LABELLA Associates, P.C.

Engineering
Architecture
Environmental
Planning

Remedial Alternatives Analysis Report & Remedial Action Work Plan

Location:

15-Acre Praxair Site
137 47th Street
Niagara Falls, New York

Prepared for:

Covanta Niagara, L.P.
100 Energy Boulevard at 56th Street
Niagara Falls, New York 14304

LaBella Project No. 212399

March 2013

Remedial Alternatives Analysis Report & Remedial Action Work Plan

Location:

15-Acre Praxair Site
137 47th Street
Niagara Falls, New York

Prepared for:

Covanta Niagara, L.P.
100 Energy Boulevard at 56th Street
Niagara Falls, New York 14304

LaBella Project No. 212399

March 2013

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Table of Contents

Section **Page**

1.0 Introduction 1

2.0 Background 1

3.0 Results of Previous Investigations 2

4.0 Objectives 8

5.0 Remedial Action Objectives 9

6.0 Development of Remedial Alternatives 10

7.0 Detailed Evaluation of Alternatives 13

8.0 Comparative Evaluation of Alternatives and Recommended Actions 20

9.0 Summary of Recommended Final Remedial Actions 22

10.0 Remedial Action Work Plan 22

11.0 Schedule and Reporting 32

Figures

Figure 1 – Site Location
Figure 2 – Existing Conditions Map
Figure 3 – Areas of Concern
Figure 4 – Historic Sewer Map
Figure 5 – Site Development Plan
Figure 6 – Preliminary Stormwater System Design
Figure 7 – Site Grading Plan
Figure 8 – Proposed Cover System
Figure 9 – Cover System Sections
Figure 10 – Project Schedule

Tables

Table 1 – Remedial Cost Estimate – Select Fill Removal and Cover System Installation
Table 2 – Remedial Cost Estimate – Complete Fill Removal
Table 3 – Remedial Cost Estimate – Pits and Sumps – Impacted Water Removal and Closure
Table 4 – Remedial Cost Estimate – Regulated Building Materials Removal and Demolition

Appendices

Appendix A – Worker Dose Rate Estimates
Appendix B – Radiological Fill Screening Plan
Appendix C – Imported Fill and Soil Values
Appendix D – Site-Specific Community Air Monitoring Plan
Appendix E – Health and Safety Plan

Certification

I DANIEL NOLL certify that I am currently a NYS registered professional engineer and that this Remedial Action Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Signed:

3/18/2013
Date:

1.0 Introduction

This Remedial Alternatives Analysis Report (RAAR) and Remedial Action Work Plan (RAWP) identifies, evaluates, and details remedial alternatives to address contamination encountered at the 15-Acre Praxair property located at 137 47th Street in the City of Niagara Falls, Niagara County, New York and provides a detailed plan for implementation of the recommended remedy. Hereinafter, this property will be referred to as the "Site." Figure 1 shows the location of the Site.

The remedial alternatives were evaluated based on the data obtained during various pre-BCP activities, including a recent Remedial Investigation (RI) conducted at the Site. This RAAR and RAWP summarizes the findings of the Remedial Investigation Report for the Site; however, the RI Report should be referenced for greater details on these activities. The alternatives are developed in response to the findings of the RI and are compared using the New York State Department of Environmental Conservation's (NYSDEC's) guidance documents. Based on the use of the surrounding area and the proposed re-use of the Site, appropriate remedial actions are recommended for implementation. The RAWP details the specific actions necessary to implement the recommended alternative.

2.0 Background

2.1 Site Description

The Site encompasses approximately 15 acres of a larger, former industrial complex that is located at 137 47th Street in the City of Niagara Falls and is owned by Praxair, Inc. The Site consists of portions of two tax parcels (SBL #160.09-1-7.111 and SBL #160.06-3-3). As shown by Figure 2, the Site is occupied by one building that was formerly utilized for the maintenance and repair of locomotives; an inactive rail yard; and concrete floor slabs that are remnants of the former industrial complex. The on-site structure encompasses approximately 13,700 square feet, is not currently utilized, and is in a deteriorated state. The remaining portions of the Site generally consist of aged asphalt, concrete and gravel surfaces with some successional vegetation occurring along the eastern site boundary.

2.2 Site History

The Site, formerly part of a larger industrial complex, was owned and operated by the Union Carbide Corporation Metals Division, which first developed the complex in the early 1900s. The plant reportedly produced special alloys, tungsten, ferroalloys, calcium carbide and ferrorvanadium ferrotungsten. Processes used at the plant included submerged arc, open arc, and globar electric furnaces, as well as exothermic and induction furnaces. Wastes generated by the plant included furnace slag (ferroalloys), hydrated lime and miscellaneous plant waste, which were reportedly disposed of at Union Carbide's former disposal site at 56th Street and Pine Avenue in Niagara Falls.

Union Carbide's Linde Division also operated a welding flux manufacturing facility on the plant property. Waste from this operation included sludge from a rotary air filter, which was reportedly disposed of off-site.

The current owner of the property containing the Site, Praxair, Inc., is a corporate successor to Union Carbide's Linde Division. Other industrial operators on the plant property have included ESAB, L-Tech, Stratcor, Inc., US Vanadium and UMETCO. With the exception of the locomotive house, all of the buildings on the Praxair property have been demolished within the last decade.

From the time of the initial development of the Union Carbide plant, the 15-acre Site was primarily utilized for rail facilities that serviced the plant and other adjacent industries. A portion of the welding flux manufacturing facility that was operated by Union Carbide's Linde Division and later by ESAB/L-TEC, however, was located on the western portion of the Site.

3.0 Results of Previous Investigations

This section summarizes the investigation work completed at the Site and presents the Areas of Concern (AOCs) identified at the Site. These AOCs will be subsequently evaluated for remedial alternatives, and are depicted on Figure 3.

3.1 Remedial Investigation Fieldwork

The RI fieldwork included:

- Completion of a geophysical survey to investigate metallic anomalies (e.g., potential buried tanks, vaults, underground utilities) potentially present in the area surrounding the Locomotive House.
- Collection and analysis of on-site surface soil/fill samples to characterize the chemistry of these materials.
- Completion of test pits, test borings and soil probes to enable the classification, screening, sampling and chemical characterization of subsurface soil/fill.
- Radiological screening of soil/fill excavated from the test pits.
- Installation, development and sampling of groundwater monitoring wells in an effort to determine groundwater flow direction and gradient, as well as to enable the collection and chemical analysis of groundwater samples.
- Execution of a geophysical survey in areas of the site that were not historically occupied by rail facilities in an effort to identify subsurface anomalies potentially indicative of buried drums of radioactive slag.
- Performance of a radiological survey to assess baseline gamma radiation levels across the Site and establish current background radiation levels.
- Completion of a radiological investigation, including the excavation of test pits and field screening and laboratory analysis of soil/fill samples, to characterize and delineate the extent of material exhibiting elevated gamma radiation levels, and to investigate subsurface anomalies identified by the geophysical survey.
- Collection and chemical analysis of liquid and sediment samples from onsite pits and sumps within and adjacent to the Locomotive House to characterize and profile for disposal these materials.
- Implementation of a Regulated Building Material (RBM) survey of the Locomotive House to investigate asbestos containing materials (ACMs), lead-based paint (LBP) and/or polychlorinated biphenyl (PCB) containing electrical equipment.

- The survey of surface soil sample locations, test pit locations, soil probe locations, monitoring well locations and elevations and the sediment sample locations.

3.2 Areas of Concern

As described in the RI Report, the results of this investigation identified a number of Areas of Concern (AOCs) at the Site that warrant further consideration. The nature and extent of impacts for these areas have been defined and are summarized in the sections below. For discussion purposes, these impacts were compared to with the Standards Criteria and Guidance values (SCGs) applicable to each medium sampled, including:

- Soil/Fill: NYSDEC's 6NYCRR Part 375 Environmental Remediation Programs: Part 375-6.8: Residential, Commercial and Industrial Use Soil Cleanup Objectives (SCOs)
- Groundwater: NYSDEC's June 1998 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations in the Technical and Operational Guidance Series (TOGS) 1.1.1

Additionally, gamma radiation measurements were recorded during a walkover survey of the Site using a hand-held gamma scintillation meter/probe system and compared to local background gamma radiation measurements and other threshold values.

3.2.1 AOC #1 Surface Fill

3.2.1.1 AOC #1A – Site-Wide Contaminants of Concern

Polycyclic aromatics hydrocarbons (PAHs) exceeding the Industrial Use SCOs and the Restricted Use SCOs for Groundwater Protection were detected in surface soil/fill samples collected from the northern portion of the Site. The presence of these contaminants is likely related to past industrial operations in that area. The PAHs may also be associated with the operation of railroad spurs in this area.

Pesticide levels exceeding the Industrial Use SCOs were detected in only one location along the edge of the former rail yard on the Site. Levels of pesticides exceeding the Restricted Use SCOs for Groundwater Protection were also detected in several locations along the former rail yard. The presence of these compounds is likely related to the surface application of pesticides on the Site for the control of vegetation during operation of the rail yard and industrial complex.

Arsenic and manganese levels exceeding the Industrial Use SCOs and the Restricted Use SCOs for Groundwater Protection were detected in the surface soil/fill samples collected from several areas of the site. A number of other metals exceeding the Restricted Use SCOs for Groundwater Protection were detected in surface soils/fill across the Site. The presence of these metals is likely related to the deposition of slag, off-specification products and various other processing wastes (e.g., manganese-containing liquids) associated with former industrial operations on and/or adjacent to the Site. This is supported by a correlation with the analytical results from the subsurface fill material and the locations of the samples relative to the welding-flux production facility formerly operated along the western side of the Site.

Based on the findings of the RI, impacts in this AOC have been identified at levels exceeding Site SCOs. As such, remediation and/or engineering controls to address this AOC appear warranted.

3.2.1.2 AOC #1B – Radiological Material

Radiological concerns were identified in the fill material at the Site during the RI.

A baseline radiological assessment performed as part of the RI identified areas of elevated gamma radiation, and was followed by a radiological investigation designed to better characterize and delineate the radiological material present on the Site. The findings of the radiological investigation are summarized below:

- The laboratory results indicate that the material exhibiting elevated gamma radiation consists primarily of slag comprised of 50% iron (FE), 25% calcium oxide (CaO) and 13% silcon monoxide (SiO), which has been previously identified as cyclowollastonite.
- This slag material is typically a by-product of the electrochemical production of elemental phosphorous using uranium-bearing raw materials. Previous radiological surveys of the Niagara Falls area indicate that this material was historically utilized for bedding under paved surfaces (e.g., roads, building slabs) as well as for general hard fill applications.
- No large continuous lenses or laterally extensive subsurface layers of radioactive slag were observed.
- The radioactive slag occurs primarily within two feet of the ground surface in the hot spot areas and appears to be mixed with other non-radiologically impacted fill materials. Gamma radiation levels detected in this material during the on-site investigation generally ranged from 15,000 to 60,000 counts per minute (CPM), with higher readings of 120,000 to 170,000 CPM limited to the area in the vicinity of the TP03 test pit cluster.
- The source of the previously detected peak gamma reading of 420,000 CPM was determined to be a single, football-sized piece of slag that was partially exposed at the ground surface. This piece of slag was removed from the Site for laboratory analysis.
- With the exception of two boring locations, no radiological material was detected via "down-hole" gamma readings taken under the concrete pads. The exceptions to this occurred in the central portion of the large concrete pad that occurs along the western side of the Site. Slightly elevated gamma radiation readings of 22,000 CPM and 19,000 CPM were recorded in the non-native fill material underlying the slab at these locations. Furthermore, some of the concrete appeared to have slag-like material incorporated in the concrete matrix, which may have contributed to the slightly elevated gamma readings in this area.

Based upon the results of this investigation, five discrete areas (among other isolated, smaller areas) were identified as containing slag and slag-like material with gamma radiation surface measurements up to and exceeding approximately six times local background gamma radiation values. These areas are located in the northern portion of the site and are depicted on Figure 3. The maximum depth of the impacted slag observed within these areas was 2.5 feet below grade, and the total estimated amount of radioactive material on the project site at 7,149 tons. This estimate also includes the potential sporadic occurrences of impacted slag in other areas of the site, outside of the five areas of radiological concern.

Despite the elevated gamma radiation measurements, the annual dose rates for on-site workers at one meter and on contact were conservatively calculated to be approximately 200 and 400 mrem per year, respectively (i.e., 2,080 hours per year or 40 hours per work week). These values are well below NYSDOH 16 NYCRR 16.6 - Occupational dose limits of 5,000 mrem per year, which only apply to radiological workers managing the radioactive materials. Conservatively comparing these occupational dose rates to NYSDOH 16 NYCRR 16.7 - Dose Limits to Individual Members of the Public, these values exceed the total effective dose equivalent of 100 mrem per year. Appendix A contains details on anticipated worker dose rate estimates during construction and subsequent public dose rate estimates after site restoration.

Based on the findings of the RI, radiological impacts within this AOC have been identified at gamma radiation levels up to and exceeding approximately six times local background values. As such, remediation and/or engineering controls to address this AOC appear warranted.

3.2.2 AOC #2: Subsurface Fill

3.2.2.1 AOC #2A – Site-Wide Contaminants of Concern

PAHs exceeding the Industrial Use SCOs and the Restricted Use SCOs for Groundwater Protection were detected in one sample originating from subsurface fill located in the north-central portion of the site. The presence of these contaminants likely reflects the chemistry of the fill in that location, but could also be related to past industrial and/or rail activities in that area.

Arsenic and manganese levels exceeding the Industrial Use SCOs and the Restricted Use SCOs for Groundwater Protection were detected in the subsurface fill samples collected from the southern, central and northern portions of the Site. A number of other metals exceeding the Restricted Use SCOs for Groundwater Protection were also detected in subsurface fill samples from across the Site. These results appear to reflect the chemistry of the slag and other industrial fill that is present across the Site to depths ranging from 2 to 8 feet BGS, as well as the fill material that appeared to contain off-specification welding product, which was encountered in the area of the former settling pond near the northern limits of the Site.

The disposal of various other processing wastes (e.g., manganese-containing liquids) associated with former industrial operations on and/or adjacent to the Site may also have contributed to the metals levels in the fill material.

Based on the findings of the RI, impacts in this AOC have been identified at levels exceeding Site SCOs. As such, remediation and/or engineering controls to address this AOC appear warranted.

3.2.2.2 AOC #2B – Petroleum Contamination in the Former USTs/Locomotive House Area:

Although the analytical results from subsurface soil/fill samples collected in the vicinity of the former underground storage tanks (USTs) and Locomotive House did not indicate the presence of volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs) at levels exceeding Commissioner's Policy CP-51 SCOs, evidence of petroleum impacts consisting of elevated photoionization detector (PID) measurements, staining, sheen and petroleum odors were observed in this area during the field investigation.

Based upon the field screening data and observations collected during the soil probe, test pit and monitoring well programs, the fill displaying petroleum nuisance characteristics occurs in the former UST cavity near the southeast corner of the Locomotive House and in the shallow fill to the east and south of the building. The presence of residual petroleum contamination in this area is likely related to leaks or spills associated with the former USTs and related piping and/or incidental releases associated with maintenance and repair activities conducted in this area.

The RI concluded that, although concentrations did not exceed Site SCOs, nuisance characteristic impacts have been identified in this AOC. As such, remediation and/or engineering controls to address this AOC appear warranted.

3.2.3 AOC #3 Pits and Sumps

Low concentrations of a handful of VOCs commonly associated with solvents and degreasers were detected in the water present in the maintenance pit located within the central bay of the Locomotive House. These contaminants are likely related to the maintenance and repair activities formerly conducted in this building. The elevation of the water within this pit is higher than the water levels within the micro-wells installed around the building. Therefore, it would appear that this water is the result of precipitation that has entered the building through the failing roof and collected in the pit, rather than through groundwater infiltration.

Contamination was detected in the historic sewer system discovered around the perimeter of the Locomotive House. This contamination was characterized by SVOC tentatively identified compounds (TICs) detected in aqueous samples collected from the manholes, as well as sheen and odor when sediments within these structures were disturbed. The highest concentration of SVOC TICs was detected in a brick manhole proximate the southeast corner of the Locomotive House, near the former USTs. Floating globules of Liquid Phase Hydrocarbon (LPH) were observed on the surface of the fluid within this manhole, and a strong petroleum odor was noted when the manhole cover at this location was removed.

A 1977 plant drawing, included as Figure 4, shows the sewer system. It was reported by Praxair that all utilities within the Site had been closed and capped; however, no information regarding this specific sewer system was provided. Therefore, the extent and corresponding volume of this system is not known. No flow was observed in any of the manholes on multiple occasions during the RI field program.

Based on the findings of the RI, impacts including globules of LPH have been identified in this AOC. As such, remediation and/or engineering controls to address this AOC appear warranted.

3.2.4 AOC #4 Regulated Building Materials

The Site is occupied by a 13,700-square-feet building that was formerly utilized for the maintenance and repair of locomotives that is not currently utilized and is in a deteriorated state. As described in the RI, asbestos-containing materials (ACMs), lead-based paint (LBP), polychlorinated biphenyl- (PCB-) containing light fixtures, and mercury vapor-containing light bulbs were identified in the Locomotive House. As such, remediation to address this AOC appears warranted.

3.2.5 Other Media: Groundwater

3.2.5.1 Perched Water

Monitoring wells screened within the fill surrounding the Locomotive House contained low levels of aromatic hydrocarbons and PAHs, as well as VOC and SVOC TICs, which is consistent with the evidence of residual petroleum contamination observed in the fill. Only one VOC was detected in this area at a concentration that slightly exceeded the groundwater standard.

Numerous metals were also detected in the perched water occurring in the fill in the vicinity of the Locomotive House, and the samples collected in this area contained the only contraventions of the groundwater standards for chromium and manganese encountered on the Site. The presence of these contaminants likely reflects the chemistry of the fill in this area.

The same is true of the perched water occurring within the fill in the vicinity of the former settling pond in the northern portion of the site. The only contraventions of the groundwater standards for arsenic and vanadium on the Site were detected in a well in this area, which is screened in the fill. Concentrations of arsenic and vanadium in subsurface fill in this area exceed the Restricted Use SCO for groundwater protection. Therefore, the presence of these contaminants likely reflects the chemistry of the fill in this area.

Based on the findings of the RI, only minor impacts to perched groundwater have been identified at the Site. As such, active remediation to address perched groundwater does not appear to be warranted. However, placement of a restriction on the use of groundwater at the Site is appropriate and will be included in the recommended remedy. Additionally, any future placement of impervious surfaces on the Site (i.e., asphalt or concrete) would help to limit the percolation of precipitation through the fill and reduce impacts to groundwater quality.

3.2.5.2 Overburden Groundwater

The RI included the installation of monitoring wells screened in the upper-most water-bearing unit that occurs within the glaciolacustrine and glacial till deposits on the Site. With the exception of low concentrations of several VOCs in the southern portion of the site and low level, unknown SVOC TICs across the Site, organic contaminants were not detected in this hydrostratigraphic unit. The low level VOCs in the southern portion of the Site could be related to petroleum contamination in the Locomotive House area and/or could have migrated onto the Site from an off-site source. The nature and source of the unknown SVOC TICs are not currently known, but they are likely reflective of the industrial character of the Site and surrounding properties.

Metals detected above the groundwater standards in this hydrostratigraphic unit were limited to aluminum, iron, magnesium and sodium. These parameters are commonly encountered in uncontaminated, natural environments and do not appear to be associated with the contaminated fill on the Site. No exceedances of the groundwater standards for arsenic, chromium or manganese were detected in this groundwater zone.

Based on the findings of the RI, only minor impacts to overburden groundwater have been identified at the Site. As such, active remediation to address overburden groundwater does not appear to be warranted. However, placement of a restriction on the use of groundwater at the Site is appropriate and will be included in the recommended remedy. Additionally, any future placement of impervious surfaces on the Site (i.e., asphalt or concrete) would help to limit the percolation of precipitation through the fill and reduce impacts to groundwater quality.

3.3 Summary of Areas of Concern

Based on the similarities of the proposed remedial actions for AOCs #1 and #2, these AOCs have been classified into one category to provide clarity from a remedial standpoint. Additionally, because the results of the RI indicate that groundwater impacts are minimal, no further discussion of groundwater treatment methods is included in the following sections.

4.0 Objectives

The objectives of this RAA & RAWP are to evaluate remedial alternatives to address the AOCs presented above and select remedial actions to be implemented. As defined in NYSDEC DER-10 (Section 4.0), remedial alternatives will be evaluated based on the following criteria:

a. Overall Protection of Public Health and the Environment: This criterion evaluates exposure and residual risks to human health and the environment during or subsequent to implementation of the alternative.
b. Compliance with SCGs: This criterion evaluates whether the remedial alternative will ultimately result in compliance with SCGs, to the extent practicable.
c. Long-Term Effectiveness and Permanence: This criterion evaluates if the remedy is effective in the long-term after implementation (e.g., potential rebound). In the event that residual impacts will remain as part of the alternative, then the risks and adequacy/reliability of the controls are also evaluated.
d. Reduction of Toxicity, Mobility, or Volume with Treatment: This criterion evaluates the reduction of contaminant toxicity, mobility or volume as a result of the remedial alternative. In addition, the reversibility of the contaminant destruction or treatment is evaluated.
e. Short-Term Effectives: This criterion evaluates if the remedial alternative protects the community, workers and the environment during implementation.
f. Implementability: This criterion evaluates the remedial alternative based on its suitability, implementability at the specific site, and availability of services and materials that will be required.
g. Cost: This criterion evaluates the capital, operation, maintenance, and monitoring costs for the remedial alternative. The estimated costs are presented on a present worth basis.
h. Community Acceptance: This criterion takes into account concerns of the community regarding the proposed remedy. Any public comments and overall public perception are addressed as part of the criterion.
i. Land Use: This criterion evaluates the proposed remedial approach against the current, intended, and reasonably anticipated future use of the land and its surroundings.

5.0 Remedial Action Objectives

Remedial Action Objectives (RAOs) are medium-specific objectives for the protection of public health and the environment and are developed based on contaminant-specific standards, criteria, and guidance (SCGs) established by NYSDEC and/or New York State Department of Health (NYSDOH).

Fill RAOs

The RAOs for fill used in this RAA & RAWP are:

- RAOs for Public Health Protection
    - Prevent ingestion/direct contact with contaminated fill.
    - Prevent exposure to elevated radiation levels within slag fill.
    - NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (RPSCOs) for the Protection of Public Health/Industrial Use.
    - NYSDEC CP-51 Supplemental Soil Cleanup Objectives (SSCOs) for the Protection of Ecological Resources.
    - NYCRR Subpart 375-6 RPSCOs for the Protection of Groundwater.
- RAOs for Environmental Protection
    - Prevent migration of contaminants that would result in groundwater or surface water contamination.
    - Prevent impacts to biota from ingestion/direct contact with fill causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

Pits and Sumps RAOs

The RAOs for the water in the sumps and pits used in this RAA & RAWP are:

- RAOs for Public Health Protection
    - Prevent ingestion of water impacted by contaminants.
    - Prevent contact with contaminants in the impacted water.
    - Prevent surface water contamination.
- RAOs for Environmental Protection
    - Prevent impacts to biota from ingestion/direct contact with surface water causing toxicity and impacts from bioaccumulation through the marine or aquatic food chain.

Regulated Building Materials

The RAOs for regulated building materials used in this RAA & RAWP are:

- RAOs for Public Health Protection
    - Prevent contact with or inhalation of contaminants in building materials.
    - Prevent the release of contaminants via wind erosion of deteriorated asbestos containing materials.

6.0 Development of Remedial Alternatives

This section develops the remedial alternatives being considered to address the AOCs identified for the Site. The remedial alternatives evaluated are summarized below:

6.1 Fill

As discussed in Section 3.3, this category includes AOC #1 (surface fill) and AOC #2 (subsurface fill).

6.1.1 No Action

The No Action Alternative is included as a procedural requirement and as a baseline to evaluate other alternatives. Under this alternative, no further remedial or monitoring activities would occur and no environmental easement would be recorded. The fill at the Site would remain virtually as it is and change in use would not be limited except by existing land use controls such as zoning.

6.1.2 Site Management Plan with Institutional Controls

Under this Restricted Use Alternative, institutional controls (e.g., deed restrictions, NYSDEC Environmental Easement, etc.) would be placed on the property to control use of the Site and a Site Management Plan (SMP), including a Health and Safety Plan (HASP), would be developed to protect against exposure.

6.1.3 Selected Fill Removal and Cover System Installation (BCP Track 4 – Restricted Use Cleanup - Industrial)

The planned site redevelopment consists of the construction of an intermodal transportation facility with associated rail yard, green space, and concrete- and asphalt-paved areas.

Under this Industrial Restricted Use Alternative, any fill excavated during the site redevelopment activities (such as the construction of the stormwater conveyance system and other utilities) will be disposed of at an off-site waste facility. Additionally, grossly contaminated fill exhibiting significant nuisance characteristics in the area of the former UST cavity near the southeast corner of the Locomotive House would be removed and disposed off-site.

During removal, the fill will be screened for radiological impacts and the material with significant radiological impacts will be segregated for disposal at an appropriately permitted out-of-state facility, while the remaining excavated material will be disposed at a facility in New York State. Underlying native soil would be characterized for potential re-use on- or off-site.

The extent of the excavation of the grossly contaminated fill impacted with petroleum nuisance characteristics in the area of the former UST cavity near the southeast corner of the Locomotive House will be based on visual and olfactory evidence. Fill with significant petroleum-related olfactory and visual impacts will be excavated for off-site disposal. No post-excavation confirmation sampling will be completed because previous sampling indicates that the material in this area meets the SCOs.

Any on-site fill not excavated as part of site redevelopment activities would be left in place and covered to limit the potential for exposure. Institutional controls in the form of an NYSDEC Environmental Easement would be placed on the property to control use of the Site and an Operations, Maintenance, and Monitoring Plan (OM&M Plan), including a Site Management Plan (SMP) and a Health and Safety Plan (HASP), would be developed to further protect against exposure.

The estimated volume of the material to be excavated during the construction of the stormwater conveyance system is 10,450 tons. However, a portion of this material is native material, as the excavation extends below the fill/native material interface, resulting in the anticipated off-site disposal of approximately 5,200 tons of fill. Additionally, another approximately 2,900 tons of fill will be generated during grading activities and the removal of railroad ties from the Site. An estimated 100 tons of material will be excavated to facilitate the installation of utilities to service the new structure that will be constructed in the general area of the Locomotive House. Lastly, an estimated 7,200 tons of petroleum-contaminated soil will be generated during excavation activities in the former UST cavity near the southeast corner of the Locomotive House.

The cover system would be integrated into the redevelopment plans for the Site, and would therefore consist of a variety of cover materials, each of which will provide adequate protection of human health. (It should be noted that the Site contains one existing set of railroad tracks that are actively used; the construction of which used ballast imported from off-site which adequately covers the on-site fill in the area of these extant tracks.) Figure 5 shows the Site Development Plan, and the following is a breakdown of the planned development and cover system to be placed at the Site based on that plan:

New Cover Type	Estimated Area (square feet)
Asphalt	186,000
Concrete	125,000
Railroad Ballast	90,000
Cover Soil	129,000
Building	10,000

For the area of the active existing railroad and ballast, the fill material has already been covered by the ballast, so no new material will be placed in this area. The fill in the remaining areas will be covered with new, clean material imported to the Site during construction.

The Environmental Easement will be filed with Niagara County to run with the deed and include the following requirements:

- The property use will remain industrial
- The cover system will remain in place
- A Soil/Fill Management Plan will be implemented for all invasive activities at the Site
- The use of groundwater without treatment and Niagara County Department of Health approval will be prohibited
- Annual certification that institutional and engineering controls will be required

6.1.4 Complete Fill Removal and Disposal (BCP Track 1 – Unrestricted Use Cleanup)

Under this Unrestricted Use Alternative, the fill impacted with contaminants at concentrations above the appropriate Unrestricted Use SCOs would be excavated and disposed of at appropriately permitted off-site waste disposal facilities.

Based on the RI results, and for purposes of this assessment, all fill has been assumed to contain concentrations of contaminants above the Unrestricted Use SCOs. Based on an estimated average fill thickness of five feet throughout the Site, the estimated volume of fill at the Site is 121,323 cubic yards. Assuming a conversion rate of 1.62 tons per cubic yard, the weight of this fill material is estimated at 196,500 tons.

This alternative assumes that the radiologically impacted fill will be disposed separately from the remainder of the fill from the Site. Based on this, the following material is estimated to be removed and disposed off-site:

- Fill with radiological impacts – 7,150 tons
- Remaining on-site fill – 189,400 tons

6.2 Pits and Sumps

As discussed in Section 3.2.3, the maintenance pit in the Locomotive House and the historic sewer system around the perimeter of the Locomotive House were found to be impacted with contaminants. In the historic sewer system, the most significant impacts were identified in manhole MH-02.

6.2.1 No Action

The No Action Alternative is included as a procedural requirement and as a baseline to evaluate other alternatives. Under this alternative, no further remedial or monitoring activities would occur and no environmental easement would be recorded. These areas would remain virtually as they are and change in use would not be limited except by existing land use controls such as zoning.

6.2.2 Site Management Plan with Institutional Controls

Under this restricted use alternative, institutional controls (e.g., deed restrictions, NYSDEC Environmental Easement, etc.) would be placed on the property to control use of the Site and a Site Management Plan (SMP), including a Health and Safety Plan (HASP), would be developed to protect against exposure.

6.2.3 Impacted Water Removal and Structure Closure (BCP Track 4 – Restricted Use Cleanup-Industrial)

Under this restricted use alternative, a video inspection of the historic sewer system will be performed and the potential for removal of the water from and closure of the system will be evaluated. No flow has been observed in this historic sewer system, so it is assumed that the system is inactive. If it is confirmed that the historic sewer system is inactive and closure is feasible, a marine-type concrete will be used to close the sewer at manholes MH-01 and MH-03 in order to isolate the most impacted area (MH-02). After

allowing the concrete to set, the water in the sewer will be removed from MH-02 and discharged to holding tanks and later to the adjacent Covanta facility for incineration. Flowable fill or other similar product will be used to fill the sewer following removal of the water.

The water in the maintenance pit in the Locomotive House will be pumped and discharged to holding tanks for later discharge to the adjacent Covanta facility for incineration. The pit will be backfilled with clean material following removal of the water and perforation of the bottom of the pit.

6.3 Regulated Building Materials:

This category includes ACMs, LBP, PCB-containing light fixtures, and mercury vapor-containing light bulbs in the Locomotive House.

6.3.1 No Action

The No Action Alternative is included as a procedural requirement and as a baseline to evaluate other alternatives. Under this alternative, no further remedial or monitoring activities would occur and no environmental easement would be recorded. The building materials would remain in-place and change in use would not be limited except by existing land use controls such as zoning.

6.3.2 Regulated Building Materials Removal (BCP Track 1 - Unrestricted Use Cleanup)

Under this Unrestricted Use Alternative, the regulated building materials will be properly removed and disposed off-site. The building will be demolished and the slab will be left in place for potential reuse.

7.0 Detailed Evaluation of Alternatives

7.1 Fill

This category includes AOC #1 (surface soil) and AOC #2 (subsurface soil).

7.1.1 No Action Alternative

Description

The No Action Alternative is included as a procedural requirement and as a baseline from which to evaluate other alternatives. Under this alternative, no further remedial or monitoring activities would occur and no environmental easement would be recorded. The fill at the Site would remain virtually as it is and change in use would not be limited except by existing land use controls such as zoning.

Assessment

This alternative will not be protective of human health or the environment. A number of surface and subsurface fill samples contained contaminants concentrations exceeding the NYSDEC Part 375 Soil Cleanup Objectives and measurements of radiological activity in the fill significantly exceeded thresholds

typically utilized by the NYSDEC. Therefore, the potential exists for human exposure and impacts to the environment.

This alternative would not result in the reduction of contaminant toxicity, mobility or volume and therefore would not be in compliance with the RAOs for the fill material.

There would be no increased short-term risks associated with the No Action Alternative for the fill since remedial activities are not implemented; however, this alternative will not be effective in the long-term and is not a permanent remedy.

Based on the findings of the studies performed to date, it is anticipated that this alternative will not be acceptable to the community.

Of the alternatives being considered, the No Action Alternative for the fill material is not effective for the long-term and does not reduce toxicity, mobility, or volume of contamination. There is no cost associated with this alternative.

7.1.2 Restricted Use Alternative - Site Management Plan with Institutional Controls

Description

Under this Restricted Use Alternative, institutional controls (e.g., deed restrictions, NYSDEC Environmental Easement, etc.) would be placed on the property and an SMP including a HASP, would be developed and implemented to minimize potential exposures and also control Site use. The SMP would include procedures for properly handling and disposing of impacted media (e.g., fill, etc.) during future invasive activities.

Assessment

This alternative will not be protective of human health or the environment. A number of surface and subsurface fill samples contained contaminants concentrations exceeding the NYSDEC Part 375 Soil Cleanup Objectives and measurements of radiological activity in the fill exceeded the thresholds typically applied by the NYSDEC. Although the SMP would minimize potential future exposures during invasive activities performed at the Site and the institutional controls would provide the necessary mechanism to ensure proper notification to future owners, the potential remains for human exposure and impacts to the environment.

This alternative would not result in the reduction of contaminant toxicity, mobility or volume and therefore would not be in compliance with the RAOs for the fill material.

There would be no increased short-term risks associated with this Restricted Use Alternative for this area since active remedial activities are not implemented; however, this alternative will not be effective in the long-term and is not a permanent remedy.

Based on the findings of the studies performed to date, it is anticipated that this alternative will not be acceptable to the community.

The institutional action alternative for this AOC is feasible. However, based on the planned development in this area, this alternative for the fill material is not effective for the long-term and does not reduce

toxicity, mobility, or volume of contamination. As such, this alternative may not be the most practical for this AOC at this time. The estimated cost for this alternative is $25,000.

7.1.3 Restricted Industrial Use Alternative - Select Fill Removal and Cover System Installation

Description

Under this BCP Track 4 Restricted Industrial Use Alternative, the fill excavated during site redevelopment activities would be disposed of at an off-site waste facility while the remaining fill would be left in place and covered to limit the potential for exposure. Backfill of these any utility excavations would include the piping and stone necessary to construct the storm water conveyance system or other utilities at the Site. Due to the presence of petroleum nuisance characteristics, the grossly contaminated fill proximal to the Locomotive House will be excavated and disposed off-site. Backfill of this excavation will include the placement of clean material from an off-site source. Institutional controls in the form of an NYSDEC Environmental Easement would be placed on the property to control use of the Site and an SMP, including a HASP, would be developed to further protect against exposure.

Assessment

This alternative is protective of human health and the environment. Impacted fill would be removed and disposed of off-site, or would be covered with clean material to limit the potential for exposure to fill. Subsequent to railroad and site construction, the presence of the cover would reduce gamma radiation levels at the Site's surface, as demonstrated in the Review of Overburden Shielding Calculation in Appendix A. These calculations address those residual "hot spots" remaining in the subsurface that are not within the excavation limits of the project, and thus will not be removed. In summary, the calculations used conservative assumptions to calculate an annual dose following placement of the cover system. These calculations demonstrate that the expected annual dose rate for future on-site workers will be well below the NYSDOH guidance. To confirm the efficacy of the cover system, a final site gamma survey will be conducted following the placement of the cover system. To further protect human health, any future invasive work would be performed in accordance with an NYSDEC-approved Site Management Plan, and certification of the engineering and institutional controls would be performed on an annual basis.

The removal of a portion of the fill would result in the reduction of the toxicity, mobility, and volume of contaminants on the Site, and the placement of a clean cover system across the entire Site would reduce the mobility of organic and metal analytes in the remaining material. Additionally, the potential for radiological exposure (which was already shown to be low) would be further reduced through removal and capping. Therefore, the Site would be in compliance with RAOs.

This alternative would increase short-term risks for the community and the workers implementing the alternative (i.e., through the disturbance of impacted fill). However, these risks would be minimized through the implementation of appropriate fill handling procedures, air monitoring, and dust suppression techniques. Furthermore, this alternative would be effective in the long-term. The fill removal and disposal would be a permanent remedy to address that material removed from the Site, and the placement of a cover system over the remaining material; the enactment of Environmental Easements; and the use of an OM&M Plan and an SMP for future invasive activities at the Site would also constitute a long-term remedy.

The restriction of the land use to industrial uses conforms to uses in the surrounding area, which is heavily industrial in nature. Additionally, the City of Niagara Falls' Strategic Master Plan indicates that "given the likely extent of contamination of these lands (referring to industrial lands within the Buffalo Avenue Corridor and other corridors), reuse for non-industrial activities is not expected in the short to medium-term." The Site is also located within the limits of the proposed Buffalo Avenue Industrial Corridor Brownfield Opportunity Area (BOA). The Pre-Nomination Phase of the BOA Program has been completed, and the study has also indicated that use of the property for industrial purposes provides the most benefit for the community.

Based on the findings of the studies performed to date, it is anticipated that the results of this alternative would be acceptable to the community.

The Restricted Industrial Use Alternative for this AOC is feasible. The cost for this alternative is approximately $8,530,000, as shown on Table 1.

7.1.4 Unrestricted Use Cleanup - Complete Fill Removal and Disposal

Description

Under this Unrestricted Use Alternative, all of the fill would be excavated and disposed of off-site in accordance with applicable regulations. The need for the removal of the entire volume of fill on-site is based on the RI results, which indicate that the fill material contains contaminants at concentrations at least as high as the Unrestricted Use SCOs, and, in many instances, in excess of the less stringent Restricted Use SCOs.

Assessment

This alternative would be protective of human health and the environment. Soil with contaminant concentrations above RAOs on-site would be removed and disposed of off-site.

This alternative would result in the reduction of the toxicity, mobility, and volume of contaminants in the soil. Therefore, the removal of fill would be in compliance with the SCGs.

This alternative would increase short-term risks for the community and the workers implementing the alternative (i.e., through the disturbance of impacted fill). However, these risks would be minimized through the implementation of appropriate fill handling procedures, air monitoring, and dust suppression techniques. Furthermore, this alternative would be effective in the long-term. The fill removal and disposal alternative would be a permanent remedy to address radiological concerns at the Site as well as the contaminant concentrations in the fill throughout the Site.

Based on the findings of the studies performed to date, it is anticipated that the results of this alternative would be acceptable to the community.

The cost for this alternative is $26.6M, as shown in Table 2. The high cost of this alternative makes this approach infeasible.

7.2 Pits and Sumps

This category includes the maintenance pit in the Locomotive House and the historic sewer system around the perimeter of the Locomotive House.

7.2.1 No Action Alternative

Description

Under this alternative, impacted media in this AOC would remain as is and future Site use and development would not be limited. In addition, remedial and monitoring activities as well as placement of institutional controls at the Site would not be implemented.

Assessment

This alternative may not be protective of human health or the environment. These structures were found to be impacted with contaminants.

This alternative would not result in the reduction of contaminant toxicity, mobility or volume and therefore would not be in compliance with the SCGs.

There would be no increased short-term risks associated with the no action alternative for this area since remedial activities are not implemented; however, this alternative may not be effective in the long-term and is not a permanent remedy.

Based on the findings of the studies performed to date, it is anticipated that this alternative may not be acceptable to the community.

Of the alternatives being considered, the No Action Alternative for the pits and sumps is not effective for the long-term and does not reduce toxicity, mobility, or volume of contamination. There is no cost associated with this alternative.

7.2.2 Restricted Use Alternative - Site Management Plan with Institutional Controls

Description

Under this Restricted Use Alternative, institutional controls (e.g., deed restrictions, NYSDEC Environmental Easement, etc.) would be placed on the property and an SMP including a HASP, would be developed and implemented to minimize potential exposures and also control Site use. The SMP would include procedures for properly handling and disposing of impacted media (e.g., soil, etc.) in these areas should they be disturbed in the future.

Assessment

This alternative will not be protective of human health or the environment. The pit and the historic sewer system contained water with contaminant impacts, and this water would remain in place. Although the SMP would minimize potential future exposures and the institutional controls would provide the necessary mechanism to ensure proper notification to future owners, the potential remains for human exposure and impacts to the environment.

This alternative would not result in the reduction of contaminant toxicity, mobility or volume and therefore would not be in compliance with the RAOs for the pit and sumps.

There would be no increased short-term risks associated with the no action alternative for this area since active remedial activities are not implemented; however, this alternative will not be effective in the long-term and is not a permanent remedy.

Based on the findings of the studies performed to date, it is anticipated that this alternative will not be acceptable to the community.

The Restricted Use Alternative for this AOC is feasible. However, based on the planned development for the Site, this alternative for the pits and sumps is not effective for the long-term and does not reduce toxicity, mobility, or volume of contamination. As such, this alternative may not be the most practical for this AOC at this time. The estimated cost for this alternative is $25,000.

7.2.3 Restricted Use Alternative - Impacted Material Removal and Structure Closure

Description

Under this alternative, a video inspection of the historic sewer system will be performed and the potential for removal of the water from and closure of the system will be evaluated. No flow has been observed in this historic sewer system, so it is assumed that the system is inactive. If it is confirmed that the historic sewer system is inactive and closure is feasible, a marine-type concrete will be used to close the sewer at manholes MH-01 and MH-03 in order to isolate the most impacted area (MH-02). After allowing the concrete to set, the water in the sewer will be removed from MH-02 and discharged to holding tanks and later to the adjacent Covanta facility for incineration. Flowable fill or other similar product will be used to fill the sewer following removal of the water.

The water in the maintenance pit in the Locomotive House will be pumped and discharged to holding tanks for later discharge to the adjacent Covanta facility for incineration. The pit will be backfilled with clean material following removal of the water and perforation of the bottom.

Assessment

This alternative would be protective of human health and the environment. Water in the pit in the Locomotive House and in the historic sewer system with contaminant impacts would be removed and disposed of off-site.

This alternative would result in the reduction of the toxicity, mobility, and volume of contaminants in the site structures. Therefore, the alternative would be in compliance with the SCGs.

This alternative would increase short-term risks for the community and the workers implementing the alternative. However, these risks would be minimized through the implementation of appropriate water handling procedures. Furthermore, this alternative would be effective in the long-term. The Impacted Material Removal and Structure Closure Alternative would be a permanent remedy to address the contaminant impacts in the pits and sumps at the Site.

Based on the findings of the studies performed to date, it is anticipated that the results of this alternative would be acceptable to the community.

The Impacted Material Removal and Structure Closure Alternative for this AOC is feasible. The estimated cost for this alternative is $52,000, as shown on Table 3.

7.3 Regulated Building Materials

This category includes ACMs, LBP, PCB-containing light fixtures, and mercury vapor-containing light bulbs in the Locomotive House.

7.3.1 No Action Alternative

Description

Under this alternative, impacted media in this AOC would remain as is and future Site use and development would not be limited. In addition, remedial and monitoring activities as well as placement of institutional controls at the Site would not be implemented.

Assessment

This alternative may not be protective of human health or the environment due to the continued presence of these regulated building materials.

This alternative would not result in the reduction of contaminant toxicity, mobility or volume and therefore would not be in compliance with the SCGs.

There would be no increased short-term risks associated with the no action alternative for this area since remedial activities are not implemented; however, this alternative may not be effective in the long-term and is not a permanent remedy.

Based on the findings of the studies performed to date it is anticipated that this alternative may not be acceptable to the community.

Of the alternatives being considered, the No Action Alternative for the regulated building materials is not effective for the long-term and does not reduce toxicity, mobility, or volume of contamination. There is no cost associated with this alternative.

7.3.2 Unrestricted Use Alternative - Regulated Building Materials Removal

Description

Under this Unrestricted Use Alternative, all of the regulated building materials will be properly removed from the Locomotive House and disposed off-site. The building will be demolished and the slab will be left in place for potential reuse.

Assessment

This alternative should be protective of human health and the environment. All of the regulated building materials will be removed from the Site.

This alternative would result in the reduction of the toxicity, mobility, and volume of contaminants in the site structure. Therefore, this alternative would be in compliance with the SCGs.

This alternative would increase short-term risks for the community and the workers implementing the alternative. However, these risks would be minimized through the implementation of appropriate materials handling procedures and air monitoring. Furthermore, this alternative would be effective in the long-term. The Regulated Building Materials Removal Alternative would be a permanent remedy to address the materials present in the on-site building.

Based on the findings of the studies performed to date, it is anticipated that the results of this alternative would be acceptable to the community.

The Regulated Building Materials Removal Alternative for this AOC is feasible. The cost for this alternative is $202,000, as shown on Table 4.

8.0 Comparative Evaluation of Alternatives and Recommended Actions

This section of the report compares the remedial alternatives proposed for each of the impacted media and presents the recommended action for each media group.

8.1 Fill

- The No Action Alternative will not be protective of human health and the environment and would likely not be acceptable to the community. In addition, development of the Site is anticipated to take place and, as such, impacts are likely to be encountered, which indicates a level of risk in relation to exposure to workers in these areas.
- The Site Management Plan with Institutional Controls Alternative will not be protective of human health and the environment and would likely not be acceptable to the community. Although this alternative would begin to manage the risk associated with the Site, the contaminated fill will remain at the surface of the Site and could cause exposure to site workers and those near the site. Additionally, the material with radiological impacts would remain at the site, potentially exposing site workers. As such, this alternative does not effectively protect human health.
- The Selected Fill Removal and Cover System Installation Alternative would be a long-term and permanent remedy and is anticipated to be acceptable to the community. The remedy reduces the toxicity, mobility and volume of impacted media via removal of a portion of the fill from the Site and effectively reduces or eliminates potential exposure routes through the construction of a cover system; the placement of an environmental easement; the use of an OM&M Plan; annual certification; and the implementation of an SMP. As such, this alternative appears to be practical to address the impacted fill.
- The Complete Fill Removal and Disposal Alternative would be a long-term remedy and is anticipated to be acceptable to the community. This alternative effectively reduces the toxicity, mobility, and volume of impacted media through the removal of all fill from the Site and replacement with clean material. However, removal of more than 15 acres of fill to an estimated average depth of five feet is impractical, and the high cost of this option makes this alternative infeasible.

The recommended remedial action for the fill at the Site is the Selected Fill Removal and Cover System Installation (Restricted Industrial Use) Alternative, which includes:

- The off-site disposal of fill excavated during redevelopment activities
- The excavation and off-site disposal of grossly contaminated fill in the former UST cavity
- The installation of a cover system across the entire Site
- The placement of an environmental easement on the property
- The implementation of an OM&M Plan and annual certification of the engineering and institutional controls
- The use of a SMP for future invasive actions at the Site

8.2 Pits and Sumps

- The No Action Alternative is not protective of human health or the environment. In addition, the No Action Alternative may not be acceptable to the community and may not be appropriate for redevelopment of the Site.
- The Site Management Plan with Institutional Controls Alternative will not be protective of human health and the environment and would likely not be acceptable to the community. Although this alternative would begin to manage the risk associated with the Site, the contaminated material will remain at the Site and could cause exposure to site workers or be released to the environment. As such, this alternative does not effectively protect human health.
- The Impacted Material Removal and Structure Closure Alternative would be a long-term and permanent remedy and is anticipated to be acceptable to the community. This action would effectively reduce the toxicity, mobility, and volume of impacted media through the removal of impacted materials and adequately protect human health and the environment. The relatively low cost of this alternative makes it practical.

The recommended remedial action is the Impacted Material Removal and Structure Closure (Restricted Use Cleanup) Alternative, which includes the removal of impacted water from the historic sewer system followed by closure of the sewer system. The water in the maintenance pit in the Locomotive House will be removed and the pit will be filled with clean material following perforation of the bottom of the pit.

8.3 Regulated Building Materials

- The No Action Alternative is not protective of human health or the environment. In addition, the No Action Alternative may not be acceptable to the community.
- The Regulated Building Materials Removal Alternative is anticipated to be acceptable to the community. This remedial alternative reduces the toxicity, mobility and volume of impacted media through removal of all regulated building materials. The relatively low cost of this alternative makes it practical.

The recommended remedial action is the Regulated Building Materials Removal (Unrestricted Use Cleanup) Alternative. This action combines removal of all appropriate material and demolition of the structure.

9.0 Summary of Recommended Final Remedial Actions

Based on the above recommendations, this section summarizes the overall final remedial strategy for the Site.

The following table summarizes the recommended remedy and associated costs:

Category	Recommended Remedy	Estimated Cost
Fill	Selected Fill Removal and Cover System Installation	$8,530,000
Pits and Sumps	Impacted Material Removal and Structure Closure	$52,000
Regulated Building Materials	Regulated Building Materials Removal	$202,000
Total		**$8,784,000**

Subsequent to NYSDEC approval and completing the recommended remedy, a Final Engineering Report would be submitted with the SMP.

10.0 Remedial Action Work Plan

This section presents the Remedial Action Work Plan for the recommended actions for the Site. The development of this RAWP is in accordance with the Brownfield Cleanup Program Guide dated May 2004 and NYSDEC DER-10 dated May 2010.

The remedial activities will be conducted in support of the redevelopment of the Site as an intermodal transportation facility. The facility will include a rail yard, concrete- and asphalt-paved working areas, one new building, and grassed areas. Figure 5 shows the Site Development Plan. As part of the development, a conveyance system will be constructed to handle stormwater, and Figure 6 shows the preliminary design of this system. The following sub-sections present the methods for implementation of the RAWP.

10.1 Standards, Criteria and Guidance

The Standards, Criteria and Guidance (SCGs) utilized as part of this RAWP were identified in Section 5.0.

10.2 Summary of the Remedial Goals

The proposed future use for the Site is industrial. As such, at a minimum, the remedy must eliminate or mitigate all significant threats to public health and/or the environment presented by the impacts identified at the Site through the proper application of scientific and engineering principles.

The Remedial Goals for this Remedial Action Work Plan are as follows:

a. Remove and dispose of fill material excavated to facilitate site redevelopment (i.e., for the construction of the stormwater conveyance system, utilities, etc.).
b. Remove and dispose grossly contaminated fill impacted with significant nuisance characteristics in the area of the former UST cavity near the southeast corner of the Locomotive House.
c. Cover entire site with clean fill, asphalt, concrete or railroad ballast.
d. Remove contaminated water from sumps and pits and close the structures in place.
e. Remove and properly dispose regulated building materials.
f. Place an environmental easement on the property.
g. Implement an OM&M Plan for the engineering controls at the Site.
h. Perform annual certification of the engineering and institutional controls.
i. Use a SMP to manage fill excavated during future invasive actions at the Site.

All work will be completed in accordance with applicable local, state, and federal regulations.

10.3 Field Activities Plan

The field activities for the remedial actions are described in the following subsections:

- Fill removal and off-site disposal (Section 10.3.1)
- Remediation of pits and sumps (Section 10.3.2)
- Construction water management (Section 10.3.3)
- Waste stream tracking (Section 10.3.4)
- Backfill (Section 10.3.5)
- Monitoring well decommissioning (Section 10.3.6)
- Cover system construction (Section 10.3.7)
- Regulated building materials (Section 10.3.8)
- Decontamination (Section 10.3.9)
- Health and Safety and Community Air Monitoring (Section 10.3.10)
- Dust Control (Section 10.3.11)
- Stormwater Management (Section 10.3.12)
- Site Control (Section 10.3.13)
- Site Management Plan/Institutional Controls (Section 10.3.14)

10.3.1 Fill Removal and Off-Site Disposal

The site redevelopment plans require the excavation of fill from areas in which the stormwater conveyance system and other utilities will be constructed and the grading of the planned rail yard to create a stable surface upon which to construct the rail facilities. Additionally, grossly contaminated fill in the area of the former UST cavity near the southeast corner of the Locomotive House will be excavated and disposed off-site. This work will include:

- For grading purposes, unsuitable fill will be removed from the Site, including the existing railroad ties; fill that is present between the ties; and stockpiled wood chips. Figure 7 shows the approximate extent of the areas that currently contain these materials. These materials will be properly disposed off-site via:
    - Wood chips and railroad ties will be incinerated at the adjacent Covanta facility.
    - Fill material will be properly disposed off-site.
- The unsuitable fill will be removed using a bulldozer, excavator, loader, or other appropriate equipment.
- In the areas of utilities and other site development structures and in the area of the former UST cavity near the southeast corner of the Locomotive House, fill will be excavated using a backhoe, excavator, loader or other appropriate equipment.
- A LaBella scientist or engineer will screen the removed fill for visual and olfactory observations and for total volatile compounds using a photoionization detector (PID).
- Additionally, a GRD radiological technician will screen the fill for radiological constituents using a Ludlum model #2221 scaler with a #44-10 probe. Appendix B contains additional information on the radiological screening of excavated materials.
- Based on the screening results, the excavated fill will be segregated into one of several classes of materials and staged in discrete piles (or directly loaded into trucks). Table 1 identifies the criteria for segregation of excavated fill and the currently anticipated volumes of each type of material.
- Fill materials not direct-loaded onto trucks for off-site disposal will be segregated by class, as shown in Table 1, and handled, stockpiled, and characterized accordingly.

Table 1 - Soil and Fill Segregation Plan

Class of Material	Physical Description	Anticipated Weight and General Depths
Class 1	Fill materials exhibiting gamma radiation field survey results less than 10,000 cpm with PID measurements of less than 5 ppm and no observable free product	9,111 tons[1] (0 to 5 ft.)
Class 2	Fill materials exhibiting gamma radiation field survey results less than 10,000 cpm with PID measurements of more than 5 ppm and/or observable free product	0 tons (0 to 5 ft.)
Class 3	Any fill materials exhibiting gamma radiation field survey results ranging from 10,000 to 30,000 CPM	2,000 tons (0 to 5 ft.)
Class 4	Any fill materials exhibiting gamma radiation field survey results over 30,000 CPM	0 tons (0 to 5 ft.)
Class 5	Non-impacted, native soils	4,320 tons[1] (5 to 25 ft.)

Note: The average depth to the native material is estimated at five feet; however, the top six inches of the native material will also be handled as Class 1 material to address any potential impacts form the overlying fill material.

- Excavated fill to be stockpiled on-site will be placed on and covered by a minimum of double 6-mil polyethylene sheeting which is sufficiently anchored to prevent any wind and water erosion. The cover will be inspected at least once per day with corrective action taken as needed. The inspections and any corrective actions will be documented in logs and will occur until the fill materials have been properly removed and disposed off-site.
- Characterization sampling of the stockpiled fill (Classes 1 through 4) will conform to the requirements of the facility at which the material is planned to be disposed.
- The final, off-site disposal location will be based on the characterization data obtained at the time of the work and at a facility approved for such waste.
    - Class 1 and 2 materials may be disposed at Modern Landfill in Model City, New York.
    - Class 3 materials will likely be disposed at the EQ Landfill in Wayne, Michigan.
    - Class 4 materials will likely be disposed at the EnergySolutions Landfill in Tooele County, Utah.
    - Railroad ties and stockpiled wood chips will be incinerated at the adjacent Covanta facility.
- Excavation and handling of the non-impacted, native soils underlying the fill (Class 5 Materials) will include:
    - The removal of the top six inches of native material and handling the uppermost native material in the same manner as the fill material above it.
    - Native soil will be re-used on-site to create berms or other features and will be covered with one foot of clean, off-site material.
- The excavation of the grossly contaminated fill impacted with petroleum nuisance characteristics in the area of the former UST cavity near the southeast corner of the Locomotive House will proceed based on the following:
        - Visual and olfactory evidence will be used to determine the limits of the grossly contaminated materials.
        - Fill with significant petroleum-related olfactory and visual impacts will be excavated for off-site disposal.
        - Fill that does not display significant petroleum-related olfactory and visual impacts will be left in place.
        - Once the limits of grossly contaminated fill have been reached, the excavation activities will be terminated.
        - No post-excavation confirmation sampling will be completed because previous sampling indicates that the material in this area meets the SCOs.
- Good housekeeping practices will be followed during excavation activities to prevent leaving contaminated material on the ground surface (e.g., precautions will be taken to prevent impacts to the ground surface due to material spilled from the excavator bucket). Any material that does spill on to the ground surface will be promptly picked up and placed in an appropriate location (e.g., dump truck, fill pile, etc.).
- Transportation of all wastes will be completed by properly permitted vehicles.
- To the extent practicable, trucks will travel along routes that avoid residential areas.
- Soil/fill excavated from the Site will not be re-used at other sites. All excavated soil/fill will be properly disposed at a permitted landfill or will be re-used on-site (native material only).

10.3.2 Remediation of Pits and Sumps

10.3.2.1 Historic Sewer

To initiate the cleaning and closure of the historic sewer system, a video inspection will be performed and the potential for removal of the water from and closure of the system will be evaluated. The video inspection will include the use of a video camera mounted on a camera tractor to assess the condition and length of the historic sewer. Figure 4 shows the approximate location of the historic sewer.

The video equipment will be lowered into the center access point (manhole) and will remotely travel as far as possible in both directions. If the termination of the sewer is not reached in one or both directions, the equipment will be extracted and placed in other manholes to attempt to reach the termination point. The equipment will be decontaminated following completion of the survey.

No flow has been observed in this historic sewer system, so it has been assumed that the system is inactive. If the video survey confirms that the historic sewer system is inactive and that the closure of the sewer is feasible, a marine-type concrete will be used to seal the sewer at manholes MH-01 and MH-03. The water will be removed from the entire system via pumps and discharged into containment tanks. The contained water will be incinerated at the adjacent Covanta facility.

Following removal of the water from the sewer, flowable fill or a similar product will be pumped into the sewer piping to permanently close the system. The flowable fill will meet the provisions of the Allowable Constituent Levels for Imported Fill or Soil, which are included in Appendix C.

10.3.2.2 Locomotive House Maintenance Pit

Following demolition of the structure, the water within the maintenance pit in the Locomotive House will be removed and the bottom of the pit will be perforated. The water will be removed from the pit via pumps and discharged into containment tanks and the contained water will be incinerated at the adjacent Covanta facility.

Following removal of the water from the pit, clean fill or gravel will be placed in the pit and compacted as appropriate.

10.3.3 Construction Water Management

This section identifies proper handling, treatment and discharge procedures for groundwater and/or rainwater that may enter excavations during remediation/redevelopment activities.

Contractors performing subsurface work at the Site will be required to provide temporary dewatering to handle groundwater and stormwater run-in to excavations during the remedial/redevelopment activities. Dewatering methods may include the use of sumps and pumps or the installation of well points. The water will be pumped or hauled from the collection points to the ground surface at on-site locations downgradient of the excavation, where it will be allowed to infiltrate back into the porous fill. No water that is collected will be allowed to be discharged off-site. Alternatively, the water may be pumped from the excavations and stored in tanks for ultimate discharge at the adjacent Covanta facility.

If the groundwater or stormwater that collects in the excavations exhibits evidence of contamination (i.e., sheen, odor, etc.), it may be necessary to treat the water prior to surface discharge or to discharging the water to the incinerator at the adjacent Covanta facility.

10.3.4 Waste Stream Tracking and Verification

The following documentation will be kept in relation to waste streams:

- Correspondence from the facility accepting the waste stream
- Waste profiles
- Waste characterization sampling, and results
- Manifests
- Bills of lading
- Weight tickets

The tracking information will be provided in the FER**.**

10.3.5 Backfill

Following completion, the excavations will generally be backfilled to pre-existing grade or proposed final grade of the development. Because the excavations will be completed to facilitate the installation of the stormwater conveyance system, the backfill will include appropriate stone, piping and other materials necessary for its construction.

For each source of backfill that is imported to the Site, one of the following will be completed prior to importing the backfill.

a. Documentation will be provided to NYSDEC as to the source of the material and the consistency of the material in accordance with the exemption for no chemical testing listed in DER-10 Section 5.4(e)(5); **OR**
b. Chemical testing will be completed in accordance with the following table:

Recommended Number of Soil Samples for Soil Imported To or Exported From a Site			
Contaminant	**VOCs**	**SVOCs, Inorganics & PCBs/Pesticides**	
Soil Quantity (cubic yards)	**Discrete Samples**	**Composite**	**Discrete Samples/Composite**
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
1000	Add an additional 2 VOC and 1 composite for each additional 1000 Cubic yards or consult with DER		

Taken from DER-10 - Table 5.4(e)10

In the event that laboratory analytical testing is conducted, the results for each new source of fill must meet the values provided in Appendix 5 of DER-10 (provided as Appendix C in this Work Plan) for Restricted Residential use and must receive approval by the NYSDEC.

Prior to performing backfilling activities, all equipment that has come into contact with impacted soils will be decontaminated on the decontamination pad, which is discussed in Section 10.3.9.

10.3.6 Monitoring Well Decommissioning

A number of monitoring wells currently exist on-site. Because groundwater does not exhibit significant impacts, long-term groundwater monitoring will not be a part of the final remedy for the Site. To facilitate the construction of the cover system, all on-site monitoring wells will be decommissioned in accordance with the procedures listed in NYSDEC's *CP-43: Groundwater Monitoring Well Decommissioning Policy, November 2009*. The decommissioning of these wells will include:

- Removing the protective casing and riser pipe
- Excavating the concrete surface seal
- Injecting grout into the bottom of the well via a tremie pipe
- Backfilling the upper five feet with clean fill
- Preparing decommissioning logs that will be included as an attachment in the FER

10.3.7 Cover System Construction

To eliminate potential exposure to the fill material at the surface of the Site, a cover will be installed across the entire Site. The installed cover will constitute the site restoration efforts for the Site. As shown on Figures 8 and 9, the cover will vary across the Site based on planned redevelopment requirements and will consist of the following:

Cover System Details

Cover Type	Cross-Section
Asphalt	Top Course - 1.5 inches Base Course - 3 inches Binder - 2.5 inches Subbase - 12 inches
Railroad Ballast	Ties intermixed with ballast – 7 inches Ballast – 4 inches Sub-ballast – 6 inches
Concrete	Concrete – 8 inches Subbase – 12 inches
Clean Fill	Clean fill – 12 inches

Prior to placement of the cover, rough grading will be performed using a bulldozer. In areas to be covered by soil, orange snow fence or similar demarcation layer will be placed on the graded ground surface. The soil cover material will be imported from an approved source and documentation will be provided to demonstrate that the imported soil conforms to the SCOs. The soil will be dumped, spread with a

bulldozer, and properly compacted to minimize future settling. Following placement, the soil cover will be seeded.

In the case of the ballast, asphalt, and concrete, a proof roller will be used following grading to smooth the subgrade surface. Once the subgrade is prepared, a gravel subbase or sub-ballast to provide stability for construction and limit subsidence will be placed using a bulldozer. Rail ballast, asphalt, or concrete will be placed on the subbase in accordance with standard construction practices.

Following placement of the cover, annual inspections will be performed in accordance with the Site Management Plan prepared for the Site.

10.3.8 Regulated Building Materials

Asbestos-containing materials (ACMs), lead-based paint (LBP), polychlorinated biphenyl- (PCB-) containing light fixtures, and mercury vapor-containing light bulbs were identified in the Locomotive House. The planned action to address these issues includes the abatement of asbestos and the removal of the light fixtures and bulbs. A certified asbestos contractor will remove, handle, and dispose the asbestos in accordance with State and Federal regulatory requirements. The light fixtures and bulbs will also be removed and disposed in accordance with regulatory requirements.

Following removal of the regulated building materials, the building will be demolished.

10.3.9 Decontamination

To prevent cross-contamination to surrounding areas, vehicles (excavators, drill rigs, etc.) and equipment that contact contaminated material will be decontaminated prior to leaving the Site. A decontamination pad will be created on-site and the size will be large enough to accommodate the placement of equipment requiring decontamination.

Water utilized for decontamination will be containerized and handled in the same manner as any construction water, as discussed in Section 10.3.3.

The tracking of site soil/fill onto public streets will not be permitted, and provisions will be made to ensure that any material tracked off-site will be addressed via street-sweeping or other means.

10.3.10 Health and Safety and Community Air Monitoring

Appendix D provides the Site-Specific Community Air Monitoring Plan and Fugitive Dust and Particulate Monitoring Plan that will be utilized during the implementation of the remedy. GRD's radiological air monitoring plan is also included in Appendix D. Appendix E includes LaBella's Health and Safety Plan (HASP) for the project, as well as GRD's HASP regarding radiological monitoring.

10.3.11 Erosion and Dust Controls

As part of the remedial actions to be performed at the Site, measures will be needed to limit erosion and dust generation. Erosion control and dust suppression techniques will be employed as necessary to limit

erosion and fugitive dust generated in disturbed areas during remediation and redevelopment activities. Such techniques may be employed even if the community air monitoring results indicate that particulate levels are below action levels. Techniques may include but are not limited to:

- Using silt fencing, hay bales, and/or mulching
- Applying water on haul roads
- Wetting equipment and excavation surfaces
- Hauling materials in properly tarped or watertight containers
- Limiting vehicle speed on the Site
- Limiting the size of excavations
- Covering excavated areas and materials following excavation

Effectiveness of the dust suppression measures will be evaluated based on the results of the air monitoring that will be conducted under the Site-Specific Community Air Monitoring Plan provided in Appendix D.

10.3.12 Stormwater Management

Stormwater management is an important component of the remedial construction at the Site. Therefore, the following Stormwater Pollution Prevention Plan (SWPPP) was developed to help control runoff and pollutants during remedial construction at the Site. This SWPPP is not intended to address post-development stormwater, as that topic will be addressed during final design of the intermodal transportation facility. However, Figure 6 includes a preliminary, conceptual plan for the construction of the permanent stormwater management system.

The following subsections comprise the SWPPP as it relates to the remedial construction activities, and were developed in general accordance with the NYSDEC's *Instruction Manual for Stormwater Construction Permit*, July 2004. All work will comply with the applicable local, state, and federal regulations, including, but not limited to, the provisions set forth in the NYSDEC SPDES General Permit for Stormwater Discharge GP-02-01.

10.3.12.1 Stormwater Management Objectives

The principal objective of this SWPPP is to comply with the NYSDEC SPDES Stormwater Permit for remedial construction activities by planning and implementing the following practices:

- Reduction and/or elimination of erosion and sediment loading to water bodies during remedial construction
- Maintenance of stormwater controls during remedial construction.

As discussed previously, the stormwater management structures and procedures necessary to address post-remediation stormwater will be addressed during final design of the intermodal transportation facility.

10.3.12.2 Pre-Remediation Conditions

The Site encompasses approximately 15 acres of a larger, former industrial property that is located at 137 47th Street in the City of Niagara Falls. As shown by Figure 2, the Site is occupied by one building that was formerly utilized for the maintenance and repair of locomotives; an inactive rail yard; and concrete floor slabs that are remnants of the former industrial complex. The on-site structure encompasses approximately 13,700 square feet, is not currently utilized, and is in a deteriorated state. The remaining portions of the Site generally consist of aged asphalt, concrete and gravel surfaces with some successional vegetation occurring along the eastern site boundary. Generally, the Site drains from west to east, and ponding is generally absent from the Site.

Recent subsurface investigations indicated that the Site contains an approximate average of four feet of relatively porous fill. In areas not overlain by impervious surfaces, this fill material appears to drain surface water effectively.

10.3.12.3 Proposed (Post-Remedial) Conditions

As shown in Figure 5, the proposed intermodal facility will include the installation of large sections of impervious (asphalt- and concrete-paved) surfaces. Stormwater drainage will be addressed through construction of appropriate facilities designed to handle the 100-year storm. These facilities will include a series large diameter pipes, separators, a drainage swale, and a pump station. Figure 6 shows a preliminary design of the stormwater facilities, although these plans may be modified during final design. Permanent stormwater drainage issues will be addressed during the detailed design stage.

The proposed stormwater drainage system will include one swale that is designed to receive overflow during large storm events. The swale is not designed to act as a bio-filtration system but instead is used for overflow relief during large storm events. Water within the swale will return to the system when surcharge levels in the storm sewer return to previous levels. The swale will be excavated into the fill at the Site, and the soil will be field screened and disposed appropriately off-site. The area of the swale will be covered with a minimum of one foot of imported clean fill.

10.3.12.4 Erosion and Sediment Control

Every effort will be made to minimize erosion and sediment runoff during remedial construction. Measures described in Section 10.3.12 will be implemented to control the migration of sediment from the Site.

10.3.12.5 Water Quantity and Quality Control

The permanent water quantity and quality controls will be addressed during detailed design in accordance with all applicable regulations.

10.3.13 Site Control

Site control is an important aspect of this remedial program. In order to safeguard the health and safety of site workers and the general public, access to all remedial work areas will be restricted. Existing perimeter

fencing and security/surveillance will facilitate site control. Additionally, temporary construction fencing will be erected around accessible excavations and staging areas to prevent unauthorized personnel from entering these areas as appropriate.

10.3.14 Site Management Plan/Institutional Controls

A Site Management Plan (SMP) coupled with Institutional Controls will be developed for the entire Site. The intent of this document will be to manage any soil impacts remaining at the Site at levels above the Part 375-6 Unrestricted Use SCOs and to restrict groundwater use at the Site. This document will be developed and submitted for regulatory approval during the course of the remedial activities.

The SMP will include the following:

- Identification of specific areas of residual impacted fill that remain on-site and illustrate these areas on mapping.
- A Soil/Fill Management Plan that identifies proper handling, characterization, transportation and disposal requirements for the various impacted material should such material be encountered during any site redevelopment or future construction activities (e.g., underground utility work). This Soil/Fill Management plan will include provisions for radiological monitoring as well as other monitoring that may be appropriate for the Site.
- An Operation, Maintenance and Monitoring (OM&M) Plan for the Site that includes the requirements for cover system monitoring, as appropriate.
- Indicate that groundwater cannot be used as a source of drinking water or extracted for any reason without prior approval from regulatory agencies.
- Indicate that the above Site use and groundwater use restrictions are part of an environmental easement and will include a copy of the easement.
- Indicate that these measures are included on the deed (i.e., deed restrictions) and that these restrictions are recorded with the Niagara County Clerk.
- Indicate that an annual certification be submitted to NYSDEC certifying that the requirements of the SMP were adhered to.
- The environmental easement that indicates the above requirements and the SMP will be recorded with the Niagara County Clerk and will be provided to NYSDEC prior to finalizing/recording these documents.

11.0 Schedule and Reporting

Schedule

Implementation of the RAWP is scheduled to begin within 30 days of NYSDEC approval of this work plan. The work will be completed in accordance with the schedule shown on Figure 10.

Periodic Reporting

Following initiation of the remedial efforts, periodic job progress meeting will be held at the Site until the completion of the remedial work. In addition, monthly progress reports will be submitted in accordance with the BCP agreement until the Certificate of Completion is issued.

Site Management Plan/Institutional Controls

The draft SMP and deed restrictions to be recorded with the Clerk will be submitted to the NYSDEC within one month of initiating remedial construction.

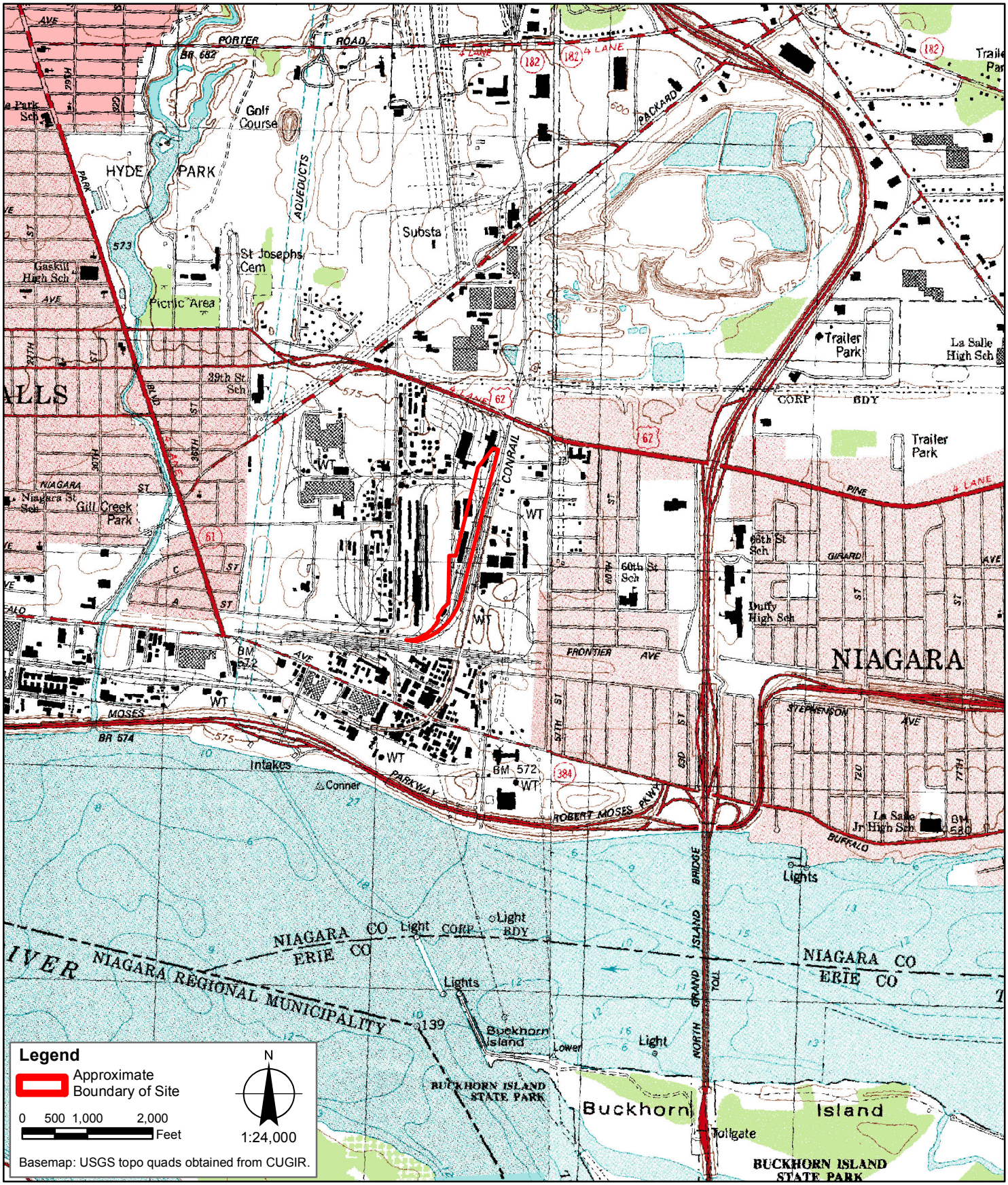
Final Engineering Report

The information and laboratory analytical data obtained during the remedy will be included in the FER. The FER will be completed in accordance with DER-10.

I:\COVANTA 4RECOVERY, LP\212399\REPORTS\AA AND RAWP\COVANTA AA&RAWP FINAL.DOC

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Figures



Path: J:\Covanta 4Recovery, LP\212399\Drawings\MAP\2012.05.07.Fig1_USGS_Small.mxd

PROJECT/DRAWING NUMBER

212399

FIGURE 1

DRAWING TITLE

SITE LOCATION MAP

ISSUED FOR: REVIEW

DESIGNED BY: RCN

DRAWN BY: KMN

DATE: NOV. 2012

REVIEWED BY: DR

PROJECT/CLIENT

ALTERNATIVES ANALYSIS/ REMEDIAL ACTION WORK PLAN FOR 15-ACRE SITE at 137 47TH ST, NIAGARA FALLS, NY

COVANTA 4RECOVERY, L.P.

LABELLA Associates, P.C.

300 PEARL STREET
BUFFALO, NY 14202
P: (716) 551-6281
F: (716) 551-6282

www.labellapc.com

Path: J:\Covanta 4Recovery, LP\212399\Drawings\MAP.2012.05.07.Fig2_Aerial.mxd

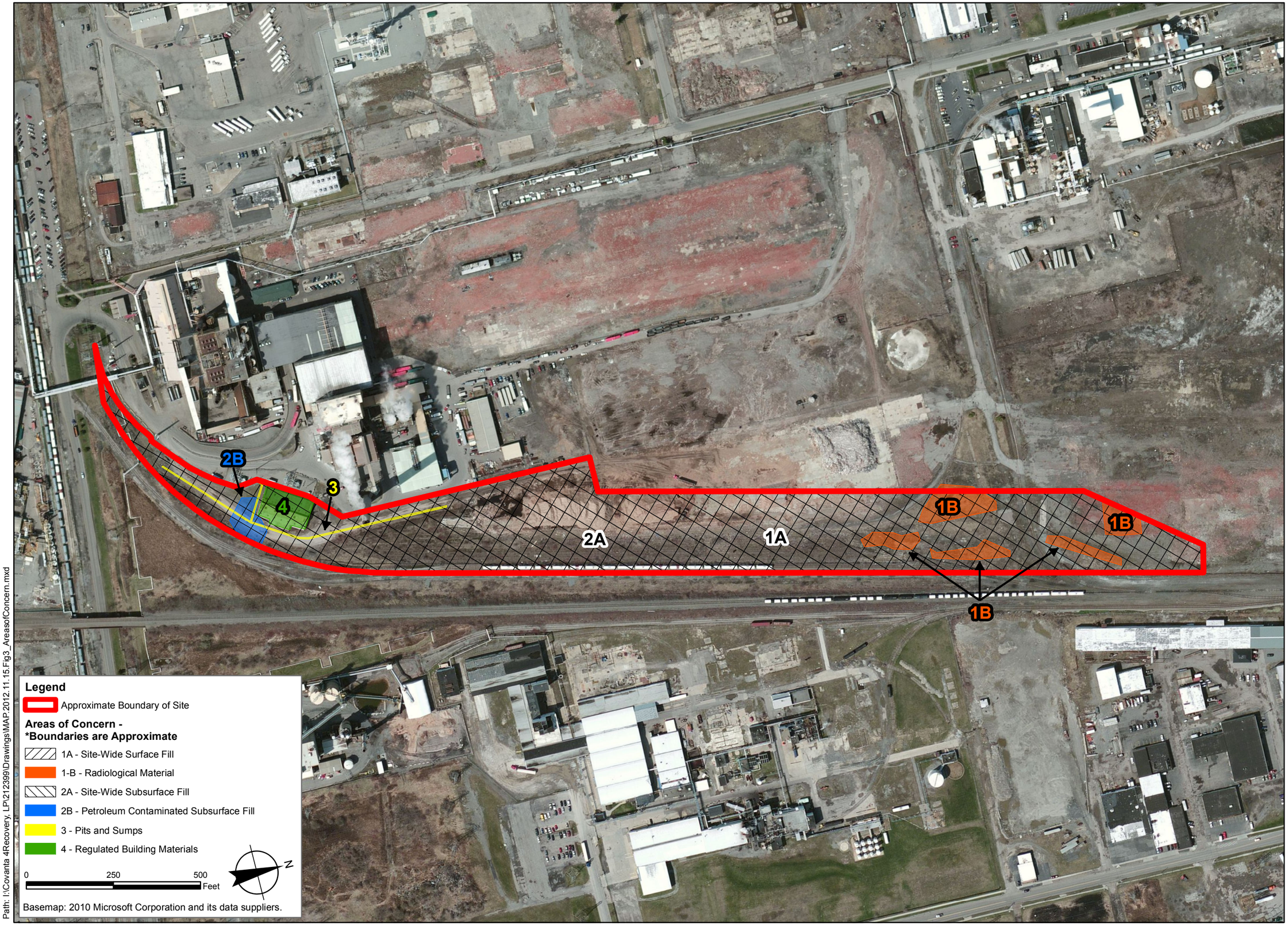
PROJECT/DRAWING NUMBER
212399
FIGURE 2

DRAWING TITLE
EXISTING CONDITIONS MAP

ISSUED FOR
REVIEW
DATE: NOV 2012
DESIGNED BY: RCN
DRAWN BY: KMN
REVIEWED BY: DR

PROJECT/CLIENT
ALTERNATIVES ANALYSIS / REMEDIAL ACTION WORK PLAN FOR 15-ACRE SITE at
137 47TH ST,
NIAGARA FALLS, NY
COVANTA 4RECOVERY, L.P.

LABELLA Associates, P.C.
300 PEARL STREET
BUFFALO, NY 14202
P: (716) 551-6281
F: (716) 551-6282
www.labellapc.com



Path: I:\Covanta 4Recovery. LP\212399\Drawings\MAP 2012.11.15.Fig3_AreasofConcern.mxd

LABELLA Associates, P.C.
300 PEARL STREET
BUFFALO, NY 14202
P: (716) 551-6281
F: (716) 551-6282
www.labellapc.com

PROJECT/CLIENT

ALTERNATIVES ANALYSIS / REMEDIAL ACTION WORK PLAN FOR 15-ACRE SITE at
137 47TH ST, NIAGARA FALLS, NY
COVANTA 4RECOVERY, L.P.

DRAWING TITLE

AREAS OF CONCERN

ISSUED FOR: REVIEW
DATE: NOV 2012
DESIGNED BY: RCN
DRAWN BY: KMN
REVIEWED BY: DR

PROJECT/DRAWING NUMBER

212399

FIGURE 3

Path: J:\Covanta 4Recovery, LP\212399\Drawings\MAP.2012.07.05.Fig9_1977.mxd

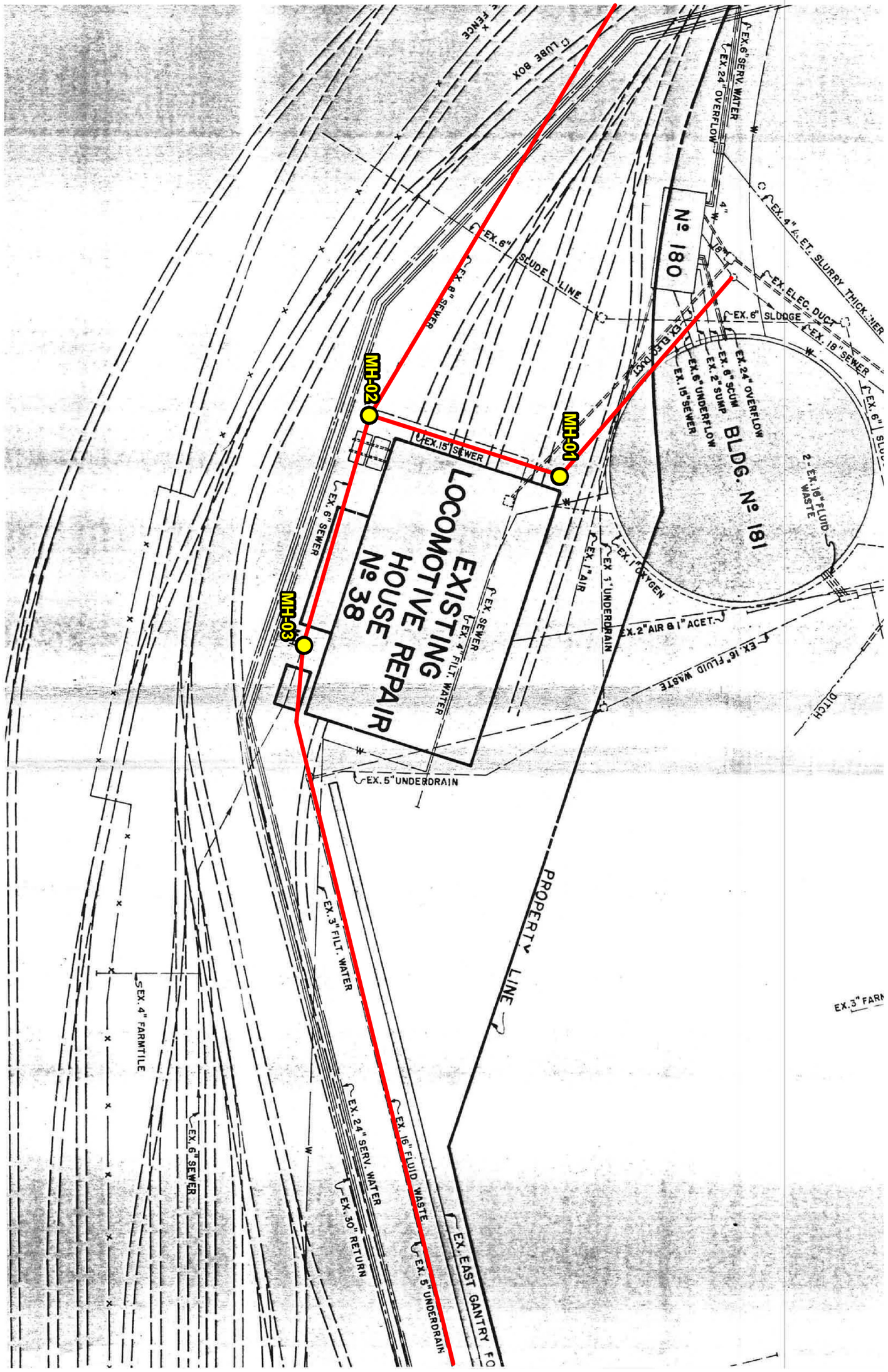


FIGURE 4

212399

PROJECT/DRAWING NUMBER

DRAWING TITLE

HISTORIC SEWER MAP

ISSUED FOR: REVIEW

DATE: NOV. 2012

DESIGNED BY: XXX

DRAWN BY: JMG

REVIEWED BY: DR

PROJECT/CLIENT

ALTERNATIVES ANALYSIS / REMEDIAL ACTION WORK PLAN FOR 15-ACRE SITE at

137 47TH ST, NIAGARA FALLS, NY

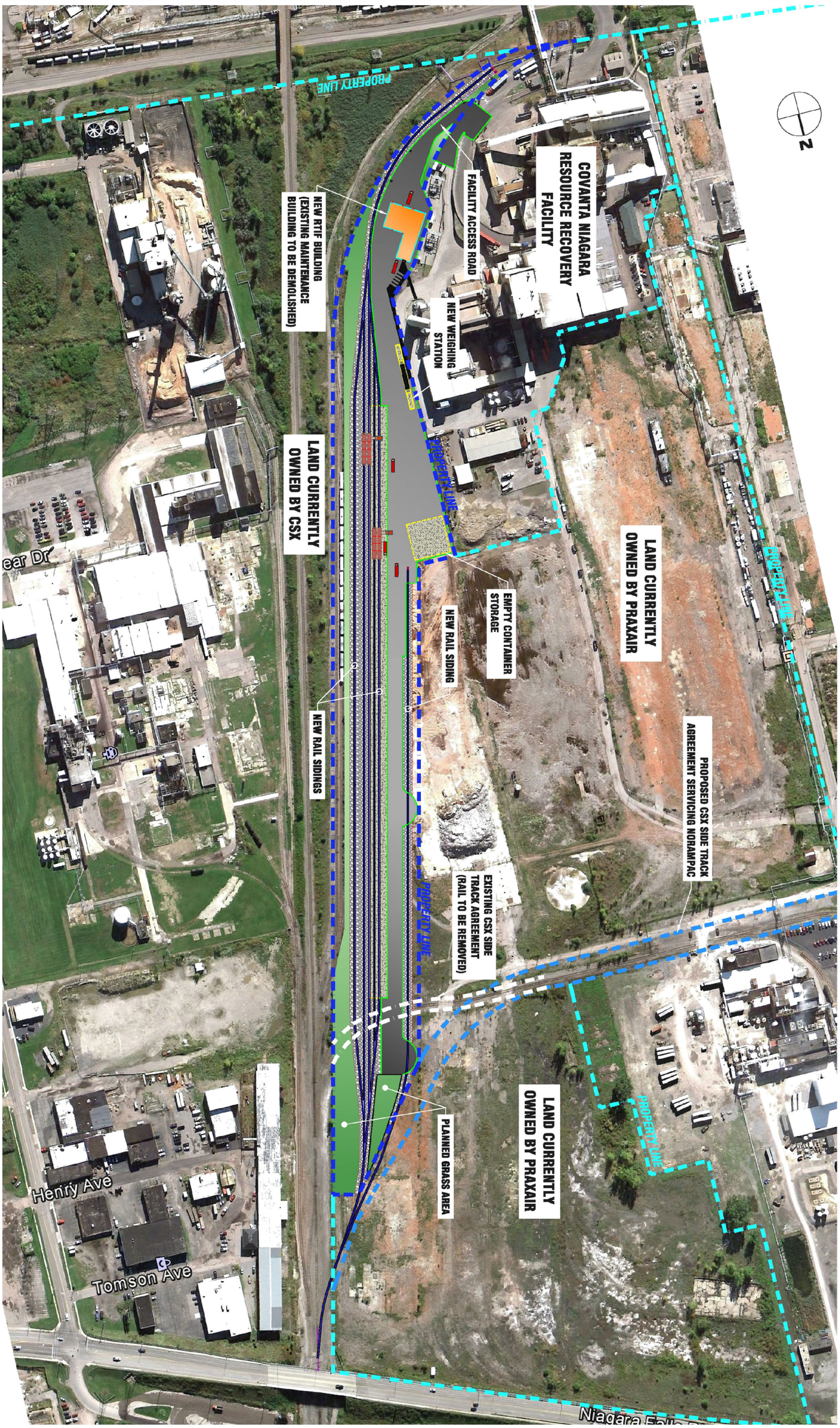
COVANTA 4RECOVERY, L.P.

LABELLA Associates, P.C.

300 PEARL STREET
BUFFALO, NY 14202
P: (716) 551-6281
F: (716) 551-6282

www.labellapc.com

Path: J:\Covanta 4Recovery, LP\212399\Drawings\MAP.2012.11.16.Fig5SitePlan.mxd



DRAWING TITLE

PROPOSED SITE PLAN

ISSUED FOR: REVIEW
DATE: NOV. 2012
DESIGNED BY: XXX
DRAWN BY: JMG
REVIEWED BY: DR

PROJECT/CLIENT

ALTERNATIVES ANALYSIS / REMEDIAL ACTION WORK PLAN FOR 15-ACRE SITE at

137 47TH ST, NIAGARA FALLS, NY

COVANTA 4RECOVERY, L.P.

FIGURE 5

PROJECT/DRAWING NUMBER: 212399

LABELLA Associates, P.C.

300 PEARL STREET
BUFFALO, NY 14202
P: (716) 551-6281
F: (716) 551-6282

www.labellapc.com

MH STORM 101
STA: 100+00.00
NORTHING: 1123497.56
EASTING: 1035316.00

MH STORM 102
STA: 101+53.64
NORTHING: 1123608.08
EASTING: 1035422.71

MH STORM 103
STA: 103+53.32
NORTHING: 1123792.25
EASTING: 1035499.89

MH STORM 104
STA: 105+52.09
NORTHING: 1123989.83
EASTING: 1035521.58

MH STORM 105
STA: 106+36.01
NORTHING: 1124072.46
EASTING: 1035536.27

MH STORM 106
STA: 107+38.81
NORTHING: 1124174.48
EASTING: 1035548.92

MH STORM 107
STA: 109+45.24
NORTHING: 1124374.53
EASTING: 1035599.82

MH STORM 108
STA: 111+46.46
NORTHING: 1124569.69
EASTING: 1035648.85

MH STORM 109
STA: 114+47.14
NORTHING: 1124860.89
EASTING: 1035723.73

MH STORMCEPTOR (1)
STA: 116+90.00
NORTHING: 1125096.31
EASTING: 1035783.39

MH STORM 110
STA: 117+10.12
NORTHING: 1125115.81
EASTING: 1035788.34

MH STORMCEPTOR (2)
STA: 206+30.17
NORTHING: 1125131.05
EASTING: 1035792.29

MH STORM 301
STA: 300+00.00
NORTHING: 1124845.56
EASTING: 1035696.35

MH STORM 111
STA: 117+35.15
NORTHING: 1125122.66
EASTING: 1035764.26

MH STORM 112
STA: 117+59.88
NORTHING: 1125140.09
EASTING: 1035781.81

MH STORM 201
STA: 200+00.00
NORTHING: 1125741.98
EASTING: 1035946.78

MH STORM 202
STA: 202+02.36
NORTHING: 1125545.46
EASTING: 1035898.49

MH STORM 203
STA: 203+02.87
NORTHING: 1125448.27
EASTING: 1035872.91

MH STORM 204
STA: 204+00.81
NORTHING: 1125353.12
EASTING: 1035849.67

C-502
C-506
C-503
C-505
C-504

OVERFLOW SWALE /GRASS AREA

APPROXIMATE LOCATION OF EXISTING COMBINED SEWER

MONITORING STATION

ACCESS MANHOLE AND LATERAL (TYP.) SPACED MAX. 300-FT

0 50 100 200
PLAN SCALE (IN FT)

LEGEND

UD — UD — UD — UNDER DRAIN

TRENCH DRAIN

800+00 — 801+00 — STORM SEWER

801+24 — Ⓓ STORM MANHOLE

ACCESS MANHOLE

Path: I:\Covanta 4Recovery, LP\212399\Drawings\MAP.2013.03.07.Fig6Stormwater.mxd

300 PEARL STREET
BUFFALO, NY 14202
P: (716) 551-6281
F: (716) 551-6282
www.labellapc.com

LABELLA Associates, P.C.

PROJECT/CLIENT

ALTERNATIVES ANALYSIS / REMEDIAL ACTION WORK PLAN FOR 15-ACRE SITE at

137 47TH ST,
NIAGARA FALLS, NY

COVANTA 4RECOVERY, L.P.

DRAWING TITLE

PRELIMINARY STORMWATER SYSTEM DESIGN

ISSUED FOR: REVIEW

DESIGNED BY: DER
DRAWN BY: KMN
REVIEWED BY: DER

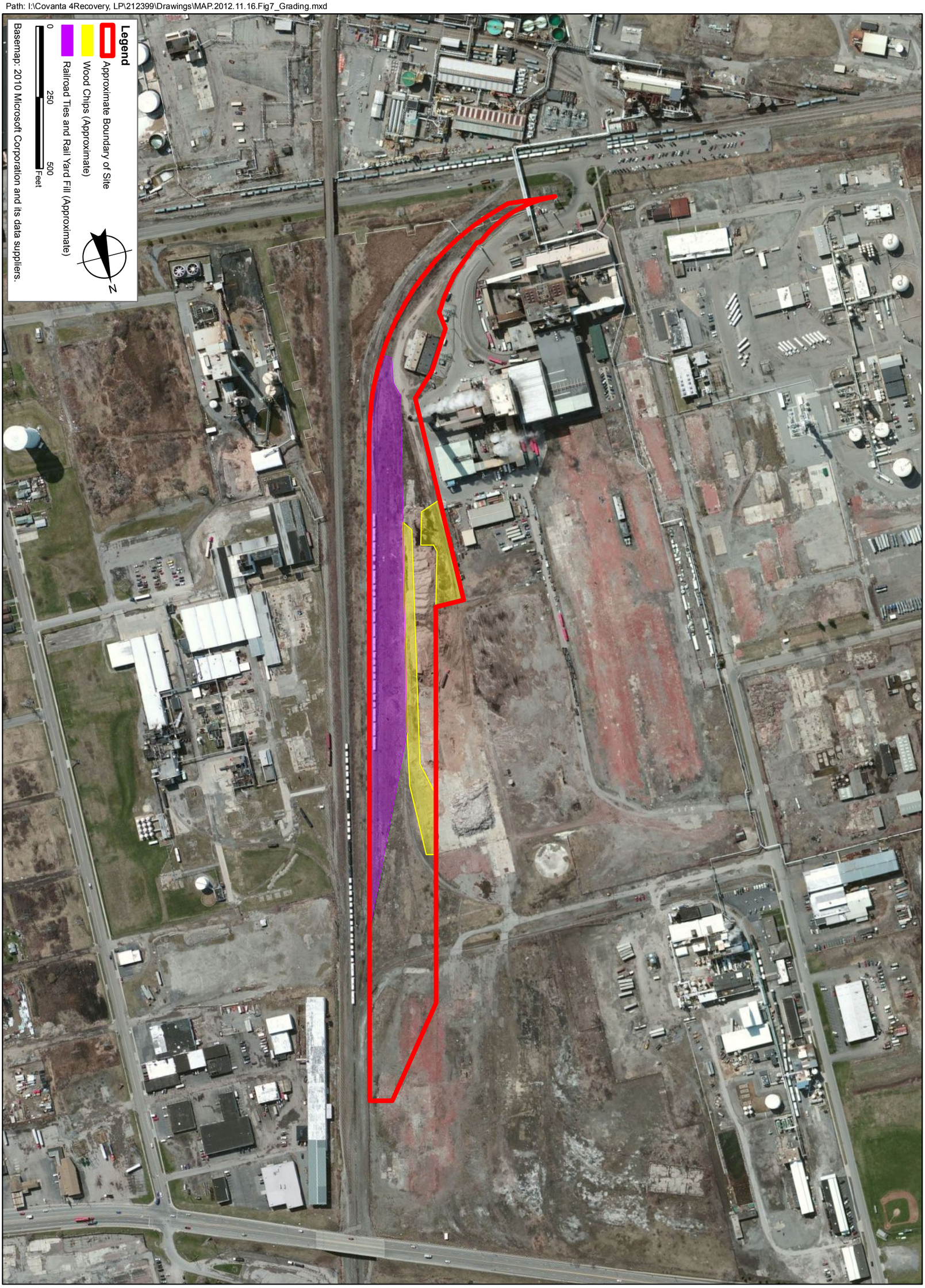
DATE: MAR. 2013

PROJECT/DRAWING NUMBER

212399

FIGURE 6

Path: I:\Covanta 4Recovery, LP\212399\Drawings\MAP.2012.11.16.Fig7_Grading.mxd



PROJECT/DRAWING NUMBER

212399

FIGURE 7

DRAWING TITLE

SITE GRADING PLAN

ISSUED FOR: REVIEW

DATE: NOV. 2012

DESIGNED BY: RCN

DRAWN BY: KMN

REVIEWED BY: DR

PROJECT/CLIENT

ALTERNATIVES ANALYSIS / REMEDIAL ACTION WORK PLAN FOR 15-ACRE SITE at

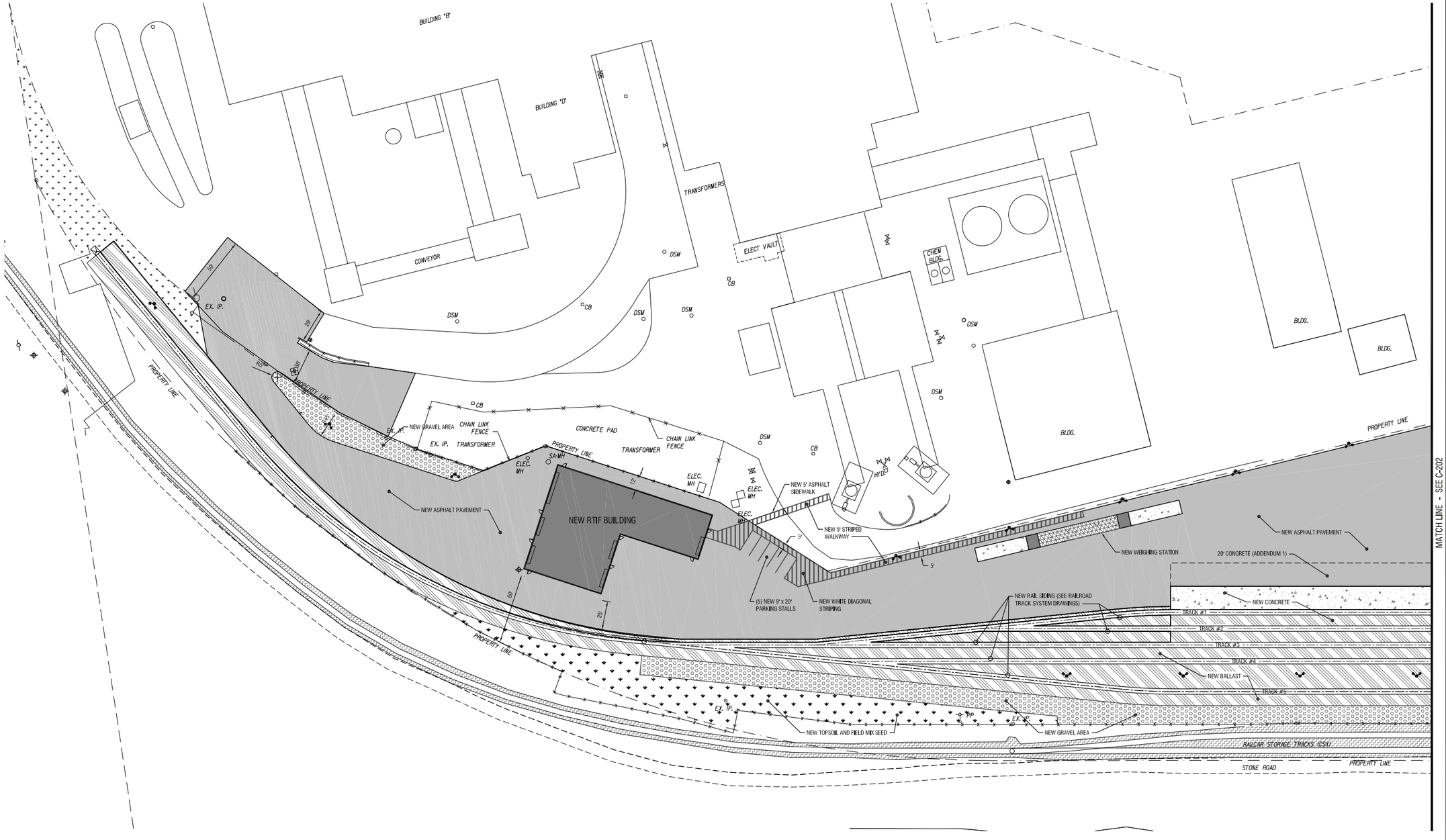
137 47TH ST, NIAGARA FALLS, NY

COVANTA 4RECOVERY, L.P.

LABELLA Associates, P.C.

300 PEARL STREET
BUFFALO, NY 14202
P: (716) 551-6281
F: (716) 551-6282

www.labellapc.com



1 C-201 SITE PLAN
1" = 40'

N

SITE PLAN LEGEND:

- NEW ASPHALT PAVEMENT
- NEW TOPSOIL AND FIELD MIX SEEDING
- NEW CONCRETE
- NEW BALLAST
- NEW GRAVEL
- EXISTING BALLAST

24"X36" PLOT SHEET

LABELLA Associates, P.C.
Engineering, Architecture, Environmental, Planning
www.labellapc.com
300 STATE STREET
ROCHESTER, NY 14614
P: (585) 454-6110
F: (585) 454-3066
Engineering
Architecture
Environmental
Planning

COVANTA ENERGY
for a cleaner world
100 ENERGY BLVD. AT 56TH STREET
NIAGARA FALLS, NY 14304

COVANTA NIAGARA L.P.
NIAGARA RAIL TO TRUCK
INTERMODAL FACILITY (RTIF)
NIAGARA FALLS, NY

PROJECT NUMBER
212399

NO.	DATE	REVISION
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--

DRAWN BY:

APPROVED BY:

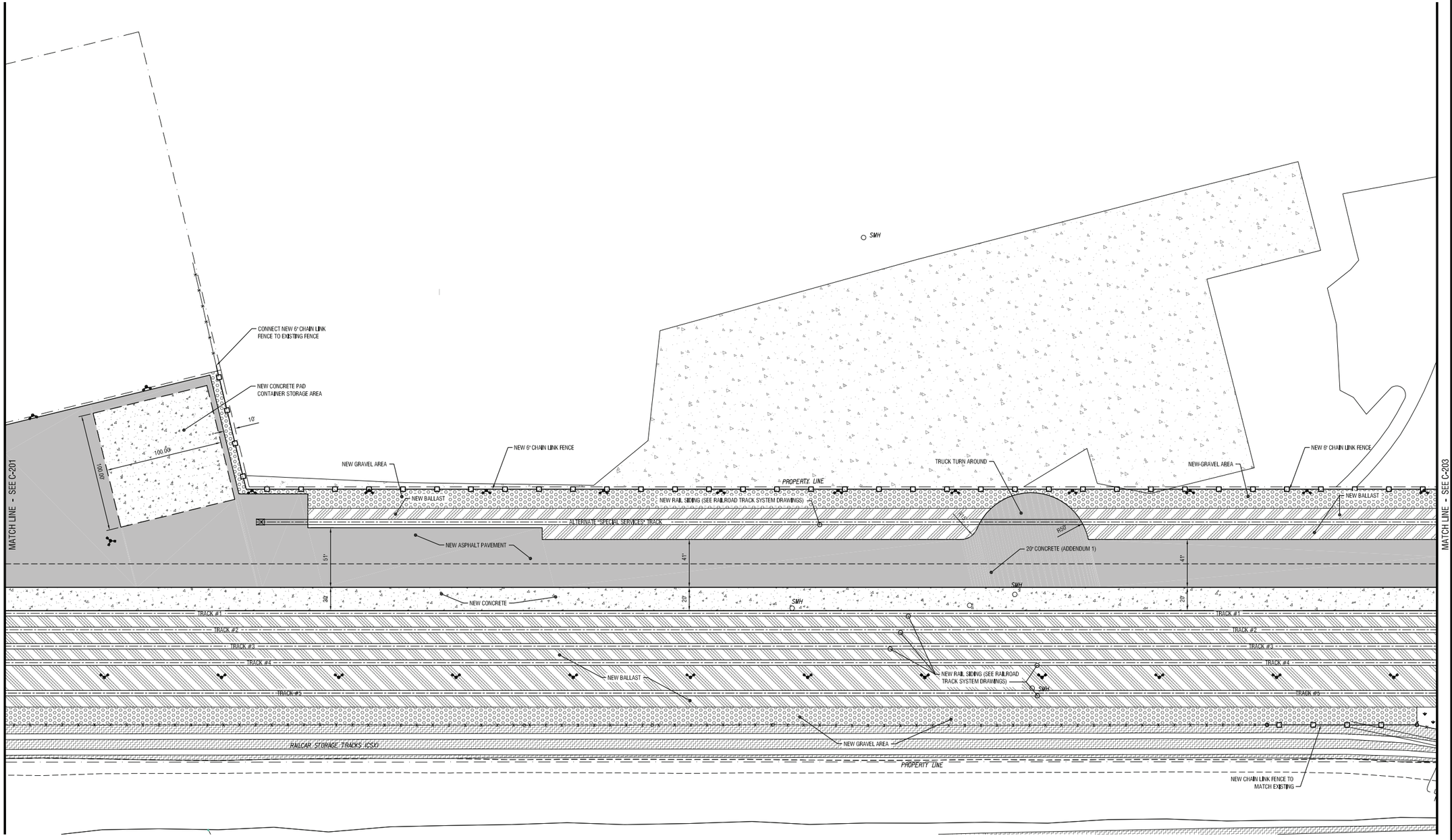
ISSUED FOR

30% DRAWINGS

DATE: FEBRUARY 2013

PROPOSED COVER SYSTEM

FIG. 8A



1 C-202 SITE PLAN
1" = 40'

N

SITE PLAN LEGEND:

- NEW ASPHALT PAVEMENT
- NEW TOPSOIL AND FIELD MIX SEEDING
- NEW CONCRETE
- NEW BALLAST
- NEW GRAVEL
- EXISTING BALLAST

24"X36" PLOT SHEET

LABELLA Associates, P.C.
Rochester ▪ Buffalo ▪ Toronto
www.labellapc.com
300 STATE STREET
ROCHESTER, NY 14614
P: (585) 454-6110
F: (585) 454-3066
Engineering
Architecture
Environmental
Planning

COVANTA ENERGY
for a cleaner world
100 ENERGY BLVD. AT 56TH STREET
NIAGARA FALLS, NY 14304

COVANTA NIAGARA L.P.
NIAGARA RAIL TO TRUCK
INTERMODAL FACILITY (RTIF)
NIAGARA FALLS, NY

PROJECT NUMBER
212399

NO.	DATE	REVISION
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--

DRAWN BY:

APPROVED BY:

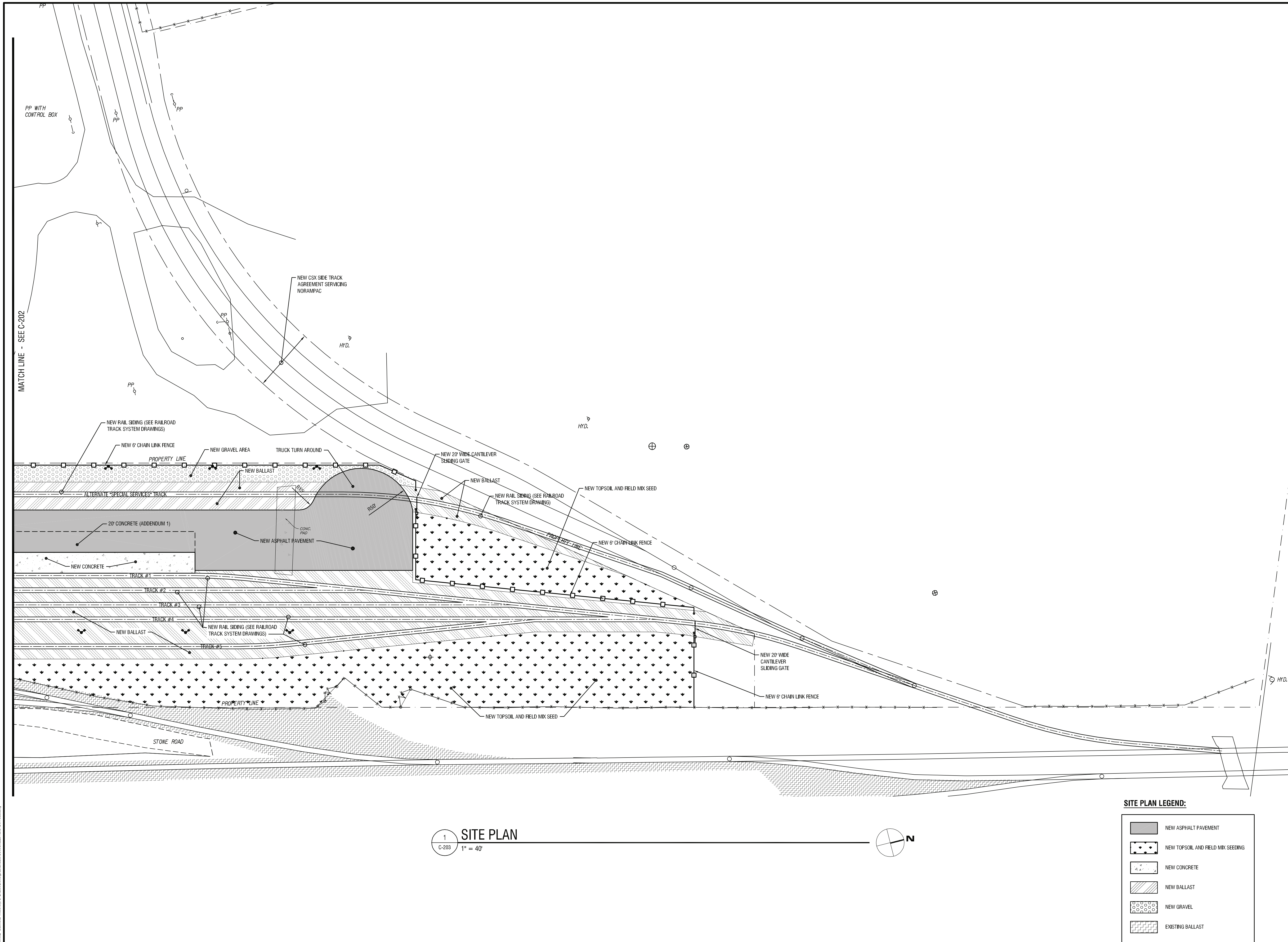
ISSUED FOR

30% DRAWINGS

DATE: FEBRUARY 2013

PROPOSED COVER SYSTEM

FIG. 8B



24"X36" PLOT SHEET

LABELLA Associates, P.C.

Relationships. Resources. Results.

www.labellapc.com
300 STATE STREET
ROCHESTER, NY 14614
P: (585) 454-6110
F: (585) 454-3066

Engineering
Architecture
Environmental
Planning

COVANTA ENERGY
for a cleaner world
100 ENERGY BLVD. AT 56TH STREET
NIAGARA FALLS, NY 14304

COVANTA NIAGARA L.P.
NIAGARA RAIL TO TRUCK INTERMODAL FACILITY (RTIF)
NIAGARA FALLS, NY

PROJECT NUMBER
212399

NO.	DATE	REVISION
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--
--	--	--

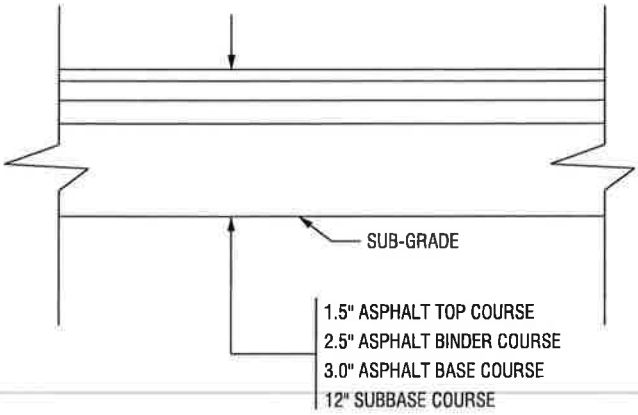
DRAWN BY:
APPROVED BY:

ISSUED FOR
30% DRAWINGS

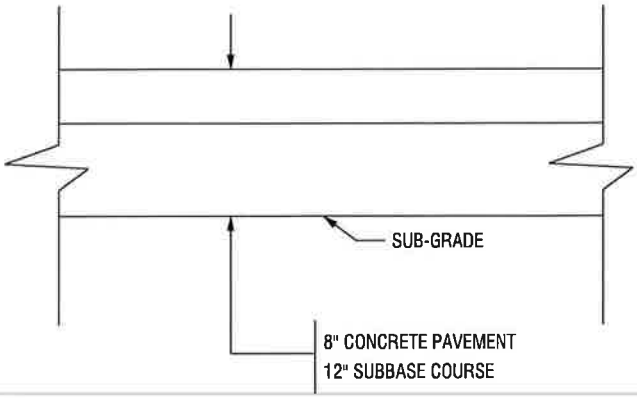
DATE: FEBRUARY 2013

PROPOSED COVER SYSTEM

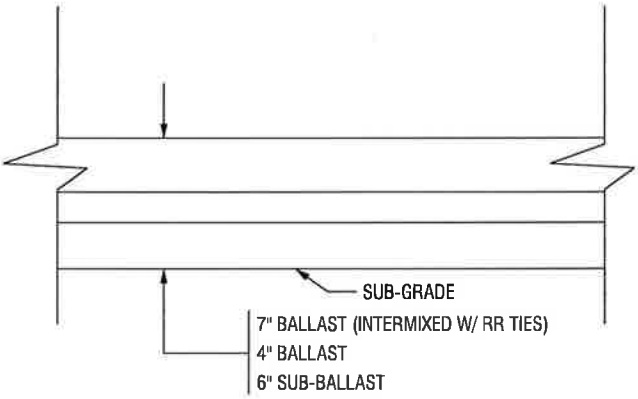
FIG. 8C



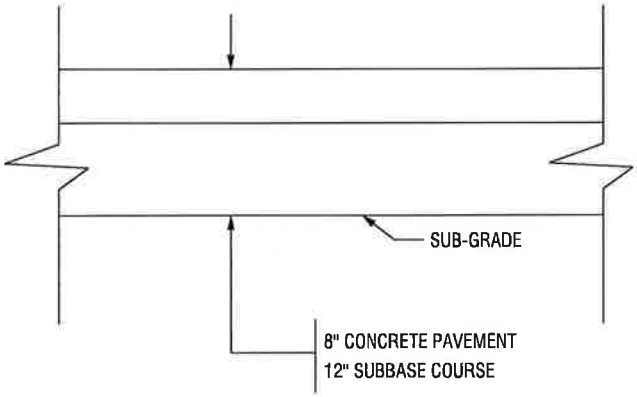
TYPICAL PROPOSED ASPHALT SECTION
N.T.S.



TYPICAL PROPOSED CONCRETE SECTION
N.T.S.



TYPICAL PROPOSED RAILROAD SECTION
N.T.S.



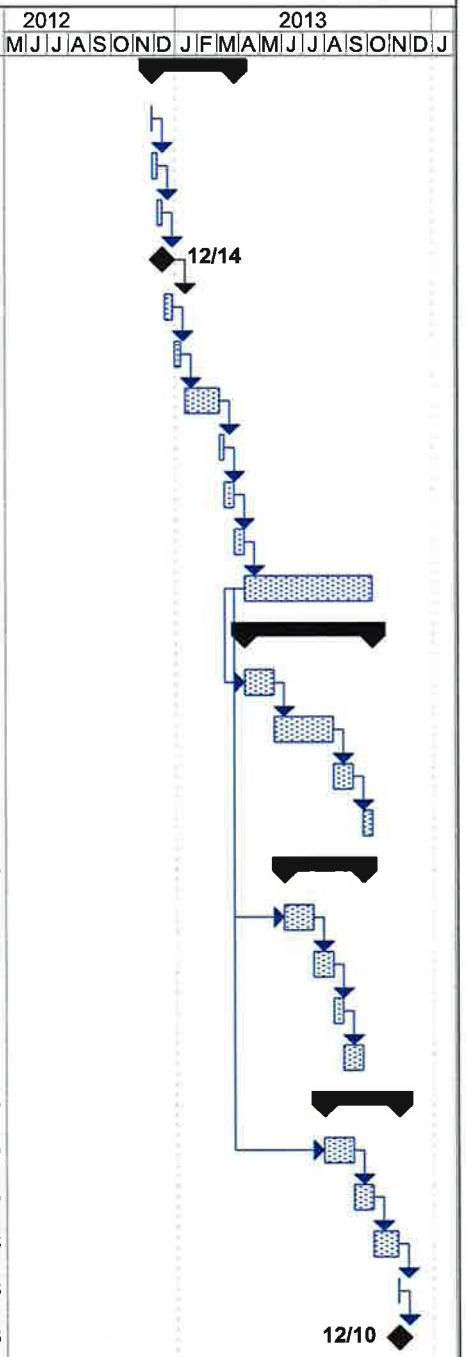
TYPICAL PROPOSED FILL SECTION
N.T.S.

PROJECT NO: 212399	COVER SYSTEM SECTIONS		COVANTA NIAGARA L.P. NIAGARA RAIL TO TRUCK INTERMODAL FACILITY NIAGARA FALLS, N.Y. COVANTA 4RECOVERY, L.P.
DRAWING NAME: FIGURE 9	ISSUED FOR: REMEDIAL INV. REPORT DATE: MAR. 2013	DESIGNED BY: DB DRAWN BY: ETE REVIEWED BY: RCN	

LABELLA Associates, P.C.
300 STATE STREET
ROCHESTER, NY 14614
P: (585) 454-6110
F: (585) 454-3066
www.labellapc.com

FIGURE 10
Covanta 4Recovery Brownfield Cleanup Program
Schedule - 15-Acre Praxair Site

ID	Task Name	Duration	Start	Finish
1	**Application Process**	**83 days**	**Thu 11/29/12**	**Mon 3/25/13**
2	Submit Draft RI Report and RAAR & RAWP to Covanta	1 day	Thu 11/29/12	Thu 11/29/12
3	Covanta Review of RI Report and RAAR & RAWP	1 wk	Fri 11/30/12	Thu 12/6/12
4	Revise Draft RI Report and RAAR & RAWP	1 wk	Fri 12/7/12	Thu 12/13/12
5	Submit BCP Application w/ Draft RI Report and RAAR & RAWP	1 day	Fri 12/14/12	Fri 12/14/12
6	NYSDEC BCP Application Completeness Review	2 wks	Mon 12/17/12	Fri 12/28/12
7	Public Notice	7 days	Mon 12/31/12	Tue 1/8/13
8	45-day Public Comment Period on Application, RI Report and RAAR & RAWP	7 wks	Tue 1/15/13	Mon 3/4/13
9	NYSDEC Acceptance	1 wk	Tue 3/5/13	Mon 3/11/13
10	Execute Brownfield Cleanup Agreement	2 wks	Tue 3/12/13	Mon 3/25/13
11	Formal DEC Approval of RI/AA Report and RAWP	2 wks	Tue 3/26/13	Mon 4/8/13
12	Implement Remedial Actions (estimated)	26 wks	Tue 4/9/13	Mon 10/7/13
13	**Environmental Easement**	**130 days**	**Tue 4/9/13**	**Mon 10/7/13**
14	Prepare Draft Environmental Easement, Title Report, and Survey	6 wks	Tue 4/9/13	Mon 5/20/13
15	NYSDEC Review of Environmental Easement	12 wks	Tue 5/21/13	Mon 8/12/13
16	Execute Environmental Easement	4 wks	Tue 8/13/13	Mon 9/9/13
17	Record Environmental Easement	2 wks	Tue 9/24/13	Mon 10/7/13
18	**Site Management Plan**	**80 days**	**Tue 6/4/13**	**Mon 9/23/13**
19	Prepare Draft SMP	6 wks	Tue 6/4/13	Mon 7/15/13
20	NYSDEC Review of Draft SMP	4 wks	Tue 7/16/13	Mon 8/12/13
21	Revise SMP	2 wks	Tue 8/13/13	Mon 8/26/13
22	NYSDEC Approval of Final SMP	4 wks	Tue 8/27/13	Mon 9/23/13
23	**Final Engineering Report**	**76 days**	**Tue 7/30/13**	**Tue 11/12/13**
24	Prepare Draft FER	6 wks	Tue 7/30/13	Mon 9/9/13
25	DEC Review of Draft FER	4 wks	Tue 9/10/13	Mon 10/7/13
26	Revise FER	5 wks	Tue 10/8/13	Mon 11/11/13
27	Submit Final FER	1 day	Tue 11/12/13	Tue 11/12/13
28	NYSDEC Issues Certificate of Completion	4 wks	Wed 11/13/13	Tue 12/10/13



LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Tables

TABLE 1
REMEDIAL COST ESTIMATE
Select Fill Removal and Cover System Installation
15-Acre Praxair Site

Item	Estimated Quantity	Unit Cost	Estimated Total
Select Fill Removal and Placement of Cover			
Clearing and Grubbing	6 acres	$10,000 acre	$60,000
Removing Existing Ties[2]	1 LS	$100,000 LS	$100,000
Mill Asphalt Pavement, Stockpile and Lay Down	25,000 SF	$1 SF	$25,000
Cracking & Seating of Concrete	1 LS	$10,000 LS	$10,000
Removal and Disposal of Unsuitable Material (Woodchips)	4,000 CY	$10 CY	$40,000
Concrete Pavement (20' west of Track 1 and Storage area)	45,000 SF	$8 SF	$337,500
Asphalt Pavement	186,000 SF	$6 SF	$1,116,000
Gravel Drives	67,000 SF	$3 SF	$201,000
Import Topsoil	3,400 CY	$40	$136,000
Establish Field Mix Turf	2 acres	$3,000	$6,000
Erosion Control	1 LS	$20,000 LS	$20,000
Ballast in Track	9,300 TF	$30 TF	$279,000
Concrete Pavement (inside rail section - 8" in depth)	80,000 SF	$8 SF	$600,000
Ballast for Turnouts	11 each	$5,000 each	$55,000
Monitoring Station	1 LS	$28,500 LS	$28,500
144" Dia. Sewer	275 LF	$1,200 LF	$330,000
6" Dia. Sewer	10 LF	$85 LF	$850
24" Dia. Sewer	1,325 LF	$110 LF	$145,750
36" Dia. Sewer	750 LF	$140 LF	$105,000
Combined Sewer Connection	1 LS	$15,000 LS	$15,000
5' Dia, Manhole	6 EA	$6,600 EA	$39,600
6' Dia. Manhole	1 EA	$9,600 EA	$9,600
8' Vortex Separator	1 EA	$71,800 EA	$71,800
12' Vortex Separator	1 EA	$102,100 EA	$102,100
Trench Drain	2,450 LF	$200 LF	$490,000
4" Underdrain (with sock and stone)	5,150 LF	$30 LF	$154,500
Detention Basin	5,850 CY	$20 CY	$117,000
4' MH	16 EA	$5,500 EA	$88,000
Cleanouts	16 EA	$1,000 EA	$16,000
Catch Basins	5 EA	$5,000 EA	$25,000
12-inch RCP Pipe	750 LF	$100 LF	$75,000
		Fill Removal Subtotal:	$4,799,200
Transportation, Disposal, Testing, and Monitoring			
Transportation and Off-Site Disposal - Rail Yard Fill[5]	2,900 tons	$60 /ton	$174,000
Transportation and Off-Site Disposal - Non-rad[6]	3,450 tons	$60 /ton	$207,000
Transportation and Off-Site Disposal - Rad[6,7]	1,750 tons	$275 /ton	$481,250
Handling and On-site Placement of Clean, Native Soil[8]	5,250 tons	$20 /ton	$105,000
Radiological Monitoring	50 days	$800 /day	$40,000
Characterization Analysis	16 samples	$800 /sample	$12,800
Disposal of water[9]	100,000 gallons	$0.10 /gallon	$10,000
Frac Tank Mobilization/Demob. & Cleaning	5 lump sum	$1,500 each	$7,500
Frac Tank Rental[10]	250 days	$50 /day	$12,500
		Transportation, Disposal, Testing, and Monitoring Subtotal:	*$1,050,050*
Fill Removal and off-site Disposal - Locomotive House Area			
Petroleum-Contam. Fill: Excav. and Transport to Adjacent Facility	7,200 tons	$20 ton	$144,000
Fill Generated During Installation of Utilities to Service New Building	100 tons	$20 ton	$2,000
Off-site Disposal[11]	7,300 tons	$0 ton	$0
Clean Backfill for Petroleum Excavation	7,200 tons	$15 ton	$108,000
		Fill Removal Subtotal:	$254,000
Environmental Easement and Site Management Plan			
Placement of Environmental Easement	1 each	$15,000 each	$15,000
Preparation of OM&M Plan	1 each	$10,000 each	$10,000
		EE and SMP Subtotal:	*$25,000*
		Subtotal:	**$6,128,250**
Taxes (8%)			$467,940
Engineering Fees (10%)			$612,825
Contingency (20%)			$1,319,238
		Estimated Total Cost	**$8,528,253**

Notes/Assumptions:
1. Rail cost estimates from Lee Fulton & Associates
2. Assumes ties can be incinerated at adjacent Covanta facility.
3. Stormwater improvement cost estimates from AECOM
4. Cost estimates includes excavation, labor, backfill materials (piping, equipment, stone, etc.)
5. Assumes off-site disposal of 60% of the material in the top 8 inches of material over the 4.5 acre existing rail yard
6. Assumes all fill is non-hazardous
7. Assumes disposal in Michigan
8. Assumes native material can be re-used on-site and average fill depth of five feet, plus off-site disposal of top six inches of native material
9. Containerized water can be discharged to the ground surface or the adjacent Covanta facility
10. Assumes 5 tanks for 50 working days
11. Assumes that the petroleum-contaminated fill can be incinerated at the adjacent Covanta facility.

TABLE 2
REMEDIAL COST ESTIMATE
Complete Fill Removal
15-Acre Praxair Site

Item	Estimated Quantity		Unit Cost		Estimated Total
Complete Fill Removal					
Excavation of Fill[1]	196,543	tons	$10	/ton	$1,965,427
Transportation and Off-Site Disposal - Radiological Fill[2]	7,149	tons	$275	/ton	$1,965,975
Transportation and Off-Site Disposal - Non-Radiological Fill[2]	189,394	tons	$60	/ton	$11,363,623
Radiological Monitoring	125	days	$800	/day	$100,000
Importation, Placement & Compaction Exc. Backfill	196,543	tons	$18	/ton	$3,537,769
Frac Tank Mobilization/Demob. & Cleaning	5	lump sum	$1,500	each	$7,500
Frac Tank Rental[3]	600	days	$50	/day	$30,000
Disposal of Water[4]	1,000,000	gallons	$0.10	/gallon	$100,000
			Fill Removal Subtotal:		*$19,070,294*
			Subtotal:		**$19,070,294**
Taxes (8%)					$1,525,624
Engineering Fees (10%)					$1,907,029
Contingency (20%)					$4,119,184
			Estimated Total Cost		**$26,622,131**

Notes/Assumptions:
1. Average fill depth is five feet across the Site
2. All fill is non-hazardous
3. Use of 5 tanks for six months
4. Containerized water can be discharged to the adjacent Covanta facility

TABLE 3
REMEDIAL COST ESTIMATE
Pits and Sumps - Impacted Water Removal and Closure
15-Acre Praxair Site

Item	Estimated Quantity	Unit Cost	Estimated Total
Water Removal and Decommissioning of Historic Sewer System			
Video Inspection	1 each	$10,000 each	$10,000
Closure of Sewer Manholes 1 and 3 - Concrete[1]	20 CY	$100 /CY	$2,000
Frac Tank Mobilization/Demob. & Cleaning	3 each	$1,500 each	$4,500
Frac Tank Rental[2]	30 days	$50 /day/tank	$1,500
Labor - Water Removal/Disposal	5 days	$1,000 /day	$5,000
Closure of Sewer - Flowable fill[3]	116.4 CY	$80 CY	$9,308
Disposal of Water[4]	23,499 gallons	$0.10 /gallon	$2,350
		Water Removal/Sewer Closure Subtotal:	*$34,658*
Water Removal - Pit[5]			
Water Removal	1 days	$1,000 /day	$1,000
Disposal of water[4]	7,330 gal	$0.10 /gal	$733
Importation, Placement & Compaction of Backfill	58.8 tons	$20 /ton	$1,176
		Water Removal/Pit Closure Subtotal:	*$2,909*
		Subtotal:	**$37,567**
Taxes (8%)			$3,005
Engineering Fees (10%)			$3,757
Contingency (20%)			$8,115
		Estimated Total Cost	**$52,444**

Assumptions:
1. 10 CY fill per manhole (2 manholes)
2. 3 tanks for two weeks
3. Assumes 250 linear feet of 4-foot diameter sewer piping
4. Containerized water can be discharged to the adjacent Covanta facility
5. Water removal for both tasks will occur consecutively, and tanks can be used for both tasks

TABLE 4
REMEDIAL COST ESTIMATE
Regulated Building Materials Removal and Demolition
15-Acre Praxair Site

Item	Estimated Quantity	Unit Cost	Estimated Total
Regulated Building Materials Removal - Interior			
Transite Electrical Panel	3 each	$30 each	$90
Black Pier Packing (may need excavator or tents)	50 SF	$40 /SF	$2,000
Light Fixture Gaskets	54 each	$25 /day	$1,350
		Interior Removal Subtotal:	*$3,440*
Regulated Building Materials Removal - Exterior			
Built-Up Roof	7,500 SF	$5 /SF	$37,500
Grey Roof Cement	280 SF	$5 /SF	$1,400
Black Caulk	10 LF	$10 /LF	$100
Grey Window Caulk	125.0 LF	$10 /LF	$1,250
		Exterior Removal Subtotal:	*$40,250*
Asbetos Project Air/Project Monitor			
Asbetos Project Air/Project Monitor	3 days	$425 /day	$1,275
		Asbestos Monitor Subtotal:	*$1,275*
Building Demolition			
Building Demolition	1 each	$94,500 /each	$94,500
		Building Demolition Subtotal:	*$94,500*
		Subtotal:	**$139,465**
Taxes (8%)			$11,157
Engineering Fees (15%)			$20,920
Contingency (20%)			$30,124
		Estimated Total Cost	**$201,666**

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Appendix A
Worker Dose Rate Estimates

Greater Radiological Dimensions, Inc.

1527 Ridge Road – Lewiston, NY 14092

Phone: (716)754-2654 Fax: (716)754-2622

Memo

Date: October 18, 2012

Prepared for: LaBella Associates, P.C.

Project Location: 137 47TH Street, Niagara Falls, NY

RE: Follow-up question responses regarding Worker Dose Rate estimates

Worker Dose Rate Estimate:

For the calculation of our annual worker dose rate estimate, we assume an 8 hour work day and a 40 hour work week. This results in a work year time estimate consisting of 2080 hours / year.

Using the laboratory results from the samples taken, we were able to use the "Infinite Slab" method in order to determine the highest radioisotopic content found at the site. The highest radioisotopic content on contact = 1.956E-1 mrem. The highest radioisotopic content at one meter = 0.01883 mrem.
The highest radioisotopic content is multiplied by the greatest possible time of exposure on the worksite, in order to calculate the "worst case scenario" worker dose rate estimate.

The annual worker dose rate estimates are calculated using following two conventions:

1. Workers in direct contact with the radiologically impacted materials.
   1.956E-1 mrem x 8 hours (on contact, daily exposure) = 1.564 mrem or 1.56×10^{-3} rem
   1.956E-1 mrem x 2080 hours (on contact, annual exposure) = 406.848 mrem or 0.407rem

2. Workers working at a distance of 1 meter from the impacted materials.
   0.01883 mrem x 8 hrs / workday (@1 meter, daily dose) = 0.151 mrem or 1.51×10^{-4} rem
   0.01883 mrem x 2,080 hrs / yr. (@1 meter, yearly dose) = 39.166 mrem

DOE Limits for Rad Workers: Whole Body Exposure: 5 rem/year
Extremities: 50 rem/year
Skin and other organs: 50 rem/year
Lens of eye: 15 rem/year

Date: **March 6, 2013**

To: **Jason Brydges, PE**

From: **Wayne Gaul. Ph.D., CHP, CHMM**

Subject: **Review of Overburden Shielding Calculation**

Reference: **"Dose Calculation for Slag at 137 47th St. Niagara Falls, NY", by Stan Stephens, dated October 12, 21012**

This review is for the calculation of the attenuation for different cover materials that may be use over hot spots. The intent is to assist in determining what cover material may be suitable for the hot spots around the site. The source term used was from the Referenced document above. Two calculations were done; the first used the source term from Test Pit 1 and the second used the highest nuclide concentration for each radionuclide without regard from which test pit the highest activity was in. The model was run in MicroShield version 7.02. The source term had used in the calculations had a density of 1.73 g/cm^3. There is a potential that a denser source may be present at 3.23 g/cm^3, if so the exposure received with the 1.73 g/cm^3 source can be multiplied by 0.6 to get a conservative estimate of the exposure from a 3.23 g/cm^3 source.

The table below (Table 1) shows the results at contact (approximately one inch from the surface) and one meter above the ground. The results are for exposure to the Test Pit 1 nuclides and a compilation of the highest nuclide from any test pit. The density of the cover is given for the material used in the cover. Clean fill is assumed to be normal soil. The concrete cover result is for 8" of concrete on the pit and then the combination of 8" concrete plus a 12" base material of compacted soil. The railroad ballast is 14" thick with an assumed density of 1.9 g/cm^3. The asphalt layer has a 12' sub base (1.7 g/cm^3), plus a 5" binder/base material (1.9 g/cm^3) with 1.5" of asphalt (2.2 g/cm^3) on top of that combination.

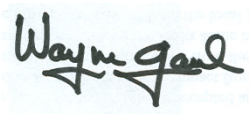
An approximation can be made of the additional contribution from this material using the manufacturer specifications for a gamma detector probe. For example, a Ludlum 44-10 2" x 2" NaI probe has a manufacturer response of 900 cpm per µR/hr. With the exposure rate of test pit 1 with 12" of clean fill the modes shows about an increase of 3.2 µR/hr or 2,880 cpm increase (3.2 µR/hr x 900 cpm/µR/hr). Again it should be noted this is an approximation of the meters response and may vary by 50% under certain circumstances.

50 Lyme Bay
Columbia, SC 29212-0915
803.732.1017 803.732.6548 (Fax)

Table 1, Exposure Rate on the Surface and at 1 meter with Different Cover Materials

Material		Test Pit 1			High Nuclide Value	
	Bulk density g/cm^3	mR/hr Contact	mR/hr at 1 meter		mR/hr Contact	mR/hr at 1 meter
Source	1.73	8.65E-02	8.47E-02		1.42E-01	1.39E-01
Source	3.23	5.23E-02	5.13E-02		8.72E-02	8.56E-02
12" clean full	1.6	3.16E-03	3.14E-03		6.70E-03	6.60E-03
8"concrete	2.35	3.35E-03	3.33E-03		7.05E-03	7.01E-03
plus 12" base	1.85	1.87E-04	1.86E-04		5.57E-04	5.55E-04
RR Ballast 14" equivalent	1.9	1.45E-03	1.14E-03		2.73E-03	2.72E-03
Asphalt with material	As noted.	4.88E-04	4.85E-04		1.29E-03	1.28E-03

If you have any questions please contact me.



Wayne Gaul, Ph.D., CHP, CHMM

50 Lyme Bay
Columbia, SC 29212-0915
803.732.1017 803.732.6548 (Fax)

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Appendix B
Radiological Fill Screening Plan

Greater Radiological Dimensions, Inc.

1527 Ridge Road – Lewiston, NY 14092

Phone: (716)754-2654 Fax: (716)754-2622

Description: **COVANTA RAIL WORK PLAN / TECHNICAL APPROACH**

Document #: GRD-TA011 **Revision # / Date:** 01 / October 29, 2012

Prepared for: LaBella Associates PC

Project Location: 137 47th Street, Niagara Falls, NY

1.0 Purpose:

The purpose of this Work Plan and Technical Approach is to describe the means and methods that Greater Radiological Dimensions, INC. (GRD) will implement in order to provide radiological support/oversight in order to release all contaminated excavation areas at Covanta's property: (i.e. Covanta Energy's Proposed Rail-To-Truck Intermodal Facility (RTIF) Project @ 137 47th Street, Niagara Falls N.Y.) GRD will provide radiological oversight for the minimization, segregation and shipment of waste for disposal at EQ Landfill in Belleview, Michigan. A final status survey will be performed of the previously affected area after the excavation has been completed.

2.0 Background:

In June of 2012, LaBella Associates PC contracted GRD to perform a GPS gamma walkover survey. All accessible areas of the 15 acre parcel were surveyed. It was determined that a part of the property is contaminated with low level radioactive slag. This contaminated material was used as fill on many other road and building sites in the Niagara Falls N.Y. area. In August of 2012, GRD performed test pit and sampling activity in order to determine the amount, and disposition, of the contaminated material. Six (6) samples were sent to Pace Analytical Laboratories for gamma spectroscopy. The isotopic analysis revealed that Radium, Uranium and Thorium were the main isotopes of concern. The results are discussed in detail in LaBella's Remedial Investigation Report.

The data from the sample results was used to derive the dose estimate for worker and public safety included in GRD's Rad Safety Plan, which is found in *Appendix E of LaBella's Alternatives*

Greater Radiological Dimensions, Inc.

1527 Ridge Road – Lewiston, NY 14092

Phone: (716)754-2654 Fax: (716)754-2622

Analysis Report and Remedial Action Work Plan (AAR/RAWP). The safety plan will be followed during the course of the excavation, segregation, load out and shipment of the contaminated material, which is expected to commence in March 2013.

3.0 Rail Replacement, Installation and Excavation of Contaminated Material:

During the rail removal and replacement, it will be necessary to remove the contaminated overburden and soil in and around the old rail yard. During the excavation of soil, a radiological technician will utilize a Ludlum model #2221 scaler paired with a model # 44-10 sodium iodine detector to survey each bucket during the excavation activity. The technician will scan each bucket, any material that is determined to be slag with gamma activity over the New York State Department of Environmental Conservation's (NYSDEC's) threshold of separation, will be loaded into a plastic lined dump truck and transported to the contaminated material laydown area.

A contaminated material laydown area will be established and appropriately posted. This area will have a plastic underlayment and will be covered with poly sheeting at all times. Once all of the material within the excavation footprint has been excavated, a GRD technician will then perform a GPS walkover of the area using a Ludlum model #2221 scaler and #44-10 probe paired with a Trimble GPS data logger in order to provide LaBella and the NYDEC a final status survey of the excavation area.

General area air monitoring will be used utilized during the excavation activity and load out. Four (4) F&J" lo-vol" Air Monitors will be placed waist high, north, south, east and west of excavation/load out area. The monitors will run during all excavation/load out activities and the filter cartridges will be collected daily. The 47mm filters will be counted immediately for any excessive levels then held for 5 days for radon decay, then recounted with a Ludlum model #2929 alpha/beta filter counter or equivalent. The results of Air Monitoring data will be reported using the guidance in NRC Regulatory Guide 8.25. All Air Sample data will be compared with the derivative air concentrations (DAC) that are the most conservative for the contaminants expected to be present. Radioactive contaminants in Appendix B. of New York's State Sanitary code# "10 NYCRR part 16-ionizing radiation" will be used to assess the exposure potentials, as appropriate. All instruments will be calibrated in accordance with regulatory guidance and subjected to daily quality checks to ensure proper operating condition and

functionality. The data will be recorded, documented on GRD survey forms and reviewed by senior radiological professional staff.

4.0 Preparation of Contaminated Material for Shipment to Disposal Facility:

The material in the contaminated laydown area will be sorted. A GRD technician along with an operator will sort waste at the contaminated stockpile. As the soil is removed from the stockpile, the surface of the soil shall be surveyed within the bucket for the total radiation count rate. If the radiation count rates are at background levels or below the threshold of material separation, the soil spoils can be loaded directly to a clean stockpile for disposal at a municipal disposal facility. If count rates are greater than the threshold of material separation, it can be blended with remainder of excavated spoils and resurveyed. The follow-up survey will determine if material is disposed of at EQ or a municipal disposal facility depending on count rates.

5.0 Oversight/Rad Support of Load Out, Shipping and Disposal of Contaminated Material:

With the acceptance of sample results from EQ Landfill in Belleview, Michigan (and the State of Michigan Department of Health) and the procurement of a certified waste shipper, GRD will prepare for NYSDEC approval a Transportation and Disposal Plan to ensure that all of the necessary permits and state regulatory requirements are fulfilled. Following NYSDEC approval, the contaminated material will be loaded onto 22 ton semi-tractor trailers for disposal at the EQ Landfill. The trucks will be lined with poly and covered (tarped). A dose rate survey of the trailer and cab will be performed, with a Bicron µR meter, in order to determine the dose rate in (µr/hr). The tires will be scanned, and decontaminated where appropriate, prior to the truck leaving the excavation site.

Once the load out of contaminated material has been completed, all of the appropriate equipment will be scanned and released. A gamma walkover survey of the contaminated laydown area will be performed. GRD will provide a release survey of the property.

Path: I:\Covanta 4Recovery, LP\212399\Drawings\MAP 2013.03.07 RadioLaydown.mxd

LABELLA Associates, P.C.
300 PEARL STREET
BUFFALO, NY 14202
P: (716) 551-6281
F: (716) 551-6282
www.labellapc.com

PROJECT/CLIENT

REMEDIAL INVESTIGATION OF
15-ACRE SITE at
137 47TH ST,
NIAGARA FALLS, NY
COVANTA 4RECOVERY, L.P.

DRAWING TITLE

RADIOLOGICALLY IMPACTED
MATERIAL LAYDOWN AREA

ISSUED FOR: REVIEW
DATE: MAR. 2013
DESIGNED BY: DER
DRAWN BY: KMN
REVIEWED BY: DER

PROJECT/DRAWING NUMBER

212399

FIGURE 1

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Appendix C
Imported Fill and Soil Values

Appendix 5
Allowable Constituent Levels for Imported Fill or Soil
Subdivision 5.4(e)

Source: This table is derived from soil cleanup objective (SCO) tables in 6 NYCRR 375. Table 375-6.8(a) is the source for unrestricted use and Table 375-6.8(b) is the source for restricted use.

Note: For constituents not included in this table, refer to the contaminant for supplemental soil cleanup objectives (SSCOs) in the Commissioner Policy on *Soil Cleanup Guidance*. If an SSCO is not provided for a constituent, contact the DER PM to determine a site-specific level.

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Metals					
Arsenic	13	16	16	16	13
Barium	350	350	400	400	433
Beryllium	7.2	14	47	47	10
Cadmium	2.5	2.5	4.3	7.5	4
Chromium, Hexavalent[1]	1 [3]	19	19	19	1 [3]
Chromium, Trivalent[1]	30	36	180	1500	41
Copper	50	270	270	270	50
Cyanide	27	27	27	27	NS
Lead	63	400	400	450	63
Manganese	1600	2000	2000	2000	1600
Mercury (total)	0.18	0.73	0.73	0.73	0.18
Nickel	30	130	130	130	30
Selenium	3.9	4	4	4	3.9
Silver	2	8.3	8.3	8.3	2
Zinc	109	2200	2480	2480	109
PCBs/Pesticides					
2,4,5-TP Acid (Silvex)	3.8	3.8	3.8	3.8	NS
4,4'-DDE	0.0033 [3]	1.8	8.9	17	0.0033 [3]
4,4'-DDT	0.0033 [3]	1.7	7.9	47	0.0033 [3]
4,4'-DDD	0.0033 [3]	2.6	13	14	0.0033 [3]
Aldrin	0.005	0.019	0.097	0.19	0.14
Alpha-BHC	0.02	0.02	0.02	0.02	0.04 [4]
Beta-BHC	0.036	0.072	0.09	0.09	0.6
Chlordane (alpha)	0.094	0.91	2.9	2.9	1.3
Delta-BHC	0.04	0.25	0.25	0.25	0.04 [4]
Dibenzofuran	7	14	59	210	NS
Dieldrin	0.005	0.039	0.1	0.1	0.006
Endosulfan I	2.4[2]	4.8	24	102	NS
Endosulfan II	2.4[2]	4.8	24	102	NS
Endosulfan sulfate	2.4[2]	4.8	24	200	NS
Endrin	0.014	0.06	0.06	0.06	0.014
Heptachlor	0.042	0.38	0.38	0.38	0.14
Lindane	0.1	0.1	0.1	0.1	6
Polychlorinated biphenyls	0.1	1	1	1	1

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Semi-volatile Organic Compounds					
Acenaphthene	20	98	98	98	20
Acenaphthylene	100	100	100	107	NS
Anthracene	100	100	100	500	NS
Benzo(a)anthracene	1	1	1	1	NS
Benzo(a)pyrene	1	1	1	1	2.6
Benzo(b)fluoranthene	1	1	1	1.7	NS
Benzo(g,h,i)perylene	100	100	100	500	NS
Benzo(k)fluoranthene	0.8	1	1.7	1.7	NS
Chrysene	1	1	1	1	NS
Dibenz(a,h)anthracene	0.33 [3]	0.33 [3]	0.33 [3]	0.56	NS
Fluoranthene	100	100	100	500	NS
Fluorene	30	100	100	386	30
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.5	5.6	NS
m-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
Naphthalene	12	12	12	12	NS
o-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
p-Cresol(s)	0.33	0.33	0.33	0.33	NS
Pentachlorophenol	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]
Phenanthrene	100	100	100	500	NS
Phenol	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	30
Pyrene	100	100	100	500	NS
Volatile Organic Compounds					
1,1,1-Trichloroethane	0.68	0.68	0.68	0.68	NS
1,1-Dichloroethane	0.27	0.27	0.27	0.27	NS
1,1-Dichloroethene	0.33	0.33	0.33	0.33	NS
1,2-Dichlorobenzene	1.1	1.1	1.1	1.1	NS
1,2-Dichloroethane	0.02	0.02	0.02	0.02	10
1,2-Dichloroethene(cis)	0.25	0.25	0.25	0.25	NS
1,2-Dichloroethene(trans)	0.19	0.19	0.19	0.19	NS
1,3-Dichlorobenzene	2.4	2.4	2.4	2.4	NS
1,4-Dichlorobenzene	1.8	1.8	1.8	1.8	20
1,4-Dioxane	0.1 [3]	0.1 [3]	0.1 [3]	0.1 [3]	0.1
Acetone	0.05	0.05	0.05	0.05	2.2
Benzene	0.06	0.06	0.06	0.06	70
Butylbenzene	12	12	12	12	NS
Carbon tetrachloride	0.76	0.76	0.76	0.76	NS
Chlorobenzene	1.1	1.1	1.1	1.1	40
Chloroform	0.37	0.37	0.37	0.37	12
Ethylbenzene	1	1	1	1	NS
Hexachlorobenzene	0.33 [3]	0.33 [3]	1.2	3.2	NS
Methyl ethyl ketone	0.12	0.12	0.12	0.12	100
Methyl tert-butyl ether	0.93	0.93	0.93	0.93	NS
Methylene chloride	0.05	0.05	0.05	0.05	12

Volatile Organic Compounds (continued)					
Propylbenzene-n	3.9	3.9	3.9	3.9	NS
Sec-Butylbenzene	11	11	11	11	NS
Tert-Butylbenzene	5.9	5.9	5.9	5.9	NS
Tetrachloroethene	1.3	1.3	1.3	1.3	2
Toluene	0.7	0.7	0.7	0.7	36
Trichloroethene	0.47	0.47	0.47	0.47	2
Trimethylbenzene-1,2,4	3.6	3.6	3.6	3.6	NS
Trimethylbenzene-1,3,5	8.4	8.4	8.4	8.4	NS
Vinyl chloride	0.02	0.02	0.02	0.02	NS
Xylene (mixed)	0.26	1.6	1.6	1.6	0.26

All concentrations are in parts per million (ppm)
NS = Not Specified

Footnotes:
[1] The SCO for Hexavalent or Trivalent Chromium is considered to be met if the analysis for the total species of this contaminant is below the specific SCO for Hexavalent Chromium.
[2] The SCO is the sum of endosulfan I, endosulfan II and endosulfan sulfate.
[3] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.
[4] This SCO is derived from data on mixed isomers of BHC.

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Appendix D

Site-Specific Community Air Monitoring Plan

LABELLA Associates, P.C.

Engineering
Architecture
Environmental
Planning

Site-Specific Community Air Monitoring Plan

Location:

15-Acre Praxair Site
137 47th Street
Niagara Falls, New York

Prepared For:

Covanta Niagara, L.P.
100 Energy Boulevard at 56th Street
Niagara Falls, New York 14304

LaBella Project No. 212399

December 13, 2012

Site-Specific Community Air Monitoring Plan

Location:

15-Acre Praxair Site
137 47th Street
Niagara Falls, New York

Prepared for:

Covanta Niagara, L.P.
100 Energy Boulevard at 56th Street
Niagara Falls, New York 14304

LaBella Project No. 212399

December 13, 2012

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Table of Contents

Page

1.0 Introduction 1

2.0 Responsibilities 1

3.0 Activities Covered 1

4.0 Work Area Access and Site Control 1

5.0 Volatile Organic Compound Monitoring 1

6.0 Particulate Monitoring 1

7.0 Radiological Monitoring 2

Attachment 1 – NYSDOH Community Air Monitoring Plan
Attachment 2 – NYSDEC Fugitive Dust and Particulate Monitoring Plan
Attachment 3 – Greater Radiological Dimensions, Inc. (GRD) Radiological Air Monitoring Plan

1.0 Introduction

The purpose of this Site-Specific Community Air Monitoring Plan (SSCAMP) is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities at the Site located at 137 47th Street in the City of Niagara Falls, Niagara County, New York. This SSCAMP is not intended for use in establishing action levels for worker respiratory protection.

This SSAMP requires real-time monitoring for volatile organic compounds (VOCs), particulates (i.e., dust), and radiation at the downwind perimeter of each designated work area when certain activities are in progress at the Site. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the SSAMP will help to confirm that work activities have not spread contamination off-site through the air.

2.0 Responsibilities

This SSAMP is applicable to the remedial and redevelopment activities of contractors, engineers, consultants, facility employees, and their authorized visitors. The Project Engineer shall implement the provisions of this SSAMP for the duration of the project. It is the responsibility of all remedial and redevelopment workers to follow the requirements of this SSAMP, and all applicable air safety procedures.

3.0 Activities Covered

The activities covered under this SSAMP include the following:

- Management of environmental investigation and remediation activities
- Environmental monitoring
- Management of excavated soil and fill
- Management of groundwater, surface water, and excavation water
- Installation of engineering controls (i.e., site cover)

4.0 Work Area Access and Site Control

The contractor(s) will have primary responsibility for work area access and site control.

5.0 Volatile Organic Compound Monitoring

Monitoring for volatile organic compounds (VOCs) will be implemented in accordance with the New York State Department of Health Generic Community Air Monitoring Plan, which is included in Attachment 1.

6.0 Particulate Monitoring

Monitoring for dust will be implemented in accordance with the New York State Department of Health Generic Community Air Monitoring Plan (Attachment 1) as well as NYSDEC's Fugitive Dust and Particulate Monitoring (Attachment 2).

7.0 Radiological Monitoring

Monitoring for radiological parameters will be implemented in accordance with Greater Radiological Dimensions' Air Monitoring Plan, which is included as Attachment 3.

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Attachment 1
NYSDOH Community Air Monitoring Plan

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Attachment 2
NYSDEC Fugitive Dust and Particulate Monitoring Plan

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Attachment 3
Greater Radiological Dimensions, Inc.
Radiological Air Monitoring Plan

GREATER RADIOLOGICAL DIMENSIONS

1527 RIDGE ROAD LEWISTON NY 14092 PHONE: (716) 754-2564 FAX: (716) 754-2522 11/16/12

GRD RECOMMENDATIONS FOR COVANTA 137 47th STREET RADIOLOGICAL MONITORING:

Greater Radiological Dimensions (GRD) is pleased to assist LaBella PC in providing Health Physics support and radiation control services for the Niagara Falls Covanta 137 47th Street remediation project. The following are GRD's recommendations and costs for worker and public monitoring.

ENVIRONMENTAL TLDs: A cost effective and proactive approach for public radiation monitoring would be the use of Environmental TLD's. Thermo Luminescent Detectors (TLD's) are used to measure radiation exposures at the site location. GRD proposes twelve (12) TLD's be placed at random locations inside and around the perimeter of the Covanta site. The TLD's will measure ionizing radiation exposures from all sources, including, natural radioactivity, cosmic radiation, fallout from nuclear weapons testing, radioactivity from fossil burning, and radioactive effluents from industrial operations and processes. The TLD's are typically used quarterly, but can be changed out and analyzed in any cycle desired. The badges after collection are sent back for lab analysis, GRD will prepare a standard report and archive data collected.

GENERAL AREA AIR MONITORING: During excavation activities; GRD recommends that General Area air sampling be conducted. The monitoring will be conducted in accordance with the guidance in NRC Regulatory Guide 8.25. Air sampling will be employed during excavation activity to determine whether confinement or suppression of radioactive material is effective, to determine required workplace administrative controls, to estimate worker intakes, and to determine what personal protective equipment (PPE) is appropriate.

General Area air sampling for airborne radioactivity will be conducted with low-volume air samplers F&J Model LV-1 or equivalent (0-100 lpm). Three (3) Samplers will be set up; upwind, downwind, and crosswind of the excavation area. The low-volume samplers will use 47mm filters and will be counted on a Ludlum model #2929 sample counter or equivalent, for alpha and beta immediately to determine any excessive levels. The filters will be changed daily. Following a 5 day hold time for radon decay, the samples will be recounted for alpha and beta values and recorded.

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Appendix E
Health and Safety Plan

LABELLA Associates, P.C.

Engineering
Architecture
Environmental
Planning

Site Health and Safety Plan

Location:

15-Acre Praxair Site
137 47th Street
Niagara Falls, New York

Prepared For:

Covanta Niagara, L.P.
100 Energy Boulevard at 56th Street
Niagara Falls, New York 14304

LaBella Project No. 212399

December 13, 2012

Site Health and Safety Plan

Location:

15-Acre Praxair Site
137 47th Street
Niagara Falls, New York

Prepared for:

Covanta Niagara, L.P.
100 Energy Boulevard at 56th Street
Niagara Falls, New York 14304

LaBella Project No. 212399

December 13, 2012

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Table of Contents

Page

SITE HEALTH AND SAFETY PLAN i
EMERGENCY CONTACTS ii
MAP AND DIRECTIONS TO THE MEDICAL FACILITY iii

1.0 Introduction 1

2.0 Responsibilities 1

3.0 Activities Covered 1

4.0 Work Area Access and Site Control 1

5.0 Potential Health and Safety Hazards 1

6.0 Work Zones 4

7.0 Decontamination Procedures 4

8.0 Personal Protective Equipment 4

9.0 Air Monitoring 5

10.0 Emergency Action Plan 6

11.0 Medical Surveillance 6

12.0 Employee Training 6

Attachment 1 – Greater Radiological Dimensions, Inc. (GRD) Health and Safety Plan

SITE HEALTH AND SAFETY PLAN

Project Title:	15-Acre Praxair Site –Remedial Action Work Plan
Project Number:	212399
Project Location (Site):	137 47th Street, Niagara Falls, New York
Environmental Director:	Gregory Senecal, CHMM
Project Manager:	Robert Napieralski, CPG
Plan Review Date:	December 7, 2012
Plan Approval Date:	December 7, 2012
Plan Approved By:	 Mr. Richard Rote, CIH
Site Safety Supervisor:	Chris Kibler
Site Contact:	Kevin O'Neil
Safety Director:	Rick Rote, CIH
Proposed Date(s) of Field Activities:	To Be Determined
Site Conditions:	Relatively flat site, undeveloped, encompassing approximately 15 acres
Site Environmental Information Provided By:	Remedial Investigation, LaBella Associates
Air Monitoring Provided By:	LaBella Associates, P.C. and Greater Radiological Dimensions, Inc. (GRD)
Site Control Provided By:	Contractor(s)

EMERGENCY CONTACTS

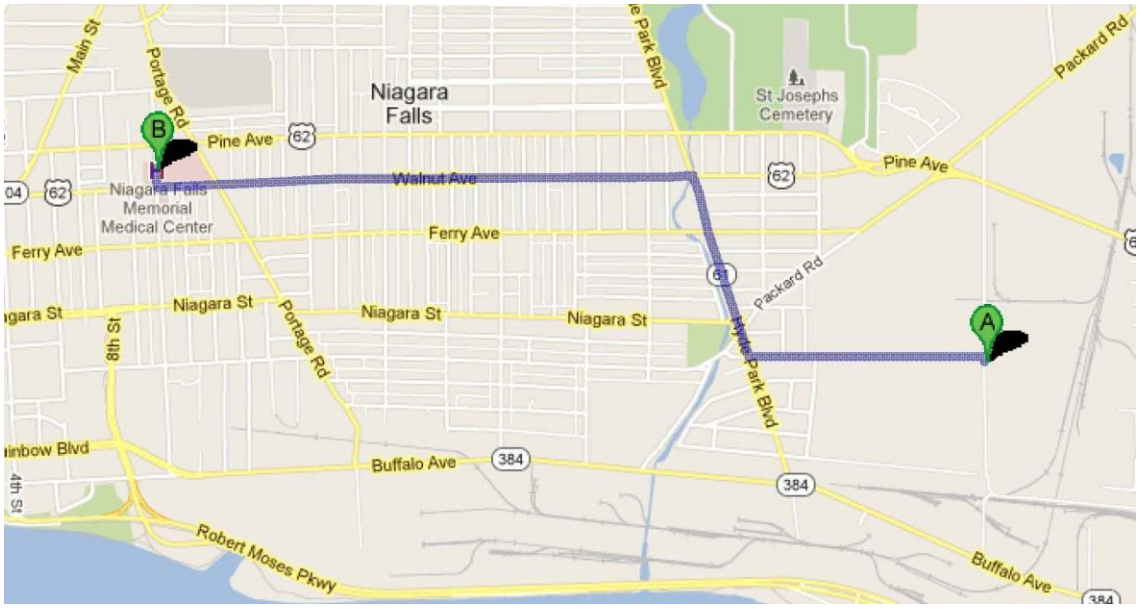
	Name	Phone Number
Ambulance:	As Per Emergency Service	911
Hospital Emergency:	Niagara Falls Memorial Medical Center	716-278.4569
Poison Control Center:	National Poison Control Center (serving Niagara Falls Area)	800-222-1222
Police (local, state):	Niagara Falls Police	911
Fire Department:	Niagara Falls Fire Department	911
Site Contact:	Kevin O'Neil (Covanta Niagara, L.P.)	Direct: 716-278-8548 Cell: 716-818-0986
Agency Contact:	Greg Sutton (NYSDEC)	716-851-7220
Environmental Director:	Greg Senecal, CHMM (LaBella)	Direct: 585-295-6243 Cell: 585-752-6480 Home: 585-323-2142
Project Manager:	Rob Napieralski, CPG (LaBella)	Direct: 716-551-6283 Cell: 716-253-0444
Site Safety Supervisor:	Chris Kibler (LaBella)	Direct: 716-873-2115
Safety Director	Rick Rote, CIH (LaBella)	Direct: 585-295-6241

MAP AND DIRECTIONS TO THE MEDICAL FACILITY: NIAGARA FALLS MEMORIAL HOSPITAL

A 137 47th St, Niagara Falls, NY 14304

1.	Head **north** on **47th St** toward **Royal Ave**	go 72 ft total 72 ft
2.	Take the 1st left onto **Royal Ave** About 2 mins	go 0.6 mi total 0.6 mi
3.	Take the 3rd right onto **Hyde Park Blvd** About 2 mins	go 0.5 mi total 1.1 mi
4.	Turn left onto **Walnut Ave** About 4 mins	go 1.4 mi total 2.5 mi
5.	Turn right onto **10th St** Destination will be on the right	go 256 ft total 2.5 mi

B **Niagara Falls Memorial Medical Center**
621 10th Street, Niagara Falls, NY 14301



LABELLA

1.0 Introduction

The purpose of this Health and Safety Plan (HASP) is to provide guidelines for responding to potential health and safety issues that may be encountered during the field activities relating to the implementation of the Remedial Action Work Plan (RAWP) at the Site located at 137 47th Street in the City of Niagara Falls, Niagara County, New York. This HASP only reflects the policies of LaBella Associates P.C. The requirements of this HASP are applicable to all approved LaBella personnel at the work site. This document's project specifications and the Site-Specific Community Air Monitoring Plan are to be consulted for guidance in preventing and quickly abating any threat to human safety or the environment. The provisions of the HASP were developed in general accordance with 29 CFR 1910 and 29 CFR 1926 and do not replace or supersede any regulatory requirements of the USEPA, NYSDEC, OSHA or and other regulatory body.

2.0 Responsibilities

This HASP presents guidelines to minimize the risk of injury to project personnel, and to provide rapid response in the event of injury. The HASP is applicable only to activities of approved LaBella personnel and their authorized visitors. The Project Manager shall implement the provisions of this HASP for the duration of the project. It is the responsibility of LaBella employees to follow the requirements of this HASP, and all applicable company safety procedures.

3.0 Activities Covered

The activities covered under this HASP are limited to the following:

- Management of environmental investigation and remediation activities
- Environmental monitoring
- Collection of samples
- Management of excavated soil and fill
- Management of groundwater, surface water, and excavation water

4.0 Work Area Access and Site Control

The contractor(s) will have primary responsibility for work area access and site control.

5.0 Potential Health and Safety Hazards

This section lists some potential health and safety hazards that project personnel may encounter at the project site and some actions to be implemented by approved personnel to control and reduce the associated risk to health and safety. This is not intended to be a complete listing of any and all potential health and safety hazards. New or different hazards may be encountered as site environmental and site work conditions change. The suggested actions to be taken under this plan are not to be substituted for good judgment on the part of project personnel. At all times, the Site Safety Officer has responsibility for site safety and his or her instructions must be followed.

5.1 Hazards Due to Heavy Machinery

Potential Hazard:
Heavy machinery including trucks, excavators, backhoes, etc will be in operation at the site. The presence of such equipment presents the danger of being struck or crushed. Use caution when working near heavy machinery.

Protective Action:
Make sure that operators are aware of your activities, and heed operator's instructions and warnings. Wear bright colored clothing and walk safe distances from heavy equipment. A hard hat, safety glasses and steel toe shoes are required.

5.2 Excavation Hazards

Potential Hazard:
Excavations and trenches can collapse, causing injury or death. Edges of excavations can be unstable and collapse. Toxic and asphyxiant gases can accumulate in confined spaces and trenches. Excavations that require working within the excavation will require air monitoring in the breathing zone (refer to Section 9.0).

Excavations left open create a fall hazard which can cause injury or death.

Protective Action:
Personnel must receive approval from the Project Manager to enter an excavation for any reason. Subsequently, approved personnel are to receive authorization for entry from the Site Safety Officer. Approved personnel are not to enter excavations over 4 feet in depth unless excavations are adequately sloped. Additional personal protective equipment may be required based on the air monitoring.

Personnel should exercise caution near all excavations at the site as it is expected that excavation sidewalls will be unstable. The contractor will be responsible to ensure that all excavations are left in a safe condition.

Fencing and/or barriers accompanied by "no trespassing" signs should be placed around all excavations when left open for any period of time when work is not being conducted.

5.3 Cuts, Punctures and Other Injuries

Potential Hazard:
In any excavation or construction work site there is the potential for the presence of sharp or jagged edges on rock, metal materials, and other sharp objects. Serious cuts and punctures can result in loss of blood and infection.

Protective Action:
The Project Manager is responsible for making First Aid supplies available at the work site to treat minor injuries. The Site Safety Officer is responsible for arranging the transportation of authorized on-site personnel to medical facilities when First Aid treatment in not sufficient. Do not move seriously injured workers. All injuries requiring treatment are to be reported to the Project Manager. Serious injuries are to be reported immediately to the Site Safety Officer.

5.4 Injury Due to Exposure of Chemical Hazards

Potential Hazards:
Volatile organic vapors from petroleum products, chlorinated solvents or other chemicals may be encountered during excavation activities at the project work site. Inhalation of high concentrations of organic vapors can cause headache, stupor, drowsiness, confusion and other health effects. Skin contact can cause irritation, chemical burn, or dermatitis.

Protective Action:
The presence of organic vapors may be detected by their odor and by monitoring instrumentation. Approved employees will not work in environments where hazardous concentrations of organic vapors are present. Air monitoring (refer to Section 9.0 and to the Site-Specific Community Air Monitoring Plan in Appendix D of the Alternatives Analysis Report and Remedial Action Work Plan (AAR/RAWP) of the work area will be performed at least every 60 minutes or more often using a Photoionization Detector (PID). Personnel are to leave the work area whenever PID measurements of ambient air exceed 25 ppm consistently for a 5 minute period. In the event that sustained total volatile organic compound (VOC) readings of 25 ppm is encountered personnel should upgrade personal protective equipment to Level C (refer to Section 8.0) and an Exclusion Zone should be established around the work area to limit and monitor access to this area (refer to Section 6.0).

5.5 Injuries Due to Extreme Hot or Cold Weather Conditions

Potential Hazards:
Extreme hot weather conditions can cause heat exhaustion, heat stress and heat stroke or extreme cold weather conditions can cause hypothermia.

Protective Action:
Precaution measures should be taken such as dress appropriately for the weather conditions and drink plenty of fluid. If personnel should suffer from any of the above conditions, proper techniques should be taken to cool down or heat up the body and taken to the nearest hospital if needed.

5.6 Potential Exposure to Asbestos

Potential Hazards:
During building demolition, building materials containing asbestos may be encountered. Asbestos is friable when dry and can be inhaled when exposed to air.

Protective Action:
The site's remedial plans require the abatement of asbestos during building demolition. The work will conform to all applicable state and federal regulations, and proper personal protective equipment will be required. Air monitoring will also be performed during asbestos abatement.

5.6 Potential Exposure to Radiation

Potential Hazards:
During ground intrusive activities (e.g., excavating or drilling) fill containing radiological impacts may be encountered. Additionally, on-site workers may be exposed to ionizing radiation.

Protective Action:
The presence of radiological impacts will be evaluated and addressed via the implementation of a monitoring and screening program. This program is discussed in Greater Radiological Dimensions, Inc.'s (GRD's) Radiological Safety Plan, which is included as Attachment 1.

6.0 Work Zones

In the event that conditions warrant establishing various work zones (i.e., based on hazards - Section 5.4), the following work zones should be established:

Exclusion Zone (EZ):
The EZ will be established in the immediate vicinity and adjacent downwind direction of site activities that elevate breathing zone VOC and/or dust concentrations to unacceptable levels based on field screening. These site activities include contaminated soil excavation and soil sampling activities. If access to the site is required to accommodate non-project related personnel then an EZ will be established by constructing a barrier around the work area (yellow caution tape and/or construction fencing). The EZ barrier shall encompass the work area and any equipment staging/soil staging areas necessary to perform the associated work. The contractor(s) will be responsible for establishing the EZ and limiting access to approved personnel. Depending on the condition for establishing the EZ, access to the EZ may require adequate PPE (e.g., Level C).

Contaminant Reduction Zone (CRZ):
The CRZ will be the area where personnel entering the EZ will don proper PPE prior to entering the EZ and the area where PPE may be removed. The CRZ will also be the area where decontamination of equipment and personnel will be conducted as necessary.

7.0 Decontamination Procedures

Upon leaving the work area, approved personnel shall decontaminate footwear as needed. Under normal work conditions, detailed personal decontamination procedures will not be necessary. Work clothing may become contaminated in the event of an unexpected splash or spill or contact with a contaminated substance. Minor splashes on clothing and footwear can be rinsed with clean water. Heavily contaminated clothing should be removed if it cannot be rinsed with water. Personnel assigned to this project should be prepared with a change of clothing whenever on site.

Personnel will use the contractor's disposal container for disposal of PPE.

8.0 Personal Protective Equipment

Generally, site conditions at this work site require level of protection of Level D or modified Level D. However, air monitoring will be conducted to determine if up-grading to Level C PPE is required (refer to Section 9.0). Descriptions of the typical safety equipment associated with Level D and Level C are provided below:

Level D:
Hard hat, safety glasses, rubber nitrile sampling gloves, steel toe construction grade boots, etc.

Level C:
Level D PPE and full or ½-face respirator and tyvek suit (if necessary). [*Note: Organic vapor cartridges are to be changed after each 8 hours of use or more frequently.*]

9.0 Air Monitoring

According to 29 CFR 1910.120(h), air monitoring shall be used to identify and quantify airborne levels of hazardous substances and health hazards in order to determine the appropriate level of employee protection required for personnel working onsite. Air monitoring will consist at a minimum of the procedures described in LaBella's Site-Specific Community Air Monitoring Plan.

The Air Monitor will utilize a photoionization Detector (PID) to screen the ambient air in the work areas for total Volatile Organic Compounds (VOCs) and a DustTrak tm Model 8520 aerosol monitor or equivalent for measuring particulates. Work area ambient air will generally be monitored in the work area and downwind of the work area. Air monitoring of the work areas and downwind of the work areas will be performed at least every 60 minutes or more often using a PID, and the DustTrak meter.

If sustained PID readings of greater than 25 ppm are recorded in the breathing zone, then either personnel are to leave the work area until satisfactory readings are obtained or approved personnel may re-enter the work areas wearing at a minimum a ½ face respirator with organic vapor cartridges for an 8-hour duration (i.e., upgrade to Level C PPE). Organic vapor cartridges are to be changed after each 8 hours of use or more frequently, if necessary. If PID readings are sustained, in the work area, at levels above 25 ppm for a 5 minute average, work will be stopped immediately until safe levels of VOCs are encountered or additional PPE will be required (i.e., Level B).

If dust concentrations exceed the upwind concentration by 150 $\mu g/m^3$ (0.15 mg/m^3) consistently for a 10 minute period within the work area or at the downwind location, then LaBella personnel may not re-enter the work area until dust concentrations in the work area decrease below 150 $\mu g/m^3$ (0.15 mg/m^3), which may be accomplished by the construction manager implementing dust control or suppression measures.

As described in the Site-Specific Community Air Monitoring Program, General Area air sampling will be conducted. The monitoring will be conducted in accordance with the guidance in NRC Regulatory Guide 8.25. Air sampling will be employed during excavation activity to determine whether confinement or suppression of radioactive material is effective, to determine required workplace administrative controls, to estimate worker intakes, and to determine what personal protective equipment (PPE) is appropriate.

General Area air sampling for airborne radioactivity will be conducted with low-volume air samplers F&J Model LV-1 or equivalent (0-100 lpm). Three Samplers will be set up; upwind, downwind, and crosswind of the excavation area. The low-volume samplers will use 47mm filters and will be counted on a Ludlum model #2929 sample counter or equivalent, for alpha and beta immediately to determine any excessive levels. The filters will be changed daily. Following a 5 day hold time for radon decay, the samples will be recounted for alpha and beta values and recorded.

If ground intrusive activities are conducted at more than one location simultaneously, additional upwind and downwind perimeter sampling will be completed to comply with the intent of the Site-Specific Community Air Monitoring Plan.

10.0 Emergency Action Plan

In the event of an emergency, employees are to turn off and shut down all powered equipment and leave the work areas immediately. Employees are to walk or drive out of the Site as quickly as possible and wait at the assigned 'safe area'. Follow the instructions of the Site Safety Officer.

Employees are not authorized or trained to provide rescue and medical efforts. Rescue and medical efforts will be provided by local authorities.

11.0 Medical Surveillance

Medical surveillance will be provided to all employees who are injured due to overexposure from an emergency incident involving hazardous substances at this site.

12.0 Employee Training

Personnel who are not familiar with this site plan will receive training on its entire content and organization before working at the Site.

Individuals involved with the remedial investigation must be 40-hour OSHA HAZWOPER trained with current 8-hour refresher certification.

Table 1
Exposure Limits and Recognition Qualities

Compound	PEL-TWA (ppm)(b)(d)	TLV-TWA (ppm)(c)(d)	STEL	LEL (%)(e)	UEL (%)(f)	IDLH (ppm)(g)(d)	Odor	Odor Threshold (ppm)	Ionization Potential
Acetone	750	500	NA	2.15	13.2	20,000	Sweet	4.58	9.69
Anthracene	0.2	0.2	NA	NA	NA	NA	Faint aromatic	NA	NA
Benzene	1	0.5	5	1.3	7.9	3000	Pleasant	8.65	9.24
Benzo (a) pyrene (coal tar pitch volatiles)	0.2	0.1	NA	NA	NA	700	NA	NA	NA
Benzo (a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo (b) Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo (g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo (k) Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA	NA	10.88
Carbon Disulfide	20	1	NA	1.3	50	500	Odorless or strong garlic type	0.096	10.07
Chlorobenzene	75	10	NA	1.3	9.6	2,400	Faint almond	0.741	9.07
Chloroform	50	2	NA	NA	NA	1,000	ethereal odor	11.7	11.42
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethylene	200	200	NA	9.7	12.8	400	Acrid	NA	9.65
1,2-Dichlorobenzene	50	25	NA	2.2	9.2		Pleasant		9.07
Ethylbenzene	100	100	NA	1	6.7	2,000	Ether	2.3	8.76
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	500	50	NA	12	23	5,000	Chloroform-like	10.2	11.35
Naphthalene	10, Skin	10	NA	0.9	5.9	250	Moth Balls	0.3	8.12
n-propylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Isopropylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethane	NA	NA	NA	NA	NA	NA	Sweet	NA	NA
Toluene	100	100	NA	0.9	9.5	2,000	Sweet	2.1	8.82
Trichloroethylene	100	50	NA	8	12.5	1,000	Chloroform	1.36	9.45
1,2,4-Trimethylbenzene	NA	25	NA	0.9	6.4	NA	Distinct	2.4	NA
1,3,5-Trimethylbenzene	NA	25	NA	NA	NA	NA	Distinct	2.4	NA
Vinyl Chloride	1	1	NA	NA	NA	NA	NA	NA	NA
Xylenes (o,m,p)	100	100	NA	1	7	1,000	Sweet	1.1	8.56
Metals									
Arsenic	0.01	0.2	NA	NA	NA	100, Ca	Almond	NA	NA
Cadmium	0.2	0.5	NA	NA	NA	NA	NA	NA	NA
Chromium	1	0.5	NA	NA	NA	NA	NA	NA	NA
Lead	0.05	0.15	NA	NA	NA	700	NA	NA	NA
Mercury	0.05	0.05	NA	NA	NA	28	Odorless	NA	NA
Selenium	0.2	0.02	NA	NA	NA	Unknown	NA	NA	NA
Other									
Asbestos	0.1 (f/cc)	NA	1.0 (f/cc)	NA	NA	NA	NA	NA	NA

(a) Skin = Skin Absorption
(b) OSHA-PEL Permissible Exposure Limit (flame weighted average, 8-hour): NIOSH Guide, June 1990
(c) ACGIH – 8 hour time weighted average from Threshold Limit Values and Biological Exposure Indices for 2003.
(d) Metal compounds in mg/m3
(e) Lower Exposure Limit (%)
(f) Upper Exposure Limit (%)
(g) Immediately Dangerous to Life or Health Level: NIOSH Guide, June 1990.

Notes:
1. All values are given in parts per million (PPM) unless otherwise indicated.
2. Ca = Possible Human Carcinogen, no IDLH information.

LaBella Associates, P.C.
300 Pearl Street, Suite 325
Buffalo, New York 14202

Attachment 1
Greater Radiological Dimensions, Inc.
Radiological Safety Plan

Greater Radiological Dimensions, Inc. 1527 Ridge Road Lewiston, NY 14092	Document: GRD-TI-021 Revised: 11/15/12
LOCATION: Covanta – 137 47th Street, Niagara Falls, NY	

RADIOLOGICAL SAFETY PLAN

Prepared By:	Louis Rosocha Senior Project Manager	
Approved By:	Stuart Pryce Project Manager / Sr. Technician	
Approved By:	George Weissenburger Program Manager / Sr. Technician	

1. Scope

1.1. Purpose

This document establishes the basis for the radiological controls to be implemented during the performance of work at any client's facility. Operations are subject to the conditions of the applicable Radioactive Materials License and the requirements of applicable regulations. The requirements and guidelines in this document were developed to ensure workers are afforded a safe work environment, to provide a compliant Radiation Protection Program, and to maintain occupational and environmental exposure to ionizing radiation "As Low As Reasonably Achievable" (ALARA).

1.2. Applicability

This document applies to all GRD, Inc. employees, contractors, subcontractors, and visitors at any licensed facility or job site.

1.3. Policy

GRD, Inc. places its highest priority on ensuring the safety and health of its employees and neighbors and protecting the environment. This priority extends to all areas affected by site operations. GRD, Inc. is committed at all levels to implementing a Radiation Protection Program based on the highest standards.

1.4. Responsibilities

1.4.1 The Radiation Safety Officer (RSO) is responsible for ensuring compliance with this Plan, associated procedures, and GRD, Inc. Radioactive Materials License. He has the authority to direct all aspects of the Radiation Protection Program and to ensure compliance with required regulations. The RSO is organizationally independent from operations and has the authority and responsibility to stop any activity which is not conducted in a safe manner or in compliance with the license, applicable regulations, and procedures.

1.4.2 Radiological Safety Technicians (RST) are responsible for determining, by sampling and measurement, compliance with this document. An RST has the authority to stop work if he/she suspects the initiation or continuation of the activity will result in either imminent danger to a worker or a violation of program requirements.

1.4.3 All site personnel are responsible for compliance with the requirements of the Radiation Protection Program and implementation procedures. All personnel have the responsibility and authority to stop work through their supervisor if considered unsafe.

1.5. Quality Assurance

1.5.1 Periodic audits (at least annually) of the Radiation Protection Program will be made during the course of operations to ensure compliance with this document. Audit schedules for individual activities will be identified considering the ALARA, regulatory, and safety reviews in accordance with implementing procedures.

1.5.2 Key elements of Quality Assurance include:

- Conducting Pre-construction quality control meetings
- Performance of daily quality control checks;
- Daily inspection of site, materials, equipment and construction progress;
- Conduct process and materials audits and quality control tests;
- Tracking and documentation of performance versus standards;
- Development of corrective actions;
- Provision of continuing support;
- Maintain "as-built" drawings current with field changes

1.6. Implementation

The provisions of this document will be implemented through radiological safety procedures. These procedures are working documents and will be updated and modified as changes in facilities, equipment, regulations and conditions change.

2. Worker Training In Radiation Protection

2.1. Radiological Safety Training Requirements

2.1.1 Periodic radiological safety training is necessary to ensure that all individuals understand the general and specific radiological hazards, their responsibility to GRD, Inc. and the public for safe handling of radioactive materials, and to maintain their individual radiation exposure ALARA.

2.1.2 The appropriate degree of training for each individual will be established based on the nature of the job assignment (i.e. the location where the work will be performed, the hazards associated with that particular area, and the methods used to perform the work). Workers will be categorized as General Workers (those who do not frequent the Controlled Radiation Zone (CRZ) and typically do not work with radiation or radioactive materials), or Radiation Workers (those who do). General Workers will not have unescorted access to the CRZ. Visitors may be exempted from training requirements provided that he/she is escorted, has received a safety briefing, and has written authorization from the RSO or designee.

2.2. Basic Radiological Safety Training

2.2.1 Each worker who is categorized as a Radiation Worker will receive a minimum of 8 hours classroom training prior to initial assignment if they have no prior experience in equivalent radiological work. The purpose of the training is to teach proper methods for working with radiation and handling radioactive materials, to discuss the effects of radiation to explain the risks of occupational exposure, and to identify the specific hazards associated with the operations to be conducted.

2.2.2 The following topics will be covered:

- Radioactive materials and radiation;
- Biological effects of radiation;
- Risks of occupational exposure;
- Exposure limits;
- ALARA, minimizing exposure (time distance, and shielding);
- Personnel dosimetry;
- Protective clothing and equipment (PPE);
- Radiation detection - operation, calibration, and use;
- Contamination control;
- Decontamination;
- Responsibilities of radiation workers;
- Federal and State Regulations and License provisions for the protection of
- Personnel from radiation and radioactive material;
- Emergency response;
- Radiation exposure reports available to workers;
- Respiratory protection program;
- Radiation work permits (RWPs).

2.2.3 Workers with documented prior radiological work experience need receive only as much training as is necessary to ensure a level of competence comparable with trained workers. Reciprocity will be established with radiation worker qualification through other nuclear facility training programs. Qualifications of the trainer shall be a minimum of five (5) years operational radiation protection experience plus 40 hours of formal training in radiation protection. The training session is followed by a written test which must be passed (80% pass rate) before unescorted access is allowed to the RCA. Records of required training are

maintained in each worker's file. The RSO may authorize individuals to challenge any training requirement and demonstrate the requisite level of knowledge in radiation safety by successfully completing a written exam and demonstration of practical factors. Hands-on training should be used for newly trained individuals without prior radiation work experience to ensure understanding and proficiency in radiation safety practices.

3. Radiation Surveys

3.1. General

3.1.1 Radiation surveys are performed as necessary to ensure personnel do not exceed radiation exposure limits and to meet requirements for posting Radiation, High Radiation, and Very High Radiation Areas. These surveys are performed to determine whether abnormal radiation levels exist and to determine the extent and magnitude of radiation levels. The surveys in this section shall be the minimum performed.

3.1.2 Radiation surveys shall be performed whenever operations are performed that might be expected to change existing radiation levels. Examples of such operations include movement or removal of shielding, radioactive waste processing, and relocation of radioactive materials.

3.1.3 Temporary boundaries (e.g., rope boundaries) of radiation areas shall be surveyed weekly to ensure radiation areas do not extend beyond posted boundaries.

3.1.4 Gamma surveys shall be performed at least weekly in posted radiation, high radiation (if accessible), and radioactive material storage areas. Very high radiation areas shall be surveyed upon entry or when a change of conditions warrant.

3.1.5 When highly radioactive equipment (i.e., contact radiation level greater than 100 mrem/hr) is moved, gamma surveys should be performed in spaces surrounding work areas (including the spaces above and below them if applicable) where personnel are likely to be exposed to radiation.

3.1.6 Potentially contaminated ducts, piping, and hoses outside the RCA shall be surveyed at least monthly when in use or at least annually when not in use (e.g., deactivated systems) for gamma radiation.

3.1.7 Beta-gamma surveys of ventilation system filters shall be performed whenever maintenance work or filter change-out is performed.

3.1.8 Other surveys should be performed as necessary to control personnel exposure to gamma, beta, and alpha radiation. Such surveys should include: (1) a gamma survey during initial entry into a confined space containing potentially radioactive piping; (2) gamma surveys in spaces where significant radiation levels might exist from adjacent operating equipment; (3) alpha, beta/gamma measurements when personnel might come in contact with surfaces contaminated with alpha and beta-emitting radioactive material.

3.1.9 Surveys shall be conducted when performing operations which could result in personnel being exposed to small intense beams of radiation. These operations include maintenance which requires the removal of shielding, or opening shipping/storage containers of radioactive equipment. When surveying are as or equipment where intense small beams of radiation could be present, an instrument should be used with an audible response (e.g., earphones). The probe is moved at a speed which is determined by considering the size of the probe, the instrument response time, the possible intensity of the beam, and the general dose rates in the area. For equipment with complex shield designs, RSTs and workers should be briefed on the equipment design so that the areas most likely to have small beams can be given special attention.

3.1.10 Gamma radiation surveys shall be performed weekly on a revolving basis in the areas of the work site where radioactive materials are not stored or handled. The survey should consist of a scan of accessible areas, offices, lunchrooms, etc. Unrestricted areas adjacent to the restricted area boundary shall be surveyed on a weekly basis. The survey shall consist of measurements taken at 50 foot intervals around the entire perimeter.

3.2. Contamination Surveys for Material Release

3.2.1 Material that is removed from the RCA will be surveyed for surface contamination. Only material which meets the requirements of GRD, Inc.'s free release criteria will be allowed to exit the RCA without

restriction. Material not meeting the free release criteria must be transferred directly to another RCA and/or packaged and labeled for storage or shipment prior to release from the RCA.

3.3. Normal Survey Plan

3.3.1 A free release survey shall be conducted by first surveying the item for removable contamination. The smears shall be counted using an appropriate portable survey instrument. To obtain better sensitivity for radionuclides with very restrictive release limits, a low background laboratory instrument may be used.

3.3.2 A fixed contamination survey is subsequently performed on the item using an appropriate portable survey instrument. The scan rate should not exceed 1 inch per second. The entire surface of the item to be released shall be surveyed. For greater sensitivity where required, a scaler equipped detector can be used along with a statistically valid survey plan approved by the RSO.

3.4. Special Survey Plan

3.4.1 For large amounts of homogeneous material with known history, and the material is either (a) not been exposed to contamination, (b) only suspected of being contaminated, or (c) decontaminated with a method that removes the entire surface area that was contaminated; a special survey plan may be used that surveys less than 100 percent of the surface area. This plan must be specific to the material surveyed and specify a detailed sample and survey plan. This survey plan must be approved by the RSO.

4. ALARA Program

4.1. Minimizing Radiation Exposure

4.1.1 GRD, Inc. shall maintain personnel radiation exposure ALARA. A continuing effort is required to meet this goal by developing and implementing improvements to work procedures and work performance.

4.1.2 All work shall be performed in the RCA under the direction of an approved procedure, approved work instruction, or RWP

4.1.3 Individual work procedures shall specify applicable actions (e.g. mockup training, use of temporary shielding, or removal of equipment from high radiation areas) to be used to minimize radiation exposure while working.

4.1.4 Supervisory personnel and radiological safety personnel shall ensure that personnel are not lingering unnecessarily in radiation areas.

4.1.5 Before entering the RCA, a worker shall receive specific job training and/or briefings necessary to enable him/her to perform his/her work with minimum radiation exposure. Examples include mockup training for specific jobs or periodic briefings by supervisory personnel for routine work.

4.1.6 Radiation levels shall be identified by the use of signs which clearly show the areas with the high and low radiation levels.

4.1.7 GRD, Inc. maintains records of the cumulative radiation exposure involved in performing work and establishes ALARA goals as necessary to improve methods to minimize personnel radiation exposure in future work.

4.2. Plans, Procedures and work instructions

4.2.1 Major work shall be performed under the guidance of a task specific plan, procedure, work instruction, or RWP. Determination of the need for specific approved plans, procedures, work instructions, or permits shall be made by the OM, the RSO, and the Quality Assurance Manager.

4.2.2 Plans, procedures or work instructions may describe the task, radiological conditions, or radiological controls, and shall be approved by the RSO or designee. A RWP will supplement the above with specific contamination or exposure control measures, monitoring requirements, and work instructions.

4.2.3 A pre-job ALARA briefing shall be held prior to beginning work performed under a plan, procedure, work instruction, or RWP to ensure all personnel understand the task, radiological conditions, and radiological controls.

4.3. Radiological Work Permit (RWP)

4.3.1 The RWP is an administrative mechanism to inform personnel of area radiological conditions, entry/exit requirements and specific work requirements that may apply to the task being performed. The RWP shall be used to maintain occupational radiation exposure ALARA, to minimize the spread of contamination, and to provide for augmented monitoring and surveillance where required. A description of the task to be performed and the radiological conditions associated with the work shall be recorded on the RWP. Also specified are the protective measures, dosimetry, and training required by personnel entering the designated area.

4.3.2 A standing RWP is used to govern activities in areas where hazards have been well characterized and radiological conditions are relatively stable. This includes routine activities such as tours and inspections, radiological surveys, and "light work" activities covered by procedures. Standing RWPs must be approved by the RSO or designee and the OM, and are reissued 011 an annual basis. Specific task RWPs are generally issued for the duration of the activity to be performed.

4.3.3 An RWP shall be obtained for all work activities that involve occupational radiation exposure or the potential spread of contamination. This includes activities not specifically covered by an approved plan, procedure or work instructions that are performed in any of the following conditions:

- Entry into a posted Radiation, High Radiation, or Very High Radiation Area;
- Entry into a posted Contamination or Airborne Radioactivity Area;
- Any work within the RCA or on contaminated or potentially contaminated equipment or surfaces;
- Maintenance work that would require the breaking of any process line, tank, vessel, or enclosure containing radioactive material that may become loose or airborne during the task

4.3.4 Signs indicating the need for the RWP shall be conspicuously posted at the entrances to areas were the RWP is required.

4.3.5 It is the responsibility of supervisors proposing to conduct work activities within required areas to initiate the issue of the RWP.

4.3.6 The RST shall complete the RWP after discussion of proposed work activities with the supervisor and performance of appropriate surveys.

4.3.7 Prior to beginning work, the RST shall conduct a pre-job ALARA. Briefing with all personnel working under the RWP. Items discussed shall include work scope, radiological conditions, dosimetry and protective clothing requirements, limiting conditions including stay times and hold points, and emergency actions. All personnel to perform work shall sign the RWP signature form to indicate an understanding of the requirements. Personnel added to the RWP after initiation of work shall be briefed by the RST prior to starting work and shall sign the RWP signature form.

4.3.8 During work under the conditions of a RWP, if radiological conditions change, or the scope of work is changed or expected to change, another RWP will be required and a pre-job ALARA briefing held.

4.3.9 The RST shall determine the type and degree of radiological monitoring required for a specific task. This determination should be based on the potential for radiation exposure or contamination spread and the experience of the personnel conducting the work.

4.3.10 An RWP shall be terminated by the initiator one year from the date of its initiation, or at the completion of the task, whichever comes first. If the work must be continued, a new RWP shall be initiated with the appropriate approvals, briefings, and documentation.

4.3.11 The RSO or designee shall ensure an indexed RWP log is maintained. The RWP log shall include: RWP #, date of issuance, date of termination and reason for RWP (work scope).

4.3.12 The RSO or designee shall ensure that all RWPs are terminated within the time allotted by paragraph 8.3.8 above, and shall ensure copies of all terminated R\VPs are maintained in the facility file throughout the duration of the activities.

5. **Access Control and Restricted Areas**

5.1. General Access

5.1.1 Restricted Areas are maintained for purposes of protecting members of the public against undue risk from exposure to radiation or radioactive materials. Radiation levels at the facility are controlled such that an individual at the Restricted Area boundary could not receive a dose in excess of2 mrem in any hour from external sources, or a cumulative exposure of 100 mrem in a year. Within the Restricted Area are the RCA and support areas. All visitors and vendors must enter the site through the administrative area where a visitor access log is maintained. Visitors are escorted in the RCA.

5.1.2 The RCA may include Radiation, High Radiation, Very High Radiation, Contamination, Airborne Radioactivity, and approved Radioactive Material Storage Areas as appropriate. Access control to the RCA shall be provided via the RW'P process and a formal access control point. The RCA boundary shall consist of engineered barriers and administrative controls which prevent access by unauthorized personnel, and ensure that authorized personnel have received appropriate training arid qualification. The access control requirements are applicable to all employees, contractors and visitors who may have need to enter this area.

5.2. Radiological Areas and Postings

5.2.1 Radiological areas are maintained at various locations inside the RCA, as required. Radiological areas include and will be posted as follows.

• Radiation Area is an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5mrem in an hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates. To mark such areas, signs shall be conspicuously posted; signs shall contain the conventional magenta three bladed symbol on yellow background and the words "CAUTION RADIATION AREA"; signs are permitted to state the general area radiation level. In addition, "DOSIMETRY REQUIRED" and "RWP REQUIRED" may be posted. No loitering is allowed in these areas.

• High Radiation Area is an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 100 mrem in an hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates. Such areas shall be posted and locked or guarded. The requirement to lock or guard a posted high radiation area does not apply to tanks or voids posted as high radiation areas if entry requires the removal of complex closures. Positive control shall be established for each individual entry into a high radiation area and shall be established in such a way that no individual is prevented from leaving the high radiation area. Prior to locking an unoccupied high radiation area, the area shall be inspected to ensure that no personnel remain inside. No loitering or entry by unauthorized personnel shall be allowed in these spaces. High radiation areas shall be conspicuously posted at entrances into the area. Signs shall contain the conventional magenta three-bladed symbol on yellow background and the words "CAUTION: HIGH RADIATION AREA". In addition, "CONTACT RADIATION SAFETY PRIOR TO ENTRY" shall be posted.

• Very High Radiation Area is an area, accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads in 1 hour at 1 meter from a radiation source or from any surface that the radiation penetrates. Signs shall contain the conventional magenta three-bladed symbol on yellow background and the words: "GRAVE DANGER, VERY HIGH RADIATION AREA". In addition to the control requirements described above for a High Radiation Area, access and security controls for very high radiation areas shall be implemented to ensure an individual cannot gain unauthorized access.

NOTE: PRIOR WRITTEN APPROVAL FROM THE RSO AND QA MANAGER IS REQUIRED FOR ENTRY INTO VERY HIGH RADIATION AREAS.

• Airborne Radioactivity Area is an area where airborne radioactive material exists in concentrations in excess of the derived air concentrations (DACs) specified in Table 1, column 3 of Appendix. B to 10 CFR 20 *(OAC 3701:1-38- 12, Appendix* C, *Table* 1), or to such a degree that an individual in the area without respiratory protection could exceed during a week, an intake of 0.6% of the ALI or 12 DAC-hours. Signs shall be posted at entrances to areas where airborne radioactivity levels exceed or have the potential to

exceed these levels. These signs shall contain the conventional three-bladed magenta symbol on yellow background and the words "CAUTION: AIRBORNE RADIOACTIVITY AREA." The requirements to wear respiratory equipment may also be included on the sign along with the anti-contamination clothing requirements.

• Contamination Area is an area having loose (removable) contamination on exposed surfaces greater than 1000 dpm/100 cm2 beta-gamma activity or 20 dpm/100 cm2 alpha radioactivity. Signs shall be posted at entrances to areas where surface contamination levels exceed or have the potential to exceed these levels. These signs shall contain the conventional three-bladed magenta symbol on yellow background and the words "CAUTION: CONTAMINATION AREA." The requirements to wear anti-contamination clothing or perform personal contamination surveys may also be included on the sign.

• Radiologically Controlled Area (RCA) is an area to which access can be controlled for radiation exposure or contamination control purposes. An RCA typically serves as a buffer around a contamination or radiation area and provides access control for personnel, equipment and material monitoring. Signs shall be posted at entrances to these areas which contain the conventional three-bladed magenta symbol on yellow background and the words "CAUTION: RADIOLOGICALLY CONTROLLED AREA."

• Radioactive Material Storage Area is an area where radioactive material is used or stored in amounts exceeding 10 times the quantity of such material specified in appendix C to 10 CFR 20 *(OAC 3701:1-38-18, Appendix A).* Entrances to areas where radioactive materials are handled or stored that meet this criteria shall be posted with signs having the conventional magenta three-bladed symbol on yellow background and the words "CAUTION: RADIOACTIVE MATERIAL." This posting is in addition to posting required for other radiological areas.

5.2.2 An Access Control Point is a location on the perimeter of a restricted area, or the RCA through which all entries and exits are made. Precautions are taken at the appropriate access control point to prevent the inadvertent exposure to radiation or the spread of contamination to adjacent uncontaminated areas. The dimensions and material requirements of an access control point depend on the type of work to be performed, the number of personnel involved, and the location of the work.

5.3. Temporary Shielding

5.3.1 Since incorrect installation, unauthorized movement, or removal of temporary shielding can result in large changes in work area radiation levels and subsequent radiation exposure, control of temporary shielding is essential.

5.3.2 Temporary shielding installation and removal should be controlled by written instructions. These instructions shall specify locations and amounts of temporary shielding.

5.3.3 After installation, temporary shielding shall be inspected and surveys conducted to ensure it is properly located.

6. **Controlling Airborne Radioactivity**

6.1. General

6.1.1 The primary reason for control of airborne radioactivity is to minimize internal radiation exposure resulting from inhalation of airborne radioactive materials. An intake of radioactive material is measured in units of DAC-hours (DAC multiplied by hours of exposure), which is directly proportional to CEDE.

6.1.2 Radioactivity in the form of particulates, gases, or both can become airborne through sources such as (1) radioactive system leaks, (2) grinding or welding a contaminated component, (3) decontamination operations, (4) disturbing surface contamination deposited on a work surface, (5) improper use of a containment enclosure, (6) inadequate vacuum cleaner and ventilation system control, (7) inadequate application of procedures for venting and draining radioactive systems or components, (8) damage or detects in instrumentation calibration or check sources, and (9) radon from radium sources or from trace amounts of natural radium impurities in construction materials.

6.1.3 Engineering controls shall be used, to the extent practical, to reduce the potential for the release of airborne radioactivity. These -include agents that fix loose contamination, HEPA-filtered ventilation, local exhaust ventilation, containments, decontamination, and wrapping, as required.

6.1.4 Airborne radioactivity monitoring provides a record of ambient airborne radioactivity in the work place, a tool to assess worker intakes, verify required posting, and evaluate the adequacy of engineered and administrative controls for maintaining exposure ALARA.

6.1.5 The RSO will prescribe the continuous or periodic sampling required to detect and evaluate the levels of airborne radioactivity in work areas and exhaust air systems in accordance with this section and Reference 2.1.7. Air sampling is required for activities where an individual is likely to receive in one year, an intake in excess of 10% of the applicable ALL Representative air samples are collected and intakes tracked and controlled such that personnel exposure complies with 10 CFR § 20.1502 *(OAC 3701:1-38-12)* requirements. Continuous air monitoring systems with local and remote alarm capability are provided where the potential for airborne radioactivity is higher during maintenance or off-normal conditions. Portable air samplers and/or personal breathing zone air samplers are used as necessary to monitor specific work activities.

6.1.6 It should be noted that this monitoring is primarily concerned with the control of particulate airborne activity. Certain unique situations with noble gases may be encountered, and will require special monitoring techniques.

6.1.7 Routine bioassays may be performed to supplement air monitoring data for workers where normal operating conditions would result in an intake of radioactive material in excess of 10% of the applicable ALI in 10 CFR 20 *(OAC 3701:1-38).* Routine bioassays include baseline measurements prior to exposure, termination measurements at termination of employment or change in work status, and periodic measurements (as determined 011 a site specific basis to meet 10 CFR § 20.1204 *(OAC 3701:1-38-12)* requirements). Special monitoring bioassays will be performed on a case-by-case basis in the event of unusual or unexpected monitoring results at the discretion of the RSO. Examples of situations that may require special monitoring include: the presence of unusually high levels of facial or nasal contamination, entry into airborne radioactivity areas without appropriate exposure controls, loss of system or container integrity, a CAM alarm, or incidents that result in contamination of wounds or other skin absorption.

6.1.8 Unplanned individual exposures with estimated intakes greater than 0.02 Annual Limit on Intake (ALI) will be investigated. Individual intakes greater than 0.1 ALI will be investigated using follow-up bioassay measurements and available work place monitoring data.

6.2. Limits for Airborne Radioactivity

6.2.1 The administrative limit for occupational exposure to airborne radioactivity is 8 DAC hours in anyone day. The DAC values are found in table 1 of appendix B to 10 CFR 20 *(OAC 3701:1-38-12, Appendix* C *Table* 1). Site specific administrative control levels for occupational exposure to airborne radioactivity are given in Section 6.1.3.

6.2.2 Engineering controls should be designed and operated in such a manner that personnel are not routinely exposed to airborne radioactivity levels that may require use of respiratory protection equipment

6.2.3 Investigation Levels. Any measurement which indicates the airborne radioactivity concentration to be in excess of 2% of the applicable DAC shall be investigated to determine the cause of the airborne radioactivity levels. Appropriate controls shall be implemented to maintain the airborne radioactivity levels ALARA.

6.3. Requirements for Controlling Personnel Exposure to Airborne Radioactivity

6.3.1 Personnel exposure to airborne radioactivity is controlled using fixatives, ventilation, containments or respiratory protection equipment for work in areas with high levels of surface contamination (e.g., >100,000 dpm/100 cm2 beta-gamma, >2000 dpm/100 cm2 alpha) because of the likelihood that this surface contamination could be resuspended. In some circumstances, respiratory equipment might be necessary in areas where surface contamination exists at lower levels due to the nature of the work.

6.3.2 Engineered controls shall be used to the maximum extent practicable to prevent personnel from being exposed to airborne radioactivity above the administrative control levels in Section 6.1.3. These controls are

recommended during radiological work which has been known to cause or is expected to cause airborne radioactivity, and will be provided for in the RWP.

6.3.3 The need for personnel to wear respiratory protection equipment where airborne radioactivity is likely to exceed 25% of the DAC in table 1 of appendix B of 10 CFR 20 *(OAC 3701:1-38-12, Appendix C Table 1)* shall be evaluated and documented prior to area entry. Worker efficiency with respiratory protection equipment will be considered in areas with elevated external radiation in order to maintain the TEDE ALARA.

6.3.4 Personnel shall not be exposed to airborne radioactivity such that their daily intake exceeds 8 DAC-hours without prior approval of the RSO.

6.3.5 Signs shall be posted at entrances to airborne radioactivity areas. The requirements for respiratory protection equipment shall also be included on the sign with the anti-contamination clothing requirements where appropriate.

6.3.6 When personnel not wearing respiratory equipment may be exposed to airborne radioactivity above the limits of Section 10.2, ventilation and/or containment should be provided which will capture airborne particulate radioactivity U1 a controlled ventilation system with a high efficiency particulate au' (HEP A) filter. Other controls such as the use of loose fitting prefabricated drapes, ventilated shrouds, ventilated glove-bags, the use of fixatives, or misting may reduce ambient airborne radioactivity to a level that would preclude the use of respiratory protection.

- HEP A filters shall be installed in the ventilation exhaust from radioactive work areas in which work in progress could cause the discharge of airborne radioactivity to the environment.
- HEPA filters shall be installed in the exhaust from contamination containments to prevent personnel from being exposed to high airborne radioactivity.
- HEP A filters shall be installed in vacuum cleaners used for decontamination of loose surface contamination.

6.3.7 Positive pressure air purifying respirators, air supplied masks, hoods, or suits may be worn for work where airborne radioactivity is expected to be significant. Self contained breathing apparatus will be utilized for very significant airborne radioactivity concentrations.

6.4. Elevated Airborne Radioactivity Response

6.4.1 Elevated airborne radioactivity associated with operations can result from many causes. It can be indicated by a CAM alarm, retrospectively by a portable or personal air sample exceeding the applicable limit of Section 10.2, or by visual observation of a radioactive system leak or rupture. General methods for controlling personnel exposure to airborne radioactivity are contained in Section 10.3. An appropriate response to elevated airborne radioactivity is given below:

6.4.2 Immediate Action. Operations identified to be the cause of elevated airborne radioactivity shall be stopped until adequate control is established. Unessential personnel shall be evacuated from the affected area. Essential personnel shall don respiratory protection in accordance with Section 6.7. Unfiltered ventilation from the affected spaces shall be secured. Ventilation systems which contain high efficiency filters in exhaust ducts need not be secured. The extent of the airborne radioactivity should be determined by sampling the affected area and adjacent areas using p0l1abie air samplers. If the elevated airborne radioactivity is indicated by alarm of a CAM monitoring a ventilation exhaust or a work area, the instrument should be checked to ensure the alarm is not the result an electrical transient. Gamma radiation levels at the CAM should be measured to determine if the CAM alarm was caused by high radiation levels external to the CAM. Supplementary actions need not be taken if the alarm is determined to be a false alarm.

6.4.3 Supplementary Action. Supplementary actions are carried out to facilitate recovery operations and the return of the plant to normal status. Sampling and analysis shall be performed to identify the source of the airborne radioactivity. In order to minimize the need for respiratory protection equipment, and reduce personnel exposures to airborne radioactivity, consideration shall be given to ventilating the facility with additional HEPA filtered ventilation systems. Gamma surveys of ventilation filters and ducts as well as surface contamination in the vicinity should be performed to facilitate recovery. When resuming operations, portable air samples are used to confirm the cause of elevated airborne radioactivity has been corrected.

Evacuated personnel should be monitored for contamination and decontaminated as necessary. Personnel exposed to elevated airborne radioactivity shall be evaluated for intake in accordance with Section 6.1.

6.4.4 Reports - A report of any occurrence involving elevated airborne radioactivity (above the limits of Section 6.2) in areas occupied by personnel not wearing respiratory equipment shall be made in accordance with Section 17. This report shall include the results of monitoring personnel for internally deposited radioactive material as required.

6.5. Monitoring for Airborne Radioactivity

6.5.1 The method used for monitoring airborne radioactivity shall have a Minimum Detectable Activity (MDA) equal to or less than 10% of the applicable DAC. Refer to Reference 2.1.7 for MDA calculations.

6.5.2 Airborne particulate surveys shall be performed with portable air samplers whenever airborne radioactivity levels above the limits of Section 6.1 are suspected.

6.5.3 Personnel air samplers (lapel type) shall be used whenever portable sampling cannot be positioned in such a manner to be representative of the breathing zone of the worker. Examples would include large work areas with intervening structures, components, etc., or activities which require the worker to be mobile.

6.5.4 Records of airborne radioactivity measurements are required for regulatory purposes. The records shall be maintained legibly and retained in the on site file in accordance with Section 17.0. These records should include at least the following information:

- Date and time of sample and measurement
- Location
- Reason for sample
- Sampling equipment and counting Instrument used
- Results of most recent efficiency, MDA, and background measurements
- Airborne radioactivity in µCi/ml
- Signature of RST
- Signature of persons reviewing records.

6.6. Air Sample Analysis

6.6.1 When handling air samples collected from areas known or suspected of containing airborne radioactivity care should be taken to prevent the spread of contamination and cross contamination of samples taken. If significant short lived radionuc1ide concentrations are expected, the samples shall be counted initially and then decay counted to determine the actual long-lived radioactivity.

6.6.2 Counting Activities. Low background automatic alpha/beta counting systems are used for screening and gross activity analysis. Spectroscopy is used to identify a particular radionuclide in an air sample. All systems used for air sample analysis shall be set up and operated in accordance with manufacturer's instruction.

6.6.3 Calculation of Airborne Radioactivity Concentration. Airborne radioactivity concentration is typically recorded in units of mCi/ml, and reported as a percentage of the applicable DAC. In order to calculate concentration, it is necessary to accurately determine the volume of air sampled and the radioactivity deposited on/in the air sample filter media. Additionally, due to unique characteristics of the filter media such as collection efficiency, self-adsorption, and flow rate, correction factors may be necessary to accurately calculate concentration.

6.6.4 Determination of DAC-Hours. A DAC-hour is a mathematical expression of intake, derived by dividing the measured concentration of radioactive material in air by the respective DAC for the radionuclide in question, and then, multiplying by the number of hours of exposure to that radionuclide. One ALI can be expressed as 2000 DAC-hours, which is equivalent to a CEDE of 5 rem.

6.6.5 An individual's expected intake in DAC-hours should be estimated during the work planning process by considering measured air concentrations, the expected stay time in the work area, and the nature of the activity. In the interest of maintaining radiation exposure ALARA, stay times, the use of engineered or administrative controls including respiratory protection, and the methods used to conduct the work activity can be optimized in order to minimize overall dose. A record of intake in DAC-hours shall be recorded in

order to demonstrate compliance with conditions of 10 CFR 20 (*OAC 3701:1-38*). Records shall be maintained in accordance with 10 CFR 20.2103 (*OAC 3701:1-38-20*) and section 17.0.

7. **Use of Respiratory Protection Equipment**

7.1. General

7.1.1 Table 1 of appendix B to 10 CFR 20 (*OAC 3701:1-38-12 Appendix C, Table 1*) lists the ALIs and DACs for occupational exposure to radioactive materials. GRD, Inc. is committed to design of processing facilities and control of work in such a manner as to maintain CEDE ALARA. However, when process or other engineering controls are not practical to control airborne radioactive materials below those contained in the definition of an airborne radioactivity area, intakes may be limited by use of respiratory protection equipment.

7.1.2 The RSO or designee is responsible to ensure that the qualification requirements are met and documented for personnel using respiratory protection equipment. A copy of this document shall be maintained by the RSO or designee in the on-site file.

7.1.3 The use, cleaning and inspection requirements for respiratory protection equipment shall be accordance with Reference 2.1.11.

7.1.4 No person shall wear a respiratory protection device for a period of more than four consecutive hours without a one ham break and for more than a total of six hours in any one day.

7.2. High Efficiency Particulate Air CHEPA) Filter Requirements

7.2.1 HEPA filtered systems shall be tested prior to use following each set up and after each filter change. Acceptance criteria is a transmission of 0.03% or less dioctylphthalate (DOP) (or use of equivalent testing methodology) particulate per applicable DOP test procedure.

7.2.2 Great care shall be used in installing HEPA filters to assure the filter material separators are in the vertical position, tight seals are made around the edges of the filters, and that filters are not damaged during installation. Minor damage will greatly reduce the efficiency of these filters.

7.2.3 Used filters shall be disposed of as radioactive waste since loose surface contamination could be present on interior pleats.

7.2.4 Instructions in manufacturers' manuals shall be followed for use and filter change-out.

7.3. Portable Ventilation System

7.3.1 A portable ventilation system can be constructed by adapting a portable blower with a HEPA filter. Such a system can be used during maintenance or an elevated airborne radioactivity condition to reduce airborne radioactivity without contaminating installed ventilation systems.

7.3.2 A vacuum cleaner with installed HEPA filter can also be used effectively to reduce airborne radioactivity in a space by re-circulating the air in the space through the high efficiency filter. Such a system must be tested prior to use as per Section 6.8.1.

7.4. Release of Airborne Radioactivity to the Environment

7.4.1 Releases of airborne radioactivity to the environment may require an Environmental Protection Agency (EPA) permit and/or a State Air Quality Control Permit. Required permitting and limits shall be evaluated prior to each project at a customer's facility. Such releases shall be evaluated for compliance with regulatory requirements (EPA, State, etc.) and the evaluation documented.

7.4.2 Airborne effluents should be controlled when possible through wet scrubbing and/or HEPA filtration of the exhaust. Monitoring is conducted by taking a representative sample at the exhaust stack during all periods of processing operation, and measuring for selected radionuclides. Processing of radioactive materials shall be stopped immediately if these systems are in-operative.

7.4.3 The site specific requirements for environmental monitoring may include air monitoring stations. The licensee requirements for the type and frequency will be followed. Analysis of these samples is performed to demonstrate compliance with Subpart D-Radiation Dose Limits for Individual Members of the Public of 10 CFR 20 dose limits (*OAC 3701:1-38-13*). Specific environmental monitoring guidelines are provided in Section 16.

8. **Surface Contamination Control**

8.1. General

8.1.1 It is the intention of GRD, Inc. to maintain generally accessible areas free of contamination. Office areas and other areas outside the RCA will be maintained to keep surface contamination levels as low as possible, but in no case greater than the unrestricted release criteria in Appendix B.

8.1.2 Surface contamination levels in the RCA will be maintained ALARA to facilitate optimum access for operations, use of personal protective equipment, and dose reduction in accordance with established plans, procedures and instructions. Should there be an increase in contamination outside the RCA, it will be investigated by the RSO or designee. Procedures to prevent recurrence will be implemented. Radioactive contamination of surfaces (such as floors, equipment, clothing and skin) may result from work operations, leaks of radioactive fluids, or gradual precipitation of airborne radioactive contamination onto exposed surfaces. The primary reason for limiting surface contamination is to minimize possible ingestion or inhalation of radioactive materials. In addition, surface contamination is limited to minimize transfer of radioactive materials to the environment beyond the control of GRD. In case of very high levels of surface contamination, control of external radiation exposure from this contamination may be necessary. Surface contamination is divided into two classes in this section: (1) loose contamination can be removed from surfaces with relative ease and may be readily dispersible, and (2) fixed contamination remains on affected surfaces and is not further reduced by normal non-destructive decontamination techniques. Areas where loose contamination levels exceed the applicable limits in Appendix B are posted and controlled as a Contamination area. The controls shall include conspicuous boundaries, restricted access, step-off pads, protective clothing requirements, and monitoring upon exit. A typical method for determining levels of loose contamination is to wipe the surface in question (usually a 100 sq. cm area) with a dry adsorbent material using moderate pressure, and then measuring the wipe for radioactivity. Levels of fixed contamination on a surface is determined by placing a radiation detector in direct contact with the surface, and either making a static measurement or scanning the surface by moving the detector slowly.

8.1.3 Contamination control procedures should be considered in planning and performance of all jobs. A dedicated set of "hot tools" should be used in the RCA to avoid the necessity to transfer the equipment across a contamination control boundary. When using clean tools or equipment in contaminated areas, the use of plastic sleeves or strippable paint to prevent contamination or facilitate decontamination is warranted. The extent of the contamination control procedures used should be commensurate with the amount of radioactive material being handled, and the nature of the task.

8.2. Surface Contamination in Uncontrolled Areas

8.2.1 Surface contamination levels for uncontrolled surfaces should be kept as low as possible. Areas where contamination exceeds established limits shall be either decontaminated in a timely manner, or painted or otherwise sealed to prevent the spread of contamination.

8.2.2 Acceptable surface contamination levels in uncontrolled areas are dependent upon (1) radionuclides being processed in the facility (2) applicable regulatory requirements, and (3) facility operating parameters.

8.2.3 Limits for loose and fixed contamination are usually dictated in the "NRC or Agreement State Radioactive Materials License, are based on the release limits found in Appendix B.

8.3. Surface Contamination in Radiologically Controlled Areas

8.3.1 The RCA is established, among other things, as a formal boundary to prevent the uncontrolled spread of radioactive materials. This boundary serves as the point at which certain precautions are taken, including training, protective clothing, and monitoring to prevent a worker from unknowingly contaminating his/her self, and transferring the contamination to the uncontrolled area. The RCA serves as a buffer between the more contaminated areas and those that are not contaminated. Significant levels of fixed contamination may exist in these areas; however, loose contamination levels are maintained to established limits.

8.3.2 Areas where surface contamination exceeds the established limits, areas "where equipment or materials are handled with exposed parts exceeding these levels, and areas where activities may cause contamination in excess of the limits in Appendix B shall be designated as Contamination Areas (CA) until such areas,

equipment, or materials have been adequately sealed or decontaminated to meet these limits. CAs may be established on a more permanent basis to facilitate operations. The CA boundary will serve as the initial and primary boundary to prevent the spread of contamination.

8.3.3 Access to a CA shall be limited by the conditions of a RWP to allow only personnel with appropriate anti-contamination clothing, monitoring equipment, and participation in the internal dosimetry program to enter. Choice of appropriate anti-contamination clothing is discussed in Section 12.1.

8.3.4 Personnel with open wounds shall not enter CA without prior approval of the RSO or designee. Open wounds shall be adequately protected from contamination prior to a person working in these conditions.

8.3.5 Entrances to CA shall be posted conspicuously with signs, stating the access restrictions, requirements for anti-contamination clothing and masks, levels of loose surface contamination and radiation dose rates. If the entrance to a CA and the step-off pad cannot be positioned at an existing barrier (door), magenta and yellow rope barriers or equivalent shall be used to mark the affected area clearly.

8.3.6 Smoking, eating, drinking and chewing shall not be permitted in CAs. Prescription medications may be taken under approved and controlled conditions. This provision is essential to minimize the possibility of transferring contamination from the hands or other areas to the mouth. For the same reason, hands should be kept away from the face, nose, mouth, and ears while in a CA.

8.3.7 Where operations such as grinding or machining are being performed without containment on contaminated components or equipment, the area of the operations shall be considered subject to the spread of loose contamination. The area shall be posted as a CA until such time as the work can be completed, the area surveyed, and down-posted.

8.3.8 Where surveys for loose contamination have not been made, but contamination is suspected, the area shall be posted as a CA pending the results of contamination surveys.

8.3.9 Levels and extent of loose surface contamination inside a CA shall be limited to control possible re-suspension of radioactive materials, to reduce airborne radioactivity, to reduce the potential for the spread of contamination, to simplify subsequent decontamination, and to minimize personnel radiation exposure.

8.3.10 Personnel leaving a CA shall (a) remove their outer anti-contamination clothing and (b) monitor or be monitored for surface contamination where background levels of radiation will permit.

8.4. Methods for Controlling Surface Contamination

8.4.1 The most effective means of controlling radioactive surface contamination is containment at the source through the use of ventilated enclosures around contaminated items to keep the radioactive material inside. Containments can be simple drapes, tents, or pans, or elaborate pre-fabricated glove-bags or large walk-in enclosures. Containments should be used as much as practical when working on the surfaces or components which have been exposed to radioactive materials. Plastic sheet, bags, or easily decontaminated containers may be used to enclose clean material and prevent contamination of clean items inside the enclosure. The following specific requirements shall be followed when working or handling contaminated equipment and materials.

8.4.2 Workers shall have been trained on the use of containments and instructions for using containment enclosures shall be readily available during work planning.

8.4.3 Containment enclosures shall be inspected prior to use to determine if they are properly constructed and ready for use. Enclosures shall then be marked to certify this inspection was completed. Personnel using containment enclosures shall inform radiological safety personnel of any damage to containment enclosures which occurs during work. When a containment enclosure is damaged or is unfit for use, the enclosure shall be conspicuously tagged to prevent its inadvertent use by personnel unaware of the problem until repaired. Containment enclosures shall not be removed or altered without approval of the RSO or designee.

8.4.4 Ventilation should be controlled during operations involving radioactivity to prevent spreading the radioactive contaminants through an area or to the environment. The basic methods of controlling contamination by ventilation are by providing clean supply air into the contaminated work area and by providing filtered local exhaust ventilation close to the work, or from a containment enclosure erected

around it. The exhaust capability should always exceed the supply including discharges from pneumatic tools.

8.4.5 HEPA filters (and HEPA system pre-filters) may become contaminated so that handling a used filter may spread contamination. Therefore, great care should be exercised when removing used filters. Contaminated used filters are normally removed by the bag-out method into plastic bags.

8.4.6 A buildup of detectable levels of surface contamination can occur through the deposition of radioactive material from the air without having significant levels of airborne radioactivity. Therefore, all process ventilation exhaust ducts or ventilation system ducts from radioactive work areas should be considered potentially contaminated. When opening these potentially contaminated systems, they should be surveyed and decontaminated as practical for similar reasons, if a portable exhaust blower is used in a contaminated space, surface contamination should be checked on surfaces exposed to the filtered exhaust of this blower.

8.4.7 When HEPA filters are installed in ventilation systems for radiological areas, labels should be prominently affixed verifying proper installation of the filters. These labels should be located so that they are destroyed when the filters are removed. HEPA filtered ventilation systems shall be tested in accordance with Section 10.8.

8.4.8 Potentially contaminated air that has not passed through a high efficiency filter should not be discharged to locations occupied by personnel or where supply ventilation can return it to an occupied area.

8.4.9 Consideration should be given to controlling contamination which has been collected in ventilation equipment and systems not normally used for radiological work, i.e. HVAC systems, and in particular those systems in adjacent spaces which may have become contaminated during a spill Prior to work on these items, radiation measurements should be taken, the items treated as contaminated, and radiological control precautions established to prevent spreading contamination.

8.5. Method for Measuring Surface Contamination

8.5.1 A rate meter with a thin window probe (G-M) or equivalent will detect radioactive beta-gamma surface contamination on materials and personnel by slowly scanning the probe held within about *1/2* inch of the surface. Alpha-emitting contamination is normally monitored using a sensitive proportional or scintillation detector. An instrument and detector should be used that has a MDA for contamination measurements of < 90% of the applicable limit with a goal of <10% of the limit. If background levels are higher than will permit the above stated NIDA, equipment or personnel to be monitored for release shall be relocated to an area of lower radiation levels or the area or instrument detector shielded to lower background levels. A reading of 100 cpm above background indicates excess contamination.

8.6. Method for Monitoring Personnel Contamination

8.6.1 Personnel monitoring (frequently referred to as "frisking" when done with a handheld instrument) shall be performed when exiting CAs or RCAs. Monitoring of personnel for surface contamination is typically done with all automated portal type personnel contamination monitor established at a formal control point.

8.6.2 Monitoring of personnel by taking swipes for loose surface contamination on the skin or clothing shall not be done since swipes may tend to imbed radioactive particles. Special circumstances may require the use of adhesive tape to remove contaminated particles for measurement.

8.6.3 When personnel have been adequately trained in frisking procedures, self monitoring will be permitted; however, frisking may be performed by a RST.

8.6.4 If facial contamination is detected, or it is suspected that radioactive material have been taken into the body even though no facial contamination is evident, the RSO or designee shall be notified and the individual monitored for internal radioactivity. Measurements of the radioactivity of nose and throat swabs may be used. Decontamination shall be performed in accordance with Section 13.4.

8.7. Frequency of Surveys for Monitoring Areas for Surface Contamination

8.7.1 Minimum site specific contamination survey requirements are dictated by the NRC or Agreement State Radioactive Materials License, and detailed in Reference 2.1.14.

8.7.2 Routine contamination surveys shall be performed at a frequency commensurate with the risk of loss of surface contamination control for the area in question. In the interest of ALARA, contamination surveys in High or Very High Radiation Areas are done only upon entry, or when a change of conditions dictates.

8.7.3 Sealed source leak testing, if required, will be performed in accordance with Reference 2.1.3.

8.7.4 Operations such as the following also require surveys:

- Decontamination and release of equipment
- Inspection or maintenance on components and piping which are associated with radioactive or potentially radioactive systems
- Areas where radioactive liquid leaks have occurred or where airborne radioactivity has exceeded the concentrations of Section 10.2. Surveys are required to determine the need for anti-contamination clothing and to determine the extent of contaminated areas
- Upon initial entry into tanks or voids potentially contaminated radioactive materials and when opening ventilation exhaust ducting from radioactive material work areas
- In addition, any normally uncontaminated system which is suspected of containing radioactive materials shall be surveyed when opened for inspection, maintenance or repair. Contamination control procedures should be used until the portion of the system being worked on is proven to be uncontaminated. Water drained or flushed from these systems shall be treated as radioactive and sampled as appropriate;
- Contamination surveys should be performed in plenums downstream of HEP A filters during routine filter replacement, to determine radioactivity buildup in ducts downstream of filters;
- Prior to replacing filters on HVAC ducts serving a radiological work area, filters should be surveyed to determine if radioactivity is present;
- Surveys for contamination fixed in paint should be performed prior to removal of paint in potentially contaminated areas. These surveys should be performed by counting paint scrapings for gross activity;
- Surveys to support RWP development or work planning.

8.8. Records of Contamination

8.8.1 Records of surface contamination surveys shall be maintained in the on site files throughout the duration of the operations in accordance with Section 17.0

8.8.2 Any occurrence which results in loose surface contamination greater than the applicable site specific free release limits for uncontrolled areas shall be reported in accordance with Section 17.0.

8.8.3 Any spread of contamination in the RCA or CAs which results in work being stopped for more than four hours or takes more than four hours to clean up shall be reported in accordance with Section 17.0.

8.8.4 Records of surface contamination surveys shall be retained in the on site file throughout the duration of the operations file in accordance with Section 17.0.

9. **Anti-Contamination Clothing and Equipment**

9.1. General

9.1.1 Anti-contamination clothing (Anti-Cs) is used to help prevent personal skin and clothing contamination, and the spread of radioactive materials outside the RCA or CAs. Anti-contamination clothing is required when either surface contamination or airborne radioactivity levels exceed prescribed limits.

9.2. Requirements for Wearing Anti-Contamination Clothing

9.2.1 The RSO or designee in consultation with other safety disciplines shall determine the appropriate requirements for Anti-Cs and shall so note on the applicable RWP. The recommended type of Anti-Cs for various applications and radiological conditions are provided in Reference 2.1.10. In addition, miscellaneous equipment used for the control of exposure to radioactive materials is described.

9.3. Donning and Doffing of Anti-Contamination Clothing

9.3.1 It may be necessary to remove personal clothing before putting on Anti-Cs for comfort when working in high temperature spaces. Typically, a modesty garment is worn from the change facility to and from the donning/doffing point for the Anti-Cs.

9.3.2 Anti-Cs shall be inspected by the wearer prior to donning to ensure the garment is free of rips, tears, missing buttons, or malfunctioning zippers. Damaged clothing shall not be worn.

9.3.3 Used Anti-Cs shall be removed at the appropriate step-off pad in a manner that will preclude personal skin or clothing contamination and the spread of contamination across the boundary. Used Anti-Cs shall be deposited in the appropriate receptacle upon doffing.

10. **Radioactive Decontamination**

10.1. General

10.1.1 Decontamination may be required for components, tools and equipment, work areas, clothing or personnel. Each of these subjects as well as alternatives to decontamination is discussed in this section. These include, in some case, storage for decay, disposal without decontamination, or restricted use without complete decontamination. By the very nature of decontamination process, the generation of secondary waste materials must be considered. Volumes of both solid and liquid wastes shall be minimized. Unauthorized chemicals shall not be used. These may cause difficulties in waste processing. Most radioactive contamination can be removed by normal cleaning. Wiping with a damp rag soaked with an appropriate cleaning agent will usually provide satisfactory decontamination.

10.1.2 If large variations in surface contamination levels exist on highly contaminated surfaces, cleaning shall be from less contaminated toward more contaminated areas to prevent radioactivity from being spread to less contaminated areas. Cleaning solutions and cloths used in these decontamination operations shall be disposed of as radioactive waste. During decontamination operations, precautions shall be taken to limit the spread of contamination, such as by taking care not to splash solutions, by properly wearing anti-contamination clothing, and by wearing masks as necessary" Filtered ventilation may be required to minimize the possibility of contamination being inhaled by personnel performing the decontamination.

10.2. Decontamination of Tools and Equipment

10.2.1 In decontaminating tools and equipment, appropriate radiological control shall be used to prevent the spread of contamination, and to control airborne radioactivity, and radiation exposure. The following applies to the decontamination of tools and equipment.

10.2.2 Tools and equipment which may be used again in contaminated areas may be temporarily stored in the contaminated area or in a "hot tool locker" without decontamination if proper radiological controls and procedures are used. If certain tools are to be used solely in CAs, these tools should be durable and distinctively marked to indicate they are always treated as potentially contaminated.

10.2.3 In some cases, the need for decontaminating tools may be minimized by taping some portions, such as the handles, prior to use and stripping off the contaminated tape after use. Large tools are often wrapped in plastic instead of tape. These tools need to be swiped or frisked at completion of decontamination to verify the effectiveness of the treatment.

10.2.4 Heavily contaminated tools can spread surface contamination. Therefore: such tools should be partially decontaminated as may be necessary several times throughout a work shift. Heavily contaminated tools can be readily identified without taking swipes by measuring their radiation level The purpose of decontaminating these tools will usually be to reduce their radiation levels rather than to remove all loose surface contamination.

10.2.5 When only a few tools require decontamination, wiping with cloths soaked in an approved decontamination solution is a convenient, effective procedure. This method is also useful when only a portion of a tool is contaminated. A disadvantage of wiping procedures is the potentially large amount of solid radioactive waste produced.

10.2.6 Mechanical decontamination methods, such as using abrasives which remove some of the surface of the tool, can be useful in special circumstances where contamination is not removed by chemical cleaning. In such cases, control of possible airborne radioactivity is essential.

10.2.7 In decontaminating oily or greasy tools or equipment, consideration should be given to the fact that oil or grease may inhibit waste processing or disposal only decontamination solutions approved by the RSO or designee may be used.

10.3. Decontamination of Areas

10.3.1 Contaminated areas shall first be isolated and radioactive materials then removed while being careful to avoid spreading contamination. In some cases, tape may be used to lift loose contamination from surfaces. If contamination levels are not sufficiently reduced, use of solvents (non-hazardous to prevent mixed waste), strong chemicals, or mechanical removal of some of the surface may be necessary. The areas shall be surveyed by approved methods prior to release to ensure surface contamination is below the established limits. On painted or covered surfaces, if washing will not remove the contamination, the paint or covering shall be removed. During the process of paint removal, control of airborne and surface contamination from dust and paint chips will be necessary.

10.3.2 Contaminated areas should be decontaminated as soon as practical to minimize spread of contamination and to facilitate removal before the contamination is fixed on the surface. If high radiation levels from the contamination contribute significantly to personnel radiation exposure during cleanup, it may be desirable to decontaminate the most heavily contaminated area first.

10.4. Decontamination of Clothing

10.4.1 Anti-contamination clothing shall be laundered and surveyed before reuse to minimize the possibility of spreading radioactive contamination to the wearer. This requirement does not apply to disposable Anti-Cs.

10.5. Decontamination of Personnel

10.5.1 Decontamination of personnel shall be performed within an established RCA (unless otherwise approved by the RSO or designee).

10.5.2 The objectives of skin decontamination are to remove as much of the radioactive material as practicable in order to reduce the skin dose rate and to prevent the ingestion or inhalation of the material An over-aggressive skin decontamination effort must be avoided since it may injure the natural barriers in the skin and so increase absorption.

10.5.3 Reports of skin contamination shall be made in accordance with the requirements of Section 17.

11. **Radioactive Waste Handling**

11.1. Packaging Radioactive Materials

11.1.1 Radioactive materials shipped for disposal or to another location shall be appropriately packaged and treated as required by USDOT, applicable federal and state regulations, and applicable disposal site criteria. Shipping shall be performed by the RSO or designee, or a Shipper/Broker in accordance with applicable plans, procedures, and/or instructions. The specific radioactive material handling and packaging requirements will be identified in operations procedures.

11.2. Radioactive Material Storage

11.2.1 Storage of radioactive materials will be in accordance with all applicable license requirements and, at a minimum, all radioactive material storage areas will be posted. Access to these areas will be controlled to prevent unauthorized access, unauthorized removal of radioactive material, and to minimize radiation exposure.

11.3. Fire Protection Practices

11.3.1 Proper selection of a fire resistant storage area for radioactive material will minimize release of radioactivity to the environment in the event of a fire. However, the following additional fire protection practices shall be considered for storage of radioactive material to minimize the possibility of a fire and spread of contamination in the event of a fire.

- Storage of radioactive material in fire-resistant containers or spaces is desirable to minimize contamination spread. In addition, containers of highly flammable radioactive materials shall be stored in areas segregated from other storage to reduce the risk: of spreading a fire. These areas will be approved by the RSO or designee.
- Smoking shall not be permitted in radioactive material storage areas.
- An up-to-date inventory of locations where radioactive materials are stored shall be available to personnel who might be called to fight a fire in such areas. This list shall also identify unusual hazards which may be present.

- Periodic inspections of radioactive material storage areas shall be made to identify fire hazards. Deficiencies shall be promptly corrected.
- Combustible materials shall be minimized inside radioactive material storage areas and should not be stored next to surrounding walls.
- Welding, burning, or other operations which may cause a fire shall not be conducted inside or next to radioactive material storage areas without prior authorization of the RSO or designee.

11.4. Contamination Control

11.4.1 Storage locations should be considered potentially contaminated. Personnel in these areas, particularly if they handle contaminated material, shall wear Anti-Cs commensurate with the task. Reasonable care shall be taken in packaging and storing contaminated items to prevent the spread of contamination and to ensure that entry to areas where such storage is permitted does not result in the contamination of personnel or other areas.

11.5. Radiation Exposure Control

11.5.1 Storage of radioactive materials can result in possible personnel radiation exposure in the storage area and surrounding areas. Facilities should store radioactive material so as to minimize the radiation exposure of personnel entering or working in the area and of personnel in surrounding spaces. Radiation surveys of the storage area and of spaces immediately around the storage area shall be performed to ensure proper posting of radiation areas and prevent inadvertent exposure of personnel in the storage space or surrounding spaces. When necessary, temporary shielding should be used to reduce radiation levels.

11.6. Outdoor Storage

11.6.1 Radioactive materials shall be stored where they are protected from adverse weather. Radioactive material shall not be stored outside the Restricted Area. Outdoor storage is only permitted in a covered storage area with a permanent roof, or during short periods to accommodate loading or unloading as required. It is important that packaged materials be stored in a manner that permits periodic monitoring of the area and adjacent containers to ensure there is no release of radioactive materials.

11.7. Minimize Radioactive Material in Storage

11.7.1 In order to minimize the complexities of accounting for a large amount of radioactive material and the possibility of losing radioactive material, it shall be consolidated in as few areas as practical and the amount of radioactive material in storage shall be minimized.

11.8. Labeling of Radioactive Material

11.8.1 Each container of radioactive material shall bear a durable clearly visible label which identifies the radioactive contents (radionuclides present, quantity of radioactivity present, material description, date for which the activity was estimated, and radiation levels), and depicts the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL". Exceptions include the following:

- The quantity of radioactive material is less than the amounts listed 111 Appendix C 10 CFR 20 *(OAC 3701:1-38-18, Appendix A)*
- The material is continuously attended by a trained radiation worker
- The material is in transport and is packaged and labeled in accordance with DOT regulations;
- The material is contained in installed process equipment such as piping, tanks, transfer equipment, and treatment units.
- Empty containers which are used or intended to be used for the packaging or handling of radioactive materials will be clearly marked "EMPTY", and any radioactive markings defaced or removed from any container released off-site for unrestricted use.

11.9. Shipping Radioactive Materials

11.9.1 All shipments or transfers of radioactive material over public areas (i.e., public highways, waterways, airways, etc.) including shipments made with private or government vehicles, must comply with appropriate USDOT, federal, state, and local transportation regulations.

11.9.2 Shipments of radioactive material shall be performed in accordance with established plans, procedures, and/or instructions. Records of radioactive material transfer shall be maintained in the permanent site files by the RSO or designee.

11.10. Contaminated Equipment Repair. Maintenance and/or Storage

11.10.1 Equipment which has been used in the nuclear industry may require repairs, maintenance, or storage. All work of this nature is performed per *RWPs* and plans, procedures and instructions as required.

11.11. Actions and Reporting in Case of Loss of Radioactive Material

11.11.1 If radioactive material associated with GRD operations is suspected of being lost, immediately notify the RSO and OM and conduct a search for the lost material. A primary purpose of this search is to ascertain that no persons will receive inadvertent internal or external radiation exposure from this material.

12. Radioactive Waste Management

12.1. General

12.1.1 Working with radioactive material can frequently lead to contamination of structures and equipment, protective equipment and clothing, and material used in decontamination. If any of the contaminated material cannot be used further, it becomes radioactive waste. Waste minimization consists of three primary objectives; (1) source reduction, (2) recycling, and (3) volume reduction. Waste minimization must be practiced on levels of the company, from top-level management down to the worker. Training programs, procedures, and work practices will be reviewed annually for waste minimization practices.

12.2. Source Reduction

12.2.1 Source reduction activities are those which reduce or eliminate the production of radioactive waste, or seek to reduce the volume or amount of clean material that comes in contact with radioactive material. Examples include:

- Taking care to 110tstore radioactive materials with non-radioactive materials
- Removal of packaging from clean material before taking the material into the
- RCA, or bringing the minimum amount of clean material into the RCA necessary to perform a task
- Taking care to not bring clean tools, equipment or material into the RCA unless a contaminated tool, equipment or material is not already available
- Taking care not to touch a contaminated surface or allow clothing, tools, or other equipment to do so;
- Confining radioactive material and contamination to as small an area as practical to minimize the decontamination effort later
- Avoiding the use of disposable liners, drip pads or plastic floor covers in the RCA. Do use smooth non-porous surfaces that can be easily decontaminated
- Minimizing loose surface contamination levels and airborne contamination levels to prevent inadvertent contamination of adjoining areas and equipment
- Choosing decontamination methods that generate the smallest total waste volume
- Preventing spills of contaminated materials.

12.3. Recycling

12.3.1 Recycling is using, reusing or reclaiming material that would become radioactive waste and aims to delay the point at which there is no further use for contaminated equipment or material Some strategies include:

- Returning contaminated waste generated at the site while processing a customer's material to the customer;
- Recycling contaminated laundry by using it in first stage decontamination of highly contaminated areas
- Using contaminated wood for cribbing inside burial boxes
- Choosing decontamination methods that recycle or regenerate the cleaning media
- Reusing contaminated equipment or areas with as little decontamination between jobs as practical, cross contamination and dose considerations taken into account

12.4. Volume Reduction

12.4.1 Volume reduction is reducing the waste volume to the minimum practical and is not strictly waste minimization, but is essential to conserve disposal site resources. Work practices will consider the following strategies;

- Packing material in burial containers to reduce void space to a minimum
- Cutting or segmenting of odd shapes to facilitate packing
- Using compaction for compressible material
- Evaporation of liquids as much as practical before disposal.

13. **Personnel Monitoring and Bioassay**

13.1. External Dosimetry Program

13.1.1 For purposes of monitoring exposure to radiation, personnel dosimetry shall be provided to an individual likely to exceed 10% of the limits in Section 6.1.1. The specific monitoring requirements for personnel radiation exposure for all GRD activities is determined and approved by the RSO. Reference 2.1.8 provides the procedure for the issue and processing of dosimetry, and the recording of personnel radiation exposure for all personnel working at the site.

13.1.2 All individuals shall wear appropriate personnel dosimetry for RCA entry Visitors or contract workers shall be issued personnel dosimetry (TLD or SRD) for Radiation Area entry and shall not be allowed access to High Radiation Areas or Airborne radioactivity Areas. Specific requirements for a particular work activity shall be communicated to personnel in the ALARA briefing conducted in accordance with Reference *2.1A.* The RSO may allow access by Visitors or Contractors to an RCA provided continually monitored by a Radiation Worker with appropriate monitoring and/or dosimetry.

13.2. Thermoluminescent Dosimetry (TLD) or Optically Stimulated Luminescent (OSL) Dosimetry

13.2.1 TLDs or OSLs shall be the dosimetry of record and shall be worn on the frontal area of the torso between the neck and the waist. TLD's will be processed and evaluated by a dosimetry processor who holds current accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) for the radiation(s) most closely approximating the type of radiation(s) to which individuals are exposed. Normal issue TLDs or OSLs will be worn to assess whole body deep and shallow dose. If dose to the extremities or the lens of the eye is anticipated to exceed 10% of the limits in Section 6.1.1, special TLDs or OSLs will be issued.

13.2.2 In situations where beta radiation is significant, the lens of the eye shall receive special consideration. Personnel shall be shielded from the beta radiation using masks or eye protection (safety glasses), and/or anti-contamination clothing. If the beta radiation cannot be shielded, methods for controlling beta radiation exposure shall be evaluated and implemented to maintain exposures ALARA.

13.2.3 Certain radioactive isotopes commonly given for medical diagnostic purposes can result in measurable radiation levels for some period after receiving the administration. The dose received from this administration is exempt from regulation. All individuals shall notify the RSO if they have received such treatment. In such a situation, the person may be restricted from wearing dosimetry until the medical isotope is eliminated from the body to the extent that it will not affect TLD or OSL measurements. The purpose of the restriction is to avoid including radiation exposure from the medical isotope to that received from occupational sources.

13.2.4 Such personnel shall also be restricted from entering areas requiring monitoring for contamination until the medical isotope is eliminated from the body to the extent that it will not affect personnel monitoring equipment. In such situations, the RSO and the OM shall determine an appropriate work assignment for the individual until the restriction can be released.

13.2.5 Lost or damaged dosimetry shall be reported to the RSO.

13.2.6 Personnel dosimetry records for an individual shall be made available to an authorized requestor and to the individual upon written request. This information will be readily available to enable an individual to keep track of their own exposure.

13.3. Self-Reading Dosimeters (SRDs)

13.3.1 In addition to the TLD, SRDs shall be worn to monitor radiation exposure in certain circumstances. SRD's shall be worn in accordance with the applicable RWP. The following circumstances shall require SRD:

- All personnel entering a Radiation or High Radiation shall be monitored by a SRD WOI11 at the same location on the body as the TLD. The above does not preclude the use of SRDs for other exposure monitoring.
- Additional SRDs may be required if the location of the maximum dose on the body is not certain.
- Typically, devices used as SRDs include pocket ionization chambers or electronic dosimeters.

13.3.2 SRD Records. The RSO or designee shall maintain a log of all SRD results between routine TLD read-out cycles. Before an SRD is re-zeroed, the measured radiation exposure is recorded. The individual's monthly, quarterly and/or yearly exposure totals are determined. The individual is thereby prevented from inadvertently exceeding the administrative control levels

13.3.3 Reading SRDs. SRDs shall be read by the wearer prior to entering High Radiation or Very High Radiation Areas and periodically thereafter to maintain their own radiation exposure ALARA. To prevent an off-scale reading, dosimeters shall be read, re-zeroed, and doses recorded whenever the reading exceeds three-fourths of full scale. When a pocket dosimeter reading is off-scale or a dosimeter is lost under conditions such that an elevated exposure is possible, the person's TLD shall be processed immediately and the person restricted from work in radiological areas until their exposure bas been determined. The RSO or designee shall notify the OM for appropriate work assignment for the individual during the restriction.

13.3.4 SRD Testing Requirements. SRDs in use shall be tested at least every six months to ensure accuracy. If dosimetry performance is suspected to be unacceptable due to excessive drift or fails in use, the RSO shall initiate action to correct the problem.

13.4. Internal Dosimetry Program

13.4.1 The site internal dosimetry requirements for specific activities will be determined and approved by the RSO. Reference 2.1.9 provides the procedure for the internal radiation monitoring of individuals, submittal of bioassay samples, and the types and applications of various measurements. Specific requirements for a particular work activity shall be communicated to personnel during the ALARA briefing.

13.4.2 Internal radiation monitoring shall be performed when an individual is likely to receive an intake of radioactive material in excess of 10% of the Annual Limits on Intake (ALIs) as defined in 10 CFR § 20.1003 *(OAC 3701:1-38-12).* All personnel with the intake potential as defined above shall participate in the internal radiation monitoring program. Monitoring shall consist of baseline, routine, diagnostic, and termination bioassay sampling and/or in-vivo counts as determined to be appropriate by the RSO. Additionally, suspected intakes of radioactive materials as may be indicated by a positive routine bioassay, significant personnel contamination, elevated airborne radioactivity, or an ingestion of radioactive material shall be investigated by internal monitoring. Waivers of internal monitoring requirements may be granted by the RSO for contractors and visitors, provided the basis for the waiver is documented. Access restrictions for contractors and visitors are given in Section 6.1.7 above. Minors and declared pregnant women who are likely to receive in one year a CEDE in excess of 10% of the applicable limits in 10 CFR 20 *(OAC 3701:1-38)* shall participate in an internal monitoring program.

13.4.3 The following techniques for internal radiation monitoring shall be employed by the RSO or designee depending upon the workplace contaminant and conditions, and the nature of the activity:

- Air Sampling - Concentrations of radioactive materials in air in work areas may be used in lieu of bioassay measurements to determine internal exposure if the bioassay data is unavailable, inadequate, or the air sampling data is
demonstrated to be more accurate.
- Bioassay - An estimate of the amount of internal exposure can be calculated by measuring the quantity of radionuclides in bodily excreta (collections of
urine, feces, etc.) and relating the excretion rate to body burden by the use of biokinetic models.
- In-vivo counting - An estimate of the amount of internal contamination by gamma emitting radionuclides is obtained by measuring the gamma radiation emitted from the body and analyzing the pulse height spectrum. This technique can also be used to measure the bremsstrahlung from energetic beta emitters.

13.4.4 Each occupational intake of radioactive material that is confirmed by a positive bioassay shall be investigated and an estimate of the initial intake calculated using standard retention models.

13.4.5 For a confirmed intake, the CEDE will be determined and entered in the individual's exposure record. An intake resulting in a CEDE of greater than 0.1 rem will require an investigation to determine cause and identify corrective actions. .A. CEDE of greater than 0.5 rem will result in a restriction from radiological areas pending completion of the investigation and an exposure evaluation.

13.4.6 Procedures for the collection of in-vitro bioassay samples are found in Reference 2.1.9. The services of an accredited laboratory will be used to perform the analysis of samples. In-vivo counting shall be performed by an approved vendor.

13.4.7 All reports of internal radiation monitoring shall be maintained on site in a readily retrievable file in accordance with Section 17.0. Copies of these reports shall be made available to the monitored individual upon written request, as required by Section 17.0.

13.4.8 Exposure Records. The RSO or designee shall maintain records of personnel exposure and shall forward those records and data as required by 10 CFR 20 (OA C 3701: 1-38).Occupational exposure records are recorded on NRC Form 5 or equivalent. GRD will demonstrate compliance with the requirements of 10 CFR 20 (OAC 3701:1-38) by summing external and internal doses. Any recorded eye dose, skin dose, or planned special exposure dose will be maintained separately. Dose evaluation reports are prepared, maintained, and submitted per 10 CFR 20 (OAC 3701:1-38) and provided to workers per 10 CFR 19.13 (OAC 3701:1-38-10).

Worker Dose Rate Estimate:

For the calculation of our annual worker dose rate estimate, we assume an 8 hour work day and a 40 hour work week. This results in a work year time estimate consisting of 2080 hours / year.

Using the laboratory results from the samples taken, we were able to use the "Infinite Slab" method in order to determine the highest radioisotopic content found at the site. The highest radioisotopic content on contact = 1.956E-1 mrem. The highest radioisotopic content at one meter = 0.01883 mrem.

The highest radioisotopic content is multiplied by the greatest possible time of exposure on the worksite, in order to calculate the "worst case scenario" worker dose rate estimate.

The annual worker dose rate estimates are calculated using following two conventions:

1. Workers in direct contact with the radiologically impacted materials.

1.956E-1 mrem x 8 hours (on contact, daily exposure) = 1.564 mrem or 1.56×10^{-3} rem

1.956E-1 mrem x 2080 hours (on contact, annual exposure) = 406.848 mrem or 0.407rem

2. Workers working at a distance of 1 meter from the impacted materials.

0.01883 mrem x 8 hrs / workday (@1 meter, daily dose) = 0.151 mrem or 1.51×10^{-4} rem

0.01883 mrem x 2,080 hrs / yr. (@1 meter, yearly dose) = 39.166 mrem

DOE Limits for Rad Workers: Whole Body Exposure: 5 rem/year

Extremities: 50 rem/year

Skin and other organs: 50 rem/year

Lens of eye: 15 rem/year