CONESTOGA-ROVERS
& ASSOCIATES

285 Delaware Avenue, Suite 500, Buffalo, New York 14202
Telephone: (716) 856-2142 Fax: (716) 856-2160
www.CRAworld.com

November 15, 2011 Reference No. 047392

Mr. Gregory Sutton
Division of Environmental Remediation
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, NY 14203

Dear Mr. Sutton:

Re: Focused Feasibility Study
Frontier Chemical Site, Niagara Falls, New York

On behalf of the Frontier Chemical Site PRP Group, Conestoga-Rovers & Associates is submitting the Focused Feasibility Study Report for the Frontier Chemical Site in Niagara Falls, New York. The report provides the re-evaluation of remedial alternatives to address the source area soil on the Frontier Site as requested by the NYSDEC. This re-evaluation takes into consideration the additional soil characterization data that were collected during the Pre-Design Investigation Activities of 2008 through 2010 and the more recent advancements in remedial technologies in evaluating the remedial alternatives for the source area soil. As such, this report is a supplement to the May 2004 Feasibility Study Report prepared by Ecology & Environment Engineering, P.C.

The Frontier Group is prepared to meet with the NYSDEC should you decide that it would more quickly advance the resolution of this component of the Site's remedy.

Should you have any questions regarding the report, please do not hesitate to call.

Yours truly,

CRA INFRASTRUCTURE
& ENGINEERING, INC.

James K. Kay

JKK/lp/3
Encl. Report

cc: James Charles (NYSDEC)
Tim Webster (Frontier Chemical PRP Group)
Mike Bellotti (Frontier Chemical PRP Group)

CRA Infrastructure & Engineering, Inc.

FOCUSED FEASIBILITY STUDY

FRONTIER CHEMICAL SITE
NIAGARA FALLS, NEW YORK

Prepared by:
CRA Infrastructure & Engineering, Inc.

285 Delaware Avenue
Suite 500
Buffalo, New York 14202

Office: (716) 856-2142
Fax: (716) 856-2160

web: http:\\www.CRAworld.com

NOVEMBER 2011
REF. NO. 047392 (8)

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1.0 FOCUSED FEASIBILITY STUDY

This Focused Feasibility Study (FFS) evaluates potential remedial actions to address source area soil at the former permitted Treatment, Storage, and Disposal Facility (TSD) known as the Frontier Chemical Site (Site) with the intent to identify the appropriate remedial action in accordance with the federal and state requirements pertaining to hazardous waste sites.

In March 2006, the New York State Department of Environmental Conservation (NYSDEC) issued a Record of Decision (ROD) for the Site encompassing components that cover the Site features, overburden soil, overburden groundwater, and shallow bedrock groundwater (as Operable Unit 1) and the deep bedrock groundwater (as Operable Unit 2). For the overburden soil component of the remedy, the ROD selected source area soil excavation, trucking, and off-Site treatment / disposal with clean soil backfilling of the excavation as the appropriate methodology.

Through an Order on Consent and Administrative Settlement (Index #89-0571-00-01) entered into between the NYSDEC and the Potentially Responsible Parties Group (Frontier Group), a series of pre-design investigations were performed from 2008 through 2010 in support of the final remedial design. These additional investigations have provided the necessary information to finalize the remedy concerning the Site features and the overburden soil, shallow bedrock, and deep bedrock groundwater components. The additional investigations also provided further evaluation and insight into the remedy for the source area soil. The results of a treatability study performed during the remedial pre-design investigation and subsequent evaluations performed since, demonstrated that other remedial alternatives are viable, equally or more effective, more consistent with current sustainability goals, and will have significantly less impact on the surrounding area and off-Site environment than the ROD-selected source area soil remedy. The investigations improved the delineation of the source area soil allowing for a more accurate assessment of the Site conditions than was possible at the time the original pre-ROD Feasibility Study (Ecology & Environment Engineering P.C. - May 2004) was prepared.

Based upon this improved understanding of Site conditions, and considering the improvements in various remedial technologies over the past several years (particularly thermal treatment options), it is necessary and appropriate to re-evaluate the remedial alternatives for the source area soil to ascertain whether the excavation, trucking, and off-Site treatment/disposal option is still the appropriate alternative. Consequently, the NYSDEC has requested the Frontier Group to prepare and submit a FFS comparing the ROD-selected remedy with the thermal treatment remedy.

To the extent appropriate, information and text from the May 2004 Feasibility Study (2004 FS) have been incorporated into this FFS.

2.0 SITE BACKGROUND

2.1 SITE DESCRIPTION

This former permitted TSD Site is an inactive 9-acre parcel located at 4626 Royal Avenue within the industrial area of the City of Niagara Falls, New York (see Figure 2.1). The Niagara River lies about 1 mile south of the Site.

The Site is bordered to the north by property identified as owned by the Niagara Junction Railway Company, to the northwest by property identified as owned by the Niagara County Industrial Development Agency, to the south by Elkem Metal Company and to the southwest by Frank's Vacuum Truck Service (both along Royal Avenue), and to the east by 47th Street, beyond which is an industrial site (Strator).

The property had historically been the site of a chemical manufacturing facility and then later became a NYSDEC TSD-permitted facility storing and treating chemical wastes from 1974 until December 1992, when the facility closed. When in operation, approximately 25,000 tons of chemical wastes were treated each year.

2.2 SITE HISTORY

The Site was originally developed in 1906 by ISCO Chemical Company (ISCO) as a caustic-chlorine plant. During World War II, the International Minerals and Chemicals Corporation bought the Site and operated the facility as a caustic soda/potash and chlorine plant. In 1974, the Frontier Chemical Company, which provided hazardous and non-hazardous chemical treatment, moved their operations to the Site from Pendleton, New York. Frontier Chemical expanded its on-Site operations, which included wastewater treatment, fuels blending, and bulking chemicals for off-Site disposal.

In 1985, Frontier Chemical and a sister company, BLT Services, Inc., became wholly owned subsidiaries of Environmental Services Associates, Inc. (ESA). In February 1990, ROE Consolidated Holdings assumed operational control of ESA, which had operational control of the Site. The current site owner is 5335 River Road, Inc.

The facility ceased operations in December 1992. Beginning in 1999, most of the Site's buildings were demolished to grade and some rubble remains on Site. The Site remains a vacant industrial property and is secured with a perimeter fence.

2.3 SUBSURFACE CONDITIONS

The overburden thickness ranges from 14.7 feet to 17.1 feet. It consists of up to 2 feet of fill material (topsoil, silt, sand, and gravel with some cinder blocks, glass, wood, slag, bricks, crushed stone, concrete, and asphalt) followed by 12 feet to 15 feet of silty clays overlying the bedrock. The natural soils encountered generally consist of brown to red to green silty clays or fine sand and silt, with trace gravel at most localities.

Bedrock underneath the Site is classified as Lockport Dolomite.

2.4 NATURE AND EXTENT OF SOURCE AREA SOIL

Due to the long history of industrial activities at the Site, there are a variety of contaminants detected in the subsurface (soil and groundwater). The nature and extent of source area soil were originally determined through the remedial investigations that were performed on the Site in the 1990s and early 2000s. Additional delineation was performed as part of the pre-design work for the final remedy that has expanded the understanding of the nature and extent of source area soil. The additional investigation and pre-design was implemented pursuant to NYSDEC-approved work plans.

Although there are a variety of contaminants present on the Site, Volatile Organic Compounds (VOCs) are the primary contaminants of concern with regard to the soil remediation. This was determined in the 2004 FS based on the following factors:

- Historic operations at the Site included treatment and storage of chemical wastes that primarily included a variety of VOCs
- VOCs were the contaminants detected most frequently and at the highest concentrations
- In general, other types of contamination detected were located proximate to the areas significantly contaminated with VOCs

Consequently, VOCs were used in the Supplemental Remedial Investigation (2002) to delineate the source area soil that requires remediation. That report used the analytical data from 29 soil samples that had been collected and analyzed for chemical presence to define the extent of contamination in the soil. NYSDEC used this initial delineation to select the remedy for the source area soil in the ROD.

As part of the pre-design investigation performed by the Frontier Group in 2008 through 2010, an additional 174 samples were collected and analyzed to vastly improve the delineation of the nature and extent of the source area soil in both the horizontal and vertical direction. This delineation of the source area soil requiring remediation was approved by the NYSDEC on October 13, 2010 as part of the approval of the Remedial Pre-Design Investigation Report (CRA September 2010).

Using all of the available soil data, a set of figures depicting the source area soil approved for remediation is presented on Figures 2.2 through 2.9. Each successive figure presents a 2-foot interval of the soil horizon, starting with the interval at the ground surface and descending to the bottom interval overlying the top of bedrock which is located at a depth of approximately 16 feet below ground surface (ft bgs). As can be seen on the figures, there are considerable discontinuities in the adjoining and overlying/underlying areas that are considered source area soil. This is indicative of a multi-release site.

3.0 FOCUSED FEASIBILITY STUDY PROTOCOLS

This FFS has been prepared in general accordance with:

- Procedures recommended in the NYSDEC Division of Hazardous Waste Remediation, TAGM 4025 Guidance, *Guidelines for Remedial Investigation/Feasibility Studies* (March 1989)
- NYSDEC Division of Hazardous Waste Remediation TAGM 4030 Guidance, *Selection of Remedial Actions at Inactive Hazardous Waste Sites*, as revised May 1990
- U.S. Environmental Protection Agency (EPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (October 1988),
- NYSDEC DER-31 / Green Remediation, August 11, 2010.

By agreement with the NYSDEC, the evaluations performed in this FFS are limited to those pertaining solely to the two alternative remedies for source area soil currently under consideration for the Site. The two alternatives are:

1. The excavation, trucking, and off-Site treatment/disposal (with clean soil backfill) remedy originally selected in the 2006 ROD
2. The ex situ on-Site thermal treatment remedy (with all soil meeting treatment objectives being used as backfill)

3.1 POTENTIALLY APPLICABLE STANDARDS, CRITERIA, AND GUIDELINES AND OTHER CRITERIA

The first step in assessing remedial alternatives is to determine which Standards, Criteria, and Guidelines (SCGs) need be considered in the evaluation process. The SCGs include applicable or relevant and appropriate requirements and other applicable requirements. The SCGs include:

- *Applicable Requirements* are legally enforceable standards or regulations such as cleanup standards for contaminated soil that have been promulgated under state law.
- *Applicable or Relevant and Appropriate Requirements* (ARARs) include those requirements that have been promulgated under state law that may not be "applicable" to the specific contaminant released or the remedial actions contemplated, but are sufficiently similar to site conditions to be considered relevant

and appropriate. If a relevant or appropriate requirement is well suited to a site, it carries the same weight as an applicable requirement during the evaluation of remedial alternatives.

- *To Be Considered Criteria (TBCs)* are non-promulgated advisories or guidance issued by state agencies that may be used to evaluate whether a remedial alternative is protective of human health and the environment in cases where there are no standards or regulations for a particular contaminant or site condition. These criteria may be considered with SCGs in establishing cleanup goals for protection of human health and the environment.

The following sections present the three categories of SCGs: chemical-specific, location-specific, and action-specific.

3.1.1 CHEMICAL-SPECIFIC SCGs

Chemical-specific SCGs are typically technology- or health-risk-based numerical limitations on the contaminant concentrations in the ambient environment. They are used to assess the extent of remedial action required and to establish cleanup goals for a site. Chemical-specific SCGs may be directly used as actual cleanup goals or as a basis for establishing appropriate cleanup goals for the contaminants of concern at a site. Chemical-specific SCGs for on-Site soil at the Frontier Chemical Site are presented in Table 3.1. The list of chemical-specific SCGs was developed using the risk-based criteria presented as part of the qualitative risk assessment for the 2002 Supplemental Remedial Investigation.

3.1.2 LOCATION-SPECIFIC SCGs

Location-specific SCGs are site or activity-specific. Examples of location-specific SCGs include building code requirements and zoning requirements. Location-specific SCGs are commonly associated with features such as wetlands, floodplains, sensitive ecosystems, or historic buildings that are located on or close to the site (see Table 3.2).

3.1.3 ACTION-SPECIFIC SCGs

Action-specific SCGs are usually administrative or activity based limitations that guide how remedial actions are conducted. These may include record keeping and reporting

requirements; permitting requirements; design and performance standards for remedial actions; and treatment, storage, and disposal requirements (see Table 3.2).

The ARARs are used to develop remedial action objectives (RAOs) and to scope and formulate remedial action technologies and alternatives.

3.2 REMEDIAL ACTION GOALS AND OBJECTIVES

3.2.1 REMEDIAL ACTION GOALS

Proposed cleanup goals are developed by evaluating the identified SCGs for each contaminant. In general, this process selects standards as preliminary screening values. If no standards exist for a given contaminant (as was the case at the time the 2004 FS was prepared), the most appropriate criterion or guidance value is selected as a preliminary screening value. Where appropriate, the preliminary screening values are then compared to site-specific background values for naturally occurring compounds to confirm that no preliminary screening value is set below site background concentrations. If the site-specific background concentration is higher than the SCG-based preliminary screening value, then the background concentration is selected as the preliminary screening value. These preliminary screening values are compared to site data to identify which contaminants may require cleanup. These contaminants are then considered with regard to other factors influencing the need for cleanup, including comparison with regional background levels and an evaluation of contamination. The cleanup goals proposed by this process are compared again to site data in order to identify areas that must be addressed in the FS.

At the time the 2004 FS was prepared for the Site, there were no promulgated regulatory soil cleanup standards. As a result, the 2004 FS relied upon NYSDEC TAGM 4046, a New York State administrative guidance document that provided soil cleanup guidance values. The ROD issued for the Site also generally relied upon the administrative guidance provided in NYSDEC TAGM 4046. The ROD specified that source area soil exceeding 100 parts per million (ppm) of the total sum of VOCs (including monochlorotoluene) be removed and treated/disposed off Site. In December 2006, subsequent to issuance of the ROD, New York State promulgated 6 NYCRR Part 375-6 which provides applicable regulatory soil cleanup standards and criteria for the Site. The standards and criteria promulgated in 6 NYCRR Part 375-6 are different than the guidance values in NYSDEC TAGM 4046 and take into account the use and zoning applicable to a Site subject to remediation. Although the 6 NYCRR Part 375-6 criteria would require considerably less soil to be defined as source area soil requiring

remediation, the NYSDEC and the Frontier Group have agreed to rely upon the delineation of source area soil as determined through the NYSDEC-approved pre-design investigation as the horizontal and vertical limits of the soil requiring remediation. The extent of the source area soil requiring remediation is shown on Figures 2.2 through 2.9. This delineation is consistent with the remediation objectives of the 2006 ROD.

Thus the RAO for the Frontier Site will be to address the 15,000 cubic yards of source area soil identified through the pre-design investigation delineation.

The remedy selection process will be performed with the intent to ensure that this RAO is achieved.

3.2.2 REMEDIAL ACTION OBJECTIVES

This section presents the objectives for on-Site remedial actions that may be taken to protect human health and the environment. The RAOs were developed based on information contained in the 2002 Supplemental Remedial Investigation, which:

- Identified contaminants present in the environmental media in the study area
- Evaluated existing or potential exposure pathways in which the contaminants may affect human health and the environment
- Identified pathways having a moderate to high likelihood for exposure and
- Identified chemical-specific SCGs that apply to the likely exposure routes to establish the contaminants of concern and proposed cleanup goals for purposes of remediation

Based on the contaminants of concern and proposed cleanup goals, RAOs for the Site subsurface soils are to:

- Eliminate to the extent practicable the potential for direct human or animal contact with the contaminated subsurface soils
- Reduce the risk of further contamination of the groundwater by reducing the potential for leaching of contaminants into the groundwater, and
- Eliminate to the extent practicable the potential for human exposures to organic vapors in Site buildings, structures, and subsurface utilities

4.0 GENERAL RESPONSE ACTIONS AND IDENTIFICATION OF REMEDIAL TECHNOLOGIES

General response actions are remedial approaches encompassing those actions that will satisfy the RAOs. General response actions may include treatment, containment, disposal, institutional controls, or a combination of these, if required, to address source area soil impacts and to be effective in meeting all of the RAOs. The general response actions and remedial technologies evaluated for the source area soil were subject to preliminary screening and assessment in the 2004 FS. In accordance with guidance documents issued by NYSDEC (TAGM 4030) and the EPA (Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA [October 1988]), the criteria used for preliminary screening of general response actions and remedial technologies included effectiveness, implementability, and relative cost. Once the preliminary screening of general response actions is complete and viable remedial technologies identified, a more thorough screening is performed that assesses additional factors such as long and short term impacts, land use, reduction in toxicity, mobility, and volume, etc.

Following through the rest of the evaluation process in the 2004 FS resulted in NYSDEC's selection of excavation, trucking, and off-Site treatment/disposal as the soil remedy. Given the success of on-Site treatment methods in the past several years and the improved characterization of Site conditions now available, the evaluation process is being repeated to take into account the new information and to compare the previously selected active remedial technology to a new proposed on-site thermal treatment remedial technology. Thus, in addition to the "no action" alternative, the evaluations in this FFS will focus on two active remedial technologies:

1. The excavation, trucking, and off-Site treatment/disposal remedy that was selected in the 2006 ROD
2. The excavation and on-Site thermal treatment of soil, as evolved as a viable remedy over the past several years and as effectively implemented at other VOC sites across the State

For the source area soil remedy, various technology components were evaluated under the 2004 FS. To the extent appropriate, this FFS relies upon this past evaluation process. Only a brief discussion of the previous technologies evaluated and screened is included in this FFS.

It is noted that the other components of the remedy for the Site have already been resolved and some have even been implemented. Some of these remedial components also have an influence on the soil remedy selection. To the extent that these other remedial components are already in place or contemplated, they will be taken into consideration in the evaluation process for the Site's soil remedy.

4.1 NO ACTION

The No Action response is primarily used as a basis for comparison with other alternatives. Under the No Action response, no remedial measures are taken to improve environmental conditions with regard to the soil at the Site. As described below, there are no complete pathways for exposure to residual materials under existing Site conditions and current (and contemplated future) use scenarios. However, it is recognized that the "no action" alternative does not reduce the volume, mobility, or toxicity of the hazardous constituents in the Site soil beyond the reductions that are achieved through the ongoing natural attenuation mechanisms.

In the case of the Site soil, the No Action Alternative includes the engineering control measures for the Site that are already in place. These engineering controls include the following:

i) The overburden and shallow bedrock groundwater that is impacted by source area soil is captured by the City of Niagara Falls (City) sewer system that is located on Royal Avenue and 47th Street. This groundwater is then treated at the City's wastewater treatment facility. A Significant Industrial User Permit has been issued by the Niagara Falls Water Board allowing this naturally occurring groundwater capture and treatment remedy to continue under proper authorization and control. This groundwater remedy will supplement any remedy selected for the source area soil.

ii) The deep bedrock groundwater has been assessed and has been determined to be unaffected or minimally impacted by source area soil. A monitored natural attenuation remedy has been selected for the deep bedrock groundwater and therefore will supplement any remedy selected for the source area soil.

iii) The Site is enclosed within a fence and signs have been posted.

iv) The Site is generally covered with asphalt, concrete, or clean soil that prevents contact with impacted soil. This cover will be reinstated and improved (by whatever means deemed appropriate by the Frontier Group in consultation with the NYSDEC) following implementation of the soil remedy.

4.2 INSTITUTIONAL CONTROL

The institutional control response is not intended to reduce the toxicity, mobility, or volume of hazardous Site contaminants of concern, but to reduce the potential for human and wildlife exposure to those contaminants of concern. Institutional controls may include controls to restrict or limit the use of the Site or the contaminated media until such time that it is restored to acceptable quality consistent with the intended use. Implementation of a long-term monitoring program to track contaminant migration and transport, and/or development of protective work procedures to reduce the potential for exposure, will be put in place under the Site Management Plan that will be developed as a component of the Final Remedial Design.

The Institutional Controls that could be put in place to augment the engineering controls that have already been implemented are as follows:

i) Groundwater use from beneath or immediately adjacent to the Site will be restricted. Authorization from the NYSDEC will be required for all activities associated with groundwater removal or manipulation to ensure that Site groundwater is not used for inappropriate uses and that chemicals do not migrate off-Site in an unacceptable or undesirable manner via natural or imposed groundwater flow.

ii) The property owner of the Frontier Site has agreed to implement deed restrictions which will be filed to ensure that future owners and neighbors are aware of the chemicals on-Site and the restrictions on Site use. The restrictions will cover use of the Site as a commercial/industrial property (consistent with current zoning), with protection when subsurface work is performed, protection from vapor emissions, and cover maintenance.

4.3 EXCAVATION, TRUCKING, AND OFF-SITE TREATMENT / DISPOSAL

This action involves excavation of contaminated soils within the areal and vertical limits of the source area soil defined during the pre-design soil characterization program. This soil would be excavated, loaded onto trucks, and shipped to an off-Site facility for treatment and/or disposal at a permitted solid waste facility. While some of the impacted soil would be permitted for direct disposal, a portion of the soil would have to be treated prior to disposal in order to comply with the restrictions that regulate

impacted soil disposal at the permitted solid waste facilities. Some of the impacted soil would require incineration due to the elevated concentrations of some of the source area soil. Fill material from a regional borrow pit would be used as a source of backfill that would require excavation, loading, and trucking back to the Site.

Through discussion with the NYSDEC, it has been determined that the soil that has to be excavated to access the source area soil can be set aside temporarily and used as backfill for the excavation once all of the source area soil has been removed. Air vapor control measures and appropriate air monitoring to protect workers and neighboring occupied properties will be an integral component of this technology.

The preliminary screening of this technology is provided in the following:

- **Effectiveness.** Excavation and treatment/disposal of contaminated soil at a permitted facility is an effective method of reducing potential for direct contact with contaminated soils. In addition, this action reduces the potential for future contamination of groundwater. Incineration or other treatment of the soil would be effective in reducing the volume and mobility of soil contamination. Placing excavated or treated materials in a permitted solid waste facility reduces the risk to human health and the environment since the materials would be in a secure location with environmental controls and monitoring.
- **Implementability.** Contractors, treatment facilities, and/or disposal facilities are available to implement this technology. Preliminary treatability studies have been performed to evaluate the level of treatment required for the various soil intervals (i.e., thermal treatment - low or high temperature, chemical oxidation, etc.) in order to be acceptable for placement in a landfill.
- **Cost.** The cost of implementing excavation is expected to be moderate to high in comparison with the other technologies. Vapor suppression and/or soil containment structures would be necessary to limit off-Site vapor migration, which will further increase costs associated with excavation activities. The cost for off-Site treatment and disposal is high but may be cost effective when considering the lifetime for treatment and operation/maintenance costs of other technologies.

4.4 EXCAVATION AND ON-SITE TREATMENT / DISPOSAL

This action involves excavation of contaminated soils within the areal and vertical limits of the source area soil defined during the NYSDEC-approved pre-design soil characterization program. This soil would be treated on-Site in a thermal desorption

unit that would be mobilized to the Site. Following all the procedures necessary for permitting such a unit (i.e., test burn, etc.), the unit would be placed into service and the source area soil would be processed. The off-gases from the thermal desorption unit would be scrubbed and cleaned to comply with air regulations.

Through discussion with the NYSDEC, it has been determined that the soil that has to be excavated to access the source area soil can be set aside temporarily and used as backfill for the excavation once all of the source area soil has been removed. Air vapor control measures and appropriate air monitoring to protect workers and neighboring occupied properties will be an integral component of this technology.

The preliminary screening of this technology is provided in the following:

- **Effectiveness.** Excavation and on-Site treatment of contaminated soil with placement of the non-source and treated soil back into the excavation is an effective method of reducing potential for direct contact with contaminated soils. In addition, this action reduces the potential for future contamination of groundwater. Thermal treatment of the soil would be effective in reducing the volume and mobility of soil contamination. Placing the excavated non-source and treated material back into the excavation reduces the risk to human health and the environment since the materials would be in a restricted location with environmental controls and monitoring.
- **Implementability.** Contractors and the mobile technology are available to implement this technology. Treatability studies performed to evaluate the level of treatment required for the various soil intervals and levels of chemical presence are available from other remedial sites in New York and across the U.S. and demonstrate effective remediation of VOC-contaminated soil. Given that many of these other sites have had soils requiring treatment for compounds that are more heat resistant to removal (such as PCBs) than the VOCs at the Frontier Site, this treatment technology is readily capable of treating the soil at the Site.
- **Cost.** The cost of implementing excavation is expected to be moderate to high in comparison with the other technologies. Vapor suppression and/or soil containment structures would be necessary to limit off-Site vapor migration, which will further increase costs associated with excavation activities. The cost for on-Site treatment is high but may be cost effective when considering the lifetime for treatment and operation/maintenance costs of other technologies.

5.0 DEVELOPMENT OF ALTERNATIVES

In this section, the most effective technologies identified in the previous subsections have been combined into remedial alternatives to address soil contamination at the Frontier Chemical Site.

In order to address the source area soil, the following alternatives were developed:

i) Alternative No. 1: No action

ii) Alternative No. 2: Institutional controls (i.e., access/use restrictions, deed restrictions)

iii) Alternative No. 3: Excavation, trucking, and off-Site treatment/disposal of soils

iv) Alternative No. 4: Excavation and on-Site treatment of soils

5.1 ALTERNATIVE NO. 1 – NO ACTION

The No Action alternative involves taking no further action to remedy Site conditions. NYSDEC and EPA guidance requires that the No Action alternative be considered in the detailed analysis of alternatives. However, according to the State, the No Action alternative is considered an unacceptable alternative because the Site would remain in its present condition and human health and the environment would not be adequately protected.

5.2 ALTERNATIVE NO. 2 – INSTITUTIONAL CONTROLS

Institutional controls, which include access/use restrictions and deed restrictions, are viable options for controlling the potential for direct contact with contaminated media. They are often utilized on contaminated industrial sites (such as this Site) where it may not be technically practical to achieve the proposed cleanup goals for soil or groundwater in a reasonable/predictable time frame (less than 30 years) due to the likely presence of dense non-aqueous phase liquid on Site.

Access/use restrictions for the Site would include utilizing the existing fencing and posting signs. Deed restrictions would be filed to control future use/activities at the Site. The groundwater remedy is already in place and allows for the natural collection of impacted groundwater and treatment by the Niagara Falls Water Board. For the

groundwater, long-term groundwater monitoring would be included as an institutional control. This alternative assumes that semi-annual groundwater monitoring would be conducted in on-Site wells for 5 years, followed by a reduced frequency and sample parameter monitoring plan for an extended period of time. For the purpose of this FFS, it is assumed that 15 wells are included in the monitoring program.

The program would include the monitoring required to measure the overburden and shallow bedrock groundwater discharge to the City sewer system (as part of the Significant Industrial User Permit). In addition, a few bedrock wells positioned in the C-Zone will be included to measure the level of natural attenuation that is achieved in the deep bedrock groundwater. Water levels would be measured in the wells prior to purging/sample collection. Groundwater samples would be analyzed for VOCs and other compounds of concern consistent with the Significant Industrial User Permit.

No long-term soil monitoring program is needed for the Site and therefore none is included in this alternative. It is assumed that the existing Site fencing is adequate to restrict access and that long-term operation and maintenance (O&M) is not needed. Routine O&M would be required for the monitoring wells.

5.3 ALTERNATIVE NO. 3 – EXCAVATION, TRUCKING, AND OFF-SITE TREATMENT / DISPOSAL OF SOIL

The overall approach associated with this alternative is to excavate through the area in which the source area soil is present, isolate the source area soil from the surrounding soil intervals, and transport the source area soil off-Site for disposal and/or treatment at a permitted facility. The source area soil is present in pockets throughout the south central area of the Site and is present as deep as the top of bedrock (about 16 ft bgs). This alternative would allow soil that is not defined as source area soil to remain on-Site and be used as backfill for the excavation. Since additional backfill will be required for this alternative, hard fill from demolished buildings/foundations may be available for use as backfill. The remainder of the backfill will be clean imported fill from off-Site, resulting in significant trucking and land consumption. Removal of the source area soil would reduce the overall time required to clean up the Site compared to Alternatives 1 and 2 by reducing the overall mass of contamination. Figures 2.2 through 2.9 present the source area soil locations.

This alternative would include the following actions:

- Approximately 47,000 in-place cubic yards of soil would be removed by conventional excavation techniques. Vapor suppression may be necessary to limit migration of vapors off-Site from the excavation area. The proposed excavation is located in the south central part of the Site. Of the 47,000 cubic yards of soil removed, approximately 15,000 cubic yards is defined as source area soil requiring off-Site disposal/treatment.
- Building foundations would be removed and demolished as encountered during excavation. The removed foundations (assumed to be steel-reinforced concrete) would be broken up and reused as backfill, cap material, or stockpiled on-Site. The reinforcing steel would be segregated and recycled. Conduits, drains, and other piping that are encountered would be removed and the ends sealed or plugged with grout. Accumulated precipitation water in open excavations would be allowed to infiltrate to groundwater or be pumped to the City sanitary sewer under the Significant Industrial User Permit and consistent with the storm water / erosion control plan developed for the Site.
- Excavated soils may be staged in a containment structure(s) to limit off-Site vapor migration before transportation off-Site by dump truck to a permitted treatment/disposal facility. It is assumed that the source area soil would be pre-characterized to allow for direct loading and immediate off-Site transport to the treatment/disposal facility (load-and-go technique).

  Based on the current information concerning the chemical characteristics of the source area soil, it is expected that about 2,000 cubic yards of the source area soil would be characterized for disposal as hazardous waste requiring incineration. Another 3,000 cubic yards of the source area soil would require disposal as hazardous waste requiring pre-treatment since the VOC concentrations exceed acceptable land disposal criteria. The remainder of the source area soil (about 10,000 cubic yards) would meet the direct burial criteria and therefore require no pretreatment prior to disposal.
- Clean suitable soil backfill would be brought on-Site by truck and placed in lifts into the excavation. Additionally, it is assumed that some of the hard material currently staged on Site may be used as backfill in the excavation. The backfilling will result in the Site being returned to currently existing grades consistent with the plan to match the surrounding asphalt pavement and concrete cover areas on the Site. Areas of existing asphalt pavement or concrete at the surface would remain as is and complete the Site cap.

- Visual observation, organic vapor meter field screening, and analytical testing would confirm whether the excavated soil is defined as source area soil requiring off-Site treatment/disposal or is suitable for use as backfill.
- As part of the excavation activities, it is assumed that existing monitoring wells and piezometers (which would no longer be required for monitoring purposes) would be decommissioned.

Long-term O&M for the soil component of the remedy would not be required for this alternative.

5.4 ALTERNATIVE NO. 4 – EXCAVATION AND ON-SITE TREATMENT OF SOIL

The overall approach associated with this alternative is to excavate the source area soil depicted in Figures 2.2 through 2.9, isolate these source area soils from the surrounding soil intervals (using photoionization detector units, or other applicable field instruments), and process the source area soil through the on-Site thermal treatment unit. The source area soil is present in pockets throughout the south central area of the Site and is present as deep as the top of bedrock (about 16 ft bgs). The treated soil would be tested (by laboratory analyzed samples to confirm the treatment is complete) and then returned to the excavation as backfill, along with the non-source area soil that was excavated. Treatment of the source area soil would reduce the overall time required to clean up the Site compared to Alternatives 1 and 2 by reducing the overall mass of contamination. Figures 2.2 through 2.9 present the source area soil locations.

This alternative would include the following actions:

Excavation

- Approximately 47,000 in-place cubic yards of soil would be removed by conventional excavation techniques. Vapor suppression may be necessary to limit migration of vapor off-Site from the excavation area. The proposed excavation is located in the south central part of the Site. Of the 47,000 cubic yards of soil removed, approximately 15,000 cubic yards is defined as source area soil requiring treatment.
- Building foundations would be removed and demolished as encountered during excavation. The removed foundations (assumed to be steel-reinforced concrete) would be broken up and reused as backfill, cap material, or stockpiled on Site. The

reinforcing steel would be segregated and recycled. Conduits, drains, and other piping that are encountered would be removed and the ends sealed or plugged with grout. Accumulated precipitation water in open excavations would be allowed to infiltrate to groundwater or be pumped to the City sanitary sewer system under the Significant Industrial User Permit and consistent with the storm water / erosion control plan developed for the Site.

- Excavated soil would be segregated into appropriate categories as each layer is removed and may be staged in a containment structure(s) to limit off-Site vapor migration. The soil would then be mixed by mechanical means (typically a front-end loader), screened, and fed to a blender or pug mill to ensure that the feed to the thermal desorption unit is relatively homogeneous. The screening would remove objects/rocks greater than 3 inches that would be set aside for placement back into the excavation or, if necessary, processed in a grinder to reduce their size and then returned for blending with the soil. The soil would then be fed to the thermal desorption unit (a rotary dryer). Treated soil exiting the thermal desorption unit would be stockpiled until cooled and confirmatory tested (by laboratory analysis) to ensure that treatment levels had been attained. The soil would then be used for backfilling the excavated areas.
- Visual observation and organic vapor meter field screening would confirm whether the excavated soil is defined as source area soil requiring thermal treatment or is suitable for use as backfill without treatment.
- As part of the excavation activities, monitoring wells and piezometers which would no longer be required for monitoring purposes would be decommissioned.

<u>On-Site Treatment</u>

- A trial burn would be completed to establish thermal desorption system parameters (such as temperature and feed rate) as well as effectiveness of the technology and confirmation that the thermal treatment will achieve the cleanup criteria of 100 ppm total VOCs. Additionally, soil samples would be collected for testing to evaluate parameters such as organic content, density, moisture content, and particle size that can affect treatment.
- Approximately 15,000 in-place cubic yards (22,500 tons) of source area soil would be treated using a mobile thermal desorption unit. Samples will be collected and submitted to a laboratory to confirm that the soil has achieved the cleanup criteria of 100 ppm total VOCs.

Long-term O&M for the soil component of the remedy would not be required for this alternative.

6.0 DETAILED ANALYSES OF RETAINED REMEDIAL ALTERNATIVES

Remedial alternatives for the source area soil were developed in Section 5 for possible application at the Site. These alternatives are subject to a detailed analysis using the evaluation criteria outlined in USEPA and NYSDEC guidance. The evaluation criteria are as follows:

i) Overall protection of human health and the environment
ii) Compliance with ARARs
iii) Reduction of toxicity, mobility, or volume
iv) Short-term impacts and effectiveness
v) Long-term effectiveness and permanence
vi) Implementability
vii) Cost
viii) State acceptance
ix) Community acceptance
x) Land use
xi) Sustainability

These criteria are divided into two primary groups, namely threshold criteria and balancing criteria.

The threshold criteria include compliance with applicable ARARs and overall protection of human health and the environment. With the exception of the No Action alternative, all remedial alternatives must meet the threshold criteria to be eligible for further consideration.

The remaining evaluation criteria are considered the balancing criteria. Each of the remedial alternatives is assessed and analyzed on a comparative basis using these evaluation criteria. Ultimately, a remedial action plan is proposed that incorporates the alternatives and provides the best solution with respect to the balancing criteria.

The detailed analysis of retained alternatives has been performed in a manner consistent with the applicable regulations. The analyses are described in detail in the following subsections.

The source area soil remedial technologies retained following the initial screening have been assembled into the following alternatives for detailed analysis.

i) Alternative 1: No Action

ii) Alternative 2: Institutional Control

iii) Alternative 3: Excavation, Trucking, and Off-Site Treatment/Disposal with Institutional Control

iv) Alternative 4: Excavation and On-Site Thermal Treatment with Institutional Control

Each of the source area soil remedial alternatives is described and evaluated in detail in the following subsections.

6.1 ALTERNATIVE 1 - NO ACTION

Description

The No Action alternative is presented as a baseline for comparison with other alternatives. This alternative does not include remedial action, institutional or engineering controls (other than those already in place), or long-term monitoring. It is noted that under the existing conditions, the Site is secure, no contaminated soils are present for contact on the ground surface, and appropriate groundwater controls are already in place.

Overall Protection of Human Health and the Environment

According to the State, this alternative is not protective of human health and the environment, because the Site would remain in its present condition. Source area soil would serve as a continuing source of impact to groundwater, although the groundwater is controlled and being treated. Uncontrolled excavations or entering subsurface structures could lead to risk to human health.

Compliance with SCGs

The contaminant levels in soil are not expected to decrease appreciably over time. Therefore, this alternative would not comply with the chemical-specific SCGs for the Site soil.

Short-Term Impacts and Effectiveness

No short-term impacts (other than those existing) are anticipated during the implementation of this alternative since there are no remedial activities involved.

This alternative does not include source removal or treatment and would not meet any of the three RAOs (as defined in Section 3.2.2) in a reasonable or predictable timeframe.

Long-Term Effectiveness and Permanence

This alternative would not be effective in the long term because this alternative does not involve removal or treatment of the contaminated soil. The risks involved with direct contact with contaminants would remain the same.

Reduction in Toxicity, Mobility, or Volume

This alternative does not involve the removal or treatment of contaminated soil. Therefore, neither the toxicity, nor mobility, nor volume of contamination in the soil is expected to be reduced. Natural attenuation of contaminants may reduce the concentrations in soil over time. However, this reduction is not expected to be significant within a reasonable or predictable timeframe.

Implementability

This alternative is readily implementable on a technical basis in that it involves no actions.

Cost

There is no cost associated with this alternative. This is reflected in the cost summary that is presented in Table 6.1.

State Acceptance

The State has determined that this alternative is unacceptable as it does not address the residual risks associated with the source area soil.

Community Acceptance

Based upon the results of the 2006 ROD and the public review process associated with the selection of a specific remedy for the Site, it is unlikely that the public would support a "no action" alternative for this Site.

Land Use

The Site is currently zoned for industrial use. There are no current plans to modify this zoning designation and documents available regarding this area of Niagara Falls show this area to remain industrial for the foreseeable future. Given the chemicals on the Site, future use of the Site as a commercial/industrial property is appropriate and can accommodate multiple uses under this designation.

Sustainability

Since there are no actions involved with this alternative, there is no environmental footprint associated with the implementation of this alternative.

Summary

Alternative 1 (No Action) is readily implementable with minimal short-term risks because no intrusive work would be done. However, this alternative leaves the soil contamination in place (unchanged) and does not reduce or eliminate exposure pathway risks.

6.2 ALTERNATIVE 2 - INSTITUTIONAL CONTROL

Description

Institutional controls such as access, use, and deed restrictions at the Site would include utilizing the existing fencing and posting signs. Deed restrictions would be filed to control future use/activities at the Site. It is assumed that the existing Site fencing is adequate to restrict access and long-term O&M is not needed. Like Alternative 1, this alternative does not include active remedial action.

Overall Protection of Human Health and the Environment

Because this alternative includes placement of institutional controls such as access and deed restrictions, (that would control future use/activities at the Site), it would provide some long-term protection of human health. At the present time there is no contaminated soil present on the ground surface and therefore poses no exposure potential to Site visitors or workers. Fencing alone may not be adequate to prevent unauthorized access to the Site by trespassers, although under present conditions, no ground surface exposure potential exists. Since subsurface soils would serve as a continuing source of impact to groundwater, this alternative may not be protective of the environment, although the groundwater is in a controlled state and treatment is being provided.

Compliance with SCGs

The contaminant levels in soil are not expected to decrease appreciably over time. Therefore, this alternative would not comply with the chemical-specific SCGs for the Site soil. Action-specific SCGs (e.g., safety regulations) would be included in the institutional controls and complied with for Site activities.

Short-Term Impacts and Effectiveness

No short-term impacts (other than those existing) are anticipated during the implementation of this alternative since there are no remedial activities involved. Controlling future use and activities on-Site would protect workers' health. This alternative would provide some protection to the community by limiting Site access.

This alternative meets one of the three soil RAOs. It reduces (to the extent practicable) the potential for direct contact with on-Site contaminated soil. However, it does not significantly eliminate the potential for human exposure to organic vapors (due to the presence of existing on-Site structures) and does not adequately reduce the risk of further contamination of groundwater, although the groundwater is currently controlled and appropriate treatment is being provided.

Long-Term Effectiveness and Permanence

According to the State, this alternative would not be effective in the long term in protecting human health and the environment because this alternative does not involve removal or treatment of the contaminated soil. The risks involved with direct contact with on-Site contaminants would be limited since all contaminants are subsurface. Deed

or other restrictions would be effective in the long term as long as they are interpreted correctly and/or are not modified by future Site users. Contaminated subsurface soil would serve as a continuing source of impact to groundwater, although the groundwater is currently controlled and appropriate treatment is being provided.

Reduction in Toxicity, Mobility, or Volume

This alternative does not involve the removal or treatment of contaminated soil. Therefore, neither the toxicity, nor mobility, nor volume of contamination, are expected to be reduced. Natural attenuation of contaminants may somewhat reduce the concentrations in soil over time. However, this reduction is not expected to be significant within a reasonable or predictable timeframe.

Implementability

This alternative can be readily implemented on a technical and administrative basis using typical institutional control practices and procedures. The property owner is willing to implement the institutional controls.

Cost

The total present-worth cost of this alternative based on a 30-year period and a discount rate of 5 percent is $3,000. Table 6.2 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. No O&M costs are anticipated with this alternative.

State Acceptance

The State has determined that this alternative is unacceptable as it does not address the residual risks associated with the source area soil and it provides no treatment or removal of contaminants.

Community Acceptance

Based upon the results of the 2006 ROD and the public review process associated with the selection of a specific remedy for the Site, it is unlikely that the public would support the "institutional control" alternative for this Site.

Land Use

The Site is currently zoned for industrial use. There are no current plans to modify this zoning designation and documents available regarding this area of Niagara Falls show this area to remain industrial for the foreseeable future. Given the chemicals on the Site, future use of the Site as a commercial/industrial property is appropriate and can accommodate multiple uses under this designation. The implementation of institutional controls will ensure the safety of those working on the Site in the future.

Sustainability

Since there are no actions involved with this alternative, there is no environmental footprint associated with the implementation of this alternative.

Summary

Alternative 2 (institutional controls) is readily implementable with minimal short-term risks because no intrusive work would be done. This alternative reduces risks associated with direct contact with on-Site soil contamination. However, the effectiveness of this alternative in reducing exposure pathway risks would be based on enforcement of the restrictions/controls over an extended period of time (greater than 30 years).

6.3 ALTERNATIVE 3 – EXCAVATION, TRUCKING, AND OFF-SITE TREATMENT / DISPOSAL OF SOILS (WITH INSTITUTIONAL CONTROL)

Description

The overall approach associated with this alternative is to excavate the source area soil and transport the material off-Site for treatment/disposal at a permitted facility. Vapor suppression would be needed to limit off-Site vapor migration from the excavation area. The void left by the off-Site removal of soil will be filled with imported clean soil and available on-Site demolition debris.

Since the source area soil would be removed under this program, the only long-term O&M required for this alternative would be that specified under the institutional controls.

Overall Protection of Human Health and the Environment

This alternative is considered protective of human health and the environment since source area soil would be treated/disposed off-Site to meet the proposed cleanup goals. This reduces risk due to contact with the Site chemicals and reduces the risk to groundwater (to the extent practicable).

In order to maintain long-term protection of human health, institutional controls such as access and activity restrictions would be implemented to ensure future exposure pathway risks to human health are minimized.

Compliance with SCGs

This alternative would comply with SCGs since the source area soil would be removed. Excavated soil would be tested prior to treatment/disposal to determine the waste profile (hazardous waste or non-hazardous waste) as per disposal facility requirements.

Applicable action-specific SCGs, including noise limitations and safety regulations, would be complied with during implementation of the alternative.

Short-Term Impacts and Effectiveness

Several significant short-term impacts to the community and workers may arise during excavation, trucking, and soil handling. The primary on-Site impact of concern is the volatilization of VOCs from soil during excavation and handling activities. Trucking material off-Site would pose an impact on the community from increased truck traffic, exhaust emissions, vapor releases, dust, noise, and the potential for injury in the event of an accident involving transport vehicles. The potential for spills during transport also exists. While there is a risk of spills due to accidents, this risk would be mitigated by using covered and lined containers for transport and a licensed, experienced hauler.

Appropriate measures such as proper protective equipment for the workers, vapor suppression (i.e., foam and/or covering material with tarps) to prevent off-Site migration of vapors, and covering of trucks to minimize vapor emissions would be necessary to protect both workers and the surrounding community. A community air monitoring plan/program would be established. Action levels would be set prior to intrusive work, and an appropriate corrective action would be implemented if these action levels were exceeded.

This alternative (once complete) meets all three soil RAOs. It eliminates (to the extent practicable) the potential for direct contact with on-Site contaminated soil. It eliminates (to the extent practicable) the potential for human exposure to on-Site organic vapors (by the excavation and off-Site treatment/disposal of the source area soil). It also reduces (to the extent practicable) the risk of further contamination of groundwater. The potential for volatile vapor migration off-Site through the subsurface would also be reduced by this alternative.

Excavation and off-Site treatment/disposal of contaminated soils is estimated to take about 5 months to complete.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness in terms of protecting human health and the environment because the risks associated with direct contact with contaminants would be minimized by the excavation, trucking, and off-Site treatment/disposal of source area soil and implementation of institutional controls. The removal of the source area soil would also be protective (to the extent practicable) of groundwater. The potential for contaminated surface water runoff from the Site would be reduced by the placement of the Site cover.

A long-term off-Site adverse impact would result from the consumption of available permitted disposal facility capacity and the consumption of significant quantities of clean soil from a borrow pit to provide backfill for the excavation.

Reduction in Toxicity, Mobility, or Volume

Because this alternative removes soil containing contaminants of concern, the toxicity, mobility, and volume of the contaminants at the Site would be reduced. The degree of reduction would be based on the selected treatment/disposal facility and whether the soil is treated or disposed. Even the soil that is disposed will be in an engineered and controlled system so the mobility will be reduced.

Implementability

This alternative can be readily implemented on a technical and administrative basis using standard construction means/methods and typical institutional control practices/procedures. VOC emissions would be difficult to control because of the high concentration of VOCs and the large area requiring excavation. Engineering consultants and contractors are readily available to design and complete such an alternative. No

other technical difficulties are anticipated during excavation and removal of contaminated soil. Whether the soil is disposed or treated would be based on the acceptance/operating criteria of the disposal/treatment facility.

No delay is anticipated in obtaining the necessary approvals/permits from the state and local agencies for implementation of this alternative.

Cost

The total present worth cost of this alternative based on a 30-year period and a discount rate of 5 percent is $11,300,000. Table 6.3 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. No O&M costs are anticipated with this alternative other than those associated with the implementation of the institutional controls.

State Acceptance

The State previously selected this alternative as the alternative for implementation in the 2006 ROD. Therefore the state accepts this alternative as a viable alternative.

Community Acceptance

Based upon the results of the 2006 ROD and the public review process associated with the selection of this alternative as the alternative for implementation, it is likely that the public would support this alternative.

Land Use

The Site is currently zoned for industrial use. There are no current plans to modify this zoning designation and documents available regarding this area of Niagara Falls show this area to remain industrial for the foreseeable future. Given that this alternative would reduce the chemicals remaining on the Site, future use of the Site for commercial/industrial development is enhanced by implementation of this alternative. The implementation of institutional controls will ensure the safety of those working on the Site in the future.

Sustainability

This alternative has limited positive impact on sustainability. Through the cleanup of the source area soil, the Site fosters a greener community. It encourages redevelopment

of the Site. However, implementing the remedy will result in several adverse environmental impacts including the following:

- Increase in greenhouse gas emissions from the equipment used for excavating, transporting, and treating the soil
- Consumption of energy to excavate, transport, and treat the soil
- Increases in truck traffic, vapor releases, dust, noise, and potential for injury in the event of an accident involving transport vehicles
- Consumption of clean soil needed to backfill the excavation
- Consumption of permitted waste disposal facility capacity

Summary

Alternative 3 (excavation, trucking, and off-Site treatment/disposal of soils) is readily implementable. The primary short-term risk is associated with controlling volatile vapors during excavation and handling of highly contaminated soil. This alternative reduces the risks associated with directly contacting highly contaminated subsurface soil by reducing toxicity, mobility, and volume. This alternative would result in the removal of all contaminant mass above SCGs and replacement with clean backfill material. This alternative improves the ability to redevelop the Site for a broader range of potential uses but increases greenhouse gas emissions and consumes valuable energy, clean soil, and permitted disposal facility capacity in doing so. It also increases truck traffic, vapor releases, dust, noise, and the potential for injury in the event of an accident involving transport vehicles.

6.4 ALTERNATIVE 4: EXCAVATION AND ON-SITE TREATMENT OF SOILS (WITH INSTITUTIONAL CONTROL)

Description

The overall approach associated with this alternative is to excavate the source area soil, treat the contaminated soil on-Site by thermal desorption, and return the treated soils to the excavation. Vapor suppression would be needed to limit off-Site vapor migration from the excavation area.

Since the source area soil would be removed under this program, the only long-term O&M required for this alternative would be that specified under the institutional controls.

Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment since source area soil would be thermally treated on-Site to meet proposed cleanup goals for VOCs. This reduces exposure pathway risks due to contact with the Site chemicals and reduces the risk to groundwater (to the extent practicable).

In order to maintain long-term protection of human health, institutional controls such as access and activity restrictions, would be implemented to ensure future exposure pathway risks are minimized.

Compliance with SCGs

This alternative would comply with SCGs since soil contamination above SCGs would be treated to levels below the SCGs.

Applicable action-specific SCGs, including air discharge permits and requirements, noise limitations, and safety regulations would be complied with during treatment and implementation of the alternative.

Short-Term Impacts and Effectiveness

Several short-term impacts to the community and workers may arise during excavation and treatment of contaminated soil on-Site. The primary on-Site impact of concern is the volatilization of VOCs from soil during excavation and soil handling activities. Appropriate measures such as proper protective equipment for the workers and vapor suppression (i.e., foam and/or covering material with tarps or providing enclosed structures for soil storage) to prevent off- Site migration of vapors would be necessary to protect both workers and the surrounding community. With this alternative, an inhalation exposure risk to workers exists because they would be handling soils with high concentrations of VOCs. This risk can be eliminated by proper safety equipment. Community impacts include potential odors, dust, and noise from equipment operation. Continuous (24-hour) operation of the thermal desorption system may have the potential for noise impacts on the surrounding community. These noise impacts would be reduced through proper design and the use of mitigation measures such as noise barriers. To minimize other short-tem impacts, Site access would be restricted during construction and remediation activities. A community air monitoring plan/program would be established. Action levels would be set prior to intrusive work, and an appropriate corrective action would be implemented if these action levels were exceeded.

This alternative (once complete) meets all three soil RAOs. It eliminates (to the extent practicable) the potential for direct contact with on-Site contaminated soil and (to the extent practicable) the potential for human exposure to on-Site organic vapors (by the excavation and treatment of source area soil). It also reduces the risk of further contamination of groundwater (to the extent practicable). The potential for volatile vapor migration off-Site through the subsurface would also be reduced by this alternative.

Excavation and thermal desorption of contaminated soil is estimated to take about 7 months to complete.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness (in terms of protecting human health) because the risks associated with direct contact with contaminants would be minimized by the excavation and on-Site treatment of source area soil and implementation of institutional controls. The removal of the source area soil would also be protective (to the extent practical) of groundwater. The potential for contaminated surface water runoff from the Site would be reduced by the placement of the Site cover.

Reduction in Toxicity, Mobility, or Volume

Because this alternative actively treats VOCs, the volume of contamination would be reduced at the Site. Consequently, the toxicity and mobility of the contaminants would also be reduced.

Implementability

This alternative can be readily implemented on a technical and administrative basis using standard construction means/methods and typical institutional control practices/procedures. VOC emissions would need to be controlled because of the high concentration of VOCs and the large area requiring excavation. Engineering controls would be used as necessary to control such emissions. No other significant technical difficulties are anticipated during excavation, handling, and treatment of contaminated soil. A contractor specializing in thermal desorption systems would be retained for installation and operation of the thermal treatment system. Engineers and contractors are readily available to design and operate such a treatment system. Although start-up problems may be encountered initially, technical difficulties are not anticipated once the thermal treatment system is fully operational. Due to the heterogeneity of some soils,

adjustment in operational parameters may be required during treatment. This, however, should not affect the performance or implementability of the alternative. Monitoring and sampling of the thermal treatment system would be conducted to ensure that proposed Site cleanup goals are met for excavated soils and that air discharge and noise standards are not exceeded. Finally, no delay is anticipated in obtaining the necessary approvals/permits from the state and local agencies for implementation of this alternative.

Cost

The total present-worth cost of this alternative based on a 30-year period and a discount rate of 5 percent is $7,100,000. Table 6.4 presents the quantities, unit costs, and subtotal costs for the various work items in this alternative. No O&M costs are anticipated with this alternative other than those associated with the implementation of the institutional controls.

State Acceptance

The State previously selected an alternative similar to this for implementation in the 2006 ROD. Given the advancement in thermal treatment technology over the past several years and the fact that implementation of such an alternative has been approved for use at a number of New York State sites, the State is likely to accept this alternative as a viable alternative.

Community Acceptance

Based upon the fact that the public accepted a similar technology at the time the 2006 ROD was issued, and this alternative avoids large scale trucking in the community, expectations are that this alternative will be acceptable to the community.

Land Use

The Site is currently zoned for industrial use. There are no current plans to modify this zoning designation and documents available regarding this area of Niagara Falls show this area to remain industrial for the foreseeable future. Given that this alternative would reduce the chemicals remaining on the Site, future use of the Site for commercial/industrial use is enhanced by implementation of this alternative. The implementation of institutional controls will further eliminate exposure pathways to those working on the Site in the future.

Sustainability

This alternative does have some positive impact on sustainability. Through the cleanup of the source area soil, the Site fosters a greener community. It encourages redevelopment of the Site. Implementing the remedy will result in some temporary environmental impacts including the following:

- Increase in greenhouse gas emissions from the equipment used for excavating and treating the soil
- Consumption of energy to excavate and treat the soil
- Increases in vapor releases, dust, and noise

Summary

Alternative 4 (excavation and on-Site treatment of soils) is readily implementable. The primary short-term risks are associated with controlling volatile vapors during excavation and handling of highly contaminated soil. This alternative reduces the risks associated with directly contacting highly contaminated subsurface soil by reducing toxicity, mobility, and volume. This alternative would result in the treatment of all contaminant mass above SCGs. This alternative improves the ability to redevelop the Site but in the short term causes greenhouse gas emissions and consumes energy.

7.0 COMPARATIVE ANALYSES OF REMEDIAL ALTERNATIVES

The purpose of the comparative analysis is to identify the relative advantages and disadvantages of each alternative evaluated in detail in the previous sections. The detailed evaluation assessed each remedial alternative independently. The comparison of remedial alternatives in this section evaluates the relative performance of each alternative with respect to the detailed evaluation criteria which include overall protection of human health and the environment; compliance with ARARs; short term impact and effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, and volume; implementability; cost; State acceptance; community acceptance; land use; and sustainability.

Table 7.1 presents a ranking of each of the remedial alternatives included in the detailed analysis in Section 6. Discussions of the relative advantages and disadvantages of the alternatives are presented in the following subsections.

Overall Protection of Human Health and the Environment

The remedial alternatives are ranked (from lowest to highest) as follows relative to overall protection of human health and the environment:

i) Alternative 1, No Action

ii) Alternative 2, Institutional Controls

iii) Alternative 3, Excavation, Trucking, and Off-Site Treatment / Disposal

iv) Alternative 4, Excavation and On-Site Treatment

Alternatives 2, 3, and 4 provide varying degrees of long-term protection of human health and the environment. Alternative 2 depends entirely on institutional controls as the primary method of protection of human health and the environment over and above the current conditions. Alternatives 3 and 4 provide additional protection because source area soil would be removed or treated to comply with SCGs. In the case of Alternative 3, the removal and transportation of this soil creates significant short term impacts and transfers the contamination to another permitted facility that is expected to be properly controlled. The Frontier Site itself was a permitted facility and was expected to provide for the protection of human health and the environment, but failed to do so. Transport of the source area soil to an off-Site treatment / disposal facility also exposes the public to some risk due to the significant number of trucks required to haul the soil and the noise and diesel emissions associated with the truck exhaust.

In Alternative 4, the soil is treated on-Site to levels below SCGs to reduce the on-Site risks to the extent practicable. Under both Alternatives 3 and 4, there will be some soil that remains on-Site that still contains VOCs. However, all of the soil will meet SCGs and therefore the ongoing risk to human health and the environment is the same for both alternatives. The low level concentrations of VOCs remaining in the soil pose the exact same risk to potential contact (which is to be controlled by institutional controls) and impact to the groundwater. Most of the surface area on the Site is already clean hard surface (asphalt or concrete) and therefore prevents exposure to Site chemicals. Consequently, there is no risk to Site visitors or workers. Since a Site cap will also be installed over the soil-covered and excavation areas of the Site, there will be no risk of exposure to Site visitors or workers anywhere on the Site. Excavation and treatment/disposal of source area soil, as provided by both Alternatives 3 and 4, would result in a lower potential for direct contact with highly contaminated soil, would result in lower potential for vapor generation, and would therefore be more protective than the other Alternatives. It is noted that, at present, the Site is secure, there is no contaminated surface soil, and groundwater is currently under control and appropriately treated. Therefore, Alternatives 1 and 2 provide reasonable overall protection of human health and the environment.

Compliance with SCGs

The remedial alternatives are ranked as follows relative to compliance with SCGs:

i) Alternative 1, No Action

ii) Alternative 2, Institutional Controls

iii) Alternative 3/4, Excavation, Trucking, and Off-Site Treatment/Disposal and Excavation and On-Site Treatment

Both Alternatives 3 and 4 would achieve complete compliance with the chemical-specific SCGs. Alternatives 2, 3, and 4 would comply with action-specific SCGs. Alternative 1 does not meet SCGs.

Short-Term Impact and Effectiveness

The remedial alternatives are ranked as follows relative to short-term impact and effectiveness:

i) Alternative 1, No Action

ii) Alternative 2, Institutional Controls

iii) Alternative 4, Excavation and On-Site Treatment

iv) Alternative 3, Excavation, Trucking, and Off-Site Treatment/Disposal

Alternatives 3 and 4 involve intrusive work which could cause releases of contamination during remedial activities. VOC emissions may be difficult to control during excavation activities in Alternatives 3 and 4 and could result in potential impact on workers and the surrounding community. Since Alternative 4 includes the extra component of on-Site treatment of the source area soil, it would pose a slightly greater potential for impact to on-Site workers and the immediate surrounding community than Alternative 3. On the other hand, Alternative 3 involves trucking of the contaminated soil on public streets and highways. As a result, this alternative has a greater short term impact on the community due to the increase in greenhouse gas emissions, energy consumption, dust, noise, and substantial truck traffic (with its inherent additional risk for accidents and injury). Alternatives 1 and 2 would not have any short-term impacts.

Once complete, Alternatives 3 and 4 would meet the RAO to limit (to the extent practicable) direct contact with on-Site contaminated soil. Alternatives 3 and 4 also meet the RAO to eliminate (to the extent practicable) the potential for human exposure to on-Site vapors. Alternatives 3 and 4 also meet the RAO to reduce the risk of further contamination of groundwater by leaching of contaminants. Alternatives 1 and 2 are not expected to be effective in meeting the RAOs.

Each alternative that includes remedial action (Alternatives 3 and 4) can be completed in the same general timeframe of approximately 5 to 7 months.

Long-Term Effectiveness and Permanence

The remedial alternatives are ranked as follows relative to long-term effectiveness and permanence:

i) Alternative 1, No Action

ii) Alternative 2, Institutional Controls

iii) Alternative 4, Excavation and On-Site Treatment

iv) Alternative 3, Excavation, Trucking, and Off-Site Treatment/Disposal

Alternatives 3 and 4 would provide long-term effectiveness (in protecting human health) because the risk associated with directly contacting the contaminated soil would be minimized through the excavation and disposal or treatment of source area soil. Future potential for exposure to Site vapors will be addressed by the institutional controls that will

dictate that future buildings incorporate gas venting technologies to protect indoor air quality. Alternatives 3 and 4 are the most effective and are the most permanent alternatives (in the long term). Alternative 2 provides long-term effectiveness through institutional controls only. Institutional controls, when combined with either Alternative 3 or 4 will provide additional protection of human health through the prevention of contact with the remaining impacted soil. According to the State, Alternative 1 is not considered an adequate, reliable, or permanent long-term soil remedy. However, the Site is secure, there is no contaminated surface soil, and groundwater is currently under control and appropriately treated. Therefore, Alternative 1 provides reasonable long-term effectiveness but does not compare well with Alternatives 3 and 4.

Once the source area soil has been excavated and disposed or treated, Alternatives 3 and 4 also offer protection of the environment since the primary contaminant source for the groundwater will have been eliminated.

Alternative 3 provides a potential remedy which increases the liability risk to the Frontier Group because it simply shifts contamination from a former permitted facility to a present permitted facility. Alternative 3 relies upon long term compliance at multiple sites since the source area soil will be deposited at multiple sites consistent with the waste profiles developed for the soil and the treatment/disposal restrictions at the permitted facility(s) to which the soil is sent. The disposal of soil at these other sites and the provision of clean soil from a local borrow pit consume available capacities of these other sites. Consequently, Alternative 3 has a greater adverse long-term impact than Alternative 4.

Reduction in Toxicity, Mobility, or Volume

The remedial alternatives are ranked as follows relative to reduction (from least to most) in toxicity, mobility, or volume:

i) Alternative 1, No Action

ii) Alternative 2, Institutional Controls

iii) Alternative 3, Excavation, Trucking, and Off-Site Treatment/Disposal

iv) Alternative 4, Excavation and On-Site Treatment

Alternatives 3 and 4 provide for reduction of toxicity, mobility, and volume of Site contaminants, as the alternatives would reduce contaminant concentrations through treatment and to a lesser degree through disposal of the source area soil. Alternative 3 does not treat as much of the soil as Alternative 4 since it places a large portion of the

source area soil into an off-site controlled facility. Since Alternative 4 results in treatment of all of the source area soil, it results in a greater reduction in toxicity, mobility, and volume and therefore is ranked higher than Alternative 3. Alternatives 1 and 2 would not reduce the toxicity, mobility, and volume of Site contaminants, except as would occur through natural attenuation.

Implementability

The remedial alternatives are ranked as follows relative to implementability:

i) Alternative 4, Excavation and On-Site Treatment

ii) Alternative 3, Excavation, Trucking, and Off-Site Treatment/Disposal

iii) Alternative 2, Institutional Controls

iv) Alternative 1, No Action

Alternatives 1, 2, 3, and 4 are technically implementable (with readily available methods, equipment, materials, and services) and administratively implementable. However, Alternative 3 is more difficult to implement than Alternatives 1 and 2 as many arrangements and procedures need to be followed in removing and disposing/treatment of the source area soil. Alternative 4 is the most difficult to implement because of issues associated with on-Site treatment.

Cost

The remedial alternatives are ranked as follows (from least to most) relative to cost:

i) Alternative 1, No Action

ii) Alternative 2, Institutional Controls

iii) Alternative 4, Excavation and On-Site Treatment

iv) Alternative 3, Excavation, Trucking, and Off-Site Treatment/Disposal

Alternative 1 calls for no action and thus incurs no cost. Institutional controls are the only actions that would be implemented for Alternative 2; therefore its total present cost of $3,000 is the least expensive of the remaining alternatives. Alternatives 3 and 4 are the most expensive alternatives, with Alternative 3 being the most expensive ($11,300,000) and Alternative 4 being next at $7,100,000).

State Acceptance

The remedial alternatives are ranked as follows relative to State acceptance (from least to most):

i) Alternative 1, No Action

ii) Alternative 2, Institutional Controls

iii) Alternative 3, Excavation, Trucking, and Off-Site Treatment/Disposal

iv) Alternative 4, Excavation and On-Site Treatment

Based on the previous FS, the State has expressed that Alternatives 1 and 2 are unacceptable alternatives. Alternative 2 includes some protection as offered by the institutional controls but this improvement over Alternative 1 is marginal. Alternative 3 is the remedy that was previously selected by the State, although this alternative has impacts on at least two other sites (the disposal / treatment facilities to which the source area soil would be transported and a borrow pit which would provide clean soil for backfill). Given the advancement in thermal technologies over the past several years, the gaining of acceptance of thermal technologies, less sustainability impact, and the fact that this alternative can be performed on-Site without involving any other property, it should be acceptable to the State.

Community Acceptance

The remedial alternatives are ranked as follows relative to community acceptance (from least to most):

i) Alternative 1, No Action

ii) Alternative 2, Institutional Controls

iii) Alternative 3, Excavation, Trucking, and Off-Site Treatment/Disposal

iv) Alternative 4, Excavation and On-Site Treatment

Based on the previous FS and the review process that was offered to the community in selecting the 2006 ROD remedy, it is expected that the community will not accept Alternative 1 or 2. It is evident that the community was in support of the treatment or removal remedy. Due to the industrialized nature of Niagara Falls, the community is familiar with remediation projects. Many projects are completed on-site and have become common to the residents of Niagara Falls. Expectations are that their preference would be to perform an on-Site remedy and avoid the remedy that would involve the

transit of thousands of trucks on the city streets. Therefore, it is expected that the community would prefer the on-Site Alternative 4 rather than the off-Site Alternative 3.

Land Use

The remedial alternatives are ranked as follows relative to land use (from least to most):

i) Alternative 1, No Action

ii) Alternative 2, Institutional Controls

iii) Alternative 3/4, Excavation, Trucking, and Off-Site Treatment/Disposal and Excavation and On-Site Treatment

Since Alternative 1 offers no improvement to Site conditions, it is the least valuable in promoting or developing the Site for future use, although the Site currently has no impacted surface soil and groundwater is currently under control and being appropriately treated. Alternative 2 offers some additional value in that protection to future users is provided by the enforcement of institutional controls. Both Alternatives 3 and 4 address the source area soil thereby improving the quality of the soil on the Site and making it easier to develop the Site for commercial or industrial purposes. The degree of Site improvement under Alternatives 3 and 4 are the same and therefore they are ranked the same.

Sustainability

The remedial alternatives are ranked as follows relative to compliance with sustainability goals (from least to most):

i) Alternative 3, Excavation, Trucking, and Off-Site Treatment/Disposal

ii) Alternative 4, Excavation and On-Site Treatment

iii) Alternative 2, Institutional Controls

iv) Alternative 1, No Action

Alternative 1 has no active remedial component and Alternative 2 involves minimal Site effort and therefore these two alternatives have no or minimal sustainability impact. However, Alternatives 3 and 4 include considerable active components and therefore have an impact on sustainability.

Both Alternatives 3 and 4 involve excavation of the source area soil and the surrounding soil in which it is encapsulated. As a result, the two alternatives have the same environmental footprint since they both use similar equipment and involve a similar level of effort with regard to excavation.

Both alternatives will require thermal treatment of the high concentration source area soil and therefore the alternatives have the same environmental footprint in this regard. The only difference is that Alternative 3 requires the transportation of these soils to an off-Site facility, resulting in a considerable impact on sustainability.

For the source area soil that requires pre-treatment prior to disposal, Alternative 3 again requires off-Site transportation that results in an additional component of effort and adverse environmental footprint. Expectations are that the level of effort to pre-treat these soils at the off-Site facility will be similar to the level of effort associated with running these soils through the on-Site thermal unit as occurs in Alternative 4. So for these soils, the only measurable difference is the increased footprint resulting from the transportation of the soil to the off-Site facility under Alternative 3.

For the source area soil that can be directly buried at the off-Site facility under Alternative 3, this will require less effort than the running of the thermal treatment unit as occurs under Alternative 4. However, the additional environmental footprint associated with transporting the source area soil to the off-Site facility under Alternative 3 offsets having to operate the thermal treatment unit at the Site under Alternative 4. Further, since the soil taken to the off-Site facility is not treated prior to transportation and placement of the soil, there is an outstanding environmental risk (exposure and possible releases from the receiving facility) associated with Alternative 3 that is eliminated by the treatment offered under Alternative 4.

Since Alternative 4 does not require any off-Site transportation of the soil that is to be treated, it has a smaller environmental and public safety footprint than Alternative 3. All transportation components include:

- The consumption of fuel
- The emission of the spent fuel as exhaust from transport vehicles
- Wear and tear on the vehicle resulting in maintenance and replacement of vehicles from time to time
- Risks associated with vehicle traffic on public streets and highways that ultimately place the public at risk from accidents and injuries sustained therefrom

- The generation of additional dust, noise, and vapor releases from the trucks while transporting to the disposal / treatment facility

The transportation of source area soil to off-Site facilities results in a significant increase in the environmental footprint associated with the implementation of Alternative 3.

With the off-Site disposal of soil under Alternative 3, two other additional environmental footprint factors are triggered. First, the placement of the soil at the off-Site facility results in the consumption of valuable permitted landfill storage space. Under Alternative 4, no landfill space is consumed since all of the excavated and treated soil will be placed back into the excavation from which it came. In addition, since Alternative 3 takes soil off-Site, it is necessary to replace this soil with clean soil from a second site. This consumes valuable clean soil from this second site and also involves additional transportation that does not occur under Alternative 4.

Summary

Based upon this comparison summary, Alternative 4, excavation and on-Site treatment of the source area soil has the highest ranking, is protective of human health and the environment, and has fewer adverse impacts off-Site.

8.0 RECOMMENDED REMEDIAL ALTERNATIVE

The remedial alternative recommended for the Site is Alternative 4, Excavation and on-Site Treatment with Institutional Controls. The primary reasons for its selection are as follows:

i) This remedy has been shown through this FFS to be the highest ranked alternative and has been proven through application at multiple sites to be effective in addressing the contaminants of concern that are present at the Frontier Chemical Site.

ii) It successfully meets remedial action objectives of contaminant reduction to regulatory levels.

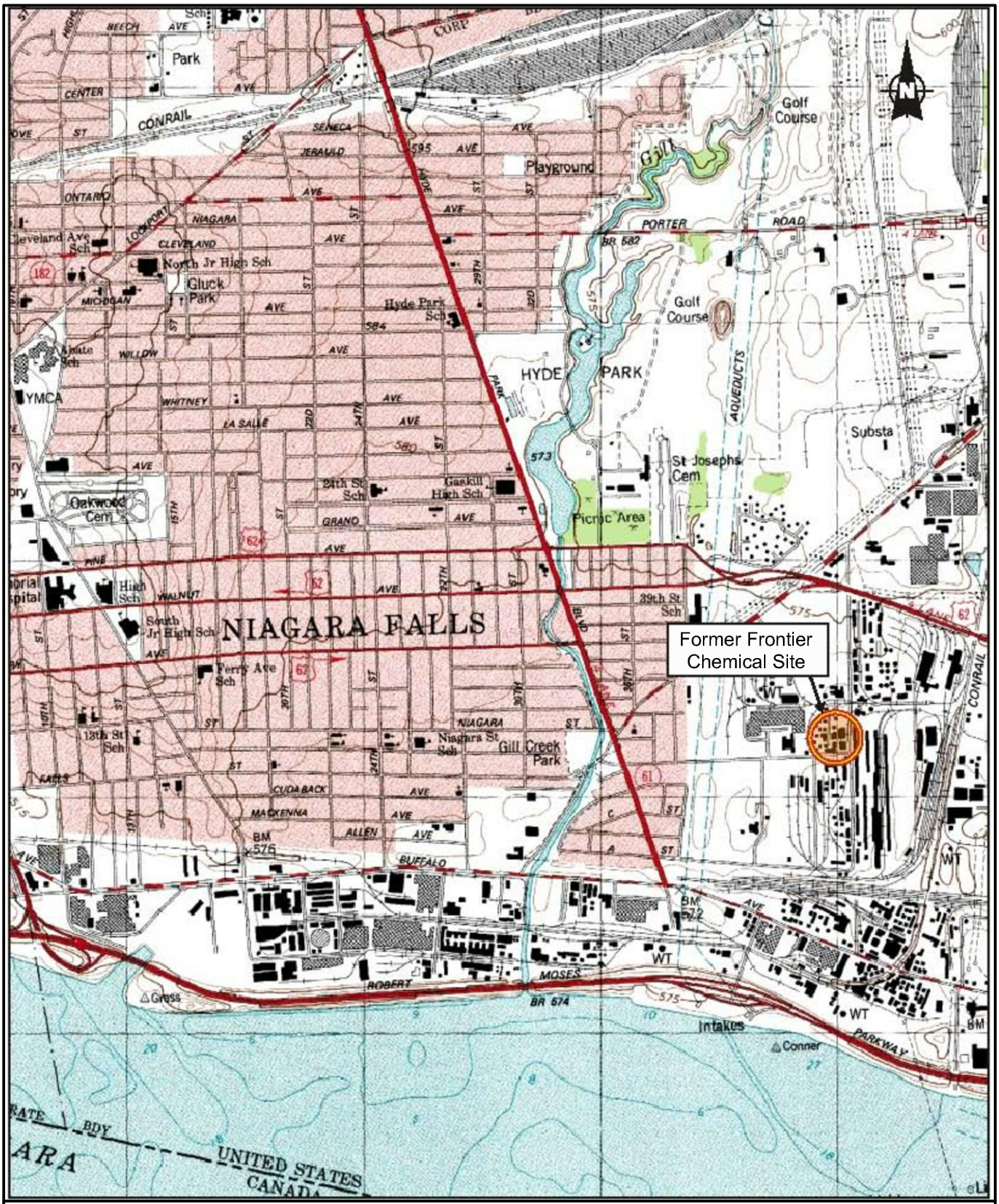
iii) Treatment of the source area soil on-Site creates a Site-specific remedy rather than relying upon the management of a second off-Site facility to provide control of the impact from the soil in the future.

iv) The on-Site treatment remedy is more compliant with New York's green remedy mandate under DER-31 / Green Remediation since it:

- Involves a smaller environmental footprint
- Does not rely on a second site for future soil management
- Does not consume permitted landfill space
- Eliminates off-Site traffic emissions associated with hauling the source area soil to an off-Site facility and hauling clean imported backfill soil to the Site
- Significantly reduces truck traffic through the neighborhood and on City streets
- Lessens generation of VOC releases, dust, and noise associated with the hauling of source area soil and backfill material
- Does not consume clean soil from a licensed borrow pit
- Lessens the risk of a traffic accident that could cause bodily harm to the public

v) The on-Site treatment remedy is less costly than, but as protective as, the off-Site disposal/treatment remedy.

FIGURES



SOURCE: E & E, 2002

figure 2.1

SITE LOCATION MAP

Frontier Chemical Site - Niagara Falls, New York

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SOURCE: E & E, 2002

figure 2.2

SOURCE AREA SOIL
0 TO 2 FT.

Frontier Chemical Site - Niagara Falls, New York

SOURCE: E & E, 2002

figure 2.3

SOURCE AREA SOIL
2 TO 4 FT.

Frontier Chemical Site - Niagara Falls, New York

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REPUTED OWNER
NIAGARA JUNCTION RAILWAY COMPANY

REPUTED OWNER
NIAGARA COUNTY INDUSTRIAL DEVELOPMENT AGENCY
L-2087, P-89

REPUTED OWNER
FRANK'S VACUUM TRUCK SERVICE
L-2362, P-255

REPUTED OWNER
5335 RIVER ROAD, INC.
L-3118, P-293

REPUTED OWNER
ELKEM METALS COMPANY

METAL BLDG.
CONCRETE PAD
DEMOLITION DEBRIS
PAVED
SHED
BLOCK BLDG.
CLAY BLOCK BLDG.
GATE
GRAVEL
FIBERGLASS BUILDING
FRAME BLDG.
CHAIN LINK FENCE
HYD.

BH10-08
BH11-08
PZ-01-04
PZ-01-05
BH9-08
BH14-08
BH19-08
BH21-10
PZ-01-06
BH7-08
BH8-08
PZ-01-08
BH13-08
BH15-08
BH1-08
MW-88-2A(R)
MW-88-7OB(R)
BH22-10
BH23-10
BH24-10
BH25-10
PZ-01-07
BH17-08
BH12-08
BH16-08
BH2-08
BH6-08
BH30-10
BH31-10
PZ-01-10
BH29-10
BH26-10
BH27-10
MW-01-1OB
BH28-10
BH87-4B
(DESTROYED)
BH4-08
BH3-08
BH33-10
BH18-08
PZ-01-11
BH5-08
BH32-10
BH20-08
PZ-01-12
GP-01-08

6' x 5' NEW ROAD SEWER TUNNEL (UNLINED)
47th STREET
ROYAL AVENUE
7' x 6' FALLS ST.
SEWER TUNNEL (UNLINED)
SOUTHSIDE INTERCEPTOR
SEWER TUNNEL
(72-INCH DIAMETER)
DIVERSION/REGULATOR 8 WEIR

N
0 50 100ft

LEGEND

- PROPERTY LINE
- PZ-01-06 MONITORING WELL/BOREHOLE LOCATION
- SOURCE AREA SOIL 4 to 6-FT. INTERVAL

SOURCE: E & E, 2002

figure 2.4

SOURCE AREA SOIL
4 TO 6 FT.
Frontier Chemical Site - Niagara Falls, New York

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REPUTED OWNER
NIAGARA JUNCTION RAILWAY COMPANY

REPUTED OWNER
NIAGARA COUNTY INDUSTRIAL DEVELOPMENT AGENCY
L-2087, P-89

REPUTED OWNER
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L-2362, P-255

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L-3118, P-293

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ELKEM METALS COMPANY

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CONCRETE PAD
DEMOLITION DEBRIS
PAVED
SHED
BLOCK BLDG.
CLAY BLOCK BLDG.
GATE
GRAVEL
FRAME BLDG.
FIBERGLASS BUILDING
CHAIN LINK FENCE

BH10-08
BH11-08
PZ-01-04
PZ-01-05
BH9-08
BH14-08
BH19-08
BH21-10
PZ-01-06
BH7-08
BH8-08
PZ-01-08
BH13-08
BH15-08
BH1-08
MW-88-2A(R)
MW-88-7OB(R)
BH22-10
BH23-10
BH24-10
BH25-10
PZ-01-07
BH17-08
BH12-08
BH16-08
BH2-08
BH6-08
BH30-10
BH31-10
BH26-10
BH27-10
MW-01-1OB
BH28-10
PZ-01-10
BH29-10
BH87-4B
(DESTROYED)
BH18-08
BH4-08
BH3-08
BH33-10
PZ-01-11
BH32-10
BH5-08
BH20-08
PZ-01-12
GP-01-08

6' x 5' NEW ROAD SEWER TUNNEL (UNLINED)
47th STREET
ROYAL AVENUE
7' x 6' FALLS ST.
SEWER TUNNEL (UNLINED)
SOUTHSIDE INTERCEPTOR
SEWER TUNNEL
(72-INCH DIAMETER)
DIVERSION/REGULATOR 8 WEIR

N

0 50 100ft

LEGEND

- PROPERTY LINE
- PZ-01-06 MONITORING WELL/BOREHOLE LOCATION
- SOURCE AREA SOIL 6 to 8-FT. INTERVAL

SOURCE: E & E, 2002

figure 2.5
SOURCE AREA SOIL
6 TO 8FT.
Frontier Chemical Site - Niagara Falls, New York

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SOURCE: E & E, 2002

figure 2.6

SOURCE AREA SOIL
8 TO 10 FT.

Frontier Chemical Site - Niagara Falls, New York

REPUTED OWNER
NIAGARA JUNCTION RAILWAY COMPANY

REPUTED OWNER
NIAGARA COUNTY INDUSTRIAL DEVELOPMENT AGENCY
L-2087, P-89

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FRANK'S VACUUM TRUCK SERVICE
L-2362, P-255

REPUTED OWNER
5335 RIVER ROAD, INC.
L-3118, P-293

REPUTED OWNER
ELKEM METALS COMPANY

METAL BLDG.
CONCRETE PAD
DEMOLITION DEBRIS
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CHAIN LINK FENCE
GRAVEL
FRAME BLDG.
FIBERGLASS BUILDING
HYD.

BH10-08
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BH14-08
BH19-08
BH21-10
PZ-01-08
BH13-08
BH15-08
BH1-08
PZ-01-06
BH7-08
BH8-08
MW-88-7OB(R)
MW-88-2A(R)
BH22-10
BH23-10
BH24-10
BH25-10
PZ-01-07
BH17-08
BH12-08
BH16-08
BH2-08
BH6-08
BH30-10
BH31-10
PZ-01-10
BH29-10
BH26-10
BH27-10
BH28-10
MW-01-1OB
BH87-4B
(DESTROYED)
BH4-08
BH3-08
BH33-10
BH18-08
PZ-01-11
BH32-10
BH5-08
BH20-08
PZ-01-12
GP-01-08

6' x 5' NEW ROAD SEWER TUNNEL (UNLINED)
47th STREET
ROYAL AVENUE
7' x 6' FALLS ST. SEWER TUNNEL (UNLINED)
SOUTHSIDE INTERCEPTOR SEWER TUNNEL (72-INCH DIAMETER)
DIVERSION/REGULATOR 8 WEIR

N
0 50 100ft

LEGEND
- PROPERTY LINE
- PZ-01-06 MONITORING WELL/BOREHOLE LOCATION
- SOURCE AREA SOIL 10-12-FT. INTERVAL

SOURCE: E & E, 2002

figure 2.7
SOURCE AREA SOIL
10 TO 12 FT.
Frontier Chemical Site - Niagara Falls, New York

SOURCE: E & E, 2002

figure 2.8

SOURCE AREA SOIL
12 TO 14 FT.

Frontier Chemical Site - Niagara Falls, New York

REPUTED OWNER
NIAGARA JUNCTION RAILWAY COMPANY

REPUTED OWNER
NIAGARA COUNTY INDUSTRIAL DEVELOPMENT AGENCY
L-2087, P-89

REPUTED OWNER
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CHAIN LINK FENCE

BH10-08
BH11-08
PZ-01-04
PZ-01-05
BH9-08
BH14-08
BH19-08
BH21-10
PZ-01-08
BH13-08
BH15-08
BH1-08
PZ-01-06
BH7-08
BH8-08
MW-88-7OB(R)
MW-88-2A(R)
BH22-10
BH23-10
BH24-10
BH25-10
PZ-01-07
BH6-08
BH17-08
BH12-08
BH30-10
BH16-08
BH31-10
BH2-08
BH26-10
BH27-10
MW-01-1OB
PZ-01-10
BH28-10
BH29-10
BH87-4B (DESTROYED)
BH18-08
BH4-08
BH3-08
BH33-10
PZ-01-11
BH5-08
BH32-10
BH20-08
PZ-01-12
GP-01-08

6' x 5' NEW ROAD SEWER TUNNEL (UNLINED)
47th STREET
HYD.

ROYAL AVENUE
7' x 6' FALLS ST. SEWER TUNNEL (UNLINED)
SOUTHSIDE INTERCEPTOR SEWER TUNNEL (72-INCH DIAMETER)
DIVERSION/REGULATOR 8 WEIR

N
0 50 100ft

LEGEND
- PROPERTY LINE
- PZ-01-06 MONITORING WELL/BOREHOLE LOCATION
- SOURCE AREA SOIL 14 to 16-FT. INTERVAL

SOURCE: E & E, 2002

figure 2.9
SOURCE AREA SOIL
14 TO 16 FT.
Frontier Chemical Site - Niagara Falls, New York

TABLES

TABLE 3.1

CHEMICAL SPECIFIC SCGS
FRONTIER CHEMICAL SITE

Analyte	*Soil Cleanup Objective [1] (mg/Kg)*
1,1,1-Trichloroethane	1000
1,1-Dichloroethane	480
1,2,4-Trichlorobenzene	NL
1,2-Dichlorobenzene	1000
1,3-Dichlorobenzene	560
1,4-Dichlorobenzene	250
Acetone	1000
Benzene	89
Chlorobenzene	1000
Ethylbenzene	780
Methylene chloride	1000
Monochlorotoluene	1000 [2]
Tetrachloroethene	300
Toluene	1000
Trichloroethene	400
Vinyl chloride	27
Xylenes, Total	1000

Key:

mg/Kg = Milligrams per kilogram
NL = Not Listed

Notes

(1) Reference: Table 375-6.8(b): Restricted Use Soil Cleanup Objective - Industrial
(2) Reference: Remedial Pre-design Investigation Report. September 2010.

TABLE 3.2

LOCATION AND ACTION-SPECIFIC SCGS
FRONTIER CHEMICAL SITE

Act/Authority	*Criteria/Issues*	*Citation*	*Brief Description*	*Status*	*Comments*
Local Action-Specific SCGs					
	Effluent discharge to Niagara Falls		See report text	Potentially Applicable	
	Maximum Permissible Sound Levels		Establishes allowable noise emissions from construction equipment and property line noise limits	Potentially Applicable	
	Nuisance Noise and Vibration		Sets limitations on certain nuisance noise and vibrations	Potentially Applicable	
	Construction-Related Street Closure and Placement of Equipment or Materials on Streets, Sidewalks, and other Public Ways		Construction-related street closure and placement of equipment or material on local streets	Potentially Applicable	
	Air Pollution Control		Establishes limitations for emissions of various air pollutants such as combustion engine exhaust and particulates.	Potentially Applicable	
	Solid Waste		Waste haulers local requirements	Potentially Applicable	Relevant to off-site transport of remediation derived wastes
State Action-Specific SCGs					
	Transportation of Hazardous Materials	6 NYCRR 364	Regulates transportation of hazardous materials	Potentially Applicable	Relevant to off-site transport of remediation derived wastes
New York State Vehicle and Traffic Law, Article 386; Environmental Conservation Law Articles 3 and 19.	Noise from Heavy Motor Vehicles	6 NYCRR 450	Defines maximum acceptable noise levels.	Potentially Applicable	Marginally applicable; appears to apply to over-the-road vehicles, not construction equipment.
Environmental Conservation Law, Articles 3, 15, 17, 19 and 70; Administrative Procedures Act, Article 301	Uniform Procedures	6 NYCRR 621	Establishes the procedures used in the processing of applications for permits	Applicable	

LOCATION AND ACTION-SPECIFIC SCGS
FRONTIER CHEMICAL SITE

Act/Authority	*Criteria/Issues*	*Citation*	*Brief Description*	*Status*	*Comments*
Environmental Conservation Law, Articles 3, 15, and 17	New York State Pollutant Discharge Elimination System	6 NYCRR 750-758	Establishes permit requirements for point source discharges into state waters.	Potentially Applicable	Supersedes need to obtain NPDES permits since New York has an approved SPDES program. New York SPDES program does not require a permit for discharge of uncontrolled stormwater
Environmental Conservation Law, Articles 3 and 19.	Prevention and Control of Air Contaminants and Air Pollution	6 NYCRR 200 - 202	Establishes general provisions and requires construction and operation permits for emission of air pollutants.	Potentially Applicable	2001 -Identifies NYC as non-attainment area for ozone, CO, and PM10
Environmental Conservation Law, Article 15; also Public Health Law Articles 1271 and 1276 (Part 288 only)	Air Quality Classifications and Standards	6 NYCRR 256, 257, and 288	Establishes air quality classification system and air quality standards for various pollutants including particulates and non-methane	Potentially Applicable	
Environmental Conservation Law, Articles 3, 19, 23, 27, and 70	Hazardous Waste Management System -General	6 NYCRR 370	Provides definition of terms and general standards applicable to 6 NYCRR 370 -374, 376.	Potentially Applicable	
	Identification and Listing of Hazardous Waste	6 NYCRR 371	Identifies characteristic hazardous waste and lists specific wastes.	Potentially Applicable	
	Hazardous Waste Manifest System and Related Standards	6 NYCRR 372	Establishes manifest system and record keeping standards for generators and transporters of hazardous waste and for treatment, storage, and disposal facilities.	Potentially Applicable	Relevant to transportation and off-site treatment of hazardous waste treatment/disposal of hazardous waste
	Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements	6 NYCRR 373	Regulates treatment, storage,and disposal of hazardous waste.		

LOCATION AND ACTION-SPECIFIC SCGS
FRONTIER CHEMICAL SITE

Act/Authority	*Criteria/Issues*	*Citation*	*Brief Description*	*Status*	*Comments*
	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	6 NYCRR 374	Subpart 374-1 establishes standards for the management of specific hazardous wastes. (Subpart 374-2 establishes standards for the management of used oil.)	Potentially Applicable	
Environmental Conservation Law, Articles 1, 3, 27, and 52; Administrative Procedures Act Articles 301 and 305.	Inactive Hazardous Waste Disposal Site	6 NYCRR 375	Identifies process for investigation and remedial action at state funded Registry site; provides exception from NYSDEC permits; provides soil cleanup objectives.	Applicable	Replaces TAGM 4046 which was used in ROD
Environmental Conservation Law, Articles 3 and 27.	Land Disposal Restrictions	6 NYCRR 376	Identifies hazardous wastes that are restricted from land disposal. Defines treatment standards for hazardous waste.	Potentially Applicable	
Environmental Conservation Law, Articles 1, 3, 8, 19, 23, 27, 52, 54, and 70.	Solid Waste Management Facilities	6 NYCRR 360	360-1: General provisions; includes identification of "beneficial use" potentially applicable to non-hazardous oily waste/soil (360-1.15). 360-2: Regulates construction and operation of landfills, including construction & demolition (C&D) debris landfills	Potentially Applicable	May be applicable for establishing off-site treatment and disposal options for excavated contaminated non-hazardous soil and debris.
	Site Investigation and Remediation	DER-10	Provides overview of site investigation and remediation processes	Applicable	
	Soil Vapor Intrusion	Guidance for Evaluating Soil Vapor Intrusion	Possible overview of soil vapor intrusion investigation remediation process	Potentially Applicable	Any new structures constructed on-site will require soil vapor controls
	Groundwater Monitoring Well Abandonment	CP-43	Provides procedures for the proper abandonment of groundwater monitoring wells	Applicable	

LOCATION AND ACTION-SPECIFIC SCGS
FRONTIER CHEMICAL SITE

Act/Authority	*Criteria/Issues*	*Citation*	*Brief Description*	*Status*	*Comments*
Federal Action-Specific SCGs					
Comprehensive Environmental Response, Compensa-tion, and Liability Act of 1980 and Superfund Amendments and Reauthorization Act of 1986 (SARA)	National Contingency Plan	40 CFR 300, Subpart E	Outlines procedures for remedial actions and for planning and implementing off-site removal actions.	Potentially Applicable	
Occupational Safety and Health Act	Worker Protection	29 CFR 1904, 1910, and 1926	Specifies minimum requirements to maintain worker health and safety during hazardous waste operations. Includes training requirements and construction safety requirements.	Potentially Applicable	Under 40 CFR 300.38, requirements of OSHA apply to all activities that fall under jurisdiction of the National Contingency Plan.
Executive Order	Delegation of Authority	Executive Order 12316 and Coordination	Delegates authority over remedial actions to federal agencies		
Clean Water Act	National Pollutant Discharge Elimination System (NPDES)	40 CFR 122 and 125	Issues permits for discharge into navigable waters. Establishes criteria and standards for imposing treatment requirements on permits.	Potentially Applicable	New York SPDES program incorporates the NPDES program by reference.
Safe Drinking Water Act	Underground Injection Control Program	40 CFR 144	Establishes performance standards, well requirements, and permitting requirements for groundwater re-injection wells.	Potentially Applicable	Potentially applicable for remedial alternatives utilizing Fenton's reagent chemistry in which non-hazardous reagents are introduced to the subsurface via injection wells.
	Underground Injection Control Program: Technical Criteria and Standards	40 CFR 146	Establishes technical criteria and standards that must be met in groundwater re-injectionpermits for Class V wells. ClassV wells include wells used in experimental technologies.	Potentially Applicable	

LOCATION AND ACTION-SPECIFIC SCGS
FRONTIER CHEMICAL SITE

Act/Authority	*Criteria/Issues*	*Citation*	*Brief Description*	*Status*	*Comments*
Clean Air Act	National Primary and Secondary Ambient Air	40 CFR 50	Establishes emission limits for six pollutants (SO_2, PM_{10}, CO, O_3, NO_2, and Pb).	Potentially Applicable	
	National Emission Standards for Hazardous Air Pollutants	40 CFR 61	Provides emission standards for 8 contaminants. Identifies 25 additional contaminants, including PCE and TCE, as having serious health effects but does not provide emission standards for these contaminants.	Potentially Applicable	
Resource Conservation and Recovery Act	Criteria for Municipal Solid Waste Landfills	40 CFR 258	Establishes minimum national criteria for management of non-hazardous waste.	Potentially Applicable	Applicable to remedial alternatives that involve generation of non-hazardous waste. Non-hazardous waste must be hauled and disposed of in accordance with RCRA.
	Hazardous Waste Management System -General	40 CFR 260	Provides definition of terms and general standards applicable to 40 CFR 260 -265, 268.	Potentially Applicable	Applicable to remedial alternatives that involve generation of a hazardous waste (e.g., contaminated soil). Hazardous waste must be handled and disposed of in accordance with RCRA.
	Identification and Listing of Hazardous Waste	40 CFR 261	Identifies solid wastes that are subject to regulation as hazardous wastes.	Potentially Applicable	

LOCATION AND ACTION-SPECIFIC SCGS
FRONTIER CHEMICAL SITE

Act/Authority	*Criteria/Issues*	*Citation*	*Brief Description*	*Status*	*Comments*
	Standards Applicable to Generators of Hazardous Waste	40 CFR 262	Establishes requirements (e.g., EPA ID numbers and manifests) for generators of hazardous waste.	Potentially Applicable	
	Standards Applicable to Transporters of Hazardous Waste	40 CFR 263	Establishes standards that apply to persons transporting manifested hazardous waste within the United States.	Potentially Applicable	
	Standards Applicable to Owners and Operators of Treatment, Storage, and Disposal Facilities	40 CFR 264	Establishes the minimum national standards that define acceptable management of hazardous waste.	Potentially Applicable	
	Standards for owners of hazardous waste facilities	40 CFR 265	Establishes interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities.	Potentially Applicable	
	Land Disposal Restrictions	40 CFR 268	Identifies hazardous wastes that are restricted from land disposal.	Potentially Applicable	
	Hazardous Waste Permit Program	40 CFR 270, 124	USEPA administers hazardous waste permit program for CERCLA/Superfund Sites. Covers basic permitting, application, monitoring, and reporting requirements for off-site hazardous waste management facilities.	Potentially Applicable	

Note:

Location-specific SCGs apply to sites that contain features such as wetlands, floodplains, sensitive ecosystems, or historic buildings that are located on or close to the site. Based on the Supplemental Remedial Investigation, wetlands, floodplains, sensitive ecosystems, or historic buildings are not located on or close to this site. Thus, location-specific SCGs were not identified for this site.

TABLE 6.1

COST ANALYSIS SUMMARY
ALTERNATIVE NO. 1 - NO ACTION
FRONTIER CHEMICAL SITE

Item Description	*Comment*	*Unit*	*Quantity*	*Unit Cost*	*Cost*
Capital Costs					
					$0
Subtotal					$0
				Capital Cost Subtotal:	$0
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (1.028):	$0
				10% Legal, administrative, engineering fees, construction management:	$0
				15% Contingencies:	$0
				Total Capital Cost:	$0
Annual Costs					
Not Applicable					$0
Subtotal					$0
				Annual Cost Subtotal:	$0
				Adjusted Annual Cost Subtotal for Niagara Falls, New York Location Factor (1.028):	$0
				10% Legal, administrative, engineering fees:	$0
				15% Contingencies:	$0
				Annual Cost Total:	**$0**
				30-Year Present Worth of Annual Costs:	**$0**
				Total Present Worth Cost:	**$0**

TABLE 6.2

COST ANALYSIS SUMMARY
ALTERNATIVE NO. 2 - INSTITUTIONAL CONTROL
FRONTIER CHEMICAL SITE

Item Description	*Comment*	*Unit*	*Quantity*	*Unit Cost*	*Cost*
Capital Costs					
Institutional Control		Each	1	$2,000	$2,000
Subtotal					$2,000
				Capital Cost Subtotal:	$2,000
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (1.028):	$2,056
				10% Legal, administrative, engineering fees, construction management:	$206
				15% Contingencies:	$339
				Total Capital Cost:	$3,000
Annual Costs					
Not Applicable					$0
Subtotal					$0
				Annual Cost Subtotal:	$0
				Adjusted Annual Cost Subtotal for Niagara Falls, New York Location Factor (1.028):	$0
				10% Legal, administrative, engineering fees:	$0
				15% Contingencies:	$0
				Annual Cost Total:	**$0**
				30-Year Present Worth of Annual Costs:	**$0**
				Total Present Worth Cost:	**$3,000**

TABLE 6.3

COST ANALYSIS SUMMARY
ALTERNATIVE NO. 3 - EXCAVATION, TRUCKING AND OFF-SITE TREATMENT/DISPOSAL WITH INSTITUTIONAL CONTROLS
FRONTIER CHEMICAL SITE

Item Description	*Comment*	*Unit*	*Quantity*	*Unit Cost*	*Cost*
Capital Costs					
Construction Management (2.5% of total capital cost)	Includes submittals, reporting, meetings	LS	1	NA	$212,000
Institutional Controls		Each	1	$2,000	$2,000
Subtotal					$214,000
Site Preparation					
Mobilization	Set up for work	LS	1	$40,000	$40,000
Surveying Crew	2-person crew @ $50/hr, 8hr/day	Day	50	$1,000.00	$50,000
Site Clearing	With dozer, light clearing; assume 25% of site area	Acre	2	$1,000.00	$2,000
Erosion & Sediment Control	Silt fence and barriers	LS	1	$30,000.00	$30,000
Water Handling Equipment	Supply and Set up	LS	1	$10,000.00	$10,000
Site Trailers	Mobilize, set up, and maintain	Months	5	$6,000.00	$30,000
Subtotal					$162,000
Health and Safety					
Construct Decontamination Pad & Containment	For equipment & personnel, including maintenance	LS	1	$20,000.00	$20,000
Community/Exclusion Zone Air Monitoring	Photoionization detector (Qty 1) & particulate meter rental (Qty 3)	months	5	$3,300.00	$16,500
Site Safety Officer	8 hrs/day, 5days/wk	months	6	$14,000.00	$84,000
Personal Protective Equipment	Includes coveralls, hard hats, safety glasses, reusable boots, gloves; assume 10-persons on-site per day changing twice per day	months	5	$6,000.00	$30,000
Subtotal					$150,500
Demolition					
Wall & Foundation Demolition	Assume reinforced concrete and stockpile	CY	1,500	$80.00	$120,000
Pavement Demolition	Hydraulic hammer and stockpile	SY	9,700	$11.00	$106,700
Subtotal					$226,700
Development of Stockpile Area					
Soil Stockpile Pad	Thin Concrete Pad for Piles & Enclosed Structure	SF	40,000	$6.00	$240,000
Temporary Fabric Building	Erect & Dismantle	LS	1	$185,000.00	$185,000
Temporary Fabric Building	Lease structure and carbon system O&M	months	5	$65,000.00	$325,000
Carbon System	Mobilization and demobilization	LS	1	$45,000.00	$45,000
Subtotal					$795,000

COST ANALYSIS SUMMARY
ALTERNATIVE NO. 3 - EXCAVATION, TRUCKING AND OFF-SITE TREATMENT/DISPOSAL WITH INSTITUTIONAL CONTROLS
FRONTIER CHEMICAL SITE

Item Description	*Comment*	*Unit*	*Quantity*	*Unit Cost*	*Cost*
Soil Excavation					
Utility Repair	Seal pipes	Each	5	$5,000.00	$25,000
Excavation & Deliver to Stockpile	Hydraulic excavator w/2 CY bucket and off-road trucks	CY	47,000	$7.00	$329,000
Application of Foam	Includes rental of foam dispensing unit, foam (for excavation area)	Day	90	$900.00	$81,000
Stockpiling & Covering	Includes sorting into haz / non haz categories	CY	47,000	$3.50	$164,500
Characterization Sampling	Includes TCLP, Pesticides/PCB, PAH, RCRA ignitability, RCRA corrosivity, RCRA reactivity analyses; Assume 24 hr turnaround; one sample per 500 tons	Each	60	$1,200.00	$72,000
Loading Trucks	300 Horsepower Front End Loader to load trucks for off-site disposal	CY	15,000	$2.00	$30,000
Off-Site Disposal (Non-Haz Soil) Including Transportation	Dump truck transport; soil @ 1.5 Tons/CY; assume 10,000 CY of excavated soil	Ton	15,000	$155.00	$2,325,000
Off-Site Disposal (Haz Soil) - Pre-treatment Including Transportation	Dump truck transport; soil @ 1.5 Tons/CY; assume 3,000 CY of excavated soil	Ton	4,500	$290.00	$1,305,000
Off-Site Disposal (Haz Soil) - Incineration Including Transportation	Dump truck transport; soil @ 1.5 Tons/CY; assume 2,000 CY of excavated soil	Ton	3,000	$650.00	$1,950,000
Groundwater Handling	Contain, test, and discharge to sanitary sewer	Gallon	2,000,000	$0.05	$100,000
Subtotal					$6,381,500
Monitoring Well Decommissioning / Installation					
Monitoring Well Decommissioning	Excludes existing destroyed or unusable wells/piezometers; 33 in excavation limits + 7 in stockpile areas	Each	30	$150.00	$4,500
Drill Rig Mob/Demob		LS	1	$1,000.00	$1,000
Subtotal					$5,500
Backfilling					
Load & Deliver Excavated Soil to Excavation	300 Horsepower Front End Loader & Off-Road Trucks - Includes 32,000 cy soil and 3,000 cy demolition debris	CY	35,000	$5.00	$175,000
Import Backfill to Site	Clean Imported Soil to Replace Material Sent Off-Site	CY	12,000	$24.00	$288,000
Placement of Fill & Backfill (Excavation)	300 Horsepower Front End Loader Including Compaction	CY	47,000	$6.00	$282,000
Subtotal					$745,000

COST ANALYSIS SUMMARY
ALTERNATIVE NO. 3 - EXCAVATION, TRUCKING AND OFF-SITE TREATMENT/DISPOSAL WITH INSTITUTIONAL CONTROLS
FRONTIER CHEMICAL SITE

Item Description	*Comment*	*Unit*	*Quantity*	*Unit Cost*	*Cost*
Site Restoration					
Remove Stockpile Pad	Crush & Reuse as Cover Material	CY	750	$80.00	$60,000
Equipment Decontamination	All Equipment	LS	1	$20,000	$20,000
General Site Cleanup	Clear Site	LS	1	$25,000	$25,000
Subtotal					$105,000
				Capital Cost Subtotal:	$8,785,200
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (1.028):	$9,031,186
				10% Legal, administrative, engineering fees, construction management:	$903,119
				15% Contingencies:	$1,354,678
				Total Capital Cost:	**$11,288,982**
Annual Costs					
Not Applicable					$0
Subtotal					$0
				Annual Cost Subtotal:	$0
				Adjusted Annual Cost Subtotal for Niagara Falls, New York Location Factor (1.028):	$0
				10% Legal, administrative, engineering fees:	$0
				15% Contingencies:	$0
				Annual Cost Total:	**$0**
				30-Year Present Worth of Annual Costs:	**$0**
				Total Present Worth Cost:	**$11,288,982**

TABLE 6.4

COST ANALYSIS SUMMARY
ALTERNATIVE NO. 4 - EXCAVATION AND ON-SITE TREATMENT WITH INSTITUTIONAL CONTROLS
FRONTIER CHEMICAL SITE

Item Description	*Comment*	*Unit*	*Quantity*	*Unit Cost*	*Cost*
Capital Costs					
Construction Management (2.5% of total capital cost)	Includes submittals, reporting, meetings	LS	1	NA	$135,000
Institutional Controls		Each	1	$2,000	$2,000
Subtotal					$137,000
Site Preparation					
Mobilization	Set up for work	LS	1	$40,000	$40,000
Surveying Crew	2-person crew @ $50/hr, 8hr/day	Day	50	$1,000.00	$50,000
Site Clearing	With dozer, light clearing; assume 25% of site area	Acre	2	$1,000.00	$2,000
Erosion & Sediment Control	Silt fence and barriers	LS	1	$30,000.00	$30,000
Water Handling Equipment	Supply and Set up	LS	1	$10,000.00	$10,000
Site Trailers	Mobilize, set up, and maintain	Months	7	$6,000.00	$42,000
Thermal Desorption Unit	Mobilize, set up, testing, dismantle	LS	1	$830,000.00	$830,000
Subtotal					$1,004,000
Health and Safety					
Construct Decontamination Pad & Containment	For equipment & personnel, including maintenance	LS	1	$22,000.00	$22,000
Community/Exclusion Zone Air Monitoring	Photoionization detector (Qty 1) & particulate meter rental (Qty 3)	months	7	$3,300.00	$23,100
Site Safety Officer	8 hrs/day, 5days/wk	months	8	$14,000.00	$112,000
Personal Protective Equipment	Includes coveralls, hard hats, safety glasses, reusable boots, gloves; assume 10-persons on-site per day changing twice per day	months	7	$6,000.00	$42,000
Subtotal					$199,100
Demolition					
Wall & Foundation Demolition	Assume reinforced concrete and stockpile	CY	1,500	$80.00	$120,000
Pavement Demolition	Hydraulic hammer and stockpile	SY	9,700	$11.00	$106,700
Subtotal					$226,700

TABLE 6.4

COST ANALYSIS SUMMARY
ALTERNATIVE NO. 4 - EXCAVATION AND ON-SITE TREATMENT WITH INSTITUTIONAL CONTROLS
FRONTIER CHEMICAL SITE

Item Description	*Comment*	*Unit*	*Quantity*	*Unit Cost*	*Cost*
Development of Stockpile Area					
Soil Stockpile Pad	Thin Concrete Pad for Piles & Enclosed Structure	SF	40,000	$6.00	$240,000
Temporary Fabric Building	Erect & Dismantle	LS	1	$185,000.00	$185,000
Temporary Fabric Building	Lease structure and carbon system O&M	months	7	$65,000.00	$455,000
Carbon System	Mobilization and demobilization	LS	1	$45,000.00	$45,000
Subtotal					$925,000
Soil Excavation					
Utility Repair	Seal pipes	Each	5	$5,000.00	$25,000
Excavation & Deliver to Stockpile	Hydraulic excavator w/2 CY bucket and off-road trucks	CY	47,000	$7.00	$329,000
Application of Foam	Includes rental of foam dispensing unit, foam (for excavation area)	Day	90	$900.00	$81,000
Stockpiling & Covering	Includes sorting into source / non source categories	CY	47,000	$3.50	$164,500
Screen Source Area Soil	Screen, remove debris	CY	5,000	$8.00	$40,000
Deliver Source Area Soil to Thermal Unit	Including blending in pug mill	CY	15,000	$7.00	$105,000
Thermal Treatment of Source Area Soil	Through thermal desorption unit including vapor control	Ton	22,500	$65.00	$1,462,500
Interim Stockpiling of Treated Soil	To allow cooling and testing	CY	15,000	$4.50	$67,500
Confirmatory Testing of Treated Soil	One sample per 200 cy	Each	75	$200.00	$15,000
Groundwater Handling	Contain, test, and discharge to sanitary sewer	Gallon	2,000,000	$0.05	$100,000
Subtotal					$2,389,500
Monitoring Well Decommissioning / Installation					
Monitoring Well Decommissioning	Excludes existing destroyed or unusable wells/piezometers; 33 in excavation limits + 7 in stockpile areas	Each	30	$150.00	$4,500
Drill Rig Mob/Demob		LS	1	$1,000.00	$1,000
Subtotal					$5,500

TABLE 6.4

COST ANALYSIS SUMMARY
ALTERNATIVE NO. 4 - EXCAVATION AND ON-SITE TREATMENT WITH INSTITUTIONAL CONTROLS
FRONTIER CHEMICAL SITE

Item Description	*Comment*	*Unit*	*Quantity*	*Unit Cost*	*Cost*
Backfilling					
Load & Deliver Excavated & Treated Soil to Excavation	300 Horsepower Front End Loader & Off-Road Trucks - Includes 32,000 cy soil overlying soil and 15,000 cy treated soil	CY	47,000	$5.00	$235,000
Placement of Fill & Backfill (Excavation)	300 Horsepower Front End Loader Including Compaction	CY	47,000	$6.00	$282,000
Subtotal					$517,000
Site Restoration					
Remove Stockpile Pad	Crush & Reuse as Cover Material	CY	750	$80.00	$60,000
Equipment Decontamination	All Equipment	LS	1	$20,000	$20,000
General Site Cleanup	Clear Site	LS	1	$25,000	$25,000
Subtotal					$105,000
				Capital Cost Subtotal:	$5,508,800
				Adjusted Capital Cost Subtotal for Niagara Falls, New York Location Factor (1.028):	$5,663,046
				10% Legal, administrative, engineering fees, construction management:	$566,305
				15% Contingencies:	$849,457
				Total Capital Cost:	**$7,078,808**
Annual Costs					
Not Applicable					$0
Subtotal					$0
				Annual Cost Subtotal:	$0
				Adjusted Annual Cost Subtotal for Niagara Falls, New York Location Factor (1.028):	$0
				10% Legal, administrative, engineering fees:	$0
				15% Contingencies:	$0
				Annual Cost Total:	**$0**
				30-Year Present Worth of Annual Costs:	**$0**
				Total Present Worth Cost:	**$7,078,808**

TABLE 7.1

COMPARATIVE RANKING OF REMEDIAL ALTERNATIVES
FRONTIER CHEMICAL SITE

Alternative	Overall Protection of Human Health and the Environment	Compliance with SCG	Short-term Impact & Effectiveness	Long-term Effectiveness & Permanence	Reduction in Toxicity Mobility on Volume	Implementability	Cost	State Acceptance	Community Acceptance	Land Use	Sustainability	Total Score
1. No Action	2	1	2	2	1	5	5	1	1	2	5	**27**
2. Institutional Controls	3	3	3	3	1	4	5	2	2	3	4	**33**
3. Excavation, Trucking, & Off-Site Disposal / Treatment	4	5	4	4	4	2	1	4	4	5	2	**39**
4. Excavation & On-Site Treatment	5	5	4	5	5	1	2	5	5	5	3	**45**