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Buffalo District
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Five-Year Review Report for the Linde FUSRAP Site Town of Tonawanda Erie County, New York

Prepared for:

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LIST OF ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
BRA	Baseline Risk Assessment
CANiT	Coalition Against Nuclear Materials in Tonawanda
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Ci	Curie
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
cm	Centimeter
cm^2	Square centimeter
cm^3	Cubic centimeter
COC	Contaminant of concern
cpm	Counts per minute
CRP	Community Relations Plan
CSX	CSX Corporation
DCF	Dose Conversion Factor
DCGL	Derived Concentration Guideline Level
DOE	(U.S.) Department of Energy
DQO	Data Quality Objectives
dpm	Disintegrations per minute
EE/CA	Engineering Evaluation/Cost Analysis
EPA	(U.S.) Environmental Protection Agency
FACTS	For a Clean Tonawanda Site
FGR-12	Federal Guidance Report No. 12
FGR-13	Federal Guidance Report No. 13
FS	Feasibility Study
FSS	Final Status Survey
FSSP	Final Status Survey Plan
FSSU	Final Status Survey Unit
ft	Foot (feet)
FUSRAP	Formerly Utilized Sites Remedial Action Program
g	Gram
HAZWOPER	Hazardous Waste Operations and Emergency Response
IRIS	Integrated Risk Information System

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

ISCORS	Interagency Steering Committee on Radiation Standards
IUC	International Uranium Corporation
m^2	Square meter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual (NUREG-1575)
MED	Manhattan Engineer District
µCi/Ml	microcuries per milliliter
mg/kg/day	Milligrams per kilogram per day
mrem/yr	Millirem per year
NCP	National Contingency Plan
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NUREG	U.S. NRC Regulation
NYCRR	New York State Official Compilation of Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
O&M	Operations and Maintenance
ORNL	Oak Ridge National Laboratory
PAH	Polycyclic Aromatic Hydrocarbons
Pb-210	Lead-210
pCi	Picocurie
pCi/g	Picocuries per gram
pCi/sec-m^2	Picocuries per second per square meter
PE	Professional Engineer
PG	Professional Geologist
Ph.D.	Doctor of Philosophy
PL	Public Law
PP	Proposed Plan
PPRTV	Provisional Peer Reviewed Toxicity Value
PRP	Potentially Responsible Party
QA/QC	Quality Assurance/Quality Control
Ra	Radium
Ra-226	Radium-226
Radworker	Radiation worker
RAO	Remedial Action Objective

LIST OF ACRONYMS AND ABBREVIATIONS (Concluded)

RESRAD	Residual Radioactivity (environmental analyses)
RfD	Reference Dose
RI	Remedial Investigation
ROD	Record of Decision
RME	Reasonable Maximum Exposure
SOR	Sum of Ratios
SRA	Site Radiological Assessment
TBCs	To Be Considered (requirements)
Th	Thorium
Th-230	Thorium-230
U	Uranium
U-234	Uranium-234
U-235	Uranium-235
U-238	Uranium-238
U_3O_8	Triuranium octoxide
U_{total}	Total Uranium
UDF	Unit Dose Factor
UMTRCA	Uranium Mill Tailings Radiation Control Act
URS	URS Group, Inc.
U.S.	United States
USACE	United States Army Corps of Engineers
WCS	Waste Control Specialists
WRS	Wilcoxon Rank-Sum (statistical test)

EXECUTIVE SUMMARY

The purpose of this Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) five-year review is to determine the effectiveness of the selected remedial actions contained within the Record of Decision (ROD) for the Linde Site, Tonawanda, New York, of March 2000. The United States Army Corps of Engineers (USACE) is preparing this five-year review pursuant to CERCLA §121 and the National Oil and Hazardous Substances Pollution Contingency Plan or National Contingency Plan (NCP), contained in title 40 of the Code of Federal Regulations, Part 300 (40 CFR 300).

Based on the Linde Site remedial action start in 2000, the first five-year review was due in 2005. However, it is only now being completed.

The remedy selected by USACE, as stated in the ROD, called for complete excavation and offsite disposal of Manhattan Engineer District (MED)-contaminated soils containing radionuclides above defined guidelines. It also specified that structural surfaces exceeding guidelines would be decontaminated. As put forth in the ROD, cleanup actions for the Linde Site were as follows:

- the removal of soils exceeding the 40 CFR 192 standards for radium, which includes consideration of thorium, when averaged over 100 square meters;
- removal of soils with residual radionuclide concentrations within a 100-square-meter area that result in exceeding unity for the sum of the ratios of these radionuclide concentrations to the associated concentration limits (above background): 554 picocuries per gram (pCi/g) for total uranium (U_{total}), 5 pCi/g for radium-226 (Ra-226), and 14 pCi/g for thorium-230 (Th-230) for surface cleanups and 3,021 pCi/g of U_{total}, 15 pCi/g of Ra-226 and 44 pCi/g of Th-230 for subsurface cleanups; and
- removal of residual radioactive materials from surfaces necessary to meet the benchmark dose for surfaces of 8.8 millirem per year (mrem/yr) based on the specific location of the surfaces and exposure scenarios.

In addition to the above applicable or relevant and appropriate requirements (ARARs), USACE stated that it would remediate the Linde Site to ensure that no concentration of total uranium exceeding 600 pCi/g above background would remain in the site soils. In response to public comments, USACE also committed to achieving an average residual concentration of Total Uranium of 60 pCi/g when averaged over an area of 2000 m^2 and a depth of 3 meters.

In order to assess the protectiveness of the remedy in accordance with CERCLA, the following three questions are to be answered:

Question A: Is the remedy functioning as intended by the decision documents?

The remedy is currently being implemented. To date, it is functioning as intended.

Reports for each Final Status Survey Unit (FSSU) completed to date indicate that the remediation has achieved the criteria specified above. In addition, the data show that the average residual concentrations of total uranium are well below the 60 pCi/g average level committed to by USACE.

The mean of all samples collected from the FSSUs is about 7% of the ROD criterion for surface soils. Since the ROD levels correspond to an annual dose of 8.8 mrem to a future site worker, the actual residual levels would result in an estimated dose of approximately 0.6 mrem.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

Overall, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid. There have been several slight changes, as discussed below that do not change the overall conclusions or decisions.

The underlying standards for the ARARs – 40CFR192 (Uranium Mill Tailings Radiation Control Act [UMTRCA]) and 10 CFR 40 Appendix A (Source Material Waste Management) – have not changed since the ROD was finalized. The cleanup criteria are thus consistent with the existing ARARs identified in the ROD. Conditions on and near the Linde Site have not changed the human health or ecological routes of exposure or receptors in a way that could affect the protectiveness of the remedy. Slight changes in the radiological dose and risk assessment results based on changes in knowledge about toxicity for contaminants at the Linde Site do not suggest any change in the protectiveness of the remedy. The Remedial Action Objectives from the ROD, 40 CFR 192 (UMTRCA) and 10 CFR 40 Appendix A (Source Material Waste Management), continue to be applicable.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There has been no additional information identified that could call into question the protectiveness of the remedy.

RECOMMENDATIONS

There is one primary recommendation contained in the Five-Year Review report: efforts should be made to improve outside communications, primarily between the USACE, the public, local interest groups, and the local governments. However it should be noted that there is no legal requirement for further opportunities for public comment and the five-year review does not necessarily require a review of the Community Relations Plan (CRP). Specific actions recommended for improving communications are as follows:

- Review the content of the interviews regarding requests for additional public awareness sessions, and consider corrective actions as necessary;
- Review and update the public mailing lists on a more frequent (annual) basis.

REMEDY PROTECTIVENESS DETERMINATION

The remedy at the Linde Site, Soils Operable Unit, is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risk are being controlled.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site name: Linde FUSRAP Site (Union Carbide Industrial Gases Inc.)		
EPA ID: NYD002123792		
Region: 2	State: NY	City/County: Tonawanda, Erie County
SITE STATUS		
NPL status: Not on the NPL		
Remediation status (choose all that apply): Under Construction		
Multiple OUs? YES	Construction completion date: NA – Under Construction	
Has site been put into reuse? Areas of the site where remediation has been completed have been reused by the current property owner.		
REVIEW STATUS		
Lead agency: US Army Corps of Engineers		
Author name: URS Group, Inc.		
Review period: 5 years ending March 2010		
Date(s) of site inspection: January 21, 2010		
Type of review: Non-NPL Remedial Action Site		
Review number: ☒ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify) _____		
Triggering action: ☐ Actual RA Onsite Construction at OU #____ ☐ Construction Completion	☒ Actual RA Start at Soils Operable Unit ☐ Previous Five-Year Review Report	
Triggering action date *(from WasteLAN)*: 08 / 01 / 2000		
Due date *(five years after triggering action date)*: 08 / 01 /2005		

FIVE-YEAR REVIEW SUMMARY FORM (CONTINUED)

Issues:

Communication

Based on the comments and the general tone of some of the interview responses, the Linde Site remediation appears to be lacking in general communication. A community relations plan (CRP) specific to the Linde Site was also not identified or reviewed to assess compliance. Ultimately, the level of protectiveness of the remediation (at this point) is not impacted by the level or effectiveness of communication.

Cleanup Criteria

The cleanup criteria contained in the ROD, and therefore recognized as the primary goals for remediation of the site, were the subject of several comments during the interviews. Although the ROD criteria are not issues that can be resolved in the five-year review process, they are recognized as issues to the public and certain stakeholders. In terms of protectiveness, the determination of the remedy protectiveness was measured primarily against the ROD criteria. Accordingly, the recommendations below do not address this issue.

Recommendations and Follow-up Actions:

A recommendation for the remedy going forward is improvement of outside communications, primarily between the USACE, the public, local interest groups, and the local governments. The USACE will review the substance of the interviews compared to the USACE commitments on public involvement/awareness, and will implement corrective actions if deemed necessary.

Protectiveness Statement(s):

The remedy at the Linde Site, Soils Operable Unit, is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risk are being controlled.

I. INTRODUCTION

The purpose of this five-year Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) review is to determine the effectiveness of the selected remedial actions contained within the Record of Decision (ROD) for the Linde Site, Tonawanda, New York, of March 2000. This five-year review is not intended to reconsider the remedial cleanup decisions, but evaluate the implementation and performance of the current cleanup strategy, and to determine if the remedy is, or will be, protective of human health and the environment. The five-year review report is utilized to identify issues found during the review, if any, and present recommendations to address these issues.

The United States Army Corps of Engineers (USACE) is preparing this five-year review pursuant to CERCLA §121 and the National Oil and Hazardous Substances Pollution Contingency Plan or National Contingency Plan (NCP), contained in title 40 of the Code of Federal Regulations (CFR), Part 300 (40 CFR 300). Under CERCLA Section 121(c), a five-year review is required for remedial actions conducted at sites where hazardous substances, pollutants, or contaminants are above levels that allow for "unlimited use and unrestricted exposure." "Unlimited use and unrestricted exposure" means that the selected remedy will place no restrictions on the potential use of land or other natural resources. Five-year reviews are performed in a manner consistent with the CERCLA and the NCP. CERCLA Section 121(c) states the following:

> *"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented."*

The NCP in 40 CFR 300 states:

> *"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."*

The USACE has conducted this five-year review of the remedial actions implemented at the Linde Site. URS Group, Inc. (URS), employed as a contractor for the USACE, performed several components of the five-year review on behalf of the USACE including:

- Prepared community notifications and placed them in the Buffalo News (December 13, 2009), Tonawanda News (December 13, 2009), and Ken-Ton Bee (December 16, 2009);
- Prepared a Linde Site newsletter and distributed it to more than 500 people on the Linde Site mailing list (mailed on December 16, 2009);
- Conducted the site inspection (January 21, 2010);
- Conducted the interviews (between January 20 and 29, 2010);
- Performed document review and data analysis tasks;
- Performed analysis in support of the technical assessment and protectiveness determination, and;
- Prepared the draft Five-Year Review Report.

All of the work prepared by URS for the USACE was subjected to USACE review and acceptance prior to completion and distribution. The work in support of this Five-Year Review Report was performed between November 2009 and February 2010.

This Five-Year Review report has been prepared in accordance with the United States (U.S.) Environmental Protection Agency (EPA) *Comprehensive Five-Year Review Guidance*, dated June 2001. A Content Checklist for the Linde Formerly Utilized Sites Remedial Action Program (FUSRAP) Site Five-Year Review Report is included as Attachment A.

II. SITE CHRONOLOGY

During the early to mid-1940s, portions of the property formerly owned by Linde Air Products Corp., a subsidiary of Union Carbide Industrial Gas (Linde), now owned by Praxair, Inc., in the Town of Tonawanda, New York, were used for the separation of uranium ores. The site location map is included as Figure II-1. The separation processing activities, conducted under a Manhattan Engineer District (MED) contract, resulted in elevated radionuclide levels in portions of the Linde property. Subsequent disposal and relocation of the processing wastes from the Linde property resulted in elevated levels of radionuclides at three nearby properties in the Town of Tonawanda: the Ashland 1 property; the Seaway property; and the Ashland 2 property. Together, these three (3) properties, with Linde, were referred to by the U.S. Department of Energy (DOE) as the Tonawanda Site.

Under its authority to conduct the FUSRAP, the DOE conducted a Remedial Investigation (RI), Baseline Risk Assessment (BRA), and Feasibility Study (FS) of the Tonawanda Site. In November 1993, DOE issued a Proposed Plan (PP) for public comment for the Tonawanda Site, describing the preferred remedial action alternative for disposal of remedial waste and cleanup plans for each of the Tonawanda Site properties. The 1993 PP recommended that remedial wastes from the Tonawanda Site properties be disposed in an engineered onsite disposal facility to be located at Ashland 1, Ashland 2, or Seaway.

Numerous concerns and comments were raised by the community and their representatives regarding the preferred alternative identified in DOE's 1993 PP and the proposed onsite disposal of remedial action waste. In 1994, DOE suspended the decision-making process on the 1993 PP and re-evaluated the alternatives that were proposed.

On October 13, 1997, the Energy and Water Development Appropriations Act, Public Law (PL) 105-62, was signed into law, transferring responsibility for the administration and execution of FUSRAP from DOE to USACE. In April 1998, USACE issued a ROD for cleanup of Ashland 1, Ashland 2, and Area D of the Seaway Site properties. Remediation of those properties was initiated by USACE in June 1998.

On March 26, 1999, after reviewing the history of the Linde Site and conducting an evaluation of Linde Site information not available in 1993 and potential remedial alternatives, USACE issued a revised PP for cleanup of the Linde Site. Additional Linde Site information reviewed for preparation of the revised PP included the following documents prepared by the USACE:

USACE. November 1998. *Post-Remedial Action Report for Building 14 at the Linde Site, Tonawanda, New York.*

USACE. March 1999a. *Technical Memorandum: Linde Site Radiological Assessment.*

USACE. March 1999b. *Synopsis of Historical Information on Linde Effluent Injection Wells.*

USACE. March 1999c. *Addendum to the Feasibility Study for the Linde Site.*

After addressing comments from the public, regulatory agencies, and other stakeholders, the USACE issued the final ROD for the Linde Site in March 2000. Remediation of the Linde Site in accordance with the ROD began shortly thereafter.

The first Final Status Survey (FSS) Plan (FSSP) for the Linde Site remediation was issued in November 2000. The FSSP described methods for collecting and evaluating data from a remediated unit to demonstrate compliance with ROD cleanup criteria. FSS reports were subsequently generated to document the remediation effort and the survey results from each unit completed. The first FSS report (for remediation unit #01) was issued in 2001, and remediation activities continue through the present. A chronology of events pertaining to the Linde Site is presented in Table II-1.

TABLE II-1. CHRONOLOGY OF SITE EVENTS

Event	Date
Linde Site owned by Union Carbide, Linde Division (after previous ownership by the Town of Tonawanda, Excelsior Steel Ball Company, Metropolitan Commercial Corporation, and the Pullman Trolley Land Company)	1936
Linde Air Products conducting commercial industrial processes	Prior to MED operations in 1940s
Linde Air Products Division under contract to Manhattan Engineer District (MED) to perform uranium separation	1940-1948
Laboratory and pilot plant studies for MED contract	1942-1943
Processing of about 28,000 tons of uranium ore from Africa and Colorado. Liquid waste to injection wells, storm sewers, or sanitary sewers; solid wastes to other Tonawanda Site properties (e.g., Ashland 1) or to offsite locations (e.g., Lake Ontario Ordnance Works in Lewiston, New York).	1943-1946
Radiological survey of the site by Oak Ridge National Laboratory (ORNL).	1976
Remedial Investigation (RI) of the Tonawanda Site (i.e., Ashland 1 & 2, Seaway, and Linde) conducted by the United States (U.S.) Department of Energy (DOE). The RI summarized earlier investigations (including ORNL 1976).	1988-1992
DOE issues two-volume RI and a Baseline Risk Assessment (BRA) based on RI findings.	1993
DOE issues a Feasibility Study (FS) with cleanup objectives for the Tonawanda Site (including Linde).	1993
DOE issues a Proposed Plan (PP) for Linde that recommended containment of MED-contaminated soil in an engineered cell on one of the other Tonawanda Site properties.	1993
Due to public concern over PP recommendations, DOE suspends further actions pending re-evaluation.	1994
DOE issues Engineering Evaluations/Cost Analyses (EE/CAs) for remediation activities at Praxair, including the intent to decontaminate Buildings 14, 30, and 31 and to demolish Buildings 30 and 38. (Buildings formerly used for uranium processing.)	1996
Public Law (PL) 105-62, Energy and Water Development Appropriations Act signed into law, transferring responsibility for the administration and execution of the Formerly Utilized Sites Remedial Action Program (FUSRAP) from DOE to the U.S. Army Corps of Engineers (USACE).	1997
USACE prepares Technical Memorandum: Linde Site Radiological Assessment, proposing risk-based cleanup criteria for uranium.	1999
New regulations amending 10 Code of Federal Regulations (CFR) part 40, Appendix A, Criterion 6(6), addressing residual uranium and radionuclides at uranium mill sites, promulgated by the U.S. Nuclear Regulatory Commission (NRC). These regulations were determined relevant and appropriate for the Linde Site.	1999
USACE issues a PP for the Linde Site, including a preferred alternative.	1999
Review of the PP and comment from public, regulatory agencies, and other stakeholders.	1999-2000
After addressing stakeholder comments, USACE issues a Record of Decision (ROD) for the Linde Site.	March 2000
USACE issues a Final Status Survey Plan (FSSP) for FUSRAP Linde Remedial Action.	November 2000
First Final Status Survey (FSS) Report (for unit 001) completed	May 2001
USACE issues a ROD for Building 14.	April 2003
USACE issues a Groundwater ROD for the Linde Site.	December 2006
Remediation and closure of 84 of 94 Final Status Survey Units (FSSUs) addressed.	December 2009
Five-year review for the Linde Site	2009-2010
Linde Site Remediation	Ongoing

III. BACKGROUND

Site Characteristics and Uses

The Linde Site comprises about 135 acres located at 175 East Park Drive (off Sheridan Drive) in the Town of Tonawanda, New York. The Site Location Map is illustrated in Figure II-1. The Linde Site is bounded on the north and south by other industrial properties and small businesses, on the east by CSX Corporation (CSX) railroad tracks and National Grid property and easements, and on the west by a park owned by Praxair, Inc. A low-density residential area and an elementary school lie west of the park. The Site Plan is illustrated in Figure III-1, an aerial photograph of the Linde Site taken in April 2009.

The property contains office buildings, fabrication facilities, warehouse storage areas, material laydown areas, and parking lots with access to the property controlled by Praxair, Inc. The property is underlain by a series of utility tunnels that interconnect some of the main buildings and by an extensive network of storm and sanitary sewers. Public water and sanitary sewer services are provided to the property. The cleanup criteria proposed by USACE was developed to provide for an acceptable level of protection in accordance with CERCLA and was based on an industrial exposure scenario, which is the most likely future land use.

Land uses in close proximity to the property include the CSX property, commercial and residential areas, and Kenmore Sisters of Mercy Hospital to the east; small businesses, light industries, and residential areas to the north; business and industrial areas to the south; and a low-density residential area and Holmes Elementary School to the west. Sheridan Park, owned by the Town of Tonawanda's Parks and Recreation Department, is located a quarter mile to the northwest of the property. Two Mile Creek flows through this property.

Recreational uses near the property include an 18-hole public golf course, picnicking, and playgrounds. Sensitive uses within one mile of the Linde property include five schools, two community buildings, and a senior citizens' center. The Linde property is fenced and has a buffer zone of grass and trees around the main buildings.

Site History and Contaminants

During the early to mid-1940s, portions of the property formerly owned by Linde Air Products Corp., a subsidiary of Union Carbide Industrial Gas, now owned by Praxair, Inc., were used for the separation of uranium ores. These processing activities, conducted under MED contracts,

resulted in radioactive contamination of portions of the property and buildings. A radiological survey report prepared for the Linde Site by Oak Ridge National Laboratory (ORNL) in 1978 reported that uranium dioxide was separated from uranium ores and uranium dioxide was converted to uranium tetrafluoride at the site between 1940 and 1948. The 1978 ORNL report also stated that the Linde Air Products Division was under contract to MED to perform uranium separations from 1940 through approximately 1948.

As described in the RI report for the Tonawanda Sites (DOE 1993), five (5) Linde buildings were involved in MED activities: Building 14 (built by Union Carbide in the mid-1930s) and Buildings 30, 31, 37, and 38 (built by MED on land owned by Union Carbide). Ownership of Buildings 30, 31, 37, and 38 was transferred to Linde when the MED contract was terminated. As discussed in the RI report, there were three phases to the processing conducted at the Linde Site as follows:

- Phase 1: uranium separation from the ore, which consisted of separating triuranium octoxide (U_3O_8) from the feedstock materials by a series of process steps consisting of acid digestion, precipitation, and filtration.
- Phase 2: conversion of U_3O_8 to uranium dioxide
- Phase 3: conversion of uranium dioxide to uranium tetrafluoride

The RI report states that the contaminants of concern at the Linde Site were primarily associated with the waste streams and residues of the Phase 1 operation and that any residues from the Phase 2 and 3 operations were reprocessed. The primary activity was the separation of uranium from the ore, and the principal contaminants of concern (COCs) were from the processing of wastes and residues from Phase I processing.

Under the MED contract, uranium ores from seven different sources were processed at Linde: four African ores (three low-grade pitchblendes and torbernite) and three domestic ores (carnotite from Colorado). The domestic ore tailings sent to Linde resulted from commercial processing, conducted primarily in the Western United States, to remove vanadium. The vanadium removal process resulted in disruption of the uranium decay chain and the removal of radium. For this reason, uranium supplied to Linde had low concentrations of radium compared with the natural uranium (U) and thorium-230 (Th-230) concentrations.

The African ores shipped to Linde as unprocessed mining ores contained uranium in equilibrium with all of the daughter products in its decay chain (e.g., Th-230 and radium-226 [Ra-226]). The

other constituents of the ores were similar to those of the domestic ores. From mid-1943 to mid-1946, approximately 28,000 tons of ore was processed at the Linde Site.

The principal solid waste resulting from Phase 1 processing was a solid, gelatinous filter cake consisting of impurities remaining after filtration of the uranium carbonate solutions. Phase 1 processing also produced insoluble precipitates of the dissolved constituents, which were combined with the tailings. The precipitated species included large quantities of silicon dioxide, iron hydroxide, calcium hydroxide, calcium carbonate, aluminum hydroxide, lead sulfate, lead vanadate, barium sulfate, barium carbonate, magnesium hydroxide, magnesium carbonate, and iron complexes of vanadium and phosphorus.

COCs that impacted soils and buildings and posed an unacceptable risk to human health and the environment under an industrial scenario (including construction and utility workers) were identified as radium, thorium, and uranium, specifically:

- Ra-226
- Th-230
- Total uranium (U_{total})

Basis for Taking Action

The 1993 RI identified contamination from MED-related sources in four areas of the site:

- Area 1 contained primarily superficial radioactive contamination located in the northwest corner of the main parking lot area at Linde. The RI report indicated that the contamination did not extend deeper than four feet (ft).
- Area 2 contained primarily superficial contamination located along the northern boundary of Linde and the northeastern corner of the main parking area. A temporary storage pile for the consolidation of radioactively contaminated soils and windrow materials was located in this area. Contamination did not extend deeper than four ft.
- Area 3 was located along the fence line in the northeastern corner of the property. Evidence of radioactive contamination in this area extended off the property and encompassed a railroad spur formerly used to haul uranium ore into Linde. Sampling results show that the radioactive contamination was present to a depth of four ft in the area west of the railroad tracks and to a depth of two ft east of the tracks.

- Area 4 included the areas of Buildings 30, 31, 38, 58, and a blast wall outside Building 58. Sampling results showed that the soil beneath Building 30 was radioactively contaminated to a depth of eight ft.

As described in the ROD, several remedial actions have been conducted at Linde since the 1993 RI and FS reports were prepared. These remedial actions included the demolition of Buildings 38 and 30 and the decontamination of Buildings 31 and 14. A subsurface investigation at Buildings 31 and 57 was conducted in 1996. Results of the investigation indicated the presence of radioactive contamination in soils at locations not reported in the 1993 DOE documents, including contamination under Building 57.

IV. REMEDIAL ACTIONS

As specified in the ROD, the general remedial action objectives for cleanup of the Linde Site are the CERCLA threshold criteria:

- the remedy must be protective of human health and the environment; and
- the remedy must attain applicable or relevant and appropriate requirements (ARARs).

To meet these general remedial action objectives, USACE determined that the standards of 40 CFR 192 and 10 CFR 40, Appendix A, Criterion 6(6) were relevant and appropriate for cleanup of the Linde Site.

Remedy Selection

The remedy selected by USACE, as stated in the ROD, called for complete excavation and offsite disposal of MED-contaminated soils containing radionuclides above defined guidelines. It also specified that structural surfaces exceeding guidelines would be decontaminated. (Building 14 and the soils beneath it and groundwater were excluded from the scope of the remedy, with the understanding that they would be addressed separately. These were addressed in subsequent RODs in 2003 and 2006 and are outside the scope of this review.) As put forth in the March 2000 ROD, cleanup actions for the Linde Site were as follows:

- the removal of soils exceeding the 40 CFR 192 standards for radium, which includes consideration of thorium (Th), when averaged over 100 square meters (m^2);
- removal of soils with residual radionuclide concentrations within a 100-m^2 area that results in exceeding unity for the sum of the ratios of these radionuclide concentrations to the associated concentration limits, above background, of 554 picocuries per gram (pCi/g) for U_{total}, 5 pCi/g for Ra-226, and 14 pCi/g for Th-230 for surface cleanups and 3,021 pCi/g of U_{total}, 15 pCi/g of Ra-226 and 44 pCi/g of Th-230 for subsurface cleanups; and
- removal of residual radioactive materials from surfaces necessary to meet the benchmark dose for surfaces of 8.8 millirem per year (mrem/yr) based on the specific location of the surfaces and exposure scenarios.

In addition to the above requirements of the ARARs, USACE stated that it would remediate the Linde Site to ensure that no concentration of total uranium exceeding 600 pCi/g above

background would remain in the site soils. In response to public comments, USACE also committed to achieving an average residual concentration of Total Uranium of 60 pCi/g when averaged over an area of 2000 square meters (m^2) and a depth of 3 meters.

The selected remedy involved the demolition of buildings necessary to remediate the site, which included Buildings 57, 67, 73, 73B, 75 and 76 and their slabs and foundations. The slabs remaining after the demolition of Buildings 30 and 38 and the tank saddles north of Building 30 would also be removed. A wall in Building 31 would be removed to access subslab and sub-footing soils exceeding criteria. The selected remedy would also include remediation of the adjacent Niagara Mohawk and CSX Corporation (formerly Conrail) properties, where radioactive contamination had already been identified (or may be identified as the remediation work is implemented) and would be limited to following releases that originated from the Linde Site resulting from MED-related operations. The plan also included the removal of contaminated sediments from drain lines and sumps, the removal of contaminated soil from a blast wall structure located east of Building 58, and remediation of a subsurface vault structure located just west of Building 73. It also provided the best balance among the considered alternatives with respect to the evaluation criteria.

As stated in the ROD, upon completion, the selected remedy for the Linde Site is expected to be fully protective of human health and the environment and meet cleanup criteria based on the ARARs. During remedial activities, engineering controls during construction would be put in place as required and environmental monitoring and surveillance activities would be maintained to ensure protectiveness, so that no member of the public would receive radiation doses above guidelines from exposure to residual radioactive contaminants. No short-term threats associated with the selected remedy were identified that could not be readily controlled and mitigated. In addition, no adverse cross-media impacts were identified as expected from the remedy.

In April 2003, a ROD was issued for Building 14 at the Linde FUSRAP Site. Implementation of this remedy required the demolishing Building 14 and removing the building demolition debris. The utility located beneath Building 14 will be relocated to allow for removal of contamination within and around the tunnel structure. Building components and soils under Building 14 will be surveyed to determine the materials and soils that are radioactively contaminated with contaminants of concern above the soil cleanup criteria.

In addition, a groundwater ROD was issued for the Linde FUSRAP Site in December 2006. The groundwater ROD recommended no further action for that operable unit.

Remedy Implementation

Since the signing of the ROD in 2000, the USACE has been remediating the Linde Site soils. Soil has been excavated and removed and remaining structural surfaces (e.g., foundations) have been decontaminated. During this period, concentrations of radionuclides in ambient air have been (and continue to be) monitored at perimeter locations around the Linde Site. FSSs have been performed to compare residual radiological conditions (e.g., soil radionuclide concentrations and the dose derived surface contamination release criteria for buildings) with guidelines established in the ROD.

As mentioned earlier in Section III, the 1993 RI discussed types and extent of contamination in four primary areas of the Linde Site. For cleanup under the present ROD, the USACE has utilized the general approaches outlined in the U.S. Nuclear Regulatory Commission (NRC) Regulation (NUREG), Multi-Agency Radiation Surveys and Site Investigation Manual (MARSSIM [NUREG-1575]). This manual provides detailed guidance for planning, implementing, and evaluating environmental and facility radiological surveys conducted to demonstrate compliance with a dose- or risk-based regulation. MARSSIM (developed in cooperation with DOE, the EPA, and the NRC) focuses on the demonstration of compliance during the FSS following scoping, characterization, and any necessary remedial actions. Under MARSSIM, the site is divided into smaller subareas (survey units) based on common characteristics or investigation data. Under MARSSIM, a survey unit is a physical area consisting of structure or land areas of specified size and shape for which a separate decision will be made as to whether or not that area exceeds the release criterion, typically derived concentration guideline levels (DCGLs) or cleanup criteria. Units were assigned classifications based on expected levels of radiological contamination, according to MARSSIM, as follows:

- Class 1 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiation surveys) above the DCGL;
- Class 2 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination or known contamination, but are not expected to exceed the DCGL;

- Class 3 Areas: Any impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the DCGL, based on site operating history and previous radiation surveys.

Class 1 areas have the greatest potential for contamination and therefore receive the highest degree of survey effort for the FSS using a graded approach, followed by Class 2, and then by Class 3. Figure IV-1 illustrates the delineation of Class 1, 2, and 3 areas at the site. The 1993 RI Report Source Areas (Source Areas) discussed earlier and in Section III are also illustrated on this map. Although most of the Source Areas correlate well with the MARSSIM Class I areas, some of the limits extend outside of the Class I limits, and a smaller fraction of these areas lie outside of the Class II limits. These Source Areas that are within either a Class I or a Class II area have been thoroughly evaluated using MARSSIM, and have been addressed as determined to be appropriate based on the MARSSIM procedures. The areas that extend beyond the Class I or Class II limits are either scheduled to be addressed during future remediation (rail spur area) or have been adequately classified using the surrounding data points, and concluded that no further remediation is deemed necessary (northern property boundary). Since the remedy is still underway, any data pertaining to portions of these Source Areas that lie outside of the MARSSIM Class I or Class II areas would not have been reviewed during this investigation.

The FSSP describes the process by which radiological surveys and site investigations of soils, buildings, and utility tunnels at the Linde Site are conducted to demonstrate successful cleanup and attainment of release criteria specified in the ROD. FSSP methods were based on the criteria from the Data Quality Objective (DQO) process, the ROD, and, in general, the guidance found in MARSSIM. The FSSP contains flow charts that provide a step-by-step sequence for performing an FSS. Types of survey and/or sampling are based on the type of unit (i.e., soil, structure) and the unit class (i.e., Class 1, Class 2). The flow charts include decision points with criteria for determining whether or not additional remediation may be necessary.

The FSSP also discusses survey methods, selection of sampling locations, sampling methods, analytical methods, methods for evaluating data, and information to be included in reports.

After remediation of a unit was determined to be complete (i.e., ROD cleanup criteria had been met) based on remedial action surveying, an FSS was implemented and an FSS report was prepared and submitted to the New York State Department of Environmental Conservation (NYSDEC) and other stakeholders. NYSDEC was also afforded the opportunity to survey all completed survey units and collect samples at their discretion. A summary of FSS results for soil

remediation units is included in Section V of this five-year review. In summary, data from all FSS Reports reviewed were compliant with ROD criteria.

Summary of Completed Remediation Activities

Remediation activities commenced in 2000 following the signing of the ROD. Between July and December 2000, Buildings 57, 58, 67, 73, and 73A were demolished. In 2009, Buildings 8 (East Annex), 31, 73B, and 90 were demolished. Soil excavation and disposal commenced in late 2000 and continued through November 2009. The site was divided into 19 main excavation areas. Total depths of excavation for these areas ranged from approximately 3 to 18 feet below ground surface.

Throughout the duration of these remedial activities completed under the 2000 ROD, contaminated materials were shipped via rail to three different out-of-state facilities:

- International Uranium Corporation (IUC), Blanding, Utah
- Waste Control Specialists, LLC (WCS), Andrews County, Texas
- US Ecology Corporation, Grandview, Idaho

Since commencement of remediation activities at the Linde Site in 2000, approximately 344,529 tons of contaminated material has been removed and shipped out of state for disposal.

Non-impacted materials generated during remediation activities associated with the 2000 ROD were shipped to three different disposal/recycling facilities within New York:

- Niagara Falls Landfill, Niagara Falls, New York
- Niagara Metals, Lockport, New York
- Swift River, Tonawanda, New York

All non-impacted materials were surveyed and the NYSDEC concurrence was granted prior to release. Approximately 4,046 tons of non-impacted materials were shipped from the site between December 2008 and November 2009.

Table IV-1 summarizes the quantities of contaminated and non-contaminated materials shipped from the site during the course of remediation activities.

TABLE IV-1. SUMMARY OF MATERIALS DISPOSAL

Shipments of Soil Contaminated with Radioactive Residuals			
Qualified Disposal Facility	**Shipping Dates**	**Total Tons Shipped**	**Containers Shipped**
Linde to IUC	9/11/2000 - 10/20/06	118,687	5,950
Linde to WCS	10/18/2000 - 9/29/06	138,360	5,903
Linde to US Ecology Corporation	10/9/2006 - 11/25/09	87,482	3,839
Total		344,529	15,692
Shipments of non-impacted materials to New York State Facilities			
Niagara Falls Landfill	12/3/08 - 11/12/09	1,425	197
Niagara Metals	12/3/08 - 1/15/10	305	54
Swift River	12/3/08 - 11/12/09	2,316	162
Total		4,046	413

V. FIVE-YEAR REVIEW PROCESS

Administrative Components

The review team consisted of individuals from USACE and URS. The project organization for the USACE consisted of [redacted] (Project Manager), [redacted] (Project Engineer), [redacted] (Project Certified Health Physicist [CHP]), [redacted] (Risk Assessor), and [redacted] (Outreach Program Specialist).

The project organization for URS consisted of: [redacted], Vice President (Program Manager), [redacted], Professional Engineer (PE) (Project Manager), [redacted], Doctor of Philosophy (Ph.D.) (Project Quality Assurance/Quality Control [QA/QC] Officer), [redacted], Ph.D., PE, CHP (Senior Technical Reviewer), and [redacted], Professional Geologist (PG) (Team Coordinator). [redacted] was responsible for organizing the technical team for conducting the various tasks in the five-year review.

The Community Notification represents the initial step in the five-year review process. The five-year review for the Linde Site is expected to be completed in August 2010, culminating with the publication of this report and a final public notification. Interim steps in the five-year review were completed according to the following schedule:

- Community Notification — December 2009
- Document Review — January 2010
- Conduct Community Interviews — January 2010
- Data Analysis — February 2010
- Protectiveness Determination — February 2010
- Draft Five-Year Review Report — February 2010
- Final Five-Year Review Report — August 2010
- Final Public Notification (for the Report) — August 2010

The following sub-sections discuss the completion of these and other significant activities under the five-year review process.

Community Notification and Involvement

Public notices of the commencement of the five-year review for the Linde Site were published in three local newspapers. The Buffalo News (December 13, 2009), the Tonawanda News (December 13, 2009), and the Ken-Ton Bee (December 16, 2009) each contained an article or advertisement of the five-year review, and provided the same contact information included in the Linde Site News.

Other community involvement activities have been an ongoing part of the remediation activities at the Linde Site. At critical points during the remedial action, the USACE has conducted progress meetings and informational sessions intended to provide the public, local governments, and other stakeholders with a detailed update on the progress of the remediation.

Newsletters are also recognized as an important component of the community notification and involvement. USACE has published newsletters, titled "Linde Site News," which have been distributed via U.S. mail service to approximately 500 individuals on the mailing list. The Linde Site News was reportedly mailed prior to milestone events or accomplishments where public involvement or notification was appropriate. The Linde Site News contained a section titled "Contact Us!" which provided contact information and suggested that the Linde Site News be shared with local friends and residents (of the recipient). Instructions were also provided in such case where an individual would desire to be added to the mailing list. The most recent mailing of the Linde Site News occurred in December 2009 which provided information on the five-year review and included an approximate schedule of five-year review activities. However, based on interviews, it appears that review of the mailing list on a more frequent basis may assist in reaching all of the interested stakeholders. Section VIII presents recommendations for improving public awareness and participation.

Document Review

The document review task involved gathering and reviewing the site documents related to the remedy selection and implementation. The documents reviewed are listed in Attachment B, and the relevant information collected from these documents is summarized in the following paragraphs.

Remedial Investigation Report (RI) for the Tonawanda Site (United States Department of Energy [DOE], February 1993, volumes 1 and 2). The RI for the Tonawanda Site, which included Ashland 1, Ashland 2, and Seaway Industrial Park, as well as the Linde Site, was prepared by the

DOE to document existing conditions at the Tonawanda Site. Sources of contamination were listed, primary contaminants were identified, analyses of samples of environmental media (e.g., soil, groundwater) were summarized, levels of contamination were assessed, and areas of contamination were defined. Information in the RI supported the selection of remedial action alternatives for the site as a whole.

Baseline Risk Assessment (BRA) for the Tonawanda Site (DOE, August 1993). The BRA, based upon information in the RI, was prepared to evaluate risk to human health and the environment from the contaminants present on the Tonawanda Site properties. The BRA assumed no remedial action and served as a baseline for evaluating alternative remedies.

Feasibility Study (FS) for the Tonawanda Site (DOE, November 1993). The FS summarized considerations for selection of ARARs for the remedial activity. The FS also discussed six alternatives for the site, the "No Action" scenario and five remediation alternatives. Alternatives were evaluated in detail from a number of perspectives (e.g., protectiveness, effectiveness, risk, implementability, cost).

Proposed Plan (PP) for the Tonawanda Site (DOE, November 1993). The PP presented a summary of the six alternatives addressed in the FS, with radiological risks and costs of each. A rationale was given for selection of the preferred remedy (partial excavation with onsite disposal). The PP stressed that the final decision would be made only after public comments and new information were considered.

Addendum to the FS for the Linde Site (USACE, March 1999). The 1993 PP was not implemented because of community concern over the use of onsite disposal. In 1997, FUSRAP was transferred from the DOE to the USACE. The 1999 FS was prepared to focus on remediation of the Linde Site only, and to incorporate information available since August 1993, including sample data acquired during building removal and/or decontamination.

Proposed Plan for the Linde Site (United States Army Corps of Engineers [USACE], March 1999). The revised PP for the Linde Site only described revised alternatives for remediation. Three alternatives ("no action," "complete excavation and decontamination with offsite disposal," and "excavation, decontamination and institutional controls") were compared with respect to protectiveness, compliance with ARARs, implementability, risk reduction, cost, etc. The USACE preferred alternative was "excavation, decontamination, and institutional controls." ("Institutional controls" applied solely to inaccessible soils under Building 14. A subsequent ROD, issued in 2003, specifically addressed Building 14 and the soils below.)

Technical Memorandum: Linde Site Radiological Assessment (USACE, February 2000). This memorandum described assumptions, parameters, and methods for calculating source terms, exposure, residual radioactivity, and screening criteria based on selected ARARs in 40 CFR 192, and 10 CFR 40, Appendix A, Criteria 6(6), amended in 1999.

Record of Decision (ROD) for the Linde Site (USACE, March 2000). Comments on the 1999 PP from the public, the New York State Department of Environmental Conservation (NYSDEC), United States Environmental Protection Agency (EPA), and other agencies and groups were summarized. The selected remedy included removing radioactive material and buildings with offsite disposal (except for Building 14 and soil below the building, which were addressed in 2003 in a separate ROD). ARARs cited were 40 CFR 192, and 10 CFR 40, Appendix A, Criteria 6(6). NYSDEC reserved support for the ROD pending review of the FSS data once remediation is complete. NYSDEC included a list of state criteria (more conservative than the ROD criteria) that it would use to evaluate FSS data for residual radioactivity in soil. USACE anticipated that residual activity after remediation would be far below both NYSDEC and ROD limits.

Final Status Survey Plan (FSSP) (USACE, November 2000, Revisions 2 [January 2002] and 3 [October 2005]). The FSSP described methods for acquiring FSS data for both soils and structures in MARSSIM Class 1, Class 2, and Class 3 survey units. It described how data were to be evaluated, presented, and reported.

Technical Data Packages for Final Status Surveys of soil remediation units (2001-2009). Packages included field gamma measurement data and plots from walkover surveys conducted at each unit after remediation. They also included sample data (residual contamination in units of pCi/g Ra-226, Th-230, and U_{total}), associated quality control data, statistical data evaluations, comparisons with ROD cleanup criteria, summary data for FSS soil samples, and average residual soil concentrations for the unit.

Technical Data Packages for Final Status Surveys of structural features within remediation units (2002-2009), as indicated by a letter following a unit number (i.e., "30A" for a foundation in unit 30). Packages included field gamma scan measurements of building surfaces after decontamination (i.e., residual contamination on the surface of structural features such as foundations or slabs in units of disintegrations per minute [dpm] beta activity per 100 square centimeters [cm^2], i.e., dpm beta/100 cm^2), together with a description of how measurements were made and diagrams showing the locations of each. Packages also summarized comparisons of field measurements with respect to dose-based screening criteria.

Technical Reports for calculation of surface contamination limits for structural features within remediation units (2003-2009). These technical reports described the assumptions and methods by which the dose-based screening criteria specific to each unit were calculated.

Technical Report, Radiological Parameters for Use at the Linde FUSRAP Site, January 2005 (Rev. 3). This report listed physical constants, dose conversion factors (DCFs), time factors, assumptions pertaining to sources and receptors, use of the Residual Radioactivity (RESRAD) program (from Argonne National Laboratory and the DOE), and other topics pertaining to radiological calculations at the Linde Site.

Data Review

The data review task is intended to compile, summarize, and analyze the remedial action data, such that the remedial actions completed to date can be assessed and the protectiveness of the remedy determined. In addition to the environmental data, the site-specific cleanup criteria are compiled under this task, to provide a basis for comparison against the environmental data.

Compilation of Cleanup Criteria and Comparison Data

The first subtask completed in support of data review was compilation of the site-specific cleanup criteria, ARARs, and other regulatory requirements applied to or considered during the remediation. The primary ARARs and cleanup criteria were taken directly from the Linde Site ROD, which applied the following criteria to surface soils and subsurface soils, respectively:

TABLE V-1. ROD CLEANUP CRITERIA

Radionuclide	Surface Soil Criteria (0 to 15 cm deep) pCi/g above background	Subsurface Soil Criteria (more than 15 cm deep) pCi/g above background
Radium-226 (Ra-226)	5	15
Thorium-230 (Th-230)	14	44
Uranium, total (U_{total})	554	3,021

USACE further stated that it would remediate the Linde Site to ensure that no concentration of total uranium exceeding 600 pCi/g above background would remain in site soil. In response to public comments, USACE also committed to achieving an average residual concentration of Total Uranium of 60 pCi/g when averaged over an area of 2000 m^2 and a depth of 3 meters.

Two additional comparison points were identified during the ROD public comment period and the resulting comparison data were also compiled during this task for informational purposes. When commenting on the ROD, NYSDEC submitted to the USACE an alternative set of

screening criteria against which it would evaluate FSS data for the Linde Site. These criteria are included in the table below.

Also during the ROD comment period, the USACE predicted (as discussed in a letter dated 1/12/2000 from EPA to USACE) that remediation to the ROD requirements (i.e., surface and subsurface the sum of ratios [SOR] criteria [less than unity] and U_{total} criterion [less than 600 pCi/g]) would result in soils with average "expected" residual concentrations that are much lower than the ROD requirements. These "expected" soil concentrations are not primary ROD requirements, but are the average residual radionuclide values that were derived after modeling the backfilled excavation using the ROD criteria. Although these calculated concentration criteria are supposed to be average concentrations modeled based on a certain volume of soil, they are more simply compared in the FSS Technical Data Packages to the mean (average) concentration of all of the FSS samples for each parameter in each unit. The USACE Expected Residual Concentrations (above background) are summarized below.

TABLE V-2. ADDITIONAL CLEANUP CONSIDERATIONS FROM THE ROD

Radionuclide	NYSDEC Recommended Soil Criteria pCi/g	USACE "Expected" Residual Concentrations pCi/g
Ra-226	5	2.0
Th-230	5	3.5
U_{total}	60	60.8

Compilation of Environmental Data Pertaining to the Remediation

The second subtask in completing the data review is compilation and analysis of the pre- and post-remediation sampling and FSS sample data. These data are compiled mainly from the gamma walkover surveys completed, as well as the FSS sample analyses, both contained in the numerous reports entitled "Technical Data Package, Final Status Survey, Survey Unit XX" prepared during the soils remediation project between 2001 and 2009. Final Status Survey Units (FSSUs) are shown on Figure V-1.

After a survey unit was remediated (i.e., after contaminated soil had been removed), a gamma survey of the area was performed by walking a grid across the survey unit and then walking a second grid perpendicular to the first to provide complete coverage of the unit (i.e., an orthogonal survey). Gamma measurements (in counts per minute [cpm]) were plotted and summarized in the FSS Technical Data Packages. Points exceeding the gross gamma investigation level of 18,000 cpm for subsurface soil were identified. Areas measuring greater than 18,000 cpm were examined for slag or other non-MED material that could effect measurements. In some instances,

it was not possible to survey the entire unit (for instance, because of slopes or ponded water). Conditions where walkover measurement readings were not possible were indicated on plots. Additional characterization samples were collected in these locations. All plots in reviewed documents were examined. As part of the data review, areas where elevated readings were recorded were confirmed against tables of field measurements.

When the field survey was complete, FSS soil samples were collected at predetermined points, with a goal of collecting at least one sample from each 100-m^2 area. Also collected were "biased" samples (from areas that could not be surveyed) and "anomaly" samples (from areas where gamma measurements exceeded 18,000 cpm). The "biased" and "anomaly" samples were first analyzed onsite by gamma spectroscopy to confirm that soil concentrations were below subsurface soil cleanup concentrations in the ROD. If concentrations indicated that further remediation was not required (i.e., results from the "biased" and "anomaly" samples were acceptable), the FSS samples were sent offsite for analysis.

Deviations from the FSSP were reviewed. Examples of deviations included offsetting predetermined FSS sampling locations because of obstructions or underground utilities, and not surveying the entire surface of the unit because of slopes or ponding.

FSS soil samples sent offsite were analyzed by alpha spectroscopy at subcontract laboratories (e.g., General Engineering Laboratories). Analytical data, data from associated quality control samples, and data validation results were presented in the FSS Technical Data Packages.

Utilizing all of the analytical data points (all FSS samples in each FSSU, a total of 1332 soil samples) for each parameter, the mean, median, maximum, minimum, and standard deviation were calculated. The mean (or average) concentrations of Ra-226, Th-230, and U_{total} in pCi/g were reported in the Executive Summary section of these Technical Data Packages for each remediation unit. Concentrations from the reviewed Technical Data Packages were compared with ROD cleanup criteria for subsurface soil (subsurface samples), "expected" residual concentrations, and background concentrations (see summary table below). Post-remediation average concentrations for the FSS Data Packages reviewed were similar to background and were well below each of the ROD criteria, NYSDEC-Recommended Soil Criteria, and USACE "Expected" Residual Concentrations. Table V-3 lists the FSS units that have been addressed up to the date of the Five-Year Review. This table includes a summary of the average concentrations of Ra-226, Th-230, and U_{total} in the FSS samples collected from each soil unit.

(Additional analysis of the individual data points [not the averages], as well as an evaluation of samples collected after the FSS report dates, is presented in Section VI, Technical Assessment.)

TABLE V-3. SUMMARY OF FSS UNIT STATUS, INCLUDING POST-REMEDIATION SOIL CONCENTRATIONS*

	Ra-226	Th-230	U_{total}	
FSS Subsurface Soil Cleanup Criteria (pCi/g)	15	44	600	
ROD Subsurface Soil Cleanup Criteria (pCi/g)	15	44	3021	
ROD Surface Cleanup Criteria (pCi/g)	5	14	554	
Expected Residual Concentrations (pCi/g)	2	3.5	60.8	
Background Concentrations (pCi/g)	1.1	1.4	6.1	
FSS Unit Reviewed	Average (Mean) Sample Concentration (pCi/g)			NYSDEC Concurrence Received***
001 – Class 2	0.27	1.11	1.95	7/6/2001
002 – Class 2	0.43	2.49	5.87	--
003 – Class 2[A]	0.39	2.56	6.17	--
004 – Class 3[A]	1.10	1.13	1.13	--
005 – Class 1	0.39	1.65	3.54	3/28/2002
005A – Class 2	N/A	N/A	N/A	7/17/2002
005B – 005F – Class 2	N/A	N/A	N/A	--
006 – Class 1	0.49	1.65	6.66	6/14/2002
007 – Class 1	0.58	1.29	3.33	5/17/2002
008 – Class 1	0.82	1.74	3.77	5/30/2002
009 – Class 1	0.83	1.74	4.51	3/28/2002
010 – Class 1	0.69	2.03	3.89	5/2/2002
011 – Class 1	0.72	1.87	4.31	4/3/2002
011A, 014A, 014B – Class 1	N/A	N/A	N/A	11/20/2003
012 – Class 1	0.63	1.39	6.95	8/26/2002
013 – Class 1	0.37	1.35	4.14	8/21/2002
014 – Class 1	0.65	1.52	2.49	3/20/2003
015 – Class 2	1.38	1.84	9.32	--
016 – Class 1	1.62	1.39	2.40	9/17/2002
016A – Class 1	N/A	N/A	N/A	12/16/2003
017 – Class 1	1.29	1.26	1.90	8/14/2003
017A, B, C – Class 2	N/A	N/A	N/A	6/8/2004
018 – Class 1	0.33	1.22	4.92	2/25/2003
019 – Class 1	0.92	1.07	3.36	11/3/2003
020 – Class 1	0.83	1.30	1.92	2/14/2005
020A– Class 1	N/A	N/A	N/A	--
021 – Class 2	0.52	1.99	3.19	--
022 – Class 2	0.46	2.56	4.44	--
023 – Class 1	1.12	1.48	3.95	10/10/2003
024 – Class 1	1.09	1.19	2.03	9/22/2003
025 – Class 2	1.84	2.09	4.55	--

TABLE V-3. SUMMARY OF FSS UNIT STATUS, INCLUDING POST-REMEDIATION SOIL CONCENTRATIONS*

	Ra-226	Th-230	U_{total}	
FSS Subsurface Soil Cleanup Criteria (pCi/g)	15	44	600	
ROD Subsurface Soil Cleanup Criteria (pCi/g)	15	44	3021	
ROD Surface Cleanup Criteria (pCi/g)	5	14	554	
Expected Residual Concentrations (pCi/g)	2	3.5	60.8	
Background Concentrations (pCi/g)	1.1	1.4	6.1	
FSS Unit Reviewed	Average (Mean) Sample Concentration (pCi/g)			NYSDEC Concurrence Received***
026 – Class 1	1.19	1.28	2.09	1/9/2004
027 – Class 1	1.00	1.11	1.88	1/21/2004
028 – Class 1	1.06	1.33	2.66	1/9/2004
028A – Class 1	N/A	N/A	N/A	1/12/2004
029 – Class 2	1.32	1.63	2.22	--
030 – Class 1	1.24	1.66	2.37	Reserved
030A – Class 1	N/A	N/A	N/A	5/28/2004
031 – Class 1	1.14	1.27	1.82	1/14/2004
032[A]	N/A	N/A	N/A	N/A
033 – Class 1	0.80	1.21	1.33	--
033A – Class 2	N/A	N/A	N/A	--
034 – Class 1	1.14	1.38	2.03	8/16/2004
035 – Class 1	1.01	1.13	2.45	7/27/2004
036 – Class 1	1.37	2.38	2.45	10/6/2004
037 – Class 1	0.96	1.61	1.75	3/11/2005
038 – Class 1	0.91	1.10	1.97	--
039 – Class 1	0.93	1.21	2.01	--
040 – Class 1	0.90	1.32	3.78	1/16/2009
041 – Class 1	1.20	1.21	3.00	2/2/2005
042 – Class 1	1.04	1.13	1.95	--
043 – Class 1	0.92	1.17	2.03	11/9/2006
044 – Class 1	1.08	1.27	2.24	11/8/2006
045 – Class 1	1.22	1.37	3.28	12/19/2006
046 – Class 1	0.94	1.13	1.88	1/22/2007
047 – Class 1	0.95	1.10	2.01	10/3/2005
048 – Class 1	0.64	0.96	1.88	11/2/2007
049 – Class 1	0.73	1.10	2.68	10/22/2008
049A – Class 1	N/A	N/A	N/A	9/22/2008
050 – Class 1	0.38	0.85	1.82	--
051 – Class 1	0.82	0.89	1.64	--
052 – Class 1	0.87	1.24	3.53	9/2/2008
053[A]	N/A	N/A	N/A	N/A
054 – Class 1	0.90	1.44	3.68	3/12/2007
055 – Class 1	0.78	1.09	2.30	1/3/2007

TABLE V-3. SUMMARY OF FSS UNIT STATUS, INCLUDING POST-REMEDIATION SOIL CONCENTRATIONS*

	Ra-226	Th-230	U_{total}	
FSS Subsurface Soil Cleanup Criteria (pCi/g)	15	44	600	
ROD Subsurface Soil Cleanup Criteria (pCi/g)	15	44	3021	
ROD Surface Cleanup Criteria (pCi/g)	5	14	554	
Expected Residual Concentrations (pCi/g)	2	3.5	60.8	
Background Concentrations (pCi/g)	1.1	1.4	6.1	
FSS Unit Reviewed	Average (Mean) Sample Concentration (pCi/g)			NYSDEC Concurrence Received***
056 – Class 2	1.00	1.18	2.81	--
057 – Class 1	1.08	1.02	1.97	10/22/2008
058 – Class 1	0.97	0.91	1.71	1/16/2009
059 – Class 1	0.92	0.94	1.54	--
060 – Class 1	1.17	1.02	2.11	--
060A, 060B – Class 1	N/A	N/A	N/A	1/16/2009
061 – Class 1	0.99	1.01	2.01	--
062 – Class 1	1.03	1.22	1.84	--
063 – Class 1	1.22	1.17	2.41	9/2/2008
064 – Class 1	1.10	0.94	1.71	9/2/2008
065 – Class 1	1.42	1.28	3.17	--
066 – Class 1	1.50	1.10	1.97	10/22/2008
067 – Class 1	1.00	0.94	2.92	--
068 – Class 1	1.30	3.02	11.10	10/22/2008
069 – Class 2	1.32	1.80	2.50	--
070 – Class 2	1.28	1.60	2.81	--
071 – Class 1	1.24	1.67	1.86	--
071A, B, C – Class 1	N/A	N/A	N/A	9/2/2008
072 – Class 1	1.14	1.70	3.78	--
073 – Class 1	1.19	1.23	2.01	--
074 – Class 1	1.15	1.02	2.14	3/10/2009
075 – Class 1	1.39	1.15	3.76	--
076 – Class 1	1.17	1.05	2.11	3/10/2009
077 – Class 1	1.64	1.32	2.14	--
078 – Class 1	1.25	1.08	2.20	--
079 – Class 1	1.23	0.97	2.07	--
080 – Class 1	1.23	1.01	1.63	--
080A – Class 1	N/A	N/A	N/A	--
081 – Class 1	1.32	1.40	3.06	--
082 – Class 1	1.34	1.09	2.15	--
082A, B, E – Class 1	N/A	N/A	N/A	--
082 C, D – Class 1 [B]	N/A	N/A	N/A	--
083 – Class 1[B]	N/A	N/A	N/A	--
084 – Class 1	0.86	1.08	2.04	--

TABLE V-3. SUMMARY OF FSS UNIT STATUS, INCLUDING POST-REMEDIATION SOIL CONCENTRATIONS*

	Ra-226	Th-230	U_{total}	
FSS Subsurface Soil Cleanup Criteria (pCi/g)	15	44	600	
ROD Subsurface Soil Cleanup Criteria (pCi/g)	15	44	3021	
ROD Surface Cleanup Criteria (pCi/g)	5	14	554	
Expected Residual Concentrations (pCi/g)	2	3.5	60.8	
Background Concentrations (pCi/g)	1.1	1.4	6.1	
FSS Unit Reviewed	Average (Mean) Sample Concentration (pCi/g)			NYSDEC Concurrence Received***
085 – Class 1[B]	N/A	N/A	N/A	--
086 – Class 1	0.67	0.41	1.99	--
087A – Class 1 [B]	N/A	N/A	N/A	--
088 – Class 1 [B]	N/A	N/A	N/A	--
089 – Class 2	1.22	1.69	6.36	--
090 – Class 2	0.88	1.50	2.48	--
094 – Class 1	0.89	1.25	1.92	--
Average****:	1.00	1.37	2.97	--
Standard deviation****:	0.31	0.43	1.69	--
Maximum****:	1.84	3.02	11.1	--

N/A = Not applicable or not available. FSS unit numbers followed by a letter designator indicate structural features (e.g., foundations), therefore no concentration data are reported.
*Not a complete listing. Remediation is ongoing at the Linde Site and this table includes only the remediated units for which Technical Data Packages were reviewed in December 2009, in addition to those identified with footnotes [A] or [B].

**Note that, when commenting on the ROD, NYSDEC submitted to the USACE an alternative set of screening criteria against which it would evaluate FSS data for the Linde Site. NYSDEC criteria are included in this table for comparison purposes. Post-remediation averages from the above soil units are below both ROD and NYSDEC criteria for each constituent.

***The notation "- -" indicates that no documentation of NYSDEC approval was available from the documents reviewed (Final Status Survey Reports, 2001-2009; Tables 1-1 and 1-2, Scope of Work, 2009). The "Reserved" notation for unit #30 indicates that, on 8/16/2004, NYSDEC reserved approval pending additional characterization because one of the "biased" samples exceeded a NYSDEC screening criterion.

****The number shown represents the average, standard deviation, and maximum of all numbers in the column above, not the statistics of all FSS data points in every unit.

[A]Information on this line was obtained from Table 1-1 of the "Scope of Work for Five-Year CERCLA Review of Linde FUSRAP Site"
[B]Information on this line was obtained from Table 1-2 of the "Scope of Work for Five-Year CERCLA Review of Linde FUSRAP Site"

During this five-year review, tables of results from individual samples that had been included in FSS reports, including comparisons with ROD cleanup criteria and "expected" residual concentrations, were spot checked in the FSS Technical Data Packages. An estimated ten percent of the data were reviewed. In a review of the radiological database, alpha spectroscopy data and SOR calculations from all FSS samples were evaluated also. (No U_{total} data were included in the database, because U_{total} concentrations had been calculated from U-isotopic measurements.) For all individual FSS samples (as well as the mean [average] of sample results), the SOR calculations contained in the Technical Data Packages indicated values less than 1.0 based on the ROD subsurface soil cleanup criteria.

Data from FSS of Structures: Surface contamination limits (release criteria) were calculated for each structure (e.g., a foundation surface exposed during excavation). Using the RESRAD computer code (input parameters defined in each Technical Report) together with isotopic distributions from samples collected in the area of interest, unit dose factors (UDFs) were calculated. UDFs were used to derive surface activity (in alpha and beta dpm/100 cm^2) corresponding to the ROD benchmark dose of 8.8 mrem/yr. Calculations and screening limits were summarized for each survey unit in a Technical Report; Surface Contamination Limits for Final Status Survey. Due to difficulty in measuring alpha in the field, a total beta DCGL was calculated as a field screening value. Direct measurements of each surface were made in the field, and background measurements were subtracted. The Wilcoxon Rank-Sum (WRS) statistical test, as described in MARSSIM, was used to test if the median survey unit measurement exceeded the contamination limit. These calculations and discussions are presented in the FSS reports.

As part of the data review, diagrams of measurement locations, measurement listings, and summary statistics were spot-checked. No measurements exceeding screening criteria were noted.

Data from NYSDEC reviews of Technical Data Packages for FSS Reports: FSS reports are submitted by USACE to NYSDEC for review. NYSDEC reviews of the FSS Technical Data Packages often included results from an independent walkover gamma survey by NYSDEC, and at some times included data from additional samples collected by NYSDEC for confirmatory analysis. Of the 96 FSS Technical Data Packages (for both soil units and structural units) reviewed, NYSDEC had concurred that 53 of the documents demonstrated that the unit had been remediated in a manner that was protective of the public and the environment. NYSDEC requested additional characterization for one unit (unit 030), because, while FSS samples were all

in compliance with both ROD and NYS criteria, one of the "biased" samples had exceeded a NYS screening criterion. Formal response from NYSDEC was not included (or was not available) for the remainder of the packages. Technical data packages for several units were not available, but the information on these units is presented in Table V-3 based on the "Scope of Work for Five-Year CERCLA Review of Linde FUSRAP Site," Tables 1-1 and 1-2.

Air Monitoring Data from the Radiological Database for the Linde Site: Between 1999 and the present, locations around the site perimeter have been (and continue to be) continuously monitored for radionuclide concentrations in airborne particulates. Air samples were analyzed for Ra-226, Th-230, and the uranium isotopes uranium-234, uranium-235, and uranium-238 (U-234, U-235, and U-238). As shown in the summary table below (Table V-4), results from perimeter air monitoring samples were consistent with results from background ambient air ("Perimeter #12" in Table V-4) for all nuclides measured.

TABLE V-4. AVERAGE CONCENTRATIONS (µCI/ML) OF RADIONUCLIDES IN PERIMETER AIR

	# samples	Ra-226	Th-230	U-234	U-235	U-238
Perimeter #01	90	2.8E-17	2.8E-17	5.4E-17	<1.0E-17	5.1E-17
Perimeter #02	89	2.4E-17	2.9E-17	5.2E-17	<1.0E-17	5.0E-17
Perimeter #03	88	2.9E-17	<1.1E-16	5.1E-17	<1.0E-17	5.1E-17
Perimeter #04	89	2.6E-17	<1.3E-16	5.0E-17	<9.8E-18	4.8E-17
Perimeter #05	88	2.9E-17	3.3E-17	5.1E-17	<1.1E-17	4.8E-17
Perimeter #06	90	2.4E-17	<4.3E-17	5.1E-17	<1.0E-17	4.9E-17
Perimeter #07	89	2.8E-17	2.8E-17	4.9E-17	<1.1E-17	5.0E-17
Perimeter #08	89	2.3E-17	3.3E-17	5.4E-17	<1.1E-17	5.0E-17
Perimeter #09	89	2.6E-17	<4.6E-17	5.3E-17	<9.5E-18	4.8E-17
Perimeter #10	89	2.7E-17	2.9E-17	5.0E-17	<1.0E-17	5.1E-17
Perimeter #11	90	2.9E-17	<6.7E-17	5.3E-17	<9.9E-18	5.2E-17
Perimeter #12 (bkg)	88	2.4E-17	<5.0E-17	5.3E-17	<1.0E-17	5.0E-17

*The symbol "<" indicates that the nuclide was not detected.

Note that, when surface soil was being removed from remediation units, portable air sampling units were installed at the work site and samples were collected upwind, downwind, and crosswind of the active excavation for worker protection. Data from these portable samplers were not included in this review.

Site Inspection

The purpose of the five-year site inspection was to obtain information about the cleanup status and to visually confirm and document the conditions of the remedy, the site, and the surrounding area. The site inspection was performed on Thursday, January 21, 2010, and documentation of

the site inspection, in the form of the site inspection checklist, is included as Attachment C to this report. A photographic log of the conditions observed during the site inspection is included as Attachment D to this report.

The site inspection was conducted by [redacted] and [redacted] of URS, under the escort of [redacted] of USACE. In general, the site inspection consisted of three parts:

1. Site indoctrination, safety briefing, and general site background provided by USACE.
2. Discussion of site inspection checklist items, including review of site documents, records, and procedures; and
3. Site, perimeter, and vicinity properties tour, inspection, and photographing.

Upon arriving at the site, URS was directed to the USACE field office where the site indoctrination was conducted by [redacted]. [redacted] reviewed the safety requirements at the site, discussed the USACE and Praxair policies and procedures, and provided URS with a basic overview of the site layout including illustrations using a site map.

The second phase of the site inspection was generally conducted using the site inspection checklist as a guide. For detailed documentation on the site inspection, refer to Attachments C and D. Some of the more notable discussions surrounding the checklist items consisted of:

- Site Health and Safety and Emergency Response Plan, in terms of the plan contents, location, and use at the site;
- Worker training documentation (radiation worker [Radworker] training, Hazardous Waste Operations and Emergency Response [HAZWOPER] training, etc);
- Preparation, storage location, and use of as-built drawings and confirmatory soil sample data;
- Effluent permitting and monitoring requirements, including sanitary sewer discharges and monitoring, stormwater discharge and monitoring, water pretreatment, air monitoring program and locations targeted,
- Site access by the public and Praxair, in terms of access to active excavation areas;
- Typical depth of excavations, backfill materials and procedures, etc; and
- Soil and waste management, stockpiling, runoff control, waste handling and disposal, and operations in Class 1 and Class 2 areas.

One notable discussion that occurred during the site indoctrination and interview was related to the discharge of excavation water to the Town of Tonawanda sanitary sewer system. USACE identified a permitted process by which excavation water is pumped from excavations to an above ground tank for particulate settlement. Excavation water was typically contained in the tank until pretreatment and discharge to the sewer. The pretreatment steps were described as air stripping and bag filtering. The effluent water was subsequently sampled and analyzed during discharge. This water management procedure was subsequently confirmed during the review of the "Site Operations Plan, Linde, Tonawanda FUSRAP Project," last revised April 2001. The Site Operations Plan describes the specifications for the filtering and air stripping of excavation water, and indicated that samples were to be collected at a frequency of one sample per 100,000 gallons of water discharged. The samples were to be analyzed for radiological constituents (suspended and dissolved Ra-226, uranium isotopes, and thorium isotopes), and volatile organic compounds, to ensure that the limitations set forth by the Town were being met. In addition, a sample is collected semiannually from the raw excavation water in the tank for analyses of radiological and priority pollutants. The analytical data were subsequently submitted to the Town of Tonawanda in accordance with the permit. URS reviewed a database containing radiological results from the excavation water (dated between April 2001 and August 2009) and self-monitoring reports to the Town of Tonawanda for the same time period. All results were in compliance with the limits referenced in the permit (i.e., the limits for releases to sewers from New York State Official Compilation of Codes, Rules, and Regulations (NYCRR), Title 6, part 380).

USACE described the air monitoring network of high-volume air samplers located around the perimeter of the site. Many of these air monitors were visually identified during the site inspection, and in general, the locations were consistent with the Section 5.9 of the Site Operations Plan. Based on discussions with USACE, these air monitors run 24 hours per day, and collect composite air samples, during the remedial action work. The high-volume air samplers were not running at the time of the inspection because the project is undergoing a change in remediation contracts and contractors. In addition, all remediation areas observed were found completely backfilled with imported crushed stone (or clean excavate). There were no visible signs of settlement, ponding, or erosion of the backfilled areas.

Per discussions with the USACE and review of the work plan documents, procedures are in place for setup of worksite air monitoring. The results of these air monitoring programs were not reviewed (only the perimeter data).

The perimeter fence was observed and was generally found to provide adequate restriction against intruder access to the remaining Class 1 areas (targeted for remediation). Several newly installed lengths of fence were also being constructed and some of the automatic gates were not yet installed (did not affect the site accessibility discussed above). A few of the completed excavation areas (FSS units 041, 045, and 074, for example) were conducted behind a site fence, but were reportedly not secured with an active gate (no active gate in place). However, public access to these areas would be unlikely due to the close proximity to the main guard house and the fact that these excavations were reportedly secured using high-visibility construction fencing or chain link fencing. In addition, signage to indicate the presence of the contamination and warn against unauthorized entry was placed around these areas.

There were no obvious signs of vandalism or trespassing observed during the site inspection. However, there was one discussion related to the theft of copper wire and other copper parts from an area onsite, within the perimeter fence. This event was portrayed as an isolated incident. Along the west side of the Praxair facility buildings, the two known site outfalls (Outfall 1 and Outfall 2) were observed.

Offsite areas on the east side of the site were also inspected. One facility in particular, the Mil-Sher Building, was thought to have been constructed following the plant operations, potentially in contaminated soil. A relatively large area of shallow subsurface contamination was removed from the lot surrounding the Mil-Sher Building (including the areas between the building and the CSX rail line). Contamination of this area is believed to have occurred as a result of rail loading/unloading operations associated with the MED activities. The contamination was reported to extend to areas immediately outside of the building, but remediation was stopped for fear of causing damage to the buildings foundation. The building area is identified as an area targeted for future remediation as shown on Figure V-2.

The site inspection continued back through the front gate of Praxair, and concluded back at the site remediation construction trailers.

Interviews

The purpose of the interviews was to obtain additional information about the remediation, from nearby public, business owners, school officials, Praxair operations and management personnel, Town of Tonawanda officials, and other stakeholder and active community groups (For A Clean Tonawanda Site [FACTS], and Coalition Against Nuclear Materials in Tonawanda [CANiT]). Parties were selected for interviews based on the following criteria:

- Individuals or businesses adjacent to the site or affected by site related contaminants;
- Public entities/agencies having stake in or affected by operation of the remedy;
- Interested and concerned citizens or citizen groups

There were two instances where the individual being interviewed asked to remain anonymous. These individuals were the nearby business owner and the representative from CANiT. Most interviews were conducted by telephone, with a few conducted face-to-face. The interviewed parties were as follows:

TABLE V-5. LIST OF INTERVIEWEES

Interviewee	*Affiliation*	*Format*	*Date*
[redacted]	NYSDEC	telephone	January 20, 2010
[redacted]	Praxair	in person	January 21, 2010
[redacted]	Praxair	in person	January 21, 2010
[redacted]	Nearby Business	in person	January 21, 2010
[redacted]	FACTS	telephone	January 25, 2010
[redacted]	CANiT	telephone	January 25, 2010
[redacted]	Grubb & Ellis	telephone	January 25, 2010
[redacted]	Town of Tonawanda	telephone	January 26, 2010
[redacted]	resident	telephone	January 27, 2010
[redacted]	Holmes Elementary	telephone	January 29, 2010

Summaries of the interviews are provided in Attachment E. Interviewees were asked general questions about their opinions relative to the site remediation, site operations, impacts on the surrounding businesses and public, concerns expressed by the surrounding community, and how well informed they felt regarding the project and progress. In closing, each interviewee was asked if they had any comment or suggestions for the continued implementation of the project.

Most of the comments were positive or neutral regarding the conduct of operations at the site. The few interviewees that rely on day-to-day cooperation from USACE (Praxair, Grubb & Ellis, NYSDEC) felt generally that the communication and responsiveness to comments and questions was adequate. Most other interviewees were neutral with regard to the site operations. The FACTS representative felt that the site was being mismanaged both now and in the past.

A comment that was common to several of the interviewed groups (NYSDEC, Praxair, Grubb & Ellis, FACTS) was that the parties disagreed with the cleanup criteria in the ROD (the level to which the cleanup was being performed). The comment was expressed in slightly different ways, but the overall comment made was that the current cleanup will allow contamination to remain onsite and offsite at levels that will not allow unrestricted future use of the land. In addition,

there was concern expressed by NYSDEC and Praxair that if Praxair were to undertake a construction project in a "Class 2 area" there would be a need for Health Physics support as well as personal protective equipment and procedures, due to the presence of radioactive contamination. In addition, there was a concern the material would need to be managed according to NYCRR Part 380, potentially causing Praxair to become a potentially responsible party (PRP).

Most of the interviewees provided comments on the communication channels used throughout the project. Both the Town of Tonawanda (Technical Support Department) and the representative from CANiT made reference to periodic (monthly/quarterly/semiannually) status meetings that USACE would initiate, and expressed an interest in having these meetings continue into the future.

The nearby business owner was generally not well informed on the project, but did not notice any impacts on the surrounding community (increased traffic, etc). Overall, he thought that the business is actually positively impacted by its proximity to Praxair.

Based on these interviews and comments provided, it may be beneficial to revisit the communication channels (possibly reinstating communications programs that have proved to work in the past), investigate web-based notifications and communications, and increase the volume and frequency of the Linde Site News mailings.

VI. TECHNICAL ASSESSMENT

Upon completion of the document review task, URS identified several changes in toxicological factors and regulatory interpretations from those incorporated in the risk assessment and ROD for the Linde Site. These changes were considered in performing the technical assessment and reviewing the protectiveness of the remedy. In implementing the technical assessment, the following steps were taken:

1. Evaluated impact of changes in the radiological and chemical risk factors used in the risk assessment. Chemical factors were listed in Tables 4-1 and 4-2 of the Baseline Risk Assessment. Dose factors from the Baseline Risk Assessment are listed in Table B-4, and the FS Addendum references use of RESRAD Version 5.6.1. This evaluation included consideration of the relative change of the toxicity of the contaminants.
2. The results of Final Status Surveys were compared against the surface soil remediation criteria set forth in the ROD - 5 pCi/g Ra-226, 14 pCi/g Th-230, and 554 pCi/g U_{total} - to determine whether the remedy is achieving the level of protectiveness set forth in the ROD. In addition, the results of post remediation subsurface samples were compared against the subsurface soil remediation criteria set forth in the ROD of 15 pCi/g Ra-226, 44 pCi/g Th-230, and 3,021 pCi/g U_{total}. The evaluation was performed to identify any sample results exceeding the SOR criteria. Those sample results were used as an indicator of which of the FSS units were examined more closely.
3. The results of Final Status Surveys were also compared against the average concentration (over 2000 m^2 and 3 m depth) of 60 pCi/g U_{total} residual level committed to by USACE.
4. A summary dose estimate was calculated based on the average concentrations across the site. The target dose rate for the ROD cleanup criteria was 8.8 mrem per year. In order to calculate this dose estimate, the average Sum of the Ratios for all FSS samples was multiplied by the target annual dose rate to produce an estimated residual dose rate. For example, with the average surface SOR found to be 0.07, then the estimated residual dose would be 0.6 mrem/yr (7% of 8.8 mrem).

During the evaluation, there were no changes in current or anticipated future land use identified for the Linde Site. This observation was subsequently confirmed during the interview with the Town of Tonawanda supervisor's office. During the interview with the town Technical Support group, the interviewee confirmed that the only known land use for the site was further development as a research campus under an industrial-use setting.

Question A: Is the remedy functioning as intended by the decision documents?

The remedy is currently being implemented. To date, it is functioning as intended.

Remedial Action Performance

The remedy selected in the ROD was for complete excavation of MED-contaminated soils containing radionuclides above guidelines and offsite disposal, and decontamination of the surfaces of structures exceeding guidelines. This is intended to remove sources of elevated levels

of radionuclides from the Linde Site, and thus does not involve active containment or long-term control.

The remediation of the Linde Site continues through excavation of contaminated soils and disposal of waste offsite. Post-remediation conditions have been verified through Final Status Surveys planned, implemented, and evaluated under MARSSIM guidance.

Reports for each FSS Unit completed to date indicate that the remediation has achieved the criteria specified in the ROD. The ROD does not identify any requirements for post remedial controls. The data also show that the average residual concentrations of the Total Uranium across the site are below the 60 pCi/g criteria committed to by USACE in response to comments on the ROD.

System Operations/Operation and Maintenance (O&M)

The remedy being implemented removes the contamination from the site, and does not include waste treatment as a primary component. The remedy does not directly involve operation and maintenance of any systems aimed at treatment of the soil. There are other secondary waste streams (air, excavation water, etc.) that may or may not be treated as appropriate. Note that analytical results for radionuclides in treated excavation water released to the Town of Tonawanda sewer system were all in compliance with permit limits. Therefore, system operations and maintenance are not relevant considerations in this review.

Opportunities for Optimization

The remedial design and implementation was based on site characterization data. Remediation activities are adjusted in the field to reflect “as found” conditions, including additional excavation and restoration when contaminants differ from the modeled configuration.

Early Indicators of Potential Issues

Excavation of contaminants has been successfully accomplished, and has been confirmed by final status surveys and sampling.

Implementation of Institutional Controls and Other Measures

The Linde Site currently consists of two ongoing activities: the FUSRAP remediation effort and the commercial operations of the site owner. USACE and the remediation contractor have implemented access controls for the areas undergoing remediation. Praxair, the owner, controls access to their facilities. These combined controls are adequate to protect the public from potential exposure to the contaminants during the remediation effort.

Ongoing progress on the remediation project continues to reduce the potential environmental threats.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection still valid?

Overall, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of remedy selection are still valid. There have been several slight changes, as discussed below that do not change the overall conclusions or decisions.

Changes in Standards and To-Be-Considered Requirements (TBCs)

In the ROD, USACE determined that the cleanup standards found in 40 CFR Part 192, the standards for cleanup of the uranium mill sites designated under UMTRCA and the NRC standards for decommissioning of licensed uranium and thorium mills, found in 10 CFR Part 40, Appendix A, Criterion 6(6), were relevant and appropriate for cleanup of MED-related contamination at the Linde Site. The major elements of this remedy, relevant to this review, involve excavation of the soils with COCs (radium, thorium and uranium) above the soil cleanup levels and placement of clean materials to meet the other criteria of 40 CFR 192. Compliance with these standards requires USACE to:

- Remove MED-related soil so that the concentrations of radium do not exceed background by more than 5 pCi/g in the top 15 cm of soil or 15 pCi/g in any 15 cm layer below the top layer, averaged over an area of 100 m^2.
- Control the releases of radon into the atmosphere resulting from the management of uranium byproduct materials so that they do not exceed an average release rate of 20 pCi/second per m^2 (pCi/sec-m^2);
- Removal of MED-related soils with residual radionuclide concentrations averaged over a 100-m^2 area that exceeds unity for the sum of the ratios of these radionuclide

concentrations to the associated concentration limits, above background, of 554 pCi/g for U_{total}, 5 pCi/g for Ra-226 and 14 pCi/g for Th-230 for surface cleanups and 3,021 pCi/g of U_{total}, 15 pCi/g of Ra-226 and 44 pCi/g of Th-230 for subsurface cleanups; and

- Removal of MED-related residual radioactive materials from surfaces necessary to meet the benchmark dose for surfaces of 8.8 mrem/yr based on the specific location of the surfaces and exposure scenarios.

The Administrative Record for the Linde Site, in the Proposed Plan, had indicated that a total uranium limit of 600 pCi/g above background would be established for the site. The ROD noted that the basis for this separate requirement in the proposed plan for a site-specific uranium criterion was overtaken with the promulgation of an amendment to 10 CFR Part 40, Appendix A, Criterion 6(6) in June 1999, which established a dose equivalent basis for determining residual criteria. For Linde, those criteria are set forth in the third bullet above.

The underlying standards for the ARARs – 40 CFR 192 (UMTRCA) and 10 CFR 40 Appendix A (Source Material Waste Management) – have not changed since the ROD was finalized. The cleanup criteria are thus consistent with the existing ARARs identified in the ROD.

Separate from the ARAR-based criteria, USACE committed to ensuring that the remaining soils will not exceed an average of 60 pCi/g of U_{total}, as measured over a volume of soil 2,000 m^2 by 3 m thick. This value is consistent with criteria set forth in a letter from USEPA to USACE-Buffalo District on January 12, 2000, suggesting that final residual values should conform to limits of 5 pCi/g for Ra-226, 5 pCi/g for Th-230, and 60 pCi/g of U_{total}, regardless of depth. NYSDEC indicated in a subsequent letter to USACE (February 18, 2000) that they would evaluate any FSS reports for remediation against the criteria listed by EPA.

Changes in Exposure Pathways

Land use on or near the site has not changed from the industrial use considered in the ROD. Praxair continues to be the owner and occupier of the site, with ongoing commercial activities.

Conditions on and near the Linde Site have not changed the human health or ecological routes of exposure or receptors in a way that could affect the protectiveness of the remedy. The construction activities that have necessarily disturbed the contaminated soils during the remediation were anticipated, monitoring has been carried out, and potential impacts from dispersion have been mitigated through engineering controls.

As is common during removal actions such as the Linde remediation, the location and extent of contamination does not exactly match the model predictions from site characterization. The remediation project has managed this using the common approach of using in-process radiation surveys and sampling to identify contaminated soils uncovered during the excavation and to continue the excavation until the residual soils meet the cleanup criteria.

Since the remedial action involves removal of the contaminated materials, there are no unanticipated toxic byproducts being generated.

Contamination is being removed and transported offsite. While physical site conditions have not changed other than from the remedial activities, any such changes would not affect the protectiveness of the remedy.

Changes in Toxicity and Other Contaminant Characteristics

The Baseline Risk Assessment estimated risks from exposure to radioactive contaminants following EPA (EPA 1989) recommendations. This involves a two-step process wherein an annual radiation dose to the individual due to the concentration of radionuclide in the soil is calculated using radionuclide-specific DCFs. The risk associated with this radiation dose is then calculated through multiplication by a dose-to-risk coefficient, similar to the chemical risk calculated by the contaminant uptake multiplied by a slope factor.

The BRA used the RESRAD computer code, version 4.7 (Yu, 1991) to model radiological doses. The exposure scenario was an adult occupational worker exposed to each of the radioactive contaminants and their decay progeny, including the inhalation of radon progeny. The radiation doses estimated in the BRA are evaluated for a one-year exposure, expressed in units of mrem/yr, for all exposure routes.

For this BRA, a population-weighted average risk coefficient of 6E-07/mrem was used to estimate the likelihood of cancer induction from the calculated radiation dose. EPA used this risk coefficient for radionuclides (EPA 1989), and for the BRA it was believed to be representative of conditions anticipated for the exposure scenarios at the Linde Site.

The BRA determined that the direct gamma irradiation contribution to Linde employees ranges from 45 percent of the total radiological risk for mean conditions at one location (Subarea B in the BRA) to 88 percent for the reasonable maximum exposure (RME) conditions at another location (Subarea A in the BRA). The majority of the remainder of the employee risk is derived from the radon exposure pathway. The particulate inhalation and ingestion pathways contribute

an insignificant amount to overall radiological risk. As such, the discussion below highlights any changes in the risk resulting from changes in DCFs and risk factors in the direct exposure pathway.

Table VI-1 shows the variation in DCF values between those used in the RESRAD version 4.7 (used in the BRA) and those in the current version, RESRAD 6.5 (RESRAD, 2001). The DCF values in the current RESRAD are based on updated values published by the EPA in Federal Guidance Report No. 12 (FGR-12), dated 1993.

TABLE VI-1. CHANGES IN RADIATION DOSE CONVERSION FACTORS

	Direct Radiation (mrem/yr) / (pCi/cm^3)			
Radionuclide	BRA	FGR-12	Change	%Change
Th-232	6.04E-04	2.9E-04	-3.1E-04	-52.1%
Ra-228 + D	4.51E+00	3.3E+00	-1.2E+00	-26.3%
Th-228 + D	7.36E+00	5.7E+00	-1.7E+00	-23.0%
U-238 + D	6.97E-02	7.6E-02	6.4E-03	9.2%
U-234	6.97E-04	2.2E-04	-4.7E-04	-68.0%
Th-230	1.03E-03	6.7E-04	-3.6E-04	-34.7%
Ra-226 + D	8.56E+00	6.2E+00	-2.3E+00	-27.3%
Lead-210 + D	2.31E-03	3.4E-03	1.1E-03	45.5%
U-235 + D	4.9E-01	4.2E-01	-6.9E-02	-14.2%
Pa-231	1.21E-01	1.1E-01	-1.5E-02	-12.3%
Ac-227 + D	1.52E+00	1.1E+00	-4.0E-01	-26.5%

NOTE: BRA is baseline Risk Assessment for the Tonawanda Site, 1993
FGR-12 is USEPA Federal Guidance Report No. 12, 1993
"+ D" indicates that decay progeny are included in the values

The table indicates that with updated EPA guidance most DCF values have decreased (from -12% to -52%) except for increases for U-238+D (~10%) and for lead-210 (Pb-210)+D (~50%). Generally, these differences are within the uncertainty of transport and uptake portions of dose or risk modeling and, therefore, do not invalidate the previous calculations. Changes to the DCFs are not sufficient in magnitude to invalidate the conclusion that remedial action is warranted.

With respect to any changes in the risk coefficient, EPA has produced updated radionuclide and scenario-specific risk coefficients (FGR-13). The use of this extensive set of risk coefficients would be applied if the BRA were to be performed to current standards. However, the Interagency Steering Committee on Radiation Standards (ISCORS) indicates it is appropriate to still use a single risk coefficient conversion to make a general qualitative statement about the risk associated with dose (such as in this review). For this situation a cancer morbidity risk coefficient of 8E-07/mrem is recommended for the population-weighted average. The DOE has

indicated that for a worker population the single morbidity risk coefficient could be addressed as 7E-07/mrem (DOE), but that within the uncertainties in the risk estimates, either 8E-07/mrem or 7E-07/mrem could be used for workers. The updated values are approximately 33% higher (ISCORS) or 16% higher (DOE). These slight increases are within the uncertainty of transport and uptake portions of dose or risk modeling and, therefore, do not invalidate the previous calculations nor the conclusion that remedial action is warranted.

Prior to finalizing the ROD the potential radiological exposure and risk estimates for radionuclide contaminants in the BRA were updated in a Site Radiological Assessment (USACE, 2000). The Site Radiological Assessment (SRA) used the RESRAD computer code, version 5.82 (Yu, 1993) to model radiological doses. The exposure scenario was an adult occupational worker for the full year or a construction worker for a partial year exposed to each of the radioactive contaminants and their decay progeny. Because of uncertainties in the hypothetical building occupied at some point in the future, the SRA did not include the inhalation of radon progeny, which was included in the BRA. The dose rates and risks were calculated for unit contaminant concentrations (1 pCi/g) for each of the COCs, allowing for calculation of cleanup goals for a range of risk and dose endpoints covering a range of potential cleanup alternatives.

RESRAD version 5.82 used in the SRA provided updated libraries of DCFs and risk slope factors from those used in the BRA. In version 5.82 the DCFs were based on FRG-12 and the risk slope factors incorporated the radionuclide and scenario-specific risk coefficients of FGR-13, rather than the single risk value used previously. While there have been slight radionuclide-specific changes to these DCFs (for instance the external DCF value for U-238+D changed from 0.137 to 0.152 or +11% in 2002), the risk factors of FGR-13 have not been updated since the SRA was performed. Overall the methods and values used in the SRA are those that are current today, and the risk estimates presented in Table B-3 of the SRA would still be appropriate. There is no basis to change the conclusion that remedial action at the Linde Site is warranted.

Based on only slight changes in the radiological dose and risk assessment results, changes in knowledge about toxicity for radiological contaminants at the Linde Site do not suggest any change in the analyses demonstrating compliance with the ARARs.

Changes in Chemical Toxicity Factors

The Baseline Risk Assessment evaluated risks from chemical carcinogens and non-carcinogens based on data from the Integrated Risk Information System (IRIS, 1992). Some of the toxicity factors for chemicals considered in the BRA have been modified, which can affect the estimated carcinogenic risk and non-carcinogenic Hazard Quotient. Cancer risk is estimated by multiplying the average uptake of a contaminant, in milligrams of contaminant per kilogram of body weight per day (mg/kg/day), by the slope factor for that contaminant. Acceptable incremental risk levels for CERCLA sites are usually between 1E-06 and 1E-04. Non-carcinogenic risk from a contaminant is estimated with a Hazard Quotient, found by dividing the average uptake of the contaminant by the Reference Dose (RfD), which is the threshold amount for negative impacts from that substance. A Hazard Quotient of one indicates that the exposure could cause unacceptable impacts. Summing the Hazard Quotients for all contaminants gives the Hazard Index, which can similarly be compared to unity to determine if the cumulative impacts are unacceptable.

Tables VI-2 and VI-3 show the variation between the 1992 toxicity values and the 2009 values, summarized in the EPA Region IX Regional Screening Table, for carcinogenic and non-carcinogenic impacts, respectively. All Reference Dose values from EPA Region IX are from the IRIS except Dibenzofuran, which EPA obtained form the Provisional Peer Reviewed Toxicity Value (PPRTV) Appendix. Slope factors for carcinogens arsenic and Bis(2-ethylhexyl)phthalate in Table VI-2 are from IRIS. Slope factors for Benzo(k)fluoranthene, Chrysene, and Indeno(1,2,3-c,d)pyrene are from EPA's Environmental Criteria and Assessment Office.

The dominant pathway for chemical exposure at the Linde Site was shown in the BRA to be through soil ingestion. As listed in Table 5-2 of the BRA, the RME risk for an employee was estimated to be 8E-05. As shown in Table VI-2, the current risk estimate is less than that from the BRA. This is mostly due to variations in the slope factors for some of the polycyclic aromatic hydrocarbons (PAHs).

TABLE VI-2. CHANGES IN CHEMICAL CARCINOGENIC TOXICITY VALUES

	ORAL SLOPE FACTOR		UPTAKE	RISK		CHANGE
	BRA	EPA 2009	BRA	CURRENT	BRA	
	1/(mg/kg/day)		(mg/kg/day)			
Benzo(k)fluoranthene	7.3	0.073	9.10E-08	6.64E-09	6.64E-07	-6.58E-07
Chrysene	7.3	0.0073	1.29E-07	9.42E-10	9.42E-07	-9.41E-07
Indeno(1,2,3-c,d)pyrene	7.3	0.73	7.30E-08	5.33E-08	5.33E-07	-4.80E-07
Bis(2-ethylhexyl)phthalate	7	0.014	3.37E-08	4.72E-10	2.36E-07	-2.35E-07
Arsenic	1.75	1.5	9.14E-06	1.37E-05	1.60E-05	-2.29E-06
TOTAL				1.38E-05	1.84E-05	-4.60E-06

The RME Hazard Index was estimated at 0.3 in the BRA (Table 5-3) for an employee. Changes in the RfDs for non-carcinogenic impacts suggest a small increase in the cumulative Hazard Index of about 0.015, mostly due to the impact of manganese. This would result in a slight increase in the overall Hazard Index, but it would still be well below one.

TABLE VI-3. CHANGES IN CHEMICAL NON-CARCINOGENIC TOXICITY VALUES

	ORAL RfD		UPTAKE	HAZARD QUOTIENT		CHANGE
	BRA	EPA 2009	BRA	CURRENT	BRA	
	(mg/kg/day)		(mg/kg/day)			
Naphthalene	0.04	0.02	7.05E-08	3.53E-06	1.76E-06	1.76E-06
Dibenzofuran	0.004	0.001	7.22E-08	7.22E-05	1.81E-05	5.42E-05
Acetone	0.1	0.9	1.94E-08	2.16E-08	1.94E-07	-1.72E-07
Toluene	0.2	0.08	1.64E-09	2.05E-08	8.20E-09	1.23E-08
Barium	0.07	0.2	7.51E-05	3.76E-04	1.07E-03	-6.97E-04
Berylium	0.005	0.002	1.07E-06	5.35E-04	2.14E-04	3.21E-04
Manganese	0.1	0.024	4.90E-04	2.04E-02	4.90E-03	1.55E-02
TOTAL				2.14E-02	6.21E-03	1.52E-02

Based on the slight changes in the chemical risk results, changes in knowledge about toxicity for chemical contaminants at the Linde Site do not suggest any change in the protectiveness of the remedy. Using current chemical toxicity factors, the concentrations found in previous site investigation results would not result in the identification of any chemical contaminants of concern.

Changes in Risk Assessment Methods

The basis for the Linde ROD criteria is the 5 pCi/g limit on the Ra-226 concentration identified in the ARARs (40 CFR 192). This limit was translated to limits on Th-230 and U_{total} using the radiological dose assessment program RESRAD. While new versions have been developed, from Version 5.0 in 1993 to the current Version 6.5, the changes generally relate to selection of exposure factors, modeling improvements, or improvements in the user interface. The methods

for considering potential exposure mechanisms have not changed in a manner significant to evaluating protectiveness of the remedy.

Expected Progress Towards Meeting RAOs

The Remedial Action Objectives can be summarized in two steps. The ROD criteria are the primary consideration for evaluation through the FSS process, and provide separate levels for surface and subsurface soils. Separately, USACE committed during comment responses to meet a Total Uranium concentration of 60 pCi/g averaged over an area of 2000 m^2 to a depth of 3m. Table VI-4 shows the different criteria. The associated background concentrations from the Risk Assessment are also listed.

TABLE VI-4. LINDE SITE CLEANUP CRITERIA

ISOTOPE	ROD		TOTAL URANIUM	BACKGROUND
	SURFACE	SUBSURFACE		
Ra-226	5	15		1.1
Th-230	14	44		1.4
Total U	554	3021	60	6.1
U-238	262	1429	28.4	3.1

U-238 is surrogate for Total U
All concentrations in pCi/g

All FSS reports completed to date suggest that the remediation is achieving the ROD criteria. However, in addition to the FSS report review, a complete review of the Linde Site sample database was performed to further assess the remediation protectiveness. The database contained sample results from the remediation activities and was maintained by USACE and the remediation contractor. Analytical results from this database were parsed to retrieve only FSS sample results and post-remediation soil samples from the survey units. Also retrieved were analytical evaluations of the data against the various cleanup criteria. A number of calculations are performed in the database to assist in evaluating the overall data. This review used the following relevant comparisons from the database:

SOR Surface – Calculates the Sum of the Ratios for the Ra-226, Th-230, and U-238 results against the ROD surface criteria of 5 pCi/g, 14 pCi/g, and 262 pCi/g, respectively. The U-238 is used as a surrogate for the total uranium limit of 554 pCi/g, assuming natural uranium isotopic mix. The ratio for each isotope is net of background.

SOR Subsurface – Calculates the Sum of the Ratios for the Ra-226, Th-230, and U-238 results against the ROD subsurface criteria of 15 pCi/g, 44 pCi/g, and 1429 pCi/g, respectively. The U-

238 is used as a surrogate for the total uranium limit of 3021 pCi/g, assuming natural uranium isotopic mix. The ratio for each isotope is net of background.

Table VI-5 provides a data summary for each survey unit, listing the mean concentration for each of the three key isotopes and Total Uranium in that survey unit, the calculated SOR values against the ROD Surface and Subsurface Criteria (for surface and subsurface samples, respectively), and the maximum concentration of Total Uranium measured in that Survey Unit. This table considers all of the data points included in the sample database that were tagged with the sample identifier "FS," "FSS," or "FSSU" within the sample number or location. These samples included samples that occurred prior to the final status survey reports for certain areas, as well as samples that occurred following completion and closure of certain FSSUs. Discussion of unusual results is presented after the table.

TABLE VI-5. SUMMARY OF SURVEY UNIT RESULTS							
	AVERAGE CONCENTRATIONS IN SURVEY UNIT				MAXIMUM VALUES IN SURVEY UNIT		
SURVEY UNIT	Ra-226 (pCi/g)	Th-230 (pCi/g)	U-238 (pCi/g)	Total Uranium (pCi/g)	ROD Subsurface SOR (Net of BG)	ROD Surface SOR (Net of BG)	Total Uranium (pCi/g)
1	0.7	1.1	1.0	2.1	0.0	0.0	3.7
2	0.8	2.7	5.1	10.9	0.6	0.5	122.1
3	1.1	2.3	3.6	7.7	0.4		41.8
4	1.1	1.1	1.0	2.1	0.1	0.1	6.3
5	0.4	1.7	1.7	3.5	0.0	0.2	13.1
6	0.5	1.7	3.1	6.5	0.1		41.3
7	0.6	1.3	1.6	3.3	0.0		9.5
8	0.8	1.7	1.8	3.8	0.1		10.4
9	0.8	1.7	2.1	4.5	0.1		10.1
10	0.7	2.0	1.9	4.0	0.2		12.1
11	0.7	1.9	2.0	4.3	0.2		12.8
12	0.6	1.4	3.3	6.9	0.2		30.0
13	0.4	1.4	2.0	4.1	0.0		32.8
14	0.7	1.5	1.2	2.5	0.1		5.1
15	1.4	1.8	4.4	9.3		0.7	91.7
16	1.6	1.4	1.1	2.4	0.2		4.1
17	1.3	1.3	0.9	1.9	0.0		2.8
18	0.3	1.2	2.3	4.9	0.0		40.0
19	0.9	1.1	1.6	3.4	0.0		23.7
20	0.8	1.3	0.9	1.9	0.0		2.5
21	1.2	2.7	2.1	4.5	0.5	0.4	14.0
22	1.7	3.8	3.3	7.0	0.5		18.2
23	1.1	1.5	1.9	3.9	0.1		10.9
24	1.1	1.2	1.0	2.0	0.1		3.8
25	2.2	2.5	2.7	5.7	0.6	0.6	17.0
26	1.2	1.3	1.0	2.1	0.1		5.0
27	1.0	1.1	0.9	1.9	0.0		3.0
28	1.1	1.3	1.3	2.7	0.0		16.4
29	1.3	1.6	1.1	2.3		0.2	3.7
30	1.2	1.7	1.1	2.4	0.1		3.6
31	1.1	1.3	0.9	1.8	0.0		2.3
32	1.3	1.4	0.9	2.0		0.1	2.6
33	0.8	1.2	0.6	1.3	0.0		1.8
34	1.1	1.4	1.0	2.0	0.1		6.3
35	1.0	1.1	1.1	2.4	0.1		11.4
36	1.4	2.4	1.2	2.5	0.1		4.1
37	1.0	1.6	0.8	1.7	0.1		2.4
38	0.9	1.1	0.9	2.0	0.0		3.4
39	0.9	1.2	1.0	2.0	0.0		3.5
40	0.9	1.3	4.1	8.7	0.0		97.2
41	1.2	1.2	1.4	3.0	0.1		15.6
42	1.0	1.1	0.9	1.9	0.1		3.2
43	0.9	1.2	1.0	2.0	0.0		2.8
44	1.1	1.3	1.1	2.2	0.0		4.1
45	1.2	1.4	1.5	3.3	0.1		16.5
46	0.9	1.1	0.9	1.9	0.0		2.3
47	1.0	1.1	0.9	2.0	0.0		3.7
48	0.6	1.0	0.9	1.9	0.0		2.8
49	0.7	1.1	1.3	2.7	0.0		9.0
50	0.4	0.9	0.9	1.8			2.6

TABLE VI-5. SUMMARY OF SURVEY UNIT RESULTS							
	AVERAGE CONCENTRATIONS IN SURVEY UNIT				MAXIMUM VALUES IN SURVEY UNIT		
SURVEY UNIT	Ra-226 (pCi/g)	Th-230 (pCi/g)	U-238 (pCi/g)	Total Uranium (pCi/g)	ROD Subsurface SOR (Net of BG)	ROD Surface SOR (Net of BG)	Total Uranium (pCi/g)
51	0.8	0.9	0.8	1.6	0.0		2.1
52	0.9	1.2	1.7	3.5	0.2		16.5
53	0.9	0.9	1.1	2.4	0.0		5.9
54	0.9	1.4	1.7	3.7	0.2		12.4
55	0.8	1.1	1.1	2.3	0.0		5.6
56	1.0	1.1	1.2	2.5		0.1	5.2
57	1.1	1.0	0.9	2.0	0.0		2.5
58	1.0	0.9	0.8	1.7	0.0		2.4
59	0.9	0.9	0.7	1.6	0.0		2.7
60	1.2	1.0	1.0	2.1	0.1		6.0
61	1.0	1.0	1.0	2.1	0.0		3.8
62	1.0	1.2	0.9	1.8	0.1		2.9
63	1.2	1.2	1.1	2.4	0.1		7.8
64	1.1	0.9	0.8	1.7	0.1		3.8
65	1.4	1.3	1.5	3.2	0.1		6.9
66	1.5	1.1	0.9	2.0	0.2		2.9
67	1.0	0.9	1.4	2.9	0.0		6.9
68	1.3	3.0	5.3	11.1	0.3		39.3
69	1.3	1.8	1.2	2.5		0.2	4.1
70	1.2	1.6	1.3	2.7		0.3	4.5
71	1.2	1.7	0.9	1.8	0.1		2.6
72	1.1	1.7	1.8	3.8	0.1		16.5
73	1.2	1.2	1.0	2.0	0.1		2.7
74	1.1	1.0	1.0	2.1	0.1		6.9
75	1.4	1.1	1.8	3.8	0.1		13.7
76	1.2	1.1	1.0	2.1	0.0		2.8
77	1.6	1.3	1.0	2.1	0.2		2.8
78	1.3	1.1	1.0	2.2	0.1		8.6
79	1.2	1.0	1.0	2.1	0.0		2.6
80	1.2	1.0	0.8	1.6	0.0		2.4
81	1.3	1.4	1.4	3.1	0.2		10.7
82	1.3	1.1	1.0	2.1	0.1		3.4
83	0.9	0.8	0.8	1.7	0.1		2.6
84	0.9	1.1	1.0	2.0	0.0		2.2
85	0.8	0.9	0.8	1.7	0.0		2.1
86	0.5	0.6	0.9	2.0	0.0		2.6
88	1.0	1.1	2.4	5.1	0.1		29.8
89	1.1	1.5	2.5	5.4		0.4	22.8
90	0.9	1.5	1.2	2.5		0.2	4.6
91	1.1	1.4	1.3	2.7		0.4	7.1
92	1.2	1.4	1.3	2.8		0.2	13.7
94	0.9	1.2	0.9	1.9	0.1		5.2
95	1.0	1.3	1.2	2.5	0.2		7.6
97	0.6	0.8	0.8	1.6	0.0		2.0
98	0.9	0.8	0.9	1.8	0.0		2.8
Maximum	**2.2**	**3.8**	**5.3**	**11.1**	**0.6**	**0.7**	**122.1**

Overall, the mean results for each of the completed FSSUs met the relevant ROD SOR criteria. More specifically, each sample had a relevant SOR less than unity, meaning that all locations met the ROD criteria individually.

A total of four samples had a Total Uranium concentration in excess of 60 pCi/g, with the highest result being 122 pCi/g at B14-FSSU02-07. As shown in the Table VI-5, all Survey Units have an average Total Uranium concentration well below the 60 pCi/g target level. The maximum average concentration is 11.1 pCi/g in Survey Unit 68.

Table VI-6 summarizes the sampling data according to surface or subsurface samples across all survey units.

TABLE VI-6. AVERAGE CONDITIONS ACROSS ALL SURVEY UNITS

	MEAN RESULTS FOR STRATA						
STRATA	# Samples	Ra-226	Th-230	U-238	ROD Surface SOR (Net of BG)	ROD Subsurface SOR (Net of BG)	Total U
Subsurface	1068	1.03	1.44	1.65		0.02	3.50
Surface	275	1.02	1.67	1.84	0.07		3.89
ALL	1343	1.03	1.03	1.69	0.07	0.02	3.58

Note: Concentrations in pCi/g

Based on the average results across all survey units, the remedy is achieving the protective levels set forth in the ROD. The mean of all surface samples collected from the FSSUs is about 7% of the ROD criteria for surface soils. Based on the risk assessment supporting the ROD, the clean-up levels correspond to an annual dose of 8.8 mrem to a future site worker. With actual residual levels at about 7% of the surface criteria (on average), a conservative estimate of the potential dose is 0.6 mrem per year.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

Newly Identified Ecological Risks

The Linde Site was a developed commercial property prior to selection and implementation of the removal remedy. As stated in the Risk Assessment (1993), the site provides minimal urban wildlife habitat, supporting only cosmopolitan species of birds and small mammals. Restoration

of the site after excavation of the contaminated soils is consistent with maintaining this type of habitat.

Impacts from Natural Disasters

The Linde Site has not been subject to any natural disasters during the remediation activities.

Other Information Affecting Protectiveness

The remediation is occurring on a developed, active industrial facility. Contamination has been found adjacent to and beneath some structures, necessitating some excavation in those areas. This has required structural analysis and engineering to assure stability in the area, such as described in the FSS Report for Building 31 in Survey Unit 2. While this does not reflect on the overall protectiveness of the remedy, the circumstances for each structure affected by nearby contamination must be individually evaluated to assure overall physical site safety during and after the remedial activities.

Technical Assessment Summary

The removal of contaminated soil has achieved the cleanup criteria specified in the ROD for all the survey units completed to date.

This review identified some changes in radiological and chemical toxicological factors and determined they would not have a significant effect on determining the remediation goals.

Standards established in Applicable or Relevant and Appropriate regulations have not changed since the ROD was finalized. Site characteristics and environmental factors are consistent with the basis for the ROD.

VII. ISSUES

There were two key issues that were either identified by multiple individuals during the interviews or discovered during the five-year review process:

- Communication - identified by several individuals as an area that should be improved.
- Cleanup Criteria – identified mainly by stakeholders with significant interest in the project (Praxair, NYSDEC, FACTS) as the primary issue with the remediation.

Communication

One focus under CERCLA is to ensure that citizens living near remediation sites are given the opportunity to influence cleanup decisions affecting their community, and that they can voice concerns throughout the cleanup process. Soliciting input from citizens living near remediation sites provides the lead agency with valuable information for selecting and implementing appropriate remedies. Community involvement also allows potentially affected citizens, interested parties, organized citizen groups, and elected officials to engage in meaningful dialogue with the lead agency implementing the remedy. This two-way communication ensures public concerns are accounted for when final remedy selection decisions are made, guarantees meaningful local participation, and forms the basis for building trust and lead agency credibility.

The USACE believes that commitments for community involvement were met during the decision-making process for the Linde Site. The Corps recognizes that some of the interviewees expressed concerns about public involvement and communications during the remediation process. As discussed in the recommendations that follow, USACE will review the interview substance related to public involvement and will consider corrective actions if needed.

During this Five-Year Review, a Community Relations Plan (CRP) specific to the Linde Site was not identified or reviewed to assess compliance. Ultimately, the level of protectiveness of the remediation (at this point) is not impacted by the level or effectiveness of communication.

Cleanup Criteria

The cleanup criteria that are contained in the ROD and therefore recognized as the primary goals for remediation of the site, were the subject of numerous comments during the interviews. Although the ROD criteria are not an issue that can be resolved in the five-year review process, they are recognized as an issue to the public and certain stakeholders. In terms of protectiveness,

the determination of how protective the remedy is was measured primarily against the ROD criteria. The protectiveness determination is now and will be in the future primarily measured against the ROD criteria, as well as any changes to those criteria that may have occurred to date. The ROD criteria were determined to be protective for the identified industrial use of the site. Evaluation against alternative criteria reflects some consideration of other site models. Refer to Section VI for detailed discussions on the remedy protectiveness determination. This issue is not addressed in the Recommendations Section.

VIII. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

A recommendation for the remedy going forward is improvement of outside communications, primarily between the USACE, the public, local interest groups, and the local governments. However it should be noted that there is no legal requirement for further opportunities for public comment and the five-year review does not necessarily require a review of the CRP. Specific actions recommended for improving public awareness are as follows:

- Review the content of the Five-year review interviews related to public awareness and communications, and consider corrective actions if needed;
- Review and update the public mailing lists on a more frequent (annual) basis.

Table VIII-1 provides suggested responsibility and schedule for completion of the recommended actions.

TABLE VIII-1. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
1	Improve Community Awareness and Offsite Communications	Community Involvement Coordinator	USACE		N	N

IX. PROTECTIVENESS STATEMENT

There were two key components to determining the remedy protectiveness. The first component was to determine whether the remedy is currently meeting the ROD criteria for soil cleanup. In summary, for all individual final status survey samples (as well as the mean [average] of sample results), in addition to soil samples collected in these units after final status surveys had been completed, the sum of ratios calculations indicated values less than 1.0 (based on the ROD subsurface cleanup criteria). The second component in determining remedy protectiveness was to determine whether the active construction process is protective in terms of air and water quality (discharges). Air samples were analyzed for Ra-226, Th-230, and the uranium isotopes U-234, U-235, and U-238. As shown in Table V-4, results from perimeter air monitoring samples were consistent with results from background ambient air. Water discharges from excavations to the Town of Tonawanda sanitary sewer system were managed in accordance with Industrial Sewer Connection Permit Number 513-S. After pretreatment (e.g., bag filtering and air stripping) water samples were collected and analyzed for total and soluble concentrations of isotopic uranium, isotopic thorium, and Ra-226, as well as for volatile organic compounds. Self-monitoring reports were submitted to the Town of Tonawanda Wastewater Treatment Facility for every 100,000 gallons (approximate) of water released to the sewer system. Radiological measurements were all below the permit-required limits for releases to sewers, as specified in 6 NYCRR part 380.

The remedy at the Linde Site, Soils Operable Unit, is expected to be protective of human health and the environment upon completion, and in the interim, exposure pathways that could result in unacceptable risk are being controlled.

X. NEXT REVIEW

Remediation of the Linde Site is ongoing. The next five-year review will be due in August 2015.

XI. REFERENCES

Argonne National Laboratory. 2001. *User's Manual for RESRAD Version 6, ANL/EAD-4.* Argonne, IL. July.

Interagency Steering Committee on Radiation Standards (ISCORS). 2002. *A Method for Estimating Radiation Risk from TEDE, Report No. 1.* Washington, DC. July.

United States Army Corps of Engineers (USACE). 2009. *Scope of Work for Five-Year CERCLA Review of Linde FUSRAP Site*. Buffalo, New York. April.

USACE. 2010. *Email from* [redacted] *to* [redacted] *dated February 12, 2010.* Buffalo, New York. February.

USACE, 2000. *Technical Memorandum: Linde Site Radiological Assessment*. Buffalo, NY. February.

United States Department of Defense (DOD), et al. 2000. *Multi Agency Radiation Survey and Site Investigation Manual (MARSSIM), Rev. 1 NUREG-1575, EPA-402-R-97-016, DOE/EH-0774.* Washington, DC. August.

United States Department of Energy (US DOE), Office of Environmental Policy and Guidance. 2002. *Radiation Risk Estimation from Total Effective Dose Equivalents, Memo: EH-412.* Washington, DC. August.

United States Environmental Protection Agency (US EPA), Office of Radiation Programs. 1989. *Risk Assessment Methodology, Environmental Impact Statement, NESHAPS for Radionuclides, Background Information Document - Volume I, EPA/5201-89-005.* September.

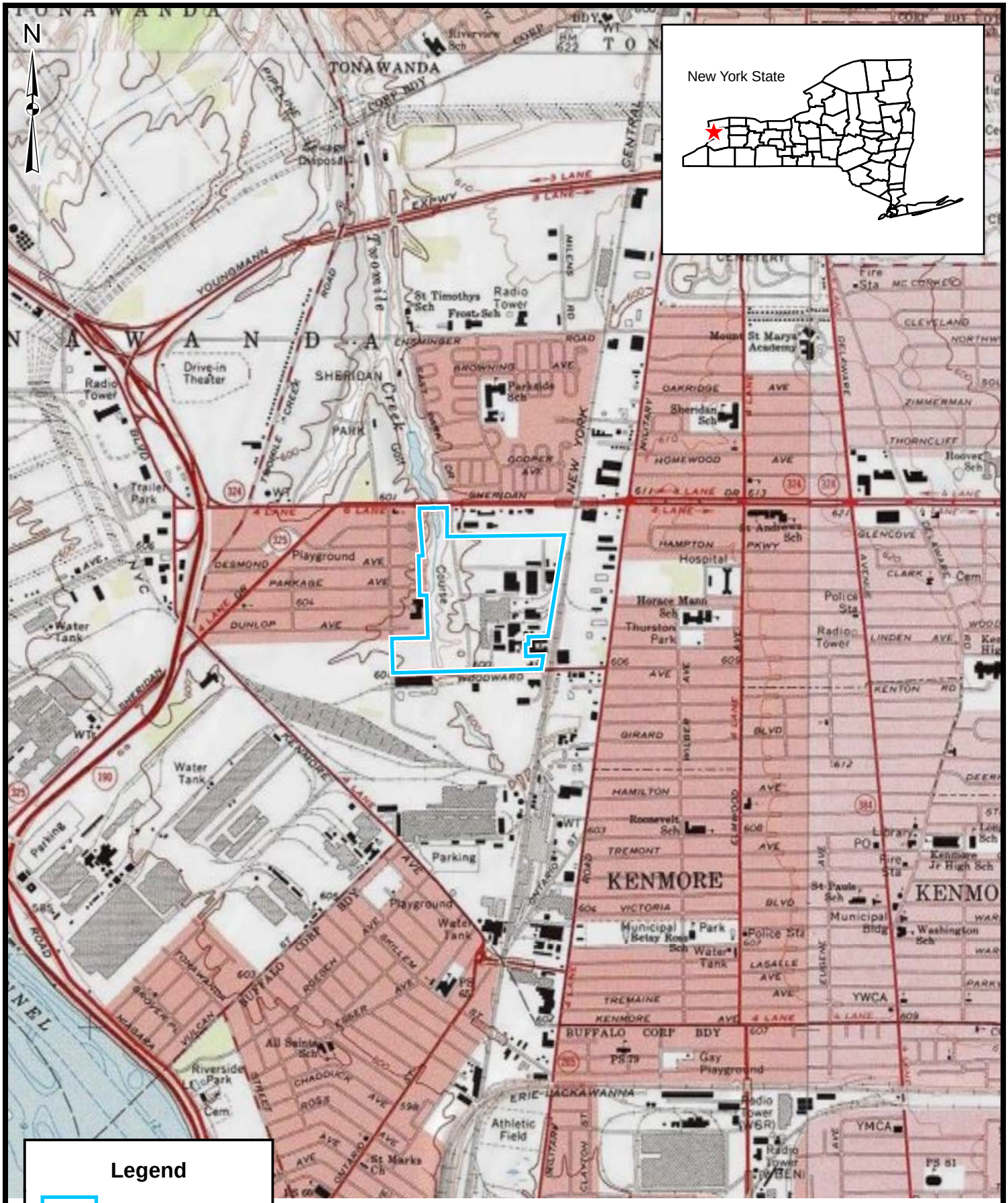
US EPA. 1999. *Cancer Risk Coefficients for Environmental Exposure to Radionuclides, Federal Guidance Report No. 13, EPA 402-R-99-001.* Washington, DC. September.

US EPA Office of Emergency and Remedial Response. 2001. *Comprehensive Five-Year Review Guidance, EPA 540-R-01-007.* Washington, DC. June.

Yu, C., Argonne National Laboratory. 1991. *Draft "User's Guide for RESRAD."* Argonne, IL. October.

Yu, C., A.J. Zielen, L. Cheng, et al. Argonne National Laboratory. 1993. *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0,* ANL/EAD/LD-2, Argonne, IL. September.

FIGURES



LINDE SITE
TONAWANDA, NY
SITE LOCATION MAP

FIGURE II-1

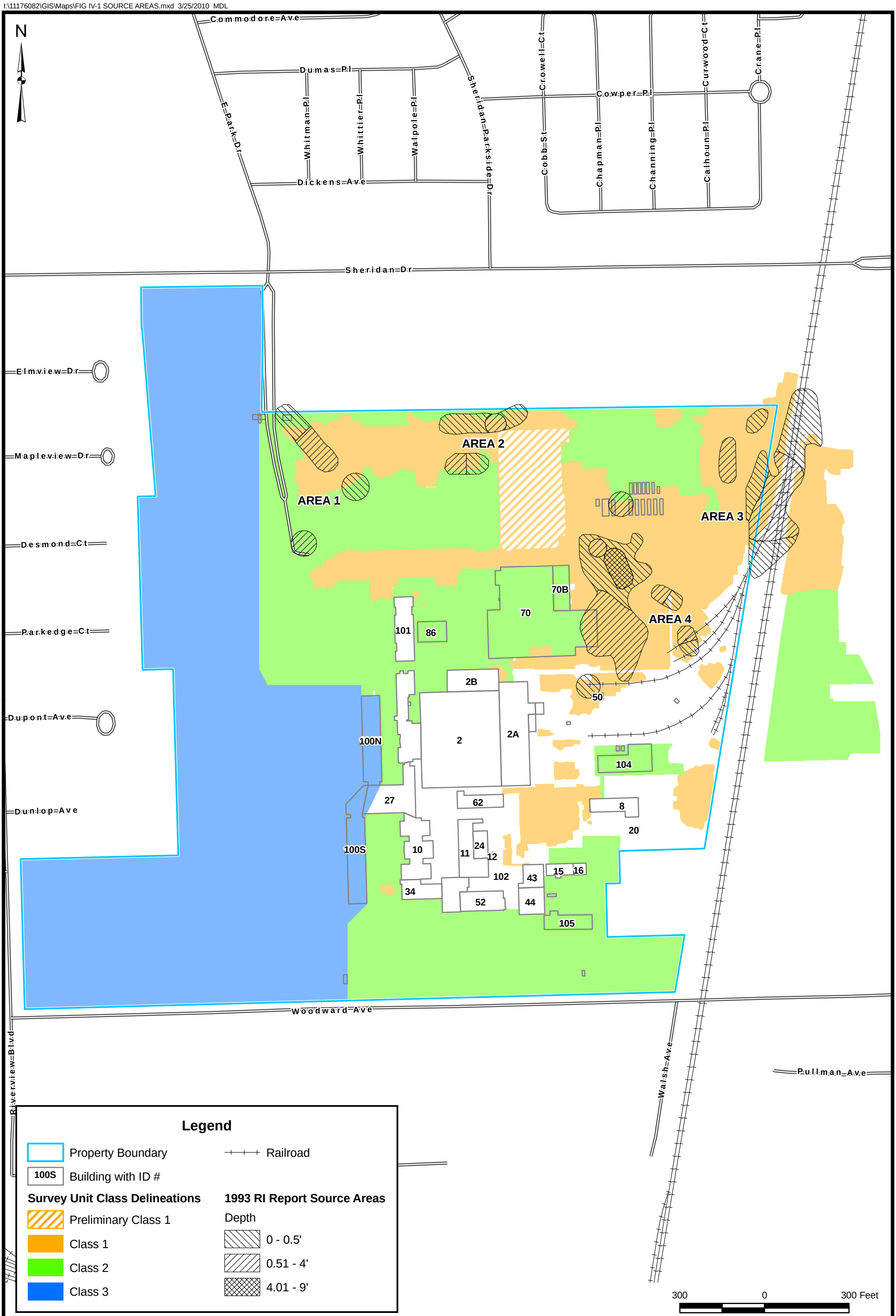
I:\11176082\GIS\Maps\FIG II-1 SITE LOCATION.mxd 3/25/2010 MDL

I:\11176082\GIS\Maps\FIG III-1 SITE PLAN.mxd 3/25/2010 MDL

LINDE SITE
SITE PLAN

FIGURE III-1

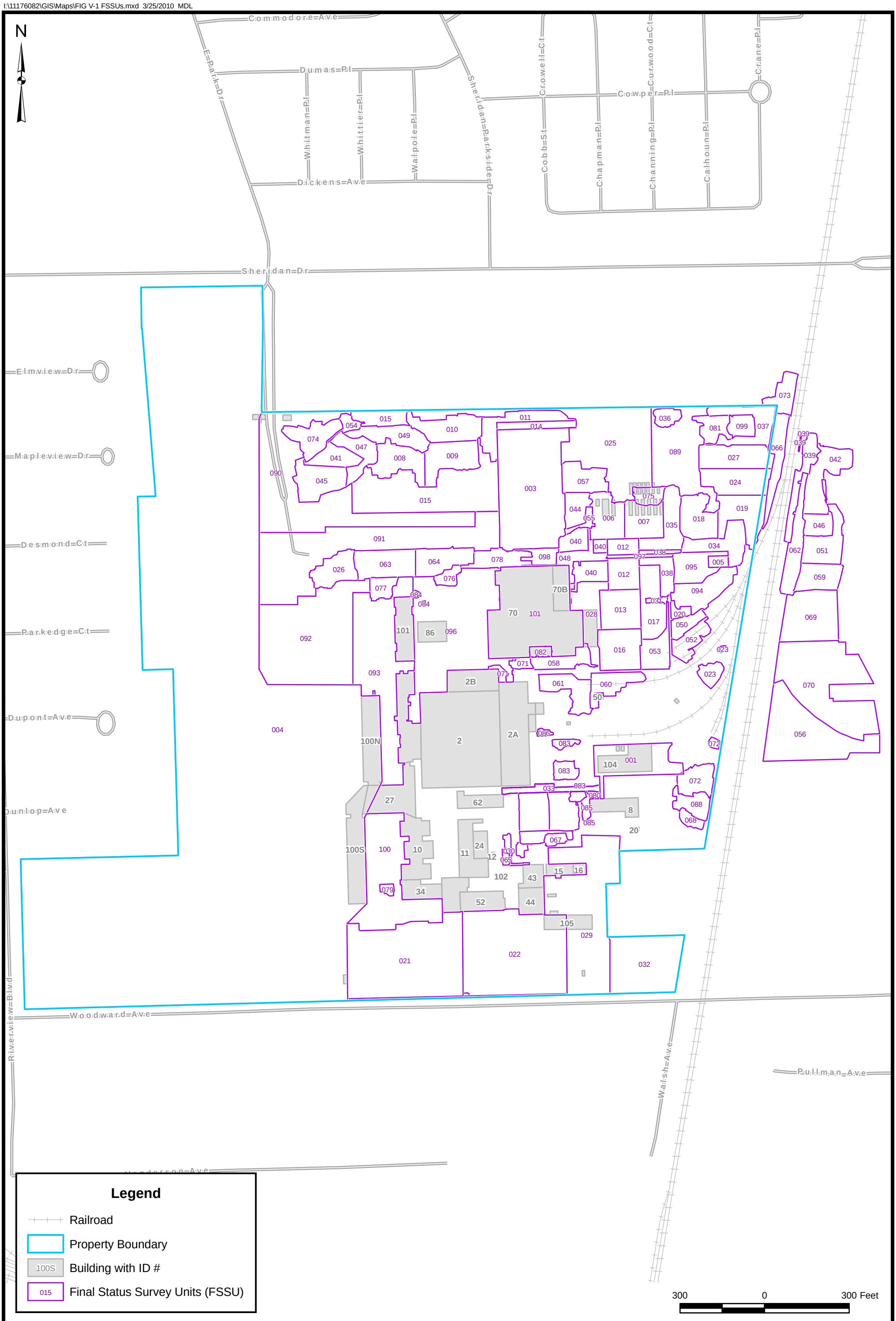
I:\11176082\GIS\Maps\FIG IV-1 SOURCE AREAS.mxd 3/25/2010 MDL



LINDE SITE
DEFINITION OF CLASS 1, 2, AND 3 AREAS

FIGURE IV-1

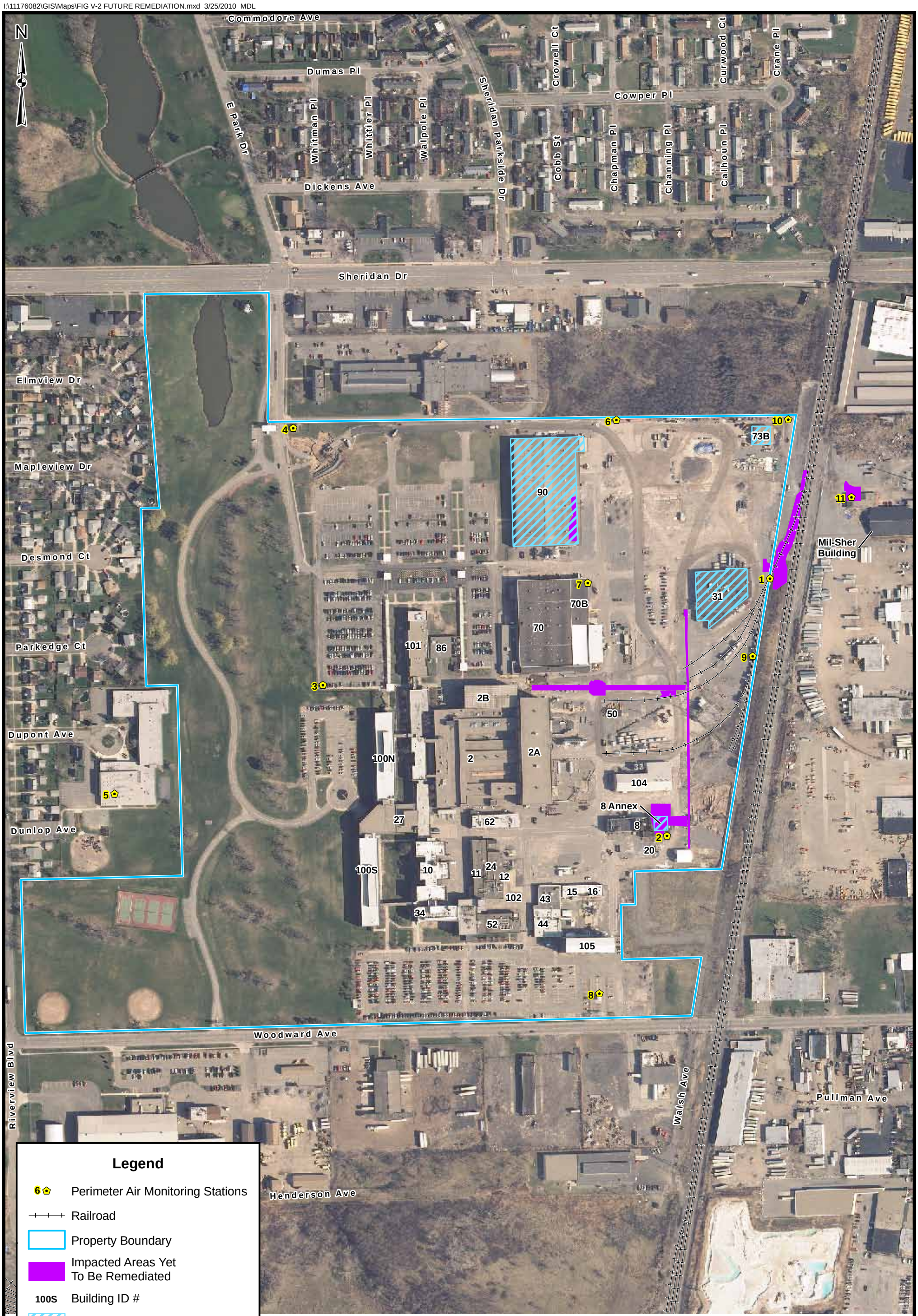
I:\11176082\GIS\Maps\FIG V-1 FSSUs.mxd 3/25/2010 MDL



LINDE SITE
FINAL STATUS SURVEY UNITS

FIGURE V-1

I:\11176082\GIS\Maps\FIG V-2 FUTURE REMEDIATION.mxd 3/25/2010 MDL



LINDE SITE
FUTURE REMEDIATION

FIGURE V-2

ATTACHMENTS

ATTACHMENT A – CONTENT CHECKLIST FOR THE LINDE FUSRAP SITE FIVE-YEAR REVIEW REPORT

CONTENT CHECKLIST FOR THE

LINDE FUSRAP SITE FIVE-YEAR REVIEW REPORT

This checklist may be used by you, your managers, etc., to verify that you have included all of the appropriate information in your Five-Year Review report. Depending on site-specific circumstances, some items may not be applicable. For example, a report for a site just beginning construction will generally contain less data than for a site that has reached construction completion.

General Report Format

NA Signed concurrence memorandum (as appropriate)
☒ Title page with signature and date
☒ Completed five-year review summary form
☒ List of documents reviewed
☒ Site maps
☒ List of tables and figures
☒ Interview report
☒ Site inspection checklist
☒ Photos documenting site conditions (as appropriate)

Introduction

☒ The purpose of the five-year review
☒ Authority for conducting the five-year review
☒ Who conducted the five-year review (lead agency) and when
  ☒ Organizations providing analyses in support of the review (e.g., the contractor supporting the lead agency)
☒ Review number (e.g., first, second)
☒ Trigger action and date
☒ Number, description, and status of all operable units at the site
NA If review covers only part of a site, explain approach
  NA Define which areas are covered in the five-year review
  NA Summarize the status of other areas of the site that are not covered in the present five-year

Site Chronology

☒ List all important site events and relevant dates (e.g., date of initial discovery of problem, dates of pre-NPL responses, date of NPL listing, etc.)

Background

☒ General site description (*e.g.*, size, topography, and geology)
☒ Former, current, and future land use(s) of the site and surrounding areas
☒ History of contamination
☒ Initial response (e.g., removals)
☒ Basis for taking remedial action (e.g., contaminants)

Remedial Actions

☒ Regulatory actions (e.g., date and description of Records of Decision, Explanations of Significant Difference, Administrative Orders on Consent, Consent Decrees and Action Memorandum)
☒ Remedial action objectives
☒ Remedy description
☒ Remedy implementation (e.g., status, history, enforcement actions, performance)
NA Systems operations/Operations & Maintenance
  NA Systems operations/O&M requirements
  NA Systems operations/O&M operational summary (*e.g.*, history, modifications, problems, and successes)
  NA Summary of costs of system operations/O&M effectiveness (*i.e.*, are requirements being met and are activities effective in maintaining the remedy?)

Progress Since Last Five-Year Review (if applicable)

NA Protectiveness statements from last review
NA Status of recommendations and follow-up actions from last review
NA Results of implemented actions, including whether they achieved the intended effect
NA Status of any other prior issues

Five-Year Review Process

☒ Administrative Components
  ☒ Notification of potentially interested parties of initiation of review process
  ☒ Identification of five-year review team members (as appropriate)
  ☒ Outline of components and schedule of your five-year review
NA Community Involvement
☒ Community notification (prior and post review)
☒ Other community involvement activities (e.g., notices, fact sheets, etc., as appropriate)
☒ Document review
☒ Data review
☒ Site inspection
  ☒ Inspection date
  ☒ Inspection participants

Five-Year Review Process, cont'd.

- ☒ Site inspection scope and procedures
- ☒ Site inspection results, conclusions
- ☒ Inspection checklist

☒ Interviews

- ☒ Interview date(s) and location(s)
- ☒ Interview participants (name, title, etc.)
- ☒ Interview documentation
- ☒ Interview summary

Technical Assessment

☒ Answer Question A: Is the remedy functioning as intended by the decision documents?

- ☒ remedial action performance (i.e., is the remedy operating as designed?)
- NA system operations/O&M
- NA cost of system operations/O&M
- NA opportunities for optimization
- ☒ early indicators of potential issues
- NA implementation of institutional controls and other measures

☒ Answer Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

- ☒ changes in standards, newly promulgated standards, TBCs
- ☒ expected progress towards meeting RAOs
- ☒ changes in exposure pathways
- ☒ changes in land use
- ☒ new contaminants and/or contaminant sources
- NA remedy byproducts
- ☒ changes in toxicity and other contaminant characteristics
- NA risk recalculation/assessment (as applicable)

☒ Answer Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

- ☒ new or previously unidentified ecological risks
- ☒ natural disaster impacts
- ☒ any other information that could call into question the protectiveness of the remedy

☒ Technical Assessment Summary

Issues

☒ Issues identified during the technical assessment and other five-year review activities

☒ Determination of whether issues affect current or future protectiveness

Issues, cont'd.

☒ A discussion of unresolved issues raised by support agencies and the community (States, Tribes, other Federal agencies, local governments, citizens, PRPs, other interested parties), if applicable

Recommendations and Follow-up Actions

☒ Required/suggested improvements to identified issues or to current site operations
☒ Note parties responsible for actions
☒ Note agency with oversight authority
NA Schedule for completion of actions related to resolution of issues

Protectiveness Statements

☒ Protective statement(s) for each OU (If the remedy is not protective of human health and/or the environment, have you provided supporting discussion and information in the report to make this determination, such as current threats or level of risk?)
☒ Comprehensive protectiveness statement covering all of the remedies at the site (if applicable)

Next Review

☒ Expected date of next review
NA If five-year reviews will no longer be done, provide a summary of that portion of the technical analysis presented in the report that provides the rationale for discontinuation of five-year reviews.

ATTACHMENT B – LIST OF DOCUMENTS REVIEWED

LIST OF DOCUMENTS REVIEWED

U.S. Department of Energy (DOE). February 1993. Remedial Investigation Report for the Tonawanda Site. Tonawanda, New York. DOE/OR/21949-300. Volume I. U.S. Department of Energy, Oak Ridge Operations Office. Formerly Utilized Sites Remedial Action Program (FUSRAP).

DOE. February 1993. Remedial Investigation Report for the Tonawanda Site. Tonawanda, New York. DOE/OR/21949-300. Volume II. U.S. Department of Energy, Oak Ridge Operations Office. FUSRAP.

DOE. August 1993. Baseline Risk Assessment for the Tonawanda Site. Tonawanda, New York. DOE/OR/21950-003. U.S. Department of Energy, Oak Ridge Operations Office. Formerly Utilized Sites Remedial Action Program.

DOE. November 1993. Proposed Plan for the Tonawanda Site, Tonawanda, New York. Oak Ridge Operations Office, Formerly Utilized Sites Remedial Action Program. DOE/OR/21950-233.

DOE. November 1993. Feasibility Study for the Tonawanda Site, Tonawanda, New York. Oak Ridge Operations Office, Formerly Utilized Sites Remedial Action Program. DOE/OR/21950-234.

U.S. Army Corps of Engineers (USACE), Buffalo District. March 1999. Proposed Plan for the Linde Site. Tonawanda, New York.

USACE. March 1999. Addendum to the Feasibility Study for the Linde Site, Tonawanda, New York.

USACE. February 2000 (Rev. 1), Technical Memorandum: Linde Site Radiological Assessment, Tonawanda, New York.

USACE. March 2000. Record of Decision for the Linde Site. Tonawanda, New York.

USACE. May 2000 (revised April 2001). Site Operations Plan. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. November 2000 (Rev. 02 January 2002). Final Status Survey Plan. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. January 2005 (Rev 3). Technical Report, Radiological Parameters for Use at the Linde FUSRAP Site. FUSRAP Linde Remedial Action. Tonawanda, New York.

USACE. October 2005 (Revision 03). Final Status Survey Plan. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. April 2009. Scope of Work for Five-Year CERCLA Review of Linde FUSRAP Site, Town of Tonawanda, New York. Prepared by USACE – Buffalo District.

USACE Technical Data Packages for Final Status Surveys and Technical Reports with Surface Contamination Limits, in order of Survey Unit:

USACE. May 2001. Technical Data Package. Final Status Survey. Survey Unit 001. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. February 2002 (Revised March 2002). Technical Data Package. Final Status Survey. Survey Unit 002. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. February 2002. Technical Data Package. Final Status Survey. Survey Unit 005. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. June 2002. Technical Data Package. Final Status Survey. Survey Unit 005A. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. February 2003. Technical Data Package. Final Status Survey. Survey Unit 005B-005F. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. February 2002. Technical Data Package. Final Status Survey. Survey Unit 006. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. February 2002. Technical Data Package. Final Status Survey. Survey Unit 007. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. March 2002. Technical Data Package. Final Status Survey. Survey Unit 008. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. February 2002. Technical Data Package. Final Status Survey. Survey Unit 009. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. January 2002 (Revised May 2002). Technical Data Package. Final Status Survey. Survey Unit 010. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. January 2002. Technical Data Package. Final Status Survey. Survey Unit 011. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. April 2003. Technical Report. Surface Contamination Limits for Final Status Survey Unit 011A. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. September 2003. Technical Data Package. Final Status Survey. Survey Units 011A, 014A and 014B. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. August 2002. Technical Data Package. Final Status Survey. Survey Unit 012. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. July 2002. Technical Data Package. Final Status Survey. Survey Unit 013. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. December 2002. Technical Data Package. Final Status Survey. Survey Unit 014. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. April 2003. Technical Report. Surface Contamination Limits for Final Status Survey Units 014A and B. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. September 2002. Technical Data Package. Final Status Survey. Survey Unit 015. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. August 2002. Technical Data Package. Final Status Survey. Survey Unit 016. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. June 2003 (Revision 1). Technical Report. Surface Contamination Limits for Final Status Survey Unit 016A. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. October 2003. Technical Data Package. Final Status Survey. Survey Unit 016A. Revision 1. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. July 2003. Technical Data Package. Final Status Survey. Survey Unit 017. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. June 2003. Technical Report. Surface Contamination Limits for Final Status Survey Units 017A, 017B, and 017C. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. February 2004. Technical Data Package. Final Status Survey. Survey Units 017B and 017C. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. January 2003. Technical Data Package. Final Status Survey. Survey Unit 018. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. August 2003. Technical Data Package. Final Status Survey. Survey Unit 019. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. November 2004. Technical Data Package. Final Status Survey. Survey Unit 020. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. April 2003. Technical Report. Surface Contamination Limits for Final Status Survey Unit 20A. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. March 2003. Technical Data Package. Final Status Survey. Survey Unit 021. FUSRAP Linde Remedial Action. Tonawanda, New York. IT Corporation.

USACE. August 2006 (Revision 1). Technical Data Package. Final Status Survey. Survey Unit 022. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. July 2003. Technical Data Package. Final Status Survey. Survey Unit 023. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. August 2003. Technical Data Package. Final Status Survey. Survey Unit 024. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. July 2003. Technical Data Package. Final Status Survey. Survey Unit 025. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. October 2003. Technical Data Package. Final Status Survey. Survey Unit 026. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. August 2003. Technical Data Package. Final Status Survey. Survey Unit 027. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. November 2003 (Revision 1). Technical Data Package. Final Status Survey. Survey Unit 028. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. September 2003. Technical Report. Surface Contamination Limits for Final Status Survey Unit 028A. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. November 2003. Technical Data Package. Final Status Survey. Survey Unit 028A. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. March 2004. Technical Data Package. Final Status Survey. Survey Unit 029. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. January 2004. Technical Data Package. Final Status Survey. Survey Unit 030. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. October 2003. Technical Report. Surface Contamination Limits for Final Status Survey Unit 030A. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. December 2003. Technical Data Package. Final Status Survey. Survey Unit 030A. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. November 2003. Technical Data Package. Final Status Survey. Survey Unit 031. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. April 2004. Technical Data Package. Final Status Survey. Survey Unit 033. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. February 2004 (Revision 1). Technical Data Package. Final Status Survey. Survey Unit 033A. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. May 2004. Technical Data Package. Final Status Survey. Survey Unit 034. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. May 2004. Technical Data Package. Final Status Survey. Survey Unit 035. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. August 2004. Technical Data Package. Final Status Survey. Survey Unit 036. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. August 2004. Technical Data Package. Final Status Survey. Survey Unit 037. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. February 2005 (Revision 2). Technical Data Package. Final Status Survey. Survey Unit 038. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. September 2004. Technical Data Package. Final Status Survey. Survey Unit 039. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. November 2004. Technical Data Package. Final Status Survey. Survey Unit 040. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. December 2004. Technical Data Package. Final Status Survey. Survey Unit 041. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. June 2005. Technical Data Package. Final Status Survey. Survey Unit 042. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. March 2005. Technical Data Package. Final Status Survey. Survey Unit 043. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. May 2005. Technical Data Package. Final Status Survey. Survey Unit 044. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. June 2005. Technical Data Package. Final Status Survey. Survey Unit 045. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. August 2005. Technical Data Package. Final Status Survey. Survey Unit 046. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. July 2005. Technical Data Package. Final Status Survey. Survey Unit 047. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. December 2005. Technical Data Package. Final Status Survey. Survey Unit 048. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. November 2005. Technical Data Package. Final Status Survey. Survey Unit 049. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. November 2005. Technical Data Package. Final Status Survey. Survey Unit 049A. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. January 2006. Technical Data Package. Final Status Survey. Survey Unit 050. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. February 2007. Technical Data Package. Final Status Survey. Survey Unit 051. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. April 2006 (Revision 1). Technical Data Package. Final Status Survey. Survey Unit 052. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. June 2006. Technical Data Package. Final Status Survey. Survey Unit 054. FUSRAP Linde Remedial Action. Tonawanda, New York. Shaw Environmental, Inc.

USACE. July 2006. Technical Data Package. Final Status Survey. Survey Unit 055. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. October 2006. Technical Data Package. Final Status Survey. Survey Unit 056. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. October 2006. Technical Data Package. Final Status Survey. Survey Unit 057. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. November 2006. Technical Data Package. Final Status Survey. Survey Unit 058. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. March 2007. Technical Data Package. Final Status Survey. Survey Unit 059. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. January 2007. Technical Data Package. Final Status Survey. Survey Unit 060. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. March 2007. Technical Data Package. Final Status Survey. Survey Units 060A and 60B. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. December 2006. Technical Report. Surface Contamination Limits for Final Status Survey Units 060A and 60B. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. May 2007. Technical Data Package. Final Status Survey. Survey Unit 061. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. July 2007. Technical Data Package. Final Status Survey. Survey Unit 062. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. December 2007. Technical Data Package. Final Status Survey. Survey Unit 063. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. December 2007. Technical Data Package. Final Status Survey. Survey Unit 064. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. February 2008. Technical Data Package. Final Status Survey. Survey Unit 065. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. March 2008. Technical Data Package. Final Status Survey. Survey Unit 066. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. January 2008. Technical Data Package. Final Status Survey. Survey Unit 067. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. March 2008. Technical Data Package. Final Status Survey. Survey Unit 068. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. May 2008. Technical Data Package. Final Status Survey. Survey Unit 069. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. May 2008. Technical Data Package. Final Status Survey. Survey Unit 070. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. April 2008. Technical Data Package. Final Status Survey. Survey Unit 071. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. May 2008. Technical Data Package. Final Status Survey. Survey Units 071A, B, and C. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. March 2008. Technical Report. Surface Contamination Limits for Final Status Survey Units 071A, B, and C. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. April 2008. Technical Data Package. Final Status Survey. Survey Unit 072. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. September 2008. Technical Data Package. Final Status Survey. Survey Unit 073. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. July 2008. Technical Data Package. Final Status Survey. Survey Unit 074. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. August 2008. Technical Data Package. Final Status Survey. Survey Unit 075. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. August 2008. Technical Data Package. Final Status Survey. Survey Unit 076. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. September 2008. Technical Data Package. Final Status Survey. Survey Unit 077. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. November 2008. Technical Data Package. Final Status Survey. Survey Unit 078. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. December 2008. Technical Data Package. Final Status Survey. Survey Unit 079. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. January 2009. Technical Data Package. Final Status Survey. Survey Unit 080. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. October 2008. Technical Report. Surface Contamination Limits for Final Status Survey Unit 080A. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. March 2009. Technical Data Package. Final Status Survey. Survey Unit 080A. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. February 2009. Technical Data Package. Final Status Survey. Survey Unit 081. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. July 2009. Technical Data Package. Final Status Survey. Survey Unit 082. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. April 2009. Technical Report. Surface Contamination Limits for Final Status Survey Unit 082A, B, and E. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. May 2009. Technical Data Package. Final Status Survey. Survey Unit 082A, B, and E. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. March 2009. Technical Data Package. Final Status Survey. Survey Unit 084. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. April 2009. Technical Data Package. Final Status Survey. Survey Unit 086. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. July 2009. Technical Data Package. Final Status Survey. Survey Unit 089. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. September 2009. Technical Data Package. Final Status Survey. Survey Unit 090. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

USACE. September 2009. Technical Data Package. Final Status Survey. Survey Unit 094. Linde FUSRAP Site. Tonawanda, New York. Shaw Environmental, Inc.

ATTACHMENT C

SITE INSPECTION CHECKLIST

Site Inspection Checklist

I. SITE INFORMATION

Site name: Linde FUSRAP Site	**Date of inspection:** January 21, 2010
Location and Region:	**EPA ID:**
Agency, office, or company leading the five-year review: US Army Corps of Engineers	**Weather/temperature:** Sunny, approximately 30 deg F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☐ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☒ Excavation with offsite disposal
- ☒ Other: limited surface decontamination
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☒ Inspection team roster attached ☒ Site map attached

II. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☒ As-built drawings — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks: As-built drawings currently being brought up to date. The site is currently transitioning from one contractor (Shaw Environmental) to another (Cabrera Services).

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A
   - ☒ Contingency plan/emergency response plan — ☒ Readily available — ☐ Up to date — ☐ N/A

   Remarks: The HASP and ERP are both included in the same document.

3. **O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A

   Remarks: Certificates for OSHA HAZWOPER, RAD worker, and asbestos training are all maintained onsite by the Contractor.

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ☒ N/A
   - ☒ Effluent discharge(1) — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — ☒ N/A

   Remarks: (1) Town of Tonawanda discharge requirements. Quarterly monitoring of sediment in outfalls 001 and 002 is performed.

5. **Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

   Remarks_____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A

   Remarks_____

7. **Groundwater Monitoring Records** ☐ Readily available ☐ Up to date ☒ N/A

   Remarks_____

Site Inspection Checklist (continued)

8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks_____			
	_____			
9.	**Discharge Compliance Records**			
	☒ Air	☒ Readily available	☒ Up to date	☐ N/A
	☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A
	Remarks_____			
	_____			
10.	**Daily Access/Security Logs**	☒ Readily available	☒ Up to date	☐ N/A
	Remarks: Security guard maintains visitors logs that are provided to the Contractor QA person. Visitors must sign in.			

	III. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A			
	A. Fencing			
1.	**Fencing damaged**	☐ Location shown on site map	☒ Gates secured	☐ N/A
	Remarks: Fencing appeared to be intact and functioning. All outer gates were secured – either locked or manned by a security guard.			
	B. Other Access Restrictions			
1.	**Signs and other security measures**	☐ Location shown on site map		☐ N/A
	Remarks: Manned guard shack, visitors must sign in with a security guard at two places – the main Praxair entrance and the Linde project area entrance.			

Site Inspection Checklist (continued)

C. Institutional Controls (ICs) ☐ Applicable ☒ N/A

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☒ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks: No vandalism evident during site inspection. According to [redacted] (USACE), Building 8 was broken into approximately two years ago, and electrical wiring and equipment were taken – presumably for the copper scrap value.

2. **Land use changes on site** ☒ N/A
Remarks_____
_____

3. **Land use changes off site** ☒ N/A
Remarks_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks_____
_____

Site Inspection Checklist (continued)

B. Other Site Conditions

Remarks:

No active excavation activities were occurring during the site inspection. All excavation areas are backfilled to surrounding grade with imported crushed stone or non-impacted excavated soil. No ponding, settling, or significant erosion was observed.

Several air monitoring stations were observed during the site inspection. Air monitors were not operating at the time as no active work was occurring.

The west side of the Praxair facility is generally secured by decorative wrought-iron fence. The north, south, and east property boundaries were enclosed by chain link fencing approximately 10 feet high. Some excavated areas (e.g., survey units 041, 045, 074, and 090) were located outside of the perimeter fencing. During excavation activities, these areas were reportedly roped-off and signed to indicate the presence of contamination and warn against unauthorized entry.

No visible signs of vandalism or trespassing were observed. USACE described an incident in the past when Building 8 was entered, and copper wire and other copper electrical supplies were taken – apparently for their scrap value. This was an isolated incident, and not other reports of vandalism were described.

Two storm sewer outfalls were observed on the west side of the Praxair facility. Routine (quarterly) sediment sampling is conducted at these locations.

Offsite areas east of the railroad tracks were inspected. Former excavation areas adjacent to the Mil-Sher Building were evident due to the crushed stone backfill material visible at grade. A relatively large area of surface and shallow subsurface contamination was excavated from the lot surrounding the Mil-Sher Building (including areas between the building and the CSX railroad tracks. According to the USACE, excavation activities were mainly guided by visual observation of darkly impacted material. Excavation activities were halted over concerns of damaging the building foundation. This area is also targeted for additional remediation activities.

Site Inspection Checklist (continued)

Excavation Area ☐ Applicable ☒ N/A

1. **Excavation Collapse** ☐ Location shown on site map ☐ Collapse/Settlement not evident
   Areal extent_____ _____
   Remarks_____
   _____

2. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
   ☐ Wet areas ☐ Location shown on site map Areal extent_____
   ☐ Ponding ☐ Location shown on site map Areal extent_____
   ☐ Seeps ☐ Location shown on site map Areal extent_____
   ☐ Soft subgrade ☐ Location shown on site map Areal extent_____
   Remarks_____
   _____

2. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
   Areal extent_____
   Remarks_____
   _____

4. **Obstructions** Type_____ ☐ No obstructions
   ☐ Location shown on site map Areal extent_____
   Size_____
   Remarks_____
   _____

5. **Excavation Access Restrictions** Type_____ ☐ No obstructions
   ☐ Location shown on site map
   Remarks_____
   _____

6. **Active Excavation Areas** ☐ No Active Work ☐ Location shown on site map
   Remarks_____
   _____

Site Inspection Checklist (continued)

X. OTHER REMEDIES
If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.
XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). The remedy is intended to excavate and remove contaminated soil from the site for offsite disposal in accordance with the ROD. The remedy is effective and functioning as designed.
C. Early Indicators of Potential Remedy Problems
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. No indicators of potential remedy problems were noted during the site inspection.
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. No opportunities for optimization of operation of the remedy were identified.

ATTACHMENT D

SITE INSPECTION PHOTOGRAPHIC RECORD

ATTACHMENT E

INTERVIEW SUMMARIES

LINDE FIVE-YEAR REVIEW
INTERVIEW DOCUMENTATION FORM

The following is a list of individuals interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
[redacted]	Project Manager	NYSDEC Bureau of Hazardous Waste & Radiation Management	January 20, 2010
[redacted]	Manager, Health, Safety, Environmental, and Security Services	Praxair, Inc.	January 21, 2010
[redacted]	Site Manager	Praxair, Inc.	January 21, 2010
[redacted]	Manager of local business	Local Business	January 21, 2010
[redacted]	Secretary	For A Clean Tonawanda Site (FACTS)	January 25, 2010
[redacted]		Coalition Against Nuclear Materials in Tonawanda (CANiT)	January 25, 2010
[redacted]	Property Manager	Grubb & Ellis	January 25, 2010
[redacted]	Technical Support	Town of Tonawanda Supervisor's Office	January 26, 2010
[redacted]	Local Resident	Local Community	January 27, 2010
[redacted]	Principal	Holmes Elementary School	January 29, 2010

INTERVIEW RECORD

Site Name: Linde FUSRAP Site	**EPA ID No.:**	
Subject: Soils Remediation Five-Year Review	**Date:** 1/20/2010	**Time:** 10:55am
Type: ☒ Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☒ Outgoing	

Contact Made By:

Name: [redacted]	**Title:** Team Coordinator	**Organization:** URS Group, Inc.

Individual Contacted:

Name: [redacted]	**Title:** Project Manager	**Organization:** NYSDEC Bureau of Hazardous Waste & Radiation Management

Telephone No: [redacted] **Fax No:** **E-Mail Address:**	**Street Address:** 625 Broadway **City, State, Zip:** Albany, NY 12233-7255

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: They're doing a good job – it's hard to argue with digging down to native clay. They have encountered problems in sidewalls. If contamination above the cleanup level is identified in a sidewall, the Corps will stop excavating and say it is outside of the unit.

Offsite, there were definitely areas where the NYSDEC thought the Corps stopped excavating prematurely.

The NYSDEC has not agreed to the ROD, and they specifically don't agree with the ROD cleanup levels. As a result of some residual contamination being left in place, the Corps has left Praxair in a precarious situation. If Praxair ever has to excavate soil in a Class 2 area, contaminated material that will then have to be managed according to Part 380, and Praxair could become a PRP.

Overall, impression is that the Corps is going a good job.

Once or twice, a Class I area excavation extended into a Class II area which had been deemed acceptable based on surface and subsurface criteria.

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details.
Response 2: No, there have not been too many problems. There have not been any dust complaints that I am aware of. A rail car derailed at the Frontier rail yard. I'm not aware of any public complaints.

When building 30 was taken down, the material was taken to Schultz Landfill in Cheektowaga and some of it went to Buttonwillow in California. Cheektowaga residents were concerned that the material would contaminate groundwater. I had to do two rounds of groundwater sampling to demonstrate that there was no impact to groundwater.

It has been a learning process that has improved since earlier in the project. The Corps is now working well with the NYSDEC in making determinations of whether or not material is acceptable for recycling or for offsite disposal per part 380 regs. *(interview continued on next page)*

INTERVIEW RECORD (continued)		
Individual Contacted:		
Name: [redacted]	**Title:** Project Manager	**Organization:** NYSDEC Bureau of Hazardous Waste & Radiation Management

Question 3: Are you aware of any general or specific community concerns regarding the administration or operation of the soils remediation project by the Corps? If so, please give details
Response 3: Because it's a big site, there aren't too many noise considerations, and there have not been any dust complaints as far as I know. There have been some concerns of contamination near residences along the bike path in the park. The Corps demonstrated that there was no risk to bike path users. The Corp has handled everything pretty well with regards to the citizen concerns on the soils remedy.

Question 4: Do you feel well informed on the remediation progress and site operations?
Response 4: Yes, I participate in weekly calls, and also participate in Final Status Surveys whenever they occur. We've had fairly good communication.

Question 5: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation?
Response 5: The Corp is working under the ROD, which the NYSDEC doesn't accept. The NYSDEC has its own criteria. There are some areas across the railroad tracks that the Corps feels are done, but the NYSDEC thinks they stopped excavating prematurely.

It's unfortunate that it was a unilateral process for determining the criteria for the ROD. Since the Corps didn't seek concurrence, they won't be able to satisfy the state in the final outcome because there are two different standards being used.

In the past, it has been difficult to get timely information due to the chain of communication through the Corps to the contractor – particularly when there was lots of soil being moved. I would like to see more flexibility in communications with the contractor.

INTERVIEW RECORD

Site Name: Linde FUSRAP Site		**EPA ID No.:**
Subject: Soils Remediation Five-Year Review		**Date:** 1/21/2010 **Time:** 1:30pm
Type: ☐ Telephone ☒ Visit ☐ Other **Location of Visit:** Praxair, 175 E. Park Drive, Tonawanda, NY 14150		☐ Incoming ☐ Outgoing
Contact Made By:		
Name: [redacted]	**Title:** Team Coordinator	**Organization:** URS Group, Inc.
Name: [redacted]	**Title:** Team Engineer	**Organization:** URS Group, Inc.
Individual Contacted:		
Name: [redacted]	**Title:** Manager, Health, Safety, Environmental, and Security Services	**Organization:** Praxair, Inc.
Telephone No: [redacted] **Fax No:** **E-Mail Address:**		**Street Address:** 175 E. Park Drive **City, State, Zip:** Tonawanda, NY 14150

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: Has been aware over the last several years of buildings coming down and soils being removed. They are making progress. The contractors work in their own established zones. He is generally well informed and well aware of where the work is being done and moving to.

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details
Response 2: No.

Question 3: Are you aware of any general or specific community concerns regarding the soils remediation project at the Linde Site? If so, please give details
Response 3: No.

Question 4: Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Response 4: No.

Question 5: Do you feel well informed on the remediation progress and site operations?
Response 5: Has limited involvement in the project. Gets updated by [redacted] as needed. Occasionally, has the need to send out a memo to Praxair employees notifying them of work activities in certain areas, and possible detours around these areas, or informing the employees of general activities as they relate to safety. The biggest complaint from Praxair employees is "when will we get our parking lot back" for example (issues of inconvenience).

Question 6: Do you feel the plan for transporting contaminated soil offsite and clean soil to the site has been adequate in terms of ensuring public protection?
Response 6: Yes. *(interview continued on next page)*

INTERVIEW RECORD (continued)		
Individual Contacted:		
Name: [redacted]	**Title:** Manager, Health, Safety, Environmental, and Security Services	**Organization:** Praxair, Inc.
Question 7: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation? ***Response 7:*** Would like to see safety remain a priority, and keep the communication channels open through [redacted] and [redacted] with respect to work activities and areas. Anytime that Praxair has had to contact the Corps regarding an issue, [redacted] of the Corps has been very receptive and cooperative – but have not had to contact the Corps very often. Would suggest that the Corps continue to provide sufficient notice of work activities to allow for notification of Praxair employees.		

INTERVIEW RECORD

Site Name: Linde FUSRAP Site		**EPA ID No.:**
Subject: Soils Remediation Five-Year Review		**Date:** 1/21/2010 **Time:** 2:00pm
Type: ☐ Telephone ☒ Visit ☐ Other **Location of Visit:** Praxair, 175 E. Park Drive, Tonawanda, NY 14150		☐ Incoming ☐ Outgoing
Contact Made By:		
Name: [redacted]	**Title:** Team Coordinator	**Organization:** URS Group, Inc.
Name: [redacted]	**Title:** Team Engineer	**Organization:** URS Group, Inc.
Individual Contacted:		
Name: [redacted]	**Title:** Site Director	**Organization:** Praxair, Inc.
Telephone No: [redacted] **Fax No:** **E-Mail Address:**		**Street Address:** 175 E. Park Drive **City, State, Zip:** Tonawanda, NY 14150

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: The United States Army Corps of Engineers (USACE) has made tremendous progress to date and is working diligently to remove all contaminated materials from the Former Linde Site according to the Record of Decision. The former Linde property is an active campus that employs more than 1300 people and regular communication meetings are facilitated by US ACE to coordinate daily remedial efforts to minimize the impact to site employees.

Communication between the USACE and Praxair is excellent. [redacted] is the main liaison. Either [redacted] or [redacted] attends weekly meetings.

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details
Response 2: No.

Question 3: Are you aware of any general or specific community concerns regarding the soils remediation project at the Linde Site? If so, please give details
Response 3: Yes, I have received inquiries on occasion regarding the general concern of the presence of contaminants on the property, potential health effects, and inquiries regarding the status of the project. For external inquiries, I direct people to the Linde FUSRAP web site (www.lrb.usace.army.mil/fusrap/linde/index). I occasionally get questions about white suits and respirators. Also, town officials occasionally ask when the work will be completed.

Question 4: Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Response 4: No. If any such things occur, Praxair would be notified.

Question 5: Do you feel well informed on the remediation progress and site operations?
Response 5: Information related to short-term remediation progress and site operations is readily available. We would appreciate more frequent updates regarding the longer term aspects of the project.
(interview continued on next page)

INTERVIEW RECORD (continued)		
Individual Contacted:		
Name: [redacted]	**Title:** Site Director	**Organization:** Praxair, Inc.

Question 6: Do you feel the plan for transporting contaminated soil offsite and clean soil to the site has been adequate in terms of ensuring public protection?
Response 6: Yes.

Question 7: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation?
Response 7: We have continued concerns, that we have expressed over the years, that Federal criteria differs from the State DEC criteria as it relates to the surface and sub-surface clean up criteria. As property owners and operators we would prefer remedial action that will allow for the "unrestricted use and unrestricted exposure" which would result in no restrictions, whatsoever, on the potential use of land. According to the existing ROD, there will be no Federal restrictions, however should a Class 2 sub surface area (soil below 15cm below surface) be disturbed there may be continued State restrictions which would hinder business operations with every day use such as maintenance repairs or infrastructure changes. We believe that removal of all radiological and mixed wastes along with continued Health Physics radiological support in Class 2 areas is necessary.

One example would be the “south parking lot”. Praxair would like to replace the stormwater receiver in this Class 2 area. But, they feel like they would need rad support from the Corps. Praxair would like to see the ROD reviewed, and the site cleaned up to unrestricted use. Other maintenance items would be affected also such as landscaping and parking lot maintenance.

INTERVIEW RECORD

Site Name: Linde FUSRAP Site		**EPA ID No.:**
Subject: Soils Remediation Five-Year Review		**Date:** 1/21/2010 **Time:** 1:00pm
Type: ☐ Telephone ☒ Visit ☐ Other **Location of Visit:** Local Business, Sheridan Drive Tonawanda, NY 14150		☐ Incoming ☐ Outgoing
Contact Made By:		
Name: [redacted]	**Title:** Team Coordinator	**Organization:** URS Group, Inc.
Name: [redacted]	**Title:** Team Engineer	**Organization:** URS Group, Inc.
Individual Contacted:		
Name: Anonymous	**Title:** Manager	**Organization:** Local Business
Telephone No: **Fax No:** **E-Mail Address:**		**Street Address:** Sheridan Dr **City, State, Zip:** Tonawanda, NY 14150

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: Doesn't know much about the project.

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details
Response 2: Knows of two people that live in the area who have cancer. Has heard of some people having problems due to the site. Hasn't personally noticed any effects.

Question 3: Are you aware of any general or specific community concerns regarding the soils remediation project at the Linde Site? If so, please give details
Response 3: Just the health concerns stated above.

Question 4: Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Response 4: No.

Question 5: Do you feel well informed on the remediation progress and site operations?
Response 5: No. Knows that they removed a couple buildings. Not currently on the mailing list, but would like to receive future notices.

Question 6: Do you feel the plan for transporting contaminated soil offsite and clean soil to the site has been adequate in terms of ensuring public protection?
Response 6: Not knowledgeable about the soil transportation. He hasn't noticed any additional truck traffic.

Question 7: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation?
Response 7: Would like to see the problem taken care of.

INTERVIEW RECORD

Site Name: Linde FUSRAP Site		**EPA ID No.:**
Subject: Soils Remediation Five-Year Review		**Date:** 1/25/2010 **Time:** 8:00am
Type: ☒ Telephone ☐ Visit ☐ Other **Location of Visit:**		☐ Incoming ☒ Outgoing
Contact Made By:		
Name: [redacted]	**Title:** Team Engineer	**Organization:** URS Group, Inc.
Individual Contacted:		
Name: [redacted]	**Title:** Secretary	**Organization:** For A Clean Tonawanda Site (FACTS)
Telephone No: [redacted] **Fax No:** **E-Mail Address:**		**Street Address:** **City, State, Zip:**

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: Cleanup Criteria are grossly inadequate, and don't meet the requirements for 1981 Branch Technical Position (– FACTS website). Not long term protective for very long term residential that will establish in the future. Believes the site is being mis-managed now and in the past, mainly since it was let go for so long. Also feels that groundwater is being mismanaged, another topic. Gradual erosion of environmental quality is what is happening in this area, Tonawanda, Niagara Falls. Since these areas are so heavily contaminated, none of the responsible parties are being held accountable to bring the cleanup to residential criteria or drinking water criteria. The failure is that the site was let go for so long and that the cleanup criteria is not adequate. Light industrial use at LINDE is inadequate. The site will ultimately be used heavily for residential use

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details.
Response 2: Not aware of any. But suggests that the site is fenced in a very protective manner. Also, stated that during the interim measures that DOE did, the site operations were not protective. They tore down building 38 (1990's) with no enclosure and a single stream of water from a garden hose.

Question 3: Are you aware of any general or specific community concerns regarding the soils remediation project at the Linde Site? If so, please give details
Response 3: Yes, general community concern is that the remediation is inadequate. Public is concerned that the cleanup should be to residential levels. There has not been retention of public involvement due to no public meetings. Advertisement in Buffalo news occurred on 11/29/09, but it appeared in the 12/20/09 edition, the same time that the LINDE Site News was mailed out. [redacted] refused to send additional LINDE Site News updates to FACTS suggesting that the contractor had only provided enough copies for the current mailing list. [redacted] suggested that the offer to be on the mailing list should have been sent far in advance of the newsletter, to allow more individuals in the public to sign up.

Question 4: Do you feel well informed on the remediation progress and site operations?
Response 4: No – in general he has asked for USACE to provide information and they have refused to hold public meetings to provide updates. In particular, he does not feel well informed on the final status surveys and what cleanup criteria the USACE is meeting. *(interview continued on next page)*

INTERVIEW RECORD (continued)		
Individual Contacted:		
Name: [redacted]	**Title:** Secretary	**Organization:** For A Clean Tonawanda Site (FACTS)

Question 4: Have there been any site related discussions or community issues raised at FACTS meetings? If so, please provide general topics and outcomes.
Response 4: All of the discussions here, inadequate cleanup, same things are discussed over and over. Also that there was only 1 respondent to the LINDE mailing – FACTS. Their suspicion is that the USACE selectively designed the mailing list to limit the public involvement.

Question 5: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation?
Response 5: The LINDE remedial program should be returned to NRC agreement state regulatory control under the authority of the NYSDEC.

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INTERVIEW RECORD

Site Name: Linde FUSRAP Site		**EPA ID No.:**
Subject: Soils Remediation Five-Year Review		**Date:** 1/25/2010 **Time:** 1:15pm
Type: ☒ Telephone ☐ Visit ☐ Other **Location of Visit:**		☐ Incoming ☒ Outgoing
Contact Made By:		
Name: [redacted]	**Title:** Team Engineer	**Organization:** URS Group, Inc.
Individual Contacted:		
Name: Anonymous	**Title:**	**Organization:** Coalition Against Nuclear Materials in Tonawanda (CANiT)
Telephone No: **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: That it is moving forward, good amount of work to do. Biggest drawback is funding.

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details.
Response 2: Not aware of any health related problems. However there may still be some folks in the surrounding community that perceive there to be a problem (health related) due to the nature of the radioactive residue.

Question 3: Are you aware of any general or specific community concerns regarding the soils remediation project at the Linde Site? If so, please give details
Response 3: No, in general, but for a small group of individuals, yes. There are a few individuals that have expressed health related concerns directed toward the LINDE Site. Sometimes the individuals who have expressed concerns have not been able to substantiate their concerns with scientific data. Gave an example of concerns for the health of the Holmes Elementary School children by [redacted].

Question 4: Do you feel well informed on the remediation progress and site operations?
Response 4: In the past, better informed. In the past there would be periodic briefings for public officials, to keep them posted in between newsletters. But those have not happened since [redacted] left office. These briefings were generally in the form of power point presentations, etc. Overall, we are not as informed as we used to be.

Question 5: Have there been any site related discussions or community issues raised at CANiT meetings? If so, please provide general topics and outcomes.
Response 5: Last CANIT meeting might have been a year ago. The primary discussions were the Tonawanda Landfill and the Seaway Landfill. Discussions at that time focused on whether the waste there is MED/FUSRAP or not, proximity of waste to the fenceline and the nearby homes. Feels that the lack of updates has caused the lack of CANiT discussions on the LINDE Site.

Question 6: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation?
Response 6: USACE is working hard to clean up LINDE. There may be a perceived lack of progress, due to the uncovering of additional wastes. Communications on cleanup progress would be appreciated.

INTERVIEW RECORD

Site Name: Linde FUSRAP Site		**EPA ID No.:**
Subject: Soils Remediation Five-Year Review	**Date:** 1/25/2010	**Time:** 10:20am
Type: ☒ Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming ☒ Outgoing	

Contact Made By:

Name: [redacted]	**Title:** Team Coordinator	**Organization:** URS Group, Inc.

Individual Contacted:

Name: [redacted]	**Title:** Property Manager	**Organization:** Grubb & Ellis
Telephone No: [redacted] **Fax No:** **E-Mail Address:**	**Street Address:** 175 E. Park Drive **City, State, Zip:** Tonawanda, NY 14150	

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: Has been on site since 1974. Worked in all the buildings and dug in the areas that are not OK to dig, and brought contamination home on his shoes. Overall, the Corps is doing a good job in certain respects such as the civil and mechanical work.

The original object was to clean up the site, and work hand in hand. The biggest flaw is that the cleanup is handcuffed by the ROD. When the cleanup is done, there will be areas on site still needing attention. There are areas that the Corps is walking away from such as the south parking lot. They know from testing that if the pavement is removed, the underlying soil would fail, but it meets the ROD criteria. As long as the soil is covered with pavement, then it's OK – it doesn't make sense to him.

Is concerned about what Praxair will be able to do with the property in the future. After spending a couple hundred million dollars on the cleanup, the property will be a no-man's land. What did they really accomplish after spending all this money?

With respect to the onsite work, the Corps is doing a good job.

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details
Response 2: Just rumors and horror stories about the contamination. If they really cleaned it up properly, it could be a gold star – but with current cleanup they will have to double-talk their way out of it.

Question 3: Are you aware of any general or specific community concerns regarding the soils remediation project at the Linde Site? If so, please give details
Response 3: Whatever people read in the newspaper. There are so many unknowns on the site. Early in the RI process, the initial cleanup time estimate was two years – but the extent of contaminated material ballooned.

Originally, the government told the site operator that everything was OK and to go about their business – as a result people were exposed to contamination.

The most common comment is "You mean they're still digging?" *(interview continued on next page)*

INTERVIEW RECORD (continued)

Individual Contacted:

Name: [redacted]	**Title:** Property Manager	**Organization:** Grubb & Ellis

Question 4: Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Response 4: No, not really. One guy almost had a heart attack. Security is pretty tight – 24/7. Occasionally they will get people walking along the railroad tracks. Once, a Washington Post reporter was encountered walking along tracks taking pictures and was told to leave or the railroad security would be informed.

The contractor has a really good safety record.

Question 5: Do you feel well informed on the remediation progress and site operations?
Response 5: Yes – knows on a day-to-day basis, is deeply involved with coordinating site activities.

Question 6: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation?
Response 6: Onsite day-to-day management has been excellent. The biggest deal is the surface/subsurface soil criteria. There have been some issues between Praxair and the Corps regarding underground utilities. After excavating and backfilling certain areas, in some cases the Corps has not replaced main utilities, and this is a bone of contention between Praxair and the Corps. The main utilities should be replaced – that is, the main utilities such as main sewer branches. And this goes back to the surface/subsurface issue.

For instance, a snow plow working the south parking lot could accidentally rip up some pavement exposing the contaminated soil, and this mud could be tracked in by unsuspecting employees. It is not the right thing to do.

Under the current protocol, no Praxair contractors are allowed to excavate without rad support (guy with a meter) present. If excavation will be in a cleared area, then Praxair will get a letter saying the area is clear and rad support is not needed. There have only been two of these letters in 10 years – meaning that most areas need rad support.

If they could only get rid of the surface/subsurface issue and use only one criterion that the State could sign-off on. Then, when the Corps is long gone, Praxair wouldn't need rad support. They have had holes open for six or eight months while waiting for sample testing results to be able to make a decision to backfill or not.

The Corps is spending a lot of money to still have deed restrictions. If they did it right, then the land could be developed.

INTERVIEW RECORD

Site Name: Linde FUSRAP Site		**EPA ID No.:**
Subject: Soils Remediation Five-Year Review		**Date:** 1/26/2010 **Time:** 10:30am
Type: ☒ Telephone ☐ Visit ☐ Other **Location of Visit:**		☐ Incoming ☒ Outgoing
Contact Made By:		
Name: [redacted]	**Title:** Team Engineer	**Organization:** URS Group, Inc.
Individual Contacted:		
Name: [redacted]	**Title:** Technical Support	**Organization:** Town of Tonawanda Supervisor's Office
Telephone No: [redacted] **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: The project is much larger and much longer duration than anticipated. The town does recognize the LINDE project as a necessary project, which needs to be completed.

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details
Response 2: No. The town is aware of complaints, and knows of activists and organizations with claims of impacts, but not aware of actual conclusive studies.

Question 3: Are you aware of any general or specific community concerns regarding the soils remediation project at the Linde Site? If so, please give details.
Response 3: Yes. The town is aware that there are residents concerned about FUSRAP causing cancer and other health issues. The concerns are usually expressed about LINDE and Town Landfill where there are actual lawsuits against the town.

Question 4: Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Response 4: No not aware of any

Question 5: Do you feel well informed on the remediation progress and site operations?
Response 5: Yes, the town is generally kept up to date from the USACE on all of the FUSRAP projects, either through newsletters or other mailings, depending on what the process is. The USACE used to do semi-annual progress updates at the USACE offices. These updates were, from the town perspective, very informative, but they have stopped. The town is in favor of continuing the progress updates (slide show presentations) in the near future.

Question 6: Have there been any Linde Site-related discussions within the town board recently? If so, please provide general topics and outcomes.
Response 6: No not in the last year. *(interview continued on next page)*

INTERVIEW RECORD (continued)

Individual Contacted:

Name: [redacted]	**Title:** Technical Support	**Organization:** Town of Tonawanda Supervisor's Office

Question 7: Are you aware of any future land use planning or concerns for parts of the Linde Site?
Response 7: The town is aware that Praxair is trying to develop the site into a type of campus. No other future use plans or changes that they are aware of.

Question 8: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation?
Response 8: Referred to response to question 5. USACE has had semiannual meetings in the past to provide the town and other groups with site progress updates. These meetings have stopped happening for some reason and the town would like them to continue. Town attendees are usually [redacted], the Supervisor, other town board members, and town attorneys.

At the conclusion of the interview I asked [redacted] whether he thought the Supervisor would need to be interviewed, based on the types of questions asked, and he suggested no, that the Supervisor would not need to be interviewed.

[redacted] – Town of Tonawanda Supervisor [redacted]

INTERVIEW RECORD

Site Name: Linde FUSRAP Site		**EPA ID No.:**
Subject: Soils Remediation Five-Year Review		**Date:** 1/27/2010 **Time:** 1:45pm
Type: ☒ Telephone ☐ Visit ☐ Other **Location of Visit:**		☐ Incoming ☒ Outgoing
Contact Made By:		
Name: [redacted]	**Title:** Team Coordinator	**Organization:** URS Group, Inc.
Individual Contacted:		
Name: [redacted]	**Title:** Local Resident	**Organization:** Local Community
Telephone No: [redacted] **Fax No:** **E-Mail Address:**		**Street Address:** [redacted] **City, State, Zip:** Tonawanda, NY 14150

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: Knows that they are working, but doesn't know how successful they have been over the years. Moved to the neighborhood in 1960, and has been there since except for a gap from 1981 to 1993. He knows that radioactive materials last for eons, and doesn't know how they can be successful.

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details
Response 2: No, not really. He knows of one friend and neighbor who had cancer, but he doesn't know if it was caused by radioactive material in the ground.

Question 3: Are you aware of any general or specific community concerns regarding the soils remediation project at the Linde Site? If so, please give details
Response 3: No.

Question 4: Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Response 4: No. You used to be able to drive between Woodward and Sheridan, but that is now gated. He used to play tennis at the tennis courts.

Question 5: Do you feel well informed on the remediation progress and site operations?
Response 5: No. All he knows is that something is being done about it, and he hopes that it is successful and comes to an early end.

Question 6: Do you feel the plan for transporting contaminated soil offsite and clean soil to the site has been adequate in terms of ensuring public protection?
Response 6: He doesn't know what has been done. Was not aware of these specific activities.

Question 7: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation?
Response 7: No, is really not knowledgeable enough to be able to answer the question.

INTERVIEW RECORD

Site Name: Linde FUSRAP Site		**EPA ID No.:**
Subject: Soils Remediation Five-Year Review		**Date:** 1/29/2010 **Time:** 1:50pm
Type: ☒ Telephone ☐ Visit ☐ Other **Location of Visit:**		☐ Incoming ☒ Outgoing

Contact Made By:

Name: [redacted]	**Title:** Team Coordinator	**Organization:** URS Group, Inc.

Individual Contacted:

Name: [redacted]	**Title:** Principal	**Organization:** Holmes Elementary School
Telephone No: [redacted] **Fax No:** **E-Mail Address:**		**Street Address:** [redacted] **City, State, Zip:** Tonawanda, NY 14150

Summary Of Conversation

Question 1: What is your general impression of the Linde Soils Remediation Project?
Response 1: Doesn't know much about it except that it is going on. Nothing strikes her as positive or negative.

Question 2: Are you aware of any effects that site operations have had on the surrounding community? If so, please give details
Response 2: No. On occasion, Praxair has provided notification of increased activities or people. But does not know of any particular concerns.

Question 3: Are you aware of any general or specific community concerns regarding the soils remediation project at the Linde Site? If so, please give details
Response 3: This neighborhood is generally industrial, and there is a general interest among residents in issues dealing with environmental testing and living in a safe environment.

Question 4: Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Response 4: No, not aware of any.

Question 5: Do you feel well informed on the remediation progress and site operations?
Response 5: To be honest, No. Has only a general understanding of what's going on mainly through her contacts at Praxair. Two years ago, had done a tour of the site and work that was going on – but hasn't heard much about the project since then.

Question 6: Do you feel the plan for transporting contaminated soil offsite and clean soil to the site has been adequate in terms of ensuring public protection?
Response 6: Can't answer the questions because she hasn't been aware of the process or seen it happening.

Question 7: Do you have any comments, suggestions, or recommendations regarding the Linde Formerly Utilized Sites Remedial Action Program site management or operation?
Response 7: Knows that the newsletter just came out – would be good to get more frequent updates – more than once a year. Overall the work being done is good, and is being handled well.