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Risk Summary

Exposure pathways described previously for the site, and the resulting incremental risk estimates are calculated separately for adults and children ages 1 to 6, and then are summed for total lifetime risks. Below is a breakdown of the risk estimates for the Fletcher's Paint Site.

<u>Surface Soils:</u> Risks to surface soils are presented in Tables 7-9 of the ROD. Exposure pathways for surface soil include incidental ingestion and dermal contact. Cancer risks for adults and children exposed to surface soils at the Elm Street Site, Mill Street Site, and the Draper Energy property exceeded 1×10^{-6} in all cases. The total lifetime incremental cancer risk for the average case scenario for incidental ingestion of soils for children and adults combined is 2×10^{-4} while for maximum concentrations, the total lifetime cancer risk is 2×10^{-3}. For potential dermal contact of soils for both children and adults combined, the estimated total lifetime incremental cancer risks are 1×10^{-3} for the average scenario and 1×10^{-2} for the reasonable maximum exposure (RME) scenario. The highest individual estimated cancer risks are for Aroclor 1248 and for Aroclor 1254. Although risks are not calculated for inhalation of particulates, risks associated with inhalation may be similar to those associated with soil ingestion. The total surface soil incremental cancer risk for the incidental ingestion and dermal contact with surface soils is 1×10^{-3} for the average scenario and 1×10^{-2} for the maximum scenario. Both the average and maximum incremental cancer risk estimates exceed EPA's acceptable risk range of 10^{-6} to 10^{-4}.

Hazard quotients were not derived for PCBs in the 1994 BHRA because a reference dose ("RfD") for Arochlor 1254 did not exist at the time. Hazard quotients were mistakenly omitted from the 1996 amended BHRA and have been added into the risk tables in this ROD. These additional HQs further support previous risk management conclusions based on the 1994 and 1996 BHRA as to which media pose potential risks to human health. The noncancer hazard indices for incidental ingestion is12.4 for average concentrations and 124 for the RME scenario for children and adults combined. PCBs are the major contributor to these hazard indices. For dermal contact, the hazard index is 21.8 for the average and 223 for the RME scenario. The major contributor to the hazard indices are PCBs. The total HI, including dermal contact and ingestion pathways, is 47.8 for the average case and 479 for the RME scenario. These values greatly exceed EPA's acceptable noncancer risk range of a total hazard index of 1 to 10.

The results of the Lead Uptake Model for children ages 0 to 6 were evaluated. Predicted blood lead levels for this age group do not exceed a level of concern, defined as greater than 5 percent of the population exceeding a 10ug/dL increase in blood lead as a result of site exposures.

Subsurface Soils (Elm Street and Draper Energy): Risks to subsurface soils are presented in Tables 11 - 13 in the ROD. Exposures pathways to subsurface soils in the Elm Street Site and evaluated in the 1996 amended BHRA include incidental ingestion and dermal contact with soil. Cancer risks for adults and children exposed to subsurface soils at the Elm Street Site exceeded 1×10^{-6} in all cases. The total lifetime incremental cancer risk for the average case scenario for the incidental ingestion by children and adults combined is 1×10^{-3} while for maximum concentrations, the total lifetime cancer risk is 7×10^{-3}. For potential dermal contact of soils for both children and adults combined, the estimated total lifetime incremental cancer risks are 7×10^{-3} for the average scenario and 4×10^{-2} for the RME scenario. The highest individual estimated cancer risks are for Aroclor 1242, Aroclor 1248 and for Aroclor 1254. Although risks are not calculated for inhalation of particulates, risks associated with inhalation may be similar to those associated with soil ingestion. The total subsurface soil incremental cancer risk for all pathways and al receptors is 8×10^{-3} for the average scenario and 5×10^{-2} for the maximum scenario. Both the average and maximum incremental cancer risk estimates exceed EPA's acceptable risk range of 10^{-6} to 10^{-4}.

Hazard quotients were not derived for PCBs in the 1994 BHRA because a reference dose ("RfD") for Arochlor 1254 did not exist at the time. Hazard quotients were mistakenly omitted from the 1996 amended BHRA and have been added into the risk tables in this ROD. These additional HQs further support previous risk management conclusions based on the 1994 and 1996 BHRA as to which media pose potential risks to human health. The noncancer hazard indices for incidental ingestion for adults and children combined is 97.2 for the average scenario and 427 for the RME scenario. PCBs are responsible for the majority of the HQ. For dermal contact, the hazard index for adults and children combined is 250 for the average and 1225 for the RME scenario. The total HI for subsurface soils for all receptors combined and for all pathways is 347 for the average case and 1652 for the RME scenario. These HIs greatly exceed EPA's acceptable noncancer risk range of a total hazard index of 1 to 10.

Groundwater: Risks to groundwater are presented in Table 24 in the ROD. In the future, residential wells could be installed at the Fletcher's Paint Site, therefore future risks associated with ingestion of groundwater were calculated.

The estimated total incremental cancer risks are 1×10^{-3} for the average scenario and 3×10^{-2} for the RME scenario. The highest individual estimated cancer risks are for benzene, and PCBs. The contribution of the inhalation pathway from groundwater to the total risk was qualitatively evaluated in the risk assessment by assuming the exposure from inhalation was approximately equivalent to the exposure risk from the ingestion of 2 liters per day of groundwater. Thus the total risk from groundwater is about double the risk from ingestion. This approach was adopted by EPA Region 1 due to the uncertainty in inhalation models at the time. Both the average and maximum incremental cancer risk estimates exceed EPA's acceptable risk range of 10^{-6} to 10^{-4}.

Hazard quotients were not derived for PCBs in the 1994 BHRA because a reference dose ("RfD") for Arochlor 1254 did not exist at the time. Hazard quotients were mistakenly omitted from the 1996 amended BHRA and have been added into the risk tables in this ROD. These additional HQs further support previous risk management conclusions based on the 1994 and 1996 BHRA as to which media pose potential risks to human health. Noncancer hazard indices for adult residents are 18 for the average case scenario and 381 for the RME scenario. PCBs are the only contributor to the HI for the average case. For the RME scenario, the individual hazard quotients for ethylbenzene, toluene, manganese and PCBs exceed 1, with PCBs being the major contributor to the risk. for the RME scenario. These HIs greatly exceed EPA's acceptable noncancer risk range of a total hazard index of 1 to 10.

Drainage Ditch: Risks for exposure to surface water and sediment in the drainage ditch for adults and children combined, are presented in Tables 15 through 23 in this ROD. Exposures to contaminants in surface soil, sediments and surface water in the area of the drainage ditch could occur via incidental ingestion and dermal contact for adults and children ages 1 to 6. Ingestion of garden vegetables could also contribute to exposures for individuals gardening near the ditch.

Estimated lifetime cancer risks associated with ingestion of surface soils in the drainage ditch for adults and children combined are 3×10^{-5} for the average case scenario and 1×10^{-4} for the RME scenario. The contaminants of concern with individual cancers risks of greater than 1 x 10-6 are PAHS, PCBs and arsenic. The compounds contributing the majority of the potential cancer risk in drainage ditch surface soils are carcinogenic PAHs. Dermal contact with the drainage ditch surface soils for adults and children combined, results in a lifetime cancer risk of 5×10^{-6} for the average case scenario and 2×10^{-5} for the RME scenario. Dermal risks were only calculated for Aroclors 1248 and 1254. Although risks are not calculated for inhalation of particulates, risks associated with inhalation may be similar to those associated with soil ingestion.

Ingestion of garden vegetables grown in drainage ditch soils results in cancer risks of 3×10^{-5} for the average case and 1×10^{-4} for the RME scenario for adults.

The total incremental cancer risks through all exposure routes and across all receptors to the surface soils in the drainage ditch are 7×10^{-5} for the average scenario and 2×10^{-4} for the maximum scenario.

Incidental ingestion of drainage ditch soils for adults and children combined, results in a hazard index of 1.1 for the average scenario and 4.4 for the RME scenario. Although no individual chemical hazard quotient exceeds 1, both antimony and chromium (for children) have a calculated hazard quotient of 1. Dermal contact to surface soils for both adults and children combined results in a hazard index of 0.16 for the average case and 0.82 for the RME scenario. The total hazard index for exposure to surface soils in all pathways for all receptors combined is

1.7 for the average case and 6.9 for the RME scenario.

Estimated lifetime cancer risks associated with ingestion of sediments in the drainage ditch for children and adults combined, are 2×10^{-6} for the average case scenario and 1×10^{-5} for the RME scenario. Dermal contact with the drainage ditch surface soils for both adults and children combined, result in a lifetime cancer risk of 4×10^{-6} for the average case scenario and 1×10^{-5} for the RME scenario. Dermal risks were only calculated for Aroclors 1248 and 1254. The total HI for the drainage ditch sediments for all pathways is 6×10^{-6} for the average case and 2×10^{-5} for the RME scenario. The total hazard index for ingestion and dermal contact with drainage ditch sediments for all receptors combined is 0.2 for the average case and 0.6 for the RME scenario.

The estimated lifetime cancer risks associated with dermal contact of the surface waters in the drainage ditch are 9×10^{-9} for the average case scenario and 2×10^{-8} for the RME scenario.

The total incremental cancer risks for exposure to the surface water, sediment and soils in the drainage ditch are 7×10^{-5} for the average scenario and 2×10^{-4} for the maximum scenario. After consideration and review of the conservative nature of the assumptions used in calculating the risk estimates, these cancer risk estimates are determined to be acceptable and reasonably within the bounds of the EPA's acceptable risk range of 10^{-6} to 10^{-4}.

The total hazard index for exposure to all medium in the drainage ditch is 1.9 for the average case and 7.5 for the RME. After review of the conservative nature of the assumptions used in estimating these risks, these HI's are considered to be within EPA Region 1 acceptable risk range.

Summary:

There are uncertainties and limitations associated with the BHRA including, data collection, exposure assessment, toxicity assessment and risk characterization, the details of which are described in Section 2.6. 4 of the FS. These uncertainties resulted in the selection of conservative exposure parameters and model inputs which resulted in conservative estimates of potential site-related risks. Because of the uncertainties, the Fletcher's Paint site Baseline risk Assessment is not an absolute estimate of risks to human health resulting from exposure at the Fletcher's Paint Site. Rather, it is a conservative analysis that is a rough measure of the potential for adverse health effects to occur, based on the postulated exposures scenarios.

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, welfare, or the environment. Exposure to the following media was determined to exceed EPA's cancer risk range of concern: surface soils at the Elm Street and

Mill Street locations, subsurface soil at Elm Street Site and the Draper Energy Portion of the Mill Street Site, and groundwater. The compounds contributing to the majority of the potential cancer risk in Elm Street and Mill Street soils are PCBs. The compounds contributing to the majority of the potential cancer risk in ground water are benzene, 1,2-dichloroethane, trichloroethene, and PCBs.

As can be seen in the Risk Summary Table, which follows this discussion, hazard indices exceed 1 for surface soils at the Elm Street and Mill Street Sites, subsurface soils at the Elm Street Site, for total exposures to surface soil near the drainage ditch (RME case scenario) and for ground water ingestion in the future. The contaminants contributing to the majority of the potential noncarcinogenic effects in ground water are ethylbenzene, manganese and PCBs.

ECOLOGICAL RISK ASSESSMENT

A Preliminary Ecological Risk Assessment was conducted as part of the Phase 1A RI to assess the potential site contamination risks to the dominant biota and major ecosystems found in the vicinity of the Site. The primary objectives of the preliminary ecological risk assessment were to document the baseline ecological conditions at the Site and in the surrounding local study area, and evaluate the need for supplemental field studies to fully characterize the biological communities of the study area that may have been or could have been affected by site-derived contamination. The findings of this study were reported as part of the Phase 1A RI, in the March 15, 1994 Final Report for the Preliminary Ecological Risk Assessment at the Fletcher's Paint Site.

From a toxicity and bioaccumulation perspective, the contaminants and four exposure zones of greatest potential ecological concern, and warrant further ecological consideration are:

- On-site surface soils - inorganics, PCBs and pesticides
- Mill Street Pond - inorganics, PCBs, Pesticides and PAHS
- Drainage Ditch - Inorganics, PCBs, Pesticides, PAHS
- Souhegan River - Inorganics, PCBs Pesticides and PAHS

As a result of the Preliminary Ecological Risk Assessment Evaluation, the Souhegan River Study area was separated from the OU1 study area, and will be further investigated as part of OU2 activities. The conclusion from the Preliminary Ecological Risk Assessment was that there were areas of the site which held potential for ecological impacts as a result of site-related contamination, and that the potential risks should be quantified by computing analyte-specific hazard quotients (HQs) and aggregate hazard indices (HIs) for each pairing of ecological receptors and exposure zones. As part of the future risk assessment for the benthic community of the river, a quantitative benthic invertebrate survey was recommended, together with a characterization of benthic substrate features and sediment contamination, in order to supplement quantitative risk estimates risk estimates to be developed for the benthic community, by using NOAA sediment guidelines to calculate inferential risk quotients. Food chain exposure models were recommended to calculate HQs and HIs for a selection of aquatic, wetland, and/or terrestrial faunal indicator species. As part of OU2, field studies were completed in 1995 and a Final Ecological Risk Assessment Report for the Souhegan River was completed in April of 1998.

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:

1. Prevent the ingestion of groundwater contaminated in excess of drinking water standards (MCLs/MCLGs) or, in their absence, which produces an incremental cancer risk greater than 10^{-6}, for each carcinogenic compound. Also prevent ingestion of contaminated groundwater which produces an incremental cancer risk level greater than 10^{-4} to 10^{-6} for all carcinogenic compounds together.

2. Prevent ingestion of groundwater contaminated in excess of drinking water standards for each non-carcinogenic compound which produces a hazard quotient greater than 1 and a total hazard index of 1 to 10.

3. Restore the groundwater to drinking water standards or, in their absence, the more stringent of an incremental cancer risk of greater than 10^{-6}, for each carcinogenic

compound, or a hazard quotient of 1 for each non-carcinogenic compound. Also restore the aquifer to the more stringent of (1) a total incremental cancer risk level of 10^{-4} to 10^{-6} for all carcinogenic compounds; or (2) a hazard index of 1 to 10.

4. Prevent contact with soil contamination through ingestion or dermal contact which produces an incremental cancer risk of greater than 10^{-6} for each carcinogenic compound. Also prevent dermal contact with and ingestion of contaminated soil which produces a total incremental cancer risk level of 10^{-4} to 10^{-6} for all carcinogenic compounds.

5. Prevent contact with soil contamination which, through ingestion or dermal contact, produces a hazard quotient greater than 1 for each non-carcinogenic compound and a total hazard index of 1 to 10.

6. Prevent the leaching of contaminants from the soil to the groundwater that would result in groundwater contamination in excess of drinking water standards.

7. Prevent or mitigate the release of contaminants to the Souhegan River in excess of surface water standards.

B. Technology and Alternative Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives was developed for the site. With respect to source control, the RI/FS developed a range of alternatives in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This range included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing to the degree possible the need for long term management. This range also included alternatives that treat the principal threats posed by the Site but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; alternative(s) that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative.

With respect to groundwater response action, the FS developed a limited number of remedial alternatives that attain site specific remediation levels within different time frames using different technologies; and a no action alternative.

As discussed in Chapter 3.4 of the FS, soil and groundwater treatment technologies were identified, assessed and screened on implementability, effectiveness, and cost. These technologies were combined into source control (SC) and management of migration (MOM) alternatives. Chapter 3.4 of the Feasibility Study 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 National Contingency Plan ("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 detail in Chapters 4.2 and 4.3 of the FS.

In summary, of the 30 source control and 39 management of migration remedial alternatives screened in Chapters 3.4, 35 were retained as possible options for the cleanup of the Site. From this screening, remedial options were combined, and eight (8) source control and six (6) management of migration alternatives were selected for detailed analysis.

VIII. DESCRIPTION OF ALTERNATIVES

A. Source Control (SC) Alternatives Analyzed

The source control alternatives analyzed for the Site include:

SC Alternative 1: *No action*
SC Alternative 2: *Limited action/ Institutional controls*
SC Alternative 3: *Containment*
SC Alternative 4: *Off -site disposal of soils at a chemical waste landfill*
SC Alternative 5: *Off- site incineration*
SC Alternative 6: *Thermal desorption*
SC Alternative 7: *Stabilization/Solidification*
SC Alternative 8: *Solvent Extraction*

Each of the eight source control alternatives are summarized below. A more complete, detailed presentation of each alternative, along with comparison to the nine NCP criteria, are found in Section 4.2 of the FS.

Source Control 1: No-Action

Under this alternative, no actions would be taken to address the threat to public health and the environment from soil contamination found at the Site. The no action alternative would not result in the attainment of the interim cleanup levels for soils or groundwater in the near future. The contaminated soils would remain a threat to human health through dermal contact and ingestion for a very long time, greater than 100 years, and until natural processes reduce the concentrations of the contaminants in the soil. Contaminants would continue to migrate to surface waters, ground water and sediments, and exposures could take place as the temporary cover at Elm Street erodes without continued maintenance.

The only costs associated with this alternative would be for mandated reviews every five years, to determine if the alternative remains protective to human health; this alternative would not provide protection for human health or the environment. EPA must include a no action alternative to serve as a baseline against which to compare the other alternatives.

Estimated time for design and construction:	None
Estimated time for operation:	Indefinitely, however monitoring costs are estimated over 30 years
Estimated capital cost (1996 dollars):	$ 0
Estimated 0 & m (present worth):	$ 4,000 per year for 30 years
Estimated total cost sc-1 (present worth for 30 years at 7% interest):	$51,000

Source Control 2: Limited Action/ Institutional Controls

The implementation of the Limited Action/Institutional Controls alternative would involve taking legal and physical measures to restrict access to and the use of the Fletcher's Paint Site, repairing and maintaining the existing temporary caps, as necessary, and conducting long-term monitoring of the soils, sediments, surface waters and groundwater. Physical measures would include building a fence around both the Elm Street and Mill Street Sites and utilizing the current fencing as much as possible. Land use restrictions would have two purposes:

- Restricting access to the Fletcher's Paint site in order to prevent direct human exposure through dermal contact or ingestion to contaminants in the soil, and
- Restricting future land use at the Fletcher's Paint site to prevent, or limit, residential, recreational and industrial development and prohibiting excavation, drilling, or otherwise intrusive activities at the Site.

The contaminated soils would remain a threat to human health through dermal contact and ingestion for a very long time, greater than 100 years, and until natural processes reduce the concentrations of the contaminants in the soil. Contaminants would continue to migrate to surface waters, ground water and sediments, and exposures could take place as the temporary cover at Elm Street erodes without continued maintenance. If imposed, deed restrictions would be retained at the Fletcher's Paint site until future reviews indicated that the Site no longer posed a human health threat.

Repair and maintenance of the existing caps would also occur under this alternative. The caps, installed and repaired during several of the previous removal actions at the Site, consist of a permeable liner, soil, stone dust, and gravel.

Estimated time for design and construction:	1-3 months
Estimated time for operation and maintenance:	30 years of long-term monitoring and cap maintenance
Estimated capital cost (1996 dollars):	$ 96,000
Estimated 0 & m (present worth):	$ 42,000 per year for 30 years
Estimated total cost sc-2 (present worth for 30 years at 7% interest):	$ 600,000

Source Control-3: Containment

This alternative includes the removal of the top three feet of soil from both the Elm Street and Mill Street Sites in order to install a cap that would protect human health and the environment by eliminating exposure to the contaminated soils, promoting drainage, and minimizing infiltration; and which would be complimentary of the existing natural grade. The actions that would be required under this alternative include:

- Removal of the top three feet of contaminated soils for off-site disposal or treatment.

- Covering of the remaining highly contaminated soils with a protective, impermeable cap to prevent direct contact with the contaminated soils and to prevent infiltration and the leaching of contaminants from the soils into the groundwater in excess of the interim cleanup levels.

- Installation of a vertical underground barrier, called a slurry wall, at the Mill Street area to keep contaminants from migrating away from the Site, and to reduce the amount of groundwater extracted from the Mill Street property and requiring treatment at the surface.

- Installation of an extraction well at the Mill Street Site, within the slurry wall area, to prevent groundwater from migrating out of the contained area. Operation of a groundwater treatment system to treat the extracted groundwater. (Costs for this treatment would be considered with the groundwater "MOM" alternatives).

- Disposal of the excavated soils off-site to either an approved hazardous waste landfill or an approved hazardous waste incinerator.
- The re-routing of the Town's storm water drainage system around the capped areas of the Elm Street Site.
- Use of institutional controls such as deed restrictions to restrict the use of the Site, to prevent activities that could damage the integrity of the cap and allow direct contact with the soil contamination under the cap.

The cap required, a Resource Conservation and Recovery Act ("RCRA") Subtitle C Cap, would consist of several layers of natural (sand, gravel, clay) and man-made materials (synthetic liners) to form an impermeable barrier over the contamination to prevent infiltration. A slurry wall would be installed around the Mill Street Site to keep groundwater from mounding and carrying contamination away from the Site. While not required, the slurry wall would be cost-effective at limiting the amount of groundwater removed from the area over time, which would then require treatment at the surface. The excavated soil would be transported by rail car either to an approved hazardous waste landfill or approved hazardous waste incinerator. Future Site access and use would be restricted to prevent damage to the cap that could release contamination or allow direct contact with the contamination.

Estimated time for design and construction:	13 months
Estimated time for operation:	30 years
Estimated capital cost (1996$):	$ 6.7 million for off-site disposal and $13.1 million for off-site incineration of the excavated soils
Estimated 0 & m (Present Worth):	$42,000 per year for 30 years
ESTIMATED TOTAL COST SC-3 (Present worth for 30 years at 7 % interest):	$ 7.2 million - with off-site landfilling of excavated soils; and $ 13.6 million with off-site incineration of the excavated soils.

SC Alternative 4: Off -Site Disposal of Soils at a Chemical Waste Landfill

Under this alternative, soils would be excavated which exceed soil cleanup levels for risk-based protection at both Elm and Mill Street sites. The excavated soils would be disposed of at a Toxic Substances Control Act (TSCA) approved landfill and/or a RCRA Subtitle D landfill (depending upon PCB concentration). Containment of the remaining contaminated soils at the Site would be consistent with one of three options detailed for the long-term protection of groundwater. The existing storm sewer at the Elm Street Site would be replaced and/or re-routed and clean soils would be used to backfill the Site prior to surface restoration consistent with the expected future uses of the Sites. Specifically, the activities included under this alternative include:

- Removal of the surface soils at both Elm and Mill Street Sites in the top foot (0-1 foot) wherever PCB concentrations are greater than 1 mg/kg.

- At the Elm Street Site, removal of the subsurface soils to a depth of 10 feet (1 to 10 feet) wherever PCB concentrations are greater than 1 mg/kg.

- For all soils deeper than one foot at the Mill Street Site, and deeper that 10 feet at the Elm Street Site, three long-term management options were developed for the long-term protection of the groundwater:

  Option 1, Containment and Capping - Concentrations remaining in the soils would be greater than 500 mg/kg PCB.

  Elm Street – Leave the remaining contaminated soils in place; backfill to a depth that would allow construction of an impermeable RCRA composite cap; construct an RCRA Subtitle C composite cap to minimize infiltration of precipitation through the contamination and into the groundwater; and, implement institutional controls as necessary to allow for future limited access to the site.

  Mill Street - Leave the remaining contaminated soils in place; backfill to a depth that would allow construction of an impermeable RCRA composite cap; construct a RCRA Subtitle C composite cap to minimize infiltration of precipitation through the contamination and into the ground water; construct a hydraulic containment system consisting of a ground water extraction well and a slurry wall; and, implement institutional controls as necessary to allow for future limited access to the site. Groundwater extraction from within the slurry wall system would be considered part of the management of migration alternative selected to complement the source control action.

Option 2, Partial Removal and Capping - Concentrations remaining in the soils would be less than 500 mg/kg PCB.

Elm Street – Excavate all PCB-contaminated soils with concentrations greater than 500 mg/kg PCBs and dispose of them in an off-site TSCA-approved chemical landfill. Over the remaining soils, backfill to a depth which would allow construction of an impermeable single-barrier cap; and, construct a single-barrier cap (RCRA Subtitle D) to minimize infiltration of precipitation through the contamination and into the ground water.

Mill Street – Excavate all PCB-contaminated soils with concentrations greater than 500 mg/kg and dispose of in an off-site TSCA-approved chemical landfill. Over the remaining soils, backfill to a depth which would allow construction of an impermeable single-barrier cap; construct a single-barrier cap (RCRA Subtitle D) to minimize infiltration of precipitation through the contamination and into the groundwater; construct a hydraulic containment system consisting of a groundwater extraction well and a slurry wall; and, implement institutional controls as necessary to allow for future limited access to the site. Groundwater extraction from within the slurry wall system would be considered part of the management of migration alternative selected to complement the source control action.

Option 3, Additional Excavation and Soil Cover - Concentrations remaining in the soils would be less than those capable of leaching into the ground water and causing future contamination in excess of the PCB ground water standard.

Elm Street – Excavate all soils to a concentration at which leaching models and/or column testing show that infiltration through the remaining PCB soil concentrations will not result in future ground water concentrations in excess of the 0.5 $\mu g/l$ Maximum Contaminant Level (MCL) groundwater concentration for PCBs. For the Elm Street Site, 100 mg/kg PCB is used as the value representing the PCB concentration which can remain in the subsurface and not impact the groundwater in the future above drinking water standards. Backfill the excavation with clean fill.

Mill Street – Excavate all soils to a concentration of 1 mg/kg PCB, or to a concentration at which leaching models and/or column testing show that infiltration through the remaining PCB soil concentrations will not result in future ground water concentrations in excess of the 0.5 $\mu g/l$ MCL ground water concentration for PCBs. Backfill the excavation with clean fill.

- Disposal of excavated soils off-site by rail car to a TSCA-approved landfill (for soils with

PCB concentrations greater than 50 mg/kg) and/or a RCRA Subtitle D landfill (for soils with PCB concentrations less than 50 mg/kg), depending upon PCB concentration.

- Backfill of the excavated areas with clean fill and containment of both Elm Street and Mill Street, consistent with one of the three options described above.
- Restoration of the surface of the Sites, consistent with the expected future uses.
- Placement of restrictions on the future use of the Site, to prevent damage to cover materials; and implementation of long-term monitoring consistent with the institutional controls and long-term monitoring described in detail in SC-2.

Estimated time for design and construction:	24 to 29 months, depending on the containment option selected
Estimated time for operation:	30 years (long-term monitoring)

Option	Capital Cost (1996$)	O&M Cost (1996$)			SC-4 Total Net Present Value* (1996$)
		Annual Cost	Years of Operation	O&M Net Present Value	
Base Case	$11,122,700	$36,830	30	$472,897	$11,595,597
Option 1					
Elm Street	$510,600	$5,200	30	$66,768	$577,368
Mill Street	$375,200	$5,200	30	$66,768	$441,968
Option 2					
Elm Street	$1,248,000	$5,200	30	$66,768	$1,314,768
Mill Street	$2,021,900	$5,200	30	$66,768	$2,088,688
Option 3					
Elm Street	$2,786,600	-	-	-	$2,786,600
Mill Street	$4,487,900	-	-	-	$4,487,900

NOTE: * - The Base Case Costs and the costs for one of the "Containment Options" for both Elm Street and Mill Street are added to determine the Total Present Value of the

Alternative for the selected criteria. The containment option selected for Elm Street and Mill street do not have to be the same. Dewatering costs ($500,000) would also need to be added if groundwater treatment is not selected as part of the management of migration portion of the remedy.

SC Alternative 5: Off- Site Incineration

This alternative involves the same activities and long-term management options as described in alternative 4 above, except that the excavated materials would be sent to an off-site hazardous materials incinerator instead of an off-site chemical waste landfill.

Soils that exceed soil cleanup levels for risked-based protection to a depth of one foot at the Mill Street Site and down to 10 feet at the Elm Street Site would be excavated and sent to a TSCA-approved incinerator for treatment and disposal. The existing Elm Street storm sewer would be re-routed and/or replaced; and, the Site would be backfilled with clean fill. The three long-term management options presented in Alternative 4, would be the same, with the exception that any excavated soils would be sent to an incinerator rather than disposed of at a landfill.

Institutional controls restricting the future uses of the Site to prevent damage to the containment materials would be implemented consistent with those previously described in Alternative SC-2.

Estimated time for design and construction:	22 to 27 months, depending on the containment option selected
Estimated time for operation:	30 years (long-term monitoring)

Option	Capital Cost (1996$)	O&M Cost (1996$)			SC-5 Total Net Present Value (1996$)
		Annual Cost	Years of Operation	O&M Net Present Value	
Base Case	$23,834,100	$36,830	30	$472,897	$24,306,997
Option 1					
Elm Street	$506,000	$5,200	30	$66,768	$572,768
Mill Street	$375,100	$5,200	30	$66,768	$441,868
Option 2					
Elm Street	$2,606,500	$5,200	30	$66,768	$2,673,268
Mill Street	$4,877,400	$5,200	30	$66,768	$4,944,168
Option 3					
Elm Street	$7,477,100	-		-	$7,477,100
Mill Street	$8,974,300	-		-	$8,974,300

NOTE: * - The Base Case Costs and the costs for one of the "Containment Options" for both Elm Street and Mill Street are added to determine the Total Present Value of the Alternative for the selected criteria. The containment option selected for Elm Street and Mill street do not have to be the same. Dewatering costs ($500,000) would also need to be added if groundwater treatment is not selected as part of the management of migration portion of the remedy.

SC Alternative 6: Thermal Desorption

The use of Thermal Desorption to reach cleanup levels in the Site soils is currently EPA's **preferred alternative**. The discussion of the preferred alternative includes details which differ slightly from the SC-6- thermal desorption alternative detailed in the FS and in the Proposed

Plan. The FS alternative for SC-6 Thermal Desorption included the same activities and long-term management options as described in alternative SC-4 above, except that the excavated soils would be treated on-site by ex-situ(above ground) thermal desorption instead of being sent off-site to a landfill (SC-4) or incinerator (SC-5).

Under the SC-6 alternative, soils that exceed soil cleanup levels for risked-based protection to a depth of one foot at the Mill Street Site and down to 10 feet at the Elm Street Site would be excavated and treated by on-Site, ex-situ thermal desorption to remove PCB contamination. The treated soils would be returned to the Site. The PCB concentrate would be incinerated off-site at a TSCA-approved incinerator. Any soils that cannot be treated by thermal desorption would be disposed of off-site in a TSCA-approved chemical waste landfill or a RCRA-approved Subtitle D landfill (depending upon PCB concentration). The existing Elm Street storm sewer system would be re-routed and/or replaced. The three long-term management options presented in Alternative SC-4 would be the same, with the exception that any excavated soils would be treated by the on-Site thermal desorber rather than disposed of at a landfill or incinerator.

Institutional Controls restricting the future uses of the Site to prevent damage to the containment materials would be implemented consistent with those previously described in Alternative SC-2.

Estimated time for design and construction:	26 to 31 months, depending on the containment option selected
Estimated time for operation:	30 years (long-term monitoring)

Option	**Capital Cost (1996$)**	**O&M Cost (1996$)**			**SC-6 Total Net Present Value (1996$)**
		Annual Cost	**Years of Operation**	**O&M Net Present Value**	
Base Case	$10,920,700	$36,830	30	$472,897	$11,393,597
Option 1					
Elm Street	$506,000	$5,200	30	$66,768	$572,768
Mill Street	$375,100	$5,200	30	$66,768	$441,868
Option 2					
Elm Street	$1,099,700	$5,200	30	$66,768	$1,166,468
Mill Street	$1,680,600	$5,200	30	$66,768	$1,747,368
Option 3					
Elm Street	$2,193,200	-		-	$2,193,200
Mill Street	$4,957,600	-		-	$4,957,600

NOTE: * - The Base Case Costs and the costs for one of the "Containment Options" for both Elm Street and Mill Street are added to determine the Total Present Value of the Alternative for the selected criteria. The containment option selected for Elm Street and Mill street do not have to be the same. Dewatering costs would also need to be added if groundwater treatment is not selected as part of the management of migration portion of the remedy.

SC Alternative 7: Stabilization/Solidification

This alternative would involve the same steps and long-term management options as alternative SC-4 except that excavated soil would be treated through stabilization/solidification technologies prior to placement back into the Site.

Under this alternative, the soils that exceed soil cleanup levels for risked-based protection to a depth of one foot at the Mill Street Site and down to 10 feet at the Elm Street Site would be excavated and treated by on-Site solidification/ stabilization to contain the PCB contamination. Solidification/Stabilization would occur when a binding agent, such as Portland cement, asphalt, or fly ash, is added to the contaminated soil to encase the contaminants, forming a solid material. The solidified soils would be returned to the Site and an engineered, impermeable cap would be constructed over the solidified soils to limit access to the soils and prevent infiltration of precipitation. Any soils that could not be treated by solidification/ stabilization would be disposed of off-site in a TSCA-approved chemical waste landfill or a RCRA-approved Subtitle D landfill (depending upon PCB concentration). The existing Elm Street storm sewer would be re-routed and/or replaced. The three long-term management options presented in Alternative SC-4 would remain the same, with the exception that any excavated soils would be treated by the on-Site solidification/stabilization unit rather than disposed of at a landfill.

Institutional controls restricting the future uses of the Site to prevent damage to the cap materials would be implemented consistent with those previously described in Alternative SC-2.

Estimated time for design and construction:	24 to 29 months, depending on the containment option selected
Estimated time for operation:	30 years (long-term monitoring)

Option	Capital Cost (1996$)	O&M Cost (1996$)			Total Net Present Value (1996$)
		Annual Cost	Years of Operation	O&M Net Present Value	
Base Case	$7,283,100	$36,830	30	$472,897	$7,755,997
Option 1					
Elm Street	$510,600	$5,200	30	$66,768	$577,368
Mill Street	$376,100	$5,200	30	$66,768	$442,868
Option 2					
Elm Street	$860,800	$5,200	30	$66,768	$927,568
Mill Street	$1,191,200	$5,200	30	$66,768	$1,257,968
Option 3					
Elm Street	$1,581,600	-		-	$1,581,600
Mill Street	$3,122,300	-		-	$3,122,300

NOTE: * - The Base Case Costs and the costs for one of the "Containment Options" for both Elm Street and Mill Street are added to determine the Total Present Value of the Alternative for the selected criteria. The containment option selected for Elm Street and Mill street do not have to be the same. Dewatering costs would also need to be added if groundwater treatment is not selected as part of the management of migration portion of the remedy.

SC Alternative 8: Solvent Extraction

This alternative would involve the same activities and long-term management options as described in alternative SC-4 above, except that the excavated materials would be treated on-site by solvent extraction, instead of being transported to an off-site chemical waste landfill.

Soils that exceed soil cleanup levels for risked-based protection to a depth of 1 foot at the Mill Street Site and down to 10 feet at the Elm Street Site would be excavated and treated on-site using solvent extraction. Solvent extraction of the contaminated soils involves adding a liquid solvent to wash PCBs from the excavated soil. The washing process separates contaminates into treated solids, water and the solvent containing the contamination. The treated soils would be placed back into the Site. The concentrated contaminants would be sent off-site to an approved hazardous waste incinerator. Any soils that cannot be treated by solvent extraction would be disposed of off-site in a TSCA-approved chemical waste landfill or a RCRA-approved Subtitle D landfill (depending upon PCB concentration). The existing Elm Street storm sewer would be re-routed and/or replaced. The three long-term management options presented in Alternative 4, would be the same, with the exception that any excavated soils would be treated using solvent extraction rather than disposed of at a landfill.

Institutional controls restricting the future uses of the Site to prevent damage to the containment materials would be implemented consistent with those previously described in Alternative SC-2.

Estimated time for design and construction:	29 to 35 months, depending on the containment option selected
Estimated time for operation:	30 years (long-term monitoring)

Option	**Capital Cost (1996$)**	**O&M Cost (1996$)**			**SC-8 Total Net Present Value (1996$)**
		Annual Cost	**Years of Operation**	**O&M Net Present Value**	
Base Case	$10,386,500	$36,830	30	$472,897	$10,859,397
Option 1					
Elm Street	$510,600	$5,200	30	$66,768	$577,268
Mill Street	$375,100	$5,200	30	$66,768	$441,868
Option 2					
Elm Street	$1,064,900	$5,200	30	$66,768	$1,131,668
Mill Street	$1,611,000	$5,200	30	$66,768	$1,677,768
Option 3					
Elm Street	$2,077,900	-		-	$2,077,900
Mill Street	$4,696,500	-		-	$4,696,500

*** - The Base Case Costs and the costs for one of the "Containment Options" for both Elm Street and Mill Street are added to determine the Total Present Value of the Alternative for the selected criteria. The containment option selected for Elm Street and Mill street do not have to be the same. Dewatering costs would also need to be added if groundwater treatment is not selected as part of the management of migration portion of the remedy.**

B. Management of Migration (MOM) Alternatives Analyzed

Management of Migration alternatives address contaminants that have migrated into and with the groundwater from the original source of contamination. At the Site, contaminants have migrated from the Mill Street and Elm Street properties into the groundwater and to the Souhegan River. The Management of Migration alternatives evaluated for the Site include:

MOM Alternative 1: *No action*
MOM Alternative 2: *Limited action*
MOM Alternative 3: *Air Stripping*
MOM Alternative 4: *Granular Activated Carbon*
MOM Alternative 5: *U/V Oxidation*
MOM Alternative 6: *Treat at Milford Wastewater Treatment Facility*

Each of the six management of migration alternatives are summarized below. A more complete, detailed presentation of each alternative, along with comparison to the nine NCP criteria, are found in Section 4.3 of the FS.

MOM-1: No-Action

No activity would occur under this alternative. Contaminants would remain in the groundwater and slowly move through groundwater and discharge into the Souhegan River. If soils are addressed under one of the source control alternatives described previously (except no action and limited action), thereby eliminating or controlling the source of the groundwater contamination, then the VOC contamination in the overburden groundwater would persist for 20 to 25 years, while the PCB contamination in the overburden groundwater would persist for more than 100 years. Groundwater restoration time frames are expected to take even longer within the bedrock, and are dependent on the full extent of the contamination within the bedrock. If soils are not addressed, thereby leaving the source of the groundwater contamination in place, the time frame for groundwater restoration to drinking water standards would be much longer. EPA must include a no action alternative to serve as a baseline against which to compare the other alternatives.

Estimated time for design and construction:	No Construction Activity
Estimated time for operation:	30+ years (5 year reviews)
Estimated capital cost (1996 dollars):	$ 0
Estimated 0 & m (present worth):	$4,000 per year
Estimated total cost mom-1 (present worth over 30 years at 7% interest):	$ 51,000

MOM-2: Limited Action/ Institutional Controls

This alternative involves the use of monitored natural attenuation and institutional controls to reach cleanup levels in the groundwater at the Site. This is **EPA's preferred alternative**. Under this alternative, restrictions would be imposed on the use of the groundwater as a drinking water supply for as long as drinking water standards are exceeded. No treatment would occur under this alternative. Contaminants would remain in the groundwater, slowly moving through groundwater to either be reduced to cleanup levels through natural processes or discharged into the Souhegan River. If soils are addressed under one of the source control alternatives described previously (except no action and limited action), thereby eliminating or controlling the source of the groundwater contamination, then the VOC contamination in the overburden groundwater would persist for 20 to 25 years, while the PCB contamination in the overburden groundwater would persist for more than 100 years. Groundwater restoration time frames are expected to take even longer within the bedrock, and are dependent on the full extent of the contamination within the bedrock. If soils are not addressed, thereby leaving the source of the groundwater contamination in place, the time frame for groundwater restoration to drinking water standards would be much longer.

Institutional controls would be implemented in the form of restrictions imposed on the use of the groundwater as a drinking water supply as long as concentrations in the groundwater remain above drinking water standards. Long-term monitoring of the groundwater would be conducted to determine if contaminant concentrations are declining, and to ensure that the contamination is not migrating away from the Site area or impacting the Souhegan River. Monitoring would continue for as long as the contamination levels exceeded the Interim Cleanup Levels. Five (5) year reviews would be conducted to ensure that the restrictions imposed on the use of the groundwater were effective in controlling the human health risk posed by ingestion of the contaminated groundwater.

Estimated time for design and construction:	No Construction Activity
Estimated time for operation and maintenance:	30+ years (5 year reviews)
Estimated capital cost (1996 dollars):	$ 0
Estimated 0 & m (present worth):	$200,000 per year
Estimated total cost mom-2 (present worth over 30 years at 7% interest):	$2.55 million

MOM-3: Groundwater Treatment using Air Stripping

Under this alternative, groundwater would be pumped from several site locations to a central treatment unit. The contaminated groundwater would be treated with an on-site air-stripping tower. Air stripping occurs when air is forced through contaminated waters, and the contamination moves from the water into the air. The captured air emissions are then sent through a filter system (granular activated carbon) that collects the volatile organic chemicals. The spent filter would be sent off-site for recycling or disposal. The treated water would be discharged to the Souhegan River.

Institutional controls would be implemented in the form of restrictions imposed on the use of the groundwater as a drinking water supply as long as concentrations in the groundwater remain above drinking water standards. Long-term monitoring of the groundwater would be conducted to determine if the contamination levels are decreasing, are migrating away from the site area or impacting the Souhegan River. Monitoring would continue for as long as the contamination levels exceeded the interim cleanup levels. Five (5) year reviews would be conducted to ensure that the restrictions imposed on the use of the groundwater were effective in controlling the human health risk posed by ingestion of the contaminated groundwater.

The time frame for the groundwater to reach the cleanup levels is dependent on the source control action selected and implemented. The time to reach groundwater cleanup levels using a groundwater extraction system was estimated using a MODFLOW-based model utilizing groundwater concentrations and the desired cleanup levels. Various pumping rates were also analyzed. If the contaminated soils are addressed under one of the source control alternatives described previously (except no action and limited action), thereby eliminating or controlling the source of the groundwater contamination, then, the VOCs in the groundwater in the overburden, may reach cleanup levels in 5 to 10 years. While the time frame cannot be estimated for TCB and PCBs using this model, they are expected to take many more years to reach their groundwater cleanup levels, and could take up to 100 years depending on the ability of these contaminants to move through the aquifer and be captured by the treatment system. Since PCBs and to a lesser extent TCB are more resistant to the flow of groundwater, the pump and treat alternative has a much lower impact in the removal of those types of contaminants than for the more readily removed contaminants at the Site (VOCs). PCBs, while not typically mobile in groundwater, may move with the particulate materials also found in the groundwater at the Mill Street Site. Any mobile PCB material would be removed readily with the VOCs during the pump and treat operation.

If the contaminated soils are not addressed, thereby leaving the source of the groundwater contamination in place, the time frame for groundwater restoration to drinking water standards would be greater than 100 years.

Future studies will be undertaken during design, to further investigate the groundwater contamination in the bedrock and the impacts of the contamination on the ability of and the estimated time frame of the groundwater within the bedrock to reach drinking water standards in the future. Regardless, groundwater contamination in the bedrock would be expected to take significantly longer to reach cleanup levels, as compared to the overburden.

Estimated time for design and construction:	No Construction Activity
Estimated time for operation and maintenance:	10 years (operation of the pump and treat system in the overburden)
Estimated capital cost (1996 dollars):	$490,000 per year
Estimated 0 & m (present worth):	$450,000 per year
Estimated total cost mom-3 (present worth over 30 years at 7% interest):	$3.77 million

M0M-4: Groundwater Treatment using Granular Activated Carbon

Under this alternative, groundwater would be pumped from several site locations to a central treatment unit. The contaminated groundwater would be treated by filtering the groundwater through granular activated carbon. Chemicals cling to the surface of the carbon material, thereby removing contaminants from the water. The spent carbon can then be sent off-site for recycling or disposal. The treated water would be discharged to the Souhegan River.

Institutional controls would be implemented in the form of restrictions imposed on the use of the groundwater as a drinking water supply as long as concentrations in the groundwater remain above drinking water standards. Long-term monitoring of the groundwater would be conducted to determine if the contamination levels are decreasing, are migrating away from the site area or impacting the Souhegan River. Monitoring would continue for as long as the contamination levels exceeded the interim cleanup levels. Five (5) year reviews would be conducted to ensure that the restrictions imposed on the use of the groundwater were effective in controlling the human health risk posed by ingestion of the contaminated groundwater.

The time frame for the groundwater to reach the cleanup levels is dependent on the source control action selected and implemented. The time to reach groundwater cleanup levels using a groundwater extraction system was estimated using a MODFLOW-based model utilizing groundwater concentrations and the desired cleanup levels. Various pumping rates were also analyzed. If the contaminated soils are addressed under one of the source control alternatives described previously (except no action and limited action), thereby eliminating or controlling the source of the groundwater contamination, then, the VOCs in the groundwater in the overburden may reach cleanup levels in 5 to 10 years. While the time frame cannot be estimated for TCB and PCBs using this model, they are expected to take many more years to reach their groundwater cleanup levels, and could take up to 100 years depending on the ability of these contaminants to move through the aquifer and be captured by the treatment system. Since PCBs and to a lesser extent TCB are more resistant to the flow of groundwater, the pump and treat alternative has a much lower impact in the removal of those types of contaminants than for the more readily removed contaminants at the Site (VOCs). PCBs, while not typically mobile in groundwater, may move with the particulate materials also found in the groundwater at the Mill Street Site. Any mobile PCB material would be removed readily with the VOCs during the pump and treat operation.

If the contaminated soils are not addressed, thereby leaving the source of the groundwater contamination in place, the time frame for groundwater restoration to drinking water standards would be greater than 100 years.

Future studies will be undertaken, to further investigate the contamination in the bedrock and the impacts of the contamination on the ability of and the estimated time frame of the groundwater within the bedrock to reach drinking water standards in the future. Regardless, groundwater contamination in the bedrock would be expected to take significantly longer to reach cleanup levels, as compared to the overburden.

Estimated time for design and construction:	No Construction Activity
Estimated time for operation and maintenance:	10 years (operation of the pump and treat system in the overburden)
Estimated capital cost (1996 dollars):	$370,000 per year
Estimated 0 & m (present worth):	$480,000 per year
Estimated total cost mom-4 (present worth over 30 years at 7% interest):	$3.84 million

M0M-5: Groundwater Treatment using U/V Oxidation

Under this alternative, groundwater would be pumped from several site locations to a central treatment unit. The contaminants in the groundwater would then be destroyed by exposing the contaminated groundwater to ultraviolet light and chemicals such as ozone and peroxide. The treated water would be discharged to the Souhegan River.

Institutional controls would be implemented in the form of restrictions imposed on the use of the groundwater as a drinking water supply as long as concentrations in the groundwater remain above drinking water standards. Long-term monitoring of the groundwater would be conducted to determine if the contamination levels are decreasing, are migrating away from the site area or impacting the Souhegan River. Monitoring would continue for as long as the contamination levels exceeded the interim cleanup levels. Five (5) year reviews would be conducted to ensure that the restrictions imposed on the use of the groundwater were effective in controlling the human health risk posed by ingestion of the contaminated groundwater.

The time frame for the groundwater to reach the cleanup levels is dependent on the source control action selected and implemented. The time to reach groundwater cleanup levels using a groundwater extraction system was estimated using a MODFLOW-based model utilizing groundwater concentrations and the desired cleanup levels. Various pumping rates were also analyzed. If the contaminated soils are addressed under one of the source control alternatives described previously (except no action and limited action), thereby eliminating or controlling the source of the groundwater contamination, then the VOCs in the groundwater in the overburden may reach cleanup levels in 5 to 10 years. While the time frame cannot be estimated for TCB and PCBs using this model, they are expected to take many more years to reach their groundwater cleanup levels, and could take up to 100 years depending on the ability of these contaminants to move through the aquifer and be captured by the treatment system. Since PCBs and to a lesser extent TCB are more resistant to the flow of groundwater, the pump and treat alternative has a much lower impact in the removal of those types of contaminants than for the more readily removed contaminants at the Site (VOCs). PCBs, while not typically mobile in groundwater, may move with the particulate materials also found in the groundwater at the Mill Street Site. Any mobile PCB material would be removed readily with the VOCs during the pump and treat operation.

If the contaminated soils are not addressed, thereby leaving the source of the groundwater contamination in place, the time frame for groundwater restoration to drinking water standards would be greater than 100 years.

Future studies will be undertaken, to further investigate the contamination in the bedrock and the impacts of the contamination on the ability of and the estimated time frame of the groundwater within the bedrock to reach drinking water standards in the future. Groundwater contamination in the bedrock would, however, be expected to take significantly longer to reach cleanup levels, as compared to the overburden.

Estimated time for design and construction:	No Construction Activity
Estimated time for operation and maintenance:	10 years (operation of the pump and treat system in the overburden)
Estimated capital cost (1996 dollars):	$620,000 per year
Estimated 0 & m (present worth):	$440,000 per year
Estimated total cost mom-5 (present worth over 30 years at 7% interest):	$3.82 million

MOM-6: Groundwater Treatment at the Milford Water Treatment Facility

Under this alternative, groundwater would be pumped from several site locations to the Milford Publicly Owned Treatment Works (POTW) for treatment. The treated water would be discharged to the Souhegan River. At this time, it is understood that the Milford POTW may not be able to accept the contaminated groundwater from the Site due to the chlorine-containing compounds. However, this alternative was developed and included for review should the future conditions change and discharge from the Site to the POTW be allowed.

Institutional controls would be implemented in the form of restrictions imposed on the use of the groundwater as a drinking water supply as long as concentrations in the groundwater remain above drinking water standards. Long-term monitoring of the groundwater would be conducted to determine if the contamination levels are decreasing, are migrating away from the site area or impacting the Souhegan River. Monitoring would continue for as long as the contamination levels exceeded the interim cleanup levels. Five (5) year reviews would be conducted to ensure that the restrictions imposed on the use of the groundwater were effective in controlling the human health risk posed by ingestion of the contaminated groundwater.

The time frame for the groundwater to reach the cleanup levels is dependent on the source control action selected and implemented. The time to reach groundwater cleanup levels using a groundwater extraction system was estimated using a MODFLOW-based model utilizing groundwater concentrations and the desired cleanup levels. Various pumping rates were also analyzed. If the contaminated soils are addressed under one of the source control alternatives described previously (except no action and limited action), thereby eliminating or controlling the source of the groundwater contamination, then, the VOCs in the groundwater in the overburden may reach cleanup levels in 5 to 10 years. While the time frame cannot be estimated for TCB and PCBs using this model, they are expected to take many more years to reach their groundwater cleanup levels, and could take up to 100 years depending on the ability of these contaminants to move through the aquifer and be captured by the treatment system. Since PCBs and to a lesser extent TCB are more resistant to the flow of groundwater, the pump and treat alternative has a much lower impact in the removal of those types of contaminants than for the more readily removed contaminants at the Site (VOCs). PCBs, while not typically mobile in groundwater, may move with the particulate materials also found in the groundwater at the Mill Street Site. Any mobile PCB material would be removed readily with the VOCs during the pump and treat operation.

If the contaminated soils are not addressed, thereby leaving the source of the groundwater contamination in place, the time frame for groundwater restoration to drinking water standards would be greater than 100 years.

Future studies will be undertaken, to further investigate the contamination in the bedrock and the impacts of the contamination on the ability of and the estimated time frame of the groundwater within the bedrock to reach drinking water standards in the future. Regardless, groundwater contamination in the bedrock would be expected to take significantly longer to reach cleanup levels, as compared to the overburden.

Estimated time for design and construction:	No Construction Activity
Estimated time for operation and maintenance:	10 years (operation of the pump and treat system in the overburden)
Estimated capital cost (1996 dollars):	$620,000 per year
Estimated 0 & M (present worth):	$310,000 per year
Estimated total cost MOM-6 (present worth over 30 years at 7% interest):	$2.85 million

IX. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section l2l(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 NCP 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 or 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 as the final evaluation of remedial alternatives after EPA has received public comment on the RI/FS and Proposed Plan.

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

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

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Tables 4.4.1-1 and 4.4.2.-1 of the Feasibility Study, and attached to the ROD as Tables 25 and 26.

The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis. Only those alternatives which satisfied the first two threshold criteria were balanced and modified using the remaining seven criteria.

Comparative Analysis of Source Control Alternatives

The comparative analysis of the eight source control alternatives is presented below for each of the NCP evaluation criteria, except State and community acceptance.

Protection of Human Health and the Environment. Alternatives SC-4, Off-site Disposal, and SC-5, Off-site Incineration, would provide the greatest protection of both current and future human health and the environment by requiring the excavation of all soils to a depth of 1 foot at Mill Street and down to 10 feet at Elm Street with contaminant concentrations greater than the soil cleanup levels for risk-based protection. Removal of the contaminated soils to these depths would reduce risks associated with exposure to contaminants from direct contact with and ingestion of soils. The amount of soils deeper than 1 foot at Mill Street and 10 feet at Elm Street to be excavated for Alternatives SC-4 and SC-5 would depend upon which of the three long-term management options was selected. All of the excavated soils for these alternatives would either be disposed of or treated off-site. After excavation, the areas would either be capped with a RCRA composite cap, capped with a single membrane liner, or backfilled with clean soil.

Alternatives SC-6, Thermal Desorption, SC-7, Solidification/Stabilization, and SC-8, Solvent Extraction, would provide slightly less protection of current and future human health and the environment because the contaminated soils would be treated on-Site and placed back in the excavation after treatment. These treated soils, while protective of human health and the environment, would have detectable levels of contamination whereas the clean backfill used for Alternatives SC-4 and SC-5 would not. Treatment of the contaminated soils to a depth of one foot at Mill Street and down to 10 feet at Elm Street would reduce risks associated with exposure to contaminants from direct contact with and ingestion of soils.

Alternatives SC-4, SC-5, SC-6, SC-7, and SC-8 would remediate the risks to human health and environment from the soils at a depth of greater than 1 foot at Mill Street and 10 feet at Elm Street using one of the following three long-term management options:

- Option 1- Containment and Capping - Construction of a RCRA composite cap over the soils contaminated at a depth of greater than one foot at Mill Street and 10 feet at Elm Street and a hydraulic containment system at Mill Street.

- Option 2 - Partial Removal and Capping - Excavation of the soils at a depth greater than 1 foot at Mill Street and 10 feet at Elm Street that contain PCB concentrations greater than 500 mg/kg and treatment or disposal with the other soils, installation of a single barrier cap, and construction of a hydraulic containment system at Mill Street.

- Option 3 - Additional Excavation and Soil Cover - Excavation of the soils at a depth greater than 1 foot at Mill Street and deeper than 10 feet at Elm Street that could cause an exceedance of the PCB Maximum Contaminant Level ("MCL") in ground water, and off-site treatment in a TSCA incinerator or disposal in a RCRA landfill.

Option 3 provides the greatest protection of human health and the environment because it removes all the PCB-contaminated soil that could cause an exceedance of the PCB MCL. By removing the PCB contamination in soils in excess of that capable of exceeding the PCB MCL, Option 3 limits human exposure to PCB contamination through the ingestion of ground water in excess of the MCL and prevents migration of the contamination from the Elm Street Site to the Souhegan River where both human and ecological receptors might come into contact with it.

Option 2 would provides less protection of human health and the environment than Option 3 because it would leave soils deeper than 1 foot at Mill Street and 10 feet at Elm Street contaminated with less than 500 mg/kg in place. This option would require installation of a single barrier cap over the contamination at Elm Street and a single barrier cap with a hydraulic containment system at Mill Street. The caps at both Elm Street and Mill Street would minimize the infiltration of precipitation but soils deeper than 10 feet contaminated with less than 500 mg/kg PCBs would be left slightly above and in contact with the ground water table. The cap and hydraulic containment system at Mill Street would capture contaminated ground water but soils deeper than 1 foot contaminated with less than 500 mg/kg PCB would again be left in place.

Option 1 would provide significantly less protection of human health and the environment than Options 2 or 3 because it would leave all contamination below 1 foot at Mill Street and 10 feet at Elm Street in place. This option would require the installation of a RCRA C composite cap over the remaining contaminated soils at both Elm Street and Mill Street, as well as a hydraulic containment system at Mill Street. The cap at Elm Street would minimize the infiltration of precipitation but high concentrations of PCBs would be left slightly above and in contact with the ground water table. The cap and hydraulic containment system at Mill Street would capture contaminated ground water, but all soil contaminants deeper than 1 foot would be left in place.

Alternative SC-3, Containment, would protect human health and the environment by requiring the excavation of approximately the top three feet of contaminated soils at both the Elm and Mill Street Sites, followed by the installation of a RCRA C composite cap over the contamination in order to limit human and environmental contact with the contaminants. A hydraulic containment system would also be installed at the Mill Street Site. These caps would reduce risks associated with exposure to contaminants from direct contact with and ingestion of soils. Capping the soil contamination that exceeds the cleanup levels for risk-based protection reduces the potential for dermal contact with and ingestion of the contaminated soils. However, as with Options 1 and 2 above, Alternative 3 would leave high concentrations of PCBs above and in contact with the ground water table. The contaminants could then potentially migrate from the Site into the river, where they would pose a risk to human health and the environment. Because this alternative neither removes nor treats the soils deeper than approximately 3 feet, it is considered to be less protective than Alternatives SC-4 through SC-8.

Alternative SC-2, Limited Action/Institutional Controls, would provide a limited amount of protection to human health and the environment by requiring repair of the geotextile membrane that is currently installed over the contamination and by physically and legally restricting the use of the Site, to prevent exposure, access and damage to the cap. Those areas of the Site not currently capped (edges of the Keyes Drive, the banks of the Souhegan River and the Draper Energy property) would require the addition of cover soils and regular maintenance to minimize direct contact and incidental ingestion exposures. The current cap is temporary and would provide neither long-term protection to human health nor long-term containment of the soils. Contaminants would continue to leach from the soils into the groundwater and Souhegan River, at levels which would exceed drinking water standards.

The SC-1, No Action alternative would not be protective of human health or the environment. The no action alternative would not reduce or restrict exposures to the contaminated soils and groundwater at the Site. The risks posed by the contamination to the soils would remain at the current unacceptable levels. Contaminants would also continue to leach from the soils into the groundwater and Souhegan River, at levels which would exceed drinking water standards.

Compliance with ARARs. Federal environmental laws from which ARARs for Alternatives SC-3, SC-4, SC-5, SC-6, SC-7, and SC-8 are derived include TSCA and RCRA. The comparative analysis in the FS was conducted before TSCA 40 CFR, Part 761 was revised. The TSCA PCB Spill Policy would be considered (TBC) during the implementation of the remedial action. The state environmental regulations that are applicable or relevant and appropriate to the alternatives presented above are the State of New Hampshire Air Regulations and New

Hampshire Revised Statutes Annotated, Title XXVI, Chapter 289. Each of these alternatives would meet the requirements of these ARARs.

Alternatives SC-1 and SC-2 do not have any federal ARARs because the contaminated soils would be left in place; however, the TSCA PCB Spill Policy would be considered a TBC requirement. The only state environmental regulation that would be considered an ARAR is the State of New Hampshire Air Regulations for fugitive dusts during any excavation or repair of the geotextile liner. Alternatives SC-1 and SC-2 would not meet the intent of the TSCA PCB Spill Policy because they would leave PCBs greater than 1 mg/kg on the Site and would not adequately protect human health and the environment.

A brief discussion of how the alternatives meet these requirements follows:

TSCA: The PCB Disposal Requirements promulgated under TSCA are applicable to Alternatives SC-3 through SC-8 because these alternatives involve storage and disposal of soils and liquids contaminated with PCBs in excess of 50 mg/kg. The PCB-contaminated extract produced from the thermal desorption and solvent extraction treatment (SC-6 and SC-8) as well as contaminated soils in Alternatives SC-3 and SC-5 would be treated off-site in an incinerator meeting the standards of 40 C.F.R. §761.69. Soils generated by Alternatives SC-3 and SC-4 and any soils or debris contaminated with PCBs that cannot be treated or incinerated in Alternatives SC-5 through SC-8 and have a PCB concentration greater than 50 mg/L would be disposed of off-site in a landfill meeting the requirements of 40 CFR §761.75.

In Alternatives SC-6 and SC-8, the PCB-contaminated soils would be treated on-site and placed back in the excavated area with a residual PCB contamination of 1 mg/kg. Placement of soils with PCB levels of approximately 1 mg/kg under a 10-inch soil cover would provide a permanent and protective remedy that satisfies the TSCA Spill Policy, and requirements of the Part 761 landfill regulations. Long-term monitoring of ground water wells may also be instituted, as required by the chemical waste landfill regulations.

For Alternative SC-7, the contaminated soils would be solidified to reduce the mobility of the contaminants. Under the Disposal Requirements, 40 CFR §761.60(a)(4), 761.60(e), soils contaminated with PCBs may be disposed of in an incinerator, chemical waste landfill, or may be disposed of by an alternate method that provides a performance similar to that of incineration. In this case, placement of solidified soils in the excavated pits and construction of an impermeable cap over the Site or a hydraulic containment system would satisfy the requirements of a TSCA landfill. The monitoring of ground water wells would be instituted, as required by the TSCA landfill regulations.

Alternatives SC-3 through SC-8 would also comply with the storage requirements of the PCB Disposal Regulations by the construction of a storage area meeting the standards of 40 CFR §761.65.

Neither SC-1 nor SC-2 would meet the intent of the TSCA PCB Spill Policy because they would leave soils contaminated with greater than 1 mg/kg PCBs on the Site and would not adequately protect human health and the environment.

RCRA: The applicability of Hazardous and Solid Waste Amendments to RCRA (HSWA) regulations as action-specific requirements for disposal depends on whether the wastes are hazardous, as defined under RCRA. The wastes at the Site have not been characterized as RCRA waste but are similar to RCRA waste, therefore RCRA is relevant and appropriate to wastes left in place. HSWA Land Disposal Restrictions do not apply because placement does not occur.

The minimum technology standards for closure of the excavated areas are based on TSCA and RCRA landfill regulations. In this case, landfill requirements may be relevant and appropriate for contamination left on Site. Under the SC-4 through SC-8 alternatives, the capping options are consistent with these closure requirements.

Executive Order 11988, Floodplain Management: This executive order sets forth EPA policy to minimize the impact of floods and preserve the natural and beneficial value of floodplains, and provides for consideration of floodplains during remedial actions. All systems in Alternatives SC-3 through SC-8 would be assembled and operated away from the 100-year floodplain. If Alternative SC-3 or Option 1 or 2 for Alternatives SC-4 through SC-8 is chosen for Elm Street, the cap would be constructed with engineering controls to prevent damage from a 100-year flood.

NH Air Regulations: Dust emissions from the Site during Alternatives SC-2 through SC-8 would comply with the Clean Air Act and the State of New Hampshire Air Regulations for dust emissions during excavation and transportation of the contaminated soils. Engineering controls would be used to minimize the fugitive dust emissions, including wetting the soils and using foams.

In Alternative SC-6, the thermal desorption system would discharge between 25 and 75 scfm of treated nitrogen carrier gas to the atmosphere. Air monitoring would be performed to ensure compliance with the New Hampshire air regulations.

In Alternative SC-8, the solvent extraction system is a closed system to minimize air emissions but nitrogen gas does flow through the extractor in order to create an oxygen free environment and to purge any non-condensible gases. Air monitoring would be performed to verify that the NH Ambient Air Levels are met.

NH Cemetery Regulations: Alternatives SC-3 through SC-8 would require demolition of the Fletcher building in order to contain or remove all the contamination at Elm Street. In removing this building the New Hampshire historic regulations would be applicable because of the possibility of affecting the historic cemetery that is adjacent to the building.

Long-Term Effectiveness and Permanence. Alternatives SC-4 and SC-5 would provide the greatest long-term effectiveness and permanence by excavating all soils to a depth of 1 foot at Mill Street and down to 10 feet at Elm Street containing contaminant concentrations greater than soil cleanup levels for risk-based protection. The excavated soils would then be either disposed of or treated off-site. After excavation, clean soil would be backfilled into the area. Removal of the contaminated soils to a depth of 1 foot at Mill Street and 10 feet at Elm Street would reduce risks associated with exposure to contaminants from direct contact with and ingestion of soils. Removing the soil contamination that exceeds the cleanup levels for risk-based protection reduces the ingestion and dermal contact risks. The long-term controls required at the Site would be dependant upon which of the long-term management options was selected for the soils deeper than 1 foot at Mill Street and 10 feet at Elm Street. If Option 3 is chosen for both Elm Street and Mill Street using either SC-4 or SC-5, long-term controls would not be required because both alternatives would meet EPA criteria for remediation of PCB-contaminated Sites.

Alternatives SC-6 and SC-8 would provide slightly less long-term effectiveness and permanence because the contaminated soils would be treated on Site and placed back in the excavation after treatment. These treated soils, while protective of human health and the environment, would have detectable levels of contamination, whereas clean backfill would not. Treatment of the contaminated soils to a depth of 10 feet would reduce risks associated with exposure to contaminants from direct contact with and ingestion of soils. Treating the soil contamination that exceeds the cleanup levels reduces the total risk due to ingestion of and dermal contact with the soil.

SC-7 would provide only moderate long-term effectiveness and permanence because, while it would reduce the risks from ingestion and dermal contact as effectively as SC-6 or SC-8, implementation of the alternative would not destroy or remove contamination from the Site. One specific concern is the long-term uncertainty associated with the integrity of the solidified material and the possibility that contaminants could leach in the future. Because of the uncertainty with solidification/ stabilization, long-term monitoring and controls would be required for the Site.

Each of these five alternatives (SC-4, SC-5, SC-6, SC-7, SC-8) would achieve long-term effectiveness and permanence for the soils at a depth of greater than 10 feet using one of three options:

- Option 1 - Containment and Capping - Construction of a RCRA composite cap over the soils contaminated at a depth of greater than 1 foot at Mill Street and 10 feet at Elm Street and a hydraulic containment system at Mill Street.

- Option 2 - Partial Removal and Capping - Excavation of the soils at a depth greater than one foot at Mill Street and 10 feet at Elm Street that contain PCB concentrations greater than 500 mg/kg and treatment or disposal with the other soils, installation of a single barrier cap, and construction of a hydraulic containment system at Mill Street.

- Option 3 - Additional Excavation and Soil Cover - Excavation of the soils at a depth greater than one foot at Mill Street and deeper than 10 feet at Elm Street that could cause an exceedance of the PCB MCL in ground water, and off-site treatment in a TSCA incinerator or disposal in a RCRA landfill.

Option 3 provides the greatest protection of human health and the environment because it removes all the PCB-contaminated soil that could cause an exceedance of the PCB MCL. By removing the PCB contamination in soils in excess of that capable of exceeding the PCB MCL, Option 3 limits human exposure to PCB contamination through the ingestion of ground water in excess of the MCL and prevents migration of the contamination from the Elm Street Site to the Souhegan River where both human and ecological receptors might come into contact with it. Therefore Option 3 would not require extensive long-term monitoring and controls.

Option 2 would provides less protection of human health and the environment than Option 3 because it would leave soils deeper than 1 foot at Mill Street and 10 feet at Elm Street contaminated with less than 500 mg/kg in place. This option would require installation of a single barrier cap over the contamination at Elm Street and a single barrier cap with a hydraulic containment system at Mill Street. The caps at both Elm Street and Mill Street would minimize the infiltration of precipitation but soils deeper than 10 feet contaminated with less than 500 mg/kg PCBs would be left slightly above and in contact with the ground water table. The cap and hydraulic containment system at Mill Street would capture contaminated ground water but soils deeper than one foot contaminated with less than 500 mg/kg would again be left in place. Because contamination would be left on Site, institutional controls would be required.

Option 1 would provide significantly less protection of human health and the environment than Options 2 or 3 because all contamination below one foot at Mill Street and 10 feet at Elm Street would be left in place. This option would require the installation of a RCRA C composite cap over the remaining contaminated soils at both Elm Street and Mill Street, as well as a hydraulic containment system at Mill Street. The cap at Elm Street would minimize the infiltration of precipitation but high concentrations of PCBs would be left slightly above and in contact with the ground water table. The cap and hydraulic containment system at Mill Street would capture contaminated ground water but all soil contaminants deeper than 1 foot would be left in place. Because contamination would be left on Site, long-term monitoring and controls would be required.

Alternative SC-3 would provide less long-term effectiveness and permanence than the other alternatives discussed thus far. The concern with SC-3 is that it would only remove contamination from the top 3 feet of soils and would leave high concentrations of PCBs above and in contact with the ground water table. The contaminants could then potentially migrate from the Site into the river, where they would pose a risk to human health and the environment. Because this alternative neither removes nor treats the soils to 10 feet, it is considered to be significantly less effective than SC-4 through SC-8.

Neither SC-1 nor SC-2 would provide long-term effectiveness and permanence. SC-1 would not remove or cover any of the contamination that is on Site and therefore leaves the Site in its current state. SC-2 does cover the contamination but, as can be seen by the continued migration of contamination, it is not an effective long-term alternative.

Reduction of Toxicity, Mobility, or Volume through Treatment. Alternatives SC-5, SC-6, and SC-8 provide reductions in toxicity, mobility, and volume through the treatment and ultimate destruction of the contaminants. SC-5 requires the excavation and off-site incineration of the contaminated soil. The incineration would oxidize the contaminants to carbon dioxide, water and hydrochloric acid. SC-6 requires the excavation and thermal desorption of the contaminated soils. Thermal desorption would volatilize the contaminants and then condense them separately from the soil. The condensed contaminants would then be incinerated at an off-site TSCA incinerator. Similarly, SC-8 separates the contaminants from the soils using solvent extraction and incinerates the separated contaminants in an off-site TSCA incinerator.

The amount of contamination removed and treated from the Site using one of the three alternatives discussed above depends on the option chosen for the remediation of soils deeper than 10 feet at Elm Street and deeper than 1 foot at Mill Street. The estimated total volume of contaminated soil for the base case at both Elm Street and Mill Street is 24,000 CY. Assuming an average PCB concentration of 1,300 mg/kg, if the PCB-contaminated soils are removed to a cleanup level of 1 mg/kg, these alternatives are estimated to remove and treat 37,000 kg of contaminants for the base case.

Depending on the option chosen for the remediation of the remaining soils, the reduction of toxicity, mobility, and volume would increase. If Option 1 is chosen, there would be no increase in the reduction of toxicity, mobility, or volume through treatment because the remaining soils would be capped and left in place. Option 3 represents the largest increase in reduction of toxicity, mobility, or volume because all of the remaining soil with PCB concentrations that could impact ground water would be removed. The estimated total volume of contaminated soil for Option 3 at Elm Street and Mill Street is 5,300 yd^3 and 12,000 yd^3. The resulting total contaminant removal for this option would be 10,000 kg. If Option 3 is chosen, all remaining soils with PCB concentrations greater than 500 mg/kg would be excavated and a single barrier cap installed. Option 3 would result in an additional 1,600 yd^3 from Elm Street and 3,200 yd^3 from Mill Street being removed, resulting in the additional removal of approximately 6,000 kg of PCBs.

Alternative SC-7, Solidification/Stabilization, would immobilize the contamination from the excavated soil but would have no effect on the contaminant toxicity, and would increase the contaminant volume through the addition of binding agents by approximately 20 to 25 percent. Capping of the remaining contaminants or excavation and treatment of the remaining contaminants would reduce the mobility of the contaminants. However, while the mobility would be decreased the level of toxicity would remain the same and the contaminant volume would increase due to the addition of binding agents.

The other four alternatives, SC-1, SC-2, SC-3, and SC-4, would not affect the toxicity, mobility, or volume of the contamination through treatment, with the exception of SC-3, which would result in the removal of soils from the top 3 feet to install the cap. If those soils are incinerated rather than landfilled, SC-3 will result in the reduction of the toxicity, mobility, and volume of a portion of the contamination. SC-4 would remove the contamination from the Site but would dispose of the contaminated soil in a TSCA-approved landfill. SC-3 would contain the vertical migration of the contaminants through the installation of a cap over the contamination.

Short-Term Effectiveness. One of the major uncertainties for Alternatives SC-3 through SC-8 is the protection of the community and Site workers while the soils are being excavated. The concern is caused by the proximity of the residents to the Site, the high volume of vehicular traffic on Elm Street (approximately 20,000 vehicles per day), and the high concentration of PCBs in the soils. To limit this risk during excavation, wetting agents and other engineered controls would be used to reduce the particulate emissions from the Site. However, the actual air emissions that would result from the excavation is uncertain and air monitoring would be performed to ensure that the community and Site workers were not exposed to undue risks. In order to minimize the risk to workers, trained personnel would operate the system. The risk to residents, and/or inconvenience to the residents could also be minimized by relocating some of the residents on Mill Street during the excavation of the Mill Street area. Adjacent portions of Keyes Field may also need to be temporarily closed during the remedial action if air monitoring demonstrates an exceedance.

Additional short-term risks would be presented by Alternatives SC-4 and SC-5 due to the need to transport the contaminated soils off Site for disposal and incineration, respectively.

Alternative SC-2 would present minimal risks to the community while the geotextile membrane was being installed. Risks to the workers would be similar to Alternatives SC-4 through SC-5 and activities associated with these alternatives may require the workers to use Level C protection.

To ensure protection of the environment, all remedial alternatives would be constructed and operated above the 100-year floodplain level. This measure would prevent accidental flooding if the water level of the Souhegan River rose substantially. All caps would have engineering controls for protection. In addition, storm water collection systems would be designed to collect runoff from the Site in order to minimize the spread of contamination.

Implementation. In general, Alternatives SC-4 through SC-8 should be both technically and administratively implementable. However, two issues do pose a potential concern regarding the ability to implement these alternatives as described. Because the Sites are small, space consideration is the largest consideration in implementing any of the alternative. Use of a portion of the adjacent Keyes Field, with the Town's permission, may be considered if all operations cannot be conducted solely on the Site itself. Consideration of the use of Keyes Field would be focused on staging of clean fill, equipment and construction offices, as necessary. Also related to this issue is the potential inconvenience of closing all or portions of Mill Street, Elm Street and the Keyes Drive even temporarily during the excavation.

Another issue for implementing the alternatives at the Mill Street Site is the active railway that borders the Mill Street Site. A representative from Boston & Maine Railroad met with the EPA and members of the local businesses, and discussed allowable modification of the rail spurs running through the Mill Street Site in order to allow the remedial action to take place while continuing to operate one rail spur at all times. Discussions with the railroad would need to continue through the remedial design and action to ensure the safe implementation of any of the alternatives.

An additional concern for Alternatives SC-6 through SC-8 is the ability to treat the soils to the PCB cleanup level. Each of these technologies is considered innovative technologies, and has somewhat limited operating experience. Because of the limited experience and the variability between Sites, treatability studies may be required for each of these alternatives.

Alternatives SC-1 through SC-3 would be technically easy to implement. However, there are administrative considerations that may impact their overall implementability. Among these considerations are the potential for future use restrictions to be imposed as a result of the continued existence of contamination at the Fletcher's Paint Site and potential liabilities associated with the continued presence of PCBs in the subsurface.

Cost

Comparative Cost of Source Control Alternatives

Alternative	Capital Cost (a) ($1996)	O & M Cost (a) ($1996)	Total Cost (a) ($1996)		
SC-1 No Action	—	$51,000	$51,000		
SC-2 Limited Action	$96,000	$460,000	$600,000		
SC-3 Containment and Off-site Disposal	$6,700,000	$540,000	$7,240,000		
SC-3 Containment and Off-site Incineration	$13,000,000	$540,000	$13,500,000		
SC-4 TSCA Landfill (Base Case)	$11,000,000	$470,000	$11,500,000		
Option 1 - Elm St.	$510,000	$67,000	$290,000		
Option 1 - Mill St.	$370,000	$67,000	$100,000		
Option 2 - Elm St.	$1,200,000	$67,000	$1,270,000		
Option 2 - Mill St.	$2,000,000	$67,000	$2,070,000		
Option 3 - Elm St.	$2,800,000	/////	$2,800,000		
Option 3 - Mill St.	$4,500,000	/////	$4,500,000		
				Range of Costs for SC-4, depending on long-term management options selected:	$11,890,000 to $18,800,000
SC-5 TSCA Incinerator (Base Case)	$24,000,000	$470,000	$24,500,000		
Option 1 - Elm St.	$510,000	$67,000	$290,000		
Option 1 - Mill St.	$370,000	$67,000	$100,000		
Option 2 - Elm St.	$2,600,000	$67,000	$2,670,000		
Option 2 - Mill St.	$4,900,000	$67,000	$4,970,000		
Option 3 - Elm St.	$7,500,000	/////	$7,500,000		
Option 3 - Mill St.	$9,000,000	/////	$9,000,000		
				Range of Costs for SC-5, depending on long-term management options selected:	$24,890,000 to $41,000,000

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SC-6 Thermal Desorption (Base Case)	$11,000,000	$470,000	$11,500,000		
Option 1 - Elm St.	$510,000	$67,000	$290,000		
Option 1 - Mill St.	$370,000	$67,000	$100,000		
Option 2 - Elm St.	$1,100,000	$67,000	$1,170,000		
Option 2 - Mill St.	$1,700,000	$67,000	$1,770,000		
Option 3 - Elm St.	$2,200,000	/////	$2,200,000		
Option 3 - Mill St.	$5,000,000	/////	$5,000,000		
				Range of Costs for SC-6, depending on long-term management options selected:	$11,890,000 to $18,700,000
SC-7 Solidification/Stabilization (Base Case)	$7,300,000	$470,000	$7,770,000		
Option 1 - Elm St.	$510,000	$67,000	$290,000		
Option 1 - Mill St.	$380,000	$67,000	$100,000		
Option 2 - Elm St.	$860,000	$67,000	$927,000		
Option 2 - Mill St.	$1,200,000	$67,000	$1,270,000		
Option 3 - Elm St.	$1,600,000	/////	$1,600,000		
Option 3 - Mill St.	$3,100,000	/////	$3,100,000		
				Range of Costs for SC-7, depending on long-term management options selected:	$8,160,000 to $12,470,000
SC-8 Solvent Extraction (Base Case)	$10,000,000	$470,000	$10,500,000		
Option 1 - Elm St.	$510,000	$67,000	$290,000		
Option 1 - Mill St.	$370,000	$67,000	$100,000		
Option 2 - Elm St.	$1,100,000	$67,000	$1,170,000		
Option 2 - Mill St.	$1,600,000	$67,000	$1,670,000		
Option 3 - Elm St.	$2,100,000	/////	$2,100,000		
Option 3 - Mill St.	$4,700,000	/////	$4,700,000		
				Range of Costs for SC-8, depending on long-term management options selected:	$10,890,000 to $17,300,000

Note:

Cost shown for Options is the amount to be added to the base case cost

////// No associated cost

(a): Total NPV at a 7% interest rate; discount factor used dependant upon time required to complete remediation.