Supplemental Feasibility Study Report

Brandt-Airflex Site

937 & 965 Conklin Street
Village of East Farmingdale
Town of Babylon
Suffolk County, New York

NYSDEC Site Number: 152183

Prepared by:

NYSDEC

January 2015

1. Introduction

This Supplemental Feasibility Study (SFS) is being submitted to augment the December 16, 2014 Feasibilty Study (FS) report developed by Henningson, Durham & Richardson Architecture and Engineering P.C. (HDR), to evaluate remedial alternatives for the Brandt Airflex Superfund Site, located at 937 and 965 Conklin Street in the Hamlet of East Farmingdale, Town of Babylon, Suffolk County, New York. A Remedial Investigation (RI) was completed by HDR from January 2011 through November 2013. The RI and FS were completed under a NYSDEC Standby Engineering Contract, Work Assignment #D006129-11.

This SFS combines selected media-specific General Response Actions (GRA), outlined in the FS report, into fully developed multi-media remedial alternatives for the Site. The remedial alternatives are evaluated for effectiveness in achieving chemical-specific and site-related Remedial Action Objectives (RAO).

2. Media-specific General Response Actions

Three environmental media have been identified as impacted by contamination at the site: soils, groundwater and soil vapor. General Response Actions (GRAs) were developed for each of the impacted media in the FS, and are presented in the Table 1.

Table 1 – Media-Specific General Response Actions (GRA)

General Response Action ID	GRA Description	Capital Cost	O&M Cost (Active Remediation Timeframe)	Total Present Worth
Soil Response Actions				
S1	No Action (soils)	$0	$0	$0
S2	Institutional Controls with Site Management	$36,000	$7,000 (indefinite)	$43,000
S3	Excavation and Off-site Disposal	$164,000	$0 (1-2 months)	$164,000
Groundwater Response Actions				
G1	No Action (groundwater)	$0	$0	$0
G2	In-situ Chemical Oxidation w/ LTM[1]	$1,110,000	$50,000 (1-2 years)	$2,631,000
G3	In-situ Thermal Treatment w/LTM[1]	$1,402,000	$50,000 (6-12 months)	$2,971,000
G4	Pump and Treat w/LTM[1]	$1,113,000	$230,000 (30 years)	$6,741,000
Soil Vapor Intrusion Response Actions				
SV1	No Action (soil vapor)	$0	$0	$0
SV2[2]	Onsite SSDS (2 bldgs.) Off-site SSDS (1 bldg.) Combined Cost	$254,000 $ 66,750 $320,750	$23,000 (30 years) $17,000 (30 years) $40,000	$785,000 $184,000 $969,000
SV3[3]	SVE System	$525,000	$48,000 (3-years)	$663,000

1) LTM – Long Term Monitoring: Cost of groundwater monitoring is projected for 30 years. LTM consists of quarterly monitoring for two years, then annual monitoring thereafter.

2) Alternative proposes individual SSDS for each building (2 onsite and 1 off-site)

3) Soil Vapor Extraction System (SVE) – When properly designed, could remediate soil vapors both on-site and off-site, obviating the need for off-site SSDS.

3. Remedial Action Objectives

The objectives for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. The goal for the remedial program is to restore the site to pre-disposal conditions to the extent feasible. At a minimum, the remedy shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the site through the proper application of scientific and engineering principles.

The remedial action objectives for this site are:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

4. Development and Evaluation of Alternatives

In accordance with DER-10 Technical Guidance for Site Investigation and Remediation, May 3, 2010 (DER-10), remedial alternatives for a site are developed by combining the remedial technologies that have successfully passed the screening stage into a range of alternatives.

DER-10 requires a No-Action alternative and an alternative that would restore the site to "pre-disposal conditions". Other alternatives are to be included based on:

- Current, intended, and reasonably anticipated future use of the site;
- Removal of source areas of contamination; and
- Containment of contamination.

Four (4) alternatives have been developed as potential remedies at the site. The alternative names and estimated costs to implement and/or operate them are presented in Table 2.

Table 2 – Remedial Alternatives

Alternative	Capital Cost	Periodic Cost	Present Worth Cost
Alt. No. 1: No Action	$0	$0	$0
Alt. No. 2: Vapor Mitigation w/ Institutional Controls and Site Management	$357,000	$47,000	$ 1.0 M
Alt. No. 3: Restricted Residential Use with Site Management AKA In-situ Chemical Oxidation (ISCO) of Groundwater and Soil Vapor Extraction (SVE) w/ Institutional Controls and Site Management	$1.7M	$105,000	$3.3M
Alt. No. 4: Attempted Restoration to Pre-Disposal or Unrestricted Conditions[1]	$10.8M	$105,000	$13.5M

1. This alternative attempts to restore the property to pre-disposal conditions by treating or removing all known and accessible contamination at the site. However, there is suspected contamination under the on-site buildings which could not be investigated without disrupting business operations. As such, this alternative

will require an environmental easement and site management plan to allow for further investigation to refine the nature and extent of contamination under the on-site buildings if and when the buildings are demolished. Therefore this alternative cannot reasonably achieve unrestricted conditions.

4.1 Evaluation Criteria

This Section describes the evaluation criteria used to develop and compare remedial alternatives. The evaluation criteria were established under NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation, Section 4.2, and are listed below. The first two criteria are threshold criteria which must be satisfied in order for an alternative to be considered for selection. The next six are primary balancing criteria which are used to compare the positive and negative aspects of each of the remedial alternatives, provided the alternative satisfies the threshold criteria.

Threshold Criteria

- Overall protection of human health and the environment: This criterion is an evaluation of the alternative's ability to protect public health and the environment, assessing how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, engineering controls or institutional controls. The alternative's ability to achieve each of the RAOs is evaluated.

- Compliance with Standards, Criteria and Guidance: This criterion evaluates the compliance of the alternative with all identified SCGs. All SCGs for the site will be listed along with a discussion of whether or not the remedy will achieve compliance.

Balancing Criteria

- Long term effectiveness and permanence: Each alternative is evaluated for its long-term effectiveness after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated:

    - The magnitude of the remaining risks (i.e., any significant threats, exposure pathways, or risks to the community and environment from the remaining wastes); and
    - The adequacy of the engineering and institutional controls intended to limit the risk.

- Reduction of toxicity, mobility, or volume of contamination through treatment: The alternative's ability to reduce the toxicity, mobility or volume of site contamination is evaluated. Preference should be given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the site.

- Short term impacts and effectiveness: The potential short-term adverse impacts and risks of the remedy upon the community, the workers, and the environment during the construction and/or implementation are evaluated. A discussion of how the identified potential adverse impacts to the community or workers at the site will be controlled, and the effectiveness of the controls, should be presented. Provide a discussion of engineering controls that will be used to mitigate short term impacts (i.e., dust control measures). The length of time needed to achieve the remedial objectives is also estimated.

- Implementability: The technical and administrative feasibility of implementing each alternative is evaluated for this criterion. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedy. For administrative feasibility, the availability of the necessary personnel and material is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, etc.

- Cost Effectiveness: This criterion is an evaluation of the overall cost effectiveness of an alternative or remedy. This criterion evaluates the estimated capital, operations, maintenance, and monitoring costs. Costs are estimated and presented on a present worth basis.

- Land Use: This criterion evaluates the current, intended and reasonably anticipated future use of the site and its surroundings, as it relates to an alternative or remedy, when unrestricted levels would not be achieved.

4.2 Evaluation of Alternatives

<u>Alternative #1: No Action</u>

The "No Action" Alternative is evaluated as a procedural requirement and as a basis for comparison with other alternatives. The Site would remain in an unremediated state. No institutional or engineering controls would be placed on the Site property and no additional costs would be incurred. This alternative does not achieve any of the remedial action objectives for this site, is not protective of public health or the environment, and will not be retained for further consideration.

- **Overall protection of human health and the environment:** This alternative
    - provides no control of exposure to contaminated media (soil, groundwater and soil vapor) and no reduction in risk to human health posed by these contaminated media. The alternative allows for the continued off-site migration of contaminated soil vapor and groundwater.

    - **Compliance with SCGs:** This alternative does not comply with any of the SCGs.

    - **Long term effectiveness and permanence:** This alternative does not provide any long-term effectiveness or permanence. No long-term management or controls for exposure are provided for in this alternative. Long term potential risks will remain unchanged under this alternative.

- **Reduction of toxicity, mobility, or volume of contamination through treatment:** This alternative does not provide a reduction in toxicity, mobility, or volume of the contaminated soil, groundwater or soil vapor.

- **Short term impacts and effectiveness:** This alternative does not result in disruption of, or removal of the subsurface impacts; therefore, no additional risks are posed to the community, workers, or the environment from additional exposure to the soil impacts as a result of implementing this alternative. Remedial objectives are not achieved so no remedial time frame is associated with this alternative.

- **Implementability:** There are no implementability concerns posed by this remedy as no remedial actions are considered.

- **Cost Effectiveness**: Because this is a no action alternative, the capital, operations and maintenance, and net present value costs are estimated to be $0.

- **Land Use:** The no action alternative would result in soil contaminants exceeding unrestricted SCOs remaining in place at the site. There would be no restrictions placed on the future use of the site to prevent redevelopment to a residential or commercial use that could expose future occupants to soils impacted above SCOs identified for residential or commercial uses.

<u>Alternative #2: Vapor Mitigation w/ Institutional Controls and Site Management</u>

Sub-slab depressurization systems (SSDS) would be installed to mitigate the potential for vapor-phase volatile organic compounds (VOC) to enter the indoor air of onsite and off-site buildings via a process known as soil vapor intrusion (SVI). The SSDS will minimize exposure to VOCs migrating from contaminated groundwater by eliminating vapor accumulation beneath the buildings. A separate SSDS would be required for each of the three impacted buildings. A forth building located downgradient of the site, the East Farmingdale Fire Department, has yet to be evaluated for SVI and may also require mitigation.

Institutional controls, in the form of an Environmental Easement (EE), are required to provide an enforceable legal instrument for ensuring compliance with all engineering controls (EC) and institutional controls (IC) placed on the site. A Site Management Plan (SMP) is required that identifies all use restrictions, institutional and engineering controls for the site, and details the steps and media-specific requirements necessary to ensure that the controls remain in place and are effective.

This alternative would not remediate groundwater contamination (VOC) or subsurface soil contamination (VOC, metals and SVOC) at the site. Protection of public health would be achieved by a restriction on groundwater use at the site and limiting future excavation in areas of remaining contaminated soils, as outlined in the EE and SMP. Use of the site would be restricted to Industrial purposes only.

- **Overall protection of human health and the environment:**

Soil Vapor Intrusion- This alternative provides overall protection of human health and the environment by mitigating vapor beneath the impacted buildings and preventing vapors from entering the buildings.

Soils and Groundwater- As no groundwater or soil remediation is contemplated by this alternative, protection of human health is achieved through the execution of an environmental easement which will restrict use of the groundwater and limit the future intended use of the site to industrial. Contaminated onsite soil meets the Industrial Use SCOs and is considered protective of public health and the environment for the current site use.

- **Compliance with SCGs:**

Soil Vapor Intrusion- This alternative will achieve compliance with NYSDOH air guideline values by preventing the accumulation of vapors beneath impacted buildings. Emissions from the SSDS will comply with the State and Federal ambient air quality regulations. If necessary, emissions from the SSDS will be treated using vapor phase GAC prior to release to the atmosphere.

Soils- Soil contamination is already below industrial use SCOs and will be compliant with SCGs. Based on groundwater samples collected from the on-site monitoring wells, soil contaminants that exceed the unrestricted use and protection of groundwater SCOs do not appear to have impacted groundwater quality at the site. With the implementation of a Site Management Plan and institution controls future use of the site will be restricted to industrial use and will comply with applicable soil SCGs.

Groundwater- Since no remediation is contemplated, VOC contaminated groundwater will continue to exhibit concentrations above the NYS Class GA GWQS. This alternative will not comply with groundwater SCGs.

- **Long term effectiveness and permanence:**

Soil Vapor Intrusion- Sub-slab depressurization systems provide a high degree of long-term effectiveness and permanence. The long-term effectiveness and permanence of the SSDS installed in the buildings will depend on the routine maintenance and operation of the system. Periodic repairs and equipment replacement will be necessary for the system to work effectively.

Soils- Use restrictions imposed by an environmental easement provide long-term effectiveness and permanence. However, the effectiveness and permanence is dependent on the enforcement of the institutional controls by regulating agencies and adherence to the restrictions by the property owner.

Groundwater- No action on groundwater contamination does not provide long-term effectiveness and permanence. Existing groundwater contamination at the site poses potentially unacceptable human health risks under current and likely future groundwater use scenarios. No long-term management or controls for exposure are included in this alternative. Human health and environmental risks would remain unchanged over the long term for expected groundwater uses.

- **Reduction of toxicity, mobility, or volume of contamination through treatment:**

Soil Vapor Intrusion- Sub-slab depressurization systems effectively reduce the concentrations of vapors beneath the building and minimize indoor air exposures. The use of vapor phase GAC, if necessary, prior to emitting vapors will reduce the overall toxicity, mobility and volume of contaminants.

Soils and Groundwater- Since no soil or groundwater remediation is contemplated, this alternative will not provide a reduction in toxicity, mobility, or volume of contamination in soils or groundwater.

- **Short term impacts and effectiveness:**

Soil Vapor Intrusion- Installation of SSDS will result in some disruption of building operations during installation. Measures will be taken during design and construction of the system to minimize the disruption. The installation is not expected to expose workers or building occupants to contaminated soil vapor since the installation of ports will be accomplished through drilling into the slab and exposure to contaminants beneath the slab will be minimal. Risks associated with installation of SSDS will be minimized by the preparation of a Remedial Action Work Plan and a Health and Safety Plan.

Soils and Groundwater- This alternative will not result in any short term impacts to the site or neighboring properties. The effectiveness of the alternative will depend on the enforcement of the environmental easement by regulating agencies.

- **Implementability:**

Soil Vapor- Sub-sab depressurization systems are implementable with readily available equipment and materials; however, the buildings are all actively used which will require coordination with the owners/operators for access to install the SSDS.

Soils and Groundwater- An environmental easement can be implemented administratively, and requires no special equipment or materials.

- **Cost Effectiveness:**

Soil Vapor Intrusion- The estimated total present value cost of the Vapor Mitigation alternative is approximately $1.0 million, which entails the installation of a SSDS in each of the three impacted buildings. This alternative includes O&M for the SSDS estimated for a lifetime operation of 30 years.

Soils and Groundwater- an environmental easement is expected to cost approximately $43,000, which includes execution of the easement, preparation of a Site Management Plan and O&M for periodic certifications and inspections.

- **Land Use:**

Soil contamination at the site currently meets Industrial Use SCOs, which is consistent with the current and reasonably anticipated future use of the site.

<u>Alternative #3: Restricted Residential Use with Site Management</u>

AKA

<u>In-situ Chemical Oxidation (ISCO) of Groundwater and Soil Vapor Extraction (SVE) w/ Institutional Controls and Site Management</u>

This alternative remediates groundwater contamination via ISCO- the subsurface injection of chemical oxidation compounds into the groundwater plume source area to react with and destroy volatile organic compounds (VOC) present in the saturated zone. A soil vapor extraction (SVE) system and/or sub-slab depressurization systems (SSDS) will be installed to remove suspected soil contamination from under the on-site buildings, and to protect impacted buildings from the threat of soil vapor intrusion. The SVE system will remove soil vapors and prevent the accumulation of vapors under the onsite and off-site buildings. This alternative assumes that a properly designed SVE system will obviate the need for separate mitigation (via SSDS) of the off-site building.

SVE is preferred to SSDS in this alternative because it actively remediates the source of soil vapors while simultaneously protecting impacted buildings from the threat of soil vapor intrusion. If it is determined during implementation of the remedy, that SVE will not adequately protect all of the impacted buildings, then additional vapor mitigation measures will be undertaken for each building, as deemed necessary by the Department

Institutional controls, in the form of an Environmental Easement (EE), are required to provide an enforceable legal instrument for ensuring compliance with all engineering controls (EC) and institutional controls (IC) placed on the site. The EE will control the use and development of the site for restricted residential, commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws. The EE will contain a provision for evaluation of the potential for soil vapor intrusion for any buildings developed on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion.

A Site Management Plan (SMP) is required that identifies all use restrictions, institutional and engineering controls for the site, and details the steps and media-specific requirements necessary to ensure that the controls remain in place and are effective. Long term monitoring (LTM) of groundwater quality is included in this alternative.

The active use of the on-site buildings prevented an investigation of the soils below the building slabs. The high levels of VOC detected in sub-slab vapor samples indicates a suspected but unconfirmed source of contamination under the buildings. As the extent of VOC contamination under the Site buildings cannot be ascertained without disrupting business operations, the SMP should contain a provision for further investigation to refine the nature and extent of contamination under the on-site buildings if and when the buildings are demolished or when a change of use of the site is contemplated.

This alternative considers that the Site buildings and pavement together constitute cover system adequate to allow for restricted residential use of the site. The cover system must be maintained, and any future site redevelopment must maintain an adequate a cover system.

This alternative will not remove soil contamination (metals and SVOC) in the onsite dry wells. The surface pile of discarded polishing grit is a solid waste and should be referred to the DEC Division of Materials Management for follow up enforcement action.

- **Overall protection of human health and the environment:**

  Soil Vapor Intrusion- A soil vapor extraction system provides overall protection of human health and the environment by remediating soil vapors beneath the impacted buildings and preventing vapors from entering the buildings.

  Soils- The SVE will also remediate suspected (but unconfirmed) VOC contamination in the onsite soils. Metals and SVOC contamination present in two onsite drywells currently meets the industrial Use SCOs and is considered protective of public health and the environment for the current use of the site.

  Groundwater- This alternative will protect human health and the environment at the site through a combination of ISCO injections in the source area and long term monitoring of groundwater quality. Institutional controls will restrict local groundwater use. Since there are no public water supply sources down gradient of the site, injection of oxidants is not a concern to public health. Long term monitoring of groundwater quality and for the presence of ISCO compounds will be conducted.

- **Compliance with SCGs:**

Soil Vapor Intrusion- The SVE system will achieve compliance with NYSDOH air guideline values by preventing the accumulation of vapors beneath impacted buildings. Emissions from the SVE system will be treated using vapor phase GAC to ensure compliance with applicable air quality standards. The SVE system is expected to achieve SCGs in approximately 3 years.

Soils- Contaminated soil will be removed from three drywells along with the surface pile of abrasive polishing grit. Based on groundwater samples collected from the site, soil contaminants that exceed the unrestricted use and protection of groundwater SCOs do not appear to have impacted groundwater quality at the site. VOC contamination under the Site buildings will be adequately covered by the building slabs. With the implementation of a Site Management Plan and institution controls, future use of the site will be restricted to restricted residential use and soils will comply with applicable soil SCGs.

Groundwater- Groundwater is expected to achieve compliance with SCGs including NYS Class GA GWQS in the onsite source area within two years. Injections of a chemical oxidant will require an underground injection control (UIC) permit mandated by the Safe Drinking Water Act (SDWA). In addition if large quantities of chemicals regulated under the Emergency Planning and Community Right to Know Act (EPCRA) are stored on-site during the injection events compliance with Sections 310, 311, and 312 under the act may be required. Areas outside the source area remediation zone will degrade naturally over a longer period of time and eventually should achieve the NYS Class GA GWQS.

- **Long term effectiveness and permanence:**

Soil Vapor Intrusion- A SVE system provides a high degree of long-term effectiveness and permanence by removing the VOC contamination responsible for soil vapors. The long-term effectiveness and permanence of the SVE system will depend on the routine maintenance and operation of the system. Periodic monitoring, repairs and equipment replacement will be necessary for the system to work effectively.

Soils- Use restrictions imposed by an environmental easement provide long-term effectiveness and permanence. However, the effectiveness and permanence is dependent on the enforcement of the institutional controls by regulating agencies and adherence to the restrictions by the property owner.

Groundwater- ISCO treatment has been demonstrated to be effective and reliable for groundwater treatment of VOCs at numerous sites and is expected to be effective at this site. While ISCO will significantly reduce VOCs in the source area, residual VOC concentrations in the dissolved phase plume will continue to exceed the NYS Class GA GWQS for an unknown period of time. Institutional controls and long term monitoring of the plume will provide adequate protection of human health from the diluted residual plume.

- **Reduction of toxicity, mobility, or volume of contamination through treatment:**

Soil Vapor Intrusion- The SVE system will effectively reduce the concentrations of vapors beneath the impacted buildings and minimize indoor air exposures. The use of vapor phase GAC on the exhaust stream will further reduce the overall toxicity, mobility and volume of contaminants.

Soils- This alternative does not address the toxicity, mobility and volume of contaminants in the onsite drywells by removing all contaminated soil. The drywell contamination is minor, and not impacting the groundwater, and is considered immobile. Soil contamination under the buildings will be reduced by the SVE.

Groundwater- ISCO treatment uses chemical processes to transform VOCs in groundwater to less harmful compounds. ISCO will permanently reduce the toxicity, mobility and volume of contaminants in groundwater onsite, effectively cutting off the source of the plume. With time, the toxicity, mobility or volume of contaminants in the downgradient plume will attenuate through natural processes.

- **Short term impacts and effectiveness:**

Soil Vapor Intrusion- SVE installation and operation will result in minimal impacts to human health or the environment. Site operations may temporarily be impacted during installation and startup, and increased traffic and noise during vacuum well installation and trenching is expected. Dry wells located in the source area may need to be covered and sealed during operation of the system to prevent the short circuiting of the vacuum wells. If dry wells are required to be sealed, an alternative means for storm water management on the site will need to be designed. Risks associated with this alternative will be mitigated by the preparation of a Remedial Action Work Plan and a Health and Safety Plan.

Soils- Use restrictions imposed by an environmental easement will result in no short term impacts to the site or neighboring properties. Remaining soil contamination will be under the building slabs. The effectiveness of this alternative will depend on the enforcement of the institutional controls by regulating agencies and adherence to the use restrictions by the property owner.

Groundwater- Implementation of ISCO will result in some disruption to the site due to the site being small (0.5 acres) and being an active manufacturing facility. Available space is limited and equipment, materials and vehicles currently located in the vicinity where injection wells will be installed will have to be temporary moved to get equipment in to install the wells and during subsequent injection events. Disruptions during injection events can be minimized by the installation of a central injection vault which can be used to push chemicals to all injection wells from one location. This alternative requires the use and handling of chemicals that could potentially pose a risk to workers. This risk is mitigated by wearing the appropriate level of personal protection equipment and using workers trained on the safe use and handling of the oxidizing agents. Use of hydrogen peroxide or Fenton’s Reagent will cause an exothermic reaction; however, due to the depth of injections (30 – 125 feet bgs) the potential risks for on-site occupants and workers will be minimal. Noise from drill rigs used to install injection wells and generators used by the injection equipment may be a nuisance for the on-site occupants and neighboring properties.

- **Implementability:**

Soil Vapor- Soil vapor extraction systems are implementable with readily available equipment and materials. Vapor extraction wells will be installed outside of the building, resulting in minor disruption to the facility. Further site evaluation is necessary to access the impact source area dry wells will have on SVE effectiveness and the feasibility of providing alternative storm water management.

Soils- SVE is readily implementable.

Groundwater- ISCO is a well-established technology and the equipment and services to install and operate the injection system are commercially available. Implementation will require the use of secondary containment measures for oxidants and the use of personal protective equipment. Workers responsible for injecting the oxidant will be trained in the safe handling and storage of the chemicals. Additional pre-design investigation bench scale and pilot testing will be necessary to determine the optimal well placement, oxidant demand, achievable radius of influence and number of injections. Trenching and site work for ISCO can be combined with SVE installation to make best use of limited available space.

- **Cost Effectiveness:** Total Present worth of this combined alternative is $3.3 M.

Soil Vapor Intrusion- The estimated total present value cost for the SVE system is approximately $0.7 million, which includes the installation of the SVE system and O&M for the estimated operational lifetime of 3 years.

Groundwater- The estimated present value cost for groundwater remediation is approximately $2.6 million which includes the installation of permanent ISCO injection wells and assumes two injection events spaced six months apart. O&M costs associated with this alternative include performance monitoring to verify the effectiveness of ISCO in the source area and costs associated with the long term monitoring program, estimated to continue for 30 years.

- **Land Use:**

Soil contamination at the site currently meets Industrial Use SCOs, which is consistent with the current and reasonably anticipated future use of the site.

Alternative #4: Attempt at Restoration to Pre-Disposal or Unrestricted Conditions

AKA

<u>In-situ Chemical Oxidation of Groundwater, Soil Vapor Extraction and Soil Removal</u>

This alternative has been disqualified due to the Department's inability to adequately define the nature and extent of suspected VOC contamination under the on-site buildings. Though all documented contamination can be removed through this alternative, the Department is reluctant to allow for the unrestricted use of an historically industrial property with severe soil vapor intrusion issues, simply because it doesn't have sample data to prove that soil contamination in excess of SCGs is present under the on-site buildings.

This alternative remediates groundwater contamination via ISCO- the subsurface injection of chemical oxidation compounds into the groundwater plume source area to react with and destroy volatile organic compounds (VOC) present in the saturated zone. A soil vapor extraction (SVE) system and/or sub-slab depressurization systems (SSDS) will be installed to remove suspected soil contamination from under the on-site buildings, and to protect impacted buildings from the threat of soil vapor intrusion. The SVE system will remove soil vapors and prevent the accumulation of vapors under the onsite and off-site buildings. This alternative assumes that a properly designed SVE system will obviate the need for separate mitigation (via SSDS) of the off-site building.

SVE is preferred to SSDS in this alternative because it actively remediates the source of soil vapors while simultaneously protecting impacted buildings from the threat of soil vapor intrusion. If it is determined during implementation of the remedy, that SVE will not adequately protect all of the impacted buildings, then additional vapor mitigation measures will be undertaken for each building, as deemed necessary by the Department

Soil contamination in three onsite drywells (metals and SVOC) exceeding Unrestricted Use SCOs will be excavated and removed, along with a surface pile of discarded garnet polishing grit which exceeds UUSCOs for metals- chromium, copper, nickel and zinc.

This alternative remediates or removes all contamination above SCGs and requires no use restrictions of the site.

- **Overall protection of human health and the environment:**

Soil Vapor Intrusion- A soil vapor extraction system provides overall protection of human health and the environment by remediating soil vapors beneath the impacted buildings and preventing vapors from entering the buildings.

Soils- Protection of human health and the environment is achieved through the removal of all soils exceeding Unrestricted Use SCOs.

Groundwater- This alternative will protect human health and the environment at the site through a combination of ISCO injections in the source area and long term monitoring of groundwater quality. Institutional controls will restrict local groundwater use. Since there are no public water supply sources down gradient of the site, injection of oxidants is not a concern to public health. Long term monitoring of groundwater quality and for the presence of ISCO compounds will be conducted.

- **Compliance with SCGs:**

Soil Vapor Intrusion- The SVE system will achieve compliance with NYSDOH air guideline values by preventing the accumulation of vapors beneath impacted buildings. Emissions from the SVE system will be treated using vapor phase GAC to ensure compliance with applicable air quality standards. The SVE system is expected to achieve SCGs in approximately 3 years.

Soils- This alternative provides overall protection of human health and the environment by permanently removing soil with contaminant concentrations greater than the unrestricted use SCOs from the site.

Groundwater- Groundwater is expected to achieve compliance with SCGs including NYS Class GA GWQS in the onsite source area within two years. Injections of a chemical oxidant will require an underground injection control (UIC) permit mandated by the Safe Drinking Water Act (SDWA). In addition if large quantities of chemicals regulated under the Emergency Planning and Community Right to Know Act (EPCRA) are stored on-site during the injection events compliance with Sections 310, 311, and 312 under the act may be required. Areas outside the source area remediation zone will degrade naturally over a longer period of time and eventually should achieve the NYS Class GA GWQS.

- **Long term effectiveness and permanence:**

Soil Vapor Intrusion- A SVE system provides a high degree of long-term effectiveness and permanence by removing the VOC contamination responsible for soil vapors. The long-term effectiveness and permanence of the SVE system will depend on the routine maintenance and operation of the system. Periodic monitoring, repairs and equipment replacement will be necessary for the system to work effectively.

Soils- This alternative provides a high degree of long-term effectiveness and permanence. The contamination will be permanently removed from the site and disposed in a permitted landfill.

Groundwater- ISCO treatment has been demonstrated to be effective and reliable for groundwater treatment of VOCs at numerous sites and is expected to be effective at this site. While ISCO will significantly reduce VOCs in the source area, residual VOC concentrations in the dissolved phase plume will continue to exceed the NYS Class GA GWQS for an unknown period of time. Institutional controls and long term monitoring of the plume will provide adequate protection of human health from the diluted residual plume.

- **Reduction of toxicity, mobility, or volume of contamination through treatment:**

Soil Vapor Intrusion- The SVE system will effectively reduce the concentrations of vapors beneath the impacted buildings and minimize indoor air exposures. The use of vapor phase GAC on the exhaust stream will further reduce the overall toxicity, mobility and volume of contaminants.

Soils- This alternative will reduce the toxicity, mobility, and volume of contamination in soils on-site by transferring them from the site to a permitted landfill for disposal. The actual toxicity and volume will remain unchanged in the landfill, but the mobility will decrease.

Groundwater- ISCO treatment uses chemical processes to transform VOCs in groundwater to less harmful compounds. ISCO will permanently reduce the toxicity, mobility and volume of contaminants in groundwater onsite, effectively cutting off the source of the plume. With time, the toxicity, mobility or volume of contaminants in the downgradient plume will attenuate through natural processes.

- **Short term impacts and effectiveness:**

Soil Vapor Intrusion- SVE installation and operation will result in minimal impacts to human health or the environment. Site operations may temporarily be impacted during installation and startup, and increased activity and noise during vacuum well installation and trenching is expected. Dry wells located in the source area may need to be covered and sealed during operation of the system to prevent the short circuiting of the vacuum wells. If dry wells are required to be sealed, an alternative means for storm water management on the site will need to be designed. Risks associated with this alternative will be mitigated by the preparation of a Remedial Action Work Plan and a Health and Safety Plan.

Soils- This alternative will result in some disruption of the site and some risks will be imposed to the community, workers, and the environment. The additional risks will be generated from the excavation of contaminated soils from the drywells. These risks will be minimized by the development and implementation of a Remedial Action Work Plan including a Health and Safety Plan and Community Air Monitoring Plan. Estimated time to achieve the applicable SCGs in 1-2 months.

Groundwater- Implementation of ISCO will result in some disruption to the site due to the site being small with limited available space and being an active manufacturing facility. Available space is limited and equipment, materials and vehicles currently located in the vicinity where injection wells will be installed will have to be temporary moved to get equipment in to install the wells and during subsequent injection events. Disruptions during injection events can be minimized by the installation of a central injection vault which can be used to push chemicals to all injection wells from one location. This alternative requires the use and handling of chemicals that could potentially pose a risk to workers. This risk is mitigated by wearing the appropriate level of personal protection equipment and using workers trained on the safe use and handling of the oxidizing agents. Use of hydrogen peroxide or Fenton's Reagent will cause an exothermic reaction; however, due to the depth of injections (30 – 125 feet bgs) the potential risks for on-site occupants and workers will be minimal. Noise from drill rigs used to install injection wells and generators used by the injection equipment may be a nuisance for the on-site occupants and neighboring properties.

- **Implementability:**

Soil Vapor- Soil vapor extraction systems are implementable with readily available equipment and materials. Vapor extraction wells will be installed outside of the building, resulting in minor disruption to the facility. Further site evaluation is necessary to access the impact that source area dry wells will have on SVE effectiveness and the feasibility of providing alternative storm water management.

Soils- This alternative is. The excavation of contaminated soil from drywells is implementable with readily available equipment and materials. Remediation of the suspected source of contamination under the building slabs is achievable with a SVE system, full remediation cannot be confirmed without sampling through the building slabs.

Groundwater- ISCO is a well-established technology and the equipment and services to install and operate the injection system are commercially available. Implementation will require the use of secondary containment measures for oxidants and the use of personal protective equipment. Workers responsible for injecting the oxidant will be trained in the safe handling and storage of the chemicals. Additional pre-design investigation bench scale and pilot testing will be necessary to determine the optimal well placement, oxidant demand, achievable radius of influence and number of injections. Trenching and site work for ISCO can be combined with SVE installation to make best use of limited available space.

- **Cost Effectiveness:** Total Present worth of this combined alternative is $3.5 M.

Soil Vapor Intrusion- The estimated total present value cost for the SVE system is approximately $0.7 million, which includes the installation of the SVE system and O&M for the estimated operational lifetime of 3 years.

Soils- The estimated total present value cost is approximately $164,000 which includes the excavation and disposal of contaminated soils. This alternative does not have any O&M cost.

Groundwater- The estimated present value cost for groundwater remediation is approximately $2.7 million which includes the installation of permanent ISCO injection wells and assumes two injection events spaced six months apart. O&M costs associated with this alternative include performance monitoring to verify the effectiveness of ISCO in the source area and costs associated with the long term monitoring program, estimated to continue for 30 years.

- **Land Use:**

This alternative will achieve unrestricted use SCOs and no long-term restrictions on property use would be necessary.

5. Comparative Analysis of Alternatives

This section compares and ranks each alternatives ability to meet the site specific RAOs for each specific evaluation criteria.

Overall Protectiveness of Public Health and the Environment
Alternative 1 would do nothing to protect public health and the environment. All contamination would remain in place and no restrictions on property use are imposed.

Alternative 2 is protective of public health and the environment by preventing soil vapor from entering impacted buildings and restricting future use of the Site to restricted residential uses. An environmental easement and site management plan will be developed for the site which will limit excavation in areas with soil contamination and prohibit use of contaminated groundwater. This alternative leaves soil and groundwater contamination in place, relying on institutional controls to minimize human health exposures.

Alternatives 3 and 4 provide substantially more protection of public health and the environment than Alternative 2 because they address the primary significant threat- VOC contamination in the soil and groundwater. With ISCO treatment of groundwater, and SVE treatment of soil, Alternatives 3 and 4 remediate the highly mobile VOC soil and groundwater contamination responsible for soil vapors. Alternative 3 does not remove the immobile metals and SVOC contaminated in the onsite drywell sediments making it somewhat less protective than Alternative 4.

Alternative 4 is the most protective alternative because it remediates all contamination associated with the Site, including the immobile metals and SVOC contaminated drywell sediments.

Compliance with Standards, Criteria and Guidance (SCGs)
Alternative 1 does not remediate any contamination and therefore does not comply with any of the applicable SCGs. Since Alternative 1 fails both threshold criteria, it will not be retained for further evaluation.

Alternative 2 will achieve compliance with NYSDOH air guideline values by preventing the accumulation of vapors beneath impacted buildings. Groundwater contamination is not addressed and will continue to exhibit concentrations above the NYS Class GA GWQS. Soil contamination exceeds Commercial Use SCOs, but does not exceed Industrial Use SCOs. An environmental easement, restricting the Site to industrial uses and prohibiting the use of groundwater, will bring compliance with SCGs.

Alternatives 3 and 4 achieve compliance with NYSDOH air guideline equally well as Alternative 2. Yet, Alternatives 3 and 4 further address source area VOC groundwater contamination and are expected to eventually achieve compliance with NYS groundwater quality standards.

Alternatives 3 and 4 equally achieve compliance with SCGs by additionally removing soil contamination exceeding NYSDEC Unrestricted Use Soil Cleanup Objectives from two on-site drywells.

Long term effectiveness and permanence
Alternatives 2, 3 and 4 will all provide long term effectiveness. Generally, alternatives that remove or treat contamination are considered more effective than alternatives that rely on future owner/operator compliance with easements, use restrictions or site management plans. Alternatives 3 and 4 are equally effective and remove more contamination than alternative 2.

Reduction of toxicity, mobility, or volume of contamination through treatment
Generally, alternatives that remove or treat contamination are considered more effective than alternatives that rely on future owner/operator compliance with easements, use restrictions or site management plans. Alternative 2 prevents VOC vapors from entering buildings, but does not address the source(s) of the VOC vapors. Therefore Alternative 2 does little to reduce the toxicity, mobility or volume of contamination. Alternatives 3 and 4 treat VOC contamination in all three impacted media- groundwater, soil and soil vapor- and are equally effective at significantly reducing the toxicity, mobility and volume of highly mobile VOC contamination. Alternative 4 additionally removes immobile SVOC and metals contamination in the onsite dry wells, and therefore best satisfies this criterion.

Alternative 2 would control potential exposures with institutional and engineering controls only, but will not reduce the toxicity, mobility or volume of contaminants remaining. Alternatives 3 and 4 equally reduce the toxicity, mobility and volume of the primary contaminants of concern (CVOC). Only Alternative 4 removes the metals and SVOC contamination from the onsite dry wells. The dry well contamination is not impacting groundwater quality and is considered to be relatively immobile. With the removal and off-site disposal of contaminated dry well soils, the volume of on-site contamination is reduced.

Short term impacts and effectiveness
Alternatives 2, 3 and 4 all require installation of equipment - fans/motors, ductwork and/or plumbing. All will result in some disruption of building operations during installation. Alternative 2 has no groundwater treatment component, resulting in the least disruption at the site, but it will impact neighboring properties that require sub-slab depressurization systems (SSDS) to be installed. Alternative 2 requires access to three buildings to install the SSDS. Coordination to minimize impacts to property and business operations could prove difficult and may require scheduling of work to occur during non-business hours. Space is required in each building to permanently house electrical/control equipment. The SSDS must be run indefinitely, and have an anticipated operational lifetime of 30-years. Alternatives 3 and 4 place all remediation activities on the Site resulting in more disruption of on-site operations, but little disruption to neighboring properties. Alternatives 3 and 4 both contemplate a soil vapor

extraction system (SVE) to remediate soil vapors, and in-situ chemical oxidation (ISCO) for treatment of groundwater contamination. Due to the lack of available space at the site, it is expected that SVE extraction wells and ISCO injection wells will be placed in trenches, where appropriate and power equipment will be roof-mounted, where possible. Normal site operations may temporarily be impacted during installation and startup, and increased traffic and noise during well installation and trenching is expected. Although Alternative 4 will have the greatest short term impact on Site operations because of the additional time and heavy equipment necessary for soil removal from the dry wells, the impacts are minor when compared to installation of the SSDS, SVE and ISCO systems.

Implementability

Each alternative is implementable with readily available equipment and materials; however, the buildings are all actively used which will require coordination with the owners/operators for access, and to minimize impacts to business operations during the remedial construction. Furthermore, available space on the site on which to stage equipment and construct the remedial systems is limited. Potential impacts to business operations during construction of any of the remedial systems must be reviewed

Further evaluation of site conditions will be necessary when planning locations for drilling, trenching and equipment placement. Pilot testing to determine the radius of influence of soil vapor extraction points will influence the final design of the SVE and/or SSDS systems. Additional pre-design investigation bench scale and pilot testing is necessary to determine the optimal well placement, oxidant demand, achievable radius of influence and number of injections in the final ISCO remedial design.

It is anticipated that many components of the SVE and SSDS systems, such as blowers and fans, electrical closets, plumbing manifolds, etc., can be roof-mounted on one or more of the impacted buildings, enhancing implementability. However, if system components cannot be roof-mounted, then on-site placement and construction of equipment sheds must be considered.

There is little practical difference between alternatives 3 and 4 in the amount of remedial work and cost. Alternative 4 is not implementable due to the Department's inability to adequately define the nature and extent of suspected VOC contamination under the on-site buildings. The buildings are actively occupied and collecting soil samples through the floor of the buildings would have required unacceptable disruption to the occupants. It is imprudent to grant unrestricted use status on an historically industrial property with extremely high levels of soil vapor contamination simply because the Remedial Investigation was unable to adequately define the source of contamination under the buildings. Therefore, Alternative 4 is disqualified.

Cost Effectiveness

Alternative 2 has the lowest cost, but it leaves all of the contamination in the environment. Protection of public health is achieved through the indefinite use of engineering and institutional controls. Alternatives 3 and 4 cost substantially more than Alternative 2, but they permanently remediate the primary threat to public health and the environment and will achieve remedial action objectives in about 3-years

Land Use

The current zoning and land use of the site is light-industrial. It is reasonably foreseeable that the site could one day be redeveloped into condominiums or apartments. For this reason, the Department has elected to remediate the site to restricted residential land use standards. As previously mentioned, VOC contamination is present under the on-site buildings which will require further evaluation once the buildings are demolished or a change of use of the site is contemplated.