TETRA TECH EC, INC.

DRAFT PHASE III REMEDIAL ACTION PLAN REVISION 0

FIREWORKS I SITE
(FORMER FIREWORKS FACILITY)
HANOVER, MASSACHUSETTS
TIER 1A PERMIT #100223
RTN: 4-0090

November 2007

Prepared for:

The Fireworks Site Joint Defense Group

Prepared by:

Tetra Tech EC, Inc.
133 Federal Street
Boston, Massachusetts 02110
(617) 457-8200
(617) 457-8498 (Fax)

5.3 DETAILED SOIL ALTERNATIVE DESCRIPTIONS

The following sections provide a detailed description of the soil alternatives for each Risk Characterization Area (RCA) and RCA-specific assumptions made during the development of remedial alternatives for each RCA. The general assumptions made for soil alternatives are as follows:

For all soil alternatives that include excavation of soil, it has been assumed that backfill of the excavation to match existing grade would be required.

Backfill material will be clean material from local sources. Backfill material will be tested to ensure COCs levels are less than the soil PRGs established for the Site prior to its use. Backfilling of an excavation is not considered capping and therefore does not require long-term monitoring.

Excavated material will be required to pass the Paint Filter Liquids Test (PFLT) prior to transport for off-site disposal and material will be stabilized/solidified if necessary to pass the PFLT.

For areas requiring long-term monitoring of soil COC concentrations, a 40-year monitoring period was assumed.

Pretreatment by filtration of any groundwater incidental to the excavation area and truck transport and disposal of water at an off-site, permitted publicly owned treatment works (POTW) is assumed.

5.3.1 Upper North Area Soil Alternative Descriptions

In the Upper North Area, there were no human health or ecological PRG exceedances. There is one soil UCL exceedance (for antimony) at sample location NSR 01 (Figure 5-1). To address this exceedance, three soil alternatives were developed for the Upper North Area soil as follows:

No Action – Soil Alternative UNA-1;

Limited Action – Soil Alternative UNA-2; and

- Removal of soil in the area of the UCL exceedance for antimony – Soil Alternative UNA-3.

5.3.1.1 Soil Alternative UNA-1 – No Action

The No Action alternative serves as a baseline for comparison of overall effectiveness of the other remedial alternatives. The No Action alternative would not involve implementation of any remedial activities to remove, treat, or contain the COCs in Site soil within this Risk Characterization Area. This alternative relies on natural attenuation processes alone to potentially reduce the concentrations of the COCs in Site soil to potentially attain the ROs, but does not include post-remediation monitoring to assess future COC concentrations. The Site soil

in this Risk Characterization Area would be allowed to remain in its current condition; no activities would be undertaken to change the current conditions and no monitoring would be implemented.

5.3.1.2 Soil Alternative UNA-2 – Limited Action

The limited action alternative involves a combination of monitored natural attenuation (MNA) and non-engineering measures for the Site soil with UCL exceedances. Non-engineering measures would be implemented by the owner(s), Cooperating Parties, and/or regulatory agencies to reduce the potential of human receptors coming into contact with the soil in the area of the UCL exceedance.

Specifically, the components of this limited action alternative include:

Establishing a monitoring program to collect and analyze soil samples to track soil COC (antimony) concentrations over time. It is assumed that monitoring would occur once at 2 years, 5 years, and every 5 years after the year 5 monitoring through a 40-year monitoring period (or until such time as the antimony concentrations in the area fall below the corresponding UCL); and

- Implementing AULs for soil in the UCL exceedance area.

5.3.1.3 Soil Alternative UNA-3 – Excavation/Backfill with Off-Site Disposal

This removal action alternative involves a combination of excavation, backfill of the area excavated, and off-site disposal of the excavated soil with (UNA-3B) or without (UNA-3A) solidification/stabilization of the excavated soil as necessary for transport. No long-term monitoring would be required as no further potential risk would exist within this Risk Characterization Area after excavation and off-site disposal of the contaminated soil from the UCL exceedance area. It was assumed that the excavated soil could be disposed of locally at a permitted, non-Resource Conservation and Recovery Act (RCRA) landfill. To ensure complete removal of soil with concentrations above the UCL for antimony, an excavation depth of 1 foot was assumed.

Specifically, the components of this complete removal alternative include:

Excavation of approximately 142 cubic yards (cy) of soil from around sample location NSR01;

Backfill of the excavated area with clean material;

Solidify or stabilize excavated soils prior to transport for disposal, if necessary; and

- Transport excavated materials by truck to a local, permitted disposal facility for disposal.

5.3.2 Potential Greenway Area Soil Alternative Descriptions

In the Potential Greenway Area, there were no UCL exceedances or human health PRG exceedances. Mercury and thallium ecological PRG exceedances in surface soils exist within the Potential Greenway Area. To address these exceedances, four soil alternatives were developed for the Potential Greenway Area soil as follows:

No Action – Soil Alternative PGA-1;

Limited Action – Soil Alternative PGA-2;

Removal or Capping and Long-Term Monitoring (LTM) of Soil with Mercury Ecological PRG Exceedances – Soil Alternative PGA-3; and

- Removal or Capping and LTM of Soil with Mercury and Thallium Ecological PRG Exceedances – Soil Alternative PGA-4.

5.3.2.1 Soil Alternative PGA-1 – No Action

The No Action alternative serves as a baseline for comparison of overall effectiveness of the other remedial alternatives. See Section 5.3.1.1 for additional description of this alternative.

5.3.2.2 Soil Alternative PGA-2 – Limited Action

The limited action alternative involves MNA of the Site soil with the ecological PRG exceedances (Figure 5-2). Non-engineering measures would not be implemented because they are not effective in reducing the potential of ecological receptors coming into contact with the soil in the areas with ecological PRG exceedances.

Specifically, the components of this limited action alternative include:

- Establishing a monitoring program to collect and analyze soil samples to track soil COC (mercury and thallium) concentrations over time. It is assumed that monitoring would occur once at 2 years, 5 years, and every 5 years after the year 5 monitoring through a 40-year monitoring period (or until such time as the mercury and thallium concentrations in the area fall below the corresponding ecological PRGs).

5.3.2.3 Soil Alternative PGA-3 – Excavation/Backfill with Off-Site Disposal or Capping and LTM of Areas with Ecological Mercury PRG Exceedances

This alternative (Figure 5-3) involves a combination of excavation, backfill of the area excavated, and off-site disposal of the excavated soil with (PGA-3B) or without (PGA-3A) solidification/stabilization of the excavated soil as necessary for transport or engineered capping with long-term maintenance and monitoring of the capped area in areas with total mercury ecological PRG exceedances and MNA in areas with thallium ecological PRG exceedances. Non-engineering measures would not be implemented as they are not effective in reducing the

Specifically, the components of this partial removal or partial capping alternative include:

Excavation of approximately 10,601 cy of soil (Alternatives PGA-4A and PGA-4B);

Engineered capping of 286,215 sf of soil (Alternative PGA-4C [same footprint as the excavations in Alternatives PGA-4A and PGA-4B]);

Backfilling of the excavated areas with clean material from local sources (Alternatives PGA-4A and PGA-4B);

Solidifying or stabilizing excavated soil prior to transport for disposal, if necessary (Alternative PGA-4B);

Transporting excavated materials by truck to a local, permitted disposal facility for disposal (Alternatives PGA-4A and PGA-4B); and

- Establishing monitoring and maintenance program for the engineered cap (Alternative PGA-4C). The frequency of required monitoring and maintenance will be dependent upon the type of cap installed. For the purposes of this report, it has been assumed that the cap would require annual monitoring through a 40-year monitoring period and that maintenance would be required every 5 years.

5.3.3 Southern Disposal Area Soil Alternative Descriptions

In the Southern Disposal Area, there were UCL exceedances for lead; human health PRG exceedances for chromium, 1,1-dichloroethene (1,1-DCE), trichloroethene (TCE), and lead; and ecological PRG exceedances for antimony, barium, chromium, copper, lead, mercury, and zinc. To address these exceedances, five soil alternatives were developed for the Southern Disposal Area soil as follows:

No Action – Soil Alternative SDA-1;

Limited Action – Soil Alternative SDA-2;

Removal of Soil with UCL Exceedances – Soil Alternative SDA-3 (3A or 3B);

Removal of Soil with UCL Exceedances and Removal or Capping and LTM of Soils with Highest Human Health Risks (1,1 DCE PRG Exceedances) – Soil Alternative SDA-4 (4A, 4B,or 4C); and

- Removal of Soil with UCL Exceedances and Removal or Capping and LTM of Soil with Human Health and Ecological PRG Exceedances – Soil Alternative SDA-5 (5A, 5B, or 5C).

5.3.3.1 Soil Alternative SDA-1 – No Action

The No Action alternative serves as a baseline for comparison of overall effectiveness of the other remedial alternatives. See Section 5.3.1.1 for additional description of this alternative.

5.3.3.2 Soil Alternative SDA-2 – Limited Action

The limited action alternative involves a combination of MNA and non-engineering measures for the Site soil with UCL, ecological and human health exceedances. Non-engineering measures would be implemented by the owner(s), Cooperating Parties and/or regulatory agencies to reduce the potential of human receptors coming into contact with the soil in the area of the UCL and human health PRG exceedances. Although non-engineering measures are not effective in reducing the potential of ecological receptors coming into contact with the soil in the areas with ecological PRG exceedances, for the purposes of this report, the areas with only ecological PRG exceedances were not separated out for just MNA under this alternative (Figure 5-4).

Specifically, the components of this limited action alternative include:

Establishing a monitoring program to collect and analyze soil samples to track soil COC (lead, chromium, 1,1-DCE, TCE, antimony, barium, copper, mercury, and zinc) concentrations over time. It is assumed that monitoring would occur once at 2 years, 5 years, and every 5 years after the year 5 monitoring through a 40-year monitoring period (or until such time as the COC concentrations in the area fall below the corresponding UCL, human health PRG, or ecological PRG);

Implementing AULs for this area;

Installing and maintaining fencing and warning signs around the perimeter of the areas with UCL, ecological, and human health PRG exceedances; and

- Implementation of educational programs to inform future Site workers (utility and construction workers) and local recreational users engaged in potential soil disturbing activities of the health and safety considerations associated with COC-impacted soils. Site workers would receive pre-work briefings.

5.3.3.3 Soil Alternative SDA-3 – Excavation/Backfill with Off-Site Disposal of Areas with UCL Exceedances for Lead

This removal action alternative involves a combination of excavation of soil with UCL exceedances for lead, backfill of the area excavated, and off-site disposal of the excavated soil with (SDA-3B) or without (SDA-3A) solidification/stabilization of the excavated soil as necessary for transportation. All soil with human health and ecological PRG exceedances not co-located with UCL exceedances would be subject to MNA and non-engineering measures. As previously discussed in Section 5.3.3.2 above, areas with just ecological PRG exceedances outside areas with UCL exceedances have not been separated out for just MNA under this alternative (Figure 5-5). It was assumed that the excavated soil could be disposed of locally at a permitted, non-RCRA landfill. To ensure complete removal of soil with concentrations above the UCL for lead, an excavation depth of 3 feet was assumed.

Specifically, the components of this partial removal alternative to address UCL exceedances for lead include:

- Excavation of approximately 855 cy of soil (Alternatives SDA-3A and SDA-3B);
- Backfilling of the excavated areas with clean material from local sources (Alternatives SDA-3A and SDA-3B);
- Solidifying or stabilizing excavated soil prior to transport for disposal, if necessary (Alternative SDA-3B);
- Transporting excavated materials by truck to a local, permitted disposal facility for disposal (Alternatives SDA-3A and SDA-3B);
- Establishing a monitoring program to collect and analyze soil samples to track soil COC (lead, chromium, 1,1-DCE, TCE, antimony, barium, copper, mercury, and zinc) concentrations over time. It is assumed that monitoring would occur once at 2 years, 5 years and, every 5 years after the year 5 monitoring through a 40-year monitoring period (or until such time as the COC concentrations in the area fall below the corresponding human health PRG or ecological PRG);
- Implementing AULs for this area for areas with human health PRG exceedances;
- Installing and maintaining fencing and warning signs around the perimeter of the areas with ecological and human health PRG exceedances; and
- Implementation of educational programs to inform future Site workers (utility and construction workers) and local recreational users engaged in potential soil disturbing activities of the health and safety considerations associated with COC-impacted soils. Site workers would receive pre-work briefings.

5.3.3.4 Soil Alternative SDA-4 – Removal of Soil with UCL Exceedances and Removal or Capping and LTM of Soils with Highest Human Health Risks (1,1-DCE PRG Exceedances)

This removal action alternative involves a combination of excavation of soil with UCL exceedances for lead, backfill of the area excavated, and off-site disposal of the excavated soil with (SDA-4B) or without (SDA-4A) solidification/stabilization of the excavated soil as necessary for transport and excavation/backfill/off-site disposal with or without solidification/stabilization as necessary for transport or engineered capping with long term monitoring and maintenance of capped areas with 1,1-DCE PRG exceedances (SDA-4C). 1,1-DCE PRG exceedances were identified for utility and construction workers as well as adult and child recreational users. The remaining area with human health and/or ecological PRG exceedances not co-located with UCL exceedances is the area around sample location SWBP17. This area would be subject to MNA only because there are only ecological PRG exceedances in

- Implementation of educational programs to inform future Site workers (utility and construction workers) engaged in potential cap disturbing activities of the health and safety considerations associated with COC-impacted soils in Alternative SDA-5C. Site workers would receive pre-work briefings.

5.3.4 Southern Conservation Commission Area Soil Alternative Descriptions

In the Southern Conservation Commission Area (SCCA), there were no UCL exceedances or human health PRG exceedances. Mercury, chromium, copper, barium, and zinc ecological PRG exceedances in surface soils exist within the SCCA. To address these exceedances, four soil alternatives were developed for the SCCA as follows:

No Action – Soil Alternative SCCA-1;

Limited Action – Soil Alternative SCCA-2;

Removal or Capping and LTM of Surface Soils with Mercury Concentrations Greater Than or Equal to 1 mg/Kg – Soil Alternative SCCA-3 (3A, 3B or 3C); and

- Removal or Capping and LTM of Surface Soils with Ecological PRG Exceedances – Soil Alternative SCCA-4 (4A, 4B or 4C).

5.3.4.1 Soil Alternative SCCA-1 – No Action

The No Action alternative serves as a baseline for comparison of overall effectiveness of the other remedial alternatives. See Section 5.3.1.1 for additional description of this alternative.

5.3.4.2 Soil Alternative SCCA-2 – Limited Action

The limited action alternative involves MNA of the Site soil with the ecological PRG exceedances (Figure 5-9). Non-engineering measures would not be implemented because they are not effective in reducing the potential of ecological receptors coming into contact with the soil in the areas with ecological PRG exceedances.

Specifically, the components of this limited action alternative include:

- Establishing a monitoring program to collect and analyze surface soil samples to track soil COC (mercury, chromium, zinc, copper, barium, and zinc) concentrations over time. It is assumed that monitoring would occur once at 2 years, 5 years and, every 5 years after the year 5 monitoring through a 40-year monitoring period (or until such time as the COC concentrations in the area fall below the corresponding ecological PRGs).

assumed that the cap would require annual monitoring through a 40-year monitoring period and that maintenance would be required every 5 years;

Implementing AULs for the capped area (Alternative SCCA-4C);

Installing and maintaining fencing and warning signs around the perimeter of the capped areas (Alternative SCCA-4C); and

- Implementation of educational programs to inform future Site workers (utility and construction workers) engaged in potential cap disturbing activities of the health and safety considerations associated with COC-impacted soils (Alternative SCCA-4C). Site workers would receive pre-work briefings.

5.3.5 Marsh Upland Area Soil Alternative Descriptions

In the Marsh Upland Area, there are UCL exceedances for mercury, human health PRG exceedances for mercury, and ecological PRG exceedances for mercury, chromium, copper, and lead. To address these exceedances, four soil alternatives were developed for the Marsh Upland Area soil as follows:

No Action – Soil Alternative MUA-1;

Limited Action – Soil Alternative MUA-2;

Removal of Soil with UCL Exceedances – Soil Alternative MUA-3 (3A or 3B); and

- Removal of Soil with UCL Exceedances and Removal or Capping and LTM of Soil with Human Health and Ecological PRG Exceedances – Soil Alternative MUA-4 (4A, 4B, or 4C).

5.3.5.1 Soil Alternative MUA-1 – No Action

The No Action alternative serves as a baseline for comparison of overall effectiveness of the other remedial alternatives. See Section 5.3.1.1 for additional description of this alternative.

5.3.5.2 Soil Alternative MUA-2 – Limited Action

The limited action alternative involves a combination of MNA and non-engineering measures for the Site soil with UCL, ecological, and human health PRG exceedances. Non-engineering measures would be implemented by the owner(s), Cooperating Parties and/or regulatory agencies to reduce the potential of human receptors coming into contact with the soil in the area of the UCL and human health PRG exceedances (Figure 5-11). Although non-engineering measures are not effective in reducing the potential of ecological receptors coming into contact with the soil in the areas with ecological PRG exceedances, for the purposes of this report, the areas with only ecological PRG exceedances were not separated out for just MNA under this alternative.

Specifically, the components of this limited action alternative include:

Establishing a monitoring program to collect and analyze soil samples to track soil COC (mercury, chromium, copper, and lead) concentrations over time. It is assumed that monitoring would occur once at 2 years, 5 years, and every 5 years after the year 5 monitoring through a 40-year monitoring period (or until such time as the COC concentrations in the area fall below the corresponding UCL, human health PRG or ecological PRG);

Implementing AULs for the areas with UCL, ecological, and human health PRG exceedances;

Installing and maintaining fencing and warning signs around the perimeter of the areas with UCL, ecological, and human health PRG exceedances; and

- Implementation of educational programs to inform future Site workers (utility and construction workers) engaged in potential soil disturbing activities of the health and safety considerations associated with COC-impacted soils. Site workers would receive pre-work briefings.

5.3.5.3 Soil Alternative MUA-3 – Excavation/Backfill with Off-Site Disposal in Areas with UCL Exceedances for Mercury

This removal action alternative involves a combination of excavation of soil with UCL exceedances for mercury, backfill of the area excavated, and off-site disposal of the excavated soil with (MUA-3B) or without (MUA-3A) solidification/stabilization of the excavated soil as necessary for transport. All soil with human health and ecological PRG exceedances not co-located with UCL exceedances would be subject to MNA and non-engineering measures. As previously discussed in Section 5.3.3.2 above, areas with just ecological PRG exceedances outside areas with UCL exceedances have not been separated out for just MNA under this alternative (Figure 5-12). It was assumed that the excavated soil could be disposed of locally at a permitted, non-RCRA landfill. To ensure complete removal of soil with concentrations above the UCL for lead, excavation depths of 3 feet and 6 feet were assumed.

Specifically, the components of this partial removal alternative to address UCL exceedances for mercury include:

Excavation of approximately 353 cy of soil (Alternatives MUA-3A and MUA-3B) to address UCL exceedances for mercury;

Backfilling of the excavated areas with clean material from local sources (Alternatives MUA-3A and MUA-3B);

Solidifying or stabilizing excavated soil prior to transport for disposal (Alternative MUA-3B);

Transporting excavated materials by truck to a local, permitted disposal facility for disposal (Alternatives MUA-3A and MUA-3B);

Establishing a monitoring program to collect and analyze soil samples to track soil COC (mercury, chromium, copper, and lead) concentrations over time. It is assumed that monitoring would occur once at 2 years, 5 years, and every 5 years after the year 5 monitoring through a 40-year monitoring period (or until such time as the COC concentrations in the area fall below the corresponding human health PRG or ecological PRG) (Alternatives MUA-3A and MUA-3B);

Implementing AULs for areas with ecological and human health PRG exceedances not-co-located with UCL exceedances (Alternatives MUA-3A and MUA-3B) ;

Installing and maintaining fencing and warning signs around the perimeter of the areas with ecological and human health PRG exceedances not co-located with UCL exceedances (Alternatives MUA-3A and MUA-3B); and

- Implementation of educational programs to inform future Site workers (utility and construction workers) engaged in potential soil disturbing activities of the health and safety considerations associated with COC-impacted soils. Site workers would receive pre-work briefings (Alternatives MUA-3A and MUA-3B).

5.3.5.4 Soil Alternative MUA-4 – Removal of Soil with UCL Exceedances and Removal or Capping and LTM of Soil with Human Health and Ecological PRG Exceedances

This removal action alternative involves a combination of excavation of soil with UCL exceedances for mercury, backfill of the area excavated, and off-site disposal of the excavated soil with (MUA-4B) or without (MUA-4A) solidification/stabilization as necessary for transport or engineered capping with long-term monitoring and maintenance of capped areas with human health or ecological PRG exceedances outside the areas with UCL exceedances (MUA-4C). It was assumed that the excavated soil could be disposed of locally at a permitted, non-RCRA landfill. Excavation depth in areas outside the UCL exceedance areas was assumed to be 1 foot. To ensure complete removal of soil with concentrations above the UCL for lead, excavation depths of 3 feet and 6 feet were assumed.

Specifically, the components of this alternative to remove UCL exceedances for mercury and address human health and ecological PRG exceedances not co-located with the UCL exceedances include:

Excavation of approximately 353 cy of soil (Alternatives MUA-4A, MUA-4B, and MUA-4C) to address mercury UCL exceedances;

Excavation of an additional 867 cy of soil (Alternatives MUA-4A and MUA-4B) to address all human health and ecological PRG exceedances not co-located with UCL exceedances (Figure 5-11);

Engineered capping of 21,437 square feet (sf) of soils (Alternative MUA-4C) to address human health and ecological PRG exceedances not co-located with UCL exceedances (same footprint as the additional excavations [Alternatives MUA-4A and MUA-4B]) (Figure 5-13);

Backfilling of the excavated areas with clean material from local sources (Alternatives MUA-4A, MUA-4B, and MUA-4C);

Solidifying or stabilizing excavated soil prior to transport for disposal, if necessary (Alternative MUA-4B);

Transporting excavated materials by truck to a local, permitted disposal facility for disposal (Alternatives MUA-4A, MUA-4B, and MUA-4C);

Establishing a monitoring and maintenance program for the engineered cap (Alternative MUA-4C). The frequency of required monitoring and maintenance will be dependent upon the type of cap installed. For the purposes of this report, it has been assumed that the cap would require annual monitoring through a 40-year monitoring period and that maintenance would be required every five years;

Implementing AULs for the capped area (Alternative MUA-4C);

Installing and maintaining fencing and warning signs around the perimeter of the capped areas (Alternative MUA-4C); and

- Implementation of educational programs to inform future Site workers (utility and construction workers) engaged in potential cap disturbing activities of the health and safety considerations associated with COC-impacted soils (Alternative MUA-4C). Site workers would receive pre-work briefings.

5.3.6 Floodplain Area Soil Alternative Descriptions

In the Floodplain Area, there were no UCL exceedances or human health PRG exceedances. One surface soil ecological lead PRG exceedance was detected. To address this exceedance, three soil alternatives were developed for the Floodplain Area soil as follows:

No Action – Soil Alternative FPA-1;

Limited Action – Soil Alternative FPA-2; and

- Removal of Soil with Lead Ecological PRG Exceedance – Soil Alternative FPA-3 (3A and 3B).

5.3.6.1 Soil Alternative FPA-1 – No Action

The No Action alternative serves as a baseline for comparison of overall effectiveness of the other remedial alternatives. See Section 5.3.1.1 for additional description of this alternative.

5.3.6.2 Soil Alternative FPA-2 – Limited Action

The limited action alternative involves MNA of soil with the ecological PRG exceedance for lead. Non-engineering measures would be not implemented as they are not effective in reducing the potential of ecological receptors coming into contact with the soil in the areas with ecological PRG exceedances (Figure 5-14).

Specifically, the components of this limited action alternative include:

- Establishing a monitoring program to collect and analyze surface soil samples to track soil COC (lead) concentrations over time. It is assumed that monitoring would occur once at 2 years, 5 years, and every 5 years after the year 5 monitoring through a 40-year monitoring period (or until such time as the lead concentration in the area falls below the corresponding ecological PRG).

5.3.6.3 Soil Alternative FPA-3 – Excavation/Backfill with Off-Site Disposal

This removal action alternative involves a combination of excavation, backfill of the area excavated, and off-site disposal of the excavated soil with (FPA-3B) or without (FPA-3A) solidification/stabilization of the excavated soil as necessary for transport. No MNA would be required as no further potential risk would exist within the Floodplain Area after excavation and off-site disposal of the contaminated soil from the lead PRG exceedance area (Figure 5-14). It was assumed that the excavated soil could be disposed of locally at a permitted, non-RCRA landfill. To ensure complete removal of soil with concentrations above the ecological PRG for lead, an excavation depth of 0.5 foot was assumed.

Specifically, the components of this complete removal alternative include:

Excavation of approximately 211 cy of soil from around sample location FEMA 02 to address the lead PRG exceedance (Alternatives FPA-3A and FPA 3B);

Backfill of the excavated area with clean material from local sources (Alternatives FPA 3A and FPA 3B);

Solidifying or stabilizing excavated materials prior to transport for disposal, if necessary (FPA-3B); and

Transporting excavated materials by truck to a local, permitted disposal facility for disposal (Alternatives FPA-3A and FPA-3B).

8.1.3 Alternative 3 – Targeted Removal to Address Soil and Groundwater UCLs and Limited Removal of Sediments to Meet Human Health and Ecological THg PRGs (Overall Sediment SWA < 22.2 mg/Kg THg)

Alternative 3 includes enough sediment removal and sediment capping such that the overall (Site-wide) SWA will meet human health and ecological PRGs for THg, soil removal and backfill to address soil and groundwater UCLs, a long-term monitoring and maintenance program for the sediment cap, MNR for Site sediment, MNA for Site soil and groundwater, a monitoring program to collect and analyze mercury in fish, and non-engineering measures including AULs, fencing, warning signs, and educational programs (Figure 8-3). A list of the specific soil, sediment, and groundwater alternatives that make up Site-wide Alternative 3 are provided in Table 8-2. Site-wide Alternative 3 is a Permanent Solution. The overall estimated cost of this alternative is approximately $36.4 million. Tables B-3A and B-3B provide the details of the cost estimate for this Site-wide alternative.

8.1.4 Alternative 4 – Targeted Removal to Address Soil and Groundwater UCLs, Intermediate Range Soil Removal to Address Human Health and Ecological Risks not Co-located with UCL Exceedances and Limited Removal of Sediments to Meet Human Health and Ecological THg PRGs in Each Sediment RCA (Sediment SWA < 22.2 mg/Kg THg in Each Sediment RCA)

Alternative 4 includes enough sediment removal and sediment capping such that the SWA in each sediment RCA will meet human health and ecological PRGs for THg, soil removal and backfill to address soil and groundwater UCL exceedances and soil and groundwater human health and ecological PRG exceedances, a long-term monitoring and maintenance program for sediment capping, MNR for the Site sediment, MNA for the Site soil and groundwater, a monitoring program to collect and analyze mercury in fish, and non-engineering measures including AULs, fencing, warning signs, and educational programs (Figure 8-4). A list of the specific soil, sediment, and groundwater alternatives that make up Site-wide Alternative 4 are provided in Table 8-2. Site-wide Alternative 4 is a Permanent Solution. The overall estimated cost of this alternative is approximately $45.6 million. Tables B-4A and B-4B provide the details of the cost estimate for this Site-wide alternative.

8.1.5 Alternative 5 – "Approaching Background"

Alternative 5 will include sediment removal and capping such that the SWA for THg is approaching the background concentration of 0.62 mg/Kg, soil removal and backfill to address soil and groundwater UCL exceedances and soil and groundwater human health and ecological PRG exceedances, a long-term monitoring and maintenance program for the sediment cap, a long-term monitoring program for the Site groundwater, a monitoring program to collect and

sub-criteria ranking in each evaluation category (each of the eight evaluation categories were equally weighted) were averaged for each Site-wide alternative and these averages summed to calculate a numerical score for each Site-wide alternative. The overall rankings for each of the alternatives are presented in Table 8-5.

8.5 RECOMMENDED REMEDIAL ACTION ALTERNATIVE

The comparative evaluation of the five Site-wide alternatives ranked Alternative 3 as the alternative with the best (highest) ranking. Therefore, Site-wide Alternative 3 was selected as the recommended remedial action alternative for the Site because it achieves a level of No Significant Risk at a far lesser cost and less impact to the natural resources on the Site than Site-wide Alternatives 4 and 5.

8.6 FEASIBILITY EVALUATIONS

Under 310 CMR 40.0860, the following feasibility evaluations must be conducted after selection of a remedial action alternative:

1. Evaluating the feasibility of implementing a Permanent Solution;
2. Evaluating the feasibility of reducing the concentrations of OHM in the environment to levels that achieve or approach background;
3. Evaluating the feasibility of reducing the concentrations of OHM in soil at a disposal site to levels at or below applicable soil UCLs; and
4. Evaluating the feasibility of eliminating, preventing, or mitigating critical exposure pathway(s).

310 CMR 40.0860(5) further states that a remedial action alternative that would achieve the above conditions "shall be considered feasible" unless:

1. The alternative is not technologically feasible;
2. The costs of conducting, or the risks resulting from, the alternative would not be justified by the benefits as determined by a benefit-cost analysis;
3. Individuals with the expertise needed to effectively implement the alternative would not be available, regardless of arrangements for securing their services;
4. The alternative would necessitate land disposal other than at the site itself and no off-site facility is available in the Commonwealth or in other states that is in full compliance with all applicable federal and state regulatory requirements; or

The removal, capping, and long-term monitoring and maintenance techniques are all proven techniques for soil, sediment, and groundwater remediation. This alternative, when fully designed and implemented, can comply with the applicable regulatory requirements discussed in Section 8.2 above.

8.6.2 Benefit-Cost Analysis

The second feasibility evaluation required by 310 CMR 40.0860 is the benefit-cost analysis. Pursuant to 310 CMR 40.0860 (7), the benefits of implementing a remedial action alternative to achieve a Permanent Solution or Temporary Solution and the benefits, when performing a Permanent Solution, of reducing the concentrations of OHM in the environment at the disposal site to levels that achieve or approach background or reducing the concentrations of oil and hazardous material in soil at the disposal site to levels at or below applicable soil UCLs shall justify the related costs unless:

The incremental cost of conducting the remedial action alternative is substantial and disproportionate to the incremental benefit of risk reduction, environmental restoration, and monetary and non-pecuniary values;

The risk of harm to health, safety, public welfare, or the environment posed by the implementation of the alternative cannot be adequately controlled; or

The alternative would destroy more than 5,000 square feet of wetlands or wildlife habitat, or would otherwise result in a substantial deleterious impact to the environment and:

Other feasible Temporary or Permanent Solutions exist;

The oil and/or hazardous materials, if any, that have come to be located in such resources do not bio-accumulate and are not likely to migrate; and

The damage to such resources resulting from the implementation of the alternative would be permanent and irreparable.

For comparison purposes, both Site-wide Alternative 3 and Site-wide Alternative 5 have been evaluated using the following criteria, because in Alternative 5, concentrations of COCs are reduced to background.

The overall cost of Alternative 3 is approximately $36.4 million (M) whereas Alternative 5 has a cost of approximately $158.4M, representing an incremental cost difference of approximately $122M. To evaluate the relative reduction in risk, TtEC considered how each alternative would impact the number of human health and ecological receptors currently at risk, on both an area-weighted and non-area-weighted basis. Specifically, TtEC evaluated the reduction in the number of receptors at risk for each alternative. Table 8-6 provides a summary of that evaluation.

From this evaluation, both Alternative 3 and Alternative 5 had no human health receptors at risk. For ecological risks under Alternative 3, the number of ecological receptors not at risk on an

area-weighted basis was 39 percent for soil (50 percent non area-weighted) and 60 percent for sediment (74 percent non area-weighted). Under Alternative 5, the number of ecological receptors not at risk on an area-weighted basis was 49 percent for soil (95 percent non area-weighted) and 75 percent for sediment (82 percent non-area-weighted). This represents an incremental risk benefit for Alternative 5 of 10 percent for soil and 15 percent for sediment over Alternative 3. The incremental cost difference of $122M for Alternative 5 is substantial and disproportionate to the incremental reduction of risk for this alternative and thus does not justify its selection.

With regard to protection of nonpecuniary interest, such as aesthetic values and wetland and wildlife habitat, implementation of Alternative 5 ("approaching background") would result in a significant and extensive impact/destruction of habitat across the majority of the Site (82.74 acres would be disturbed under Site-wide Alternative 5). Although both alternatives would result in the loss of greater than 5,000 square feet of wetlands or wildlife habitat, Alternative 5 would involve substantially greater impacts and loss of habitat over Alternative 3 (only 8.86 acres would be disturbed under Site-wide Alternative 3) and would require significant efforts relative to environmental restoration.

Based on the feasibility evaluation and benefit-cost analysis above, Site-wide Alternative 3 is the recommended remedial action alternative for the Site. This alternative is protective of human health and the environment (meets Site-specific PRGs), reduces COC concentrations in soil to levels at or below applicable UCLs, substantially reduces both human health and ecological risks from their present levels, and the costs, when compared with Alternative 5, are proportionate to the benefits of implementing this remedial action alternative.

8.7 STEPS TO ACHIEVE A PERMANENT SOLUTION

The MCP in 310 CMR 40.0861(1)(h) requires that if the selected remedy is a Temporary Solution, the RAP must provide a description of "definitive and enterprising steps to identify and develop an alternative that is a likely Permanent Solution and a schedule for implementation of such steps."

As indicated in section 8.2 above, the only limiting factor to not being able to achieve a Permanent Solution at this time is the presence of OHM in isolated areas above applicable groundwater UCLs, specifically, lead in the Southern Disposal Area and mercury in the Marsh Uplands Area. In each area, the groundwater UCL exceedance is localized and attributable specifically to the presence of lead (in the SDA) and mercury (in the MUA) in the overburden soils directly above and upgradient of the groundwater UCL exceedance. The selected remedial alternative includes excavation of the source area soils in the SDA and MUA and monitoring of the groundwater to demonstrate that once the soils are removed, the groundwater will likely attenuate to levels below applicable UCLs (which may already have occurred). The removal of