetrachloride, and trichloroethene had an excess of lung, cervical, and skin cancers and leukemia. Tetrachloroethene is moderately toxic to aquatic organisms. It is toxic to trout at an LC of 4.8 mg/l.

Standards for Tetrachloroethene

EPA class falls on a continuum of B_2 to C

oral slope factor:	5.2×10^{-2} (mg/kgday)$^{-1}$
chronic oral RfD:	1×10^{-2} mg/kgday
subchronic oral RfD:	1×10^{-1} mg/kgday
MCL:	0.005 mg/l

Trichloroethene

Trichloroethene (TCE) is a synthetic chlorinated hydrocarbon that is colorless, nonflammable, and noncorrosive. It is used as a metal degreaser, to decaffeinate coffee, as a dry cleaning agent, and as an intermediate in the production of pesticides, paints, and varnishes. TCE is moderately volatile and used nationwide so it appears in many hazardous waste sites. About 3 percent of drinking water supplies came from well water containing TCE above 0.5 $\mu g/l$. Much of the TCE released comes from the metal degreasing industry in the form of volatilization and accidental spills. Large amounts of spent TCE is now reclaimed. TCE volatilizes from surface waters and soils and is rapidly degraded in air. In moist soil and groundwater, TCE is stable and can remain there for months or years. TCE usually degrades to 1,2 dichloroethene or vinyl chloride. The major avenue of TCE contamination to humans is via groundwater. It does not bioaccumulate in animals or food chains. TCE ingested by rats concentrated in the fat, kidney, lung, male reproductive system, brain, and liver. TCE and its metabolites excrete via urine, exhalation, sweat, feces, and saliva.

Oral exposure of humans to 15 to 25 ml TCE caused vomiting and abdominal pain followed by transient unconsciousness; it damages the liver. In rats and mice it caused kidney damage. There is a high rate of miscarriages among women exposed to TCE in the workplace. In animals, exposure caused reduced fetal body weight, delay in development of the skeleton, male reproductive problems, and hydrocephalus. It is mutagenic in bacteria.

TCE is produces liver cancer in different strains of mice via inhalation or oral exposure. A study in the dry cleaning industry (see tetrachloroethene) showed cancer in the workers. It took very high concentrations of TCE to kill freshwater aquatic organisms (about 39 to 100 mg/l) so that at most concentrations found in water, TCE is practically nontoxic for freshwater aquatic organisms.

Standards for Trichloroethene

EPA class on a continuum from B2 to C

oral slope factor:	**1.1 x 10-2 (mg/kgday)-1**
chronic oral RfD:	**6 x 10-3 mg/kgday**
MCL:	**0.005 mg/l**

Vinyl Chloride

Vinyl chloride is used in the manufacture of polyvinyl chloride (PVC), rubber, glass, electrical wire, and automotive parts. When released to surface waters, vinyl chloride volatilizes to the atmosphere within a few hours where it chemically degrades. In the atmosphere it degrades within a day or two of its release. When released to the ground, it does not absorb to soils and leaches readily to groundwater. In groundwater it may degrade to carbon dioxide and the chloride ion. Groundwater is the major source of human exposure to vinyl chloride. In groundwater vinyl chloride forms as a byproduct of the degradation of some chlorinated hydrocarbon solvents such as trichloroethene and tetrachloroethene. Vinyl chloride is absorbed rapidly in rats exposed via inhalation and ingestion. It concentrates in the liver, kidneys, muscle, lungs, spleen, brain, and fat of rats. Vinyl chloride produces acutely and chronically toxic, developmental, and carcinogenic effects in humans and animals. Vinyl chloride and its metabolites are excreted in the urine. Vinyl chloride is toxic to the liver in workers exposed during the manufacture of PVC. Chronic exposure to high concentrations of vinyl chloride causes bronchitis, headache, irritability, and severe systemic disorders such as sclerotic syndrome[36], bone alterations, a decrease in blood platelets, and liver damage. Vinyl chloride causes skeletal abnormalities and increase in fetal death rates in animals exposed via inhalation. A significant increase in fetal deaths was noted in women whose husbands were occupationally exposed. Vinyl chloride also produced abundant chromosomal aberrations in exposed workers. It appears to be mutagenic in bacteria and fruit flies. Vinyl chloride is a known human and animal carcinogen. Chronic occupational exposure increases the number of carcinogenic tumors in the liver, brain, lung, hemopoietic system, and the lymphopoietic system.

Standards for Vinyl Chloride

EPA Class A Carcinogen

Oral slope factor:	**1.9 $(mg/kgday)^{-1}$**
chronic oral RfD:	**NA**
AIC:	**2 x 10-2 mg/m3 (not protective against cancer)**
MCL:	0.002 mg/l

[36]Hardening of the skin

APPENDIX B

Responsiveness Summary

PREFACE

The U.S. Environmental Protection Agency (EPA) held a public comment period, from December 15, 1993, to February 14, 1994, to provide an opportunity for interested parties to comment on the March 1993 Feasibility Study (FS), the Feasibility Study Addendum and the December 1993 Proposed Plan prepared for the Somersworth Sanitary Landfill Superfund Site (the "Site") in Somersworth, New Hampshire. The FS examines and evaluates various options, called remedial alternatives, for addressing contamination of groundwater, soil and sediment at the Site. EPA identified its preferred alternative for the cleanup of the Site in the Proposed Plan before the start of the public comment period.

The purpose of this responsiveness summary is to identify major comments raised during the public comment period and to provide EPA response to the comments. EPA has considered all of the comments summarized in this document before selecting a final remedial alternative for the contamination at the Site.

This responsiveness summary is divided into the following sections:

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

II. Background on Community Involvement and Concerns - This section provides a brief history of community interest and concerns regarding the Site, as well as, EPA initiatives in keeping the community informed of Site activities.

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

Exhibit A - This exhibit is a copy of the transcript from the informal public hearing that was held on December 14, 1993.

I. OVERVIEW OF REMEDIAL ALTERNATIVES CONSIDERED IN THE DRAFT FEASIBILITY STUDY AND FEASIBILITY STUDY ADDENDUM, INCLUDING THE PREFERRED ALTERNATIVE

Alternative 1: No Action. This alternative was evaluated in the FS to serve as a baseline for all remedial alternatives under consideration. Under this alternative, no action would be taken except for long-term monitoring of ground water near the site on a semi-annual basis.

Alternative 2: Limited Action. This alternative is similar to Alternative 1, except in addition to semi-annual ground water monitoring, it would include institutional controls to minimize the potential of exposure to contamination.

Alternative 3: Limited Action, Landfill Cover, Extraction of Bedrock Ground Water with Treatment, Ground Water Monitoring. This alternative combines the Limited Action alternative (identified above) with an engineered landfill cover and extraction of ground water from the bedrock at monitoring well B-12R and from a series of wells in the bedrock downgradient of the landfill.

Alternative 4: Limited Action, Landfill Cover, Enhanced In-Situ Biological Treatment, Natural Attenuation, Bedrock Ground Water Extraction with In-Situ Treatment, and Ground Water Monitoring. This alternative uses enhancement of natural biological processes to treat the contamination flowing through the landfill. Additional, necessary nutrients would be applied to the landfill to hasten the biological degradation processes and naturally detoxify the contaminated ground water entering the wetlands area.

EPA's selected remedy is Alternative 5.

Alternative 5, Limited Action, Landfill Cover, In-Situ Chemical Treatment and Ground Water Diversion, Ground Water Extraction from Bedrock, and Ground Water Monitoring. The key element of this alternative is the construction of a permeable treatment wall composed of impermeable barrier sections and innovative, permeable, chemical treatment sections to provide in-situ (in-place), flow-through treatment of contaminated ground water at the landfill waste boundary.

Alternatives 6a and 6b: Limited Action, Landfill Cover, Slurry Wall (Partial [6a] or Perimeter [6b]), Natural Attenuation, Bedrock Ground Water Extraction with Treatment, and Ground Water Monitoring. These alternatives would add a partial or a perimeter slurry wall to Alternative 3 in order to more effectively contain the waste by lowering the ground water below the waste thus, minimizing migration of contaminants to the wetlands area ground water. Upgradient ground water diversion would be required to prevent the artificial raising of the ground water when it encounters the slurry wall. This diverted ground water would be recharged into the wetlands to lessen the impacts caused by the interruption of flow.

Alternatives 7a and 7b: Limited Action, Landfill Cover, Bedrock and Overburden Ground Water Extraction With On-Site (7a) or Off-Site (7b) Ground Water Treatment, and Ground Water Monitoring. These alternatives provide for a landfill cover with the addition of extraction of contaminated ground water from the overburden aquifer underlying the landfill. For Alternative 7a, the groundwater would be treated and discharged on site. For the off-site treatment option, Alternative 7b, treatment would be done at the Somersworth wastewater treatment facility. Pretreatment might be needed.

Alternatives 8a and 8b: Limited Action, Landfill Cover, Bedrock and Overburden Ground Water Extraction with On-Site (8a) or Off-Site Ground Water Treatment (8b) and Partial Slurry Wall, and Ground Water Monitoring. These alternatives include the same components as Alternatives 7a and 7b (Limited Action, Landfill Cover, On-Site and Off-Site Ground Water Extraction/Treatment/Discharge) with the addition of a partial slurry wall upgradient from the landfill (8a for on-site treatment and 8b for off-site treatment).

EPA's contingency remedy would be Alternative 8c or 8d.

Alternative 8c or 8d: Limited Action, Landfill Cover, Perimeter Slurry Wall with Ground Water Diversion, Overburden Ground Water Extraction within Slurry Wall, Bedrock Ground Water Extraction, On-Site (8c) or Off-Site (8d) Ground Water Treatment and Discharge,and Ground Water Monitoring. These alternatives differ from Alternatives 8a and 8b by the addition of a perimeter slurry wall which would result in lower pumping rates and minimization of wetland dewatering effects.

Alternative 9: Complete Excavation, Removal, and Off-Site Disposal of Landfilled Waste, Natural Attenuation, Bedrock Ground Water Extraction with Treatment, and Ground Water Monitoring. Alternative 9 involves the excavation and off-site disposal of solid wastes and surface soils present at the site. Extraction and treatment of bedrock ground water would be conducted as in Alternative 3.

Alternative 10: Limited Action, Landfill Cover, Complete Excavation and On-Site Reconsolidation of Landfilled Waste, Bedrock Ground Water Extraction with Treatment, and Ground Water Monitoring. This alternative would differ from Alternative 9 in that wastes would be completely removed from below the water table, reconsolidated on-site and placed entirely above the water table, then capped with an impermeable cover.

II. Background on Community Involvement

Throughout the Site's history, community concern and involvement have been increasing as costs of the remedy have become clearer. EPA has kept the community and other interested parties apprised of the Site activities through informational meetings, fact sheets, press releases and public meetings.

Since the lead agency for the performance of the Remedial Investigation was the New Hampshire Water Supply and Pollution Control Commission (NHWSPCC), the predecessor to the Department of Environmental Services, Waste Management Bureau, NHWSPCC addressed community concerns and kept citizens informed about and involved in activities during the Remedial Investigation. On December 10, 1984, NHWSPCC held an informational meeting in the Wood School, Somersworth to describe the plans for the Remedial Investigation. On June 21, 1989, NHWSPCC held an informational meeting in the Wood School, Somersworth to discuss the results of the Remedial Investigation and to describe plans for the Feasibility Study.

On December 9, 1993, EPA made the administrative record available for public review at EPA's offices in Boston and at the Somersworth Public Library. EPA published a notice and brief analysis of the Proposed Plan in Foster's Daily Democrat on December 29, 1993, and made the plan available to the public at the Somersworth Public Library.

On December 14, 1993, EPA held an informational meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan. Also during this meeting, the Agency answered questions from the public. From December 15, 1993, through February 14, 1994, the Agency held a public comment period to accept comments on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public. On February 8, 1994, the Agency held an informal public hearing to discuss the Proposed Plan and to accept any oral comments. A transcript of this hearing is included as Exhibit A.

III. Summary of Comments Received During the Public Comment Period and EPA Responses

A. Citizen and Interested Party Comments

Comment A-1: One resident of Somersworth expressed concern over the appearance of the landfill and the odor on a hot summer day. He felt that complete excavation and incineration was the only way to solve the problem.

EPA Response: Excavation and off-site disposal was evaluated in the Feasibility Study and Proposed Plan. This alternative was not chosen because: it would not address ground water contamination as effectively as the preferred alternative and its costs were much higher than the preferred alternative. The incineration technology option was screened out during the Feasibility Study on the basis of technical inapplicability. Also, the cost of this option would be much higher than the preferred alternative.

Comment A-2: Several commenters expressed concerns about the costs associated with both the preferred alternative and the contingency alternatives and the impacts upon the taxpayers of Somersworth.

EPA Response: EPA is sensitive to the cost impacts that Superfund remedies have on municipalities. One reason that EPA chose the innovative technology alternative and would allow the contingency alternative to be staged is the potential cost savings which could be realized. In addition, while EPA believes that the City is a Potentially Responsible Party for contributions to the cost of the cleanup, EPA has also named other parties as being responsible for cleanup costs.

Comment A-3: Several commenters stated that the Superfund Law should not require PRPs to pay for activities done before the law was enacted. These commenters suggested that the federal government should pay for remedial actions rather than placing the burden on municipalities.

EPA Response: The Superfund Law does not affix blame for actions taken prior to its enactment, but rather it requires parties that took actions that caused or may cause public health or environmental problems to be responsible for funding the remedies to those problems. If no such parties are found, Superfund monies are then able to be expended on the cleanup. To use the limited Superfund monies to pay for cleanups at all Superfund sites would be impossible.

Comment A-4: One commenter provided business literature from a firm specializing in bioremediation techniques to assist in EPA's evaluation of alternatives.

EPA Response: Bioremediation was an integral element in Alternative 4. This option was not selected, principally due to concerns about the ability of the distribution system to deliver the appropriate nutrients without setting up preferred pathways and causing short-circuiting around the contamination. A more detailed discussion of bioremediation can be found in the Feasibility Study and the Proposed Plan.

Comment A-5: One commenter wrote that the preferred alternative with the contingency alternative did not meet the first threshold evaluation criteria of "Overall Protection of Human health and the Environment " since there was a "lack of consideration of the detriment to human health and represented by the expenditure of public resources." A similar sentiment had been expressed in the public meeting held December 14, 1993. This resident amplified on his comment by comparing the calculated excess cancer cases associated with ingestion of ground water at the Site (based on recent Site data this ranges from a maximum of 47 per 1000 to an average of 0.6 per 1000) to the cancer risk which the general population faces (about 250 per 1000). He further stated that EPA's alternative is 150 to 500 times greater than "the societally defined value of public health protection."

EPA Response: EPA's evaluation criteria are defined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) which regulates implementation of the Superfund law. The source of remedy funding is not and cannot be addressed by these criteria. In the case of the Somersworth Sanitary Landfill Superfund Site, there is currently no way of knowing how costs will be apportioned between public and private responsible parties nor how those parties may choose to finance those costs.

With respect to the comments concerning the risks associated with the Site, EPA's cleanup is consistent with the NCP's regulatory requirement which sets the upper bound of the acceptable cancer related risk of not more than 0.1 excess cancer cases in 1000 (one in 10,000) which, also, means that any exposed individual should not have an additional risk greater that one in 10,000. EPA is required to select a remedial action to achieve that goal in a **cost-effective** manner.

Comment A-6: A resident wrote that since there is not a current risk to either human health or the environment and there are initiatives currently in progress to improve the Superfund law (especially in the areas of risk assessment and cost considerations), EPA should choose Alternative 2 (limited action and monitoring) until the law is changed and the need for a remedial action is clearer. A similar sentiment was expressed at the December 14, 1993, public meeting and in a letter from the Somersworth City Council.

EPA Response: Regarding potential amendments to the Superfund law, it is undoubtedly possible that legislation could be adopted that changes the Superfund law. The Clinton administration has, in fact, proposed a comprehensive Superfund reform proposal to Congress. However, there is no certainty that amendments will be adopted in the current congressional session, or as to what they might contain if adopted; nor, would any revised statute necessarily result in a change to the remedy for this Site. Under these circumstances, postponing action could result in an indefinite delay in Site cleanup. Moreover, if the Agency were to postpone all remedial decision making until a new law is enacted, the entire national cleanup program would be stalled. Therefore, EPA believes an appropriate remedy should be selected under the current law. People will continue to live around this Site and therefore, can potentially be exposed to contaminated ground water. This potential will exist even if public water is available, as people do not always behave as prescribed by governmental institutions. Therefore, it is incumbent on EPA to implement a remedial action which will remove that potential risk as soon as practicable.

Comment A-7: Several commenters at the public hearing expressed the opinion that only monitoring and institutional controls should be required since the landfill is at a steady-state condition and appears to be cleaning itself up.

EPA Response: Monitoring and institutional controls were evaluated as Alternative 2. There were several problems cited in the Proposed Plan and Feasibility Study Addendum with how this alternative complies with the NCP evaluation criteria: a failure to achieve protectiveness over the long period of time that contamination would remain in the ground water; failure to comply with applicable or relevant and appropriate requirements; failure to provide a permanent remedy; no reduction in toxicity, mobility or volume through treatment; and, no short-term effectiveness since the time to reach cleanup goals could not be predicted (but, much more than eighty-three years, the longest projected cleanup time for the remedial alternatives evaluated). In addition, ground water that is a potential drinking water source is required by the statute and regulations to be cleaned up to regulatory standards. However, a remedy relying on institutional controls would not achieve those levels for the indefinite future. The length of time required for the contaminants to attenuate is so long that even for an aquifer that is not currently used it exceeds a time frame that EPA would consider reasonable to allow the contamination to remain; that approach would not comply with the regulatory expectation that cleanup goals will be achieved within a reasonable timeframe. See 40 CFR 300.430(a)(1)(iii)(F). It is virtually impossible to predict groundwater needs for as long as 80 to 100 years. Furthermore, over that span of time the reliability of controls on well drilling or other exposure is very difficult to predict. There is also evidence that contamination from the landfill may not decline steadily. For example, the oldest portion of the landfill lies under the tennis courts. Given the amount of subsidence (settling due to decomposition of organic material) that has occurred in this area just in the last few years, as evidenced by the cracks and unevenness of the tennis courts' surface, steady-state within the landfill waste may not have been achieved. In addition, the fact that vinyl chloride was detected at very high levels in a well at the edge of the landfill could suggest that mechanisms are occurring within the landfill that make it prudent to implement a treatment-based remedy at least for source control. Finally, the NCP clearly indicates [40 CFR 300.430a(1)(iii)(D)] that sole reliance on institutional controls is the least desirable option to provide protection of public health, since such controls can be changed or ignored over time.

B. Comments from the Somersworth Landfill Trust (SLT) and PRP Representatives

Comment B-1: The SLT maintains that the source of all contamination in the bedrock ground water is located in the vicinity of monitoring well B-12R. Therefore, the SLT disagrees with the need for down-gradient bedrock extraction wells unless an extraction well at B-12R is shown to be ineffective through performance monitoring. Furthermore, the SLT has concerns that the operation of down-gradient bedrock extraction wells will draw ground water beneath the chemical treatment wall, thus adversely affecting its performance.

EPA Response: The Record of Decision allows for the opportunity to demonstrate the effectiveness of an extraction well at B-12R before downgradient extraction wells are required. EPA continues to believe that this area could not be the source of all bedrock ground water contamination, however, early implementation of extraction at B-12R could determine that. With respect to the adverse impacts of the downgradient bedrock extraction wells on the performance of the chemical treatment wall, if they are required, EPA believes that given the low total expected extraction rates (approximately equal to the bedrock ground water flow under the landfill) and a predicted discharge of bedrock ground water to the overburden on the upgradient side of the treatment wall, proper design should eliminate any such impacts.

Comment B-2: The SLT has provided a schedule for implementation of the chemical treatment wall which indicates that the design could be complete within two years and the installation could be complete within two and a half years. However, they indicate only two one month review periods and a desire for flexibility in the three year time frame for implementation which was specified in the Proposed Plan.

EPA Response: The Record of Decision modifies the proposed plan so as not to establish a deadline for full implementation and evaluation of the remedy. Instead, it establishes a two-year schedule for design completion. As specified in the Record of Decision, activities to be performed during this time period include: collection of additional, necessary hydrogeologic data; bench-scale studies to determine the degradation rate of VOCs in site ground water under simulated in-situ conditions, if evaluation of the bench-scale studies indicate the applicability of the technology to the Site; installation of an in-situ, pilot-scale chemical treatment wall; development of a ground water flow model for evaluation of pilot-scale field results; and if this evaluation continues to demonstrate the applicability of the technology, completion of final design of the full-scale chemical treatment wall. The time frame for full implementation will be determined later, although EPA still hopes that a three-year period will be sufficient. Should the responsible parties agree to conduct the remedial design and remedial action, EPA intends to require few deliverables during the design in order to expedite the process. The only review with approval will be required on the full-scale design. The bidding and construction should begin immediately after the design is approved. However, the evaluation of the viability of the full-scale treatment wall will begin as soon as it is installed. Data will be carefully reviewed so that interpretations can be made to determine if the system is functioning effectively and whether it appears that the cleanup levels will be attained. Therefore, depending on data interpretation, a decision on the effectiveness of the remedy, and on the potential need for implementation of the contingency remedy could be made anytime after construction. This will provide flexibility and incentive for both parties to work closely and cooperatively in the data gathering and interpretation process so that appropriate actions can be taken.

Comment B-3: The SLT believes that after the treatment wall has operated for fifty-five years that there will be no need for any cover since the landfill will have been flushed clean.

EPA Response: First, neither the Proposed Plan nor the Record of Decision state that the treatment wall will be in operation for fifty-five years (or for any other specific period of time). Fifty-five years is the length of time over which EPA estimates the wetland ground water will naturally attenuate. EPA agrees that if a point is reached at which ground water leaching from the landfill is below the cleanup levels even before treatment, it will no longer be necessary to maintain the chemical treatment wall and the landfill can be closed; how long this would take is unknown. (However, before that decision could be made EPA would require a high degree of confidence that contamination levels have been permanently reduced.) What the appropriate landfill cover may be at that time will depend on the circumstances as they then exist. Since this could be far in the future, when scientific knowledge and technology could have changed significantly, EPA believes it would be premature to determine now what the appropriate closure would consist of. EPA wishes to preserve the flexibility of making those decisions after having reviewed actual monitoring data which will have spanned several years. EPA notes that the New Hampshire Hazardous Waste laws have been identified as relevant and appropriate to the site, and for that reason a RCRA Subtitle C type cap has been assumed for purposes of evaluating the cost and other aspects of the remedy; however, the appropriateness of the closure requirements can only be assessed in light of the circumstances as they are exist at the time closure is conducted. In addition, the State of New Hampshire will play a role in determining how the landfill will ultimately be closed.

The SLT contends that the contingency remedy is not appropriate for this Site and inconsistent with applicable law. Each comment and response relative to this contention is listed individually below as B-4 through B-9.

Comment B-4: The SLT states that there is no current public health risk because (1) there are no receptors to groundwater at the site (i.e., no drinking water wells in the area); (2) the highest level of contamination of surface waters associated with the landfill ever detected was 118 ppb of total VOCs in 1988, and more recent samples have been much lower; (3) the Salmon Falls River is not impacted; (4) there is no documentation of any recreational use of the wetlands. The fishing derby is downstream and there is no evidence of fish contamination, and a state health assessment concluded that exposure to water in the wetlands is not expected to result in adverse health effects. However, the Proposed Plan states, without supporting documentation in the RI or Risk Assessment, that a carcinogenic health risk could exist through contact with contaminated sediments or surface water in Peter's Marsh Brook.

The SLT also states that there is no current risk to the environment because (1) water quality criteria for aquatic life are being met in Peters Marsh Brook; (2) there is no evidence of any harm to biota in the wetlands; (3) the RI says the Site does not appear to present a threat to organisms in the brook; (4) the Proposed Plan acknowledges the Site is "not likely" to pose a risk to the environment.

EPA Response: As indicated in the Record of Decision, EPA agrees that there is little current risk to the public or the environment from exposure to contaminated media at this Site. The Baseline Risk Assessment did, however, present a "worst case" carcinogenic risk slightly greater than EPA's goal of not more than one excess cancer risk in ten thousand, principally as a result of exposure to arsenic in Peter's Marsh Brook (Remedial Investigation, Table 42).

Comment B-5: The SLT believes that there is no "real" future risk because (1) the plume has stabilized and has been at a steady state for 10-30 years and is unlikely to migrate further, and so does not pose a threat to any location where drinking water wells are located; (2) any use of groundwater by residents of Blackwater Road is highly unlikely as city water is available and the groundwater has a high natural metals content; (3) the installation of other drinking water wells is highly unlikely because of poor experience with the prior well which was shut down for reasons unrelated to the site; (4) the City has recently constructed a new water treatment facility using the Salmon Falls River as a source which will meet city's need for the foreseeable future; (5) residential development in wetlands is virtually inconceivable due to inhospitable terrain and various federal, state and local laws. The SLT cites statements in the preamble to the National Contingency Plan to the effect that residential development should not be assumed where its likelihood is small, and similar agency risk assessment guidance. The SLT contends that the mere length of time does not demonstrate that there is a great likelihood of development. The SLT also contends that an exceedance of MCLs is not enough to show risk unless there is also evidence of potential exposure.

EPA Response: For the purposes of a baseline risk assessment, EPA has used the exposure scenario of human consumption of ground water to represent a realistic, potential future exposure pathway. EPA, as stated in the Feasibility Study Addendum, believes this to be appropriate for several reasons. First, the ability of the aquifer affected by the Site to produce useable quantities of ground water has been demonstrated in the past by the installation of two municipal water supply wells. The principal reason that neither is currently being used is purely economic: a water supply source is available which can be made potable more cheaply. EPA believes that it is realistic and appropriately conservative to assume that over fifty-five or more years, changes in economics and water resource availability could make this aquifer attractive once again. Therefore, given the very long period over which the aquifer would remain contaminated in the absence of any response action, it is reasonable to take the possible future demand for this water as a municipal drinking water source into account. The existence of the new water treatment plant makes such usage unlikely for the near future, but by no means for the full length of time that contamination would remain present in the absence of remediation. Furthermore, with respect to potential use by residents, portions of the contaminated aquifer are currently overlain by residential land. In spite of the availability of an alternate water supply, there is always a potential that the ground water will be used. Again, economics is often the reason, i.e. it may be cheaper to use a private well than to pay for municipal water. Finally, while a great deal of the contaminated plume is overlain by wetlands, some is not and areas adjacent to the wetlands could be built upon and wells installed which could draw contaminated ground water to them. Also, institutional controls to prevent construction in wetlands are not fool proof. As time passes, the pressure to develop wetlands will continue. All of these factors imply that the assumption of potential consumption of contaminated ground water is realistic.

With respect to the appropriateness of the original risk assessment procedures, EPA has provided a Supplemental Risk Assessment for potential future ground water consumption down-gradient of the landfill and along Blackwater Road (Record of Decision, Appendix A). This has reconfirmed the magnitude of potential risk even with updated exposure scenarios.

Comment B-6: The SLT maintains that since there is an absence of risk, no remedy may be implemented.

EPA Response: As stated in the response to Comment B-5, a potential risk has been established and confirmed.

Comment B-7: The SLT in its written and oral comments, as well as, other representatives at the public hearing, expressed concern over mandating a contingency remedy at this time rather than reevaluating the options available at the time a contingency is needed.

EPA Response: EPA's past experience has shown that time and money can be saved by having chosen a contingency remedy during the remedy selection process. Furthermore, in this case there is enough uncertainty about the effectiveness of the innovative remedy that the agency wishes to be in a position to immediately begin implementing a contingency remedy in the case of failure. If a contingency remedy is not chosen at this time, more delay would occur while the replacement remedy was selected, after an intervening delay of several years or more. If, during design of the contingency remedy, new, site-specific information is discovered which could have an impact on the previously selected contingency, EPA would evaluate that information and proceed accordingly.

Comment B-8: **The SLT believes that if the innovative technology is ineffective, the contingent remedy should not include an overburden pump-and-treat system nor a cover consistent with RCRA Subtitle C. The SLT maintains that MCLs are not ARARs because no one will ever consume the water due to poor quality (iron and manganese) and the availability of public water. This, according to the SLT, obviates the need for pump-and-treat. Also, the SLT cites the Feasibility Study as indicating the negative affects of the pump-and-treat system on wetlands, which the SLT believes are so severe that if MCLs were ARARs they could be waived since the** pump-and-treat option would "result in greater risk to human health and the environment than alternative options." The SLT maintains that an impermeable RCRA C cover is not necessary for two reasons: there is no dermal exposure risk and a permeable cover would prevent exposure to contaminated wastes, and waste is already in the ground water so that prevention of infiltration through the waste to prevent leachate generation would not be effective.

EPA Response: The NCP requires ARARs to be attained in potential drinking water sources; 40 CFR 300.430. This applies to both the preferred and contingency alternatives. In applying this requirement, it is EPA's policy to treat all aquifers as potential drinking water sources unless they are contaminated naturally or from other, non-site related sources to such a degree as to be unusable. See 55 FR 8732-33 (March 8, 1990). Previous responses concerning the potential of this aquifer as a drinking water source indicate that MCLGs and/or MCLs are ARARs. The presence of iron and manganese does not result in this aquifer being considered to be unusable as a drinking water source, since standard water treatment technology (coagulation, sedimentation and rapid sand filtration) is routinely employed to remove iron and manganese, as well as other metals. Furthermore, it should be noted that the State of New Hampshire has not classified this aquifer as not suitable as a drinking water supply. As discussed above, the fact that the ground water is not currently used does not show that it will not be used in the future over the long period that contaminants would remain in the wetland in the absence of remediation. In order to attain the ARARs, a pump-and-treat system provides the best balance of the remedy selection criteria among the alternatives considered, for reasons stated in the Feasibility Study Addendum, the Proposed Plan, and the Record of Decision.

EPA has provided a clear rationale for the contingency remedy in the Feasibility Study Addendum. The contingency remedy is intended to function as a system and its individual components cannot be evaluated unrelated to each other. Alternatives 8c and 8d employ landfill covers in conjunction with perimeter slurry walls and ground water extraction wells with on-site and off-site disposal options. The FS prepared by the SLT's contractor estimated a pumping rate of 600 gpm with additional study recommended to determine the impact on wetlands. EPA believes that the pumping rate is unnecessarily high and that effective mitigation of wetland impacts can be made when using a lower, more appropriate pumping rate. This conclusion is based upon the evaluation of Alternative 6b in the Feasibility Study which indicates that without overburden ground water extraction only ten gallons per minute would move through the landfill by flowing through the slurry wall. If overburden extraction is necessary, it is likely to be only enough to lower the water table within the slurry wall to below the wastes and to maintain it there.

To meet ARARs (wastes similar to RCRA hazardous wastes were disposed of at the landfill), the landfill cover must comply with the RCRA C landfill cover requirements. Meeting these requirements will minimize infiltration of precipitation and leachate generation and thus, lower pumping rates. The pumping rate should be set to depress the ground water to below the bottom of the waste and maintain it there if the first stage of the contingency alternative (RCRA C cover, perimeter slurry wall and upgradient diversion drain) cannot accomplish this. Since flow in the bedrock under the landfill is only about 5% of the flow through the landfill, EPA does not expect a significant amount of bedrock ground water to be captured by overburden pumping within the slurry wall. In addition, the series of down gradient bedrock wells intended to be used outside the slurry wall will tend to counteract any effects on the bedrock ground water by the overburden pumping, i.e. the existing gradient in the bedrock should be maintained. Pumping at 600 gpm, however, would tend to induce gradients which would result in forcing upgradient overburden ground water to flow beneath the slurry wall, severely impacting the wetlands. Therefore, total pumping rates expected for this alternative should be significantly less than 600 gpm recommended by the SLT in the Feasibility Study. A flow of 125 gpm, treatment costs for which are presented in Appendix F of the FS, is a more appropriate pumping rate for this alternative. Furthermore, the pumping rate necessary to maintain the ground water below the landfill waste will probably be significantly less than 125 gpm. Ground water diverted by the trench upgradient of the slurry wall would tend to lower the water table outside the slurry wall which will further reduce the tendency for flow beneath the slurry wall. This ground water collected by the upgradient trench would be reintroduced to the wetlands in such a manner as to prevent dewatering. Thus, the implementation of the contingency remedy would not result in greater risk to human health and the environment.

Comment B-9: The SLT argues that the landfill closure requirements of RCRA Subtitle C are neither applicable nor relevant and appropriate for the contingency remedy because there is no evidence that RCRA wastes were accepted at the landfill after the date that the RCRA regulations went into effect and the low contaminant concentrations in ground water.

EPA Response: EPA agrees that RCRA Subtitle C is not applicable. However, it is relevant and appropriate because hazardous materials sufficiently similar to RCRA hazardous wastes were disposed of in the landfill. Furthermore, the evidence indicates that such wastes were disposed of over an extended period of time, and while precise volumes are unknown the evidence is that such volumes were significant. The concentration of contaminants in the ground water generally does not determine whether RCRA is relevant and appropriate; EPA guidance suggests only that RCRA may not be suitable where contamination does not impact ground water at all, or where leachate meets health-based levels. (CERCLA Compliance With Other Laws Manual, Interim Final (Aug. 8, 1988) at 2-20.) Neither condition is true at the Somersworth landfill.

Comment B-10: The SLT maintains that the cost estimates for the contingency remedies are too low because the appropriate pumping rate is 600 gallons per minute.

EPA Response: The pumping rate used by EPA (140 gpm) was estimated and, as indicated in the Record of Decision, will need to be verified during design. As previously noted, EPA believes that the 600 gpm pumping rate is excessive. However, as mentioned in the Feasibility Study Addendum, the costs for the pumping rate for the overburden aquifer (125 gpm) were obtained from the Feasibility Study prepared by the SLT's contractor.

Comment B-11: Neither the chemicals listed in the Proposed Plan as representing health risks nor those listed as requiring cleanup levels match the VOCs presented in the Feasibility Study that were detected at concentrations in excess of their MCLGs or MCLs.

EPA Response: The list of chemicals representing unacceptable Site risks was taken from the original risk assessment to which vinyl chloride was added since it was subsequently detected several orders of magnitude above its MCL. Those chemicals and several others which exceeded MCLs or MCLGs in subsequent sampling rounds were listed in the Proposed Plan to have cleanup levels set. Even though a compound may not present a risk exceeding the goal, once risks from any site-related chemicals are identified, all Site-related compounds must achieve ARARs. The Feasibility Study correctly includes benzene and 1,2-dichloroethane as being detected above MCLs and thus are included on the list of compounds having a cleanup level set. Vinyl chloride should have been included in that list of compounds in the Feasibility Study, however. For a complete discussion of Site risks and cleanup levels, see Sections VI. and X.A. of the Record of Decision.

Comment B-12: An SLT contractor questioned how extraction of down gradient bedrock ground water could speed up the time required to achieve MCLs at the compliance boundary as stated in the Proposed Plan.

EPA Response: The bedrock ground water discharge to the overburden just down gradient of the treatment wall is contaminated above MCLs. Since that is the point of compliance, by capturing and treating that ground water, MCLs at the compliance boundary will be met.

Comment B-13: The SLT contractor supports the theory of biodegradation as it was described in the Feasibility Study and questions EPA's rationale for not being convinced that the biodegradation mechanisms are operating at the Somersworth Landfill as described in the Feasibility Study.

EPA Response: EPA's position in this regard is stated in detail in the FS addendum. In brief, however, there are two bases for EPA's rationale that we are not convinced that the biodegradation mechanisms are operating as described in the Feasibility Study. First, biodegradation is described as the mechanism responsible for observed contaminant reductions. Much of the apparent reduction in concentration of contaminants and the apparent steady-state condition is as likely to have occurred at this Site from dilution, advection, dispersion, volatilization, chemical reduction, and adsorption as from biodegradation mechanisms. Secondly, as this commenter points out, "there is no one case study that demonstrates the interrelationship of these organisms in a landfill/wetland environment" and yet that undemonstrable interrelationship forms the cornerstone of the biodegradation discussion in the FS. EPA acknowledges that biodegradation is occurring, but its importance to the cleanup at this Site has not and can not be documented without major expenditures of time and money. Even then, it may not be the most important factor. In the absence of more substantial evidence than the FS presents, EPA is unwilling to design a remedy based on mere assumptions about what may be occurring at the Site.

Comment B-14: The contractor believes that EPA is inconsistent in the Feasibility Study Addendum because it states that an impermeable cover won't adversely affect natural attenuation mechanisms yet previously stated that biodegradation mechanisms were not necessarily operating as described in the Feasibility Study.

EPA Response: As stated previously, EPA acknowledges the existence of the biodegradation mechanisms but is not convinced as to their degree of importance. Other natural attenuation mechanisms are also at work. By installing an impermeable cover, these physical/chemical mechanisms are not appreciably affected, especially in the down gradient wetlands where an impermeable cover may result in a much lower influx of contaminants thus allowing the other mechanisms to continue to be effective on a lesser mass of contamination.

Comment B-15: The contractor disagrees with what it characterizes as EPA's assertion that an impermeable cover will not affect methane production.

EPA Response: EPA's position on the impact of an impermeable cover is more accurately reflected by this sentence in the Feasibility Study Addendum, "While an impermeable cap could severely limit aerobic microbial activity, given the limited amount of oxygen which is no doubt presently available, the effect when weighed against source reduction is minimal."

Comment B-16: The contractor believes that an effective nutrient delivery system could be designed for the Somersworth Landfill, contrary to the evaluation of Alternative 4 in the Proposed Plan which expresses concern over preferred pathways being developed so that portions of the wastes would not receive nutrients.

EPA Response: The effectiveness of in situ bioremediation is dependent on the efficiency of the nutrient delivery system. Since water is often used as a carrier for these nutrients, the permeability of the soil to water is a critical parameter. Soils with a low permeability to water (such as the extensive amount of peat in the wetland areas needing to be remediated) may not be suitable for in-situ bioremediation since the nutrients will tend to develop preferred pathways through more permeable soils.

EXHIBIT A

PUBLIC HEARING TRANSCRIPT

FEBRUARY 8, 1994

U.S. ENVIRONMENTAL PROTECTION AGENCY
EPA REGION I PROPOSED PLAN
SUPERFUND PROGRAM
SOMERSWORTH SANITARY LANDFILL SITE
SOMERSWORTH, NEW HAMPSHIRE

In the Matter of:)
)
PUBLIC HEARING ON)
EPA REMEDIAL INVESTIGATION/FEASIBILITY STUDY)
AND PROPOSED PLAN FOR THE CLEANUP OF THE)
SOMERSWORTH SANITARY LANDFILL SUPERFUND SITE)

COPY

Somersworth Vocational High School
Cemetery Road
Somersworth, New Hampshire 03878

Tuesday, February 8, 1994
7:03 p.m.

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PROCEEDINGS

MR. COUGHLIN: Good evening. I want to thank you for coming tonight. Can everyone hear me all right? I understood last time we had a little problem. So we have a mike here, and hopefully you can -- If you can't hear me, say so.

My name is Dan Coughlin, I'm the Chief of the New Hampshire Superfund Section at EPA in Boston. My staff and I are responsible for the implementation of the Superfund Program in New Hampshire.

With me tonight are, on my right, direct right, is Roger Duwart, he's the Remedial Project Manager for the Somersworth Superfund Site, and Paul Lincoln, who is the Project Manager for the New Hampshire Department of Environmental Services.

We are here tonight to conduct a public hearing to get public comments on EPA's Remedial Investigation/Feasibility Study and the proposed plan for the cleanup of the Somersworth Sanitary Landfill Superfund Site.

As you probably are aware, we held a public meeting on December 14th, 1993 to discuss the Remedial Investigation/Feasibility Study and the proposed cleanup with you. A 30-day public comment period was announced at that meeting. We subsequently, upon request of members of the public, extended that to a 60-day comment period, so the comment period will now end on February 14th, 1994.

Before we start the hearing, let me describe the format for tonight. First Roger will give you a very brief overview of the proposed plan and how we are recommending that the landfill be cleaned up.

Following his presentation, we will accept any oral comments that you may wish to make. And those comments will be for the record. As you can see, we have the entire meeting being transcribed, and everything that you wish to say will be transcribed in its entirety.

Those of you who wish to make a comment should have signed in up front, signed in on a blue index card. I have them up here. If you haven't signed in and wish to make a comment, would you please fill out one of the index cards, either now or sometime during the presentation and get the card to me, or Norm probably will get the card to me.

Also available up front are copies of the proposed plan. If you don't have one with you, I would recommend that you get it.

I'm going to call on you generally in order of when you signed up tonight, unless there's somebody who wishes to make a statement, or indicated they wished to make a statement earlier because of some pressing time commitments or other commitments this evening.

As I said, all comments will be transcribed. After everybody has made their comments, we will close the public hearing. Just so there is no misunderstanding, we will be only taking comments, we will not answer any questions or respond to the comments tonight. That will be done in the Responsiveness Summary, which is made part of our decision document when we render a decision on the cleanup of the Superfund Site. That decision document is known as the Record of Decision. So that is when your comments and questions will be responded to as a result of this hearing.

We will stay around after the formal hearing and talk to whoever would like to talk with us, answer any questions you'd like, whatever, if you just want to come up and speak to any of us.

And with that, that pretty much describes how we will run the hearing. Does everybody understand? Are there any questions before we start?

(No response.)

MR. COUGHLIN: Okay, with that, I'm going to ask Roger to do his brief summary.

MR. DUWART: As Dan said, this will be very brief, it's just to set the tone for this evening, remind us why we're here and what we're here to comment on.

As you all are by this time aware, the Somersworth Sanitary Landfill began in operation in the early to mid 1930s, continued until 1981. At that time the city began closure proceedings, and as part of that, four wells were installed and sampled. The samples came back with levels of volatile organic compounds which are called VOCs, they're industrial solvents and degreasers.

As a result of these compounds, the landfill was placed on the national priority list, making it eligible for federal funding. The final listing was in 1984, September 8th to be exact, and money was presented to the state in 1984 to conduct a remedial investigation. They hired a contractor in order to assess the nature and extent of the contamination at the site. This was completed in 1989 and published.

The findings, basically, very quickly, were that there was contaminated groundwater found beneath and downgradient from the landfill, extending into the wetlands, and extended across Blackwater Road to the south of Blackwater Road.

At about the same time that these findings were published, the Somersworth Landfill Trust was formed by the city, and several interested industries and businesses came to EPA and requested the responsibility and requested the opportunity to conduct the Feasibility Study for the

Somersworth Sanitary Landfill Superfund Site.

A Feasibility Study is the basis of our proposed plan, it's what we built, our proposed plan, the alternatives that were developed by the consultants to the Somersworth Landfill Trust beginning back in 1989.

Very briefly, our proposed plan consists of a couple of different alternatives. Our preferred alternative, which was indicated the proposed plan as Alternative No. 5, is an emerging, innovative alternative of an In-Situ chemical treatment wall which is designed to completely detoxify the groundwater as it flows through it. It would have a permeable cover during implementation and an appropriate cover at closure, and that to be determined at the time of closure.

Bedrock groundwater that is contaminated around the site would be collected through wells and treated through the chemical treatment wall, either by a reapplication to the landfill to help it flush or injected just behind the chemical treatment wall if we can't get it onto the landfill, if it can't be designed that way.

Three other aspects of this alternative, the preferred alternative, are also common to the contingency alternative that we proposed. These are institutional controls to prevent people from drinking the groundwater, natural attenuation in the wetlands area, allowing that groundwater to clean itself as the clean water flows through the chemical treatment wall and helps to flush it, and finally groundwater monitoring, to make sure that this alternative is, in fact, doing what it was advertised to do.

Total costs without a cap is approximately $6 million. Depending on the type of cap that is put on, it could be as much as $9 million more, unlikely that it would be that expensive.

As I said earlier, this is an emerging, innovative technology, and as a result, we have also proposed a contingency remedy, which is a more traditional impermeable cap with pump-and-treat technology for the groundwater. It would be a multi-layer impermeable cap, the $9 million impermeable cap, a perimeter slurry wall around the site to isolate the waste from the groundwater, both bedrock pumping as well as overburdened groundwater pumping, the groundwater that is in beneath the landfill, with treatment either on site at a treatment plant to be constructed at the landfill or off site at the Somersworth Municipal Treatment Facility.

Groundwater would be recharged to the wetlands, because we would be taking some groundwater out of the recharge area. We would recharge the wetlands, so that we would try not to dry those up and not cause problems there.

Again, the three final aspects are the same as with the original preferred alternative, institutional controls, natural attenuation, and groundwater monitoring. These contingency alternatives would run in the order of 20 to $22 million, which is why we have proposed the innovative technology. We believe the innovative technology offers some significant advantages, and this is why we believe it is worth trying and why we also expect it to work. It gives complete degradation of the contamination. There are no contaminated residuals that we have to worry about disposing of, there are no moving parts, it's low in maintenance, low in operation, and, relatively speaking, lower in cost.

Now to get to the part of the evening that we're here for, I'll turn it back to Dan and we'll take your comments.

MR. COUGHLIN: Okay, we will go into the public hearing now. If you would stand up and try to speak clearly and loudly so that our transcriber can hear it and we can have exactly what you have to say on record, we would appreciate it.

And I will start with Doug Elliott, the Manager of the City of Somersworth.

MR. ELLIOTT: Thank you, Dan.

Good evening, my name is Douglas Elliott, and I'm City Manager for the City of Somersworth. As set forth in Resolution 2594, adopted by the Somersworth City Council on January 24th, 1994, the City Council voted to support

Alternative 5 as the final cleanup plan for the Somersworth Landfill.

I've been authorized and directed by the City Council to comment on the EPA proposed plan. Tonight I will present a brief statement in support of the city's position and will submit detailed written comment on or before February 14th, 1994.

The City of Somersworth, by resolution of the City Council adopted on February 6th, 1989, signed an Administrative Order with the United States and State of New Hampshire to participate in the completion of the remedial investigation and preparation of the Feasibility Study for the Somersworth Landfill. Joining the city in the Administrative Order were some 36 area businesses. During the past five years the city and these businesses, functioning together as the Somersworth Landfill Trust, have worked diligently to complete their obligations under the Administrative Order.

The trust has spent approximately $2.2 million, and the city has contributed in excess of $1 million towards this amount, for various environmental studies at the landfill and the surrounding area. Through the expenditure of this very significant sum of money, the city has concluded that the landfill presents no real present or future risk to health or the environment, and that only institutional controls and monitoring is necessary at this time.

Like the Federal and State Governments, the city, too, is concerned first and foremost about the health and welfare of its citizens and the environment with which it has been entrusted to manage. As a result, the city would not support a course of action that it believes would put the public's health at risk.

Both the city and the EPA appear to agree that the contaminated groundwater at the site does not present a current risk as the city water supply is available to all potentially-affected residents. However, we believe that the potential future threat to public health that has been identified by the EPA is based on highly unrealistic assumptions about future groundwater usage and should not be the driving force behind any closure plan or other remedy for the landfill.

During this five-year process, the city has recognized the limitations of the Federal Superfund Loan, and that's probably an understatement, and has encouraged both the federal and state environmental agencies to make use of the flexibilities that currently exist within the law and to also look at new and innovative ways to address old problems.

With the limitations of the law in mind and knowing what remedies have been selected at other sites here in New Hampshire, the city and other trust members have looked at and presented to the EPA certain new technologies that present viable alternatives to the standard cap, pump and treat approach for municipal landfills. In light of the existing federal law and EPA's interpretation of the law, the Somersworth City Council has endorsed and supports Alternative 5 as the final cleanup plan for the landfill, finding that it is in the best interest of the city.

Despite our differences with EPA about whether any significant remedy is required for landfill, we applaud the agency for having the courage to look at new solutions that satisfy the law and are more cost-effective than traditional approaches.

While the city supports the selection of Alternative 5, it cannot support Alternatives 8-C or 8-D as a contingent remedy, as the city believes they represent a grossly wasteful response that is neither justified by any present or future risk or appropriate under existing federal law. The cost of such a remedy would be ruinous to the city and other members of the trust.

In addition to being a wasteful response to a site where there's no significant risk presented, a cap, pump or treat remedy is likely to have adverse environmental consequences at this site. We believe it will dewater some of the adjacent wetlands which serves as a nutrient for bacteria, there would be great contaminants.

Should the treatment wall and Alternative 5 fail to produce satisfactory results, the EPA has the authority to consider an alternative remedy. We believe any future remedy should be based on the conditions present at this site at that time.

Contaminant levels in the groundwater have been declining over time, and we believe there is substantial evidence that the groundwater is being cleaned through natural attenuation.

In addition, during the public debate of the Superfund statute during the past two years, there has been substantial criticism of both the remedy selection process and the EPA's method of assessing risk. While we acknowledge that the EPA can only enforce and implement the Superfund statute as it is currently written, the city cannot support a contingent remedy that it believes is not currently justifiable and will clearly not be justifiable under Superfund after it is amended.

Of course the city will submit written detailed comments on the proposed plan that will be consistent with my remarks tonight before the end of the public comment period.

We do indeed appreciate the considerable effort that both the U.S. EPA and the New Hampshire Department of Environmental Services have made on behalf of this project, and we look forward to working with you to bring this matter to a successful final close.

Thank you.

MR. COUGHLIN: Thank you.

Richard -- you're going to have to help me on this, Richard --

MR. GOUPIL: Goupil.

MR. COUGHLIN: Goupil? Could you spell that for me, sir, just so I get the spelling right in the transcript.

MR. GOUPIL: G-o-u-p-i-l.

MR. COUGHLIN: G-o-u-p-i-l. Thank you very much.

MR. GOUPIL: I just have a couple of questions to ask.

I've been a resident of Somersworth for the last 22 years, and I have struggled for the last 22 years to pay my taxes to this town. And what the City Manager has just said and what I've been understanding, that the Somersworth Landfill is non-hazardous, that it is cleaning itself up. The EPA has also, if I'm misunderstood, has also said that it is cleaning itself up, that it's not hazardous. So why are we taking a chance of putting a burden on this city, forcing people out of their homes when they cannot afford a substantial amount of tax increases on their property?

As it stands now, we're fighting against this one here. Last week we had a meeting, they want to build more schools. We can't handle it. We can't handle new schools, we can't handle another project like this as taxpayers.

What happened to freedom? If we fight you people, you people are going to take us to court, drag us through the courts, and you've all said, it's not hazardous. I just can't understand that.

Twenty-five years ago I went Viet Nam because my country told me, my government, all these agencies told me it was my duty, that I had to go for freedom. Right now, what I can see, the EPA is taking our freedom away from us. They're telling us, you will do it, we will make you do it, we will force you out of your homes. If you can't afford to do it, we don't care.

That's all I have to say.

MR. COUGHLIN: Thank you very much, well stated.

Bill Boulanger. Did I pronounce that right?

MR. BOULANGER: Boulanger, B-o-u-l-a-n-g-e-r.

My name is Bill Boulanger, I'm a Ward 4 Councilor for the City of Somersworth, and I do agree, just to echo some of the City Manager's comments on that we are not in total agreement of what the EPA has stuck us with on the remedy, but in the best interest of the public, we had to choose Alternative 5, just to keep our costs down.

However, I'm here to fight on your contingency that you proposed on the city, that you're not leaving any leeway on that at all. I mean if this doesn't work three years down the road, that we're getting stuck with pump and treat, regardless if pump and treat works or not. Pump and treat, from what I can understand, is not a proven formula either, that the contingency plan should be left open, that if this doesn't work, that the city and the trust and the EPA can come back and look at the landfill again, not just strap us with this pump and treat method, because that may not work three or four years down the road.

As far as the cap, if we flush out the dump and the dump is clean, I can't see why we have to put a cap on it. I mean if it's clean to the EPA's regulations, why should we have to do any more work on it?

I'd just like to echo the City Manager's comments, and I support his comments as well.

Thank you.

MR. COUGHLIN: Thank you very much.

William Farrell.

MR. FARRELL: I'm Bill Farrell for General Linen Service.

The information to date indicates that the landfill presents no risk to the human element. General Linen, therefore, believes that institutional controls would be a sufficient remedy. However, in case a more substantial cleanup is required, General Linen would support Alternative, preferred Alternative No. 5, and at the same time would oppose Alternative, contingency Alternative No. 8.

Thank you.

MR. COUGHLIN: Thank you.

Is it Michael Micucci?

MR. MICUCCI: Yes. Michael Micucci, Ward 3 Councilor from Somersworth.

I was a big opponent of Alternative 5, but in a show of unity with the City Council, I will back Alternative 5, although I feel that the experimental nature of this project leaves a big risk for the contingency to be in place in later years.

I feel that it should be a renegotiated thing if this does not work, where the City of Somersworth is reluctantly looking at this Alternative 5. And I just feel the experimental nature of this whole thing could leave the city paying a lot more money than what it should.

I also know the EPA's position in that the EPA is just doing what the law requires, but the Congress is what has to change the law as it is written.

You have to understand, too, that I believe that the state and the Federal Government are at fault here also.

Number one, they are the ones who years ago said, bury your trash, burn your trash, do what you have to do to get rid of it. They're the ones who gave the permission to go ahead with this. So I don't feel that the state or the Federal Government are without fault.

And I would also like you to consider not giving us the contingent alternatives that you have come up with, and hopefully this Alternative 5 will work.

Thank you.

MR. COUGHLIN: Thank you, sir.

Roger Berube.

MR. BERUBE: Yes, Roger Berube, Councilor Member at Large.

It's been a long time coming, this decision. I am supporting Alternative No. 5 because I believe it is the most cost-effective way to go.

The problem that I have, like I have stated in the past, is that if the Federal Government is to mandate laws the way they do to the cities and state, then they should be paying the cost, I have a problem with the cost. I think the people in Washington are getting the message, because I understand there's probably three bills in the Congress right now at this time reviewing what has happened with EPA's man -- well, it's not really EPA's mandated fix, it is the Congress. And I think they're looking at that, because it's going to be very costly and it's going to bankrupt some cities, I believe, because we're having hard times right now. We're looking, especially in the northeast, you're looking at the State of New Hampshire where there's a lot of jobs that's been lost, we don't have the growth. We're looking at the shipyard, a problem with the shipyard, looking at Pratt Whitney.

Again, you know, if there is no life-threatening situation at that dump at this time, I can't understand how, you know, they want us to spend the kind of money that we're talking about.

Like I said, I do support Alternative No. 5 because we really don't have any choice. And I think it is the most cost-effective. Because we have to do something, according to the law.

But I would hope that the people in the Congress that are always coming back to the state and telling us, well, if anything is mandated, then, you know, we're going to change the law and it should be paid by whoever is mandating those laws. And it's not happening. And I'm sure we'll have people running around for office again very shortly throughout the country making these type of statements, but they don't deliver, that's the whole idea. Who delivers is the small towns. And I guarantee you, when you start going after the larger cities in this country, they're going to have the power, the law will be changed, and we're going to pay again. Because we're not only going to pay once, we're going to be paying two times, and we all know that. A small state like New Hampshire, they get away with it, we don't have much representative in Washington.

Thank you.

MR. COUGHLIN: Thank you, sir.

Rich Rouleau.

MR. ROULEAU: Rich Rouleau representing R.M. Rouleau Incorporated. R.M. Rouleau has been selected as one of the 31 potentially-responsible parties. I've got, basically, four points. Three of them are basically recapping what everyone else has already indicated.

R.M. Rouleau feels that there is enough evidence which indicates that:

A: The site does not pose a threat to the health or lives of people.

B: The site does not pose a significant threat to the environment.

And, C: The site is at a steady state and possibly even cleaning itself up, to justify the implementation of institutional controls and future monitoring only, rather than the remedial action being suggested by EPA.

It seems absolutely ludicrous for EPA to require remedial action which will destroy the financial status of the city as well as that of many PRPs if it isn't really necessary or justifiable.

Point 2: If EPA does require remedial action beyond institutional controls and monitoring, we suggest that Alternate 5 be implemented.

Point 3: We disagree with the inclusion of the contingency plan which will require the conventional cap, pump and treat remedial action in the event that Alternate 5 is not successful. We suggest that if Alternate 5 is not effective after a few years, then the condition of the site and the available technology at the time should be reassessed and further action should then be determined. Mandating a contingency plan at this time which may not be the most feasible and practical contingency at the time of possible implementation seems ludicrous.

And Point 4: With regard to the selection of the 31 potentially-responsible parties, we question EPA's method of selection of the said parties. We ask why R.M. Rouleau Incorporated is the only contractor selected. Certainly there are other general contractors, possibly painting contractors, maybe roofing contractors, and a variety of other types of contractors who use the dump as much or more than R.M. Rouleau Incorporated.

Another example, there are several automotive repair shops in town who are not on the list. Why are they not on it when others are? They all do the same types of oil changes, for instance.

It appears that the selection process may not be fair, and we do not appreciate having been selected as one of the 31 potentially-responsible parties.

As one of only 31 selected parties, we will be saddled with a cleanup contribution which will be far in excess of what we would feel would be our fair share. We suggest that the selection of PRPs be looked at again with the possibility of adding more low contributors to the list, thus spreading out the expense of remedial action.

Thank you.

MR. COUGHLIN: Thank you.

That completes all the cards that I have here. Is there anybody else who would like to make a statement?

(No response.)

MR. COUGHLIN: Last chance.

(No response.)

MR. COUGHLIN: If not, I would encourage you, if you would like to say something or make a comment, to submit written comments to the agency. You can submit comments as long as they're postmarked before Valentine's Day, February 14th, and we will consider them and include responses to them in the responsiveness summary, which, as I said, is part of the Record of Decision.

So with that I will declare the meeting closed. And we will stay around up front here, if anybody has any questions or would like to talk to us.

Thank you for coming.

(Whereupon, at 7:30 p.m., the hearing was concluded.)

CERTIFICATE

STATE OF NEW HAMPSHIRE
Rockingham, ss.

I, Victor C. Rasmussen, Court Reporter and Notary Public in and for the State of New Hampshire, do hereby certify that the foregoing Pages 1 through 23 to be a true, complete and accurate transcript of the hearing In the Matter of the Public Hearing on EPA Remedial Investigation/Feasibility Study and Proposed Plan for the cleanup of the Somersworth Sanitary Landfill Superfund Site, held at the time and place hereinbefore set forth, to the best of my knowledge, skill and ability.

Victor C. Rasmussen
Court Reporter/Notary Public

APPENDIX C

ARAR Tables

Somersworth Sanitary Landfill Superfund Site
CHEMICAL-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Medium	Requirement	Synopsis of Requirement	Applicable or Relevant and Appropriate
	FEDERAL REQUIREMENTS:		
Ground Water and Surface Water	40 CFR 141.11-141.16 Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs)	Standards for public drinking water systems. Used as cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	Relevant and appropriate where no non-zero MCLG is available
Ground Water	40 CFR 141.50 - 141.62 SDWA Maximum Contaminant Level Goals (MCLGs)	Nonenforceable goals for public drinking water systems. Where relevant and appropriate, non-zero MCLGs are used as cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	Non-zero MCLGs are potentially relevant and appropriate
Surface Water	Clean Water Act (CWA) Federal Water Quality Criteria (FWQCs) for protection of human health	WQC are nonenforceable standards developed under the CWA and used by the state in conjunction with a designated use for a stream segment to establish water quality standards. Levels are provided for exposure both from drinking water and from consuming aquatic organisms (primarily fish) and from fish consumption alone.	Relevant and appropriate
Surface Water	CWA Federal Water Quality Criteria (FWQCs) for protection of aquatic life	Potentially relevant and appropriate as cleanup standard for surface water bodies where protection of aquatic organisms is being considered.	Relevant and appropriate
	STATE REQUIREMENTS:		
Ground Water and Surface Water	New Hampshire Primary Drinking Water Criteria (MCLs and MCLGs) under RSA Ch. 485, promulgated at Env-Ws 316 and 317	Standards for public drinking water systems. Used as cleanup standards for aquifers and surface water bodies that are potential drinking water sources.	Relevant and appropriate, to extent more stringent than federal MCLs and MCLGs.
Ground Water	Env-WS Part 432 Water Quality Criteria for Protection of Human Health and protection of Aquatic Life	Specifies ambient levels of contaminants in surface water that are protective of human health and aquatic life.	Relevant and appropriate.
Ground Water	Env-WS 410.05 Ambient Ground Water Quality Standards	Standards for quality of groundwater. See also location specific requirements under Part 410.	Relevant and appropriate, to extent more stringent than federal MCLs and MCLGs.

Somersworth Sanitary Landfill Superfund Site
GENERAL ACTION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Medium	Potential Requirement	Synopsis of Requirement	Action to be Taken to Attain Requirement	Applicable or Relevant and Appropriate
	FEDERAL REQUIREMENTS:			
Hazardous Waste	Hazardous Waste Regulations, RCRA Subtitle C, 40 CFR Part 264	RCRA Subtitle C establishes standards applicable to treatment, storage, transport, and disposal of hazardous waste and the closure of hazardous waste facilities.	Management of hazardous wastes as part of the CERCLA response must comply with substantive requirements of Subtitle C regulations.	Applicable to some alternatives, relevant and appropriate to others Has effect through state hazardou- waste requirements, which operat in lieu of direct federal regulatic. See discussion of tho.. requirements below.
Ground Water	Discharge of Treatment System Effluent, 40 CFR 122, 40 CFR 125, 40 CFR 131, and 40 CFR 136, National Pollutant Discharge Elimination System.	Imposes limitations on discharge to surface water.	Discharge of treated ground water and treated leachate to surface water must comply with these requirements.	Applicable.
	STATE REQUIREMENTS:			
Hazardous Waste	RSA Ch. 147-A, New Hampshire Hazardous Waste Management Act and Hazardous Waste Rules, Env-Wm Chapters 100-1000. Specific requirements detailed below.	Standards for management of hazardous waste and closure of hazardous waste facilities. Operates in lieu of Federal RCRA Subtitle C requirements.	Management of hazardous waste as part of the CERCLA response must comply with the substantive standards of these rules.	See following section by section analysis.
Hazardous Waste	Env-Wm 353.09 and 353.10 Siting requirements for hazardous waste facilities and variances	Restrictions on siting of hazardous waste facilities.	Any new hazardous waste facility must comply with the siting requirements or with criteria for a variance.	Applicable.
Hazardous Waste	Env-Wm 702.08 Environmental and Health Requirements	Requires operator of a hazardous waste facility to meet certain standards for surface water, ground water, air.	Operation of hazardous waste facility must meet relevant standards and criteria. NOTE: worker protection requirements are not ARAR, but OSHA and state law approved under OSHA must be complied with per §. 300.150(e) of NCP	Applicable or relevant and appropriate, depending on alternative.
Hazardous Waste	Env-Wm 702.09 General Design Requirements	All hazardous waste and transfer facilities are to meet specified design requirements.	Construct any hazardous waste treatment facility in accordance with design requirements.	Applicable or relevant and appropriate, depending on alternative.
Hazardous Waste	Env-Wm 702.11 Ground Water Monitoring	Specified types of hazardous waste treatment facilities must monitor migration of hazardous waste as specified.	Implement a ground water monitoring program per requirements.	Relevant and appropriate.

GENERAL ACTION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Medium	Potential Requirement	Synopsis of Requirement	Action to be Taken to Attain Requirement	Applicable or Relevant and Appropriate
	FEDERAL REQUIREMENTS:			
Ground Water	Env-Ws 410.07, 410.09, 410.10 Prohibited Discharge, Groundwater Discharge Zone, Groundwater Discharge Permit Compliance Criteria	Prohibits discharges to ground water without use of BAT; requires controls on use of groundwater within discharg zone; sets limits on discharges to groundwater	Remedial measures involving discharges to ground water must comply with this regulation.	Applicable.
Ground Water	Env-Wm 403 Industrial and Municipal Wastewater Discharge Permits	This regulation requires a permit for discharge of wastewater.	Discharge of treated ground water and disposal of treated leachate must comply with these requirements.	Relevant and appropriate.
Ground Water	We 604 Abandonment of Wells	Imposes requirements for closure of wells.	If ground water wells are abandoned, requirements for closure must be followed.	Applicable.
Surface Water	Env-Ws Part 437 Antidegradation Policy	Requires existing beneficial uses and the water quality to sustain existing beneficial uses to be maintained and protected. Limited degradation as a result of insignificant discharges may be allowed.	Discharge to surface water must comply with this requirement.	Applicable.

Somersworth Sanitary Landfill Superfund Site
LOCATION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Medium	Requirement	Synopsis of Requirement	Applicable or Relevant and Appropriate
	FEDERAL REQUIREMENTS:		
Wetlands	CWA Section 404; 40 CFR Part 230; 33 CFR Parts 320-330	These requirements control the discharge of dredged or fill material into wetlands and require mitigation for any such discharge.	Applicable
Wetlands	Executive Order 11990 -- Wetlands	Federal agencies are required to preserve and enhance natural and beneficial values of wetlands and to minimize the destruction, loss, and degradation of wetlands.	To be considered
Wetlands	40 CFR Part 6, Appendix A	Contains the EPA policy for carrying out the provisions of EO 11990.	To be considered
Floodplains	Executive Order 11988 -- Floodplains	Federal agencies are required to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial value of floodplains.	To be considered
Floodplains	40 CFR Part 6, Appendix A	Contains the EPA policy for carrying out the provisions of EO 11988.	To be considered
	STATE REQUIREMENTS:		
Groundwater	Env-Ws 410.26 Groundwater Management Zone	At contaminated sites, requires groundwater management zone to be designated and use restricted. Where wells are currently in service, alternative drinking water must be provided. Groundwater extraction from well within in the zone must be "restricted by easement or ownership if required to complete the remedy."	Relevant and appropriate
Endangered plant species	RSA 217A NH Native Plant Protection Act	Prohibits damaging plant species listed as endangered within the state.	Applicable
Wetlands	RSA 485-A-17, Dredging and Control of Run-Off; Env-Ws Part 415, Dredging Rules	These requirements establish criteria for conducting any activity in or near state surface waters which significantly alters terrain or may otherwise adversely affect water quality, impede natural runoff, or create unnatural runoff. This includes excavation, dredging, and grading of topsoil in or near wetlands areas.	Applicable

LOCATION-SPECIFIC
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Medium	Requirement	Synopsis of Requirement	Applicable or Relevant and Appropriate
Wetlands	**FEDERAL REQUIREMENTS:** RSA Ch. 482-A, Fill and Dredge in Wetlands; and Env-Wm 300-400, and 600, Criteria and Conditions for Fill and Dredge in Wetlands	These requirements regulate filling and other activities in or adjacent to wetlands. They establish criteria for the protection of wetlands from adverse impacts on fish, wildlife, commerce, and public recreation.	Applicable.

Somersworth Sanitary Landfill Superfund Site

ACTION-SPECIFIC ARARS

Alternative 5: Limited action, landfill cover, enhanced in-situ chemical restoration, natural attenuation, bedrock ground water extraction with in-situ treatment, and ground water monitoring

Medium	Potential Requirement	Synopsis of Requirement	Action to be Taken to Attain Requirement	Applicable or Relevant and Appropriate
	FEDERAL REQUIREMENTS:			
Hazardous Waste	Hazardous Waste Regulations, RCRA Subtitle C, 40 CFR Part 264	RCRA Subtitle C establishes standards applicable to treatment, storage, transport, and disposal of hazardous waste and the closure of hazardous waste facilities.	Management of hazardous wastes as part of the CERCLA response must comply with substantive requirements of Subtitle C regulations.	Relevant and appropriate. Has effect through state hazardous waste requirements, which operate in lieu of direct federal regulation. See discussion of those requirements below.
	STATE REQUIREMENTS:			
Hazardous Waste	RSA Ch. 147-A, New Hampshire Hazardous Waste Management Act and Hazardous Waste Rules, Env-Wm Chapters 100-1000, in so far as they are relevant to this alternative, including in particular those listed below.	Standards for management of hazardous waste and closure of hazardous waste facilities. Operates in lieu of Federal RCRA Subtitle C requirements.	Management of hazardous waste as part of the CERCLA response must comply with the substantive standards of these rules.	See following section by section analysis.
Hazardous Waste	Env-Wm 353.09 and 353.10 Siting requirements for hazardous waste facilities and variances	Restrictions on siting of hazardous waste facilities.	Any new hazardous waste facility must comply with the siting requirements or with criteria for a variance.	Applicable.
Hazardous Waste	Env-Wm 702.08 Environmental and Health Requirements	Requires operator of a hazardous waste facility to meet certain standards for surface water, ground water, air.	Operation of hazardous waste facility must meet relevant standards and criteria. NOTE: worker protection requirements are not ARAR, but OSHA and state law approved under OSHA must be complied with per §. 300.150(e) of NCP	Applicable.
Hazardous Waste	Env-Wm 702.09 General Design Requirements	All hazardous waste and transfer facilities are to meet specified design requirements.	Construct any hazardous waste treatment facility in accordance with design requirements.	Applicable.
Hazardous Waste	Env-Wm 702.11 Ground Water Monitoring	Specified types of hazardous waste treatment facilities must monitor migration of hazardous waste as specified.	Implement a ground water monitoring program per requirements.	Relevant and appropriate.

Somersworth Sanitary Landfill Superfund Site

ACTION-SPECIFIC ARARS

Alternative 5: Limited action, landfill cover, enhanced in-situ chemical restoration, natural attenuation, bedrock ground water extraction with in-situ treatment, and ground water monitoring

Medium	Potential Requirement	Synopsis of Requirement	Action to be Taken to Attain Requirement	Applicable or Relevant and Appropriate
Hazardous Waste	Env-Wm 702.12 Other Monitoring	Requires groundwater monitoring by certain facilities.	Implement ground water monitoring as specified, if necessary.	Relevant and Appropriate.
Hazardous Waste	Env-Wm 708.02 Operation Requirements	Variety of requirements relating to operation and closure of hazardous waste treatment facility.	Comply with substantive specified requirements, not with procedural requirements.	Applicable to operation of a hazardous waste facility; relevant and appropriate as to closure.
Hazardous Waste	Env-Wm 708.03 Technical Requirements.	Imposes various requirements for operation of a hazardous waste treatment facility	Comply with specified requirements.	Applicable to operation of a hazardous waste treatment facility
Air	RSA Ch. 125-C, Air Pollution Control; NH Admin. Rules, Env-A 100-1300, as specified below.	Air pollution controls, as specified below.	See below.	See below.
Air	Fugitive Dust Emission Control, NH Admin. Rules, Env-A 1002	Activities such as construction and excavation must include precautions to prevent, abate, and control fugitive dust emissions.	Maintain dust control during site remediation.	Applicable.
Ground Water	Env-Ws 410.24(a) and (b), Criteria for Remedial Action	Requires remedial action for groundwater to ensure protection of human health and the environment and attain the groundwater quality criteria of Env-Ws 410.03.	The remedy must achieve these specified goals.	Applicable.
Ground Water	Env-Ws 410.27, Groundwater Management Permit Compliance Criteria	Where an approved remedial action plan fails to meet performance standards, a revised plan must be developed. Additional investigation or remedial action may be required. Groundwater must be monitored and managed in accordance with the plan until contamination sources are removed or treated and compliance with groundwater quality criteria are achieved.	If the preferred remedy fails to meet performance standards, a revised plan consisting of the contingent remedy will be adopted. Groundwater must be monitored and managed as prescribed.	Applicable.
Ground Water	Env-Wm 403 Industrial and Municipal Wastewater Discharge Permits	This regulation requires a permit for discharge of wastewater.	Discharge of treated ground water and disposal of treated leachate must comply with these requirements.	Relevant and appropriate.
Ground Water	We 604 Abandonment of Wells	Imposes requirements for closure of wells.	If ground water wells are abandoned, requirements for closure must be followed.	Applicable.

Somersworth Sanitary Landfill Superfund Site
ACTION-SPECIFIC ARARS
Alternative 8: Limited action, landfill cover, perimeter slurry wall, groundwater extraction (with on-site or off-site treatment), natural attenuation, overburden and bedrock ground water extraction with treatment, and ground water monitoring

Medium	Potential Requirement	Synopsis of Requirement	Action to be Taken to Attain Requirement	Applicable or Relevant and Appropriate
	FEDERAL REQUIREMENTS:			
Hazardous Waste	Hazardous Waste Regulations, RCRA Subtitle C, 40 CFR Part 264	RCRA Subtitle C establishes standards applicable to treatment, storage, transport, and disposal of hazardous waste and the closure of hazardous waste facilities.	Management of hazardous wastes as part of the CERCLA response must comply with substantive requirements of Subtitle C regulations.	Relevant and appropriate. Has effect through state hazardous waste requirements, which operate in lieu of direct federal regulatior. See discussion of thos requirements below.
Ground Water	Discharge of Treatment System Effluent, 40 CFR 122, 40 CFR 125, 40 CFR 131, and 40 CFR 136, National Pollutant Discharge Elimination System.	Imposes limitations on discharge to surface water.	Discharge of treated ground water and treated leachate to surface water must comply with these requirements.	Applicable if treated ground wate discharged to surface water.
	STATE REQUIREMENTS:			
Hazardous Waste	RSA Ch. 147-A, New Hampshire Hazardous Waste Management Act and Hazardous Waste Rules, Env-Wm Chapters 100-1000, in so far as they are relevant to this alternative, including in particular those listed below.	Standards for management of hazardous waste and closure of hazardous waste facilities. Operates in lieu of Federal RCRA Subtitle C requirements.	Management of hazardous waste as part of the CERCLA response must comply with the substantive standards of these rules.	See following section by section analysis.
Hazardous Waste	Env-Wm 353.09 and 353.10 Siting requirements for hazardous waste facilities and variances	Restrictions on siting of hazardous waste facilities.	Any new hazardous waste facility must comply with the siting requirements or with criteria for a variance.	Applicable.
Hazardous Waste	Env-Wm 702.08 Environmental and Health Requirements	Requires operator of a hazardous waste facility to meet certain standards for surface water, ground water, air.	Operation of hazardous waste facility must meet relevant standards and criteria. NOTE: worker protection requirements are not ARAR, but OSHA and state law approved under OSHA must be complied with per §. 300.150(e) of NCP	Applicable.
Hazardous Waste	Env-Wm 702.09 General Design Requirements	All hazardous waste and transfer facilities are to meet specified design requirements.	Construct any hazardous waste treatment facility in accordance with design requirements.	Applicable.

Somersworth Sanitary Landfill Superfund Site
ACTION-SPECIFIC ARARS
Alternative 8: Limited action, landfill cover, perimeter slurry wall, groundwater extraction (with on-site or off-site treatment), natural attenuation, overburden and bedrock ground water extraction with treatment, and ground water monitoring

Medium	Potential Requirement	Synopsis of Requirement	Action to be Taken to Attain Requirement	Applicable or Relevant and Appropriate
Hazardous Waste	Env-Wm 702.11 Ground Water Monitoring	Specified types of hazardous waste treatment facilities must monitor migration of hazardous waste as specified.	Implement a ground water monitoring program per requirements.	Relevant and appropriate.
Hazardous Waste	Env-Wm 702.12 Other Monitoring	Requires groundwater monitoring by certain facilities	Implement ground water monitoring as specified, if necessary.	Relevant and Appropriate.
Hazardous Waste	Env-Wm 708.02 Operation Requirements	Variety of requirements relating to operation and closure of hazardous waste treatment facility.	Comply with substantive specified requirements, not with procedural requirements.	Applicable to operation of hazardous waste facility; relevant and appropriate as to closure.
Hazardous Waste	Env-Wm 708.03 Technical Requirements.	Imposes various requirements for operation of a hazardous waste treatment facility	Comply with specified requirements.	Applicable to the operation of hazardous waste treatment facility
Air	RSA Ch. 125-C, Air Pollution Control; NH Admin. Rules, Env-A 100-1300, as specified below.	Air pollution controls, as specified below.	See below.	See below.
Air	Env-A 505.02(e) Emergency Procedures	Imposes obligations on sources of air pollution in cases of pollution emergency.	Comply with directions of state in case of "warning" status.	Applicable.
Air	Env-A 902 Malfunctions of Air Pollution Control Equipment	Provides limited relief from other requirements in case of malfunction. Notification requirements are not ARARs.	No action required. Provides relief from other ARARs.	Relevant and appropriate.
Air	Fugitive Dust Emission Control, NH Admin. Rules, Env-A 1002	Activities such as construction and excavation must include precautions to prevent, abate, and control fugitive dust emissions.	Maintain dust control during site remediation.	Applicable.
Air	Env-A 1305 Impact Analysis and Permit Requirements	Requires air quality impact analysis of devices emitting regulated substances.	Discharge from any new or modified facility must comply with requirements of section.	Applicable.
Surface Water	RSA 485-A:8 Surface Water Classifications	Prohibits disposal to Class B waters unless treated to prevent lowering below classification	Surface water discharge from any response action must comply with these requirements	Applicable.
Ground Water/ Surface Water	RSA 485-A:12 Enforcement of Classification	Any discharge to ground water or surface water that lowers the quality of the water below its classification is prohibited.	Remedial alternatives involving the discharge to ground water or surface water must comply with these standards.	Applicable.

Somersworth Sanitary Landfill Superfund Site
ACTION-SPECIFIC ARARS
Alternative 8: Limited action, landfill cover, perimeter slurry wall, groundwater extraction (with on-site or off-site treatment), natural attenuation, overburden and bedrock ground water extraction with treatment, and ground water monitoring

Medium	Potential Requirement	Synopsis of Requirement	Action to be Taken to Attain Requirement	Applicable or Relevant and Appropriate
Ground Water/ Surface Water	RSA 485-A:13 Permit for discharge	Discharge or disposal must comply with effluent limitations.	Remedial measures involving discharges to ground or surface water must comply with these standards. On-site discharges do not require permit.	Applicable.
Ground Water	Env-Ws 410.24(a) and (b), Criteria for Remedial Action	Requires remedial action for groundwater to ensure protection of human health and the environment and attain the groundwater quality criteria of Env-Ws 410.03.	The remedy must achieve these specified goals.	Applicable.
Ground Water	Env-Ws 410.07, 410.09, 410.10 Prohibited Discharge, Groundwater Discharge Zone, Groundwater Discharge Permit Compliance Criteria	Prohibits discharges to ground water without use of BAT; requires controls on use of groundwater within discharg zone; sets limits on discharges to groundwater	Remedial measures involving discharges to ground water must comply with this regulation.	Applicable if treatment effluent discharged to ground water.
Ground Water	Env-Ws 410.27, Groundwater Management Permit Compliance Criteria	Where an approved remedial action plan fails to meet performance standards, a revised plan must be developed. Additional investigation or remedial action may be required. Groundwater must be monitored and managed in accordance with the plan until contamination sources are removed or treated and compliance with groundwater quality criteria are achieved.	If the preferred remedy fails to meet performance standards, a revised plan will be adopted. Groundwater must be monitored and managed as prescribed.	Applicable.
Ground Water	Env-Wm 403 Industrial and Municipal Wastewater Discharge Permits	This regulation requires a permit for discharge of wastewater.	Discharge of treated ground water and disposal of treated leachate must comply with these requirements.	Relevant and appropriate.
Ground Water	We 604 Abandonment of Wells	Imposes requirements for closure of wells.	If ground water wells are abandoned, requirements for closure must be followed.	Applicable.
Surface Water	Env-Ws Part 437 Antidegradation Policy	Requires existing beneficial uses and the water quality to sustain existing beneficial uses to be maintained and protected. Limited degradation as a result of insignificant discharges may be allowed.	Discharge to surface water must comply with this requirement.	Applicable.

APPENDIX D

State Declaration of Concurrence

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
603-271-3503 FAX 603-271-2867
TDD Access: Relay NH 1-800-735-2964

NHDES

June 21, 1994

John P. DeVillars
Regional Administrator
USEPA-Region I
JFK Federal Building (RAA)
Boston, MA 02203

RE: Record of Decision
Somersworth Municipal Landfill
Somersworth, New Hampshire

Dear Mr. DeVillars:

The New Hampshire Department of Environmental Services has reviewed the Record of Decision (ROD) for the Somersworth Municipal Landfill Superfund Site located in Somersworth, NH. The ROD was drafted by the United States Environmental Protection Agency and selects a preferred remedy having the following components:

(1) an innovative, in-situ chemical treatment wall with groundwater diversion. The wall will be composed of permeable treatment sections and impermeable barrier sections and will be located to intercept contaminated groundwater flowing from the landfill. The barrier sections will divert contaminated groundwater through chemical treatment sections where detoxification of volatile organic compounds will occur.

(2) a permeable landfill cover. The permeable cover will promote leaching of soluble contaminants from the landfill waste by allowing infiltration of precipitation. After specified groundwater clean-up levels are achieved and maintained without use of the treatment wall, an appropriate landfill cover will be designed and constructed.

(3) a bedrock groundwater extraction well. Initially, one extraction well will be constructed (outside the landfill footprint) to remove contaminated groundwater from bedrock. Effluent from the well will be either discharged to the landfill (where it will percolate into the waste mass and enhance flushing of landfill contaminants) or will be injected just upgradient of the treatment wall. In both cases, the effluent will pass through the treatment wall for detoxification. The need for additional bedrock groundwater extraction wells will be evaluated during the remedial design of the preferred remedy.

AIR RESOURCES DIV.
64 No. Main Street
Caller Box 2033
Concord, N.H. 03302-2033
Tel. 603-271-1370
Fax 603-271-1381

WASTE MANAGEMENT DIV.
6 Hazen Drive
Concord, N.H. 03301
Tel. 603-271-2900
Fax 603-271-2456

WATER RESOURCES DIV.
64 No. Main Street
P.O. Box 2008
Concord, N.H. 03302-2008
Tel. 603-271-3406
Fax 603-271-6588

WATER SUPPLY & POLLUTION CONTROL DIV.
P.O. Box 95
Concord, N.H. 03302-0095
Tel. 603-271-3503
Fax 603-271-2181

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Contingency Remedy

The ROD also specifies a contingency remedy if the preferred remedy proves to be ineffective and does not meet specified performance standards. The contingency remedy will be constructed in two stages, with the first stage being evaluated to determine if the next stage is required. The first stage of the contingency remedy has the following components:

(1) a perimeter slurry wall. A slurry wall (extending to bedrock) will encompass the existing landfill waste mass in an effort to minimize overburden groundwater/waste contact and thus reduce formation of leachate and migration of contaminants. Existing impermeable barrier sections will be incorporated into the perimeter slurry wall.

(2) a groundwater diversion trench. A groundwater diversion trench will be constructed on the upgradient side of the landfill to prevent an artificial rise of the groundwater surface when it encounters the slurry wall. Overburden groundwater will be intercepted and diverted to wetlands located downgradient of the landfill.

(3) a landfill cap. A multi-layer, impermeable cap will be constructed over the entire landfill in accordance with RCRA Subtitle C requirements.

(4) bedrock groundwater extraction. Item (3) of the preferred remedy, bedrock groundwater extraction, will be included with this stage of the contingency remedy. Extracted bedrock groundwater will likely be treated at the Somersworth Wastewater Treatment Facility.

The design objective of Stage One of the contingency remedy is to eliminate the source of groundwater contamination and to meet interim groundwater cleanup levels in the overburden aquifer at the compliance boundary. Groundwater levels and quality in the vicinity of the landfill will be monitored to verify that the Stage One design objective has been achieved. If construction of Stage One does not result in both elimination of waste/groundwater contact and attainment of specified interim groundwater cleanup levels, Stage Two of the contingency remedy will be implemented.

New Hampshire Department of Environmental Services

The second stage of the contingency remedy has the following component:

(5) extraction and treatment of overburden groundwater located within the slurry wall. The remedial design will determine the location, number and pumping rates of each well, along with the most appropriate treatment technology and discharge location of contaminated groundwater. On-site treatment and disposal methods and pretreatment and discharge at the Somersworth Wastewater Treatment Facility are the two options which will be evaluated. Extracted bedrock groundwater (see Item (4) of the Contingency Remedy) will be treated and disposed along with the extracted overburden groundwater.

State of New Hampshire Remediation Policy

The *New Hampshire Code of Administrative Rules,* Env-Ws 410 establish standards, criteria and procedures to remediate sites with contaminated groundwater. Generally, the rules require that remediation of such sites include source removal, containment, or treatment, containment of groundwater contamination within the limits of a specified groundwater management zone, and reduction of groundwater contaminant levels within that zone.

Both the preferred and contingency remedies described in the ROD are consistent with the approach that would be required under Env-Ws 410 and State policy, although the proposed remedial techniques differ from those typically required by the State. The preferred remedy is designed to treat the source of groundwater contamination via an in-situ chemical treatment wall. The contingency remedy is designed to minimize groundwater/waste contact, thus eliminating the source of groundwater contamination, by constructing a perimeter slurry wall and a landfill cap (constructed in accordance with RCRA Subtitle C specifications) . Both remedies will include periodically monitoring groundwater to verify effectiveness.

ARARs

The preferred remedy and the contingency remedy will comply with applicable or relevant and appropriate state requirements that pertain to the site.

State Concurrence

The New Hampshire Department of Environmental Services, acting on behalf of the State of New Hampshire, concurs with the preferred and contingency remedies described in the ROD. The State assures that if the Superfund Trust Fund is used, the State will contribute its statutorily required cost share, if State funds are available.

Sincerely,

Robert W. Varney
Commissioner

PJO/TGH/amk/smlfrod.ltr
cc: Daniel Coughlin, P.E., USEPA
Roger Duwart, USEPA
Philip J. O'Brien, Ph.D., Director, NHDES-WMD
Harry Stewart, P.E., NHDES-GPB
Carl W. Baxter, P.E., NHDES-WMEB
Maureen Smith, Esq., NHDOJ-AGO
Paul Lincoln, P.E., NHDES-WMEB
Talcott Hubbard, P.E., NHDES-WMEB

APPENDIX E

Administrative Record Index

SOMERSWORTH SANITARY LANDFILL
NPL SITE ADMINISTRATIVE RECORD

Table of Contents

SOMERSWORTH SANITARY LANDFILL
NPL SITE ADMINISTRATIVE RECORD
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NPL SITE ADMINISTRATIVE RECORD

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SOMERSWORTH SANITARY LANDFILL
NPL SITE ADMINISTRATIVE RECORD

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VOLUME XV (continued)

Introduction

This document is the Index to the Administrative Record for the Somersworth Sanitary Landfill National Priorities List (NPL) site. Section I of the Index cites site-specific documents, and Section II cites guidance documents used by EPA staff in selecting a response action at the site.

The Administrative Record is available for public review at EPA Region I's Office in Boston, Massachusetts, 90 Canal Street (617-573-5729) and the Somersworth Public Library, 27 Main Street, Somersworth, New Hampshire 03878. Questions concerning the Administrative Record should be addressed to the EPA Region I site manager.

The Administrative Record is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Section I

Site-Specific Documents

ADMINISTRATIVE RECORD INDEX

for the

Somersworth Sanitary Landfill

1.0 Pre-Remedial

1.2 Preliminary Assessment

1. "Potential Hazardous Waste Site: Identification and Preliminary Assessment" Form, EPA Region I (April 29, 1982).

1.3 Site Inspection

1. "Potential Hazardous Waste Site: Site Inspection Report," EPA Region I (July 26, 1982).

1.18 FIT Technical Direction Documents (TDDs) and Associated Records

1. NUS Corporation, Superfund Division, Document Transmittal addressed to Peter McGlew, EPA Region I (May 24, 1983). With attached memo from John M. Panaro, NUS Corporation to Peter McGlew, EPA Region I (May 24, 1983). Concerning Dover and Somersworth Landfill Sampling Project.
2. NUS Corporation, Superfund Division, Document Transmittal from Rich DiNitto to Peter McGlew, EPA Region I (September 21, 1983) with attached memo from John Panaro, NUS Corporation to Peter McGlew, EPA Region I (September 1, 1983). Concerning summary of laboratory data for Dover and Somersworth, New Hampshire.

* Additional FIT Technical Direction Documents (TDDs) and Associated Records may be reviewed, by appointment only, at EPA Region I, Boston, Massachusetts.

3.0 Remedial Investigation (RI)

3.1 Correspondence

1. Telephone Record of phone call from Norm Leclerc, Project Coordinator, to Diana King, EPA Region I (November 25, 1991). Concerning deadline for PRP response to SOW and possibility that plume has moved further than thought and the obligation to measure it to its end.

3.2 Sampling and Analysis Data

* Sampling and Analysis Data from the Remedial Investigation may be reviewed, by appointment only, at EPA Region I, Boston, Massachusetts.

1. Sampling results for the new wells at Somersworth Municipal Landfill collected November 7 and 8, 1990.
2. EPA 624 sample results from samples collected January 24 through January 27, 1992.
3. Results from NHDES Sampling on March 12, 1992.
4. Tables which summarize results from field activities for the Somersworth Landfill Site prior to March 26, 1992.

3.3 Scope of Work

1. Letter from Mark E. Beliveau, Sanders & McDermott (attorney for Blackwater Road Landfill PRP Group) to Sila Gonzalez, EPA Region I (October 25, 1991). Concerning EPA October 11, 1991 Supplemental Additional Remedial Investigation Data Gathering Activities Scope of Work.

3.4 Interim Deliverables

1. "Preliminary Draft Remedial Action Master Plan for Somersworth Landfill, Somersworth, New Hampshire, (January 5, 1983)" prepared by Camp Dresser & McKee, Inc., and subconsultants.
2. "Site Safety Plan - Remedial Investigation Somersworth Municipal Landfill, Somersworth, New Hampshire," Wehran Engineering Corporation (January 1985). (Note: Original is missing page 13.)
3. "Quality Assurance Project Plan - Remedial Investigation, Somersworth Municipal Landfill, Somersworth, New Hampshire," Wehran Engineering Corporation (July 1985).
4. "Appendices - Quality Assurance Project Plan - Remedial Investigation, Dover Municipal Landfill, Dover, New Hampshire, Somersworth Municipal Landfill, Somersworth, New Hampshire," Wehran Engineering Corporation (April 1985).
5. "Ground Water Extraction, Somersworth Landfill, Somersworth, New Hampshire," Canonie Environmental (October 1988).

3.6 Remedial Investigation (RI) Reports

1. "Remedial Investigation, Somersworth Municipal Landfill, Somersworth, New Hampshire," Volume I (text), Volume II (Tables and Figures, Appendices A-F), and Volume III (Appendices G-L), Wehran Engineers and Scientists (May 1989).
2. "RI Data Gathering Report, Somersworth Landfill, Somersworth, New Hampshire," Canonie Environmental (May 1990).
3. "RI Data Gathering Report, Somersworth Landfill, Somersworth, New Hampshire," Canonie Environmental (May 1992).

3.7 Work Plans and Progress Reports

1. "Investigation Plan - Remedial Investigation, Somersworth Municipal Landfill, Somersworth, New Hampshire," Wehran Engineering Corporation (March 1985).
2. Letter from Diana King, EPA Region I, to Norman Leclerc, Project Coordinator, City of Somersworth (December 27, 1991). Concerning the Review and Acceptance of Work Plan Addendum for Additional Remedial Investigation Activities - Somersworth Landfill, Somersworth, New Hampshire, prepared by Canonie Environmental (December 17, 1991).

3.9 Health Assessments

1. "Health Assessment for Somersworth Municipal Landfill Site," New Hampshire Department of Health and Human Services and the Agency for Toxic Substances and Disease Registry U.S., Public Health Service (March 1989).
2. "Addendum to Public Health Assessment, Somersworth Sanitary Landfill, Somersworth, Strafford County, New Hampshire". Cerclis No. NHD980520225. New Hampshire Department of Health and Human Services and the Agency for Toxic Substances and Disease Registry U.S., Public Health Service.

3.12 Action Memoranda

1. Memorandum from Merrill S. Hohman, EPA Region I to Michael R. Deland, EPA Region I. Concerning authorization to conduct a remedial investigation and feasibility study (February 8, 1984).

4.0 Feasibility Study (FS)

4.1 Correspondence

1. Letter from Norman Leclerc, Project Coordinator, to Diana King, EPA Region I (April 16, 1991). Concerning Ms. King's comments relative to the Somersworth Landfill Feasibility Study not being received as promised, and the subsequent rescheduling of the meeting originally scheduled for May 10, 1991.
2. Letter from Diana King, EPA Region I, to Norman Leclerc, Project Coordinator (April 23, 1991). Concerning the transmittal of attached set of partial comments made on the Draft Feasibility Study (FS) for Somersworth Landfill (February 1991).
3. Letter from Norman Leclerc, Project Coordinator, to Diana King, EPA Region I (April 30, 1991). Concerning the receipt of "partial set of comments" from Ms. King, the need to reschedule the meeting scheduled for May 10, 1991, and the date when final comments will be received.
4. Letter from Douglas R. Elliott, Jr., City Manager, to Merrill S. Hohman, Director Waste Management Division, EPA Region I (May 20, 1991). Concerning the distress of the Trustees of the Somersworth Landfill Trust with the Agency's decision not to allow the proposed additional work.
5. Letter from Diana King, EPA Region I, to Norman Leclerc, Project Coordinator (May 20, 1991). Concerning transmittal of attached supplemental comments made on the Draft Feasibility Study (FS) for Somersworth Landfill (February 1991).
6. Letter from Diana King, EPA Region I, to Norman Leclerc, Project Coordinator (May 27, 1991). Concerning transmittal of attached Final Review Comments on Draft Feasibility Study (FS) for Somersworth Landfill (February 1991).
7. Letter from Sherilyn Burnett Young, Rath, Young, Pignatelli & Oyer (attorney for PRP Steering committee) to Sila Gonzalez, EPA Region I (June 18, 1991). Concerning Somersworth Municipal Landfill Feasibility Study.
8. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (June 19 , 1991). Concerning the Settling parties being unable to submit the FS until July 5, 1991.

4.1 Correspondence (continued)

9. Letter from Diana King, EPA Region I, to Norman Leclerc, Project Coordinator (June 21, 1991). Concerning revision of Somersworth Sanitary Landfill Feasibility Study submittal extension to June 28, 1991.
10. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (June 26, 1991). Concerning the Settling Parties continued need for the July 5, 1991 date for FS submittal and disagreements with Diana King's letter dated June 21, 1991.
11. Memo from John W. Billiard, Canonie Environmental to Diana King, EPA Region I (July 2, 1991). Concerning the expected delivery of 6 copies of the Somersworth Landfill Feasibility Study on or before July 5, 1991.
12. Letter from John W. Billiard, Canonie Environmental, to Diana King, EPA Region I (July 3, 1991). Concerning transmittal of six copies of the "Feasibility Study, Somersworth Landfill, Somersworth, New Hampshire".
13. Telephone Record of phone call from Norman Leclerc, Project Coordinator, to Diana King, EPA Region I (March 19, 1992). Concerning mailing of sampling results on March 27, 1992, wetlands evaluation, and the possibility of non-attainment zone for ground water.
14. Telephone Record for phone call from Diana King, EPA Region I, to Norman G. Leclerc, Project Coordinator (March 25, 1992). Concerning request for final sampling data to be sent today, and Norman Leclerc's notification that he will request an extension for the Technical Memorandum submittal.
15. Letter from Diana King, EPA Region I, to Norman G. Leclerc, Project Coordinator (March 25, 1992). Concerning Somersworth Sanitary Landfill Superfund Site Supplemental Additional Remedial Investigation Data Gathering (RIDG) Activities.
16. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (March 25, 1992). Concerning the official request for an extension to April 10, 1992 of the schedule required by the approved Revised Work Plan Addendum.
17. Letter from Diana King, EPA Region I, to Norman G. Leclerc, Project Coordinator (March 26, 1992). Concerning the April 1, 1992 deadline to submit the Technical Memorandum to EPA.

4.1 Correspondence (continued)

18. Letter from Douglas R. Elliott, Jr., City Manager, to Julie Belaga, EPA Region I (April 13, 1992). Concerning the Somersworth Landfill PRP Group's disagreements with EPA's refusal to allow an extension to grant an additional investigation.
19. Letter from Douglas R. Elliott, Jr., Chairman, Somersworth Landfill Trust, to Phillip J. O'Brien Ph.D, New Hampshire Department of Environmental Services (April 13, 1992). With attached letter to Julie Belaga (April 13, 1992). Concerning the request for support on the matter of an additional investigation at the Somersworth Municipal Landfill Site.
20. Letter from Merrill S. Hohman, EPA Region I, to Douglas R. Elliott, Jr., City Manager (May 15, 1992). Concerning response to April 13, 1992 letter to Julie Belaga, and EPA refusal to grant a further extension of time to do the work proposed in the SOW.
21. Letter from Douglas R. Elliot, Jr., City Manager, to Merrill S. Hohman, EPA Region I (May 20, 1991). Concerning Doug Elliott's request to meet with Merrill Hohman to discuss the latest proposal for innovative ground water treatment.
22. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (June 5, 1992). Concerning the request for permission to obtain a 100 liter sample of water from monitoring well No. OB-17U to be used for a laboratory bench scale test to evaluate the effectiveness of the EnviroMetal process on the ground water from the site containing high concentrations of vinyl chloride.
23. Letter from Douglas R. Elliott, Jr., City Manager, to Merrill S. Hohman, EPA Region I (May 29, 1992). Concerning meeting date following submittal of FS, and disappointment with "statement that a meeting to allow us to present and explain the "EnviroMetal" process would be of no value".
24. Letter from Merrill S. Hohman, EPA Region I, to Douglas R. Elliot, Jr., City Manager (June 10, 1992). Concerning response to May 20, 1992 letter regarding the decision by EPA not to allow a schedule delay to study bioremediation at the Somersworth Sanitary Landfill Superfund Site.

4.1 Correspondence (continued)

25. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (June 12, 1992). Concerning the request to see R.S. Kerr Environmental Research Laboratory's comments on the FS, and to express the disappointment of the Somersworth Landfill Trust to Merrill Hohman's letter of May 15, 1992 rejecting the Trust Proposal to perform a short study.
26. Letter from John W. Billiard, Canonie Environmental, to Diana King, EPA Region I (June 15, 1992). Concerning transmittal of eleven copies of the Feasibility Study Report for review and approval.
27. Letter from Douglas R. Elliott, Jr., City Manager, to Merrill S. Hohman, EPA Region I (July 15, 1992). Concerning response to July 14, 1992 meeting, and the renewal of the request for a six month suspension to allow the Trust to conduct a treatability study for both the biorestoration and the EnviroMetal alternatives.
28. Letter from Merrill S. Hohman, EPA Region I, to Douglas R. Elliott, Jr., City Manager (August 5, 1992). Concerning response to July 15, 1992 letter and agenda for August 10, 1992 meeting.
29. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (October 14, 1992). Concerning transmittal of October 14, 1992 "Risk Assessment for the Somersworth Municipal Landfill, Somersworth, New Hampshire", by Cambridge Environmental, Inc.
30. Letter from Diana King, EPA Region I, to Norman Leclerc, Project Coordinator (December 3, 1992). Concerning the transmittal of attached comments on the Draft Feasibility Study for the Somersworth Landfill (June 1992).
31. Letter from Diana King, EPA Region I, to Norman Leclerc, Project Coordinator (December 16, 1992). Concerning transmittal of additional comments on the Draft Feasibility Study for the Somersworth Landfill (June 1992).
32. Letter from John W. Billiard, Canonie Environmental, to Diana King, EPA Region I (March 5, 1993). Concerning transmittal of 13 copies of the Final Feasibility Study Report.

4.1 Correspondence (continued)

33. Letter from John W. Billiard, Canonie Environmental, to Mr. Norman G. Leclerc, Project Coordinator (July 20, 1993). Concerning Canonie Environmental's response to EPA comments in regard to the Somersworth Landfill Feasibility Study. With attached letter to Mr. Roger Duwart, EPA concerning transmittal of same.
34. Letter from David Major, Beak Consultants Limited, to Mr Roger Duwart, EPA Region I (July 21, 1993). Concerning transmittal of attached "Technical Memorandum: Recent Developments of the Envirometal Process", prepared by Enviromental Technologies, Inc., for Beak Consultants Limited (July 1993).
35. Letter from Mr. David Major, Beak Consultants Limited, to Mr. Roger Duwart, EPA Region I (August 10, 1993). Concerning documentation of telephone conversation from August 3, 1993 regarding the solubility of dechlorinated end-products by the EnviroMetal process.
36. Letter from John H. Guswa, GeoTrans, Inc., to Mr. Roger Duwart, EPA Region I (September 8, 1993). Concerning summary of GeoTrans technical approach for remediation of VOC contaminated groundwater in bedrock beneath and adjacent to the Somersworth Landfill site.

4.2 Sampling and Analysis Data

1. Memorandum from Paul Lincoln, New Hampshire Department of Environmental Services, to Diana King, EPA Region I (February 12, 1993). Concerning transmittal of map and list of residences that were previously sampled at Somersworth, NH.

4.4 Interim Deliverables

1. "Draft Initial Screening Report", Canonie Environmental (February 1991).
2. "Draft Technical Memorandum, Remedial Response Objectives and Response Actions", Canonie Environmental (February 1991).
3. "Risk Assessment for the Somersworth Municipal Landfill, Somersworth, New Hampshire (October 14, 1992)".Prepared by Cambridge Environmental Inc., with attached transmittal letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (October 14, 1992).

4.5 Applicable or Relevant and Appropriate Requirements (ARARS)

1. Draft ARAR tables, U.S. Environmental Protection Agency, Region I (December 8, 1993).

4.6 Feasibility Study

1. "Draft Feasibility Study for Somersworth Municipal Landfill, Volume I (Text, Tables, and Figures, Appendices A-E), Somersworth, New Hampshire," Canonie Environmental (February 1991).
2. "Feasibility Study (June 1991), Somersworth Landfill Site, Somersworth, New Hampshire", Volume I (Text, Tables, and Figures), Volume II (Appendices A-G), and Volume III (Appendix F: Supporting calculations), prepared by Canonie Environmental.
3. "Feasibility Study (June 1992), Somersworth Landfill Site, Somersworth, New Hampshire", Volume I (Text, Tables, and Figures, Appendices A-B), Volume II (Appendices C-H), prepared by Canonie Environmental.
4. "Feasibility Study (March 1993), Somersworth Landfill Site, Somersworth, New Hampshire", Volume I (Text, Tables, and Figures), Volume II (Appendices A-G), and Volume III (Appendices H-J), prepared by Canonie Environmental.
5. "Addendum to the Feasibility Study (December 1993), Somersworth Sanitary Landfill Superfund Site, Somersworth, New Hampshire", prepared by U.S. Environmental Protection Agency.

4.7 Work Plans and Progress Reports

1. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (April 10, 1991). Project Progress Report (No. 22) concerning additional remedial investigation (RI) and data collection and feasibility study (FS).
2. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (May 8, 1991). Project Progress Report (No. 23) concerning additional remedial investigation (RI) and data collection and feasibility study (FS).
3. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (June 11, 1991). Project Progress Report (No. 24) concerning additional remedial investigation (RI) and data collection and feasibility study.

4.7 Work Plans and Progress Reports (continued)

4. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (July 8, 1991). Project Progress Report (No. 25) concerning additional remedial investigation (RI) and data collection and feasibility study (FS).
5. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (August 8, 1991). Project Progress Report (No. 26) concerning additional remedial investigation (RI) and data collection and feasibility study (FS).
6. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (October 10, 1991). Project Progress Report (No. 28) concerning additional remedial investigation (RI) and data collection and feasibility study (FS).
7. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (March 11, 1992). Project Progress Report (No, 33) concerning additional remedial investigation (RI) and data collection and feasibility study (FS).
8. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (April 13, 1992). Project Progress Report (No. 34) concerning additional remedial investigation (RI) and data collection and feasibility study (FS).
9. Letter from Norman G. Leclerc, Project Coordinator, to Diana King, EPA Region I (May 8, 1992). Project Progress Report (No. 35) concerning additional remedial investigation (RI) and data collection and feasibility study (FS).

4.9 Proposed Plans for Selected Remedial Action

1. "Proposed Plan for Cleanup at the Somersworth Sanitary Landfill," U.S. Enviornmental Protection Agency (December 1993).

5.0 Record of Decision (ROD)

5.1 Correspondence

1. Letter from Roger Duwart, EPA Region I to the City Council, City of Somersworth (April 8, 1994). Concerning EPA response to letter dated February 28, 1994, requesting a delay in a decision on site remedial action.

5.3 Responsiveness Summaries

1. Cross-Reference: Responsiveness Summary is Appendix C of the Record of Decision [Filed and cited as entry number 1 in 5.4 Record of Decision (ROD)].

The following citations indicate documents received by EPA Region I during the formal public comment period.

2. Comments dated December 16, 1993 from Shirley J. White on the December 1993 "Proposed Plan for Cleanup at the Somersworth Sanitary Landfill," EPA Region I.
3. Comments dated January 5, 1994 from Keith H. Dinger on the December 1993 "Proposed Plan for Cleanup at the Somersworth Sanitary Landfill," EPA Region I.
4. Comments dated January 18, 1994 from Robert M. Tarr on the December 1993 "Proposed Plan for Cleanup at the Somersworth Sanitary Landfill," EPA Region I.
5. Comments dated February 11, 1994 from Francis Garofano on the December 1993 "Proposed Plan for Cleanup at the Somersworth Sanitary Landfill," EPA Region I.
6. Comments dated February 14, 1994 from Douglas R. Elliott, City Manager, City of Somersworth on the December 1993 "Proposed Plan for Cleanup at the Somersworth Sanitary Landfill," EPA Region I.
7. Letter from the City of Somersworth City Councilors to Roger Duwart, EPA Region I (February 28, 1994). Concerning a request to delay a Record of Decision on the Somersworth Landfill Site.
8. Comments (no date given) from John Young on the December 1993 "Proposed Plan for Cleanup at the Somersworth Sanitary Landfill," EPA Region I.

5.4 Record of Decision (ROD)

1. "Record of Decision Summary, Somersworth Sanitary Landfill Superfund Site," EPA, Region I, June 21, 1994.

10.0 Enforcement

10.7 Administrative Orders

1. Administrative Order, In the Matter of Somersworth Sanitary Landfill, Somersworth, New Hampshire, Docket No. I-89-1020 (April 28, 1989).

11.0 Potentially Responsible Party (PRP)

11.5 Site Level - General Correspondence

1. Letter from Philip L. Munck, City of Somersworth to Daniel Coughlin, EPA Region I and Michael Sills, New Hampshire Department of Environmental Services (July 31, 1987). Concerning PRP take-over of Feasibility Study.
2. Letter from Philip L. Munck, City of Somersworth and William E. McDonogh, General Electric Co. Community Relations to Richard Pease, New Hampshire Department of Environmental Services and Roger Duwart, EPA Region I (September 22, 1987). Concerning reaffirmation of desire to assume responsibility for completion of Remedial Investigation/Feasibility Study for Somersworth Site and designation of co-chairs for the PRP Group.

11.7 PRP Steering Committee Documents

1. Letter from Sherilyn Burnett Young, Rath, Young, Pignatelli & Oyer (attorney for PRP Steering Committee) to Daniel Coughlin, EPA Region I (April 6, 1988). With the attached, "Shift Toward Enforcement" article and letter from Oliver P. Wesley, Canonie Environmental to Norman Leclerc, Somersworth PRP Technical Committee (March 30, 1988). Concerning request for expedited remedy as solution to the municipal owned and operated landfill. (Note: Second letter from Canonie Environmental is missing).

11.9 PRP-Specific Correspondence

1. Letter from Seth D. Jaffe, Foley, Hoag, & Eliot, (Attorney for New England Telephone), to Norman G. Leclerc, Project Coordinator (May 5, 1992). Concerning transmittal of signature pages to the Administrative Order and Trust Agreement for the Somersworth Municipal Landfill Site. With attached signature pages.

13.0 Community Relations

13.3 News Clippings/Press Releases

1. "What's really in Somersworth dump?", Foster's Daily Democrat, April 7, 1983.

13.3 News Clippings/Press Releases (continued)

2. Informational Notice - Results of groundwater and surface water monitoring for Somersworth Landfill, New Hampshire Water Supply and Pollution Control Commission (October 6, 1983).
3. Informational Notice - Results of ground water and surface water monitoring for Dover Landfill, New Hampshire Water Supply and Pollution Control Commission (October 6, 1983).
4. Notice of Public Meeting - December 10, 1984, New Hampshire Water Supply and Pollution Control Commission.
5. "State Pollution Control Commission Updates Progress at Somersworth Municipal Landfill," New Hampshire Water Supply and Pollution Control Commission (May 1985).
6. "State Pollution Control Commission Updates at Somersworth Municipal Landfill," New Hampshire Water Supply and Pollution Control Commission (September 1985).
7. "Environmental News - EPA Reaches Settlement With 32 Parties For Past Costs at Somersworth Superfund Site," EPA Region I (December 20, 1989).

13.4 Public Meetings

1. New Hampshire Water Supply and Pollution Control Commission Agenda, Public Informational Meeting (June 21, 1989) for the Somersworth Municipal Landfill Superfund Site, with attached flow chart of site responsibilities.
2. Transcript of Public Hearing on EPA Remedial Investigation/Feasibility Study and Proposed Plan for the Cleanup of the Somersworth Sanitary Landfill Superfund Site (February 8, 1994).

13.5 Fact Sheets

1. "Remedial Investigation Somersworth Municipal Landfill" Agenda, New Hampshire Water Supply and Pollution Control Commission (December 10, 1984). With attached fact sheet.

14.0 Congressional Relations

14.1 Correspondence

1. Letter from James M. McLin, Mayor of Somersworth, NH, to the Honorable Bill Zeliff, Member of Congress (May 6, 1991). Concerning Somersworth Municipal Landfill history, current status, and city concerns.
2. Letter from the Honorable William H. Zeliff, Jr., Member of Congress, to James M. McLin and Somersworth City Council, City of Somersworth (May 31, 1991). Concerning response to May 6, 1991 letter.
3. Letter from the Honorable William H. Zeliff, Jr., Member of Congress, to Julie Belaga, EPA Region I (June 3, 1991). Concerning request for removal of the Somersworth Landfill Site from the National Priorities List.
4. Letter from Julie Belaga, EPA Region I, to the Honorable William H. Zeliff, Jr., Member of Congress (July 10, 1991). Concerning response to June 3, 1991 letter, and notification that the Somersworth Landfill Site cannot be considered for deletion from the NPL at this time.
5. Letter from William K. Reilly, EPA, to the Honorable Robert Smith, Member of Congress (March 13, 1992). Concerning response to meeting with New Hampshire Congressional delegation, with attached newspaper clipping concerning "NH Superfund sites part of pilot program".
6. Letter from Julie Belaga, EPA Region I, to the Honorable William H. Zeliff, Jr., Member of Congress (May 18, 1992). Concerning response to April 14, 1992 letter forwarded on behalf of the City of Somersworth, New Hampshire.
7. Letter from Julie Belaga, EPA Region I, to the Honorable Robert Smith, Member of Congress (May 18, 1992). Concerning response to April 14, 1992 letter forwarded on behalf of the City of Somersworth, New Hampshire.
8. Letter from Julie Belaga, EPA Region I, to the Honorable Warren B. Rudman, Member of Congress (May 18, 1992). Concerning response to April 14, 1992 letter forwarded on behalf of the City of Somersworth, New Hampshire.

14.1 Correspondence (continued)

9. Letter from the Honorable Robert Smith, Member of Congress, to Merrill S. Hohman, EPA Region I (June 1, 1992), with attached letter from Douglas Elliott, City Manager to Merrill S. Hohman, EPA Region I (May 20, 1991). Concerning lack of response to April 14, 1992 request, and the request of a review of the matter and an explanation of the outcome.
10. Letter from the Honorable William H. Zeliff, Jr., Member of Congress to Julie Belaga, EPA Region I (July 17, 1992). Concerning response to Public Meeting cosponsored with the City of Somersworth Tuesday, July 14, 1992.

16.0 Natural Resource Trustee

16.1 Correspondence

1. Letter from Jonathan P. Deason, Office of Environmental Affairs, to Merrill S. Hohman, EPA Region I (October 7, 1991). Concerning the Preliminary Natural Resources Survey (PNRS) and report of the Somersworth Municipal Landfill Site, Somersworth, New Hampshire.
2. Letter from Cyndi Perry, U.S. Fish and Wildlife Service, to Diana King, EPA Region I (February 6, 1992). Concerning EPA's inquiry about Department of the Interior's position regarding a covenant not to sue for natural resource damages at the Somersworth Municipal Landfill Site.

16.4 Trustee Notification Form and Selection Guide

1. Letter from Merrill S. Hohman, EPA Region I to William Patterson, U.S. Department of the Interior (May 27, 1987) with attached Trustee Notification Form and Selection Guide. Concerning notification of potential damages to natural resources under the jurisdiction of the Department of the Interior.
2. Letter from Merrill S. Hohman, EPA Region I to Sharon Christopherson, National Oceanographic and Atmospheric Administration - Coastal Resource Coordinator (May 27, 1987). Concerning notification of potential damages to natural resources under the jurisdiction of National Oceanographic and Atmospheric Administration.

16.4 Trustee Notification Form and Selection Guide (continued)

3. Letter from Gordon Beckett, U.S. Department of the Interior to Paul Marchessault, EPA Region I (July 21, 1987). Concerning the receipt of the Trustee Notification and interest in further coordination with the EPA.
4. Letter from Daniel Coughlin, EPA Region I to Kenneth Finkelstein, National Oceanographic and Atmospheric Administration - Coastal Resource Coordinator (November 21, 1988). Concerning notification of EPA's concluding negotiations with a self - appointed "PRP Group."
5. Letter from Daniel Coughlin, EPA Region I to William Patterson, U.S. Department of the Interior (November 21, 1988). Concerning notification of EPA's concluding negotiations with a self-appointed "PRP Group."

17.0 Site Management Records

17.4 Site Photographs/Maps

* The photographs referenced below may be reviewed, by appointment only, at EPA Region I, Boston, Massachusetts.

1. Letter from Thomas R. Osberg, EPA Region I to Tim Porter, EPA Region I (April 4, 1985). Concerning transmittal of Report, "Site Analysis Somersworth Landfill NPL Site;Somersworth, New Hampshire (PIC #85009)," a series of five photographic coverages (April 1985).
2. Memorandum from David E. Strzempko, Roy F. Weston, Inc. Technical ·istance Team, to Ruth Leabman, Enviropod Aeria_ .otography Site File Spring 1992 (August 20, 1992). Concerning transmittal of explanation of the Enviropod aerial photography deliverables for the Somersworth Landfill Site, Somersworth, NH (TDD #01-9204-07A, PCS # 1933), an oblique photograph (May 7, 1992).

17.7 **Reference** Documents

1. United States Department of the Interior Geological Survey, "High levels of arsenic in the groundwaters of southeastern New Hampshire: a geochemical reconnaissance". Preliminary report.

17.8 State and Local Technical Records

1. "Solid Waste Management Alternatives for Dover and Somersworth, New Hampshire -Summary," The MITRE Corporation, Metrek Division (December 1978).
2. "Solid Waste Management Alternatives for Dover and Somersworth, New Hampshire -Detailed Report," The MITRE Corporation, Metrek Division (December 1978).
3. Letter Report from Michael P. Donahue, New Hampshire Water Supply and Pollution Control Commission to Richard Hughto, Camp, Dresser & McKee (December 21, 1982). Concerning transmittal of attached analytical data.
4. Letter Report from Michael P. Donahue, New Hampshire Water Supply and Pollution Control Commission to Norman LeClerc, Project Coordinator, Somersworth, New Hampshire (May 2, 1983). Concerning installation of monitoring wells.
5. Letter from James R. Dalton, General Electric Company to Thomas Sweeny, Bureau of Solid Waste Management (February 9, 1977).
6. Letter from Thomas E.Roy, Bureau of Solid Waste Management, to Coleen Fuerst, General Electric Company (March 22, 1979). Concerning guidance on metal sludges.
7. Letter from Norman Leclerc, Project Coordinator, to Paul Sanborn, Bureau of Solid Waste Management (June 18, 1981). Concerning landfill closure by the city of Somersworth.
8. Letter from Norman Leclerc, Project Coordinator, to Paul Sanborn, Bureau of Solid Waste Management (July 13, 1981). Concerning more information regarding the landfill closure and environmental sampling.
9. Letter from Chris Hagger, Ecology and Environment, Inc., to Bob Young, Ecology and Environment, Inc. (August 3, 1982). Concerning site inspection of the Somersworth Municipal Landfill.
10. Letter from Dawn Channing, Bureau of Hazardous Waste Management, to Brenda Short, Somersworth Wood Heel (September 22, 1982). Concerning the Hazardous Waste Generator notification form to be completed.
11. Letter from Michael P. Donahue, PE, State of New Hampshire Water Supply and Pollution Control Commission, to Mr. Norman Leclerc, Project Coordinator (May 2, 1983). Concerning the installation of monitoring wells. With attached site plan.

17.8 State and Local Technical Records (continued)

12. "Site Inspection, GE Site, Somersworth, New Hampshire D-583-3-4-20 Rev. 2.0" by NUS Corporation of US EPA.
13. Letter from Patrick Gillespie, Wehran Engineering, to Donald Onusseit, New Hampshire Water Supply and Polution Control Commission (January 8, 1985). Concerning a drum with a General Electric label found in the landfill.
14. Letter from Kenneth W. Marschner, New Hampshire Office of Waste Management, to Colleen Fuerst, General Electric (February 1, 1985). Concerning the Notice of violation and order of abatement.
15. Letter from Sharon A. Yergeau, New Hampshire Bureau of Hazardous Waste Compliance and Enforcement, to Susan Hanamoto, US EPA Region I (May 12, 1986). Concerning attached supporting documentation for the declassification of Miller Shoes.

Section II

Guidance Documents

GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at EPA Region I, Boston, Massachusetts.

General EPA Guidance Documents

1. U.S. Environmental Protection Agency. Office of Research and Development. Municipal Environmental Research Laboratory. Handbook for Evaluating Remedial Action Technology Plans (EPA-600/2-83-076), August 1983. [2307]

2. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Community Relations in Superfund: A Handbook (Interim Version) (EPA/hw-6), September 1983.

3. U.S. Environmental Protection Agency. Office of Ground-Water Protection. Ground-Water Protection Strategy, August 1984. [2403]

4. "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Final Rule and Interim Final Rule and Proposed Rule" (40 CFR Part 136), Federal Register, October 26, 1984. [c036]

5. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Hazardous Response Support Division. Standard Operating Safety Guides, November 1984. [c082]

6. "National Oil and Hazardous Substances Pollution Contingency Plan," Code of Federal Regulations (Title 40, Part 300), 1985.

7. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Guidance on Feasibility Studies under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (EPA/540/G-85/003), June 1985. [c034]

8. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Guidance of Remedial Investigations under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) (EPA/540/G-85/002), June 1985. [c035]

9. Memorandum from Gene Lucero to the U.S. Environmental Protection Agency, August 28, 1985 (discussing community relations at Superfund Enforcement sites). [c053]

10. U.S. Department of Health and Human Services. National Institute for Occupational Safety and Health, and Occupational Safety and Health Administration. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985. [c065]

11. U.S. Environmental Protection Agency. Office of Research and Development. Hazardous Waste Engineering Research Laboratory. Handbook: Remedial Action at Waste Disposal Sites (Revised) (EPA/625/6-85/006), October 1985. [2309]

12. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Community Relations in Superfund: A Handbook (Interim Version) (EPA/HW-6, OSWER Directive 9230.0-3A) March 1986.

13. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Mobil Treatment Technologies for Superfund Wastes (EPA/540/2-86/003 (f)), September 1986. [2311]

14. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Draft Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites (OSWER Directive 9283.1-2), September 20, 1986. [c022]

15. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Superfund Public Health Evaluation Manual (OSWER Directive 9285.4-1), October 1986. [5014]

16. Comprehensive Environmental Response, Compensation, and Liability Act of 1980, amended October 17, 1986. [c018]

17. "Hazardous Waste Management Systems Land Disposal Restrictions Final Rule," (November 1986), 40 CFR Part 260 Et Al. [c103]

18. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Superfund Federal-Lead Remedial Project Management Handbook (EPA/540/G-87/001, OSWER Directive 9355.1-1), December 1986. [2010]

19. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Interim Guidance on Superfund Selection of Remedy (OSWER Directive 9355.0-19), December 24, 1986. [9000]

20. U.S. Environmental Protection Agency. Office of Research and Development. Hazardous Waste Engineering Research Laboratory. Technology Briefs: Data Requirements for Selecting Remedial Action Technology (EPA/600/2-87/001), January 1987. [c088]

21. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Data Quality Objectives for Remedial Response Activities: Development Process (EPA/540/G-87/003), March 1987. [2001]

22. Letter from Lee M. Thomas to James J. Florio, Chairman, Subcommittee on Consumer Protection and Competitiveness, Committee on Energy and Commerce, U.S. House of

Representatives, May 21, 1987 (discussing EPA's implementation of the Superfund Amendments and Reauthorization Act of 1986). [c044]

23. Memorandum from J. Winston Porter to Addressees ("Regional Administrators, Regions I-X; Regional Counsel, Regions I-X; Director, Waste Management Division, Regions I, IV, V, VII, and VIII; Director, Emergency and Remedial Response Division, Region II; Director, Hazardous Waste Management Division, Regions III and VI; Director, Toxics and Waste Management Division, Region IX; Director, Hazardous Waste Division, Region X; Environmental Services Division Directors, Region I, VI, and VII"), July 9, 1987 (discussing interim guidance on compliance with applicable or relevant and appropriate requirements). [c055]

24. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. A Compendium of Superfund Field Operations Methods (EPA/540/p-87/001, OSWER Directive 9355.0-14), December 1987. [2100]

25. U.S. Environmental Protection Agency. Interim Guidance on Potentially Responsible Party Participation in Remedial Investigations and Feasibility Studies (OSWER Directive 9835.1a) (May 1988). [8001]

26. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Community Relations in Superfund: A Handbook (Interim Version) (EPA/HW-6, OSWER Directive 9230.0-03B) (June 1988). [7000]

27. "Catalog of Superfund Program Directives," (July 1988), OSWER #9200.7-01. [co12]

28. "CERCLA Compliance with Other Laws Manual, Draft Guidance," (August 1988), OSWER #9234.1-01. [3002]

29. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA/540/G-89/004, OSWER Directive 9355.3-01) (October 1988). [2002]

30. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater: A Compendium of Examples (EPA/540/2-89/057) October 1989. [c133]

31. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Personnel Protection and Safety. [c071]

32. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments. (EPA/530-SW-89-047), July 1989.