TECHNICAL MEMORANDUM NO. 6
PROPOSED CLEANUP GOALS AND JUSTIFICATION

TAYLOR INSTRUMENTS SITE INVESTIGATION
95 AMES STREET
ROCHESTER, NEW YORK

NOVEMBER 1997

This document is being submitted by Combustion Engineering for settlement purposes and in support of the offer of proposed on-site cleanup levels for the Taylor Instruments Site. Should the cleanup levels proposed not be accepted by NYSDEC, and should subsequent discussions prior to November 30, 1997 (or agreed-upon alternate date) also fail to produce mutually agreeable on-site cleanup levels, Combustion Engineering withdraws this document in its entirety.

ABB Environmental Services, Inc.

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Technical Memorandum No. 6
Proposed Cleanup Goals and Justification
Taylor Instruments Site

This document is submitted to the Department in partial satisfaction of a Voluntary Cleanup Agreement and as a settlement proposal. If agreement on cleanup standards is not reached pursuant to the VCA, CE withdraws this proposal.

I. Introduction

In this Technical Memorandum ("TM"), CE provides its proposed on-site cleanup levels for the Taylor Instruments Site ("Site"). This TM is the sixth in a series of TM which submitted and discussed the results of supplemental investigations performed at the Site in 1997. Accompanying this TM is a draft Evaluation of On-Site Remedial Alternatives" which evaluates, against the criteria for remedy selection set forth in 6 NYCRR Part 375 (§375-1.10), various remedial options and considers their technical implementability at assumed cleanup levels ranging from ones set forth in TAGMs to the levels demonstrated to be protective for the intended future industrial/commercial use of the Site.

Pursuant to the Voluntary Cleanup Agreement ("VCA") entered into by the parties, these TMs will be incorporated into an Investigative Report which summarizes the extensive site investigations performed in 1996 and 1997, the 1996 Human Health Risk Assessment, and any feedback received from NYSDEC on CE's 1997 series of Technical Memoranda. The detailed remedial alternatives evaluation presented in the draft FS, which is an attachment to this TM No. 6, also will be included in the Investigative Report. Ultimately, a Work Plan will be developed to describe how agreed-upon on-site cleanup goals will be achieved, once off-site cleanup goals are also agreed upon, pursuant to the schedule established in the VCA.

As further explained below, CE's proposed goals are protective of human health and the environment taking into account the current and proposed uses of the Site, and they conform to NYSDEC standards, criteria and guidance to the extent they are applicable, relevant and appropriate. The proposed goals are also consistent with cleanups performed at other sites (including ones within New York State) and with standards for site remediation established in other states and by EPA based upon generally accepted and peer reviewed scientific evidence. CE has applied the most advanced technical analytical techniques currently available to evaluate how mercury, in particular, can affect human health and the environment.

Because the Site is located within an Economic Development Zone and a City of Rochester Enterprise Zone, and because the City has expressed great interest in the development potential of its largest vacant parcel of industrially zoned property, CE has made every effort in its proposal to identify a remedial approach and cleanup goals that render the site safe for beneficial redevelopment for industrial and commercial purposes rather than simply proposing to cap the site. CE elected to pursue remediation of this property pursuant to the VCA program in large part due to that program's focus on establishing cleanup objectives based on applying NYSDEC guidance on determining soil cleanup levels under exposure scenarios tailored to the circumstances of the site's contemplated use. [See, *The Department of Environmental Conservation's Brownfields Programs*, by Charles E. Sullivan, Jr., Esq., Chief, State Superfund and Voluntary Cleanup Practice Group, Division of Environmental Enforcement, 27 March 1997, p.2.] CE's 1996 Human Health Risk Assessment and the 1997 supplemental investigations focused on realistic exposure scenarios likely to be encountered anticipating a commercial ("big box-type") use, assuming certain institutional controls are applied, because this is the use the City has indicated has the greatest potential for the site and is most consistent with the City's objectives within the development zone.

II. Proposed Cleanup Goals and Remedial Action Concept (On-Site)

CE proposes the following cleanup goals for the Taylor Instruments site.

A. Mercury

1. Previous Proposals -- The 1996 Human Health Risk Assessment ("HHRA") demonstrated that, with appropriate institutional controls, due to the very stable (low mobility) character of the mercury present at the site and because of its low bioavailability, it is safe to use the site for commercial and industrial purposes with residual levels of mercury as high as 2500 ppm. NYSDEC and NYDOH expressed concerns about this level and the modelling assumptions upon which it was based, and requested additional investigations, particularly with respect to the issue of the extent to which mercury in soils can volatilize and create vapor exposures in buildings constructed over soils with residuals at that level. CE ultimately proposed, in April 1997, a cleanup goal of 400 ppm for mercury based on other site remediations throughout the USA establishing cleanup goals at or near that level.

CE performed a supplemental investigation which, as discussed in TM 5, indicated that mercury levels at the site, even if left in place, most likely would not produce a vapor inhalation threat to occupants of a future industrial/commercial structures of slab-on-grade construction. Further, the supplemental investigation indicated that a remedial approach which removes or isolates soils containing mercury above approximately 4,000 mg/kg should permanently preclude the potential for an inhalation threat under this future use scenario. However, in limited areas of highest average mercury concentrations e.g. where substantial glass shard waste is present in an excavation, exposure to mercury vapors may exceed worker exposure standards. Such potential exposures could be easily mitigated through the use of standard health and safety procedures. In addition, as discussed in TM 2, mercury was detected in low levels in water and sediment samples collected in on-site and nearby off-site sewers. The sources of this mercury were interpreted to be a combination of infiltration of mercury contaminated groundwater into, and the presence of contaminated sediments, in the sewers. Past repair and/or replacement of on-site sewer lines is believed to have resulted in an improved and improving situation. These investigations (see TM 4) also showed that despite mercury having been present in soils for many decades, the highest levels have remained confined to groundwater close to soils continuing elevated levels of mercury (concentrated glass shard waste areas).

2. Current Proposal -- NYSDEC has expressed a desire for CE to address "gross contamination" apparently consistent with its developing concept of removing "readily apparent contamination." NYSDEC has also stated that any departures from the TAGM for mercury (0.1 ppm) must be justified by applying the good cause criteria of 6 NYCRR §375-1.10(c)(1)(a-d), and it has requested that CE consider the precedential effect of any cleanup goal proposed for mercury. NYSDEC also stated that environmental considerations must be considered in addition to human health exposures. In considering these comments, CE proposes to both remove the identified mercury source material and perform additional soil cleanup in order to eliminate human health and environmental threats as follows:

- Removal of "concentrated glass shard wastes" and soil containing visible liquid mercury from the Site;
- Implementation of one of the identified remedial alternatives for on-Site soils containing mercury concentrations in excess of 150 mg/kg (ppm);
- Replace removed or treated soils with clean soil containing 0.1 mg/kg (ppm) or less of mercury;
- Eliminate introduction of Site-related mercury into the Ames Street and Hague Street sewers from Taylor Instruments sewer connections (i.e., replacement of all remaining clay tile sewer lines to eliminate the potential for infiltration [most former process-related sewer connections were removed or severed as an IRM]);
- Imposition of legally enforceable institutional controls (such as deed restrictions as contemplated in the VCA) for all or portions of the Site to ensure that future site uses are limited to commercial / industrial applications, that such uses do not include use of groundwater or construction of basements; and
- Post-remediation perimeter groundwater monitoring for a period of one year to confirm that mercury levels in the on-Site overburden and bedrock groundwater remain at or below New York's groundwater standard.

Figure 6-1 indicates the approximate areas where concentrated shard wastes and soils with mercury greater than ~~100~~ mg/kg would be removed.

150

B. TCE

1. Previous Proposals -- The 1996 HHRA suggested that, with appropriate institutional controls to eliminate the potential for direct contact with soils, it is safe to use the site for commercial and industrial purposes with residual levels of TCE in on-site soils as high as 140 mg/kg if engineering restrictions are applied. NYSDEC expressed concerns about the potential for volatile organic compounds to present off-site inhalation exposures through volatilization from groundwaters into basements or through soil gases, and requested additional investigations. CE ultimately proposed, in April 1997, a cleanup goal of 2.7 ppm for TCE in overburden unsaturated soils, based on other site remediations throughout the USA, and in New York, which had established cleanup goals at or near those levels.

CE performed a supplemental investigation which, as explained in TM 3, demonstrated that, off-Site residential and commercial receptors were not subject to inhalation risk from Site-related VOCs, and that, with the exception of two source areas, the same is true at the Site. The additional data allow an estimation of groundwater and soil concentrations which would be protective of an inhalation risk at the Site. As discussed in TM 1, TCE concentrations range up to just under 10 mg/kg (ppm) in the two source areas while outside the source areas, TCE levels in soil are either very low (approximately 10 ug/kg (ppb)) or not detected at all. Other chlorinated VOC's (TCE degradation products) were found in association with TCE and at much lower levels. During the supplemental investigation TCLP analyses for VOCs detected only TCE and only in the high-TCE concentration samples from the TCE source areas. As discussed in TM 2, TCE and its breakdown products were found at several on and off-site sewer locations. Only 2 (of 6) of the samples contained detectable VOCs in sediments and these were on-site samples. ABB-ES' interpretation is that the VOCs are entering on-site sewers via infiltrating groundwater; sediments are probably not a significant contributing source. Past repair and/or replacement of on-site sewer lines is believed to have resulted in an improved and improving situation.

2. Current Proposal - CE proposes to address the two TCE source areas in order to eliminate human health (inhalation) risk and remove the primary potential source of environmental (i.e., groundwater) impact. CE proposes to address these concerns as follows:

- Implementation of one of the identified remedial alternatives for on-Site soils containing TCE concentrations in excess of 7 mg/kg (ppm) and/or Total VOC concentrations in excess of 10 mg/kg (ppm). This proposal is *not* restricted to the unsaturated zone in the overburden soils.

- Eliminate introduction of Site-related TCE into the Ames Street and Hague Street sewers from Taylor Instruments sewer connections (i.e., through replacement of all remaining clay tile sewer lines to eliminate the potential for infiltration [most former process-related sewer connections were removed or severed as an IRM]);

- Imposition of legally enforceable institutional controls (such as deed restrictions as contemplated in the VCA) for all or portions of the Site to ensure that future site uses are limited to commercial / industrial applications, that such uses do not include use of groundwater or construction of basements; and

- This soil remediation proposal is intended to address soils as a source of groundwater impacts as well as a source of potential inhalation threat. TCE present in groundwater will be considered and, if necessary, addressed as part of the "Evaluation of Off-Site Cleanup Goals and Remedial Actions" report anticipated to be submitted in January 1998, pursuant to the Voluntary Cleanup Agreement. This approach recognizes the linkage between the achievement of on-Site cleanup goals for soils and the off-Site remedial action objectives for groundwater and allows a comprehensive remedial approach to be developed for groundwater.

Figure 6-1 indicates the approximate areas where soils with TCE levels above 7 mg/kg would be remediated or removed.

C. Other Contaminants of Concern (COCs)

CE is not proposing in this memorandum numeric cleanup numbers for lead, PCE, 1,2-DCE and any other Site-related COCs because of their co-location with the mercury and TCE for which cleanup goals were proposed as outlined above. It is CE's expectation that these other contaminants will, therefore, be addressed as a consequence of performing the remediation needed to achieve the proposed final on-Site cleanup goals.

III. Rationale for Proposed On-site Cleanup Levels

CE applied four key considerations in deriving its proposed cleanup goals for the site:

A. Protective of Human Health and the Environment -- CE performed an extensive site-specific human health risk assessment to evaluate all potential pathways which could result in human exposure based on the contemplated future use of the Site. In order to further assure protectiveness of human health and the environment, CE also performed an extensive state-of-the-art mercury vapor investigation and a speciation / bioavailability / bioaccessibility analyses for mercury at the site. These analyses, and the comprehensive modelling into which these data were factored, have been applied at the country's most highly impacted mercury sites and should be considered as scientifically-valid precedents for New York.

These analyses show that the site will be safe for human use, in commercial and industrial contexts, at residual levels of mercury and TCE orders of magnitude above the ones proposed in this document. For example, the mercury level proposed for soil outside of the concentrated shard waste area is more than 200 times less than the 2500 mg/kg level shown to be protective in the HHRA for commercial/industrial worker exposure and 2000 times less than the 25,000 mg/kg level protective for a construction worker. Subsequent analyses demonstrated that the vapor exposure assumptions for mercury utilized in that model were extremely conservative and that even higher levels for mercury in soil would likely be deemed safe to humans. The level proposed for mercury (150 mg/kg) is also substantially below a number that NYSDEC regional technical representatives have acknowledged is technically acceptable and protective of human health and the environment (the 400 mg/kg level contained in the April 1997 TM). In the case of TCE, the level proposed is almost 10 times lower than the approximate level which would be protective of an inhalation exposure, 5 times lower than that which would be protective of a direct contact exposure for a full-time commercial/industrial worker, and over 20 times lower than what would be protective of a direct contact exposure for a construction worker. Similar and higher levels have been deemed by NYSDEC to be protective of human health and the environment.

In terms of protectiveness of the environment, the proposed permanent elimination of the contaminant source areas (the concentrated glass shard wastes and the two TCE source areas) represents a long-term, effective means of dramatically reducing the potential for these areas to impact surrounding soils, groundwater or other environmental media. For mercury, combining source removal with additional removal of soils exceeding 150 mg/kg is clearly protective of the environment for a site which features no environmental receptors and a contaminant that has been demonstrated to have limited mobility in soils, is present in a relatively non-toxic/non-bioavailable forms and which has not been found, generally, in groundwater at levels above the Class GA standard. Completing sewer rehabilitation will eliminate the only known pathway for mercury movement from the Site and removal of the concentrated glass shard wastes and visible liquid mercury soils will eliminate the soil source areas. For TCE, addressing the source areas protects the environment by dramatically reducing potential additional contributions to the bedrock and overburden groundwater at, and moving from, the site. CE intends to evaluate the groundwater impact, to develop off-site cleanup goals and, if necessary, develop an on-site groundwater cleanup goal to protect off-site groundwater and environmental resources, as part of the off-site remedial evaluation.

B. Consistency with New York Standards, Criteria and Guidance

1. Applicable or Relevant Criteria -- It is a policy objective of the Voluntary Cleanup Program to make brownfield sites competitive with greenfield sites by encouraging such sites to be considered for the location of new or expanded commercial or industrial development, thus assuring the community many benefits inherent in the reuse of such sites, consistent with appropriate public health and environmental protections. [See, *The Department of Environmental Conservation's Brownfields Programs*, by Charles E. Sullivan, Jr., Esq., Chief, State Superfund and Voluntary Cleanup Practice Group, Division of Environmental Enforcement, 6 March 1996, p.2.] Cleanup levels established under the policy must be "...a level consistent with the safe use of the property for the purpose to which the volunteer intends the property to be used". "[R]isk-based assessments determine cleanup levels." [Id. at 4-5.] Thus, the ARAR concept does not automatically drive cleanup levels, although they "...must be accounted for in the risk-based assessment decisionmaking..." on a site-specific basis. [Id. at 5.] In a subsequent policy statement, Mr. Sullivan noted that the cleanup objective for on-site must be to make it "...safe for the contemplated use, from a human health and environmental protection perspective..." and that TAGM 4046 "will *guide* soil cleanup determinations." [See, *The Department of Environmental Conservation's Brownfields Programs*, by Charles E. Sullivan, Jr., Esq., Chief, State Superfund and Voluntary Cleanup Practice Group, Division of Environmental Enforcement, 26 March 1997, p.2., emphasis added] In his most recent statement, Mr. Charles contrasted the application of TAGM 4046 in a voluntary remedial program context, where the TAGM evaluation method is used with an exposure scenario tailored to the circumstances of the site's contemplated use, from the application of the TAGM in the context of the State Superfund program , where restrictions on site use are not taken into account. [Id. at 2.]

In addition, the Department has indicated that, pursuant to 6 NYCRR §375-1.10(c)(1), a site remediation program must be designed to conform to standards and criteria that are generally applicable, consistently applied and officially promulgated, or where not directly applicable, where relevant and appropriate, unless good cause is shown why conformity should be dispensed with, and guidance is to be applied as a criterion only "after the exercise of engineering judgment" and on a case-specific basis. That section sets forth several rationales for demonstrating when good cause exists to depart from the standards and criteria, including that conformity to the standard or criterion is technically impracticable from an engineering perspective, or where conformity will result in greater risk to public health of the environment than the alternatives. 6 NYCRR §375-1.10(c)(1)(b) and (c). Technical feasibility encompasses considerations such as implementability and cost-effectiveness. 6 NYCRR §375-1.10(c)(6).

2. Criteria Applied by CE -- In considering these criteria in developing its on-site cleanup proposal, CE also took into account NYSDEC comments regarding concerns about the precedent that each site sets for subsequent ones being addressed under the voluntary cleanup program, and the desire for consistency with previous cleanups performed at other New York sites.

In performing its site investigations, CE conformed to established State criteria. It utilized investigation procedures that were in accordance with the quality assurance / quality control procedures developed by its consultant, ABB-ES, specifically for use as a NYSDEC contractor engaged in investigating hazardous waste sites, and New York ELAP-certified analytical laboratory contractors were used. In evaluating remedial options and assessing them for implementability (and, in the case of some TAGM levels, technical infeasibility), CE utilized the standards specified in Part 375-1.10 and accorded them relative weighting as specified in TAGM 4030 "Selection of Remedial Actions at Inactive Hazardous Waste Sites" (rev. May 1990). In addition, CE received guidance from NYSDOH concerning the human health risk assessment (1996) which it incorporated into its interpretation of the results of subsequent investigations.

Further, CE applied the ASTM Risk-Based Corrective Action ("RBCA") standard to develop risk-based cleanup levels for the site, which is the standard adopted by the Spills section within NYSDEC, and which is under consideration by the Hazardous Waste Remediation Branch as the emerging process by which environmental cleanup goals and targets will be developed. These approaches were similar to the ones adopted in developing the April 1997 proposal. NYSDEC regional technical staff (after consultation with NYDOH and MCDOH) have generally indicated that the approaches taken were technically acceptable.

3. Precedent -- This site is precedent-setting for mercury as it represents the first application within New York of the most sophisticated mercury risk-based analytical techniques yet developed, including use of highly sensitive mercury vapor detection equipment to analyze the flux levels of mercury in soil gases, and the use of extensive testing to establish the speciation of the mercury present in soils at the site and the derivation of a site-specific Bioavailability Adjustment Factor (BAF). These precedent-setting approaches mean that sites previously investigated in New York are not directly comparable to establishing site remediation objectives than mercury-impacted sites outside of New York that have applied these emerging technologies and analytical approaches, and, conversely, that the precedential value of the Taylor Instruments Site to other sites in New York should be restricted to sites at which these emerging approaches have been applied.

30 ppm assumed worst case 100% bioavailable

Therefore, in considering NYSDEC's desire for consistency, CE evaluated not only sites located in New York State, but also sites outside of New York at which these techniques had been applied. CE endeavored to approximate an "apples-to-apples" comparison of previous mercury cleanup levels in New York by converting the level of protectiveness of that level (reportedly 30 mg/kg without speciation/bioavailability analyses) to the level of protectiveness posed by CE's proposed mercury number for areas outside the concentrated shard waste area (150 mg.kg). The site-specific bioavailability factors applied to the 30 mg/kg number yields 150 mg/kg, indicating that the level proposed by CE in this TM is *as protective* as 30 mg/kg applied at the other site despite being expressed with a higher number. NYSDEC, in considering the precedent being established here, should consider not the number itself but the method by which the number is shown to be protective.

In C-E's April, 1997 submission to NYSDEC several other sites were referenced at which mercury and TCE contamination had been addressed, and the cleanup levels for mercury were cited and compared to those being proposed for the Taylor Instrument Site. Based on verbal comments from NYSDEC, ABB-ES reviewed the information available on those sites to ensure that the cited cleanup levels were reasonably comparable to the Taylor Instrument Site. ABB-ES has also further researched standards mercury cleanup standards promulgated by other states for commercial/industrial land use.

Since detailed mercury speciation and bioavailability characterization has been done at the Taylor Instrument Site, CE looked for recent sites which had undergone a site-specific mercury speciation and bioavailability characterization study, as well as ones where industrial or commercial uses were assumed. In general, CE found that the cleanup levels established for such sites were in the 100 mg/kg - 500 mg/kg range. For sites which had not undergone site-specific mercury speciation and bioavailability characterization, or where a future residential use of the property was assumed, the cleanup numbers were generally below 100 mg/kg.

The table below provides several recent examples of cleanup levels for mercury approved for use at Sites in Tennessee, Nevada and California. Attachment 2 to this Memorandum provides copies of excerpts from the referenced documents stating the cleanup level accepted by regulators and describing the evaluation criteria applied at each Site.

Examples of Mercury Soil Cleanup Levels at Other Sites

Site/Location	Lead Agency	Mercury Cleanup Level (mg/kg)	Source/Date
(1) Alameda Quicksilver County Park Santa Clara County, CA	Cal-EPA	300-500 (for various areas of Site) [1]	RAP, 12/94
(2) Lower East Fork Poplar Creek Oak Ridge, TN	USEPA	400 [2]	ROD, 5/95
(3) Carson River Mercury Site (OU1) Lyon/Churchill Co., NV	USEPA	80 [3]	ROD, 3/95
(4) Citric Block Site/Williamsburg Facility, Brooklyn, NY	NYSDEC	removal of all hazardous waste (fails TCLP) [4]	NYSDEC VCA signed July 1996
(5) G.E. Wiring Juana Diaz, PR	USEPA	16 [5]	ROD, 9/88
(6) Frontera Creek Rio Abajo, PR	USEPA	35 [6]	ROD, 9/91
Unknown	NYSDEC	30	Note 7

[1] Excavation or capping of contaminated soils in excess of health-based goals protective for long-term exposure to children.
[2] Excavation of contaminated soils in excess of health-based goal protective for long-term exposure to children.
[3] Excavation of contaminated soils in excess of health-based goal protective for long-term exposure to children.
[4] Interim remedial measure (although it is CE's understanding that no further action is planned).
[5] Excavation of contaminated soils in excess of health-based goal protective for residential exposures.
[6] Excavation of contaminated soils in excess of health-based goal protective for residential exposures.
[7] We are awaiting additional information from NYSDEC concerning this site.

Although there are differences in site conditions, intended land use, geologies, quantities of substances released and receptors among the seven sites (the six cited plus the Taylor Instrument Site), there are several critical similarities:

- Human health risk assessments were performed at each Site;
- In addition to human and environmental risks, remedies at each Site were evaluated against criteria similar, or identical, to those found in New York's Part 375 regulations and guidance, including long-term effectiveness, cost, implementability, and protectiveness of human health and the environment; and
- Speciation/bioavailability work similar to that performed by CE at the Taylor Instrument Site was performed at sites 1-4 and was used to adjust cleanup levels to be specific to the mercury species actually present.

Despite these similarities, several factors suggest that the range of cleanup levels at sites 1-6 would be conservative if applied to the Taylor Instrument Site. Most importantly:

- Cleanup levels at each Site are protective for residential, recreational, or similar land use involving long term exposure to children. This contrasts sharply with the intended future use at the Taylor Instrument Site, which will be restricted, by deed or other land use enforceable restrictions, to future commercial/industrial uses.

- The Oak Ridge and California sites has significant potential environmental receptors due to widespread surface soil and (particularly at the Oak Ridge Site) sediment impacts. This is again in contrast to Taylor Instrument Site where there exists neither identified environmental pathways nor receptors, and no sediment impacts.

- The Oak Ridge and California sites feature much greater overall volume/weight of mercury (hundreds of thousands of pounds in Tennessee) and aerial extent over which the impact is spread. Mercury at the Taylor Instrument Site is confined to a few acres and is believed to have resulted from release of a much smaller total amount of the mercury.

  The Lower East Fork Poplar Creek number is of interest for several important reasons. First, the mercury-related issues at the Oak Ridge National Lab (of which Lower East Fork Poplar Creek is a part) are very high profile due to community concerns and the large amount (estimated to be several hundreds of thousands of pounds) of mercury that was released. Consequently, Lower East Fork Poplar Creek and associated sites are among the most well-studied mercury sites in the country. They are the source of much state-of-the-art knowledge relative to human health and environmental issues related to mercury. Second, its ROD is fairly recent (1995) and represents both recent thinking on the part of both the technical community and a recent record of local community reaction to a mercury cleanup project. While community reaction also clearly varies from site to site, it is worth noting that the cleanup numbers at Oak Ridge were commented upon by a very large and diverse group of interested individuals. Third, the cleanup levels were established in the 400 ppm range when the Site posed far more significant risks to human health and the environment [due to the magnitude of the mercury released, risk found to be posed to neighboring residences, and impacts detected in a wetland and flood plain] than posed at the Taylor Site, making the cleanup number a conservative one if applied here. In addition, contrary to NYSDEC's information, CE has confirmed that the location of the East Fork Poplar Creek site is not an area of restricted access despite being partially situated on the Oak Ridge DOE site. Most of the Oak Ridge DOE site is now open to the general public.

The Citric Block Site in Brooklyn, New York site was cleaned up pursuant to a Voluntary Cleanup Agreement which was based upon a future industrial, commercial or recreational use. In fact, an anticipated potential future use for a portion of this Site was to pave it and turn it into a park/playground for an immediately adjacent school. NYSDEC's approval of the remedial approach was predicated on excavation of soils that exceeded the TCLP level for hazardous waste, an approach for which NYSDEC was subsequently praised at a Congressional hearing. Mercury speciation was done as a part of the VCA, but only after the cleanup goals were established. It is our understanding that although this work was performed as an Interim Remedial Measure, no further mercury related remediation is planned for the site.

Examples of Mercury Remedial Action Goals in Other States

State	Industrial or Commercial Land Use	Residential Land Use	Citation
New Jersey	270 mg/kg	14 mg/kg	New Jersey Soil Cleanup Criteria
Florida	480 mg/kg	23 mg/kg	Florida DEP Soil Cleanup Goals
Connecticut	610 mg/kg	20 m/kg	Section 22a-133k-2
Rhode Island	610 mg/kg	23 mg/kg	DEM-DSR-01-93; Rule 8.02.A
Massachusetts	60 mg/kg	30 mg/kg	310 CMR 40.0975(6)

Site/Location	Lead Agency	TCE Cleanup Level (mg/kg)	Source/Date
Lehigh Valley RR Derailment (Site 819014)	NYSDEC	7	*
Rochester Fire Academy (Site 828015)	NYSDEC	10 for total VOCs**	ROD, March 1993
Grumman Aerospace-Bethpage OU A-1 (Site 130-003A)	NYSDEC	levels achievable by SVE	***

* According to David Napier, (NYSDOH) based on the PRAP and the draft ROD which was to be finalized and signed by NYSDEC on 3/31/97.
** According to Mark Gregor of the City of Rochester's Division of Environmental Quality, TCE was one of the 3 primary VOC contaminants at this Site.
*** Based upon information received from Andrew Barber, formerly of Geraghty & Miller, who was the Project Manager

D. CE's Proposed Goals Allow Site Redevelopment

The On-Site Remedial Alternatives Evaluation Report demonstrates that for mercury in soil at the Taylor Site, 150 mg/kg is the point just above that at which costs for two of the remedial alternatives identified -- excavation and off-site disposal and installation of an on-site cover system -- begin to diverge (allowing for a +50%/-30% accuracy range typical of feasibility study cost estimates). At cleanup levels above that point, implementation costs for the two options are approximately the same. However, due largely to the fact that the soil *volume* rises much faster than the *area* of impacted soil, excavation and disposal costs rise much more rapidly after this point than do costs for installing a cover system.

Achieving mercury levels substantially below 150 mg/kg through removing the soil and transporting it off site for treatment/disposal requires excavation of tremendous volumes of soil and would likely produce significantly higher potential risks to the public or the environment both because of the heavy truck traffic that would be involved and the associated risks with excavating, temporarily storing and the tremendous volumes of soil that would be involved. In addition, by requiring excavation below the water table (which cleanup levels below 150 mg/kg may require) the feasibility of the remedial action is jeopardized and the costs increase dramatically despite there being little or no commensurate health or safety benefit (indeed, health or safety may be less protected under that scenario).

Actual removal of the concentrated shard waste area and mercury-impacted soils above 150 mg/kg produces a site which can be readily redeveloped. Few if any special developer, contractor or long-term use procedures must be developed and applied to achieve this highly protective site-specific level which is focused on its intended use. The "brownfields" property could be redeveloped and used largely identical to a "greenfields" property, consistent with NYSDEC's voluntary cleanup program policy.

CE's proposal is conservatively protective for the intended future industrial/commercial use and does not require incurrence of the many risks imposed by attempting to achieve the 0.1 TAGM guidance number at the site. While no cost inflection point above the proposed mercury in soil cleanup level is shown on Figure 7-1 of the attachment, this is an artifact of the fact that CE is proposing to remove the concentrated shard wastes. As shown by Figure 3-1 in the attachment, without this source area removal objective, there might be significant differences in the relative volume of soil removed at soil cleanup levels in the 1000, 500 and 100 mg/kg ranges. Finally, Figures 7-1 and 7-2 indicate that cleanup (as opposed to capping in place) below our proposed goals, would quickly become cost-prohibitive, driving the preferred remedial alternative to a cover system.

In addition, removal of the majority of the mass of mercury at the site through the proposed cleanup goals is preferrable to the installation of a cover system, which provides an equivalent level of human health and environmental protection but also requires that a number of measures be implemented which are incompatible with site development. Prominent among these measures are the need to continually monitor and maintain the integrity of the "cap" during both development and long-term use - a difficult prospect for any developer. The cover system would not address the issue of the inhalation pathway, extensively investigated during the site investigation - and in order for development to occur, site buildings would need to have some type of vapor barrier installed and maintained if the impacted soil were left in place. Deed restrictions and other institutional controls, which are a prominent feature of a site cover option, would need to be much more robust - and much more closely managed - in order to allow site redevelopment to occur at a comparable cost and with a comparable level of protectiveness, making a cover system only marginally compatible with redevelopment.

It is CE's belief based on past experience with a community "hot line" for this site, a view we understand is shared by the City of Rochester, is that community reaction relative to remedy at the Taylor Instrument Site is likely to focus as much or more on the Site's redevelopment and future use as on environmental issues. Redevelopment of the Taylor Instrument site has community support because it will fill a long-standing need in the community for commercial or industrial development. Although CE acknowledges that community concerns relative to environmental issues at the Taylor Instrument site may need to be addressed, there is substantial reason to believe that community questions relative to potential long-term impacts relative to the proposed clean up level can be effectively answered.

IV. Conclusion

CE has established, through sound science, that cleanup levels far in excess of those proposed here are protective of human health and the environment for the intended future uses of the site. CE has performed detailed analyses using the Department's established criteria, which assess the effectiveness of remedies that can reasonably be used to achieve the proposed cleanup levels and contrasted them with the expenditures required, and risks posed, by adherence to TAGM levels which NYSDEC is using to guide derivation of cleanup levels for the site. CE has made a strong technical case in support of the proposed cleanup levels and justified any proposed departures from the TAGM both from a technical perspective and from the perspective of how the site fits within the precedents of site remediations, particularly for mercury. It has made substantial compromises and is committed to performing the remediation necessary to achieve the level of protectiveness necessary to ensure that the community's interest in redevelopment of the site can be satisfied. Based upon the cost data developed in connection with this proposal, it is clear that in order to achieve levels below those proposed in this TM, the redevelopment objectives of CE and the community would have to be sacrificed in the interest of technical feasibility and cost-efficiency. Given that the proposal is supported by a human health risk assessment demonstrating the over protectiveness of the proposal by a wide margin, and that the proposal provides for removal of source areas having the potential to cause further environmental impacts, this proposal meets and satisfies all of the criteria of Part 375, and which, therefore, should readily satisfy the criteria to be imposed in a voluntary cleanup program which places tremendous emphasis on restoring the site to levels safe for redevelopment.

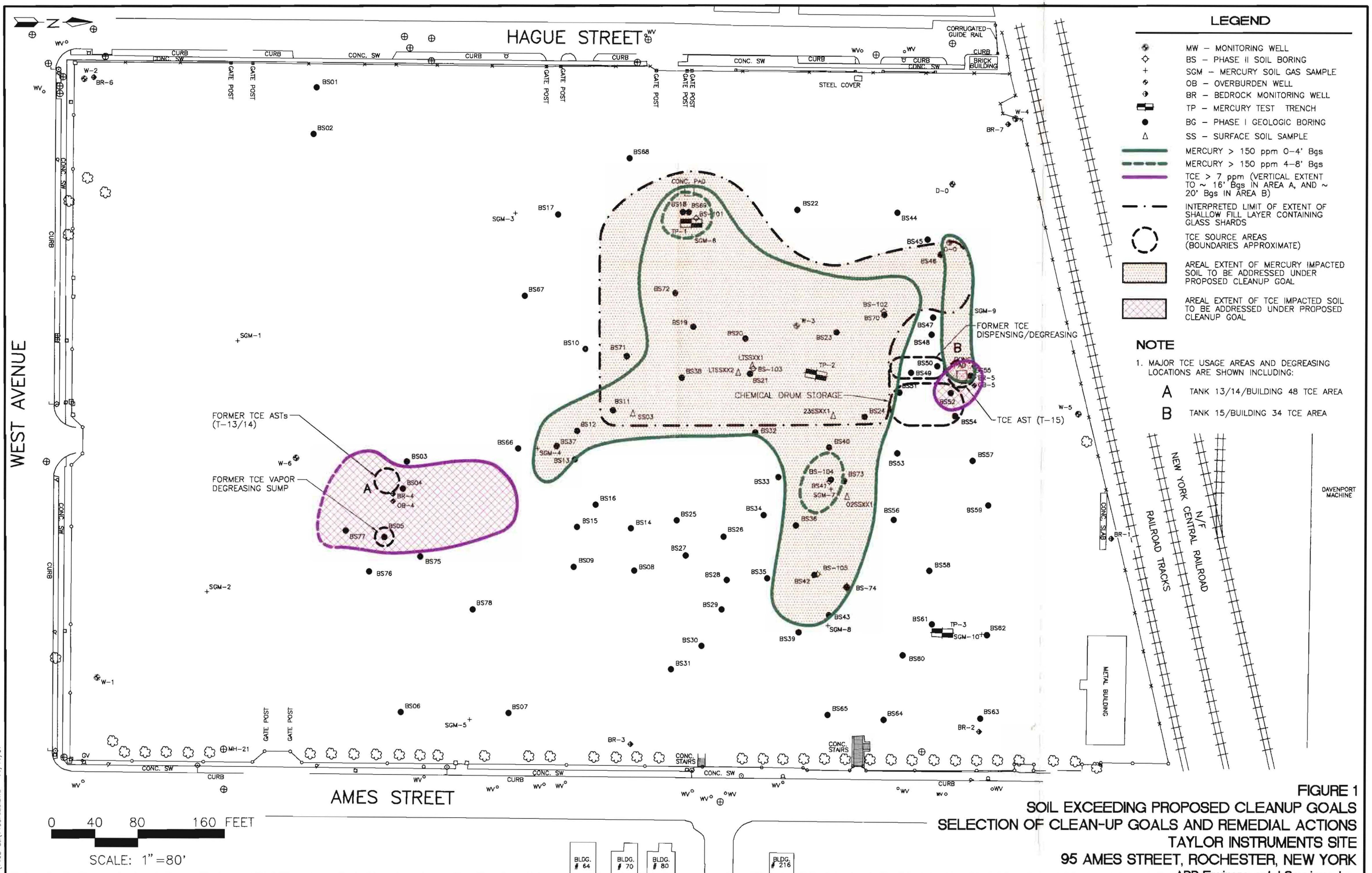

FIGURE 1
SOIL EXCEEDING PROPOSED CLEANUP GOALS
SELECTION OF CLEAN-UP GOALS AND REMEDIAL ACTIONS
TAYLOR INSTRUMENTS SITE
95 AMES STREET, ROCHESTER, NEW YORK
ABB Environmental Services, Inc.

ATTACHMENT TO TECHNICAL MEMORANDUM 6: EVALUATION OF ON-SITE REMEDIAL ALTERNATIVES

TAYLOR INSTRUMENTS FACILITY SITE INVESTIGATION 95 AMES STREET SITE ROCHESTER, NEW YORK

NOVEMBER 1997

Disclaimer

This Draft document is being submitted by Combustion Engineering as an attachment to Technical Memorandum No. 6 for purposes of reaching settlement and in support of the offer of proposed on-site cleanup levels for the Taylor Instruments Site contained therein. Should the cleanup levels proposed not be accepted by NYSDEC, and should subsequent discussions prior to November 30, 1997 (or agreed-upon alternate date) also fail to produce mutually agreeable on-site cleanup levels, Combustion Engineering withdraws this Draft document in its entirety

ABB Environmental Services, Inc.

ASEA BROWN BOVERI

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EVALUATION OF ON-SITE
REMEDIAL ALTERNATIVES**

**TAYLOR INSTRUMENTS FACILITY SITE INVESTIGATION
95 AMES STREET SITE
ROCHESTER, NEW YORK**

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1.0 INTRODUCTION

The purpose of this document is to evaluate potential remedial action alternatives for the Taylor Instruments Site (Site) located in Rochester, New York. This evaluation was conducted for a range of potential cleanup goals for mercury and trichloroethene- (TCE) impacted soil at the Site.

In order to propose cleanup goals for mercury and TCE-impacted soil at the Site which are: protective of human health and the environment; consistent with applicable guidance and standards; achievable within the constraints of remedial technologies; and appropriate for the projected future site use, a range of potential cleanup levels was evaluated. This document evaluates potential remedial action alternatives over the potential range of cleanup goals considered. The evaluation is based upon the criteria set forth in 6 New York Code of Rules and Regulations (NYCRR) Part 375 and pertinent New York State Department of Environmental Conservation (NYSDEC) guidance.

The document is organized into the following sections:

- Section 2 presents a summary of the Site Investigations conducted to date;
- Section 3 presents the Remedial Action Objectives (RAOs) developed for the Site;
- Section 4 identifies and screens applicable remedial technologies;
- Section 5 identifies the potential remedial alternatives;
- Section 6 presents the detailed analysis of the alternatives over the range of potential cleanup goals; and
- Section 7 presents the comparative analysis of alternatives.

2.0 SITE INVESTIGATION SUMMARY

This section presents a summary of the Site history and briefly discusses key findings of the environmental investigations conducted at the Taylor Instruments Site.

2.1 SITE LOCATION AND HISTORY

The Taylor Instruments Site (Site) covers approximately 13 acres north of West Avenue in the city of Rochester. The Site is bounded on the south by West Avenue, the west by Hague Street, east by Ames Street and to the north by Conrail railroad tracks (Figure 2-1). The Site is essentially flat with a maximum slope of 3-percent. There are no identified wetlands or surface water bodies on-site.

The area within one-half mile of the Site is primarily mixed residential and light industrial. Rochester Gas and Electric has a leased facility on the west side of Hague Street. South of West Avenue and east of Ames Street is predominantly residential.

The Site was the location of a manufacturing facility from 1904 to 1993. Fluid-filled instruments such as mercury thermometers were produced at the Site until the mid-1960's at which time most mercury-handling operations were transferred out of state and became a very minor aspect of facility operations. With the advent of computers, various operations required for printed circuit-board manufacture and assembly were introduced and performed at the Site. In 1993 all operations were transferred to a separate location.

Demolition activities were initiated in May 1995. All buildings, except metal storage Building 60, were razed. Shallow building footings, subsurface utilities, and underground storage tanks were removed. The Site was rough-graded flat pending the completion of the Phase I Site Investigation, which was conducted in spring 1996. Following Phase I sampling activities, final grading was completed and a storm water drainage system installed.

Except for landscaped areas around the perimeter, the Site is completely paved. Fencing prevents access by unauthorized persons.

2.2 SITE GEOLOGY AND HYDROGEOLOGY

Unconsolidated soils (overburden) at the Site consist of glacial sand, silt, and gravel. The overburden varies from about 14 to 30 feet thick, generally thickening towards the northwest corner. Soils below about 12 feet consist of dense basal till. This till restricts the downward movement of water (or contaminants) from more transmissive shallow sandy soils (native undisturbed or disturbed soils and various fill soils). Bedrock underlying the Site has been mapped as the Lockport Dolomite. It is flatly bedded with interconnected sub-horizontal fractures.

The water table is found within the shallow overburden at about 6 to 8 feet below ground surface (bgs) and slopes generally from southwest to northeast. Piezometric levels in bedrock wells are variable, ranging from about 9 to 22 feet bgs. The data available are not sufficient to determine flow direction within the bedrock. However, chemical data (discussed below) appears to indicate a similar northward or northeastward direction of flow.

2.3 CONTAMINATION ASSESSMENT SUMMARY

Since 1981, various environmental investigation efforts have been undertaken at the Taylor Instruments Site. This section briefly summarizes the scope and findings of significant sampling efforts, with emphasis on 1996 and 1997 sampling data. Analytical and other data associated with previous work have been provided to NYSDEC and may be found in a number of reports generated by Taylor Instruments during the 1980's; in the Background Document submitted by Combustion Engineering (CE) in 1995; in the Voluntary Site Investigation (VSI) Report (2 volumes) prepared by ABB Environmental Services, Inc. (ABB-ES) in 1996; and in Technical Memoranda (TM) presenting results of recent investigations submitted by ABB-ES in October and November 1997.

2.3.1 Pre-Demolition Investigations

Sampling efforts prior to the demolition and removal of the Taylor Instruments Buildings included investigation of mercury-impacted soils and a limited pre-demolition soil investigation.

Mercury Soil Sampling. In 1981, glass instrument shards containing visible mercury were observed on the surface and in shallow subsurface soil near the northwestern corner of the Site. Soil samples contained mercury at concentrations up to 52,000 milligram per kilogram (mg/kg) in shallow soil. NYSDEC became involved in early 1982, and additional sampling was conducted. NYSDEC approved installation of asphalt paving over a one-half acre area as a remedial measure. This was completed early in 1983. Quarterly groundwater monitoring was initiated and continued until September 1986, by which time mercury concentrations were generally below the Class GA standard. The area continues to be listed as a "Class 4" on the New York Registry of Inactive Hazardous Waste Sites.

Discovery of glass shards in an area beneath a former water tower led to a soil investigation in 1984 and 1985. Soil samples were collected and analyzed for mercury by the Extraction Procedure (EP) Toxicity method. NYSDEC approved installation of asphalt paving as a remedial measure to close this area. This area is within the larger 'glass shard' area discussed within this document.

1993 Site Investigation. In May 1993, ABB-ES conducted a limited Site investigation to establish the general environmental condition of the property prior to building demolition. Soil samples were collected near each existing underground tank; the former Building 42 solvent recovery/drum storage area, the former Tank 15 TCE area, and several other locations. Inside buildings, shallow soils samples were collected by hand from beneath floor slabs in several areas, including the plating and degreasing areas, Building 30 mercury filling room, Building 12 and the former Tank 13 and 14 locations.

Results of field screening, field lab analysis and off-site lab analysis of the samples indicated the presence of mercury and VOCs in some areas. The findings led to a "protective filing" to the NYSDEC Spills Division pursuant to NYCRR Part 595 since the source of the VOCs may have been from on-site storage tanks.

2.3.2 1996 Voluntary Site Investigation

In 1996 CE undertook a major investigation effort designed to characterize soil and groundwater conditions at the Site and to assess potential risks to human health and the environment. The scope of work included 78 soil borings, installation of 23 monitoring wells, and associated soil and groundwater sampling. A comprehensive human health risk assessment was completed. This included mercury speciation analyses to identify the forms and bioavailability of mercury compounds that are present.

The investigation identified mercury and halogenated VOCs (e.g. TCE, tetrachloroethene (PCE), and 1,2-dichloroethene (DCE)) as the principal contaminants of concern in Site soils.

Mercury. More than 520 soil samples from 56 borings were analyzed for mercury. Mercury was detected in 98-percent of the borings. The data clearly show, however, that mercury at higher concentrations (greater than 10 mg/kg) is depth-limited and restricted to definable mercury source areas.

The highest mercury concentrations in soils (greater than 100 mg/kg) are associated with two source areas: 1) shallow fill soils containing glass shards; and 2) a former subsurface trench beneath former Building 2.

Shallow fill containing glass shards is present at various points in the northwest part of the property. The fill is usually present as a thin (one foot) layer of debris located within a few feet of the ground surface. Nine borings completed within the suspected area of shard fill had at least one sample with mercury at concentrations between 100 and 1000 mg/kg.

The second area containing high concentrations of mercury in soils is the former Building 2 trench. During demolition of Building 2 and this subsurface concrete trench, mercury droplets were observed in soils. Three of four borings drilled through the trench location contained mercury at concentrations above 1000 mg/kg.

All 19 samples with mercury above 100 mg/kg and 42 samples (90-percent) of samples with mercury above 10 mg/kg were from samples collected at these two source areas within 8 feet of the ground surface.

Mercury concentrations drop abruptly below 8 feet throughout the Site to levels below 1 mg/kg. All borings with elevated shallow mercury results show this pattern of rapidly decreasing concentration with depth. However mercury at low concentrations, (0.1 to 1.0 mg/kg and occasionally between 1 and 10 mg/kg), can occur sporadically in virtually any boring and at any depth above bedrock. For example, only one of 12 samples collected from boring BS-01 contained mercury and this was at 20 feet bgs. Also, 3 of 11 samples from nearby BS-02 contained mercury. One of these (9 mg/kg at 18 feet bgs) is an unexpected higher result that is bracketed above and below by non detections. These borings are in the southwestern part of the Site and upgradient of all primary areas of former mercury use.

This apparent randomness of detection of mercury at lower concentrations suggests that it would be impossible to accurately delineate contiguous areas of impact in soil at concentrations below about 10 mg/kg. Mercury at lowest detectable concentrations (0.1 to 1.0 mg/kg) is potentially present in any soil sample collected beneath the Site at any depth above bedrock.

Mercury speciation analysis found that elemental mercury was the predominant form of Site mercury. Only 0.3-percent on average was found to be present as organic species. The findings are consistent with the history of the Site, where elemental mercury was the only form used. As discussed in detail in the Human Health Risk Assessment (HHRA), elemental mercury is a relatively non-toxic, non-mobile form of mercury.

Volatile Organic Compounds (VOCs). One compound, TCE, was detected frequently in Site soils and groundwater. PCE and, to a lesser extent, other VOCs (e.g. 1,2-DCE, xylenes, etc.) were found in association with TCE at low concentrations. The highest levels at TCE were found at two source areas, where TCE was stored and used. These areas are termed the former Tank 13-14/Building 48 Area and the former

Tank 15/Building 34 Areas. Limited soil sampling conducted at the immediate source areas found TCE at concentrations of up to 280 mg/kg.

Human Health Risk Assessment. The 1996 HHRA developed a set of quality goals appropriate to the site's likely future use. Based on a comparison of these goals to soil and groundwater data, there does not appear to be any threat to human health associated with soil and groundwater under current land use. The HHRA found that unacceptable risks may be present under some future development scenarios unless some remediation is undertaken. The 1996 HHRA also identified data needs that would reduce the uncertainty associated with some of its findings. This data was collected as part of the 1997 investigation described below.

Groundwater Sampling. Groundwater results reflecting current Site conditions are discussed in the following section.

2.3.3 1997 Site Investigation

Additional Site investigations were performed in Fall 1997 to address data needs requested by and discussed with the NYSDEC, the New York and Monroe County Departments of Health, and Monroe County Pure Waters (MCPW). These included:

- air and soil sampling to evaluate emissions of volatile mercury from Site soils,
- soil gas sampling to determine the presence of VOCs in shallow soils at on-site and off-site locations,
- soil and groundwater sampling to provide correlative data at soil gas sampling locations,
- groundwater sampling to evaluate shallow on-site overburden and bedrock water quality,
- sampling to determine levels of mercury and VOCs in on-site and off-site sewers

The results of these sampling efforts were summarized in TM issued to NYSDEC and concerned parties in October and November 1997. Significant preliminary findings are listed below. Conclusions regarding the data will be formally issued in an Investigation Report, to be submitted to NYSDEC in late 1997.

TM No.1 – Full Suite and Toxicity Characteristic Leaching Procedure (TCLP) Soil Analysis. Five borings were drilled at locations of high mercury soil hits in 1996 and one boring was completed at each of the two TCE source areas to collect samples for full target compound list (TCL) and TCLP analysis. The borings at the TCE source areas contained TCE at concentrations up to about 10 mg/kg and lesser amounts of 1,2-DCE.

The samples collected at mercury locations contained mercury at concentrations lower than in 1996. The mercury data is thought to illustrate the intermittent nature of elevated mercury concentrations at the Site. Also, mercury was not detected above the TCLP limit of 0.2 milligrams per liter (mg/L) in any sample.

TM No. 2 – Sewer Investigation. Sediment and water samples were collected from on-site and off-site locations to assess the presence of VOCs and mercury. TCE and related halogenated compounds were found at several on-site and off-site locations. The highest concentrations were found in sewers near the known TCE source areas. ABB-ES' initial interpretation is that VOCs are entering the sewers via infiltrating groundwater. Mercury was detected in most water and sediment samples. The water results are all below MCPW's current industrial discharge limit. In general, mercury concentrations were much lower than when sampled in 1994. This is thought to be due to on-site sewer repair and removal of some old sewer lines.

TM No.3 – VOC Soil Gas Sampling. On-site and off-site soil gas samples were collected to assess the presence of VOCs and to identify health risks (if any) to off-site commercial or residential receptors. TCE, 1,2-DCE, and PCE were detected in soil gas and displayed appropriate consistency with on-site soil and groundwater to be used to estimate inhalation exposures and risks. The data were used in fate and transport models to estimate indoor air concentrations in existing or potential buildings. These concentrations were compared to risk-based screening levels and to workplace air standards. The VOC concentrations measured in soil gas along the Site perimeter and off-site do not pose a significant health risk to receptors.

TM No. 4 – Groundwater Investigations. Groundwater samples were collected from all Site overburden wells (18), bedrock wells (7), and at four of the off-site soil gas locations. Results were found to be consistent with the 1996 data, where present. Mercury was detected in about half of the overburden well samples and in none of the bedrock samples from the most recent sampling event. Only one well contained mercury at concentrations above the Class GA groundwater standard. Although mercury is present at high concentrations in shallow soils at the Site, it does not appear to mobilize to groundwater and migrate off-site at concentrations above groundwater standards.

TCE and 1,2-DCE are the principal VOCs detected in overburden and bedrock well samples. At the two source areas, TCE was found in overburden groundwater at concentrations up to 550 mg/L and in bedrock groundwater at up to 27 mg/L. Overburden wells along the downgradient Site perimeter contain TCE at concentrations up to 2.2 mg/L. Bedrock wells along the Site perimeter contain TCE at concentrations up to 18 mg/L.

TM No. 5 – Volatile Mercury Investigations. Several different techniques were used to determine if mercury is present in soil vapor at concentrations that would potentially pose a risk to human health. These included emission flux measurements at ground surface, passive soil gas data collection in shallow boreholes, mercury vapor emissions in test trenches, and soil sampling to provide correlative data. Results were compared to potentially applicable limits for Site workers. Preliminary conclusions include:

- mercury vapor emissions are unlikely to produce an inhalation risk to future occupants of on-site buildings, and
- under current Site conditions, mercury vapors in trenches could exceed applicable exposure standards in areas of the Site containing the highest concentrations of mercury in soils.

2.4 Risk Assessment Summary

This section summarizes the human health risk assessments performed to date and provides updated human health risk-based screening levels.

2.4.1 VSI Human Health Risk Assessment Summary

As part of the Voluntary Site Investigation, a HHRA was performed to conservatively evaluate the human health risks that may exist at the Taylor Instruments Site and to develop site-specific health Risk-Based Screening Levels (RBSLs) for Chemicals of Potential Concern (CPCs) in soil and groundwater at the Site. RBSLs represent concentrations which do not pose risks of concern for potential exposures to Site soil and groundwater under the exposure scenarios and land uses evaluated in the HHRA.

The exposure parameters and assumptions used in the RBSL calculations were selected from appropriate NYSDEC, ASTM, and United States Environmental Protection Agency (USEPA) risk assessment guidance and, together with conservative dose-response values, result in RBSLs that are protective of human health for reasonable maximum exposures. RBSLs were calculated to correspond to a target excess lifetime cancer risk of 1 in 1 million, or a non-cancer hazard index (HI) of 1.

The direct-contact RBCs for mercury incorporate a site-specific bioavailability adjustment factor of 0.2, or 20%. As described in the HHRA, this factor was developed to reduce uncertainty associated with the oral bioavailability of mercury in Site soils. Bioavailability factor (BAF) development was based on characterization of mercury species in soil, which showed that, on average, greater than 90-percent of mercury present at the Site is in elemental or other relatively non-bioavailable forms.

2.4.2 Updated Health Risk Assessment

The HHRA-calculated RBSLs utilized conservative fate and transport models that did not incorporate Site specific information for several sensitive parameters (e.g., soil or groundwater to air partition). At NYSDEC and New York State Department of Health (NYSDOH) request, additional environmental data were collected to supplement and refine the modeling. These data primarily consisted of on-site and off-site soil gas measurements of VOCs, and on-site mercury vapor emission measurements. Data collection and interpretation for these activities are discussed in detail in TM No. 3 (VOCs in soil gas) and TM No. 5 (mercury in soil gas). The results of the health risk evaluations for those activities are summarized below.

VOCs in Soil Gas. As described in TM 3, soil gas data were evaluated to determine if the detected concentrations would pose an unacceptable risk to public health under current and potential future land use conditions. The evaluation involved substituting the soil gas data for default assumptions in the previously utilized fate and transport models to estimate the indoor air concentrations for both an off-site, residential receptor and an on-site, commercial/industrial receptor. The estimated indoor air concentrations of each detected VOC were compared to RBSLs for ambient air and workplace air standards that are protective for inhalation exposures.

For all compounds detected in soil gas samples, the estimated indoor air concentrations were substantially below RBSLs indicating that even under very conservative assumptions, soil gas and soil gas source areas do not pose an unacceptable public health risk to current off-site residents or future on- and off-site commercial/industrial workers occupying buildings constructed at the Site perimeter (where the soil gas data was collected.)

Although soil gas levels at the perimeter of the Site were determined to be far below those necessary to produce an inhalation risk concern, soil gas data was not collected in the Site interior. However, evaluation of the four pairs of on-site, perimeter groundwater/soil/soil gas measurements allows an estimation to be made of the approximate maximum groundwater and soil concentrations in those areas that would not produce an unacceptable inhalation risk. For groundwater, the approximate concentration is 170 mg/L in overburden groundwater; bedrock groundwater cannot produce an inhalation risk when it is below the overburden saturated zone. In soil, the approximate concentration is 130 mg/kg. Therefore, when both soil and groundwater contain TCE, the approximate TCE concentrations below which no inhalation threat would exist would be one-half of these numbers, or approximately 65 mg/kg for soil and 88 mg/L for groundwater.

Volatile mercury Mercury vapor emission data and worker exposure assessment data were also collected in August 1997. Data evaluation consisted of utilizing the flux data as input into a simplified fate and transport model to estimate a future potential indoor air concentration, and then combining this with an ambient air RBSL protective of inhalation exposures in order to estimate an HI. Data from a simple, very conservative worker exposure were compared directly to workplace air standards to determine if mercury emissions would pose an unacceptable risk to future construction or utility workers performing excavations at the Site.

The HI that corresponded to the maximum measured flux values at the on-site sampling areas is 1. This evaluation suggests that mercury in soils at the Taylor Instruments Site probably do not pose an unacceptable public health inhalation risk to future on-site commercial industrial workers occupying buildings constructed at the Site. Flux measurements do not show good correlation with individual soil samples from the measurement locations, but do correlate well with broad areas of on-site mercury distribution.

Mercury was detected at concentrations exceeding worker exposure limits used as benchmarks in air samples from only one of the three test trenches excavated for the worker exposure assessment. The exceedances occurred at an area known to have one of the highest average mercury concentrations at the Site. Due to both the pronounced worst-case nature of the exposure scenarios in the assessment (e.g., assuming an 8-hour exposure three feet off the five foot deep trench floor) and the relatively small number of data points, it is difficult to predict an average mercury in soil concentration which would likely produce air concentrations exceeding the applicable standards. As rough guidance, it appears that where substantial amounts of glass shard wastes (or, probably, visible mercury droplets regardless of glass shard presence) are present in excavation sidewalls, exceedance of applicable standards at levels below the normal breathing zone is possible. When none or only small amounts of this waste (as was present in one of the non-exceeding trenches) it appears that construction/utility work could occur without significant risk from an inhalation exposure.

Mercury Direct Contact As summarized in 2.4.1, the VSI HHRA calculated values for mercury in soil which would be protective of a direct contact exposure by future industrial/commercial workers and excavation workers. The excavation worker calculations were based on the sub-chronic reference dose (RfD) for mercury that was in effect in November, 1996. In 1997, USEPA published a revised sub-chronic RfD of 0.003 mg/kg/day (HEAST, 1997). The calculated values for excavation worker (i.e., utility or construction worker) direct contact from the 1996 HHRA have accordingly been updated in Section 2.4.3, with the practical effect that the values have increased to levels significantly higher than the average mercury concentration, and approach the maximum concentration, observed at the Taylor Instruments Site.

2.4.3 Updated Human Health Risk-Based Screening Levels

Updated RBSLs are provided in Table 2-1. These RBSLs represent the concentrations of each chemical of concern that are protective for future exposures to Site media under the assumed exposure conditions for each receptor scenario. Potential exposures to Site media would not result in unacceptable risks if the media concentrations are less than or equal to the RBSLs, under these conditions.

Due to the difficulty in precisely calculating bulk soil concentrations which would be protective for potential indoor inhalation exposures, RSBLs for the inhalation route can only be approximated. For the Taylor Instruments Site, these RSBLs would need to be applied along with soil gas concentration monitoring or compliance targets, as discussed in Table 2-1. Other than these RBSLs, the RSBLs presented are based on the same exposure assessments used in the 1996 HHRA, updated as discussed in Section 2.4.2. The only other change from the HHRA is the further focus on mercury and TCE as the primary Site contaminants and therefore the only ones for which RSBLs are presented. As described in the 1996 Investigation Report, secondary contaminants such as 1,2-DCE and lead are so strongly associated with the primary contaminants that separate RBSLs (and remedial goals) appear unnecessary.

The RBSLs presented do not necessarily represent CE's proposed clean up levels for the Taylor Instruments Site.

3.0 REMEDIAL OBJECTIVES

This section presents the remedial action objectives for soil and groundwater on-site at the Taylor Property. It also presents a discussion of various potential cleanup goals evaluated for the primary Site contaminants (mercury and TCE), and presents volume estimates of the quantity of soil exceeding each of the cleanup goals.

3.1 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) for Site soils, groundwater, and sewer remediation are developed to protect on-site receptors from direct contact, inhalation, and ingestion hazards that could be caused by the Site contaminants. They present the broad goals of Site remediation alternatives to protect human health and the environment.

For the purpose of remedial action objective development, CE has assumed that the Site's best future use would be as a redeveloped commercial or industrial property. This assumption is consistent with site zoning, its location within Enterprise and Economic Development Zones, and our past discussions with the City of Rochester. It is consistent with their goals for the property as the largest undeveloped commercial or industrial property within the City. It is also consistent with the executed Voluntary Cleanup Agreement (VCA).

The discussion below for Site soil and groundwater focuses on the on-site cleanup objectives. Off-site cleanup will be covered in a separate technical report entitled "Selection of Off-Site Cleanup Goals and Remedial Actions" which is scheduled to be submitted to NYSDEC in January, 1998.

Soil Remedial Action Objectives

The following are the identified soil RAOs for the organic and inorganic contaminants at the Taylor Instruments Site.

- Prevent ingestion/direct contact/inhalation of soil (vapor) having concentrations of mercury, lead, TCE, DCE and PCE and other Site-related contaminants that would pose a potential cancer risk greater than 10^{-6} and/or would result in a combined HI greater than 1.
- Remediate soil at one or more on-site locations as necessary to achieve groundwater RAOs.
- Select cleanup levels which are consistent with New York guidance as applied to Site specific-conditions including the reasonable best future use for the Site.

Sewers Remedial Action Objectives

The following RAO has been developed for Site sewers:

- Prevent or reduce off-site migration of contaminants via the on-site sewers.

Groundwater Remedial Action Objectives

In evaluating on-site groundwater, we have decided not to develop on-site RAOs at this time, and instead, intend to develop RAOs for on-site and off-site groundwater as part of the January 1998 "Selection of Off-Site Cleanup Goals and Remedial Actions". This has been done for the following reasons:

- Groundwater is believed to be the most significant route of contaminant transport off the Site. The mercury at the Site appears to be relatively immobile, however, the TCE does appear to be migrating off-site via the groundwater.
- On-site TCE contamination in groundwater and soil is inextricably linked to the off-site groundwater contaminant levels. The ultimate cleanup goal for TCE in on-site groundwater will be largely influenced by the off-site groundwater conditions and goals.
- If off-site groundwater extraction or control is necessary, it would almost certainly be combined with on-site groundwater extraction or control.

Therefore, cleanup objectives related to groundwater and groundwater migration are not discussed in this report, but will be included in the January 1998 Off-Site Report.

3.2 CLEAN-UP GOALS

This and previous technical memoranda on the Taylor Instruments Site have presented Site human health risk assessment information, and cleanup goals calculated to protect human health and the environment. For a future commercial/industrial use, these evaluations have shown that a substantial amount of the existing contamination at the Site could be left in place, and would not adversely affect future Site workers or visitors. Based on the most current information about the Site and its future intended uses, soil cleanup levels of 2,500 mg/kg for mercury and 31 mg/kg for TCE would mitigate Site risks to acceptable levels. However, NYSDEC's Technical and Administrative Guidance (TAGM) 4046 (*Division Technical and Administrative Guidance Memorandum on Determination of Soil Cleanup Objectives and Cleanup Levels,* HWR-94-4046, January 24, 1994) appends "recommended soil cleanup objectives, which are several orders of magnitude less than the risk-based calculations completed for this Site (i.e., 0.1 mg/kg for mercury and 0.7 mg/kg for TCE). The TAGM values are not promulgated standards, and the TAGM recognizes that differing Site conditions may require different Site cleanup goals than the TAGM's listed goals, given conditions such as the technical feasibility of meeting the TAGM numerical criteria, or other cleanup levels that may be equally protective of human health and the environment for a specific site's conditions and planned use. TAGM 4046 states:

> "Recommended soil cleanup objectives should be utilized in the development of final cleanup levels through the Feasibility Study (FS) process. During the FS, various alternative remedial actions developed during the Remedial Investigation (RI) are initially screened and narrowed down to the list of potential alternatives that will be evaluated in detail. These alternative remedial actions are evaluated using the criteria discussed in TAGM 4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites, revised May 15, 1990, and the preferred remedial action will be selected. After the detailed evaluation of the preferred remedial action, the final cleanup levels which can actually be achieved using the preferred remedial action must be established"..

Remedy selection, which will include final cleanup levels, is the subject of TAGM 4030".

The remainder of this section discusses in more detail the NYSDEC regulatory requirements for Site cleanup. In the remainder of this report, alternatives for Site remediation are developed and evaluated for a wide range of cleanup goals. This allows, consistent with TAGM 4030, an evaluation of technical feasibility, human health and environmental protectiveness, and cost to be compared not just between differing alternatives, but also between various cleanup goals using the same cleanup technology.

Evaluation of Regulatory Requirements, NYSDEC Policy and Guidance

The Taylor Instruments Site will be remediated under New York's Voluntary Cleanup Program (VCP). A VCA has been signed by Combustion Engineering and NYSDEC.

New York's VCP is intended to provide a structured but more flexible approach then the State's Inactive Hazardous Waste Site program as set out in 6 NYCRR Part 375. While the approach to investigating and remediating the Site is more flexible than the Inactive Hazardous Waste Site program, Part 375 and its underlying guidance and policy provide a framework from which to evaluate potential remedial approaches and resulting clean-up goals with specific emphasis being placed on the intended future use of the site and the realistic exposure scenarios posed by such uses. This document therefore evaluates remedial options following the criteria presented in the Part 375 guidance.

One of the goals of New York's Inactive Hazardous Waste Site program (IHWP) is the cleanup or restoration of an inactive hazardous waste Site "to its original state" which is "the condition of the area immediately before [the disposal of hazardous waste], or if that condition can not be determined, to a "reasonably environmentally sound condition" (6 NYCRR Section 375-1.1 (b) (2), and 375-1.3(p).). However, as a matter of policy, while New York's VCP's primary focus is to identify cleanup levels which are "consistent with the safe use of the property for [the intended use]" (NYSDEC Policy: Voluntary Cleanup organization and delegation Memorandum #94-32 at 2), in order to promote beneficial redevelopment of the site.

Another general tenet of the IHWP is that the selection of the cleanup goals and remedial alternatives must conform with such standards, "unless good cause exists why conformity should be dispensed with" (6 NYCRR Section 375-1.0 (c)(1)). This section also indicates the circumstances under which such "good cause" exists:

- the proposed action is only one part of a complete program,
- conformity would result in a greater risk to the public health or the environment,
- conformity is technically impracticable from an engineering perspective; or
- the program will attain a level of performance that is equivalent to the standard or criteria.

New York's recommended residential-based soil cleanup generic objectives set forth in Appendix A to TAGM 4046, to the extent they are risk-based (i.e., for VOCs), are not considered to be directly applicable to the Taylor Instruments Site because they are based upon an assumed future residential use of the Site, because they were intended to "eliminate all significant threats to human health or the environment" in a residential scenario. According to TAGM 4046, the generic cleanup objectives are used as a screen to select alternatives which will be evaluated in the Feasibility Study. (TAGM 4046 at 1.) The residential TAGM guidance levels appended to TAGM 4046 are, therefore, still used in the range of cleanup levels evaluated in this report for the purposes of evaluating the feasibility of remedial alternatives.

NYSDEC TAGM 4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites, revised May 15, 1990, generally sets out the following steps in selecting remedial alternatives and establishing cleanup levels:

- Develop and screen remedial alternatives based upon the nature and the volume or area of contamination

- Do a detailed analyses of alternatives.

- Recommend a remedial alternative for the Site.

During the detailed analysis, the ability of alternatives to meet standards, criteria and guidance is considered (SCG). If an alternative does not meet a SCG, it can be retained with an explanation as to "why compliance with SCGs was not needed to protect human health and the environment". (TAGM 4030 at 5.1, see also 5.2.3.1.).

3.3 Soil Volume Estimates

Estimates of the volume of soil exceeding NYSDEC TAGM 4046 recommended generic cleanup objectives, and other potential cleanup levels for mercury and TCE were performed as part of this evaluation. Discussions of procedures used in estimating the volume of impacted soil are presented in the following paragraphs.

<u>Soil Volume Estimates - Mercury Impacted Soils.</u> To generate soil volume estimates for mercury impacted soil, analytical and observational data collected during the Phase I Voluntary Site Investigation (VSI) and subsequent investigations were evaluated. Results of mercury analysis from Site soils were plotted onto a Site map and mercury concentration contours were developed at various depth intervals. Evaluation of the data indicated that the highest concentrations of mercury (greater than 1000 mg/kg) in Site soils are present from 0 to 4 feet bgs in the areas believed to contain glass shard wastes and in the former Building 2 trench area. Both of these areas are located in the northwestern portion of the Site. Results of soil analysis at depths below 4 feet bgs indicated similar areal distribution of mercury at the Site. No soil analytical results have indicated mercury is present at concentrations greater than 100 mg/kg below 8 feet bgs, although sporadic analytical results indicate the presence of mercury exceeding 0.1 mg/kg occurs as deep as the bedrock surface. Based on this distribution of mercury impacted soil, contours were developed for the following mercury concentrations: 0.1 mg/kg (residential TAGM guidance), 1 mg/kg, 10 mg/kg, 100 mg/kg, 500 mg/kg, and 1000 mg/kg. Soil depth was divided into the following intervals: 0-4 feet bgs, 4-8 feet bgs, 8-16 feet bgs, and 16-24 feet bgs. For the purpose of this soil volume estimate the following general assumptions were made:

- Depth to groundwater at the Site ranges from 4-8 feet bgs; assume that 50 percent of the material encountered from 4-8 feet bgs will be saturated.
- Depth to the bedrock surface at the Site ranges from 19-24 feet bgs; assume that the bedrock surface is at 24 feet bgs throughout the Site.

Figures 3-1, 3-2, 3-3 and 3-4 present the results of mercury concentration contouring, Table 3-1 summarizes the estimated soil volumes associated with each concentration at the four specified depth intervals. The contours presented on Figures 3-1, 3-2, 3-3 and 3-4 represent an approximated areal extent of mercury at the specified concentrations based on available Site specific analytical results.

Examination of the mercury distribution suggests that mercury is present at concentrations exceeding 0.1 mg/kg at approximately 75 % of the Site soils from 0 to 4 feet below ground surface (bgs). As stated above, the contours also indicate that the highest concentrations of mercury (greater than 1000 mg/kg) in Site soils are present from 0 to 4 feet bgs corresponding with the areas believed to contain concentrated glass shard wastes and visible mercury in soils in the former Building 2 trench area in the northwestern portion of the Site.

Soil Volume Estimates - TCE Impacted Soils. To generate soil volume estimates for TCE impacted soil, analytical and observational data collected during the Phase I VSI and subsequent investigations were evaluated. The data indicates that the areal extent of TCE impacted soil is in the vicinity of two former TCE use areas at the Site and extends down to the bedrock surface in these areas.

Results of TCE analyses from Site soils were plotted onto a Site map and TCE concentration contours were developed. The evaluation of the data indicated that the highest concentrations of TCE (greater than 70 mg/kg) in Site soils are present in the immediate vicinity of the former TCE vapor degreasing sump in Area A (Figure 3-5), and in immediate area of the former TCE above ground storage tank (AST) in Area B (see Figure 3-5). Contours were developed for the following TCE concentrations: 0.7 mg/kg (residential TAGM guidance), 7 mg/kg, and 70 mg/kg.

TCE concentrations in these areas exceed 0.7 mg/kg from the ground surface to the bedrock surface. TCE concentrations in these areas exceed 7 mg/kg to depths of 16 feet bgs in Area A and to the bedrock surface in Area B. TCE concentrations in these areas exceed 70 mg/kg to depths of 8 feet bgs in Area A and to 2 feet bgs in Area B. Estimates of soil volume exceeding these TCE concentrations were based on the aerial extent shown on Figure 3-5 and these depth intervals. The areal extent presented on Figure 3-5 represents an approximated areal extent based on available Site specific analytical results. For the purpose of this soil volume estimate the following general assumptions were made:

- Depth to groundwater at the Site ranges from 4-8 feet bgs; assume that 50 percent of the material encountered from 4-8 feet bgs will be saturated.
- Depth to the bedrock surface at the Site ranges from 19-24 feet bgs; assume that the bedrock surface is at 24 feet bgs throughout the Site.

The associated estimated soil volumes for each area are presented on Table 3-2.

4.0 IDENTIFICATION AND SCREENING OF APPLICABLE TECHNOLOGIES

In order to determine cleanup goals for the Site potential remediation technologies for the contaminants of concern at the Site were evaluated for technical feasibility and evaluated for implementability at a range of potential cleanup goals. Remedial technologies were identified based on a review of literature sources and electronic databases, contacts with vendors to obtain specific information and performance data, and experience in developing similar evaluations. The following subsections present the technologies identified for mercury and TCE-impacted soil at the Site.

4.1 MERCURY REMEDIAL TECHNOLOGIES

Due to the unique nature and behavior of mercury in the environment, successful remediation of mercury impacted soil requires consideration of the physical, chemical, biological processes that affect the fate and transport of mercury at a given site.

Mercury exists in both organic and inorganic forms and may occur in three different valance states: elemental mercury in the Hg^0 state and ionic mercury in either a Hg^+ or Hg^{+2} state. Elemental mercury, one of a few metals that is a liquid at room temperature, has a melting point of -38.87 °C (-37.97 °F) and a boiling point of 356.6 °C (673.9 °F). It is 13.5 times more dense than water and approximately 5 times more dense than most soils. It has a vapor pressure of 0.0012 millimeters (mm) Hg at 20 °C (68 °F), which increases by orders of magnitude with relatively small increases in temperature. Although its vapor pressure is high for a metal, it is too low for treatment in the environment by vapor extraction type technologies. Elemental mercury is sparingly soluble in water (0.056 mg/L at 25 °C [77 °F]). There is a strong tendency for mercury, in all of its elemental, ionic, and organomercurical forms to sorb to nearly every available surface. The positive aspect of this behavior is that mercury is not highly mobile under most environmental conditions.

Due to the specialized use of mercury in industrial and manufacturing operations, mercury contamination is infrequently encountered, and thus, remedial technologies are not as well developed as they are for more common environmental contaminants (e.g., VOCs) Due to the wide use of mercury in the natural gas industry in metering and monitoring equipment, extensive research into mercury remediation has been conducted by the Environment and Safety Research Group of the Gas Research Institute (GRI). The GRI published "A Review of Remediation Technologies Applicable to Mercury Contamination at Natural Gas Industry Sites" (GRI, 1993) to evaluate the properties of mercury and potential mercury remediation technologies. The review included physical, chemical, electrolytic, and biological treatment technologies, and immobilization/encapsulation technologies. This review, other current published literature, and contact with technology vendors were used as the basis for identifying technologies for consideration at the Site.

In general, in-situ remedial technologies such as in-place fixation/stabilization are not applicable for use at the Site. Most in-situ remedial technologies for mercury rely on solidification or chemical fixation to immobilize, but not remove the mercury; no net mass removal results from the application of these technologies. Site-specific mercury speciation results indicate that the majority of the mercury at the Site is in the elemental (Hg^0) form, a non-mobile, non-bioavailable form (ABB-ES, 1996). Therefore there would tend to be little or no environmental or human health benefit from the application of such technologies.

In addition, few in-situ mercury treatment methods have been developed, however these lack a full or even pilot-scale demonstration of either short-term or long-term effectiveness. For example, vitrification is a commonly mentioned in-situ technology for fixation of contamination in the soil matrix. However, it remains limited in full-scale application and demonstrated long-term effectiveness, and is extraordinarily costly. For these reasons, in-situ fixation/stabilization remedial approaches which would result in no net mass contaminant removal and have uncertain long-term effectiveness were not considered further for the Site.

On-site containment using a cap was considered as a potentially applicable technology for mercury-impacted soil at the Site. While installation of a cap would not result in any net mass removal, it would prevent potential direct contact with mercury-impacted soils and potential migration of mercury vapors. Institutional controls were also considered potentially applicable technology for mercury-impacted soil at the Site. Institutional controls would prevent potential direct contact with mercury-impacted soils.

In contrast to in-situ remedial technologies, there are a number of well established ex-situ methods for addressing mercury contaminated soils. Most prominent are direct disposal and, to a lesser extent, thermal treatment technologies. Direct disposal of mercury contaminated soil in a regulated disposal facility is the most widely used technology for mercury contaminated soil. While direct disposal does not reduce the mass or recover mercury from the contaminated media, it does provide permanent isolation. The USEPA identified thermal roasting or retorting as best demonstrated available technology (BDAT) for the treatment of high-mercury contaminated materials. Studies reported by both the GRI and USEPA's SITE program indicate these methods are generally effective, and several are readily available commercially in both mobile and fixed-base applications. Therefore, thermal treatment technologies were considered further.

Ex-situ physical treatment technologies were also researched for applicability at the Site. However, physical processes are effective only for removing unbound liquid elemental mercury from most contaminated geologic materials and would not be effective for removing dispersed mercury or mercuric compounds from soils at the Site since mercury is bound in the soil matrix.

The technologies identified and screened for mercury remediation at the Site are presented in Table 4-1.

4.2 TCE REMEDIAL TECHNOLOGIES

Due to the widespread commercial and industrial use of chlorinated solvents, remediation of soil impacted by chlorinated VOCs has been extensively conducted. There are a number of proven, commercially available ex-situ and in-situ technologies for addressing TCE contamination in soils. Although the effectiveness of the various technologies can vary widely dependent upon site conditions and other factors, proper engineering analysis can enable design and implementation of a remediation approach to achieve a range of soil cleanup goals. Ex-situ methods for remediating TCE are relatively abundant and well tested; thermal treatment technologies and off-site disposal are believed to be most applicable to the Site and would likely be conducted in conjunction with mercury remediation. In-situ technologies including soil vapor extraction (SVE), Vacuum Enhanced Recovery (VER), and bioventing are also widely used and potentially applicable to the Site. Containment on-site using a capping system is also a potentially applicable technology.

The technologies researched for TCE remediation at the Site are presented in Table 4-2.

5.0 IDENTIFICATION OF REMEDIAL ALTERNATIVES

Several remedial alternatives have been developed to address mercury and TCE contamination at the Taylor Instruments Site based on technology screening performed in Section 4 and the remedial action objectives. The alternatives developed for remediation of mercury-impacted soil at the Site and the major technical components of each are presented in Tables 5-1 and 5-2, respectively. The alternatives developed for remediation of TCE-impacted soil at the Site and the major technical components of each are presented in Tables 5-3 and 5-4, respectively.

6.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This section provides a detailed analysis for each of the mercury and TCE remedial alternatives developed in Section 5. Subsequently each alternative is evaluated based on the criteria set forth in the TAGM: Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC, 1990) and Part 375. A summary of these criteria are listed in Table 6-1.

6.1 Remedial Alternatives for Mercury-Contaminated Soil

This section presents the detailed analysis for the four remedial alternatives developed to address mercury contamination at the Site. Each alternative is evaluated at the various cleanup goals presented in Section 3.

6.1.1 Alternative HG-1: Minimal Action

This alternative does not actively remediate mercury contaminated soil, but relies on institutional controls to reduce the potential for exposure to mercury in Site soil by eliminating potential exposure pathways. Deed restrictions would be implemented to restrict future Site use no use, or low intensity use (i.e., parking lot) only. These controls would be drafted, implemented, and enforced in cooperation with the Site owner, state and local governments. An evaluation of Alternative HG-1 against the evaluation criteria is presented in Table 6-2 and a cost summary is included as Table 6-3.

6.1.2 Alternative HG-2: Off-Site Disposal

A description of Alternative HG-2, Off-Site Disposal for mercury-contaminated soil, is presented in this subsection. An evaluation of Alternative HG-2 against the evaluation criteria is presented in Table 6-4.

Components of Alternative HG-2. Alternative HG-2 utilizes excavation and off-site disposal in an approved landfill to remove mercury impacted soil from the Site. Under this alternative mercury impacted soil would be excavated, loaded into transport trucks, and shipped to an approved disposal facility to be landfilled. After excavation, the area would be backfilled with clean fill to restore Site grade.

Soil would be excavated within pre-determined areas that include known exceedances of mercury cleanup goal (see Figures 3-1 through 3-4). Excavated soil would be stockpiled on-site for characterization sampling and analysis prior to disposal. Excavated soil would be managed by segregating debris soil (e.g., glass shards, metal, ash, wood fill) and non-debris soil (segregates as "clean cover soils", elemental mercury soils, and soils with lower expected mercury concentrations, etc.). Characterization testing would include, at a minimum, testing for TCLP metals. Soil exceeding TCLP criteria would require disposal as a hazardous waste, whereas, soil passing TCLP would be disposed as a non-hazardous material. Once excavation of an area is completed, the limits of the excavation would be sampled for total mercury, and the results would be compared to the cleanup goal. Areas exceeding the cleanup goal would undergo additional soil removal, and subsequent re-testing.

When significant excavation below the water table is necessary, the excavation area will requiring dewatering, and treatment of the collected groundwater prior to discharge in accordance with applicable requirements. For this evaluation, the hydraulic conductivity of the soil was estimated using Site specific data, and the volume of water generated during excavation below the water was estimated based on the area of the excavation sidewalls. Treatment of groundwater was assumed to be via an air stripper and carbon adsorption system, with discharge to the sewer for treatment at MCPW Publicly Owned Treatment Works (POTW).

Institutional controls in the form of deed or comparable land-use restrictions would be implemented to restrict future Site use to industrial/commercial activities only. These controls would be drafted, implemented, and enforced in cooperation with the Site owner, state and local governments.

Technical Challenges of Alternative HG-2. While excavation and off-site disposal are relatively straight forward remediation practices, this alternative does present some technical challenges with the methods of excavation and management of excavated soil due to the potential large volume of soil to be disposed, large area of excavation, depth of excavation, and excavation activities below the groundwater table. For higher cleanup goals (100 mg/kg and above) these challenges are minor because the excavation is limited below the water table and would likely be conducted without dewatering, and the volumes while large are manageable and do not extend near any structures. However lower cleanup goals result in progressively greater challenges as the aerial extent and the depth of the excavation increases.

Soil management will be conducted in a manner that segregates areas of high mercury contamination (i.e., glass shard area, and Building 2 trench area) from soils outside these areas. Proper management and segregation of soils will help in controlling the cost of the remedial action.

The areal extent and depth of excavation may also present technical challenges in conducting remedial actions. As the areal extent of the excavation moves toward the Site boundaries at the lower cleanup goals, surrounding roadways, railways, and public walkways may require shoring and bracing to prevent structural damage. As the depth of the excavation increases, excavation of soils from below the groundwater table will require management of dewatering fluids generated, and stabilization or sloping of the excavation sidewalls to prevent collapse.

Cost Evaluation. A relative cost evaluation was conducted for the various cleanup goals for this alternative. The evaluation utilized unit costs to approximate the total cost of the remedial action. The cost evaluation utilized the following general assumptions for the Site:

- depth to groundwater at the Site varies between 4-8 feet bgs at the Site; to be conservative assume that 50 percent of soil from 4-8 feet bgs will be saturated, assume all soil below 8 feet bgs will be saturated;
- depth to the bedrock surface Site various between 18-24 feet bgs at the Site, assume the maximum depth of soil at the Site is 24 feet bgs throughout the Site;
- within the glass shards area, glass shards are concentrated in an average 0.5 foot thick layer across the entirety of the area; assume that this layer will require disposal as a hazardous waste;
- to be conservative, assume that 5-percent of the soil with mercury concentrations greater than 100 mg/kg will fail TCLP for mercury and will require disposal as a hazardous waste; and
- assume that no soil with mercury concentrations less than 100 mg/kg will not fail TCLP for mercury and will be disposed of as a non-hazardous waste.

Table 6-5 presents the cost evaluation for Alternative HG-2.

6.1.3 Alternative HG-3: Low Temperature Thermal Desorption

A description of Alternative HG-3, On-Site Thermal Treatment for mercury-contaminated soil, is presented in this subsection. An evaluation of Alternative HG-3 against the evaluation criteria is presented in Table 6-6.

Components of Alternative HG-3. Alternative HG-3 relies on on-site ex-situ treatment of mercury contaminated soil using a mobile low temperature thermal desorption unit. Site preparation and mobilization activities for the on-site thermal treatment option would consist primarily of mobilizing excavation and treatment equipment and constructing stockpile, treatment, and decontamination areas. After treatment, the soil would be backfilled into the excavation to restore Site grade. It is anticipated that soil from the glass shard area at the Site would not be suitable for use as backfill material. This evaluation assumes that this material will be disposed of off-site after treatment.

Soil would be excavated within pre-determined areas that include known exceedances of mercury cleanup goal (see Figures 3-1 through 3-4). Excavated soil would be stockpiled adjacent to the treatment unit prior to treatment. Once excavation of an area is completed, the limits of the excavation would be sampled for total mercury, and the results would be compared to the cleanup goal. Areas exceeding the cleanup goal would undergo additional soil removal, and subsequent re-testing.

If significant excavation below the water table is necessary, the excavation area will requiring dewatering, and treatment of the collected groundwater prior to discharge will be required in accordance with applicable requirements. Excavation below the groundwater table is discussed in Section 6.1.2.

Thermal desorption describes any number of processes that use indirect heat exchange to vaporize organic contaminants and some high vapor pressure inorganics (e.g., mercury) from soil. Prior to treatment, excavated soil would be screened to remove oversized objects. Screened soil would be loaded into the desorption chamber of the low temperature thermal desorption (LTTD) unit using a front-end loader. The type of desorption chamber used in the process is specific to the vendor's equipment, and could include indirect-fired rotary kiln, internally heated screw augers, or a series of externally heated distillation chambers. In contrast to much higher temperature incineration technologies, soil does not come in direct contact with a flame source during the process; rather, the soil contacts a heat transfer surface within the desorption chamber. Thermal treatment of mercury contaminated soil typically involves purging the system of oxygen, heating the contaminated materials in either a nitrogen atmosphere or in a vacuum to up to temperatures near 1500 °F, collecting and condensing evolved vapors, and recovering elemental mercury. Off-gases from the desorption chamber are treated in an air-pollution control system prior to discharge. Thermal units can treat up to 10 tons of material per hour depending on material characteristics and treatment goals.

During operation of the thermal unit performance testing would be conducted to ensure that thermal treatment reduces mercury concentrations to below remediation goals. Compliance monitoring would also be conducted periodically during operation of the unit to ensure that air emission standards are not being exceeded.

Operation of thermal desorption systems typically create several residuals, including treated material, oversized material, condensed contaminants, water particulate control system dust, treated off-gas, and spent carbon. Treated soil would be sampled and based on analytical results, either treated again or used as backfill on-site. Depending on size, oversized material would be either crushed and thermally treated or steam-cleaned and returned to the excavation or disposed off-site. Condensed water and scrubber purge water may be used as a dust suppressant and coolant for the treated soil. Concentrated, condensed elemental mercury would be recycled. Dust collected from particulate control devices may be combined with treated soil or recycled through the desorption unit, if necessary. Treated off-gas would be released to the atmosphere. Spent carbon would be regenerated or disposed in an off-site landfill.

Institutional controls in the form of deed or comparable land-use restrictions would be implemented to restrict future Site use to industrial/commercial activities only. These controls would be drafted, implemented, and enforced in cooperation with the Site owner, state and local governments.

Technical Challenges of Alternative HG-3. The technical challenges of alternative HG-3 include: methods of excavation and management of excavated soil due to the potential large volume of soil to be treated, large area of excavation, depth of excavation, and excavation activities below the groundwater table. These are discussed in the Section 6.1.2 under Alternative HG-2.

Alternative HG-3 will also provide challenges in coordination and scheduling of remediation activities. Throughput of the thermal treatment system would be the limiting factor expediting the duration of remedial activities at the Site. At lower cleanup goals, the volume of material to treat increases drastically (see Table 3-1), the treatment time required to achieve the lower cleanup goals increases, and the duration of the remediation period is greatly lengthened.

Cost Evaluation. A cost evaluation was conducted for the various cleanup goals for this alternative. The evaluation utilized unit costs to approximate the total cost of the remedial action. In addition to the general assumptions presented for Alternative HG-2, Alternative HG-3 assumed that material treated using thermal extraction would meet the mercury cleanup goal. All treated material expect material continuing glass shards, would be used as backfilled on-site. Material containing glass shards would be disposed off-site. Table 6-7 presents the cost evaluation for Alternative HG-3.

6.1.4 Alternative HG-4: Cap

A description of Alternative HG-4, Cap for mercury-contaminated soil, is presented in this subsection. An evaluation of Alternative HG-4 against the evaluation criteria is presented in Table 6-8.

Components of Alternative HG-4. Alternative HG-4 would include capping of mercury-contaminated soils with a low-permeability cover system and long-term environmental monitoring. The purposes of the low-permeability cover system would be to reduce the potential for mercury vapor migration, reduce infiltration of rainwater through contaminated soils into groundwater, promote good surface drainage, and eliminate human and ecological receptors exposure pathways.

Site preparation and mobilization would include all activities required to prepare the Site for construction. This would include (but not limited to) delivery and setup of Site trailers, connections to utilities, survey of the cap layout, mobilization of construction equipment and materials, and construction of staging areas. Underground utilities would be identified and possibly relocated before construction activities commence. Also as part of Site preparation, mercury-contaminated soil outside the limits of the proposed cap would be excavated and consolidated within the limits to provide the necessary slopes for drainage. Clean fill would be imported to backfill and regrade these excavations.

For the purposes of this evaluation, a landfill cap consistent with the NYSWR as described in 6 NYCRR Part 360 was assumed. NYSWR recommends a cover system composed of a vegetative top cover layer, a barrier protection layer, a low-permeability barrier, and a gas venting system. This cross section is the basis for the preliminary cost estimates provided. The actual cross-section of the cover system would be proposed during the design. The size of cap is dependent upon the final agreed upon cleanup goal, but would range between 11.5 acres for a mercury cleanup goal of 0.1 mg/kg, and less than 1 acre for a mercury cleanup goal of 100 mg/kg or greater.

Following construction of the cap, a maintenance and monitoring program would be implemented to maintain the integrity of the cover system and evaluate the effectiveness of the remedial action for controlling soil and groundwater contamination. Maintenance would include inspections of the cover system and its components. Monitoring would involve periodic sampling of groundwater.

Institutional controls in the form of deed or comparable land-use restrictions would be implemented to restrict future Site use in the area of the cap, thereby limiting the potential for exposure to Site contaminants and disturbance of the cap. Use would be limited to activities that would not impact the cover systems effectiveness (e.g., greenspace or park). These controls would be drafted, implemented, and enforced in cooperation with the Site owner, state and local governments. Alternatively, the cap could be designed to allow for construction of structures above the cap.

At sites where wastes have not been treated permanently, five-year Site reviews are required to ensure that public heath and the environment are being protected. The five-year review would organize, present, and interpret data gathered during sampling events in report format. The review could recommend to continue or modify the maintenance and monitoring program and five-year reviews, or to implement additional remedial action, as appropriate.

Technical Challenges of Alternative HG-4. Construction of cover system over the area exceeding cleanup goals is a relatively straight forward remediation practice.

Cost Evaluation. A cost evaluation was conducted for the various cleanup goals for this alternative. The evaluation utilized unit costs to approximate the total cost of the remedial action. The present worth of the operation and maintenance costs associated with this alternative were calculated using a 7-percent interest rate for a period of 30 years. Table 6-9 presents the cost evaluation for Alternative HG-3.

6.2 Remedial Alternatives for TCE Contaminated Soil

This section presents the detailed analysis for the five remedial alternatives developed to address TCE contamination at the Site. Each alternative is evaluated at the various cleanup goals presented in Section 3.

6.2.1 Alternative TCE-1: Minimal Action

Alternative TCE-1, Minimal Action for TCE-contaminated soil, would be similar to that described in Subsection 6.1.1 for Alternative HG-1. An evaluation of Alternative TCE-1 against the evaluation criteria is presented in Table 6-10 and a cost summary is included as Table 6-11.

6.2.2 Alternative TCE-2: Off-Site Disposal

A description of Alternative TCE-2, Off-Site Disposal for TCE-contaminated soil, is presented in this subsection. An evaluation of Alternative TCE-2 against the evaluation criteria is presented in **Table 6-12**.

Components of Alternative TCE-2. Alternative TCE-2 would utilize excavation and off-site treatment and disposal to remove TCE-contaminated soil from the Site. Under this alternative TCE-contaminated soil would be excavated, loaded into transport trucks, and shipped to an approved treatment and disposal facility. After excavation, the area would be backfilled with clean fill to restore Site grade.

Soil would be excavated within pre-determined areas that include known exceedances of TCE cleanup goal (see Figures 3-5). Excavated soil would be managed by segregating debris soil (e.g., metal, ash, wood fill) and non-debris soil (segregated as "clean cover soils" and soil contaminated with TCE). Excavated soil would be stockpiled on-site for characterization sampling and analysis prior to disposal. Characterization testing would be tailored to comply with the requirements of the disposal facility. Once excavation of an area is completed, the limits of the excavation would be sampled for TCE, and the results would be compared to the cleanup goal. Areas exceeding the cleanup goal would undergo additional soil removal and subsequent re-testing.

When significant excavation below the water table is necessary, the excavation area will requiring dewatering, and treatment of the collected groundwater prior to discharge in accordance with applicable requirements. Excavation below the groundwater table is discussed in Section 6.1.2.

Institutional controls in the form of deed or comparable land-use restrictions would be implemented to restrict future Site use to industrial/commercial activities only. These controls would be drafted, implemented, and enforced in cooperation with the Site owner, state and local governments.

Technical Challenges of Alternative TCE-2. While excavation and off-site disposal are relatively straight forward remediation practices, this alternative does present some technical challenges with the methods of excavation and management of excavated soil due to the potential large volume of soil to be disposed, large area of excavation, depth of excavation, and excavation activities below the groundwater table. As the excavation progress to the saturated soil zone the excavation will require management of dewatering fluids generated, and stabilization or sloping of the excavation sidewalls to prevent collapse.

Cost Evaluation. A cost evaluation was conducted for the various cleanup goals for this alternative. The evaluation utilized unit costs to approximate the total cost of the remedial action. The general assumptions presented for Alternative HG-2 were used in estimating this cost. Table 6-13 presents the cost evaluation for Alternative TCE-3.

6.2.3 Alternative TCE-3: Thermal Treatment

A description of Alternative TCE-3, Thermal Treatment for TCE-contaminated soil, is presented in this subsection. An evaluation of Alternative TCE-3 against the evaluation criteria is presented in Table 6-14.

Components of Alternative TCE-3. A description of thermal treatment process is described in Subsection 6.1.3 for Alternative HG-3. The thermal treatment process assumed in this evaluation for treatment of TCE contaminated soil is a static pile. A static pile was assumed because treatment costs associated with static pile treatment are typically less per ton than costs using a thermal treatment unit. Static piles are not applicable for mercury contaminated material because removal of mercury in thermal treatment relies on higher temperatures and turbulence in the treatment unit to aid in mercury removal.

Static piles use lifts of soil placed into covered treatment piles with air injection and extraction piping placed within the soil lifts. Typical piles sizes range from 1,000 to 2,000 tons of soil per pile. Piles require an area approximately 100 feet by 40 feet for construction and are typically 12 feet high. To reduce downtime and decrease the duration of the remediation, multiple piles would be used at the Site.

The batch thermal system evaluated uses air heated by propane to temperatures of up to 600-800°F is delivered to the soil pile and promotes volatilization of contaminants. Once the air contacts the soil and volatilizes contaminants, it is collected and removed from the pile by the extraction piping. Up to 90-percent of the off gas from the pile is recycled to the propane burner and reused. Off gas that is not recycled is treated in a catalytic oxidizer prior to discharge to the atmosphere. Air emissions from this type of unit are typically less than 0.1 pounds per hour. Piles are typically treated for a period of five to seven days. Treatment duration is dependent upon operating conditions, soil types, contaminant concentrations, and cleanup goals. Treatment duration for the Site would be determined during bench- or pilot-scale testing.

Technical Challenges of Alternative TCE-3. The technical challenges of alternative TCE-3 include: methods of excavation and management of excavated soil due to the potential large volume of soil to be treated, large area of excavation, depth of excavation, and excavation activities below the groundwater table. These are discussed in the Section 6.1.2 under Alternative HG-2.

Alternative TCE-3 will also provide challenges in coordination and scheduling. Limitations in size of the static pile, and the duration of pile treatment would the limiting factors in expediting the duration of remedial activities at the Site. At lower cleanup goals, the volume of material to treat increases drastically (see Table 3-2) and the duration of the remediation period is greatly lengthened. Additional at lower cleanup goals, the amount of saturated soil to be treated increases, and treatment via thermal processes will require more energy to vaporize water to increase the soil temperature.

Cost Evaluation. A cost evaluation was conducted for the various cleanup goals for this alternative. The evaluation utilized unit costs to approximate the total cost of the remedial action. In addition to the general assumptions presented for Alternative HG-2, Alternative TCE-3 assumed that all material treated using thermal extraction would meet the TCE cleanup goal and would be backfilled on-site. Table 6-15 presents the cost evaluation for Alternative HG-3.

6.2.4 Alternative TCE-4: Cover System

Alternative TCE-4, Cover System for TCE-contaminated soil is similar to that described in Subsection 6.1.4 for Alternative HG-4. An evaluation of Alternative TCE-4 against the evaluation criteria is presented in Table 6-16 and a cost summary for various cleanup goals is included as Table 6-17.

6.2.5 Alternative TCE-5: Soil Vapor Extraction

A description of Alternative TCE-5, SVE/VER for TCE-contaminated soil, is presented in this subsection. An evaluation of Alternative TCE-5 against the evaluation criteria is presented in Table 6-18.

Components of Alternative TCE-5. SVE is an in-situ remedial technology capable of reducing concentrations of volatile and semivolatile constituents adsorbed to subsurface soil. This technology involves creating a negative pressure in the vadose zone to collect contaminant vapors. A blower or vacuum pump is used to create a vacuum in extraction wells installed in the vadose zone. This applied pressure promotes mass transfer of VOCs and semivolatile organic compounds (SVOCs) from the soil matrix to the surrounding air. The resulting vapor is drawn through the extraction wells and to a vapor/liquid separator which removes liquids from the vapor stream and protects the blower from corrosion. The vapors are then treated using an adsorption system, such as activated carbon canisters, before being discharged to the atmosphere.

The performance of a SVE system can be enhanced in areas where the vadose zone is thin and soil contamination extends into the saturated zone by VER to increase effectiveness. VER uses the negative pressure created to also extract groundwater from extraction well. As groundwater is drawn through the soil, contaminants in the soil dissolve into the groundwater, and are extracted through the well. The SVE/VER combination requires the use of a liquid ring pump to accomplish the extraction of both vapor and liquid simultaneously. The extracted water is then treated in treatment system, such as an air stripper or activated carbon canisters, before being discharged.

Vapor monitoring points would be installed to monitor contaminant vapor concentrations, pressure differentials, and flow rates in the subsurface to determine system effectiveness and removal rates. Sample ports within the control structure, as well as the vapor monitoring points, would be sampled to monitor system effectiveness. Measurements collected during sampling would be used to adjust system operation and to obtain maximum removal efficiency.

The treatment system would operate until treatment goals are reached, or until monitoring results indicate that no further removal of contamination is occurring. Confirmation soil sampling would then be performed to provide information on residual contaminant concentrations and the results would be evaluated against the cleanup goal. The length of operation would be dependent upon the cleanup goal. For cost estimating purposes, an operation time of 2 years was assumed to achieve a TCE cleanup goal of 70 mg/kg, three years was assumed to achieve a TCE cleanup goal of 7 mg/kg, and five years was assumed to achieve a TCE cleanup goal of 0.7 mg/kg.

Extraction wells would be installed in the areas shown on Figure 3-5. Based on the soil type at the Site, the area of influence for the extraction wells was estimated to be approximately 20 feet. This would require installation of between 6 and 30 wells in the two areas depending on the selected cleanup goal. A pilot-test would be required to collect design data prior to implementing full-scale.

For all of the cleanup goals an SVE/VER system was assumed since TCE contamination exceeding the cleanup goals is present below the groundwater table . For this evaluation, it was assumed that the extraction wells from both the north and south source areas would be connected to a single control structure housing the blower, blower silencers, carbon filtration units, and control system via insulated, underground piping. For this evaluation treatment of extracted groundwater was assumed to be via an air stripper and carbon adsorption system, with discharge to the sewer for treatment at the MCPW POTW.

Technical Challenges of Alternative TCE-5. The use of an SVE/VER system to remediate VOC contamination is a common remediation technique. However, the low permeability of the Site soils, and the shallow water table will present challenges in system design. A pilot-test would be conducted to evaluate Site specific conditions prior to design of the system. The pilot-test would focus on the following:

- determining the radius of influence of the extraction wells;
- evaluating enhancement of the SVE system with a VER system;
- determining flow rates to properly size pumps, blowers, and treatment units; and
- estimating removal efficiencies to evaluate the duration of operation

Cost Evaluation. A cost evaluation was conducted for this alternative. The cost estimate utilized a conceptual design of an SVE/VER system to remediate the two areas shown on Figure 3-5. The conceptual system utilized between 6 and 30 SVE extraction wells depending on the cleanup goal to provide sufficient coverage in the north and south source areas. A cost evaluation was conducted the various cleanup goals for this alternative. The present worth of the operation and maintenance costs associated with this alternative were calculated using a 7-percent interest rate for an anticipated operation periods of 2-5 years depending on the cleanup goal. Table 6-19 presents the cost evaluation for Alternative TCE-5.

7.0 COMPARATIVE ANALYSIS

This section presents the comparative for the mercury and TCE remedial alternatives analyzed in detail in Section 6.

7.1 COMPARATIVE ANALYSIS - MERCURY ALTERNATIVES

A comparative analysis was conducted to evaluate the relative performance of each Alternative in relation to the criteria set forth in the TAGM: Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC, 1990) and Part 375. In accordance with the TAGM, the comparative analysis includes scoring of the Alternatives based on the evaluation criteria.

The detailed evaluation for remedial action to address mercury evaluated four potential remedial alternatives based on a range of mercury cleanup goals. Results of the detailed evaluation indicated that cleanup goals that include remediation of the area of glass shards (see Figure 3-1), and areas outside of the area of glass shards with mercury concentrations 100 mg/kg and higher do not differ in substantially in cost comparison. This is because at higher cleanup goals (100 mg/kg and higher) the bulk mass of mercury contamination exceeding cleanup goals at the Taylor Instruments Site is associated with the areas of glass shards. For this reason, cleanup goals of 500 and 1,000 mg/kg were eliminated from the comparative analysis.

Additionally, the detailed analysis indicated that some alternatives were evaluated to be more likely to be implemented at some cleanup goals than rather than others. For example, at the lowest mercury cleanup levels evaluated (0.1 mg/kg and 1 mg/kg) treatment using LTTD would not be implemented because of the large volume of soil requiring treatment (approximately 109,000 to 270,000 cy), the duration of the remediation period (between 3 to 5 years of continuous operation), and the high estimated cost ($49.8 to $124.3 million). Instead, Alternatives HG-2 or HG-4 would be more applicable for Site remediation to achieve the lower cleanup goals. In order to focus the comparative analysis on evaluating remedial alternatives that would be potentially selected for implementation at the various cleanup levels, the evaluation of Alternative HG-3, LTTD, was limited to cleanup goals of 10 and 100 mg/kg mercury. The remaining three alternatives are evaluated for the entire range of cleanup values retained as mercury cleanup goals (i.e., 0.1, 1, 10 and 100 mg/kg).

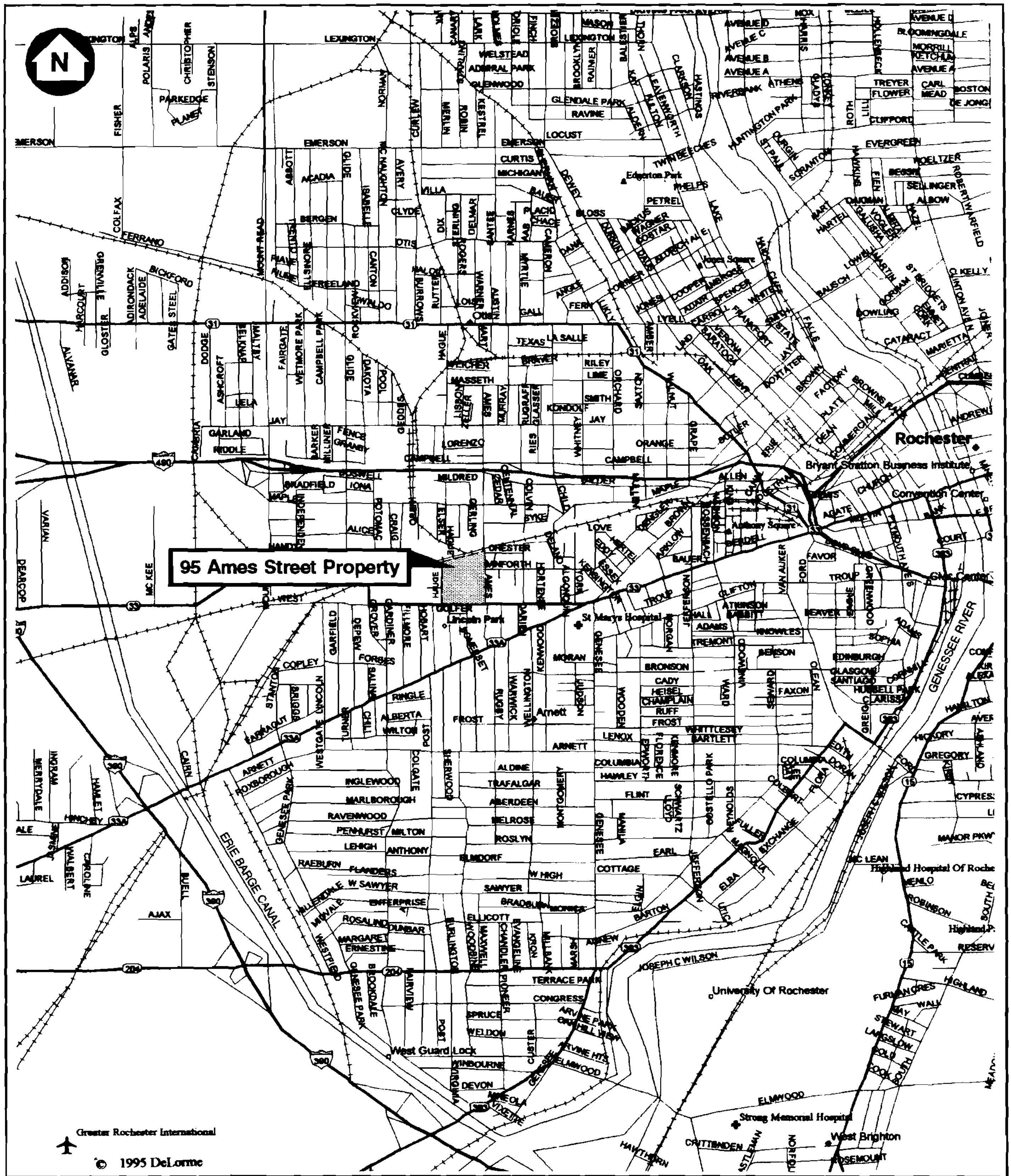
Tables 7-1, 7-3, 7-5, and 7-7 present the comparative analysis of the Alternatives at cleanup goals of 0.1, 1, 10 and 100 mg/kg respectively. Tables 7-2, 7-4, 7-6, and 7-8 present the scoring for each alternative at the respective cleanup goals. The scoring results are summarized on Table 7-9. A graphical comparison of the estimated costs of the remedial alternatives for mercury at the range of cleanup goals is presented on Figure 7-1.

7.2 COMPARATIVE ANALYSIS - TCE ALTERNATIVES

A comparative analysis was conducted to evaluate the relative performance of each Alternative in relation to the criteria set forth in the TAGM: Selection of Remedial Actions at Inactive Hazardous Waste Sites (NYSDEC, 1990) and Part 375. In accordance with the TAGM the comparative analysis includes scoring of the Alternatives based on the evaluation criteria. . The comparative analysis evaluated all of the Alternatives presented for TCE remediation at the cleanup goals presented in Section 3.

Tables 7-10, 7-12, and 7-14 present the comparative analysis of the Alternatives at cleanup goals of 0.1, 1, 10 and 100 mg/kg respectively. Tables 7-11, 7-13, and 7-15 present the scoring for each alternative at the respective cleanup goals. The scoring results are summarized on Table 7-16. A graphical comparison of the estimated costs of the remedial alternatives for TCE at the range of cleanup goals is presented on Figure 7-2.

FIGURES



Approximate
Scale in Miles

0 0.5 1

FIGURE 2-1
SITE LOCATION MAP
SELECTION OF CLEAN-UP GOALS AND REMEDIAL ACTION
TAYLOR SITE
ROCHESTER, NEW YORK

ABB Environmental Services, Inc.

W9511023D(c)

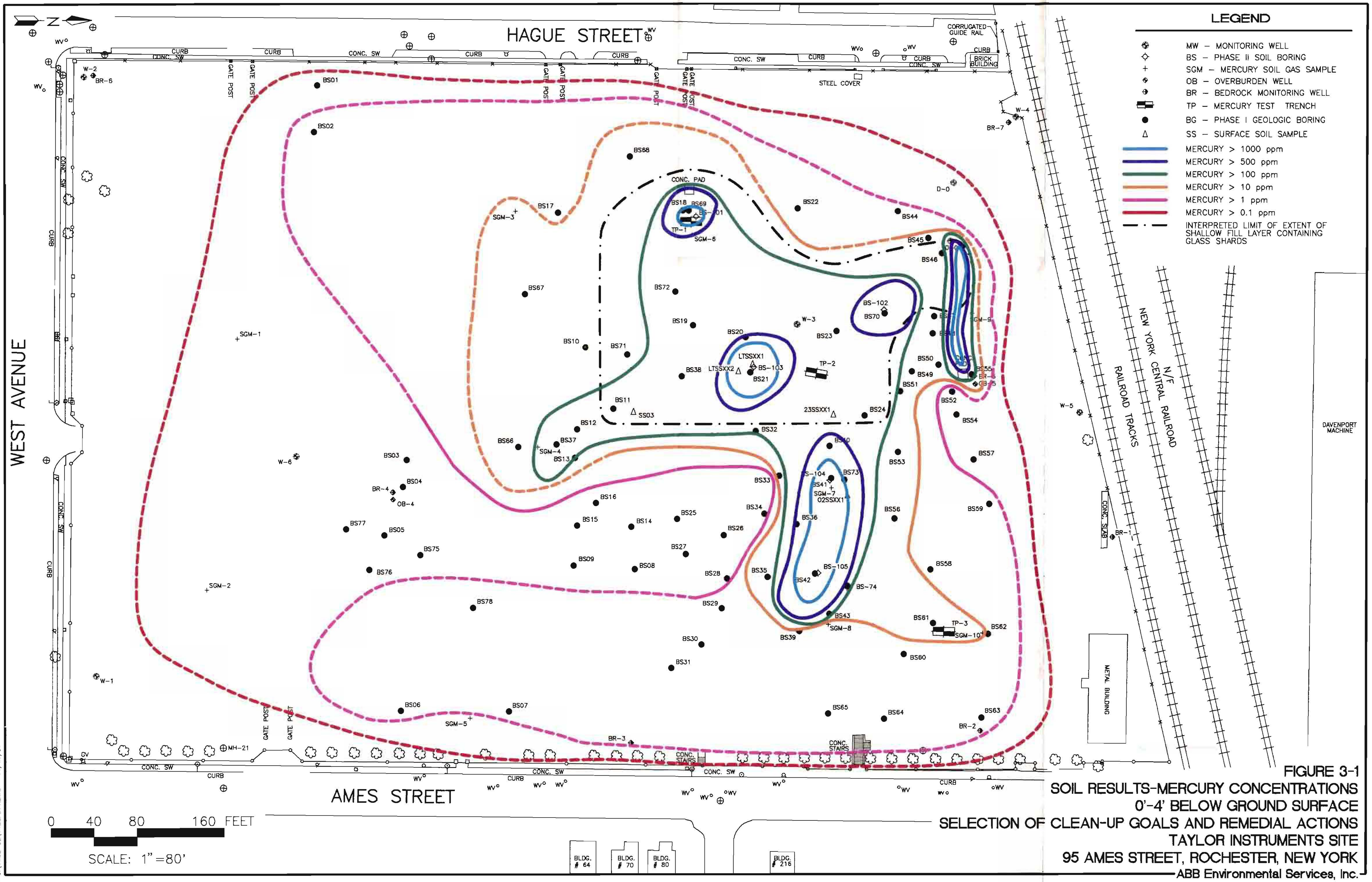


FIGURE 3-1
SOIL RESULTS-MERCURY CONCENTRATIONS
0'-4' BELOW GROUND SURFACE
SELECTION OF CLEAN-UP GOALS AND REMEDIAL ACTIONS
TAYLOR INSTRUMENTS SITE
95 AMES STREET, ROCHESTER, NEW YORK
ABB Environmental Services, Inc.

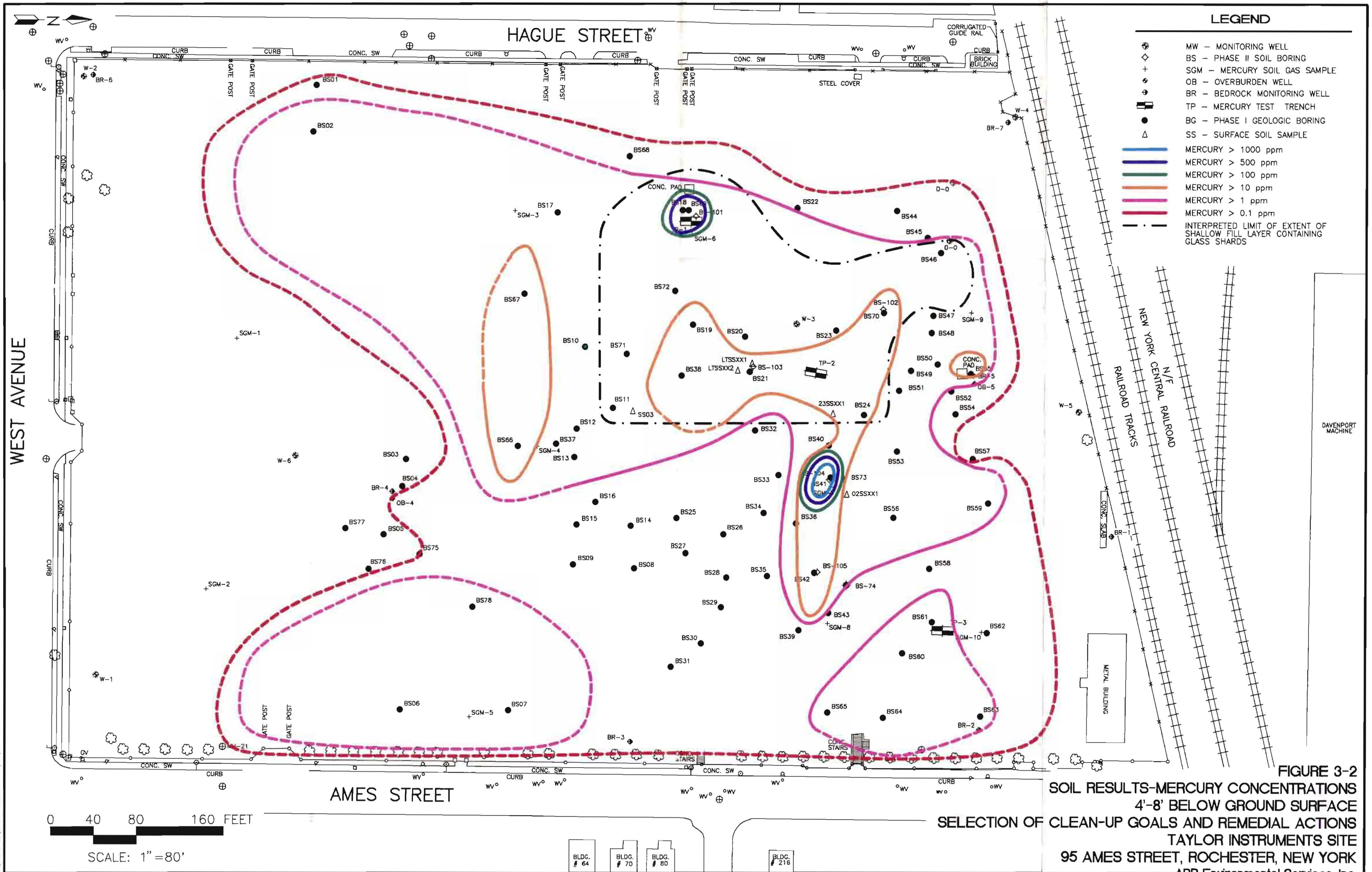


FIGURE 3-2
SOIL RESULTS-MERCURY CONCENTRATIONS
4'-8' BELOW GROUND SURFACE
SELECTION OF CLEAN-UP GOALS AND REMEDIAL ACTIONS
TAYLOR INSTRUMENTS SITE
95 AMES STREET, ROCHESTER, NEW YORK
ABB Environmental Services, Inc.

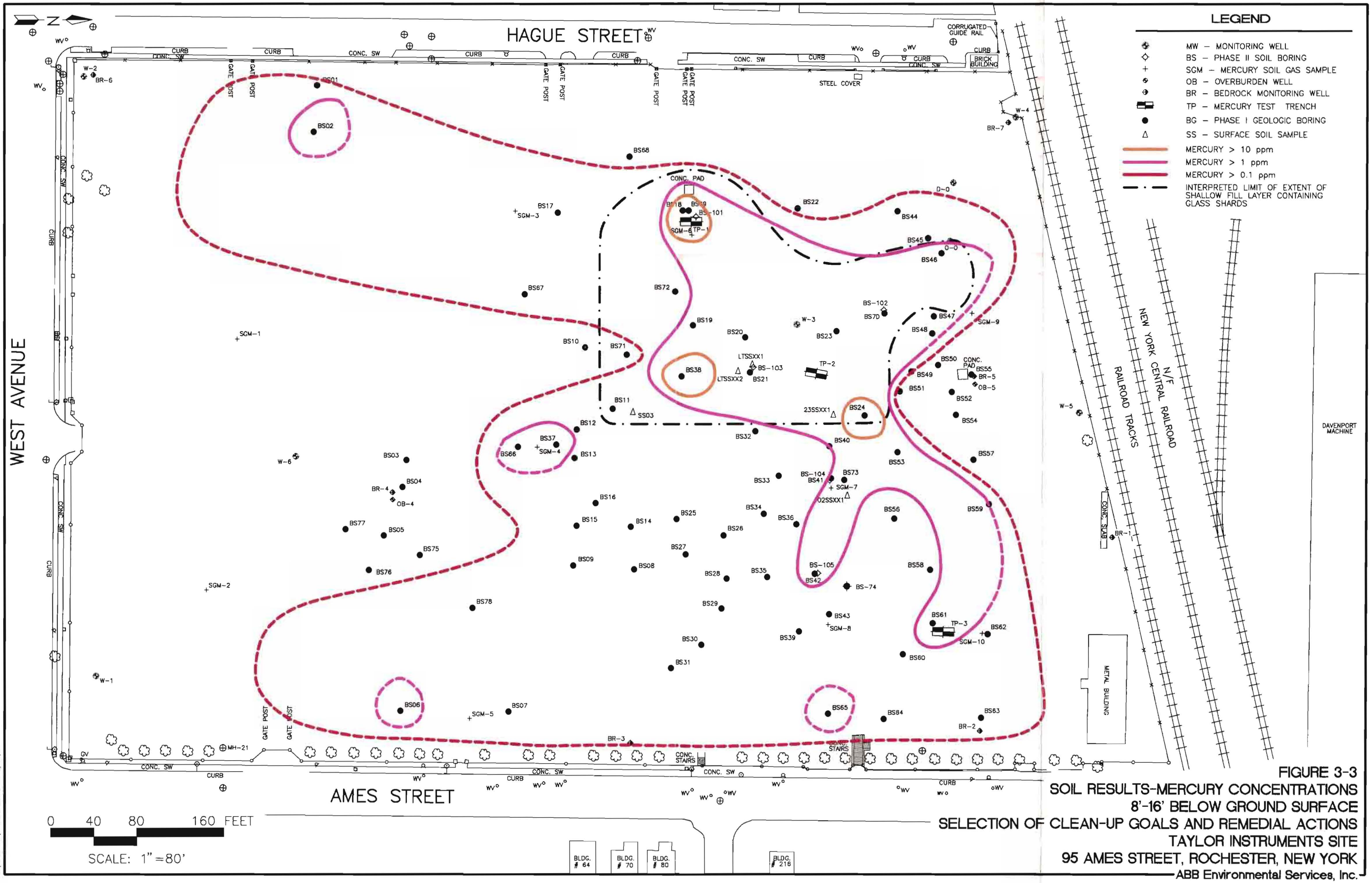


FIGURE 3-3
SOIL RESULTS-MERCURY CONCENTRATIONS
8'-16' BELOW GROUND SURFACE
SELECTION OF CLEAN-UP GOALS AND REMEDIAL ACTIONS
TAYLOR INSTRUMENTS SITE
95 AMES STREET, ROCHESTER, NEW YORK
ABB Environmental Services, Inc.

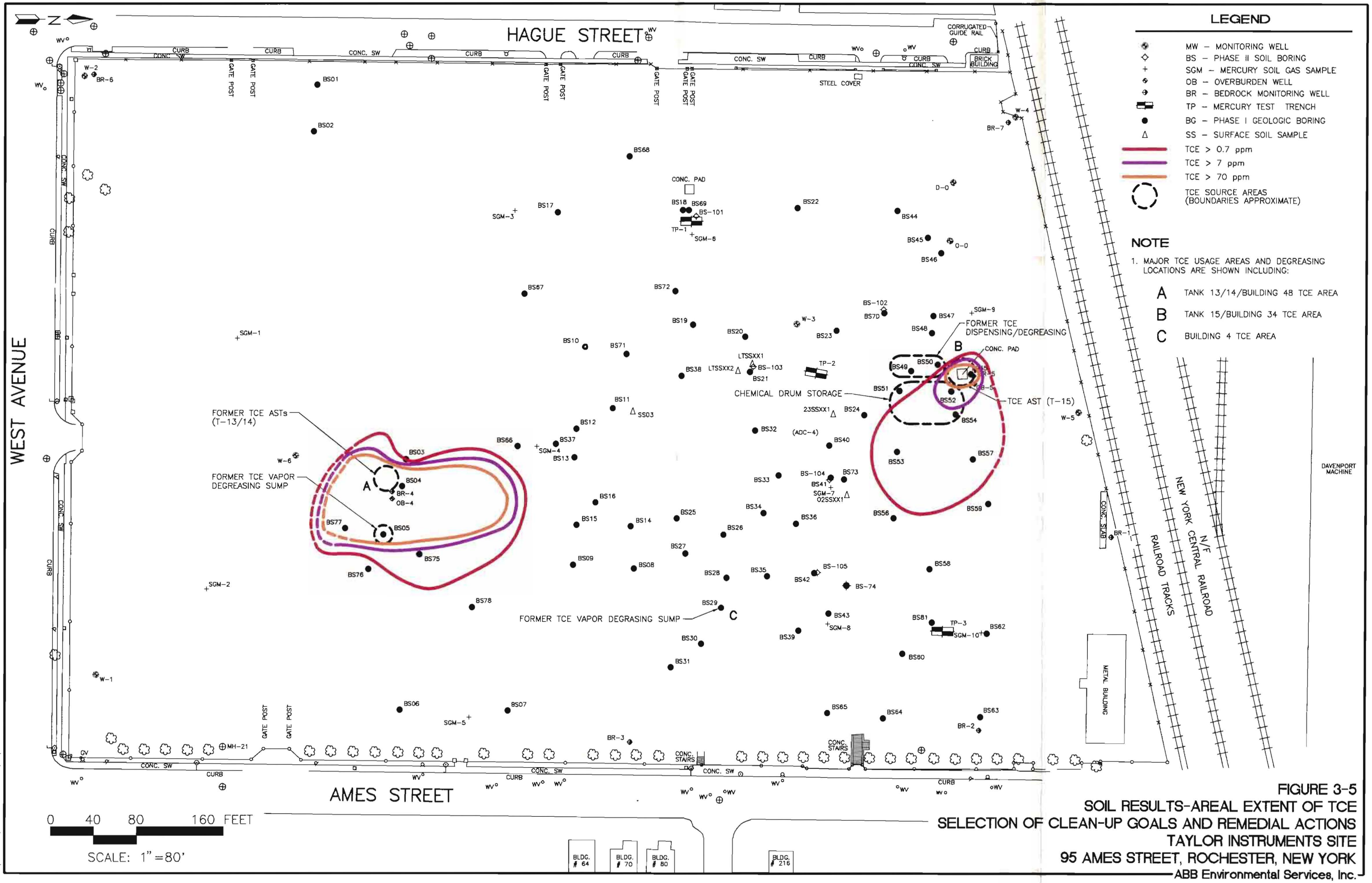


FIGURE 3-5
SOIL RESULTS-AREAL EXTENT OF TCE
SELECTION OF CLEAN-UP GOALS AND REMEDIAL ACTIONS
TAYLOR INSTRUMENTS SITE
95 AMES STREET, ROCHESTER, NEW YORK
ABB Environmental Services, Inc.

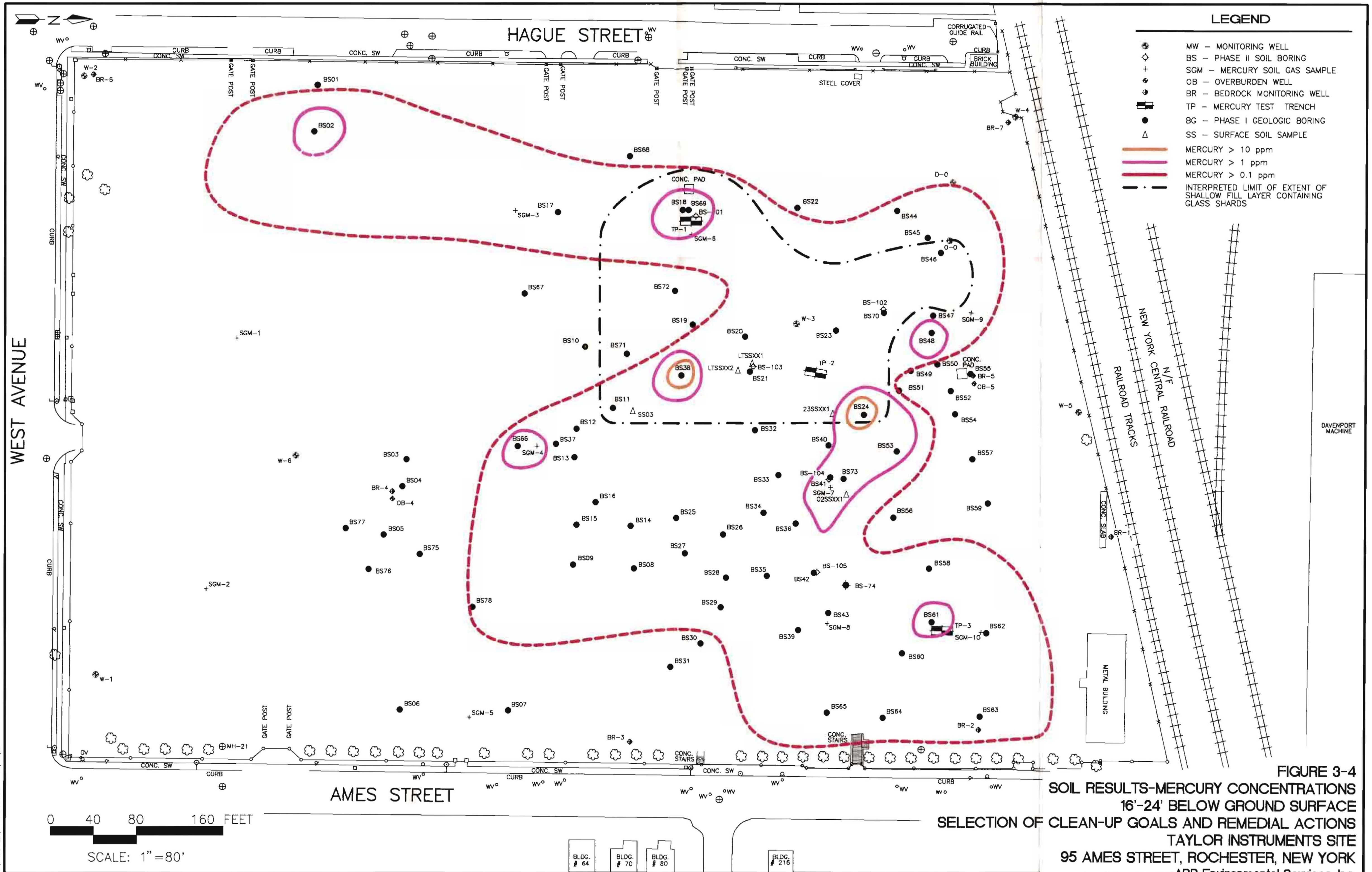


FIGURE 3-4
SOIL RESULTS-MERCURY CONCENTRATIONS
16'-24' BELOW GROUND SURFACE
SELECTION OF CLEAN-UP GOALS AND REMEDIAL ACTIONS
TAYLOR INSTRUMENTS SITE
95 AMES STREET, ROCHESTER, NEW YORK
ABB Environmental Services, Inc.

FIGURE 7-1
COST COMPARATIVE ANALYSIS - MERCURY ALTERNATIVES

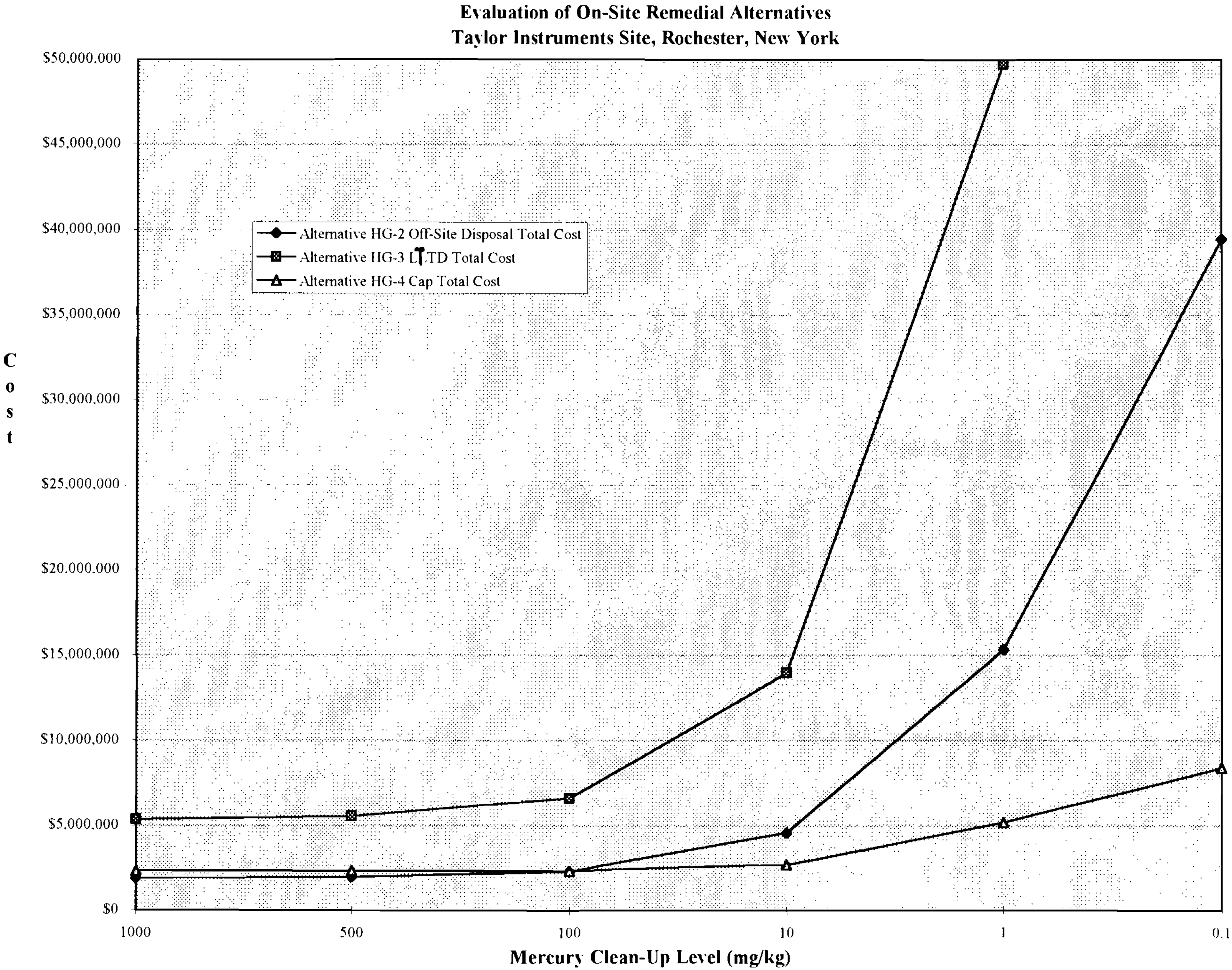
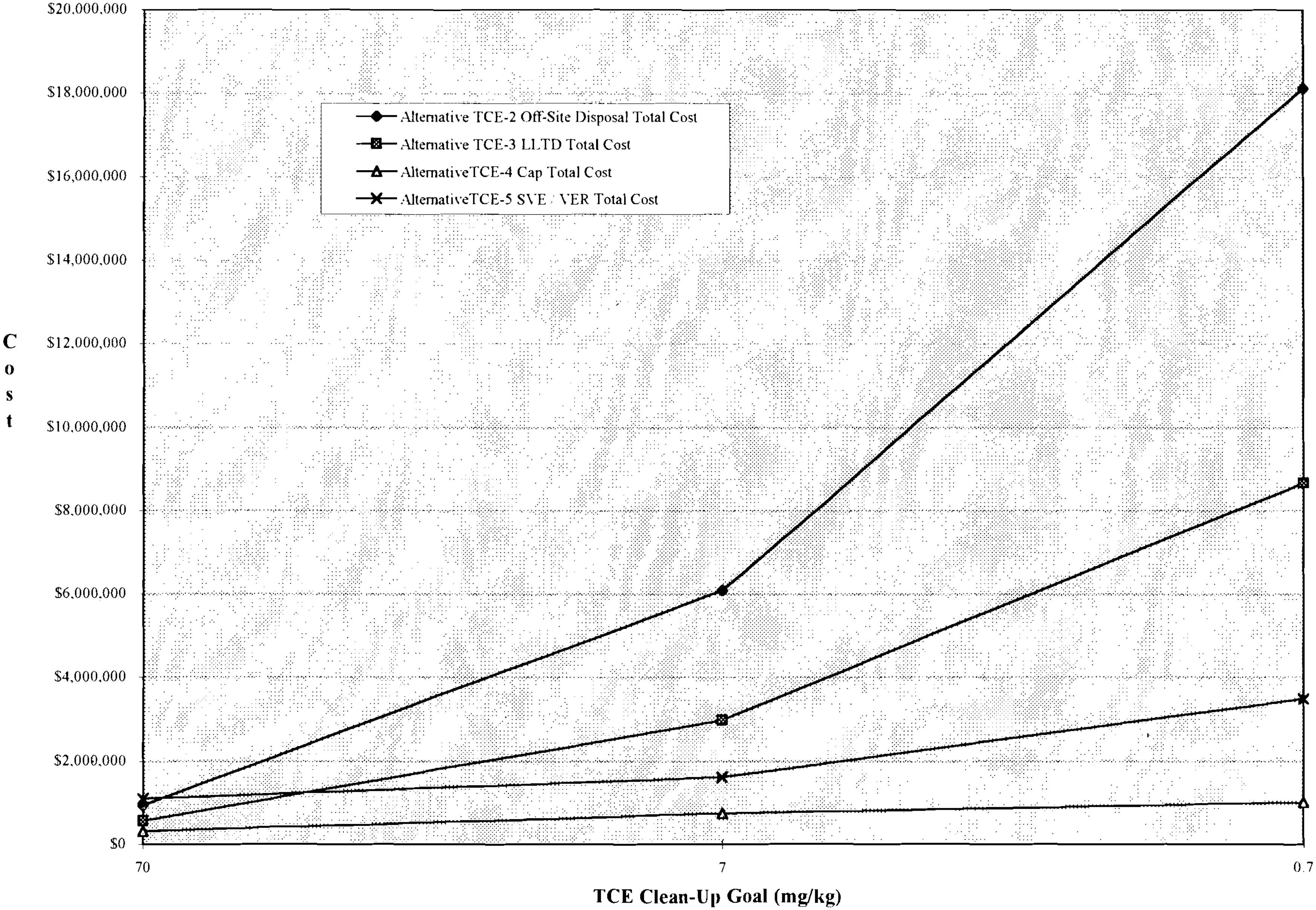


FIGURE 7-2
COST COMPARATIVE ANALYSIS - TCE ALTERNATIVES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York



TABLES

TABLE 2-1
SUMMARY OF HUMAN HEALTH RISK-BASED SCREENING LEVELS
ON-SITE SOIL

Evaluation of On-Site Remedial Alternatives
Taylor Site, Rochester, New York

Constituent	Commercial Worker Outdoor	Commercial Worker Indoor	Construction Worker	Utility Worker
Trichloroethene (TCE)	31 mg/kg [a]	65 mg/kg soil; 88 mg/L water [c]	140 mg/kg [e]	8,200 mg/kg [b]
Mercury	2,500 mg/kg [b]	4,213 $ug/m^2/hr$ [d]	25,000 mg/kg [f,g]	25,000 mg/kg [f,g]

Notes:
[a] Value is based on direct-contact exposure @ ELCR = 1E-06.
[b] Value is based on direct-contact exposure @ HI = 1.
[c] These values correspond to a soil gas concentration of 523 mg/m3. This is the soil gas concentration that corresponds to an inhalation target ELCR of 1E-06, and represents the maximum soil gas concentration which is protective for potential indoor inhalation exposures. Target soil and groundwater concentrations were calculated using the following equality:

[maximum detected soil gas concentration / associated soil (or groundwater) concentration] / [523 mg/m3 / RBSL soil (or groundwater) concentration]

The maximum detected soil gas and associated soil and groundwater concentrations are 3.873 mg/m3, 0.95 mg/kg, and 1.3 mg/L, respectively, for sample SGV-8, as presented in TM 3. The resulting soil and groundwater concentrations are 130 mg/kg and 175 mg/L.

Although soil gas is a cumulative concentration resulting from the presence of chemical in both soil and groundwater, the resulting soil and groundwater RBSLs are calculated on the assumption that the soil gas concentration is generated entirely from single-medium sources (e.g., 175 mg/L TCE in groundwater produces 523 mg/m3 in soil gas). Since the measured soil gas concentration used in this analysis is a result of contributions from both soil and groundwater sources, this approach yields a conservative estimate of the theoretical contribution to soil gas from single-medium sources. However, it does not consider soil gas contribution from both soil and groundwater. Therefore, one-half the calculated values for soil and groundwater were used as the health-based RBSLs. These value represent the media concentrations that together, would not be expected to result in a soil gas concentration greater than 523 mg/m3.
[d] The flux value presented corresponds to an inhalation target HI of 1, and represents the maximum flux which is protective for potential indoor inhalation exposures.
[e] Value is based on inhalation exposures @ ELCR = 1E-06.
[f] Value is based on direct-contact exposures (adjusted from value presented in VSI HHRA with subchronic RfD published in USEPA Health Effects Assessment Summary Tables, FY 1997).
[g] The selected remedy must be protective for potential mercury inhalation exposures to on-site excavation workers.

NA = Not applicable; constituent is not volatile
ELCR = Excess lifetime cancer risk
HI = Hazard index

TABLE 3-1
MERCURY IMPACTED SOIL - VOLUME ESTIMATES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Mercury Concentration	0.1 mg/kg	1 mg/kg	10 mg/kg	100 mg/kg + Shards	Shards Only	500 mg/kg + Shard	1,000 mg/kg + Shards
	Volume CY	Volume CY	Volume CY	Volume CY	Volume CY	Volume CY	Volume CY
Depth Interval							
0-4 ft bgs	56,885	43,060	19,170	11,723	9,668	9,668	9,668
4-8 ft bgs	52,157	34,560	5,833	1,334	0	890	445
8-16 ft bgs	95,222	23,670	2,667	0	0	0	0
16-24 ft bgs	66,310	8,135	1,778	0	0	0	0
Total Volume CY	**270,574**	**109,425**	**29,448**	**13,057**	**9,668**	**10,558**	**10,113**

Notes:
1. Depth to groundwater is assumed to be 6-8 feet bgs throughout the site.
2. Depth to bedrock surface assumed to be 24 feet bgs throughout the site.
3. Reference Figures 3-1 through 3-4 for areal extent of mercury impacted soil.

mg/kg = milligram per kilogram
CY = cubic yards
shards = fill material containing substantial concentration of glass shards; this material is assumed to contain greater than 100 mg/kg mercury.

TABLE 3-2
TCE IMPACTED SOIL - VOLUME ESTIMATES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Area	TCE Clean-Up Level 0.7 mg/kg		TCE Clean-Up Level 7 mg/kg		TCE Clean-Up Level 70 mg/kg	
	Vertical Extent	Volume CY	Vertical Extent	Volume CY	Vertical Extent	Volume CY
Area A - Former Building 48 Area	24 feet bgs	17,800	16 feet bgs	8,300	12 feet bgs	900
Area B - Former Building 34 Area	24 feet bgs	11,500	20 Feet bgs	1,350	4 feet bgs	300
	Total Volume CY	29,300		9,650		1,200

Notes:

1. Depth to groundwater is assumed to be 6-8 feet bgs throughout the site.
2. Depth to bedrock surface assumed to be 24 feet bgs throughout the site.
3. Reference Figure 3-5 for areal extent of TCE impacted soil exceeding 0.7 mg/kg.

mg/kg = milligrams per kilogram
CY = cubic yards

TABLE 4-1
MERCURY REMEDIATION TECHNOLOGIES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Technology	Description	Comments	Status
Institutional Controls	Legal restrictions would be incorporated into the property transfer that limit the use of the Site to industrial or commercial use. Restrictions could also be instituted to prevent invasive site activities and use of groundwater, and restrict subsurface construction.	Easily implemented and would prevent potential exposure to soil impacted by mercury by restricting use of the site.	Retained.
Cap	A low-permeability cover system including materials such as clay or synthetic membranes would be placed over contaminated areas to prevent human and ecological exposure to contaminants, prevent the transport of vapors, and minimize infiltration of surface water through contaminated soil.	Installation of cover system is easily implemented. Would not reduce net mass of mercury in soils.	Retained.
In-situ Fixation Stabilization	Materials would be mixed in place with contaminated soil which limit the solubility or mobility of contaminants through chemical interaction.	Used to reduce and limit the mobilization of mercury in geologic materials, would not reduce the net mass of mercury in soils. A majority of the mercury at the Site is already in a non-mobile, non-bioavailable form.	Eliminated.
Vitrification	Metal electrodes would be buried in the soil and electricity applied to heat and melt the soil, destroying organics and encapsulating inorganics.	Used to reduce and limit the mobilization of mercury in geologic materials, would not reduce the net mass of mercury in soils. A majority of the mercury at Site is already in a non-mobile, non-bioavailable form. Long-term effectiveness is not proven for mercury. Limited full and pilot-scale application.	Eliminated.
Chemical Leaching	Excavated soil is contacted with a leaching solution to solubilize mercury. The mercury-containing leachate is collected and further treated to recover mercury.	Leaching may produce an exothermic chemical reaction. Must recover mercury from leaching solution, and neutralize soil after leaching. Chemical separation processes are new to remediation of mercury contaminated material, and not well demonstrated.	Eliminated.
Off-Site Disposal	Excavated soil would be transported to a permitted off site treatment, storage, and disposal facility for treatment and/or disposal.	Widely used as a disposal method for mercury contaminated soil. Disposal in a regulated facility provides permanent isolation of contaminated material. Removes contaminant mass from the Site. Soil may require treatment at disposal site.	Retained.
Low Temperature Thermal Desorption	Excavated soil would be treated on-site in a mobile thermal desorption unit. Thermal desorption uses relatively low temperatures (typically 200 to 800 F) and direct or indirect heat to volatilize organic contaminants and high vapor pressure inorganic contaminants from contaminated soil. The volatilized organics and inorganics in desorber off-gases are captured and treated or destroyed. The treated soil may be suitable for use as backfill on-site.	USEPA best demonstrated available treatment technology for mercury contaminated soil. Elemental mercury is recovered from treated soil, and recycled.	Retained.

TABLE 4-2
TCE REMEDIATION TECHNOLOGIES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Technology	Description	Comments	Status
Institutional Controls	Legal restrictions would be incorporated into the property transfer that limit the use of the Site to industrial or commercial use. Restrictions could also be instituted to prevent invasive site activities and use of groundwater, and restrict subsurface construction.	Easily implemented and would prevent potential exposure to soil impacted by VOCs by restricting use of the site.	Retained.
Cap	A low-permeability cover system including materials such as clay or synthetic membranes would be placed over contaminated areas to prevent human and ecological exposure to contaminants, prevent the transport of vapors, and minimize infiltration of surface water through contaminated soil.	Installation of cover system is easily implemented. Would not reduce net mass of VOCs in soils, but would prevent direct contact with impacted soils, and migration of vapors.	Retained.
Off-Site Disposal	Excavated soil would be transported to a permitted off-site treatment, storage, and disposal facility for treatment and/or disposal.	VOC contaminated soil may require treatment at the disposal facility to comply with disposal restrictions. Disposal in a regulated facility provides permanent isolation of contaminated material. Removes contaminant mass from the Site.	Retained.
Low Temperature Thermal Desorption (LTTD)	Excavated soil would be treated on-site in a mobile thermal desorption unit or static pile. Thermal desorption uses relatively low temperatures (typically 200 to 800 F) and direct or indirect heat to volatilize organic contaminants and high vapor pressure inorganic contaminants from contaminated soil. The volatilized organics and inorganics in desorber off-gases are captured and treated or destroyed. The treated soil may be suitable for use as backfill on-site.	Widely used ex-situ treatment technology for soil impacted by VOCs. Several vendors available. Proven and an effective technology. Removes contaminant mass from the Site. Off-gases from thermal treatment require treatment prior to discharge.	Retained.
Soil Vapor Extraction (SVE)	Vapor extraction wells are installed to extract soil gas and the volatilized VOCs. The extracted soil gas would be treated to remove VOCs prior to discharge to the atmosphere	Widely used in-situ treatment technology for soil impacted by VOCs. Several vendors available. Proven and an effective technology. Removes contaminant mass from the Site. Off-gases from SVE require treatment prior to discharge.	Retained.
Vacuum Enhanced Recovery (VER)	VER could be used to increase the performance of an SVE system by applying a high vacuum to a well and extracting both soil vapor and groundwater using a liquid ring pump.	Used in conjunction with SVE to improve contaminant removal and effectiveness of SVE system. Both extracted soil vapor and groundwater would require treatment prior to discharge.	Retained.
Bioventing	Injection extraction wells would be installed to circulate air through unsaturated soil, and due to the addition of oxygen, the biodegradation of organic contaminants can be achieved.	High concentrations of VOCs in source areas would be toxic to microorganisms. Soil type at site may limit ability to deliver nutrients and oxygen required for bioremediation.	Eliminated.

TABLE 5-1
DEVELOPMENT OF MERCURY REMEDIAL ALTERNATIVES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Technology	Alternative HG-1: Minimal Action	Alternative HG-2: Off-Site Disposal	Alternative HG-3: LTTD	Alternative HG-4: Cap
Institutional Controls	X	X	X	X
Low-permeability Cover				X
Off-Site Disposal		X	X	
Low Temperature Thermal Desorption			X	

TABLE 5-2
COMPONENTS OF MERCURY REMEDIAL ALTERNATIVES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Alternative	Key Components
HG-1: Minimal Action	* Institutional controls to limit site use to no use or low intensity use (i.e., parking lot) *. Five-year site reviews
HG-2: Off-Site Disposal	* Mobilization and Site Preparation * Excavate soil exceeding cleanup goal and stockpile on-site * Dewater excavation as necessary, and treat and dispose of water removed * Conduct characterization sampling on stockpiled material * Load and transport excavated material to appropriate treatment, storage, and disposal facility for treatment and/or disposal based on characterization sampling results * Backfill and regrade excavated areas with clean fill and provide surface erosion protection * Institutional controls to limit site use to industrial/commercial * Five-year site reviews
HG-3: Low Temperature Thermal Desorption	* Mobilization and Site Preparation * Excavate soil exceeding cleanup goal and stockpile on-site * Dewater excavation as necessary, and treat and dispose of water removed * Conduct characterization sampling on stockpiled material * Ex-situ treatment using a thermal desorbtion unit including off-gas control (e.g., carbon filtration) and compliance testing * Load and transport treatment residuals and debris that is not suitable for treatment to an appropriate treatment, storage, and disposal facility based on characterization sampling results * Backfill and regrade excavated areas with treated soil and provide surface erosion protection. Augment with imported clean fill to replace volume sent off-site for disposal. * Institutional controls to limit site use to industrial/commercial * Five-year site reviews
HG-4: Cap	* Mobilization and Site Preparation * Consolidate soil exceeding cleanup goal as necessary * Construct low permeability cover system * Backfill and regrade excavated areas with clean fill * Environmental monitoring * Institutional controls to limit site use to activities that would not impair cover system's effectiveness (i.e., greenspace, park, etc.) * Five-year site reviews

TABLE 5-3
DEVELOPMENT OF TCE REMEDIAL ALTERNATIVES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Technology	Alternative TCE-1: Minimal Action	Alternative TCE-2: Off-Site Disposal	Alternative TCE-3: LTTD	Alternative TCE-4: Cap	Alternative TCE-5: SVE / VER
Institutional Controls	X	X	X	X	X
Low-permeability Cover				X	
Off-Site Disposal		X			
Low Temperature Thermal Desorption (LTTD)			X		
Soil Vapor Extraction (SVE)					X
Vacuum Enhanced Recovery (VER)					X

TABLE 5-4
COMPONENTS OF TCE REMEDIAL ALTERNATIVES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Alternative	Key Components
TCE-1: Minimal Action	* Institutional controls to limit site use to no use or low intensity use (i.e., parking lot) * Five-year site reviews
TCE-2: Off-Site Disposal	* Mobilization and Site Preparation * Excavate soil exceeding cleanup goal and stockpile on-site * Dewater excavation as necessary, and treat and dispose of water removed * Conduct characterization sampling on stockpiled material * Load and transport excavated material to appropriate treatment, storage, and disposal facility for treatment and/or disposal based on characterization sampling results * Backfill and regrade excavated areas with clean fill and provide surface erosion protection * Institutional controls to limit site use to industrial/commercial * Five-year site reviews
TCE-3: Low Temperature Thermal Desorption	* Mobilization and Site Preparation * Excavate soil exceeding cleanup goal and stockpile on-site * Dewater excavation as necessary, and treat and dispose of water removed * Conduct characterization sampling on stockpiled material * Ex-situ treatment using a thermal desorbtion unit including off-gas control (e.g., carbon filtration) and compliance testing * Load and transport treatment residuals and debris that is not suitable for treatment to an appropriate treatment, storage, and disposal facility based on characterization sampling results * Backfill and regrade excavated areas with treated soil and provide surface erosion protection. Augment with imported clean fill to replace volume sent off site for disposal. * Institutional controls to limit site use to industrial/commercial * Five-year site reviews
TCE-4: Cap	* Mobilization and Site Preparation * Consolidate soil exceeding cleanup goal as necessary * Construct low permeability cover system * Backfill and regrade excavated areas with clean fill * Environmental monitoring * Institutional controls to limit site use to activities that would not impair cover system's effectiveness (i.e., greenspace, park, etc.) * Five-year site reviews
TCE-5: Soil Vapor Excavation / Vacuum Enhanced Recovery	* Mobilization and Site Preparation * Conduct pilot-scale SVE (potentially with vacuum enhanced recovery [VER]) test with confirmation sampling * Re-evaluate design assumptions based on pilot test information * Install full-scale SVE/VER system * Operate and maintain until cleanup goal is met * Conduct performance monitoring * Institutional controls to limit site use to industrial/commercial * Five-year site reviews

TABLE 6-1
CRITERIA FOR DETAILED ANALYSIS OF ALTERNATIVES

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Description
Compliance with standards, criteria, and guidance	Describes how the alternative complies with standards, criteria, and guidance.
Overall protectiveness of public health and the environment	Describes how each alternative, as a whole, protects and maintains human health and the environment.
Short-term effectiveness	Examines the effectiveness of alternative in protecting human health and the environment during the construction and implementation period until the response objectives are met.
Long-term effectiveness	Evaluates the effectiveness of alternatives in protecting human health and the environment after response objectives have been met.
Reduction of toxicity, mobility, and volume	Evaluates USEPA and NYSDEC's preference for treatment (i.e., for technologies that will permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances.
Feasibility/Implementability	Assesses the technical and administrative feasibility of alternatives and the availability of required resources.
Cost	Evaluates the capital and operation and maintenance costs of each alternative within a range of +30/-50 percent.

TABLE 6-2
ALTERNATIVE HG-1 DETAILED ANALYSIS
MINIMAL ACTION

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-1: MINIMAL ACTION
Compliance with ARARs and New York SCGs	
Chemical-specific SCGs	The Minimal Action alternative would not comply with ARARs and SCGs.
Action-specific SCGs	The Minimal Action alternative would comply with ARARs and SCGs.
Location-specific SCGs	The Minimal Action alternative would comply with ARARs and SCGs.
Protection of Human Health and the Environment	
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Transport of Hazardous Materials	The Minimal Action alternative would not reduce migration of contaminants.
Health Impacts	The Minimal Action alternative relies on institutional controls, such as deed and land-use restrictions, to reduce contaminant exposure risks to human receptors.
Short-term Impacts and Effectiveness	
Protection of Community During Remedial Actions	Because no remedial actions would be implemented under this alternative, there would be no adverse effects on the local community from implementing this alternative.
Protection of Workers During Remedial Actions	No remedial actions would be implemented under this alternative.
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	Unknown. Remedial objectives may never be achieved with the Minimal Action alternative.
Long-term Effectiveness and Permanence	
Magnitude of Residual Risk	Implementation of deed and land-use restrictions would reduce contaminant exposure risks to human receptors. Potential migration of contaminants would not be reduced.
Adequacy of Controls	If managed properly, institutional controls would effectively reduce the potential for exposure to mercury in site soils.
Reliability of Controls	If managed properly, institutional controls would effectively reduce the potential for exposure to mercury in site soils.
Reduction of Toxicity, Mobility, or Volume	
Treatment Process Used and Materials Treated	None.
Amount of Hazardous Materials Destroyed or Treated	No amount of hazardous material would be destroyed or treated.
Degree of Expected Reductions in Toxicity, Mobility or Volume	The Minimal Action alternative would not employ removal or treatment technologies to address mercury contamination at the Site. No reduction in toxicity, mobility, or volume of mercury through treatment would be achieved.
Degree to Which Treatment is Irreversible	Not difficult to institute restrictions.
Type and Quantity of Hazardous	Not applicable.

TABLE 6-2
ALTERNATIVE HG-1 DETAILED ANALYSIS
MINIMAL ACTION

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-1: MINIMAL ACTION
Residuals Remaining After Treatment	
Implementability	
Ability to Construct and Operate the Technology	Not applicable.
Reliability of the Technology Based on its Acceptable Demonstrations	Not applicable.
Ease of Undertaking Additional Remedial Actions, if necessary	The Minimal Action alternative would not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Not applicable.
Availability of Necessary Equipment and Specialists	Readily available.
Timing of New Technology Under Consideration	Not applicable.
Cost	
Net Present Worth Cost	$ 0.04 million

TABLE 6-3
ALTERNATIVE HG-1 COST SUMMARY: MINIMAL ACTION

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Item	Unit	Unit Cost	Units	Cost
DIRECT COSTS				
Institutional Controls	Lump Sum	$25,000	1	$25,000
TOTAL DIRECT COSTS				**$25,000**
INDIRECT COSTS				
Legal, Administrative, & Permitting @ 10 % of Total Direct Cost				$2,500
TOTAL INDIRECT COSTS				**$2,500**
PRESENT WORTH OF OPERATION AND MAINTENANCE COSTS			**Cost**	**Present Worth**
Site Reviews Every 5 Years for 30 Years Beginning Year 5			$5,000 each	$10,789
PRESENT WORTH OF OPERATION & MAINTENANCE COSTS				**$10,789**
TOTAL COST				**$38,289**

TABLE 6-4
ALTERNATIVE HG-2 DETAILED ANALYSIS
OFF-SITE DISPOSAL

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-2: OFF-SITE DISPOSAL
Compliance with ARARs and New York SCGs	
Chemical-specific SCGs	A cleanup goal of 0.1 mg/kg for mercury would comply with TAGM 4046. Alternate cleanup goals being considered (e.g., 1, 10, 100, 500, and 1000 mg/kg) would be protective of human health for projected future commercial/industrial property use.
Action-specific SCGs	This alternative would be designed to comply with pertinent action-specific SCGs.
Location-specific SCGs	This alternative would be designed to comply with pertinent location-specific SCGs.
Protection of Human Health and the Environment	
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Transport of Hazardous Materials	Soil with mercury concentrations above the cleanup goal would be removed and disposed off-site, thereby reducing potential for future migration of contaminants. Additionally, site-specific mercury speciation results indicate that the majority of the mercury at the Site is in the elemental form and is not highly mobile under most environmental conditions
Health Impacts	This alternative provides protection of human health by achieving remedial action objectives; soil with mercury concentrations above the cleanup goal would be removed and disposed off-site.
Short-term Impacts and Effectiveness	
Protection of Community During Remedial Actions	Short-term impacts to the community are anticipated during implementation of this alternative. Community tolerance of nuisance factors, such as dust, noise, and increased truck traffic (e.g., several hundred truckloads daily for the lower cleanup goals) will be dependent on the time needed to achieve remedial objectives which varies greatly depending on the cleanup goal selected. Transportation of various materials, both hazardous and non-hazardous, would be required. Appropriate DOT regulations would be followed to reduce potential exposures.
Protection of Workers During Remedial Actions	The most significant risks to workers during implementation of this alternative would be associated with the use of heavy machinery, excavation to excessive depths at lower cleanup levels, and exposure to contaminated soil and mercury vapors during excavation, transport, and disposal. To minimize these risks, a site-specific Health and Safety Plan (HASP) would be developed and implemented.

TABLE 6-4
ALTERNATIVE HG-2 DETAILED ANALYSIS
OFF-SITE DISPOSAL

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-2: OFF-SITE DISPOSAL
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative. The potential for dust/air emissions will be addressed as part of the health and safety plan.
Time Until Remedial Action Objectives are Achieved	The time until remedial objectives are achieved varies greatly based on the cleanup goal. It is anticipated that cleanup times would range from greater than 2 years to design, implement, and remediate to a cleanup goal of 0.1 mg/kg, to less than 2 years for a cleanup goal of 1,000 mg/kg.
Long-term Effectiveness and Permanence	
Magnitude of Residual Risk	Contaminated soil in excess of the cleanup goal would be transported off-site for disposal. The magnitude of residual risk would be minimal regardless off the cleanup goal selected, because each of the cleanup goals being considered is protective of human health for an industrial/commercial exposure scenario. With the exception of cleanup to 0.1 mg/kg which could result in unrestricted land use, institutional controls would be implemented to restrict future site use to industrial/commercial applications.
Adequacy of Controls	Off-site landfilling is a containment technology which would control the mobility of contaminants but is not considered a permanent remedy. The off-site landfill would be properly managed to ensure that contaminants are isolated from potential receptors. Since the mercury appears to be relatively immobile even under unprotected conditions, the potential for future migration from a secure landfill is minimal. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to mercury in site soils.
Reliability of Controls	Transport and disposal of contaminated soil off-site would permanently eliminate exposure to contaminant concentrations exceeding the cleanup goal. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to mercury in site soils.
Reduction of Toxicity, Mobility, or Volume	
Treatment Process Used and Materials Treated	Treatment is not a principle element of this alternative. Off-site landfilling is a containment technology which would control the mobility of contaminants.

TABLE 6-4
ALTERNATIVE HG-2 DETAILED ANALYSIS
OFF-SITE DISPOSAL

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-2: OFF-SITE DISPOSAL
Amount of Hazardous Materials Destroyed or Treated	No amount of hazardous material would be destroyed or treated. Depending on the cleanup goal selected, a range of approximately 10,800 cubic yards (cy) (1,000 mg/kg) to 270,500 cy (0.1 mg/kg) of contaminated soil would be disposed at an appropriate off-site landfill.
Degree of Expected Reductions in Toxicity, Mobility or Volume	No reduction in toxicity, mobility, or volume of mercury through treatment would be achieved. Off-site disposal in a landfill would slightly reduce contaminant mobility potential, but would not provide reduction in contaminant toxicity or volume.
Degree to Which Treatment is Irreversible	Containment of material at an off-site disposal facility is irreversible.
Type and Quantity of Hazardous Residuals Remaining After Treatment	Soil in excess of the cleanup goal would be excavated and transported off-site for disposal in a landfill. No hazardous residuals would remain on-site.
Implementability	
Ability to Construct and Operate the Technology	Excavation and off-site disposal are relatively straight forward remediation practices, however there are some technical challenges with methods of excavation associated with implementation of lower cleanup goals. Remediation to lower cleanup goals (e.g., 0.1, 1, and 10 mg/kg) would require excavation of significant volumes of soil beneath the water table to depths of up to 24 feet bgs. Dewatering and treatment of collected groundwater would be required. Additionally, the areal extent and depth of excavation may also present technical challenges. As the areal extent of the excavation extends toward the site boundaries at lower cleanup levels, surrounding roadways, railways, and public walkways may require shoring and bracing to prevent structural damage. As the depth of the excavation increases, stabilization of the excavation sidewalls would be required to prevent collapse.
Reliability of the Technology Based on its Acceptable Demonstrations	Site preparation and excavation services are well developed, reliable, and readily available. Off-site disposal at a licensed facility is a reliable, proven method for disposing of contaminated wastes.
Ease of Undertaking Additional Remedial Actions, if necessary	Coordination with future developers would be required to implement future remedial actions, if necessary.
Ability to Monitor Effectiveness of Remedy	Soil samples would be collected and analyzed during excavation to confirm that soil in excess of the cleanup goal has been excavated. Additionally, groundwater and soil gas samples would be collected as part of a long-term monitoring program.
Availability of Necessary Equipment and Specialists	Local contractors are readily available to conduct site preparation and excavation activities. Off-site disposal facilities would provide transportation. The potentially large volume of soil requiring off-site disposal may exceed the available capacity of nearby landfills. Due to high levels of mercury, it is assumed that hazardous material would be transported to Stablex in Canada for disposal.

TABLE 6-4
ALTERNATIVE HG-2 DETAILED ANALYSIS
OFF-SITE DISPOSAL

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-2: OFF-SITE DISPOSAL
Cost	
Net Present Worth Cost for a cleanup goal of *0.1 mg/kg*	$ 39.5 million
Net Present Worth Cost for a cleanup goal of *1 mg/kg*	$ 15.3million
Net Present Worth Cost for a cleanup goal of *10 mg/kg*	$ 4.6 million
Net Present Worth Cost for a cleanup goal of *100 mg/kg (plus the glass shards)*	$ 2.3 million
Net Present Worth Cost for a cleanup goal of *500 mg/kg (plus the glass shards)*	$ 2.0 million
Net Present Worth Cost for a cleanup goal of *1,000 mg/kg (plus the glass shards)*	$ 1.9 million

TABLE 6-5
ALTERNATIVE HG-2 COST SUMMARY: OFF-SITE DISPOSAL

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

	Mercury Clean-Up Goal		1000 ppm + Shards		500 ppm + Shards		100 ppm + Shards		10 ppm		1 ppm		0.1 ppm	
Item	Unit	Unit Cost	Units	Cost	Units	Cost	Units	Cost	Units	Cost	Units	Cost	Units	Cost
DIRECT COSTS														
Mob/Demob	Lump Sum	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000
Site Preparation	Lump Sum	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000
Excavation (above water table)	CY	$10	9,890	$98,900	10,113	$101,130	12,390	$123,900	22,087	$220,870	60,340	$603,400	82,964	$829,640
Excavation (below water table)	CY	$20	223	$4,460	445	$8,900	667	$13,340	7,361	$147,220	49,085	$981,700	187,610	$3,752,200
Transport and Disposal at ChemWaste (Non-Hazardous)	CY	$50	8,849	$442,450	9,238	$461,900	11,612	$580,600	28,628	$1,431,400	107,980	$5,399,000	269,129	$13,456,450
Transport and Disposal at Stablex (Hazardous)	CY	$350	1,264	$442,400	1,320	$462,000	1,445	$505,750	1,445	$505,750	1,445	$505,750	1,445	$505,750
Treatment System for Excavation Dewatering	Lump Sum	$50,000	0	$0	0	$0	0	$0	1	$50,000	1	$50,000	1	$50,000
Treatment and Disposal of Contaminated Groundwater	1000 gallon	$100	0	$0	0	$0	0	$0	1,004	$100,400	7,600	$760,000	30,000	$3,000,000
Delivery and Placement of Backfill Material	CY	$10	10,113	$101,130	10,558	$105,580	13,057	$130,570	29,448	$294,480	109,425	$1,094,250	270,574	$2,705,740
Site Restoration	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
Institutional Controls	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
SUBTOTAL DIRECT COSTS				**$1,159,340**		**$1,209,510**		**$1,424,160**		**$2,820,120**		**$9,464,100**		**$24,369,780**
MISCELLANEOUS SITE COSTS @ 20%				**$231,868**		**$241,902**		**$284,832**		**$564,024**		**$1,892,820**		**$4,873,956**
TOTAL DIRECT COSTS				**$1,391,208**		**$1,451,412**		**$1,708,992**		**$3,384,144**		**$11,356,920**		**$29,243,736**
INDIRECT COSTS														
Health & Safety @ 5 % of Total Direct Cost				$69,560		$72,571		$85,450		$169,207		$567,846		$1,462,187
Legal, Administrative, & Permitting @ 10 % of Total Direct Cost				$139,121		$145,141		$170,899		$338,414		$1,135,692		$2,924,374
Engineering @ 10% of Total Direct Cost				$139,121		$145,141		$170,899		$338,414		$1,135,692		$2,924,374
Services During Construction @ 10% of Total Direct Cost				$139,121		$145,141		$170,899		$338,414		$1,135,692		$2,924,374
TOTAL INDIRECT COSTS				**$486,923**		**$507,994**		**$598,147**		**$1,184,450**		**$3,974,922**		**$10,235,308**
TOTAL COST				**$1,878,131**		**$1,959,406**		**$2,307,139**		**$4,568,594**		**$15,331,842**		**$39,479,044**

TABLE 6-6
ALTERNATIVE HG-3 DETAILED ANALYSIS
THERMAL TREATMENT

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-3: THERMAL TREATMENT
Compliance with ARARs and New York SCGs	
Chemical-specific SCGs	A cleanup goal of 0.1 mg/kg for mercury would comply with TAGM 4046. Alternate cleanup goals being considered (e.g., 1, 10, 100, 500, and 1000 mg/kg) would be protective of human health for projected future commercial/industrial property use.
Action-specific SCGs	This alternative would be designed to comply with pertinent action-specific SCGs.
Location-specific SCGs	This alternative would be designed to comply with pertinent location-specific SCGs.
Protection of Human Health and the Environment	
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Transport of Hazardous Materials	Mercury-contaminated soil would be excavated and treated to the cleanup goal with an on-site low temperature thermal desorption unit, thereby reducing the potential for future migration of contaminants. Additionally, site-specific mercury speciation results indicate that the majority of the mercury at the Site is in the elemental form and is not highly mobile under most environmental conditions
Health Impacts	This alternative provides protection of human health by achieving remedial action objectives. Soil with mercury concentrations above the cleanup goal would be excavated and thermally treated on-site. Treated soil containing glass shards would be transported off-site for non-hazardous disposal.
Short-term Impacts and Effectiveness	
Protection of Community During Remedial Actions	Short-term impacts to the community are anticipated during implementation of this alternative. Community tolerance of nuisance factors, such as dust, noise, and increased truck traffic will be dependent on the time needed to achieve remedial objectives which varies greatly depending on the cleanup goal selected. Air emissions from the treatment would also be monitored to ensure compliance with applicable requirements. Transportation of various materials, both hazardous and non-hazardous, would be required. Appropriate DOT regulations would be followed to reduce potential exposures.
Protection of Workers During Remedial Actions	The most significant risks to workers during implementation of this alternative would be associated with the use of heavy machinery, excavation to excessive depths at lower cleanup levels, and exposure to contaminated soil and mercury vapors during excavation, transport, and disposal. To minimize these risks, a site-specific Health and Safety Plan (HASP) would be developed and implemented.

TABLE 6-6
ALTERNATIVE HG-3 DETAILED ANALYSIS
THERMAL TREATMENT

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-3: THERMAL TREATMENT
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	The time until remedial objectives are achieved varies greatly based on the cleanup goal. It is anticipated that cleanup times would range from more than 5 years to design, implement, and remediate to a cleanup goal of 0.1 mg/kg to approximately 2 years for a cleanup goal of 1,000 mg/kg.
Long-term Effectiveness and Permanence	
Magnitude of Residual Risk	Treated soils would be used to backfill the excavations (with the exception of those containing glass shards which would be disposed off-site as a non-hazardous waste after treatment). Concentrated, condensed mercury recovered during treatment would be transported off-site for recycling. The magnitude of residual risk would be minimal regardless of the cleanup goal selected, because each of the cleanup goals being considered is protective of human health for an industrial/commercial exposure scenario. With the exception of cleanup to 0.1 mg/kg which could result in unrestricted land use, institutional controls would be implemented to minimize residual risks by restricting future site use to industrial/commercial applications.
Adequacy of Controls	Thermal desorption would permanently reduce contaminant concentrations to the cleanup goal because contaminated soil would be removed and treated. Concentrated, condensed mercury recovered during treatment would be transported off-site for recycling Treated soil containing glass shards would be transported off-site for disposal after treatment. Landfilling is a containment technology which would isolate wastes from potential receptors and would control the mobility of contaminants, but is not considered a permanent remedy. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to mercury in site soils.
Reliability of Controls	Thermal treatment and off-site disposal of contaminated soil are reliable, proven technologies that would permanently eliminate exposure to contaminant concentrations exceeding the cleanup goal. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to mercury in site soils.

TABLE 6-6
ALTERNATIVE HG-3 DETAILED ANALYSIS
THERMAL TREATMENT

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-3: THERMAL TREATMENT
Reduction of Toxicity, Mobility, or Volume	
Treatment Process Used and Materials Treated	On-site thermal desorption would be used to recover mercury from excavated soil containing mercury above the cleanup goal. Off-site landfilling is a containment technology which would control the mobility of contaminants.
Amount of Hazardous Materials Destroyed or Treated	Depending on the cleanup goal selected, a range of approximately 10,800 cubic yards (cy) (1,000 mg/kg) to 270,500 cy (0.1 mg/kg) of contaminated soil would be treated on-site by thermal desorption. The amount of mercury recovered for recycling would vary slightly based on the cleanup-goal however, a large percentage of the total mercury would be recovered at the higher cleanup goals which would target the most contaminated areas (i.e., glass shard and Building 2 trench areas).
Degree of Expected Reductions in Toxicity, Mobility or Volume	The mobility and toxicity of mercury in soil would be reduced by the thermal desorption process. Additionally, the volume of mercury would be reduced from potentially large volumes of soil to a significantly smaller volume of condensed mercury which would be recycled.
Degree to Which Treatment is Irreversible	Because thermal desorption separates mercury from soil, treatment is permanent.
Type and Quantity of Hazardous Residuals Remaining After Treatment	Treated soil would be returned to the excavation with the exception of treated soil containing glass shards. This material would be transported off-site for non-hazardous disposal. Concentrated, condensed mercury recovered during treatment would be transported off-site for recycling. If necessary, activated carbon used for off-gas treatment would be regenerated or disposed off-site.
Implementability	
Ability to Construct and Operate the Technology	Several vendors have developed mobile thermal desorption units to treat organic contaminants, however only a small number of vendors have experience with recovering mercury. Construction and operation of the treatment unit would be performed by the vendor. In order to achieve lower cleanup goals, each batch of soil may need to be treated multiple times which could significantly increase overall operation time. There are some technical challenges with methods of excavation associated with implementation of lower cleanup goals. Remediation to lower cleanup goals (e.g., 0.1, 1, and 10 mg/kg) would require excavation of significant volumes of soil beneath the water table to depths of up to 24 feet bgs. Dewatering and treatment of collected groundwater would be required. Additionally, the areal extent and depth of excavation may also present technical challenges. As the areal extent of the excavation extends toward the site boundaries at lower cleanup levels, surrounding roadways, railways, and public walkways may require shoring and bracing to prevent structural damage. As the depth of the excavation increases, stabilization of the excavation sidewalls would be required to prevent collapse.

TABLE 6-6
ALTERNATIVE HG-3 DETAILED ANALYSIS
THERMAL TREATMENT

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-3: THERMAL TREATMENT
Reliability of the Technology Based on its Acceptable Demonstrations	Thermal desorption is an innovative treatment technology that has been used at pilot-scale to remediate mercury-contaminated soil. Thermal desorption may not be possible to reach lower cleanup goals (i.e., 0.1, 1, 10 mg/kg). Site preparation and excavation services are well developed, reliable, and readily available. Off-site disposal at a licensed facility is a reliable, proven method for disposing of contaminate wastes.
Ease of Undertaking Additional Remedial Actions, if necessary	Coordination with future developers would be required to implement future remedial actions, if necessary.
Ability to Monitor Effectiveness of Remedy	Soil samples would be collected and analyzed during excavation to confirm that soil in excess of the cleanup goal has been excavated. Monitoring of the treatment process would be conducted including pre-treatment and post-treatment soil sampling and air monitoring. Additionally, groundwater and soil gas samples would be collected as part of a long-term monitoring program.
Availability of Necessary Equipment and Specialists	Several vendors have developed mobile thermal desorption units to treat organic contaminants, however only a small number of vendors have experience with recovering mercury. Local contractors are readily available to conduct site preparation and excavation activities. Off-site disposal facilities would provide transportation.
Timing of New Technology Under Consideration	Thermal desorption is at pilot-scale for treatment of mercury.
Cost	
Net Present Worth Cost for a cleanup goal of *0.1 mg/kg*	$ 124.3 million
Net Present Worth Cost for a cleanup goal of *1 mg/kg*	$ 49.9 million
Net Present Worth Cost for a cleanup goal of *10 mg/kg*	$ 13.9 million
Net Present Worth Cost for a cleanup goal of *100 mg/kg (plus the glass shards)*	$ 6.6 million
Net Present Worth Cost for a cleanup goal of *500 mg/kg (plus the glass shards)*	$ 5.5 million
Net Present Worth Cost for a cleanup goal of *1,000 mg/kg (plus the glass shards)*	$ 5.3 million

TABLE 6-7
ALTERNATIVE HG-3 COST SUMMARY: LTTD

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

	Mercury Clean-Up Goal		1000 ppm + Shards		500 ppm + Shards		100 ppm + Shards		10 ppm		1 ppm		0.1 ppm	
Item	**Unit**	**Unit Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**
DIRECT COSTS														
Mob/Demob	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
Site Preparation	Lump Sum	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000
Excavation (above water table)	CY	$10	9,890	$98,900	10,113	$101,130	12,390	$123,900	22,087	$220,870	60,340	$603,400	82,964	$829,640
Excavation (below water table)	CY	$20	223	$4,460	445	$8,900	667	$13,340	7,361	$147,220	49,085	$981,700	187,610	$3,752,200
LTTD Treatment	CY	$250	10,113	$2,528,250	10,558	$2,639,500	13,057	$3,264,250	29,448	$7,362,000	109,425	$27,356,250	270,574	$67,643,500
Treatment System for Excavation Dewatering	Lump Sum	$50,000	0	$0	0	$0	0	$0	1	$50,000	1	$50,000	1	$50,000
Treatment and Disposal of Contaminated Groundwater	1000 gallon	$100	0	$0	0	$0	0	$0	1,004	$100,400	7,600	$760,000	30,000	$3,000,000
Transport and Disposal of Treated Shard Material (Non-Hazardous)	CY	$50	9,668	$483,400	9,668	$483,400	9,668	$483,400	9,668	$483,400	9,668	$483,400	9,668	$483,400
Purchase and Place Backfill	CY	$10	9,668	$96,680	9,668	$96,680	9,668	$96,680	9,668	$96,680	9,668	$96,680	9,668	$96,680
Placement of Treated Material	CY	$3	445	$1,335	890	$2,670	3,389	$10,167	19,780	$59,340	99,757	$299,271	260,906	$782,718
Site Restoration	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
Institutional Controls	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
SUBTOTAL DIRECT COSTS				**$3,298,025**		**$3,417,280**		**$4,076,737**		**$8,604,910**		**$30,715,701**		**$76,723,138**
MISCELLANEOUS SITE COSTS @ 20%				**$659,605**		**$683,456**		**$815,347**		**$1,720,982**		**$6,143,140**		**$15,344,628**
TOTAL DIRECT COSTS				**$3,957,630**		**$4,100,736**		**$4,892,084**		**$10,325,892**		**$36,858,841**		**$92,067,766**
INDIRECT COSTS														
Health & Safety @ 5 % of Total Direct Cost				$197,882		$205,037		$244,604		$516,295		$1,842,942		$4,603,388
Legal, Administrative, & Permitting @ 10 % of Total Direct Cost				$395,763		$410,074		$489,208		$1,032,589		$3,685,884		$9,206,777
Engineering @ 10% of Total Direct Cost				$395,763		$410,074		$489,208		$1,032,589		$3,685,884		$9,206,777
Services During Construction @ 10% of Total Direct Cost				$395,763		$410,074		$489,208		$1,032,589		$3,685,884		$9,206,777
TOTAL INDIRECT COSTS				**$1,385,171**		**$1,435,258**		**$1,712,230**		**$3,614,062**		**$12,900,594**		**$32,223,718**
TOTAL COST				**$5,342,801**		**$5,535,994**		**$6,604,314**		**$13,939,954**		**$49,759,436**		**$124,291,484**

TABLE 6-8
ALTERNATIVE HG-4 DETAILED ANALYSIS
CAP

Evaluation of On-Site Remedial Alternatives Actions
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-4: CAP
Compliance with ARARs and New York SCGs	
Chemical-specific SCGs	A cleanup goal of 0.1 mg/kg for mercury would comply with TAGM 4046. Alternate cleanup goals being considered (e.g., 1, 10, 100, 500, and 1000 mg/kg) would be protective of human health for projected future commercial/industrial property use.
Action-specific SCGs	This alternative would be designed to comply with pertinent action-specific SCGs including design and construction of a cover system which would meet the performance criteria set forth under NYSWR (6 NYCRR Part 360).
Location-specific SCGs	This alternative would be designed to comply with pertinent location-specific SCGs.
Protection of Human Health and the Environment	
Environmental Impacts	Because of the lack of environmental receptors, no significant adverse environmental impacts would be anticipated from the implementation of this alternative. A top vegetative cover layer of the cover system may provide a future habitat.
Transport of Hazardous Materials	Soil with mercury concentrations above the cleanup goal would be consolidated beneath the cap, thereby reducing potential for future migration of contaminants. Additionally, site-specific mercury speciation results indicate that the majority of the mercury at the Site is in the elemental form and is not highly mobile under most environmental conditions.
Health Impacts	This alternative provides protection of human health by complying with the NYSWR. The low-permeability cover system would isolate contaminated soils and eliminate potential for direct exposure and also reduce the amount of water infiltrating the contaminated soil to groundwater. Additionally, institutional controls would be implemented to reduce contaminant exposure risks.
Short-term Impacts and Effectiveness	
Protection of Community During Remedial Actions	Short-term impacts to the community are anticipated during implementation of this alternative. Community tolerance of nuisance factors, such as dust, noise, and increased truck traffic will be dependent on the time needed to achieve remedial objectives which varies greatly depending on the cleanup goal selected and size of cap being constructed.
Protection of Workers During Remedial Actions	The most significant risks to workers during implementation of this alternative would be associated with the use of heavy machinery during construction. To minimize these risks, a site-specific Health and Safety Plan (HASP) would be developed and implemented.
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.

TABLE 6-8
ALTERNATIVE HG-4 DETAILED ANALYSIS
CAP

Evaluation of On-Site Remedial Alternatives Actions
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-4: CAP
Time Until Remedial Action Objectives are Achieved	Time to design and construct a cap would range from approximately 1 year for a 11.5 acre cap (0.1 mg/kg) to 4 months for a 2 acre cap (1,000 mg/kg).
Long-term Effectiveness and Permanence	
Magnitude of Residual Risk	Because untreated soil would remain on-site, installation of a cover system would not be considered a permanent remedy, however it would isolate the contaminated soil from potential exposure and minimize infiltration and migration of contaminants. Institutional controls would be implemented to minimize risks by restricting future site use to industrial/commercial applications.
Adequacy of Controls	Contaminated soil would remain on-site but would be isolated from potential receptors by a cover system. Since the mercury appears to be relatively immobile even under unprotected conditions, the potential for future migration from a secure landfill is minimal. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to mercury in site soils.
Reliability of Controls	The cover system would be inspected and maintained to ensure continued isolation of contaminated soil. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to mercury in site soils.
Reduction of Toxicity, Mobility, or Volume	
Treatment Process Used and Materials Treated	Treatment is not a principle element of this alternative. A cover system would isolate contaminated soil from potential receptors and would control the mobility of contaminants.
Amount of Hazardous Materials Destroyed or Treated	No amount of hazardous material would be destroyed or treated.
Degree of Expected Reductions in Toxicity, Mobility or Volume	No reduction in toxicity, mobility, or volume of mercury through treatment would be achieved. A cover system would slightly reduce contaminant mobility potential.
Degree to Which Treatment is Irreversible	Not applicable.
Type and Quantity of Hazardous Residuals Remaining After Treatment	Soil in excess of the cleanup goal would remain on-site beneath a low permeability cover system.
Implementability	
Ability to Construct and Operate the Technology	Construction of a low-permeability cover system is a well-developed technology and has been used at numerous hazardous and municipal landfills.

TABLE 6-8
ALTERNATIVE HG-4 DETAILED ANALYSIS
CAP

Evaluation of On-Site Remedial Alternatives Actions
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE HG-4: CAP
Reliability of the Technology Based on its Acceptable Demonstrations Ease of Undertaking Additional Remedial Actions, if necessary	Techniques used for cap construction are well developed, reliable, and readily available. Care would need to be taken when implementing future remedial actions so as to not damage or compromise the integrity of the cover system.
Ability to Monitor Effectiveness of Remedy	A long-term monitoring program would be implemented to monitor the effectiveness of the remedy and would involve periodic sampling of soil gas and groundwater.
Availability of Necessary Equipment and Specialists	Contractors to perform construction services are readily available, and several could be included in a competitive bid process.
Timing of New Technology Under Consideration	Cover system construction is a proven technology.
Cost	
Net Present Worth Cost for a cleanup goal of *0.1 mg/kg*	$ 8.4 million
Net Present Worth Cost for a cleanup goal of *1 mg/kg*	$ 5.2 million
Net Present Worth Cost for a cleanup goal of *10 mg/kg*	$ 2.7 million
Net Present Worth Cost for a cleanup goal of *100 mg/kg (plus the glass shards)*	$ 2.3 million
Net Present Worth Cost for a cleanup goal of *500 mg/kg (plus the glass shards)*	$ 2.3 million
Net Present Worth Cost for a cleanup goal of *1,000 mg/kg (plus the glass shards)*	$ 2.3 million

TABLE 6-9
ALTERNATIVE HG-4 COST SUMMARY: CAP

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

	Mercury Clean-Up Goal		1000 ppm + Shards		500 ppm + Shards		100 ppm + Shards		10 ppm		1 ppm		0.1 ppm	
Item	**Unit**	**Unit Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**
DIRECT COSTS														
Mob/Demob	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
Site Preparation	Lump Sum	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000	1	$10,000
Installation of NYSWR Cap	acre	$300,000 - $450,000	2	$900,000	2	$900,000	2	$900,000	3.5	$1,050,000	7	$2,100,000	11.5	$3,450,000
Site Restoration	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
Institutional Controls	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000	1	$25,000
SUBTOTAL DIRECT COSTS				**$985,000**		**$985,000**		**$985,000**		**$1,135,000**		**$2,185,000**		**$3,535,000**
MISCELLANEOUS SITE COSTS @ 20%				**$197,000**		**$197,000**		**$197,000**		**$227,000**		**$437,000**		**$707,000**
TOTAL DIRECT COSTS				**$1,182,000**		**$1,182,000**		**$1,182,000**		**$1,362,000**		**$2,622,000**		**$4,242,000**
INDIRECT COSTS														
Health & Safety @ 5 % of Total Direct Cost				$59,100		$59,100		$59,100		$68,100		$131,100		$212,100
Legal, Administrative, & Permitting @ 10 % of Total Direct Cost				$118,200		$118,200		$118,200		$136,200		$262,200		$424,200
Engineering @ 10% of Total Direct Cost				$118,200		$118,200		$118,200		$136,200		$262,200		$424,200
Services During Construction @ 10% of Total Direct Cost				$118,200		$118,200		$118,200		$136,200		$262,200		$424,200
TOTAL INDIRECT COSTS				**$413,700**		**$413,700**		**$413,700**		**$476,700**		**$917,700**		**$1,484,700**
PRESENT WORTH OF OPERATION AND MAINTENANCE COSTS														
			Cost	**Present Worth**	**Cost**	**Present Worth**	**Cost**	**Present Worth**	**Cost**	**Present Worth**	**Cost**	**Present Worth**	**Cost**	**Present Worth**
Site Reviews Every 5 Years Beginning Year 5			$5,000	$10,789	$5,000	$10,789	$5,000	$10,789	$5,000	$10,789	$5,000	$10,789	$5,000	$10,789
Cap Maintenance and Monitoring @ 5 % of Total Direct Cost for 30 Years			$59,100	$733,372	$59,100	$733,372	$59,100	$733,372	$68,100	$845,053	$131,100	$1,626,820	$212,100	$2,631,949
PRESENT WORTH OF OPERATION & MAINTENANCE COSTS				**$744,160**		**$744,160**		**$744,160**		**$855,841**		**$1,637,608**		**$2,642,737**
TOTAL COST				**$2,339,860**		**$2,339,860**		**$2,339,860**		**$2,694,541**		**$5,177,308**		**$8,369,437**

TABLE 6-10
ALTERNATIVE TCE-1 DETAILED ANALYSIS
MINIMAL ACTION

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-1: MINIMAL ACTION
Compliance with ARARs and New York SCGs	
Chemical-specific SCGs	The Minimal Action alternative would not comply with ARARs and SCGs.
Action-specific SCGs	The Minimal Action alternative would comply with ARARs and SCGs.
Location-specific SCGs	The Minimal Action alternative would comply with ARARs and SCGs.
Protection of Human Health and the Environment	
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Transport of Hazardous Materials	The Minimal Action alternative would not reduce migration of contaminants.
Health Impacts	The Minimal Action alternative relies on institutional controls, such as deed and land-use restrictions, to reduce contaminant exposure risks to human receptors.
Short-term Impacts and Effectiveness	
Protection of Community During Remedial Actions	Because no remedial actions would be implemented under this alternative, there would be no adverse effects on the local community from implementing this alternative.
Protection of Workers During Remedial Actions	No remedial actions would be implemented under this alternative.
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	Unknown. Remedial objectives may never be achieved with the Minimal Action alternative.
Long-term Effectiveness and Permanence	
Magnitude of Residual Risk	Implementation of deed and land-use restrictions would reduce contaminant exposure risks to human receptors. Potential migration of contaminants would not be reduced.
Adequacy of Controls	Institutional controls would effectively reduce the potential for exposure to TCE in site soils.
Reliability of Controls	Institutional controls would effectively reduce the potential for exposure to TCE in site soils.
Reduction of Toxicity, Mobility, or Volume	
Treatment Process Used and Materials Treated	None.
Amount of Hazardous Materials Destroyed or Treated	No amount of hazardous material would be destroyed or treated.
Degree of Expected Reductions in Toxicity, Mobility or Volume	The Minimal Action alternative would not employ removal or treatment technologies to address TCE contamination at the Site. No reduction in toxicity, mobility, or volume of TCE through treatment would be achieved.
Degree to Which Treatment is Irreversible	Not applicable.

TABLE 6-10
ALTERNATIVE TCE-1 DETAILED ANALYSIS
MINIMAL ACTION

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-1: MINIMAL ACTION
Type and Quantity of Hazardous Residuals Remaining After Treatment	Not applicable.
Implementability	
Ability to Construct and Operate the Technology	Not difficult to institute restrictions.
Reliability of the Technology Based on its Acceptable Demonstrations	Not applicable.
Ease of Undertaking Additional Remedial Actions, if necessary	The Minimal Action alternative would not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Not applicable.
Availability of Necessary Equipment and Specialists	Readily available,
Timing of New Technology Under Consideration	Not applicable.
Cost	
Net Present Worth Cost	$ 0.04 million

TABLE 6-11
ALTERNATIVE TCE-1 COST SUMMARY: MINIMAL ACTION

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Item	Unit	Unit Cost	Units	Cost
DIRECT COSTS				
Institutional Controls	Lump Sum	$25,000	1	$25,000
TOTAL DIRECT COSTS				**$25,000**
INDIRECT COSTS				
Legal, Administrative, & Permitting @ 10 % of Total Direct Cost				$2,500
TOTAL INDIRECT COSTS				**$2,500**
PRESENT WORTH OF OPERATION AND MAINTENANCE COSTS				
			Cost	**Present Worth**
Site Reviews Every 5 Years for 30 Years Beginning Year 5			$5,000 each	$10,789
PRESENT WORTH OF OPERATION & MAINTENANCE COSTS				**$10,789**
TOTAL COST				**$38,289**

TABLE 6-12
ALTERNATIVE TCE-2 DETAILED ANALYSIS
OFF-SITE TREATMENT AND DISPOSAL

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-2: OFF-SITE TREATMENT AND DISPOSAL
Compliance with ARARs and New York SCGs	
Chemical-specific SCGs	A cleanup goal of 0.7 mg/kg for TCE would comply with TAGM 4046. Alternate cleanup goals being considered (e.g., 7 and 70 mg/kg) would be protective of human health for projected future commercial/industrial property use.
Action-specific SCGs	This alternative would be designed to comply with pertinent action-specific SCGs.
Location-specific SCGs	This alternative would be designed to comply with pertinent location-specific SCGs.
Protection of Human Health and the Environment	
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Transport of Hazardous Materials	Soil with TCE concentrations above the cleanup goal would be removed from the site and disposed off-site, thereby reducing potential for migration. Residual contamination after soil removal may act as a continuing source for groundwater contamination and migration.
Health Impacts	This alternative provides protection of human health by achieving remedial action objectives; soil with TCE concentrations above the cleanup goal would be removed from the site and disposed off-site.
Short-term Impacts and Effectiveness	
Protection of Community During Remedial Actions	Short-term impacts to the community are anticipated during implementation of this alternative. Community tolerance of nuisance factors, such as dust, noise, and increased truck traffic (e.g., several hundred truckloads daily for the lower cleanup goals) will be dependent on the time needed to achieve remedial objectives which varies greatly depending on the cleanup goal selected. Vapor emissions during excavation may pose short-term risks to the community. Transportation of various materials, both hazardous and non-hazardous, would be required. Appropriate DOT regulations would be followed to reduce potential exposures.
Protection of Workers During Remedial Actions	The most significant risks to workers during implementation of this alternative would be associated with the use of heavy machinery, excavation to excessive depths at lower cleanup levels, and exposure to contaminated soil and vapors during excavation, transport, and disposal. To minimize these risks, a site-specific Health and Safety Plan (HASP) would be developed and implemented. Based on contaminant concentrations, Level C or B protection may be required during excavation of most contaminated areas.

TABLE 6-12
ALTERNATIVE TCE-2 DETAILED ANALYSIS
OFF-SITE TREATMENT AND DISPOSAL

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-2: OFF-SITE TREATMENT AND DISPOSAL
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	The time until remedial objectives are achieved varies greatly based on the cleanup goal. It is anticipated that cleanup times would range from approximately 12 months to design, implement, and remediate to a cleanup goal of 0.7 mg/kg (approximately 29,300 cy) to 8 months for a cleanup goal of 70 mg/kg (approximately 1,200 cy).
Long-term Effectiveness and Permanence	
Magnitude of Residual Risk	Contaminated soil in excess of the cleanup goal would be transported off-site for treatment and/or disposal and the excavation would be backfilled with clean fill. The magnitude of residual risk would be minimal regardless off the cleanup goal selected, because each of the cleanup goals being considered is protective of human health for an industrial/commercial exposure scenario and because excavations would be backfilled with clean fill. With the exception of cleanup to 0.7 mg/kg which could result in unrestricted land use, institutional controls would be implemented to restrict future site use to industrial/commercial applications.
Adequacy of Controls	Transport and off-site treatment/disposal of contaminated soil off-site would materially reduce the risk of contaminant exposure. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to TCE in site soils.
Reliability of Controls	Treatment and/or disposal of contaminated soil off-site would permanently eliminate contaminant non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure potential at the Site. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to TCE in site soils.
Reduction of Toxicity, Mobility, or Volume	
Treatment Process Used and Materials Treated	Soil would be treated (i.e., incinerated) to meet LDRs prior to disposal..
Amount of Hazardous Materials Destroyed or Treated	Depending on the cleanup goal selected, a range of approximately 1,200 cy (70 mg/kg) to 29,300 cy (0.7 mg/kg) of contaminated soil would be treated and/or disposed at an appropriate off-site TSDF
Degree of Expected Reductions in Toxicity, Mobility or Volume	Incineration would permanently reduce the toxicity, mobility, and volume of TCE.
Degree to Which Treatment is Irreversible	Containment of material at an off-site disposal facility is irreversible.

TABLE 6-12
ALTERNATIVE TCE-2 DETAILED ANALYSIS
OFF-SITE TREATMENT AND DISPOSAL

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-2: OFF-SITE TREATMENT AND DISPOSAL
Type and Quantity of Hazardous Residuals Remaining After Treatment	Treated soil, even though it meets LDRs, is still a RCRC-listed waste and would be disposed as a hazardous waste. No hazardous residuals would remain on-site.
Implementability	
Ability to Construct and Operate the Technology	Excavation and off-site disposal are relatively straight forward remediation practices, however there are some technical challenges with methods of excavation associated with implementation of lower cleanup goals. Excavation of soil beneath the water table to depths of up to 24 feet bgs would be required resulting in the need for dewatering and treatment of collected groundwater. As the depth of the excavation increases, stabilization of the excavation sidewalls would be required to prevent collapse.
Reliability of the Technology Based on its Acceptable Demonstrations	Site preparation and excavation services are well developed, reliable, and readily available. Off-site disposal at a licensed facility is a reliable, proven method for disposing of hazardous wastes.
Ease of Undertaking Additional Remedial Actions, if necessary	Coordination with future developers would be required to implement future remedial actions, if necessary.
Ability to Monitor Effectiveness of Remedy	Soil samples would be collected and analyzed during excavation to confirm that soil in excess of the cleanup goal has been excavated.
Availability of Necessary Equipment and Specialists	Local contractors are readily available to conduct site preparation and excavation activities. Off-site disposal facilities would provide transportation. The potentially large volume of soil requiring off-site disposal may exceed the available capacity of nearby TSDFs. It is assumed that TCE at the Site is a RCRA- listed waste and soil would require disposal in accordance with Land Disposal Restrictions.
Timing of New Technology Under Consideration	Excavation and incineration to meet LDRs are established technologies.
Cost	
Net Present Worth Cost for a cleanup goal of *0.7 mg/kg*	$ 18.1 million
Net Present Worth Cost for a cleanup goal of *7 mg/kg*	$ 6.1 million
Net Present Worth Cost for a cleanup goal of *70 mg/kg*	$ 0.9 million

TABLE 6-13
ALTERNATIVE TCE-2 COST SUMMARY: OFF-SITE DISPOSAL

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

	TCE Clean-Up Goal		70 ppm		7 ppm		0.7 ppm	
Item	Unit	Unit Cost	Units	Cost	Units	Cost	Units	Cost
<u>DIRECT COSTS</u>								
Mob/Demob	Lump Sum	$10,000	1	$10,000	1	$10,000	1	$10,000
Site Preparation	Lump Sum	$10,000	1	$10,000	1	$10,000	1	$10,000
Excavation (above water table)	CY	$10	750	$7,500	3,361	$33,610	7,300	$73,000
Excavation (below water table)	CY	$20	450	$9,000	6,289	$125,780	22,000	$440,000
Transport and Disposal (Hazardous)	CY	$350	1,200	$420,000	9,650	$3,377,500	29,300	$10,255,000
Treatment System for Excavation Dewatering	Lump Sum	$50,000	1	$50,000	1	$50,000	1	$50,000
Treatment and Disposal of Contaminated Groundwater	1000 gallon	$100	25	$2,500	40	$4,000	100	$10,000
Delivery and Placement of Backfill Material	CY	$10	1,200	$12,000	9,650	$96,500	29,300	$293,000
Site Restoration	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
Institutional Controls	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
SUBTOTAL DIRECT COSTS				**$571,000**		**$3,757,390**		**$11,191,000**
MISCELLANEOUS SITE COSTS @ 20%				**$114,200**		**$751,478**		**$2,238,200**
TOTAL DIRECT COSTS				**$685,200**		**$4,508,868**		**$13,429,200**
<u>INDIRECT COSTS</u>								
Health & Safety @ 5 % of Total Direct Cost				$34,260		$225,443		$671,460
Legal, Administrative, & Permitting @ 10 % of Total Direct Cost				$68,520		$450,887		$1,342,920
Engineering @ 10% of Total Direct Cost				$68,520		$450,887		$1,342,920
Services During Construction @ 10% of Total Direct Cost				$68,520		$450,887		$1,342,920
TOTAL INDIRECT COSTS				**$239,820**		**$1,578,104**		**$4,700,220**
TOTAL COST				**$925,020**		**$6,086,972**		**$18,129,420**

TABLE 6-14
ALTERNATIVE TCE-3 DETAILED ANALYSIS
THERMAL TREATMENT

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-3: THERMAL TREATMENT
Compliance with ARARs and New York SCGs	
Chemical-specific SCGs	A cleanup goal of 0.7 mg/kg for TCE would comply with TAGM 4046. Alternate cleanup goals being considered (e.g., 7 and 70 mg/kg) would be protective of human health for projected future commercial/industrial property use.
Action-specific SCGs	This alternative would be designed to comply with pertinent action-specific SCGs.
Location-specific SCGs	This alternative would be designed to comply with pertinent location-specific SCGs.
Protection of Human Health and the Environment	
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Transport of Hazardous Materials	TCE-contaminated soil would be excavated and thermally treated on-site to the cleanup goal with static piles, thereby mitigating the potential for future migration of contaminants.
Health Impacts	This alternative provides protection of human health by achieving remedial action objectives. Soil with TCE concentrations above the cleanup goal would be excavated and thermally treated on-site.
Short-term Impacts and Effectiveness	
Protection of Community During Remedial Actions	Short-term impacts to the community are anticipated during implementation of this alternative. Community tolerance of nuisance factors, such as dust, noise, and increased truck traffic will be dependent on the time needed to achieve remedial objectives which varies greatly depending on the cleanup goal selected. Vapor emissions during excavation may pose short-term risks to the community. Transportation of various materials, both hazardous and non-hazardous, would be required. Appropriate DOT regulations would be followed to reduce potential exposures.
Protection of Workers During Remedial Actions	The most significant risks to workers during implementation of this alternative would be associated with the use of heavy machinery, excavation to excessive depths at lower cleanup levels, and exposure to contaminated soil and vapors during excavation and treatment. To minimize these risks, a site-specific Health and Safety Plan (HASP) would be developed and implemented. Based on contaminant concentrations, Level C or B protection may be required during excavation of most contaminated areas.
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.

TABLE 6-14
ALTERNATIVE TCE-3 DETAILED ANALYSIS
THERMAL TREATMENT

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-3: THERMAL TREATMENT
Time Until Remedial Action Objectives are Achieved	The time until remedial objectives are achieved varies greatly based on the cleanup goal. It is anticipated that cleanup times would range from greater than 2 years to design, implement, and remediate to a cleanup goal of 0.1 mg/kg to less than 2 years for a cleanup goal of 1,000 mg/kg.
Long-term Effectiveness and Permanence	
Magnitude of Residual Risk	Treated soils would be used to backfill the excavations (with the exception of those containing glass shards which would be disposed off-site as a non-hazardous waste. Concentrated, condensed organics recovered during treatment would be transported off-site for further treatment. The magnitude of residual risk would be minimal regardless of the cleanup goal selected, because each of the cleanup goals being considered is protective of human health for an industrial/commercial exposure scenario. With the exception of cleanup to 0.7 mg/kg which could result in unrestricted land use, institutional controls would be implemented to minimize residual risks by restricting future site use to industrial/commercial applications.
Adequacy of Controls	Thermal desorption would permanently reduce contaminant concentrations to the cleanup goal because contaminated soil would be removed and treated. Concentrated, condensed organics recovered during treatment would be transported off-site for further treatment. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to TCE in site soils.
Reliability of Controls	Thermal treatment and off-site disposal of contaminated soil are reliable, proven technologies that would permanently eliminate contaminant exposure potential at the Site. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to TCE in site soils.
Reduction of Toxicity, Mobility, or Volume	
Treatment Process Used and Materials Treated	On-site thermal treatment would be used to recover TCE from excavated soil containing TCE above the cleanup goal. Off-site landfilling is a containment technology which would control the mobility of contaminants.
Amount of Hazardous Materials Destroyed or Treated	Depending on the cleanup goal selected, a range of approximately 29,300 cubic yards (cy) (70 mg/kg) to 1,200 cy (0.7 mg/kg) of contaminated soil would be treated on-site by thermal desorption. The amount of TCE recovered would vary based on the cleanup-goal selected however, a large percentage of the total TCE on Site would be recovered at the higher cleanup goals which would target the most contaminated areas.

TABLE 6-14
ALTERNATIVE TCE-3 DETAILED ANALYSIS
THERMAL TREATMENT

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-3: THERMAL TREATMENT
Degree of Expected Reductions in Toxicity, Mobility or Volume	The mobility and toxicity of TCE in soil would be reduced by the thermal treatment process. Additionally, the volume of TCE would be reduced from potentially large volumes of soil to a significantly smaller volume of condensed organics. Condensed organics would be transported off-site for treatment (i.e., incineration) which would permanently reduce the toxicity, mobility, and volume.
Degree to Which Treatment is Irreversible	Because thermal treatment separates TCE from soil, treatment is permanent.
Type and Quantity of Hazardous Residuals Remaining After Treatment	Treated soil would be returned to the excavation. Concentrated, condensed organics recovered during treatment would be transported off-site for treatment. If necessary, activated carbon used for off-gas treatment would be regenerated or disposed off-site.
Implementability	
Ability to Construct and Operate the Technology	Several vendors have developed mobile thermal desorption units to treat organic contaminants. Construction and operation of the treatment unit would be performed by the vendor. In order to achieve lower cleanup goals, each batch of soil may need to be treated multiple times which could significantly increase overall operation time. Excavation and off-site disposal are relatively straight forward remediation practices, however there are some technical challenges with methods of excavation associated with implementation of lower cleanup goals. Excavation of soil beneath the water table to depths of up to 24 feet bgs would be required resulting in the need for dewatering and treatment of collected groundwater. As the depth of the excavation increases, stabilization of the excavation sidewalls would be required to prevent collapse.
Reliability of the Technology Based on its Acceptable Demonstrations	Thermal desorption has been demonstrated full-scale to remediate organic-contaminated soil. Site preparation and excavation services are well developed, reliable, and readily available. Off-site disposal at a licensed facility is a reliable, proven method for disposing of contaminated wastes.
Ease of Undertaking Additional Remedial Actions, if necessary	Coordination with future developers would be required to implement future remedial actions, if necessary.
Ability to Monitor Effectiveness of Remedy	Soil samples would be collected and analyzed during excavation to confirm that soil in excess of the cleanup goal has been excavated. Monitoring of the treatment process would be conducted including pre-treatment and post-treatment soil sampling and air monitoring.
Availability of Necessary Equipment and Specialists	Several vendors have developed mobile thermal desorption units to treat organic contaminants. Local contractors are readily available to conduct site preparation and excavation activities. Off-site disposal facilities would provide transportation.
Timing of New Technology Under Consideration	Thermal desorption is a full-scale treatment technology for organics.

TABLE 6-14
ALTERNATIVE TCE-3 DETAILED ANALYSIS
THERMAL TREATMENT

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-3: THERMAL TREATMENT
Cost	
Net Present Worth Cost for a cleanup goal of *0.7 mg/kg*	$ 8.7 million
Net Present Worth Cost for a cleanup goal of *7 mg/kg*	$ 3.0million
Net Present Worth Cost for a cleanup goal of *70 mg/kg (plus the glass shards)*	$ 0.6 million

TABLE 6-15
ALTERNATIVE TCE - 3 COST SUMMARY: LTTD

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

	TCE Clean-Up Goal		70 ppm		7 ppm		0.7 ppm	
Item	Unit	Unit Cost	Units	Cost	Units	Cost	Units	Cost
DIRECT COSTS								
Mob/Demob	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
Site Preparation	Lump Sum	$10,000	1	$10,000	1	$10,000	1	$10,000
Excavation (above water table)	CY	$10	750	$7,500	3,361	$33,610	7,300	$73,000
Excavation (below water table)	CY	$20	450	$9,000	6,289	$125,780	22,000	$440,000
LTTD Treatment (Static Pile)	CY	$150	1,200	$180,000	9,650	$1,447,500	29,300	$4,395,000
Treatment System for Excavation Dewatering	Lump Sum	$50,000	1	$50,000	1	$50,000	1	$50,000
Treatment and Disposal of Contaminated Groundwater	1000 gallon	$100	25	$2,500	40	$4,000	100	$10,000
Placement of Treated Material	CY	$10	1,200	$12,000	9,650	$96,500	29,300	$293,000
Site Restoration	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
Institutional Controls	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
SUBTOTAL DIRECT COSTS				**$346,000**		**$1,842,390**		**$5,346,000**
MISCELLANEOUS SITE COSTS @ 20%				**$69,200**		**$368,478**		**$1,069,200**
TOTAL DIRECT COSTS				**$415,200**		**$2,210,868**		**$6,415,200**
INDIRECT COSTS								
Health & Safety @ 5 % of Total Direct Cost				$20,760		$110,543		$320,760
Legal, Administrative, & Permitting @ 10 % of Total Direct Cost				$41,520		$221,087		$641,520
Engineering @ 10% of Total Direct Cost				$41,520		$221,087		$641,520
Services During Construction @ 10% of Total Direct Cost				$41,520		$221,087		$641,520
TOTAL INDIRECT COSTS				**$145,320**		**$773,804**		**$2,245,320**
TOTAL COST				**$560,520**		**$2,984,672**		**$8,660,520**

TABLE 6-16
ALTERNATIVE TCE-4 DETAILED ANALYSIS
CAP

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-4: CAP
Compliance with ARARs and New York SCGs	
Chemical-specific SCGs	A cleanup goal of 0.7 mg/kg for TCE would comply with TAGM 4046. Alternate cleanup goals being considered (e.g., 7 and 70 mg/kg) would be protective of human health for projected future industrial/commercial property use.
Action-specific SCGs	This alternative would be designed to comply with pertinent action-specific SCGs including design and construction of a cover system which would meet the performance criteria set forth under NYSWR (6 NYCRR Part 360).
Location-specific SCGs	This alternative would be designed to comply with pertinent location-specific SCGs.
Protection of Human Health and the Environment	
Environmental Impacts	Because of the lack of environmental receptors, no significant adverse environmental impacts would be anticipated from the implementation of this alternative. A top vegetative cover layer of the cover system may provide a future habitat.
Transport of Hazardous Materials	Soil with TCE concentrations above the cleanup goal would be consolidated beneath the cap. However based on the relatively small areal extent of the contamination and cap (i.e., less than 0.75 acre) and the amount of TCE contamination in soils beneath the water table, minimal reduction in contaminant migration is anticipated.
Health Impacts	This alternative provides protection of human health by complying with the NYSWR and would isolate contaminated soils and eliminate potential for direct exposure. This alternative would not be effective in preventing on-site TCE contamination from being a continued source to groundwater. Institutional controls would be implemented to reduce contaminant exposure risks.
Short-term Impacts and Effectiveness	
Protection of Community During Remedial Actions	Short-term impacts to the community are anticipated during implementation of this alternative. Community tolerance of nuisance factors, such as dust, noise, and increased truck traffic will be dependent on the time needed to achieve remedial objectives which varies depending on the cleanup goal selected and size of cap being constructed.
Protection of Workers During Remedial Actions	The most significant risks to workers during implementation of this alternative would be associated with the use of heavy machinery during construction. To minimize these risks, a site-specific Health and Safety Plan (HASP) would be developed and implemented.
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.

TABLE 6-16
ALTERNATIVE TCE-4 DETAILED ANALYSIS
CAP

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-4: CAP
Time Until Remedial Action Objectives are Achieved	Approximately 6 months would be required to design, and construct a 0.75 acre cap or smaller.
Long-term Effectiveness and Permanence	
Magnitude of Residual Risk	Because untreated soil would remain on-site, installation of a cover system would not be considered a permanent remedy, however it would isolate the contaminated soil from potential exposure and would provide some reduction of infiltration and migration of contaminants. Institutional controls would be implemented to minimize risks by restricting future site use to industrial/commercial applications.
Adequacy of Controls	Contaminated soil would remain on-site but would be isolated from potential receptors by a cover system. A cover system would not provide adequate containment and it is likely that deeper TCE contaminated soils would be a continuing source of contamination to groundwater. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to TCE in site soils.
Reliability of Controls	The cover system would be inspected and maintained to ensure continued isolation of contaminated soil. A cover system would not reliably control migration of contaminants since soil contamination is present in the saturated zone.. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to TCE in site soils.
Reduction of Toxicity, Mobility, or Volume	
Treatment Process Used and Materials Treated	Treatment is not a principle element of this alternative. A cover system would isolate contaminated soil from potential receptors and would provide some reduction to the mobility of contaminants.
Amount of Hazardous Materials Destroyed or Treated	No amount of hazardous material would be destroyed or treated.
Degree of Expected Reductions in Toxicity, Mobility or Volume	No reduction in toxicity, mobility, or volume of TCE through treatment would be achieved. A cover system would provide some reduction to the mobility of contaminants.
Degree to Which Treatment is Irreversible	Not applicable.
Type and Quantity of Hazardous Residuals Remaining After Treatment	Soil in excess of the cleanup goal would remain on-site beneath a low permeability cover system.

TABLE 6-16
ALTERNATIVE TCE-4 DETAILED ANALYSIS
CAP

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-4: CAP
Implementability	
Ability to Construct and Operate the Technology	Construction of a low-permeability cover system is a well-developed technology and has been used at numerous hazardous and municipal landfills.
Reliability of the Technology Based on its Acceptable Demonstrations	Techniques used for cap construction are well developed, reliable, and readily available.
Ease of Undertaking Additional Remedial Actions, if necessary	Care would need to be taken when implementing future remedial actions so as to not damage or compromise the integrity of the cover system.
Ability to Monitor Effectiveness of Remedy	A long-term monitoring program would be implemented to monitor the effectiveness of the remedy and would involve periodic sampling of soil gas and groundwater.
Availability of Necessary Equipment and Specialists	Contractors to perform construction services are readily available, and several could be included in a competitive bid process.
Timing of New Technology Under Consideration	Cover system construction is a proven technology.
Cost	
Net Present Worth Cost for a cleanup goal of *0.7 mg/kg*	$ 1.0 million
Net Present Worth Cost for a cleanup goal of *7 mg/kg*	$ 0.7 million
Net Present Worth Cost for a cleanup goal of *70 mg/kg*	$ 0.3 million

TABLE 6-17
ALTERNATIVE TCE-4 COST SUMMARY: CAP

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

	TCE Clean-Up Goal		70 ppm		7 ppm		0.7 ppm	
Item	**Unit**	**Unit Cost**	**Units**	**Cost**	**Units**	**Cost**	**Units**	**Cost**
DIRECT COSTS								
Mob/Demob	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
Site Preparation	Lump Sum	$10,000	1	$10,000	1	$10,000	1	$10,000
Installation of NYSWR Cap	acre	$450,000	0.1	$45,000	0.5	$225,000	0.75	$337,500
Site Restoration	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
Institutional Controls	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
SUBTOTAL DIRECT COSTS				**$130,000**		**$310,000**		**$422,500**
MISCELLANEOUS SITE COSTS @ 20%				**$26,000**		**$62,000**		**$84,500**
TOTAL DIRECT COSTS				**$156,000**		**$372,000**		**$507,000**
INDIRECT COSTS								
Health & Safety @ 5 % of Total Direct Cost				$7,800		$18,600		$25,350
Legal, Administrative, & Permitting @ 10 % of Total Direct Cost				$15,600		$37,200		$50,700
Engineering @ 10% of Total Direct Cost				$15,600		$37,200		$50,700
Services During Construction @ 10% of Total Direct Cost				$15,600		$37,200		$50,700
TOTAL INDIRECT COSTS				**$54,600**		**$130,200**		**$177,450**
PRESENT WORTH OF OPERATION AND MAINTENANCE COSTS								
			Cost	**Present Worth**	**Cost**	**Present Worth**	**Cost**	**Present Worth**
Site Reviews Every 5 Years Beginning Year 5			$5,000 each	$10,789	5,000 each	$10,789	5,000 each	$10,789
Cap Maintenance and Monitoring @ 5 % of Total Direct Cost for 30 Years			$7,800	$96,790	$18,600	$230,807	$25,350	$314,568
PRESENT WORTH OF OPERATION & MAINTENANCE COSTS				**$107,579**		**$241,596**		**$325,357**
TOTAL COST				**$318,179**		**$743,796**		**$1,009,807**

TABLE 6-18
ALTERNATIVE TCE-5 DETAILED ANALYSIS
SOIL VAPOR EXTRACTION

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-5: SOIL VAPOR EXTRACTION
Compliance with ARARs and New York SCGs	
Chemical-specific SCGs	A cleanup goal of 0.7 mg/kg for TCE would comply with TAGM 4046. Alternate cleanup goals being considered (e.g., 7 and 70 mg/kg) would be protective of human health for projected future commercial/industrial property use.
Action-specific SCGs	This alternative would be designed to comply with pertinent action-specific SCGs.
Location-specific SCGs	This alternative would be designed to comply with pertinent location-specific SCGs.
Protection of Human Health and the Environment	
Environmental Impacts	Because of the lack of environmental receptors, no significant adverse environmental impacts would be anticipated from the implementation of this alternative. VER groundwater capture further reduces the potential for contaminant migration.
Transport of Hazardous Materials	Soil vapor extraction, potentially enhanced with VER, would be used to reduce TCE concentrations to below the cleanup goal, thereby minimizing potential contaminant migration.
Health Impacts	This alternative provides protection of human health by reducing TCE concentrations to below the cleanup goal. In combination with institutional controls, would reduce contaminant exposure risks.
Short-term Impacts and Effectiveness	
Protection of Community During Remedial Actions	Minimal short-term impacts to the community are anticipated during implementation of this alternative. Off-gases will be monitored after treatment and prior to discharge to the atmosphere.
Protection of Workers During Remedial Actions	The most significant risks to workers during implementation of this alternative would be associated with the use of heavy machinery and exposure to contaminated soil during construction and operation. To minimize these risks, a site-specific Health and Safety Plan (HASP) would be developed and implemented.
Environmental Impacts	Because of the lack of environmental receptors, no significant environmental impacts would be anticipated from the implementation of this alternative.
Time Until Remedial Action Objectives are Achieved	The time until remedial objectives are achieved varies based on the cleanup goal. It is anticipated that cleanup times would be greater than 2 years to design, construct, and remediate to any of cleanup goals evaluated.

TABLE 6-18
ALTERNATIVE TCE-5 DETAILED ANALYSIS
SOIL VAPOR EXTRACTION

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-5: SOIL VAPOR EXTRACTION
Long-term Effectiveness and Permanence	
Magnitude of Residual Risk	Because this remedial alternative treats contaminated soil in-situ, treated soils would continue to remain in place. Contaminants recovered from the vapor (and potentially water using VER) extraction would be transported off-site for treatment and/or disposal. The magnitude of residual risk would be minimal regardless of the cleanup goal selected, because each of the cleanup goals being considered is protective of human health for an industrial/commercial exposure scenario. With the exception of cleanup to 0.7 mg/kg which could result in unrestricted land use, institutional controls would be implemented to minimize residual risks by restricting future site use to industrial/commercial applications.
Adequacy of Controls	SVE/VER would permanently reduce contaminant concentrations to the cleanup goal. Contaminants recovered during treatment would be transported off-site for treatment and/or disposal. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to TCE in site soils.
Reliability of Controls	SVE is reliable, proven technology that would permanently eliminate contaminant exposure potential at the Site. The treatment system would be monitored and maintained to ensure compliance with performance goals. Institutional controls would effectively reduce the potential for non-industrial/commercial (i.e., residential neighborhoods, schools, daycare centers, etc.) exposure to TCE in site soils.
Reduction of Toxicity, Mobility, or Volume	
Treatment Process Used and Materials Treated	SVE (and potentially VER to enhance performance) would be used to permanently reduce TCE concentrations in-situ to below the cleanup goal.
Amount of Hazardous Materials Destroyed or Treated	The amount of TCE recovered would vary based on cleanup-goal. Longer treatment times would be required for effective treatment to lower cleanup goals.
Degree of Expected Reductions in Toxicity, Mobility or Volume	The mobility and toxicity of TCE in soil would be reduced by SVE/VER. Additionally, the volume of TCE would be reduced from potentially large volumes of soil to a significantly smaller volume of recovered organics
Degree to Which Treatment is Irreversible	Because SVE/VER separates TCE from soil, treatment is permanent.
Type and Quantity of Hazardous Residuals Remaining After Treatment	The amount of activated carbon used to recover organics from the off-gases would depend on the cleanup goal.
Implementability	
Ability to Construct and Operate the Technology	Construction of a SVE treatment system is a well-developed technology and has been used at numerous hazardous waste sites.

TABLE 6-18
ALTERNATIVE TCE-5 DETAILED ANALYSIS
SOIL VAPOR EXTRACTION

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

EVALUATION CRITERIA	ALTERNATIVE TCE-5: SOIL VAPOR EXTRACTION
Reliability of the Technology Based on its Acceptable Demonstrations	SVE is well developed, reliable, and readily available. Lower cleanup goals (e.g., 0.7 mg/kg) may be more difficult to achieve and require longer treatment times. Pilot-testing would be required to properly design the SVE system and evaluate VER.
Ease of Undertaking Additional Remedial Actions, if necessary	Care would need to be taken when implementing future remedial actions so as to not interfere with or compromise the integrity of the treatment system.
Ability to Monitor Effectiveness of Remedy	A monitoring program would be implemented to monitor the effectiveness and removal rates. Monitoring would involve periodic sampling of air and soil.
Availability of Necessary Equipment and Specialists	Contractors to perform construction services are readily available, and several could be included in a competitive bid process.
Timing of New Technology Under Consideration	SVE is a proven technology.
Cost	
Net Present Worth Cost for a cleanup goal of *0.7 mg/kg*	$ 3.5 million
Net Present Worth Cost for a cleanup goal of *7 mg/kg*	$ 1.6 million
Net Present Worth Cost for a cleanup goal of *70 mg/kg*	$ 1.1 million

TABLE 6-19
ALTERNATIVE TCE-5 COST SUMMARY: SVE / VER

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

	TCE Clean-Up Goal		70 ppm		7 ppm		0.7 ppm	
Item	Unit	Unit Cost	Units	Cost	Units	Cost	Units	Cost
DIRECT COSTS								
Pilot Study / Additional Soil Characterization	Lump Sum	$100,000	1	$100,000	1	$100,000	1	$100,000
Mob/Demob	Lump Sum	$10,000	1	$10,000	1	$10,000	1	$10,000
Site Preparation	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
Install SVE /VER Extraction Wells	each	$5,000	6	$30,000	15	$75,000	30	$150,000
SVE Treatment System	Lump Sum	$120,000	1	$120,000	1	$120,000	1	$120,000
Water Treatment System	Lump Sum	$100,000	1	$100,000	1	$100,000	1	$100,000
Site Restoration	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
Institutional Controls	Lump Sum	$25,000	1	$25,000	1	$25,000	1	$25,000
SUBTOTAL DIRECT COSTS				**$410,000**		**$455,000**		**$530,000**
MISCELLANEOUS SITE COSTS @ 20%				**$82,000**		**$91,000**		**$106,000**
TOTAL DIRECT COSTS				**$492,000**		**$546,000**		**$636,000**
INDIRECT COSTS								
Health & Safety @ 5 % of Total Direct Cost				$24,600		$27,300		$31,800
Legal, Administrative, & Permitting @ 10 % of Total Direct Cost				$49,200		$54,600		$63,600
Engineering @ 20% of Total Direct Cost				$98,400		$109,200		$127,200
Services During Construction @ 10% of Total Direct Cost				$49,200		$54,600		$63,600
TOTAL INDIRECT COSTS				**$221,400**		**$245,700**		**$286,200**
PRESENT WORTH OF OPERATION AND MAINTENANCE COSTS								
			Cost	**Present Worth***	**Cost**	**Present Worth***	**Cost**	**Present Worth***
Site Review Year 5			$5,000	$3,565	$5,000	$3,565	$5,000	$3,565
VER Groundwater Treatment			$105,000	$189,840	$210,000	$551,103	$520,000	$2,132,104
SVE Carbon Usage			$96,000	$173,568	$96,000	$251,933	$96,000	$393,619
Annual Treatment System Evaluation			$7,500	$13,560	$7,500	$19,682	$7,500	$30,752
PRESENT WORTH OF OPERATION & MAINTENANCE COSTS				**$380,533**		**$826,283**		**$2,560,040**
TOTAL COST				**$1,093,933**		**$1,617,983**		**$3,482,240**

Notes: * Operational period of 2 years estimated for 70 ppm TCE clean-up level.
Operational period of 3 years estimated for 7 ppm TCE clean-up level.
Operational period of 5 years estimated for 0.7 ppm TCE clean-up level.

TABLE 7-1
COMPARATIVE ANALYSIS OF MERCURY REMEDIAL ALTERNATIVES
FOR CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative HG-1: Minimal Action	Alternative HG-2: Off-Site Disposal (cleanup goal = 0.1 mg/kg)	Alternative HG-3: Thermal Treatment (cleanup goal = 0.1 mg/kg)	Alternative HG-4: Cap(cleanup goal = 0.1 mg/kg)
Compliance with ARARs and New York SCGs	Would not comply with SCGs.	Complies with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Complies with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Complies with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.
Protection of Human Health and the Environment	Would not be protective of human health. No environmental receptors identified.	Protective of human health by removing contaminated soil from the Site. No environmental receptors identified.	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified.	Protective of human health by isolating contaminated soil from potential receptors. No environmental receptors identified.
Short-term Impacts and Effectiveness	No short-term impacts.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to design, implement, and remediate is greater than 2 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to design, implement, and remediate is greater than 5 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to complete is less than 1 year.
Long-term Effectiveness and Permanence	Not applicable.	Would permanently eliminate exposure to mercury concentrations above the cleanup goal.	Thermal treatment is a permanent remedy, however may be ineffective at achieving cleanup goal 0.1 mg/kg.	Not considered a permanent remedy but would be inspected and maintained to ensure continued isolation of contaminated soil.
Reduction of Toxicity, Mobility, or Volume	Not applicable.	No reduction of toxicity, mobility or volume would occur through treatment. Landfilling would slightly reduce contaminant mobility. No hazardous residuals would	Reduction of toxicity, mobility, and volume would occur through thermal treatment. Treated soil would be used to backfill excavations.	No reduction of toxicity, mobility or volume would occur through treatment. Cap would slightly reduce contaminant mobility. Contaminated soil above cleanup goal would

TABLE 7-1
COMPARATIVE ANALYSIS OF MERCURY REMEDIAL ALTERNATIVES FOR CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative HG-1: Minimal Action	Alternative HG-2: Off-Site Disposal (cleanup goal = 0.1 mg/kg)	Alternative HG-3: Thermal Treatment (cleanup goal = 0.1 mg/kg)	Alternative HG-4: Cap(cleanup goal = 0.1 mg/kg)
		remain on-site.		remain on-site.
Implementability	Institutional controls would be relatively easy to implement.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Dewatering and shoring/bracing would be required. May exceed the available capacity of nearby landfills.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Dewatering and shoring/bracing would be required. Only a small number of vendors are experienced with thermally treating and recovering mercury.	Would be relatively easy to implement.
Cost	$0.04 million	$ 39.5 million	$ 124.3 million	$ 8.4 million

TABLE 7-2
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (Relative Weight = 10)						
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes = 4 No = 0	0	4	4	0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes = 3 No = 0	3	3	3	3
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes = 3 No = 0	3	3	3	3
TOTAL (Maximum = 10)			6	10	10	6
PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (Relative Weight = 20)						
1. Use of the site after remediation. **TOTAL (Maximum = 20)**	Unrestricted use of the land and water. **(If answer is yes, go to next analysis factor.)**	Yes = 20 No = 0	0	0	0	0
2. Human health and the environment exposure after remediation.	(i) Is the exposure to contaminants via air route acceptable?	Yes = 3 No = 0	0	3	3	3
	(ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes = 4 No = 0	4	4	4	4
Subtotal (maximum = 10)	(iii) Is the exposure to contaminants via sediments/soil acceptable?	Yes = 3 No = 0	0	3	3	3
3. Magnitude of residual public health risks after the remediation.	(i) Health risk < 1 in 1,000,000	Yes = 5 No = 0	0	5	5	5
Subtotal (maximum = 5)	(ii) Health risk < 1 in 100,000	Yes = 2 No = 0	0	NA	NA	NA

TABLE 7-2
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
4. Magnitude of residual environmental risks after the remediation.	(i) Less than acceptable. (ii) Slightly greater than acceptable. (iii) Significant risk still exists.	= 5 = 3 = 0	5	5	5	5
Subtotal (maximum = 5)						
TOTAL (Maximum = 20)			9	20	20	20
SHORT-TERM EFFECTIVENESS (Relative Weight = 10)						
1. Protection of community during remedial actions.	a) Are there significant short-term risks to the community that must be addressed?	Yes = 0 No = 4	4	0	0	4
	(If the answer is no, go to Factor 2.) b) Can the risk be easily controlled?	Yes = 1 No = 0	NA	1	1	NA
	c) Does the mitigative effort to control risk impact the community lifestyle?	Yes = 0 No = 2	NA	0	0	NA
Subtotal (maximum = 4)						
2. Environmental impacts.	a) Are there significant short-term risks to the environment that must be addressed?	Yes = 0 No = 4	4	4	4	4
	(If the answer is no, go to Factor 3.) b) Are the available mitigative measures reliable to minimize potential impacts?	Yes = 3 No = 0	NA	NA	NA	NA
Subtotal (maximum = 4)						

TABLE 7-2
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
3. Time to implement the remedy.	a) What is the required time to implement the remedy?	< 2 years = 1 > 2 years = 0	1	0	0	1
	b) Required duration of the mitigative effort to control short-term risk?	< 2 years = 1 > 2 years = 0	1	0	0	1
Subtotal (maximum = 2)						
TOTAL (Maximum = 10)			10	5	5	10
LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15)						
1. On-site or off-site treatment or land disposal.	* On-site treatment * Off-site treatment * On-site or off-site land disposal	= 3 = 1 = 0	0	0	3	0
Subtotal (maximum = 3)						
2. Permanence of the remedial alternative.	* Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c)? **(If the answer is yes, go to Factor 4.)**	Yes = 3 No = 0	0	0	3	0
Subtotal (maximum = 3)						
3. Lifetime of remedial actions.	* Expected lifetime or duration of effectiveness of the remedy.	25-30 years = 3 20-25 years = 2 15-20 years = 1 < 15 years = 0	3	3	NA	3
Subtotal (maximum = 3)						
4. Quantity and nature of waste or residual left at the site after remediation.	(i) Quantity of untreated hazardous waste left at the site.	None = 3 < 25% = 2 25-50% = 1 >50% = 0	0	3	3	0
	(ii) Is there treated residual left at the site? **(If the answer is no, go to Factor 5.)**	Yes = 0 No = 2	2	2	0	2
	(iii) Is the treated residual toxic?	Yes = 0 No = 1	NA	NA	1	NA

TABLE 7-2
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.1 mg/kg) HG-1	HG-2	HG-3	HG-4
	(iv) Is the treated residual mobile?	Yes = 0 No = 1	NA	NA	1	NA
Subtotal (maximum = 5)						
5. Adequacy and reliability of controls.	(i) Operation and maintenance required for a period of:	< 5 years = 1 > 5 years = 0	1	1	1	1
	(ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If the answer is no, go to "iv".)**	Yes = 0 No = 1	0	1	1	0
	(iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident = 1 Somewhat to not confident = 0	0	NA	NA	1
	(iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum = 2 Moderate = 1 Extensive = 0	0	1	1	1
Subtotal (maximum = 4)						
TOTAL (Maximum = 15)			6	11	14	8
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (Relative Weight = 15)						
1. Volume of hazardous waste reduced (reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.)**	(i) Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.**	99-100% = 8 90-99% = 7 80-90% = 6 60-80% = 4 40-60% = 2 20-40% = 1 <20% = 0	NA	NA	7	NA

TABLE 7-2
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
	(ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2.**	Yes = 0 No = 2	NA	NA	0	NA
Subtotal (maximum = 10) **If subtotal = 10, go to Factor 3.**	(iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal = 0 On-site land disposal = 1 Off-site destruction or treatment = 2	NA	NA	1	NA
2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.**	(i) Quality of Available Wastes Immobilized After Destruction/Treatment.	90-100% = 2 60-90% = 1 < 60% = 0	NA	2	NA	2
Subtotal (maximum = 5)	(ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 = 0 = 3	NA	0	NA	0
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste. **Subtotal (maximum = 5)**	Completely irreversible. Irreversible for most of the hazardous constituents. Irreversible for only some of the hazardous constituents. Reversible for most of the hazardous constituents.	= 5 = 3 = 2 = 0	NA	5	5	3
TOTAL (Maximum = 15)			0	7	13	5

TABLE 7-2
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
IMPLEMENTABILITY (Relative Weight = 15)						
1. Technical Feasibility						
a. Ability to construct technology.	(i) Not difficult to construct. No uncertainties in construction.	= 3	3	1	1	3
	(ii) Somewhat difficult to construct. No uncertainties in construction.	= 2				
	(iii) Very difficult to construct and/or significant uncertainties in construction.	= 1				
b. Reliability of technology	(i) Very reliable in meeting the specified process efficiencies or performance goals.	= 3	NA	3	2	3
	(ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	= 2				
c. Schedule of delays due to technical problems.	(i) Unlikely	= 2	2	1	1	2
	(ii) Somewhat likely	= 1				
d. Need of undertaking additional remedial action, if necessary.	(i) No future remedial actions may be anticipated.	= 2	1	2	2	2
	(ii) Some future remedial actions may be necessary.	= 1				
Subtotal (maximum = 10)						
2. Administrative Feasibility						
a. Coordination with other agencies.	(i) Minimal coordination is required.	= 2	2	2	0	2
	(ii) Required coordination is normal.	= 1				
	(iii) Extensive coordination is required.	= 0				
Subtotal (maximum = 2)						

TABLE 7-2
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
3. Availability of Services and Materials						
a. Availability of prospective technologies.	(i) Are technologies under consideration generally commercially available for the site-specific contamination?	Yes = 1 No = 0	1	1	1	1
	(ii) Will more than one vendor be available to provide a competitive bid?	Yes = 1 No = 0	NA	1	0	1
b. Availability of necessary equipment and specialists.	(i) Additional equipment and specialists may be available without significant delay.	Yes = 1 No = 0	NA	1	0	1
Subtotal (maximum = 3)						
TOTAL (Maximum = 15)			9	12	7	15
COST **(Relative Weight = 15)**						
Present Worth Cost	Total Present Worth (millions)		0.04	39.5	124.3	8.4
	Cost scores were assigned using the equation: 15 - Alternative Cost in $MM. Alternatives with costs from $15 to $20 MM were assigned a score of 1. Alternatives with costs above $ 20 MM were assigned a score of 0.		15	0	0	7
TOTAL (Maximum = 15)			15	0	0	7

TABLE 7-2
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 0.1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
SUMMARY OF FACTORS						
Compliance with ARARs and SCGs		(max = 10)	6	10	10	6
Protection of Public Health and the Environment		(max = 20)	9	20	20	20
Short-term Impacts and Effectiveness		(max = 10)	10	5	5	10
Long-term Effectiveness and Permanence		(max = 15)	6	11	14	8
Reduction of Toxicity, Mobility, or Volume		(max = 15)	0	7	13	5
Implementability		(max = 15)	9	12	7	15
Cost		(max = 15)	15	0	0	7
TOTAL		(max = 100)	55	65	69	71

NOTES:
Alternative HG-1: Minimal Action
Alternative HG-2: Off-Site Disposal
Alternative HG-3: Thermal Treatment
Alternative HG-4: Cover System

TABLE 7-3
COMPARATIVE ANALYSIS OF MERCURY REMEDIAL ALTERNATIVES FOR CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative HG-1: Minimal Action	Alternative HG-2: Off-Site Disposal (cleanup goal = 1 mg/kg)	Alternative HG-3: Thermal Treatment (cleanup goal = 1 mg/kg)	Alternative HG-4: Cap(cleanup goal = 1 mg/kg)
Compliance with ARARs and New York SCGs	Would not comply with SCGs.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.
Protection of Human Health and the Environment	Would not be protective of human health. No environmental receptors identified.	Protective of human health by removing contaminated soil from the Site. No environmental receptors identified.	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified.	Protective of human health by isolating contaminated soil from potential receptors. No environmental receptors identified.
Short-term Impacts and Effectiveness	No short-term impacts.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to design, implement, and remediate is greater than 2 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to design, implement, and remediate is greater than 5 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to complete is less than 1 year.
Long-term Effectiveness and Permanence	Not applicable.	Would permanently eliminate exposure to mercury concentrations above the cleanup goal.	Thermal treatment is a permanent remedy, however may be ineffective at achieving cleanup goal of 1 mg/kg.	Not considered a permanent remedy but would be inspected and maintained to ensure continued isolation of contaminated soil.
Reduction of Toxicity, Mobility, or Volume	Not applicable.	No reduction of toxicity, mobility or volume would occur through treatment. Landfilling would slightly reduce contaminant mobility. No hazardous residuals would	Reduction of toxicity, mobility, and volume would occur through thermal treatment. Treated soil would be used to backfill excavations.	No reduction of toxicity, mobility or volume would occur through treatment. Cap would slightly reduce contaminant mobility. Contaminated soil above cleanup goal would

TABLE 7-3
COMPARATIVE ANALYSIS OF MERCURY REMEDIAL ALTERNATIVES FOR CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative HG-1: Minimal Action	Alternative HG-2: Off-Site Disposal (cleanup goal = 1 mg/kg)	Alternative HG-3: Thermal Treatment (cleanup goal = 1 mg/kg)	Alternative HG-4: Cap(cleanup goal = 1 mg/kg)
		remain on-site.		remain on-site.
Implementability	Institutional controls would be relatively easy to implement.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Dewatering and shoring/bracing would be required. May exceed the available capacity of nearby landfills.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Dewatering and shoring/bracing would be required Only a small number of vendors are experienced with thermally treating and recovering mercury.	Would be relatively easy to implement.
Cost	$0.04 million	$ 15.3 million	$ 49.8 million	$ 5.2 million

TABLE 7-4
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 1 mg/kg) HG-1	HG-2	HG-3	HG-4
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (Relative Weight = 10)						
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes = 4 No = 0	0	0	0	0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes = 3 No = 0	3	3	3	3
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes = 3 No = 0	3	3	3	3
TOTAL (Maximum = 10)			6	6	6	6
PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (Relative Weight = 20)						
1. Use of the site after remediation. **TOTAL (Maximum = 20)**	Unrestricted use of the land and water. **(If answer is yes, go to next analysis factor.)**	Yes = 20 No = 0	0	0	0	0
2. Human health and the environment exposure after remediation.	(i) Is the exposure to contaminants via air route acceptable?	Yes = 3 No = 0	0	3	3	3
	(ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes = 4 No = 0	4	4	4	4
Subtotal (maximum = 10)	(iii) Is the exposure to contaminants via sediments/soil acceptable?	Yes = 3 No = 0	0	3	3	3
3. Magnitude of residual public health risks after the remediation.	(i) Health risk < 1 in 1,000,000	Yes = 5 No = 0	0	5	5	5
Subtotal (maximum = 5)	(ii) Health risk < 1 in 100,000	Yes = 2 No = 0	0	NA	NA	NA

TABLE 7-4
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
4. Magnitude of residual environmental risks after the remediation.	(i) Less than acceptable. (ii) Slightly greater than acceptable. (iii) Significant risk still exists.	= 5 = 3 = 0	5	5	5	5
Subtotal (maximum = 5)						
TOTAL (Maximum = 20)			9	20	20	20
SHORT-TERM EFFECTIVENESS (Relative Weight = 10)						
1. Protection of community during remedial actions.	a) Are there significant short-term risks to the community that must be addressed?	Yes = 0 No = 4	4	0	0	4
	(If the answer is no, go to Factor 2.) b) Can the risk be easily controlled?	Yes = 1 No = 0	NA	1	1	NA
	c) Does the mitigative effort to control risk impact the community lifestyle?	Yes = 0 No = 2	NA	0	0	NA
Subtotal (maximum = 4)						
2. Environmental impacts.	a) Are there significant short-term risks to the environment that must be addressed?	Yes = 0 No = 4	4	4	4	4
	(If the answer is no, go to Factor 3.) b) Are the available mitigative measures reliable to minimize potential impacts?	Yes = 3 No = 0	NA	NA	NA	NA
Subtotal (maximum = 4)						

TABLE 7-4
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
3. Time to implement the remedy.	a) What is the required time to implement the remedy?	< 2 years = 1 > 2 years = 0	1	0	0	1
	b) Required duration of the mitigative effort to control short-term risk?	< 2 years = 1 > 2 years = 0	1	0	0	1
Subtotal (maximum = 2)						
TOTAL (Maximum = 10)			10	5	5	10
LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15)						
1. On-site or off-site treatment or land disposal.	* On-site treatment * Off-site treatment * On-site or off-site land disposal	= 3 = 1 = 0	0	0	3	0
Subtotal (maximum = 3)						
2. Permanence of the remedial alternative.	* Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c)? **(If the answer is yes, go to Factor 4.)**	Yes = 3 No = 0	0	0	3	0
Subtotal (maximum = 3)						
3. Lifetime of remedial actions.	* Expected lifetime or duration of effectiveness of the remedy.	25-30 years = 3 20-25 years = 2 15-20 years = 1 < 15 years = 0	3	3	NA	3
Subtotal (maximum = 3)						
4. Quantity and nature of waste or residual left at the site after remediation.	(i) Quantity of untreated hazardous waste left at the site.	None = 3 < 25% = 2 25-50% = 1 >50% = 0	0	3	3	0
	(ii) Is there treated residual left at the site?	Yes = 0 No = 2	2	2	0	2
	(If the answer is no, go to Factor 5.) (iii) Is the treated residual toxic?	Yes = 0 No = 1	NA	NA	1	NA

TABLE 7-4
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
	(iv) Is the treated residual mobile?	Yes = 0 No = 1	NA	NA	1	NA
Subtotal (maximum = 5)						
5. Adequacy and reliability of controls.	(i) Operation and maintenance required for a period of:	< 5 years = 1 > 5 years = 0	1	1	1	1
	(ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If the answer is no, go to "iv".)**	Yes = 0 No = 1	0	1	1	0
	(iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident = 1 Somewhat to not confident = 0	0	NA	NA	1
	(iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum = 2 Moderate = 1 Extensive = 0	0	1	1	1
Subtotal (maximum = 4)						
TOTAL (Maximum = 15)			6	11	14	8
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (Relative Weight = 15)						
1. Volume of hazardous waste reduced (reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.)**	(i) Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.**	99-100% = 8 90-99% = 7 80-90% = 6 60-80% = 4 40-60% = 2 20-40% = 1 <20% = 0	NA	NA	7	NA

TABLE 7-4
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 1 mg/kg) HG-1	HG-2	HG-3	HG-4
	(ii) Are there untreated or concentrated hazardous waste produced as a result of (i)?	Yes = 0 No = 2	NA	NA	0	NA
	If answer is no, go to Factor 2.					
	(iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal = 0 On-site land disposal = 1 Off-site destruction or treatment = 2	NA	NA	1	NA
Subtotal (maximum = 10) **If subtotal = 10, go to Factor 3.**						
2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.**	(i) Quality of Available Wastes Immobilized After Destruction/Treatment.	90-100% = 2 60-90% = 1 < 60% = 0	NA	2	NA	2
	(ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 = 0 = 3	NA	0	NA	0
Subtotal (maximum = 5)						
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste.	Completely irreversible. Irreversible for most of the hazardous constituents. Irreversible for only some of the hazardous constituents. Reversible for most of the hazardous constituents.	= 5 = 3 = 2 = 0	NA	5	5	3
Subtotal (maximum = 5)						
TOTAL (Maximum = 15)			0	7	13	5

TABLE 7-4
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
IMPLEMENTABILITY (Relative Weight = 15)						
1. Technical Feasibility						
a. Ability to construct technology.	(i) Not difficult to construct. No uncertainties in construction.	= 3	3	1	1	3
	(ii) Somewhat difficult to construct. No uncertainties in construction.	= 2				
	(iii) Very difficult to construct and/or significant uncertainties in construction.	= 1				
b. Reliability of technology	(i) Very reliable in meeting the specified process efficiencies or performance goals.	= 3	NA	3	2	3
	(ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	= 2				
c. Schedule of delays due to technical problems.	(i) Unlikely	= 2	2	1	1	2
	(ii) Somewhat likely	= 1				
d. Need of undertaking additional remedial action, if necessary.	(i) No future remedial actions may be anticipated.	= 2	1	2	2	2
	(ii) Some future remedial actions may be necessary.	= 1				
Subtotal (maximum = 10)						
2. Administrative Feasibility						
a. Coordination with other agencies.	(i) Minimal coordination is required.	= 2	2	2	0	2
	(ii) Required coordination is normal.	= 1				
	(iii) Extensive coordination is required.	= 0				
Subtotal (maximum = 2)						

TABLE 7-4
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
3. Availability of Services and Materials						
a. Availability of prospective technologies.	(i) Are technologies under consideration generally commercially available for the site-specific contamination?	Yes = 1 No = 0	1	1	1	1
	(ii) Will more than one vendor be available to provide a competitive bid?	Yes = 1 No = 0	NA	1	0	1
b. Availability of necessary equipment and specialists.	(i) Additional equipment and specialists may be available without significant delay.	Yes = 1 No = 0	NA	1	0	1
Subtotal (maximum = 3)						
TOTAL (Maximum = 15)			9	12	7	15
COST (Relative Weight = 15)						
Present Worth Cost	Total Present Worth (millions)		0.04	15.3	49.8	5.2
	Cost scores were assigned using the equation: 15 - Alternative Cost in $MM. Alternatives with costs from $15 to $20 MM were assigned a score of 1. Alternatives with costs above $ 20 MM were assigned a score of 0.		15	1	0	9
TOTAL (Maximum = 15)			15	1	0	9

TABLE 7-4
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 1 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 1 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
SUMMARY OF FACTORS						
Compliance with ARARs and SCGs		(max = 10)	6	6	6	6
Protection of Public Health and the Environment		(max = 20)	9	20	20	20
Short-term Impacts and Effectiveness		(max = 10)	10	5	5	10
Long-term Effectiveness and Permanence		(max = 15)	6	11	14	8
Reduction of Toxicity, Mobility, or Volume		(max = 15)	0	7	13	5
Implementability		(max = 15)	9	12	7	15
Cost		(max = 15)	15	1	0	9
TOTAL		(max = 100)	55	62	65	73

NOTES:
Alternative HG-1: Minimal Action
Alternative HG-2: Off-Site Disposal
Alternative HG-3: Thermal Treatment
Alternative HG-4: Cover System

TABLE 7-5
COMPARATIVE ANALYSIS OF MERCURY REMEDIAL ALTERNATIVES FOR CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative HG-1: Minimal Action	Alternative HG-2: Off-Site Disposal (cleanup goal = 10 mg/kg)	Alternative HG-3: Thermal Treatment (cleanup goal = 10 mg/kg)	Alternative HG-4: Cap(cleanup goal = 10 mg/kg)
Compliance with ARARs and New York SCGs	Would not comply with SCGs.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.
Protection of Human Health and the Environment	Would not be protective of human health. No environmental receptors identified.	Protective of human health by removing contaminated soil from the Site. No environmental receptors identified.	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified.	Protective of human health by isolating contaminated soil from potential receptors. No environmental receptors identified.
Short-term Impacts and Effectiveness	No short-term impacts.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to design, implement, and remediate is less than 2 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to design, implement, and remediate is greater than 2 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to complete is less than 1 year.
Long-term Effectiveness and Permanence	Not applicable.	Would permanently eliminate exposure to mercury concentrations above the cleanup goal.	Thermal treatment is a permanent remedy. .	Not considered a permanent remedy but would be inspected and maintained to ensure continued isolation of contaminated soil.
Reduction of Toxicity, Mobility, or Volume	Not applicable.	No reduction of toxicity, mobility or volume would occur through treatment. Landfilling would slightly reduce contaminant mobility. No hazardous residuals would	Reduction of toxicity, mobility, and volume would occur through thermal treatment. Treated soil would be used to backfill excavations.	No reduction of toxicity, mobility or volume would occur through treatment. Cap would slightly reduce contaminant mobility. Contaminated soil above cleanup goal would

TABLE 7-5
COMPARATIVE ANALYSIS OF MERCURY REMEDIAL ALTERNATIVES FOR CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative HG-1: Minimal Action	Alternative HG-2: Off-Site Disposal (cleanup goal = 10 mg/kg)	Alternative HG-3: Thermal Treatment (cleanup goal = 10 mg/kg)	Alternative HG-4: Cap(cleanup goal = 10 mg/kg)
		remain on-site.		remain on-site.
Implementability	Institutional controls would be relatively easy to implement.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Shoring/bracing would be required.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Shoring/bracing would be required Only a small number of vendors experienced with thermally treating and recovering mercury.	Would be relatively easy to implement.
Cost	$0.04 million	$ 4.6 million	$ 14.0 million	$ 2.7 million

TABLE 7-6
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 10 mg/kg) HG-1	HG-2	HG-3	HG-4
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (Relative Weight = 10)						
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes = 4 No = 0	0	0	0	0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes = 3 No = 0	3	3	3	3
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes = 3 No = 0	3	3	3	3
TOTAL (Maximum = 10)			6	6	6	6
PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (Relative Weight = 20)						
1. Use of the site after remediation. **TOTAL (Maximum = 20)**	Unrestricted use of the land and water. **(If answer is yes, go to next analysis factor.)**	Yes = 20 No = 0	0	0	0	0
2. Human health and the environment exposure after remediation.	(i) Is the exposure to contaminants via air route acceptable?	Yes = 3 No = 0	0	3	3	3
	(ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes = 4 No = 0	4	4	4	4
Subtotal (maximum = 10)	(iii) Is the exposure to contaminants via sediments/soil acceptable?	Yes = 3 No = 0	0	3	3	3
3. Magnitude of residual public health risks after the remediation.	(i) Health risk < 1 in 1,000,000	Yes = 5 No = 0	0	5	5	5
Subtotal (maximum = 5)	(ii) Health risk < 1 in 100,000	Yes = 2 No = 0	0	NA	NA	NA

TABLE 7-6
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 10 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
4. Magnitude of residual environmental risks after the remediation. **Subtotal (maximum = 5)**	(i) Less than acceptable. (ii) Slightly greater than acceptable. (iii) Significant risk still exists.	= 5 = 3 = 0	5	5	5	5
TOTAL (Maximum = 20)			9	20	20	20
SHORT-TERM EFFECTIVENESS (Relative Weight = 10)						
1. Protection of community during remedial actions.	a) Are there significant short-term risks to the community that must be addressed?	Yes = 0 No = 4	4	0	0	4
	(If the answer is no, go to Factor 2.) b) Can the risk be easily controlled?	Yes = 1 No = 0	NA	1	1	NA
Subtotal (maximum = 4)	c) Does the mitigative effort to control risk impact the community lifestyle?	Yes = 0 No = 2	NA	2	2	NA
2. Environmental impacts.	a) Are there significant short-term risks to the environment that must be addressed?	Yes = 0 No = 4	4	4	4	4
Subtotal (maximum = 4)	**(If the answer is no, go to Factor 3.)** b) Are the available mitigative measures reliable to minimize potential impacts?	Yes = 3 No = 0	NA	NA	NA	NA

TABLE 7-6
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 10 mg/kg) HG-1	HG-2	HG-3	HG-4
3. Time to implement the remedy.	a) What is the required time to implement the remedy?	< 2 years = 1 > 2 years = 0	1	1	0	1
	b) Required duration of the mitigative effort to control short-term risk?	< 2 years = 1 > 2 years = 0	1	1	0	1
Subtotal (maximum = 2)						
TOTAL (Maximum = 10)			10	9	7	10
LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15)						
1. On-site or off-site treatment or land disposal.	* On-site treatment * Off-site treatment * On-site or off-site land disposal	= 3 = 1 = 0	0	0	3	0
Subtotal (maximum = 3)						
2. Permanence of the remedial alternative.	* Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c)? **(If the answer is yes, go to Factor 4.)**	Yes = 3 No = 0	0	0	3	0
Subtotal (maximum = 3)						
3. Lifetime of remedial actions.	* Expected lifetime or duration of effectiveness of the remedy.	25-30 years = 3 20-25 years = 2 15-20 years = 1 < 15 years = 0	3	3	NA	3
Subtotal (maximum = 3)						
4. Quantity and nature of waste or residual left at the site after remediation.	(i) Quantity of untreated hazardous waste left at the site.	None = 3 < 25% = 2 25-50% = 1 >50% = 0	0	3	3	0
	(ii) Is there treated residual left at the site?	Yes = 0 No = 2	2	2	0	2
	(If the answer is no, go to Factor 5.) (iii) Is the treated residual toxic?	Yes = 0 No = 1	NA	NA	1	NA

TABLE 7-6
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 10 mg/kg) HG-1	HG-2	HG-3	HG-4
	(iv) Is the treated residual mobile?	Yes = 0 No = 1	NA	NA	1	NA
Subtotal (maximum = 5)						
5. Adequacy and reliability of controls.	(i) Operation and maintenance required for a period of:	< 5 years = 1 > 5 years = 0	1	1	1	1
	(ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If the answer is no, go to "iv".)**	Yes = 0 No = 1	0	1	1	0
	(iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident = 1 Somewhat to not confident = 0	0	NA	NA	1
	(iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum = 2 Moderate = 1 Extensive = 0	0	1	1	1
Subtotal (maximum = 4)						
TOTAL (Maximum = 15)			6	11	14	8
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (Relative Weight = 15)						
1. Volume of hazardous waste reduced (reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.)**	(i) Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.**	99-100% = 8 90-99% = 7 80-90% = 6 60-80% = 4 40-60% = 2 20-40% = 1 <20% = 0	NA	NA	7	NA

TABLE 7-6
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 10 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
	(ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2.**	Yes = 0 No = 2	NA	NA	0	NA
Subtotal (maximum = 10) **If subtotal = 10, go to Factor 3.**	(iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal = 0 On-site land disposal = 1 Off-site destruction or treatment = 2	NA	NA	1	NA
2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.**	(i) Quality of Available Wastes Immobilized After Destruction/Treatment.	90-100% = 2 60-90% = 1 < 60% = 0	NA	2	NA	2
Subtotal (maximum = 5)	(ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 = 0 = 3	NA	0	NA	0
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste. **Subtotal (maximum = 5)**	Completely irreversible. Irreversible for most of the hazardous constituents. Irreversible for only some of the hazardous constituents. Reversible for most of the hazardous constituents.	= 5 = 3 = 2 = 0	NA	5	5	3
TOTAL (Maximum = 15)			0	7	13	5

TABLE 7-6
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 10 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
IMPLEMENTABILITY (Relative Weight = 15)						
1. Technical Feasibility						
a. Ability to construct technology.	(i) Not difficult to construct. No uncertainties in construction.	= 3	3	2	1	3
	(ii) Somewhat difficult to construct. No uncertainties in construction.	= 2				
	(iii) Very difficult to construct and/or significant uncertainties in construction.	= 1				
b. Reliability of technology	(i) Very reliable in meeting the specified process efficiencies or performance goals.	= 3	NA	3	2	3
	(ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	= 2				
c. Schedule of delays due to technical problems.	(i) Unlikely	= 2	2	1	1	2
	(ii) Somewhat likely	= 1				
d. Need of undertaking additional remedial action, if necessary.	(i) No future remedial actions may be anticipated.	= 2	1	2	2	2
	(ii) Some future remedial actions may be necessary.	= 1				
Subtotal (maximum = 10)						
2. Administrative Feasibility						
a. Coordination with other agencies.	(i) Minimal coordination is required.	= 2	2	2	0	2
	(ii) Required coordination is normal.	= 1				
	(iii) Extensive coordination is required.	= 0				
Subtotal (maximum = 2)						

TABLE 7-6
MERCURY ALTERNATIVES SCORING TABLE FOR MERCURY CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 10 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
3. Availability of Services and Materials						
a. Availability of prospective technologies.	(i) Are technologies under consideration generally commercially available for the site-specific contamination?	Yes = 1 No = 0	1	1	1	1
	(ii) Will more than one vendor be available to provide a competitive bid?	Yes = 1 No = 0	NA	1	0	1
b. Availability of necessary equipment and specialists.	(i) Additional equipment and specialists may be available without significant delay.	Yes = 1 No = 0	NA	1	0	1
Subtotal (maximum = 3)						
TOTAL (Maximum = 15)			9	13	7	15
COST **(Relative Weight = 15)**						
Present Worth Cost	Total Present Worth (millions)		0.04	4.6	14	2.7
	Cost scores were assigned using the equation: 15 - Alternative Cost in $MM. Alternatives with costs from $15 to $20 MM were assigned a score of 1. Alternatives with costs above $ 20 MM were assigned a score of 0.		15	10	1	12
TOTAL (Maximum = 15)			15	10	1	12

TABLE 7-6
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 10 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 10 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
SUMMARY OF FACTORS						
Compliance with ARARs and SCGs		(max = 10)	6	6	6	6
Protection of Public Health and the Environment		(max = 20)	9	20	20	20
Short-term Impacts and Effectiveness		(max = 10)	10	9	7	10
Long-term Effectiveness and Permanence		(max = 15)	6	11	14	8
Reduction of Toxicity, Mobility, or Volume		(max = 15)	0	7	13	5
Implementability		(max = 15)	9	13	7	15
Cost		(max = 15)	15	10	1	12
TOTAL		(max = 100)	55	76	68	76

NOTES:
Alternative HG-1: Minimal Action
Alternative HG-2: Off-Site Disposal
Alternative HG-3: Thermal Treatment
Alternative HG-4: Cover System

TABLE 7-7
COMPARATIVE ANALYSIS OF MERCURY REMEDIAL ALTERNATIVES FOR CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative HG-1: Minimal Action	Alternative HG-2: Off-Site Disposal (cleanup goal = 100 mg/kg)	Alternative HG-3: Thermal Treatment (cleanup goal = 100 mg/kg)	Alternative HG-4: Cap(cleanup goal = 100 mg/kg)
Compliance with ARARs and New York SCGs	Would not comply with SCGs.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.
Protection of Human Health and the Environment	Would not be protective of human health . No environmental receptors identified.	Protective of human health by removing contaminated soil from the Site. No environmental receptors identified.	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified.	Protective of human health by isolating contaminated soil from potential receptors. No environmental receptors identified.
Short-term Impacts and Effectiveness	No short-term impacts..	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to design, implement, and remediate is less than 2 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to design, implement, and remediate is greater than 2 years	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor mercury vapors. Estimated time to complete is less than 1 year.
Long-term Effectiveness and Permanence	Not applicable.	Would permanently eliminate exposure to mercury concentrations above the cleanup goal.	Thermal treatment is a permanent remedy.	Not considered a permanent remedy but would be inspected and maintained to ensure continued isolation of contaminated soil.
Reduction of Toxicity, Mobility, or Volume	Not applicable.	No reduction of toxicity, mobility or volume would occur through treatment. Landfilling would slightly reduce contaminant mobility. No hazardous residuals would	Reduction of toxicity, mobility, and volume would occur through thermal treatment. Treated soil would be used to backfill excavations.	No reduction of toxicity, mobility or volume would occur through treatment. Cap would slightly reduce contaminant mobility. Contaminated soil above cleanup goal would

TABLE 7-7
COMPARATIVE ANALYSIS OF MERCURY REMEDIAL ALTERNATIVES FOR CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative HG-1: Minimal Action	Alternative HG-2: Off-Site Disposal (cleanup goal = 100 mg/kg)	Alternative HG-3: Thermal Treatment (cleanup goal = 100 mg/kg)	Alternative HG-4: Cap(cleanup goal = 100 mg/kg)
		remain on-site.		remain on-site.
Implementability	Institutional controls would be relatively easy to implement.	Would be relatively easy to implement. Dewatering and shoring/bracing would not be required.	Would be relatively easy to implement. Dewatering and shoring/bracing would not be required.	Would be relatively easy to implement.
Cost	$0.04 million	$ 2.3 million	$ 6.6 million	$ 2.3 million

TABLE 7-8
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 100 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (Relative Weight = 10)						
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes = 4 No = 0	0	0	0	0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes = 3 No = 0	3	3	3	3
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes = 3 No = 0	3	3	3	3
TOTAL (Maximum = 10)			6	6	6	6
PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (Relative Weight = 20)						
1. Use of the site after remediation. **TOTAL (Maximum = 20)**	Unrestricted use of the land and water. **(If answer is yes, go to next analysis factor.)**	Yes = 20 No = 0	0	0	0	0
2. Human health and the environment exposure after remediation.	(i) Is the exposure to contaminants via air route acceptable?	Yes = 3 No = 0	0	3	3	3
	(ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes = 4 No = 0	4	4	4	4
Subtotal (maximum = 10)	(iii) Is the exposure to contaminants via sediments/soil acceptable?	Yes = 3 No = 0	0	3	3	3
3. Magnitude of residual public health risks after the remediation.	(i) Health risk < 1 in 1,000,000	Yes = 5 No = 0	0	5	5	5
Subtotal (maximum = 5)	(ii) Health risk < 1 in 100,000	Yes = 2 No = 0	0	NA	NA	NA

TABLE 7-8
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 100 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
4. Magnitude of residual environmental risks after the remediation.	(i) Less than acceptable. (ii) Slightly greater than acceptable. (iii) Significant risk still exists.	= 5 = 3 = 0	5	5	5	5
Subtotal (maximum = 5)						
TOTAL (Maximum = 20)			9	20	20	20
SHORT-TERM EFFECTIVENESS (Relative Weight = 10)						
1. Protection of community during remedial actions.	a) Are there significant short-term risks to the community that must be addressed?	Yes = 0 No = 4	4	0	0	4
	(If the answer is no, go to Factor 2.) b) Can the risk be easily controlled?	Yes = 1 No = 0	NA	1	1	NA
	c) Does the mitigative effort to control risk impact the community lifestyle?	Yes = 0 No = 2	NA	2	2	NA
Subtotal (maximum = 4)						
2. Environmental impacts.	a) Are there significant short-term risks to the environment that must be addressed?	Yes = 0 No = 4	4	4	4	4
	(If the answer is no, go to Factor 3.) b) Are the available mitigative measures reliable to minimize potential impacts?	Yes = 3 No = 0	NA	NA	NA	NA
Subtotal (maximum = 4)						

TABLE 7-8
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 100 mg/kg) HG-1	HG-2	HG-3	HG-4
3. Time to implement the remedy.	a) What is the required time to implement the remedy?	< 2 years = 1 > 2 years = 0	1	1	0	1
	b) Required duration of the mitigative effort to control short-term risk?	< 2 years = 1 > 2 years = 0	1	1	0	1
Subtotal (maximum = 2)						
TOTAL (Maximum = 10)			10	9	7	10
LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15)						
1. On-site or off-site treatment or land disposal.	* On-site treatment * Off-site treatment * On-site or off-site land disposal	= 3 = 1 = 0	0	0	3	0
Subtotal (maximum = 3)						
2. Permanence of the remedial alternative.	* Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c)? **(If the answer is yes, go to Factor 4.)**	Yes = 3 No = 0	0	0	3	0
Subtotal (maximum = 3)						
3. Lifetime of remedial actions.	* Expected lifetime or duration of effectiveness of the remedy.	25-30 years = 3 20-25 years = 2 15-20 years = 1 < 15 years = 0	3	3	NA	3
Subtotal (maximum = 3)						
4. Quantity and nature of waste or residual left at the site after remediation.	(i) Quantity of untreated hazardous waste left at the site.	None = 3 < 25% = 2 25-50% = 1 >50% = 0	0	3	3	0
	(ii) Is there treated residual left at the site? **(If the answer is no, go to Factor 5.)**	Yes = 0 No = 2	2	2	0	2
	(iii) Is the treated residual toxic?	Yes = 0 No = 1	NA	NA	1	NA

TABLE 7-8
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 100 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
	(iv) Is the treated residual mobile?	Yes = 0 No = 1	NA	NA	1	NA
Subtotal (maximum = 5)						
5. Adequacy and reliability of controls.	(i) Operation and maintenance required for a period of:	< 5 years = 1 > 5 years = 0	1	1	1	1
	(ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If the answer is no, go to "iv".)**	Yes = 0 No = 1	0	1	1	0
	(iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident = 1 Somewhat to not confident = 0	0	NA	NA	1
	(iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum = 2 Moderate = 1 Extensive = 0	0	1	1	1
Subtotal (maximum = 4)						
TOTAL (Maximum = 15)			6	11	14	8
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (Relative Weight = 15)						
1. Volume of hazardous waste reduced (reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.)**	(i) Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.**	99-100% = 8 90-99% = 7 80-90% = 6 60-80% = 4 40-60% = 2 20-40% = 1 <20% = 0	NA	NA	6	NA

TABLE 7-8
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 100 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
	(ii) Are there untreated or concentrated hazardous waste produced as a result of (i)?	Yes = 0 No = 2	NA	NA	0	NA
	If answer is no, go to Factor 2.					
Subtotal (maximum = 10) **If subtotal = 10, go to Factor 3.**	(iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal = 0 On-site land disposal = 1 Off-site destruction or treatment = 2	NA	NA	1	NA
2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.**	(i) Quality of Available Wastes Immobilized After Destruction/Treatment.	90-100% = 2 60-90% = 1 < 60% = 0	NA	2	NA	2
Subtotal (maximum = 5)	(ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 = 0 = 3	NA	0	NA	0
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste. **Subtotal (maximum = 5)**	Completely irreversible. Irreversible for most of the hazardous constituents. Irreversible for only some of the hazardous constituents. Reversible for most of the hazardous constituents.	= 5 = 3 = 2 = 0	NA	5	5	3
TOTAL (Maximum = 15)			0	7	12	5

TABLE 7-8
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 100 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
IMPLEMENTABILITY (Relative Weight = 15)						
1. Technical Feasibility						
a. Ability to construct technology.	(i) Not difficult to construct. No uncertainties in construction.	= 3	3	2	1	3
	(ii) Somewhat difficult to construct. No uncertainties in construction.	= 2				
	(iii) Very difficult to construct and/or significant uncertainties in construction.	= 1				
b. Reliability of technology	(i) Very reliable in meeting the specified process efficiencies or performance goals.	= 3	NA	3	3	3
	(ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	= 2				
c. Schedule of delays due to technical problems.	(i) Unlikely	= 2	2	2	1	2
	(ii) Somewhat likely	= 1				
d. Need of undertaking additional remedial action, if necessary.	(i) No future remedial actions may be anticipated.	= 2	1	2	2	2
	(ii) Some future remedial actions may be necessary.	= 1				
Subtotal (maximum = 10)						
2. Administrative Feasibility						
a. Coordination with other agencies.	(i) Minimal coordination is required.	= 2	2	2	0	2
	(ii) Required coordination is normal.	= 1				
	(iii) Extensive coordination is required.	= 0				
Subtotal (maximum = 2)						

TABLE 7-8
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 100 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
3. Availability of Services and Materials						
a. Availability of prospective technologies.	(i) Are technologies under consideration generally commercially available for the site-specific contamination?	Yes = 1 No = 0	1	1	1	1
	(ii) Will more than one vendor be available to provide a competitive bid?	Yes = 1 No = 0	NA	1	0	1
b. Availability of necessary equipment and specialists.	(i) Additional equipment and specialists may be available without significant delay.	Yes = 1 No = 0	NA	1	0	1
Subtotal (maximum = 3)						
TOTAL (Maximum = 15)			9	14	8	15
COST **(Relative Weight = 15)**						
Present Worth Cost	Total Present Worth (millions)		0.04	2.3	6.6	2.3
	Cost scores were assigned using the equation: 15 - Alternative Cost in $MM. Alternatives with costs from $15 to $20 MM were assigned a score of 1. Alternatives with costs above $ 20 MM were assigned a score of 0.		15	13	8	13
TOTAL (Maximum = 15)			15	13	8	13

TABLE 7-8
MERCURY ALTERNATIVES SCORING TABLE
FOR MERCURY CLEANUP GOAL OF 100 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	MERCURY REMEDIAL ALTERNATIVES (CLEANUP GOAL = 100 mg/kg)			
			HG-1	HG-2	HG-3	HG-4
SUMMARY OF FACTORS						
Compliance with ARARs and SCGs		(max = 10)	6	6	6	6
Protection of Public Health and the Environment		(max = 20)	9	20	20	20
Short-term Impacts and Effectiveness		(max = 10)	10	9	7	10
Long-term Effectiveness and Permanence		(max = 15)	6	11	14	8
Reduction of Toxicity, Mobility, or Volume		(max = 15)	0	7	12	5
Implementability		(max = 15)	9	14	8	15
Cost		(max = 15)	15	13	8	13
TOTAL		(max = 100)	55	80	75	77

NOTES:
Alternative HG-1: Minimal Action
Alternative HG-2: Off-Site Disposal
Alternative HG-3: Thermal Treatment
Alternative HG-4: Cover System

TABLE 7-9
MERCURY SUMMARY SCORING TABLE FOR MERCURY CLEANUP GOALS

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

	MERCURY SCORING SUMMARY FOR REMEDIAL ALTERNATIVES			
	Alternative			
	HG-1	HG-2	HG-3	HG-4
Mercury Cleanup Goal	Minimal Action	Off-Site Disposal	Thermal Treatment	Cap
0.1 mg/kg	55	65	69	71
1 mg/kg	55	62	65	73
10 mg/kg	55	76	68	76
100 mg/kg	55	80	75	77

TABLE 7-10
COMPARATIVE ANALYSIS OF TCE REMEDIAL ALTERNATIVES
FOR CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative TCE-1: Minimal Action	Alternative TCE-2: Off-Site Treatment & Disposal (cleanup goal = 0.7 mg/kg)	Alternative TCE-3: Thermal Treatment (cleanup goal = 0.7 mg/kg)	Alternative TCE-4: Cap(cleanup goal = 0.7 mg/kg)	Alternative TCE-5: Soil Vapor Extraction (cleanup goal = 0.7 mg/kg)
Compliance with ARARs and New York SCGs	Would not comply with SCGs.	Complies with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Complies with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Complies with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Complies with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.
Protection of Human Health and the Environment	Would not be protective of human health. No environmental receptors identified.	Protective of human health by removing contaminated soil from the Site. No environmental receptors identified.	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified.	Protective of human health by isolating contaminated soil from potential receptors. No environmental receptors identified.	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified.
Short-term Impacts and Effectiveness	No short-term impacts.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor TCE vapors. Estimated time to design, implement, and remediate is less than 1 year.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor TCE vapors. Estimated time to design, implement, and remediate is greater than 2 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor TCE vapors. Estimated time to design, implement, and remediate is less than 1 year.	Minimal impacts to the community would are anticipated. Air monitoring would be performed to monitor emissions. Estimated time to design, implement, and remediate is greater than 2 years.

TABLE 7-10
COMPARATIVE ANALYSIS OF TCE REMEDIAL ALTERNATIVES
FOR CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative TCE-1: Minimal Action	Alternative TCE-2: Off-Site Treatment & Disposal (cleanup goal = 0.7 mg/kg)	Alternative TCE-3: Thermal Treatment (cleanup goal = 0.7 mg/kg)	Alternative TCE-4: Cap(cleanup goal = 0.7 mg/kg)	Alternative TCE-5: Soil Vapor Extraction (cleanup goal = 0.7 mg/kg)
Long-term Effectiveness and Permanence	Not applicable.	Would permanently eliminate exposure to TCE concentrations above the cleanup goal.	Thermal treatment is a permanent remedy..	Not considered a permanent remedy. May not be effective at reducing the mobility of TCE.	SVE is a permanent remedy, however may be ineffective at achieving cleanup goal of 0.7 mg/kg.
Reduction of Toxicity, Mobility, or Volume	Not applicable.	Reduction of toxicity, mobility or volume would be realized by off-site treatment (i.e., incineration). Landfilling would slightly reduce contaminant mobility. No hazardous residuals would remain on-site.	Reduction of toxicity, mobility, and volume would occur through thermal treatment. Treated soil would be used to backfill excavations.	No reduction of toxicity, mobility or volume would occur through treatment. Cap would slightly reduce contaminant mobility. Contaminated soil above cleanup goal would remain on-site.	Reduction of toxicity, mobility, and volume would occur through treatment.
Implementability	Institutional controls would be relatively easy to implement.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Dewatering and shoring/bracing would be required.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Dewatering and shoring/bracing would be required.	Would be relatively easy to implement.	Would be relatively easy to implement.

TABLE 7-10
COMPARATIVE ANALYSIS OF TCE REMEDIAL ALTERNATIVES
FOR CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative TCE-1: Minimal Action	Alternative TCE-2: Off-Site Treatment & Disposal (cleanup goal = 0.7 mg/kg)	Alternative TCE-3: Thermal Treatment (cleanup goal = 0.7 mg/kg)	Alternative TCE-4: Cap(cleanup goal = 0.7 mg/kg)	Alternative TCE-5: Soil Vapor Extraction (cleanup goal = 0.7 mg/kg)
Cost	$0.04 million	$ 18.1 million	$ 8.7million	$ 1.0 million	$ 3.5 million

TABLE 7-11
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.7 mg/kg) TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (Relative Weight = 10)							
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes = 4 No = 0	0	4	4	4	4
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes = 3 No = 0	3	3	3	3	3
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes = 3 No = 0	3	3	3	3	3
TOTAL (Maximum = 10)			6	10	10	10	10
PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (Relative Weight = 20)							
1. Use of the site after remediation. **TOTAL (Maximum = 20)**	Unrestricted use of the land and water. **(If answer is yes, go to next analysis factor.)**	Yes = 20 No = 0	0	0	0	0	0
2. Human health and the environment exposure after remediation.	(i) Is the exposure to contaminants via air route acceptable?	Yes = 3 No = 0	0	3	3	3	3
	(ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes = 4 No = 0	0	0	0	0	0
	(iii) Is the exposure to contaminants via sediments/soil acceptable?	Yes = 3 No = 0	0	3	3	3	3
Subtotal (maximum = 10)							
3. Magnitude of residual public health risks after the remediation.	(i) Health risk < 1 in 1,000,000	Yes = 5 No = 0	0	5	5	5	5
	(ii) Health risk < 1 in 100,000	Yes = 2 No = 0	0	NA	NA	NA	NA
Subtotal (maximum = 5)							

TABLE 7-11
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
4. Magnitude of residual environmental risks after the remediation. **Subtotal (maximum = 5)**	(i) Less than acceptable. (ii) Slightly greater than acceptable. (iii) Significant risk still exists.	= 5 = 3 = 0	5	5	5	5	5
TOTAL (Maximum = 20)			5	16	16	16	16
SHORT-TERM EFFECTIVENESS **(Relative Weight = 10)**							
1. Protection of community during remedial actions.	a) Are there significant short-term risks to the community that must be addressed?	Yes = 0 No = 4	4	0	0	4	4
	(If the answer is no, go to Factor 2.) b) Can the risk be easily controlled?	Yes = 1 No = 0	NA	0	0	NA	NA
Subtotal (maximum = 4)	c) Does the mitigative effort to control risk impact the community lifestyle?	Yes = 0 No = 2	NA	0	0	NA	NA
2. Environmental impacts.	a) Are there significant short-term risks to the environment that must be addressed?	Yes = 0 No = 4	4	4	4	4	4
Subtotal (maximum = 4)	**(If the answer is no, go to Factor 3.)** b) Are the available mitigative measures reliable to minimize potential impacts?	Yes = 3 No = 0	NA	NA	NA	NA	NA

TABLE 7-11
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
3. Time to implement the remedy.	a) What is the required time to implement the remedy?	< 2 years = 1 > 2 years = 0	1	1	0	1	0
Subtotal (maximum = 2)	b) Required duration of the mitigative effort to control short-term risk?	< 2 years = 1 > 2 years = 0	1	1	0	1	1
TOTAL (Maximum = 10)			10	6	4	10	9
LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15)							
1. On-site or off-site treatment or land disposal. **Subtotal (maximum = 3)**	* On-site treatment * Off-site treatment * On-site or off-site land disposal	= 3 = 1 = 0	0	1	3	0	3
2. Permanence of the remedial alternative. **Subtotal (maximum = 3)**	* Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c)? **(If the answer is yes, go to Factor 4.)**	Yes = 3 No = 0	0	3	3	0	3
3. Lifetime of remedial actions. **Subtotal (maximum = 3)**	* Expected lifetime or duration of effectiveness of the remedy.	25-30 years = 3 20-25 years = 2 15-20 years = 1 < 15 years = 0	3	NA	NA	3	NA
4. Quantity and nature of waste or residual left at the site after remediation.	(i) Quantity of untreated hazardous waste left at the site.	None = 3 < 25% = 2 25-50% = 1 >50% = 0	0	2	2	0	2
	(ii) Is there treated residual left at the site? **(If the answer is no, go to Factor 5.)**	Yes = 0 No = 2	2	2	0	2	0
	(iii) Is the treated residual toxic?	Yes = 0 No = 1	NA	NA	1	NA	1

TABLE 7-11
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
	(iv) Is the treated residual mobile?	Yes = 0 No = 1	NA	NA	1	NA	0
Subtotal (maximum = 5)							
5. Adequacy and reliability of controls.	(i) Operation and maintenance required for a period of:	< 5 years = 1 > 5 years = 0	1	1	1	1	0
	(ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If the answer is no, go to "iv".)**	Yes = 0 No = 1	0	1	1	0	1
	(iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident = 1 Somewhat to not confident = 0	0	NA	NA	1	NA
	(iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum = 2 Moderate = 1 Extensive = 0	0	2	1	0	1
Subtotal (maximum = 4)							
TOTAL (Maximum = 15)			6	12	13	7	11
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (Relative Weight = 15)							
1. Volume of hazardous waste reduced (reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.)**	(i) Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.**	99-100% = 8 90-99% = 7 80-90% = 6 60-80% = 4 40-60% = 2 20-40% = 1 <20% = 0	NA	8	7	NA	7

TABLE 7-11
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
	(ii) Are there untreated or concentrated hazardous waste produced as a result of (i)?	Yes = 0 No = 2	NA	0	0	NA	0
	If answer is no, go to Factor 2.						
Subtotal (maximum = 10) **If subtotal = 10, go to Factor 3.**	(iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal = 0 On-site land disposal = 1 Off-site destruction or treatment = 2	NA	2	2	NA	2
2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.**	(i) Quality of Available Wastes Immobilized After Destruction/Treatment.	90-100% = 2 60-90% = 1 < 60% = 0	NA	NA	NA	1	NA
Subtotal (maximum = 5)	(ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 = 0 = 3	NA	NA	NA	0	NA
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste. **Subtotal (maximum = 5)**	Completely irreversible. Irreversible for most of the hazardous constituents. Irreversible for only some of the hazardous constituents. Reversible for most of the hazardous constituents.	= 5 = 3 = 2 = 0	NA	5	5	0	5
TOTAL (Maximum = 15)			0	15	14	1	14

TABLE 7-11
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
IMPLEMENTABILITY (Relative Weight = 15)							
1. Technical Feasibility							
a. Ability to construct technology.	(i) Not difficult to construct. No uncertainties in construction.	= 3	3	1	1	3	2
	(ii) Somewhat difficult to construct. No uncertainties in construction.	= 2					
	(iii) Very difficult to construct and/or significant uncertainties in construction.	= 1					
b. Reliability of technology	(i) Very reliable in meeting the specified process efficiencies or performance goals.	= 3	NA	3	2	2	2
	(ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	= 2					
c. Schedule of delays due to technical problems.	(i) Unlikely	= 2	2	1	1	2	1
	(ii) Somewhat likely	= 1					
d. Need of undertaking additional remedial action, if necessary.	(i) No future remedial actions may be anticipated.	= 2	1	2	2	1	2
	(ii) Some future remedial actions may be necessary.	= 1					
Subtotal (maximum = 10)							
2. Administrative Feasibility							
a. Coordination with other agencies.	(i) Minimal coordination is required.	= 2	2	2	1	2	1
	(ii) Required coordination is normal.	= 1					
	(iii) Extensive coordination is required.	= 0					
Subtotal (maximum = 2)							

TABLE 7-11
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
3. Availability of Services and Materials							
a. Availability of prospective technologies.	(i) Are technologies under consideration generally commercially available for the site specific contamination?	Yes = 1 No = 0	1	1	1	1	1
	(ii) Will more than one vendor be available to provide a competitive bid?	Yes = 1 No = 0	NA	1	1	1	1
b. Availability of necessary equipment and specialists.	(i) Additional equipment and specialists may be available without significant delay.	Yes = 1 No = 0	NA	1	1	1	1
Subtotal (maximum = 3)							
TOTAL (Maximum = 15)			9	12	10	13	11
COST (Relative Weight = 15)							
Present Worth Cost	Total Present Worth (millions)		0.4	18.1	8.7	1.0	3.5
	Cost scores were assigned using the equation: 15 - Alternative Cost in $MM. Alternatives with costs from $15 to $20 MM were assigned a score of 1. Alternatives with costs above $ 20 MM were assigned a score of 0.		15	1	6	14	11
TOTAL (Maximum = 15)			15	1	6	14	11

TABLE 7-11
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 0.7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 0.7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
SUMMARY OF FACTORS							
Compliance with ARARs and SCGs		(max = 10)	6	10	10	10	10
Protection of Public Health and the Environment		(max = 20)	5	16	16	16	16
Short-term Impacts and Effectiveness		(max = 10)	10	6	4	10	9
Long-term Effectiveness and Permanence		(max = 15)	6	12	13	7	11
Reduction of Toxicity, Mobility, or Volume		(max = 15)	0	15	14	1	14
Implementability		(max = 15)	9	12	10	13	11
Cost		(max = 15)	15	1	6	14	11
TOTAL		(max = 100)	51	72	73	71	82

NOTES:
Alternative TCE-1: Minimal Action
Alternative TCE-2: Off-Site Treatment and Disposal
Alternative TCE-3: Thermal Treatment
Alternative TCE-4: Cover System
Alternative TCE-5: Soil Vapor Extraction

TABLE 7-12
COMPARATIVE ANALYSIS OF TCE REMEDIAL ALTERNATIVES
FOR CLEANUP GOAL OF 7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative TCE-1: Minimal Action	Alternative TCE-2: Off-Site Treatment & Disposal (cleanup goal = 7 mg/kg)	Alternative TCE-3: Thermal Treatment (cleanup goal = 7 mg/kg)	Alternative TCE-4: Cap(cleanup goal = 7 mg/kg)	Alternative TCE-5: Soil Vapor Extraction (cleanup goal = 7 mg/kg)
Compliance with ARARs and New York SCGs	Would not comply with SCGs.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.
Protection of Human Health and the Environment	Would not be protective of human health. No environmental receptors identified.	Protective of human health by removing contaminated soil from the Site. No environmental receptors identified.	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified	Protective of human health by isolating contaminated soil from potential receptors. No environmental receptors identified	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified
Short-term Impacts and Effectiveness	No short-term impacts.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor TCE vapors. Estimated time to design, implement, and remediate is less than 1 year.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor TCE vapors. Estimated time to design, implement, and remediate is greater than 2 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor TCE vapors. Estimated time to design, implement, and remediate is less than 1 year.	Minimal impacts to the community would are anticipated. Air monitoring would be performed to monitor emissions. Estimated time to design, implement, and remediate is greater than 2 years.

TABLE 7-12
COMPARATIVE ANALYSIS OF TCE REMEDIAL ALTERNATIVES FOR CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative TCE-1: Minimal Action	Alternative TCE-2: Off-Site Treatment & Disposal (cleanup goal = 7 mg/kg)	Alternative TCE-3: Thermal Treatment (cleanup goal = 7 mg/kg)	Alternative TCE-4: Cap(cleanup goal = 7 mg/kg)	Alternative TCE-5: Soil Vapor Extraction (cleanup goal = 7 mg/kg)
Long-term Effectiveness and Permanence	Not applicable.	Would permanently eliminate exposure to TCE concentrations above the cleanup goal.	Thermal treatment is a permanent remedy.	Not considered a permanent remedy. May not be effective at reducing the mobility of TCE.	SVE is an effective, reliable remedy.
Reduction of Toxicity, Mobility, or Volume	Not applicable.	Reduction of toxicity, mobility or volume would be realized by off-site treatment (i.e., incineration). Landfilling would slightly reduce contaminant mobility. No hazardous residuals would remain on-site.	Reduction of toxicity, mobility, and volume would occur through thermal treatment. Treated soil would be used to backfill excavations.	No reduction of toxicity, mobility or volume would occur through treatment. Cap would slightly reduce contaminant mobility. Contaminated soil above cleanup goal would remain on-site.	Reduction of toxicity, mobility, and volume would occur through treatment.
Implementability	Institutional controls would be relatively easy to implement.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Dewatering and shoring/bracing would be required.	Excessive contaminated soil volumes, areal extent of excavation, and depth of excavation make this alternative very difficult to implement. Dewatering and shoring/bracing would be required.	Would be relatively easy to implement.	Would be relatively easy to implement.

TABLE 7-12
COMPARATIVE ANALYSIS OF TCE REMEDIAL ALTERNATIVES
FOR CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative TCE-1: Minimal Action	Alternative TCE-2: Off-Site Treatment & Disposal (cleanup goal = 7 mg/kg)	Alternative TCE-3: Thermal Treatment (cleanup goal = 7 mg/kg)	Alternative TCE-4: Cap(cleanup goal = 7 mg/kg)	Alternative TCE-5: Soil Vapor Extraction (cleanup goal = 7 mg/kg)
Cost	$0.04 million	$ 6.1 million	$ 3.0 million	$ 0.7 million	$ 1.6 million

TABLE 7-13
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (Relative Weight = 10)							
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes = 4 No = 0	0	0	0	0	0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes = 3 No = 0	3	3	3	3	3
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes = 3 No = 0	3	3	3	3	3
TOTAL (Maximum = 10)			6	6	6	6	6
PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (Relative Weight = 20)							
1. Use of the site after remediation. **TOTAL (Maximum = 20)**	Unrestricted use of the land and water. **(If answer is yes, go to next analysis factor.)**	Yes = 20 No = 0	0	0	0	0	0
2. Human health and the environment exposure after remediation.	(i) Is the exposure to contaminants via air route acceptable?	Yes = 3 No = 0	0	3	3	3	3
	(ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes = 4 No = 0	0	0	0	0	0
Subtotal (maximum = 10)	(iii) Is the exposure to contaminants via sediments/soil acceptable?	Yes = 3 No = 0	0	3	3	3	3
3. Magnitude of residual public health risks after the remediation.	(i) Health risk < 1 in 1,000,000	Yes = 5 No = 0	0	5	5	5	5
Subtotal (maximum = 5)	(ii) Health risk < 1 in 100,000	Yes = 2 No = 0	0	NA	NA	NA	NA

TABLE 7-13
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
4. Magnitude of residual environmental risks after the remediation.	(i) Less than acceptable. (ii) Slightly greater than acceptable. (iii) Significant risk still exists.	= 5 = 3 = 0	5	5	5	5	5
Subtotal (maximum = 5)							
TOTAL (Maximum = 20)			5	16	16	16	16
SHORT-TERM EFFECTIVENESS (Relative Weight = 10)							
1. Protection of community during remedial actions.	a) Are there significant short-term risks to the community that must be addressed?	Yes = 0 No = 4	4	0	0	4	4
	(If the answer is no, go to Factor 2.) b) Can the risk be easily controlled?	Yes = 1 No = 0	NA	0	0	NA	NA
	c) Does the mitigative effort to control risk impact the community lifestyle?	Yes = 0 No = 2	NA	0	0	NA	NA
Subtotal (maximum = 4)							
2. Environmental impacts.	a) Are there significant short-term risks to the environment that must be addressed?	Yes = 0 No = 4	4	4	4	4	4
	(If the answer is no, go to Factor 3.) b) Are the available mitigative measures reliable to minimize potential impacts?	Yes = 3 No = 0	NA	NA	NA	NA	NA
Subtotal (maximum = 4)							

TABLE 7-13
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
3. Time to implement the remedy.	a) What is the required time to implement the remedy?	< 2 years = 1 > 2 years = 0	1	1	1	1	0
Subtotal (maximum = 2)	b) Required duration of the mitigative effort to control short-term risk?	< 2 years = 1 > 2 years = 0	1	1	1	1	1
TOTAL (Maximum = 10)			10	6	6	10	9
LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15)							
1. On-site or off-site treatment or land disposal. **Subtotal (maximum = 3)**	* On-site treatment * Off-site treatment * On-site or off-site land disposal	= 3 = 1 = 0	0	1	3	0	3
2. Permanence of the remedial alternative. **Subtotal (maximum = 3)**	* Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c)? **(If the answer is yes, go to Factor 4.)**	Yes = 3 No = 0	0	3	3	0	3
3. Lifetime of remedial actions. **Subtotal (maximum = 3)**	* Expected lifetime or duration of effectiveness of the remedy.	25-30 years = 3 20-25 years = 2 15-20 years = 1 < 15 years = 0	3	NA	NA	3	NA
4. Quantity and nature of waste or residual left at the site after remediation.	(i) Quantity of untreated hazardous waste left at the site.	None = 3 < 25% = 2 25-50% = 1 >50% = 0	0	2	2	0	2
	(ii) Is there treated residual left at the site? **(If the answer is no, go to Factor 5.)**	Yes = 0 No = 2	2	2	0	2	0
	(iii) Is the treated residual toxic?	Yes = 0 No = 1	NA	NA	1	NA	1

TABLE 7-13
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
	(iv) Is the treated residual mobile?	Yes = 0 No = 1	NA	NA	1	NA	0
Subtotal (maximum = 5)							
5. Adequacy and reliability of controls.	(i) Operation and maintenance required for a period of:	< 5 years = 1 > 5 years = 0	1	1	1	1	0
	(ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If the answer is no, go to "iv".)**	Yes = 0 No = 1	0	1	1	0	1
	(iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident = 1 Somewhat to not confident = 0	0	NA	NA	1	NA
	(iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum = 2 Moderate = 1 Extensive = 0	0	2	1	0	1
Subtotal (maximum = 4)							
TOTAL (Maximum = 15)			6	12	13	7	11
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (Relative Weight = 15)							
1. Volume of hazardous waste reduced (reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.)**	(i) Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.**	99-100% = 8 90-99% = 7 80-90% = 6 60-80% = 4 40-60% = 2 20-40% = 1 <20% = 0	NA	8	7	NA	7

TABLE 7-13
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
-	(ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2.**	Yes = 0 No = 2	NA	0	0	NA	0
Subtotal (maximum = 10) **If subtotal = 10, go to Factor 3.**	(iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal = 0 On-site land disposal = 1 Off-site destruction or treatment = 2	NA	2	2	NA	2
2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.**	(i) Quality of Available Wastes Immobilized After Destruction/Treatment.	90-100% = 2 60-90% = 1 < 60% = 0	NA	NA	NA	1	NA
Subtotal (maximum = 5)	(ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 = 0 = 3	NA	NA	NA	0	NA
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste. **Subtotal (maximum = 5)**	Completely irreversible. Irreversible for most of the hazardous constituents. Irreversible for only some of the hazardous constituents. Reversible for most of the hazardous constituents.	= 5 = 3 = 2 = 0	NA	5	5	0	5
TOTAL (Maximum = 15)			0	15	14	1	14

TABLE 7-13
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
IMPLEMENTABILITY (Relative Weight = 15)							
1. Technical Feasibility							
a. Ability to construct technology.	(i) Not difficult to construct. No uncertainties in construction.	= 3	3	2	2	3	2
	(ii) Somewhat difficult to construct. No uncertainties in construction.	= 2					
	(iii) Very difficult to construct and/or significant uncertainties in construction.	= 1					
b. Reliability of technology	(i) Very reliable in meeting the specified process efficiencies or performance goals.	= 3	NA	3	2	2	2
	(ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	= 2					
c. Schedule of delays due to technical problems.	(i) Unlikely	= 2	2	1	1	2	1
	(ii) Somewhat likely	= 1					
d. Need of undertaking additional remedial action, if necessary.	(i) No future remedial actions may be anticipated.	= 2	1	2	2	1	2
	(ii) Some future remedial actions may be necessary.	= 1					
Subtotal (maximum = 10)							
2. Administrative Feasibility							
a. Coordination with other agencies.	(i) Minimal coordination is required.	= 2	2	2	1	2	1
	(ii) Required coordination is normal.	= 1					
	(iii) Extensive coordination is required.	= 0					
Subtotal (maximum = 2)							

TABLE 7-13
TCE ALTERNATIVES SCORING TABLE FOR TCE CLEANUP GOAL OF 7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
3. Availability of Services and Materials							
a. Availability of prospective technologies.	(i) Are technologies under consideration generally commercially available for the site specific contamination?	Yes = 1 No = 0	1	1	1	1	1
	(ii) Will more than one vendor be available to provide a competitive bid?	Yes = 1 No = 0	NA	1	1	1	1
b. Availability of necessary equipment and specialists.	(i) Additional equipment and specialists may be available without significant delay.	Yes = 1 No = 0	NA	1	1	1	1
Subtotal (maximum = 3)							
TOTAL (Maximum = 15)			9	13	11	13	11
COST (Relative Weight = 15)							
Present Worth Cost	Total Present Worth (millions)		0.4	6.1	3.7	0.7	1.6
	Cost scores were assigned using the equation: 15 - Alternative Cost in $MM. Alternatives with costs from $15 to $20 MM were assigned a score of 1. Alternatives with costs above $ 20 MM were assigned a score of 0.		15	9	11	15	13
TOTAL (Maximum = 15)			15	9	11	15	13

TABLE 7-13
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 7 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 7 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
SUMMARY OF FACTORS							
Compliance with ARARs and SCGs		(max = 10)	6	6	6	6	6
Protection of Public Health and the Environment		(max = 20)	5	16	16	16	16
Short-term Impacts and Effectiveness		(max = 10)	10	6	6	10	9
Long-term Effectiveness and Permanence		(max = 15)	6	12	13	7	11
Reduction of Toxicity, Mobility, or Volume		(max = 15)	0	15	14	1	14
Implementability		(max = 15)	9	13	11	13	11
Cost		(max = 15)	15	9	11	15	13
TOTAL		(max = 100)	51	77	77	68	80

NOTES:
Alternative TCE-1: Minimal Action
Alternative TCE-2: Off-Site Treatment and Disposal
Alternative TCE-3: Thermal Treatment
Alternative TCE-4: Cover System
Alternative TCE-5: Soil Vapor Extraction

TABLE 7-14
COMPARATIVE ANALYSIS OF TCE REMEDIAL ALTERNATIVES
FOR CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

Criteria	Alternative TCE-1: Minimal Action	Alternative TCE-2: Off-Site Treatment & Disposal (cleanup goal = 70 mg/kg)	Alternative TCE-3: Thermal Treatment (cleanup goal = 70 mg/kg)	Alternative TCE-4: Cap(cleanup goal = 70 mg/kg)	Alternative TCE-5: Soil Vapor Extraction (cleanup goal = 70 mg/kg)
Compliance with ARARs and New York SCGs	Would not comply with SCGs.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.	Would not comply with TAGM 4046. Would be designed in accordance with applicable action and location-specific requirements.
Protection of Human Health and the Environment	Would not be protective of human health. No environmental receptors identified	Protective of human health by removing contaminated soil from the Site. No environmental receptors identified	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified	Protective of human health by isolating contaminated soil from potential receptors. No environmental receptors identified	Protective of human health by treating contaminated soil to below the cleanup goal. No environmental receptors identified
Short-term Impacts and Effectiveness	No short-term impacts	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor TCE vapors. Estimated time to design, implement, and remediate is less than 2 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor TCE vapors. Estimated time to design, implement, and remediate is less than 2 years.	Nuisance factors include dust, noise, and increased truck traffic. Dust suppression and air monitoring would be performed to monitor TCE vapors. Estimated time to design, implement, and remediate is less than 2 years.	Minimal impacts to the community would are anticipated. Air monitoring would be performed to monitor emissions. Estimated time to design, implement, and remediate is greater than 2 years.
Long-term Effectiveness and Permanence	Not applicable.	Would permanently eliminate exposure to TCE concentrations above the cleanup goal.	Thermal treatment is a permanent remedy.	Not considered a permanent remedy. May not be effective at reducing the mobility of TCE.	SVE is an effective, reliable remedy.
Reduction of	Not applicable.	Reduction of toxicity,	Reduction of toxicity,	No reduction of	Reduction of toxicity,

TABLE 7-14
COMPARATIVE ANALYSIS OF TCE REMEDIAL ALTERNATIVES FOR CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Insturments Site, Rochester, New York

Criteria	Alternative TCE-1: Minimal Action	Alternative TCE-2: Off-Site Treatment & Disposal (cleanup goal = 70 mg/kg)	Alternative TCE-3: Thermal Treatment (cleanup goal = 70 mg/kg)	Alternative TCE-4: Cap(cleanup goal = 70 mg/kg)	Alternative TCE-5: Soil Vapor Extraction (cleanup goal = 70 mg/kg)
Toxicity, Mobility, or Volume		mobility or volume would be realized by off-site treatment (i.e., incineration). Landfilling would slightly reduce contaminant mobility. No hazardous residuals would remain on-site.	mobility, and volume would occur through thermal treatment. Treated soil would be used to backfill excavations.	toxicity, mobility or volume would occur through treatment. Cap would slightly reduce contaminant mobility. Contaminated soil above cleanup goal would remain on-site.	mobility, and volume would occur through treatment.
Implementability	Institutional controls would be relatively easy to implement.	Would be relatively easy to implement. Minimal dewatering would be required.	Would be relatively easy to implement. Minimal dewatering would be required	Would be relatively easy to implement.	Would be relatively easy to implement. Pilot-scale test would be required.
Cost	$0.04 million	$ 0.9 million	$ 0.6 million	$ 0.3 million	$ 1.1 million

TABLE 7-15
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 70 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (Relative Weight = 10)							
1. Compliance with chemical-specific SCGs.	Meets chemical specific SCGs such as groundwater standards.	Yes = 4 No = 0	0	0	0	0	0
2. Compliance with action-specific SCGs.	Meets SCGs such as technology standards for incineration or landfill.	Yes = 3 No = 0	3	3	3	3	3
3. Compliance with location-specific SCGs.	Meets location-specific SCGs such as Freshwater Wetlands Act.	Yes = 3 No = 0	3	3	3	3	3
TOTAL (Maximum = 10)			6	6	6	6	6
PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (Relative Weight = 20)							
1. Use of the site after remediation. **TOTAL (Maximum = 20)**	Unrestricted use of the land and water. **(If answer is yes, go to next analysis factor.)**	Yes = 20 No = 0	0	0	0	0	0
2. Human health and the environment exposure after remediation.	(i) Is the exposure to contaminants via air route acceptable?	Yes = 3 No = 0	0	0	0	0	0
	(ii) Is the exposure to contaminants via groundwater/surface water acceptable?	Yes = 4 No = 0	0	0	0	0	0
Subtotal (maximum = 10)	(iii) Is the exposure to contaminants via sediments/soil acceptable?	Yes = 3 No = 0	0	3	3	3	3
3. Magnitude of residual public health risks after the remediation.	(i) Health risk < 1 in 1,000,000	Yes = 5 No = 0	0	0	0	0	0
Subtotal (maximum = 5)	(ii) Health risk < 1 in 100,000	Yes = 2 No = 0	0	0	0	0	0

TABLE 7-15
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 70 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
4. Magnitude of residual environmental risks after the remediation. **Subtotal (maximum = 5)**	(i) Less than acceptable. (ii) Slightly greater than acceptable. (iii) Significant risk still exists.	= 5 = 3 = 0	5	5	5	5	5
TOTAL (Maximum = 20)			5	8	8	8	8
SHORT-TERM EFFECTIVENESS **(Relative Weight = 10)**							
1. Protection of community during remedial actions.	a) Are there significant short-term risks to the community that must be addressed?	Yes = 0 No = 4	4	0	0	4	4
	(If the answer is no, go to Factor 2.) b) Can the risk be easily controlled?	Yes = 1 No = 0	NA	0	0	NA	NA
Subtotal (maximum = 4)	c) Does the mitigative effort to control risk impact the community lifestyle?	Yes = 0 No = 2	NA	0	0	NA	NA
2. Environmental impacts.	a) Are there significant short-term risks to the environment that must be addressed?	Yes = 0 No = 4	4	4	4	4	4
Subtotal (maximum = 4)	**(If the answer is no, go to Factor 3.)** b) Are the available mitigative measures reliable to minimize potential impacts?	Yes = 3 No = 0	NA	NA	NA	NA	NA

TABLE 7-15
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 70 mg/kg) TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
3. Time to implement the remedy.	a) What is the required time to implement the remedy?	< 2 years = 1 > 2 years = 0	1	1	1	1	0
Subtotal (maximum = 2)	b) Required duration of the mitigative effort to control short-term risk?	< 2 years = 1 > 2 years = 0	1	1	1	1	1
TOTAL (Maximum = 10)			10	6	6	10	9
LONG-TERM EFFECTIVENESS AND PERMANENCE (Relative Weight = 15)							
1. On-site or off-site treatment or land disposal. **Subtotal (maximum = 3)**	* On-site treatment * Off-site treatment * On-site or off-site land disposal	= 3 = 1 = 0	0	1	3	0	3
2. Permanence of the remedial alternative. **Subtotal (maximum = 3)**	* Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c)? **(If the answer is yes, go to Factor 4.)**	Yes = 3 No = 0	0	3	3	0	3
3. Lifetime of remedial actions. **Subtotal (maximum = 3)**	* Expected lifetime or duration of effectiveness of the remedy.	25-30 years = 3 20-25 years = 2 15-20 years = 1 < 15 years = 0	3	NA	NA	3	NA
4. Quantity and nature of waste or residual left at the site after remediation.	(i) Quantity of untreated hazardous waste left at the site.	None = 3 < 25% = 2 25-50% = 1 >50% = 0	0	2	2	0	2
	(ii) Is there treated residual left at the site? **(If the answer is no, go to Factor 5.)**	Yes = 0 No = 2	2	2	0	2	0
	(iii) Is the treated residual toxic?	Yes = 0 No = 1	NA	NA	1	NA	1

TABLE 7-15
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 70 mg/kg) TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
Subtotal (maximum = 5)	(iv) Is the treated residual mobile?	Yes = 0 No = 1	NA	NA	1	NA	0
5. Adequacy and reliability of controls.	(i) Operation and maintenance required for a period of:	< 5 years = 1 > 5 years = 0	1	1	1	1	1
	(ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If the answer is no, go to "iv".)**	Yes = 0 No = 1	0	1	1	0	1
	(iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident = 1 Somewhat to not confident = 0	0	NA	NA	1	NA
Subtotal (maximum = 4)	(iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	Minimum = 2 Moderate = 1 Extensive = 0	0	2	1	0	1
TOTAL (Maximum = 15)			6	12	13	7	12
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME (Relative Weight = 15)							
1. Volume of hazardous waste reduced (reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.)**	(i) Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.**	99-100% = 8 90-99% = 7 80-90% = 6 60-80% = 4 40-60% = 2 20-40% = 1 <20% = 0	NA	8	7	NA	7

TABLE 7-15
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 70 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
	(ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2.**	Yes = 0 No = 2	NA	0	0	NA	0
Subtotal (maximum = 10) **If subtotal = 10, go to Factor 3.**	(iii) After remediation, how is the untreated, residual hazardous waste material disposed?	Off-site land disposal = 0 On-site land disposal = 1 Off-site destruction or treatment = 2	NA	2	2	NA	2
2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3.**	(i) Quality of Available Wastes Immobilized After Destruction/Treatment.	90-100% = 2 60-90% = 1 < 60% = 0	NA	NA	NA	1	NA
Subtotal (maximum = 5)	(ii) Method of Immobilization - Reduced mobility by containment - Reduced mobility by alternative treatment technologies	 = 0 = 3	NA	NA	NA	0	NA
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste. **Subtotal (maximum = 5)**	Completely irreversible. Irreversible for most of the hazardous constituents. Irreversible for only some of the hazardous constituents. Reversible for most of the hazardous constituents.	= 5 = 3 = 2 = 0	NA	5	5	0	5
TOTAL (Maximum = 15)			0	15	5	1	14

TABLE 7-15
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 70 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
IMPLEMENTABILITY (Relative Weight = 15)							
1. Technical Feasibility							
a. Ability to construct technology.	(i) Not difficult to construct. No uncertainties in construction.	= 3	3	2	2	3	2
	(ii) Somewhat difficult to construct. No uncertainties in construction.	= 2					
	(iii) Very difficult to construct and/or significant uncertainties in construction.	= 1					
b. Reliability of technology	(i) Very reliable in meeting the specified process efficiencies or performance goals.	= 3	NA	3	2	2	2
	(ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	= 2					
c. Schedule of delays due to technical problems.	(i) Unlikely	= 2	2	1	1	2	1
	(ii) Somewhat likely	= 1					
d. Need of undertaking additional remedial action, if necessary.	(i) No future remedial actions may be anticipated.	= 2	1	2	2	1	2
	(ii) Some future remedial actions may be necessary.	= 1					
Subtotal (maximum = 10)							
2. Administrative Feasibility							
a. Coordination with other agencies.	(i) Minimal coordination is required.	= 2	2	2	1	2	1
	(ii) Required coordination is normal.	= 1					
	(iii) Extensive coordination is required.	= 0					
Subtotal (maximum = 2)							

TABLE 7-15
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 70 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
3. Availability of Services and Materials							
a. Availability of prospective technologies.	(i) Are technologies under consideration generally commercially available for the site specific contamination?	Yes = 1 No = 0	1	1	1	1	1
	(ii) Will more than one vendor be available to provide a competitive bid?	Yes = 1 No = 0	NA	1	1	1	1
b. Availability of necessary equipment and specialists.	(i) Additional equipment and specialists may be available without significant delay.	Yes = 1 No = 0	NA	1	1	1	1
Subtotal (maximum = 3)							
TOTAL (Maximum = 15)			9	13	11	13	11
COST (Relative Weight = 15)							
Present Worth Cost	Total Present Worth (millions)		0.4	0.9	0.6	0.3	1.1
	Cost scores were assigned using the equation: 15 - Alternative Cost in $MM. Alternatives with costs from $15 to $20 MM were assigned a score of 1. Alternatives with costs above $ 20 MM were assigned a score of 0.		15	15	15	15	14
TOTAL (Maximum = 15)			15	14	14	15	14

TABLE 7-15
TCE ALTERNATIVES SCORING TABLE
FOR TCE CLEANUP GOAL OF 70 MG/KG

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

ANALYSIS FACTOR	BASIS FOR EVALUATION DURING DETAILED ANALYSIS	SCORE	TCE REMEDIAL ALTERNATIVES (CLEANUP GOAL = 70 mg/kg)				
			TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
SUMMARY OF FACTORS							
Compliance with ARARs and SCGs		(max = 10)	6	6	6	6	6
Protection of Public Health and the Environment		(max = 20)	5	8	8	8	8
Short-term Impacts and Effectiveness		(max = 10)	10	6	6	10	9
Long-term Effectiveness and Permanence		(max = 15)	6	12	13	7	12
Reduction of Toxicity, Mobility, or Volume		(max = 15)	0	15	5	1	14
Implementability		(max = 15)	9	13	11	13	11
Cost		(max = 15)	15	14	14	15	14
TOTAL		(max = 100)	51	74	63	60	74

NOTES:
Alternative TCE-1: Minimal Action
Alternative TCE-2: Off-Site Treatment and Disposal
Alternative TCE-3: Thermal Treatment
Alternative TCE-4: Cover System
Alternative TCE-5: Soil Vapor Extraction

TABLE 7-16
TCE SUMMARY SCORING TABLE
FOR TCE CLEANUP GOALS

Evaluation of On-Site Remedial Alternatives
Taylor Instruments Site, Rochester, New York

	TCE SCORING SUMMARY FOR REMEDIAL ALTERNATIVES				
	Alternative				
	TCE-1	TCE-2	TCE-3	TCE-4	TCE-5
TCE Cleanup Goal	**Minimal Action**	**Off-Site Treatment and Disposal**	**Thermal Treament**	**Cap**	**Soil Vapor Extraction**
0.7 mg/kg	51	72	73	71	82
7 mg/kg	51	77	77	68	80
70 mg/kg	51	74	63	60	74

Attachment 2

Copies of Relevant Material for Other Mercury-Impacted Sites

To: ABB-ES

Technical Memo #6
November 1997

CDM Camp Dresser & McKee

Report

State of California

California Environmental Protection Agency
Department of Toxic Substances Control
Region 2
700 Heinz Avenue
Berkeley, CA 94710-2737

Mark E. Piros
Hazardous Substances ~~Associate Waste Management~~ Engineer (510) 540-3832
Site Mitigation Branch CALNET 8-571-3832

Final Remedial Action Plan

Environmental Mercury Assessment Phase V Almaden Quicksilver County Park

December 6, 1994

Prepared for:

Santa Clara County
Parks and Recreation Department
Los Gatos, California

Prepared by:

Camp Dresser & McKee Inc.
Walnut Creek, California

Table 4.7-1
Remediation Goals

Area	Remediation Goals (mg/kg)	
	General Child Scenario	Localized Child Scenario
Hacienda Furnace Yard	404 (400)[1]	NA[2]
Mine Hill Area	298 (300)	NA
Enriquita Mine Retort	465 (450)	NA
San Mateo Mine Retort	495 (500)	NA
Senator Mine	402 (400)	NA
North America Tunnel	500	NA
TOTAL	NA	382 (400)

(1) Field analytical techniques only allow estimation of soil concentrations to two significant figures. Thus, actual cleanup goals would be those in parentheses.
(2) NA = Not Applicable

The most restrictive goal is for the Mine Hill area (298 mg/kg), due mainly to the large component of exposure estimated for inhalation of mercury vapor. Since this area is the largest and most "attractive" area from a historical perspective, it may be reasonable to apply a strict cleanup criteria which reflects the anticipated intensive use of this part of the park.

The remediation goal calculated for the localized child scenario (382 mg/kg) can be applied to the Hacienda Furnace Yard and the Enriquita Mine Retort areas. These areas contributed significantly to exposures for children playing in specific areas.

Remediation goals of 500 mg/kg for the San Mateo Mine Retort and North America Tunnel areas and 400 mg/kg for the Senator Mine are appropriate based upon the method of proportions. Estimated mercury vapor concentrations are highest at the Senator Mine, yielding the lower remediation goal for this site.

4.7.2 Ecological Cleanup Goals

Potential risks to terrestrial wildlife were determined to be low and thus do not require separate ecological risk-based cleanup goals for surficial mine waste materials. As discussed in the ecological risk assessment, however, soil mercury concentrations greater than 50 mg/kg may be

Enriquita Mine Retort

Alternative No. 1 — No Action
Alternative No. 2 — Removal/Disposal
Alternative No. 3 — Containment

San Mateo Mine Retort

Alternative No. 1 — No Action
Alternative No. 2 — Institutional Controls
Alternative No. 3 — Removal/Disposal

5.4 Comparison of Alternatives

The assembled alternatives were then evaluated against seven criteria as established by EPA guidance for conducting feasibility studies. These evaluation criteria are:

- Overall Protection of Human Health and the Environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- Long-term Effectiveness
- Reduction of Toxicity, Mobility, and Volume
- Short-term Effectiveness
- Implementability
- Cost

Table 5.4-1 provides a summary of the key components, including costs, of each alternative for all of the sites within the park.

The FS report concluded with the identification of a recommended, preferred remedial alternative for each area in the park. A discussion of each of the alternatives is presented below by area. The justification for selecting the preferred alternative and rejecting the other alternatives is included.

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c.1

[redacted]

DOE/OR/02-1370&D1

BD JACOB000C

Keys:
KCS
Oak Ridge [illegible] (ORNL)
Tennessee
mercury
Soils, sediment, groundwater
Bioavailability
mercuric sulfide
elemental mercury
Bioavailability Adjustment Factor (BAF)

Record of Decision for Lower East Fork Poplar Creek

CLEARED FOR

PUBLIC RELEASE

KS

DOE/OR/02-1370&D1

Record of Decision
for
Lower East Fork Poplar Creek

Date Issued—May 1995

Prepared by
Jacobs ER Team
125 Broadway Avenue
Oak Ridge, Tennessee
under contract DE-AC05-93OR22028

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management

PREFACE

This record of decision for Lower East Fork Poplar Creek (EFPC) (DOE/OR/02-1370&D1) was prepared in accordance with requirements under the Comprehensive Environmental Response, Compensation, and Liability Act to present the selected remedy to the public. This work was performed under work breakdown structure 1.4.12.3.1.04 (Activity Data Sheet 9304, "Lower East Fork Poplar Creek"). (Publication of this document meets a Federal Facility Agreement milestone of June 1, 1995.) This document provides the Environmental Restoration Program with information about the selected remedy for Lower EFPC, which involves excavating floodplain soil with mercury concentrations > 400 parts per million and disposing of the soil at a landfill at the U.S. Department of Energy—Oak Ridge Y-12 Plant. Information in this document summarizes information from the remedial investigation (DOE/OR/02-1119&D2&V1 and V2), the feasibility study (DOE/OR/02-1185&D2&V1 and V2), and the proposed plan (DOE/OR/02-1209&D3).

ACKNOWLEDGEMENTS

This document was prepared by the Jacobs ER Team under prime contract to the U.S. Department of Energy. Team members are:

Jacobs Engineering Group Inc.
Geraghty & Miller, Inc.
Lockwood Greene Technologies, Inc.
PAI Corporation
Solutions To Environmental Problems
United Science Industries
University of Tennessee

Additional support was given to the team by Martin Marietta Energy Systems, Inc.

DESCRIPTION OF THE SELECTED REMEDY

This response action fits into the overall Oak Ridge Reservation (ORR) cleanup strategy by addressing floodplain soil, sediment, and groundwater contaminated by mercury originating from the DOE Oak Ridge Y-12 Plant (Y-12 Plant). Remediation of the surface water in Lower EFPC can best be accomplished through the DOE Y-12 Environmental Restoration Program, and the continuing mercury releases will be regulated under the Clean Water Act National Pollutant Discharge Elimination System permit for the Y-12 Plant. Therefore, Lower EFPC surface water is not within the scope of this ROD, but is discussed for informational purposes only. The objective of this remedial action is to minimize the risk to human health and the environment from mercury-contaminated soil and sediment in the Lower EFPC floodplain pursuant to CERCLA and the FFA (1992).

The selected remedy addresses the principal threats at the site by excavating and disposing of the identified floodplain soils contaminated above the remediation goal of 400 ppm mercury. The major components of the selected remedy include:

- excavating identified floodplain soils with mercury concentrations greater than 400 ppm from four areas. [Three of the areas are at the National Oceanic and Atmospheric Administration (NOAA) site (two areas in Parcels #571 and one area in #461), and the other area is at the Bruner's Center site (Parcel #564). The total in situ volume to be excavated is estimated to be 7,650 m^3 (10,000 yd^3)];

- disposing of the contaminated soil in a permitted landfill at the Y-12 Plant;

- performing confirmatory sampling in the excavated areas to ensure all mercury concentrations above 400 ppm have been removed;

- backfilling the excavated areas, including the 0.24-ha (0.6-acre) wetland at the Bruner's Center, with clean borrow soil and vegetating appropriately; and

- appropriate monitoring on Lower EFPC to ensure effectiveness of the remediation.

Groundwater does not present an unacceptable risk to human health and the environment. If sufficient quantities of groundwater could be extracted from the shallow soil horizon (0–20 ft) for residential use, such groundwater could pose an unacceptable risk. However, because residential use of the shallow soil horizon (shallow) groundwater is not realistic (as explained in more detail in the Decision Summary), groundwater is not considered an unacceptable risk. As a safeguard, DOE will monitor to detect any future residential use of the shallow groundwater In the unlikely event such use is detected, DOE will mitigate, as appropriate, any risks associated with such use.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate, and is cost-effective. However, because treatment of the soils, which pose the principal threat at the site, was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. This remedy will result in remediation of hazardous substances that allows for unlimited use of, and unrestricted exposure to, the Lower EFPC OU.

APPROVALS

Manager
U.S. Department of Energy
Oak Ridge Field Office

Date

Director, DOE Oversight Division
State of Tennessee
Tennessee Department of Environment and Conservation

Date

Regional Administrator
U.S. Environmental Protection Agency
Region IV

Date

maintenance and periodic environmental monitoring, including a 5-year recurring review, would ensure that levels of risk remain acceptable. Institutional actions would include future land-use limitations, construction permit restrictions, public education, and signs.

ALTERNATIVE 7: INSTITUTIONAL ACTIONS FOR COMMERCIAL/DOE AND OTHER REMEDIAL UNITS SOILS; EXCAVATION AND DISPOSAL OF RESIDENTIAL REMEDIAL UNIT SOILS

Alternative 7 addresses remedial actions on an area-specific basis. For this alternative, DOE would acquire the real estate rights to and fence the NOAA site. Soil containing mercury above the remediation goal would remain uncovered inside the fenced area. Institutional actions, including land-use restrictions, would be implemented.

In the Residential Remedial Unit, all remaining soil with mercury concentrations greater than the remediation goal would be excavated and disposed of in a permitted landfill at the Y-12 Plant. Clean borrow soil would be used to fill the excavation.

In the remaining areas of the Commercial/DOE and Other Remedial Units, institutional actions would be implemented to maintain nonagricultural and nonresidential land use. Institutional action in these areas and in the fenced areas would include future land-use limitations, construction permit restrictions, public education, signs, environmental monitoring, and a 5-year recurring review. Implementation of this alternative would involve activities very similar to those described for Alternatives 3 and 6.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

DOE, TDEC, and EPA evaluated all alternatives against the nine criteria provided by CERCLA for final remedial actions. This comparative analysis is provided here.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Overall protection of human health and the environment addresses whether an alternative provides adequate long- and short-term protection of human health and the environment from unacceptable risks from hazardous substances by reducing, eliminating, or controlling exposure and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls. All of the alternatives, with the exception of the no action alternative, adequately protect human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, or institutional actions.

The greatest risk associated with Alternatives 2 through 7 would be to ecological receptors. Alternatives 3 and 5 would eliminate unacceptable residual risk in the floodplain and would not permanently alter floodplain habitat. These alternatives would impact ecological receptors in small areas and recovery might be slow. Alternative 7 would provide a high degree of overall protection to human health but would leave residual risk for ecological receptors. Alternatives 2 and 4 would permanently alter habitat and land use, and residual contaminants would remain. Alternative 6 provides the least overall protection of the action alternatives because containment and extensive fencing throughout the floodplain would permanently alter habitat, and long-term maintenance of fencing and access controls is considered difficult.

The no action alternative is not considered further in this analysis because it does not protect human health and the environment.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Compliance with applicable or relevant and appropriate requirements (ARARs) addresses whether a remedy will meet all ARARs of all federal and state environmental statutes and/or provide grounds for invoking a waiver. Alternatives 2 through 7 would comply with identified federal and state ARARs. No waivers would be necessary to implement any of the remedial alternatives. The "Statutory Determinations" section summarizes the ARARs for the selected remedy.

LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term effectiveness and permanence refers to the magnitude of expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environmental over time, once cleanup goals have been met. Alternatives 3 and 5 provide the greatest degree of long-term effectiveness and permanence because they would remove all contaminated material above levels of concern from the OU. Alternatives 2 and 4 provide slightly less long-term effectiveness and permanence because some of the contaminated material would remain in the floodplain and be covered by 45 cm (18 in.) of soil. Alternative 7 provides less long-term effectiveness and permanence than Alternatives 2 and 4 because only institutional actions limit contact with the contaminated material in the floodplain. Maintenance of fencing and land-use restrictions would be required for long-term effectiveness in some areas. Alternative 6 provides the least amount of long-term effectiveness and permanence because all contaminated material would remain in place, and access would be restricted by fencing.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Reduction of toxicity, mobility, or volume through treatment addresses the anticipated performance of treatment that permanently and significantly reduces toxicity, mobility, or volume of waste. Alternatives 4 and 5 would reduce the toxicity of mercury-contaminated soil through low-temperature thermal desorption. None of the other alternatives include treatment processes.

SHORT-TERM EFFECTIVENESS AND ENVIRONMENTAL IMPACTS

Short-term effectiveness considers impact to community, site workers, and the environment during construction and implementation and includes the time until protection is achieved. All of the alternatives involve minimal transportation and construction accident risks. Risk to the community and to workers from exposure to contaminants would be within acceptable limits because engineering controls and a project-specific health and safety plan, including personal protective equipment, would be used. A floodplain statement of findings, provided as an appendix to the feasibility study (DOE 1994b), is the resultant document from the floodplain assessment of Lower EFPC. The statement of findings concludes that there is no practicable alternative to remediating the Lower EFPC floodplain soil that would not destroy any wetland areas.

Alternative 7 would have the least impact on the environment because only a small area of floodplain habitat would be destroyed. Alternatives 2, 3, and 6 would have a greater adverse effect on the environment than Alternative 7 because they involve excavation of a larger area of contaminated floodplain soil. Alternatives 4 and 5 would have the largest impact on the environment because implementation would destroy the largest area of habitat of the alternatives, and treatment would involve additional handling of the soil.

IMPLEMENTABILITY

Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution. Alternatives 2 and 3 are most readily implementable because they involve only excavation, disposal, containment, and institutional actions that are commonly used and readily implementable. Alternative 7 would be slightly more difficult to implement because of the additional separate actions required to acquire a portion of land and restrict access by fencing. Alternative 6 would be less implementable if landowners were reluctant to negotiate agreements with DOE for contaminated portions of their property. Long-term maintenance of the soil cover and fencing may also be difficult. Alternatives 4 and 5 may be the hardest to implement because they include a treatment process, low-temperature thermal desorption, for which full-scale effectiveness and implementability have not been proven. Low-temperature thermal desorption is an EPA-accepted, best demonstrated available technology, effective in removing mercury from Lower EFPC soils in bench-scale and pilot-scale tests.

COST

Cost compares the differences in cost, including capital and operation and maintenance costs, expressed as estimated total present-worth cost. Alternative 7 is the least expensive action alternative. The next lowest-cost alternatives are Alternatives 6, 2, and 3. Alternatives 4 and 5 are the most expensive.

STATE ACCEPTANCE

State acceptance evaluates whether the state agrees with, opposes, or has no comment on the preferred alternative. The state of Tennessee concurs with the selected remedy.

COMMUNITY ACCEPTANCE

Community acceptance addresses the issues and concerns the public may have regarding each of the alternatives. The proposed plan (DOE 1995b) presented Alternative 3, as previously described, as DOE, EPA, and TDEC's preferred alternative. The "Selected Remedy" section reflects a compromise of the many public comments on the proposed plan. The "Highlights of Community Participation" section summarizes community participation. Part 3, the "Responsiveness Summary," summarizes and responds to comments submitted during the public comment period.

SELECTED REMEDY

Based on a comparative analysis of the alternatives presented in the feasibility study (DOE 1994b), Alternative 3 is selected as the remedial action. This alternative reflects the best balance of the evaluation criteria. The remediation goal that is protective of human health and the environment is 400 ppm mercury.

PB95-964504

PB95-964504
EPA/ROD/R09-95/134
June 1995

EPA Superfund Record of Decision:

Carson River Mercury Site
(OU 1), Lyon/Churchill County, NV
3/30/1995

PART 1. DECLARATION

SITE NAME AND LOCATION

Carson River Mercury Site
Lyon, Storey and Churchill County, Nevada

STATEMENT AND PURPOSE

This Record of Decision ("ROD") presents the selected remedial action for Operable Unit 1 ("OU-1") of the Carson River Mercury Site ("CRMS") which is located in Lyon, Storey and Churchill Counties, Nevada. This document was developed in accordance with Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA") as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), 42 U.S.C. Section 9601 et seq., and in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Section 300 et seq., ("NCP"). This decision is based on the administrative record for this operable unit.

In a letter to EPA dated March 29, 1995, the State of Nevada, through the Nevada Division of Environmental Protection (NDEP) concurred with the selected remedy for this operable unit of the CRMS.

ASSESSMENT OF THE SITE

Actual or threatened release 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.

DESCRIPTION OF THE REMEDY

The remedial action objective for OU-1 of the CRMS is to reduce human health risks by reducing direct exposure to surface soils containing mercury at concentrations equal to or greater than 80 milligrams per kilogram (mg/kg) in residential areas. There are six areas which are considered actionable based on this cleanup objective: five residential yards and one ditch ("Dayton Ditch").

The selected remedy for the five residential yards is to excavate contaminated surface soil (estimated to go to a depth of approximately 2 feet below ground surface), dispose of the soil at a RCRA municipal landfill if the soils do not exceed the TCLP standards, and restore the excavated areas. Approximately 5000 cubic yards of soil will be excavated and disposed of as part of this response action. If it is determined that all or part of the excavated soil exceeds the TCLP standards, then the excavated soil will either be treated and disposed of at a RCRA municipal landfill or disposed of at a RCRA hazardous waste landfill. Which of these sub-alternatives that will be used will depend on which sub-alternative is found to be more cost effective and the logistics of implementing each sub-alternative.

The selected remedy for the Dayton Ditch is no action. EPA selected no action for the Dayton Ditch because the health risks for this area are not great enough to warrant response actions such as capping or excavation and the State of Nevada and the community expressed opposition to institutional controls (i.e., restricting access with a fence). Although EPA has selected no action for the Dayton Ditch, additional samples will be collected from the ditch during the remedial design to further evaluate the level of impact. In the event that EPA determines that some form of remediation is warranted, then EPA will document this remedy selection in an "Explanation of Significant Differences (ESD)" or ROD amendment, or the area will be addressed as part of OU-2.

The response actions for the residential yards address the incidental soil ingestion exposure pathway which was found to be of potential concern for populations near impacted areas. Also found to be an exposure pathway of potential concem is consumption of fish or waterfowl from the Carson River system. However, this remedial action is not attempting to address this pathway. Operable unit 2 of the remedial investigation and feasibility study ("RI/FS") will evaluate methods to reduce mercury concentrations in fish and waterfowl.

The major components of the selected remedy include:

- Excavation of approximately 5000 cubic yards of contaminated soils, disposal at a RCRA municipal and/or hazardous waste landfill, and restoration of properties. In the event that subsurface soil (greater than or equal to 2 feet below ground surface) is impacted and is not addressed, then this alternative may also include institutional controls; and

- Implementation of institutional controls to ensure that any residential development in present open land use areas known or suspected to be impacted by mercury includes characterizing mercury levels in surface soils and, if necessary, addressing impacted soils. These institutional controls will be referred to as the "Long-term Sampling and Response Plan."

This remedial action addresses a principal risk at the CRMS by removing contaminants from surface soil, thereby significantly reducing the toxicity, mobility or volume of hazardous substances in surface soil. This remedial action will reduce the possibility of human contact with mercury and thereby reduce the human health risks.

STATUTORY DECLARATION

The selected remedy is protective of human health and the environment, complies with federal State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. However, because treatment of soils may not occur, this remedy may not satisfy the statutory preference for treatment as a principal element of the remedy. Because this remedy will result in hazardous substances remaining on-site above health-based levels, a five-year review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, will be conducted at least once every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Keith Takata — 3-30-95

Keith Takata
Deputy Director,
Hazardous Waste Management Division

Date

PART 2. DECISION SUMMARY

This Decision Summary provides an overview of the problems posed by the Carson River Mercury Site ("CRMS" or the "Site"), the alternatives considered for addressing those problems which are within the scope of operable unit ("OU-1"), and presents the analysis of the remediation alternatives. This Decision Summary also provides the rationale for the remedy selection and describes how the selected remedy satisfies the statutory requirements.

1.0 SITE DESCRIPTION

1.1 SITE DEFINITION

The Carson River Mercury Site (CRMS) consists of the portions of the Carson drainage and Washoe Valley in Northwestern Nevada which are affected by mercury released from milling operations during the Comstock Lode. The exact boundaries of the affected area were not defined as part of this remedial investigation because knowledge of these boundaries were considered to have little or no influence on the findings of the risk assessment.

The current definition of the CRMS study area is as follows: sediments in an approximately 70-mile stretch of the Carson River beginning near Carson City, Nevada and extending downstream through the Lahontan Reservoir to the terminal wetlands in the Carson Desert (Stillwater National Wildlife Refuge and Carson Lake); tailing piles, sediments and soil in Gold Canyon, Sixmile Canyon, and Sevenmile Canyon; and sediments and soil in Washoe Valley (Figure 1).

This Record of Decision ("ROD") calls for remedial action in Dayton and Silver City, Nevada. Both Dayton and Silver City are located in Lyon County.

1.2 SITE PHYSIOGRAPHY

The Carson River drainage basin drains approximately 3,980 square miles in east-central California and west-central Nevada. The Carson River heads in the eastern Sierra Nevada mountains south of Lake Tahoe and generally flows northeastward and eastward to the Carson Sink (Figure 1). The Carson River flows through a series of generally separate alluvial valleys from the headwaters area to the Carson Sink. In downstream order, the alluvial valleys passed by the river include Carson Valley, Eagle Valley, Dayton Plains, Stagecoach Valley, Churchill Valley, and Carson Desert (Figure 2). Between New Empire and Dayton the river flows through a narrow, high-gradient stretch along which large ore-processing mills were situated during the late 1800s. The flow of the river is interrupted west of Fallon by Lahontan Reservoir, which was constructed in 1915 as part of the Newlands Irrigation Project. Below Lahontan Dam, flow is routed through a complex network of ditches, drains, document prescribes criteria for evaluating if material is acceptable for alternate uses. Based on the FS, the technologies that would most likely be used for treating contaminated soil are either gravity separation or a conventional mining technology (i.e., cyanidation).

In the event that the excavated soil does not exceed the TCLP standard, then this alternative involves excavation of surface soil, disposal at a municipal landfill, and restoration of excavated areas. Both alternatives involve excavation of contaminated surface soil (estimated to go to depth of approximately 2 feet below ground surface), and site restoration. Site restoration would involve returning the affected area to pre-excavation conditions which may include replacing fences, structures, and vegetation. Potential institutional controls would be the same as described for Altemative 3.

Long-term Sampling and Response Plan

With exception for Alternative 1, certain institutional controls were considered to be an additional part of each of the described altematives. These institution controls, which will be known as the 'Long-term Sampling and Response Plan," are to manage impacted areas that will not be remediated as part of this operable unit. The FS did not evaluate remediation alternatives for impacted areas in Sixmile Canyon and adjacent to the Carson River between New Empire and Dayton because these areas do not pose health risks with the current land use (non-residential). In the event that residential development is proposed in these areas or other areas where mercury levels may exceed 80 mg/kg, then certain procedures described in the Long-term Sampling and Response Plan will be followed.

The Long-term Sampling and Response Plan will set forth specific sampling guidelines for characterizing mercury levels in surface soils and for addressing impacted areas. The areas where any residential development will be subject to the guidelines prescribed in this plan are generally described as follows:

Sixmile Canyon - Refers to the tributary of the Carson River that begins near Virginia City in the Virginia mountain range and meets the Carson River approximately five miles east of Dayton. The segment of concern is the canyon which begins just below Virginia City and extends to the mouth of the canyon just above the alluvial fan.

Alluvial Fan - Refers to the alluvial fan below the mouth of Sixmile Canyon. The fluvial channels extending across the fan from the mouth of Sixmile Canyon to the Carson River confluence are the areas of concern.

Brunswick Canyon - Refers to the Carson River flood plain between New Empire (the Mexican Mill) and Dayton.

Carson River Flood Plain Above Lahontan Dam - Refers to the Carson River flood plain extending between Dayton and Lahontan Reservoir.

Carson River Flood Plain Below Lahontan Dam - Refers to the flood plain of the South Branch of the Carson River beginning below Lahontan Dam and extending to Carson Lake.

In instances where residential development is proposed within these defined areas, Nevada Division of Environmental Protection (NDEP) will provide the interested parties with the Long-term Sampling and Response Plan Guidelines. The guidelines will provide specific instructions for sampling an area to assess mercury levels in surface soils, instructions for interpreting and reporting results, instructions for follow-up sampling, and instructions for addressing impacted areas.

The Long-term Sampling and Response Plan Guidelines will be developed by EPA as part of the remedial design for this operable unit. The guidelines will be administered through NDEP's Bureau of Corrective Actions. However, development within the boundaries of the specified areas will be monitored through NDEP's Bureau of Water Pollution Control which reviews sewerage facility plans for new developments made up of five or more subdivisions. For smaller developments, the county planning offices will notify NDEP of proposed developments and NDEP will contact the developer. The Long-term Sampling and Response Plan does not provide for NDEP to enforce the implementation of the guidelines. Rather, NDEP will notify EPA of any recalcitrant parties and EPA will have the discretion of using the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Sections 104 and 106 authorities to enforce compliance with the guidelines..

9.2 DETAILED ANALYSIS OF ALTERNATIVES

This section provides an explanation of the criteria used to select the remedy, and the analyses of the remedial action alternatives in light of those criteria, highlighting the advantages and disadvantages of each of the alternatives.

9.2.1 CRITERIA

The alternatives were evaluated using nine criteria. These criteria, which are listed below, are derived from requirements contained in the National Contingency Plan (NCP), 40 C.F.R. § 300 et seq. and CERCLA Section 121(b) and 121(c).

Overall Protection of Human Health and the Environment - The assessment against this criterion describes how the alternative, as a whole, achieves and maintains protection of human health and the environment.

Compliance with ARARs - The assessment against this criterion describes how the alternative complies with ARARs as well as any advisories, criteria, and guidance that the lead and support agencies have agreed are "to be considered."

Long-term Effectiveness and Permanence - The assessment of alternatives against this criterion evaluates the long-term effectiveness of alternatives in maintaining protection of human health and the environment after response objectives have been met.

Reduction of Toxicity, Mobility, and Volume Through Treatment - The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies an alternative may employ.

Short-term Effectiveness - The assessment against this criterion examines the effectiveness of alternatives in protecting human health and the environment during the construction and implementation of a remedy until response objectives are attained.

Implementability - This assessment evaluates the technical and administrative feasibility of alternatives and the availability of required goods and services.

Cost - This assessment evaluates the capital and operation and maintenance (O&M) costs of each alternative.

State Acceptance - This assessment reflects the State's (or support agency's) apparent preferences among or concerns about alternatives.

Community Acceptance - This assessment reflects the community's apparent preferences among or concerns about alternatives.

9.2.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Section 121(d) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. Section 121(d) requires that remedial actions at Superfund sites comply with all the requirements of Federal or State environmental or facility siting laws, which are known in the Superfund program as Applicable or Relevant and Appropriate Requirements (ARARs).

This section summarizes the Federal and State statutes and regulations which EPA has determined are the ARARs for the selected remedial alternative for OU 1 of the CRMS.

<u>Definition of ARARs</u>

ARARs are defined as standards or requirements that are found to be either "applicable" or "relevant and appropriate" to the conditions and circumstances found at the site. Guidance for identifying ARARs may be found in the National Contingency Plan (55 Fed. Reg. 8741 et. seq. March 8 1990) and CERCLA Compliance With Other Laws Manual, Part I, Overview of RCRA Clean Water Act and Safe Drinking Water Act, OSWER Directive 9234.1-01 (August 1988) and CERCLA Compliance with Other Laws Manual Part II Clean Air Act, State Requirements and Other Environmental Statutes, OSWER Directive 9234.1-02 (August 1989).

"Applicable" requirements are defined as those cleanup standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State law that specifically address or regulate a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a Superfund site. "Applicability" implies that the remedial action or the circumstances at the site satisfy all of the jurisdictional prerequisites of a requirement.

"Relevant and Appropriate" requirements are defined as those standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State law, that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site or to the remedial action alternatives. For example, requirements may be relevant and appropriate if they would be "applicable" but for jurisdictional restrictions associated with the requirement.

In addition to legally binding laws and regulations, EPA or the State may identify other non-promulgated advisories, criteria or guidance as "To Be Considered" requirements (TBCs). If no ARARs address a particular situation, or if existing ARARs do not ensure protectiveness, then advisories, criteria or guidelines are to be considered (TBCs) to set cleanup goals. If such an advisory, criterion or guideline is selected in the ROD, then it becomes a requirement that the remedial action must meet.

Section 121(e) implicitly states that no Federal, State, or local permits (administrative requirements) are required for remedial actions conducted entirely on site. However, these on-site remedial actions must meet the substantive requirements of ARARs. Any action which takes place off-site, however, is subject to the full requirements of Federal, State, and local regulations. Requirements which are applicable to offsite actions are not ARARs and are not "frozen" at the time the ROD is signed. Rather, all requirements--whether substantive or administrative--which exist at the time of the offsite action must be met.

COPY

CITRIC BLOCK SITE INVESTIGATION AND INTERIM REMEDIAL MEASURES WORK PLAN

Citric Block Site
Williamsburg Facility

December 12, 1995

Prepared for:

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Prepared by:

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4.0 CURRENT AND POTENTIAL FUTURE CITRIC BLOCK SITE USE

Pfizer has decommissioned the Citric Block Site to prepare this property for future redevelopment and/or beneficial use. As part of this process, the Citric Block Site buildings were demolished. (Demolition activities were completed in August 1995.) Presently, the reinforced-concrete-slab foundation is the only aboveground remnant of the former buildings. This slab is continuous throughout the entire block, and varies in thickness between approximately 0.5 and 1.5 feet. The entire Citric Block Site is surrounded by an eight-foot-high chain-link fence topped with barbed wire, and is under continuous security surveillance.

As stated earlier, the Citric Block Subsurface Investigation Report concluded that under current site-use conditions, the eastern half of the Citric Block Site does not present a risk to public health or the environment. This conclusion was based upon the absence of exposure pathways, thereby preventing contact of contaminants with a potential receptor. Since exposures to site-related chemicals cannot occur under current site conditions, there are currently no potential risks identified for the Citric Block Site. It is noted, however, that the Citric Block Subsurface Investigation Report did not address potential future use(s) of the property.

Pfizer is currently contemplating several redevelopment (future-use) scenarios for the Citric Block Site, including commercial, light industrial, or recreational use (i.e., as a park/playground for the adjoining elementary school). Redevelopment of the property would be conducted in such a manner as to preclude *any* exposure of Citric Block Site contaminants to humans (e.g., through capping, barriers, soil excavation, or a combination of these technologies). Therefore, even considering potential future-use scenarios, the Citric Block Site will not present a risk to public health or the environment.

5.0 IRM RATIONALE

Although Citric Block Site soil does not pose a current or future risk while capped with concrete, Pfizer wishes to remove "hot spot" areas of soil contamination as an added safety measure.

Excavation of soil "hot spots" will likely remove any soils that might be considered a potential RCRA characteristically hazardous waste. This conservative, yet aggressive, remediation approach is designed to provide an additional level of safety to the site (the Citric Block Site is already capped with concrete, and is surrounded by an 8-foot-high fence with 24-hour security surveillance), while ensuring that soils that could be characterized as RCRA hazardous are removed in an expeditious manner.

The IRM is designed to proceed in a phased fashion. Specifically, delineation and soil excavation will be implemented first for the eastern half of the Citric Block Site, where significant environmental data are already available. Following completion of the soil excavation efforts on the eastern half of the Citric Block Site, IRM efforts on the western half of the Citric Block Site will commence, beginning with the delineation of soil (fill) quality conditions. In this manner, information developed during IRM efforts on the eastern half of the Citric Block Site can be used to rescope and improve IRM efforts on the western half of the Citric Block Site, if necessary or desirable.

To preliminarily identify "hot spots" in the portion of the Citric Block Site where soil quality data have been already developed, soil quality data for the eastern half of the Citric Block Site were evaluated to preliminarily estimate those locations where soil could be characterized as RCRA hazardous, based upon Toxicity Characteristic Leaching Procedure (TCLP) testing. The results of this evaluation show that for the eastern portion of the Citric Block Site Soil Borings CB-1, CB-3, CB-4, CB-6, CB-8, CB-9, CB-10, CB-11, and CB-12 yield soil concentrations that could potentially "fail" a TCLP test and, therefore, be classified as a characteristically hazardous waste. Preliminarily, these borings will serve as "markers" for approximating "hot spot" areas to be removed on the eastern half of the Citric Block Site during the IRM. These "hot spots" are shown in red in Figure 6. Additional delineation efforts (Task II of this Work Plan), including TCLP testing, will be performed around each of these borings to better define "hot spot" areas prior to implementation of the IRM.

The highest concentrations of contaminants are limited to the 0- to 2-ft interval directly below the existing concrete slab. In almost all cases, soil concentrations decreased significantly at depths deeper than 2 feet below the existing slab. An exception to this is at borings CB-1 and CB-4, where lead (CB-1) and mercury (CB-4) concentrations remain elevated down to 4 feet below the concrete slab. Based upon this information, the IRM soil "hot spot" removal effort in the eastern half of the Citric Block Site will be preliminarily limited to removing the 0- to 2-foot interval immediately underlying the concrete slab in the "hot spot" areas centered on borings shown in Figure 6, with the exception of the areas around borings CB-4 and CB-1, where excavation may proceed down to 4 feet below the slab.

At each soil boring, soil samples will be collected continuously at 2-ft intervals down to the perched ground water or clay layer, whichever is first encountered. Each soil sample will be inspected by the field geologist to characterize lithology and any evidence of contamination (e.g., staining, odors). A portion of each sample will be placed in a plastic Ziploc™ bag or glass jar and screened in the field for VOCs using a photoionization detector (PID). Detailed soil boring and sampling procedures are further discussed in the SAP (Appendix A).

The soil sample collected from the 0 to 2 ft interval (i.e., immediately below the concrete slab) and the soil sample that exhibits the highest degree of contamination (e.g., staining and odors) will be selected for laboratory analysis to assess the nature and extent of any impacts. However, if no impacts are discernible, the samples collected from the 0 to 2 ft interval and the 2 ft interval immediately above the perched ground water (if present) or clay layer will be submitted for analysis.

Each soil sample submitted for laboratory analysis will be analyzed for VOCs using NYSDEC ASP Method 91-1, SVOCs using NYSDEC ASP Method 91-2, metals using Superfund Contract Laboratory Program (CLP) Inorganics Method, TOC using USEPA Method 9060, pH using USEPA Method 9045 and Eh using American Standards & Testing Method (ASTM) Method 4646. Quality assurance samples (e.g., field blanks, matrix spike) will be collected for the above analyses as described in Appendix B.

Each soil boring will be surveyed for horizontal and vertical coordinates relative to the NGVD by a New York State licensed surveyor.

<u>Background Sampling</u>

The need for Citric Block Site-specific background soil quality is based upon the natural occurrence of certain constituents (i.e., metals) at the Citric Block Site, the nature of the media (non-native fill) in which these constituents are found, and the urban setting on which the Pfizer plant resides. In these areas, naturally occurring elements such as metals, and other pervasive compounds such as PAHs are commonly present in urban fill materials at levels above regional background concentrations and even above NYSDEC RSCOs. For example, ash cinders and asphalt are common components of fill that contain high concentrations of metals (e.g., mercury, lead, etc.) and PAHs.

Therefore, to determine the significance of these constituent concentrations at a given urban site, Citric Block Site-specific background soil quality data need to be developed. These data are collected from areas of the Citric Block Site where operations were not performed and are therefore not suspected as being potentially impacted from Citric Block Site operations. These background data will be used to develop Citric Block Site-specific ranges of concentrations for naturally occurring metals and PAHs. These background data will, in turn, be compared to soil metals and base neutral compounds (i.e., PAHs) data in the known areas of concern to identify environmental impacts from these constituents. To accomplish this, five soil samples will be collected from selected locations that will be situated away from known or suspected source areas of contamination. These locations will be established during the Citric Block Site reconnaissance (Task I). Each soil sample will be collected and analyzed from the 0 to 2 ft interval.

The background soil samples will be analyzed for base neutral compounds (i.e., PAHs) using the NYSDEC ASP Method 91-2 and metals using the Superfund CLP Inorganics Method. A further discussion of background sampling can be found in the SAP (Appendix A).

Metals Speciation

To assist in the evaluation of risk, fate and transport and the development of remedial alternatives, metals speciation will be performed for certain metals on all soil samples collected from soil borings at the Citric Block Site including the background samples (but excluding monitoring well pilot boreholes). Speciation will be performed for arsenic, chromium and mercury. A brief discussion of the metals to be speciated is provided below and in Appendix A.

Arsenic speciation (i.e., As^{+3} and As^{+5}) will be performed to determine if the predominant form present in the soil is As^{+3} (carcinogenic) or As^{+5} (non-carcinogenic). It is noted that, provided an exposure pathway exists (no known exposure pathways exist at the Citric Block

Site), the risk imposed by the As^{+3} (i.e., 0.37 parts per million [ppm] for ingestion) is several orders of magnitude greater than the risk imposed by the As^{+5} (i.e., 23 ppm for ingestion) due to its known behavior as a carcinogen.

Determination of Cr^{+3} and Cr^{+6} will be performed to identify the form of chromium in the soil samples. It is noted that, provided an exposure pathway exists (no known exposure pathways exist at the Citric Block Site), the risk imposed by Cr^{+6} (i.e., 390 ppm for ingestion) is several orders of magnitude greater than the risk imposed by Cr^{+3} (i.e., 78,000 ppm for ingestion).

Determination of metallic and non-metallic mercury including organic mercury will be performed to identify the form of mercury present in the soil samples. It is noted that, provided an exposure pathway exists (no known exposure pathways exist at the Citric Block Site), the risk for organic forms of mercury (i.e., methyl mercury) and metallic mercury are greater than the risk for inorganic/non-metallic mercury. In addition, in order to evaluate the form of mercury present in the soil, a mercury vapor meter will be employed to screen the vapor emanating from the boreholes created during soil sampling. The observation of mercury in the vapor phase, will be used to indicate the presence of metallic mercury in the soils. In addition, using the concentrations for mercury in the vapor phase, as measured during screening, coupled with temperature and barometric data, estimates of soil concentrations of metallic mercury may be calculated. The significance of the presence of metallic mercury, as compared to its non-metallic forms, is that provided an exposure pathway exists (no known exposure pathways exist at the Citric Block Site), it imposes a considerably higher health risk due to its inherent toxicity, high volatilization (i.e., inhalation risk), and high trans-dermal absorption.

Data Evaluation

Soil delineation work proposed in Task II is expected to require five to six weeks to complete (i.e., including laboratory analysis). These soil quality data will be evaluated in an expedited fashion to complete the general definition of soil "hot spot" areas across the eastern portion of the Citric Block Site. Specifically, soil borings yielding soil concentrations above the TCLP limits, as discussed in Section 5.0, will be shown in a map (similar to

Figure 6) and will serve as "markers" for approximating "hot spot" areas to be removed during implementation of the IRM. The results of this work will be provided in a technical memorandum to the NYSDEC.

7.3 Task III: IRM Implementation - Eastern Portion of the Citric Block Site

The IRM for the Citric Block Site will consist of the following tasks:

- further refinement of "hot spot" areas through focused soil sampling and analysis;
- pre-excavation analysis of contaminated soil for waste characterization through TCLP analysis;
- removal of the concrete slab over the delineated soil "hot spots";
- anticipated excavation of soil in "hot spot" areas down to 2 ft below the existing slab (except near CB-1 and CB-4), based upon soil quality conditions encountered on the eastern half of the Citric Block Site;
- disposal of excavated soil; and
- backfill and regrading of excavated areas.

7.3.1 Focused Soil Boring Program

A focused soil boring program will be implemented around the "hot spot" marker borings (known "hot spot" marker borings are shown in Figure 6) in order to:

- provide a high level of definition of "hot spot" areas in an effort to minimize the volume of soil requiring excavation, and eliminate the need for post-excavation sampling; and
- expedite the soil removal process by performing waste characterization sampling prior to soil removal, thereby eliminating the need for stockpiling excavated soils onsite.

The soil boring program will include the drilling and sampling of shallow soil borings (i.e., to a depth of 2 feet below the existing concrete slab) at regular (e.g., 5-foot or 10-foot) intervals radiating outward from each "hot spot" marker boring. For example, based upon existing Citric Block Site data, additional borings would be performed around existing soil borings CB-1, CB-3, CB-4, CB-6, and CB-8 through CB-12. Soil sampling will continue radially outward from each existing soil boring until the area containing constituents of concern at concentrations exceeding their respective TCLP limits has been completely delineated. For example, as shown in Figure 8, four initial soil borings will be drilled in a "ring" around each existing soil boring. These initial borings are shown in green in Figure 8. For each initial soil boring that contains constituents of concern at concentrations above their respective TCLP limit, sampling will continue outward incrementally (e.g., in 5- and/or 10-foot intervals) from that location until concentrations of all constituents of concern are below their respective TCLP limit. The outermost, or "perimeter", borings will define the limits of the "hot spot" area. In the vicinity of borings CB-1 and CB-4, soil borings will extend downward to a depth of 4 feet below land surface, since the 2- to 4-foot horizon at these locations were also shown to be contaminated during the recent subsurface investigation.

Soil samples will be collected using a Geoprobe™, and submitted to an analytical laboratory for analysis of the toxicity characteristics of metals using the TCLP and total mercury, with a 72-hour turnaround time requested. The analytical results will be used to delineate the extent of the soils requiring excavation.

In order to expedite the removal of contaminated soil and reduce the amount of time an excavation is left open, contaminated soils targeted for excavation will be analyzed for full waste characterization prior to excavation. Specifically, additional soil will be collected from each boring and stored on ice for later compositing to determine full waste characteristics for disposal purposes.

Once a "hot spot" area has been completely delineated, the extra soil samples from those borings within the "hot spot" area will be composited, and submitted to the analytical laboratory for waste characterization. At present, Roux Associates anticipates analyzing the composite samples for RCRA characteristics using TCLP, reactivity, ignitability, and corrosivity. However, the actual analytical suite, and the number of composite samples required, will be dictated by the receiving disposal facility.

These data will be used to precisely determine the actual "hot spot" areas to be excavated. Excavation will proceed up to, but not beyond, the perimeter borings that define the limits of each "hot spot" area. The actual "hot spot" areas to be excavated during the IRM will be shown on a map. This map, along with the focused soil boring data, will be provided in a technical memorandum to the NYSDEC.

7.3.2 Soil Excavation and Disposal

Based on the results of the focused "hot spot" delineation efforts described above, an excavation contractor will remove those portions of the concrete slab that overlie contaminated soil. All soil within the uppermost two feet of each delineated "hot spot" will then be removed, based upon our current understanding of the vertical distribution of contaminants. Since the soils within the "hot spot" areas will already have been characterized for disposal, excavated soils will be loaded directly into dump trucks standing by, thereby precluding the need to stockpile the excavated soil. Roux Associates will track soil volumes and examine waste manifests for accuracy and completeness.

Upon completion of soil-removal activities, the open excavations will be backfilled with clean fill from an off-site source. Post-excavation sampling will not be required since the extent of each "hot spot" area will be well defined by a series of "perimeter" borings where concentrations of all constituents of concern are below their respective TCLP limits. These "perimeter" soil borings will serve as substitutes for the more commonly collected post-excavation samples of the sidewalls of an excavation.

Following the backfilling of the excavations, the portion of the concrete slab which was removed to permit removal of contaminated soil will be restored. Concrete will be poured over the backfilled excavations until flush with the surrounding concrete slab (or sidewalk). Roux Associates will provide oversight during the excavation and disposal of the "hot spot" area soils and concrete slab, backfilling and Site restoration. Monitoring of air quality will be conducted using a PID and a particulate monitor. All activities will be documented in a field logbook.

7.4 Task IV: Soil Boring and Sampling - Western Portion of Citric Block Site

Soil samples will be collected on the western portion of the Citric Block Site to delineate soil quality and hydrogeologic conditions. The soil boring and sampling objectives are to:

- determine the nature and extent of contamination beneath the western portion of the Citric Block Site (i.e., former Buildings 5, 8, 9 and 11);
- determine additional subsurface hydrogeologic conditions (e.g., vertical permeability [hydraulic conductivity]); and
- determine geochemical characteristics of the soil (e.g., metals speciation).

A total of 27 soil borings will be drilled and sampled using the Geoprobe™ method at the western portion of the Citric Block Site. The locations of the 22 soil borings within the former buildings on the eastern half of the Citric Block Site are shown in Figure 7 (i.e., CB-25 through CB-46). The locations were selected to achieve the above-referenced objectives and may be modified based upon the results of the Citric Block Site reconnaissance (Task I).

At each soil boring, soil samples will be collected continuously at 2-ft intervals down to the perched ground water or clay layer, whichever is first encountered. Two of the 27 soil borings will be drilled to the base of the clay layer beneath the western portion of the Citric Block Site. The locations of the deeper soil borings will be selected in the field, and will be spaced throughout the western portion of the Citric Block Site.

Each soil sample will be inspected by the field geologist to characterize lithology and any evidence of contamination (e.g., staining, odors). A portion of each sample will be placed in a plastic Ziploc™ bag or glass jar and screened in the field for VOCs using a photoionization detector (PID). Detailed soil boring and sampling procedures are further discussed in the SAP (Appendix A).

The soil sample collected from the 0 to 2 ft interval (i.e., immediately below the concrete slab) and the soil sample that exhibits the highest degree of contamination (e.g., staining and odors) will be selected for laboratory analysis to assess the nature and extent of any impacts.

However, if no impacts are discernible, the samples collected from the 0 to 2 ft interval and the 2 ft interval immediately above the perched ground water (if present) or clay layer will be submitted for analysis.

Each soil sample submitted for laboratory analysis will be analyzed for VOCs using NYSDEC ASP Method 91-1, SVOCs using NYSDEC ASP Method 91-2, metals using Superfund Contract Laboratory Program (CLP) Inorganics Method, TOC using USEPA Method 9060, pH using USEPA Method 9045 and Eh using American Standards & Testing Method (ASTM) Method 4646. Quality assurance samples (e.g., field blanks, matrix spike) will be collected for the above analyses as described in Appendix B.

Grain size distribution and vertical permeability (i.e., hydraulic conductivity) will also be established for the samples of fill material and the underlying clay at two locations (i.e., a total of four samples). Determination of these parameters will supplement existing data and assist during the evaluation, if necessary, of fate and transport of potential migration of contaminants vertically through the clay. These four samples will be collected using Shelby™ tubes driven by a truck-mounted drill rig. The locations for these samples will be selected immediately after the completion of samples collected for chemical analyses.

Each soil boring will be surveyed for horizontal and vertical coordinates relative to the NGVD by a New York State licensed surveyor.

Metals Speciation

As discussed in Section 7.2, metals speciation will be performed for certain metals on all soil samples collected from soil borings at the Citric Block Site. Speciation will be performed for arsenic, chromium and mercury. A brief discussion of the metals to be speciated is provided below and in Appendix A.

Data Evaluation

Soil delineation work proposed in Task IV is expected to require five to six weeks to complete (i.e., including laboratory analysis). These soil quality data will be evaluated in an expedited fashion to complete the general definition of soil "hot spot" areas across the western portion of the Citric Block Site. Specifically, soil borings representing "markers" for approximating "hot spot" areas to be removed during implementation of the IRM, as discussed in Section 5.0, will be shown in a map (similar to Figure 6). The results of this work will be provided in a technical memorandum to the NYSDEC.

7.5 Task V: IRM Implementation - Western Portion of the Citric Block Site

The IRM for the western portion of the Citric Block Site will consist of the following tasks:

- further refinement of "hot spot" areas through focused soil sampling and analysis;
- pre-excavation analysis of contaminated soil for waste characterization through TCLP analysis;
- removal of the concrete slab over the delineated soil "hot spots";
- anticipated excavation of soil in "hot spot" areas down to 2 ft below the existing slab, based upon soil quality conditions encountered on the eastern half of the Citric Block Site;
- disposal of excavated soil; and
- backfill and regrading of excavated areas.

The scope of IRM efforts for the western half of the Citric Block Site may be modified based upon results of IRM efforts on the eastern portion of the Citric Block Site.

7.5.1 Focused Soil Boring Program

A focused soil boring program will be implemented around the "hot spot" marker borings in order to:

- provide a high level of definition of "hot spot" areas in an effort to minimize the volume of soil requiring excavation, and eliminate the need for post-excavation sampling; and
- expedite the soil removal process by performing waste characterization sampling prior to soil removal, thereby eliminating the need for stockpiling excavated soils onsite.

The soil boring program will include the drilling and sampling of shallow soil borings (i.e., to a depth of 2 feet below the existing concrete slab) at regular (e.g., 10-foot) intervals radiating outward from each "hot spot" marker boring. Soil sampling will continue radially outward from each existing soil boring until "hot spot" areas have been completely delineated.

Soil samples will be collected using a Geoprobe™, and submitted to an analytical laboratory for analysis of the toxicity characteristic metals using TCLP and total mercury, with a 72-hour turnaround time requested. The analytical results will be used to delineate the extent of the soils requiring excavation.

In order to expedite the removal of contaminated soil and reduce the amount of time an excavation is left open, contaminated soils will be analyzed for full waste characterization prior to excavation. Specifically, additional soil will be collected from each boring and stored on ice for later compositing to determine waste characteristics for disposal purposes.

Once a "hot spot" area has been completely delineated, the extra soil samples from those borings within the "hot spot" area will be composited, and submitted to the analytical laboratory for waste characterization. At present, Roux Associates anticipates analyzing the composite samples for RCRA characteristics using TCLP, reactivity, ignitability, and corrosivity. However, the actual analytical suite, and the number of composite samples required, will be dictated by the receiving disposal facility.

These data will be used to precisely determine the actual "hot spot" areas to be excavated. Excavation will proceed up to, but not beyond, the perimeter borings that define the limits of each "hot spot" area. The actual "hot spot" areas to be excavated during the IRM will be shown on a map. This map, along with the focused soil boring data, will be provided in a technical memorandum to the NYSDEC.

7.5.2 Soil Excavation and Disposal

Based on the results of the focused "hot spot" delineation efforts described above, an excavation contractor will remove those portions of the concrete slab that overlie contaminated soil. All soil within the uppermost two feet of each delineated "hot spot" will then be removed, based upon our current understanding of the vertical distribution of contaminants. Since the soils within the "hot spot" areas will already have been characterized for disposal, excavated soils will be loaded directly into dump trucks standing by, thereby precluding the need to stockpile the excavated soil. Roux Associates will track soil volumes and examine waste manifests for accuracy and completeness.

Upon completion of soil-removal activities, the open excavations will be backfilled with clean fill from an off-site source. Post-excavation sampling will not be required since the extent of each "hot spot" area will be well defined by a series of "perimeter" borings. These "perimeter" soil borings will serve as substitutes for the more commonly collected post-excavation samples of the sidewalls of an excavation.

Following the backfilling of the excavations, the portion of the concrete slab which was removed to permit removal of contaminated soil will be restored. Concrete will be poured over the backfilled excavations until flush with the surrounding concrete slab (or sidewalk). Roux Associates will provide oversight during the excavation and disposal of the "hot spot" area soils and concrete slab, backfilling and Site restoration. Monitoring of air quality will be conducted using a PID and a particulate monitor. All activities will be documented in a field logbook.

7.6 Task VI: Perched Ground-Water Investigation

The objective of the perched ground-water investigation is to determine the occurrence, nature and continuity of perched ground water, and if migration of contaminants in the perched ground water is occurring onsite. This will be accomplished through the installation and sampling of perched zone monitoring wells and water-level monitoring. A description of each component of the perched ground-water investigation is provided below.

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:		CB-1	CB-1	CB-2	CB-2	CB-3
Sample Depth (ft bls):		0-2	2-4	0-2	2-4	0-2
Sample Date:		7/13/95	7/13/95	7/13/95	7/13/95	7/13/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)					
Aluminum	33,000'	6,260	7,280	4,530	7,090	2,980
Antimony	--	11.7	7.1 B	3.4 B	6.4 B	9.2 B
Arsenic	7.5	**10.9**	**30.2**	**72.0**	**20.9**	4.3
Barium	300	157	56.6	60.7	97.9	38.5 B
Beryllium	0.16	0.10 B	0.10 B	0.11 B	**0.18 B**	0.04 U
Cadmium	1	**1.5**	**2.9**	0.80 B	**3.9**	0.75 B
Calcium	35,000'	10,100	24,000	13,900	4,410	16,200
Chromium	10	**11.9**	**14.0**	7.9	**22.1**	**26.8**
Cobalt	30	3.1 B	5.2 B	22.1	6.9 B	12.6
Copper	25	**255**	**220**	**222**	**654**	**118**
Iron	2,000	**6,880**	**10,900**	**12,500**	**7,590**	**6,090**
Lead	400	**4,220**	**1,660**	360	**484**	**734**
Magnesium	5,000'	968	1,480	1,670	976 B	958 B
Manganese	5,000'	330	146	197	54.3	102
Mercury	0.1	**484**	**95.5**	**64.1**	**49.4**	**69.2**
Nickel	13	8.5	**29.0**	**15.5**	**42.1**	8.0
Potassium	43,000'	377 B	791 B	454 B	530 B	557 B
Selenium	2	1.7	1.4	1.5	0.84 B	0.75 B
Silver	--	14.8	1.5 B	0.12 U	0.13 U	4.5
Sodium	8,000'	147 B	744 B	295 B	163 B	215 B
Thallium	--	1.8 B	1.4 B	1.8 B	0.78 B	0.79 B
Vanadium	150	15.4	34.1	16.4	17.1	8.8 B
Zinc	20	**435**	**1,110**	**831**	**532**	**269**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-3	CB-4	CB-4	CB-5	CB-5
	Sample Depth (ft bls):	4-6	0-2	2-4	0-2	2-4
	Sample Date:	7/13/95	7/13/95	7/13/95	7/12/95	7/12/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)					
Aluminum	33,000[1]	604	4,430	7,430	3,830	4,100
Antimony	--	2.1 B	2.3 B	1.4 B	4.4 B	2.5 B
Arsenic	7.5	8.2	**31.2**	**26.4**	5.6	3.6
Barium	300	9.6 B	183	119	55.7	59.4
Beryllium	0.16	0.04 U	0.05 U	**0.19 B**	0.04 U	**0.19 B**
Cadmium	1	0.08 B	0.47 B	0.53 B	0.38 B	0.07 U
Calcium	35,000[1]	303 B	27,100	57,600	32,300	7,930
Chromium	10	0.41 B	8.7	**14.3**	9.7	7.1
Cobalt	30	4.0 B	3.9 B	4.8 B	8.8 B	4.1 B
Copper	25	12.7	**93.8**	**107**	**31.6**	**29.9**
Iron	2,000	**2,090**	**10,300**	**18,000**	**7,830**	**8,750**
Lead	400	66.3	273	158	316	190
Magnesium	5,000[1]	124 B	1,790	7,940	4,070	1,310
Manganese	5,000[1]	8.1	493	858	241	88.1
Mercury	0.1	**2.7**	**2640**	**499**	**68.8**	**85.5**
Nickel	13	**24.1**	7.9 B	12.1	11.5	11.3
Potassium	43,000[1]	209 B	1820	1610	604 B	668 B
Selenium	2	0.43 U	**11.5**	**4.4**	1.2	**5.9**
Silver	--	0.12 U	0.15 U	0.14 U	0.13 U	0.13 U
Sodium	8,000[1]	188 B	368 B	501 B	182 B	250 B
Thallium	--	0.69 U	2.9	3.3	0.71 U	1.6 B
Vanadium	150	1.3 B	20.7	30.0	11.5	13.8
Zinc	20	**714**	**150**	**307**	**93.1**	**53.1**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Sample Designation:		CB-6	CB-6*	CB-6	CB-7	CB-7
Sample Depth (ft bls):		0-2	0-2	2-4	0-2	2-4
Sample Date:		7/12/95	7/12/95	7/12/95	7/12/95	7/12/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)					
Aluminum	33,000'	4,020	6,510	5,330	3,350	6,000
Antimony	--	70.0	43.1	2.0 B	5.2 B	0.78 U
Arsenic	7.5	**22.6**	**20.5**	**10.7**	**9.8**	1.3 B
Barium	300	130	164	63.0	91.7	18.1 B
Beryllium	0.16	0.04 U	0.05 U	0.12 B	**0.22 B**	0.04 U
Cadmium	1	0.23 B	0.29 B	**1.5**	0.34 B	0.07 U
Calcium	35,000'	3,430	12,000	52,000	4,880	650 B
Chromium	10	**19.0**	**20.6**	**12.0**	8.5	9.7
Cobalt	30	3.1 B	4.6 B	5.0 B	6.1 B	2.7 B
Copper	25	**179**	**212**	**78.0**	**54.4**	8.8
Iron	2,000	**20,300**	**23,300**	**10,900**	**13,300**	**5,330**
Lead	400	**2,050**	**1,240**	**541**	145	5.8
Magnesium	5,000'	1,160	2,180	3,640	561 B	1,390
Manganese	5,000'	83.0	123	277	169	48.8
Mercury	0.1	**28.3**	**57.8**	**30.1**	**7.9**	**2.5**
Nickel	13	**16.4**	**29.7**	**61.7**	**16.6**	9.6
Potassium	43,000'	685 B	872 B	679 B	664 B	308 B
Selenium	2	**3.2**	**4.2**	2.0 U	**2.5**	0.79 B
Silver	--	0.12 U	0.14 U	0.11 U	0.14 U	0.13 U
Sodium	8,000'	102 U	118 U	150 B	381 B	114 U
Thallium	--	2.0	3.7	1.5 B	2.0 B	0.74 U
Vanadium	150	26.4	26.0	18.4	24.8	9.2 B
Zinc	20	**123**	**142**	**194**	**107**	**22.0**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-8	CB-8	CB-9	CB-9*	CB-9
	Sample Depth (ft bls):	0-2	2-4	0-2	0-2	2-4
	Sample Date:	7/14/95	7/14/95	7/14/95	7/14/95	7/14/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)					
Aluminum	33,000'	4,490	3,890	2,890	5,030	10,900
Antimony	--	6,550	7.7 B	58.7	66.7	12.5
Arsenic	7.5	7.2	5.7	**10.0**	**11.1**	**57.0**
Barium	300	55.2	37.2 B	65.0	118	39.7 B
Beryllium	0.16	**0.20 B**	0.04 U	0.04 U	0.11 B	0.04 U
Cadmium	1	0.63 B	0.06 U	0.21 B	**4.1**	0.06 U
Calcium	35,000'	14,000	1,070	16,500	25,200	2,900
Chromium	10	7.3	4.3	7.8	8.7	**18.4**
Cobalt	30	3.4 B	4.2 B	**57.4**	**46.8**	5.9 B
Copper	25	**151**	9.9	**42.0**	**53.3**	11.4
Iron	2,000	**5,960**	**7,300**	**6,440**	**7,880**	**5,820**
Lead	400	**4,630**	28.1	362	**919**	34.7
Magnesium	5,000'	816 B	771 B	1,470	1,790	1,280
Manganese	5,000'	83.9	24.4	108	157	54.6
Mercury	0.1	**17.9**	**0.43**	**52.9**	**56.8**	**0.78**
Nickel	13	10.5	**13.2**	10.1	10.3	**25.4**
Potassium	43,000'	651 B	461 B	718 B	994 B	879 B
Selenium	2	0.70 B	1.2	1.4	1.7	1.2
Silver	--	0.13 U	0.12 U	3.9	2.6	0.12 U
Sodium	8,000'	448 B	106 U	117 U	352 B	141 B
Thallium	--	0.81 B	0.81 B	1.3 B	1.3 B	0.70 U
Vanadium	150	11.7	4.2 B	14.2	15.6	19.0
Zinc	20	**192**	**78.2**	**87.4**	**131**	**534**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)	CB-10 0-2 7/13/95	CB-10 2-4 7/13/95	CB-11 0-2 7/14/95	CB-11 2-4 7/14/95	CB-12 0-2 7/12/95
Sample Designation:		CB-10	CB-10	CB-11	CB-11	CB-12
Sample Depth (ft bls):		0-2	2-4	0-2	2-4	0-2
Sample Date:		7/13/95	7/13/95	7/14/95	7/14/95	7/12/95
Aluminum	33,000'	6,040	4,150	7,910	10,200	6,240
Antimony	--	2.6 B	0.74 U	3.1 B	0.79 U	4.2 B
Arsenic	7.5	**20.3**	4.6	**33.4**	**12.1**	5.4
Barium	300	**599**	15.0 B	152.0	58.6	**411**
Beryllium	0.16	0.06 B	0.04 U	0.16 B	**0.20 B**	0.08 B
Cadmium	1	**1.9**	0.06 U	0.39 B	0.12 B	**2.7**
Calcium	35,000'	60,200	4,510	43,400	8,820	46,300
Chromium	10	**28.4**	7.5	**23.7**	**31.9**	**23.2**
Cobalt	30	5.5 B	2.5 B	5.2 B	6.2 B	5.6 B
Copper	25	**124**	11.2	**72.2**	**35.5**	**123**
Iron	2,000	**18,000**	6,840	19,700	17,600	19,700
Lead	400	665	77.9	536	54.4	427
Magnesium	5,000'	7,730	1,290	3,830	2,560	5,150
Manganese	5,000'	534	52.0	453	303	375
Mercury	0.1	**30.3**	**18.9**	**108**	**15.2**	**32.4**
Nickel	13	**24.0**	8.7	**22.1**	**20.5**	**24.1**
Potassium	43,000'	1430	300 B	1640	840 B	957 B
Selenium	2	**2.2**	0.43 U	**2.2**	**2.1**	**2.5**
Silver	--	0.11 U	0.12 U	0.60 B	0.13 U	0.13 U
Sodium	8,000'	1,050	593 B	308 B	242 B	471 B
Thallium	--	1.6 B	0.70 U	2.6	2.0 B	2.2 B
Vanadium	150	24.1	8.5 B	22.1	28.9	17.3
Zinc	20	**1,510**	**35.8**	**317**	**117**	**931**

Table 1. Summary of Metals Previously Detected in Soil During the Citric Block Subsurface Investigation, Pfizer Inc, Brooklyn, New York.

	Sample Designation:	CB-12	CB-13	CB-13
	Sample Depth (ft bls):	4-6	0-2	2-4
	Sample Date:	7/12/95	7/12/95	7/12/95
Metals (Concentrations in mg/kg)	NYSDEC RSCOs (mg/kg)			
Aluminum	33,000'	4,580	6,410	6,410
Antimony	--	0.75 U	10.8 B	1.4 B
Arsenic	7.5	1.9 B	**24.0**	**17.9**
Barium	300	46.4	186	83.3
Beryllium	0.16	**0.21 B**	0.09 B	0.06 B
Cadmium	1	0.06 U	**1.1**	0.74 B
Calcium	35,000'	1,110	53,600	29,900
Chromium	10	7.8	**20.7**	**11.9**
Cobalt	30	1.8 B	7.3 B	4.8 B
Copper	25	8.9	405	**62.6**
Iron	2,000	**3,980**	**34,700**	**8,870**
Lead	400	8.9	557	219
Magnesium	5,000'	571 B	5,220	3,590
Manganese	5,000'	13.1	410	208
Mercury	0.1	**4.3**	24.0	**24.0**
Nickel	13	5.0 B	**32.2**	**14.1**
Potassium	43,000'	538 B	1,350	981 B
Selenium	2	0.99 B	6.2	**2.4**
Silver	--	0.12 U	0.12 U	0.12 U
Sodium	8,000'	192 B	567 B	522 B
Thallium	--	1.0 B	3.6	1.9 B
Vanadium	150	15.5	25.3	**27.9**
Zinc	20	16.1	517	**119**

mg/kg - Milligrams per kilogram
ft bls - Feet below land surface
NYSDEC - New York State Department of Environmental Conservation
RSCOs - Recommended Soil Cleanup Objectives
U - Indicates compound not detected
B - Estimated value
' - Eastern U.S.A. background
* - Field duplicate
Boldface - Data highlighted in bold represent results detected above the NYSDEC RSCOs.

United States Environmental Protection Agency

Office of Emergency and Remedial Response

EPA/ROD/R02-88/069
September 1988

PB89-189518

EPA

Superfund Record of Decision:

G.E. Wiring, PR

DECLARATION STATEMENT

RECORD OF DECISION

SITE NAME AND LOCATION

GE Wiring Devices, Juana Diaz, Puerto Rico

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the GE Wiring Devices Site, in Juana Diaz, Puerto Rico, developed in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record for this site. The attached index identifies the items that comprise the administrative record upon which the selection of the remedial action is based.

The Commonwealth of Puerto Rico has concurred in the selected remedy.

DESCRIPTION OF THE SELECTION REMEDY

The remedial action would remediate the waste-fill area, perched water, and the mercury contaminated near-surface soils to levels which would be protective of public health. With respect to contaminated soils downgradient of the waste-fill area, since the mercury is primarily in the upper six inches of soil, the remedial action would include remediation of the upper six inches of soil at a minimum. Since groundwater data is limited, further investigation and monitoring will be conducted during design to determine the extent of groundwater contamination.

The major components of this remedial action are:

- Further treatability studies during remedial design to insure the implementability of hydrometallurgical processes, as well as continued study of other treatment alternatives.

- On-site hydrometallurgical treatment of the waste-fill materials (approximately 4000 cubic yards), perched water (approximately 1/2 million gallons) and contaminated near surface soils (approximatedly 1500 cubic yards);

- Treatment of the material to below health-based levels and back-filling the waste fill area with the treated materials. This area will then be covered with two feet of clean soil.

- Additional investigation of the groundwater to determine the extent of groundwater contamination;

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- Limited groundwater monitoring (i.e. for a minimum of three years), provided that the additional groundwater investigation establishes that there is no need for groundwater remediation; and

- Confirmatory air monitoring and re-sampling of soil in residential yards.

DECLARATION

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300, I have determined that the selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate for this remedial action, and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

Because this remedy will not result in hazardous substances remaining on-site above health-based levels, the five-year remedial action review will not apply to this action.

9-30-88
Date

William J. Muszynski
William J. Muszynski, P.E.
Acting Regional Administrator

soils") in an area which is in the direction of surface water runoff from the waste-fill area (i.e., south or downgradient). Since the number of valid soil samples is limited, the volume of contaminated soil has been calculated by multiplying the estimated areal extent of contamination by a depth of six inches. The volume of contaminated soil has been estimated at 1500 cubic yards using this conservative approach. The highest concentration of mercury detected in soils is 61.630 ppm.

Site Risks

An endangerment assessment was conducted to determine exposure routes and concentrations of mercury which may pose a risk to human health. The endangerment assessment evaluated the baseline public health risks associated with the site in the absence of any remedial action. The primary exposure routes of concern which were evaluated were ingestion of contaminated soils/waste-fill material and inhalation of mercury vapors.* Data gathered for the EPA Mercury Health Effect Update (1984) indicates that diet and ambient air inhalation yield an intake of methyl mercury that is 18% of the Reference Dose (the Reference dose is 0.0003 mg/kg-day). Therefore, in evaluating the risks posed by ingestion of contaminated soils/waste-fill material, the daily intake which would result in exceedence of 82% of the reference dose was calculated using various assumptions. This analysis indicates that mercury concentrations in excess of 38.8 ppm may result in exceeding the reference dose. The sampling data indicates that the concentrations of mercury in the soils and waste-fill area exceed this value. In addition, air modelling was conducted to predict the concentration of mercury vapors which could be emitted given the concentration of mercury detected in the soils and waste-fill materials. The modelling showed that soil concentrations in excess of 16.4 ppm may cause the EPA National Emission Standard for a Hazardous Air Pollutant (NESHAP) to be exceeded. The NESHAP for mercury is 1 ug/m^3. The modelling also indicates that there is a potential risk associated with vaporization of mercury from the waste-fill area. Additional air sampling will be conducted during the design to verify whether the NESHAP is being exceeded.

Scope of Response Action

The objectives of the remedial action are, in general, to achieve clean-up levels of mercury in the waste-fill area (including perched water) and downgradient soils which: adequately protect human health

*As discussed previously, the groundwater database for the site must be supplemented in order to fully characterize groundwater contamination. Therefore, a supplemental groundwater investigation will be conducted during design. Consequently, the risks posed by groundwater contamination will be evaluated after completion of the investigation.

performance standard for the treatment process would be determined by the maximum removal efficiency associated with the technology with due consideration to the corresponding incremental cost involved in achieving further removal. The mercury-laden liquid from the filtering stage would then be subjected to cementation or precipitation to remove the mercury. This result is achieved by bringing the liquid in contact with materials such as stainless steel, zinc, copper or aluminum.

During cementation, the mercury is exchanged with the metal and precipitated out. The liquid would then be recycled back through the process. It is anticipated that only one batch of leaching agent would be needed. Upon completion of the process, the remaining liquid would be treated on-site prior to discharge to a POTW. Further treatability studies will be conducted during design to optimize the treatment process. The process would be designed to meet or exceed levels protective of public health. Since the source of contamination would be treated and the residuals left on-site would be below health-based levels, no land use restrictions would be necessary. In addition, if further investigation reveals no significant ground water contamination, then only limited groundwater monitoring would be conducted with this alternative (i.e., a minimum of three years consistent with the description provided in Alternative 1).

Analysis of Remedial Action Alternatives

The remedial action alternatives described above, were then evaluated in accordance with the requirements of the National Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation and Liability Act as amended by the Superfund Amendments and Reauthorization Act of 1986 (CERCLA). Nine criteria relating directly to the factors mandated in Section 121 of CERCLA, including subsection 121(b)(1)(A-G) and EPA's Interim Guidance on Selection of Remedy (December 24, 1986 and July 24, 1987) were utilized for this evaluation and are as follows:

- Protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume
- Short term effectiveness
- Implementability
- Cost
- Community acceptance
- State acceptance

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Protection of human health and the environment is the central mandate of CERCLA. Protection is achieved primarily by taking appropriate action to ensure that there will be no unacceptable risks to human health or the environment.

Except for the No Action Alternative each of the alternatives affords adequate protection of public health and the environment.* Alternatives 4 and 7 afford protection by providing a combination of engineering (cap, slurry wall, etc.) and institutional controls (land use restrictions). Alternative 3 provides protection by fixing the waste which limits the availability of mercury for human exposure. Alternative 7 provides protection by removing the contaminated material from the site. Alternatives 8 and 9 provide protection through treatment of the waste which reduces the concentration of mercury down to or below health-based levels.

COMPLIANCE WITH ARARs

Section 121(d) of CERCLA requires that remedial actions comply with all applicable or relevant and appropriate Federal and State requirements for the hazardous substances, pollutants or contaminants that are present on site, as well as any action-specific and locational requirements.

Applicable requirements refer to those situations where the specific legal or regulatory jurisdictional prerequisites of a particular statute or regulation are met. Relevant and appropriate requirements apply only to on site portions of remedial actions and are those which were developed to address problems similar to those encountered at a site. A relevant and appropriate requirement must be complied with to the same extent as if it were applicable.

With respect to requirements which are chemical-specific for mercury contaminated soil and debris, there are no applicable or relevant and appropriate requirements (ARARs).** Therefore, an Endangerment Assessment was performed to determine the concentration of mercury that would result in an acceptable risk level if left on-site. All of the alternatives evaluated, with the exception of the No Action Alternative, will result in site remediation which would minimize exposure to mercury concentrations above acceptable health-based levels. Air modelling indicates that 16.4 ppm is the lowest concentration of mercury which would pose a risk to public health.

* Note, any potential risks posed by groundwater contamination will be addressed following the supplemental investigation to be conducted during design.

** Note, there are chemical specific ARARs for groundwater contaminated with mercury (i.e., the Maximum Contaminant Level promulgated pursuant to the Safe Drinking Water Act), however, the risks posed by groundwater contamination will be addressed using the data obtained during the additional groundwater investigation to be conducted during the design of the remedial action.

Air sampling will be conducted during remedial design to confirm the results of this air modelling. If the monitoring verifies this value, then 16 ppm will be the cleanup level for remedial action. However, if the air monitoring indicates that there are no levels exceeding the NESHAP, then 21 ppm, the lowest concentration of mercury which would pose a risk to public health through ingestion, will be used as the site cleanup level.

Potential action-specific ARARs were identified for the remedial alternatives which were evaluated. A discussion of such potential ARARs and the rationale for determining whether the requirement should be considered as an actual ARAR is presented below.

With respect to locational ARARs, the site appears to be in close proximity to known historic sites. A Stage IA survey will be conducted during design to identify any potential undocumented resources on or eligible for nomination to the National Register of Historic Places.

For the alternatives which involve landfill closure (Alternatives 4 and 7) the RCRA closure regulations would be relevant and appropriate. For Alternatives 4 and 7, the landfill would be closed in conformance with 40 CFR Part 264, Subpart N which describes the closure requirements for a RCRA hazardous waste landfill. Alternatives 3, 8 and 9 which treat the contaminated materials to below health-based levels would be closed consistant with a RCRA clean closure regulations.

For alternatives which involve discharge of perched water to a POTW, guidance from the EPA memorandum entitled "Discharge of Wastewater from CERCLA Sites into POTWs" would be used, as well as the permit requirements for the specific POTW. The guidance would preclude the use of a POTW which is out of compliance with its permit requirements. Accordingly, the treated perched water may only be discharged to a POTW that is permitted to accept such wastes and is operating in compliance with that permit. The on-site pretreatment must achieve the levels set forth in the POTW's permits.

The applicablity, relevance and appropriateness of the Land Disposal Restrictions (LDRs) under RCRA were considered with respect to the remedial alternatives evaluated. The LDRs would not be applicable since the contaminated materials are not hazardous wastes. With respect to relevancy and appropriateness, currently the only LDR treatment standards which have been promulgated are for non-soil and debris wastes. Treatment standards for soil and debris wastes are currently being developed by EPA. In the interim, because there are no treatment standards for soil and debris wastes and since the contaminated materials found at the site are not sufficiently similar to those for which such standards exist, the LDRs are not considered relevant and appropriate.

Section 121(d)(3) of CERCLA requires that if a remedial action involves off-site disposal at a RCRA hazardous waste landfill, such disposal may only take place if releases are not occuring from the unit which would receive the waste and any other releases from the disposal facility are controlled under a corrective action pursuant to RCRA. Alternative 7a, which provides for off-site disposal, will comply with this requirement.

While permits are not required for on-site remedial actions at Superfund sites, any on-site remedial action must meet the substantive requirements of the permitting process. Therefore, any alternative which includes on-site treatment (i.e., all alternatives except No Action) would be designed and implemented so as to comply with the substantive requirements of applicable permitting processes.

LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term effectiveness and permanence addresses the long-term protection and reliability of an alternative. This is a relative term and is therefore expressed in the degree of long-term effectiveness and permanence associated with an alternative in comparison to other alternatives being evaluated.

Alternative 1 The No Action Alternative offers no long-term protection to human health or the environment. The potential for direct contact with contaminated materials still exists. Furthermore, erosion from the waste-fill area would continue to contaminate downgradient (south of the waste-fill area) soils. This alternative will require long-term monitoring indefinitely. This alternative does not offer any degree of permanence.

Alternative 3 The Fixation Alternative would be somewhat effective in the long term in that contamination in excess of acceptable health-based levels would be bound up in the cement and thus exposure pathways (e.g., ingestion, inhalation) would be eliminated. However, the ability of this alternative to effectively prevent the migration of mercury from the fixed material indefinitely is uncertain. Therefore, long-term monitoring would be necessary and the possibility exists that other remedial actions may also be needed. Although quality control problems could be minimized by removing the waste and then processing it instead of in-situ fixation the waste remaining on-site would be above health-based levels. Therefore, this alternative would not be more permanent than Alternatives 7a, 8 and 9. The degree of permanence associated with this alternative is greater than that which would be achieved by Alternatives 1, 4, and 7 since the durability of cement is greater than the construction material which would be used to implement Alternatives 4 and 7.

Alternative 4 The Impervious Cap with Extraction Well Alternative is of limited effectiveness in the long term with respect to the reliabilty of the remedial action. There is the potential for remedy failure since the clay unit and underlying clay may not be adequate barriers to mercury migration. This potential appears to be further substantiated by the detection of mercury in the groundwater. Since the waste is left on site untreated, this alternative would require monitoring and maintenance indefinitely. As stated above, this alternative is considered less permanent than Alternative 3.

Alternative 7 The Excavation Alternative is of limited effectiveness in the long term with respect to its ability to function indefinitely. Although less likely, the potential for remedy failure exists, as with Alternative 4. The potential for leakage through the clays is mitigated relative to Alternative 4 by the installation of a synthetic membrane liner under the contaminated material and above the clay stratum. As with Alternative 4, this alternative would also require indefinite monitoring and maintenance. With respect to the degree of permanence, although this alternative offers a greater degree of permanence relative to Alternative 4, it is far less permanent than Alternative 3.

Alternative 7a Alternative 7 with Off-Site Disposal, calls for contaminated materials to be excavated down to acceptable health-based levels. Since all wastes in excess of health-based levels would be transported off site there would be limited groundwater monitoring to confirm that the action was satisfactorily completed and no long-term operation or maintenance. With respect to the site this alternative offers a higher degree of permanence than does Alternative 3.

Alternative 8 The Thermal Treatment Alternative is effective in the long term in that it reduces toxicity of contaminated material on site and decrease the concentration of mercury found on site to acceptable health-based levels. As with the preceding alternative, there would be limited confirmatory groundwater monitoring and no long term operation or maintenance. Since the toxicity and the concentration of mercury in the waste is reduced to health-based levels, this alternative offers a higher degree of permanence than does Alternative 3. With respect to the site, the degree of permanence associated with this alternative is equivalent to Alternative 7a. However, in a broader perspective this alternative is more permanent than Alternative 7a because the waste is treated instead of being relocated.

Alternative 9 The Hydrometallurgical Alternative is effective in the long term in that it effectively reduces the toxicity and concentration of mercury in the contaminated material on site resulting in a decrease in exposure to acceptable health-based levels. As with the preceding alternative, groundwater monitoring would be limited confirmatory sampling with no long-term operation or maintenance. Because the waste is treated this alternative has a higher degree of permanence associated with it than Alternative 3. The degree of permanence is essentially equal to Alternative 8.

REDUCTION OF TOXICITY, MOBILITY OR VOLUME

This evaluation criterion relates to the performance of a remedial alternative which involves treatment in terms of eliminating or controlling risks associated with the toxicity, mobility or volume of a hazardous substance. Since Alternatives 1, 4, 7 and 7a do not involve treatment these alternatives were not evaluated against this criterion.

With respect to toxicity, the data indicates that a substantial portion of the total mercury present is in the organic form. Organic mercury is much more toxic than inorganic mercury. Therefore, alternatives which convert organic mercury into inorganic mercury would result in a reduction in the toxicity of mercury.

Alternative 3 The Fixation Alternative is effective in reducing the mobility of the contaminant by preventing further erosion and reducing infiltration. This alternative, however, would increase the volume of contaminated material. The toxicity of the waste could potentially be reduced and exposure to mercury from the waste is also reduced because the waste is bound up with the cement.

Alternative 8 The Thermal Treatment Alternative would result in a substantial reduction of the volume of contaminated material on-site. Since the organic mercury is converted back into the elemental form, the toxicity of the waste is significantly reduced. The mobility of the waste is reduced proportionally to the reduction in concentration. This alternative would result in a reduction in the concentration of mercury in the contaminated material by roughly two orders of magnitude.

Alternative 9 The Hydrometallurgical Treatment Alternative would also result in a substantial reduction of the volume of contaminated material on-site. As with Alternative 8, the organic mercury is converted back into the elemental form, thus the toxicity of the waste is significantly reduced. In addition, the mobility of the waste is reduced proportionally to the reduction in concentration. This alternative would result in a reduction in the concentration of mercury in the contaminated material by roughly two orders of magnitude.

Short-Term Effectiveness

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

Alternative 1 The No Action Alternative does not offer any degree of protection, and therefore is not effective in the short-term. There are however, no adverse impacts associated with implementation of this alternative.

Alternative 3 The Fixation Alternative would involve excavation of contaminated material. In the short term, there would be a small potential for worker exposure to mercury contamination during consolidation of contaminated near-surface soils and during the fixation process. However, this concern would be addressed in the health and safety plan for construction activities. This alternative should take approximately 2 years to implement.

Alternative 4 The Cap with Extraction Well Alternative would also involve excavation of contaminated materials. Consequently, in the short term, there would be the potential for worker exposure to mercury contamination during consolidation of the near-surface soils. The health and safety plan would address minimizing this exposure. This alternative should take approximately 2 years to implement.

Alternative 7 The Excavation and Consolidation On-site Alternative would involve excavation of a greater volume of contaminated material (approximately 5500 cubic yards) relative to Alternatives 3 and 4 (1500 cubic yards). This may result in an incremental increase in the potential for worker exposure to mercury contamination during implementation. As stated above, this concern would be addressed in the health and safety plan. This alternative should take approximately 2 years to implement.

Alternative 7a Alternative 7 with Off-Site Disposal involves off-site disposal and would thus increase truck traffic in the area as well as the potential for accidents involving releases of contaminated materials. As with the preceding alternatives, in the short term there is the potential for worker exposure to mercury contamination during implementation. The health and safety plan would address minimizing this exposure. This alternative should take approximately a year and a half to implement.

Alternative 8 The Thermal Treatment Alternative, as with the preceding alternatives would involve the potential for worker exposure to mercury contamination during implementation. The health and safety plan would address minimizing this exposure. With this alternative mercury from the off-gases would be condensed and recovered, however, controls may be necessary to ensure that mercury and other vapors are not released above acceptable levels. This alternative should take approximately 2 years to implement

Alternative 9 The Hydrometallurgical Alternative, as with the preceding alternatives, involves the potential for worker exposure to mercury contamination during implementation. The health and safety plan would address minimizing this exposure. In addition, each of the leaching agents used in the process present health and safety and process control considerations. Specifically, for nitric acid, since the waste-material contains plastic there is the potential for formation of picric acid which is explosive; for cyanide there is the potential for evolution of hydrogen cyanide gas; and for hypochlorite there is the potential for evolution of chlorine gas. It should be noted, however, that these are standard processes which are used in industry. These potential health and safety concerns would be addressed in the design of the process. For example, the formation of picric acid would be controlled by adjusting the concentration of the acid, the formation of hydrogen cyanide gas would be controlled by buffering the pH with a base solution, and the formation of chlorine gas would also be eliminated by buffering the pH using a basic solution. This alternative should take approximately 2 years to implement.

IMPLEMENTABILITY

Implementability addresses how easy or difficult, feasible or infeasible it would be to carry out a given alternative. This covers implementation from design through construction and operation and maintenance.

The implementability of the alternatives is evaluated in terms of technical and administrative feasibility, the availability of needed goods and services. All alternatives evaluated are technically feasible. However, some implementation problems are inherent in each of the alternatives.

Alternative 1 The No Action Alternative does not have any implementation problems, however, it does not offer any degree of protection.

For alternatives which involve handling of mercury-contaminated soils it will be necessary to develop and implement a site specific health and safety plan to reduce the potential for worker exposure to mercury. Mercury contaminated material would be handled in each of the Alternatives with the exception of Alternative Number 1, the No Action Alternative.

Selected Remedy

The selected remedial action is Alternative 9: Hyrometallurgical Treatment.

This general type of treatment would be used for the contaminated near-surface soil, perched water and waste-fill materials (approximately 1500 cubic yards, 1/2 million gallons and 4000 cubic yards, respectively). This alternative involves putting the mercury into solution by using a leaching agent such as cyanide, hypochlorite or nitric acid. The mercury would then be recovered from the aqueous solution by using various metallurgical techniques such as filtration and cementation/precipitation. The waste would be mixed with the leaching agent until the desired level of mercury is extracted from the waste and put into solution. The process stream from the leaching stage would then be filtered. The residue from filtering would be disposed of in the former waste-fill area and capped with two feet of clean soil. The process would be designed to achieve treatment of mercury from the waste to below health-based levels (See ARAR discussion). Since it is anticipated that the treatment process could attain treatment of mercury to below acceptable levels, the actual performance standard for the treatment process would be determined by the maximum removal efficiency associated with the technology with due consideration to the corresponding incremental cost involved in achieving further removal. The mercury-laden liquid from the filtering stage would then be subjected to cementation or precipitation. This process is achieved by passing the liquid through a material such as stainless steel, zinc, copper or aluminum.

During cementation the mercury is exchanged with the metal and precipitated out. The liquid would then be recycled back through the process. It is anticipated that only one batch of leaching agent would be needed. Upon completion of the process, the remaining liquid would be treated on-site prior to discharge to a POTW. Further treatability studies will be conducted during design to optimize the treatment process. The process would be designed to meet or exceed levels protective of public health. The estimated cost associated with Alternative 9 is $1,912,870.

As discussed above, the location and number of existing monitoring wells are inadequate to fully characterize the extent of groundwater contamination at the site. Therefore, further investigation of the groundwater will be conducted during design of the remedial action. This work will include installation of additional groundwater monitoring wells and groundwater sampling. Additional remedial action may be necessary pending the results of this investigation. If further groundwater investigation determines that there are no current or future risks posed by groundwater contamination, then limited groundwater monitoring would be conducted to provide further verification (i.e., a minimum of three years). In addition, air modelling was used in the endangerment assessment to predict the concentration of mercury vapors which could be emitted given the concentration of mercury detected in the soils and waste-fill materials. The modelling showed that the concentration of mercury in soils and in the waste-fill area may cause the NESHAP to be exceeded. The NESHAP for mercury is 1 ug/m^3. Therefore, confirmitory air sampling will be conducted during the design to verify the whether the NESHAP is being exceeded. During design, confirmitory soil samples will also be collected from residential yards which are downgradient in terms of surface water runoff from the site.

Statutory Determinations

Section 121 of CERCLA mandates that EPA select a remedial action that is protective of human health and the environment, cost-effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Remedial actions in which treatment which permanently and significantly reduce the volume, toxicity or mobility of a hazardous substance is a principal element are to be preferred over remedial actions not involving such treatment.

Based upon the analyses presented herein the following conclusions are reached:

° Overall Protection of Public Health and the Environment

Alternative 9 provides protection through treatment of waste above health-based levels for mercury

° Compliance with ARARs

Alternative 9 would be designed to meet or exceed ARARs. As stated above, this alternative would reduce the concentration of mercury down to or below health-based levels in the absence of chemical specific ARARs for soils and debris. The residuals will be deposited on site and covered with clean soil consistent with a RCRA clean closure.

° Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

Alternative 9 is considered to be a permanent remedial action since the concentration of mercury remaining on site would be below health-based levels. For this reason Alternative 9 has a greater degree of permanence relative to Alternatives 1, 4 and 7 where wastes are left on-site, untreated, in concentrations exceeding health-based levels. Although Alternative 3 uses treatment to reduce the mobility of the waste (and possibly the toxicity) the concentration of mercury in the waste remaining on-site would be above health-based levels. Therefore, Alternative 9 is preferred over Alternative 3 because it does not require indefinite management and monitoring of the site.

The degree of permanence associated with Alternative 9 is equivalent to Alternatives 8 and 7a with respect to the site. The degree of permanence associated with Alternative 7a is limited in that it only addresses permanence in terms of on-site conditions. Alternatives 8 and 9 would be permanent with respect to off-site as well as on-site conditions.

Alternative 9 uses alternative treatment technologies to the maximum extent practicable since it includes treatment of all waste with mercury concentrations in excess of health-based levels. The other treatment alternatives (i.e., Alternatives 3 and 8) also require the treatment of all waste with mercury concentrations in excess of health-based levels. However, Alternative 3 does not provide for recovery of mercury from the waste. Thus, Alternatives 8 and 9 have the added benefit of using alternative treatment technologies to the maximum extent practicable while recovering mercury from the waste thereby resulting in the conversion of a waste into a usable material.

- Preference for Treatment as a Principal Element

  Alternative 9 satisfies the statutory preference for treatment as a principal element of a remedial action since it provides for treatment of organic mercury to inorganic mercury which significantly reduces the toxicity of the wastes.

- Cost-Effectiveness

  Although Alternative 9 is not the least costly treatment option it is cost-effective. The costs are reasonable in light of the relatively small incremental (approximately 1 million dollars) cost associated with attaining a permanent remedial action, with limited monitoring; no land use restrictions and which utlizes treatment as a principal element.

In summary, Alternative 9 is the selected alternative, it is protective of public health, is cost-effective, and utilizes treatment as a principal element. Alternative 9 would provide protection of public health by using treatment to reduce the concentration of mercury on site to below health-based levels (See ARAR discussion).

The treatment process employed would reduce the toxicity of the waste by converting organic mercury into a less toxic inorganic form and would reduce the volume of contaminated materials which are above health-based levels. Since the residual mercury concentration in materials left on site would be below health-based levels, this alternative is considered a permanent remedial action. Studies conducted by the U.S. Bureau of Mines and available information on related industrial processes suggest that this alternative could be implemented. Further bench and pilot scale studies would be required to optimize the treatment process and minimize any potential short-term impacts. Alternative 9 would be designed to meet or exceed ARARs. The estimated cost for implementing Alternative 9 is $1,912,870, which is reasonable in light of the degree of protection, treatment and permanence afforded by this alternative.

Currently, Alternative 9 appears to provide the best balance of trade-offs among the alternatives examined in detial with respect to the nine evaluation criteria. In addition to satisfying the statutory preference for remedies which utilize treatment as a principal element and for permanent remedies. EPA believes that Alternative 9 is implementable based on current information. However, since this alternative has not been fully demonstrated and further treatability studies are necessary, EPA believes that it is prudent to conduct additional treatability studies on other treatment options concurrently with those to be performed for Alternative 9. This approach would minimize any delay in remediating the site, in the event that hydrometallurgical treatment is not implementable.

Contaminant : MERCURY

ROD ID # EPA/ROD/R02-91/164 Site: FRONTERA CREEK

Location: RIO ABAJO, PR Operating Unit:

Media: SOIL
SEDIMENT

Keys: NONE

Contaminant: MERCURY
METALS

EPA Region: 2 ROD Date: 910930 EPA ID: PRD980640965

Estimated Costs: O&M Costs:

Abstract:

THE FRONTERA CREEK SITE IS COMPOSED OF 13 INDUSTRIAL FACILITIES AND 200 ACRES OF ASSOCIATED LAGOONS WITHIN THE MUNICIPALITY OF HUMACO, PUERTO RICO. THE SITE INCLUDES FRONTERA CREEK, THE INDUSTRIAL PROPERTIES ADJACENT TO THE CREEK, THE FRONTERA LAGOONS, AND THE CIUDAD CRISTIANA HOUSING DEVELOPMENT LOCATED ADJACENT TO THE CREEK. LAND SURROUNDING THE SITE CONSISTS OF MIXED RESIDENTIAL AND INDUSTRIAL AREAS, AND A WILDLIFE REFUGE. FROM 1971 TO 1981, SEVERAL INDUSTRIES WITHIN THE SITE INCLUDING TECHNICON ELECTRONICS USED MERCURY IN MANUFACTURING PROCESSES AND DISCHARGED WASTEWATER DIRECTLY INTO FRONTERA CREEK. THE COMMONWEALTH OF PUERTO RICO ENVIRONMENTAL QUALITY BOARD (EQB) FINED TECHNICON IN 1978 FOR THESE PROCESSES, RESULTING IN THE CESSATION OF ITS MERCURY DISCHARGES TO THE CREEK. DURING INVESTIGATIONS IN 1986, EPA IDENTIFIED MERCURY IN SURFACE SOIL AND SEDIMENT ON TECHNICON PROPERTY ASSOCIATED WITH THE STORAGE, USE, OR DISCHARGE OF MERCURY-CONTAINING COMPOUNDS. THIS RECORD OF DECISION (ROD) ADDRESSES CONTAMINATED SOIL AND SEDIMENT ON THE TECHNICON PROPERTY AND PROVIDES A FINAL REMEDY FOR THE SITE. THE PRIMARY CONTAMINANT OF CONCERN AFFECTING THE SOIL AND SEDIMENT IS MERCURY.

THE SELECTED REMEDIAL ACTION FOR THIS SITE INCLUDES EXCAVATING 180 CUBIC YARDS OF SOIL AND 370 CUBIC YARDS OF SEDIMENT CONTAMINATED WITH MERCURY; DEWATERING AND CONTAINING THE EXCAVATED MATERIAL, FOLLOWED BY DISPOSING OF THE MATERIAL OFFSITE AT A RCRA SUBTITLE D OR C WASTE FACILITY; PRETREATING WASTEWATER GENERATED FROM DEWATERING, FOLLOWED BY ONSITE DISCHARGE TO TECHNICON'S WASTEWATER TREATMENT PLANT, OR OFFSITE TO A LOCAL PUBLICLY OWNED TREATMENT WORKS (POTW); PERFORMING CONFIRMATORY SOIL SAMPLING IN THE REMEDIATED AREAS TO VERIFY THAT MERCURY CONCENTRATIONS IN RESIDUAL AND ONSITE MATERIALS DO NOT EXCEED THE CLEAN-UP LEVELS; AND REGRADING AND REVEGETATING THE REMEDIATED AREAS. THE ESTIMATED PRESENT WORTH COST FOR THIS REMEDIAL ACTION RANGES FROM $562,000 TO $730,000, BASED ON WHETHER THE WASTE IS DISPOSED OF AS A SOLID OR HAZARDOUS WASTE, RESPECTIVELY. THERE ARE NO O&M COSTS

ASSOCIATED WITH THIS REMEDIAL ACTION.

PERFORMANCE STANDARDS OR GOALS; CLEAN-UP LEVELS FOR THE SOIL AND SEDIMENT ONSITE WERE ESTABLISHED BASED ON A SITE-SPECIFIC RISK ASSESSMENT AND AN HI=1, AND INCLUDE MERCURY 35 MG/KG.

Remedy:

THIS ACTION ADDRESSES THE THREATS POSED BY THE SITE BY EXCAVATING MERCURY CONTAMINATED SEDIMENTS AND SOILS AT THE SITE.
THE MAJOR COMPONENTS OF THE SELECTED REMEDY INCLUDE:

* EXCAVATION OF 370 CUBIC YARDS OF MERCURY-CONTAMINATED SEDIMENTS IN THE TECHNICON DITCH.
* EXCAVATION OF 180 CUBIC YARDS OF MERCURY-CONTAMINATED SOILS AT THE TECHNICON FACILITY SURROUNDINGS.
* DEWATERING AND CONTAINMENT OF EXCAVATED MATERIAL.
* OFF-SITE DISPOSAL OF EXCAVATED MATERIAL AT A RCRA SUBTITLE D OR C WASTE FACILITY.
* PRETREATMENT OF WASTEWATER GENERATED FROM DEWATERING AND DISCHARGE TO TECHNICON'S WASTEWATER TREATMENT PLANT, A LOCAL POTW, OR AN ON-SITE TREATMENT PLANT.
* PERFORMANCE OF CONFIRMATORY SOIL SAMPLING IN THE REMEDIATED AREAS TO VERIFY THAT MERCURY CONCENTRATIONS IN RESIDUAL, ON-SITE MATERIALS DO NOT EXCEED THE REMEDIAL ACTION OBJECTIVE OF 35 PPM.
* REGRADING AND REVEGETATING THE REMEDIATED AREAS.

Text:

* EXCAVATION OF 370 CUBIC YARDS OF MERCURY-CONTAMINATED SEDIMENTS IN THE TECHNICON DITCH.

* EXCAVATION OF 180 CUBIC YARDS OF MERCURY-CONTAMINATED SOILS AT THE TECHNICON FACILITY SURROUNDINGS.

* DEWATERING AND CONTAINMENT OF EXCAVATED MATERIAL.

* OFF-SITE DISPOSAL OF EXCAVATED MATERIAL AT A RCRA SUBTITLE D OR C WASTE FACILITY.

* PRETREATMENT OF WASTEWATER GENERATED FROM DEWATERING AND

DISCHARGE TO TECHNICON'S WASTEWATER TREATMENT PLANT, A LOCAL POTW, OR AN ON-SITE TREATMENT PLANT.

* PERFORMANCE OF CONFIRMATORY SOIL SAMPLING IN THE REMEDIATED AREAS TO VERIFY THAT MERCURY CONCENTRATIONS IN RESIDUAL, ON-SITE MATERIALS DO NOT EXCEED THE REMEDIAL ACTION OBJECTIVE OF 35 PPM.

* REGRADING AND REVEGETATING THE REMEDIATED AREAS.

DECLARATION OF STATUTORY DETERMINATIONS

THE SELECTED REMEDY IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT,

COMPLIES WITH FEDERAL AND STATE REQUIREMENTS THAT ARE LEGALLY APPLICABLE OR RELEVANT AND APPROPRIATE TO THE REMEDIAL ACTION, AND IS COST EFFECTIVE. THIS REMEDY UTILIZES PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE FOR THIS SITE. HOWEVER, BECAUSE TREATMENT OF THE PRINCIPAL THREATS AT THE SITE WAS NOT FOUND TO BE PRACTICABLE, THIS REMEDY DOES NOT SATISFY THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT OF THE REMEDY. AS THIS REMEDY WILL RESULT IN NO HAZARDOUS SUBSTANCES REMAINING ON-SITE ABOVE HEALTH-BASED LEVELS, A FIVE YEAR REVIEW IS NOT REQUIRED.

CONSTANTINE SIDAMON-ERISTOFF DATE: 09/30/91
REGIONAL ADMINISTRATOR

#SLD
SITE LOCATION AND DESCRIPTION

THE FRONTERA CREEK SITE (THE "SITE") IS LOCATED ON THE EASTERN COAST OF PUERTO RICO WITHIN THE MUNICIPALITY OF HUMACAO AT APPROXIMATELY 18 DEGREES 9' NORTH LATITUDE AND 65 DEGREES 47' WEST LONGITUDE. A SITE LOCATION MAP IS PROVIDED AS FIGURE 1. THE SITE INCLUDES FRONTERA CREEK FROM EAST OF JUNQUITO WARD TO ITS ENTRY INTO THE CARIBBEAN SEA; THE 13 INDUSTRIAL PROPERTIES ADJACENT TO THE CREEK; THE NORTH, SOUTHEAST AND SOUTHWEST FRONTERA LAGOONS ALSO KNOWN AS THE SANTA TERESA LAGOONS; THEIR ASSOCIATED ABANDONED PUMP STATIONS WHICH WERE USED TO KEEP THE LAGOONS DRY FOR AGRICULTURAL PURPOSES AND THE CIUDAD CRISTIANA HOUSING DEVELOPMENT LOCATED ALONGSIDE THE CREEK. LAND USE IN THE AREA SURROUNDING THE SITE CONSISTS OF MIXED RESIDENTIAL, INDUSTRIAL AND WILDLIFE REFUGE.

THE SECTION OF FRONTERA CREEK WITHIN THE STUDY AREA EXTENDS FOR A DISTANCE OF APPROXIMATELY THREE MILES FROM ROUTE 925 TO EL MORRILLO, WHERE IT ENTERS THE CARIBBEAN SEA. IT IS A SMALL CHANNELIZED DRAINAGE DITCH THAT VARIES FROM 3 TO 45 FEET IN WIDTH AND FROM ABOUT 0.3 TO 6 FEET IN DEPTH. THE CREEK CHANNEL RUNS PAST THE 13 SITE INDUSTRIES, UNDER ROUTE 3 AND THEN PAST CIUDAD CRISTIANA BEFORE BISECTING THE FRONTERA LAGOONS AND INTERSECTING THE CARIBBEAN SEA AT EL MORRILLO.

DOWNSTREAM OF ROUTE 3, IN-STREAM FLOW IS NEGLIGIBLE AND THE CREEK CONSISTS PRIMARILY OF STAGNANT POOLS. EXCEPT FOR THE SECTION FROM THE PUMP STATION TO THE SEA, THE ENTIRE CREEK WITHIN THE STUDY AREA FLOWS THROUGH A MAN-MADE CHANNEL, CONSTRUCTED PRIOR TO THE 1960S TO IMPROVE COASTAL DRAINAGE.

THE CREEK RUNS BETWEEN THREE LARGE SHALLOW FRESHWATER LAGOONS WHICH ARE CURRENTLY OWNED BY THE PUERTO RICO DEPARTMENT OF NATURAL RESOURCES (DNR). THESE LAGOONS, WHICH COVER AN AREA OF APPROXIMATELY 200 ACRES, ARE IN HYDRAULIC CONNECTION UNDER THE CREEK. IN THE EARLY 1930S THE SECTION OF FRONTERA CREEK'S CHANNEL FROM ROUTE 3 TO THE SANTA TERESA PUMP STATION WAS CONSTRUCTED AND THE LAGOON AREAS WERE DRAINED FOR AGRICULTURAL PURPOSES, INCLUDING SUGARCANE, COCONUT AND LIVESTOCK PRODUCTION. WHEN THE DRAINAGE PUMPS LOCATED AT THE SANTA TERESA PUMP STATION CEASED OPERATIONS IN 1979, THE COASTAL LAGOONS REFILLED AND NOW SUPPORT AN ABUNDANT AND VARIED AQUATIC WILDLIFE COMMUNITY. THE DNR

CARBON DISULFIDE AND METHYL ETHYL KETONE WERE THE ONLY VOLATILE ORGANIC COMPOUNDS DETECTED ABOVE BACKGROUND CONCENTRATIONS IN SEDIMENT. THE HIGHEST CONCENTRATIONS OF THESE COMPOUNDS WERE FOUND IN ONE LAGOON SAMPLE. THE HIGHEST CONCENTRATIONS AT THE CREEK WERE DETECTED FAR DOWNSTREAM OF THE MOST LIKELY SOURCES OF THESE CHEMICALS, WHICH ARE VARIOUS INDUSTRIES WITHIN THE STUDY AREA. FURTHERMORE, THE PHYSICAL AND CHEMICAL PROPERTIES OF THESE VOLATILE ORGANIC COMPOUNDS ARE SUCH THAT THESE SAME COMPOUNDS SHOULD ALSO BE PRESENT IN SURFACE WATER, WHICH THEY ARE NOT, AT LEAST AT THE LOCATIONS WITH THE HIGHEST ALLEGED SEDIMENT

CONCENTRATIONS.

AVERAGE AND PEAK CONCENTRATIONS FOR INORGANIC HSLS FOUND AT THE CREEK WERE COMPARABLE TO BACKGROUND CONCENTRATIONS. A SUMMARY OF THE HSL DATA IS PROVIDED IN TABLE 12

AIR

MERCURY CONCENTRATIONS MEASURED IN AIR WITHIN THE STUDY AREA WERE BELOW THE NATIONAL EMISSION STANDARD FOR HAZARDOUS AIR POLLUTANTS (NESHAPS) OF 1 UG/M3 WHICH REPRESENTS AN ACCEPTABLE RISK LEVEL OF MERCURY IN THE AIR. ALSO, RESULTS WERE BELOW THE THRESHOLD LIMIT VALUE-TIME WEIGHTED AVERAGE (TWA) VALUE FOR MERCURY VAPOR OF 0.05 MG/M3. THIS REPRESENTS THE TWA CONCENTRATION FOR A NORMAL 8-HOUR WORKDAY TO WHICH WORKERS MAY BE EXPOSED WITHOUT ADVERSE EFFECTS.

AIR SAMPLES COLLECTED FOR THE ANALYSIS OF VOLATILE ORGANIC COMPOUNDS SHOWED THE PRESENCE OF METHYLENE CHLORIDE. THE HIGHEST CONCENTRATIONS OF METHYLENE CHLORIDE (840 PPB) WERE DETECTED ALONG TECHNICON-SQUIBB FENCE LINES. A SUMMARY OF THE AIR DATA IS PRESENTED IN TABLE 13.

BIOTA

ANALYTICAL DATA FROM THE BIOTA TISSUE SAMPLES INDICATE THAT THERE IS NO EVIDENCE OF SIGNIFICANT MERCURY CONTAMINATION IN FLORA OR FAUNA AT THE SITE. MERCURY CONCENTRATIONS IN ALL SAMPLES WERE BELOW THE FOOD AND DRUG ADMINISTRATION LEVEL OF 1 PPM.

THE ANALYTICAL RESULTS FOR THE OTHER HSL PARAMETERS INDICATE THAT BIOTA ARE NOT BEING IMPACTED BY THE SITE. POSITIVE HSL ANALYTICAL RESULTS WERE COMPARABLE TO BACKGROUND SAMPLES. RESULTS FOR THE BIOTA SAMPLES ARE PRESENTED IN TABLE 14 THROUGH TABLE 15.

#SSR
SUMMARY OF SITE RISKS

EPA CONDUCTED A RISK ASSESSMENT OF THE "NO-ACTION" ALTERNATIVE TO EVALUATE THE POTENTIAL RISKS TO HUMAN HEALTH AND THE ENVIRONMENT ASSOCIATED WITH THE SITE IN ITS CURRENT STATE AND WITH RESPECT TO FUTURE LAND USE. THE CONTAMINANTS OF CONCERN WERE IDENTIFIED BASED ON THEIR FREQUENCY OF DETECTION, DEGREE OF TOXICITY, DETECTION IN VARIOUS MEDIA, MOBILITY AND PREVALENCE IN THE ENVIRONMENT. THESE CHEMICALS ARE LISTED IN TABLE 16.

THE POTENTIAL EXPOSURE ROUTES IDENTIFIED AND EVALUATED IN THE RISK ASSESSMENT UNDER CURRENT AND FUTURE LAND-USE SCENARIOS ARE PRESENTED IN TABLE 17.

THE PATHWAYS EVALUATED INCLUDE:

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* EXPOSURE TO MERCURY FROM DERMAL CONTACT OF CONTAMINATED SOILS AND SEDIMENTS AT THE TECHNICON FACILITY WITHIN THE SITE.

* INHALATION EXPOSURE TO METHYLENE CHLORIDE RELEASED TO THE AIR BY STACK AND/OR FUGITIVE AIR EMISSIONS.

THE POTENTIALLY EXPOSED POPULATIONS UNDER CURRENT LAND USE ARE WORKERS AT THE TECHNICON FACILITY AND LOCAL RESIDENTS. POTENTIALLY EXPOSED POPULATIONS UNDER FUTURE LAND USE INCLUDE WORKERS AND FUTURE LOCAL RESIDENTS (ADULTS AND CHILDREN).

UNDER CURRENT EPA GUIDELINES, THE LIKELIHOOD OF CARCINOGENIC (CANCER CAUSING) AND NONCARCINOGENIC EFFECTS DUE TO EXPOSURE TO SITE CHEMICALS ARE CONSIDERED SEPARATELY. IT WAS ASSUMED THAT THE TOXIC EFFECTS OF THE SITE-RELATED CHEMICALS WOULD BE ADDITIVE. THUS, CARCINOGENIC AND NONCARCINOGENIC RISKS ASSOCIATED WITH EXPOSURES TO INDIVIDUALS WERE SUMMED TO INDICATE THE POTENTIAL RISKS ASSOCIATED WITH MIXTURES OF POTENTIAL CARCINOGENS AND NON-CARCINOGENS, RESPECTIVELY.

NONCARCINOGENIC RISKS WERE ASSESSED USING A HAZARD INDEX ("HI") APPROACH, BASED ON A COMPARISON OF EXPECTED CONTAMINANT INTAKES AND SAFE LEVELS OF INTAKE (REFERENCE DOSES). REFERENCE DOSES ("RFDS") HAVE BEEN DEVELOPED BY EPA FOR INDICATING THE POTENTIAL FOR ADVERSE HEALTH EFFECTS. RFDS, WHICH ARE EXPRESSED IN UNITS OF MILLIGRAM PER KILLOGRAM PER DAY (MG/KG-DAY), ARE ESTIMATES OF DAILY EXPOSURE LEVELS FOR HUMANS WHICH ARE THOUGHT TO BE SAFE OVER A LIFETIME (INCLUDING SENSITIVE INDIVIDUALS). ESTIMATED INTAKES OF CHEMICALS FROM ENVIRONMENTAL MEDIA (E.G., THE AMOUNT OF A CHEMICAL INGESTED FROM CONTAMINATED DRINKING WATER) ARE COMPARED WITH THE RFD TO DERIVE THE HAZARD QUOTIENT (HQ) FOR THE CONTAMINANT IN THE PARTICULAR MEDIUM. THE HI IS OBTAINED BY ADDING THE HAZARD QUOTIENTS (HQS) FOR ALL COMPOUNDS ACROSS ALL MEDIA. A HI GREATER THAN 1 INDICATES THAT POTENTIAL EXISTS FOR NONCARCINOGENIC HEALTH EFFECTS TO OCCUR AS A RESULT OF SITE-RELATED EXPOSURES. THE HI PROVIDES A USEFUL REFERENCE POINT FOR GAUGING THE POTENTIAL SIGNIFICANCE OF MULTIPLE CONTAMINANT EXPOSURES WITHIN A SINGLE MEDIUM OR ACROSS MEDIA. IF THE HI IS GREATER THAN UNITY AS A CONSEQUENCE OF SUMMING SEVERAL HAZARD QUOTIENTS (HQ) OF SIMILAR VALUE, IT WOULD BE APPROPRIATE TO SEGREGATE THE COMPOUNDS BY EFFECT AND BY MECHANISM OF ACTION TO DERIVE SEPARATE HAZARD INDICES FOR EACH GROUP. THE RDDS FOR THE CONTAMINANTS ARE PRESENTED IN TABLE 18 AND TEH HIS ARE IN TABLE 19.

THE HI FOR POTENTIAL EXPOSURE TO ADULTS FROM NONCARCINOGENIC SITE-RELATED MERCURY VIA DERMAL CONTACT WITH SOILS (8.1) AND VOLATILE ORGANIC COMPOUNDS (VOC) VIA AIR INHALATION (3.3) ARE ABOVE ONE, SUGGESTING THAT ADVERSE NONCARCINOGENIC EFFECTS ARE LIKELY TO OCCUR AT THE SITE. FURTHERMORE, THE HIS FOR A CHILD UNDER A FUTURE RESIDENTIAL EXPOSURE EXCEEDED 1 (I.E., THE MERCURY HI WAS 3.6,L THE VOC HQ WAS 35).

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A CONCENTRATION OF 35 PPM FOR MERCURY HAS BEEN ESTABLISHED AS THE CLEAN UP LEVEL FOR CONTAMINATED SOILS AND SEDIMENTS AT THE TECHNICON FACILITY. THIS CLEAN-UP LEVEL WILL RESULT IN A HI OF ONE. THEREFORE, A CONCENTRATION OF 35 PPM FOR MERCURY WILL BE PROTECTIVE OF HUMAN HEALTH UNDER ALL IDENTIFIED EXPOSURE ROUTES.

POTENTIAL CARCINOGENIC RISKS WERE EVALUATED USING THE CANCER SLOPE FACTORS DEVELOPED BY THE EPA FOR THE COMPOUNDS OF CONCERN. CANCER SLOPE FACTORS ("SFS") HAVE BEEN DEVELOPED BY EPA'S CARCINOGEN RISK ASSESSMENT VERIFICATION ENDEAVOR (CRAVE) FOR ESTIMATING EXCESS LIFETIME CANCER RISKS ASSOCIATED WITH EXPOSURE TO POTENTIALLY CARCINOGENIC CHEMICALS. SFS, WHICH ARE EXPRESSED IN UNITS OF (MG/KG-DAY), ARE MULTIPLIED BY THE ESTIMATED INTAKE OF A POTENTIAL CARCINOGEN, IN MG/KG-DAY, TO GENERATE AN UPPER-BOUND ESTIMATE OF THE EXCESS LIFETIME CANCER RISK ASSOCIATED WITH EXPOSURE TO THE COMPOUND AT THAT INTAKE LEVEL. THE TERM "UPPER BOUND" REFLECTS THE CONSERVATIVE ESTIMATE OF THE RISKS CALCULATED FROM THE SF. USE OF THIS APPROACH MAKES THE UNDERESTIMATION OF THE RISK HIGHLY UNLIKELY. THE AVAILABLE SFS FOR THE CONTAMINANTS OF CONCERN ARE LISTED IN TABLE 20 AND THE CANCER RISK LEVELS ARE PRESENTED IN TABLE 21.

FOR KNOWN OR SUSPECTED CARCINOGENS, THE USEPA CONSIDERS EXCESS UPPER BOUND INDIVIDUAL LIFETIME CANCER RISKS OF BETWEEN (10-4) TO (10-6) TO BE ACCEPTABLE. THIS LEVEL INDICATES THAT AN INDIVIDUAL HAS NOT GREATER THAN A ONE IN TEN THOUSAND TO ONE IN A MILLION CHANCE OF DEVELOPING CANCER AS A RESULT OF SITE-RELATED EXPOSURE TO A CARCINOGEN OVER A 70-YEAR PERIOD UNDER SPECIFIC EXPOSURE CONDITIONS AT THE SITE. THE CUMULATIVE UPPER BOUND RISK FOR ADULTS FOR ALL CARCINOGENS AT THE SITE IS 1.2 X (10-3) (CRISTIANA AND LOCAL RESIDENTS) UNDER CURRENT LAND USE SCENARIO AND 2.0 X (10-3) UNDER FUTURE LAND USE SCENARIO. THE CUMULATIVE UPPER BOUND RISK FOR CHILDREN FROM METHYLENE CHLORIDE AT THE SITE UNDER FUTURE LAND USE SCENARIO IS 1.1 X (10-3).

UNCERTAINTIES

THE PROCEDURES AND INPUTS USED TO ASSESS RISKS IN THIS EVALUATION, AS IN ALL SUCH ASSESSMENTS, ARE SUBJECT TO A WIDE VARIETY OF UNCERTAINTIES. IN GENERAL, THE MAIN SOURCES OF UNCERTAINTY INCLUDE:

* ENVIRONMENTAL CHEMISTRY SAMPLING AND ANALYSIS
* ENVIRONMENTAL PARAMETER MEASUREMENT
* FATE AND TRANSPORT MODELING
* EXPOSURE PARAMETER ESTIMATION
* TOXICOLOGICAL DATA

UNCERTAINTY IN ENVIRONMENTAL SAMPLING ARISES IN PART FROM THE POTENTIALLY UNEVEN DISTRIBUTION OF CHEMICALS IN THE MEDIA SAMPLED.

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CONSEQUENTLY, THERE IS SIGNIFICANT UNCERTAINTY AS TO THE ACTUAL LEVELS PRESENT. ENVIRONMENTAL CHEMISTRY ANALYSIS UNCERTAINTY CAN STEM FROM SEVERAL SOURCES INCLUDING THE ERRORS INHERENT IN THE ANALYTICAL METHODS AND CHARACTERISTICS OF THE MATRIX BEING SAMPLED.

UNCERTAINTIES IN THE EXPOSURE ASSESSMENT ARE RELATED TO ESTIMATES OF HOW OFTEN AN INDIVIDUAL WOULD ACTUALLY COME IN CONTACT WITH THE CHEMICALS OF CONCERN, THE PERIOD OF TIME OVER WHICH SUCH EXPOSURE WOULD OCCUR, AND IN THE MODELS USED TO ESTIMATE THE CONCENTRATIONS OF THE CHEMICALS OF CONCERN AT THE POINT OF EXPOSURE.

UNCERTAINTIES IN TOXICOLOGICAL DATA OCCUR IN EXTRAPOLATING BOTH FROM ANIMALS TO HUMANS AND FROM HIGH TO LOW DOSES OF EXPOSURE, AS WELL AS FROM THE DIFFICULTIES IN ASSESSING THE TOXICITY OF A MIXTURE OF CHEMICALS. THE UNCERTAINTIES ARE ADDRESSED BY MAKING CONSERVATIVE ASSUMPTIONS CONCERNING RISK AND EXPOSURE PARAMETERS THROUGHOUT THE ASSESSMENT. AS A RESULT, THE RISK ASSESSMENT PROVIDES UPPER BOUND ESTIMATES OF THE RISKS TO POPULATIONS NEAR THE SITE, AND IS HIGHLY UNLIKELY TO UNDERESTIMATE ACTUAL RISKS RELATED TO THE SITE.

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THE 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.

ENVIRONMENTAL EVALUATION

A COMPREHENSIVE AND QUALITATIVE ENVIRONMENTAL ASSESSMENT WAS PERFORMED TO COMPARE SPECIES DIVERSITY AND ABUNDANCE IN THE FRONTERA CREEK DRAINAGES WITH TWO CONTROL LOCATIONS.

IN GENERAL, THE FRONTERA LAGOONS AND THE MANDRI CANAL APPEAR TO REPRESENT THRIVING ECOSYSTEMS AS MEASURED QUANTITATIVELY BY SPECIES DIVERSITY AND ABUNDANCE, WITH HEALTHY POPULATIONS OF FISH, CRABS, AND WATER BIRDS COMPARED TO CONTROL SITES. FROM THIS PERSPECTIVE, NO NEGATIVE IMPACTS TO THESE ECOSYSTEMS ASSOCIATED WITH POTENTIAL HAZARDOUS SUBSTANCE RELEASES TO FRONTERA CREEK WERE DETECTED.

BY COMPARISON, FRONTERA CREEK ITSELF IS CLEARLY IMPOVERISHED IN THE NUMBER AND DIVERSITY OF SPECIES IT SUPPORTS. HOWEVER, THE GENERAL LACK OF SPECIES DIVERSITY AND ABUNDANCE IN THE CREEK APPEARS TO BE ATTRIBUTED TO THE PREVAILING LOW OR INTERMITTENT FLOW CONDITIONS, AND MORE IMPORTANTLY TO THE VERY LOW DISSOLVED OXYGEN LEVELS RECORDED IN MANY PARTS OF THE CREEK. SINCE MOST, IF NOT ALL, INDUSTRIAL DISCHARGES TO FRONTERA CREEK HAVE BEEN STOPPED FOR MANY YEARS, THESE DISSOLVED OXYGEN LEVELS ARE NOT LIKELY RELATED TO INDUSTRIAL DISCHARGES. IT IS POSSIBLE THAT THE LOW OXYGEN LEVELS MAY BE ATTRIBUTED IN PART TO THE RAW SEWAGE OBSERVED FLOWING INTO THE CREEK AT VARIOUS TIMES AND LOCATIONS FROM THE OBSERVED PRASA BROKEN SEWER LINE AND CIUDAD CRISTIANA PUMP STATION WHICH WAS INTERMITTENTLY BY-PASSED ALLOWING SEWER FLOW TO ENTER THE CREEK.

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THE BROKEN SEWER LINE WAS FIXED BY PRASA IN 1991.

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EVALUATES AND COMPARES THE COST OF THE RESPECTIVE ALTERNATIVES, BUT DRAWS NO CONCLUSIONS AS TO THE COST EFFECTIVENESS OF THE ALTERNATIVES. COST EFFECTIVENESS IS DETERMINED IN THE REMEDY SELECTION PHASE, WHEN COST IS CONSIDERED ALONG WITH THE OTHER BALANCING CRITERIA.

MODIFYING CRITERIA - THE FINAL TWO CRITERIA ARE REGARDED AS "MODIFYING CRITERIA", AND ARE TO BE TAKEN INTO ACCOUNT AFTER THE ABOVE CRITERIA HAVE BEEN EVALUATED. THEY ARE GENERALLY TO BE FOCUSED UPON AFTER PUBLIC COMMENT IS RECEIVED.

8. STATE ACCEPTANCE REFLECTS THE STATUTORY REQUIREMENT TO PROVIDE FOR SUBSTANTIAL AND MEANINGFUL STATE AND TRIBAL INVOLVEMENT.

9. COMMUNITY ACCEPTANCE REFERS TO THE COMMUNITY'S COMMENTS ON THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION. COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD, AND THE EPA'S RESPONSES TO THOSE COMMENTS, ARE SUMMARIZED IN THE RESPONSIVENESS SUMMARY WHICH IS APPENDED TO THIS ROD.

THE FOLLOWING IS A SUMMARY OF THE COMPARISON OF EACH ALTERNATIVE'S STRENGTHS AND WEAKNESSES WITH RESPECT TO THE NINE EVALUATION CRITERIA.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

WITH THE EXCEPTION OF ALTERNATIVE 1 (NO ACTION), AND ALTERNATIVE 2, ALL ALTERNATIVES DESCRIBED IN THIS ROD ARE PROTECTIVE OF PUBLIC HEALTH AND THE ENVIRONMENT. ALTERNATIVE 2 (LIMITED ACTION) IS NOT LIKELY TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT BECAUSE INSTITUTIONAL CONTROLS

WOULD NOT ENSURE THAT PEOPLE WOULD NOT COME IN CONTACT WITH THE CONTAMINATED SOILS AND SEDIMENTS. ALTERNATIVES 3, 4, 5, 6 AND 7 WOULD EITHER ELIMINATE OR CONTROL THE SOURCE OF CONTAMINATION AT THE SITE TO PROVIDE OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. THEREFORE, ALTERNATIVES 1 AND 2 WILL NOT BE DISCUSSED FURTHER.

COMPLIANCE WITH ARARS

THE CHEMICAL, ACTION, AND LOCATION-SPECIFIC REQUIREMENTS ARE PROVIDED IN TABLE 22. HOWEVER, BECAUSE THE REMEDIAL ACTION IS LIMITED TO THE TECHNICON DITCH AND FACILITY, WHICH DO NOT HAVE ANY SENSITIVE ENVIRONMENTS WITHIN THIS AREA, THERE ARE NO LOCATION-SPECIFIC ARARS FOR THIS REMEDIAL ACTION. AS NOTED IN TABLE 22, THERE ARE NO CHEMICAL-SPECIFIC ARARS AVAILABLE FOR MERCURY-CONTAMINATED SOILS OR SEDIMENTS. TYPICALLY, IF SUCH AN ARAR WERE AVAILABLE, IT WOULD ESTABLISH THE ACCEPTABLE MAXIMUM CONCENTRATIONS OF MERCURY IN SOILS AND SEDIMENTS.

IN CASES WHERE CHEMICAL-SPECIFIC ARARS ARE UNAVAILABLE, CERCLA REQUIRES THE COMPLETION OF A SITE-SPECIFIC RISK ASSESSMENT TO DETERMINE CONCENTRATIONS OF CONTAMINANTS IN MEDIA OF CONCERN THAT WOULD BE PROTECTIVE OF PUBLIC HEALTH AND THE ENVIRONMENT. ACCORDINGLY, A BASELINE RISK ASSESSMENT WAS PERFORMED FOR THE FRONTERA CREEK SITE AND REMEDIAL OBJECTIVES WERE ESTABLISHED FOR MERCURY IN SOILS AND SEDIMENTS. ALTERNATIVES 3 THROUGH 7 ATTAIN THE REMEDIAL ACTION OBJECTIVE OF INSURING NO EXPOSURES TO MERCURY IN SOILS AND SEDIMENTS IN EXCESS OF 35 PPM.

POTENTIAL ACTION-SPECIFIC ARARS FOR THE VARIOUS ALTERNATIVES ARE ALSO DISCUSSED IN SECTION 3 OF THE FEASIBILITY STUDY REPORT. ALTERNATIVES 3 AND 4, INCORPORATING OFF-SITE DISPOSAL, WOULD BE IMPLEMENTED SO AS TO COMPLY WITH ALL APPLICABLE RCRA REQUIREMENTS. ALTERNATIVES 5, 6, AND 7, WHICH INCLUDE ON-SITE REMEDIAL ACTIONS, WOULD HAVE TO BE DESIGNED AND IMPLEMENTED IN ACCORDANCE WITH THE SUBSTANTIVE REQUIREMENTS OF ANY OTHERWISE APPLICABLE PERMITS SUCH AS FOR AIR EMISSIONS.

LONG-TERM EFFECTIVENESS AND PERMANENCE

ALTERNATIVES 3 AND 4, WHICH INVOLVE THE EXCAVATION AND OFF-SITE DISPOSAL OF CONTAMINATED MATERIALS, OFFER THE HIGHEST DEGREE OF LONG-TERM EFFECTIVENESS AND PERMANENCE BY REMOVING THE MERCURY FROM THE SITE DOWN TO ACCEPTABLE CONCENTRATIONS. HOWEVER, THE EXTRA LONG-TERM EFFECTIVENESS AND PERMANENCE THAT ALTERNATVE 4 WOULD PROVIDE IS NOT NECESSARY BECAUSE DISPOSAL IN A PERMITTED LANDFILL WOULD BE MORE THAN ADEQUATE. ANY POTENTIAL THREATS TO HUMAN HEALTH AND THE ENVIRONMENT WILL BE ELIMINATED. THESE REMEDIAL ACTIONS WOULD PROVIDE FOR UNRESTRICTED LAND USE AND NO EXPOSURE IN THE AREA. UNDER THESE ALTERNATIVES, NO LONG-TERM MONITORING WOULD BE REQUIRED.

ALTERNATIVE 5 INVOLVES THE SOLIDIFICATION AND REDEPOSITION OF

CONTAMINATED SOILS. ALTHOUGH THIS IS AN EFFECTIVE TREATMENT FOR METALS, CONTAMINANTS WILL REMAIN ON SITE AND THE TIME PERIOD ASSOCIATED WITH THE LONG-TERM EFFECTIVENESS OF THIS ALTERNATIVE IS UNCERTAIN SINCE ANY FUTURE INTRUSIVE ACTIVITY IN THE DISPOSAL AREA MAY ORIGINATE A RELEASE. THEREFORE THIS ALTERNATIVE HAS LESS LONG-TERM EFFECTIVENESS THAN THE FULL OFF-SITE REMOVAL OR TOTAL DESTRUCTION OF ALL CONTAMINATED SOILS. ALTERNATIVE 6 USES A TREATMENT TECHNOLOGY THAT IS MORE EFFECTIVE IN THE LONG TERM BECAUSE THE MERCURY IS PERMANENTLY REMOVED FROM THE SOIL MATRIX. ALTERNATIVE 7, ON-SITE DISPOSAL WITHOUT TREATMENT WOULD NOT IMPLEMENT ANY PERMANENT TREATMENT TECHNOLOGY AND IS LESS EFFECTIVE IN THE LONG-TERM THAN TREATMENT OR OFF-SITE DISPOSAL IN A PERMITTED FACILITY. ALTERNATIVE 7 REQUIRES LONG-TERM MAINTENANCE OF THE CAP TO ENSURE LONG-TERM PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT.

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

ONLY ALTERNATIVE 6 USES A TREATMENT TECHNOLOGY. ALTERNATIVE 3 WOULD REDUCE THE MOBILITY WITHOUT TREATMENT BY REMOVING THE CONTAMINATED SOILS FROM THE SITE, BUT WOULD NOT REDUCE THE TOXICITY OR VOLUME. ALTERNATIVES 4 AND 5 WOULD REDUCE THE TOXICITY AND MOBILITY BUT WOULD INCREASE THE VOLUME BY THE ADDITION OF A STABILIZATION AGENT. IF THE MERCURY CAN BE EFFECTIVELY REMOVED FROM THE VAPOR PHASE, ALTERNATIVE 6 WOULD BEST MEET THE CRITERION BY REDUCING THE TOXICITY, VOLUME, AND MOBILITY. ALTERNATIVE 7 WOULD ONLY REDUCE THE MOBILITY OF THE CONTAMINATED SEDIMENTS AND SOILS.

SHORT-TERM EFFECTIVENESS

IN GENERAL, EFFECTIVE ALTERNATIVES WHICH CAN BE IMPLEMENTED QUICKLY WITH LITTLE RISK TO HUMAN HEALTH AND THE ENVIRONMENT ARE FAVORED UNDER THIS CRITERION. ALL OF THE ALTERNATIVES, WITH THE EXCEPTION OF ALTERNATIVE

6, WOULD TAKE APPROXIMATELY THE SAME AMOUNT OF TIME TO IMPLEMENT. ALTERNATIVE 6 WOULD REQUIRE AN EXTENSIVE TREATABILITY STUDY TO DEVELOP THE OFF-GAS TREATMENT TO REMOVE THE MERCURY FROM THE GAS, THEREBY INCREASING THE TIME TO DESIGN THIS REMEDY. FURTHERMORE, THE HIGH TEMPERATURE TREATMENT MAY INCREASE THE SHORT TERM RISKS TO PUBLIC HEALTH AND THE ENVIRONMENT DUE TO THE POSSIBLE HAZARD OF RELEASING MERCURY VAPOR INTO THE ATMOSPHERE. ALTERNATIVES 4 AND 5 WOULD ALSO REQUIRE A TREATABILITY STUDY DURING DESIGN, BUT THIS TECHNOLOGY IS MORE PROVEN, THUS THE TIME FRAME WOULD BE SHORTER THAN FOR ALTERNATIVE 6.

ALTERNATIVES 3 THROUGH 7 INCLUDE A SERIES OF ACTIVITIES THAT INVOLVE EXCAVATION, HANDLING, STORAGE, OFF-SITE TRANSPORTATION, AND/OR TREATMENT OF CONTAMINATED MEDIA. CONSEQUENTLY, THERE IS POTENTIAL FOR UNFAVORABLE SHORT-TERM HEALTH AND ENVIRONMENTAL IMPACTS. HOWEVER, THESE IMPACTS CAN BE MITIGATED BY IMPLEMENTING SITE SPECIFIC HEALTH AND SAFETY PLANS, INCLUDING THE USE OF PERSONAL PROTECTIVE EQUIPMENT DURING IMPLEMENTATION. IN ADDITION, SINCE ALTERNATIVES 3 AND 4 INVOLVE THE OFF-SITE TRANSFER AND DISPOSAL OF CONTAMINATED MEDIA, THERE WOULD BE AN INCREASE IN TRAFFIC IN THE AREA. THESE ISSUES COULD BE ADEQUATELY

MITIGATED BY DEVELOPING AND IMPLEMENTING APPROPRIATE CONTINGENCY PROCEDURES.

IMPLEMENTABLITY

ALTERNATIVES 3 AND 4 INVOLVE THE OFF-SITE DISPOSAL OF CONTAMINATED MATERIAL. THESE ALTERNATIVES MAY POSE IMPLEMENTATION PROBLEMS AS A PERMITTED SUBTITLE D OR C FACILITY WOULD HAVE TO BE LOCATED TO ACCEPT THE MATERIAL. THE TREATMENT COMPONENTS OF ALTERNATIVES 4 AND 5 USE STANDARD TECHNOLOGIES AND ARE IMPLEMENTABLE FROM AN ENGINEERING PERSPECTIVE. HOWEVER, ALTERNATIVE 5 WOULD POSE SOME IMPLEMENTATION PROBLEMS BECAUSE THE ADDITION OF A FIXATION/SOLIDIFICATION AGENT WOULD INCREASE THE VOLUME OF THE CONTAMINATED MATERIAL TO BE DISPOSED OF AT THE SITE. ALTERNATIVE 6 IS THE LEAST IMPLEMENTABLE ALTERNATIVE BECAUSE IT IS UNCERTAIN IF THE MERCURY CAN BE CONDENSED AND RECOVERED DUE TO THE LOW LEVELS OF MERCURY CONTAMINATION FOUND AT THE SITE.

COST

THESE COSTS ARE REPORTED ON THE BASIS OF NET PRESENT WORTH SO THAT ALL ALTERNATIVES CAN BE COMPARED ON THE SAME BASIS. THESE COST ESTIMATES ARE INTENDED TO PROVIDE A RANGE OF ACCURACY TO WITHIN A +50 PERCENT TO -30 PERCENT AND MAY CHANGE AS A RESULT OF DESIGN AND CONSTRUCTION MODIFICATIONS. THE LEAST COSTLY ALTERNATIVE IS ALTERNATIVE 2, LIMITED ACTION, WITH A PRESENT WORTH COST OF $209,000. ALTERNATIVE 7, ON-SITE CLOSURE WITHOUT TREATMENT IS THE NEXT LEAST COSTLY ALTERNATIVE WITH A PRESENT WORTH COST OF $442,000. ALTERNATIVE 6, EXCAVATION FOLLOWED BY ON-SITE THERMAL DESORPTION AND DISPOSAL IS THE MOST COSTLY ALTERNATIVE WITH A PRESENT WORTH COST OF $1,540,000.

STATE ACCEPTANCE

THE COMMONWEALTH OF PUERTO RICO ENVIRONMENTAL QUALITY BOARD CONCURS WITH THE SELECTED REMEDY.

COMMUNITY ACCEPTANCE

ALL COMMENTS SUBMITTED DURING THE PUBLIC COMMENT PERIOD WERE EVALUATED AND ARE ADDRESSED IN THE ATTACHED RESPONSIVENESS SUMMARY. IN GENERAL, THE COMMUNITY DID NOT SUPPORT THE REMEDY BECAUSE IT DID NOT INCLUDE A REMEDIAL ACTION FOR THE SOILS LOCATED AT THE CIUDAD CRISTIANA HOUSING DEVELOPMENT.

#DSR
DESCRIPTION OF THE SELECTED REMEDY

BASED ON THE RESULTS OF THE RI/FS REPORTS AND AFTER CAREFUL CONSIDERATION OF ALL REASONABLE ALTERNATIVES, EPA RECOMMENDS ALTERNATIVE 3 AS THE PREFERRED CHOICE FOR ADDRESSING THE CONTAMINATION OF THE

TECHNICON SOILS AND SEDIMENTS. THIS ALTERNATIVE INVOLVES:

1) EXCAVATION OF 370 CUBIC YARDS OF MERCURY-CONTAMINATED SEDIMENTS IN THE TECHNICON DITCH.

2) EXCAVATION OF 180 CUBIC YARDS OF MERCURY-CONTAMINATED SOILS IN THE TECHNICON FACILITY SURROUNDINGS.

3) DEWATERING AND CONTAINMENT OF EXCAVATED MATERIAL.

4) OFF-SITE DISPOSAL OF EXCAVATED MATERIAL AT A RCRA SUBTITLE D OR C WASTE FACILITY.

5) PRETREATMENT OF WASTEWATER GENERATED FROM DEWATERING AND DISCHARGE TO TECHNICON'S WASTEWATER TREATMENT PLANT, A LOCAL POTW, OR AN ON-SITE TREATMENT PLANT.

6) PERFORMANCE OF CONFIRMATORY SOIL SAMPLING IN THE REMEDIATED AREAS TO VERIFY THAT MERCURY CONCENTRATIONS IN RESIDUAL ON-SITE MATERIALS DO NOT EXCEED THE REMEDIAL ACTION OBJECTIVE OF 35PPM.

7) REGRADING AND REVEGETATING THE REMEDIATED AREAS.

#SD
STATUTORY DETERMINATIONS

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

THE SELECTED REMEDY PROTECTS HUMAN HEALTH AND THE ENVIRONMENT BY REMOVING CONTAMINATED SOILS AND SEDIMENTS AND ELIMINATING THE RISK FOR EXPOSURE. THIS ALTERNATIVE WILL ATTAIN THE REMEDIAL ACTION OBJECTIVE OF INSURING NO EXPOSURES TO MERCURY IN SOILS AND SEDIMENTS IN EXCESS OF 35 PPM AND WILL COMPLY WITH ALL RCRA APPLICABLE REQUIREMENTS FOR OFF-SITE DISPOSAL.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS OF ENVIRONMENTAL LAWS

A LIST OF ARARS FOR THE SELECTED REMEDY IS PRESENTED IN TABLE 23.

SINCE THE REMEDIAL ACTION IS LIMITED TO THE TECHNICON DITCH AND FACILITY, WHICH DO NOT HAVE ANY SENSITIVE ENVIRONMENTS WITHIN THIS AREA, THERE ARE NO LOCATION-SPECIFIC ARARS FOR THIS REMEDIAL ACTION. ALSO, THERE ARE NO CHEMICAL-SPECIFIC ARARS AVAILABLE FOR MERCURY-CONTAMINATED SOILS OR SEDIMENTS. REMEDIAL OBJECTIVES WERE ESTABLISHED FOR MERCURY IN SOILS AND SEDIMENTS BASED ON A SITE SPECIFIC RISK ASSESSMENT FOR THE SITE INSURING NO EXPOSURES TO MERCURY IN SOILS AND SEDIMENTS IN EXCESS OF 35 PPM.

THE OFF-SITE DISPOSAL WILL BE IMPLEMENTED AS TO COMPLY WITH ALL APPLICABLE RCRA REQUIREMENTS.

COST EFFECTIVENESS

THE SELECTED REMEDY IS COST EFFECTIVE BECAUSE IT HAS BEEN DEMONSTRATED TO PROVIDE OVERALL EFFECTIVENESS PROPORTIONAL TO ITS COSTS. THIS ALTERNATIVE INVOLVES A MINIMAL COST DUE TO THE RELATIVELY SMALL AMOUNT OF CONTAMINATED SOILS AND SEDIMENTS NEEDED TO BE EXCAVATED AND DISPOSAL OF.

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

EPA AND THE COMMONWEALTH OF PUERTO RICO HAVE DETERMINED THAT THE SELECTED REMEDY REPRESENTS THE MAXIMUM EXTENT TO WHICH PERMANENT SOLUTIONS AND TREATMENT TECHNOLOGIES CAN BE UTILIZED IN A COST EFFECTIVE MANNER FOR THE REMEDIATION OF THE CONTAMINATED SOILS AND SEDIMENTS AT THE TECHNICON FACILITY WITHIN THE SITE. DUE TO THE MINIMAL AMOUNT (550 YDS3) OF CONTAMINATED SOILS AND SEDIMENTS AT THE SITE, TREATMENT TECHNOLOGIES SUCH AS THERMAL DESORPTION ARE IMPRACTICAL BECAUSE OF THEIR VERY HIGH COST. FURTHERMORE, THE CONDENSATION OPERATION OF MERCURY OFF GASES RESULTING FROM THERMAL DESORPTION REPRESENTS A COMPLEX TECHNICAL ISSUE THAT WOULD REQUIRE CONSIDERABLE TIME AND EFFORT DURING THE DESIGN PHASE. SOLIDIFICATION AND DISPOSAL IN A PERMITTED LANDFILL WOULD NOT PROVIDE ANY MORE PROTECTION THAN DISPOSAL IN A PERMITTED LANDFILL WITHOUT SOLIDIFICATION. THEREFORE, IT WOULD NOT BE COST EFFECTIVE TO PROVIDE THIS TYPE OF TREATMENT BEFORE DISPOSAL.

THE CRITICAL DECISIONAL ROLE WAS GIVEN TO THE FIVE BALANCING CRITERIA OF "LONG-TERM EFFECTIVENESS AND PERMANENCE", "SHORT-TERM EFFECTIVENESS", "IMPLEMENTABILITY", "COST" AND "REDUCTION OF TOXICITY, MOBILITY, OR VOLUME." THE BALANCING CRITERIA ARE SUMMARIZED BELOW TO ASSESS THEIR COLLECTIVE IMPACTS ON THE REMEDY SELECTION PROCESS. FIRST, THE SELECTED REMEDY OFFERS THE HIGHEST DEGREE OF LONG-TERM EFFECTIVENESS AND PERMANENCE BY REMOVING THE MERCURY FROM THE SITE TO ACCEPTABLE CONCENTRATIONS AT A RELATIVELY MINIMAL COST. REGARDING "SHORT-TERM EFFECTIVENESS", THE SELECTED REMEDY PRESENTS MINOR PROBLEMS BY INCREASING TRAFFIC IN THE AREA, BUT THAT CAN BE ADEQUATELY MITIGATED BY DEVELOPING AND IMPLEMENTING APPROPRIATE CONTINGENCY PROCEDURES. OTHER OPTIONS SUCH AS THERMAL DESORPTION INCREASE THE SHORT-TERM RISKS TO PUBLIC HEALTH AND THE ENVIRONMENT DUE TO THE POSSIBLE HAZARD OF RELEASING MERCURY VAPOR INTO THE ATMOSPHERE. IN TERMS OF

"IMPLEMENTABILITY", THE SELECTED REMEDY MAY POSE IMPLEMENTATION PROBLEMS AS A PERMITTED SUBTITLE D OR C FACILITY WOULD HAVE TO BE LOCATED TO ACCEPT THE MATERIAL. OTHER OPTIONS SUCH AS THERMAL DESORPTION IS THE LEAST IMPLEMENTABLE, SINCE IT IS UNCERTAIN IF THE MERCURY CAN BE CONDENSED AND RECOVERED AT THE LOW LEVELS OF MERCURY CONTAMINATION FOUND AT THE SITE. THE "REDUCTION OF TOXICITY, MOBILITY OR VOLUME" WILL BE ACHIEVED TO SOME DEGREE BY, WITHOUT TREATMENT, EXCAVATING THE

CONTAMINATED SOILS AND SEDIMENTS AT THE SITE, THEREFORE ELIMINATING THE MOBILITY OF THE WASTE.

PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

THE SELECTED REMEDY DOES NOT SATISFY THE STATUTORY PREFERENCE FOR TREATMENT BECAUSE IT IS IMPRACTICAL TO DO SO AND NOT COST EFFECTIVE.

IMPLEMENTATION OF TREATMENT TECHNOLOGIES SUCH AS THERMAL TREATMENT TO TREAT A MINIMAL AMOUNT OF THE SITE WASTE MATERIAL (550 YDS3) CONTAMINATED WITH MERCURY AT RELATIVELY LOW CONCENTRATIONS IS NOT COST EFFECTIVE. FURTHERMORE, THERMAL TREATMENT OF MERCURY CONTAMINATED WASTES AT THE SITE IS IMPRACTICAL, SINCE IT MAY GENERATE INCOMPLETE COMBUSTION PRODUCTS THAT ARE DIFFICULT TO ASSESS AND CONTROL, THEREFORE POSING A RISK TO RESIDENTS AND WORKERS IN CLOSE PROXIMITY TO THE SITE. TREATMENT BY SOLIDIFICATION AND THEN DISPOSAL IN A PERMITTED LANDFILL WOULD NOT PROVIDE ADDITIONAL PROTECTIVENESS AND WOULD NOT BE COST EFFECTIVE.

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TABLE 13

SUMMARY OF AVERAGE ANALYTE CONCENTRATIONS DETECTED
AT AIR SAMPLING LOCATIONS
((VALUES IN MG/(M+3))

STATION NUMBER	MERCURY	ACETONE	METHYLENE CHLORIDE	ETHYL BENZENE	TOTAL XYLENE	TOLUENE
1	0.000043	0.018	0.059	0	0	00.006
2	0.000087	0	0.033	0	0.047	0.012
3	0.000031	NA	NA	NA	NA	NA
4	0.000031	NA	NA	NA	NA	NA
5	0.000055	0.055	2.101	0.014	0.012	0.021
6	0.002223	0	0.673	0	0.003	0.272
7	0.000245	0.453	0.841	0.019	0.039	0.029
8	0.000062	0.143	0.739	0		00.011
9	0.000111	NA	NA	NA	NA	NA
10	0.000050	0		0.054	0	00.016
11	0.000082	0	0.039	0	0.001	0.008

NA NOT ANALYZED