FINAL

Sampling and Analysis Plan Volume 1 - Field Sampling Plan

Former Guterl Specialty Steel Corporation FUSRAP Site

Lockport, New York

Prepared for

US Army Corps of Engineers
Buffalo District
Contract W912P4-05-D-0001
Delivery Order 0001

Prepared by

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January 2007
Revised June 14, 2007

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TABLE OF CONTENTS

Section No. **Page No.**

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

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LIST OF ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
AEC	Atomic Energy Commission
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CCQC	Contractor Chemical Quality Control
CD	Compact Disc
COC	Chain of Custody
COPC	Constituent of Potential Concern
CQC	Chemical Quality Control
CSM	Conceptual Site Model
DCQCR	Daily Chemical Quality Control Report
DGAR	Data Gap Analysis Report
DOE	Department of Energy
DOT	Department of Transportation
dpm/100 cm^2	Disintegration per Minute per 100 Square Centimeters
DPT	Direct Push Technology
DQO	Data Quality Objective
ERTC	Environmental Response Team Center
EU	Exposure Unit
f	Fraction
FBDU	Ford, Bacon & Davis Utah, Inc.
FS	Feasibility Study
FSA	Field Staging Area
FSP	Field Sampling Plan
FUSRAP	Formerly Utilized Sites Remedial Action Program
GIS	Geographic Information System
gpd	Gallons per Day
gpm	Gallons per Minute
GPS	Global Positioning System
GWS	Gamma Walkover Survey
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHRA	Human Health Risk Assessment
HTW	Hazardous and Toxic Waste
IA	Investigative Area
ICP-MS	Inductively Coupled Plasma – Mass Spectroscopy
ID	Inner Diameter
IDW	Investigation Derived Waste
ISOCS	In-Situ Object Counting System
K	Hydraulic Conductivity
keV	kiloelectron volt (1 keV = 1.6×10^{-16} J)
L_c	Critical Level
L_d	Detection Level
LQMP	Laboratory Quality Management Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual

MED	Manhattan Engineer District
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MDC	Minimum Detectable Concentration
NaI	Sodium Iodide
NCIDA	Niagara County Industrial Development Agency
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technologies
NLO	National Lead Company of Ohio
NRC	Nuclear Regulatory Commission
NY	New York
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
OWS	Oil/water Separator
PCB	Polychlorinated Biphenyl
PID	Photo Ionization Detector
PPE	Personal Protective Equipment
ppm	Parts Per Million
PRG	Preliminary Remediation Goal (USEPA Region 9)
PSA	Preliminary Site Assessment
PVC	Poly Vinyl Chloride
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QC	Quality Control
ROW	Right of Way
RPP	Radiation Protection Plan
RQD	Rock Quality Designation
SARSG	San Antonio Radiation Safety Group
SRSO	Site Radiation Safety Officer
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SLC	Secure Landfill Contractors, Inc.
SSHM	Site Safety and Health Manager
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SOW	Scope of Work
SVOC	Semivolatile Organic Compound
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
TPP	Technical Project Planning
USACE	United States Army Corps of Engineers

USCS	Unified Soil Classification System
USEDA	United States Economic Development Association
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound
XRF	X-ray Fluorescence

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1 SITE BACKGROUND

In accordance with United States Army Corps of Engineers (USACE), Buffalo District contract number W912P4-05-D-0001, delivery order number 0001, Earth Tech has prepared this draft *Field Sampling Plan* (FSP) for the former Guterl Specialty Steel Corporation site (Site), as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), in accordance with Task 5 of the March 2005 delivery order Scope of Work (SOW) (USACE, 2005a).

The strategy for the Site, as directed by Congress and specified by USACE, is to address all Manhattan Engineer District (MED) and Atomic Energy Commission (AEC)-related waste at the Site (and adjacent properties, if necessary). The strategy will follow the process defined in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The criteria in CERCLA (United States Environmental Protection Agency (USEPA), 1988) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (USEPA, 1990) will be used for site evaluation and remedy.

This FSP is part of the Remedial Investigation (RI) *Sampling and Analysis Plan* (SAP). The overall SAP consists of this FSP and the companion *Quality Assurance Project Plan* (QAPP). The SAP contains the overall RI approach, rationale, procedures, and quality assurance/quality control (QA/QC) program for the various field activities planned during the Site RI. The SAP has been developed using available background information, and relevant guidance documents such as the USACE Requirements for the *Preparation of Sampling and Analysis Plans Engineer Manual* (EM 200-1-3 (USACE 2001a)), and the USEPA, US Department of Energy (USDOE), and US Department of Defense, *Multi-Agency Radiation Survey and Site Investigation Manual*, 2000, referred to herein as *MARSSIM*.

The purpose of this FSP is to specify and provide for documentation of the data collection program for the Site. The FSP addresses the field activities, including all aspects of sampling (e.g., soil, subsurface soil, groundwater, surface water, sediment, building media), test boring and monitoring well installation, and field data gathering activities.

The current and future uses of the data may include performing a RI, feasibility study (FS), remedial design (RD), and remedial action (RA). Within these broad programs, data may be used to establish the nature and extent of contamination, fate and transport, human health risk assessment, screening level ecological risk assessment, estimation of quantities and classification (e.g., hazardous or non-hazardous, low level radioactive waste, etc.) of contaminated material of various matrices (i.e., soil, groundwater, surface water, sediment, and building materials), and achievement of future risk-based cleanup goals (release criteria).

1.1 SITE LOCATION

The Site is located in Lockport, Niagara County, New York (NY), approximately 20 miles northeast of Buffalo, NY.

The Site is located within the Lockport 7.5-minute topographic quadrangle (USGS, 1980), shown on **Figure 1-1**. The land surface elevation within the site vicinity is approximately 590 feet (ft) above mean sea level.

1.2 SITE HISTORY

From 1910 to 1966, the former Guterl Specialty Steel Corporation site was owned and operated by Simonds Saw and Steel Company (Simonds) to manufacture steel and specialty steel alloys (high-alloy) used in the production of saws and other tools. During World War I and World War II, normal plant operations were suspended, and the plant produced armor plating for the US Government under various contracts (Simonds Saw and Steel Company, 1943; and United States Ordnance Department, 1919).

In 1948, the NY Operations Office of the AEC negotiated a contract with Simonds. AEC operations continued until December 31, 1956. During the time between 1948 and 1952 documents indicated that Simonds processed as much as 600,000 pounds of natural uranium (i.e., processed uranium steel without enrichment supplied as metal ingots) and the plant annually conducted approximately 312 rolling turns of metal, which would process between 15,000 and 20,000 pounds of uranium ingots each. In 1953, 1954, 1955, and 1956, there was production of 29, 56, 58, and 22 turns of metal, respectively. Each turn processed between 15,000 and 20,000 pounds of uranium ingot. According to prior reports, some of the later lots contained enriched uranium and depleted uranium.[1] It is also reported that during this time period, Simonds processed 30,000 to 40,000 pounds of thorium for National Lead Company of Ohio (NLO) and the AEC (Guterl Steel Corporation, Simonds Steel Division, 1979).

In a more recent report published by the National Institute for Occupational Safety and Health (NIOSH), the authors stated that 99% of all material processed at Simonds Saw and Steel was natural uranium. There is evidence to support the processing of depleted uranium and enriched uranium (up to 2.5%), but their fractions of contribution to worker radiation dose is small compared to the amount of natural uranium present (NIOSH, 2005).

In addition, of the thorium that was processed, ^{232}Th and ^{228}Th was present in equal fractions. That is to say that of the thorium present, 50% was comprised of ^{232}Th and 50% was comprised of ^{228}Th. This NIOSH report further discusses the presence of recycled depleted uranium. Recycled depleted uranium is known to be cross-contaminated with transuranic radionuclides and for Simonds Saw and Steel, they are neptunium (^{237}Np) and plutonium (^{239}Pu). Note that the estimate of contaminant activity fractions in a recycled depleted uranium source term are 0.00182 for ^{237}Np and 0.000261 for ^{239}Pu (NIOSH 2005). These fractions are so small when compared to the 99% natural uranium that they are nearly immeasurable.

In 1966, Simonds was acquired by the Wallace-Murray Corporation (Delaware Secretary of State, 1966). Wallace-Murray Corporation continued to operate the plant as a specialty steel mill until 1978, when Guterl Specialty Steel Corporation acquired the site property (Niagara County Clerks Department, 1978).

[1] Natural uranium metal contains about 0.71% U-235, 99.28% U-238, and about 0.0054% U-234. In order to produce enriched uranium, the process of isotope separation removes a substantial portion of the U-235 for use in nuclear power, weapons, or other uses. The remainder, depleted uranium, contains only 0.2% to 0.4% U-235. Because natural uranium begins with such a low percentage of U-235, the enrichment process produces large quantities of depleted uranium. For example, producing 1 kg of 5% enriched uranium requires 11.8 kg of natural uranium, and leaves about 10.8 kg of depleted uranium with only 0.3% U-235 remaining. (Source: www.wikipedia.com)

In 1982, Guterl Specialty Steel Corporation filed for Chapter 11 bankruptcy protection in the US Bankruptcy Court for the Western District of Pennsylvania (this was changed to a Chapter 7 bankruptcy in 1990.) In 1984, using industrial development bonds received through the Niagara County Industrial Development Agency (NCIDA), Allegheny Corporation purchased Guterl Specialty Steel Corporation's assets at an auction (US Bankruptcy Court, 1984).

According to US Bankruptcy Court documents, "on information and belief, at the time, Allegheny Ludlum (Allegheny) was shown certain documents and learned from counsel for the United States Economic Development Association (USEDA), William Ogden, that the site contained radioactive contamination. On information and belief, the USEDA had certain documents in its possession that reflected the significant radiological contamination at the site. Allegheny refused to close" (US Bankruptcy Court, 2004).

As a result of the documents and information received from Mr. Ogden, Allegheny agreed to close the deal, but only after the "contaminated" area was removed from the sale. This portion of the property, approximately nine acres of land, became known as the "Excised Area." Allegheny also excluded a portion of Guterl Specialty Steel Corporation's assets from the sale, including equipment utilized during AEC-related operations at the site (US Bankruptcy Court, 1984).

The Site is currently being operated by Allegheny, which occupies the portion of the Site that is not part of the Landfill Area or Excised Area (USACE, 2005a).

1.3 PREVIOUS INVESTIGATIONS

Existing data were generated under a number of previous investigations performed at the Site, dating back to 1978. USACE personnel compiled the data and conducted a preliminary evaluation of the existing data from seven of these investigations, focusing on usability for risk assessment (which is a use that typically has the most stringent data quality requirements). Earth Tech added summary information for one additional report, Oak Ridge National Laboratories (ORNL) (1978), in the same spirit as the USACE summary.

Previous investigations that are summarized below include:

- *Radiological Survey of the Former Simonds Saw and Steel Company, Final Report*, September 1978. Prepared by ORNL for United States Department of Energy (DOE). (ORNL, 1978)
- *Preliminary Engineering and Environmental Evaluation of the Remedial Action Alternatives for the Former Simonds Saw and Steel Company Site*, November 1981. Prepared by Ford, Bacon & Davis Utah, Inc. (FBDU) for Bechtel National, Inc., for DOE. (FBDU, 1981)
- *Phase I Investigation, Guterl Specialty Steel, City of Lockport, Niagara County*, January 1988. Prepared by Engineering-Science and Dames & Moore for New York State Department of Environmental Conservation (NYSDEC). (NYSDEC, 1988)
- *Preliminary Site Assessment, Task 1 Records Search, Guterl Specialty Steel Corporation*, January 1991. Prepared by E.C. Jordan for NYSDEC. (NYSDEC, 1991)

- *Preliminary Site Assessment Evaluation Report of Initial Data, Guterl Specialty Steel, Volumes I and II,* April 1994. Prepared by ABB Environmental Services (ABB-ES) for NYSDEC. (NYSDEC, 1994)
- *Final Report, Guterl Steel Site, Lockport, New York, USEPA Work Assignment No. 2-194,* April 1998. Prepared by Roy F. Weston, Inc. for USEPA/Environmental Response Team Center (ERTC). (USEPA, 1998)
- *Radiological Survey of the Guterl Specialty Steel Corporation*, Lockport, New York, December 1999. Prepared under a contract with DOE by Oak Ridge Institute for Science and Education (ORISE) for United States Bankruptcy Court for the Western District of Pennsylvania (ORISE, 1999).
- *Immediate Investigative Work Assignment (IIWA) Report for the Unlisted Guterl Excised Area*, October 2000. Prepared by NYSDEC. (NYSDEC, 2000).

A summary of the data contained in each of these reports, as well as the preliminary conclusions regarding the usability of the data, taken from the USACE summary report (USACE, 2005b), is presented below. A summary of the analyses performed and referenced in these reports, with more details on the sample quantities and analyses of each sample type is presented in **Table 1-1**. The USACE summary report did not include a review of the ORNL (1978) report or data; the assessment and data compilation for that report was prepared by Earth Tech.

1.3.1 *Radiological Survey of the Former Simonds Saw and Steel Company, Lockport, New York, Final Report*. Prepared by ORNL for DOE under FUSRAP, September 1978

This investigation included the results of a radiological survey of Simonds, Lockport, NY. The survey was conducted "to characterize the existing radiological status of the property" (ORNL, 1978), primarily in what is now referred to as the Excised Area. Investigations, which were conducted in October 1976, included measurement of residual alpha and beta-gamma radiation levels in the rolling mill building and forging shop; external gamma radiation in the same area; uranium, radium, and thorium in soil samples taken from beneath removable floor plates in the rolling mill area and from other parts of the Site; radon and radon daughter concentrations in air samples in the rolling mill building; and contamination in drainage paths leading from the buildings and grounds. A few samples were also analyzed for individual uranium isotopes (U-234, U-235, and U-238) by mass spectrometry.

Using the same criteria as applied by USACE in its review, Earth Tech believes that these data may be usable in a risk assessment if chain-of-custody forms (COCs), equipment calibration records, detection limits, and analytical methods, are obtained from ORNL / DOE, assuming that the appropriate analytical methods were used, and that the detection limits are below appropriate screening levels for constituents of interest. Due to the age of the data, it is unlikely that all the supporting documentation will be available. However, even if the data quality does not allow the data to be used directly in a risk assessment, the data are likely to be useful for determining nature and extent of contamination, focusing subsequent investigations, and may assist in determining disposal options.

1.3.2 *Preliminary Engineering and Environmental Evaluation of the Remedial Action Alternatives for the Former Simonds Saw and Steel Company Site, Lockport, New York*, Former Utilized MED/AEC Sites Remedial Action Program, Final Report. Prepared by FBDU for Bechtel National, Inc. under FUSRAP, for DOE, November 1981

The purpose of this report was to present the results of a preliminary engineering evaluation and the environmental assessment leading to the selection of appropriate remedial action options for the Site (formally Simonds). This investigation included analysis of cinder samples from the Guterl Excised Area (Excised Area), primarily within the area of the 16-inch rolling mill. FBDU also collected external gamma radiation measurements in "Building A" (equivalent to Building 8 in the ORISE, 1999 report) in the general vicinity of the 16-inch rolling mill, and in "Building B" (equivalent to Building 3 in the ORISE, 1999 report). Test parameters included radium, thorium, and uranium. The report included analytical results with units, and sample location and depth.

USACE (2005b) concluded that the data may be usable in a risk assessment if COCs, equipment calibration records, detection limits, analytical methods, and uncertainty are obtained from Bechtel, assuming that the appropriate analytical methods were used, and that the detection limits are below appropriate screening levels for constituents of interest. As with the ORNL (1978) data, it is unlikely that all the supporting documentation will be available. However, even if the data quality does not allow the data to be used directly in a risk assessment, the data are likely to be useful for determining nature and extent of contamination, focusing subsequent investigations, and may assist in determining disposal options.

1.3.3 Engineering Investigations at Inactive Hazardous Waste Sites - Phase I Investigation, Guterl Specialty Steel, City of Lockport, Niagara County. Prepared by Engineering-Science and Dames & Moore for NYSDEC, January 1988

The purpose of this report was to assess the hazard to the environment caused by the then-present condition of the Guterl Landfill Area (Landfill Area). Materials reportedly disposed in the onsite landfill, operated from 1962 until 1981, includes slag, palletized baghouse dust, foundry sand, wood, and miscellaneous plant rubbish. The Phase I Investigation report included presentation of five rounds of prior analyses, collected between 1980 and 1982 by Secure Landfill Contractors, Inc. (SLC), for groundwater samples from the Landfill Area. Test parameters reported included oil & grease, phenols, total organic carbon (TOC), total halogenated organics, and metals. The report included analytical results with units and sample location. Boring logs and monitoring well construction logs were also included.

USACE (2005b) concluded that the data may be usable in a risk assessment if COCs, equipment calibration records, detection limits and analytical methods are obtained from NYSDEC. (Some of this information was included in the 1991 Preliminary Site Assessment (PSA)-Task 1 document [NYSDEC, 1991], described immediately below.) Earth Tech notes that the data presented in the report were from samples collected between December 1980 (approximately 25 years ago) and April 1982; as such, the data are unlikely to be representative of current conditions. As a result, the data are not likely to be useful for current and future data needs.

1.3.4 *Engineering Investigations at Inactive Hazardous Waste Sites - Preliminary Site Assessment, Task 1 Records Search, Guterl Specialty Steel Corporation, City of Lockport, Site No. 932032, Niagara County*. Prepared by E.C. Jordan for NYSDEC, January 1991

This report was prepared solely to determine the proper classification of the site in accordance with NYSDEC regulations (i.e., to determine if hazardous waste is present at the site [6 New York Codes, Rules and Regulations (NYCRR) Part 371] and if the waste at the site poses a 'significant threat'). This investigation included a summary of previous analysis of groundwater samples collected by SLC from the Landfill Area for the period 1980 to 1982. Test parameters summarized in the report included oil & grease, TOC, total halogenated organics (as lindane), metals (chromium, copper, iron, lead, magnesium, and nickel), and phenols; however, no analyses were conducted as part of this Phase 1 PSA (Task 1). Data from the December 1980 through April 1982 samples presented in this report are a re-statement of the same set of samples presented in the NYSDEC, January 1988 Phase I Report; however, a more complete summary is provided in the appendix to this 1991 PSA report than was presented in the 1988 Phase I report.

USACE (2005b) concluded that the data may not be usable in the risk assessment as only maximum concentrations are provided at each location; however, Earth Tech notes that a more complete summary is provided in Appendix D of the report (NYSDEC, 1991), which includes all the parameters and all the events, including reporting limits for non-detects. (Appendix D indicates that analyses were performed, including lindane, oil and grease, and other metals.) In addition, Earth Tech notes that the data presented in the report were from samples collected between 1980 and 1982 (more than 20 years ago); as such, the data are unlikely to be representative of current conditions. As a result, the data are not likely to be useful for current and future data needs.

1.3.5 *Engineering Investigations at Inactive Hazardous Waste Sites-Preliminary Site Assessment Evaluation Report of Initial Data, Guterl Specialty Steel, City of Lockport, Niagara County*, Volumes I and II. Prepared by ABB-ES for NYSDEC, April 1994

The purpose of this report was to establish the presence of hazardous waste at the Site and to determine if the Site posed a significant threat to public health or the environment. Specifically, the investigation was performed to develop data to reclassify the Site from a Class 2a to a Class 2 hazardous waste site.

This investigation included analysis of surface and subsurface soil, surface water, sediment, groundwater, and waste from the Landfill Area. Analytical parameters included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and toxicity characteristic leaching procedure (TCLP). Groundwater and surface water samples were also analyzed for gross alpha and gross beta activity. A survey for gamma radiation was conducted over the Landfill Area (228 grid points on a 33.33-ft spacing). In addition, split spoon samples were scanned for alpha, beta, and gamma radiation using a survey meter. The report included COCs, analytical results with units, detection limits, data qualifiers, analytical methods, equipment calibration records, and sample location and depth.

USACE (2005b) concluded that these data may be usable in a risk assessment. Data for conventional chemical analyses were validated by the contractor (ABB-ES); the laboratory data for gross alpha and gross beta radioactivity (groundwater and surface water samples) were not validated.

1.3.6 *Final Report, Guterl Steel Site, Lockport, New York*. Prepared by Roy F. Weston for USEPA, Work Assignment No. 2-194, April 1998

The purpose of this investigation was to conduct *in situ* surficial, and *ex situ* subsurface soil analyses for target metals using x-ray fluorescence (XRF). The samples were collected within the Excised Area, inside and outside Buildings 1, 2, 3, and 4/9. The samples were analyzed to evaluate the horizontal and vertical distribution of cadmium and lead (identified by the authors as primary indicators), and arsenic, nickel, and zinc (identified as secondary indicators). Additionally, shallow subsurface soil samples analyzed *ex situ* by XRF were submitted for TCLP metals analysis. Samples were also collected for PCB analysis from oil-stained areas and in the vicinity of an electric transformer.

Surficial lead and cadmium concentrations were detected in excess of the "screening level" of 400 parts per million (ppm) for lead and 200 ppm for cadmium over variable areas in each of the buildings and in the building exterior "vicinity." TCLP analyses showed limited areas of lead exceedances per regulatory guidance (5 ppm). PCBs (Aroclor 1260) were detected in samples collected near the transformer area, but were not detected in samples collected within oil-stained areas of Building 3.

The report included COCs, analytical results with units, equipment calibration records, detection limits, data qualifiers, analytical methods, and several figures depicting sample locations (without a fixed grid system) and contaminant isopleths. Data for sample depth are present, but must be derived from COCs and analytical data reports. USACE (2005b) concluded that the data may be usable in a risk assessment.

1.3.7 *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York*. Prepared under a contract with DOE by ORISE for US Bankruptcy Court for the Western District of Pennsylvania, December 1999 (ORISE, 1999)

The purpose of the ORISE investigation was to (1) adequately characterize the radiological status of the land and buildings areas located at the properties at the Site including the Allegheny property, and (2) to be comprehensive enough to provide both a volume and cost estimate for RD. This work was conducted in response to a request of the US Bankruptcy Court for the Western District of Pennsylvania and with the approval of the DOE.

This investigation included analysis of surface and subsurface soil and sediment samples from the Excised Area. The investigation also included a radiological survey of the buildings in the Excised Area. Test parameters included radium, thorium, and uranium. The report included analytical results with units, uncertainty, data qualifiers, analytical methods, and sample location and depth. Sample locations are often generalized to an item rather than a specific coordinate.

USACE (2005b) concluded that these data may be usable in a risk assessment if COCs, equipment calibration records, and detection limits are obtained from ORISE.

1.3.8 *Immediate Investigative Work Assignment Report, Guterl Excised Area, City of Lockport, Niagara County*. NYSDEC, October 2000

The purpose of this report was to determine the presence and extent of hazardous wastes at the Site. Specifically, the purpose was to determine if consequential amounts of hazardous wastes were disposed of in the Excised Area that would require the Excised Area be listed in the New York State Registry of Inactive Hazardous Waste Sites (NYSDEC, 2003). In addition, this report evaluated the effects of the Erie Barge Canal and the Frontier Stone Products quarry on the groundwater flow pattern in the vicinity of the Site by studying the strata underlying the Site.

This investigation included analysis of surface and subsurface soil, groundwater, surface water, and sediment samples collected from the Excised Area. Analytical parameters included VOCs, SVOCs, pesticides, PCBs, metals, and TCLP. The report included analytical results with units, data qualifiers, analytical methods, and sample location and depth. Sample COCs, equipment calibration records, and detection limits were not included in the report.

USACE (2005b) concluded that these data may be usable in a risk assessment if COCs, equipment calibration records, and detection limits are obtained from NYSDEC.

1.4 PHYSICAL SETTING

As defined by the RI SOW (USACE, 2005a), the Site was defined as "an approximately 70-acre site" comprised of three general areas, including the 52-acre Allegheny property, the 9-acre Landfill Area, and the 9-acre Excised Area. However, during the Technical Project Planning (TPP) Meeting conducted August 9 and 10, 2005, it was agreed to include additional properties that were at one time held by Simonds that may have been impacted by MED/AEC activity. (Simonds, a predecessor to Guterl Specialty Steel Corporation and operator of the facility during MED/AEC activity, appears in several historical report titles.)

Figure 1-2 presents the TPP-defined site boundaries including additional properties north (IA05) and northeast (IA06) of the SOW-defined boundaries. As discussed at the TPP Meeting, it was agreed to include IA05 and IA06 in the background records search and data gap analysis until individual tracts could be eliminated based on acquisition of data that would justify withdrawing the property from further consideration. **Figure 1-2** also shows two additional IAs (IA09 and IA10) that were created during development of this SAP. The two IAs were evaluated during the data gap analysis as part of IA05 and IA08, but were drawn out as individual IAs during development of the SAP to provide improved flexibility to the investigative rationale.

1.4.1 Topography

The Site is located in Lockport, Niagara County, NY, approximately 20 miles northeast of Buffalo, NY. The topography at the Site is relatively flat, with a relief of approximately 25 ft from the north side of the Site at Route 31 (elevation 595 ft) to the south side of the Site at NYS Route 93 (elevation 620 ft). The Site is located approximately one mile southeast of the west branch of Eighteen Mile Creek and 200 ft north of the northeast-southwest flowing Erie Barge Canal. There is a low-lying, seasonally wet area to the west and southwest of the Landfill Area. The Site does not contain any streams and has no visible connection to other surface water bodies (NYSDEC, 1988), including the Erie Barge Canal. The elevation of the Erie Barge Canal immediately south of the Site fluctuates by several feet due to its downstream location from the

Lockport locks, and its confluence with Tonawanda Creek. In general, the elevation of the Erie Barge Canal averages elevation 565 ft. An active dolostone quarry is located approximately 0.1 miles southwest of the Site. Earth Tech contacted the quarry to inquire about dewatering activity, and the quarry manager indicated that the open pit dewatering system operates constantly throughout the year, maintaining a dewatered condition within the pit (no elevation was provided).

1.4.2 Geology

This section of the FSP includes summaries of the regional and site-specific geologic settings for the Site.

1.4.2.1 Regional Geology

The geology of the Niagara region consists of a generally thin blanket of unconsolidated Wisconsin-age glacial sediments overlying a thick sequence of shales, sandstones, limestones and dolostones deposited in ancient seas during the Silurian and Devonian Periods (439-360 million years ago) (Buehler and Tesmer, 1963 (NYSDEC, 2000)). Bedrock bedding generally strikes in an east-west direction, approximately paralleling the east-west trending Niagara and Onondaga Escarpments, and dips to the south at approximately 30 to 40 ft per mile (Johnson, 1964; La Sala, 1968; Yager and Kappel, 1987 (NYSDEC, 2000)).

Brett, et al (1995, page 45 (NYSDEC, 2000)) describe the uppermost bedrock group, the Lockport Group, as a "massive- to medium-bedded, argillaceous dolomite with minor amounts of dolomite and shale." The uppermost bedrock formation underlying the Lockport area south of the Niagara Escarpment is the Goat Island Dolostone Formation of the Lockport Group (19 to 25 ft thick). The upper 10 to 25 ft of this unit can be heavily weathered and often contains abundant bedding planes and vertical fractures enlarged by dissolution and glacial scour (Miller and Kappel, 1987 (NYSDEC, 2000)). Stratigraphically below the Goat Island Member is the Gasport Member (15 to 30 ft thick) of the Lockport Group followed by the DeCew Formation (8 to 10 ft thick) of the Clinton Group and the Rochester Shale of the Clinton Group. The Rochester Shale is typically 55 to 65 ft thick in the Niagara region and is described as a dark bluish to brownish gray, calcareous shale with occasional argillaceous limestone layers. The upper Rochester Shale tends to be more dolomitic than the lower, especially where it contacts the DeCew Formation.

The major water-bearing units in the Niagara region are in the bedrock above the Rochester Shale. In the vicinity of the Site, this interval includes the rocks of the Goat Island and Gasport Members of the Lockport Group and the DeCew Formation of the Clinton Group.

In the recent past, most of New York, including the region of the Site, was covered by a series of continental ice sheets (often referred to as glaciers). The activity of the ice sheets widened pre-existing valleys, and deposited widespread accumulations of till. The melting of the most recent ice sheets, ending approximately 12,000 years ago in western NY, produced large volumes of melt water; this water subsequently shaped channels and deposited thick accumulations of stratified granular sediments.

As the ice sheets retreated from the region, meltwater formed proglacial lakes along the ice margin. This region is covered by lake sediments, the most recent being from Lake Iroquois (a large predecessor to Lake Ontario) and from Lake Tonawanda (an elongated lake which occupied an east-west valley and drained north into Lake Iroquois as the ice sheet retreated northward into the Ontario basin). The sediments consist of blanket sands and beach ridges which are occasionally underlain by lacustrine silts and clays (indicating quiet or deeper water deposition). In some areas, bedrock is within a few ft of the ground surface, where sediments have been eroded away. Drainage channels carved into the Niagara Escarpment, including Eighteen Mile Creek, indicate positions of former outlets of Lake Tonawanda.

Granular deposits in this area frequently act as shallow aquifers, whereas lacustrine clays, as well as tills, often inhibit groundwater movement. However, fine-grained, water-lain sediments, such as silts and clays, frequently contain horizontal laminations and sand seams. These internal features facilitate lateral groundwater movement through otherwise low permeable materials.

1.4.2.2 Site Geology

Geology for the Site has been described in several reports and is best summarized by NYSDEC (2000). As described by NYSDEC, there are three basic overburden units, one bedrock unit, and potentially two water bearing zones present at the Site. The basic overburden units include imported and/or man-made fill materials, overlying native overburden materials comprised of glaciolacustrine silts and clays overlying glacial till. The two water bearing zones previously identified at the Site include a shallow water-table zone in the overburden, and the uppermost zone of bedrock. Each component is described in more detail below.

In general, fill material ranges from 0.3 to 3.7 ft in thickness at the Site. (Fill material at the Landfill Area, however, ranges up to 14 ft in thickness.) The fill material is reported to consist predominantly of production and miscellaneous plant wastes containing coal, ash, coke, and brick.

Native overburden is described as a combination of a thin, discontinuous glaciolacustrine deposit of silts and clays overlying a thin, discontinuous glacial till of silt and clay with lesser amounts of sand and bedrock fragments. Glaciolacustrine deposits were encountered in borings and test pits (SB-6, TB-101, and TP3-94) performed by NYSDEC (NYSDEC, 2000). The unit was noted to be mottled and to contain vertical desiccation cracks throughout its thickness. Borings and test pits that have completely penetrated this deposit reveal that it directly overlies either glacial till or bedrock, and where encountered, ranges in thickness from 0.5 to 2.5 ft (NYSDEC, 2000). Based on a review of boring logs from the 1980 landfill wells and the 1997 NYSDEC bedrock wells, the glacial till unit ranged from less than 1 to approximately 2.5 ft in thickness when encountered (NYSDEC, 1988).

The uppermost bedrock unit is the east-southeast dipping Goat Island Member of the Lockport Group. Depth to bedrock, as determined from well logs and test pit information, ranges from approximately 4 ft below grade (Excised Area wells; southeast portion of the Site, i.e., MW-4) to approximately 15.3 ft below grade (landfill test borings and test pits; northwest portions of the Site, i.e., TB-104) (NYSDEC, 2000). Physical features of the Goat Island Member observed within the region include horizontal and vertical fractures, vugs, physical weathering of the bedrock surface (e.g., glacial effects), and solution weathering of the fractures (i.e., solution-widened secondary porosity) (Johnson, 1964; Yager and Kappel, 1987 (NYSDEC, 2000)).

1.4.3 Hydrogeology

This section of the FSP includes summary descriptions of the regional and site-specific hydrogeologic setting for the Site.

1.4.3.1 Regional Hydrogeology

Regional hydrogeology has been described for the Site vicinity in several prior investigation reports and is best summarized by NYSDEC (2000). The following material regarding regional hydrogeology is adapted in its entirety from NYSDEC, 2000 (Section VI, pp 17-18).

Water bearing zones in the Lockport area include unconsolidated glacial deposits and bedrock of the Lockport Group and Rochester Shale (Johnson, 1964; GZA, 1981). Most of the unconsolidated deposits in the area consist of fine grained glacial deposits with hydraulic conductivities roughly 10^{-7} centimeters per second (cm/s) or less (Earth Dimensions, 1980). These deposits, however, often contain horizontal laminations and sand lenses that can produce perched water-table conditions, or if areally extensive, can be utilized as sources of water (La Sala, 1968). Because the unconsolidated deposits in southwestern Lockport are relatively thin, and horizontal laminations and sand lenses are not common, groundwater yields from these deposits would be too low for domestic or industrial purposes. Overburden groundwater flow in the area, therefore, is expected to be highly localized and discontinuous.

The Lockport Group consists predominately of dolostone, however, thin beds of limestone and shaly dolostone, and small irregularly shaped masses of gypsum are common. These thin beds and masses are subject to dissolution by groundwater, resulting in the enlargement of fractures and the formation of migration pathways that transmit large quantities of groundwater. Groundwater wells completed in the Lockport Group have yields commonly ranging from 10 to 100 gallons per minute (gpm) (Miller and Kappel, 1987), with yields up to 950 gpm reported (Yager and Kappel, 1987). Reported transmissivity values range from 330 to 68,000 gpd/ft (Johnson, 1964). Groundwater in the Lockport Group is typically either calcium-sulfate or calcium-bicarbonate water, very hard, and highly mineralized with calcium, bicarbonate, magnesium, sulfate and chloride present in significant concentrations (Johnson, 1964; La Sala, 1968). Due to this poor water quality and the nearby presence of the Niagara River, an important source of municipal drinking water throughout Western New York, bedrock water is not extensively utilized as a source of domestic water in the Lockport area. The municipal drinking water source for the town of Lockport is the Niagara River.

Most recharge to the Lockport Group results from infiltration of rainfall, snowmelt, and surface water through the overburden deposits; subsurface flow of groundwater from areas of higher elevation (e.g., the Niagara Escarpment) also recharges the bedrock aquifer (Johnson, 1964; La Sala, 1968; Miller and Kappel, 1987; Yager and Kappel, 1987). The blocky structure, i.e., cracks that have formed as a result of swelling and shrinking of clay minerals, of the native glacial deposits in the southwestern Lockport area likely permits recharge of the upper bedrock aquifer by infiltration. Recharge of deeper bedrock aquifers by infiltration through the floor of the nearby quarry and Erie Barge Canal is also expected to occur.

Groundwater within the Lockport Group occurs primarily in the secondary porosity features such as weathered surface fractures, bedding planes, vertical joints, and small cavities and vugs. The principle control on groundwater flow, however, is the vertical joints and horizontal bedding plane fractures. The latter are the primary groundwater flow pathways in the Lockport Group and are areally extensive over several miles (Johnson, 1964; Yager and Kappel, 1987). Johnson (1964) identified seven such zones in the Niagara Falls area. Similar zones are likely to be found in the Lockport area but have not been extensively studied, or correlated with those in Niagara Falls. Some horizontal groundwater flow also occurs through small cavities and vugs (Woodward-Clyde and Conestoga-Rovers and Associates, 1992). Vertical movement of groundwater also occurs, especially in the upper 10 to 25 ft of rock where vertical fractures, created by stress relief from tectonic events, glacial rebound (Gross and Englelder, 1991), and quarrying operations (NYSDEC, 2000) have been enlarged by post-glacial fluvial exposure and fracture/joint dissolution. Vertical movement of groundwater within the Lockport Group is quite prevalent, with both upward and downward gradients observed (Woodward-Clyde and Conestoga-Rovers & Associates, 1992). Where horizontal and vertical fractures intersect, the water bearing capacity of the bedrock is substantially increased. Although such areas have been identified in the Niagara Falls area, little investigation has been conducted to identify such features in the immediate Lockport area.

1.4.3.2 Site Hydrogeology

According to NYSDEC (2000), groundwater occurs in the fill and native soils of the overburden, and in the shallow bedrock. This report concludes that groundwater flow in both the overburden and bedrock zones appears to flow outward from a northeast-southwest trending groundwater divide centered over the landfill. Groundwater west of this divide appears to flow west toward the dolostone quarry, and groundwater east of this divide appears to flow east toward the Erie Barge Canal. Additional conclusions drawn by NYSDEC include that the two water-bearing zones appear to be hydraulically well-connected, and each zone exhibits definable seasonal water level fluctuations. By comparing the limited groundwater elevation data from existing Site wells, groundwater elevation data collected from wells in the summer (August 14, 1997) are uniformly lower than groundwater elevation data collected from wells in the spring (April 20, 1998).

1.4.3.2.1 Unconsolidated Material

Five overburden monitoring wells have been installed at the Site, all of which are located in the Landfill Area. Only a small data set of water level measurements exist for these wells. No site-specific hydraulic conductivity data were located for these wells.

The available overburden groundwater data appear to indicate that fluctuations due to precipitation can be expected; i.e., in general, water levels will be higher during wet-weather conditions and lower during the relatively dry summer and fall months. At the Landfill Area, water level fluctuations up to three ft were observed in overburden monitoring wells.

1.4.3.2.2 Bedrock

Five upper bedrock monitoring wells have been installed at the Site, all of which are located in the Excised Area. Only a small data set of water level measurements exist at the Site. No site-specific hydraulic conductivity data were located for these wells.

Like the overburden hydrogeologic zone, upper bedrock zone groundwater data appear to indicate that fluctuations due to precipitation can be expected; i.e., in general, water levels will be higher during wet-weather conditions and lower during the relatively dry summer and fall months. At the Excised Area, water level fluctuations up to two ft were observed the in bedrock monitoring wells.

1.4.3.2.3 Surface Water

Based on an assessment of available information, surface water at the Site is largely unmanaged. Surface water can be considered to occur in two forms at the Site: storm water runoff, and standing or ponded water resulting from generally poor drainage patterns. Earth Tech suggests that the generally poor drainage patterns are a result of generally poor management of filling, landfilling, and grading activities at the site. USACE also notes "In general, this area of Lockport is found to have poor drainage. Due to low soil permeability, there is a high potential to collect water from precipitation and overland drainage" (USACE, 2001b; p 5).

Since storm water runoff is unmanaged, i.e., no storm sewers reportedly exist at the Site, runoff is expected to move as sheet flow from topographic highs to topographic lows. Two prominent topographic lows are apparent at the property: one at the northeastern corner of the Site (north of the Excised Area); and, another south-southwest of the landfill. USACE notes that "Drainage off the Site is to the north. During periods of high precipitation, overland runoff flowing to the north could reach Gulf Creek, a tributary of Eighteen Mile Creek" (USACE, 2001b, p. 5). The landfill is poorly graded, and has been observed to exhibit pockets of standing water (e.g., NYSDEC, 1991). Storm water that falls within the buildings of the Excised Area can be considered to be trapped, and subject to evaporation or infiltration within and around the building footprints.

No regulated wetlands have been identified at the Site. FBDU (1981) noted that the Site is not in a floodplain; but do not specifically mention the presence or absence of wetlands. NYSDEC (1988; citing Doleski, 1980) notes that there is a low-lying wet area to the west and southwest of the Site (the Landfill Area, which was the 'site' studied), but states that "this area is not classified as a regulated wetland." However, this assessment is now somewhat dated, and should be repeated to confirm the current status. The Site does not contain any streams and has no visible connection to other surface water bodies (NYSDEC, 1988), including the Erie Barge Canal located south-southeast of the Site. Historic documents indicate that a cooling water intake and an oil/water separator were located in close proximity to the Erie Barge Canal, and overflows from the oil/water separator may have reached the Erie Barge Canal.

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2 PROJECT ORGANIZATION AND RESPONSIBILITIES

The overall project organization and responsibilities of key personnel are described in the following sections. A flowchart depicting project organization is shown in **Figure 2-1**.

2.1 PROGRAM MANAGER

The Program Manager manages the overall cost and schedule performance and provides oversight on technical issues pertaining to the projects under the USACE Buffalo District general contract W912P4-05-D-0001. His duties include oversight to ensure that all contractual requirements are properly satisfied; identification and preparation of requests for changes in the project scope, schedule, or budgetary baselines; and final resolution of any conflict identified during project performance.

2.2 PROJECT MANAGER

The Project Manager manages the overall performance and quality of the delivery order project. This individual oversees the Site Supervisor in meeting project goals and objectives in a quality and timely manner and reports to the Program Manager. This individual also will serve as the primary point of contact for the Buffalo USACE Project Manager. The Project Manager will develop, monitor, and fill project staffing needs, delegate specific responsibilities to project team members, and coordinate with administrative staff to maintain a coordinated and timely flow of project activities. In coordination with the Site Supervisor and the QA/QC Officer, this individual will address issues including identification of non-conformances and verification of corrective action.

2.3 SITE SUPERVISOR

The Site Supervisor is responsible for assisting the Project Manager in all aspects of project control and oversight and serves as a secondary point of contact for the Buffalo USACE Project Manager. In addition, he is responsible for implementing field activities conducted during the project in accordance with established project procedures and protocols and serves as the field QA/QC supervisor. This individual is responsible for the coordination of field personnel activities, management of investigation derived wastes, field documentation, and preparation of field change orders if required. The Site Supervisor reports directly to the Project Manager.

The Site Supervisor is also responsible for implementation and documentation of all project QA/QC protocols during field activities and his role includes being the field Chemical Quality Control (CQC) Supervisor. In this capacity he will direct and implement the various components of the Contractor Chemical Quality Control (CCQC) program as identified in the SAP. This will include, but not be limited to the documentation of field QC activities and the completion of Daily Chemical Quality Control Reports (DCQCRs). The CCQC Representative reports directly to the QA/QC Officer, but will inform the Project Manager of all information and decisions reported.

2.4 RI FIELD GEOLOGIST

The RI Field Geologist is responsible for ensuring that the goals of the RI field data collection program are met. This individual is responsible for ensuring that the field program is performed in a manner that provides the quantity and quality of technical data required for project success. The RI Field Geologist will have site knowledge and history required to make technical decisions for the addition, deletion, or relocation of sample locations and/or numbers. This individual is responsible for the proper technical performance of drilling operations and field sampling activities, adherence to required sample, custody and other related QA/QC field procedures. The RI Field Geologist reports directly to the Site Supervisor.

2.5 QUALITY ASSURANCE/QUALITY CONTROL OFFICER

The QA/QC Officer is responsible for overall project QA/QC oversight in accordance with the requirements of the QAPP, other work plan documentation, and appropriate management guidance. This individual will be responsible for participating in project field activity readiness reviews; approving variances during field activities before work continues; approving, evaluating, and documenting the disposition of non-conformance with project documents, overseeing and approving any required project training; and designing and supervising implementation of audit/surveillance plans. The QA/QC Officer reports directly to the Project Manager but will inform the Site Supervisor and RI Field Geologist of all information and decisions reported.

2.6 SITE SAFETY AND HEALTH MANAGER

The Site Safety and Health Manager (SSHM) is the member of the Earth Tech Safety, Health and Environmental Department assigned to oversee health and safety requirements for the project and provide any needed technical support. The SSHM is responsible for confirming that health and safety procedures designed to protect personnel are maintained throughout the field activities conducted for the project. This will be accomplished by strict adherence to the project Site Safety and Health Plan (SSHP). This individual will have the authority to stop fieldwork if health and/or safety issues arise that are not immediately resolvable in accordance with the SSHP. The SSHM will coordinate with the Health Physicist on matters that involve, or might involve, health physics issues. The SSHM reports directly to the Project Manager.

2.7 SITE SAFETY AND HEALTH OFFICER

The Site Safety and Health Officer (SSHO) is the Earth Tech employee assigned to oversee daily health and safety requirements for the field investigation. The SSHO is responsible for making health and safety decisions, for specific health and safety activities, and for verifying the effectiveness of the health and safety program. The SSHO's qualifications include, at a minimum, current Hazardous Waste Operations and Emergency Response (HAZWOPER) training, HAZWOPER Supervisor training, experience with similar projects, knowledge of and understanding of the project SSHP, and the ability to use the required monitoring equipment. The SSHO will coordinate with the Health Physicist on matters that involve, or might involve, health physics issues. The SSHO reports directly to the SSHM.

2.8 HEALTH PHYSICIST

The Health Physicist is responsible for providing technical direction and support to the project related to human health issues, dose assessments and radiological data needs and interpretations. Specific responsibilities include developing risk methodologies, providing or reviewing portions of the SSHP, providing or reviewing the radiological data requirements and sampling methodology and developing responses to radiological issues associated with the Site. The Health Physicist reports directly to the Project Manager.

2.9 SITE RADIATION SAFETY OFFICER

The Site Radiation Safety Officer (SRSO) is responsible for confirming that radiation safety procedures designed to protect personnel are maintained throughout the field activities conducted for the project. This will be accomplished by strict adherence to the project Radiation Protection Plan (RPP) provided as an attachment to the SSHP. This individual will have the authority to stop fieldwork if health and/or safety issues, as they apply to radiological issues, arise that are not immediately resolvable in accordance with the SSHP. The SRSO reports directly to the Health Physicist.

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3 PROJECT SCOPE AND OBJECTIVES

This section of the FSP describes project objectives, tasks, Applicable or Relevant and Appropriate Requirements (ARARs), and the project schedule.

3.1 PROJECT DATA QUALITY OBJECTIVES

The goal of the Site RI/FS is to generate data of known and sufficient quality and quantity, with quantitation levels low enough to meet pertinent standards, ARARs, and remediation goals, with the long-term objective being the selection of a protective remedy that satisfies CERCLA. To achieve this, it is necessary to obtain data that are sufficient to determine nature and extent, risk, and fate and transport of contaminants in a RI, conducted utilizing CERCLA guidance (USEPA, 1988). A secondary objective of this data collection may be to produce data sufficient to develop an adequate volume estimate of contaminated media, as well as to assist in the development of project cost estimates, to support the feasibility study. The data may also be used to identify appropriate disposal facilities for wastes generated during site investigation activities and during RA.

A preliminary identification of data quality objectives (DQOs) and ARARs is presented in the report *Preliminary Identification of Data Quality Objectives and Applicable, Relevant, and Appropriate Requirements, Former Guterl Specialty Steel Corporation FUSRAP Site* (USACE, 2005c).

As part of the planning phase for the Site RI, a TPP Meeting was conducted August 9 and 10, 2005. The purpose of the TPP Meeting was to gather the project stakeholders for informational discussions, and to begin to develop site-specific project DQOs for the RI/FS. A total of 21 project DQOs were developed for the RI/FS during the TPP Meeting, and are summarized in the *Data Gap Analysis Report* (USACE, 2006a).

Several of the project DQOs have been accomplished prior to development of this SAP, or are not directly applicable to the RI field data collection and management program. The project DQOs that are directly applicable to this FSP are listed below and discussed in more detail in **Table 3-1**. The project DQOs applicable to this RI include (grouped by topic with TPP Meeting numbering maintained for continuity):

Overarching Objectives:

1. Determine the nature and extent of MED/AEC related constituents present at the Site (i.e., uranium, thorium, and radium[2] and the media and locations in which they are present).
2. Acquire information to define the fate and transport of contaminants from the Site.
4. Provide sufficient characterization data to allow completion of subsequent FS, RD,

[2] Radium was not included in the constituent list developed during the TPP Meeting, but was added to the list of constituents of potential concern during development of this FSP in response to further technical evaluation of the Site. This note applies to each of the project DQOs where radium is listed. Additional detail is provided in Section 3.4.

and RA.

Operations:

6. Identify the underground utility system within the Site, including if possible, utilities in place at the time of AEC contracted efforts and utilities installed after the AEC contracted efforts. Includes both between building and within building utilities.

Nature and Extent:

9. Define nature and extent of isotopic uranium, thorium, and radium in surface soils, subsurface soils, and buildings to support risk assessment (using Nuclear Regulatory Commission (NRC) screening levels for human health and DOE guidance for ecological [DOE, 2002]) and development and evaluation of FS alternatives (volume determination).[3]
10. Determine whether groundwater has been impacted by isotopic uranium, thorium, and radium above screening levels; and if so, determine nature and extent to support risk assessment, and development and evaluation of FS alternatives.
11. Determine whether surface water and sediments have been impacted by isotopic uranium, thorium, and radium above screening levels.
13. Determine if isotopic uranium, thorium, and radium has contaminated underground utilities.

Risk Assessment/Feasibility Study:

14. Determine the magnitude of any chemical contamination to support establishing transportation and disposal requirements (e.g., waste classification) and associated costs to be included in various FS alternatives.
15. Conduct an inventory of building content/structures to support FS alternatives and evaluations.
19. Gather sufficient data to complete a Baseline Human Health Risk Assessment (HHRA) for human health and a screening level ecological risk assessment.

3.2 TASK DESCRIPTION

Earth Tech has developed this FSP to specify the scope and provide for documentation of the RI field data collection program. The FSP has been developed prior to the start of field sampling activities and describes field investigation methods and procedures, including equipment decontamination. In addition, the FSP includes plans for mobilization to the Site, disposal plans for investigation derived wastes (IDW) and field personnel organization chart and responsibilities.

[3] Since these elements are naturally occurring, a background concentration will be established for each radioisotope. The background concentration for each will be added to the appropriate NRC-provided screening level to derive an effective (working) screening level for RI purposes.

The general approach in preparing the FSP is to first review data collected from previous investigations and other available sources to initially delineate the areas of concern. Earth Tech conducted a data gap analysis for the project Site that included evaluation of ten historical data reports and three additional related reports. Earth Tech prepared a *Data Gap Analysis Report* (USACE, 2006a), referred to herein as DGAR, that summarized the findings of the data gap analysis. The DGAR was organized by investigative areas (IA). Earth Tech also prepared a Data Gap Analysis Summary Document (USACE, 2006b), organizing data gaps by media. The media evaluated include soil/sediment, groundwater, surface water, and buildings surfaces. Earth Tech also considered two additional categories – sewers/drains and "other data gaps" (i.e., not media specific).

The data gap analysis identified documented, or in some cases a strong probability for, MED/AEC (i.e., FUSRAP-eligible) radiological contamination within seven of the eight IAs, including each of the media evaluated. Recommendations for additional data collection to fill the data gaps and develop data of sufficient quality and quantity to meet the project objectives have been presented in detail for each media, and are summarized in Section 5.

3.3 Investigative Areas

During the TPP Meeting, the concept of developing IAs to better manage the assessment of existing data and future data needs was introduced and developed. The list of IAs was refined during the preparation of project plans, to better provide investigative flexibility. The organizational benefit of developing IAs is demonstrated by developing a correlation between the Conceptual Site Model (CSM) and data gap analysis. These IAs may also be useful for developing exposure units (EU) for risk assessment purposes.

IA01 Excised Area – Building Surfaces and Interiors (including Building 24)

IA02 Excised Area – Building Exterior Areas

IA03 Landfill Area

IA04 NCIDA Property (Allegheny operations area, not including Excised Area, Landfill Area, or Building 24)

IA05 Railroad Right-of-Way North of Site Proper

IA06 Off-site Northeast Properties

IA07 Groundwater

IA08 Site Utilities (sewers and drains)

IA09 Erie Barge Canal (adjacent to the Site)

IA10 Lot 4.1 ("Lombardi Property")

Figure 1-2 depicts the Site IAs. A detailed discussion of the extent and concerns associated with each of the IAs is presented in **Section 4.2.2** of this FSP.

3.4 CONSTITUENTS OF POTENTIAL CONCERN

The initial list of constituents of potential concern (COPCs) was presented in the DGAR (USACE, 2006a; Section 2.4) and consisted of U-234, U-235, U-238, and Th-232. During the development and review of project plans, additional site-specific COPCs have been identified and will be addressed during this RI/FS. These additional radiological isotopes are Th-228 and Th-230, and radium (Ra)-226 and Ra-228. These isotopes were added to the COPC list based on their being key daughter products of the initial COPC list; potential impurities in the raw materials processed at Guterl; and risk assessment needs.

Therefore, for this SAP (including both the FSP and QAPP), the COPC list consists of:

- Isotopic uranium (U-234, U-235, and U-238)
- Isotopic thorium (Th-228, Th-230, and Th-232)
- Ra-226 and Ra-228.

3.5 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A preliminary identification of ARARs is presented in the report *Preliminary Identification of Data Quality Objectives and Applicable, Relevant, and Appropriate Requirements, Former Guterl Specialty Steel Corporation FUSRAP Site* (USACE, 2005c). The preliminary list of ARARs will be evaluated throughout the RI process, and will be updated, if necessary, in the RI Report.

3.6 SCHEDULE

A summary schedule for the activities to be performed during the RI data acquisition phase of this project is provided in **Figure 3-1.** The proposed schedule is based upon the following assumptions:

- Approval of the SAP (i.e., FSP and QAPP) by USACE and issuance of Notice to Proceed on or about June 4, 2007.
- Availability of sufficient funding from the Federal Government for the performance of work
- Obtaining access agreements for the Site and neighboring properties (as needed) by June 11, 2007.

If each of the above-listed items is completed by the anticipated dates shown, it is anticipated that RI field work will begin on June 11, 2007.

4 NON-MEASUREMENT DATA ACQUISITION

Several types of non-measurement data have been (and may continue to be) acquired during the course of the Site RI. Non-measurement data types include historic records and facility operation documents, historic aerial photographs, land ownership deeds and legal descriptions, and historic analytical data from previous site investigations.

4.1 RECORDS REVIEW AND EVALUATION

Earth Tech conducted a site-specific records review and evaluation utilizing documents provided by Buffalo District USACE. The reports and data generated from the previous investigations were reviewed for applicability and potential usefulness going forward in the RI process. The evaluation is summarized in **Section 1.3** of this FSP, and was the first step of the data gap analysis.

4.2 RI TASK 4: DATA GAP ANALYSIS

Earth Tech performed a data gap analysis to provide a summary of existing data, including an assessment of the existing data for usability in the RI/FS. The usability assessment consisted of determining if the data generated to date is of sufficient quantity and quality for its intended uses. These uses include both the purposes for which the data were originally generated; and the extent to which these data are also adequate for current and future uses. The results of this review are briefly presented in this report. Complete results and a more detailed description of the evaluation methodology are presented in the *Data Gap Analysis Report* (USACE, 2006a).

An important aspect of the data gap analysis was the conduct of a TPP Meeting to gather the project stakeholders for informational and technical discussions regarding the project details and objectives. The TPP Meeting for the Site was conducted August 9 and 10, 2005.

4.2.1 Preliminary Conceptual Site Model

A preliminary CSM has been developed for the Site. The preliminary CSM helps the data evaluation process, and assists with the evaluation of the impacts of MED/AEC operational history at the Site on the distribution, and potential fate and transport mechanisms of MED/AEC related wastes. **Figure 4-1** represents the Preliminary CSM and Pathways for Human Exposure at the Site.

The preliminary CSM helps to identify and visually organize potential exposure pathways and receptors and identifies those pathways, which may be complete or incomplete, for the purpose of the data needs determination. The preliminary CSM will be refined utilizing additional site information collected during the RI. The elements of the preliminary CSM are:

- Contamination Mechanism (Rolling Mill Operations)
- Source Media (Building Surfaces and Surface Soil)
- Transportation Mechanisms (Wind, Surface Water Runoff/Sewers and Drains, Leaching, and Land Disposal/Disturbance)
- Exposure Media (Building Surfaces, Soil (Surface and Subsurface), Surface Water/Sediment, and Groundwater)

- Exposure Routes (Ingestion, Dermal Contact, Inhalation (Fugitive Dust), External Radiation, and Ingestion of Produce)
- Current and Future Human Receptors (Trespasser, On-Site Worker, Construction Worker, Commercial/Industrial, and Residential)

4.2.2 Investigative Areas

As noted in **Section 3.3** of this FSP, IAs have been established to better manage the assessment of existing data and future data needs. A more detailed discussion of each of the ten IAs (as listed in **Section 3.3** and illustrated on **Figure 1-2**) is presented below.

4.2.2.1 Investigative Area 01 (IA01) - Excised Area – Building Surfaces and Interiors (Including Building 24)

The buildings included in IA01 are the nine buildings within the Excised Area; several of the buildings are attached and appear to be a single building. The nine buildings in the Excised Area are Buildings 1 and 2; the attached (co-joined) buildings 3, 4, 5, 6, 8, and 9; and Building 35. Building 24, which is attached to the north side of Building 8, is not part of the Excised Area but is discussed within this section due to the impact of MED/AEC operations on the south end of the building. **Table 4-1** provides a summary of building construction date, floor space, and use.

4.2.2.2 Investigative Area 02 (IA02) - Excised Area – Building Exterior Areas

The exterior grounds of the Excised Area include a crane yard to the east of Buildings 1 and 2; an alleyway between Buildings 2 and 3; an alleyway surrounding Building 5; a courtyard area between Buildings 3 and 24; and the exterior loading dock area to the west of Buildings 6 and 8 and north of Buildings 4 and 9.

4.2.2.3 Investigative Area 03 (IA03) – Landfill Area

The Landfill Area is a Class 2 NYSDEC Inactive Hazardous Waste Site (ID 9-32-032). It consists of an 8.6-acre area located in the northwest portion of the Site. Available records indicate that from 1962 to 1980 the landfill was used for the disposal of wastes such as slag, baghouse flue dust, foundry sand, and other plant rubbish. The operators of the facility during that period include Simonds (to 1963), Wallace-Murray Corporation (1963 to 1972), and Guterl Specialty Steel Corporation (1972 to 1980). Undeveloped property is present to the west and south of the landfill, and these areas exhibit marsh characteristics (at least seasonally). A private light industrial property (Lombardi) is present north of the northeast corner of the landfill.

4.2.2.4 Investigative Area 04 (IA04) – Niagara County Industrial Development Agency (NCIDA) Property (Excluding Excised Area, Landfill Area, and Building 24)

IA04 comprises the areas of the USACE SOW-defined project Site, including those areas of the primary plant Site that are not included in the Excised Area, the Landfill Area, or Building 24. ORISE (1999) discovered potential MED/AEC-related wastes north of the Excised Area and adjacent to the northeastern corner of the Landfill Area. During the July 1996 USEPA radiological survey, soil on the Allegheny property was determined to be contaminated.

4.2.2.5 Investigative Area 05 (IA05) – Railroad Right-of-Way North of Site

IA05 includes the narrow, former railroad right-of-way corridor extending north from the northwest corner of the main plant area to NY Route 31. The former railroad corridor was included as an area of interest during the TPP Meeting. Available records indicate that the MED/AEC materials arrived at, and left, the facility via rail car. Based on available information, it appears materials were delivered to, or picked up at, the loading dock located at the west side of Building 6 (ORNL, 1978). Simonds did grant an easement to NY Central Railroad, and Simonds indicated in an August 1949 memorandum to the AEC, that the NY Central RR was the railroad company that transported materials from Simonds (Simonds Saw, 1949). Transport of radioactive materials was allowed by law and in fact there were a number of regulations and guidelines for transportation of such materials by various means. For example, an adequately trained AEC representative was required to accompany shipments of radioactive materials (AEC, 1958).

4.2.2.6 Investigative Area 06 (IA06) - Off-site Northeast Properties

During the TPP Meeting, the status of three parcels of land that were historically owned by Simonds but are located off the FUSRAP-defined Site property was discussed. The lots are shown on Tax Map 108.20, Lots 27 and 29, Lots 23 and 25, and Lots 15, 17, 19, and 21 (Niagara County Real Property Tax Services, May 2004). The lots are not contiguous to the rest of the Site, and are not in an area (e.g., railroad right-of-way) likely to have been affected by the manufacturing, processing, storage, or transportation of MED/AEC materials at the Site. Based on available records, the parcels were sold by Simonds to third parties in February 1943; i.e., several years before Simonds began MED/AEC activities (Niagara County Clerks Department, 1943a, 1943b, and 1943c). Therefore, it does not appear reasonable that these parcels would be located in an area that would have been affected by Simonds' MED/AEC activities. As a result, Earth Tech recommends removing these properties, and thus this IA, from further consideration under the FUSRAP investigation. No additional investigations are planned for this IA.

4.2.2.7 Investigative Area 07 (IA07) – Groundwater

IA07 consists of the unconsolidated overburden and the uppermost bedrock zone at the Site. Previous investigations have detected the presence of radiological contamination within overburden groundwater at the landfill (gross alpha slightly above guidance value); no isotopic data have been developed for the overburden groundwater zone. The source and extent of the overburden groundwater contamination has not yet been determined. No radiological data have been developed for the bedrock groundwater zone.

4.2.2.8 Investigative Area 08 (IA08) – Site Utilities (Sewers and Drains)

Only a limited amount of data exists to define the presence and status of Site utilities and drains. For the purpose of this report, IA08 is intended to include storm sewers, sanitary sewers, trenches constructed for sewer, gas, water, or electric service, and Excised Area building interior floor trenches or drains.

4.2.2.9 Investigative Area 09 (IA09) – Erie Barge Canal

This IA was evaluated in the DGAR within IA08; however, during development of the FSP a technical adjustment was made to identify this potentially affected area as a separate IA. The Erie Barge Canal IA is defined as surface water and sediment within the segment of the Erie Barge Canal that is just beyond the most upstream and most downstream IA08 discharge points to the Canal. No prior radiological data were found for surface water or sediment over this potentially impacted segment of the Canal.

4.2.2.10 Investigative Area 10 (IA10) – Tax Lot 4.1 (Lombardi Property)

This IA was evaluated in the DGAR within IA03 and IA05; however, during development of the FSP a technical adjustment was made to identify this potentially affected area as a separate IA. Lot 4.1 (Tax Map 108.20; Niagara County Real Property Tax Services, 2004) is located immediately north of the northeast portion of IA03, and immediately west of the southwest portion of IA05. This privately owned parcel was partially investigated in 1999 by NYSDEC. Field inspection (NYSDEC, 1999) and analysis of aerial photos (USACE, 2006a) identified the potential for FUSRAP-related materials to have been inadvertently moved onto this IA as a result of land development activity. The IA is defined by the tax lot boundaries for the parcel. In prior reports, this IA has been referred to as the "Lombardi Property."

5 REMEDIAL INVESTIGATION DATA COLLECTION PROGRAM

5.1 GENERAL

The RI data collection program is based on a progression of evaluation of information from the preceding phases of work and is designed to utilize identified data collection options to meet the identified project objectives and data needs. Brief discussions of specific data collection rationale and approaches are included in the following sections.

- Section 5.2 describes the bases for the design of the radiological survey program.
- Section 5.3 describes the classification of Site areas and facilities.
- Section 5.4 describes the characterization survey design and investigation methods.
- Section 5.5 describes investigation derived waste disposition.
- Section 5.6 summarizes the level of effort.

5.1.1 Observational Approach

An observational approach with respect to the extent of radiological surface soil, subsurface soil, groundwater, surface water, sediment, and building material contamination will be employed during sampling activities conducted within applicable IAs. Additional detail regarding data management related to the characterization activity is provided in **Section 6.**

The observational approach for surface soil and subsurface soil samples incorporates the use of a real-time scan of the recovered soil core using a scintillation detector to screen segments of the core and identify segments for analysis at the on-site gamma spectroscopy laboratory. The on-site gamma spectroscopy laboratory will provide near real-time quantitative radiological data for site COPCs. Field screening data and onsite laboratory data will be evaluated to determine if the extent of radiological soil contamination has been defined. If the extent has not been defined, the installation of additional soil borings and collection of additional soil samples will be considered in coordination with USACE.

Two sampling events are planned for groundwater wells. The observational approach for groundwater samples includes an initial sampling event for all new and existing monitoring wells to occur early in the field investigation schedule[4]. The groundwater samples will be analyzed using fixed laboratory alpha spectroscopy (U and Th isotopes) and EPA method 903/904 (Ra-226 and Ra-228). Laboratory data will be evaluated immediately upon receipt. In this manner, the need for additional monitoring wells, parameters, and/or sampling events will be considered while the field investigation is still active. The project team will review the first round data prior to implementation of the second round. Based on this review, the project team may, as appropriate, reduce the analyte list or add analytes necessary for fate and transport, risk assessment, or other project data needs. It is possible that secondary sampling locations may be required if primary sample results indicate the presence of contamination within soil and/or

[4] "Existing monitoring wells" refers to wells installed by Simonds Saw in 1981, and NYSDEC in 1994 and 2006. USACE will negotiate access to the NYSDEC wells with NYSDEC.

groundwater and if the associated extent of contamination has not been defined based on available data. Every effort will be made to limit secondary sampling to locations and sample intervals necessary to completely define the extent of radiological soil and groundwater contamination at the Site.

The observational approach for surface water and sediment samples incorporates the use of fixed laboratory gamma spectroscopy, alpha spectroscopy (U and Th isotopes), and EPA method 903/904 (Ra-226 and Ra-228) to provide radiological data. Similar to the groundwater approach, surface water and sediment samples will be collected early in the RI field schedule so that analytical data can be evaluated to determine if the extent of radiological contamination has been defined while the RI is ongoing. If the extent has not been defined, the collection of additional data points will be considered in coordination with USACE.

The observational approach for building materials also incorporates the use of fixed laboratory alpha spectroscopy to provide radiological data. The use of field gamma spectroscopy is not considered appropriate for this matrix (comprised of a variety of materials, such as concrete, brick, firebrick, *etc*.). Analytical data will be evaluated upon receipt to determine if the extent of radiological contamination has been defined. If the extent has not been defined, the collection of additional data points will be considered in coordination with USACE.

5.1.2 General Characterization

Several types of data will be collected during the RI to support general site characterization activities. The types of general characterization data include soil geotechnical parameters, RI IDW characterization, groundwater aquifer properties, geophysical utility clearance surveys, and civil location surveys.

Disturbed and undisturbed (if possible) soil samples will be collected and submitted for laboratory analyses for the following geotechnical parameters:

- Atterberg Limits (ASTM D 4318)
- Grain Size (ASTM D 422-63(2002))
- Moisture Content (determined from radiological analysis dry weight calculations)
- Hydraulic Conductivity (ASTM D 5084-03)
- Bulk Density (determined from soil core volume and weight)
- Effective Porosity (estimated from literature for soil types identified and site-specific geotechnical testing)

Soil samples will be collected to allow for characterization of the listed parameters for three distinct soil types during the RI (fill, glaciolacustrine, and till). Data resulting from geotechnical characterization will support potential contaminant fate and transport modeling, groundwater modeling, and evaluations of preliminary remedial alternatives.

Investigation derived waste (IDW) samples will be collected by Cavanagh Services Group for a limited number of parameters. Waste characterization sample parameters are based on the potential waste acceptance criteria of potential disposal sites. Anticipated IDW sample types include soil (drill cuttings, excess sample volume, etc.) and liquid (monitoring well development purge water and equipment decontamination fluids).

Data will be collected for groundwater aquifer characterization during the RI. Slug tests will be conducted for existing wells and new wells. Water level measurements will be collected during one or more synoptic events to provide information on groundwater flow patterns. Additional groundwater characterization program details are presented in **Section 5.4.4** of this FSP.

Limited geophysical surveys will be conducted to support underground utility clearance activities during the RI. Utility clearance activities are discussed in more detail in **Section 5.4.3.2.1** of this FSP.

Civil location surveys will be conducted for completed sample locations, monitoring wells, and other Site features using total station and/or GPS methods. Preliminary field sample staking and locations will be measured using a sub-meter accurate portable GPS unit to allow for accurate mapping of field screening data in support of the RI observational approach. Civil location surveys are discussed in more detail in **Section 5.4.7** of this FSP.

5.2 RADIOLOGICAL SURVEY PROGRAM

The design of the Site RI radiological data collection program will follow, as a starting point, the model in the *MARSSIM* (NRC, 2000) for a characterization survey. However, as discussed in **Section 5.4,** the data collection program for this remedial investigation will devote the greatest effort on areas for which the nature and extent of contamination have the greatest uncertainty; that is, it will focus on defining the limits of contamination or the boundaries between contaminated and uncontaminated areas using observational methods to respond to real-time data analyses.

5.2.1 Characterization Surveys

Previous surveys and reports (for example, FBDU, 1981; NYSDEC, 1994; NYSDEC, 1999; NYSDEC, 2000; ORISE, 1999; USACE, 2001; USACE, 2006; USEPA, 1998) have provided data that can be interpreted to show that portions of the Site can be classified as Class 1 or Class 2 for a *MARSSIM* final status survey; therefore, a characterization survey is warranted. Planning of the characterization survey is based on the historical site assessment and on scoping survey results. This type of survey is a detailed radiological environmental characterization of the area.

In general, the primary objectives of a characterization survey, which directly correlate with the RI project objectives, are to:

- Determine the nature and extent of the contamination
- Collect data to support evaluation of remedial alternatives and technologies
- Evaluate whether the survey plan can be optimized for use in the final status survey, as appropriate
- Support Remedial Investigation/Feasibility Study requirements
- Provide input to the final status survey design

In particular, a specific objective of the present survey is to generate data that are sufficient to allow accurate estimation of radioactive waste disposal costs resulting from site remediation. These data will include estimated volumes, mass activity concentrations, and media types in order to identify disposal sites that may be suitable for disposal and the costs associated with disposal at those sites (for example, costs of special treatment, packaging, and transportation associated with a particular disposal site).

Section 2.4.4 of *MARSSIM* says, "The characterization survey is the most comprehensive of all the survey types and generates the most data. It includes preparing a reference grid, systematic as well as judgment measurements, and surveys of different media (for example, surface soils, interior and exterior surfaces of buildings, building and paving materials, cracks, crevices, drains, trenches, surface water, ground water, and sediments)."

The decision as to which media will be surveyed is a site-specific decision addressed in detail in the following sections.

5.2.2 Preliminary Survey Considerations

The following discussion follows the guidance shown in **Figure 5-1** (adapted from MARSSIM Figure 4.1).

5.2.2.1 Identify Contaminants

As determined during preparation of the DGAR (USACE, 2006a) and as refined during the preparation of the project plans (see **Section 3.4**), the radioactive COPCs at the Site are isotopes of uranium (^{238}U, ^{235}U, and ^{234}U), thorium (^{232}Th), and radium (^{226}Ra and ^{228}Ra).

Additional data will be collected to evaluate the presence of enriched and recycled uranium. Presence of ^{236}U indicates recycled uranium; enhanced abundances of ^{234}U and ^{235}U indicate enriched uranium. A limited number of samples (anticipated to be 12) will be selected from the offsite laboratory alpha spectroscopic analyses that have significantly elevated uranium activities to also undergo inductively coupled plasma – mass spectroscopy (ICP-MS) analysis for uranium isotopes to determine the relative abundances of ^{234}U, ^{235}U, U-236, and ^{238}U to be used to evaluate the presence of recycled or enriched uranium. A similar number of background samples will also be analyzed by ICP-MS.

Gross alpha and gross beta radiation analyses will also be performed on the above samples for comparison to values from alpha spectroscopy and/or mass spectroscopy for COPC total alpha and total beta emissions.

5.2.2.2 Establish Screening Levels

Section 2.6 of the DGAR presents screening levels adapted from other sources that will be used as the screening levels for this survey. **Table 5-1** presents screening levels for building surfaces.[5] **Table 5-2** presents screening levels for soil (above local natural background) for the COPCs. Table 5-1 of the QAPP presents aqueous screening levels.

The surface screening levels for radium, uranium, and thorium will be the same as the values presented in **Table 5-1**.

The gross activity screening level for multiple radionuclides is calculated as follows:

[5] The radium isotopes are progeny in the thorium and uranium decay chains and, hence, Table 5-1 includes them with their parent radionuclides.

1. Determine the relative fraction (f_i) of the total activity contributed by each radionuclide *i* of the number *n* of radionuclides.
2. Obtain the screening level for each radionuclide present.
3. Substitute the values of f_i and the screening level for each radionuclide in the following equation (adapted from *MARSSIM* equation 4-4).[6]

$$\text{gross activity screening level} = \frac{1}{\sum_{i=1}^{n} \frac{f_i}{(\text{screening level})_i}}$$

The alpha activity of processed natural uranium is the sum of the individual activities of ^{234}U (48.2 percent), ^{235}U (2.2 percent), and ^{238}U (48.2 percent). The surrogate soil (volume) screening level for natural processed uranium will be 13 pCi/g (rounded) alpha activity as calculated from the above equation.[7]

The ^{232}Th soil (volume) contamination screening level will be 1.1 pCi/g. **Table 5-3** summarizes the soil (volume) screening levels for this survey.

Although enriched uranium is not expected to be present in significant amounts, if enriched uranium is present, 13 pCi/g will still be used as a surrogate for uranium. Enriched uranium has a much higher specific activity of ^{234}U in it than does natural uranium. For example, uranium enriched to 3.5 percent by weight of ^{235}U usually contains relative activities of 14.7 percent for ^{238}U, 3.4 percent for ^{235}U, and 81.8 percent for ^{234}U. Using these values in the above equation also leads to 13 pCi/g (rounded) alpha activity.[8]

The DGAR indicates that uranium concentrations generally are much greater than thorium concentrations at the Site. Therefore, the screening levels for uranium normally will be used. If measurements indicate a significant (more than 10 percent) contribution to contamination activity from thorium in an area, then a gross activity screening level for that area will be developed. This approach enables field measurement of gross activity, rather than determination of individual radionuclide activity, for comparison to the screening level.

Considering the field instruments available, only the Canberra *In Situ* Object Counting System (ISOCS)[9] can give a quantitative direct result for uranium and ^{232}Th concentrations in the field and it will be used whenever it appears necessary to differentiate uranium and thorium. Therefore, if ^{232}Th contamination is encountered in significant amounts in soil or other bulk materials, the situation will require special consideration and analysis. As mentioned above, this

[6] Generally, a radionuclide must be included in the calculation only if its term in the formula is greater than 0.1; that is, only if $\frac{f_i}{(\text{screening level})_i} \succ 0.1$.

[7] The calculation actually results in 13.3 pCi/g, to which ^{238}U and ^{234}U each contribute 6.5 pCi/g and ^{235}U contributes 0.3 pCi/g.

[8] The calculation actually results in 12.9 pCi/g, to which ^{238}U contributes 1.9 pCi/g, ^{235}U contributes 0.4 pCi/g, and ^{234}U contributes 10.5 pCi/g (the results do not sum exactly to 12.9 pCi/g because of round-off error).

[9] The ISOCS is discussed and described in Section 5.4.1.3, and Attachment 3.

is considered to be unlikely in most locations, but some exceptions were observed in previous surveys.

5.2.2.3 Classify Areas by Contamination Potential

To make the best use of resources, *MARSSIM* places greater survey efforts on areas that have or had the highest potential for contamination. This is referred to as a *graded approach*.

Classification is the process by which an area is described according to radiological characteristics. The significance of survey unit classification is that this process determines the final status survey design and the procedures used to develop this design. Preliminary area classifications are made earlier in the *MARSSIM* process and are useful for planning subsequent surveys.

Areas that have no reasonable potential for residual contamination are classified as *non-impacted areas*. These areas have no radiological impact from Site operations, are typically identified early in the process, and require no further evidence to demonstrate compliance with the release criteria.

Areas with reasonable potential for residual contamination are classified as *impacted areas*. Impacted areas are further divided into one of three classifications:

- *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 screening level. Examples of Class 1 areas include:
    1. Site areas previously subjected to remedial actions
    2. Locations where leaks or spills are known to have occurred
    3. Former burial or disposal sites
    4. Waste storage sites
    5. Areas with contaminants in discrete solid pieces of material and high specific activity.
- *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 screening level. To justify changing the classification from Class 1 to Class 2, measurement data should exist that provides a high degree of confidence that no individual measurement would exceed the screening level. Other justifications for reclassifying an area as Class 2 may be appropriate based on site-specific considerations. Examples of Class 2 areas include:
    1. Locations where radioactive materials were present in an unsealed form
    2. Potentially contaminated transport routes
    3. Areas downwind from stack release points
    4. Upper walls and ceilings of buildings or rooms subjected to airborne radioactivity
    5. Areas handling low concentrations of radioactive materials

6. Areas on the perimeter of former contamination control areas.

- *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 screening level, based on Site operating history and previous radiation surveys. Examples of Class 3 areas include:
  1. Buffer zones around Class 2 areas
  2. Areas with very low potential for residual contamination but insufficient information to justify a non-impacted classification

Preliminary classification of IAs by contamination potential is discussed in **Section 5.3,** below. As the characterization survey proceeds, results may indicate that Class 1 or Class 2 areas may be reclassified to a lower level. Conversely, results may require reclassification of Class 2 or Class 3 areas to a higher level. Reclassification may occur during the survey, with an accompanying appropriate modification of survey efforts and techniques, or after the survey. The characterization survey report will provide all final determined classifications as a main objective in order to guide future cost estimation of, planning for, and performance of remediation.

5.2.2.4 Select Background Reference Areas

5.2.2.4.1 Surface References

For the purposes of evaluating contamination on structure surfaces, structures of similar material construction will be identified in non-impacted buildings located on-site. In the event that suitable reference materials cannot be located, reference material values may be assumed based on information provided in **Table 5-4** (Background Count Rates for Various Materials) from NUREG-1507, *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions* (NRC, 1998). The following background reference area measurements may be required to evaluate types of surface materials if the material type is identified in the study area:

- Concrete floor surfaces
- Structural steel surfaces
- Cinder block surfaces
- Fire brick surfaces
- Interior and exterior brick surfaces
- Floor tile surfaces
- Ceramic tile surfaces
- Dust/residue from overhead structures
- Floor penetration sediment
- Transite siding surfaces
- Concrete coring material

- Roofing materials
- Slag

Background reference area measurements for each of the materials listed above will be conducted according to procedures in **Section 5.4.2** and **Section 5.4.5**, as appropriate**.** Examples of material types will be sought in the interior of buildings that are outside the excised area. A total of five reference measurements will be completed for each material type.

5.2.2.4.2 Environmental Media and Background Radiation

Background samples will be collected for soil (surface and subsurface), sediment, surface water, groundwater, and building materials during the RI. A total of 12 surface soil and 12 subsurface soil samples are planned; three surface water and three sediment samples are planned; two groundwater samples are planned (one overburden and one bedrock); and one sample from each type of building material sampled is planned.

MARSSIM defines the background reference area as a geographical area in which representative reference measurements are performed for comparison with measurements performed in specific survey units. The background reference area will have similar physical, chemical, radiological, and biological characteristics as the areas being investigated but has not been contaminated by Site activities (that is, it is non-impacted).

The background reference will be only 30 m^2 for the following reasons:

- The present survey is a characterization survey, not a final status survey.
- Background reference areas are required when the COPCs occur in nature. One of the COPCs is refined uranium and some of the instruments that will be used are able to differentiate refined uranium from naturally occurring uranium. Therefore, a background reference area is not required for refined uranium.
- Thorium-232, one of the other COPCs, occurs in nature. Differentiating refined thorium from naturally occurring thorium at the concentrations the refined thorium likely will be encountered will be difficult with the instruments that will be used in the survey. However, ^{232}Th concentrations that exceed screening levels are expected to be found over relatively small areas, so a small background reference area will suffice.
- Radium occurs in nature as a progeny radionuclide in the natural uranium and thorium decay chains. It is expected that its concentration will not vary much in the surface soil of the reference area, so that results of sampling over a larger reference area would not differ significantly from the results of sampling over 30 m^2.

The background reference area for background soil samples and background radiation measurements will be surveyed as if it were a Class 1 area. Specifically, a total of 12 surface and 12 subsurface soil samples in the reference area will be collected to establish background soil concentrations for COPCs by gamma spectroscopy and alpha spectroscopy (U and Th), by EPA method 903/904 (Ra-226 and Ra-228), by mass spectroscopy for isotopic U, and gross alpha and gross beta. Sampling points will be placed at locations equidistant between the center and each corner of a 10-m grid square (that is, four sampling locations within each 10-m grid square). The location of the background reference area relative to the site is shown on **Figure 5-2**.

It is preferable to take background samples for building materials from non-impacted buildings if possible. Taking these samples likely will involve damaging property, so an approved alternative is to take samples from Class 3 areas in buildings in IA01.

The upstream transect (three points) of surface water and sediment samples obtained from the Erie Barge Canal will be considered the background location for IA09. The surface water samples will be submitted for COPC analyses by alpha spectroscopy (U, Th) and EPA method 903/904 (Ra). The sediment samples will be submitted for COPC analyses by gamma spectroscopy, alpha spectroscopy (U, Th), and EPA method 903/904 (Ra); and for total organic carbon. Samples will be collected as described in **Section 5.4.5.3** and **Section 5.4.6.3**.

An upgradient groundwater sample will be collected from one new monitoring well in the overburden and bedrock, respectively. The upgradient monitoring well pair will be located in an area not expected to be impacted by Site activities (see planned wells MW-600S/D in the northeast quadrant of IA05). Groundwater samples will be submitted for off-site laboratory analyses for filtered and unfiltered COPCs, gross alpha, and gross beta, and unfiltered total suspended solids (TSS). Samples will be collected as described in **Section 5.4.4.11**.

5.2.2.5 Identify Survey Units (Investigative Areas)

As discussed in Section 2.3 of the DGAR, the concept of developing IAs to better manage the assessment of existing data and future data needs was introduced during the TPP Meeting. The organizational benefit of developing IAs is demonstrated by developing a correlation between the conceptual site model and data gap analysis. These IAs may also be useful for developing EUs for risk assessment purposes.

The IAs developed for the Site RI are:

- IA01 Excised Area – Building Surfaces and Interiors (including Building 24)
- IA02 Excised Area – Building Exterior Areas
- IA03 Landfill Area
- IA04 NCIDA Property (Allegheny operations area, not including Excised Area, Landfill Area, or Building 24)
- IA05 Railroad Right-of-Way North of Site Proper
- IA06 Off-site Northeast Properties
- IA07 Groundwater
- IA08 Site Utilities (sewers and drains)
- IA09 Erie Barge Canal (adjacent to the Site)
- IA10 Lot 4.1 (“Lombardi Property”)

5.2.2.6 Site Preparation

Site preparation involves obtaining consent for performing the survey, establishing property boundaries, evaluating physical characteristics of the Site, accessing surfaces and land areas of interest, and establishing a reference coordinate system. Site preparation may also include removing equipment and materials that restrict access to surfaces. The presence of furnishings or equipment will restrict access to building surfaces and add additional items that the survey should address.

5.2.2.6.1 Consent for Survey

USACE will coordinate and obtain consent from the site owner before the survey is conducted. Appropriate local, State, and Federal officials as well as the site owner and other affected parties will be notified of the survey schedule.

5.2.2.6.2 Property Boundaries

Property boundaries will be determined using available public information and will be established by a NYS licensed surveyor as part of Site mobilization activities. In addition, the surveys will be performed to provide benchmarks across the Site prior to the conduct of the Gamma Walkover Survey (GWS). The benchmarks will be located to tie the GWS reference coordinate system to the New York State Plane Coordinate System (West Zone). Earth Tech will use the survey grade locations to establish local site coordinates at mapping grade (sub-meter) using a global positioning system (GPS) unit. See **Figure 1-2** for a current approximation of property boundaries. Procedures for establishing local site coordinates are discussed further in SOP 07 (**Attachment 1**).

5.2.2.6.3 Physical Characteristics of Site

Section 4.8.3 of *MARSSIM* discusses the many considerations about land areas and building structures that can impact the ability to perform a characterization survey. The land areas are generally easily accessible but overgrown, so some clearance of foliage must occur. Section 4.8.4 of *MARSSIM* discusses site clearing techniques that will be used during this survey as necessary to produce adequate results.

Because some parts are paved, drilling and other techniques will be used to access contamination under these surfaces as deemed necessary. Special techniques, discussed in **Section 5.4.5.2,** will be used to investigate potentially impacted drains and sewer lines.

Building structures are in various degrees of disrepair, structural integrity, and housekeeping. Safety considerations may limit the extent to which some of these structures may be accessed and characterized and, as a result, cause data gaps. Such instances will be noted in project logs and in the final survey report. Some special techniques, such as use of a properly collimated ISOCS from a safe distance, may possibly overcome these obstacles.

5.2.2.6.4 Reference Coordinate System

Grid systems will be established at the Site to:

- Facilitate systematic selection of measuring/sampling locations

- Provide a mechanism for referencing a measurement/sample back to a specific location so that the same survey point can be relocated
- Provide a convenient means for determining average activity levels.

Each grid will consist of a system of intersecting lines, referenced to a fixed site location or bench mark. The grid lines will be arranged in a perpendicular pattern, dividing the survey location into squares or blocks of equal area.

Earth Tech San Antonio Radiation Safety Group (SARSG) SOP 007, *Grid Systems and Surveys*, (**Attachment 1**) will be used to establish building interior grids. The basic grid system for impacted areas in building interiors will be 1 meter.

The site-wide outdoor reference coordinate system will be tied to the New York State Plane Coordinate System (West Zone). It will be established as 10-meter grid squares oriented and designed similarly to the local site grid used by ORISE (1999), including use of the same origin (southwest corner of Building 4/9) to optimize re-use of the ORISE data set.

Scale drawings of the survey areas will be developed that indicate facility features and superimposes the grid reference systems.

5.3 CLASSIFICATION OF SITE AREAS AND FACILITIES

5.3.1 General

Classification of areas and facilities at the Site are based, with minor modifications, on the historical site assessment and previous surveys, as discussed in the DGAR. The classifications as well as building and facility descriptions are tentative, and dimensions are approximate. The classifications and descriptions may be revised as this characterization survey proceeds and new data are obtained.

5.3.2 Assumption Basis (General)

Of the previous surveys, the survey by ORISE personnel most closely follows *MARSSIM* methodology. The results of the ORISE survey have been considered in the development of this FSP. To the extent possible, the ORISE data will be used to meet the needs of the current survey (i.e., preliminary identification of Class 1, Class 2, or Class 3 areas; supplement RI database pending verification and acceptance of data usability; etc.).

Refer to **Attachment 2** for ORISE (1999) summary data tables and figures. The summary tables and figures present ORISE sampling locations, the ranges of summary measurements, and the approximate extent of the contamination in the areas investigated (i.e., IA01, IA02, IA03, and IA04A and IA04B). The ORISE data are organized as follows (figures 1 through 10 intentionally excluded):

- Tables 1 through 10 and Figures 11 through 26 present a summary of Excised Area building interior surface activity (direct measurement and sampling).
- Table 12 and Figures 27 through 32 present a summary of Excised Area building interior surface soil and subsurface soil sample data (isotopic data for U-238, U-235, Th-232, and Ra-226).

- Tables 13 through 16 and Figures 33 through 35 present a summary of outdoor surface soil and subsurface soil sample data for RI-designated areas IA02, IA03, and IA04A and IA04B (isotopic data for U-238, U-235, Th-232, and Ra-226).
- Figure 36 presents the ORISE assessment of impacted areas.

Table 5-5 presents estimates for the Site by area of survey class and should be considered as gross estimates only that will be refined as better information becomes available. IA06 is a non-impacted area and, so, has no Class 1, Class 2, or Class 3 areas in it. Area is not a relevant parameter for surveys of IA07 or IA08.

Table 5-5 and the discussion that follows also do not include the surface areas of any equipment, shelves, sill, ledges, beams, and so on that might add to the areas of the surfaces to be surveyed. Information about the extent of these areas is not available; when it becomes available, it may be used to update these tables.

5.3.3 Survey Basis (General)

Survey techniques discussed in **Section 5.4** will be the preferred methods to meet the needs of the present survey. The techniques discussed in **Section 5.4** include verification of, as well as supplementation of, prior investigation data, i.e., sampling at a lesser frequency in areas of ORISE (1999) or NYSDEC (2000, 1999, and 1994) data and at a greater frequency where data gaps have been identified. If the characterization survey does not reproduce results within uncertainties (that is, more than half of the pairs of results should agree within two standard deviations), prior data may not be relied upon as heavily, and the survey techniques discussed in **Section 5.4** may need to be discussed with USACE to determine appropriate changes to ensure project DQOs are met.

Previous local sample grid coordinates (e.g., ORISE, 1999) will be correlated to the New York State Plane Coordinate System (West Zone) for entry into the project database. Prior data will be combined with RI data to assess achievement of characterizing the nature and extent of contamination at the Site. The characterization survey report will note when prior data are used.

Table 5-6 presents a general outline of the planned data collection parameters by matrix, including the general plan for radiological analyses. Specific details for each matrix are provided in the following IA-specific sections.

5.3.4 IA01 Excised Area – Building Interior Surfaces (including Building 24)

Nine buildings within the Excised Area comprise IA01. Several of the buildings are attached and appear to be a single building. These nine buildings are Buildings 1 and 2; the attached (co-joined) buildings 3, 4, 5, 6, 8, and 9; and Building 35. Additionally, Building 24, which is attached to the north side of Building 8, is not part of the Excised Area but is included within this IA due to the impact of MED/AEC operations on the south end of the building. **Table 4-1** provides a summary of building construction date, floor space, and use.

The types of roofs (for example, flat, shed, low pitch, medium pitch, louvered, etc.) vary by building. Following a review of available drawings and notes from site visits, best estimates for increase in roof area relative to building footprint were made, resulting in approximately 20 percent (shed) to 75 percent (complex shape as in Building 3) greater area than it would have been for a flat roof on the same building. These estimates will be improved as the survey progresses.

5.3.4.1 IA01 Classifications (General)

The DGAR indicates the following classifications in general.

- Class 1 areas are in Building 1 (some), Building 2 (some), Building 3 (some), Building 4 (some), Building 5 (some), Building 6 (all), Building 8 (all), Building 9 (some), and Building 24 (some of southern section).
- Class 2 areas are in Building 1 (remainder), Building 2 (remainder), Building 3 (remainder), Building 4 (remainder), Building 5 (remainder), Building 9 (remainder), Building 24 (remainder of southern section), and Building 35 (all).
- A Class 3 area is in the northern section of Building 24.

However, these classifications primarily are concerned with floors and walls up to 2 m and, so, did not include all of the interior surfaces. Therefore, for surfaces other than floors or walls below 2 m, a 2-m wide Class 2 area will be adjacent to all Class 1 areas within each building and the remainder within each building not otherwise classified will be Class 3.

Table 5-7 summarizes the estimates for interior and exterior survey areas in IA01 and IA02 by class and should be considered as gross estimates only that will be refined as better information becomes available. The information that is not available at this writing includes some of the dimensions of the buildings, such as wall heights and roof slopes, as discussed elsewhere herein. This information will be obtained on site and entered into the spreadsheet that produced the tables to improve the estimates. The spreadsheets currently have "best estimates" of these dimensions, so it should be expected that any changes in the estimated numbers of samples will be relatively small.

5.3.4.2 IA01 Assumption Basis (General)

The following are summarized from the data gap analysis and apply as the assumption basis for all IA01 buildings in addition to any specific information included in other sections below:

- No previous results are available for measurements of or samples from building exterior surfaces including roofing media.
- Exposure rate measurements taken within these buildings are specified only as a range for each building (ORISE, 1999, Table 10), so they cannot be correlated to locations.
- The limited depth profiling within the buildings precludes accurate estimates of the volume of sub-floor media above the screening levels.
- While the areal extent of the contaminated areas is generally known based on the survey findings and presentation in the ORISE figures, the accuracy of the area determination is limited by the measurement and sample density. Current data are sufficient to determine that the surface and subsurface conditions generally exceed the screening levels and to determine the nature of the COPCs. Additional surface measurements and subsurface samples may be desired to support better definition of the extent of the contamination.

- While scanning surveys were conducted on a grid basis in some buildings, the recorded direct measurement and sample locations within these buildings were based on observational results.
- Within the ORISE survey report, the scale drawings appear to be approximate, and no grid coordinates are evident for location of measurements and samples inside these buildings.
- An accurate set of drawings is desired to clearly demarcate the building boundaries between adjacent buildings that are open to each other to aid in interpretation of the survey results by building.
- Some of the reported values for surface areas in the buildings differ significantly based on the source of information.

Previous sampling by ORISE in most of IA01 was not based on a formal site-wide grid and does not provide sufficient density of coverage in all areas to meet the current survey objectives. ORISE data indicate that radioactivity is not "removable"[10] and therefore decontamination of structures is not likely to be feasible.

Building 1 was not surveyed adequately due to safety considerations and the flooded condition of the basement. The survey of Building 5 was described as "minimum" due to structural concerns and accumulated debris. No residual contamination (based on screening) was reported by ORISE in Buildings 5 and 35; however, no isotopic samples were collected in these buildings. Buildings 2, 3, 6, and 8 (initially Class 3) were re-surveyed as Class 1; coverage was adequate, but only Buildings 6 and 8 were surveyed on a grid (again, only site-specific). Not all the floor plates were removed during the survey in Building 6; therefore contamination under the plates needs to be assessed in many areas. Information on the extent of the survey in the northern part of Building 24 (24N), currently used for storage by Allegheny, is lacking.

5.3.4.3 IA01 Survey Basis (General)

The following components apply as the general survey basis for all buildings in IA01 in addition to any specific survey bases included in other sections below.

5.3.4.3.1 Survey Grids

Each IA01 building will be gridded to establish coordinate systems in accordance with **Section 5.2.2.6.4**. Scan surveys will be performed to accurately locate previously identified contamination. Scan surveys will be conducted in accordance with **Section 5.4.2.1**.

5.3.4.3.2 Swipe Tests

Since the ORISE survey indicated that removable contamination everywhere in the buildings was below the screening levels, swipe tests for removable contamination will be performed for verification purposes as discussed in **Section 5.4.2.1**. Should the results of these swipe tests fail to confirm the ORISE results (that is, results indicate levels of removable contamination greater

[10] The current survey will verify this ORISE assertion by taking a limited number of swipe tests (see **Section 5.3.4.3.2**).

than the screening levels), the rate of swipe testing will be discussed with USACE to determine an appropriate frequency adjustment to meet the project DQOs.

5.3.4.3.3 Soil Sampling

Surface and subsurface soil samples will be collected within each IA01 building. Building-specific sampling plans are discussed in the respective "Survey Basis" subsections, below. Surface and subsurface soil sampling performed during the ORISE survey may be used to complement and, in some cases, replace soil sampling for the current survey; use of these ORISE results will be in accordance with **Section 5.3.3**. Soil sampling procedures are described in **Section 5.4.3**.

5.3.4.3.4 Building Material Sampling

At least one sample will be taken in each discrete Class 1 area. Indicators for the location and type of material to be sampled are anomalous exposure rate or scanning measurements and physical indications, such as the presence of suspicious discoloration or residues. Professional judgment will be used to select building material samples in Class 2 and Class 3 areas; however, a minimum of one sample per area will be collected to verify area classification.

Off-site laboratory analysis (i.e., isotope-specific analysis by gamma and alpha spectroscopy methods) will be performed on these volumetric samples of building materials to provide data to support disposal decisions and to conduct a baseline dose and risk assessment.

5.3.4.4 Interior Surfaces - Building 1

Building 1 has a floor area of approximately 815 m^2. According to background documentation, this building was used for metal smelting and manufactured gas production. Refer to **Figure 5-3** for a layout of Building 1.

5.3.4.4.1 Class 1 Areas in Building 1

An approximately 10 m × 7 m rectangular area of approximately 70 m^2 of the floor in the work room at the south end of the building is Class 1.

The total Class 1 area in Building 1 is approximately 70 m^2.

5.3.4.4.2 Class 2 Areas in Building 1

The remainder of the floor area, 745 m^2, is Class 2, as well as the walls to a height of 2 m, adding another approximately 360 m^2 to the total Class 2 area.

The total Class 2 area in Building 1 is approximately 1100 m^2.

5.3.4.4.3 Class 3 Areas in Building 1

The exact height of each building interior is not readily available. For the purpose of illustrating the methodology to be used to determine the number of sample locations for walls and ceilings (to also include roof area), assume the building height is x.

The exterior dimensions of Building 1 according to available drawings are the result of two adjoining rectangles that are approximately 800 m × 10 m and 10 m × 10 m. This would give a total floor area of approximately 900 m^2. Presumably, wall thicknesses reduce interior dimensions of the floor area to the given area of 815 m^2, or by approximately 9 percent. Assume this same 9 percent reduction affects wall area.

Building 1's perimeter is approximately 200 m. Therefore the total interior wall area, not counting the ceiling, is approximately 200 m × 0.91 × *x*. If we assume *x* = 10 m, then the total interior wall area, not counting the ceiling is estimated as approximately 1810 m^2. Subtracting the Class 1 and Class 2 areas on the walls leaves approximately 1450 m^2 for Class 3. This will be adjusted when an accurate value for the building height is available.

The ceiling cross section area is assumed to be the same as the floor area. The pitch (deviation from the horizontal plane) of the roof is estimated from available drawings and photographs to increase this value by about 70 percent. Thus the ceiling area, which is Class 3, is 815 m^2 × 1.7 or approximately 1390 m^2.

All surfaces of the flooded basement are Class 3; however, survey of the basement surfaces is not planned for the current investigation. In order for the investigation to be conducted, the basement would have to be dewatered, a structural assessment of the corroded ceiling/floor joist must be made, and any related health and safety concerns would have to be mitigated. However, collection of up to four surface water/sediment pairs from the flooded basement is planned; see **Section 5.3.4.4.4**.

For the purpose of completing the assumption basis, the Class 3 area estimate for the basement surfaces has been completed. It is assumed the flooded basement extends from the north end approximately 70 m to the south. It has a floor area of approximately 634 m^2. The height of the wall is not available and will be assumed to be 2.5 m. A stairwell leads into the basement. It is assumed that it will reduce the basement ceiling area by approximately 4 m^2. Using the 91-percent area reduction factor mentioned above for the wall area, the total surface area of the flooded basement is approximately 634 m^2 (floor) + 630 m^2 (ceiling) + 340 m^2 (walls) or approximately 1600 m^2.

The total Class 3 area in Building 1 is approximately 2830 m^2, not counting the flooded basement, which adds approximately another 1600 m^2 to the total.

5.3.4.4.4 Other Media in Building 1

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located. In particular, the drain in the Class 1 area and the pipes leading away from it will require close scrutiny.

Four surface water and sediment (if present) pairs will be collected from the flooded basement and analyzed for COPCs to verify its classification as a Class 3 area and to characterize the water and sediment (if present). The four pairs will be spaced equidistantly across the footprint of the basement, but will be located such that confined space entry will not be required to obtain the samples. To the extent possible, the surface water and sediment samples will be collected accordance with the procedures presented in **Section 5.4.5.3**.

5.3.4.4.5 Assumption Basis for Building 1

General assumptions for IA01 are addressed in **Section 5.3.2** and **Section 5.3.4.2**. The following paragraphs address assumptions specific to Building 1.

The ORISE survey confirmed the Class 3 designation of the northern part of the building and identified elevated readings in the West Work Room (ORISE, 1999; Figure 11 and Table 2). Radiological contamination was below the direct measurement screening levels throughout the building except in the Work Room located in the southwest corner of Building 1. All of the direct measurements noted in the Work Room on the countertop, a lower shelf and the concrete floor exceed 5,000 dpm/100 cm^2. The maximum reading of 100,000 dpm/100 cm^2 was measured on the concrete floor below the shelf.

The throat of a floor drain in the immediate area is sealed with concrete and the reading for the concrete floor at the drain was 35,000 dpm/100 cm^2. As a result, the sealed drain and the drain line are suspect for contamination. Based on these findings, this area was reclassified as a Class 1 area but a more thorough survey of the Work Room was not conducted due to health and safety concerns.

The Work Room is approximately 100 m^2 and the locations of the readings that exceed the screening levels appear to be limited to the southern half of the room (ORISE, 1999, Figure 11). In the worst case, the approximate 100 m^2 area in the Work Room represents approximately 12 percent of the floor space in Building 1.

None of the measurements for removable activity identified values above the screening levels. No soil or sub-floor samples were collected for analysis in Building 1. The basement could not be surveyed since it was flooded.

5.3.4.4.6 Survey Basis for Building 1

Building surface scanning and swipe testing will be conducted in accordance with **Section 5.4.2.1**. Building material (volumetric) sampling will be conducted in accordance with **Section 5.3.4.3.4**. **Table 5-8** provides an estimate of swipe testing and building material (volumetric) sample quantities.

Surface and subsurface soil sampling will be conducted in accordance with **Section 5.4.3**. Planned soil sample locations are shown on **Figure 5-3**. An estimate of soil sample quantities is presented in **Table 5-9.**

5.3.4.5 Interior Surfaces - Building 2

Building 2 has a floor area of approximately 6400 m^2. It was used for metal rolling and manufacturing. Refer to **Figure 5-4** for a layout of Building 2.

5.3.4.5.1 Class 1 Areas in Building 2

Six separate locations in Building 2 are Class 1 areas with a total floor area of 150 m^2. Specific locations that are noted to be above the screening levels include a locker, a work bench, and a door frame. Three are adjacent to one wall, two are in a corner, and one is away from the walls.

The total Class 1 area in Building 2 is approximately 150 m^2.

5.3.4.5.2 Class 2 Areas in Building 2

The remainder of the floor area, 6250 m^2, as well as the walls to a height of 2 m, is Class 2. The perimeter of Building 2 is approximately 450 m. Using the 0.91 interior wall area reduction factor, the total wall area up to 2 m height is approximately 450 m × 2 m × 0.91 or approximately 815 m^2.

The total Class 2 area in Building 2 is approximately 7070 m^2.

5.3.4.5.3 Class 3 Areas in Building 2

The exact height of each building interior is not readily available. For the purpose of illustrating the methodology to be used to determine the number of sample locations for walls and ceilings (to also include roof area), assume the building height is x.

Building 2's perimeter is approximately 450 m. Therefore the total interior wall area, not counting the ceiling, is approximately 450 m × 0.91 × x. If we assume x = 10 m, then the total interior wall area, not counting the ceiling is estimated as approximately 4080 m^2. Subtracting the Class 2 areas on the walls (820 m^2) leaves approximately 3260 m^2 for wall area Class 3. This will be adjusted when an accurate value for the building height is available.

The ceiling cross section area is assumed to be the same as the floor area. The pitch (deviation from the horizontal plane) of the roof is estimated from available drawings and photographs to increase this value by about 70 percent. Thus the ceiling area, which is Class 3, is 6400 m^2 × 1.7 or approximately 10,880 m^2.

The total Class 3 area in Building 2 is approximately 14,140 m^2.

5.3.4.5.4 Other Media in Building 2

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located.

5.3.4.5.5 Assumption Basis for Building 2

General assumptions for IA01 are addressed in **Section 5.3.2** and **Section 5.3.4.2**.

Coverage and existing data in the ORISE report for Building 2 appear adequate; however, measurements were not taken in a grid pattern and are subject to general confirmation. Depth data are needed at the floor locations that were identified to be above the screening levels to better define the nature and extent of the contamination (ORISE, 1999, Figure 12).

5.3.4.5.6 Survey Basis for Building 2

Building surface scanning and swipe testing will be conducted in accordance with **Section 5.4.2.1**. Building material (volumetric) sampling will be conducted in accordance with **Section 5.3.4.3.4**. **Table 5-8** provides an estimate of swipe testing and building material (volumetric) sample quantities.

Surface and subsurface soil sampling will be conducted in accordance with **Section 5.4.3**. Planned soil sample locations are shown on **Figure 5-4**. An estimate of soil sample quantities is presented in **Table 5-9.**

5.3.4.6 Interior Surfaces - Building 3

Building 3 is connected and opens to Buildings 4 and 9 and to Buildings 6 and 8. It has a floor area of approximately 6300 m^2 and was used for metal rolling and grinding. See **Figure 5-5** for a layout figure of Building 3.

5.3.4.6.1 Class 1 Areas in Building 3

Three separate locations in Building 3 are Class 1 areas with a total floor area of approximately 1880 m^2. Specific locations in the North Section include the center throughway near the track, the truss above the furnace at 4 m, and the window ledge at 8 m. In the South Section, notable findings include an I-beam pedestal, a cabinet top, a roller cap, the south end of the trench, a window ledge at 8 m, a crane rail I-beam at 8 m, I-beams at 5 and 7 m, and the sidewalk near the cafeteria. As noted in the DGAR, definitive information about contamination in the two trenches in the South Section is a significant data gap.

The depths of the trenches are unavailable. It will be assumed that they are both 1.5 m deep. The walls of the trenches are not included as a floor area.

The wider trench is approximately 5 m wide and 45 m long with 40 m of that length in a Class 1 area. The area of the trench walls that are in a Class 1 area is approximately (40 m × 2 + 5 m) × 1.5 m or approximately 130 m^2.

The other trench is approximately 2 m wide and 23 m long. All of it is in a Class 1 area. It appears that one end of the trench gradually rises to floor level and so does not contribute to the wall area, so this trench wall area is approximately (23 m × 2 + 2 m) × 1.5 or approximately 70 m^2.

The total Class 1 area in Building 3 is approximately 2080 m^2.

5.3.4.6.2 Class 2 Areas in Building 3

The remainder of the floor area (including the remainder of the floor area of the wider trench), 4420 m^2, as well as the walls to a height of 2 m and the remainder of walls of the wider trench are Class 2.

The perimeter of Building 3 is approximately 450 m. Using the 0.91 interior wall area reduction factor, the total wall area up to 2 m height is approximately 450 m × 2 m × 0.91 or approximately 815 m^2.

The area of the remainder walls of the wider trench is approximately (5 m × 2 + 5 m) × 1.5 m = 22.5 m^2.

The total Class 2 area in Building 3 is approximately 5260 m^2.

5.3.4.6.3 Class 3 Areas in Building 3

The exact height of each building interior is not readily available. For the purpose of illustrating the methodology to be used to determine the number of sample locations for walls and ceilings (to also include roof area), assume the building height is x.

Building 3's perimeter is approximately 450 m. Therefore the total interior wall area, not counting the ceiling, is approximately 450 m × 0.91 × x. If we assume x = 10 m, then the total interior wall area, not counting the ceiling is estimated as approximately 4080 m^2. Subtracting the Class 2 areas on the walls (820 m^2) leaves approximately 3260 m^2 for wall area Class 3. This will be adjusted when an accurate value for the building height is available.

The ceiling cross section area is assumed to be the same as the floor area. The pitch (deviation from the horizontal plane) of the roof is estimated from available drawings and photographs and increases this value by about 70 percent. Thus the ceiling area, which is Class 3, is 6030 m^2 × 1.7 or approximately 10,710 m^2.

The total Class 3 area in Building 3 is approximately 13,790 m^2.

5.3.4.6.4 Other Media in Building 3

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located.

5.3.4.6.5 Assumption Basis for Building 3

General assumptions for IA01 are addressed in **Section 5.3.2** and **Section 5.3.4.2**.

ORISE re-surveyed Building 3 as Class 1. Coverage and existing data appear adequate; however, measurements were not taken in a grid pattern and are subject to general confirmation. Additional surface measurements and subsurface samples are needed to support better definition on the aerial and vertical extent of the contamination.

5.3.4.6.6 Survey Basis for Building 3

Building surface scanning and swipe testing will be conducted in accordance with **Section 5.4.2.1**. Building material (volumetric) sampling will be conducted in accordance with **Section 5.3.4.3.4**. **Table 5-8** provides an estimate of swipe testing and building material (volumetric) sample quantities.

Surface and subsurface soil sampling will be conducted in accordance with **Section 5.4.3**. Planned soil sample locations are shown on **Figure 5-5**. An estimate of soil sample quantities is presented in **Table 5-9.**

5.3.4.7 Interior Surfaces - Building 4 and Building 9

Building 4 and Building 9 together have a floor area of approximately 4400 m^2. Building 4 is connected to and open to Building 9 on the west side and connected and open to Building 3 on the east side. A loading dock is on the west side of Building 9. They were used for metal rolling and manufacturing. Refer to **Figure 5-6** for a layout of Buildings 4 and 9.

5.3.4.7.1 Class 1 Areas in Building 4 and Building 9

A large rectangular area near the center of the floor of Building 4/Building 9 is a Class 1 area with a total floor area of approximately 1200 m^2. Overhead surfaces above this area also had elevated activity levels in excess of the screening levels of the ORISE survey. The area of these "overhead" surfaces is not available and, so, will be assumed to be located above the Class 1 floor area and be 1200 m^2.

The total Class 1 area in Building 4 and Building 9 together is approximately 2400 m^2.

5.3.4.7.2 Class 2 Areas in Building 4 and Building 9

The remainder of the floor area, 3200 m^2, as well as the walls to a height of 2 m is Class 2.

The perimeter of Building 4 and Building 9 together is approximately 290 m. Using the 0.91 interior wall area reduction factor, the total wall area up to 2 m height is approximately 290 m × 2 m × 0.91 or approximately 525 m^2.

The total Class 2 area in Building 4 and Building 9 together is approximately 3730 m^2.

5.3.4.7.3 Class 3 Areas in Building 4 and Building 9

The exact height of each building interior is not readily available. For the purpose of illustrating the methodology to be used to determine the number of sample locations for walls and ceilings (to also include roof area), assume the building height is *x*.

Building 4 and Building 9's perimeter together is approximately 450 m. Therefore the total interior wall area, not counting the ceiling, is approximately 290 m × 0.91 × *x*. If we assume *x* = 10 m, then the total interior wall area, not counting the ceiling is estimated as approximately 2630 m^2. Subtracting the Class 2 areas on the walls (530 m^2) leaves approximately 2100 m^2 for wall area Class 3. This will be adjusted when an accurate value for the building height is available.

The ceiling cross section area is assumed to be the same as the floor area. The pitch (deviation from the horizontal plane) of the roof is estimated from available drawings and photographs and increases this value by about 45 percent. Thus the ceiling area, which is Class 3, is 4440 m^2 x 1.45 or approximately 6380 m^2.

The total Class 3 area in Building 4 and Building 9 together is approximately 8480 m^2.

5.3.4.7.4 Other Media in Building 4 and Building 9

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located.

5.3.4.7.5 Assumption Basis for Building 4 and Building 9

General assumptions for IA01 are addressed in **Section 5.3.2** and **Section 5.3.4.2**. The general assumptions adequately address the approach for Building 4 and Building 9.

5.3.4.7.6 Survey Basis for Building 4 and Building 9

Building surface scanning and swipe testing will be conducted in accordance with **Section 5.4.2.1**. Building material (volumetric) sampling will be conducted in accordance with **Section 5.3.4.3.4**. **Table 5-8** provides an estimate of swipe testing and building material (volumetric) sample quantities.

Surface and subsurface soil sampling will be conducted in accordance with **Section 5.4.3**. Planned soil sample locations are shown on **Figure 5-6**. An estimate of soil sample quantities is presented in **Table 5-9.**

5.3.4.8 Interior Surfaces - Building 5

Building 5 has a floor area of approximately 350 m^2. It was used as a transformer station and powerhouse. No dimensions are available to create a figure for Building 5.

5.3.4.8.1 Class 1 Areas in Building 5

Building 5 contains no Class 1 areas.

5.3.4.8.2 Class 2 Areas in Building 5

The entire floor area, estimated from site drawings as 350 m^2, is Class 2, as well as the walls to a height of 2 m.

The perimeter of Building 5 is approximately 110 m. Using the 0.91 interior wall area reduction factor, the total wall area up to 2 m height is approximately 110 m × 2 m × 0.91 or approximately 200 m^2.

The total Class 2 area in Building 5 is approximately 550 m^2.

5.3.4.8.3 Class 3 Areas in Building 5

The height of the interior of Building 5 is estimated from drawings and photographs as 6 m. Building 5's perimeter is approximately 110 m. Therefore the total interior wall area, not counting the ceiling, is approximately 110 m × 0.91 × 6 m or about 600 m^2. Subtracting the Class 2 areas on the walls (200 m^2) leaves approximately 400 m^2 for wall area Class 3.

The ceiling cross section area is assumed to be same as the floor area except that the pitch (deviation from the horizontal plane) of the roof is not available. Assume that the pitch of the roof increases this value by 20 percent. This will be adjusted when an accurate value for the pitch of the roof, is available. Thus the ceiling area, which is Class 3, is 350 m^2 × 1.2 or approximately 420 m^2.

The total Class 3 area in Building 5 is approximately 820 m^2.

5.3.4.8.4 Other Media in Building 5

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located.

5.3.4.8.5 Assumption Basis for Building 5

General assumptions for IA01 are addressed in **Section 5.3.2** and **Section 5.3.4.2**.

The ORISE survey report described the survey of Building 5 as "minimum" due to structural concerns and accumulated debris. No residual contamination (based on screening) was reported by ORISE; however, no samples were collected in this building. Building 5 was listed as a Class 2 area in the ORISE, 1999 report. Although no specific data are included in the ORISE report for

Building 5, the report states that no areas of elevated beta or gamma radiation were detected by surface scans within this facility.

5.3.4.8.6 Survey Basis for Building 5

ORISE survey results will not be used for Building 5. Building surface scanning and swipe testing will be conducted in accordance with **Section 5.4.2.1**. Building material (volumetric) sampling will be conducted in accordance with **Section 5.3.4.3.4**. **Table 5-8** provides an estimate of swipe testing and building material (volumetric) sample quantities.

No surface and subsurface soil sampling is planned for Building 5. However, surface scan and building material (volumetric) sampling will be reviewed to determine if subfloor sampling is warranted.

5.3.4.9 Interior Surfaces - Building 6

Building 6 is located west of and open to Building 3 and south of Building 8. It has a floor area of approximately 970 m^2 and was used for cold metal rolling. Refer to **Figure 5-7** for a layout figure of Building 6.

5.3.4.9.1 Class 1 Areas in Building 6

Four separate locations in Building 6 are Class 1 areas with a total floor area of approximately 225 m^2. Specific locations include near the loading dock, two at the corners west of the roll mill, and surrounding the furnace on the south wall.

The total Class 1 area in Building 6 is approximately 225 m^2.

5.3.4.9.2 Class 2 Areas in Building 6

The remainder of the floor area, approximately 745 m^2, as well as the walls to a height of 2 m, is Class 2.

The perimeter of Building 6 is approximately 205 m, not counting the open “wall” to Building 3. Using the 0.91 interior wall area reduction factor, the total wall area up to 2 m height is approximately 205 m × 2 m × 0.91 or approximately 370 m^2.

The total Class 2 area in Building 6 is approximately 1120 m^2.

5.3.4.9.3 Class 3 Areas in Building 6

The exact height of each building interior is not readily available. For the purpose of illustrating the methodology to be used to determine the number of sample locations for walls and ceilings (to also include roof area), assume the building height is x.

The perimeter of Building 6 is approximately 205 m, not counting the open “wall” to Building 3. Therefore the total interior wall area, not counting the ceiling, is approximately 205 m × 0.91 × x. If we assume x = 10 m, then the total interior wall area, not counting the ceiling is approximately 1860 m^2. Subtracting the Class 2 areas on the walls (370 m^2) leaves approximately 1490 m^2 for wall area Class 3. This will be adjusted when an accurate value for the building height is available.

The ceiling cross section area is assumed to be the same as the floor area. The pitch (deviation from the horizontal plane) of the roof is estimated from available drawings and photographs and increases this value by about 45 percent. Thus the ceiling area, which is Class 3, is 970 $m^2 \times 1.45$ or approximately 1410 m^2.

The total Class 3 area in Building 6 is approximately 2890 m^2.

5.3.4.9.4 Other Media in Building 6

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located.

5.3.4.9.5 Assumption Basis for Building 6

General assumptions for IA01 are addressed in **Section 5.3.2** and **Section 5.3.4.2**.

A total of 11 out of 30 measurement locations in Building 6 in the ORISE survey exceeded 1,000 dpm/100 cm^2 (ORISE, 1999, Figures 18 and 30, Tables 5 and 12), one of which exceeded 5,000 dpm/100 cm^2. The highest reading of 30,000 dpm/100 cm^2 was located on a metal floor plate near the transition to Building 8. The overhead surfaces could not be accessed for surveying. None of the removable alpha and or beta levels were in excess of the screening levels. Nine of 21 floor surface samples exceed one or more of the soil concentration screening levels. Based on the approximate 970 m^2 floor space and the 28 direct measurements on the floor, the average measurement frequency is approximately one per 35 m^2. No measurements on any surfaces above one meter and no sub-floor samples were noted.

5.3.4.9.6 Survey Basis for Building 6

Building surface scanning and swipe testing will be conducted in accordance with **Section 5.4.2.1**. Building material (volumetric) sampling will be conducted in accordance with **Section 5.3.4.3.4**. **Table 5-8** provides an estimate of swipe testing and building material (volumetric) sample quantities.

Surface and subsurface soil sampling will be conducted in accordance with **Section 5.4.3**. Planned soil sample locations are shown on **Figure 5-7**. An estimate of soil sample quantities is presented in **Table 5-9.**

5.3.4.10 Interior Surfaces - Building 8

Building 8 is connected to Building 6 and is open to Building 3. It has a floor area of approximately 3390 m^2 and was used for cold metal rolling. See **Figure 5-8** for a layout of Building 8.

5.3.4.10.1 Class 1 Areas in Building 8

The entire floor of Building 8 is a Class 1 area.

The total Class 1 area in Building 8 is approximately 3390 m^2.

5.3.4.10.2 Class 2 Areas in Building 8

The walls to a height of 2 m are Class 2.

The perimeter of Building 8, not counting its opening to Building 3, is approximately 210 m. Using the 0.91 interior wall area reduction factor, the total wall area up to 2 m height is approximately 210 m × 2 m × 0.91 or approximately 380 m^2.

The total Class 2 area in Building 8 is approximately 380 m^2.

5.3.4.10.3 Class 3 Areas in Building 8

The exact height of each building interior is not readily available. For the purpose of illustrating the methodology to be used to determine the number of sample locations for walls and ceilings (to also include roof area), assume the building height is x.

The perimeter of Building 8 is approximately 210 m, not counting the open "wall" to Building 3. Therefore the total interior wall area, not counting the ceiling, is approximately 210 m × 0.91 × x. If we assume $x = 10$ m, then the total interior wall area, not counting the ceiling is approximately 1900 m^2. Subtracting the Class 2 areas on the walls (380 m^2) leaves approximately 1520 m^2 for wall area Class 3. This will be adjusted when an accurate value for the building height is available.

The ceiling cross section area is assumed to be the same as the floor area. The pitch (deviation from the horizontal plane) of the roof is estimated from available drawings and photographs and increases this value by about 45 percent. Thus the ceiling area, which is Class 3, is 3390 m^2 × 1.45 or approximately 4920 m^2.

The total Class 3 area in Building 8 is approximately 6440 m^2.

5.3.4.10.4 Other Media in Building 8

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located.

5.3.4.10.5 Assumption Basis for Building 8

General assumptions for IA01 are addressed in **Section 5.3.2** and **Section 5.3.4.2**.

Building 8 was found during the ORISE survey to have extensive areas of elevated direct beta activity in soils and on surfaces throughout, including all of the overhead surfaces investigated (ORISE, 1999, Figures 19 and 31, Tables 6 and 12). The ORISE report referred to and verified the findings of several prior surveys that had identified cinders below the metal plates that had residual radioactivity that exceeded the screening levels.

Based on the approximate 2,300 m^2 floor space in Building 8 and the 81 direct measurements on the floor, the average measurement frequency is approximately one per 30 m^2. Essentially, all surfaces within Building 8 had some residual activity, with the highest levels noted in the central and eastern portions. A total of 110 out of 132 locations were elevated above 1,000 dpm/100 cm^2, 77 of these exceed 5,000 dpm/100 cm^2 and 34 are above 15,000 dpm/100 cm^2. Readings at three locations exceeded 50,000 dpm/100 cm^2, with the highest (64,000 dpm/100 cm^2) located on an I-beam at 4 m above the floor. These elevated areas were found primarily in the southern two-thirds of the structure, the northern point being the point at which Building 8 ended.

Although approximately 54 measurement locations showed removable alpha and or beta levels above background, none were in excess of the screening levels.

A total of 35 of the 42 surface soil samples and all 15 of the sub-floor samples exceed one or more of the soil concentration screening levels. Although large areas of Building 8 have residual contamination in excess of the screening levels, the equipment and structural surfaces that were scanned within Building 8 and found to be free of dust or other residues, and generally did not have residual contamination in excess of the screening levels.

5.3.4.10.6 Survey Basis for Building 8

Building surface scanning and swipe testing will be conducted in accordance with **Section 5.4.2.1**. Building material (volumetric) sampling will be conducted in accordance with **Section 5.3.4.3.4**. **Table 5-8** provides an estimate of swipe testing and building material (volumetric) sample quantities.

Surface and subsurface soil sampling will be conducted in accordance with **Section 5.4.3**. Planned soil sample locations are shown on **Figure 5-8**. An estimate of soil sample quantities is presented in **Table 5-9.**

5.3.4.11 Interior Surfaces - Building 24

Building 24 is outside the Excised Area but its southern end is included in this discussion of IA01 since it is adjacent to Building 8 and known to have areas of contamination above the screening levels. Building 24 is connected to and partially open to Building 8. It has a floor area of approximately 6600 m^2 and was used as a mill area. Refer to **Figure 5-9**.

5.3.4.11.1 Class 1 Areas in Building 24

The southwestern section of Building 24 had a number of areas that exceeded activity screening levels identified in past surveys. Additional elevated findings were on elevated structures above 2 m. One measurement on the concrete floor in the southeastern section also exceeded the screening levels. Additional locations on the concrete that exceeded screening levels were on the concrete floor in the Southeast Storage Room.

The total Class 1 area in Building 24 is approximately 600 m^2.

5.3.4.11.2 Class 2 Areas in Building 24

In the southern end of Building 24, the walls to a height of 2 m and the remainder of the floor are Class 2.

Approximately half of the floor area, 3300 m^2, is in the southern half of the building, so 2700 m^2 in the southern half of the building is Class 2.

The perimeter of Building 24 is approximately 520 m. Using the 0.91 interior wall area reduction factor, the total wall area up to 2 m height is approximately 520 m × 2 m × 0.91 or approximately 940 m^2. Approximately half of this area, 470 m^2, is in the southern end of the building.

The total Class 2 area in Building 24 is approximately 3170 m^2.

5.3.4.11.3 Class 3 Areas in Building 24

The north half of the floor area (½ × 6600 m^2 = 3300 m^2) in Building 24 is Class 3.

The exact height of each building interior is not readily available. For the purpose of illustrating the methodology to be used to determine the number of sample locations for walls and ceilings (to also include roof area), assume the building height is x.

The perimeter of Building 24 is approximately 520 m. Therefore the total interior wall area, not counting the ceiling, is approximately 520 m × 0.91 × x. If we assume x = 10 m, then the total interior wall area, not counting the ceiling is approximately 4710 m^2. Subtracting the Class 2 areas on the walls (approximately 470 m^2) leaves approximately 4240 m^2 for wall area Class 3. This will be adjusted when an accurate value for the building height is available.

The ceiling cross section area is assumed to be same as the floor area except that the pitch (deviation from the horizontal plane) of the roof is not available. Assume that the pitch of the roof increases this value by 20 percent. This will be adjusted when an accurate value for the pitch of the roof is available. Thus the ceiling area, which is Class 3, is 6600 m^2 × 1.2 or approximately 7920 m^2.

The total Class 3 area in Building 24 is approximately 15,500 m^2.

5.3.4.11.4 Other Media in Building 24

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located.

5.3.4.11.5 Assumption Basis for Building 24

General assumptions for IA01 are addressed in **Section 5.3.2** and **Section 5.3.4.2**.

The ORISE survey confirmed the Class 3 designation of the northern part of Building 24 (ORISE, 1999; Figures 20, 32 and Table 7); however, no sub-floor soil samples were collected in the north area. None of the 15 measurement locations in the north section are above the screening levels for total or removable activity.

5.3.4.11.6 Survey Basis for Building 24

Building surface scanning and swipe testing will be conducted in accordance with **Section 5.4.2.1**. Building material (volumetric) sampling will be conducted in accordance with **Section 5.3.4.3.4**. **Table 5-8** provides an estimate of swipe testing and building material (volumetric) sample quantities.

Surface and subsurface soil sampling will be conducted in accordance with **Section 5.4.3**. Planned soil sample locations are shown on **Figure 5-9**. An estimate of soil sample quantities is presented in **Table 5-9.**

5.3.4.12 Interior Surfaces - Building 35

Building 35 has a floor area of approximately 410 m^2 and was used for metal rolling and grinding. Refer to **Figure 5-10**.

5.3.4.12.1 Class 1 Areas in Building 35

Previous surveys identified no areas of elevated beta or gamma radiation in Building 35.

Building 35 contains no Class 1 areas.

5.3.4.12.2 Class 2 Areas in Building 35

The floor of Building 35 will be designated as Class 2.

The total Class 2 area in Building 24 is approximately 410 m^2.

5.3.4.12.3 Class 3 Areas in Building 35

The entire interior area of Building 35, except for the floor, will be designated as Class 3.

The height of the interior of Building 35 is estimated from drawings and photographs as 6 m. Building 35's perimeter is approximately 100 m. Therefore the total interior wall area, not counting the ceiling, is approximately 100 m × 0.91 × 6 m or about 540 m^2 for the Class 3 wall area.

The ceiling cross section area is assumed to be same as the floor area except that the pitch (deviation from the horizontal plane) of the roof is not available. Assume that the pitch of the roof increases this value by 20 percent. This will be adjusted when an accurate value for the pitch of the roof is available. Thus the ceiling area, which is Class 3, is 410 m^2 × 1.2 or approximately 490 m^2.

The total Class 3 area in Building 35 is approximately 1035 m^2.

5.3.4.12.4 Other Media in Building 35

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located.

5.3.4.12.5 Assumption Basis for Building 35

General assumptions for IA01 are addressed in **Section 5.3.2** and **Section 5.3.4.2**.

The ORISE survey report did not identify contamination in Building 35. However, no swipe samples or soil samples were collected in this building.

5.3.4.12.6 Survey Basis for Building 35

Building surface scanning and swipe testing will be conducted in accordance with **Section 5.4.2.1**. Building material (volumetric) sampling will be conducted in accordance with **Section 5.3.4.3.4**. **Table 5-8** provides an estimate of swipe testing and building material (volumetric) sample quantities.

Surface and subsurface soil sampling will be conducted in accordance with **Section 5.4.3**. Planned soil sample locations are shown on **Figure 5-10**. An estimate of soil sample quantities is presented in **Table 5-9.**

5.3.5 IA02 - Excised Area – Building Exterior Areas

5.3.5.1 Class 1 Areas in IA02

Based on a review of ORISE (1999) data, all of IA02 ground and paved areas are designated Class 1. Therefore, the total Class 1 area in IA02 is approximately 16,000 m^2, not including ground covered by buildings.

5.3.5.2 Class 2 Areas in IA02

There are no Class 2 areas in IA02.

5.3.5.3 Class 3 Areas in IA02

The exterior surfaces of all buildings in the Excised Area are classified as Class 3. As noted in **Section 5.3.4**, building heights are not available and will be assumed to be 10 m. **Table 5-7** shows the estimated areas of the building exteriors in the Excised Area.

The total Class 3 area in IA02, comprised entirely of building surfaces, is approximately 87,400 m^2.

5.3.5.4 Other Media in IA02

Many of the other media discussed in **Section 5.4.5** will be encountered and will be surveyed at a level commensurate with the classification of the area in which they are located.

5.3.5.5 Assumption Basis for IA02

The general assumption basis for the characterization survey is presented in **Section 5.3.2**. The following paragraphs present assumptions specific to IA02.

ORISE detected radiological contamination in soils at various locations within the outdoor areas of the Excised Area. Areas identified as contaminated by ORISE included areas directly west of Building 24 and Building 6/8, the area between Building 2 and Building 3, a portion of the small courtyard east of Building 5, and areas west of Building 2 and north of Building 1 in the general area below the former railroad tracks.

The exterior portion of the Excised Area was surveyed using a site-specific grid, but the grid used was not tied to the New York State Plane Coordinate System. The extent of radiological contamination (horizontal and vertical) was roughly established, although the sample density may not be sufficient for full delineation of impacted (contaminated) areas. Some contamination found was associated with firebrick and pieces of radioactive metal.

5.3.5.6 Survey Basis for IA02

Section 5.3.3 presents the general survey basis for the characterization survey effort.

Surface and subsurface soil samples will be collected to confirm and supplement ORISE data. ORISE soil sampling results will be verified and used as appropriate to reduce the soil sampling efforts of the present survey. RI soil sampling locations have been designed to bound areas of contamination identified by ORISE, as well as to fill potential subsurface data gaps. The soil sample locations planned for IA02 are presented on **Figure 5-11**.

Surface and subsurface soil samples will be collected in accordance with **Section 5.4.3.** Selection of recovered core intervals for on-site gamma spectroscopy laboratory analysis will be performed in accordance with the decision logic presented in **Section 5.4.3.1**.

5.3.6 IA03 – Landfill Area

The total area of the Landfill Area is approximately 36,500 m^2 (approximately 9 acres).

5.3.6.1 Class 1 Areas in IA03

Previous surveys of the Landfill Area indicate contamination potentially greater than the screening levels in the northeast corner, so that part of the northeast corner will be surveyed as Class 1.

The total Class 1 area is approximately 2300 m^2.

5.3.6.2 Class 2 Areas in IA03

The remainder of the Landfill Area will be surveyed as Class 2.

The Class 2 gamma walkover survey may demonstrate that some portions of IA03 may be reclassified as Class 3, with a commensurate reduction in survey activity in those portions.

Initially, the total Class 2 area is approximately 34,200 m^2. This will be subject to change, depending on whether the gamma walkover survey of IA03 as a Class 2 area causes portions of it to be reclassified as Class 3.

5.3.6.3 Class 3 Areas in IA03

None of IA03 will be surveyed as Class 3. However, this may change as a result of the gamma walkover survey.

5.3.6.4 Other Media in IA03

Surface water and sediment samples will be collected from the western and southern perimeter of the Landfill Area to look for possible overland migration of MED/AEC materials during times the Landfill Area was active or mined.

5.3.6.5 Assumption Basis for IA03

The general assumption basis for the characterization survey is presented in **Section 5.3.2**. The following paragraphs present assumptions specific to IA03.

The presence of radiological contamination in soils in IA03 has not been confirmed, with the exception of a limited area at the northeast corner of the Landfill Area. This area is a NYSDEC inactive hazardous waste site (NYSDEC, 2003), and as such NYSDEC has conducted several studies of this area. The chemical (non-radiological) sampling and analytical data are adequate.

Surface radiological data includes isotopic analyses of soils and are adequate except in the northeast corner of the landfill. Subsurface data in the Landfill Area are inadequate, as

MED/AEC material initially deposited in the northeast corner may have been moved (and buried) as a result of later activities (land-filling, mining, and covering). NYSDEC excavated test pits and conducted borings in areas outside of the northeast corner, but samples were only field screened for radiological contaminants (that is, not sent for laboratory analysis). Subsurface radiological data are inadequate, as ORISE subsurface data (boreholes) were obtained only from locations with evidence of surface contamination.

Samples in the southern part of the landfill, from the marshy area, were also collected and analyzed by NYSDEC for chemical parameters; these samples were reported as “surface water” and “sediment” samples.

The Landfill Area is shown in **Figure 1-2**. Refer to ORISE Figures 34 and 36 included in **Attachment 2** for presentation of the sampling locations, the ranges of summary measurements, and the approximate extent of the contamination in the Landfill Area (ORISE, 1999).

5.3.6.6 Survey Basis for IA03

Section 5.3.3 presents the general survey basis for the characterization survey effort.

Soil sample locations planned for IA03 are presented on **Figure 5-12**. ORISE (1999) and NYSDEC (1994) soil sampling results will be verified and used as appropriate to reduce the soil sampling efforts of the present survey. RI soil sampling locations have been designed to bound areas of contamination identified by ORISE and NYSDEC, as well as to fill potential subsurface data gaps.

Soil samples will be collected from the western and southern perimeter of the Landfill Area in the course of the Class 2 survey and analyzed for radiological parameters to evaluate potential overland migration of radiological contamination during times the landfill was active or mined.

Surface and subsurface soil samples will be collected in accordance with **Section 5.4.3.** Selection of recovered core intervals for on-site gamma spectroscopy laboratory analysis will be performed in accordance with the decision logic presented in **Section 5.4.3.1**.

Wetland delineation may be needed if radiological material is found in the western or southern part of the Landfill Area.

5.3.7 IA04 – NCIDA Property (Excluding Excised Area, Landfill Area, and Building 24)

The total area of IA04 is approximately 211,000 m^2 (52 acres), including areas occupied by buildings. The area occupied by buildings is approximately 12,000 m^2 (3 acres), so the total outdoor area is approximately 199,000 m^2.

During development of this FSP, the investigative area identified as IA04 during the TPP Meeting and in the DGAR was divided into subunits IA04A, IA04B, IA04C, and IA04D; the overall footprint of IA04 was not changed. The areas designated IA04A and IA04B were investigated by ORISE (1999); prior surveys have not been conducted in the areas designated IA04C or IA04D. **Figure 1-2** shows the overall IA04 boundary. **Figure 5-13** shows the areas designated IA04A and IA04B (roughly coinciding with ORISE Figures 33 and 35, respectively), and **Figure 5-14** shows the areas designated IA04C and IA04D.

IA04 building exteriors will be considered to be non-impacted.

5.3.7.1 Class 1 Areas in IA04 (Subunit 4A)

The ORISE survey detected several locations with radiological contamination greater than the screening levels. However, the survey did not adequately define the extent of this contamination. It is likely that some large portions of IA04A should be classified as Class 1, but this is uncertain.

The total Class 1 area in IA04 (Subunit 4A) is about 67,000 m^2.

5.3.7.2 Class 2 Areas in IA04 (Subunit 4B)

The ORISE survey conducted in this area did not detect radiological contamination greater than the screening levels (with the exception of location 270 which has now been incorporated into IA04A). The total Class 2 area is approximately 64,000 m^2.

5.3.7.3 Class 3 Areas in IA04 (Subunits 4C and 4D, and Building Interiors)

The total outdoor Class 3 area in IA04 (Subunit 4C) is approximately 31,000 m^2.

The total outdoor Class 3 area in IA04 (Subunit 4D) is approximately 37,000 m^2.

Building floors in IA04 (approximately 11,000 m^2) will be surveyed as Class 3 areas; approximately 10,000 m^2 are in IA04B and 1,000 m^2 are in IA04D.

5.3.7.4 Other Media in IA04

Other media not included under IA07 or IA08 are not expected to be encountered in IA04.

5.3.7.5 Assumption Basis for IA04

The general assumption basis for the characterization survey is presented in **Section 5.3.2**. The following paragraphs present assumptions specific to IA04.

As noted above, the area designated as IA04 during the TPP Meeting has been further broken down to four separate IAs for the Site RI. The areas designated IA04A and IA04B for the Site RI were investigated by ORISE (1999); prior surveys have not been conducted in the areas designated IA04C or IA04D.

Refer to **Attachment 2** for ORISE data tables (13 through 16) and figures (33, 35, and 36) for presentation of the ORISE sampling locations, the ranges of summary measurements, and the approximate extent of the contamination in those areas covered by the ORISE survey (ORISE, 1999).

5.3.7.6 Survey Basis for IA04

Section 5.3.3 presents the general survey basis for the characterization survey effort.

The soil sample locations planned for IA04A and IA04B are presented on **Figure 5-13**, and locations planned for IA04C and IA04D are presented on **Figure 5-14**. ORISE (1999) sample results within IA04A and IA04B will be verified and used as appropriate to reduce the soil sampling efforts of the present survey. RI soil sampling locations have been designed to bound areas of contamination identified by ORISE, as well as to fill potential subsurface data gaps.

Surface and subsurface soil samples will be collected in accordance with **Section 5.4.3.** Selection of recovered core intervals for on-site gamma spectroscopy laboratory analysis will be performed in accordance with the decision logic presented in **Section 5.4.3.1**.

5.3.8 IA05 – Railroad Right-of-Way North of Site

The total area of IA05 is approximately 24,300 m^2 (6 acres). During development of this FSP, the investigative area identified as IA05 during the TPP Meeting and in the DGAR was divided into subunits IA05A and IA05B; the overall footprint of IA05 was not changed. The area designated IA05A between IA04 and NY Route 31 was investigated by NYSDEC (1999); prior surveys have not been conducted in the area designated IA05B. **Figure 1-2** shows the overall IA05 boundary. **Figure 5-15** shows the areas designated IA05A and IA05B.

5.3.8.1 Class 1 Areas in IA05 (Subunit 5A)

Subunit IA05A has been designated as Class 1 based on the results of the NYSDEC (1999) survey. The total Class 1 area in IA05A is approximately 15,800 m^2.

5.3.8.2 Class 2 Areas in IA05 (Subunit 5B)

Subunit 1A05B has been designated Class 2 based on a review of available data. The total Class 2 area in IA05B is approximately 8,500 m^2.

5.3.8.3 Class 3 Areas in IA05

IA05 has no Class 3 areas.

5.3.8.4 Other Media in IA05

Other media are not expected to be encountered in IA05.

5.3.8.5 Assumption Basis for IA05

The general assumption basis for the characterization survey is presented in **Section 5.3.2**. The following paragraphs present assumptions specific to IA05.

The area of the NYSDEC (1999) USRADS survey has been designated IA05A. NYSDEC (1999) reported that “elevated uranium and thorium concentrations [were] found along the former rail spur at several locations up to about 600 ft north of the Allegheny Ludlum fence.” The findings included:

- Above background readings were found at the southern-most part of “manual survey #1,” (see **Figure 5-16**, extracted from NYSDEC 1999) on the back side of a mound of soil that was placed there during the leveling/filling work done behind the Lombardi property.
- Above background readings up to about 30,000 cpm at small spots located near what would have been the spur bed during “manual survey #2” (see **Figure 5-16**).

- Two areas with maximum count rates greater than 100,000 cpm were observed, at about 185 ft and at about 475 ft north of the intersection of two fences along the north boundary of the Allegheny Ludlum property. These areas are consistent with the disposal of radioactive waste along the rail spurs that served the steel mill. Some of the elevated areas have recognizable fire brick at or near the surface which will contribute to the measured radiation, but most of the above background readings were believed to result from uranium and thorium disposal.
- Elevated readings were noted on both sides of the former spur line (indicated by still-remaining railroad ties and northward extensions from those indications) over much of its length extending north to West Avenue.
- Radioactive material found consisted of small pieces of thorium metal, soil-like matrix containing mixtures of uranium and thorium, one location of identifiable small flakes containing uranium and thorium, slag, and fire brick.

The railroad right-of-way (ROW) is also shown on **Figure 1-2**.

5.3.8.6 Survey Basis for IA05

Section 5.3.3 presents the general survey basis for the characterization survey effort.

The GWS will be used to verify and validate the NYSDEC survey. Parts of IA05 may be reclassified to Class 1 or Class 3 as a result.

The soil sample locations planned for IA05A and IA05B are presented on **Figure 5-15**. NYSDEC (1999) scan data will be used to the extent possible to reduce the soil sampling efforts of the present survey. RI soil sampling locations have been designed to bound areas of contamination identified by NYSDEC, as well as to fill potential subsurface data gaps. Prior surveys have not been conducted in the area designated IA05B.

The GWS may locate discrete sources of radioactive material based on data presented in NYSDEC (1999). In such cases, as an ALARA measure, the sources will be recovered and handled as radioactive waste. However, it is noted that, in many cases, the discrete sources may not be easily recovered and disposed of. Several, if not dozens of “hot spot” pockets of highly concentrated soil contamination consisting of uranium and/or thorium may exists along the abandoned rail spur. A cursory survey of the area will allow for easy identification of these areas.

Surface and subsurface soil samples will be collected in accordance with **Section 5.4.3.** Selection of recovered core intervals for on-site gamma spectroscopy laboratory analysis will be performed in accordance with the decision logic presented in **Section 5.4.3.1**.

5.3.9 IA06 – Off-site Northeast Properties

As determined during the data gap analysis, IA06 includes only non-impacted areas. Based on this determination, this IA has been characterized as non-impacted and no further characterization of this area is planned.

5.3.10 IA07 – Groundwater

Evaluation of IA07, Groundwater, is presented in **Section 5.4.4**

5.3.11 IA08 – Site Utilities (Sewers and Drains)

5.3.11.1 Rationale and Design

As reported in the DGAR, limited data exist about radioactive contamination in the sewers, drains, and trenches. Five trenches (in Buildings 3 and 8) and an oil-water separator between Buildings 2 and 3 were sampled by ORISE (1999) for radiological contaminants. NYSDEC (2000) reported that a surface water sample was collected from a sewer line in Building 3 (within the Excised Area), and the sample was submitted for radiological analysis, but the results were not included in the investigation report.

Radiological contamination exceeding the ORISE screening levels (and also the currently-proposed screening levels) was reported in some of the samples analyzed by ORISE, including equipment or trenches in Buildings 3 and 8. The DGAR noted that these data suggest that the residual materials in the production area floor trenches are a concern. Plant-wide utility drawings have been made available; however, field locations need to be verified.

Historical data indicate that an oil/water separator (OWS) with an overflow to the Erie Canal existed near the Erie Canal; it is possible that MED/AEC contaminated materials were present in water that may have been discharged to the Erie Canal via an overflow outfall. NYSDEC (2000) indicates that the OWS has been abandoned, and is no longer accessible. A review of available aerial photos confirms that the OWS and pump house no longer exist. No data were located for surface water or sediment samples associated with the Erie Canal. Therefore, surface water and sediment samples are planned as discussed in **Section 5.4.5.3**.

One goal of the assessment of the IA01 trenches will be to estimate the volume of aqueous waste that may require disposal. Therefore, the dimensions of the trenches will be determined, along with the volume of water in the trench.

5.3.11.2 Field Procedures

In order to characterize the potential nature and extent of possible MED/AEC-related contamination in site utilities, sewers and drains, and trenches a series of investigative techniques are proposed.

- Field-verify utilities per available facility drawings.
    - During the mobilization phase of the RI field investigation, Earth Tech will
        - Field-verify the location and dimensions of the open trenches in the Excised Area
        - Field-audit the Excised Area and the NCIDA area for obvious signs of utilities that may not have been shown on the plant-supplied drawings (e.g., storm sewer catch basins, sanitary sewer manholes, roof drains, pavement cuts, etc.)
        - Field-audit the former OWS location near the Erie Canal to investigate potential surface soil, surface water, or sediment sample locations to investigate nature and extent of potential contamination.

  - Mark and map using civil survey methods any of the various features identified above. Determine trench dimensions, and volume of any standing liquids and/or sediments (probing).

- Sample residuals (aqueous and non-aqueous materials (e.g., sediment-like) remaining in floor drains, open trenches, lift stations, etc.) and materials of which sewers/drains are constructed.
  - Aqueous and/or non-aqueous (sediment-like) samples (if both matrices are present) from open trenches or pits within the Excised Area buildings (IA01) will be collected in accordance with the procedures outlined in **Section 5.4.5.3**. Aqueous and non-aqueous samples will be analyzed for COPCs by gamma spectroscopy (non-aqueous only), alpha spectroscopy (U, Th) and EPA method 903/904 (Ra), The estimated number of sample locations includes:

Building 1	Basement	4 pair within flooded basement
Building 2	None known	0 pair
Building 3	Open trench	Minimum 1 pair per 50 linear ft; 4 pair total
	Furnace pits	1 pair per furnace; 4 pair total
Building 4/9	Covered (steel plate) floor drain	Minimum 1 pair per 50 linear ft; 4 pair total
Building 5	None known	0 pair
Building 6/8	Open trench	Minimum 1 pair per 50 linear ft; 4 pair total
Building 24	Floor drains	Minimum 1 pair per 50 linear ft; 6 pair total

  - Sample residuals (water and/or solids remaining in storm sewer lines, catch basins, meter pits, etc.) within IA01, IA02, and IA04. Aqueous and non-aqueous samples will be analyzed for COPCs by gamma spectroscopy (non-aqueous only), alpha spectroscopy (U, Th), and EPA method 903/904 (Ra). The estimated number of sample locations includes:

IA01	Previously undiscovered drains	Assume 4 pair total
IA02	Roof drains, storm drains	Assume 4 pair total
IA04	Sewers or drains discharging from IA01/IA02	Assume 2 pair total

- Sediment and surface water samples will be analyzed at the off-site, fixed laboratory. Sample preparation and handling will be conducted in accordance with **Section 6** and **Section 7** of this FSP.

5.3.12 IA09 – Erie Barge Canal

5.3.12.1 Rationale and Design

As reported in the DGAR, the Erie Canal adjacent to the Site was evaluated as part of IA08; however, during development of the FSP a technical adjustment was made to identify this potentially affected area as a separate IA. **Figure 5-17** shows the area designated as IA09.

As noted in **Section 5.3.11.1**, five trenches (in Buildings 3 and 8) and an oil-water separator between Buildings 2 and 3 were sampled by ORISE (1999) for radiological contaminants. Radiological contamination exceeding the ORISE screening levels (and also the currently-proposed screening levels) was reported in some of the samples analyzed by ORISE, including equipment or trenches in Buildings 3 and 8. In addition, historical data indicate that an OWS with an overflow to the Erie Canal existed near the Erie Canal. The presence of radioactive contamination in the Site sewers, drains, or trenches may create a pathway for the contamination to have been discharged to the Erie Canal.

No data were located for surface water or sediment samples associated with the Erie Canal. Therefore, four transects consisting of three paired surface water and sediment samples will be collected. The four transects will be located as follows:

- Locate paired surface water and sediment samples along each transect at 25 percent, 50 percent, and 75 percent of transect width.
    - Collect aqueous sample from mid-point of water column.
    - Collect sediment sample from top six inches of sediment.
- One transect to be located upstream of potential Site influence.
- One transect to be located immediately east of the Route 93 overpass (assumed to be more than 100 feet removed from any potential Excised Area (i.e., IA01 and IA02) outfalls).
- Two transects located between the upstream and downstream points, as follows:
    - Space equidistant between upstream and downstream transects if no specific Excised Area outfalls are located.
    - If only one Excised Area outfall is located, place one transect at the outfall point and one spaced equidistant between the outfall and the most downstream transect.
    - If two Excised Area outfalls are located, place transects at each outfall.
    - If three or more outfalls are located, consult with USACE before proceeding.

Surface water samples will be analyzed by alpha spectroscopy (U, Th) and EPA method 903/904 (Ra). Each sediment sample will be analyzed for COPCs by gamma spectroscopy and alpha spectroscopy (U, Th); and 50 percent of the sediment samples will be analyzed for isotopic Ra (EPA method 903/904) and total organic carbon.

5.3.12.2 Field Procedures

In order to characterize the potential nature and extent of possible MED/AEC-related contamination in the Erie Barge Canal adjacent to the Site, the following investigation will be completed.

- Field-verify IA08 outfalls to the Erie Canal (refer to **Section 5.3.11.2**).
- Confirm direction of flow within Erie Canal to determine upstream and downstream directions.
- Collect surface water and sediment samples at the approximate locations shown on **Figure 5-17** allowing for field conditions noted in **Section 5.3.12.1**.
- Collect surface water and sediment samples in accordance with the field procedures described in **Section 5.4.5.3**.

Surface water and sediment samples will be analyzed at the off-site, fixed laboratory. Sample management and handling will be conducted in accordance with **Section 6** and **Section 7** of this FSP, respectively.

5.3.13 IA10 – Lot 4.1 ("Lombardi Property")

The total area of IA10 is approximately 6,400 m^2 (1.6 acres). This IA was evaluated in the DGAR within IA03 and IA05; however, during development of the FSP a technical adjustment was made to identify this potentially affected area as a separate IA.

5.3.13.1 Class 1 Areas in IA10

IA10 has no Class 1 areas.

5.3.13.2 Class 2 Areas in IA10

IA10 will be surveyed as a Class 2 area.

The total Class 2 area is approximately 6,400 m^2.

5.3.13.3 Class 3 Areas in IA10

IA10 has no Class 3 areas.

5.3.13.4 Other Media in IA10

Other media are not expected to be encountered in IA10.

5.3.13.5 Assumption Basis for IA10

The general assumption basis for the characterization survey is presented in **Section 5.3.2**. The following paragraphs present assumptions specific to IA10.

This IA was evaluated in the DGAR within the context of IA03 and IA05; however, during development of the FSP a technical adjustment was made to identify this potentially affected area as a separate IA. This IA is defined as Lot 4.1 (Tax Map 108.20; Niagara County Real Property Tax Services, 2004), and is located immediately north of the northeast portion of IA03, and immediately west of the southwest portion of IA05. This privately owned parcel was partially investigated in 1999 by NYSDEC. Field inspection (NYSDEC, 1999) and analysis of aerial photos (USACE, 2006a) identified the potential for FUSRAP-related materials to have been inadvertently moved onto this IA as a result of land development activity. In prior reports, this IA has been referred to as the "Lombardi Property."

This IA will be surveyed because the New York State Department of Environmental Conservation (NYSDEC, 1999) reported that "elevated uranium and thorium concentrations [were] found along the former rail spur at several locations up to about 600 ft north of the Allegheny Ludlum fence." This rail spur is immediately adjacent to the Lombardi property. Specifically:

- Above background readings were found at the southern-most part of "manual survey #1," (see **Figure 5-16**, extracted from NYSDEC 1999) on the back side of a mound of soil that was placed there during the leveling/filling work done behind the Lombardi property.
- Above background readings up to about 30,000 cpm at small spots located near what would have been the spur bed during "manual survey #2" (see **Figure 5-16**).
- Two areas with maximum count rates greater than 100,000 cpm were observed, at about 185 ft and at about 475 ft north of the intersection of two fences along the north boundary of the Allegheny Ludlum property. These areas are consistent with the disposal of radioactive waste along the rail spurs that served the steel mill. Some of the elevated areas have recognizable fire brick at or near the surface which will contribute to the measured radiation, but most of the above background readings were believed to result from uranium and thorium disposal.
- Elevated readings were noted on both sides of the former spur line (indicated by still-remaining railroad ties and northward extensions from those indications) over much of its length extending north to West Avenue.
- Radioactive material found consisted of small pieces of thorium metal, soil-like matrix containing mixtures of uranium and thorium, one location of identifiable small flakes containing uranium and thorium, slag, and fire brick.

The location of IA10 relative to IA03 and IA05 is shown on **Figure 1-2**.

5.3.13.6 Survey Basis for IA10

Section 5.3.3 presents the general survey basis for the characterization survey effort.

The GWS will be used to verify and validate the NYSDEC survey. Parts of IA10 may be reclassified to Class 1 or Class 3 as a result.

The soil sample locations planned for IA10 are presented on **Figure 5-18**. NYSDEC (1999) scan data will be used to the extent possible to reduce the soil sampling efforts of the present survey. RI soil sampling locations have been designed to bound areas of contamination identified by

NYSDEC, as well as to fill potential subsurface data gaps. Prior surveys have not been conducted over the majority of the area designated IA10.

The GWS may locate discrete sources of radioactive material based on data presented in NYSDEC (1999). In such cases, as an ALARA measure, the sources will be recovered and handled as radioactive waste. However, it is noted that, in many cases, the discrete sources may not be easily recovered and disposed of. Several, if not dozens of "hot spot" pockets of highly concentrated soil contamination consisting of uranium and/or thorium may exists along the abandoned rail spur. A cursory survey of the area will allow for easy identification of these areas.

Surface and subsurface soil samples will be collected in accordance with **Section 5.4.3.** Selection of recovered core intervals for on-site gamma spectroscopy laboratory analysis will be performed in accordance with the decision logic presented in **Section 5.4.3.1**.

5.4 CHARACTERIZATION SURVEY DESIGN

Survey design will be such that results of the characterization survey include:

- Identification and distribution of contamination in buildings, structures, and other Site facilities
- Concentration and distribution of contaminants in surface and subsurface soils
- Distribution and concentration of contaminants in groundwater, surface water, and sediments
- Distribution and concentration of contaminants in other impacted media

Personnel conducting the survey will be trained and qualified in the procedures they will use.

5.4.1 Instrumentation

Instrumentation and measurement techniques will be selected based on detection sensitivity to provide technically defensible results that meet the objectives of the survey. Because of the uncertainty associated with interpreting scanning results, the detection sensitivity of the selected instruments will be as far below the screening levels as possible within time and resource constraints. For direct measurements and sample analyses, minimum detectable concentrations (MDCs) less than 10 percent of the screening levels are preferable while MDCs up to 50 percent of the screening level are acceptable.

Table 5-10 (adapted from *MARSSIM* Table 4.1) presents the recommended survey methods that have proven to be effective for uranium and thorium based on past survey experience in the decommissioning industry. This table provides a general indication of the detection capability of commercially-available instruments. One or more of each of these instruments will be used during the survey. **Attachment 3** presents examples of some of the equipment that will be used in this survey.

5.4.1.1 Selection of Instruments

Detector selection will depend on the survey to be performed, surface contours and survey area size. The project team will normally use a dual phosphor 125-cm^2 zinc sulfide (ZnS) scintillation detector (Ludlum 43-89 or equivalent) or 545-cm^2 gas flow proportion counter (Ludlum 43-37 or equivalent) for direct alpha and beta measurements. As a general example, **Table 5-10** lists appropriate instrumentation for various direct measurement techniques.

Swipes for removable alpha and beta activity will be analyzed using the Ludlum Model 2929 coupled with a Ludlum Model 43-10-1 detector, or equivalent.

Field radiation measurements will be collected for purposes of documenting environmental exposure, assisting in field decisions, and possibly correlating them with the results of sampling. Surface soil sample locations will be screened by measuring and recording gamma radiation using Ludlum Model 19A microR meters, Inspector 1000s coupled to 2 inch × 2 inch sodium iodide (NaI) detectors, and other similar equivalent gamma detectors.

The following SOPs, included in **Attachment 1**, provide detailed procedures for radiological instrument measurement activities:

- SOP 1, Portable Detection Equipment
- SOP 2, Swipe Counter
- SOP 4, Equipment Decontamination
- SOP 6, General Radiological Equipment Checklist
- SOP 11, Radiological Survey and Postings
- SOP 12, Swipe Samples

SOPs for the onsite laboratory gamma spectroscopy laboratory will be included in the Laboratory Quality Management Plan (LQMP) (additional detail presented in Section 3.6 of the QAPP) which will be submitted under separate cover for USACE approval prior to mobilization for the field characterization surveys.

5.4.1.2 Instrument Calibration

All instruments shall be calibrated by a qualified calibration/repair facility at least annually in accordance with manufacturers' instructions. Sources used in calibration will be National Institute of Standards and Technology (NIST)-traceable. A calibration certificate will be maintained on-site for each instrument and included in the project final report. See SOP 1, Portable Detection Equipment, and SOP 2, Swipe Counter, in Attachment 1.

Each instrument shall be checked at the beginning, middle, and end of each shift with check sources to verify that its response is within ± 20 percent of the value established by the calibration laboratory for that instrument/check source/geometry combination. If the instrument fails the post-survey source check, all data collected during that time period with the instrument must be reviewed and adjusted or discarded as appropriate. The affected data shall be flagged and later studied by the SRSO to determine if they are useable.

Each item of survey equipment shall meet function response requirements before and during its use. Control charts shall be maintained to monitor the performance of field instruments for the duration of the project in accordance with SOP 1 and SOP 2. If survey equipment requires repair during a workday, it shall be repaired and its proper function verified before it is returned to use.

5.4.1.3 ISOCS QA

Quality assurance for the ISOCS will be verified by tracking peak energy, peak resolution, and net peak area for a high and low energy peak, based on daily counts of a NIST-traceable source. These quality assurance checks will be performed in accordance with the instrument's SOP.

Instrument control charts will be generated and evaluated in accordance with the following guidelines. If all QA parameter results are within the acceptable "investigation level" range, the ISOCS system shall be approved for routine use during the remainder of that day. The investigation level range encompasses ± 1 keV for the peak energy trend and ± 2σ for the resolution and net peak area trends.

If any of the results are outside the "investigation level" range but still within the "action level" range, the QC calibration check count shall be repeated and the event noted in the project logbook. If the peak energy trend falls outside of 1-keV band, then the ISOCS shall be taken out of service until the problem is resolved. If the results of the second count are within the acceptable "investigation level" range, the ISOCS system shall be approved for routine use.

If the results of the second count are outside the "investigation level" range or the results of any count are outside the "action level" range (± 3σ), the ISOCS system shall be taken out of service until the problem is resolved. This event should also be noted in the project logbook.

After performing any significant corrective actions, the Health Physicist shall require two consecutive QC calibration check counts with acceptable results before approving the system for routine use. Additionally, the Health Physicist will review each spectral data report and include them as appendices to the final project report along with the nuclide identification/quantification libraries used.

A background spectrum will be collected once each day for information purposes. Any significant changes in the background spectrum will be reviewed by the Health Physicist.

Duplicate analyses of field scans will also be performed for quality assurance purposes on ten percent of the performed measurements and evaluated in accordance with the Site QAPP.

5.4.1.4 Onsite Gamma Spectroscopy Laboratory

The primary purpose and benefit of the onsite gamma spectroscopy laboratory is to provide reliable near-real-time results to permit the survey team to locate and take additional samples where contamination is identified in order to ensure that the contamination is bounded to within an appropriate distance. The onsite gamma spectroscopy laboratory will be used to analyze selected surface soil and subsurface soil samples (see **Section 5.4.3**) for radiological COPCs. SOPs for the onsite gamma spectroscopy laboratory will be included in the LQMP (additional detail presented in Section 3.6 of the QAPP) which will be submitted under separate cover for USACE approval prior to mobilization for the field characterization surveys.

5.4.1.5 Minimum Detectable Concentrations

The following sections describe how the Minimum Detectable Concentrations (MDCs) will be determined for field equipment (as opposed to the onsite gamma spectroscopy laboratory which will be addressed in the LQMP).

5.4.1.5.1 Static Minimum Detectable Concentrations

According to *MARSSIM*, the critical level (L_C) is the level, in counts, at which there is a 5 percent statistical probability of incorrectly identifying a measurement system background value as greater than background. Any response above this level is considered to be greater than background. The detection limit (L_D) is an *a priori* estimate of the detection capability of a measurement system and is also reported in units of counts. The MDC is the detection limit (counts) multiplied by an appropriate conversion factor to give units consistent with a site guideline, such as pCi/g or dpm/100 cm^2. In other words, the MDC is the *a priori* net activity level above the critical level that an instrument can be expected to detect 95 percent of the time,

MARSSIM explains how to calculate L_C, L_D, and MDC and arrives at the following result (*MARSSIM* Equation 6-7) for the static MDC:

$$\text{Static MDC} = C\,[3 + 4.65 \times B^{1/2}].$$

C represents total detection and efficiency and other constants or factors needed to put the static MDC into appropriate units and *B* is the number of background counts that are expected to occur while performing an actual measurement. All static counts will be taken in 1 minute.

For the present purposes,

$$C = \frac{1}{A\varepsilon_i\varepsilon_s} \times \frac{100\ \text{cm}^2}{100\ \text{cm}^2}.$$

A is the effective area of the probe, ε_i is the instrument or detector efficiency, $\varepsilon_s = 0.5$ is the efficiency of the contamination source, and the final factor, which equals 1, helps put the units of scan MDC into dpm/100 cm^2.

5.4.1.5.2 Scan Minimum Detectable Concentrations

The minimum detectable concentration of a scan survey (scan MDC) depends on the intrinsic characteristics of the detector (such as efficiency and physical probe area), the nature (type, abundance, and energy) of emissions, the relative distribution of the potential contamination (point versus distributed source and depth of contamination), scan rate, and personal characteristics of the surveyor. *MARSSIM* Section 6.7.2.1 discusses the basis for estimating scanning MDCs and arrives at the following equation for scan MDC:

$$\text{Scan MDC} = \frac{\text{MDCR}}{\sqrt{p}\,A\varepsilon_i\varepsilon_s} \times \frac{100\ \text{cm}^2}{100\ \text{cm}^2}.$$

MDCR is the minimum detectable count rate (interpolated from *MARSSIM* Table 6.6), *p* is surveyor efficiency (assumed to be 0.5) and other parameters are shown above. The final factor, which equals 1, helps put the units of scan MDC into dpm/100 cm^2.

After completing reference area measurements, MDCs will be re-calculated using site-specific variables (reference activity/instrument efficiencies) to verify that all MDCs are significantly below the screening levels.

5.4.2 Scanning and Direct Measurement Survey Techniques

This section addresses non-destructive surface scanning, direct measurement, and swipe testing of building interior surfaces, building exterior surfaces, and soil/pavement surfaces.

The integrated survey design combines scanning surveys with direct measurements and field sampling. The level of survey effort is determined by the potential for contamination as indicated by the survey unit classification. Class 1 survey areas will receive scanning over 100 percent of the survey area combined with direct measurements and sampling based on evaluation of current data in conjunction with prior data (e.g., placing sampling locations on a systematic grid to fill general data gaps and/or selecting biased locations to further investigate and bound prior survey data). Class 2 survey areas will receive scanning over a portion of the survey area based on the potential for contamination combined with direct measurements and sampling based on a systematic grid to a lesser degree than performed in a Class 1 area (approximately 25 percent of the Class 1 total). Class 3 survey units will receive judgmental scanning/randomly located direct measurements and sampling based on a systematic grid to a lesser degree than performed in Class 2 areas (approximately 25 percent of the Class 2 total).

5.4.2.1 Building Interior Surfaces

For the purposes of this survey, building interior surfaces will include floors, walls (above and below 2 m), ceilings, structural surfaces, sub-floor surfaces, trench side-walls and surfaces, manufacturing components (for example, forges, baths, *etc*., that remain in the buildings), and other overhead surfaces. This effort will be performed because Site operating history and previous surveys have indicated contamination in all of these areas.

Earth Tech personnel will not walk or work on any overhead walkways or platforms inside the facilities, as no engineering or structural evaluation has been conducted as to the stability or safety of these platforms. Ladders may be used, in compliance with the Site Safety and Health Plan, *Ladders*, to access elevated work areas. Such ladders will be inspected prior to each use. Alternately, man-lifts, including scissor and boom lifts, may be used, in accordance with the Site Safety and Health Plan. Appropriate fall protection will be used by employees in man-lifts. Cones or other demarcation will be used to prevent workers from entering the area below the man lift when in use.

The primary objective of the building characterization effort is to provide data sufficient to plan future actions such as decontamination, demolition, radioactive waste disposal, or final status surveys. The survey design is not necessarily intended to conclusively demonstrate compliance with regulatory standards, although data may ultimately be used to support that purpose.

5.4.2.1.1 Class 1 Surfaces

Floors will be 100-percent surveyed with the ISOCS or a floor monitor. Commensurate with safety considerations, other surfaces will be measured by the ISOCS if possible or 100-percent scanned with an appropriate instrument otherwise. A swipe test and static measurement will be taken at the location of the highest concentration detected by scanning or by the ISOCS in each 1-m grid square or other surface or, if no contamination is detected, at the center of the grid square. Exposure rate measurements at 1 m from floor and other surfaces will be performed at a frequency of 1 systematic measurement per every 4 m^2.

5.4.2.1.2 Class 2 Surfaces

A minimum of 30 measurement locations each, on vertical and horizontal surfaces where radioactive material would likely accumulate, (air exhaust vents and horizontal surfaces where dust would settle) will be surveyed. To assure a reasonable coverage of these surfaces, an average of at least 1 measurement location per 20 m^2 of surface area will be selected. The ISOCS will be used for these measurements whenever possible. If the ISOCS can not be used for a 20-m^2 section and the section is otherwise safely accessible, a scan of the surface will be performed to identify the presence of any elevated activity levels, followed by the measurement.

Scanning will cover at least 25 percent of the surface. If scans or measurements indicate residual activity exceeding 25% of the screening level, the surface will be considered potentially contaminated and the surface exhibiting such levels will be surveyed in the same manner as Class 1 surfaces to determine whether reclassification is necessary. Exposure rate measurements at 1 m from floor and other surfaces will be performed at a frequency of 1 systematic measurement per every 16 m^2.

5.4.2.1.3 Class 3 Surfaces

MARSSIM says, "Class 3 survey units receive judgmental scanning and randomly located measurements." Therefore, Class 3 surfaces will be surveyed similar to Class 2 surfaces but to a lesser extent based on the professional judgments of the Project Manager and Project Health Physicist. For example, if they are contaminated, upper walls and ceilings are likely to be contaminated uniformly from dust deposition, so one or two measurements may suffice to adequately characterize these Class 3 areas.

As a general guideline for the beginning of the survey, the survey coverage of Class 3 areas will be approximately 5 percent to 10 percent of the area and the number of samples per unit area will be approximately one-fourth of the number for Class 2 areas (i.e., one measurement location per 80 m^2). As site experience is gained, these percentages may change. For example, if no significant contamination is found on the first few ceilings surveyed, it may be reasonable to assume that additional surveys on ceilings are unnecessary.

5.4.2.1.4 Swipe Test Counting

Swipe samples will be collected in accordance with SOP 12. Swipe test samples will be analyzed onsite for gross alpha and beta activity in accordance with SOP 2 using appropriate on-site instrumentation. **Table 5-8** presents an estimated count of swipe tests for IA01. SOPs for swipe testing and counting are presented in **Attachment 1,** and typical on-site instrumentation is presented in **Attachment 3**.

5.4.2.2 Building Exterior Surfaces

Building exterior surfaces will typically have a low potential for residual contamination. They normally will be classified as Class 3 surfaces and so will be surveyed similarly to Class 3 interior surfaces. As a general guideline for the beginning of the survey, the survey coverage of Class 3 areas will be approximately 5 percent to 10 percent of the area and the number of samples per unit area will be approximately one-fourth of the number for Class 2 areas (i.e., one measurement location per 80 m^2). As site experience is gained, these percentages may change.

For example, if no significant contamination is found on the first few roofs surveyed, it may be reasonable to assume that additional surveys on roofs are unnecessary.

The ISOCS will be used whenever possible, preferably set back with a large field of view, so that large areas may be surveyed at one time. If significant COPC contamination (more than 10 percent of the applicable screening level) is found, the ISOCS will be moved closer with a smaller field of view to better locate the contamination.

On buildings with roof exhausts, roof contamination will be investigated. Because roofs are periodically resurfaced, although this has not been confirmed for this site, contaminants may have been trapped in roofing material, and samples of this material may have to be obtained. Exterior locations near wall penetrations for process equipment, piping, and exhaust ventilation; roof drainage points such as drip-lines along overhangs, downspouts, and gutters; and window ledges and outside exits (doors, doorways, landings, stairways, *etc*.) from former contamination control areas will be surveyed.

Earth Tech personnel may use ladders or man-lifts to access elevated work areas. Use of ladders and/or man-lifts will be in accordance with the SSHP. Appropriate fall protection will be used by employees in man-lifts. Cones or other demarcation will be used to prevent workers from entering the area below the man lift when in use.

5.4.2.3 Soil and Pavement Surfaces

Exposure rates will be measured at 1 m above surfaces.

5.4.2.3.1 Class 1 Soil and Pavement Surfaces

Prior to soil sampling and static gamma radiation measurements, survey areas will be 100-percent gamma-scanned as described in the GWS Plan (submitted under separate cover) to identify the presence of elevated direct radiation that might indicate residual gross activity or hot-spots. Exposure rate measurements at 1 m from the surface will be performed at a frequency of 1 systematic measurement per every 400 m^2.

5.4.2.3.2 Class 2 Soil and Pavement Surfaces

Surface scanning of Class 2 soil and pavement will be performed similarly to Class 1 soil and pavement except that scanning will cover only 25 percent of the surface.

5.4.2.3.3 Class 3 Soil and Pavement Surfaces

Class 3 soil and pavement will be surveyed similar to Class 2 soil and pavement but to a lesser extent based on the professional judgments of the Project Manager and Health Physicist, similarly as discussed above in **Section 5.4.2.1.3**.

5.4.3 Surface and Subsurface Soil (Volumetric)

5.4.3.1 Rationale and Design

5.4.3.1.1 Soil Sampling Locations

As noted in **Section 5.3.2**, significant data are available from prior investigations to provide preliminary guidance for the current RI soil sampling program. Initial surface/subsurface soil sample locations have been developed based on IA-specific data evaluations presented in **Section 5.3.4** through **Section 5.3.13**. Soil sample locations are shown on **Figures 5-3 through 5-15, and 5-17 and 5-18**. Soil sample analyses are summarized on **Table 5-6 and Table 5-9.**

This FSP is also designed to incorporate, to the extent possible, prior investigation data into the real-time decision making process during the execution of the current RI. The first step in this process is to compare the preliminary GWS data and building scan data against the currently designed soil sampling locations. Should the GWS or preliminary scan data identify previously unknown areas of concern, adjustments to surface and subsurface soil sample locations will be made to investigate the newly identified areas.

The second step in the process is to evaluate onsite gamma spectroscopy and offsite gamma and alpha spectroscopy COPC analytical data to determine whether the nature and extent of contamination has been adequately characterized in the horizontal (x,y) and vertical (z) directions. To that end, a pair of decision logic diagrams has been developed to help guide the technical team in determining the most appropriate "next step" when evaluating surface and subsurface soil data. **Figure 5-19** presents the decision path for determining which intervals of a soil core should be selected for onsite gamma spectroscopy analysis for COPCs. **Figure 5-20** presents the decision path for determining whether identified contamination has been adequately bounded. Use of the two figures is incorporated in the following sections.

5.4.3.1.2 Decision Logic for Onsite and Offsite Gamma Spectroscopy COPC Analysis

Whenever possible, soil samples will be collected using Geoprobe® soil sampling techniques. The Geoprobe core will be taken down in 0.6 m (2 foot) intervals to a depth of 6 m (e.g., Landfill Area) or to refusal, whichever is less. Upon retrieval, the recovered core will be screened using one of two methods:

- Hand-held instrumentation: The recovered soil core will be laid lengthwise on a suitable surface (workbench, etc.) and scanned with a Ludlum Model 44-10 Gamma Scintillator or equivalent. The hand-held scanner will be passed over the soil core and readings will be noted for every 6-inch interval of core.
- Automated core scanner: The recovered soil core will be transported to a central location for scanning using an automated core scanner. The core will be scanned in a device containing two diametrically opposed 2-inch × 2-inch NaI(Tl) gamma scintillator detectors mounted in a unit with a calibrated track that will advance the core through the scanner in 4-inch intervals. The core scanner will be outfitted with an electronic data recording system to allow for electronic data transfer, minimizing the potential for transcription error. The automated core scanner method will be the preferred method for core scanning.

The core-scan data will be reviewed in accordance with **Figure 5-19**. The default soil sampling assumption will be that three soil samples will be collected at each designated soil sample location (one surface and two subsurface; or if no surface soil sample, then three subsurface soil samples). Specific considerations when reviewing the core scan data include:

- The procedure applies to both indoor and outdoor sample/boring locations.
- Soil samples segregated for onsite gamma spectroscopy analysis will be derived from the section of core between about 5 cm above and 5 cm below the target 4-inch interval; i.e., the core interval analyzed will have a length l equal to 5 cm + 10 cm + 5 cm = 20 cm. The diameter of the sample core that will be used is 2.5 inches = 6.35 cm, so the volume of this sample from the core will be $V = ¼\pi d^2 l = 0.25 \times \pi \times 6.35 \text{ cm} \times 6.35 \text{ cm} \times 20 \text{ cm} = 633 \text{ cm}^3$, which is sufficient after vegetation and rocks have been removed, to provide a 500 cm^3 = 500 mL soil sample. The range of the depth of the sample will be recorded for each sample.
- If evaluation of GWS data, scan data, ORISE data, or professional judgment suggests the possibility of surface contamination above screening levels, the surface soil sample (top 20-cm) will be analyzed in the onsite gamma spectroscopy laboratory for COPCs.
    - Surface soil samples will be collected for onsite laboratory gamma spectroscopy analysis at a frequency of not less than 50 percent of soil sample locations for each respective IA; e.g., 40 sample locations in an IA generates at least 20 surface soil samples in that IA distributed to account for high and low scan readings, as well as spatial coverage of the IA.
- The subsurface sample with the highest scan result will be analyzed for COPCs at the onsite gamma spectroscopy laboratory.
- The subsurface sample, 20 cm long, from a depth greater than that of the previous sample, that the core scan indicates is approaching background count-rate levels (the "bounding" sample) will be analyzed for COPCs at the onsite gamma spectroscopy laboratory.
- If the core scan does not indicate elevated activity, then analysis of the same vertical interval as the nearest horizontal exceedance will be analyzed; e.g., surface soil interval 20 m north was above screening levels, then analyze surface soil interval in the subject core. [This procedure is not to be confused with bounding contamination described in the next section, but rather is a default position as the pre-determined sample locations are completed.]

Finally, of the total number of samples analyzed in the field screening laboratory, five percent or 100, whichever number is greater, will be sent to the fixed analytical laboratory for gamma spectroscopic analysis for COPCs. These samples will be selected as a representative variety of high and low scan values and of the vertical and horizontal distributions. The purpose of these second measurements is to obtain results from an accredited laboratory that can be used to corroborate and/or to correlate (provide a correction factor for) the field screening laboratory results.

5.4.3.1.3 Decision Logic for Offsite Alpha Spectroscopy Analyses

A limited number of soil samples will be selected for offsite alpha spectroscopy analysis for COPCs. All of the samples selected for offsite alpha spectroscopy analysis will be analyzed for uranium and thorium COPCs; one-half (i.e., 50 percent) of those samples will also be analyzed for radium COPCs. The selection of samples for offsite alpha spectroscopy analysis is dependent upon several factors, including:

- The current arrangement of IAs is anticipated to approximate exposure units that will be evaluated during the feasibility study/risk assessment. An approximate total of 12 to 30 samples per IA and per medium (*i.e.*, surface and subsurface soil), depending on the nature and size of the IA, will be collected to accommodate risk assessment.
- For the purposes of this assessment, surface soil samples can be defined as 0 to 6 inch depth.
- Exposure point samples need to be alpha spec samples.
- Samples for offsite alpha spectroscopy analysis will be selected to ensure that each exposure unit/point is characterized at the surface and to full depth. Sample selection at depth will be determined using a decision tree based on onsite gamma spectroscopy laboratory data.
- Samples for offsite alpha spectroscopy analysis will be selected from those with the highest scan values.
- A secondary purpose of these analyses is to obtain results from an accredited laboratory that can be used to corroborate and/or to correlate (provide a correction factor for) the field screening laboratory results.

5.4.3.1.4 Offsite Analyses to Evaluate for Enriched/Recycled Uranium

Additional data will be collected to evaluate the presence of enriched and recycled uranium. Presence of ^{236}U indicates recycled uranium; enhanced abundances of ^{234}U and ^{235}U indicate enriched uranium. A limited number of samples (anticipated to be 12) will be selected from the offsite laboratory alpha spectroscopic analyses that have significantly elevated uranium activities to also undergo inductively coupled plasma – mass spectroscopy (ICP-MS) analysis for uranium isotopes to determine the relative abundances of ^{234}U, ^{235}U, U-236, and ^{238}U to be used to evaluate the presence of recycled or enriched uranium. A similar number of background samples will also be analyzed by ICP-MS.

Gross alpha and gross beta radiation analyses will also be performed on the above samples for comparison to values from alpha spectroscopy and/or mass spectroscopy for COPC total alpha and total beta emissions.

5.4.3.1.5 Decision Logic for Biased Horizontal Bounding

As noted above, prior data as well as ongoing RI-generated data will be used together to determine whether horizontal bounding of identified contamination has been adequately determined. As the data are generated and entered into the RI sample database (see **Section 6.1**), the data will be reviewed and the decision logic presented in **Figure 5-20** will be applied to determine if contamination has been adequately bounded. If the contamination above screening levels has not been bounded based on application of the decision logic, then a new biased sampling location will be installed. The selection of sample intervals will be biased by the desire to bound the specific interval(s) in question.

In order to meet the project DQOs, the tolerable uncertainty for bounding contamination has been set at 5 m. Using assumed location point G (for g*reater* than screening levels) and assumed location point L (for *lower* than screening levels) located a distance more than 10 m apart, it can be seen that a new boring location is required between point G and point L to reduce the uncertainty for the limits of contamination above screening levels to less than half the distance between the two points (i.e., point P). When considering the decision logic, it is important to note that the final point P is not "confirmed as clean." It represents the assumed boundary, within tolerance, between "clean" and "contaminated above screening levels." The region between P and G is assumed "contaminated" and the region between P and L is assumed "clean." The real boundary, wherever it is, is less than the tolerable distance from P (≤5 m in this case), which is the intended goal of the biased sampling. Therefore, the error in calculating volume estimates will not be more than 5 m.

The decision logic will be applied in all horizontal directions (i.e., to also include diagonals across a square grid).

5.4.3.1.6 Onsite Gamma Spectroscopy Analysis of Volumetric Soil Samples

An onsite gamma spectroscopy laboratory will be used to analyze discrete volumetric soil samples selected as described in the previous sections. SOPs for the on-site gamma spectroscopy laboratory will be included in the LQMP (additional detail presented in Section 3.6 of the QAPP) and submitted prior to mobilization for the field characterization surveys.

The concentrations of other gamma-emitting radionuclides may also be quantified using gamma energy and yield data from the ISOCS database as a matter of course. If unanticipated radionuclides are identified, Earth Tech will immediately notify the USACE Project Manager.

5.4.3.2 Field Procedures

5.4.3.2.1 Utility Clearances

Prior to any subsurface investigation, public utilities (water, gas, electric, phone, etc.) will be located and marked to the extent possible. The one-call Dig Safely New York center will be utilized to clear areas in public domain. In addition, available information from current property owners will be reviewed as a precautionary step to protect underground utilities in the area of subsurface sampling activities.

Limited electromagnetic geophysical surveys will be conducted around each soil boring (total depth > 2 ft) in areas where utilities may reasonably be expected (i.e., IA01, IA02, and IA04) in an attempt to identify the presence of buried utilities. The geophysical survey to clear boring locations will utilize a Geonics EM-31 ground conductivity meter to detect changes in the conductivity related to buried utilities and structures. The EM-31 transmits and receives an electromagnetic signal. Changes in the observed signal strength reflect different conductivity conditions in the subsurface. Disturbances in subsurface soil (e.g., excavations) and buried materials (e.g., USTs) typically have a different conductance than background undisturbed soil. It is possible that cultural influences such fences, buildings, or manufacturing equipment may create interference sufficient to generate inconclusive surveys.

The EM-31 will be hand carried along a grid pattern at a grid line spacing of approximately three ft while continuously monitoring the instrument in analog mode for anomalous conductivity readings. In areas where anomalous readings are detected, the line spacing will be reduced to 1 foot to confirm the readings. In addition, a metro-tech line tracer may be used to confirm the location of utilities that appear at the surface.

GPS coordinates will be collected at each of the subsurface structures or fill areas identified. These data will be collected using a backpack mounted GPS receiver system.

Soil borings to be completed at depths greater than two ft will be performed using direct push technology (DPT) methods (for example, Geoprobe®). It is anticipated the Geoprobe® will be less likely to damage any unforeseen subsurface utilities. Monitoring well borings will be completed with hollow-stem augers. A pilot Geoprobe hole will be advanced at each monitoring well location to obtain soil cores as well as to advance a potentially less destructive initial borehole.

5.4.3.2.2 Drilling Method - Direct Push Technology

Subsurface soil samples for COPC analyses will be collected using direct push technology (DPT) (e.g., Geoprobe®) drilling methods in accordance with EM 200-1-3 C.6.4.9. Subsurface soil sample collection will utilize a four-inch outside diameter (2.5-inch inside diameter), four foot long Macro-Core sampling device fitted with a disposable acetate liner. The sampler will be advanced using one inch diameter steel rods attached to the hydraulic device. The borehole will be advanced by attaching additional lengths of extension rod to the Macro-Core barrel and pushing the entire pipe string downward. DPT borings will use a truck-mounted hydraulic system of sufficient size and power to advance the Macro-Core to the required depths. Background information indicates depth to bedrock at the Site ranges from less than four ft to about 15 ft (land-filled areas).

Soil boring logs will be prepared as described in **Section 5.4.4.5.1**.

5.4.3.2.3 Sampling Method - Surface and Subsurface Soil

The primary method for collection of surface and subsurface soil samples for radiological analyses will be Geoprobe drilling and sampling techniques performed in accordance with EM 200-1-3 C.6. Dedicated acetate sleeves inside decontaminated Macro-Core® samplers will be the primary sampling tool. Soil cores will be screened for radioactivity and soil intervals for onsite gamma spectroscopy analyses will be determined as described in **Section 5.4.3.1.**

If Geoprobe access is not possible, or if frequent refusals are encountered, the bucket hand auger method will be used for collection of surface soil samples. The bucket hand auger will be a stainless steel bucket auger head attached to an extension rod and T-shaped bar. The hand auger will be advanced into the soil to the required depth designated for the sampling location. Material collected in the bucket from each interval will be removed using a stainless steel spoon and transferred into a stainless steel bowl for homogenization. Prior to homogenization, the soil material will be field-screened for radioactivity using hand-held instrumentation.

Surface and subsurface soil samples will be analyzed at the onsite gamma spectroscopy laboratory for isotopic COPCs. In addition, approximately 1 percent of the samples will be analyzed at the off-site fixed laboratory for total organic carbon. Vegetation and rocks will be excluded from the samples as much as reasonably possible using a trowel or gloved hands.

Soil sampling equipment will be decontaminated between sample intervals and between sample locations as described **Section 5.4.3.2.6**.

5.4.3.2.4 Sampling Method – Geotechnical

Geotechnical samples for Atterberg limits, grain size distribution, moisture content, and bulk density can be obtained from Macro-Core sample intervals. The default procedure will be to select five representative samples of each soil type encountered (fill, glaciolacustrine silt and clay, glacial till) from non-impacted intervals (i.e., background readings from core scanner). It is anticipated that these samples can be obtained from Class 3 areas onsite.

If a suitable soil type is located that is appropriate for undisturbed soil sampling, attempts will be made to collect undisturbed soil samples for geotechnical testing using a Shelby tube. Shelby tube samples will be collected using conventional hollow stem auger drilling methods (see **Section 5.4.4.3.1**). Shelby tubes will not be attempted in granular soil, fill material (presumed to be primarily granular in nature), or very stiff to hard cohesive soils. Once the Shelby tube is removed from the borehole, the end will be capped and orientation arrows will be drawn. Void space within the top or bottom of the tube will be filled with inert material, and the ends of the tube will be sealed with wax to prevent shifting and dehydration during shipment. Undisturbed soil samples will be submitted for hydraulic conductivity and effective porosity testing.

5.4.3.2.5 Concrete Cores

Concrete coring will be conducted to obtain samples of the concrete building floors and also allow access to subsurface soil beneath building floors (active and inactive) and paved areas. A portable industry standard concrete coring drill will be used in accordance with the manufacturer's specifications. No gasoline powered equipment will be used inside buildings without proper ventilation.

Masonry core samples (approximately 5 per building in IA01) will be collected from concrete floors and brick walls. Samples of residues from floor penetrations (for example, sumps, etc) will be obtained at locations determined by the Project Manager or Health Physicist.

Generally, floor level concrete corings will extend to the underlying soil, as these samples will be taken in conjunction with samples of soil below the building. The depth of other corings will be as deep as is reasonably achievable, depending on the nature of the subject material. The primary objective of the samples will be to produce data suitable for comparison against waste acceptance criteria.

5.4.3.2.6 Decontamination of Sampling Equipment

Two methods of decontamination will be used to minimize the generation of unnecessary IDW without impacting data quality.

- Sampling equipment used for collection of surface soil samples within an IA will be decontaminated between samples by removing gross debris and vegetation with a dry cloth or brush at the sample location, followed by a potable water rinse.
- Sampling equipment will be thoroughly decontaminated between IAs and between subsurface sample intervals. Equipment will first be decontaminated by removing gross debris and vegetation at the sampling site. The equipment will then be rinsed with tap water and soap (e.g. Alconox®) followed by a deionized water rinse. DPT rods will be decontaminated using a high-pressure steam wash, upon mobilization to the Site, in between sample locations and before leaving the Site.

All decontamination liquids will be containerized and treated as IDW (refer to Chapter 8 for additional information).

5.4.4 Groundwater

This section of the FSP describes field methods for the groundwater investigation and includes existing monitoring well inspection, monitoring well installation, monitoring well development, monitoring well abandonment, and groundwater sampling.

5.4.4.1 Rationale and Design

No groundwater sampling for radiological contamination has been conducted other than a screening analysis by NYSDEC at the Landfill Area; alpha radioactivity was reported to exceed NYSDEC groundwater standards at one location.

Only limited data are available from monitoring wells and there are no current ongoing sampling programs. Overburden monitoring wells (five total) are present only at the perimeter of the Landfill Area (IA03); and bedrock monitoring wells are concentrated in IA02, IA03, and IA04[11]. (Stratigraphic and monitoring well construction details for existing wells (NYSDEC, 2000; USACE, 2007) are included in **Attachment 2**, for reference. The locations of existing monitoring wells are shown on **Figure 5-21**.

The existing monitoring well network is not adequate to delineate groundwater occurrence or flow direction. Three of the four Landfill Area wells may need to be replaced due to inadequacies in their initial construction (that is, installed prior to current standards). Earth Tech will consult with USACE regarding use of any new, permanent overburden or bedrock wells installed at the Site in the assessment program described in this section. Earth Tech will consult with USACE regarding use of the NYSDEC wells, if the wells are determined to be appropriately located, constructed, and in good condition (i.e., the number of new wells proposed by Earth Tech may be reduced).

Each of the existing onsite monitoring wells will be visually inspected for integrity of the surface seal and the locking cap. The wells will also be sounded to identify potential obstructions and to determine if sediment infilling has occurred since installation. Based on the results of these evaluations, existing wells considered suitable for re-development and continuing use will be identified. If the well assessment inspection indicates an existing monitoring well is not capable

[11] Five bedrock monitoring wells were installed by NYSDEC in 1994 within IA02, and 21 bedrock monitoring wells were installed by NYSDEC in 2006 within IA02, IA03 and IA04.

of providing reliable data, then that monitoring well will be recommended for replacement. A replacement monitoring well will be installed with concurrence from USACE.

A total of 9 new wells are proposed for this field investigation, assuming current wells are adequate for the RI. If current wells are found to be inadequate, Earth Tech will consult with USACE regarding installation of replacement wells on a case-by-case basis. Based on a review of preliminary data from the NYSDEC 2006 well installations, groundwater occurrence in the overburden appears to be limited. As a result, Earth Tech will utilize the five existing overburden wells and will install one new overburden well at an upgradient background location. To supplement the bedrock well network (i.e., fill data gaps), one new well is proposed in the northeast corner of IA02, two new wells are proposed in the southwest quadrant of IA03, and four new bedrock wells are proposed within IA04. One additional new bedrock well will be paired with the one new overburden well at the northern limit of IA05B to provide a background monitoring location. The following paragraphs provide additional detail regarding the proposed well locations. **Figure 5-22** presents the proposed new monitoring well locations.

One new overburden monitoring well is proposed in an up-gradient location of the site (north and east of potentially affected areas) New bedrock wells are proposed in areas identified as data gaps following previous investigations. These areas include IA02, IA03, IA04 and IA05. The expanded network of bedrock monitoring wells will provide hydraulic and COPC monitoring points in the shallow bedrock.

Upon completion of new monitoring well installation and existing monitoring well re-development activities, slug tests will be performed (**Section 5.4.4.10**) and groundwater samples will be collected (**Section 5.4.4.11**) from the entire monitoring well network. Two rounds of groundwater samples will be collected (one round in the early summer and one round in late fall) and submitted for off-site laboratory analyses for TSS (unfiltered), and filtered and unfiltered samples for COPCs (alpha spectroscopy [U and Th] and EPA method 903.0/904 [Ra]), and gross alpha and gross beta.

Static water level measurements will be collected from the entire monitoring well network prior to the sampling event. Water level data will be included in subsequent evaluations to determine probable flow directions to produce potentiometric surface maps. Results from the radiological sampling event will be reviewed to determine if any groundwater radiological contamination is present. If results indicate the presence of COPCs in groundwater, the locations and concentrations of COPCs will be evaluated to determine if additional groundwater investigation activities are needed. Additional activities may include new monitoring well installations and additional radiological sampling.

5.4.4.2 Field Procedures

As described above, installation and testing of 21 new monitoring wells is planned for this RI to assess water quality parameters and to determine groundwater flow direction in the overburden and shallow bedrock units. The locations of the proposed new monitoring wells are shown on **Figure 5-22**. Existing wells that are determined to be in poor condition will be abandoned as described in **Section 5.4.4.8** and will be replaced.

Monitoring well installation will be conducted in accordance with EM 1110-1-4000 *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites*

(USACE, 1998). In general, new monitoring wells will be installed as 2-inch, Schedule 40 PVC wells with standard above-grade completions. Specifications for drilling, installation, and completion are contained in the following subsections.

5.4.4.3 Monitoring Well Equipment and Materials

5.4.4.3.1 Drilling Methods and Equipment

Conventional drilling techniques (hollow stem auger and bedrock coring) will be used to install overburden and bedrock monitoring wells.

Earth Tech will request that the drilling sub-contractor verify that drilling equipment has been decontaminated before delivery to the Site. After arrival at the Site, the drilling equipment will be cleaned with steam or pressurized hot water using approved water at the decontamination pad to ensure the equipment is clean and ready for use at the Site.

Similar decontamination of drilling and sampling equipment will be conducted upon completion of each monitoring well borehole. However, only the equipment used during the drilling and sampling activities at each borehole location will undergo decontamination.

A temporary drilling equipment decontamination pad will be constructed in such a manner to allow for containment and collection of solid and liquid wastes and to minimize loss of over-spray water during decontamination activities. Solid and liquid wastes generated from the decontamination process will be managed in accordance with the procedures defined in **Section 8** of this FSP.

Soil drilling using the hollow stem auger method will be accomplished using a truck mounted auger rig of sufficient size and power to advance augers to the required drilling depth. Background information indicates depth to bedrock at the Site ranges from less than four ft to about 15 ft (land-filled areas).

Bedrock drilling will be accomplished using the same drill rig as used for hollow-stem augering. Overburden boreholes will be cased off with permanent steel casing prior to advancing the borehole into bedrock. Bedrock cores will be collected with HX-wireline coring system, producing a nominal 3-15/16 inch bedrock borehole. Bedrock cores will be stored in standard wooden core boxes. The cores will be staged in a suitable on-site location for future reference.

5.4.4.3.2 Materials

This section describes the type and specification of the materials to be used during monitoring well construction and installation.

5.4.4.3.3 Monitoring Well Casing/Screen

The monitoring well riser, screen and fitting materials to be used for construction of overburden monitoring wells will be new, pre-cleaned, 2-inch Schedule 40 PVC. The materials to be used for construction of bedrock monitoring wells will be new, pre-cleaned, four inch steel permanent overburden casing and new, pre-cleaned, 2-inch Schedule 40 PVC riser and screen. Screen sections will be commercially fabricated and slotted with openings equal to 0.010 inches (“10 slot”). Screen and casing sections will be flush threaded; thermal or solvent welded couplings will not be used. Gaskets, pop rivets, and screws will also not be used during monitoring well construction.

Monitoring well caps and centralizers will be new, pre-cleaned PVC. The tops of the monitoring wells will be fitted with a well cap and will be designed to preclude binding to the casing resulting from tightness of fit, unclean surface, or frost and to allow for equilibration between hydrostatic and atmospheric pressures. The caps will also be designed to fit securely enough to preclude debris and insects from entering the monitoring well.

5.4.4.3.4 Filter Pack, Bentonite Seal, Cement/Bentonite Grout

A filter pack of appropriate gradation will be used for the overburden and bedrock wells, respectively. The granular filter pack material will be visually clean, greater than 99 percent free of materials that would pass through a No. 200 sieve, inert, siliceous, and composed of rounded grains. The filter materials will be packaged in bags or buckets. The filter pack will be installed through the augers after placement and centralization of the monitoring well screen and riser in the casing (bedrock) or hollow-stem augers (overburden).

Granular bentonite will be used for the creation of an annular seal during monitoring well construction between the lower granular filter pack and upper grout seal. Compressed powered bentonite pellets or chips, generally measuring 0.25 inches in size, will be used for annular seal applications. The bentonite seal will be slowly added to the open borehole, with care taken to prevent bridging. Powdered bentonite will be used for grout additive applications.

Powdered bentonite will be used as an additive in the upper grout seal mixture. The grout used during monitoring well installation will be composed of Type I Portland cement with approximately 5% powdered bentonite per 94-pound sack of dry cement, and approximately eight to nine gallons of water per sack of cement. The amount of water used to prepare grout mixtures will be minimized to the greatest extent possible for a pumpable mix.

5.4.4.3.5 Surface Completion

Surface completion installations will be required for newly installed monitoring wells, and for upgrading existing monitoring well seals if deemed necessary by Earth Tech and USACE.

The well protection assembly will be composed of new iron/steel protective casing. Protective casings for above-grade installations will be equipped with locking iron/steel covers. Covers on the protective casings will be such that the possibility of water leakage is minimized. The diameter of all protective casings will be four inches. The length of protective casings for overburden monitoring well completions will be approximately three to four ft; considering the shallow depth to rock and the desire to avoid interference with the shallow screen interval. Bedrock monitoring well surface completions will use the permanent overburden steel casing as a protective casing.

5.4.4.3.6 Water Source

Water will be used during the RI for the following purposes:

- Preparation of grout mixture used for monitoring well installation or borehole abandonment

- Preparation of cement mixture used for construction of monitoring well surface completions
- Decontamination of drilling and sampling equipment

Water will be obtained from the local municipal water supply, which draws water from the Niagara River. Water quality data will be collected from the local municipality and documented for the Administration Record.

5.4.4.3.7 Delivery, Storage, and Handling of Materials

Monitoring well construction materials will be supplied and delivered by the subcontracted drilling company. Upon delivery to the Site, the Field Geologist will inspect the materials to ensure that the required types of materials have been delivered and that the materials have not been damaged or contaminated during transport to the Site. Materials will be stored in a dry and secure location until used.

5.4.4.4 Monitoring Well Installation

A discussion of the anticipated monitoring well installation process is presented below. The actual monitoring well design may be modified due to location-specific requirements, well completion depths, or subsurface conditions. Modifications will be approved by USACE prior to completion and documented.

5.4.4.4.1 Soil Sampling and Rock Coring During Drilling

Split spoon samples will be collected, described and logged from the overburden in accordance with **Section 5.4.4.5.1**. Rock cores will be collected, described and logged during bedrock well drilling in accordance with **Section 5.4.4.5.2**.

5.4.4.4.2 Borehole Diameter and Depth

Overburden boreholes will be advanced using 4¼-inch inside diameter (ID) hollow stem augers producing a borehole of approximately eight inches inside diameter. Monitoring wells will be installed through the hollow stem augers. The 4¼-inch ID hollow-stem augers are of sufficient diameter to permit at least two inches of annular space between the auger wall and the sides of the well (centered screen and casing).

Each overburden borehole will be advanced through the overlying soil material to the underlying bedrock. If sufficient groundwater to support a functional monitoring well is found, a monitoring well will be constructed. However, if sufficient groundwater is not found, relocation of the proposed location will be discussed with USACE. Any borehole that is not completed as a monitoring well will be abandoned as discussed in **Section 5.4.4.8**.

Overburden boreholes will be advanced at bedrock well locations for permanent casing installation. The overburden portion of the borehole will be advanced using 6¼-inch ID hollow stem augers. A permanent steel casing 4-inches ID will be grouted into place and allowed to cure for a minimum of 24 hours. The casing will be installed a minimum of six inches into bedrock. The bedrock borehole will then be advanced using HX-wireline coring system producing a nominal $3\frac{15}{16}$-inch open-bedrock borehole. As done for prior investigations, 2-inch ID PVC screen and riser monitoring wells will be installed in the open-bedrock borehole and permanent casing.

The anticipated depth of overburden boreholes for overburden monitoring wells is estimated to be 4 to 7 ft. Bedrock wells will be screened within the upper 10 ft of bedrock to be consistent with existing monitoring wells installed during the 2004 NYSDEC IIWA and the 2006 NYSDEC RI/FS. However, an observational approach focusing on groundwater occurrence (e.g., more or less, or higher or lower than anticipated) and lithology (e.g., soil type, depth to bedrock, presence of water-bearing fractures, etc.) will also be employed to allow for refinement of the completed screen interval, if appropriate. Any potential refinements to the screen intervals will be discussed with USACE prior to implementation.

5.4.4.4.3 Screen and Well Casing Placement

Overburden and bedrock monitoring well screens will be installed such that the bottom of each well screen is placed no more than three inches above the bottom of the drilled borehole. The screen bottom will be securely fitted with a threaded poly vinyl chloride (PVC) cap or plug within six inches of the open portion of the screen.

Due to the shallow depth to bedrock at the Site, Earth Tech anticipates that conventional screen lengths will not be suitable for most overburden well locations. Therefore, Earth Tech will seek approval of a location-specific screen length and well construction diagram from USACE prior to completing wells where depth to bedrock is less than 15 ft. For overburden locations where depth to bedrock is greater than 15 ft, standard 10-foot screens will be installed. As noted in **Section 5.4.4.4.2**, an observational approach to setting screen intervals may also be employed.

Bedrock monitoring well screens will be five ft in length, consistent with existing bedrock wells installed during the NYSDEC IIWA (1994). As noted in **Section 5.4.4.4.2**, an observational approach to setting screen intervals may also be employed.

5.4.4.4.4 Filter Pack Placement

Granular filter pack material used for monitoring well construction will be placed within the annular space around the monitoring well screen using a tremie pipe with the monitoring well capped. For typical installations, the filter pack will extend from the bottom of the borehole to two ft above the top of the well screen. However, Earth Tech will seek approval of a location-specific filter pack interval from USACE prior to completing wells where depth to bedrock is less than 15 ft. If well depth is such that a standard thickness of normal filter pack cannot be installed, a No. 00 chocker sand will be substituted for a portion of the normal filter pack below the bentonite seal to lessen the thickness of the sand pack above the screened interval and still avoid bentonite or grout contamination. The final depth to the top of the filter pack will be measured directly with a weighted tape and recorded. The monitoring well riser will remain capped but vented during placement of the filter pack.

5.4.4.4.5 Bentonite Seal

The type of bentonite material to be used for construction of monitoring well seals will be composed of commercially available pellets or chips. For typical installations, the bentonite seal will extend one foot above the filter pack. However, Earth Tech will seek approval of a location-specific bentonite seal interval from USACE prior to completing wells where depth to bedrock is less than 15 ft. A weighted tape will be used to prevent bridging and to measure the placement of bentonite. After placement of the bentonite pellets, a small volume of approved water will be used to hydrate the pellets, and the hydration time for the pellets will be a minimum of one hour. The final depth to the top of the bentonite seal will be measured directly with a weighted tape and recorded. The monitoring well riser will remain capped during placement of the bentonite seal.

5.4.4.4.6 Cement/Bentonite Grout Placement

Grout materials to be used for monitoring well construction will be combined in an above-ground rigid container and mechanically blended to produce a thick, lump-free mixture throughout the mixing vessel. The grout will be placed from within a rigid grout pipe initially located just over the top of the bentonite seal in such a manner as to minimize disturbance of the seal.

Before exposing any portion of the borehole above the seal by removal of any surface casing (to include hollow-stem augers), the annulus between the surface casing and well casing will be filled with sufficient grout to allow for casing removal. The grout mixture will be pumped through the grout pipe until it reaches a level that will permit at least three ft of grout to remain in the annulus after removing the selected length of surface casing. Using this method, the grout pipe will only be reinserted to the base of the casing yet to be removed before repeating the process. After grouting has been completed to within approximately two ft of the ground surface, the remaining surface casing will be removed from the borehole and the remaining annulus will be grouted to within two ft of the ground surface.

After 24 hours, the site will be checked for grout settlement and more grout will be added at that time to fill any depression. This process will be repeated until firm grout remains within two ft of the ground surface. Incremental quantities of grout added in this manner will be recorded on the well construction diagram.

5.4.4.4.7 Protective Cover Placement

Protective iron/steel casing will be installed around each monitoring well. The protective casing used for overburden monitoring well installations will be set approximately one to two ft below grade and will extend approximately three ft above the ground surface. Each protective casing will be installed so that the distance between the top of the protective casing and the top of the monitoring well riser casing is no more than 4 inches (taking into account any height requirement for the riser cap).

The annulus around the outside of the protective casing (between the casing and borehole wall) will be filled with bentonite slurry or hydrated powdered bentonite prior to the placement of the concrete pad. A layer of filter pack sand will be placed on top of the annular seal to within 4-inches of the top of the riser to help prevent loss of tools or equipment that may fall in the annulus during sampling.

A sloping concrete pad measuring approximately 30-inch × 30-inch square will be poured around the exterior of the protective casing. The thickness of each concrete pad will be uniform and no less than four inches. Following placement and curing of the concrete pad, a drainage port measuring approximately 0.25 inches in diameter will be drilled into the protective casing 0.1 foot above the top of the internal mortar collar.

5.4.4.4.8 Well Identification

For each monitoring well installed during the RI, the well designation number will be painted, using white paint, on the outside of the protective casing, and/or a metal tag bearing the designation will be attached to the protective casing or well casing depending upon the type of installation.

New wells installed during this RI will be designated with a 600-sereies format, including an “S” or “D” suffix to designate shallow (overburden) or deep (top of bedrock), respectively.

5.4.4.4.9 Well Survey

Each well will be surveyed at the completion of the well installation activity. The survey data will include horizontal location to the nearest 0.1 foot, and elevation data for the top of the inner and outer casings and ground surface at the well to the nearest 0.01 foot. Additional survey detail is provided in **Section 5.4.7**.

5.4.4.5 Documentation

This section of the FSP describes monitoring well installation documentation requirements including soil boring logs, bedrock core logs, and monitoring well construction diagrams.

5.4.4.5.1 Soil Boring Logs

Each borehole log generated will fully describe the subsurface environment and the procedures used to gain that description. Borehole data will be recorded in the field by the Field Geologist on the Hazardous and Toxic Waste drilling log (**Attachment 4**). A scale of one inch on the log equaling one foot of borehole will be used during borehole log preparation.

Borehole logs generated during the RI will contain the following information:

- Unique borehole/monitoring well number.
- Depths or heights recorded in feet and decimal fractions thereof (tenths of ft).
- Field estimates of soil classification (Unified Soil Classification System [USCS]).
- Full description of each soil sample collected.
- Full description, to the greatest extent practical, of bedrock material encountered, and degree of weathering.
- Description of drilling equipment, including such information as auger size (inner and outer diameter), bit types, rig manufacturer, and model.
- Any special problems encountered during drilling and their resolution.
- Dates for the start and completion of the borehole.
- Each sequential boundary between various soil types and individual lithologies.

- The depth of first-encountered free water along with the method of determination and any subsequent distinct water level(s) encountered thereafter. Before proceeding, the first encountered water will be allowed to partially stabilize (from five to ten minutes) and will be recorded along with the time between measurements.
- Interval by depth for each sample collected, including the length of sampled interval, length of sample recovery, and the sampler type and size (diameter and length).
- Total depth of drilling and sampling.
- Results of soil core radiological scan readings. Notation will include interval sampled, corresponding radiological activity (counts per minute) and key to the specific instrument used to obtain readings. A general note will be made on the log indicating the manufacturer and model.
- Definition of any special abbreviations used at the first occurrence of their usage.

5.4.4.5.2 Rock Core Logs

Each rock core log generated will fully describe the subsurface environment and the procedures used to gain that description. All rock core data will be recorded in the field by the Field Geologist in the HTW drilling log (**Attachment 4**). A scale of one inch on the log equaling one foot of borehole will be used during rock core log preparation.

All rock core logs generated during the RI will contain the following information, in addition to the information included on the borehole log noted above:

- Full description, to the greatest extent practical, of bedrock material encountered, and degree of weathering.
- Dates for the start and completion of the rock core.
- Each sequential boundary between various rock types and characteristics including fractures, mechanical breaks, vugs, minerals, and bedding.
- Interval by depth for each rock core collected, including the core number, depth of core interval, core recovery length, and RQD.
- Results of rock core radiological scan readings. Notation will include interval surveyed, corresponding radiological activity (counts per minute) and key to the specific instrument used to obtain readings. A general note will be made on the log indicating the manufacturer and model.
- All cores will be archived on-site in a secure location for potential later reference or access for sampling.

5.4.4.5.3 Well Construction Diagrams

Each monitoring well installed will be depicted in an as-built well construction diagram (Attachment 4). Each diagram will be attached to the original borehole log for that installation and will graphically denote, by depth from the ground surface, the following information:

- Location of the borehole bottom and borehole diameter(s)

- Location of the well screen
- Location of any casing joints
- Location of the granular filter pack
- Location of the bentonite seal
- Location of grout
- Height of riser (stickup), without cap/plug, above the ground surface
- Height of the protective casing, without cap/cover, above the ground surface
- Depth of protective casing base below the ground surface
- Location and size of drainage port
- Location of the internal mortar collar

Additional information to be described on each as-built well construction diagram will include the following:

- Actual quantity and composition of the grout, bentonite seal, and granular filter pack used for construction of the monitoring wells
- Screen slot size in inches, slot configuration, outside diameter; nominal inside diameter, schedule/thickness, and composition
- Type of material located between the bottom of the borehole and the bottom of the screen
- Monitoring well riser outside diameter, nominal inside diameter, schedule/thickness, and composition
- Casing joint design and composition
- Composition and nominal inside diameter of protective casing
- Any special problems encountered during well construction and their resolution
- Dates for the start and completion of monitoring well installation
- Definition of any special abbreviations used at the first occurrence of their usage.

5.4.4.6 Monitoring Well Development

Monitoring well development will be conducted in accordance with EM 1110-1-4000 *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites (USACE, 1998).* Data will be recorded on the monitoring well development log (see **Attachment 4**).

The development of monitoring wells will not be initiated sooner than 48 hours after placement of the grout seal.

Well development will be conducted using a submersible pump and surge block to aid in the removal of sediment from the well and filter pack.

5.4.4.6.1 Development Criteria

Development of each monitoring well will proceed until each of the following criteria is achieved:

- Water is clear to the unaided eye
- The sediment thickness remaining within the well is less than 0.1 ft.
- A minimum removal of five times the standing water volume in the well (to include the well screen and casing plus saturated annulus, assuming 30% annular porosity) has been achieved.
- Equalization of required water quality parameters (for three consecutive readings at a frequency of one reading per well volume):
    - pH (variation ± 0.2 units).
    - Dissolved oxygen (variation ± 10%).
    - Specific conductivity (variation ± 3%).
    - Temperature (variation ± 1° C).
    - Turbidity (variation ± 10%).
    - Oxygen reduction potential (variation ± 10 mV).

During the course of well development, the Project Manager will be contacted for guidance if well recharge is so slow that the required volume of water cannot be removed within 48 hours of the start of development, if persistent water discoloration is observed after completion of the required volume removal, or if excessive sediment remains after completion of the required volume removal.

5.4.4.6.2 Development Records

For each monitoring well developed during the RI, a record will be prepared to include the following information:

- Project name and location
- Well designation and location
- Date(s) and time(s) of monitoring well development
- Static water level from top of well casing before and 24 hours after completion of well development with dates and times of measurements
- Quantity of standing water contained with the well, and contained within the saturated annulus (assuming 30 percent porosity), before well development
- Field readings of pH, conductivity, turbidity, oxygen reduction potential, dissolved oxygen, and temperature measured after each well volume has been removed, and at completion of well development
- Depth from top of well casing to bottom of well

- Length of the well screen
- Physical character of the removed water, including changes during development in clarity, color, particulates, and any noted odor
- Type and size/capacity of the bailer or pump used for development
- Description of the surge technique used during development
- Quantity of water removed from the well during the development operation and the time for removal, presented as both incremental and total values
- Discharge rate

5.4.4.7 Existing Monitoring Well Rehabilitation

Existing monitoring wells installed during 1980 at the Landfill Area may not be in an acceptable condition for continued use. Existing monitoring wells installed by NYSDEC during 1994 and 2006 investigations are likely to be suitable for future use. A well assessment, described above in this section, will be performed on the existing wells.

For those wells deemed suitable for use during the remainder of the RI, damaged or otherwise compromised surface completions will be rehabilitated to ensure well integrity and security. Damaged existing surface completions will be removed (including protective casing, concrete pad, and guard posts) to allow for installation of a new surface completion described above in this section.

5.4.4.8 Borehole and Monitoring Well Decommissioning/Abandonment

Abandonment of soil boreholes not completed as monitoring wells and existing, orphaned monitoring wells (i.e., Landfill Area wells installed by Guterl in December 1980) deemed unsuitable for future use will be performed during this RI. Well abandonment will include removal of casing and screen, over-drilling of the well borehole, and grouting to the surface. Abandonment of soil boreholes will be accomplished by filling the entire volume of the borehole with a bentonite grout mixture.

For each abandoned well/borehole, a record will be prepared (refer to **Attachment 4**) and submitted to the USACE Project Manager including the following information:

- Project and well/borehole designation
- Location with respect to the replacement well or borehole (if any)
- Open depth of well/borehole before grouting
- Casing or items left in borehole by depth, description, composition, and size (if applicable)
- Copy of the borehole log
- Copy of construction diagram for abandoned well (if applicable)
- Reason for abandonment

- Description and total quantity of grout used initially
- Description and daily quantities of grout used to compensate for settlement
- Dates of grouting
- Water or mud level prior to grouting and date measured

Depths reported in the borehole abandonment record will be designated in feet from the ground surface. Any replacement wells/boreholes installed during the investigation will be offset at least 10 ft from any abandoned site.

5.4.4.9 Groundwater Level Measurement

Measurement of one complete set of initial static groundwater levels for the monitoring well network will be made over a single, consecutive 4-hour period, at least 24 hours after development and sampling of the last new monitoring well.

Static water level measurements will be made using an electronic water level indicator in accordance with EM 1110-1-4000 Chapter 8, *Water Levels* and recorded on the water level data summary form (Attachment 4). Initially, the indicator probe will be lowered into each monitoring well until the alarm sounds and/or the indicator light illuminates. The distance between the top of casing and the groundwater surface will be recorded to within 0.01 ft. The static water level measurement procedure will be repeated to ensure that the water level measurements are consistent (± 0.01’).

5.4.4.10 Aquifer Testing (Slug Tests)

Aquifer testing will be conducted during the RI to determine aquifer properties. The following discussion addresses the types of aquifer testing that will be employed during field activities.

A slug test will be performed in each new and suitable existing monitoring well to determine the hydraulic conductivity of the surrounding geologic material. The slug test method involves lowering or raising the static water level in a well bore by the removal or insertion of a cylinder (slug) of known volume. The return of the water level to a pre-test static level is then measured over time. The change in water level over time is plotted to determine hydraulic conductivity (K). K is a function of the formation permeability, the fluid in the formation, and is influenced by well construction.

Each new and existing well will be tested by rising head and falling head methods. In the event one form of the test cannot be conducted, the well location and the constraint will be documented. For the rising head test, if possible, the slug test will be performed in such a manner to prevent the water level in the well from dropping below the top of the screened interval when the slug is removed. Each test will be performed after the groundwater has been sampled, and will be contingent upon a monitoring well containing sufficient water to allow testing (minimum of 5 ft or as determined by the Field Geologist).

Slug tests will only be initiated after the well has recovered from groundwater sampling (or a minimum of 12 hours has elapsed since sampling) and will be conducted in accordance with **Attachment 1**, SOP BLM 09, *Conducting Slug Tests*.

5.4.4.11 Groundwater Sampling

Two rounds of groundwater samples will be collected during the RI. Collection of groundwater samples from monitoring wells will involve three general steps: (1) well purging, (2) measurement and stabilization of field parameters, and (3) groundwater sample collection. Groundwater sampling activities will follow the requirements of *EM 200-1-3 C.2 Groundwater Sampling*. Groundwater parameter data will be entered onto the groundwater sampling log (**Attachment 4**). It is anticipated that groundwater sampling will begin no sooner than 14 days after the completion of well development.

Purging and sampling of monitoring wells will be accomplished using a peristaltic pump, a disposable bailer, or a low-flow submersible pump. The use of a peristaltic pump with dedicated Teflon tubing left in the well will be the preferred method (i.e., down-hole Teflon line, flexible pump roller tube, and Teflon outflow tube). A bailer will be used only if attempts to use a submersible pump are unsuccessful (that is, insufficient recharge). Water quality parameters will be measured using a flow-through cell designed specifically for micro-purge sampling.

For wells requiring the use of a bailer, the use of a flow-through cell will not be possible and an open vessel instrument will be used.

5.4.4.11.1 Low Flow (Micro-Purge) Sampling

In order to minimize the quantity of liquid IDW generated as a result of well purging, wells will be micro-purged where conditions permit, in accordance with EM 200-1-3 C.2.4.9, as follows:

- A submersible pump or peristaltic pump will be used for purging
- The pump intake or tubing will be located within the well screened interval
- The purge rate will not exceed 100 mL/minute unless it can be shown that higher rates will not disturb the stagnant water column above the well screen (that is, will not result in drawdown)
- The volume purged will be based on the stabilization of the following required water quality parameters for three consecutive readings (measured at ten-minute intervals):
    - pH (variation ± 0.2 units)
    - Dissolved oxygen (variation ± 10%)
    - Specific conductivity (variation ± 3%)
    - Temperature (variation ± 1° C)
    - Turbidity (variation ± 10%)
    - Oxidation reduction potential (for data needs, not as a stabilization parameter)
    - Sample collection shall occur immediately after micro-purging

5.4.4.11.2 Filtration

Filtered and unfiltered groundwater samples will be collected during the RI. Filtered samples will be collected using 0.45 micrometer (μm) disposable in-line pore filter attached to the return line of the pump. Filters will be replaced between sample locations and, if needed, as they become restricted by solids buildup at any one location.

Unfiltered samples will be collected for TSS, and filtered and unfiltered samples will be collected for gross alpha, gross beta, and isotopic analyses for uranium, thorium, and radium. The project team will review the first round data prior to implementation of the second round. Based on this review, the project team may, as appropriate, reduce the analyte list or add analytes necessary for fate and transport, risk assessment, or other project data needs.

5.4.5 Other Media

Unfiltered samples will be collected for TSS, and filtered and unfiltered samples will be collected for gross alpha, gross beta, and isotopic analyses for uranium, thorium, and radium. The project team will review the first round data prior to implementation of the second round. Based on this review, the project team may, as appropriate, reduce the analyte list or add analytes necessary for fate and transport, risk assessment, or other project data needs.

The level of survey effort will be determined by the potential for contamination as indicated by the survey area classification associated with the other media. For example, greater level of effort will be applied within Class 1 areas than within Class 2 areas, and so on for Class 3.

5.4.5.1 Expansion Joints; Stress Cracks; Penetrations into Floors and Walls for Piping, Conduit, and Anchor Bolts; and Wall/Floor Interfaces

For surveys of small penetrations, such as cracks or anchor-bolt holes, cotton swabs will be used to swipe the area of concern. Sampling may also be performed by scraping the crack or joint with a pointed tool, such as a screwdriver or chisel. Samples (smears or swabs) will be placed into small plastic envelopes or other individual containers to prevent cross-contamination. Samples and smears will be evaluated in the field by counting them on an integrating scaler unit with appropriate detectors (for example, the $Hand_E$Count).

Positive results of an analysis may indicate possible penetrating contamination (for example, sub-floor or sub-wall). Checking for activity below the floor will require sampling methods described in prior sections (for example, coring), as appropriate. After the suspect area is accessed, direct monitoring of the underlying surface will be performed and samples of soil or other media will be collected.

Coring will also be used for collecting samples of construction material that may contain activity that has penetrated below the surface. This type of sampling will also be applied to roofing material which may contain imbedded or entrapped contaminants. The profile of the distribution and the total radionuclide content will be determined by analyzing horizontal sections of the core.

If residual activity has been coated by paint or some other treatment, the underlying surface and the coating itself may be contaminated. In this case the surface layer will be removed from a 100 cm^2 area using a commercial stripping agent or by physically abrading the surface. The removed coating material will be analyzed for activity content and the results will be compared to the guidelines for surface activity in **Table 5-1**. Direct measurements will be performed on the underlying surface, after removal of the coating.

5.4.5.2 Trenches, Pipes, and Drains

Inaccessible surfaces cannot be adequately evaluated by direct measurements on external surfaces alone; therefore those locations that could contain residual radioactive material will be accessed for survey.

Residue will be collected from drain lines using a piece of wire or plumbers "snake" with a strip of cloth attached to the end; deposits on the pipe interior will be loosened by scraping with a hard tipped tool that can be inserted into the drain opening. Particular attention will be given to "low-points" or "traps" where activity would likely accumulate.

Whenever possible, potentially contaminated sanitary sewer lines and drain lines will be surveyed by passing a cable-driven 3/8-inch diameter sodium iodide (NaI(Tl)) radiation detector (Ludlum Model 44-149) through the lines. Static measurements will be taken at 1-m intervals.

The need for further internal monitoring and sampling will be determined on the basis of residue samples and direct measurements at the inlet, outlet, cleanouts, and other access points to the pipe interior.

In the event it appears that field data indicate the potential for contamination to have migrated off-site through pipes, drains, or trenches, Earth Tech will coordinate any follow-up sampling with USACE prior to performance.

5.4.5.3 Sediment and Surface Water

Sediment samples will be collected in accordance with EM 200-1-3 C.5, Sediment Sampling. Sediment samples will be collected from the sediment-water interface to a depth of six inches. Surface water samples will be collected in accordance with EM 200-1-3 C.3, Surface Water Sampling.

5.4.5.3.1 Ponar (Sediment)

The Ponar sampler will be used to collect sediment samples from 12 locations in the Erie Barge Canal (refer to **Figure 5-17**), and from deep floor trenches (for example, Building 3). The Ponar sampler is a clamshell-type scoop activated by a counter-level system. The shell is opened, latched in place, and slowly lowered to the bottom. When tension is released on the lowering cable, the latch releases and the lifting action of the cable on the lever system closes the clamshell. The Ponar is then slowly raised to the surface and free liquids are allowed to drain, being careful not to lose fine sediments. The Ponar is placed into a stainless steel tray or bowl and opened. This process is repeated until sufficient sample volume is obtained. Sediment then will be homogenized in a stainless steel bowl.

The Ponar sampler will be decontaminated between sample locations as described below in this Section.

5.4.5.3.2 Scoop/Trowel (Sediment)

The scoop/trowel method will be used for collection of easily accessible dry sediment samples and sediment samples located underwater where the water depth is less than six inches. This collection method will be accomplished using a stainless steel trowel or spoon used to manually dig into the subsurface material to the required depth designated for the sampling location. Five locations around the perimeter of the landfill, at a spacing of one sample per 500 ft (refer to **Figure 5-12**), are expected to be collected using this method. Sampled material then will be transferred to a stainless steel bowl for homogenization.

The trowel and bowl will be decontaminated between sample locations as described below in this Section.

5.4.5.3.3 Hand-Held Bottle Method (Surface Water)

Directly filling a sample container is one of the most efficient methods of surface water collection. Collection of surface water samples using the hand-held bottle method will be used for easily accessible locations (e.g., perimeter of landfill area). The sample will be collected by submerging the appropriate sample container with the cap in place into the body of water. The container will then be slowly and continuously filled using the cap to regulate the rate of sample entry into the container. The sample container should be filled such that a minimum of bubbling (and volatilization) occurs.

5.4.5.3.4 Dipper and Pond Sampler Method (Surface Water)

Dipper and pond samplers may be used to collect surface water samples from the Erie Barge Canal, the perimeter of the landfill area, and from deep floor trenches. The dipper and pond sampler perform similar functions and vary only in the length of the handle attached to the sampling vessel (usually a beaker). Before beginning sampling, a handle of appropriate length is attached to the dipper or pond sampler. Collection of surface water samples using the dipper or pond sampler method will then be accomplished by slowly submerging the device into the water so that the open end of the device is facing upstream. The sampler device will be retrieved from the water body with minimal disturbance to the sample, which will then be transferred into appropriate sample containers.

The dipper and handle will be decontaminated between sample locations as described in below in this Section

5.4.5.3.5 Decontamination of Sampling Equipment

Two methods of decontamination will be used to minimize the generation of unnecessary IDW without impacting data quality.

Sampling equipment will be thoroughly decontaminated between sample locations. The equipment will then be rinsed with tap water and soap (e.g., Alconox®) followed by a deionized water rinse.

Decontamination liquids will be containerized and treated as IDW.

5.4.6 Background Reference Areas

5.4.6.1 Surfaces

For the purposes of evaluating gross beta activity on structure surfaces, structures of similar material construction will be identified in non-impacted buildings located on-site. In the event that suitable reference materials cannot be located, reference material values may be assumed based on information provided in **Table 5-4** (Background Count Rates for Various Materials) from NUREG-1507, *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions* (NRC, 1998) or other appropriate guidance documents.

A total of five reference measurements will be completed for each material type. Swipe samples will be collected at a minimum frequency of 20% of fixed-point measurements to characterize any potential removable radioactive contamination. Swipe samples also will be collected at any fixed-point location where the total measured activity exceeds the total activity screening level.

5.4.6.2 Soil

Background soil samples will be collected from 12 locations within the background reference area (refer to **Figure 5-2**), and will include one surface soil and one subsurface soil at each location generating a total of 24 samples. The subsurface soil samples will be collected from either the 4-6 ft below ground surface (bgs) or 8-10 ft bgs depth intervals, with specific intervals varied to provide full characterization of the subsurface soil interval.

All background soil samples will be submitted for laboratory analyses for COPCs by gamma and alpha spectroscopy (U and Th), by EPA method 903/904 (Ra), by mass spectroscopy for uranium isotopes, and for gross alpha and gross beta. Samples will be collected as described in **Section 5.3**.

5.4.6.3 Groundwater, Surface Water, and Sediment

Background samples will be collected for groundwater, surface water, and sediment during the RI. Two upgradient groundwater samples are planned for collection, and one transect of three surface water/sediment pairs are planned for collection from the Erie Canal (refer to **Figure 5-22** and **Figure 5-17**, respectively).

5.4.7 Site Civil Survey

Earth Tech and its subcontractor will establish survey grade benchmarks tied to the New York State Plane Coordinate System at locations around the Site for use in the conduct of the GWS and subsequent characterization surveys. Site civil survey will be performed by a NYS licensed surveyor as part of site mobilization activities. The surveyor's license will be current and active throughout the term of performance during the project.

5.4.7.1 Property Boundaries and Reference Coordinate Benchmarks

Property boundaries and survey benchmarks will be determined using available public information. Civil surveys will be performed to provide benchmarks across the Site. These benchmarks may include property boundary locations and other locations that are convenient for access during the conduct of the investigation.

The survey grade benchmarks will be located to provide a reference for the investigation area data to local grid systems that will be established during the characterization surveys. The benchmarks will be tied to New York State Plane Coordinate System (West Zone).

5.4.7.2 Survey Units and Survey Grids

A local grid system will be established at the Site prior to investigation activities (i.e., GWS) to:

- Aid in establishing and maintaining the specified survey coverage based on local grid coordinates.
- Provide a mechanism for referencing a measurement back to a specific location so that the same survey point can be readily relocated.
- Support direct comparison to data collected in prior surveys.
- Facilitate subsequent systematic selection of subsequent measuring/sampling locations.
- Provide a convenient means for determining average activity levels by area.

Each grid will consist of a system of intersecting lines, referenced to a fixed Site location or benchmark. The grid lines will be arranged in a perpendicular pattern, dividing the survey location into squares or blocks of equal area.

The site-wide outdoor reference coordinate system will initially be established as 20-meter grid squares oriented to grid north with the origin at the southwest corner of Building 4/9. The grid numbering system will coincide with the outdoor system used by ORISE (1999) to allow for convenient comparison of data.

Scale drawings of the survey areas will be developed that indicate facility features and superimposes the grid reference systems.

5.4.7.3 Location Survey Methods

The use of a portable GPS unit may be utilized in outdoor areas to establish the general locations of soil borings, monitoring wells, and surface water/sediment samples for initial (i.e., observational) data development purposes. The GPS unit will be accurate to within approximately one meter and will be used in accordance with the GPS unit's manufacturer recommendations. Each completed sample point will subsequently be surveyed to greater accuracy as described below.

A location survey will be conducted for all groundwater monitoring wells, soil borings, and other sample locations in accordance with EM 1110-1-4000 (USACE 1998). Horizontal locations will be referenced to NAD 83 and vertical elevations will be referenced using National Geodetic Vertical Datum 88.

Groundwater monitoring wells will be surveyed at the top of the well riser (notched point), top of the protective casing, and the ground surface (north side ground surface, not the pad surface). All elements surveyed will have an accuracy of at least 0.01 feet.

A topographic survey will be completed as near as possible to the time when the last monitoring well is installed. Survey field data (as corrected), to include loop closures and other statistical data in accordance with the standards and specifications referenced above, will be provided to the USACE Project Manager. Closure will be within the horizontal and vertical limits referenced above. The following data will be clearly listed in tabular form: coordinates (and system) and elevation (ground surface and top of well) as appropriate, for all boreholes, wells, and reference marks. All permanent and semi-permanent reference marks used for horizontal and vertical control (i.e., benchmarks, caps, plates, chiseled cuts, rail spikes, etc.) will be described in terms of their name, character, physical location, and reference value.

5.4.8 Non-Impacted Areas

No surveys are required for non-impacted areas. However, if on-site personnel decide to perform quality-assurance radiological measurements in a non-impacted area for some reason (for example, for personnel testing, training, or familiarization purposes), the locations and results of such measurements will be documented and reported. However, non-impacted areas generally will not be gridded for the purposes of establishing measurement or sampling locations.

5.4.9 Other Considerations

Civil location surveys will be conducted for completed sample locations, monitoring wells, and other Site features using total station and/or GPS methods. Preliminary field sample staking and locations will be measured using a sub-meter accurate portable GPS unit to allow for accurate mapping of field screening data in support of the RI observational approach. GPS techniques are discussed in the GWS.

Limited geophysical surveys will be conducted to support underground utility clearance activities during the RI. Utility clearance activities are discussed in more detail in **Section 5.3.3**.

5.5 INVESTIGATION DERIVED WASTE DISPOSITION

IDW includes all materials generated during performance of an investigation that cannot be effectively reused, recycled, or decontaminated in the field. IDW consists of materials that could potentially pose a risk to human health and the environment (i.e., hazardous waste), as well as materials that have little potential to pose risk to human health and the environment (i.e., non-hazardous wastes). IDW will be collected and categorized as potentially hazardous or non-hazardous.

Only IDW that do not exhibit a characteristic of a RCRA hazardous waste or contain RCRA hazardous waste may be returned to the environment. IDW that contains RCRA-listed waste or exhibits a characteristic of a hazardous waste will be managed on site and disposed off-site as RCRA hazardous waste.

Cavanagh Services Group will sample all IDW to ensure conformance to the specific Waste Acceptance Criteria required by the facility receiving the IDW for disposal. Overall IDW management is discussed in more detail in **Section 8**.

5.6 LEVEL OF EFFORT

It is emphasized that the estimated level of effort summarized in this chapter is based on the best available information at the time this plan was written. The estimated level of effort will be updated continuously during the survey, with these updates provided to USACE on a regular basis.

The information presented in this FSP is an estimate, which will be updated during the survey as new and better information becomes available. Factors affecting the level of effort may include:

- Professional judgment during the survey may increase or decrease the level of effort in certain places.
- Immitigable safety hazards in certain areas may require a reduction in level of effort in those areas.
- Preliminary data gathering and assessment, such as GWS; e.g., it is possible that large portions of IA05 may be reclassified as Class 3 based on review of GWS data.

Regardless of the effort devoted to the development of this survey plan, all conditions, situations, and findings will not be as anticipated. Weather, hazardous, or site surface conditions may require changes in survey procedures, patterns, and schedules. Previously unknown areas of residual contamination may be found. Radionuclides which were not expected to be present at significant levels may be identified.

In order to be flexible and adaptable, unanticipated field conditions may require that this plan be modified based on situations and findings as the survey progresses. The RI Field Geologist will document these situations and findings as they arise and perform appropriate coordination with USACE if plan changes appear to be necessary.

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6 FIELD OPERATIONS DATA MANAGEMENT AND DOCUMENTATION

This section of the FSP describes the field documentation that will be maintained during the Site RI field work.

6.1 DATA CONTROL FOR DECISION MAKING

To address the need to implement a real-time decision making approach with respect to data generation and evaluation, Earth Tech will implement a data control system for field and analytical data. As field and analytical data are generated during the RI, the data will be reviewed, reduced, and presented in the form of tables and figures in real-time during the collection effort to allow for the identification of data gaps.

To implement this approach, steps will be taken during the project planning stage, i.e., prior to the field effort, to facilitate data sharing when the field investigation begins. The following tasks will be completed in the planning stage of the field effort:

- Create a site-specific file transfer protocol (FTP) site for data sharing
- Create a database for all planned sample locations
- Create a translation for local reference grid to New York State Plane Coordinate System
- Prepare text file template with columns for x,y,z coordinates (planned and actual), screening results, on-site laboratory results and whether or not the location exceeds thresholds (this file will not contain QC results)
- Input data from prior investigations (e.g., ORISE, 1999) and from preliminary RI activities (e.g., gamma walkover survey)
- Develop a geographic information system (GIS) routine to develop and present maps of sample locations and results (i.e., whether the location exceeds thresholds)
- Field equipment (gamma walkover survey and GPS) and laboratory instruments (core scanning and on-site) will be set up to provide data electronically, directly from the instruments (to the extent possible) to minimize transcription errors.

During the field effort coordination between the GIS operator, on-site laboratory director, and project manager (PM) or Site Supervisor (SS) dedicated to this project will be necessary. The following tasks will be completed daily during the field effort, to the extent possible, with the goal of presenting the results of the previous days' sampling on a daily basis:

- The SS and/or PM will consolidate, review and post the available results of sampling on the FTP site each day, posting QC results separately.
- The on-site laboratory director will review the data and then post the updated file to the FTP site.
- The GIS operator will identify which samples exceed screening criteria, and save and map these results to a PDF file. The operator will also check for unplanned samples (e.g.,

drainage ditch samples, or additional samples collected to reduce the uncertainty in identifying impacted areas) that may be outside areas depicted on the maps and adjust the layouts accordingly. The PDF and text files will be uploaded to the FTP site.

- The PM and/or SS will download the latest map and use the criteria in the decision making flow charts (**Figure 5-19** and **Figure 5-20**) and from the gamma walkover survey to identify data gaps and additional sample points needed to complete the delineation.
- If possible, the GIS software will be used to identify tentative data gaps based on the criteria outlined above for review by the project engineer.

Files posted to the FTP site will be named according to the date, state (field, screened, mapping) and placed in directories labeled for each day of sampling.

6.2 DAILY QUALITY CONTROL REPORTS

During the field investigation activities performed for this project, the Earth Tech Team will prepare DQCRs, which will be signed and dated by the Earth Tech RI Field Geologist. These reports will be completed each day that work activities are performed on Site and filed in the field office. A copy of the DQCRs will be submitted to the USACE Project Manager on a weekly basis (or as otherwise agreed to) during field operations. Each DQCR will include a summary of activities performed at the Site, weather conditions, results of the Earth Tech activities performed including field instrument calibrations (unless maintained in a separate calibration log book), departures from the approved SAP, problems encountered during field activities, and any instructions received from Government personnel. Any deviations that may affect achieving the project data quality objectives will be immediately conveyed to the USACE Project Manager.

6.3 FIELD LOGBOOKS

Samples will be collected following the sampling procedures documented in this FSP (see Section 5). When a sample is collected or a measurement is made, a description of the location with respect to site landmarks will be recorded in the field logbook. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. (Information recorded on other forms (for example, calibration log books or groundwater sampling logs) need not be repeated in the field logbook so long as the location of the information is clearly indicated.) A sample identification number will be assigned before sample collection. Field QA/QC samples (for example, field duplicates, spikes, and duplicates) and QA split samples will be noted under sample description. Equipment (instrumentation) employed to make field measurements will be identified.

6.4 PHOTOGRAPHS

Earth Tech will obtain representative photographs (digital format) of routine operations, and will also obtain photographs of representative samples or locations to document unusual or controlling characteristics. For each photograph taken, the following items will be noted in the field logbook (or dedicated photograph logbook):

- Date

- Time
- Name of the sample location
- General direction faced and description of the subject
- Sequential number of the photograph

After obtaining the photograph, the photographer will review the photographs to verify that the photograph was obtained as intended. If the photograph was not obtained as intended, another attempt will be made to obtain the photograph.

Standard film (analog) cameras will be maintained at the field office in the event a digital camera malfunctions. Photographs made with film cameras will be delivered in electronic format on compact discs (CDs) from the developer.

6.5 SAMPLE DOCUMENTATION

This section describes the sample documentation requirements that will be followed during field sampling activities for the Site RI.

6.5.1 Sample Numbers

A sample numbering system will be used to enable tracking and management of environmental samples and the resulting laboratory and/or field analytical data. Each sample will be assigned a unique alpha-numeric sample number that includes a matrix-specific code and a unique numeric code. Numeric codes will run consecutively through the entire course of the project and will not be re-used for the same sample matrix. Separate groups of numeric codes will be used for regular field samples and field duplicate samples for ease of identification and tracking in the field.

The following describes all of the components of the sample numbering system and provide examples of sample numbers.

Investigative Area codes:

A prefix indicating the IA from which the sample was collected will lead the sample identification string. For IA01, a modified system is proposed to allow for quick recognition of the respective building.

Bxx	Investigative Area 01, interior, where B is Building and xx is 01, 02, etc.
Exx	Investigative Area 01, exterior, where B is Building and xx is 01, 02, etc.
A02	Investigative Area 02
A03	Investigative Area 03
A04x	Investigative Area 04, where x = A, B, C, or D, as appropriate
A05x	Investigative Area 05, where x = A or B, as appropriate
- -	(IA06 intentionally omitted – no samples planned)

A07	Investigative Area 07
A08	Investigative Area 08
A09	Investigative Area 09
A10	Investigative Area 10

Sample Matrix Codes:

The sample matrix code indicates from which matrix (media) the sample was collected from.

SS	Surface soil (0 to 6 inch depth)
SB	Subsurface soil (>6 inch depth)
SD	Sediment
SW	Surface water
MWxxxx	Groundwater, where xxxx is well ID (e.g., 601S)
US	Utility-based solids
UW	Utility-based aqueous
BM	Building material
WP	Radiation swipe
FB	Field Blank (equipment rinsate blank)

Sample Numbers:

0001 - 8999	Regular field samples (each medium)
9000 – 9999	Field duplicate samples (each medium)

Lab Sample ID examples:

B01BM0009	9th BM sample from IA01, Building 1
A04SS0001	1st SS sample from IA04
A07MW9001	2nd groundwater field duplicate; IA07 by default

6.5.2 Sample Labels

Labels will be affixed to all sample containers during sampling activities. Some information may be preprinted on each sample container label (for example, project name and location). Information that is not pre-printed will be recorded on each sample container label at the time of sample collection. The information to be recorded on the labels will be as follows:

- Contractor name (Earth Tech)
- Sample identification number
- Analysis to be performed
- Type of chemical preservative present in container
- Date and time of sample collection
- Sampler's initials

6.6 RECORDS

6.6.1 Responsibilities

The Health Physicist will evaluate radiological information and verify that adequate documentation is maintained. Requirements of radiological documentation are contained in SOP 005, *Standard Operating Procedure: Documentation Control* (**Attachment 1**).

The RI Field Geologist is responsible for the maintenance, storage, and transfer of documents. Any deviation from the requirements will be reported immediately to the Project Manager.

Health Physics Technicians and other field personnel will record documentation neatly and in accordance with these and work plan procedures and requirements.

6.6.2 Controlled Records

The following is a list of field records that may be produced during the project (copies of the logs and forms are located in SOP 005):

- Instrument Calibration Records
- Instrument Source Check Records
- Radiation Survey Forms
- Medical Information
- Training Records
- Dosimetry Records
- Project Field Logs
- Project Reports
- Radioactive Material Transportation Records
- Radioactive Material Disposal Records

- Radioactive Source Transfer Receipts
- Sample Collection Forms
- Sample Chain of Custody Records
- Emergency Response Documentation
- Document Distribution and Transmittal Forms
- Respirator Issue Logs and History Records
- Bioassay Records
- Personnel and Equipment Contamination and Decontamination Reports

6.6.3 Quality Control

The project manager will verify that quality records are accurate, neatly and properly prepared, properly maintained, and periodically reviewed during the project.

The RI Field Geologist or delegated representative will periodically review the status of controlled documents, and document the findings to the program manager.

The Project Manager will verify that required records are present at the end of the project and that records are safely maintained during transfer or shipment to the archival location.

6.7 FIELD DOCUMENTATION PROCEDURES/DATA MANAGEMENT AND RETENTION

Hard copies of original site and field logbooks, COC forms, field data with analytical results and associated QA/QC information, and other field-related information will be indexed, catalogued into appropriate file groups and series, and archived.

The project data will be archived to appropriate electronic media. Originals of field data (for example, logbooks) will be scanned and archived in portable document format (that is, as a pdf). A data archive information package (that is, metadata) will be prepared that describes the data system, file format, and method of archive. Sufficient documentation will accompany the archived data to describe the source, contents, and structure of the data.

Necessary field data will be incorporated into the final Quality Control Summary Report (along with laboratory and other relevant data) in either hard copy or electronic versions, as described in **Section 8.6** of the QAPP.

7 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

The following sections describe environmental sample packaging and shipping requirements that will apply during execution of the Site RI field activities.

7.1 SAMPLE CONTAINERIZATION AND PRESERVATION

Sample containers, chemical preservation techniques, and holding times for soil and water samples collected during the RI are described in Table 4-1 of the QAPP. Sample containers will be provided by the analytical laboratory. Containers for chemical analysis of chemical (non-radiological) analyses will be provided pre-preserved, as required by the method (soil samples are not subject to chemical preservation). Soil and water samples for chemical analysis will be cooled to and maintained at 4°C (±2°C) immediately after collection by placing the sample in a cooler with ice and storing the samples either in coolers with ice or in a refrigerator. The samples will be maintained at this temperature until the samples are analyzed. In the event that sample integrity is compromised, the problem will be noted on the laboratory's "condition on receipt" form (example copy of this form is provided in QAPP Appendix A) and the laboratory will contact the designated Earth Tech QA officer or his representative for instructions.

Samples for radiological analysis do not require preservation of any type, including temperature preservation. Containers will be provided by the laboratory and packaging will be appropriate for the type of analysis and volume required (see QAPP Table 4-1).

7.2 SAMPLE PACKAGING AND SHIPPING

Environmental sample containers will be packaged and shipped in steel or sturdy rigid plastic coolers. Sample packaging and shipping will be conducted in accordance with applicable guidance following EM 200-1-3, Appendix F (USACE 2001a). Packaging and shipping procedures to be utilized for samples collected during this project will include the following:

- Use metal or waterproof high-strength plastic ice chests or coolers only.
- After filling out the pertinent information on the sample label, put the sample in the container (bottle) and secure the closure. Bottle lids may be secured with tape to reduce the likelihood of leakage during shipment; however this is not required.
- Tape cooler drain shut
- Place about 3 inches of inert cushioning material such as bubble-pack or styrofoam "popcorn" in the bottom of the cooler.
- Enclose the samples in clear plastic bags through which sample labels are visible, and seal the bag. Place bottles upright in the cooler in such a way that they do not touch and will not touch during shipment
- Put in additional inert packing material to partially cover sample bottles (more than half-way). For samples for chemical analysis only, place bags of ice or frozen ice-gel packs in double bags around, among, and on top of the sample bottles.
- Fill the remaining space in the cooler with cushioning material.

- If sending the samples by common carrier (e.g., FedEx), sign the chain-of-custody under "Relinquished by," enter the carrier name and airbill number, retain a copy for field records, and put the chain-of-custody record in waterproof, sealed plastic bag and secure it with tape to the inside lid of the cooler.
- Apply custody seals to the front and back of the cooler, across the lid.
- Secure lid by taping. Wrap the cooler completely with tape at a minimum of two locations. Do not cover any labels.
- The airbill for the shipment will be completed and attached to the top of the shipping box/cooler, which will then be transferred to the courier for delivery to the laboratory. The shipping label must include a return address.
- Ship the cooler to the laboratory by overnight express (i.e., FedEx).

For radiological analyses, samples may be consolidated over several days if appropriate to maximize shipping efficiency. Environmental samples for chemical analyses will be shipped as soon as possible, normally on the same day or by the day after sample collection. Samples may be held in a secure area for a longer period of time, provided that analyte-specific holding times are not jeopardized. During the time period between collection and shipment, samples for non-radiological analyses will be stored in ice-filled coolers or refrigerated (when required) and maintained in a secure area. Holding times are provided Table 4-1 of the QAPP.

8 INVESTIGATION-DERIVED WASTE MANAGEMENT

IDW includes all materials generated during performance of an investigation that cannot be effectively reused, recycled, or decontaminated in the field. IDW consists of materials that could potentially pose a risk to human health and the environment (i.e., hazardous waste), as well as materials that have little potential to pose risk to human health and the environment (i.e., non-hazardous wastes). IDW will be collected and categorized as potentially hazardous or non-hazardous. Potentially hazardous IDW (e.g., purge water, decontamination fluids, drill cuttings, disposable protective clothing, and dedicated disposable sampling equipment) will be tested and characterized for disposal. Non-hazardous IDW (i.e., normal trash) will be disposed of in a timely fashion during fieldwork. Existing IDW generated during previous investigations will be inventoried for informational purposes only. Procedures to be utilized for managing IDW are described below.

8.1 IDW COLLECTION AND CONTAINERIZATION

Drill cuttings will be collected and segregated according to the IA from which they were generated. Solid IDW (i.e., drill cuttings) will be contained in new or reconditioned UN1A2/X1.8/250, labeled, open-top 55-gallon drums equipped with plastic drum liners and sealed with bung-top lids. Rock cores will be placed in appropriately labeled wooden core boxes for characterization and future reference and disposal.

Other solid IDW including expendable sampling equipment, personal protective equipment (PPE), and trash will be segregated as potentially contaminated or non-contaminated material on the basis of visual inspection (e.g., soiled versus non-soiled), usage of the waste material (e.g., outer sampling gloves versus glove liners), and field screening of the material using available field instrumentation (e.g., photo-ionization detector and radiation detectors). Non-contaminated IDW will be contained in trash bags and will be placed in a rented dumpster for periodic disposal at a municipal landfill. Potentially contaminated IDW will be contained in new or reconditioned UN1A2/X1.8/250, labeled open-top 55-gallon drums equipped with plastic drum liners and sealed with bung-top lids.

Liquid IDW generated from monitoring well installation, development, and purging will be collected in new UN1A1/X1.8/250, labeled 55-gallon closed-top drums with a minimum of 10 percent headspace and segregated by well location. Liquid IDW generated from decontamination activities and rinses will be collected in new UN1A1/X1.8/250, labeled 55-gallon closed-top drums with a minimum of 10% headspace and segregated by waste stream.

During project activities, waste generation will be minimized to the greatest extent practical. Waste will be minimized by limiting access to restricted areas, reuse and decontamination of equipment, and use of non-hazardous materials.

8.2 WASTE CONTAINER LABELING

Drums and other IDW storage containers will be labeled as they are generated and collected for proper identification of the stored wastes. The following procedure will be used for waste container labeling.

Weather-resistant, commercially available Empty, Pending Analysis, Hazardous, Non-hazardous, and/or Radioactive Material labels, as appropriate, will be affixed on two sides on the upper one-third of each storage container. Each label will be placed on a smooth part of the container and will not be affixed across drum bungs, seams, ridges, or dents. Container labels will be protected in a manner to prevent damage or degradation of the recorded information. Additional label information may be recorded directly on a clean, dry drum surface using an indelible paint marker.

Information documented on container labels will be recorded with a permanent marker or paint pen, and will also be recorded in the IDW log (refer to **Attachment 4** for a copy of the IDW log). Information to be recorded on each label will include the following:

- Project name and site identification
- Container number
- Generation date(s)
- Contents / source of waste
- Physical characteristic of the waste
- Emergency contact information

All containers, including those that are empty, must be labeled appropriately. A Pending Analysis label will be affixed to applicable containers until characterization of the IDW is complete. After characterization, the Pending Analysis label will be replaced by either a Hazardous, Non-Hazardous, and/or Radioactive Material label, as appropriate.

Radioactive material labels will be affixed to those containers when radiological results from the environmental samples statistically exceed the background concentration. Liquid IDW will be labeled as radioactive material if, when evaluated against NRC water effluent release concentrations (10 CFR 20, Appendix B, Table 2, Column 2), an exceedance is noted.

8.3 IDW FIELD STAGING AREA

Subject to the review and approval of USACE, the RI Field Geologist will designate a primary IDW Field Staging Area (FSA) for the project. The primary FSA will be located within the locked fence of the Excised Area. A satellite FSA will also be established and co-located with the primary decontamination facility to store liquid and solid IDW resulting from decontamination activities. Solid and liquid IDW will be stored in an FSA until such time that the IDW is characterized for disposal in accordance with **Section 8.4**.

Each FSA will be visibly marked and any waste containers will be placed on top of plastic sheeting and/or pallets. Liquid waste containers will be stored on approved spill collection pallets and will be covered with tarps to limit surface water collection. IDW will be segregated by location and type (e.g., drill cuttings, decontamination fluids, well development and purge water, etc.) so that the IDW generated can be identified with a given location or operation. Waste containers will be stored in a manner to accommodate inspection and sampling, if necessary, and to facilitate safe handling of the containers.

Any contaminated or potentially contaminated liquid IDW that is stored in an FSA during winter months will require special management to prevent accidental releases due to freezing. IDW will be managed so that, if possible, disposal can be completed before freezing conditions arise. If disposal cannot be executed before the onset of such conditions, or if long-term storage of liquids is anticipated, suitable secondary containment will be provided.

IDW stored within the on-site FSA will be inspected on a regular basis while Earth Tech personnel are on site from the time of containerization and placement in the FSA to the time of ultimate disposition. Inspections of the FSA and associated IDW containers will be conducted a minimum of weekly while Earth Tech personnel are on site and will be documented in the field notebook. IDW containers will be visually inspected for leaks, improper seals, or other damage or unsafe condition. Any container damage or unsafe condition associated with the FSA will be reported to USACE, the RI Field Geologist, and appropriate regulatory agencies, if necessary.

8.4 IDW CHARACTERIZATION AND CLASSIFICATION FOR DISPOSAL

IDW (liquid and solid) generated as part of this investigation will be characterized for disposal based on disposal characterization samples as conducted by Cavanagh Services Group. Analytical parameters for IDW listed below are based on known site contaminants and, to a lesser extent, presumed disposal requirements. This parameter list may be modified based on the results of NYSDEC's current RI, if data are available prior to characterization of the Earth Tech-generated IDW.

Soils will be analyzed for COPCs (U, Th, and Ra isotopes), TCLP metals, and PCBs. Sediments, if any are generated (unlikely), may also be analyzed for free liquids using the paint filter test.

Groundwater will be analyzed for COPCs, gross alpha/beta, and VOCs.

Note that there is no evidence (based on site knowledge and characteristics) that any of the media being sampled would be hazardous for corrosivity (for groundwater, this will be confirmed by field pH measurements during sampling), ignitability (only a concern if there are sufficient flammable volatile organic vapors, which is not the case for the Guterl soil or water); or reactivity.

Potentially contaminated PPE and expendable sampling equipment and other items not amenable for sampling will be scanned for radiation and characterized for disposal based on its physical description, radiological screening, and general knowledge of the types and degree of contamination at the Site (both as indicated during the previous ORISE investigation as well as the current Earth Tech investigation).

All IDW will be segregated into appropriately labeled B-25 containers according to the characterization sample results. For example, IDW categories can be hazardous waste, non hazardous waste, low-level radioactive waste, and mixed low-level radioactive waste. Cavanagh Services Group will ensure that all B-25 containers will be labeled, marked, and shipped according to appropriate local, state, and federal transportation regulations.

8.5 INVENTORY OF IDW FROM PREVIOUS INVESTIGATIONS

IDW from previous investigations (believed to be generated by ORISE and NYSDEC) has been identified on Site. These materials include rock cores (currently in wooden core boxes), bagged PPE, drummed soil cuttings and/or PPE, and other miscellaneous materials, much of which may not be amenable to sampling or analysis.

Existing IDW will be inventoried by Earth Tech, with a description of the location, estimated quantity, container type, and material contained noted on the IDW log included in **Attachment 4**. Opening of any containerized IDW – drums, boxes, or other items – will be in accordance with the RPP and SSHP for the Site. Radiological screening data will be recorded, and the containers will be labeled in accordance with **Section 8.2**. Earth Tech will isolate exiting IDW areas using simple barriers (e.g., caution tape or high visibility fence) to minimize foot traffic near the staged materials.

8.6 DISPOSAL OF IDW

IDW from the Guterl Steel FUSRAP RI will be staged on site as described in **Section 8.3**. The FUSRAP RI IDW will be characterized for disposal as described in **Section 8.4**. Earth Tech will coordinate FUSRAP RI IDW disposal utilizing Cavanagh Services Group for disposal at appropriately licensed facilities as determined by characterization samples. Cavanagh Services Group will prepare waste manifests and other shipping documents, as appropriate. A representative of the USACE will sign the respective waste manifests and other shipping documents.

For the purposes of this section, all soil/solids samples (including samples returned from off-site laboratories) and building material samples (e.g., concrete cores) will be staged onsite for possible future analyses. The samples will be stored in a dry, secure area of the site, which may include rented trailer-type storage units if a suitable location cannot be identified.

Existing IDW from prior investigations will be disposed during the future remediation phase of the Site.

9 CONTRACTOR CHEMICAL QUALITY CONTROL PROGRAM /THREE-PHASE INSPECTION PROCEDURES

This section of the FSP summarizes the CCQC program that will be implemented and used during the completion of all Site RI field activities. The CCQC program to be utilized by the Earth Tech team for the project will consist of three phases. The three CCQC phases include the preparatory phase, the initial phase, and the follow-up phase. The CCQC program will be performed whether or not a USACE-Buffalo District representative is present.

Several definable features of work that make up the CCQC program are identified below:

- Soil sampling
- Sediment/surface water sampling
- Monitoring well construction
- Groundwater sampling
- Building surveys
- Background sampling

The relationship between the three phases and the definable features of work is explained in the following sections.

9.1 PREPARATORY PHASE

The preparatory phase of the CCQC program will be conducted by the Earth Tech team representative, in conjunction with the rest of the field staff, prior to beginning each definable feature of work. A summary of all activities performed during each preparatory phase meeting will be documented by the CQC Supervisor in a meeting minutes record. The USACE Project Manager may wish to attend preparatory meetings and shall be informed of these meetings.

Each preparatory phase meeting will address the following:

- Review pertinent sections of the SAP in order to ensure that field personnel are cognizant of the overall project data quality objectives, specific project activities to be accomplished, and specific sampling and analysis requirements.
- Review of calibration procedures for instruments to be used for measurement of field parameters.
- Physical examination of all materials and equipment required to accomplish the specific project activities.
- Review of equipment decontamination procedures in accordance with the project Work Plan.
- Review of how each sample type is to be collected, containerized, documented and packaged.
- Review of proper IDW management and documentation.

- Review of the procedure for completing all required information to be recorded on sample custody forms, and discussion of the project sampling numbering system. Completed examples of a COC form, sample container label, and IDW drum will be provided to the field personnel for reference.
- Review/discussion of any other activities to be performed as deemed necessary by the CQC Supervisor.
- Examination of the work area(s) to ascertain if all preliminary work is complete.
- Review of preparatory phase field equipment and support materials checklists.

9.2 INITIAL PHASE

The initial phase of the CCQC program will be conducted by the CQC Supervisor and will include the following:

- Oversight of drilling, geoprobing, monitoring well installation, field lab, and/or sampling activities and review of this work to ensure compliance with delivery order requirements.
- Inspection of individual sample labels and COC forms for accuracy, completeness, and consistency.
- Inspection of sample packaging and shipping activities.
- Observation, verification, and documentation of initial and ongoing field instrument calibration.
- Inspection of field logbooks and other field records/sketches to assure that all pertinent data are recorded in accordance with delivery order requirements.
- Inspection of the QA sample match-up table to ensure that all samples collected during each day are documented properly.

9.3 FOLLOW-UP PHASE

The follow-up phase of the CCQC program will be conducted by the CQC Supervisor. The CQC Supervisor will perform follow-up phase inspections on an as-needed basis to ensure continued compliance with contract requirements until completion of that particular feature of work. General procedures and documentation as included in the initial phase will be periodically checked to ensure they are complete, accurate, and consistently executed throughout the duration of the project.

10 CORRECTIVE ACTIONS

The ultimate responsibility for maintaining quality throughout the project rests with the Project Manager. The responsibility for the routine implementation of the QA Program during the RI, however, falls on the RI Field Geologist and the QA/QC Officer.

Corrective action will be taken when significant non-conformance with the CCQC program, QAPP or other project quality document occurs. A non-conformance is defined as an event which is beyond the limits established for a particular operation. Non-conformances can occur within the realm of sampling procedures, sample receipt, sample storage, sample analysis, data reporting, and computations.

Corrective actions will be implemented to resolve problems and to restore proper functioning to the analytical system when errors, deficiencies, or out-of-control situations occur during field activities or at the laboratory. Documentation of the corrective action procedure needed to resolve the problem will be filed with the project records, and the information will be summarized in the case narrative. A discussion of the corrective actions to be taken is presented in the following sections.

10.1 FIELD CORRECTIVE ACTIONS

The RI Field Geologist will review the procedures being implemented in the field for consistency with the established protocols in the FSP and QAPP. The RI Field Geologist will be responsible for implementation and documentation of the appropriate corrective action, and informing the Project Manager of any such actions.

10.2 LABORATORY CORRECTIVE ACTIONS

Laboratory corrective actions are addressed in Section 5.7of the QAPP.

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11 REFERENCES

AEC, 1958. Handbook of Federal Regulations Applying to Transportation of Radioactive Materials. May.

Brett, C.E., Tepper, D.H., Goodman, W.M., LoDuca, S.T., and Eckert, B.Y., 1995. Revised Stratigraphy and Correlations of the Niagara Provincial Series (Medina, Clinton, and Lockport Groups) in the Type Area Western New York: United States Geological Survey (USGS) Bulletin 2086, 66p.

Buehler, E.J., and Tesmer, I.H., 1963. Geology of Erie County, New York: Buffalo Society of Natural Sciences Bulletin, v. 21, no. 3, 118p.

Delaware Secretary of State, 1966. Certificate of Ownership and Merger, Merging Simons Saw and Steel Co. into the Wallace-Murray Corporation. June.

Department of Energy (DOE), 2002. A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota: DOE-STD-1153-2002. July.

Ford, Bacon, & Davis Utah Inc (FBDU). 1981. Preliminary Engineering and Environmental Evaluation of the Remedial Action Alternatives for the Former Simonds Saw and Steel Company Site. Prepared for Bechtel National Inc., Nuclear Fuel Operations under Contract DE-AC05-810R20722 with the Department of Energy. Bechtel Report No. 10-05-11-59A. November.

Guterl Specialty Steel Corporation, Simonds Steel Division, 1979. Memo from Guterl Steel to the U.S. Department of Energy regarding a summary of MED/AEC activities conducted at Simonds with attached copy of a document titled "Uranium History". E.C. Keller. January.

Nuclear Regulatory Commission (NRC), 1998. Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions. NUREG 1507. June.

NRC, 2000. Nuclear Material Safety and Safeguards Decommissioning Standard Review Plan. NUREG-1727. September.

New York State Department of Environmental Conservation (NYSDEC), 1988. Engineering Investigations at Inactive Hazardous Waste Sites – Phase I Investigation, Guterl Specialty Steel, City of Lockport, Niagara County. Division of Environmental Remediation, Region 9, Buffalo NY. Prepared for NYSDEC by Engineering-Science and Dames & Moore. January.

NYSDEC, 1991. Engineering Investigations at Inactive Hazardous Waste Sites – Preliminary Site Assessment, Task 1 – Records Search. Guterl Specialty Steel, City of Lockport, Niagara County. Prepared for NYSDEC by E.C. Jordan Co., Portland, ME. January.

NYSDEC, 1994. Engineering Investigations at Inactive Hazardous Waste Sites – Preliminary Site Assessment, Task 3 – Evaluation of Initial Data. Volumes I and II. Guterl Specialty

Steel, City of Lockport, Niagara County. Prepared for NYSDEC by ABB Environmental Services, Portland, ME. April.

NYSDEC, 1999. Summary of data obtained during a radiation survey of the property north of the Allegheny Ludlum Mill in Lockport, New York. October.

NYSDEC, 2000. Immediate Investigative Work Assignment (IIWA) Report – Guterl Excised Area, City of Lockport, Niagara County. Division of Environmental Remediation, Region 9, Buffalo NY. October.

NYSDEC, 2003. Registry of Inactive Hazardous Waste Disposal Sites in New York, Volume 9. April.

NYSDEC, 2007. RI/FS, Guterl Steel Site. Draft tables and figures. Prepared by MACTEC, Inc. for NYSDEC. Provided to Earth Tech by USACE via electronic mail March, 2007.

Niagara County Clerks Department (NCCD), 1943a. Deed: Simonds Saw and Steel Company to Frank B. Anderson and Louise M. Anderson, Deeds No. 711, pp 63-64. February.

NCCD, 1943b. Deed: Simonds Saw and Steel Company to Vincent Logozzo and Mary Logozzo, Deeds No. 711, pp 65-66. February.

NCCD, 1943c. Deed: Simonds Saw and Steel Company to Joseph A. Gervaise and Isabell Gervaise, Deeds No. 711, pp 71-72. February.

NCCD, 1978. Deed: Wallace-Murray Corp. to Guterl Specialty Steel Corp. Liber 1616 pp 817 – 821. May.

Niagara County Real Property Tax Services, 2004. Tax Map 108.20. May.

Oak Ridge Associated Universities, Dade Moeller & Associates, MJW Corporation, 2005. Site Profile for Simonds Saw and Steel. Dose Reconstruction Project for NIOSH, Document Number ORAUT-TKBS-0032. July.

Oak Ridge Institute for Science and Education (ORISE), Environmental Survey and Site Assessment Program (ESSAP). 1999. Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York (T. J. Vitkus for the United States Bankruptcy Court for the Western District of Pennsylvania.) December.

Oak Ridge National Laboratory (ORNL). 1978. Radiological Survey of the Former Simonds Saw and Steel Company, Lockport, New York. Final Report. Prepared by the Health and Safety Research Division, ORNL, Oak Ridge, TN. September.

Simonds Saw and Steel Company, 1943. Telegram Regarding Preference Rating Certificate TA-719927. April.

Simonds Saw and Steel Company, 1949. Memo to Atomic Energy Commission: Railroad Cars. A.D. Potts. August.

United States Army Corps of Engineers (USACE), 1997. Radiation Protection Manual, Engineer Manual (EM) 385-1-80. May.

USACE, 1998, Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Site, EM 1110-1-4000. November.

USACE, 2001a. Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3. February.

USACE, 2001b. Preliminary Assessment/Site Inspection (PA/SI) – Former Guterl Specialty Steel Corporation, Lockport, New York. US Army Corps of Engineers, Buffalo District. April.

USACE, 2005a. Scope of Work, Data Review, Data Gap Analysis, Acquisition of Field Data, and Remedial Investigation for the Former Guterl Specialty Steel Corporation. US Army Corps of Engineers (USACE), Buffalo District. March.

USACE, 2005b. Summary of Historical Analytical Data for the Guterl Steel FUSRAP Site, Lockport, New York. USACE, Buffalo District. June.

USACE, 2005c. Preliminary Identification of DQOs and ARARs for the Former Guterl Specialty Steel Corporation. Final. Prepared by Earth Tech for USACE, Buffalo District. September.

USACE, 2006a. Data Gap Analysis Report for the Former Guterl Specialty Steel Corporation. Final. Prepared by Earth Tech for USACE, Buffalo District. March.

USACE, 2006b. Data Gap Analysis Summary Report for the Former Guterl Specialty Steel Corporation. Final. Prepared by Earth Tech for USACE, Buffalo District. March.

US Bankruptcy Court, 1984. Motion and Order for approving modification of terms of sale of assets. Western District of Pennsylvania, Bankruptcy No. 82-2590. August.

US Bankruptcy Court, 2004. Motion and Cross Motion to compel disgorgement or valuation hearing and opposition to trustee's motion to abandon property of estate, disburse funds, and close case filed by interested party State of New York. Western District of Pennsylvania Consolidated Case No. 82-22590-BM. July.

US Environmental Protection Agency (USEPA), 1988. Guidance for Conducting Remedial Investigations and Feasibilities Studies under CERCLA. Interim Final. Office of Emergency and Remedial Response. EPA/540/G-89/004 (OSWER Directive 9355.3-01). October.

USEPA, 1990. National Oil and Hazardous Substances Pollution Contingency Plan. USEPA. Washington, D.C. [55 FR 8666].

USEPA, 1991. Risk Assessment Guidance for Superfund, Volume 1, Part B – Development of Risk-based Preliminary Goals. Interim. EPA/540/R-92/003. December.

USEPA, 1998. Final Report – Guterl Steel Site, Lockport, New York. Prepared by Roy F. Weston, Inc. for USEPA/ERTC). April.

USEPA, US DOE, US NRC, US Department of Defense, 2000. Multi-Agency Radiation Survey and Site Investigation Manual (*MARSSIM*). EPA 402-R-97-016, Rev 1; NUREG 1575-Rev 1; DOE-EH 624, Rev 1. August.

USGS, 1980. Lockport, New York 7 ½ Minute Topographic Quadrangle.

United States Ordnance Department, 1919. Memo Regarding Ordnance Department Contracts with the Simonds Manufacturing Company. R.H. Hawkins, E.B. Cooper. May.

TABLES

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Table 1-1

Final Field Sampling Plan
Former Guterl Specialty Steel FUSRAP Site

Prior Investigation and Analyses Summary Table

Investigation	Analysis																				Usability																		
									Analytical Method						Field Radiation Measurements						Matrix																		
	Radium	Uranium	Thorium	Metals	Pesticides	PCBs	SVOCs	VOCs	ICAP (USEPA SW-846)	Gas Chromatograph	X-Ray Fluorescence	TCLP	Gamma Spectroscopy	Gross Alpha and Beta	Alpha Contamination (direct alpha)	Beta/Gamma Contamination	Beta/Gamma Dose Rate (mrad/hr)	Gamma Exposure (uR/hr) (external Gamma)	Removable Alpha/beta-gamma	Removable Alpha and Beta	Cinders	Surface Soil Sample Locations	Subsurface Soil Sample Locations (>15 cm)	Sediment	Surface Water	Groundwater	Building Material	Waste	Results/Units	COCs	Calibration	DLs	MDLs	Uncertainty	Method	Location	Depth	Qualifiers	Building Survey
***Radiological Survey of the Former Simonds Saw and Steel Company, Lockport, New York, Final Report.* Prepared by Oak Ridge National Laboratory (ORNL) for the Department of Energy under FUSRAP, September 1978.**																																							
Excised Area	28	28	28										28	73	114	57	89	71	34			22	6		Y									X	X	X	X	X	X
Landfill																																							
Other																																							
***Preliminary Engineering and Environmental Evaluation of the Remedial Action Alternatives for the Former Simonds Saw and Steel Company Site, Lockport, New York, Former Utilized MED/AEC Sites Remedial Action Program, Final Report.* Prepared for Bechtel National, Inc., November 1981.**																																							
Excised Area	14	14	14																		14						scan		X							X	X		
Landfill																																							
Other																																							
***Engineering Investigations at Inactive Hazardous Waste Sites- Phase I Investigation, Guterl Specialty Steel, City of Lockport, Niagara County.* Prepared for NYSDEC, January 1988.**																																							
Excised Area																																							
Landfill				18			16	18																		18			X							X			
Other																																							
***Engineering Investigations at Inactive Hazardous Waste Sites - Preliminary Site Assessment, Task 1 Records Search, Guterl Specialty Steel Corp., City of Lockport, Niagara County.* Prepared for NYSDEC, January 1991.**																																							
Excised Area																																							
Landfill				18			16	18																		18			X							X			
Other																																							
***Engineering Investigations at Inactive Hazardous Waste Sites- Preliminary Site Assessment Evaluation Report of Initial Data, Guterl Specialty Steel, City of Lockport, Niagara County, Volumes I and II.* Prepared for NYSDEC, April 1994.**																																							
Excised Area																																							
Landfill				29	16	16	29	29				16		8									9	5	5	10		1	X	X	X	X	X		X	X	X	X	
Other																																							
***Final Report, Guterl Steel Site, Lockport, New York.* USEPA Work Assignment No.: 2-194, April 1998.**																																							
Excised Area				399		11			38	11	399	58										299	91					2	X	X	X		X		X	X	X	X	
Landfill																																							
Other																																							
***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**																																							
Excised Area	149	149	149										149					131				111	18						X		X	X	X	X	X	X	X	X	X
Landfill	53	53	53										53									37	4																
NCIDA	177	177	177										177					129				64	28																
Class 3	18	18	18										18									64	28																
Building interiors	135	135	135										135			473		72		473		111	18	6			scan		X		X	X	X	X	X	X	X	X	X
***Immediate Investigative Work Assignment Report, Guterl Excised Area, City of Lockport, Niagara County*. NYSDEC, October 2000.**																																							
Excised Area				34	22	22	34	29				32										18	40	1	3	4			X						X	X	X	X	
Landfill																																							
Other				2	2	2	2	1															1			2			X						X	X	X	X	

Notes:

ORNL collected one tap water sample, one surface water sample (Erie Barge Canal is assumed), and one "drain" sample.
Table based on information compiled and reviewed by USACE (June 2005); except ORNL (1978) information compiled by Earth Tech.

Table 3-1

Field Sampling Plan
Former Guterl Specialty Steel FUSRAP Site

Project Data Quality Objectives and Data Needs to be Achieved in RI/FS

Project Data Quality Objective	Data Needed
1. Determine the nature and extent of MED/AEC related constituents present at the site (i.e., uranium, thorium, radium and the media and locations in which they are present).	Isotope-specific data for the COPCs in each Investigative Area. Preliminary Gamma Walkover Survey to target areas for intrusive investigation. Subsurface sampling in IAs 01, 02, 03, 04, 05, 08, and 10. Also need to establish local background conditions for COPCs.
2. Acquire information to define the fate and transport of contaminants from the site.	Same as DQO 1; also geotechnical data (soil properties – porosity, conductivity, pH, bulk density). Also requires groundwater sampling (IA 07) and surface water/sediment sampling (IA 09).
4. Provide sufficient characterization data to allow completion of subsequent Feasibility Study (FS), Remedial Design (RD), and Remedial Action (RA).	Same as DQO 2. Additional data relevant to the FS, RD, and RA to be obtained from subcontractor-generated IDW characterization data and from the ongoing NYSDEC RI/FS.
6. Identify the underground utility system within the site, including if possible, utilities in place at the time of AEC contracted efforts and utilities installed after the AEC contracted efforts. Includes both between-building and within-building utilities.	Acquire as-built utility drawings (completed; quality is low). Evaluate other geophysical and/or remote sensing methods (see FSP).
9. Define nature and extent of isotopic uranium and thorium in surface soils, subsurface soils, and buildings to support risk assessment (using Nuclear Regulatory Commission screening levels for human health and Department of Energy [DOE, 2002] for ecological) and development and evaluation of FS alternatives (volume determination).	See DQO 1 and 2, above. Review of DOE 2002 suggests that ecological risk unlikely to be a driver at Guterl. Discuss with USACE using RESRAD models (including RESRAD-BUILD) for human health risk assessment. (See also DQO 4).
10. Determine whether groundwater has been impacted by isotopic uranium, thorium, or radium above screening levels; and if so, determine nature and extent to support risk assessment, and	Additional monitoring wells to be installed; groundwater to be sampled for radiological constituents (radiological

Table 3-1

Field Sampling Plan
Former Guterl Specialty Steel FUSRAP Site

Project Data Quality Objectives and Data Needs to be Achieved in RI/FS

Project Data Quality Objective	Data Needed
development and evaluation of FS alternatives.	COPCs and gross alpha/beta radiation).
11. Determine whether surface water and sediments (IA09 and elsewhere) have been impacted by isotopic uranium, thorium, or radium above screening levels (screening levels for these media will need to be researched and developed during RI/FS tasks).	Determine, if possible, location(s) of historical outfalls to barge canal (see DQO 6). Limited sediment sampling upstream, at discharge location, and downstream for COPCs. Surface water sampling (IA09) to be conducted, but unlikely to be useful.
13. Determine if isotopic uranium, thorium, and radium has contaminated underground utilities (IA08).	Sample solids from sewers, drains, trenches (in conjunction with DQO 6). Contingency for water sampling if present.
14. Determine the magnitude of any chemical contamination to support establishing transportation and disposal requirements (e.g., waste classification) and associated costs to be included in various FS alternatives.	See DQO 4.
15. Conduct an inventory of building content/structures to support FS alternatives and evaluations.	Compile observations from structural survey and field sampling activities in IA 01 and IA 02.
19. Gather sufficient data to complete a Baseline Human Health Risk Assessment (HHRA) for human health and a screening level ecological risk assessment.	See DQOs 9 and 10 (for use in future DQOs 17 and 18).

Note: DQO numbering, as presented in the Data Gap Analysis Report (USACE, 2006), has been retained. DQOs 5, 7, 8, 12, and 16 have already been addressed. DQOs 3, 17, 18, 20, and 21 are to be addressed in tasks subsequent to the completion of the RI/FS.

Table 4-1

Final Field Sampling Plan
Former Guterl Specialty Steel FUSRAP Site

Buildings In IA01 (Excised Area)

Building #	Year Built	~ Floor Space (sf)	~ Floor Space (sm)	Use of Building	Area of Building
1	1913	87800	815	Metal Smelting	
2	1914	68900	6400	Metal Rolling/Manufacturing	
3	1920	67800	6300	Metal Rolling and Grinding	
4	1920	28000	2600	Metal Rolling/Manufacturing and Loading Dock	
9	1918	19400	1800	Metal Rolling/Manufacturing and Loading Dock	
5	1918	3770	350	Housed Heat Exchanger	
6	1918	10400	970	Metal Rolling and Loading Dock	
8	1918	24800	2300	Metal Rolling and Loading Dock	
24SE	Before 1948	37794	3264	Mill Area	South Section (ORISE 1999)
24SW	Before 1948	uncertain	uncertain	Only SW Portion used in AEC activities (ORISE)	
24N	unknown	41657	3872	Mill Area	Northern Section (ORISE 1999)
35	1950	4400	410	Metal Rolling and Grinding	

Notes:
(sf) - square feet
(sm) - square meters
1. Building 24 and 35 are not in the Excised Area but are included here to consolidate this basic information.
2. Building 24 was built on to over time. The first part of Building 24 was built prior to 1948 and was used to support MED/AEC operations. This area is now the Southwest Section of the building. The balance of the building was built subsequent to the MED
3. The floor space values for Building 24 are calculated from Figure 32 in the ORISE 1999 report based on the drawing scale and indicated section partitions.

Table 5-1

Final Field Sampling Plan
Former Guterl Specialty Steel Corporation FUSRAP Site

Screening Levels for Building Surfaces

Nuclide[a]	*Average (dpm/100 cm^2)*[b c]	*Maximum (dpm/100 cm^2)*[b d]	*Removable (dpm/100 cm^2)*[b e]
Natural U, ^{235}U, ^{238}U and associated decay products[f]	5,000	15,000	1,000
Natural Th, ^{232}Th[f]	1,000	3,000	200

[a] Where surface contamination by both alpha- and beta/gamma-emitting nuclides exists, the limits established for alpha- and beta/gamma-emitting nuclides should apply independently.
[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive materials as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency and geometric factors associated with the instrumentation.
[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.
[d] The maximum contamination level applies to an area of not more than 100 cm^2.
[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
[f] The radium isotopes are progeny in the thorium and uranium decay chains and, hence, the listed values include them with their parent radionuclides.

SOURCE: Table 6-4, USACE Engineer Manual 385-1-80, *Radiation Protection Manual*, 30 May 1997.

Table 5-2

Final Field Sampling Plan
Former Guterl Specialty Steel Corporation FUSRAP Site

Screening Levels for Soil

Nuclide	*Soil Concentration (pCi/g)* [a, b]
^{238}U	14
^{235}U	8
^{234}U	13
^{232}Th, ^{228}Ra	1.1
^{226}Ra	0.7

[a] These values represent surficial surface soil concentrations of individual radionuclides that would be deemed in compliance with the 25 mrem/y (0.25 mSv/y) unrestricted release dose limit in 10 CFR 20.1402. For radionuclides in a mixture, the “sum of fractions” rule applies; see Part 20, Appendix B, Note 4.

[b] SOURCE: US NRC, Table C2.3, NUREG-1727, *NMSS Decommissioning Standard Review Plan*, September 2000.

Table 5-3

Final Field Sampling Plan
Former Guterl Specialty Steel FUSRAP Site

Remedial Investigation Screening Levels

ROPC	*Average (dpm/100 cm^2)* [a b]	*Maximum (dpm/100 cm^2)* [a c]	*Removable (dpm/100 cm^2)* [a d]	*Soil (volume) (pCi/g)*
^{232}Th, ^{228}Ra	1,000	3,000	200	1.1
Natural U, ^{235}U, ^{238}U and associated decay products [f]	5,000	15,000	1,000	—
U [e]	—	—	—	13
^{226}Ra	—	—	—	0.7

[a] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive materials as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency and geometric factors associated with the instrumentation.
[b] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each object.
[c] The maximum contamination level applies to an area of not more than 100 cm^2.
[d] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
[e] This value applies for processed natural uranium and for enriched uranium.
[f] The radium isotopes are progeny in the thorium and uranium decay chains and, hence, the listed values include them with their parent radionuclides.

Table 5-4

Final Field Sampling Plan
Former Guterl Specialty Steel FUSRAP Site

Background Count Rates for Various Materials

Surface Material	Background Count Rate (cpm)[a]					
	Gas Proportional			GM	ZnS	NaI
	α Only	β Only	α + β			
Ambient[b]	1.00 ± 0.45[c]	329 ± 12	331.6 ± 6.0	47.6 ± 2.6	1.00 ± 0.32	4702 ± 16
Brick	6.00 ± 0.84	567.2 ± 7.0	573.2 ± 6.4	81.8 ± 2.3	1.80 ± 0.73	5167 ± 23
Ceramic Block	15.0 ± 1.1	792 ± 11	770.2 ± 6.4	107.6 ± 3.8	8.0 ± 1.1	5657 ± 38
Ceramic Tile	12.6 ± 0.24	647 ± 14	648 ± 16	100.8 ± 2.7	7.20 ± 0.66	4649 ± 37
Concrete Block	2.60 ± 0.81	344.0 ± 6.2	325.0 ± 6.0	52.0 ± 2.5	1.80 ± 0.49	4733 ± 27
Drywall	2.60 ± 0.75	325.2 ± 8.0	301.8 ± 7.0	40.4 ± 3.0	2.40 ± 0.24	4436 ± 38
Floor Tile	4.00 ± 0.71	308.4 ± 6.2	296.6 ± 6.4	43.2 ± 3.6	2.20 ± 0.58	4710 ± 13
Linoleum	2.60 ± 0.98	346.0 ± 8.3	335.4 ± 7.5	51.2 ± 2.8	1.00 ± 0.45	4751 ± 27
Carbon Steel	2.40 ± 0.68	322.6 ± 8.7	303.4 ± 3.4	47.2 ± 3.3	1.00 ± 0.54	4248 ± 38
Treated Wood	0.80 ± 0.37	319.4± 8.7	295.2 ± 7.9	37.6± 1.7	1.20 ± 0.20	4714 ± 40
Untreated Wood	1.20 ± 0.37	338.6 ± 9.4	279.0 ±5.7	44.6 ± 2.9	1.40 ± 0.51	4623 ± 34

[a] Background count rates determined from the mean of five 1-minute counts.
[b] Ambient background determined at the same location as for all measurements, but without the surface material present.
[c] Uncertainties represent the standard error in the mean count rate, based only on counting statistics.

Table 5-5

Final Field Sampling Plan
Former Guterl Specialty Steel FUSRAP Site

Approximate Site Areas by Class

Investigative Area	*Class 1 (m^2)*	*Class 2 (m^2)*	*Class 3 (m^2)*	*Total (m^2)*
IA01	8,915	22,790	67,525	99,230
IA02	16,000	0	59,616	75,616
IA03	2,300	34,200	0	36,500
IA04 (Subunit 4A)	67,000	0	0	67,000
IA04 (Subunit 4B)	0	64,000	10,000	74,000
IA04 (Subunit 4C)	0	0	31,000	31,000
IA04 (Subunit 4D)	0	0	38,000	38,000
IA05 (Subunit 5A)	15,800	0	0	15,800
IA05 (Subunit 5B)	0	8,500	0	8,500
IA09	0	0	11,380	11,380
IA10	0	6,400	0	6,400
Total	110,015	135,890	217,521	463,426

Table 5-6

Final Field Sampling Plan
Former Guterl Specialty Steel Corporation FUSRAP Site

COPC Analytical Summary by Media

Media	Onsite gamma spec lab		Offsite lab gamma spec		Offsite lab alpha spec	
	For	Frequency	For	Frequency	For	Frequency [2, 3]
Surface soil [3,4,7]	Iso U, Th, Ra	100% of selected intervals	Iso U, Th, Ra	5% of onsite gamma spec [1]	Iso U, Th	Varies; expect 12 to 30 per EU
					Iso Ra	50% of U/Th samples per EU
Subsurface soil [3,4,7]	Iso U, Th, Ra	100% of selected intervals	Iso U, Th, Ra	5% of onsite gamma spec [1]	Iso U, Th	Varies; expect 12 to 30 per EU
					Iso Ra	50% of alpha spec samples per EU
Sediment [3,4]	none	0%	Iso U, Th	100% of samples collected	Iso U, Th	100% of samples collected
			Iso Ra	50% of samples collected	Iso Ra	50% of alpha spec samples per EU
Surface Water	none	0%	none	0%	Iso U, Th, Ra	100% of samples collected
Groundwater [5]	none	0%	none	0%	Iso U, Th, Ra	100% of samples collected
Building Materials (volumetric)	none	0%	Iso U, Th, Ra	100% of samples collected	Iso U, Th, Ra	100% of samples collected
Swipe	none [6]	0%	none [6]	0%	none [6]	0%

NOTES:

1. Off-site gamma spec analysis will be greater of 5 percent or 100 of sample quantity subject to on-site gamma spec.
2. Alpha spec analysis is independent of off-site gamma spec; quantities needed based on estimated risk assessment needs for each exposure unit.
3. Ra 226/228 analysis to be conducted on 50 percent of non-aqueous samples analyzed by off-site alpha spec, except for IA08 samples at 100%.
4. One percent of soil samples and 100% of sediment samples will be analyzed for TOC.
5. Groundwater samples will be analyzed for unfiltered TSS; and filtered/unfiltered isotopic U / Th / Ra, gross alpha, and gross beta.
6. 100% of swipe samples will be gross alpha/beta scanned on site.
7. A total of twelve surface/subsurface soil samples selected from the highest U concentration (determined by alpha spec) will be analyzed for U isotopes (234, 235, 236, 238) by ICP-MS, and gross alpha and gross beta.
8. QA/QC sample quantities are presented on QAPP Tables 3-3 and 4-2.

Site COPCs include:
Isotopic U = U-238, U-235, U-234
Isotopic Th = Th-232, Th-230, Th-228
Isotopic Ra = Ra-228, Ra-226

Table 5-7

Final Field Sampling Plan
Former Guterl Specialty Steel FUSRAP Site

Estimates of Interior and Exterior Areas in IA01 and IA02 by Class

Building	*IA01 (m^2)*				*IA02 (m^2)*
	Class 1	*Class 2*	*Class 3*	*Total*	*Class 3*
1	70	1,100	4,430	5,600	2,835
2	150	7,070	14,140	21,360	14,140
3	2,080	5,260	13,790	21,130	10,820
4 and 9	2,400	3,730	8,480	14,610	8,481
5	0	550	820	1,370	818
6	225	1,120	2,890	4,235	2,892
8	3,390	380	6,440	10,210	6,437
24	600	3,170	15,500	19,270	12,158
35	0	410	1,035	1,445	1,035
Total	8,915	22,790	67,525	99,230	59,616

Notes:

1. The Building 1 basement is included in this estimate as a Class 3 area.
2. The approximate total building IAO1 floor area is 29,635 m^2, or approximately 7.3 acres.
3. The approximate total IA01 area of 99,230 m^2 (or approximately 24.5 acres) is approximately 3.4 times the total building floor area.
4. The total IA02 area 59,616 m^2 (or approximately 14.7 acres), is approximately 2.0 times the total IA01 floor area.
5. IA02 Class 3 area includes exterior surfaces of all buildings (roofs and walls).

Table 5-8

Final Field Sampling Plan
Former Guterl Specialty Steel Corporation FUSRAP Site

Estimated Number of Swipe and Building Material Volumetric Samples including QA/QC

Building	Swipe Samples [1, 2, 3]					Building Material Volumetric Samples [4, 5]					
	IA01				IA02	IA01			Total		
	Class 1	Class 2	Class 3	Total	Class 3	Class 1	Class 2	Class 3	ά spec	γ spec	Ra [8]
Building 1	7	55	55	117	35	1	1	1	3	3	3
Building 2	15	354	177	545	177	5	3	1	9	9	9
Building 3	208	263	172	643	135	3	4	1	8	8	8
Building 4/9	240	187	106	533	106	2	1	1	4	4	4
Building 5	0	28	10	38	10	0	1	1	2	2	2
Building 6	23	56	36	115	36	3	2	1	6	6	6
Building 8	339	19	81	439	80	1	0	1	2	2	2
8	60	159	194	412	152	1	2	1	4	4	4
Building 35	0	21	13	33	13	0	1	1	2	2	2
Total	892	1140	844	2875	745	16	15	9	**40**	**40**	**40**
								Site-specific QA/QC samples [6]			
								MS or MD [7]	2	2	2
								MSD	2	0	0
								Field duplicate	2	2	2
								Field blank	2	2	2
								Total QA/QC	**8**	**6**	**6**
								Analytical Total including QA/QC	**48**	**46**	**46**

ά spec = alpha spectroscopy
γ spec = gamma spectroscopy

NOTES:

1. Estimates for interior and exterior areas by class are presented on Table 5-7.
2. Class 1 swipe samples will be collected at a frequency of 1 per 10 square meters; Class 2 at 1 per 20 square meters; and Class 3 at 1 per 80 square meters.
3. All swipe samples will be gross alpha/beta scanned on site.
4. Building material volumetric samples will be collected at a minimum frequency of 1 per each discrete class of area. For IA02, sample quantities and locations will be determined
5. All building material volumetric samples will be analyzed by offsite lab by gamma and alpha spectroscopy (standard count) for isotopic U and Th, and Ra-226/228 by G
6. QA/QC sample quantities based on one of each per group of 20 or fewer samples; see QAPP Tables 3-3 and 4-2 and Note 7.
7. MS/MSD on alpha spec; site-specific laboratory matrix duplicate (no spike duplicate) for gamma spec (in addition to field duplicate)
8. Samples to be analyzed by off site laboratory for Ra 226 and Ra-228 by GFP (EPA 903/904).

Table 5-9

Final Field Sampling Plan
Former Guterl Specialty Steel Corporation FUSRAP Site
Estimated Number of Soil Samples Including QA/QC

			Estimated Sample Quantity [4,5]								
Exterior Areas - Soil Samples [9]	Locations per Area	Samples per Location [6]	On-site Gamma Spec (all COPCs)	Off-site Gamma Spec [1] (all COPCs)	Off-site Alpha Spec [2, 10] (Isotopic U and Th)			Isotopic U by ICP/MS	Off-site Radium 226/228 [3]		
					Surface	Subsurface	Total	Total [9]	Surface	Subsurface	Total
IA02	43	3	129	6	30	30	60	2	15	15	30
IA03	42	3	126	6	30	30	60	2	15	15	30
IA04A	78	3	234	12	30	30	60	2	15	15	30
IA04B	41	3	123	6	30	30	60	2	15	15	30
IA04C	15	3	45	2	12	12	24	1	6	6	12
IA04D	32	3	96	5	12	12	24	1	6	6	12
IA05A	31	3	93	5	30	30	60	2	15	15	30
IA05B	11	3	33	2	12	12	24		6	6	12
IA10	13	3	39	2	12	12	24		6	6	12
Subtotal	**306**		**918**	**46**	198	198	**396**	**12**	99	99	**198**
Interior Areas (IA01 Soil)											
Building 1	1	3	3	0	0	0	0		0	0	0
Building 2 – North Section	19	3	57	3	4	4	8		2	2	4
Building 2 – Center Section	27	3	81	4	6	6	12		3	3	6
Building 2 – South Section	12	3	36	2	3	3	6		2	2	4
Building 3 – North Section	18	3	54	3	4	4	8		2	2	4
Building 3 – South Section	18	3	54	3	4	4	8		2	2	4
Building 4/9	41	3	123	6	9	9	18		5	5	10
Building 6	24	3	72	4	5	5	10		3	3	6
Building 8	28	3	84	4	6	6	12		3	3	6
Building 24 – North Area	17	3	51	3	4	4	8		2	2	4
Building 24 – Southeast Area	11	3	33	2	2	2	4		1	1	2
Building 24 – Southwest Area	6	3	18	1	1	1	2		1	1	2
Building 35	4	3	12	1	1	1	2		1	1	2
IA01 (Bldg Interior) subtotal	**226**		**678**	**34**	49	49	**98**	**0**	27	27	**54**
Background/reference area	12	2	24	24	12	12	24	24	12	12	24
Bkgd Area Subtotal [9]	**12**		**24**	**24**	12	12	**24**	**24**	12	12	**24**
Total (without contingency)	**544**		**1620**	**104**	259	259	**518**	**36**	138	138	**276**
Contingency Subtotal at 20%	**109**	2	**218**	**11**	0	0	**0**	**0**	0	0	**0**
TOTAL (including contingency)	**653**		**1838**	**115**	259	259	**518**	**36**	138	138	**276**
Site-specific QA/QC samples [7]											
MS or MD [11]				**6**			26	3			14
MSD				**0**			26	3			14
Field duplicate				**6**			26	3			14
Field blank [12]				**6**			16	3			8
Total QA/QC				**18**			**94**	**12**			**50**
Analytical Grand Total				**133**			**612**	**48**			**326**

NOTES:

1. Off-site gamma spec analysis will be greater of 5 percent of quantity subject to on-site gamma spec or 100.

2. Off site alpha spec analysis is independent of off-site gamma spec analyses; i.e., estimated quantities are based on anticipated risk assessment needs for each exposure unit by matrix (surface soil and subsurface soil).

3. Ra 226/228 analysis to be conducted on 50 percent of samples analyzed by off-site alpha spec.

4. A total of twelve surface/subsurface soil samples (exclusive of QA/QC; and in addition to the 24 background samples) will be selected from the highest U concentration (determined by alpha spec) will be analyzed for U isotopes (234, 235, 236, 238) by ICP-MS, and gross alpha and gross beta. See also note 9, below.

5. 1% of the estimated 1838 soil samples by on-site gamma spec will also be submitted for TOC analysis; locations determined at the discretion of the Project Chemist. The TOC total is therefore 22 analyses (18 samples plus 4 QA/QC).

6. "Samples per Location" may or may not include surface soil; default quantity is as noted, regardless. Surface soil sample quantity will be dependent upon gamma walk-over survey data, ORISE data, and Triad evaluation.

7. QA/QC sample quantities based on one of each per group of 20 or fewer samples; see QAPP Tables 3-3 and 4-2 and Note 11 b(elow). Soil considered a single matrix for purpose of QA/AC calculation, regardless of depth or physical location from which the soil was collected.

8. Geotechnical sample quantities are listed on QAPP Table 4-2.

9. Isotopic uranium by ICP/MS (SW-846 6020) and gross alpha/beta will also be performed on all 24 background samples (12 surface and 12 subsurface). Since the field sample quantity is greater than 20, this constitutes two batches (SDGs), each needing 4 QA/QC samples; therefore the background total is 24+8=32. The 12 field samples with the highest alpha spec activities in samples from IA01, 02, 03, 04, 05, 08, and 09 will also be analyzed for iso-U by ICP/MS and gross alpha/beta. This was assumed to be a separate SDG, analyzed at the end of the program (since all the data need to be completed to determine which are the samples to be analyzed). Therefore these 12 samples also need 4 QA/QC, for a total of 16 analyses. Therefore, the sum of the background samples (32) plus field samples (16) is 48 samples analyzed for iso-U by ICP/MS and gross alpha/beta. Designation of specific locations for U by ICP-MS is for informational purposes only; actual samples to be analyzed will be determined at completion of program after all data are reviewed.

10. Long count analysis to be performed on same 48 samples analyzed for isotopic U by ICP/MS (see notes 4 and 9). All others standard (short) count time.

11. MS/MSD on alpha spec; site-specific laboratory matrix duplicate (MD) (no spike duplicate) for gamma spec (in addition to field duplicate).

12. Field blanks to be collected at one/week for geoprobe sampling (estimate 12 wks) and one/20 samples for hand-augered samples (est 4 FB)

Site COPCs include:
Isotopic U = U-238, U-235, U-234
Isotopic Th = Th-232, Th-230, Th-228
Isotopic Ra = Ra-228, Ra-226

Table 5-10

Final Field Sampling Plan
Former Guterl Specialty Steel Corporation FUSRAP Site

Survey Methods
(adapted from MARSSIM Table 4.1)

Nuclide	*Structure Surfaces*			*Land Areas*			*Direct Measurement Instruments* [b c]		
	DCGL (dpm/100 cm²) MARSSIM example [a]	*Screening Level (dpm/100 cm²) This project*	*Detectable?*	*DCGL (pCi/g) MARSSIM example* [a]	*Screening Lavel (pCi/g) This project*	*Detectable?*	*Surface Activity*	*Soil Activity*	*Exposure Rate*
^{232}Th (c) [d]	200	200	Yes	9	1.1	No	GPα, αS, **GPβ**	**γS**, ISγ	**PIC**, γS, ISγ
U [e,f]	300	1000	Yes	19	13	Yes(f)	GPα, αS, **GPβ**, Isβ	γS, **ISγ** GPβ	**PIC**, γS ISγ
^{226}Ra (c) [d,g]	600	1000	Yes	6	0.7	Yes(f)	**GPα**, αS,	**γS**, ISγ	**PIC**, γS, ISγ

[a] Example Derived Concentration Guideline Levels (DCGLs) are based on values given in NRC draft report NUREG-1500 (with unit conversion from values shown in MARSSIM and rounded to one significant digit).

[b] GPα = gas-flow proportional counter (α mode); αS = alpha scintillation survey meter; GPβ = gas-flow proportional counter (β mode); γS = gamma scintillation (gross); ISγ = in situ gamma spectroscopy; PIC = pressurized ionization chamber

[c] Bold indicates the preferred method where alternative methods are available.

[d] For decay chains having two or more radionuclides of significant half-life that reach secular equilibrium. The notation "(c)" indicates the direct measurement techniques assume the presence of progeny in the chain.

[e] Depleted, natural, and enriched.

[f] Although the screening values for this project are slightly less than the derived concentration guideline levels from MARSSIM, they are close enough to be similarly detectable. This will be verified in the field when background values are available for calculating MDCs.

[g] MARSSIM Table 4.1 does not include radium-228.

Table 5-11

Final Field Sampling Plan
Former Guterl Specialty Steel Corporation FUSRAP Site

Estimated Number of Groundwater Samples - IA07, Including QA/QC

Area	Filtered Radiological Samples per Location[1]	Unfiltered Radiological Samples per Location[1]	Estimated Radiological Sample Quantity per Round[1]	Unfiltered TSS Samples per Location[1]	Estimated TSS Sample Quantity per Round[1]	Comments
Existing Overburden Wells						
MW- 81-01	1	1	2	1	1	IA03
MW- 81-02	1	1	2	1	1	IA03
MW- 81-04	1	1	2	1	1	IA03
MW- 105	1	1	2	1	1	IA03
Existing Bedrock Wells						
MW- 1	1	1	2	1	1	IA02
MW- 2	1	1	2	1	1	IA02
MW- 3	1	1	2	1	1	IA02
MW- 4	1	1	2	1	1	IA02
MW- 5	1	1	2	1	1	IA02
MW- 06	1	1	2	1	1	IA02
MW- 09	1	1	2	1	1	IA02
MW- 13D	1	1	2	1	1	IA03
MW- 14	1	1	2	1	1	IA03
MW- 16	1	1	2	1	1	IA03
MW- 17	1	1	2	1	1	IA03
MW- 19	1	1	2	1	1	IA04B
MW- 20	1	1	2	1	1	IA04A
MW- 22	1	1	2	1	1	IA04A
MW- 23	1	1	2	1	1	IA04A
MW- 24	1	1	2	1	1	IA04D
MW- 26	1	1	2	1	1	IA04B
New Overburden (S) and Bedrock (D) Wells						
MW- 600S	1	1	2	1	1	Background overburden (IA05B area)
MW- 600D	1	1	2	1	1	Background bedrock (IA05B area)
MW- 601D	1	1	2	1	1	IA04A
MW- 602D	1	1	2	1	1	IA04A
MW- 603D	1	1	2	1	1	IA04A
MW- 604D	1	1	2	1	1	IA04D
MW- 605D	1	1	2	1	1	IA04B
MW- 606D	1	1	2	1	1	IA03
MW- 607D	1	1	2	1	1	IA03
Total per Round	30	30	**60**	30	**30**	
Site-specific QC samples [2]						
MS	**2**	**2**	4		2	
MSD	**2**	**2**	4		2	
Field duplicate	**2**	**2**	4		2	
Field blank	**2**	**2**	4		0	
Total QA/QC	**8**	**8**	**16**		**6**	
Analytical Total per Round			**76**		**36**	
No. of Rounds			2		2	
Estimated Project Total			**152**		**72**	

NOTES:

NA - Not Applicable

1. All (unfiltered) groundwater samples will be analyzed by the offsite lab for TSS. Filtered and unfiltered samples will be analyzed for isotopic U and Th (alpha spec; standard count), Ra-226/228; gross alpha, and gross beta.

2. QA/QC sample quantities based on one of each per group of 20 or fewer samples; see QAPP Tables 3-3 and 4-2. For QA/AC calculation, filtered and unfiltered water are considered to be separate matrices .

Table 5-12

Final Field Sampling Plan
Former Guterl Specialty Steel Corporation FUSRAP Site

Estimated Number of Surface Water and Sediment Samples Including QA/QC

		Surface Water [1,2,3] (aqueous)		Sediment [1,2,4,5] (non-aqueous)			
Area	**Sample Locations**	**Off-site Alpha Spec (U, Th)**	**Off-site Ra**	**Off-site Gamma Spec**	**Off-site Alpha Spec (U, Th)**	**Off-site Ra**	**Total Organic Carbon**
IA03	6	6	6	6	6	3	3
IA09	12	12	12	12	12	6	6
Subtotal	18	18	18	18	18	9	9
IA08							
IA08 (outisde IA01)	6	6	6	6	6	6	0
Building 1 (basement)	4	4	4	4	4	4	0
Building 3 – North Section	4	4	4	4	4	4	0
Building 3 – South Section	4	4	4	4	4	4	0
Building 4/9	4	4	4	4	4	4	0
Building 6	2	2	2	2	2	2	0
Building 8	2	2	2	2	2	2	0
Building 24 – North Area	2	2	2	2	2	2	0
Building 24 – Southeast Area	2	2	2	2	2	2	0
Building 24 – Southwest Area – 6	2	2	2	2	2	2	0
Subtotal	32	32	32	32	32	32	0
Contingency (20%)	10	10	10	10	10	5	5
TOTAL (including contingency)	**60**	**60**	**60**	**60**	**60**	**46**	**14**
Site-specific QA/QC samples [6]							
MS or MD	**3**	**3**	**3**	**3**	**3**	**3**	**1**
MSD	**3**	**3**	**3**	**0**	**3**	**3**	**1**
Field duplicate	**3**	**3**	**3**	**3**	**3**	**3**	**1**
Field blank	**3**	**3**	**3**	**3**	**3**	**3**	**1**
Total QA/QC	**12**	**12**	**12**	**9**	**12**	**12**	**4**
Analytical Grand Total	**72**	**72**	**72**	**69**	**72**	**58**	**18**

NOTES:

1. Quantities and locations for IA01 (except Bldg 1 basement), IA02, IA04, and IA08 are estimates. Sample locations will be determined as part of mobilization / start-up task.
2. All surface water and sediment samples will be analyzed at the off-site laboratory.
3. 100% of the surface water samples will be analyzed by alpha spectroscopy (standard count(for isotopic U and Th, and by EPA method 903/904 for Ra-226/228.
4. For IA08, 100% of the sediment samples will be analyzed by gamma spectroscopy (U, Th, Ra), alpha spectroscopy (U, Th) (standard count), and EPA method 903/904 (Ra-226/228).
5. For IA03, IA09, and the contingency samples, 100% of the sediment samples will be analyzed by gamma spectroscopy (U, Th, Ra) and alpha spectroscopy (U, Th) (standard count); and 50% of the samples will be analyzed by EPA 903/904 (Ra-226/228) and for TOC.
6. QA/QC sample quantities based on one of each per group of 20 or fewer samples; see QAPP Tables 3-3 and 4-2 and Note 7.
7. MS/MSD on alpha spec; site-specific laboratory matrix duplicate (no spike duplicate) for gamma spec (in addition to field duplicate).

FIGURES

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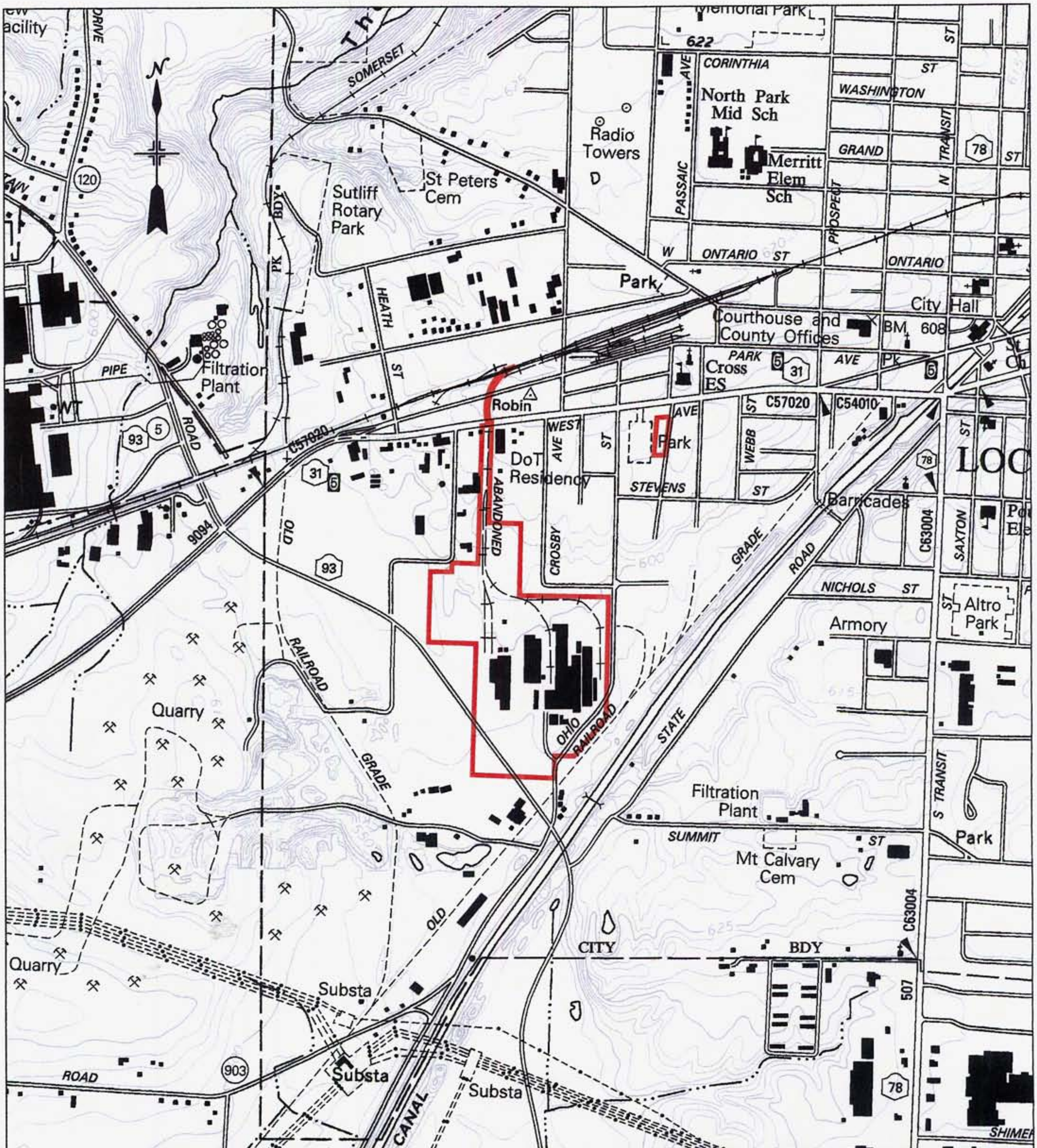


LEGEND

SITE LOCATION

750 0 750 1500

GRAPHIC SCALE

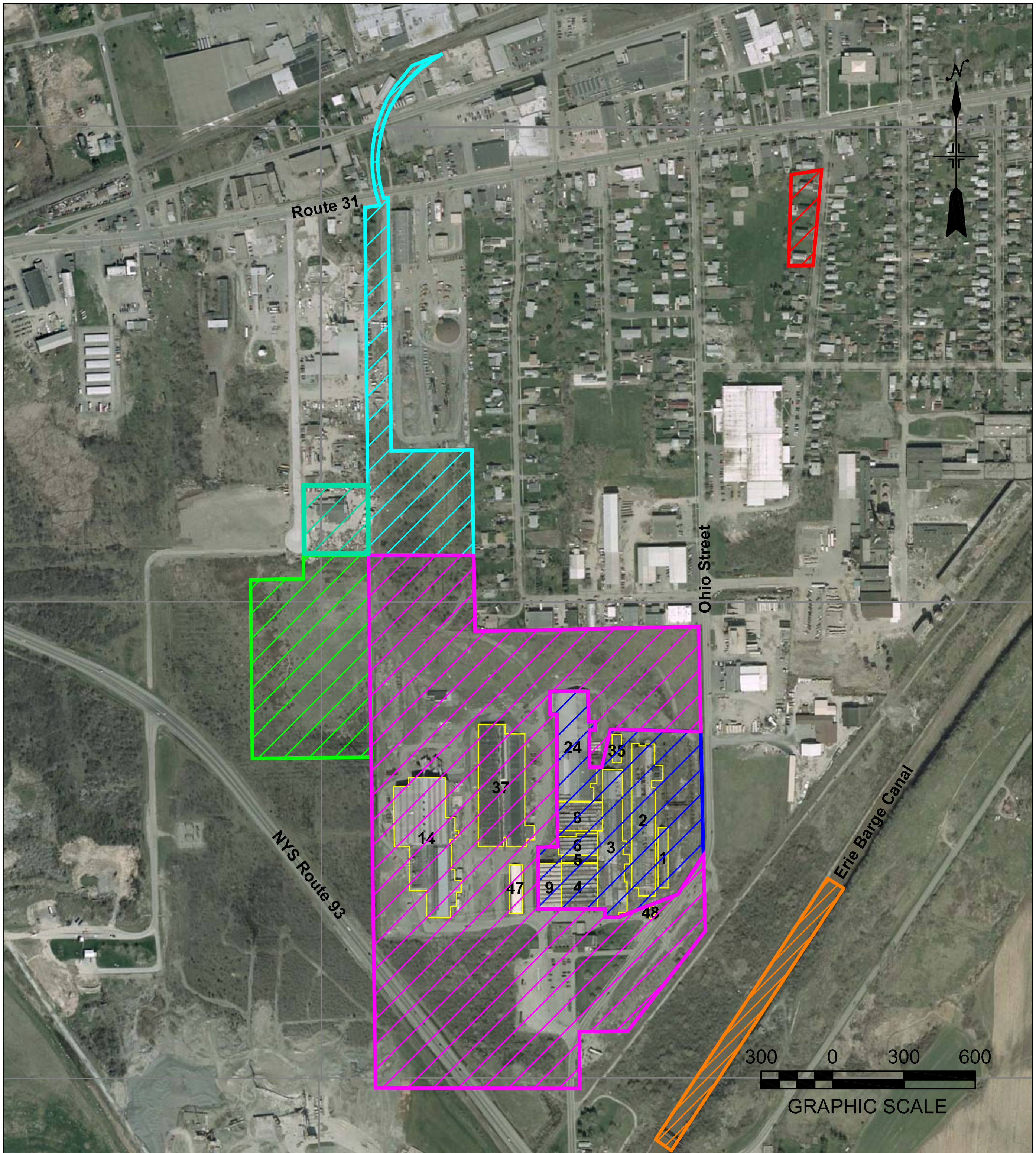
SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by: EarthTech — A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers, Buffalo District

DESIGNED BY: DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY: DB	SITE LOCATION PLAN
CHECKED BY: JK	

SUBMITTED BY:	DATE:	SCALE:	DRAWING NO.:
JK	May 25, 2006	AS SHOWN	FIGURE 1-1



LEGEND

- 24 Guterl Buildings
- IA01 Excised Area - Building Surfaces and Interiors &
  IA02 Excised Area - Building Exteriors
- IA03 Landfill Area
- IA04 NCIDA Property
- IA05 Railroad Right-of-Way
- IA06 Off-site Northeast Properties (No additional RI work required)
- IA09 Erie Canal Southeast of Site
- IA10 LOT 7.1

Note: IA07 Groundwater & IA08 Site Utilities includes IA01 - IA05 & IA10.

SYMBOL	DESCRIPTIONS	DATE	APPROVED

REVISIONS

Prepared by: EarthTech, A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers, Buffalo District

DESIGNED BY: DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY: DB	INVESTIGATIVE AREAS
CHECKED BY: JK	

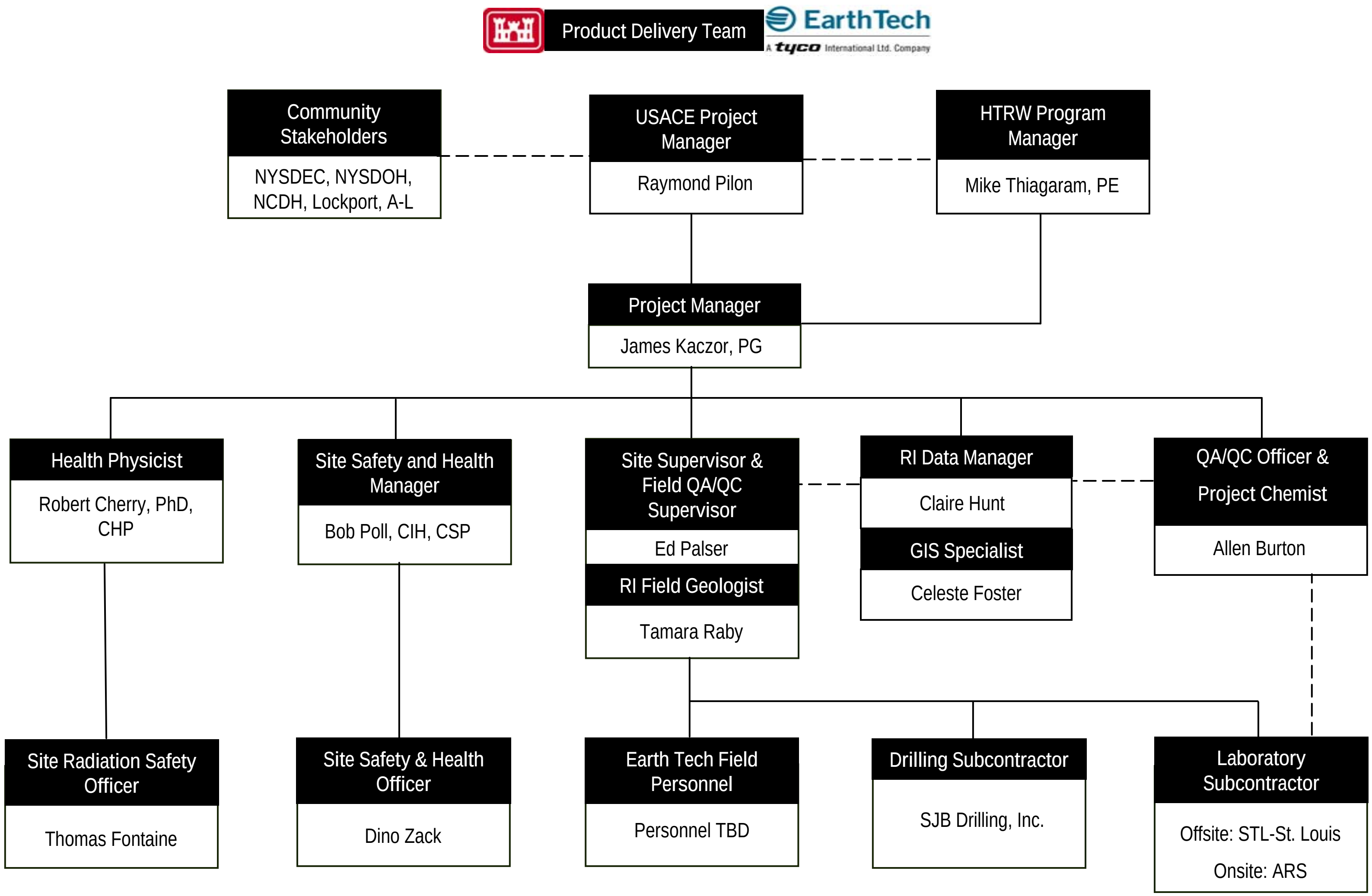
SUBMITTED BY:	DATE:	SCALE:	DRAWING NO.:
JK	Nov. 20, 2006	AS SHOWN	FIGURE 1-2

Figure 2-1

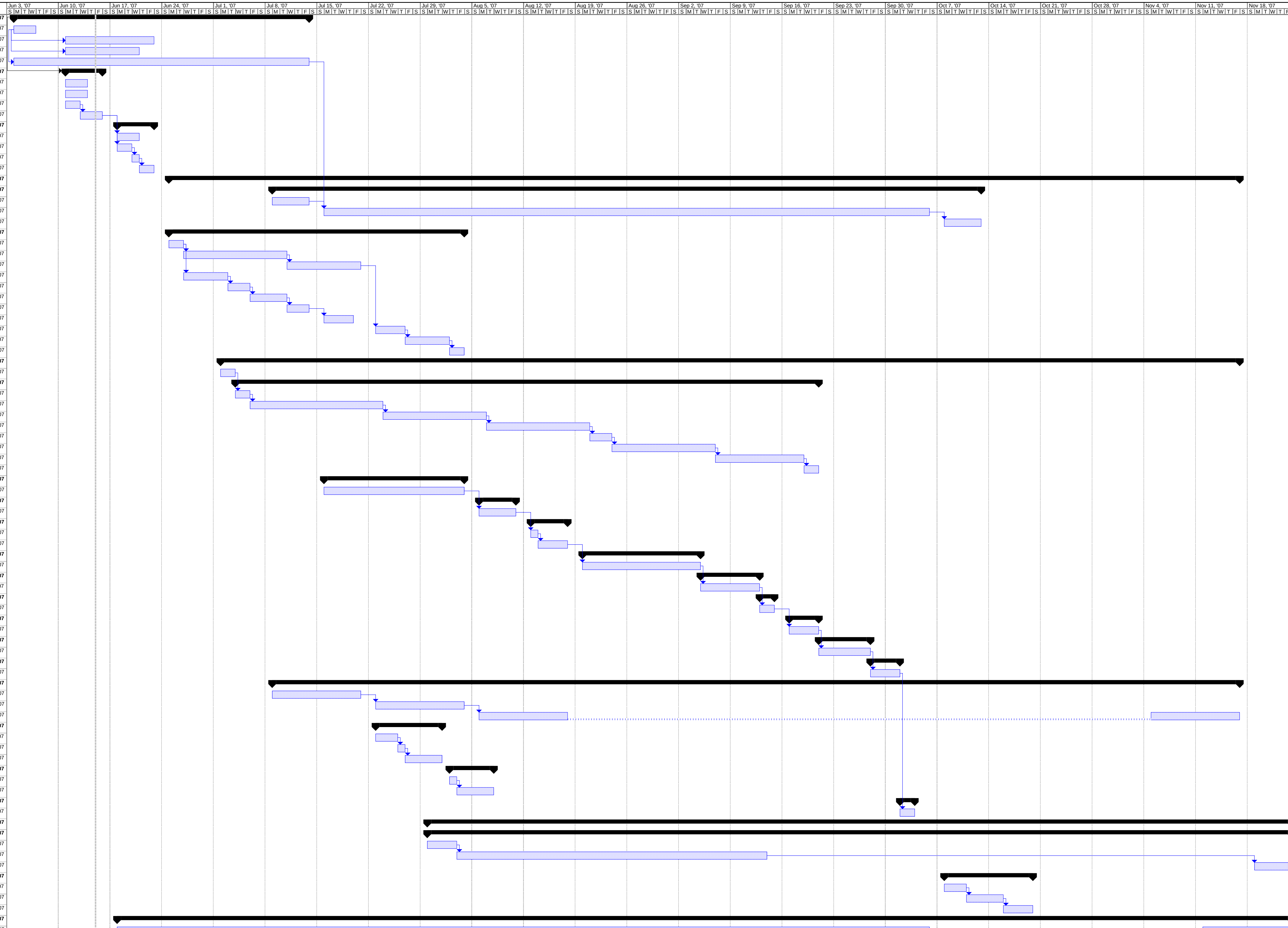
Organization Chart

Former Guterl Specialty Steel Corporation FUSRAP Site

Lockport, New York



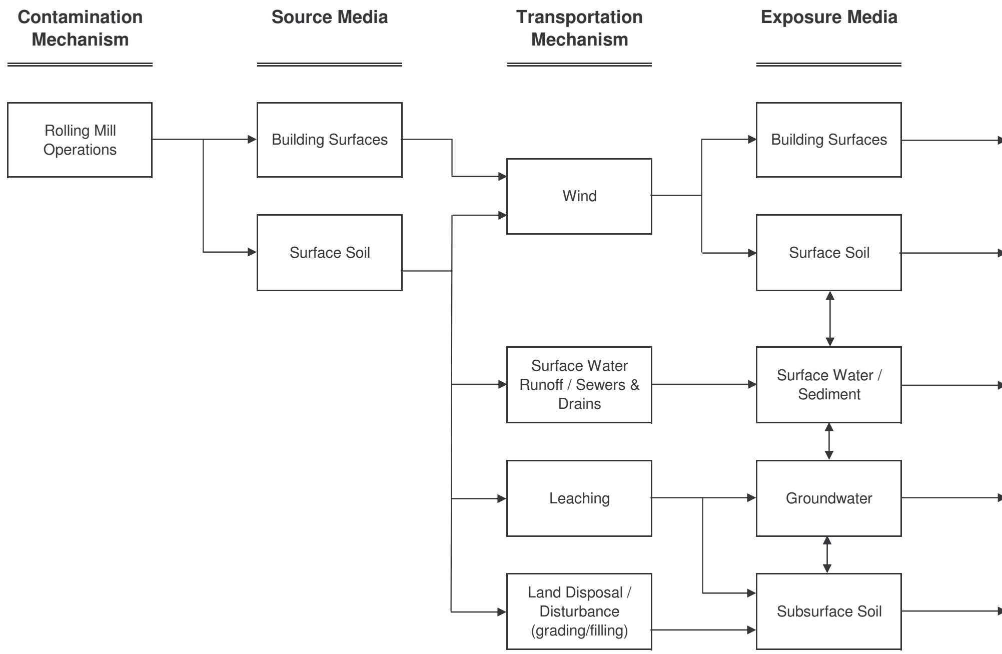
ID	Task Name	Duration	Start	Finish
1	***NOTICE TO PROCEED***	**30 days**	**Mon 6/4/07**	**Fri 7/13/07**
2	Kick-Off Meeting	3 days	Mon 6/4/07	Wed 6/6/07
3	Civil Surveys	10 days	Mon 6/11/07	Fri 6/22/07
4	Clearing/Grubbing	8 days	Mon 6/11/07	Wed 6/20/07
5	Development of LQMP/Site SOP's	30 days	Mon 6/4/07	Fri 7/13/07
6	**Mobilize to Site**	**5 days**	**Mon 6/11/07**	**Fri 6/15/07**
7	Inventory Equipment	3 days	Mon 6/11/07	Wed 6/13/07
8	Order Supplies	3 days	Mon 6/11/07	Wed 6/13/07
9	Pack Trailer	2 days	Mon 6/11/07	Tue 6/12/07
10	Transport Personnel/Equipment	3 days	Wed 6/13/07	Fri 6/15/07
11	**Setup**	**5 days**	**Mon 6/18/07**	**Fri 6/22/07**
12	Prepare/Select/Assess Site	3 days	Mon 6/18/07	Wed 6/20/07
13	Unpack Trailer	2 days	Mon 6/18/07	Tue 6/19/07
14	Equipment Setup/Checks	1 day	Wed 6/20/07	Wed 6/20/07
15	Training	2 days	Thu 6/21/07	Fri 6/22/07
16	**Begin Characterization**	**105 days**	**Mon 6/25/07**	**Fri 11/16/07**
17	**Mobile Laboratory**	**70 days**	**Mon 7/9/07**	**Fri 10/12/07**
18	Lab Mobilization	5 days	Mon 7/9/07	Fri 7/13/07
19	Lab Operations	60 days	Mon 7/16/07	Fri 10/5/07
20	Lab Demobilization	5 days	Mon 10/8/07	Fri 10/12/07
21	**Gamma Walkover Survey**	**30 days**	**Mon 6/25/07**	**Fri 8/3/07**
22	Reference Area	2 days	Mon 6/25/07	Tue 6/26/07
23	IA02 Area	10 days	Wed 6/27/07	Tue 7/10/07
24	IA03 Area	8 days	Wed 7/11/07	Fri 7/20/07
25	IA04a Area	4 days	Wed 6/27/07	Mon 7/2/07
26	IA04b Area	3 days	Tue 7/3/07	Thu 7/5/07
27	IA04c Area	3 days	Fri 7/6/07	Tue 7/10/07
28	IA04d Area	3 days	Wed 7/11/07	Fri 7/13/07
29	IA05a Area	4 days	Mon 7/16/07	Thu 7/19/07
30	IA05b Area	4 days	Mon 7/23/07	Thu 7/26/07
31	IA10 Area	4 days	Fri 7/27/07	Wed 8/1/07
32	Data Deconvolution	2 days	Thu 8/2/07	Fri 8/3/07
33	**Field Sampling**	**100 days**	**Mon 7/2/07**	**Fri 11/16/07**
34	Reference Background Area	2 days	Mon 7/2/07	Tue 7/3/07
35	**IA01 Area - Subtask 6C**	**57 days**	**Wed 7/4/07**	**Thu 9/20/07**
36	Bldg 1	2 days	Wed 7/4/07	Thu 7/5/07
37	Bldg 2	12 days	Fri 7/6/07	Mon 7/23/07
38	Bldg 3	10 days	Tue 7/24/07	Mon 8/6/07
39	Bldg 4/9	10 days	Tue 8/7/07	Mon 8/20/07
40	Bldg 5	3 days	Tue 8/21/07	Thu 8/23/07
41	Bldg 6/8	10 days	Fri 8/24/07	Thu 9/6/07
42	Bldg 24	8 days	Fri 9/7/07	Tue 9/18/07
43	Bldg 35	2 days	Wed 9/19/07	Thu 9/20/07
44	**IA01 Area - Subtask 6D**	**15 days**	**Mon 7/16/07**	**Fri 8/3/07**
45	Subsurface soil sampling	15 days	Mon 7/16/07	Fri 8/3/07
46	**IA02 Area**	**5 days**	**Mon 8/6/07**	**Fri 8/10/07**
47	Class 1	5 days	Mon 8/6/07	Fri 8/10/07
48	**IA03 Area**	**5 days**	**Mon 8/13/07**	**Fri 8/17/07**
49	Class 1	1 day	Mon 8/13/07	Mon 8/13/07
50	Class 2	4 days	Tue 8/14/07	Fri 8/17/07
51	**IA04a Area**	**12 days**	**Mon 8/20/07**	**Tue 9/4/07**
52	Class 1	12 days	Mon 8/20/07	Tue 9/4/07
53	**IA04b Area**	**6 days**	**Wed 9/5/07**	**Wed 9/12/07**
54	Class 2	6 days	Wed 9/5/07	Wed 9/12/07
55	**IA04c Area**	**2 days**	**Thu 9/13/07**	**Fri 9/14/07**
56	Class 3	2 days	Thu 9/13/07	Fri 9/14/07
57	**IA04d Area**	**4 days**	**Mon 9/17/07**	**Thu 9/20/07**
58	Class 2	4 days	Mon 9/17/07	Thu 9/20/07
59	**IA05a Area**	**5 days**	**Fri 9/21/07**	**Thu 9/27/07**
60	Class 1	5 days	Fri 9/21/07	Thu 9/27/07
61	**IA05b Area**	**2 days**	**Fri 9/28/07**	**Mon 10/1/07**
62	Class 2	2 days	Fri 9/28/07	Mon 10/1/07
63	**IA07 Area**	**95 days**	**Mon 7/9/07**	**Fri 11/16/07**
64	Well Installation	10 days	Mon 7/9/07	Fri 7/20/07
65	Well Development/Testing	10 days	Mon 7/23/07	Fri 8/3/07
66	Well Sampling	20 days	Mon 8/6/07	Fri 11/16/07
67	**IA08 Area**	**7 days**	**Mon 7/23/07**	**Tue 7/31/07**
68	Inventory facilities	3 days	Mon 7/23/07	Wed 7/25/07
69	Prep samples	1 day	Thu 7/26/07	Thu 7/26/07
70	Collect Samples	3 days	Fri 7/27/07	Tue 7/31/07
71	**IA09 Area**	**4 days**	**Thu 8/2/07**	**Tue 8/7/07**
72	Prep Water Samples	1 day	Thu 8/2/07	Thu 8/2/07
73	Sample Surface/Sediment Water	3 days	Fri 8/3/07	Tue 8/7/07
74	**IA10 Area**	**2 days**	**Tue 10/2/07**	**Wed 10/3/07**
75	Class 2	2 days	Tue 10/2/07	Wed 10/3/07
76	**Waste Disposal**	**85 days**	**Mon 7/30/07**	**Fri 11/23/07**
77	**Prepare Waste for Transport**	**85 days**	**Mon 7/30/07**	**Fri 11/23/07**
78	Characterization	4 days	Mon 7/30/07	Thu 8/2/07
79	Approve Waste Profiles	30 days	Fri 8/3/07	Thu 9/13/07
80	Waste Shipments	5 days	Mon 11/19/07	Fri 11/23/07
81	**DeMobilization From Site**	**10 days**	**Mon 10/8/07**	**Fri 10/19/07**
82	Equipment/Supply Check	3 days	Mon 10/8/07	Wed 10/10/07
83	Pack Trailer	3 days	Thu 10/11/07	Mon 10/15/07
84	Drive Trailer Back to Office	4 days	Tue 10/16/07	Fri 10/19/07
85	**Perform Data Evaluation**	**115 days**	**Mon 6/18/07**	**Fri 11/23/07**
86	Review all Forms/Maps	90 days	Mon 6/18/07	Fri 11/23/07



Project: Guterl Field Activities
Date: Fri 6/15/07

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Figure 4-1
Preliminary Conceptual Site Model
Pathways for Human Exposure
Former Guterl Specialty Steel Corporation FUSRAP Site
Lockport, New York

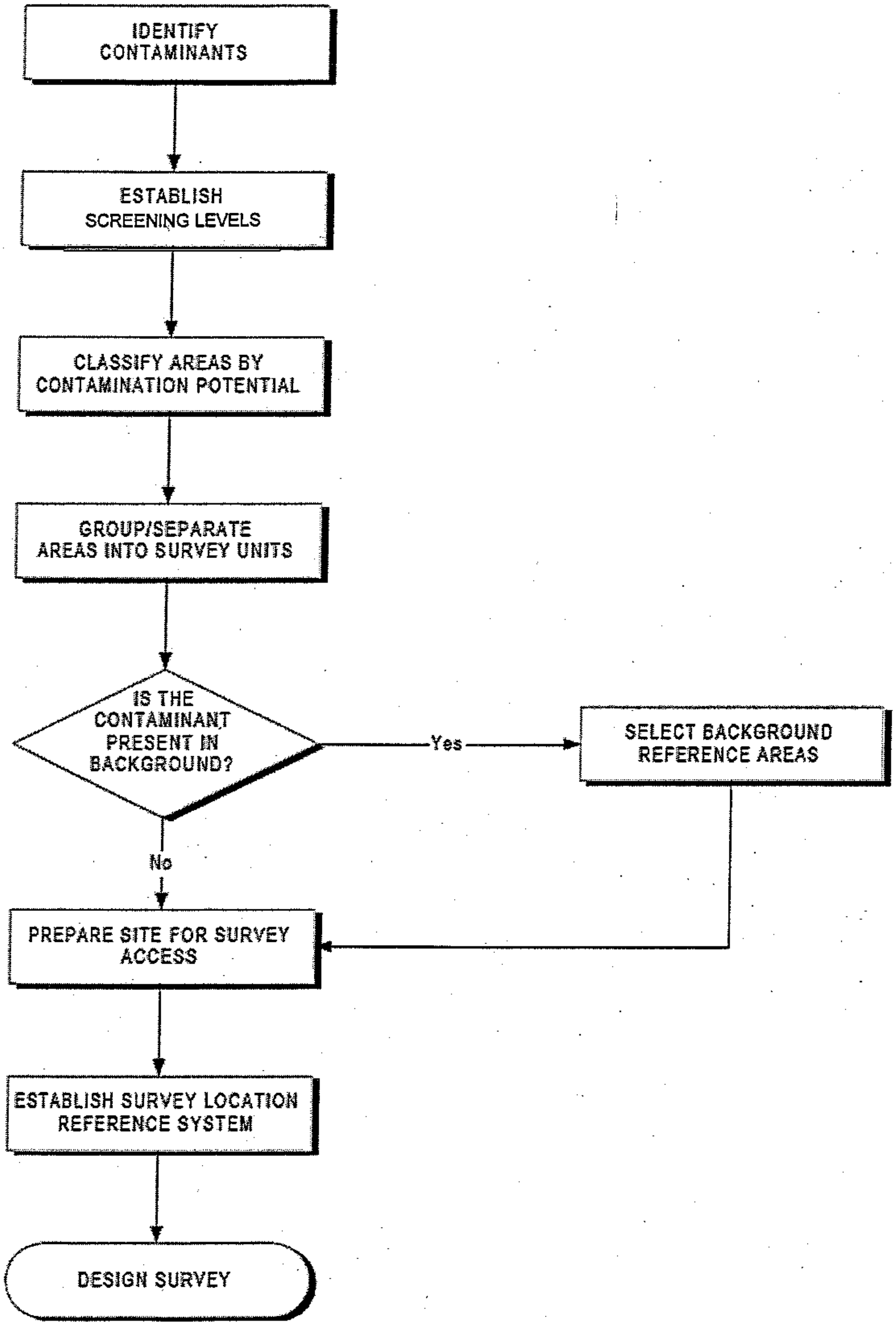


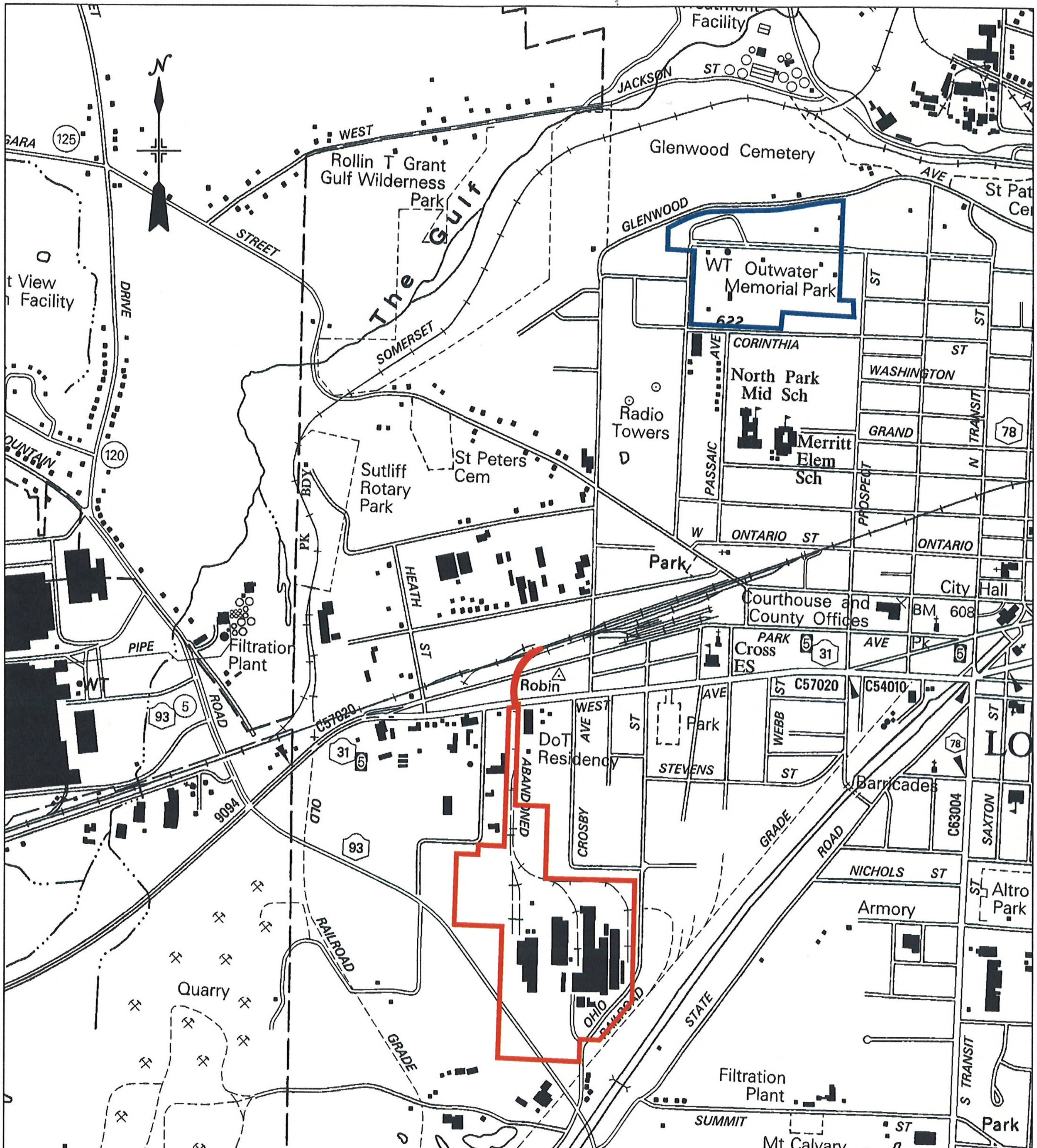
Exposure Media	Exposure Routes	Current: Tresspasser	Current: On-Site Worker	Future: Construction Worker	Future: Commercial/ Industrial	Future: Residential
Building Surfaces	Ingestion					----
	Dermal Contact					----
	Inhalation (Fugitive Dust)					----
	External Radiation					----
Surface Soil	Ingestion					
	Dermal Contact					
	Inhalation (Fugitive Dust)					
	External Radiation					
	Ingestion of Produce	----	----	----	----	
Surface Water / Sediment	Ingestion					
	Dermal Contact					
	Inhalation (Fugitive Dust)					
	External Radiation					
Groundwater	Ingestion	----	----			
	Dermal Contact	----	----			
	Inhalation (Fugitive Dust)	----	----			
	External Radiation	----	----			
Subsurface Soil	Ingestion	----	----			
	Dermal Contact	----	----			
	Inhalation (Fugitive Dust)	----	----			
	External Radiation	----	----			

Complete Exposure Pathway	(shaded)
Incomplete Exposure Pathway	----

EarthTech
A Tyco International Ltd. Company

Figure 5-1
Sequence of Preliminary Activities Leading to Survey Design (MARSSIM Figure 4.1)
Former Guterl Specialty Steel Corporation FUSRAP Site
Lockport, New York





LEGEND

SITE LOCATION

BACKGROUND SOIL SAMPLE SITE LOCATION

750 0 750 1500

GRAPHIC SCALE

NY State Index Map
Guterl Steel Site

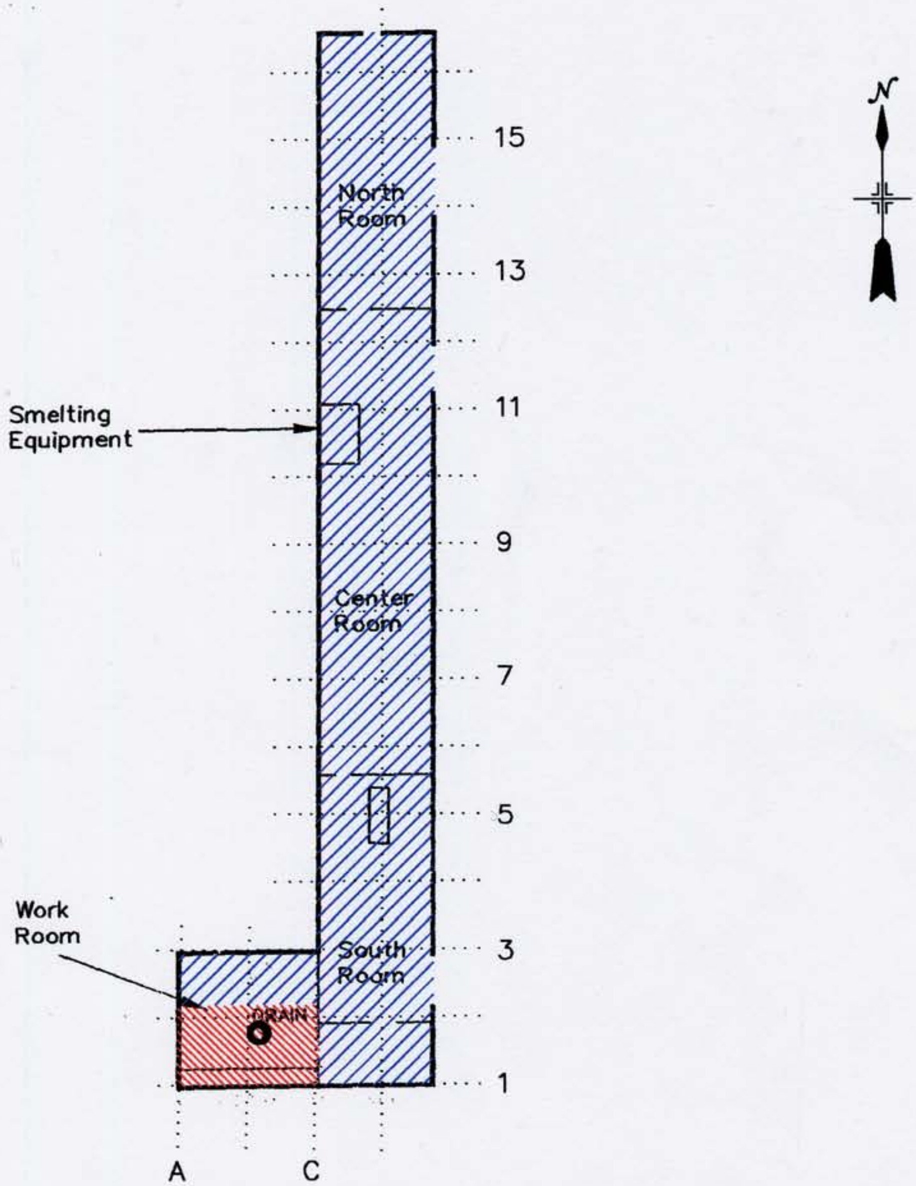
SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by: EarthTech, A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers, Buffalo District

DESIGNED BY: DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY: DB	BACKGROUND SOIL SAMPLE SITE LOCATION PLAN
CHECKED BY: JK	

SUBMITTED BY:	DATE:	SCALE:	DRAWING NO.:
JK	NOV. 25, 2006	AS SHOWN	FIGURE 5-2



NOTE: Building 1 has a basement, therefore there are no floor soil samples. One sample to be taken at floor drain located in Work Room.

FEET 0 30
METERS 0 10

LEGEND

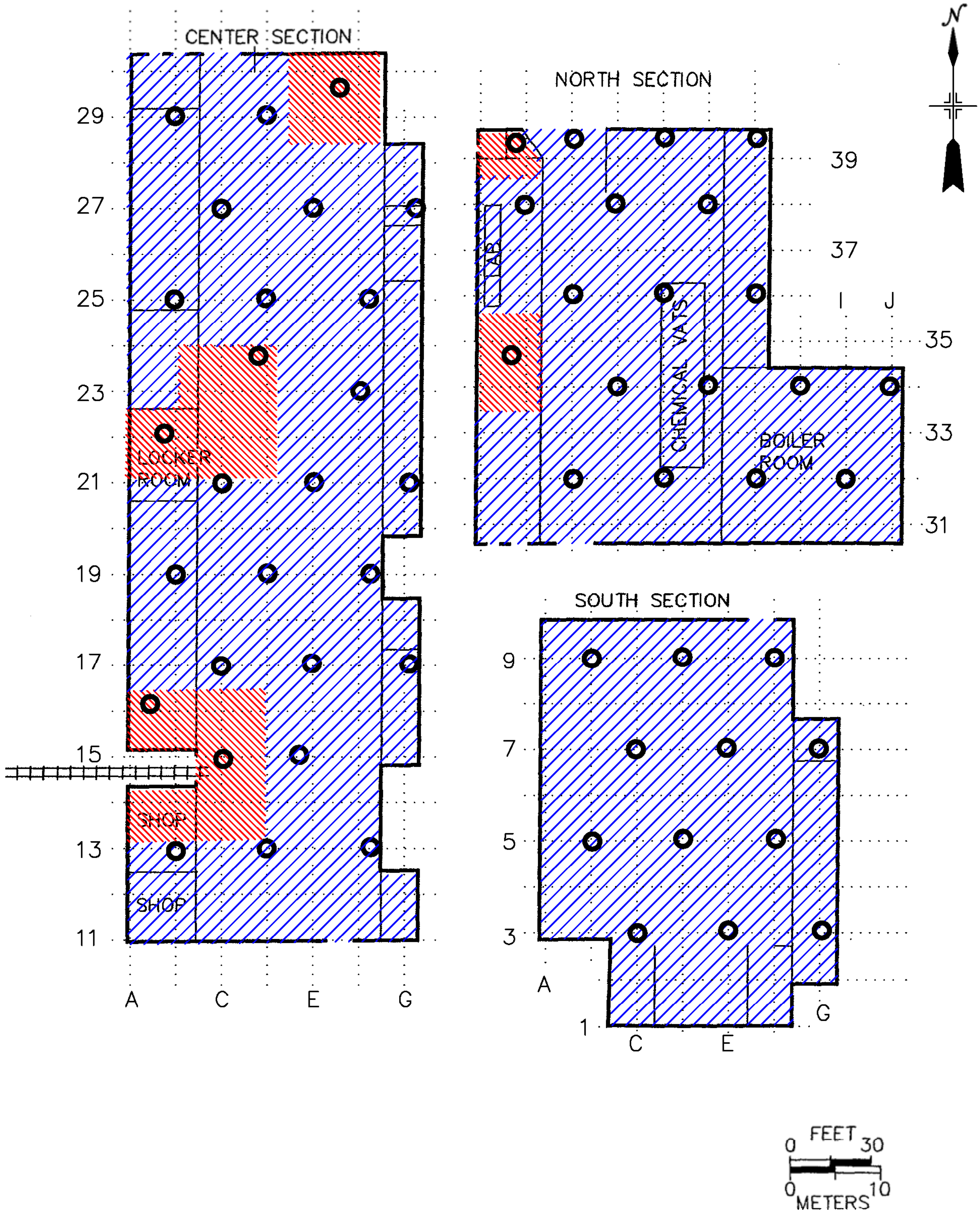
- CLASS 1 AREA
- CLASS 2 AREA
- CLASS 3 AREA
- 5 meter x 5 meter Grid
- RI Sample Point

SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by: EarthTech, A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers, Buffalo District

DESIGNED BY: DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.		
DRAWN BY: DB	BUILDING 1 SOIL SAMPLE LOCATION PLAN		
CHECKED BY: JK			
SUBMITTED BY: JK	DATE: NOV. 30, 2006	SCALE: AS SHOWN	DRAWING NO.: FIGURE 5-3



LEGEND

- CLASS 1 AREA
- CLASS 2 AREA
- CLASS 3 AREA
- 5 meter x 5 meter Grid
- RI Sample Point

SYMBOL	DESCRIPTIONS	DATE	APPROVED

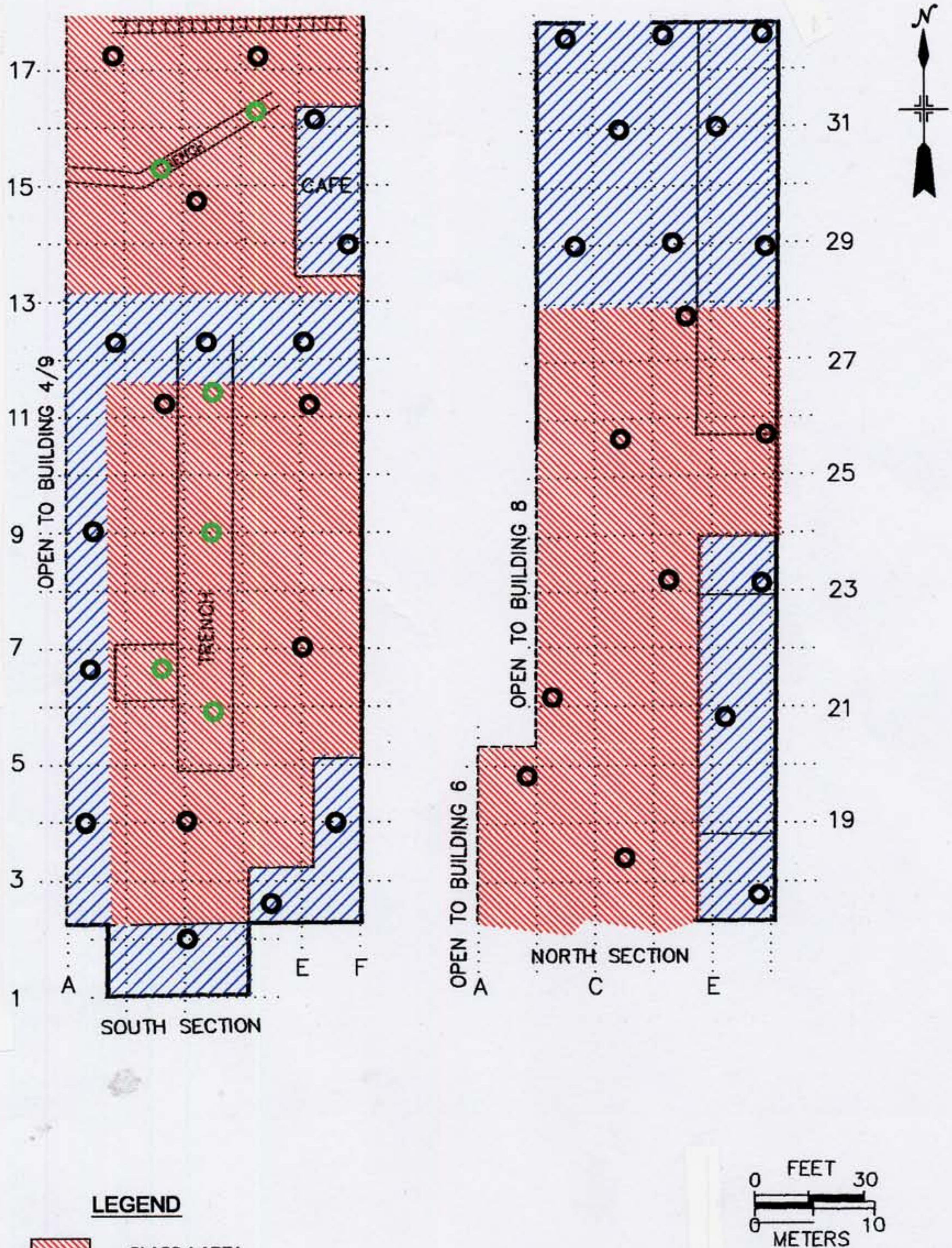
REVISIONS

Prepared by : EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY : DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY : DB	BUILDING 2 SOIL SAMPLE LOCATION PLAN
CHECKED BY : JK	

SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
JK	NOV. 20, 2006	AS SHOWN	FIGURE 5-4



LEGEND

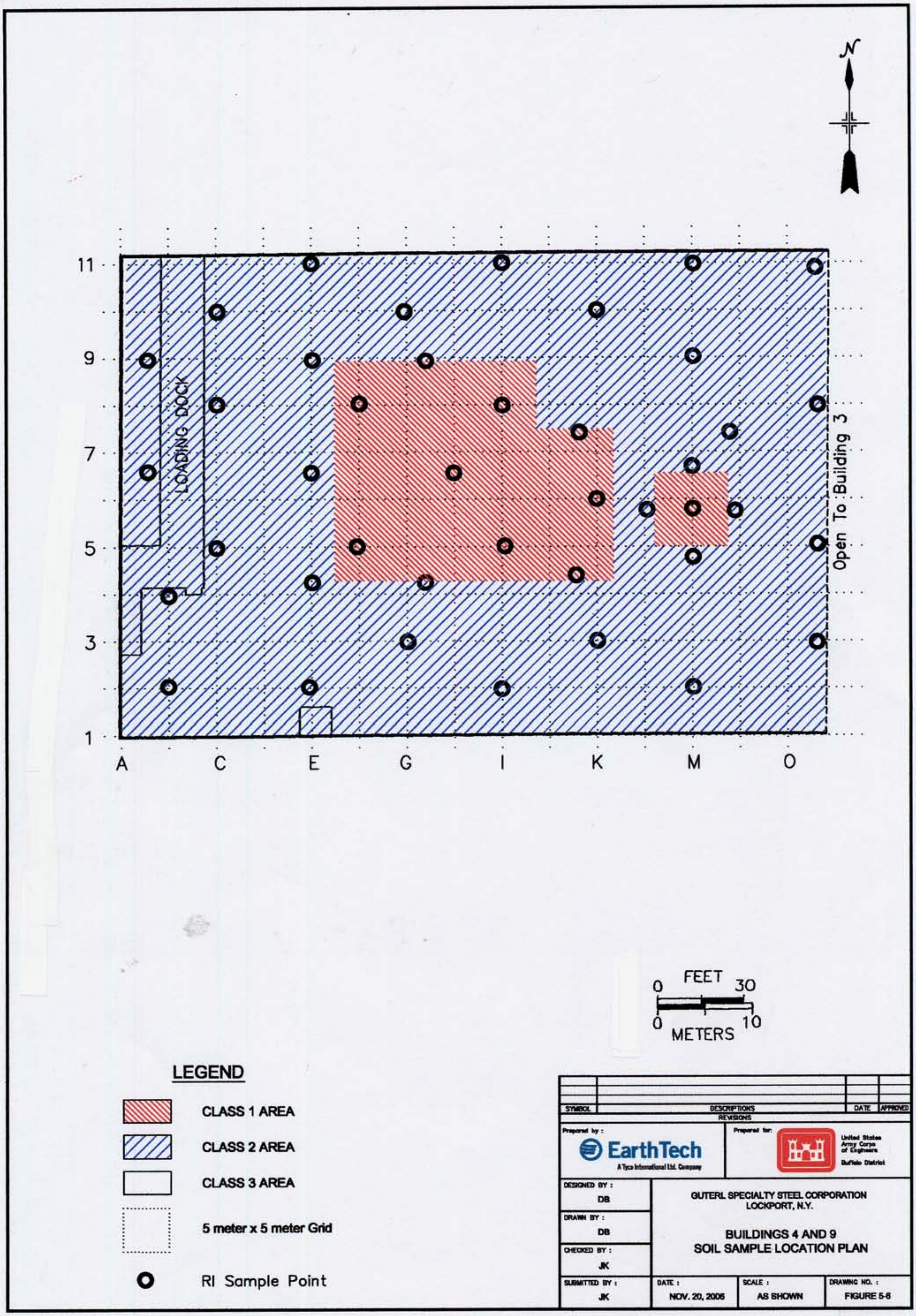
- CLASS 1 AREA
- CLASS 2 AREA
- CLASS 3 AREA
- 5 meter x 5 meter Grid
- RI Sample Point
- Water/Sediment Co-located Sample Point

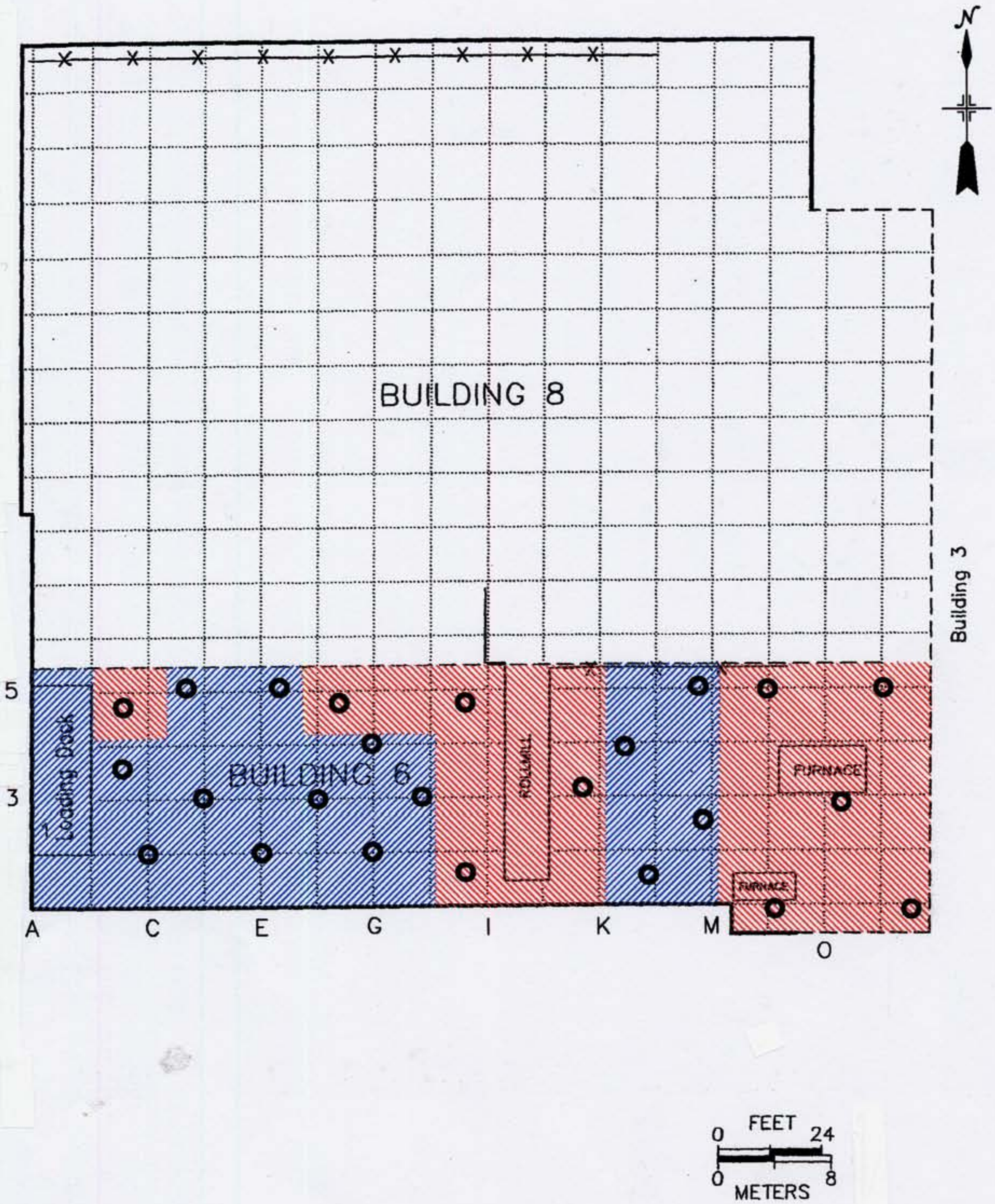
SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by: EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY: DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY: DB	BUILDING 3 SOIL SAMPLE LOCATION PLAN
CHECKED BY: JK	
SUBMITTED BY: JK	DATE: NOV. 20 2006 · SCALE: AS SHOWN · DRAWING NO.: FIGURE 5-5


N
11
9
7
5
3
1
A
C
E
G
I
K
M
O
LOADING DOCK
Open To Building 3
FEET
0
30
0
10
METERS
LEGEND
CLASS 1 AREA
CLASS 2 AREA
CLASS 3 AREA
5 meter x 5 meter Grid
RI Sample Point
SYMBOL
DESCRIPTIONS
REVISIONS
DATE
APPROVED
Prepared by :
EarthTech
A Tyco International Ltd. Company
Prepared for:
United States Army Corps of Engineers
Buffalo District
DESIGNED BY : DB
DRAWN BY : DB
CHECKED BY : JK
SUBMITTED BY : JK
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, N.Y.
BUILDINGS 4 AND 9
SOIL SAMPLE LOCATION PLAN
DATE : NOV. 20, 2006
SCALE : AS SHOWN
DRAWING NO. : FIGURE 5-6



LEGEND

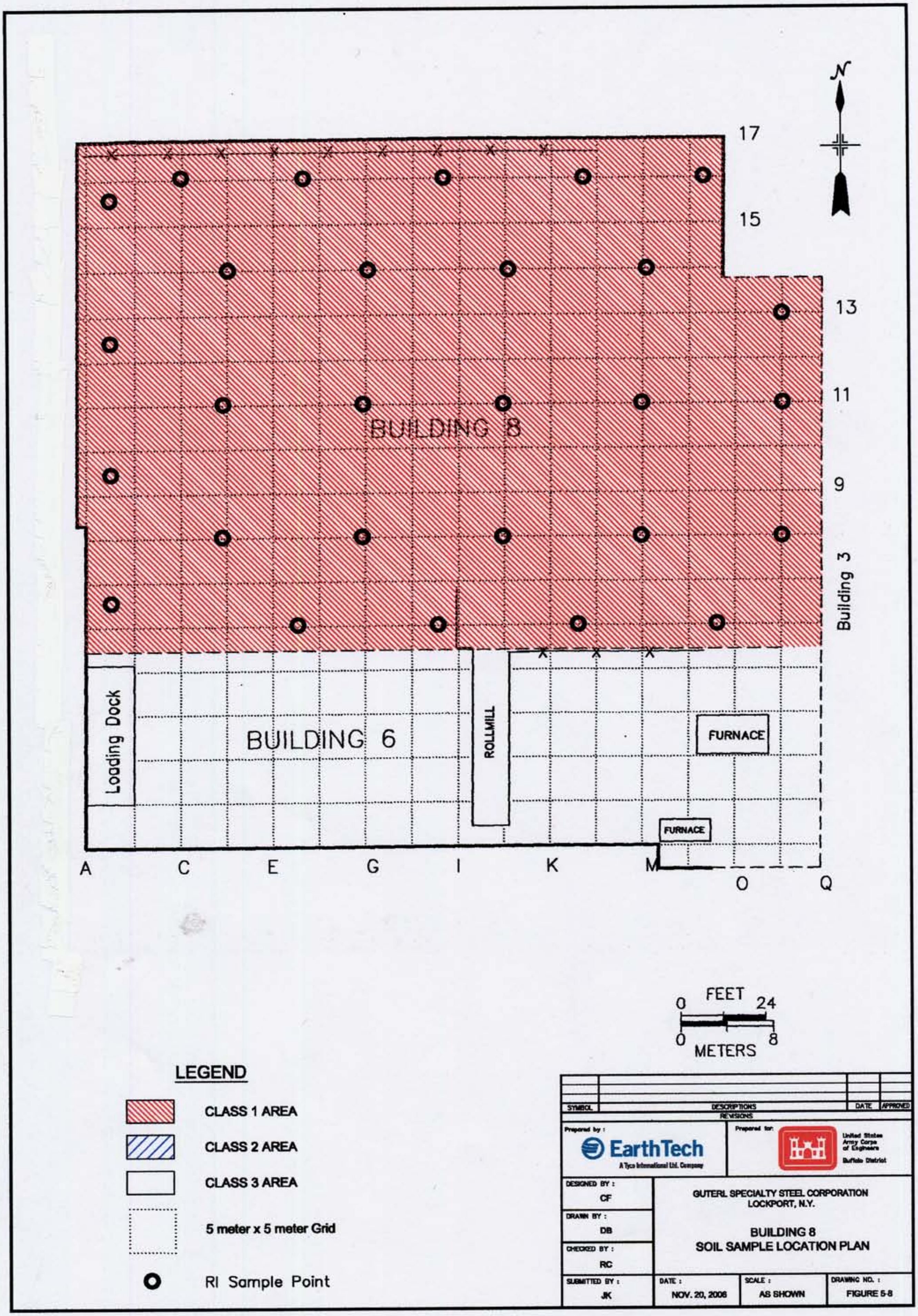
- CLASS 1 AREA
- CLASS 2 AREA
- CLASS 3 AREA
- 5 meter x 5 meter Grid
- RI Sample Point

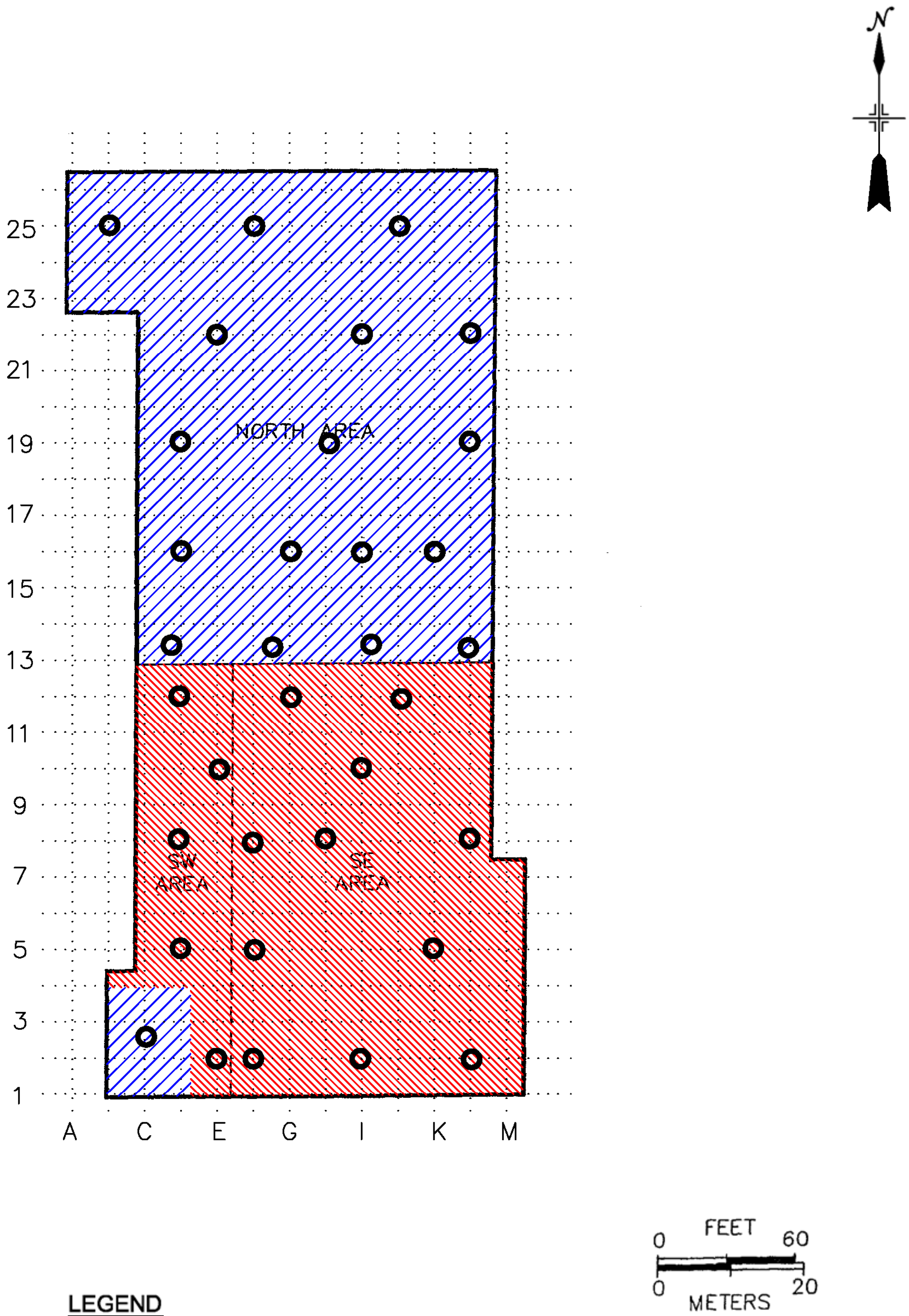
SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by: EarthTech, A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers, Buffalo District

DESIGNED BY: DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY: DB	BUILDING 6 SOIL SAMPLE LOCATION PLAN
CHECKED BY: JK	
SUBMITTED BY: JK	DATE: NOV. 20, 2006 / SCALE: AS SHOWN / DRAWING NO.: FIGURE 5-7


N
17
15
13
11
9
Building 3
BUILDING 8
Loading Dock
BUILDING 6
ROLLMILL
FURNACE
FURNACE
A
C
E
G
I
K
M
O
Q
FEET
0
24
0
8
METERS
LEGEND
CLASS 1 AREA
CLASS 2 AREA
CLASS 3 AREA
5 meter x 5 meter Grid
RI Sample Point
SYMBOL
DESCRIPTIONS
REVISIONS
DATE
APPROVED
Prepared by:
EarthTech
A Tyco International Ltd. Company
Prepared for:
United States Army Corps of Engineers
Buffalo District
DESIGNED BY: CF
DRAWN BY: DB
CHECKED BY: RC
SUBMITTED BY: JK
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, N.Y.
BUILDING 8
SOIL SAMPLE LOCATION PLAN
DATE: NOV. 20, 2006
SCALE: AS SHOWN
DRAWING NO.: FIGURE 5-8



LEGEND

- CLASS 1 AREA
- CLASS 2 AREA
- CLASS 3 AREA
- 5 meter x 5 meter Grid
- RI Sample Point

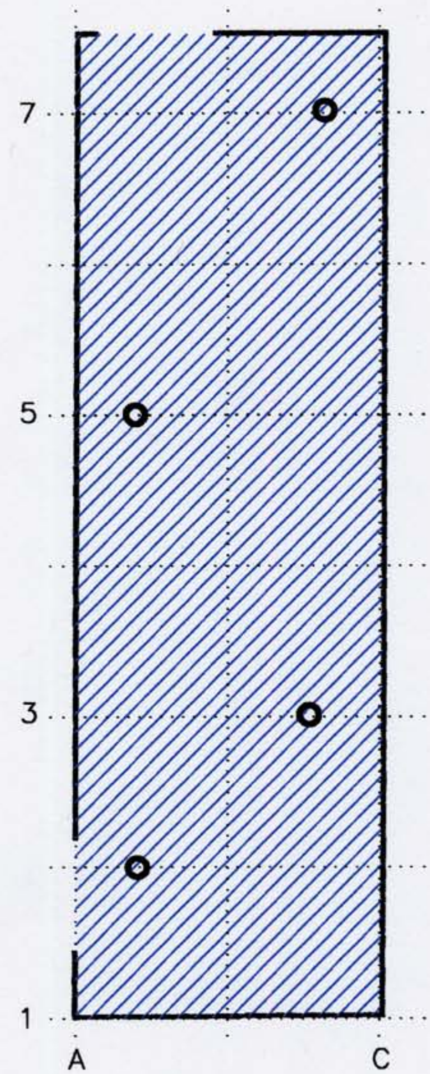
SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

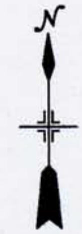
Prepared by: EarthTech, A Tyco International Ltd. Company

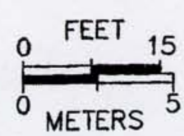
Prepared for: United States Army Corps of Engineers, Buffalo District

DESIGNED BY: DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY: DB	BUILDING 24 SOIL SAMPLE LOCATION PLAN
CHECKED BY: JK	

SUBMITTED BY:	DATE:	SCALE:	DRAWING NO.:
JK	NOV. 20, 2006	AS SHOWN	FIGURE 5-9







LEGEND

CLASS 1 AREA

CLASS 2 AREA

CLASS 3 AREA

5 meter x 5 meter Grid

RI Sample Point

SYMBOL	DESCRIPTIONS	DATE	APPROVED

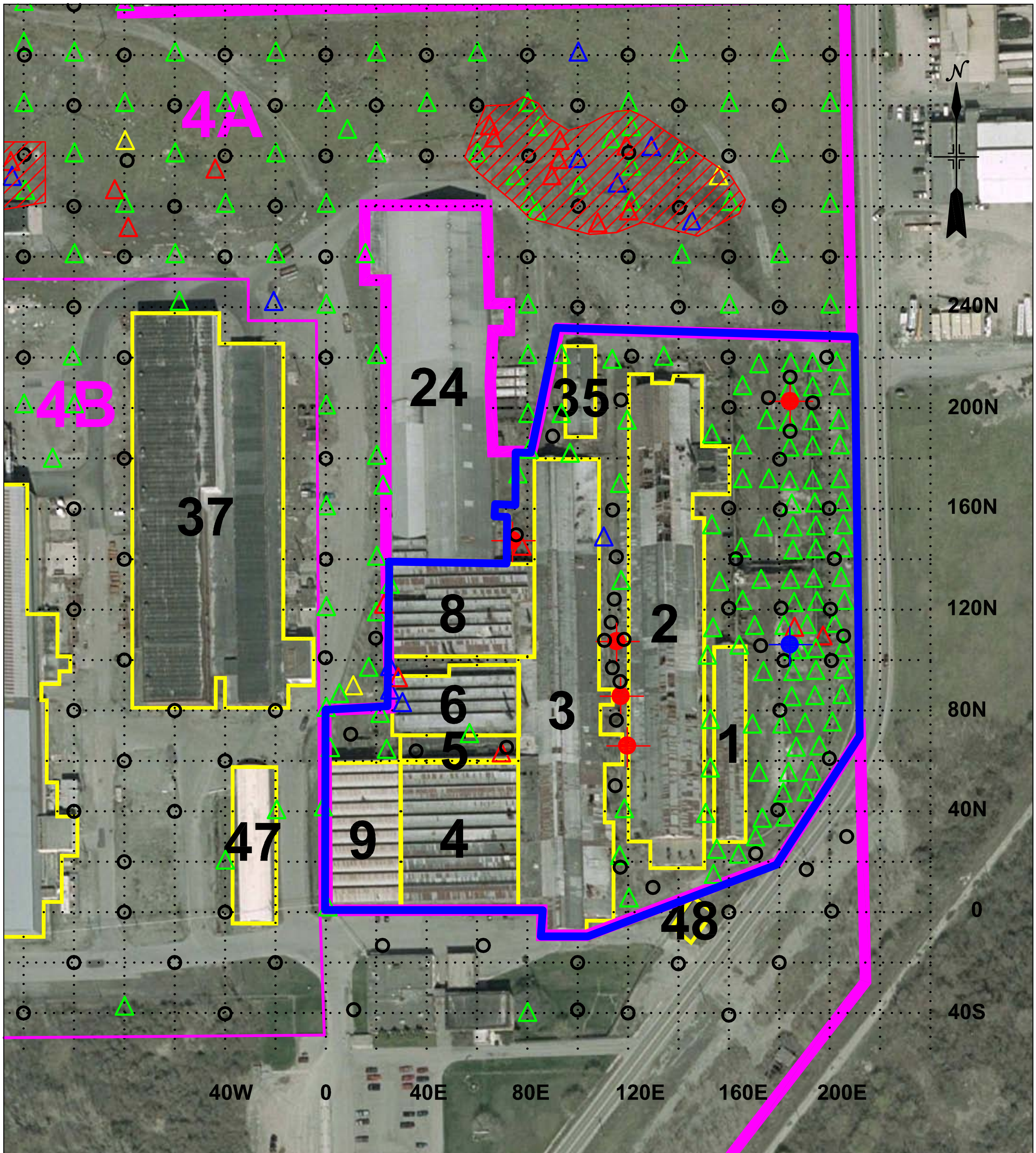
REVISIONS

Prepared by: EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY: DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY: DB	BUILDING 35 SOIL SAMPLE LOCATION PLAN
CHECKED BY: JK	

SUBMITTED BY:	DATE:	SCALE:	DRAWING NO.:
JK	NOV. 20, 2006	AS SHOWN	FIGURE 5-10



LEGEND

24	Guterl Buildings
	IA03 Landfill Area
	IA04 NCIDA Property
	IA05 Railroad Right-of-Way
	IA01 & IA02 Excised Areas
	20 meter x 20 meter grid
	RI Sample Point

(>15 cm)	(0-15 cm)	
		ORISE (1999) Sample Point ≤35 pCi/g, U-238
		ORISE (1999) Sample Point >35 and ≤100 pCi/g, U-238
		ORISE (1999) Sample Point >100 pCi/g, U-238
		ORISE (1999) Sample Point >5 pCi/g, Th-232

SYMBOL	DESCRIPTIONS	DATE	APPROVED

REVISIONS

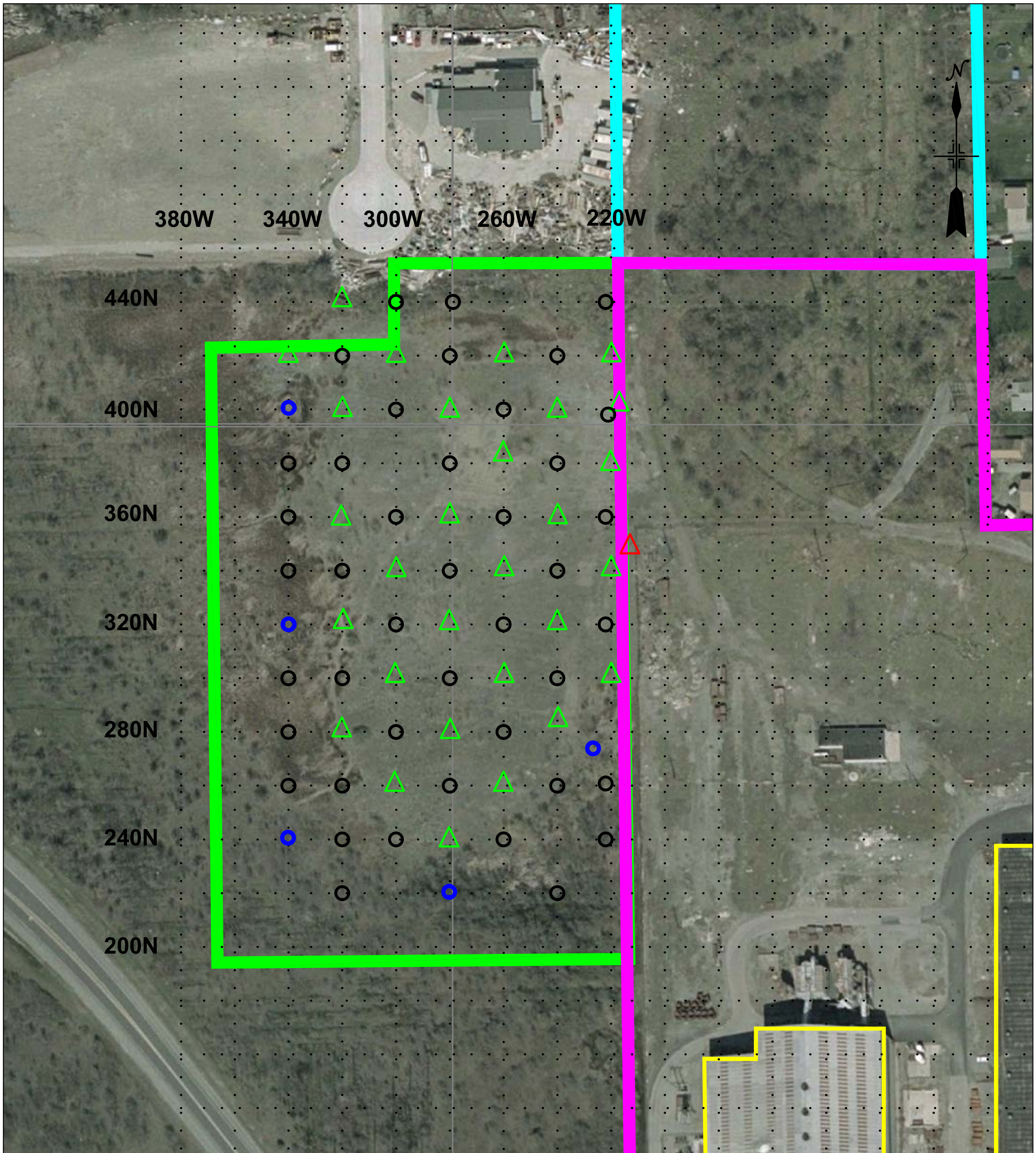
Prepared by : EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, N.Y.

IA02 SAMPLE LOCATION PLAN

DESIGNED BY :	DRAWN BY :	CHECKED BY :	SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
DB	DB	JK	JK	NOV. 20, 2006	AS SHOWN	FIGURE 5-11



LEGEND

- 24 Guterl Buildings
- IA03 Landfill Area
- IA04 NCIDA Property
- IA05 Railroad Right-of-Way
- 20 meter x 20 meter grid
- RI Sample Point
- Co-located Surface Water and Sediment Samples
- ORISE (1999) Sample Point ≤35 pCi/g, U-238
- ORISE (1999) Sample Point >100 pCi/g, U-238
- ORISE (1999) Sample Point >5 pCi/g, Th-232

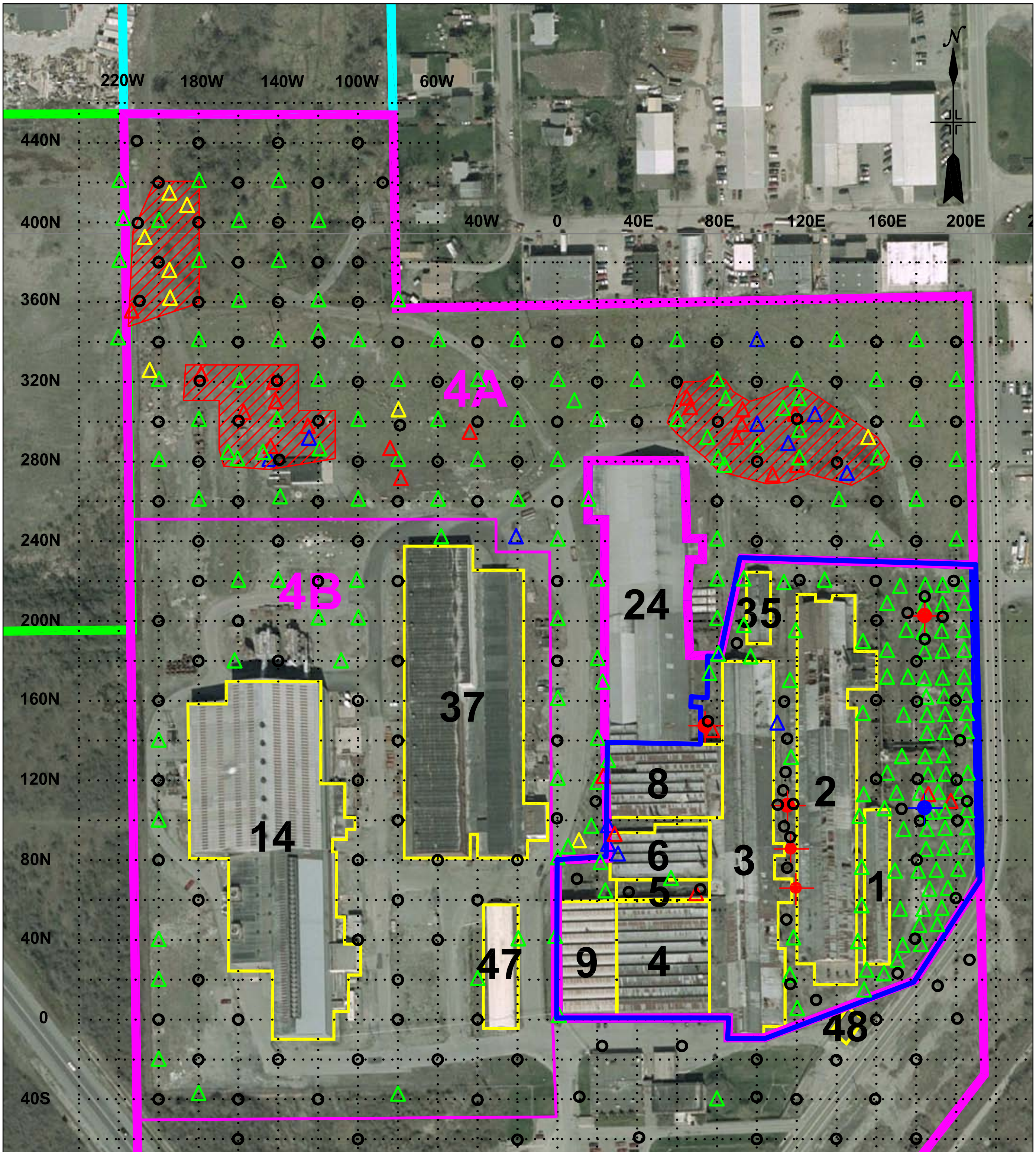
SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by : EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY : DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY : DB	IA03 SAMPLE LOCATION PLAN
CHECKED BY : JK	

SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
JK	NOV. 20, 2006	AS SHOWN	FIGURE 5-12



LEGEND

24	Guterl Buildings	△ (green)	ORISE (1999) Sample Point ≤35 pCi/g, U-238
(green box)	IA03 Landfill Area	△ (blue)	ORISE (1999) Sample Point >35 and ≤100 pCi/g, U-238
(magenta box)	IA04 NCIDA Property	△ (red)	ORISE (1999) Sample Point >100 pCi/g, U-238
(cyan box)	IA05 Railroad Right-of-Way	△ (yellow)	ORISE (1999) Sample Point >5 pCi/g, Th-232
(blue box)	IA01 & IA02 Excised Areas	(red hatched area)	Elevated ORISE Area
(dotted grid)	20 meter x 20 meter grid		
o	RI Sample Point		

SYMBOL	DESCRIPTIONS	DATE	APPROVED

REVISIONS

Prepared by: EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY : DB

DRAWN BY : DB

CHECKED BY : JK

GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, N.Y.

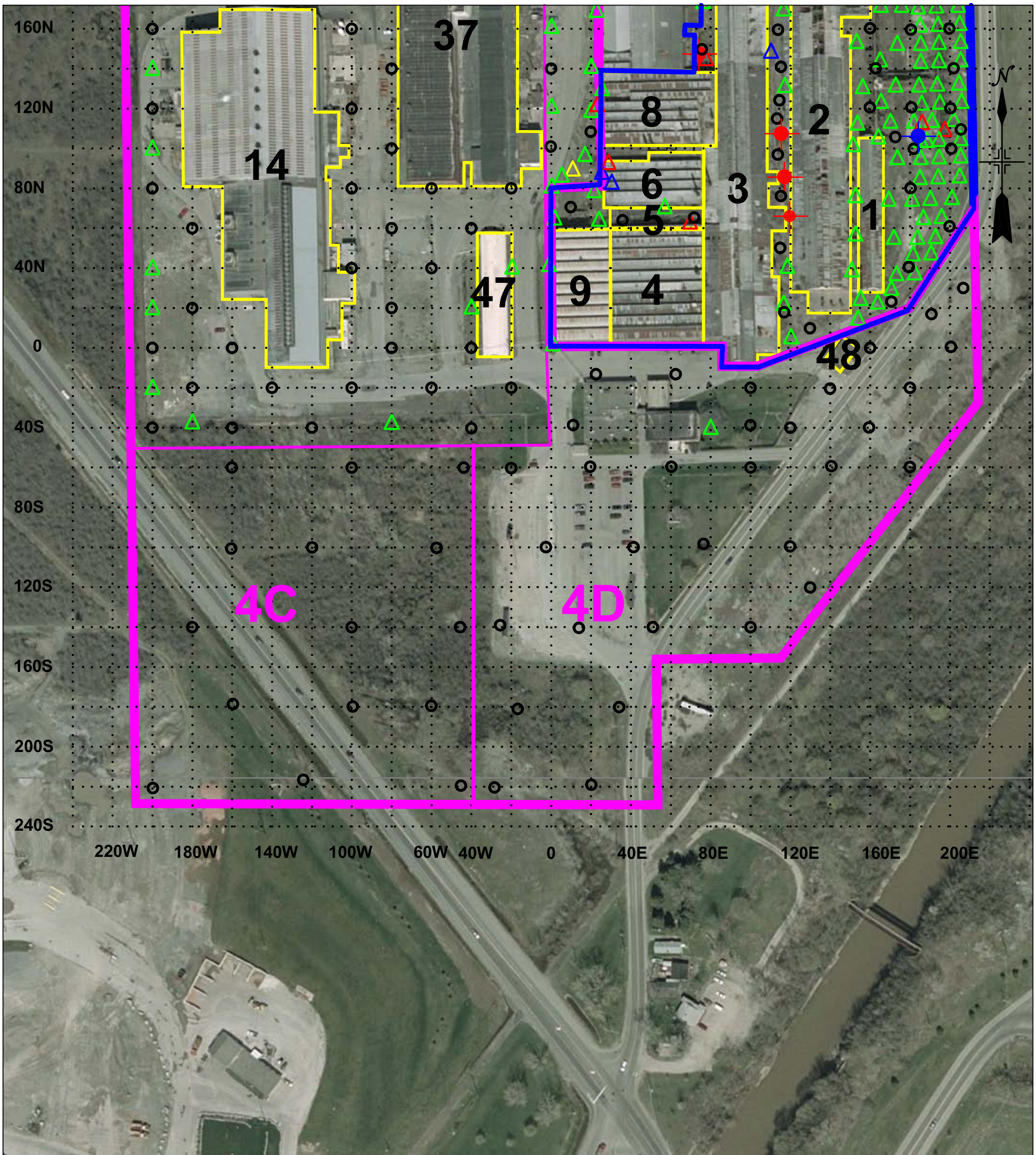
IA04A & IA04B SAMPLE LOCATION PLAN

SUBMITTED BY : JK

DATE : NOV. 20, 2006

SCALE : AS SHOWN

DRAWING NO. : FIGURE 5-13



LEGEND

24	Guterl Buildings
	IA03 Landfill Area
	IA04 NCIDA Property
	IA05 Railroad Right-of-Way
	IA01 & IA02 Excised Areas
	20 meter x 20 meter grid
	RI Sample Point
	ORISE (1999) Sample Point ≤35 pCi/g, U-238
	ORISE (1999) Sample Point >35 and ≤100 pCi/g, U-238
	ORISE (1999) Sample Point >100 pCi/g, U-238
	ORISE (1999) Sample Point >5 pCi/g, Th-232
	Elevated ORISE Area

SYMBOL	DESCRIPTIONS	DATE	APPROVED

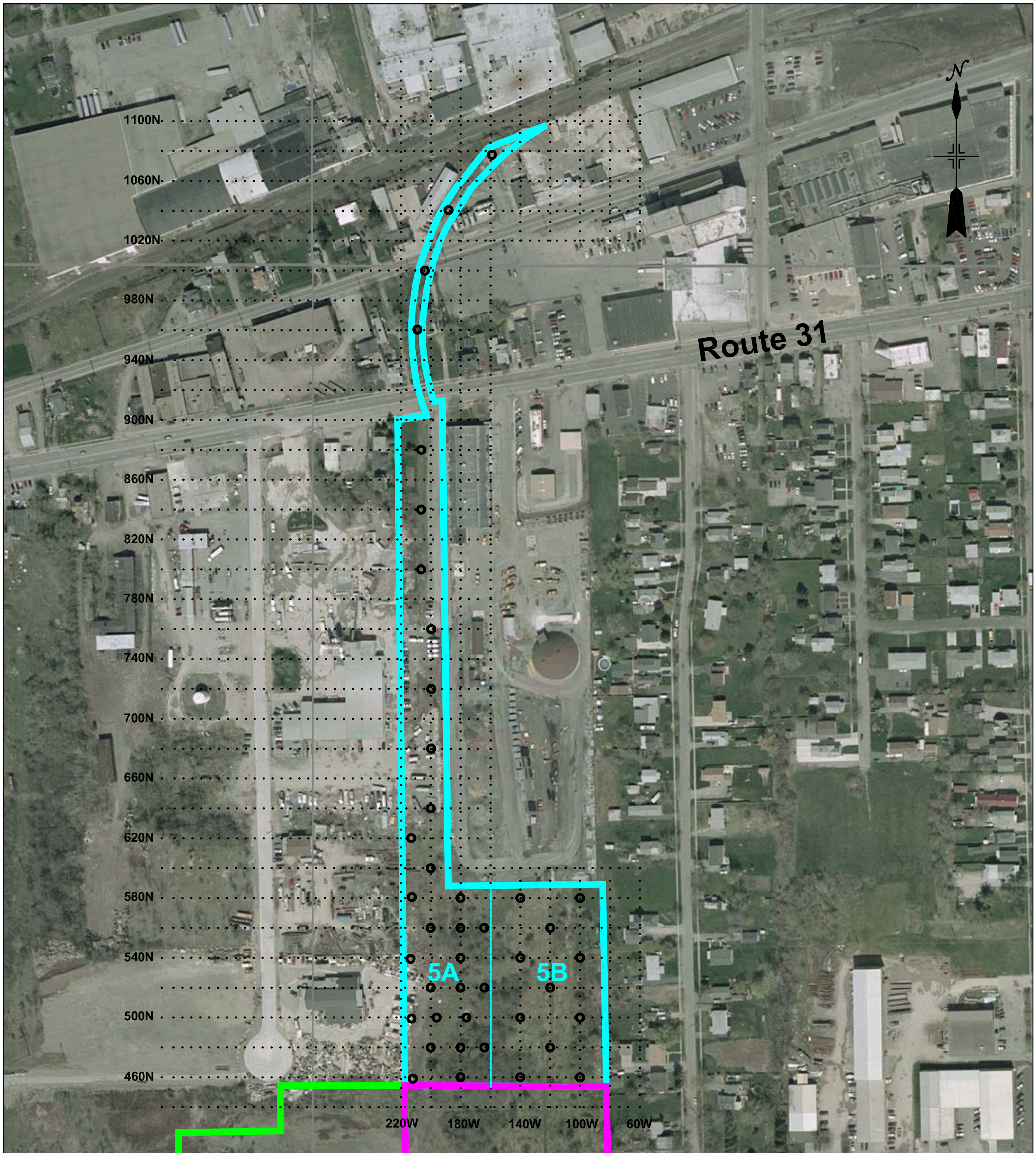
REVISIONS

Prepared by: EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY : DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY : DB	IA04C & IA04D SAMPLE LOCATION PLAN
CHECKED BY : JK	

SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
JK	NOV. 20, 2006	AS SHOWN	FIGURE 5-14



LEGEND

- 24 Guterl Buildings
- IA03 Landfill Area
- IA04 NCIDA Property
- IA05 Railroad Right-of-Way
- 20 meter x 20 meter grid
- RI Sample Point

SYMBOL	DESCRIPTIONS	DATE	APPROVED

REVISIONS

Prepared by: EarthTech A Tyco International Ltd. Company

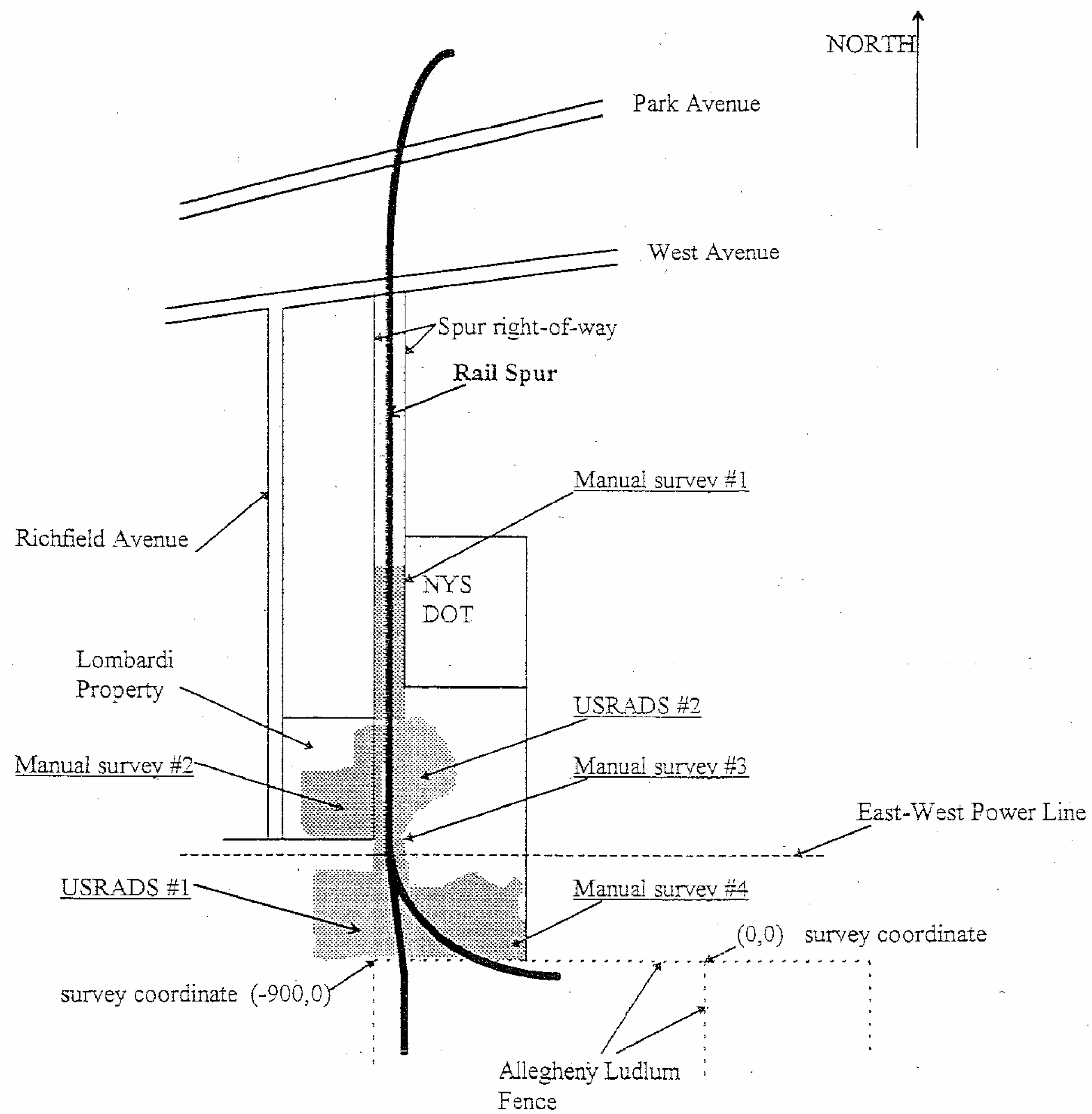
Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY : DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY : DB	IA05A AND IA05B SAMPLE LOCATION PLAN
CHECKED BY : JK	

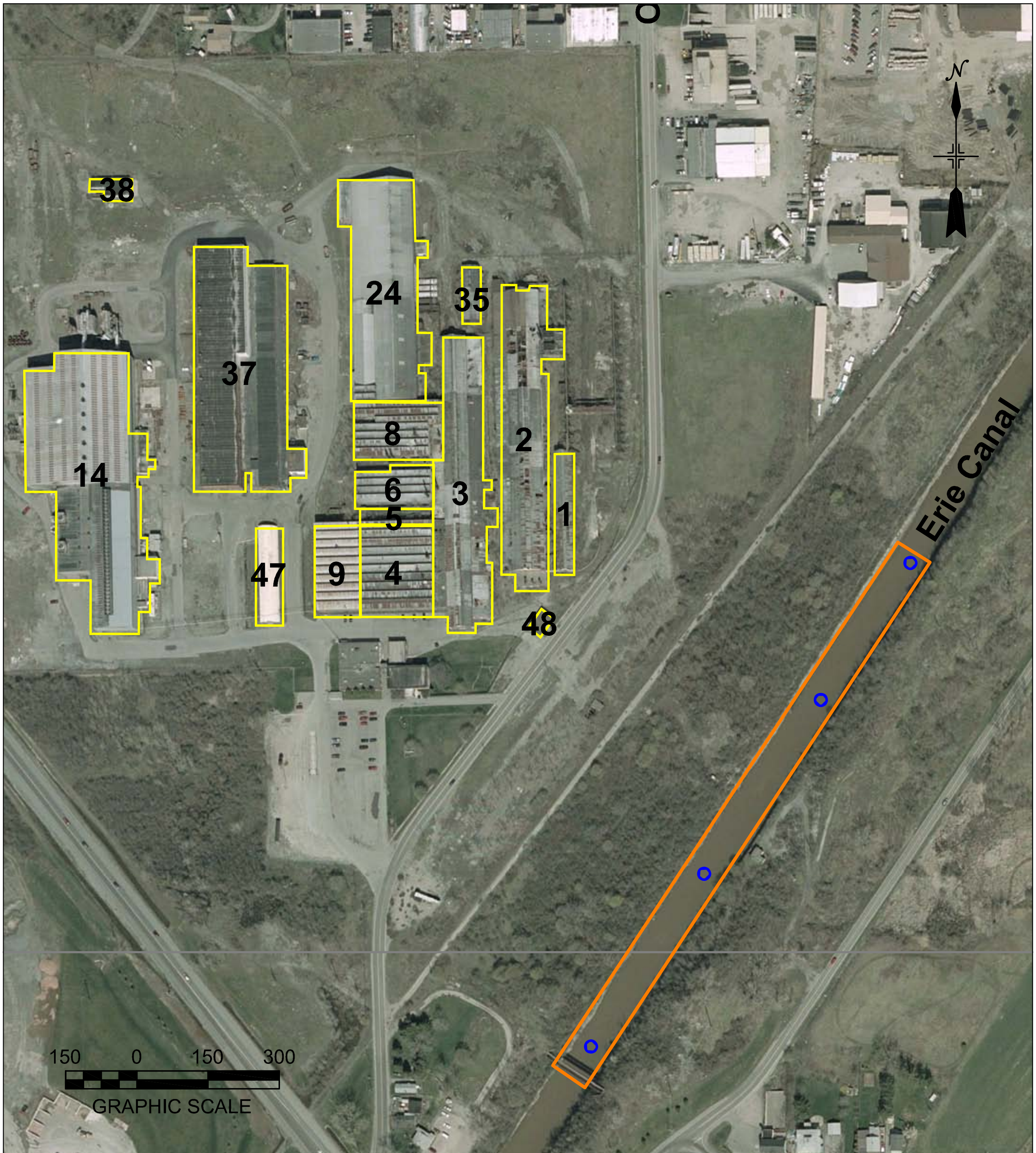
SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
JK	NOV. 20, 2006	AS SHOWN	FIGURE 5-15

Figure 5-16

Area Between Allegheny Ludlum Fence and Park Avenue (Not To Scale)
Former Guterl Specialty Steel Corporation FUSRAP Site
Lockport, New York



(Source Reference: NYSDEC, 1999 – Figure 1.)



LEGEND

(orange box)	IA09 Erie Canal Southeast of Site
24	Guterl Buildings
(blue circle)	Collocated Sediment and Surface Water Samples

NOTE: In Erie Canal, three samples on a transect across the Canal will be collected at each location shown.

SYMBOL	DESCRIPTIONS	DATE	APPROVED

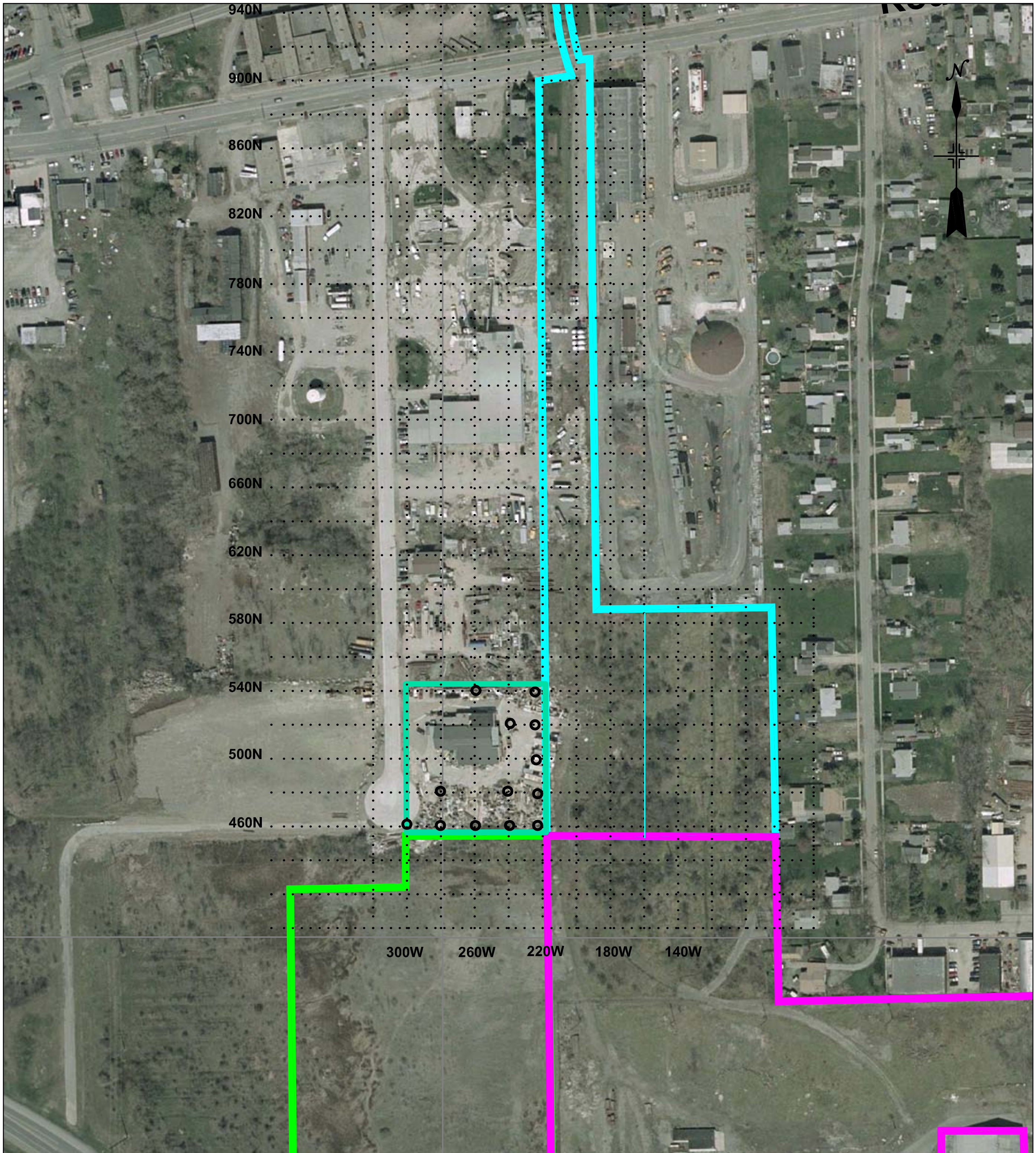
REVISIONS

Prepared by : EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY : DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY : DB	IA09 SAMPLE LOCATION PLAN
CHECKED BY : JK	

SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
JK	NOV. 20, 2006	AS SHOWN	FIGURE 5-17



LEGEND

- 24 Guterl Buildings
- IA03 Landfill Area
- IA04 NCIDA Property
- IA05 Railroad Right-of-Way
- IA10 LOT 7.1
- 20 meter x 20 meter grid
- RI Sample Point

SYMBOL	DESCRIPTIONS	DATE	APPROVED

REVISIONS

Prepared by : EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY : DB	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY : DB	IA10 SAMPLE LOCATION PLAN
CHECKED BY : JK	

SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
JK	NOV. 20, 2006	AS SHOWN	FIGURE 5-18

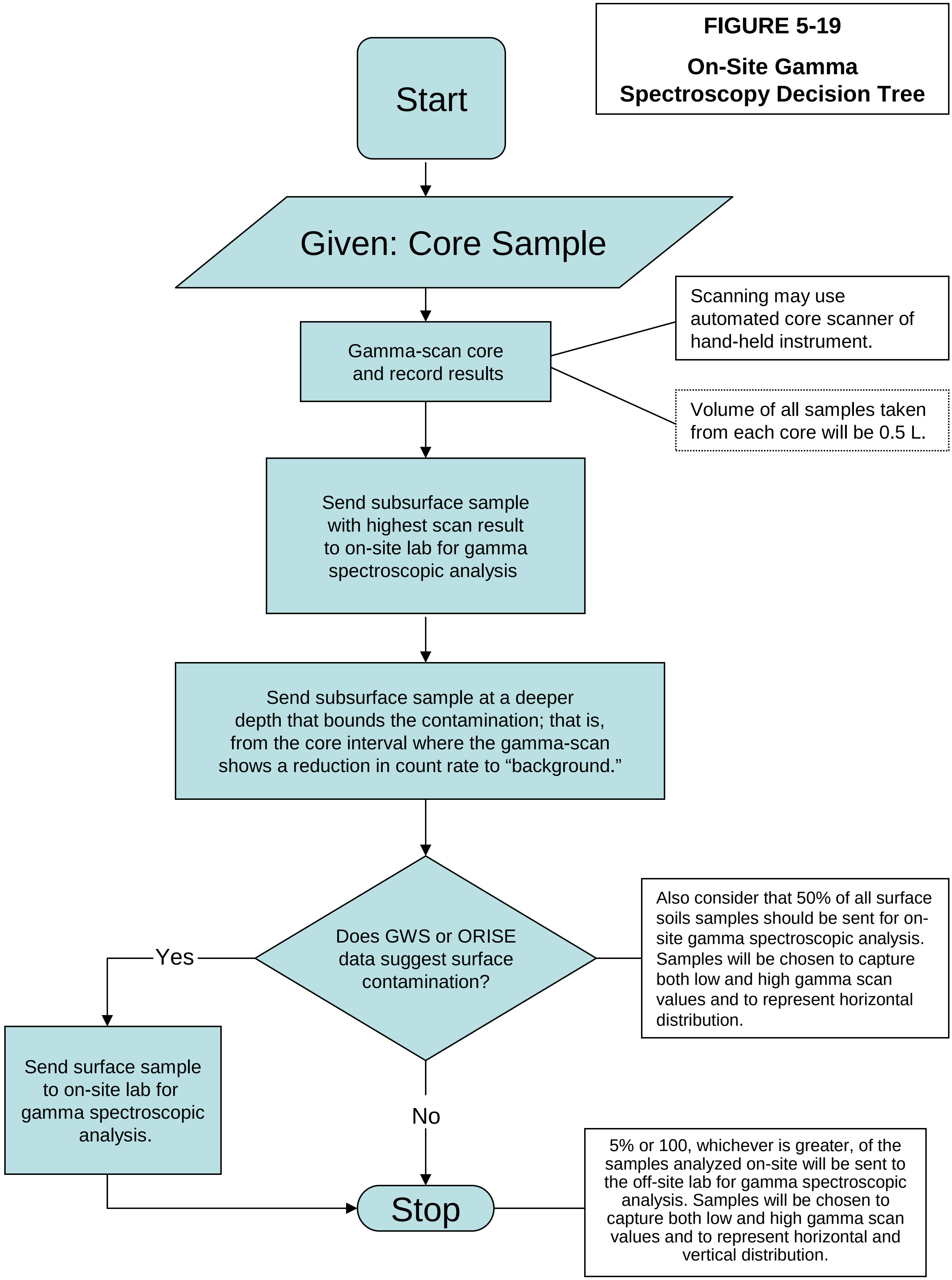
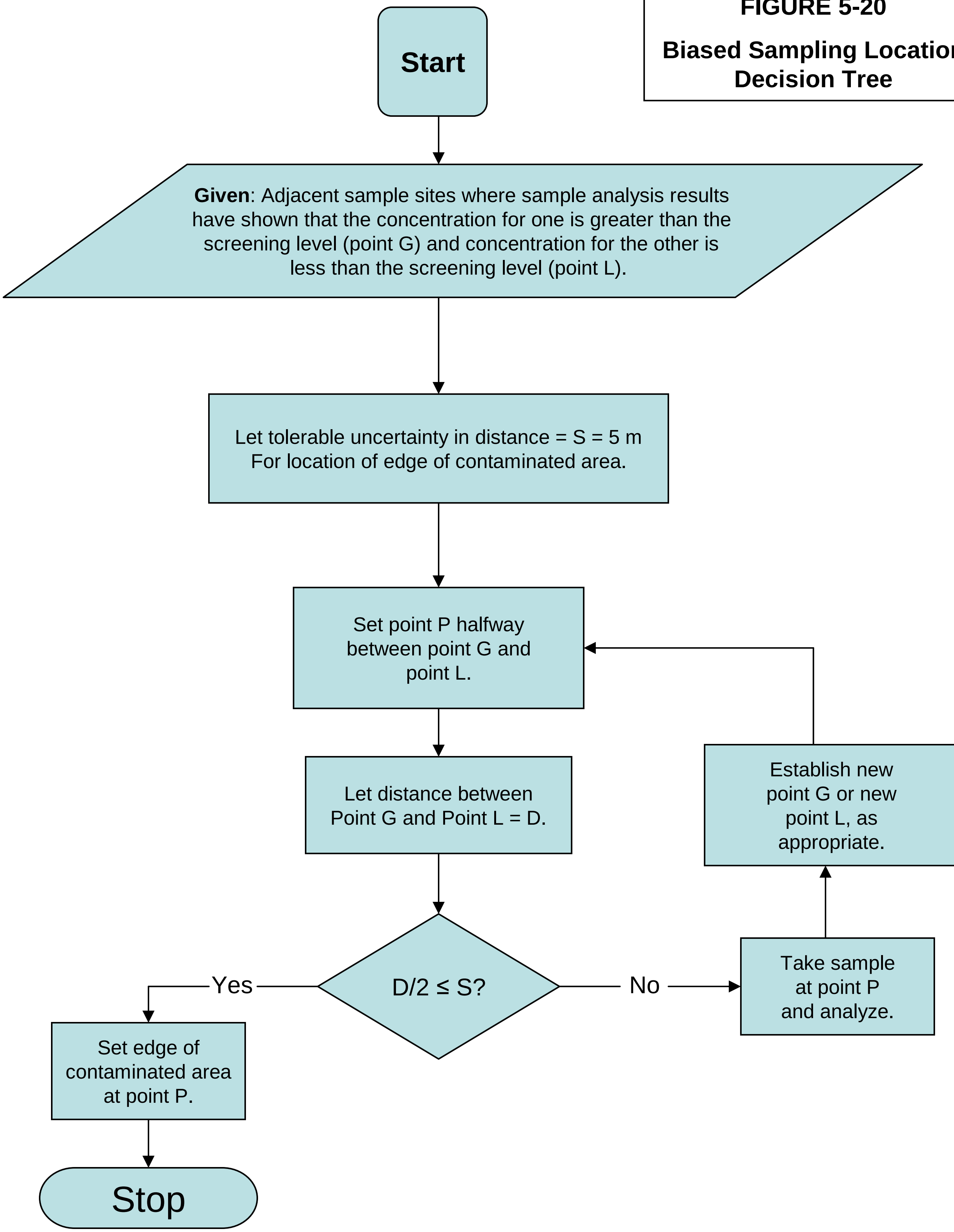
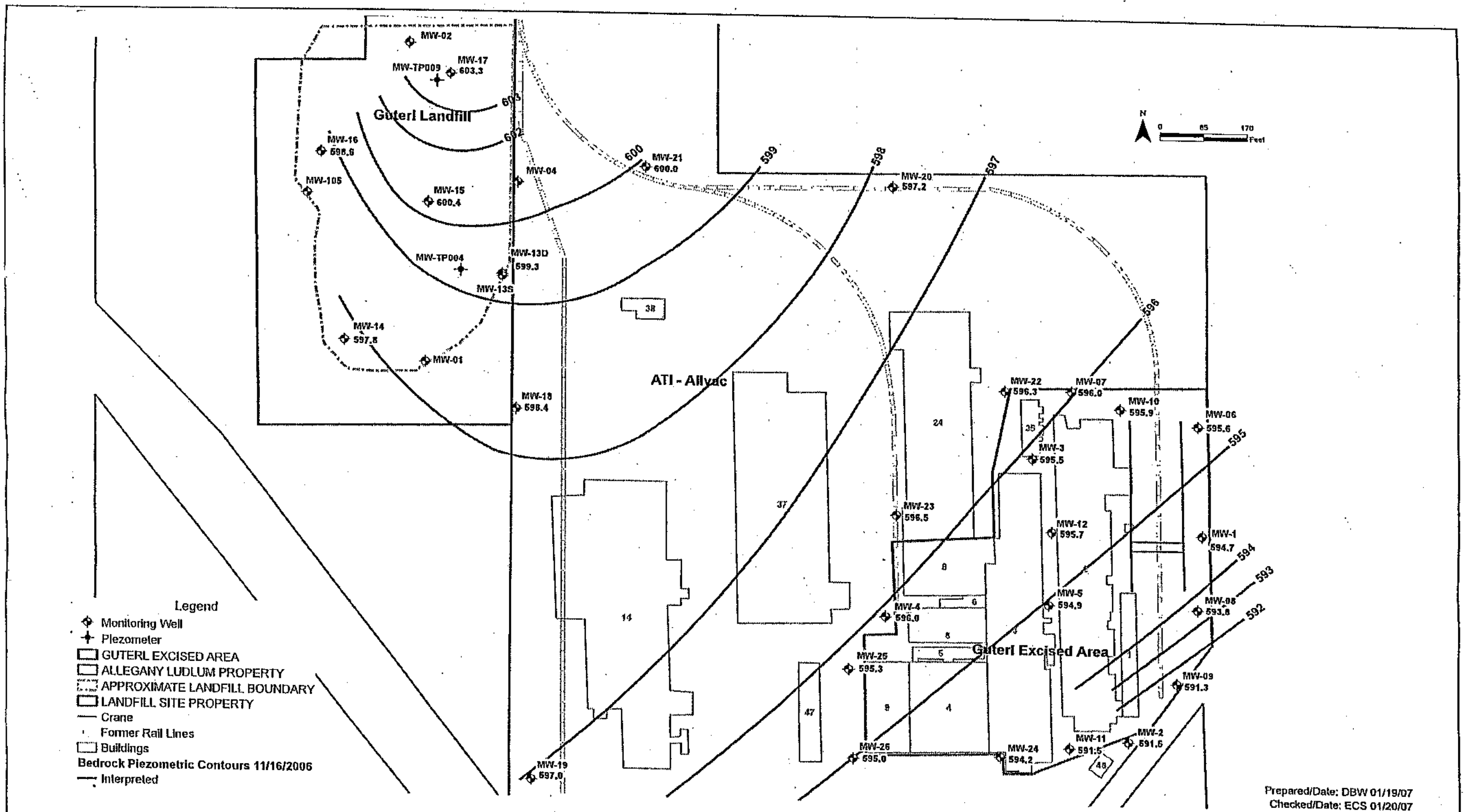


FIGURE 5-19
On-Site Gamma Spectroscopy Decision Tree
Start
Given: Core Sample
Gamma-scan core and record results
Scanning may use automated core scanner of hand-held instrument.
Volume of all samples taken from each core will be 0.5 L.
Send subsurface sample with highest scan result to on-site lab for gamma spectroscopic analysis
Send subsurface sample at a deeper depth that bounds the contamination; that is, from the core interval where the gamma-scan shows a reduction in count rate to “background.”
Does GWS or ORISE data suggest surface contamination?
Also consider that 50% of all surface soils samples should be sent for on-site gamma spectroscopic analysis. Samples will be chosen to capture both low and high gamma scan values and to represent horizontal distribution.
Yes
Send surface sample to on-site lab for gamma spectroscopic analysis.
No
Stop
5% or 100, whichever is greater, of the samples analyzed on-site will be sent to the off-site lab for gamma spectroscopic analysis. Samples will be chosen to capture both low and high gamma scan values and to represent horizontal and vertical distribution.

FIGURE 5-20

Biased Sampling Location Decision Tree





NYSDEC, 2007. RI/FS, Guterl Steel Site. Draft figures. Prepared by MACTEC, Inc. for NYSDEC.

Prepared for: United States Army Corps of Engineers Buffalo District

EarthTech
A tyco International Ltd. Company

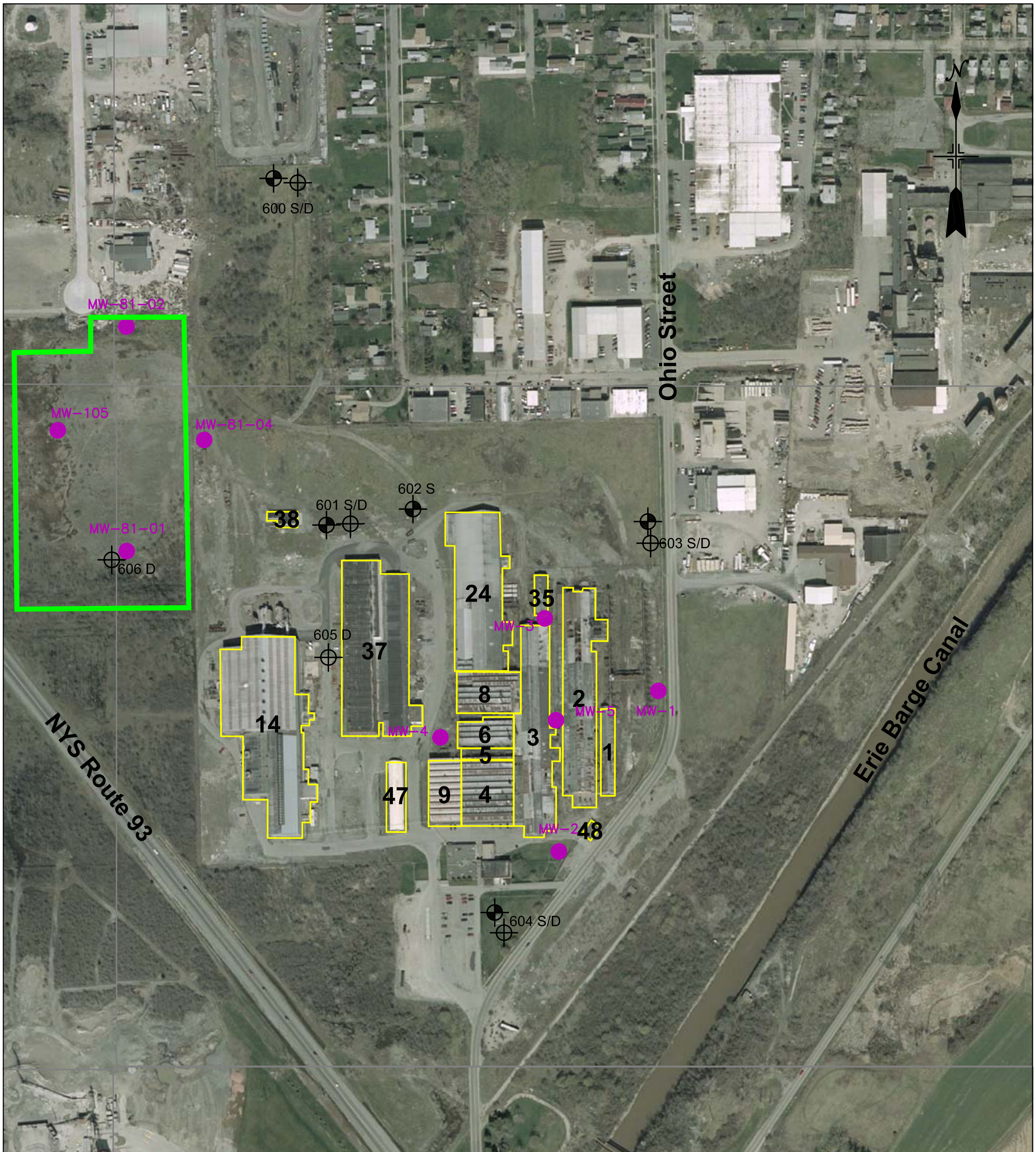
FIGURE 5-21

EXISTING MONITORING WELL LOCATIONS

GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NY

MAY 25, 2006

86184



LEGEND

(green outline)	Guterl Landfill Boundary
24 (yellow outline)	Guterl Buildings
(filled crosshair)	Proposed Overburden Monitoring Well
(open crosshair)	Proposed Bedrock Monitoring Well
(magenta circle)	Existing Monitoring Well

SYMBOL	DESCRIPTIONS	DATE	APPROVED
	REVISIONS		

Prepared by : EarthTech A Tyco International Ltd. Company

Prepared for: United States Army Corps of Engineers Buffalo District

DESIGNED BY : JMR	GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, N.Y.
DRAWN BY : JMR	Proposed Monitoring Well Locations
CHECKED BY : JK	

SUBMITTED BY :	DATE :	SCALE :	DRAWING NO. :
JK	May 30, 2007	NOT TO SCALE	FIGURE 5-22

ATTACHMENTS

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ATTACHMENT 1
Standard Operating Procedures

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Earth Tech Standard Operating Procedure	PROCEDURE NO. SARSG, SOP 001 DATE: August 20, 2001 APPROVED: ____________________ SARSG Leader
Portable Detection Equipment	

The San Antonio Radiological Services Group (SARSG) is responsible for the issuance, revision, and maintenance of this policy. Any deviations from the procedures set forth in this policy require approval of the SARSG Leader. This SOP supersedes SARSG SOP 001, February 9, 2001.

1.0 PURPOSE

The purpose of this procedure is to provide instruction for operating portable radiation detection instrumentation. For aspects of instrumentation operation not covered in this procedure, refer to the instrument technical manual.

2.0 SCOPE

This procedure provides guidance for the response and source checks of portable instrumentation and area radiation monitors. Response and source checks are the periodic checks to verify that the instrument is properly functioning within the manufacturer's specifications. Guidance is also provided for removing from service, shipping and receipt of instruments returned from repair and calibration.

3.0 EQUIPMENT

3.1 Portable instrument.

3.2 Appropriate sources for each instrument.

3.3 Source holder.

4.0 PRECAUTIONS

4.1 When operating a battery powered instrument, the batteries shall be checked each time the instrument is used and batteries changed when required.

4.2 Handle instruments with care. Do not drop or allow them to bang against hard surfaces. Use only instruments possessing a current calibration.

4.3 Care should be taken when using thin window detectors (pancake and scintillation detectors) near sharp objects so that the window and detector shall not damaged.

4.4 Slowly enter areas of unknown radiation with instruments on the high scale to avoid off-scale readings and subsequent prolonged recovery time.

4.5 Although incidental contact with the surveyed surface will not generally contaminate the detector, minimize contact with the surface.

4.6 Occasionally verify instrument is responding properly if background appears low.

4.7 When checking instruments, place the source in its holder or center it on the probe as required.

4.8 Carefully pack for shipment any instrument being sent to a facility to be calibrated or repaired to avoid damage in transit.

4.9 Radiation survey instruments and count rate instruments shall be calibrated at least every twelve months, after the instrument is repaired.

5.0 PROCEDURE

5.1 Steps prior to using instruments.

5.1.1 Calibration Verification

4.9.1.1 All portable radiological instruments shall have a current calibration label.

4.9.1.2 All field instruments will be verified to be under current source check prior to use.

5.1.2 Physical Check

5.1.2.1 Inspect the general physical condition of the instrument and detector prior to each use.

5.1.2.2 Inspect for loose, damaged knobs, buttons, cables, connectors, broken/damaged meter movements/ displays, dented or corroded instrument cases, punctured/deformed probe/probe window(s), cables, etc., and any other physical impairments that may affect the proper operation of the instrument or detector.

5.1.2.3 Any instrument or detector having a questionable physical condition shall not be used until corrected.

5.1.3 Battery Check

5.1.3.1 Check that there is sufficient voltage being supplied to the detector and instrument circuitry for proper operation.

5.1.3.2 Perform this check in accordance with the instrument's technical manual; although, it is generally performed as follows:

5.1.3.2.1 Position the appropriate selector switch to the "Batt" position or depress the "Batt Check" button with the instrument on.

5.1.3.2.2 Observe the indication for the current battery condition. Typically, the current battery condition will be indicated by a meter deflection into the "Batt OK" region or "Batt OK" on the display, etc.

5.1.3.2.3 If unsatisfactory results are obtained, refer to the technical manual for replacement of the batteries and repeat the check. The instrument shall display a satisfactory battery check prior to use.

5.1.4 High Voltage (HV) Check

5.1.4.1 HV is adjusted appropriately during instrument calibration and does not require adjustment for normal operation.

5.1.4.2 A HV check is required prior to each use as applicable in accordance with the instrument technical manual.

5.1.4.3 An instrument with suspected HV problems shall be reported to the Project Manager and RSO.

5.1.5 Instrument Source Check

This check is performed daily to verify that the instrument will respond accurately to a known source of radiation. Locate the source for the instrument/detector being used and perform the response source check as described in the following.

5.1.5.1 Determine the background radiation level. It must be low enough to allow a measurable response to the check source being used. Careful monitoring of changing background levels is necessary to obtain accurate instrument readings.

5.1.5.2 Check the battery condition. If batteries are not in the allowed range, replace the batteries or clean contacts as necessary. If battery check is not satisfactory after corrective actions, then place instrument out of service and send to an authorized calibration facility for repair and calibration.

5.1.5.3 Perform source checks with appropriate sources. For on-contact readings, verify that the source to probe geometry is reproducible, in direct contact, and facing the probe.

5.1.5.4 Record the source check results on the Radiological Instrument Daily Calibration Record, Attachment 1.

5.1.5.5 Instruments with source check responses that vary by more than 20% under identical conditions shall be removed from service and the Project Manager notified.

5.1.6 Daily Response Checks

This instrument check is performed to see if the instrument responds to a source of radiation. This is a qualitative check only.

5.1.6.1 Intermittent response checks of the count rate survey and radiation survey instruments shall be performed everyday if instrument is in use. Documentation of these response checks is not required.

5.1.6.2 Begin with the instrument on the highest range/scale and enable the audible device, if applicable.

5.1.6.3 Slowly move the detector towards the check source and observe for an increase in audible and/or visual response.

5.1.6.4 Change the range/scale of the instrument as appropriate to obtain a readable indication and to check each of the meter ranges/scales possible. If an appreciable response can not be obtained, even in the lowest range, evaluate instrument performance by comparison to previous source check data for the instrument.

5.1.7 Should the response check be unsatisfactory, the instrument shall be removed from service. Record this on the instrument check form, Attachment 1. Send the instrument to an authorized calibration facility for repair and calibration.

5.1.8 When an instrument has reached its calibration due date, the instrument shall be sent to an authorized calibration facility.

5.2 Using Exposure Rate Instruments (survey instruments that read in R/hr, mR/hr, or μR/hr)

5.2.1 General Area Surveys

Hold the detector at waist level with the most sensitive areas of the detector facing the item or areas being surveyed. Unless the radiation level on the item being surveyed is known, start on the high scale and work down scale until the instrument reading is between 1/4 and 3/4 (mid scale) scale, if possible.

5.2.2 Direct Surveys

Hold the detector at about one inch from the surface of the item being surveyed.

5.3 Using Beta-Gamma Friskers

5.3.1 Counting Smears and Air Sample Filters

Hold the detector no further than 1/2 inch from the smear or filter. Count the smear for a minimum of five seconds, or if positive indication is noted, count for at least 15 seconds or until the meter indication stabilizes.

5.3.2 Frisking

Hold the detector within 1/2 inch of the surface being frisked. Move the detector no faster than two inches per second. Stop when positive indication is noted from audio response, allow meter indication to stabilize and record that value. The background for release of materials/equipment should be 100 cpm or less.

5.4 Using Alpha Survey Meters

Hold the detector within 1/4 inch of the surface being surveyed. Move the detector no faster than two inches per second. Stop when positive indication is noted and allow meter indication to stabilize; record that value.

5.5 Instruments requiring calibration or repair at an off-site facility, as determined in Section 5.1, are treated as follows.

5.5.1 Remove the instrument from service and record information on instrument check form. In addition, fill out the appropriate information in the Out of Service Tracking Log, Attachment 2.

5.5.2 Instruments with delicate probe windows should have a probe cover secured to prevent damage. Any special instructions should be included with the instrument.

5.5.3 Carefully package the instrument and ship to the calibration facility.

5.6 Receipt of Repaired/Calibrated Instrument

5.6.1 Perform a reference source check of the instrument using the appropriate source.

5.6.1.1 Record the reference source check on Attachment 1.

5.6.1.2 Verify instrument has the correct calibration due date on the calibration sticker.

5.6.1.3 A new set of baseline dose rate/count rate numbers will be established for the instrument.

5.6.2 Place the date the instrument was returned to service in the Out of Service Tracking Log, Attachment 2.

5.7 Calibration

Instruments used for monitoring and contamination control shall be:

- Periodically maintained and calibrated on an established frequency of at least once per year;
- Appropriate for the type(s), levels, and energies of the radiation(s) encountered;
- Appropriate for existing environmental conditions; and
- Routinely tested for operability.

5.7.1 Radiological instruments shall be used only to measure the radiation for which their calibrations are valid.

5.7.2 The ANSI N323 method for radiological instrumentation calibration will be adhered to.

5.7.3 Calibrations shall use National Institute of Standards and Technology (NIST) traceable sources.

5.7.4 Calibration procedures shall be developed for each radiological instrument type and should include frequency of calibration, precalibration requirements, and primary calibration requirements, periodic performance test requirements, calibration record requirements and maintenance requirements.

5.7.5 Pocket and electronic dosimeters and area radiation monitors should be calibrated at least annually.

5.7.6 The effects of environmental conditions, including interfering radiation has on an instrument shall be known prior to use.

5.7.7 Functional tests should be used to assess the instrumentation’s features.

5.7.8 In unusual and limited situations it may be necessary to use an instrument in an application other than that envisioned by the manufacturer.

5.7.9 Special calibrations should be performed for use of instrumentation outside manufacturer's specifications.

5.7.10 The instrument should be adjusted, calibrated and labeled to identify the special conditions and used only under the special conditions for which it was calibrated.

5.7.11 Instruments should bear a label or tag with the date of calibration and date calibration expires.

5.7.12 A properly authorized company such as Ludlum or Suntrac Services will calibrate instruments, at least once per year or in accordance with manufacturer recommendations.

6.0 ACTION LEVELS

6.1 Readings that deviate more than ± 20% from reference source check readings obtained at the time the instrument was first calibrated require instrument re-calibration.

6.2 Unsatisfactory response battery check.

6.3 Unsatisfactory operation of instrument.

7.0 RECORDS

7.1 Radiological Instrument Daily Calibration Record, Attachment 1.

7.2 Out of Service Tracking Log, Attachment 2.

8.0 REFERENCES

8.1 Instrument Technical Manuals

8.2 Knoll, Glenn F., *Radiation Detection and Measurement*, 2nd Edition. John Wiley and Sons, lnc., 1979.

8.3 *Multi-Agency Radiation and Site Investigation Manual (MARSSIM),* NUREG-1575, Revision 1, Aug 2000.

ATTACHMENT 1

Radiological Instrument Daily Calibration Data

INSTRUMENT:______________________________ **SERIAL NO.:**________________________

CALIBRATION DUE DATE:_________________

DETECTOR:________________________________ **SERIAL NO.:**________________________

SOURCE CHECK MATERIAL:________________ **SERIAL NO.:**________________________

COUNT TIME:______________________________

VOLTAGE SETTING:________________________ **BATTERY CHECK:**_________________

Pre-Calibration

cpm	Average cpm	± 20% (avg. µR/hr)	Date	Initials
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Post-Calibration

cpm	Average cpm	± 20% (avg. µR/hr)	Date	Initials
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Reviewed By:____

ATTACHMENT 2

OUT OF SERVICE TRACKING LOG

Instrument [1]	Serial # [2]	Calibration Due Date [3]	Out of Service Date [4]	Remarks [5]	Returned to Service Date [6]

1. Instrument type
2. Instrument serial number
3. Calibration due date
4. Date removed from service
5. Reason instrument removed from service
6. Date instrument returned from service

Reviewed By:________________________________

Earth Tech **Standard Operating Procedure**	PROCEDURE NO. SARSG, SOP 002 DATE: June 28, 2002
Swipe Counter	APPROVED: ____________________ SARSG Leader

The San Antonio Radiological Services Group (SARSG) is responsible for the issuance, revision, and maintenance of this policy. Any deviations from the procedures set forth in this policy require approval of the SARSG Leader. This SOP supersedes SARSG SOP 002, February 9, 2001.

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes requirements for the operation of swipe counter instruments. Specific instructions for individual swipe counters may be found in the manufacturers instruction manual.

2.0 SCOPE

This procedure identifies a proper methodology for the operation of the swipe counter instruments. It is applicable to SARSG operations and provides guidelines that should be used by sub-contractor personnel.

3.0 EQUIPMENT

3.1. Swipe counter and gas flow proportional detector, or other appropriate detectors.

3.2. Check sources.

4.0 PRECAUTIONS

4.1. Check that all settings on the Hand$_E$Count are correct for the type of operation being performed. Failure to check these settings could result in improper operation.

4.2. Loose radioactive contamination on samples may contaminate holder and detector.

4.3. Use protective gloves and tweezers when handling radioactive samples.

4.4. High voltage is used to power detectors.

5.0 PROCEDURES

5.1. Pre Operational Requirements

Prior to using swipe counters and detectors, the following inspections/operational verifications are performed:

5.1.1. Calibration Verification

5.1.1.1. Radiological instruments shall have a current calibration label.

5.1.1.2. A source check shall be performed prior to use each day.

5.1.1.3. Document source check in the projects field log book or on a separate check sheet.

5.1.2. Physical Check

5.1.2.1. Inspect the general physical condition of the instrument and detector prior to each use.

5.1.2.2. Inspect for loose or damaged knobs, buttons, cables, connectors; broken/damaged meter movements/displays; dented or corroded instrument cases; punctured/deformed probe/probe window(s), cables; and any other physical impairments that may affect the proper operation of the instrument or detector.

5.1.2.3. Any instrument or detector having a questionable physical condition shall not be used until the discrepancy is corrected.

5.1.2.4. Document check in field logbook or on a separate check sheet. If discrepancy noted, discuss problem and resolution prior to use.

5.1.3. Battery Check (if applicable)

5.1.3.1. Perform this check in accordance with the instrument's technical manual; it is generally performed as follows:

5.1.3.2. Position the appropriate selector switch to the "Batt" position or depress the "Batt Check" button with the instrument on.

5.1.3.3. Observe the indication for the current battery condition. Typically, the current battery condition will be indicated by a meter deflection into the *Batt OK" region or "Batt OK" on the display, etc.

5.1.3.4. If unsatisfactory results are obtained, refer to the technical manual for replacement of the batteries and repeat the check. The instrument shall display a satisfactory battery check prior to use.

5.1.3.5. Document check in field logbook or on a separate check sheet. If discrepancy noted, discuss problem and resolution prior to use.

5.1.4. High Voltage Check (HV)

5.1.4.1. The HV is adjusted appropriately during instrument calibration and does not require adjustment for normal operation.

5.1.4.2. An HV check shall be performed prior to each use in accordance with the instrument technical manual.

5.1.4.3. An instrument with suspected HV problems shall be reported to the project on-site manager.

5.1.4.4. Document check in field logbook or on a separate check sheet. If discrepancy noted, discuss problem and resolution prior to use.

5.2. Daily Scaler Set Up

5.2.1. Turn on scaler and select a 20-minute count time.

5.2.2. Perform the background measurement and record total counts measured and background cpm on the Scaler Daily Log Sheet, Attachment 4.

Note: If single count C_b (cpm) has exceeded the high limit or is below the low limit, inform the project or on-site manager.

5.2.3. Perform a one-minute source check with the source used in the initial efficiency determination.

5.2.4. Record gross counts (cpm) C_g and net counts (cpm) C_g-C_b on the Scaler Daily Log Sheet, Attachment 4.

Note: If C_g-C_b has exceeded the source check high limit or the source check low limit, inform the project or on-site manager.

5.2.5. Estimated Minimum Detectable Activity (MDA)

5.2.5.1. The estimated minimum detectable activity is determined to verify that the detector being used will detect the presence of activity at or above the allowable limit under a given set of counting conditions. MDA is based on the estimated Minimum Detectable Counts (MDC) and detector efficiency. Determine the estimated MDC and MDA as follows:

5.2.5.2. Calculate the estimated MDC:

$$MDC = 4.65\sqrt{\frac{C_b}{t_b} + \frac{C_b}{t_s}}$$

Where: 4.65 = derived constant based on the 95% confidence

C_b = background count

t_b = background count time

t_s = sample count time (1 min swipes) (cpm)

5.2.5.3. Record the calculated MDC on the Scaler Daily Log, Attachment 4

5.2.5.4. Calculate the estimated minimum detectable activity (MDA).

$$MDA = \frac{MDC}{E}$$

Where:E = detector efficiency.

5.2.5.5. Record the calculated MDA (dpm) on the Scaler Daily Log, Attachment 4.

Note: If the calculated MDA is greater than the permissible limit, inspect for equipment problems (contaminated detector or sample holder, loose cables/connectors, etc.) and notify the project or on-site manager. If no equipment problems are found, parameters such as sample quantity, count time, or background radiation levels may have to be adjusted appropriately to obtain an acceptable MDA. If reasonable adjustment (as directed by the project or on-site manager) of these parameters does not result in an acceptable MDA, a more suitable instrument/detector will be required.

5.2.6. Control charts should be used to monitor for shifts, trends, or increases in variability. They are used as guides to indicate the need for investigative action, rather than for evaluating precise values.

5.2.6.1. The cpm for each background check should be plotted on a control chart with high and low limits.

5.2.6.2. The net cpm for each source check should be plotted on a control chart with high and low limits.

5.3 Background Measurement (Initial set up)

5.3.1 Verify the sample holder tray is empty and clean. The detector/sample holder geometry should be set up in the same configuration as that to be used when counting samples to produce the most accurate results.

5.3.2 Perform the background measurement for one minute and record the total counts measured (C_b) on the Scaler Instrumentation Background Setup Sheet, Attachment 1.

5.3.3 Repeat the background measurement 9 times, for a total of ten measurements. Record the total counts observed (C_b) for each measurement on the Scaler Instrumentation Background Setup Sheet, Attachment 1.

5.3.4 Calculate the average background counts ($\overline{C}_b$), the standard deviation (SD_b) and average background count rate ($\dot{C}$):

$$\overline{C}_b = \frac{\Sigma_i^n C_i}{N}$$

$$SD_b = \sqrt{\frac{\Sigma_i^n (C_i - \overline{C}_b)^2}{N - 1}}$$

$$\dot{C}_b = \frac{\overline{C}_b}{t_b}$$

where:

where:	$\overline{C}_b$	= average background count
	SD_b	= standard deviation of the average background
	N	= number of measurements
	Σ	= summation
	C_i	= C_1 through C_n (C_{10} if 10 measurements are made)
	$\dot{C}_b$	= average net background count rate
	t_b	= time in minutes of a background count

5.3.5 Record the average background counts ($\overline{C}_b$), the standard deviation (SD_b), and the average background count rate ($\dot{C}_b$) on the Scaler Instrumentation Background Setup Sheet, Attachment 1.

5.3.6 Calculate the limits for background and record on Attachment 2, Scaler Instrumentation Efficiency Sheet.

High limit $\dot{C}_b + 2SD_b + 1$

Low limit $\dot{C}_b$ - 2 SD_b (if less than 0, record 0)

5.4 Instrument Efficiency (E)

Efficiency is a quantitative measure of detector performance for a particular radioisotope. It provides the necessary relationship between counts per minute (cpm) as seen by the detector and disintegrations per minute (dpm) from source decay. Determine detector efficiency with a source of known activity of the nuclide (or of a nuclide with similar energy decay products) being monitored for as follows:

5.4.1 Correct source activity for decay as follows: (if necessary)

$$A = A_o e^{-\lambda T} \qquad \textit{Where: } \lambda = \frac{0.693}{t_{1/2}}$$

where: A = present source activity.

A_o = source activity at initial assay.

λ = decay constant for the source isotope.

T = time elapsed since initial source assay*

$t_{1/2}$ = source isotope half-life

*Time units must be consistent (days, hrs., or min., etc.)

5.4.2 Correct the source activity for backscatter: (if necessary)

$$A_c = A(1+B_s)$$

where: A_c = corrected activity (dpm)

A = present source activity.

B_s = percent backscatter (expressed as a decimal, i.e., 50% = 0.50 taken from source calibration sheet); $(1+B_s)$ can be found on page 127 of the Radiological Health Handbook.

5.4.3 Determine expiration date of source check limits by adding to the current date the value derived from dividing the $t_{1/2}$ of the source by 15. The limits will need to be recalculated in accordance with this section (5.4) after the expiration date.

Current date + ($t_{1/2}$)/15 (of source) = Expiration date

If this date is later than the calibration due date record calibration due date as expiration date.

5.4.4 Count the source for one minute. Count the source ten times and calculate the standard deviation (SD_n):

$$SD_g = \frac{\sqrt{\sum_i^{10}(C_i - \overline{C}_g)^2}}{N-1} = \sqrt{\frac{SS}{N-1}}$$

where: SS = sum of squares

$$SD_n = \sqrt{(SD_g)^2 + (SD_b)^2}$$

C_i = gross counts (source counts including background for a single count)
Σ = summation
N = number of measurements
SD_n = standard deviation of the average net counts.
SD_g = standard deviation of the average gross counts
SD_b = standard deviation of the average background counts (obtained from section 5.3)

Record the ten gross counts (C_g) and the standard deviations (SD_n and SD_g) on the Scaler Instrumentation Efficiency Sheet, Attachment 2

5.4.5 Calculate the net count rate ($\dot{C}_n$):

$$\dot{C}_g = \frac{\overline{C}}{t_g} \qquad \dot{C}_n = \dot{C}_g - \dot{C}_b$$

where:
$\dot{C}_g$ = average gross count rate
$\overline{C}_g$ = average gross counts
t_g = time in minutes of a source count
C_b = average background count rate (obtain from Section 5.3)

Record on Attachment 2

5.4.6 Calculate the detector efficiency (E) as follows:

$$E = \frac{\dot{C}_n}{A_c} = \frac{cpm}{dpm}$$

where: $\dot{C}_n$ = average net cpm

A_c = corrected activity (dpm).

Record on Attachment 2

5.4.7 Calculate the limits for source checks and record on Attachment 2

High limit $\dot{C}_n + 2\ SD_n$

Low limit $\dot{C}_n - 2\ SD_n$

5.5 Instrument/Detector Reliability Factor (R.F.)

5.5.1 Determination of the reliability factor will indicate if the instrument/detector is operating properly within the statistical limits of counter reliability. The reliability factor shall be determined at the initial set up of the counting system. In addition, R.F. determination will be performed following any equipment modification, replacement (i.e., new detector, cables, calibration, etc.) or whenever there is a noticeable degradation of instrument/detector performance (e.g., decreasing efficiency, erratic results, etc.). Determine the reliability factor as follows.

5.5.2 Perform ten 1-minute counts using a source of the correct size, type, and known activity. Record the total counts for each measurement (C_1 through C_{10}) on the Scaler Instrumentation Reliability Factor Sheet, Attachment 3.

Note: When using certain instruments (e.g., ESP-1/ESP-2), depending on the source strength, increasing the distance between the detector and source may be required to obtain a satisfactory R.F. This becomes evident when source radiation strength results in counts above 1,000. These instruments round off their indication to the nearest power of 10 above 1,000 counts.

5.5.3 Calculate the average ($\overline{C}$) of the ten 1-minute counts and record on the Scaler Instrumentation Reliability Factor Sheet, Attachment 3.

$$\overline{C} = \frac{(C_1 + C_2 + \ldots . C_{10})}{10}$$

5.5.4 Calculate the sum of the differences squared (SS)

$$SS = (C_1 - \overline{C})^2 + (C_2 - \overline{C})^2 + \ldots (C_{10} - \overline{C})^2$$

Subtract the average value from each of the ten measurements and square each difference. Add the ten resulting values as SS and record on the Scaler Instrumentation Reliability Factor Sheet, Attachment 3.

5.5.5 Calculate the Observed Standard Deviation (S_n):

$$S_n = \sqrt{\frac{SS}{N - 1}}$$

where: SS = sum of the squares

N = number of observations (10).

Record S_n on the Scaler Instrumentation Reliability Factor Sheet, Attachment 3.

5.5.6 Calculate the Theoretical Standard Deviation (σ_n)

$$\dot{C} = \frac{\overline{C}}{t} \qquad \sigma_n = \sqrt{\overline{C}}$$

where: $\overline{C}$ = average source count

t = count time in minutes

$\dot{C}$ = average source count rate (cpm).

5.5.7 Calculate the resulting Reliability Factor (R.F.):

$$R.F. = \frac{S_n}{\sigma_n} = \frac{S_n}{\sqrt{\overline{C}}}$$

where: S_n = observed standard deviation

σ_n = theoretical standard deviation.

5.5.8 Record the R.F. on the Scaler Instrumentation Reliability Factor Sheet, Attachment 3.

5.5.9 R.F. should be between 0.64 and 1.22 when calculated. This indicates the instrument/detector is operating reliably. The Radiation Safety Officer shall investigate an R.F. that falls between 0.50 and 0.64 or 1.22 and 1.40. An R.F. less than 0.50 or greater than 1.40 is unsatisfactory.

5.6 High Voltage Plateau (HVP)

The high voltage plateau is performed during instrument calibration and should not be required under normal conditions. However, following equipment modification, replacement (i.e., new detector, power supply, etc.) or whenever there is a noticeable degradation of instrument/detector performance (e.g., decreasing efficiency, erratic results, etc.) an HVP shall be performed. Unless a more specific procedure is in the Manufacturer's Technical Manual, the following general procedure shall be used to determine the HVP. Plot and record the HVP data on the High Voltage Plateau Data Sheet, Attachment 5 and graph.

5.6.1 Check to see that the power switch to the system is off and that the high voltage controls are set to zero or the lowest setting.

5.6.2 Turn the main power and HV switches ON.

5.6.3 Insert an appropriate alpha, beta, or gamma source in the sample counting position.

5.6.4 Set the timer to ten minutes and slowly increase the HV potentiometer until counts register on the scaler. This is the counting threshold.

5.6.5 Starting at the nearest even voltage increment mark, above the counting threshold, take 1 - 2 minute counts every 50 - 100 volt increments until the count rate starts to increase again.

5.6.6 For each data point plot, on graph paper, total counts (or count rate) versus HV setting to determine the HVP. Draw a smooth curve through the data points. A region should be reached that results in very little change in count rate with each successive change in HV. This is the HVP.

5.6.7 Repeat the above procedure without a source in the sample holder. Plot the data on the same graph paper that the source data was plotted on.

5.6.8 The operating HV should be chosen to be the mid-range of the source plateau, but not on the exponentially increasing part of the background curve. The operating HV is chosen to optimize MDA, efficiency, and stability.

5.6.9 Perform the HV check in accordance with Section 5.1.4.

5.7 Counting with Scaler Instruments

The scaler instruments may be used for a variety of different sample media.

5.7.1 Loose Contamination (Swipe) Samples.

Swipe samples may be counted for alpha and beta-gamma activity for a one-minute count.

5.7.2 Calculate activity as follows:

$$DPM = \frac{CPM\ corrected\ *}{efficiency}$$

*CPM corrected = CPM sample - CPM Background

Example: A swipe is counted on a probe with 10% efficiency (in cpm/dpm) and results in 10 counts per minute above background:

$$DPM = \frac{10\ CCPM}{0.10} = 100\ DPM$$

5.7.3 Information shall be recorded on a miscellaneous survey form.

6.0 ACTION LEVELS

In reviewing the instrument/detector performance records, the project manager and/or on-site manger should be notified when the following observations indicate detection problems.

6.1. Background drift in a continuous direction either up or down.

6.2. Alpha background greater than 0.5 counts per minute.

6.3. A calculated MDA 50% in excess of limits.

6.4. An instrument does not zero.

6.5. Battery check that does not respond.

6.6. Reliability factors greater than 1.40 or less than 0.50.

6.7. Failure to indicate response on scaler during a response check.

7.0 RECORDS

7.1. Scaler Instrumentation Background Set-up Sheet, Attachment 1.

7.2. Scaler Instrumentation Efficiency Sheet, Attachment 2.

7.3. Scaler Instrumentation Reliability Factor Check Sheet, Attachment 3.

7.4. Scaler Daily Log Sheet, Attachment 4.

7.5. High Voltage Plateau Data Sheet, Attachment 5.

8.0 REFERENCES

8.1 Nuclear Radiation Detection, second edition, McGraw-Hill Book Company: New York, New York, 1964.

8.2 Technical manuals

ATTACHMENT 1
SCALER INSTRUMENTATION BACKGROUND SET-UP SHEET

Model ____________________________ Date/Time___

____

Serial ____________________________ Technician________________________________

Probe Type/# ________________________

1. Determination of Background Deviation:

   Record Ten - 1 min. background counts: C_b

   1.___________
   2.___________
   3.___________
   4.___________
   5.___________
   6.___________
   7.___________
   8.___________
   9.___________
   10.__________

2. Sum 1 → 10 ______

3. Average background count. $(\overline{C}_b)$ $= Sum / 10 =$ _______

4. Calculate SD_b (Use of hand-held calculator with SD capability is advised)

$$SD_b = \sqrt{\frac{\sum_C^N \left(C_i - \overline{C}_b\right)^2}{N-1}} = \sqrt{\frac{\sum_i^N \left(C_i - \overline{C}_b\right)^2}{10-1}} = \_\_\_\_\_\_\_\_\_\_\_\_$$

5. Calculate background high limit

$$\left(\overline{C_b}\right) + 2\left(SD_b\right) + 1 = \_\_\_\_\_\_\_\_\_\_\_ \text{ cpm}$$

6. Calculate background low limit (of negative, record zero)

$$\left(\overline{C_b}\right) - 2\left(SD_b\right) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \text{ cpm}$$

ATTACHMENT 2
SCALER INSTRUMENT EFFICIENCY SHEET

Model ____________________________ Date/Time___

____

Serial ____________________________ Technician________________________________

Probe Type/# ______________________

Determine expiration date of source check limits

Current date + (t1/2 of source)/15 = Expiration date

___________ + _____________ = _____

2. Determination of instrument efficiency (E):

a. Record ten 1 min. source counts: Cg	b. Subtract the average counts: $-\overline{C}g$	c. Square the difference: $(Cg - \overline{C}g)^2$
1._______	_______	_______
2._______	_______	_______
3._______	_______	_______
4._______	_______	_______
5._______	_______	_______
6._______	_______	_______
7._______	_______	_______
8._______	_______	_______
9._______	_______	_______
10.______	_______	_______

3. _______(sum)/10=______avg.($\overline{C}g$) _______(sum=SS)

4. Solve for Observed Standard Deviation: (SD)

$$SD_g = \frac{\sqrt{\sum_i^{10} (C_i - \overline{C}_g)^2}}{N-1} = \sqrt{\frac{SS}{10-1}} = \sqrt{\frac{SS}{9}}$$

$$SD_n = \sqrt{(SD_g)^2 + (SD_b)^2}$$

5. Calculate the Net Count Rate

$$\dot{C}g = \frac{\overline{C}}{tg} \qquad \dot{C}n = \dot{C}g - \dot{C}b = \_\_\_\_\_\_\_ \text{CPM}$$

6. Solve for Efficiency:

$$E = \frac{\dot{C}_n}{A_c} = \frac{cpm}{dpm}$$

7. Calculate Source Check Limits:

Source high limit Source low limit

$\dot{C}n + 2(SD_n)$ = ________ $\dot{C}n - 2(SD_n)$ = ________

ATTACHMENT 3

SCALER INSTRUMENT RELIABILITY FACTOR (R.F.) SHEET

Model ______________________ Date/Time___________________
Serial ______________________
Probe Type/# ______________________ Technician___________________

Determination of Instrument Reliability Factor (R.F.):

a. Record ten 1 min. source counts: C	b. Subtract the average counts: -C	c. Square the difference: $(C- C)^2$
1._______	_______	_______
2._______	_______	_______
3._______	_______	_______
4._______	_______	_______
5._______	_______	_______
6._______	_______	_______
7._______	_______	_______
8._______	_______	_______
9._______	_______	_______
10.______	_______	_______

2. _______(sum)/10=______avg.($\overline{C}$) _______(sum=SS)

3. Calculate Observed Standard Deviation: (SDn)

$$S_n = \sqrt{\frac{SS}{N-1}} = \sqrt{\frac{SS}{9}}$$

where: SS = sum of the squares

N = number of observations (10).

4. Calculate Reliability Factor (R.F.)

$$R.F. = \frac{S_n}{\sigma_n} = \frac{S_n}{\sqrt{\overline{C}}} = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_$$

where: S_n = observed standard deviation

σ_n = theoretical standard deviation.

ATTACHMENT 4

SCALER DAILY LOG SHEET

ALPHA
Model________________ Calibrated_________________ Min Source (NCPM) _________________ Bkg Min (CPM) _________________
Serial_________________ Cal Due._________________ Max Source (NCPM) _________________ Bkg Max (CPM) _________________
Probe Type/#___________ Efficiency_________________ Source Limits Due____________________

Date	Time	Background Count Min	Gross Bkg Counts	C_b Bkg cpm	Cg Source cpm	C_g-C_b Source NCPM	MDC* cpm	MDA* dpm	Technician

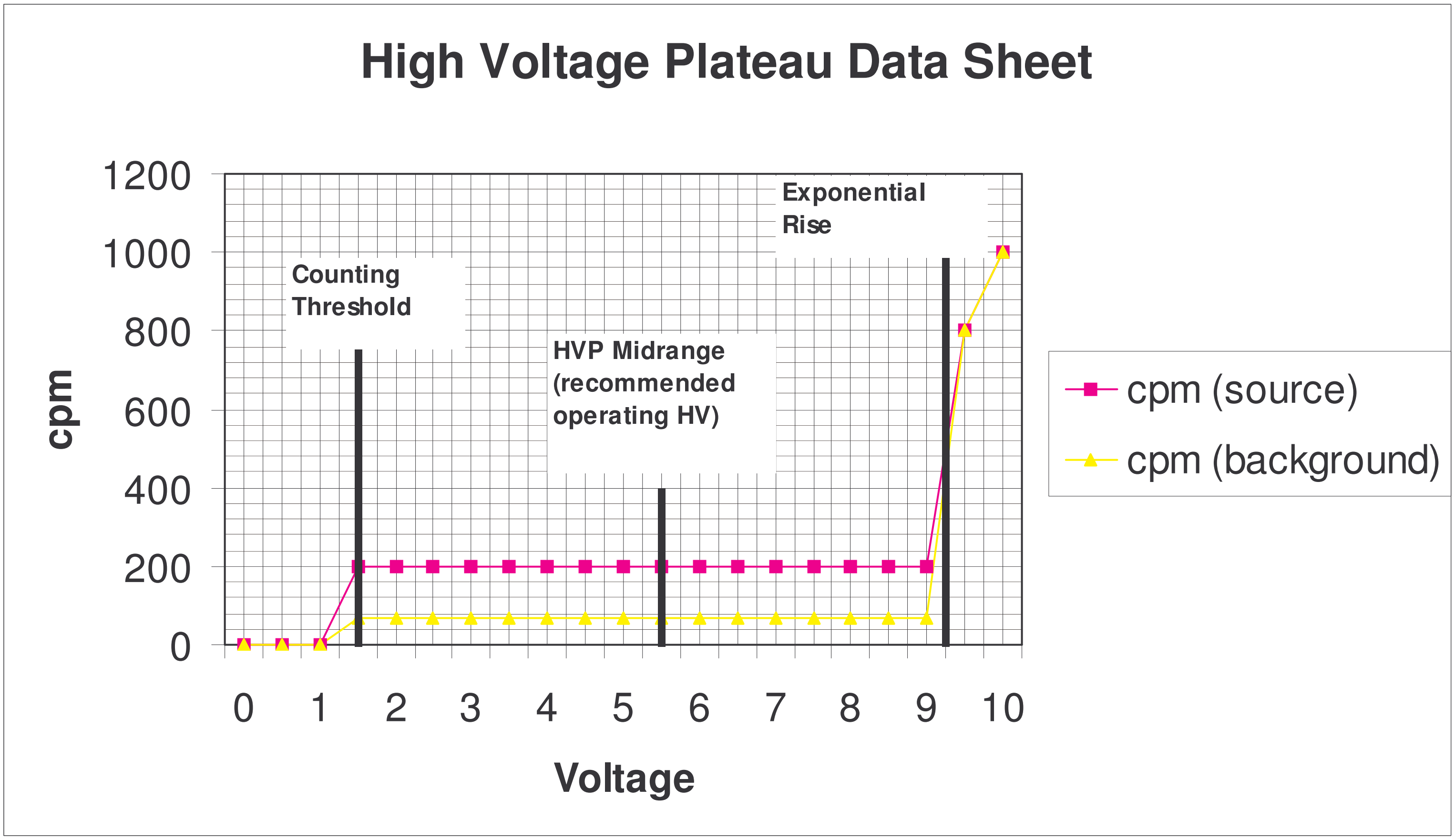
*for 1-minute sample count time

BETA/GAMMA
Model________________ Calibrated_________________ Min Source (NCPM) _________________ Bkg Min (CPM) _________________
Serial_________________ Cal Due. _________________ Max Source (NCPM) _________________ Bkg Max (CPM) _________________
Probe Type/#___________ Efficiency_________________ Source Limits Due _________________

Date	Time	Background Count Min	Gross Bkg Counts	Cb Bkg cpm	Cg Source cpm	C_g-C_b Source NCPM	MDC* cpm	MDA* dpm	Technician

*for 1-minute sample count time

ATTACHMENT 5
HIGH VOLTAGE PLATEAU DATA SHEET



Earth Tech **Standard Operating Procedure**	PROCEDURE NO. SARSG, SOP 004 DATE: October 8, 2001
Equipment Decontamination	APPROVED: ______________________ SARSG Leader

The San Antonio Radiological Services Group (SARSG) is responsible for the issuance, revision, and maintenance of this policy. SARSG radiological protection procedures are designed to minimize the items that need to be decontaminated by only using the minimum items inside the radioactive control space. Any deviations from the procedures set forth in this policy require approval of the SARSG Leader. This SOP supersedes all previous SOPs on this topic.

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish the requirements for the decontamination of equipment, material, and tools that become contaminated with radioactive material.

2.0 SCOPE

This SOP identifies a decontamination methodology for equipment, materials and tools, and provides general decontamination techniques to be utilized by field personnel for all decontamination operations. This procedure applies to all employees involved in decontamination processes.

NOTE: Personnel decontamination is not covered in this SOP but shall be covered in project/task health and safety plans.

3.0 DEFINITIONS

3.1. Survey Area – Area where radioactive materials or contamination are or may be present. Survey areas include areas where samples or smears, potentially containing radiological material, are being screened.

3.2. Decontamination – The process whereby contamination can be safely and effectively removed from equipment, tools, and materials.

3.3. MSDS – Material Safety Data Sheet; manufacturer directions, safety information, and limitations for use of decontamination related solvents or cleaning solutions.

3.4. Radiation Work Permit (RWP) – A document approved by the Radiation Safety Officer (RSO). See SARSG SOP 020, Site Ionizing Radioactive Protection Plan for further information.

4.0 GENERAL REQUIREMENTS AND LIMITATIONS

4.1. Only qualified and trained personnel shall be allowed to decontaminate equipment.

4.2. All decontamination procedures shall be performed under the direction of the Project RSO.

4.3. Decontamination activities shall be performed within a designated area.

4.4. Controls to contain the spread of loose contamination during the decontamination activity shall be determined prior to the start of decontamination operations.

4.5. Personal protective clothing worn by the personnel involved in decontamination activities shall be determined by the RSO and delineated in the RWP.

4.6. Decontamination solvents/solutions shall only be used in accordance with the directions and limitations listed on the manufacturer supplied MSDS. Solvents/solutions requiring a pH adjustment shall be modified prior to use.

4.7. Every effort shall be made to avoid recontamination of clean equipment and materials. Contamination controls shall always be observed throughout each decontamination operation.

5.0 RESPONSIBILITIES

5.1. Radiation Safety Officer (RSO)

5.1.1. Responsible for training the Health Physics Technicians in these procedures.

5.1.2. Establishing personal protective equipment requirements for performing the decontamination activities.

5.1.3. Approving RWPs.

5.2. Health Physics Technicians

5.2.1. Responsible for performing decontamination in accordance with this procedure and applicable training.

5.2.2. Reporting unsafe or unusual conditions to the Site Safety Officer (SSO)/RSO.

6.0 PROCEDURES

6.1. General

6.1.1 A radiological survey shall be performed on all equipment and materials, which are to be removed from the Radiation Control Area (RCA) that may be contaminated.

6.1.2 If a survey indicates that decontamination is required, the item shall be completely decontaminated prior to release from the RCA.

6.2. Establishing a Decontamination Area

6.2.1. The RSO and Health Physics Technicians shall determine a location for establishing the decontamination area.

6.2.2. The following materials may be required for decontamination:

- Safe, sturdy work stations with contamination resistant surfaces;
- Adequate supply of approved cleaning solutions and solvents;
- Light duty decontamination equipment such as paper wipes, paper towels, etc.;
- Medium duty decontamination equipment such as scrub pads, wire brushes, steel wool, files, sandpaper, etc.;
- Radioactive material storage bags, stickers, etc.;
- Buckets, barrels or drums for the storage of contaminated liquids, sludge or slurries, if applicable;
- Blotter paper or absorbent material such as oil dry;
- Storage drums/bags for the storage of contaminated protective clothing;
- Adequate supply of personal protective clothing;
- Step-off pad or double step-off pad in accordance with the provisions of the RWP;
- A designated area within the decontamination area for the segregation and monitoring of radioactive waste.
- Plastic drop cloth (3-6 mil)

6.2.3. Once the decontamination area has been established and stocked for operation, the bagged or wrapped contaminated equipment can be placed in the decontamination work area.

6.3. Decontamination

6.3.1. The preparation for decontaminating a particular tool, material, or piece of equipment should consider the following:

An item that is highly contaminated with removable contamination should be misted with an approved liquid. The water vapor will wet down the particulate contamination and help prevent the possibility of airborne contamination. Caution: Do not over wet the item to the point where the liquid drips from the item to be decontaminated.

6.3.2. General decontamination:

6.3.2.1. Any contaminated equipment with inaccessible areas shall be dismantled so that all surfaces are accessible for decontamination and for survey.

6.3.2.2. Decontamination shall be performed in a safe, effective manner.

6.3.3. Considerations for decontaminating items with removable contamination.

6.3.3.1. Moisten the surface of the item with an approved liquid

6.3.3.2. Fold a paper or cloth wipe into sections, using one surface of the wipe; gently wipe contamination off in ONE direction AWAY from the body to reduce the possibility of personnel contamination.

6.3.3.3. Re-fold the paper or cloth wipe so that a CLEAN surface is available (this should prevent cross-contamination) and continue until the item is ready for survey.

6.3.3.4. For some materials, duct tape will effectively remove contamination. Wrap the duct tape loosely around the gloved hand, ADHESIVE side OUT. Roll the tape over the contaminated area.

6.3.4. Considerations for abrasive hand decontamination techniques.

6.3.4.1. Remove as much removable contamination as possible.

6.3.4.2. Moisten the surface of the item to be decontaminated.

6.3.4.3. Use an abrasive cleaning tool (e.g. sandpaper, steel wool, steel brush, etc.) to loosen fixed contamination. Clean in one direction ONLY and clean AWAY from the body to prevent personnel contamination.

6.3.4.4. Continue to moisten the surface of the items to contain contamination.

6.3.4.5. Periodically remove as much removable contamination as possible.

6.3.4.6. Survey the surface to determine the effectiveness of the decontamination process.

6.3.4.7. Continue abrasive process until the item is decontaminated or three abrasive cycles have been attempted.

6.3.5. Items are to be scanned for radioactive contamination. If the readings are below the baseline survey for the item, the item is considered to be decontaminated.

6.3.6. If contamination remains after attempting to decontaminate the item, contact the Project RSO for further direction.

6.3.7. Items that cannot be effectively or economically decontaminated will either be managed as radiological waste or sent to a decontamination vendor.

6.3.8. After all decontamination operations have been completed, survey the decontamination area to ensure that no residual contamination remains.

6.4. Personnel Decontamination. Personnel decontamination methods shall be addressed in the Project/Task-Specific Health and Safety Plan

NOTE: NO WOUND SHALL BE DECONTAMINATED IN THE FIELD. MEDICAL ATTENTION MUST BE OBTAINED FOR DECONTAMINATING WOUNDS.

7.0 **RECORDS.** Record all decontamination operations into the field logbook.

EARTH TECH **Standard Operating Procedure**	PROCEDURE NO. SARSG SOP 005 DATE November 28, 2001 APPROVED ______________________ SARSG Leader
Documentation Control	

Standard Operating Procedure

DOCUMENTATION CONTROL

The San Antonio Radiological Services Group (SARSG) is responsible for the issuance, revision, and maintenance of this policy. Any deviations from the procedures set forth in this policy require approval of the SARSG Leader. This SOP supersedes SOP 005, August 7, 2001.

1 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to maintain proper control of information such as operational procedures, project reports, dose records, medical information, training records, and any additional records that may be required to demonstrate compliance with TDH license conditions. It is to be used in conjunction with the SARSG Radiological Quality Assurance and Quality Control Program.

2 SCOPE

This procedure identifies document control methods associated with license requirements, projects, personnel, and equipment. Adherence to this procedure shall provide reasonable assurance that information will be retrievable. All personnel are responsible to use good judgement in document control.

3 RESPONSIBILITIES

3.1 Program Manager. The Program Manager is responsible for:

3.3.1 Providing equipment to enable compliance with this procedure.

3.3.2 Assigning qualified personnel to the project who are responsible for the tasks of producing, validating, transferring, or controlling information for the project and who are familiar with this procedure.

3.3.3 Training all personnel in the use of this procedure and allowing personnel access to a copy of this procedure.

3.2 Project Manager

The Project Manager (PM) is responsible for the collection of and the correct recording of the project documentation in accordance with the Project Work Plan. The PM is responsible for document control of all project related quality information throughout the complete project. This responsibility can be carried out through continuous evaluation of the project.

3.3 Radiation Safety Officer (RSO)

The RSO shall establish procedures to record and evaluate all radiation safety information and to verify that adequate documentation is maintained that support the Radiation Safety Program.

3.4 Quality Assurance Coordinator (QAC)

The QAC shall verify that documents are issued, maintained, stored, and transferred in accordance with this procedure. Any deviation from the requirements shall be reported immediately to the PM following the procedures delineated in the SARSG Quality Assurance/Quality Control Program.

3.5 Health Physics Technicians and Other Field Personnel

Health Physics Technicians and other field personnel shall record documentation neatly and in accordance with these and work plan procedures and requirements.

4 GENERAL REQUIREMENTS AND LIMITATIONS

4.1 Controlled Records

The following not all inclusive list of records shall be controlled:

4.1.1 Instrument Calibration Records

4.1.2 Instrument Source Check Records

4.1.3 Radiation Survey Forms

4.1.4 Medical Information

4.1.5 Training Records

4.1.6 Dosimetry Records

4.1.7 Project Field Logs

4.1.8 Project Reports

4.1.9 Radioactive Material Transportation Records

4.1.10 Radioactive Material Disposal Records

4.1.11 Radioactive Source Transfer Receipts

4.1.12 Sample Collection Forms

4.1.13 Sample Chain of Custody Records

4.1.14 Emergency Response Documentation

4.1.15 Document Distribution and Transmittal Forms

4.1.16 Respirator Issue Logs and History Records

4.1.17 Bioassay Records

4.1.18 Personnel and Equipment Contamination and Decontamination Reports

4.2 Quality Control

4.2.1 The project manager shall verify that quality records are accurate, neatly and properly prepared, properly maintained, and periodically reviewed during the project.

4.2.2 The project manager shall verify that all records are present at the end of the project and that records are safely maintained during transfer or shipment to the archival location.

4.2.3 The QAC or delegated representative shall assess the status of controlled documents, at least semi-annually, and document the findings to the program manager. Periodic no notice audits may be used in support of this program.

5 PROCEDURES

5.1 Records Preparations

Records shall be prepared in dark ink and shall be neat and easily readable. Pre-prepared forms shall be used when available to collect information such as survey data or instrument analysis results. When a procedure has not defined a form for a specific purpose, the project manager may authorize creation of the method of documentation.

5.2 Record Review

The PM shall review all controlled records. Full signature and date of review on the record shall document this review.

5.3 Record Correction

The document creator shall correct incorrect information in records if possible. In cases where the creator is not available, the project or site managers may make corrections.

Corrections shall be made by drawing a single line through the error and making the correction adjacent to the error. The line out shall be initialed and dated by the corrector.

5.4 Record Retention

Records shall be retained at the site for the duration of the project.

5.4.1 Upon return to the location of record management, the records shall be maintained so they are protected from loss or damage. Record storage shall be in accordance with federal regulations or TDH license conditions. This may be dual storage: one copy at both facilities or storage in a certified fireproof container.

5.4.2 Records shall be retained for a minimum of 10 years from the date of creation, for the duration specified in the contract, which caused the creation of the project, or in accordance with Federal or State regulations where applicable.

Earth Tech **Standard Operating Procedure**	PROCEDURE NO. SARSG, SOP 006 DATE: September 17,2001
General Radiological Equipment Checklist	APPROVED: ____________________ SARSG Leader

The San Antonio Radiological Services Group is responsible for the issuance, revision, and maintenance of this policy. Any deviations from the procedures set forth in this policy require approval of the SARSG Leader.

1 PURPOSE

This procedure establishes a ready-reference for collecting and transporting the equipment and supplies needed during the performance of radiological surveys.

2 EQUIPMENT

The following items should be available and loaded before departing for the survey site:

a. Whatman Filter Paper ____
b. Swipe Envelopes ____
c. TLD badges ____
d. Leather/Rubber Gloves ____
e. Chalk ____
f. Grease Pencil ____
g. Small Tool Box ____
h. Thermometer ____
i. Check Sources ____
j. Labels ____
k. Duct Tape ____
l. Radiation Waste Bags ____
m. Pipe Wrench ____
n. Soil Kit ____
o. Chalk Line Kit____
p. Steel Toed Boots ____
q. Rain Gear ____
r. Sample Log or Numbers ____
s. Health & Safety Plan ____
t. Ventilation Equipment ____
u. Batteries (extra for meters) ____
v. Mantels (marked with an 'X') ____
w. Booties ____
x. Camera ____
y. Crime Tape & Radiation Signs ____
z. Nylon String ___
aa. Plastic Sheeting ____
bb. Tyvek Suits ____
cc. Bung Wrench *____
dd. Radiation Detection Meters ____

ee. Administrative supplies: Pens, paper, clipboard, grease pencils, white drum markers, permanent makers ____

ff. Step-off Pads ____

gg. Communication Devices ____

hh. P-10 Gas (extra) ____

ii. Coolers ____

jj. Flashlight ____

kk. Sample Containers ____

ll. Sampling Equipment (shovels, picks, etc.) ____

mm. Coveralls ____

nn. Decon Equipment/Supplies ____

oo. Training Folders ____

pp. Field Notebook ____

qq. References (MARSSIM, etc.) ____

rr. Emergency Telephone Numbers ____

ss. Personal Protective Equipment____

tt. QAPP ____

uu. Work Plan ____

vv. Cell Phones ____

3 Before departing for the job site verify the following tasks have been accomplished:

a. Instruments have been source checked: __________

b. Swipe paper has been marked: __________

c. Detection meters have been packed so as to avoid damage while in transport: _________

* **NOTE**: Use caution when opening waste drums. If drums or containers are leaking or bulging, notify the Site Manager/RSO.

Earth Tech **Standard Operating Procedure**	PROCEDURE NO. SARSG, SOP 007 DATE: October 8, 2001
Grid Systems & Surveys	APPROVED: ____________ SARSG Leader

The San Antonio Radiological Services Group (SARSG) is responsible for the issuance, revision, and maintenance of this policy. Any deviations from the procedures set forth in this policy require approval of the SARSG Leader.

1 PURPOSE

The purpose of this procedure provides instruction for establishing a reference grid system and performing radiological surveys for the established grids.

2 EQUIPMENT

Instrumentation shall be selected to accomplish the type of survey to be performed. All instrumentation shall be approved for use by a SARSG Certified Health Physicist (CHP) or Radiation Safety Officer (RSO). The following are examples of the instruments that can be used.

2.1 Dose rate instruments such as a Ludlum Model 19.

2.2 Count rate meters with air proportional probes or alpha scintillation detectors for alpha contamination detection.

2.3 Ludlum Model 2929 with a thin window Zinc Sulfide Scintillator detector for the swipes.

2.4 Crayons, permanent marker, or other markings devices depending on the type of surface to be marked.

2.5 The Ludlum Model 2221 Scaler with/239-1F detector shall be utilized to characterize flooring. The Model 2221 is battery capable and shall be mounted on a cart with a P-10 gas supply for easy handling and overall equipment protection.

3 PRECAUTIONS

Pre-operational checks shall be performed on all instruments prior to use to verify the following requirements:

3.1 The instrument has been pre/post source checked for the day.

3.2 The instrument has been calibrated within the past 12 months.

3.3 The battery check is satisfactory (for portable instrumentation).

3.4 Overall physical condition of the instrument is satisfactory.

3.5 The instrument manufacturers specific operational checks have been accomplished.

4 PROCEDURE

4.1 Establishing Interior Grids

4.1.1 Each interior building, (rooms, walls and hallways) shall be gridded prior to starting the instrument survey.

4.1.2 Each interior 3m x 3m grid area or 1m x 1m grid area, dependent on the CHP/RSO, shall be based on an alphanumeric numbering system.

4.1.3 Each gridded area shall begin in the northwest corner. The northwest grid corner shall be labeled as A1. Each subsequent grid to the east of that grid shall be labeled A2, A3, A4, etc. Each subsequent grid to the south of that grid shall be labeled B1, C1, D1, etc.

4.1.4 A variety of materials may be used to mark grids, including chalk lines, paint, labels, tags, etc. Uniformity and reproducibility of results shall drive material selection

4.2 Surveying Interior Floor Grids

4.2.1 All Interior grids classed as potentially contaminated shall be surveyed.

4.2.2 Interior grids classed as potentially uncontaminated shall have at least 10% of grids surveyed. Survey grids shall be selected based on areas of high probability for contamination.

4.2.3 Use Radiological Survey Report, Attachment 1 to SARSG SOP-011, to document the survey readings.

Note: There is an area for comments on the survey form. Surveying personnel are encouraged to check and comment on suspicious areas within the survey grid. Mark the areas on grid to correspond with comments.

4.3 Establishing Interior Wall Grids

4.3.1 Walls shall be identified as North, South, East, and West.

4.3.2 Walls shall be drawn on miscellaneous survey maps. Wall dimensions and descriptive material or equipment shall be indicated on map, to the extent it would aid in survey reproducibility

4.3.3 Potentially contaminated walls shall be marked with survey locations at one meter points, vertically corresponding to floor grids.

4.3.4 Survey locations shall be marked with paint, labels, tags or other methods to provide reproducibility.

4.3.5 Survey locations shall be marked numerically beginning from the northwest corner.

4.3.6 Potentially uncontaminated interior walls shall be marked in the same manner as above, but at a frequency of at least one survey location per 10 floor grids.

4.4 Establishing Survey Locations, Ceilings/Overhead

4.4.1 Ceilings shall not be gridded in the manner previously described for floors, walls, etc. Rather a prescribed number of survey locations shall be identified and marked on a per square meter basis determined by building classification.

4.4.2 Potentially contaminated rooms and/or buildings shall have at least one disk smear taken above each floor grid.

4.4.3 Potentially uncontaminated rooms and/or buildings shall have at least one disk smear taken above each 4 floor grids.

4.4.4 Survey locations shall be marked by paint, label, tag or other material.

4.4.5 Ceiling surveys shall be identified on miscellaneous survey maps

4.4.6 Survey locations shall be identified numerically, beginning in the northwest corner.

4.5 Surveying Ceilings/Overhead

4.5.1 Follow the gridding procedures listed in 4.4.1.

4.5.2 Obtain a miscellaneous survey form and draw the ceiling as viewed from below. Add equipment, lights, vent ducts, etc., to the extent it would aid in survey reproducibility.

4.5.3 Establish survey locations pursuant to Section 4.4.6. Monitoring personnel shall select locations where contamination would be most probable.

4.5.4 Disk smears shall be taken at the frequency required by Sections 4.4.2 and 4.4.3.

4.5.5 Disk smears shall be counted for one minute on the Ludlum Model 2929 Alpha/Beta counting system or pancake probe if approved by the CHP or RSO.

4.5.6 Disk smears shall be taken when contamination is suspected, consideration will be given to the use of large area swipes. This shall be dependent on surface medium, access, and building use. This shall be determined on a building-by-building basis by the CHP or RSO.

4.5.7 All survey results shall be recorded on the Radiological Survey Report Form, Attachment 1 to SARSG SOP-011.

4.6 Final Status Survey

4.6.1 Survey grid for the final status survey will be established by MARSSIMs.

4.6.2 The number of readings required for the final status survey will be established by MARSSIMs.

4.6.3 Distance between samples for final status survey will be established by MARSSIMs.

4.6.4 Other associated operations will be done in accordance with the MARSSIMs program.

5 REFERENCES

5.1 *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM),* Revision 1, August 2000.

Earth Tech Standard Operating Procedure	PROCEDURE NO. SARSG, SOP 011 DATE: September 17,2003
Radiological Surveys and Postings	APPROVED: ______________ SARSG Leader

The San Antonio Radiological Services Group (SARSG) is responsible for the issuance, revision, and maintenance of this policy. Any deviations from the procedures set forth in this policy require approval of the SARSG Leader.

1 PURPOSE

This document establishes the guidelines to be used for the monitoring and posting of radioactive materials and areas. It also provides guidelines for maintaining control of radioactive materials and areas that need to be surveyed.

2 EQUIPMENT

The following are examples of instrumentation that might be used to perform surveys.

2.1 Beta-gamma contamination surveys are performed using a thin window Geiger-Mueller (GM) probe, a Bicron or equivalent.

2.2 Alpha surveys are performed with a thin window gas flow proportional probe, a Ludlum model 2221 with 43-89 probe, or equivalent.

2.3 Disk smears from equipment or buildings may be counted in the Ludlum Model 2929 attached to a zinc sulfide thin window scintillator.

2.4 The Ludlum Model 2221 Scaler with/239-1F detector or equivalent will be utilized to Characterize flooring, during the characterization phase. The Model 2221 is battery capable and will be mounted on a cart with a P-10 gas supply for easy handling and overall equipment protection.

2.5 The Ludlum Model 19 or equivalent Micro-R meter will be used to document radiation levels. The Model 19 is portable, battery powered and durable.

3 INSTRUMENT OPERATIONAL CHECKS

3.1 A pre-operational check will be performed on all instruments prior to use to verify the following requirements.

- Instrumentation used in the surveys will be source checked in accordance with SARG SOP #2;

- The instrument has been calibrated within the last 12 months;
- The battery check is satisfactory (for portable instrumentation);
- Overall physical condition of the instrument is satisfactory; and
- Smears should be counted in an area where the background is less than 100 cpm for beta-gamma radiation.

4 POSTING

- Signs should be posted between two feet and five feet above the ground for good visibility;
- Signs should be placed so that all accessible areas are covered and posting is visible;
- Do not attach signs to items or equipment that could be moved;
- Boundary rope should be yellow and magenta;
- Radiation signs should be tri-foil caution signs with the appropriate inserts; (i.e. contaminated area, radiation area, airborne radioactive material, etc.); and
- Boundary tape (yellow and magenta).

5 PROCEDURES

5.1 Exposure rate Surveys

- Exposure rate surveys are performed, using any of the exposure rate instruments approved for use, to provide an indication of the amount and type (e.g., beta or gamma) of external radiation exposure the workers will receive while performing routine work operations;
- A reasonable amount of care should be taken when performing exposure rate surveys to identify items that are contributing to the general area exposure rates (i.e., barrels, equipment, etc.);
- All exposure rates shall be recorded on the Radiological Survey Report Form, Attachment 2-1, or equivalent;
- Gamma exposure rates are recorded as mR/hr (µSv/hr), or (µR/hr);
- Beta dose rates are recorded as mRad/hr (µGy/hr);
- Beta dose rates are derived by the following formula:

mRad/hr = (OW - CW) x CF

OW = Open window exposure rate

CW = Closed window exposure rate
CF = Correction factor*

- The beta correction factor used for each instrument shall be determined by the calibration facility;

- Exposure rates that are taken "on contact" shall be noted on the Radiological Survey Report Form, Attachment 2-1; and

- Items identified with exposure rates greater than five times the general work area shall be recorded with an asterisk indicating "hot spot". As these items are identified, the surveyor should shield the item, or remove it from the area, if possible.

5.2 Contamination Surveys

- Contamination surveys are used as a tool to maintain control of work areas, verify clean areas, and establish protective clothing and requirements;

- Surveys for removable contamination are performed by using either disk smears or large area swipes.

  (a) Disk smear surveys are performed by wiping a surface area approximately 100 cm^2.

  (b) Large area swipes are performed using either masslin or similar cloth to wipe a large surface area.

- Count rate instruments approved for use shall be used for evaluating contamination levels of disk smears or wipes;

- Smears are counted in an area where the background is less than 100 cpm;

- Smears are placed 1/2" from the surface of the detector for 15 to 20 seconds to allow the count rate meter's indication to stabilize;

- Smear results are recorded on the Radiological Survey Report Form, Attachment 2-1, in disintegrations per minute. DPM shall be calculated by the following formula:

$$DPM = \frac{Gross\ CPM - Background\ CPM}{Detector\ Efficiency}$$

$$Example: \frac{2,000\ CPM - 60\ CPM}{0.20} = 9,700\ DPM$$

Note: For detectors with an efficiency of 10 percent, multiply the net counts per minute by 10.

Example: (1,100 cpm-100 cpm) x 10 = 10,000 dpm

A. Disk smears are indicated as 100 cm^2.

Example: 1,000 dpm/100 cm^2

B. Large area swipes are indicated as probe area.

Example: 1,000 dpm/PA

Note:	Contamination surveys on material or equipment for unconditional release shall be performed with disk smears and documented in dpm/100 cm^2

- Fixed contamination surveys may be performed with any of the approved count rate instruments. Consideration should be given to using the audible setting on the instrument, if so equipped, since audible response is quicker to respond to than the visual provided by the meter.

  a) When using the beta-gamma instrument, the detector should be held within 1/2 inch of the surface being frisked and moved no faster than 2 inches per second.

  b) When using the alpha instrument, the detector should be held within 1/4 inch of the surface being monitored and the probe moved no faster than 2 inches per second. Increased counts are an indication of alpha activity, when counts increase either by audible or visual, stop all detector motion until a stable count rate is determined.

Personnel contamination surveys shall be performed by any individual exiting from the facility. Surveys are performed in accordance with section 5.2. The detector movement should be paused at locations of potential contamination such as knees, elbows, and mouth.

Posting Requirements

- "Caution Radioactive Material(s)" shall be conspicuously posted at the entrance to each room or area in which licensed material is used or stored and exceeds the quantity of such material specified in USACE Manual 385-1-80 or 10 NYCRR sect 16.
- "Caution Radiation Area" shall be conspicuously posted at the access of any area, building or room where exposure rates from the radioactivity inside that area could result in an individual receiving a dose equivalent to 5 mrem in one hour.
- "Caution Contamination Area" shall be posted at the entrance to areas where removable contamination levels meet or exceed the following activity:

  Areas that are greater than 1 times but less than 100 times levels specified in USACE Manual 385-1-80 or 10 NYCRR sect 16.
- "Caution High Contamination Area" shall be posted at areas where removable contamination exceeds the following activity:

  Areas greater than 100 times levels specified in USACE Manual 385-1-80 or 10 NYCRR sect 16.
- "No Eating, Drinking, or Smoking" shall be posted at all entrances to the restricted area.

Survey Frequency

- The frequency of routine surveys shall be determined at the start of the project by the Radiation Safety Officer based on which buildings or areas are used for storing or processing radioactive materials, the frequency of use of these areas, and traffic flow. A Routine Survey Matrix shall be generated by the Project manager or his designee at the start of the project to provide guidance for surveys of specific areas. The Project manager will update the matrix if determined necessary during the project.

Survey Documentation

- Surveys performed shall be documented on the radiological survey report for that area or item.

Surveying Miscellaneous Equipment, Pipe, Valves, Etc.

- The surveying of miscellaneous equipment shall be performed and documented as in Section 5.2.

- The miscellaneous equipment surveyed shall be drawn and described on the Radiological Survey Report, Attachment 2-1, to the extent it could be relocated and resurveyed.

6 RECORDS

a) Radiological Survey Report, Attachment 2-1

7 REFERENCES

The following document or portions thereof was used as reference.

Sources

7.1.1 USACE Manual # 385-1-80, Radiation Protection Manual.

7.1.2 New York Codes of Rules and Regulations Tital 10 section 16 “Ionizing radiation.

RADIOLOGICAL SURVEY REPORT

Building #_________

Room #___________ Date___________

Time	Instrument	AREA or GRID #	Survey Results			Comments
			Alpha	Beta	Gamma	

Surveyed By________

Reviewed By________

Earth Tech **Standard Operating Procedure**	PROCEDURE NO. SARSG, SOP 012 DATE: February 6,2001
Swipe Samples	APPROVED: ______________ SARSG Leader

The San Antonio Radiological Services Group is responsible for the issuance, revision, and maintenance of this policy. Any deviations from the procedures set forth in this policy require approval of the SARSG Leader.

1 PURPOSE

This procedure provides the requirements and techniques for collecting swipe samples to determine the amount of removable radioactive surface contamination.

2 SCOPE.

The purpose of taking removable surface measurements is three-fold:

2.1 Determine the extent of removable radioactive contamination,
2.2 Evaluate the potential for its migration, and
2.3 Assess methods for its decontamination.

This procedure establishes the requirements for performance, documentation, and review of surface contamination surveys.

3 3.0 DEFINITIONS

3.1 **Survey Area** - An area where radioactive materials or contamination are or may be present; includes areas where samples/swipes (potentially containing radioactivity) are being screened.

3.2 **Direct Surface Contamination Monitoring** - Total radioactivity measurement present on a surface; does not differentiate between fixed and loose surface contamination.

3.3 **Removable Surface Contamination Monitoring** - Measurement of the contamination transferred from a contaminated surface to a swipe by application of moderate pressure.

4 4.0 General Requirements and Limitations

4.1 Only qualified and trained personnel are allowed to collect swipe samples.

4.2 Latex or nitrile gloves shall be worn when taking swipes where radiological contamination is present or suspected. Cotton gloves may be worn under the latex or nitrile gloves.

4.3 Change gloves when contamination is suspected or gloves become torn.

4.4 Check hands periodically for contamination.

5 5.0 RESPONSIBILITIES

5.1 Project Radiation Safety Officer (RSO) is responsible for training the Radiological Control Technicians (RCTs) in the implementation of this procedure.

5.2 Radiological Control Technicians are responsible for:

5.2.1 Collecting swipe samples in accordance with this procedure and applicable training.

5.2.2 Reporting unsafe or unusual conditions to the Field Supervisor.

6 6.0 Procedures

6.1 Initial Actions

6.1.1 Follow the appropriate provisions of the Work Plan for initial actions and determining where swipes are to be collected.

6.1.2 For each new box of 500 swipes opened, randomly choose one unused swipe and submit for field gross alpha/beta counting. Perform a 5-minute background count on the swipe and use this value to establish the background cpm for the counting of swipe samples.

6.2 Collection of Swipe Samples for Surfaces

6.2.1 Measure all surfaces or items that have the potential for fixed contamination. Fixed contamination may become removable during these operations and must be identified so that proper precautions may be taken.

6.2.2 Use caution while surveying rough surfaces to avoid personal injury or tearing of the swipe paper.

6.1.1 6.2.3 Hold the swipe paper with the back of the swipe firmly against the fingers. Ensure the face of the swipe paper contacts the surface to be swiped.

6.1.2 6.2.4 Apply moderate pressure across the swipe paper to ensure that most of the swipe face comes in contact with the surface.

6.1.3 6.2.5 Swipe an area of approximately 100 square centimeters (16 square inches) per swipe. A template may be used to standardize swipe collection.

6.1.4 6.2.6 Place individual swipes in a separate envelope (or similar container) to prevent cross contamination.

6.1.5 6.2.7 Label each container with a sample location number cross-referenced to a sample location, preferably a location map.

6.1.6 6.2.8 Screen the swipe samples for the presence of radiological materials. **Do this outside the survey area.** Swipes shall be screened individually by performing a 1-minute count. Place the swipe on the same surface used to perform the background measurement. Center the swipe with the contaminated side facing upward under the alpha/beta probe. Perform a 1-minute count and subtract the previous background measurements. Report net cpm values.

6.1.7 6.3 Record the following information on the Swipe Sample Counting Data Sheet:

6.3.1 Sample location (or other specific identification)

6.3.2 Date of survey

6.3.3 Signature(s) of individual(s) performing the survey

6.3.4 Swipe screening results

6.1.7.1 NOTE: AVOID FILLING OUT UNNECESSARY PAPERWORK IN CONTAMINATED AREAS OR RADIATION FIELDS.

6.1.7.2 6.4 Collection of Swipe Samples from Sampling Equipment: When swiping non-uniform objects or surfaces with odd shapes, inside surfaces, or small items, ensuring that surfaces are adequately monitored and the face of the swipe paper has come in contact with a representative portion of the object.

NOTE: LARGE AREA SWIPES MAY BE USED TO OBTAIN A GENERAL INDICATION OF THE AMOUNT OF REMOVABLE CONTAMINATION PRESENT ON A SURFACE. HOWEVER, IT IS NOT TO BE USED TO COMPARE RESULTS AGAINST RELEASE CRITERIA.

6.1.8 6.4.1 Swipe the area following the methodology discussed previously

6.1.9 6.4.2 Outside of the survey area, screen the swipe samples for the presence of radiological materials. Swipes shall be screened one at a time.

6.1.10 6.4.3 The following information shall be recorded on the Swipe Sample Counting Data Sheet or in the field log book:

6.4.3.1 Sample location (or other specific identification).

6.4.3.2 Date of measurements.

6.4.3.3 Swipe screening results.

6.4.3.4 If the sample is a large area swipe, record the approximate area swiped in the "Remarks" column.

6.1.10.1 NOTE: AVOID FILLING OUT UNNECESSARY PAPERWORK IN CONTAMINATED AREAS OR RADIATION FIELDS.

6.5 RELEASE LEVELS –acceptable surface contamination release levels can be found in the applicable work plan.

7 6.6 records - RECORD ALL INFORMATION GENERATED DURING THIS PROJECT INTO THE FIELD LOGBOOK FOR FUTURE REFERENCE.

8 7.0 REFERENCEs

7.1 *Sampling and Surveying Radiological Environments, CRC Press, 2001.*

7.2 *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM),* Revision 1, August 2000.

1. OBJECTIVE

The objective of these guidelines is to provide general reference information for estimating the hydraulic conductivity of an aquifer by in-situ tests performed in either piezometers, monitoring wells or boreholes.

2. LIMITATIONS

These guidelines are for information only and are not to take precedence over the requirements of project-specific plans for in-situ hydraulic conductivity testing.

These tests approximate the hydraulic conductivity of the formation only at the interval of the test. The disturbance to the formations caused by drilling and the potential turbulence from the well screen can influence the data. The diameter of the well is critical to the computation of the hydraulic conductivity, and the effective diameter of a well can be increased considerably by the well development process. Poor well efficiency caused by inappropriate slot size, poor condition of the well screen, or a poorly designed gravel pack could produce results not representative of the tested formation. Hydraulic conductivity tests in wells should be conducted only after the well has been fully developed. Slug test evaluation formulas assume an instantaneous initial change in water level in the tested interval. Tests performed after extended periods of pumping or water addition may yield inaccurate results. Slug tests provide only rough estimates of hydraulic conductivity, and should not be run in preference to pumping tests.

3. DEFINITIONS

Slug Test - An aquifer test made either by pouring a small instantaneous charge of water into a well or by withdrawing a slug of water from the well. A synonym for this test, when a slug of water is removed from the well, is a bail-down test.

Rising Head Test - A test performed in an individual borehole or well within the saturated zone to estimate the hydraulic conductivity of the surrounding formation by lowering the water level in the boring or well and measuring the rate of recovery of the water level. The water level may be lowered by pumping or bailing.

Falling Head Test - A test performed in an individual borehole or well to estimate the hydraulic conductivity of the surrounding formation by raising the water level in the boring or well and measuring the rate of drop in the water level.

Constant Head Test - A constant head test is a variation of the falling head test in which water is constantly added to the borehole or well to be tested, and the flow rate required to maintain a hydraulic head at a constant level above the static water level is measured.

Packer Test - A hydraulic conductivity test using inflatable packers to isolate a discrete zone within the borehole for testing purposes.

Packer - A sealing device installed in a well or borehole which isolates intervals within the boring or well for testing purposes.

4. GUIDELINES

In-situ hydraulic conductivity testing provides a relatively rapid method of estimating the hydraulic conductivity of a portion of an aquifer and the transmissivity (if the saturated thickness of the unconfined or confined aquifer is known). While the performance of a pumping test is the optimum aquifer testing method for estimation of hydraulic conductivities, transmissivities, and storage coefficients, pumping tests are relatively expensive and time consuming. Certain methods of in-situ testing, on the other hand, are much less expensive, less time intensive per test and several wells or piezometers can be tested in a single day by one technician. These guidelines present methods for conducting in-situ hydraulic conductivity tests in piezometers, monitoring wells, and boreholes.

4.1 Slug Test

Slug tests are conducted to estimate the hydraulic conductivity of the soil/rock strata within the screen interval of a piezometer or a monitoring well. A standard slug test consists of instantaneous injection or withdrawal of a known volume that causes immediate change of water levels in the well. The subsequent amounts of rise or decline of water levels with time are recorded and used to calculate hydraulic conductivities of the in-situ materials open to the well. Because the slug is small compared to the volume of water in the surrounding aquifer, the slug test is an estimate of permeability within only a few feet of the well.

A slug test is performed by quickly lowering a slug into a well to displace the water from the initial water level and measuring the rate at which the water level declines (falling-head test), then measuring the rate at which the water level rises (rising-head test) after the slug is removed. A bailer can also be used to remove a slug of water. This type of test is usually called a "bail-down test" or "bailer" test. Water level measurements should be recorded every 5 to 10 seconds for the first two minutes and every 30 seconds thereafter. Measurement can be terminated when the depth to water has stabilized for approximately 10 minutes. Water levels during the test can be recorded manually using a water level indicator, or a Hermit Model SE 100B Data logger with a pressure transducer can be used for this purpose.

Prior to slug testing, the well should be thoroughly developed and water levels allowed to stabilize in order to obtain accurate results. The following data should be obtained when performing a slug test, in addition to the static water level and all time and water level measurements:

1. Casing diameter
2. Borehole diameter
3. Well pipe and screen diameter and length
4. Screen slot size
5. Procedures used

6. Gravel pack size
7. Saturated thickness of the aquifer being tested

4.1.1 Slug Test Data Analysis

Slug test data can be analyzed by three different methods to determine in-situ hydraulic conductivity. The first method (Cooper, Bredehoeft, and Papadopulos, 1967) assumes slug test data was collected from wells in a confined aquifer with fully penetrating wells. The second method (Bouwer and Rice, 1976), while originally developed for an unconfined aquifer, can also be used for confined or stratified aquifers if the top of the screen or perforated section is some distance below the upper confining layer (Bouwer, 1989). The third method (Hvorslev, 1951) calculates permeabilities for various well geometries based on the assumption of infinite vertical extent (upward and downward) of the flow system. Detailed description of these methods can be located in the listed references. The most widely used method to reduce slug test data is that of Hvorslev. A brief description of this method is given below.

Figure 9-1 shows the geometry of a piezometer installed in an aquifer. In the case of a piezometer installed into a low permeability unit, special attention must be paid to the method of construction. In many cases, gravel pack is used to fill the open annular space between the well screen and the wall of the open hole. Under such conditions, the radius of the well screen, R, is the radius of the borehole and the length of the well screen, L, is the length of the gravel pack. The gravel pack would typically be extended one to several feet above the well screen and the remainder of the open hole backfilled with some type of grout.

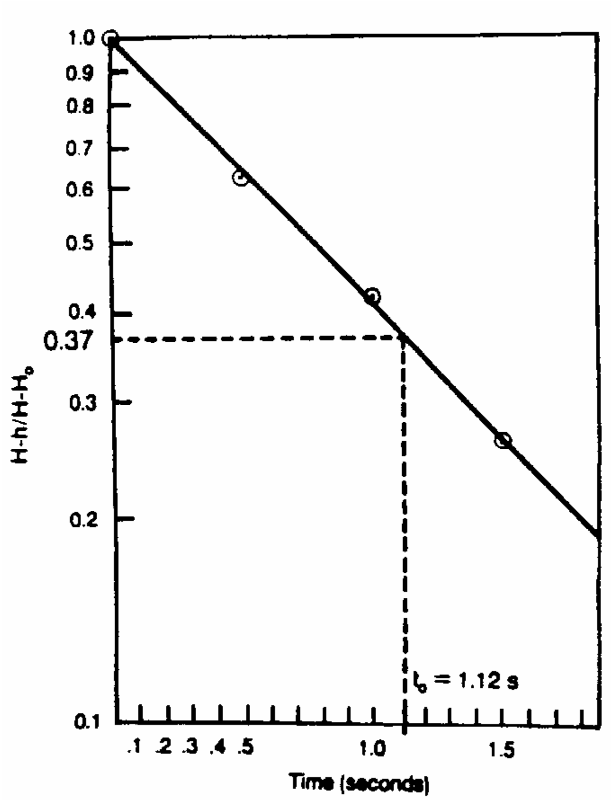


FIGURE 9-1 DIAGRAM OF HVORSLEV PIEZOMETER TEST

The data for the Hvorslev method is plotted as $H\text{-}h/H\text{-}H_o$ versus time on semi-log paper with $H\text{-}h/H\text{-}H_o$ on the log scale and time on the arithmetic scale. Ideally, the data will plot as a straight line.

Once the data has been plotted, a best fit line is drawn through the data points. A line is then drawn parallel to the time axis for $H\text{-}h/H\text{-}H_o = 0.37$. Where this line intersects the line through data points, a value for time is determined. This value is To (see Figure 9-2).

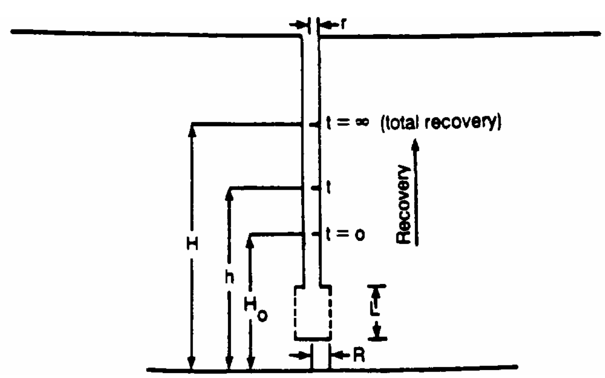


FIGURE 9-2 PLOT OF PIEZOMETER TEST DATA - HVORSLEV METHOD

The hydraulic conductivity can then be determined using the following equation:

$$K = \frac{r^2 \ln (L / R)}{2 LT_0}$$

where:

K	=	hydraulic conductivity
r	=	radius of well casing
R	=	radius of the well screen
L	=	length of the well screen
T_o	=	time required for the water level to rise or fall 37 percent of the initial change

The above equation is one of the many formulae presented by Hvorslev for different piezometer geometry and aquifer conditions. However, it is one that is quite useful and could be applied to unconfined conditions for most piezometer designs where the length is typically quite a bit greater than the radius of the well screen (L/R > 8). For other conditions, the original Hvorslev (1951) paper should be consulted.

4.2 Falling Head/Rising Head Tests

In-situ hydraulic conductivity tests can be performed in a boring while it is being advanced. This permits testing of formations at different depths throughout the drilling process. Both rising and falling head hydraulic conductivity tests can be performed in saturated formations during drilling. In general, either the rising or the falling head methods should be used if the permeability is low enough to permit accurate determination of the water level.

Borings in which permeability tests are to be performed should be designated before drilling. Therefore holes should be supported by casing, and the use of drilling mud or recirculated drill water should not be allowed.

Two different methods are described for performing variable (falling/rising) head permeability tests. In the first method, the casing is cleaned flush with the bottom of the boring; in the second method, the casing is pulled above the bottom of the cleaned borehole.

Falling Head Test: Flush Bottom

Once the desired testing depth is reached, the drilling operations should be stopped, the casing seated at the depth of the drilling bit, and the hole carefully cleaned.

After cleaning the boring to remove loose materials, the drill bit and drill rods should be withdrawn slowly to prevent loosening of the soil at the bottom of the hole.

The hole should then be maintained full of water to a level within 5 ft from the top of the casing for about 10 to 15 minutes by adding the necessary amount of water. This is essential to develop a steady seepage condition.

When the water level inside the casing has been adjusted for the last time, the depth to water should be recorded and a timer started. The depth to water should be measured with a calibrated tape equipped with a sounding device. In highly permeable soils or rock, an electric pressure transducer and recorder may be required. The level of water is then allowed to fall inside the hole from the seepage of water through the bottom of the hole.

The depth of water inside the hole should be carefully recorded at logarithmically increasing intervals of time as determined by the site geologist. The top of the casing should be used as a reference point for all measurements.

The length of the test should be determined by the site geologist.

The following data should be obtained, in addition to all time and depth measurements (when applicable):

1. Ground elevation
2. Reference elevation
3. Depth of test run
4. Casing diameter
5. Length of uncased borehole
6. Identification of equipment used

Falling Head Test: Pulling Back Casing

This method is similar to the above method except that the hole is backfilled with a clean, washed sand and the casing is bumped back a designated distance. A well screen may also be used that is fitted with threads at the top to accept pipe to pull it back out after the test is complete.

The hole should be prepared as described above. The test should be carried out in a similar manner as described previously or as determined by the site geologist, and all pertinent data should be similarly recorded.

Rising Head Test

This method is equivalent to that used for the falling head test.

The water level in the borehole is temporarily lowered as quickly as possible and readings are obtained as the water rises in the borehole. Any convenient means of rapidly lowering the water in the boring may be used, such as a bailer or pump.

All pertinent data should be similarly recorded.

4.2.1 Rising Head/Falling Head Test Data Analysis

There are many different published formulae for calculating hydraulic conductivity from in-situ borehole tests. Some of these formulae are outlined in Figure 9-2 (Hvorslev, 1951) for various geometries keeping in view the nature of subsurface materials encountered in the boreholes. Relevant formulae can be selected based on site-specific conditions for data analysis. These formulae are based on the assumptions that the effect of soil compressibility is negligible.

4.3 Constant Head Test

A constant head test is normally conducted as an inflow test in which arrangements are made for water to flow into the ground under a sensibly constant head. In this method water is added to the casing at a rate sufficient to maintain a constant water level at or near the top of the casing for a period of not less 10 minutes. The water may be added by pouring from calibrated containers or by pumping through a water meter. The intake rate is measured and the hydraulic conductivity is determined from this. It is essential to use clean water for the test. A limitation of the constant head test is that foreign water introduced into the formation must be removed from the well area before a representative groundwater sample can be obtained. This method of testing may be used in both saturated and unsaturated formations. In those cases where the permeability is so high as to preclude an accurate measurement of the rising or falling water level, the constant head test is used.

Two different setups (similar to falling/rising head tests) can be used to conduct the constant head test. In the case first case, the casing is cleaned flush with the bottom of the boring; in the second case, the casing is pulled above the bottom of the cleaned borehole. A brief description of these setups is given in Section 4.2.

4.3.1 Constant Head Test Data Analysis

Constant head test data can be analyzed by using an appropriate applicable equation from Figure 9-2, keeping in view the test setup.

4.4 Packer Test

Inflatable packers are used to isolate a test zone within the borehole to perform in-situ permeability tests. The apparatus for pressure tests usually comprises a water pump, a manually-adjusted automatic pressure relief valve, pressure gauge, a water meter, and a packer assembly. The packers, which provide a means of sealing off a limited section of borehole for testing should have a length of five times the diameter of the hole. They may be of the pneumatically or mechanically expandable type. The former are preferred since they adapt to an oversized hole, whereas the latter may not. The piping of the packer assembly is designed to permit testing of either the portion of the hole between the packers or the portion below the lower packer. Flow to the section below the lower packer is through the interior pipe; flow to the section between the packers is provided by perforations in the outer pipe which have an outlet area two or more times the cross-sectional area of the pipe. The packers are normally set 2, 5, or 10 feet apart and it is common to provide flexibility in testing by having assemblies with different packer spacings available, thereby permitting the testing of different lengths of the hole. The wider spacings are used for rock which is more uniform; the shorter spacing is used to test individual joints which may be the cause of high water loss in otherwise tight strata.

Methods of Testing

The test procedure used depends upon the condition of the rock. In rock which is not subject to cave-in, the following method is in general use. The hole is drilled to the total depth without testing. Two inflatable packers 5 to 10 feet apart are mounted near the bottom of the rod or pipe used for making the test. The bottom of the rod or pipe is sealed, and the section between the packers is perforated. The perforations should be at least one quarter of an inch in diameter, and the total area of all perforations should be greater than two times the inside cross-sectional area of he pipe or rod. Tests are made beginning at the bottom of the hole. After each test, the packers are raised the length of the test section and another test made. This procedure is followed until the entire length of the hole has been tested.

If the rock in which the hole is being drilled is subject to cave-in, the pressure test is conducted after each advance of the hole for a length equal to the maximum unsupported length of hole or the distance between the packers, whichever is less.

Cleaning Test Sections Before Testing

Before each test, the test section should be surged with clean water and bailed out to clear cuttings and drilling fluid from the face of the hole. If the test section is above the water table and will not hold water, water should be poured into the hole during the surging, then bailed out as rapidly as possible. When a completed hole is tested using two packers, the entire hole can be cleaned in one operation. Cleaning the hole is frequently omitted from testing procedures; however, this omission may result in a permeable rock appearing to be impermeable because the hole face is sealed by cuttings or drilling fluid. In such cases, the computed permeability will be lower than the true permeability.

Length of Test Section

The length of the test section is governed by the character of the rock, but generally a length of 10 feet is desirable. At times, a good seal cannot be obtained for the packer at the planned elevation because of bridging, railing, or the presence of fractures. Under these circumstances, the test section length should be increased or decreased or test sections overlapped to assure that the test is made with well-seated packers. On some tests, a 10-foot sections will take more water than the pump can deliver; hence, no back pressure can be developed. When this occurs, the length of the test sections should be shortened until back pressure can be developed, or the falling head test might be tried.

The test sections should never be shortened to where the ratio $\frac{A}{D}$ is less than 5, where *D* is the diameter of the hole and *A* is the length of the test section.

Size of Rod or Pipe to Use in Tests

Drill rods are commonly used as intake pipes to make pressure and permeability tests. NX and NW rods can be used for this purpose without seriously affecting the reliability of the test data, if the intake of the test section does not exceed 12 to 15 gallons per minute and the depth to the top of the test section does not exceed 50 feet. For tests deeper than 50 feet, head loss due to friction in pipe should be accounted for when calculating hydraulic conductivity.

Pumping Equipment

Permeability tests made in drill holes ideally should be performed using centrifugal pumps having sufficient capacity to develop back pressure. A pump with a capacity of up to 250 gallons per minute against a total head of 160 feet would be adequate for most testing. Head and discharge of such pumps are easily controlled by changing engine speed or with a control valve on the discharge.

Water Pressures, Duration of Tests, and Data to Be Recorded

A minimum of three pressures are utilized at each test section. The magnitude of the pressures should be respectively at least 10, 20, and 40 lbs/sq. in. (psi) above the natural piezometric pressure or 10, 20, and 40 psi where pressure testing above the piezometric level except that in no case should the excess pressure above natural piezometric pressure exceed one psi per foot of existing overburden. Each pressure increment should be maintained for ten or more minutes until a uniform rate of flow has been reached or until stopped by the geologist. The quantity of flow for each pressure is recorded at one, two, and five minutes, and at five minute intervals thereafter. After the rate of flow at 10, 20, and 40 psi pressures have been recorded, the water pressure should be reduced to 20 and 10 psi and the intake recorded at these pressures. Additional data to be recorded in each test are as follows:

1. Depth of hole at time of each test.
2. Depth to bottom of top packer.
3. Depth to top of lower packer.
4. Depth to water surface in boring at specified intervals.
5. Elevation of piezometer level in artesian strata.
6. Length of test section.
7. Radius of hole.
8. Length of packer.
9. Distance pressure gauge is above ground surface.

10. Description of material tested.

11. Height of water swivel above ground surface.

Packer Test Data Analysis

The following equation can be used to determine in-situ hydraulic conductivity using the packer test data:

$$K = \frac{Q}{2\pi LH} \log_e \frac{L}{r}; L \geq 10r$$

$$K = \frac{Q}{2\pi LH} \sinh^{-1} \frac{L}{2r}, 10r > L \geq r$$

where:

K	=	hydraulic conductivity
Q	=	constant rate of flow into the hole
L	=	length of the portion of the hole tested
H	=	differential head of water
r	=	radius of hole tested
$\log_e$	=	natural logarithm
$\sinh^{-1}$	=	inverse hyperbolic sine

These formulas have best validity when the thickness of the stratum tested is at least 5L, and they are considered to be more accurate for tests below groundwater table than above it.

5. REFERENCES

Bouwer, H., and R. C. Rice, 1976. "A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells." *Water Resources Research*, 12 (1976):423-428.

Bouwer, Herman, 1989. "The Bouwer and Rice Slug Test - An Update." *Ground-Water*, 27:3, pp 304 et seq.

Cooper, H. H. Jr., J. D. Bredehoeft, and I. S. Papadopulos, 1967. Response of a Finite Diameter Well to an Instantaneous Charge of Water." *Water Resources Research*, 3(1967):263-269.

Hvorslev, M. J., 1951. *Time Lag and Soil Permeability in Ground Water Observations*. U.S. Army Corps of Engineers Waterway Experimentation Station, Bulletin 36, 1951, 50 pp.

6. REVISION HISTORY

Original - revision 0 - April 1989

Revision 1 - June 1991 - complete rewrite, text expanded, graphics incorporated.

Revision 1.1 - May 1993 - typographical errors corrected, minor formatting changes

Revision 1.2 - August 1994 - Internal review; typographical errors and technical content corrected; references added.

ATTACHMENT 2

Referenced Figures and Tables

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10/28/00 Guterl 209-1d 115

1

Department of Environmental Conservation

Division of Environmental Remediation

Immediate Investigative Work Assignment Report

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MAY 17 2005
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Guterl Excised Area, City of Lockport, Niagara County

October 2000

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New York State Department of Environmental Conservation
Region 9
270 Michigan Avenue
Buffalo, New York 14203-2999

Table C-1.
Stratigraphic Summary of Borings, Test Pits, and Monitoring Wells Installed at the Guterl Excised Area, the Guterl Specialty Steel Corporation Landfill (932032), the Diamond Shamrock Site (932071), the Niagara Materials Site (932073), and the Niagara County Refuge Disposal District Landfill (932024), Lockport, New York. All Depths and Elevations are Measured in Feet.

Well or Boring Number	Date Installed or Completed	Total Boring Depth	UTM Coordinates		Ground Surface Elevation	Glaciolacustrine Deposits			Glacial Till			Lockport Dolostone	
			East	North		Depth	Surface Elevation	Thickness	Depth	Surface Elevation	Thickness	Depth	Surface Elevation
Guterl Excised Area (Unlisted)													
MW-1 (B-1)	5/15/97	15.0	686190	4780828	597.20				3.7	593.50	0.5	4.2	593.00
MW-2 (B-2)	5/16/97	14.5	686147	4780694	596.70	Indeterminate Due to Poor Sample Recovery						4.5	592.20
MW-3 (B-3)	5/14/97	14.4	686081	4780872	597.00	Indeterminate Due to Poor Sample Recovery						3.9	593.10
MW-4 (B-4)	5/16/97	14.4	685991	4780767	596.50				1.5	595.00	2.0	3.5	593.00
MW-5 (B-5)	5/15/97	15.5	686094	4780780	596.10				0.3	595.80	4.0	4.3	591.80
SB-6	5/14/97	4.3	686072	4780884	597.0+	2.7	594.30	1.6				4.3	592.70
SB-7B	5/14/97	7.2	686185	4780643	597.0+	Former Lagoon - Native Deposits Not Encountered							
Guterl Specialty Steel Corporation Landfill (Registry Number 932032)													
MW-1 (B-1)	12/3/80	5.5	685694	4780916	598.50				4.0	594.50	1.5	5.5	593.00
MW-2 (B-2)	12/3/80	3.4	685677	4781119	602.50				1.0	601.50	2.4	3.4	599.10
MW-3 (B-3)	12/3/80	3.7	Location Unknown		598.8*							3.7	595.10
MW-4 (B-4)	12/3/80	5.5	685749	4781033	603.70							5.5	598.20
B-5	12/17/80	4.9	Location Unknown		---------				2.0	---------	2.9	4.9	---------
B-6	12/17/80	3.5	Location Unknown		---------				1.3	---------	2.2	3.5	---------
MW-105	10/28/92	5.0	685616	4781033	597.40				0.6	596.80	4.0	4.6	592.80
TB-101	10/28/92	11.0	685753	4781106	605.4*	0.0	605.40	8.7	8.7	596.70	2.3	11.0	594.40
TB-103	10/28/92	10.0	685709	4781088	604.4*				6.0	598.40	4.0	10.0	594.40
TB-104	10/28/92	15.3	685691	4781071	611.2*				14.2	597.00	1.1	15.3	595.90
TB-105	10/28/92	5.2	685636	4781088	600.7*				4.0	596.70	1.2	5.2	595.50
TP-101	1/12/93	7.0	685662	4781028	604.6*								
TP-102	1/12/93	9.5	685719	4781113	604.3*				7.5	596.80			
TP-103	1/12/93	4.0	685723	4781023	602.7*							4.0	598.70
TP-104	1/12/93	7.5	685671	4780998	602.6*								
TP-105	1/12/93	4.0	685649	4780948	597.8*				2.5	595.30			
TP-106	1/12/93	6.0	685716	4780951	599.9*				4.2	595.70			

Table C-1 (continued).
Stratigraphic Summary of Borings, Test Pits, and Monitoring Wells Installed at the Guterl Excised Area, the Guterl Specialty Steel Corporation Landfill (932032), the Diamond Shamrock Site (932071), the Niagara Materials Site (932073), and the Niagara County Refuge Disposal District Landfill (932024), Lockport, New York. All Depths and Elevations are Measured in Feet.

Well or Boring Number	Date Installed or Completed	Total Boring Depth	UTM Coordinates		Ground Surface Elevation	Glaciolacustrine Deposits			Glacial Till			Lockport Dolostone	
			East	North		Depth	Surface Elevation	Thickness	Depth	Surface Elevation	Thickness	Depth	Surface Elevation
Diamond Shamrock Site (Registry Number 932071)													
TP1-94	6/21/94	1.0	686243	4781091	595.1*				0.0	595.10	0.7	0.7	594.40
TP2-94	6/21/94	2.1	686285	4781078	596.3*				1.0	595.30	1.1	2.1	594.20
TP3-94	6/21/94	0.9	686292	4781098	595.3*	0.0	595.30	0.5	0.5	594.80	0.4	0.9	594.40
TP4-94	6/21/94	4.0	686242	4781074	597.3*				2.5	594.80	1.5	4.0	593.30
BH1-94	6/21/94	4.7	686304	4780961	595.0*				3.0	592.00	1.7	4.7	590.30
MW1-94	11/8/94	14.2	686250	4781134	597.70				0.8	596.90	0.3	1.1	596.60
MW2-94	11/4/94	14.6	686307	4781049	596.75				0.5	596.25	2.4	2.9	593.85
MW3-94	11/7/94	14.5	686210	4781056	597.50							4.1	593.40
MW4-94	11/4/94	14.9	686275	4781026	595.70							2.3	593.40
MW5-94	11/8/94	15.0	686305	4780965	594.43							4.2	590.23
MW6-94	11/9/94	15.1	686217	4780918	595.60				3.5	592.10	0.4	3.9	591.70
MW7-94	11/7/94	16.3	686260	4780917	595.27	3.0	592.27	1.4	4.4	590.87	2.1	6.5	588.77
Ext. Well	Unknown	Unknown	686291	4780978	595.36	Boring Log Not Available							

* Elevation adjustments of -1.68' and -1.39' were added to the Guterl Specialty Steel Corporation Landfill and Diamond Shamrock elevations to bring all elevations into a common datum.

\+ Estimated Elevation.

Table C-2.
Monitoring Well Instrumentation Summary for Deep Overburden and Upper Lockport Bedrock Wells Installed in the Study Area.

Well Designation	Ground Surface Elevation (ft. AMSL)	Top of Riser Elevation (ft. AMSL)	Sandpack Interval (ft. BGS)	Sandpack Interval (ft. AMSL)	Well Screen Interval (ft. BGS)	Well Screen Interval (ft. AMSL)	Screened Unit
Guterl Excised Area (Unlisted)							
MW-1	597.20	599.14	7.70 to 15.00	589.50 to 582.20	9.70 to 14.70	587.50 to 582.50	Goat Island Dolostone
MW-2	596.70	598.56	7.50 to 14.50	589.20 to 582.20	9.20 to 14.20	587.50 to 582.50	Goat Island Dolostone
MW-3	597.00	598.82	7.20 to 14.40	589.80 to 582.60	9.10 to 14.10	587.90 to 582.90	Goat Island Dolostone
MW-4	596.50	598.67	6.90 to 14.40	589.60 to 582.10	9.10 to 14.10	587.40 to 582.40	Goat Island Dolostone
MW-5	596.10	598.24	8.20 to 15.50	587.90 to 580.60	10.2 to 15.20	585.90 to 580.90	Goat Island Dolostone
Guterl Specialty Steel Corporation Site (Registry Number 932032)							
MW-1	598.50	601.44	3.50 to 5.50	595.00 to 593.00	4.50 to 5.50	594.00 to 593.00	Glacial Till
MW-2	602.50	604.28	1.40 to 3.40	601.10 to 599.10	2.40 to 3.40	600.10 to 599.10	Glacial Till
MW-3	598.8*	601.5*	1.70 to 3.70	597.10 to 595.10	2.70 to 3.70	596.10 to 595.10	Misc. Fill; Destroyed
MW-4	603.70	605.29	3.50 to 5.50	600.20 to 598.20	4.50 to 5.50	599.20 to 598.20	Miscellaneous Fill
MW-105	597.40	599.25	2.00 to 5.00	595.40 to 592.40	3.00 to 5.00	594.40 to 592.40	Glacial Till
Diamond Shamrock Site (Registry Number 932071)							
MW1-94	597.70	597.35	4.50 to 14.20	593.20 to 583.50	5.51 to 13.51	592.19 to 584.19	Goat Island Dolostone
MW2-94	596.75	596.52	4.60 to 14.60	592.15 to 582.15	6.60 to 14.60	590.15 to 582.15	Goat Island Dolostone
MW3-94	597.50	596.94	5.00 to 14.50	592.50 to 583.00	6.08 to 14.08	591.42 to 583.42	Goat Island Dolostone
MW4-94	595.70	595.34	5.60 to 14.90	590.10 to 580.80	6.58 to 14.58	589.12 to 581.12	Goat Island Dolostone
MW5-94	594.43	594.14	4.50 to 15.00	589.93 to 579.43	5.88 to 13.88	588.55 to 580.55	Goat Island Dolostone
MW6-94	595.60	595.21	5.40 to 15.10	590.20 to 580.50	6.44 to 14.44	589.16 to 581.16	Goat Island Dolostone
MW7-94	595.27	594.91	7.30 to 16.30	587.97 to 578.97	8.08 to 16.08	587.19 to 579.19	Goat Island Dolostone

Ft. AMSL Feet Above Mean Sea Level. Ft. BGS Feet Below Ground Surface. * Adjusted Elevation.

RADIOLOGICAL SURVEY OF THE GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, NEW YORK

Prepared by

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Prepared for the

United States Bankruptcy Court for the
Western District of Pennsylvania

FINAL REPORT

DECEMBER 1999

This report is based on work performed under a contract with the U.S. Department of Energy.

TABLE 1

SUMMARY OF SURFACE ACTIVITY LEVELS FOR BUILDING 1 GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, NEW YORK

Location Description[a]	**Location #**	**Total Activity ($dpm/100\ cm^2$)**	**Removable Activity ($dpm/100\ cm^2$)**	
			Alpha	**Beta**
North Room				
Metal Floor Plate	9	-15	1	2
East Wall	10	-540	0	-2
Center Room				
Metal Floor Plate	11	97	0	-2
North Wall	12	-38	0	-6
Melting Equip.	13	390	0	2
Metal Floor Plate	14	35	0	-3
South Room				
Pit - Lower Ledge	15	32	0	3
East Wall	16	1,700	1	-2
East Work Room				
Concrete Floor		-240	0	-4
West Work Room				
Countertop	18	7,700	5	7
Lower Shelf	19	11,000	0	7
Concrete Floor at Drain	--[b]	35,000	--	--
Concrete Floor below Shelf	--	100,000	--	--
Wipe Rag	--	340,000	--	--

[a]Refer to Figure 11.

[b]No smear sample collected.

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

TABLE 2

SUMMARY OF SURFACE ACTIVITY LEVELS FOR BUILDING 2 GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
North Section				
Door Facing	21A	24,000	3	-1
Workbench	22A	12,000	1	-1
Near Workbench	23A	-88	0	3
Concrete Floor	24A	-140	0	2
North Wall at 0.5 m	25A	-160	1	-4
Concrete Floor	26A	-410	0	-1
Vat	27A	-270	0	-2
Concrete Floor	28A	-280	1	-1
West Wall at 1.0 m	29A	-190	0	2
Concrete Floor at Track	30A	-360	0	-2
Concrete Floor	31A	-150	1	-2
Tank	32A	-79	0	-1
Concrete Floor	33A	-360	1	-5
Fan	34A	-190	3	3
East Wall at 1.0 m	35A	-190	0	-1
Concrete Floor	36A	-240	0	-1
East Wall at 1.5 m	37A	-65	0	-1
Concrete Floor	38A	-280	0	-3
South Wall at 1.5 m	39A	-97	0	-4
Stair	40A	160	1	-1
Concrete Floor	41A	210	0	-2
Lift Platform	42A	510	0	4
I-beam at 8 m	1B	-29	1	1
On shed	2B	410	0	5
Platform at 8 m	3B	-88	0	7
Lift Frame at 5 m	4B	150	0	1
Crane at 8 m	5B	-380	3	-1

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999**

[a]Refer to Figures 12 and 13.

[b]No sample collected (smear or soil). Contamination was beneath concrete. Vitkus Rad Survey Tablesmsg6-1.xls

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 2
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Center Section				
Roofing Debris	43A	1,800	1	-1
Concrete Floor	44A	-26	0	-3
North Wall at 0.5 m	45A	-240	0	2
Concrete Floor	46A	-560	0	1
West Wall at 1.0 m	47A	360	0	1
Concrete Floor	48A	-320	0	-4
Equipment	49A	210	0	-3
East Wall at 1.0 m	50A	-270	0	-3
Metal Floor Plate	51A	-94	0	1
Concrete Floor	--b	1,800	--	--
Locker	52A	18,000	5	3
Concrete Floor	--b	11,000	--	--
Equipment	53A	-41	1	-2
East Wall at 1.0 m	54A	130	0	3
Concrete Floor	55A	-300	0	16
Concrete Floor	56A	7,300	1	2
Concrete Floor	57A	4,400	0	2
Shelving	58A	150	1	1
Concrete Floor	59A	-170	3	-3
East Wall at 1.0 m	60A	-160	0	3
Equipment	61A	230	1	-2
Metal Floor Plate at Track	62A	3,900	0	2
Pit Wall	63A	-270	0	-3
East Wall at 0.5 m	64A	-310	1	-4
Metal Floor Plate	65A	340	3	-2
West Wall at 1.0 m	66A	-130	0	2
Stairs	67A	230	3	3
Concrete Floor	68A	-200	0	-4

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999**

[a]Refer to Figures 12 and 13.
[b]No sample collected (smear or soil). Contamination was beneath concrete. Vitkus Rad Survey Tablesmsg6-1.xls

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 2
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
North End at 6m	6B	-320	1	1
I-beam at 8m	7B	240	0	2
East Wall Light at 6 m	8B	650	0	1
I-beam at 5 m	9B	1,200	0	-3
Crane Operator Bench at 7 m	10B	59	1	2
West Wall at 4 m	1 lB	1,100	0	-1
West Platform at 6m	12B	29	0	-1
Light Fixture	13B	500	0	-1
South Section				
Furnace	69A	97	0	1
Concrete Floor	70A	-350	0	2
Countertop	71A	6	0	-2
West Wall at 1.0 m	72A	-50	0	-1
Exhaust Hood at 2.5 m	73A	-9	1	3
Concrete Floor	74A	-410	3	3
Concrete Floor	75A	-380	0	-3
Pedestal	76A	-390	0	-1
Steps to Vat	77A	-120	0	3
Wood Floor	78A	260	0	-l
Door Facing at 1.5 m	79A	-300	0	18
Concrete Floor	80A	-490	0	4
Concrete Floor	81A	-530	0	3

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999**

[a]Refer to Figures 12 and 13.
[b]No sample collected (smear or soil). Contamination was beneath concrete. Vitkus Rad Survey Tablesmsg6-1.xls

TABLE 3

**SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 3
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK**

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
North Section				
Stairs	20	300	0	2
Concrete Floor at Track Intersect	21	-530	1	2
Concrete Floor	22	-420	1	-2
Incinerator Ledge	23	460	5	-1
Concrete Floor	24	310	1	1
25	25	2,700	0	2
Concrete Floor	26	-550	1	-2
I-Beam at 1.5 m	27	660	3	2
Roller	28	4,500	5	2
Concrete Floor Near Track	29	8,300	3	10
Electric Wire Casing	30	2,700	0	3
Roller Stack Pedestal	31	9,600	3	9
Concrete Floor	32	10,000	3	6
Concrete Floor	33	13,000	13	12
Equipment Room	34	270	1	-2
Equipment Room	35	-510	1	-2
Roller Stack Pedestal	36	6,900	3	2
Roller	37	2,800	7	3
Stairs Near Bldg. 6 Opening	38	3,600	7	5
Concrete Floor Near Bldg. 6	39	6,500	14	16
Concrete Floor Near Bldg. 6	40	640	1	4
Center Throughway Near Track	41	67,000	0	-1
Bathroom Floor	42	650	0	3
Top of Furnace at 4 m	19B	790	1	-1
North Wall at 7m	20B	2,400	1	-3
Light at 6 m	21B	3,400	0	-3
Overhang at 4 m	22B	2,200	0	3
Furnace I-beam at 4 m	23B	3100	3	1
Top of Electric Box at 4 m	24B	3700	1	7

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figures 14 and 15.
[b]No smear sample collected.

TABLE 3 (Continued)

**SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 3
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK**

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Truss above Furnace at 4 m	25B	56,000	9	4
Window Ledge at 8 m	26B	25,000	3	2
South Section				
I-beam Pedestal	43	5,400	53	10
Trench Cover	44	2,600	3	1
Cabinet Top	45	5,000	11	17
Trench Cover	46	660	9	2
Exterior Wall of Cafeteria at 1.5 m	47	630	3	-2
Concrete Floor	48	-28	0	7
West Wall at 1.5 m	49	-1,300	0	-3
Concrete Floor	50	470	0	-1
Concrete Floor	51	1,500	7	3
North End of Trench	52	-57	0	-3
Equipment Pedestal	53	-620	1	-4
South End of Trench	54	16,000	14	16
Roller Cap	55	340,000	130	195
South End of Trench	56	160,000	185	248
Concrete Floor Near Trench	57	12,000	3	6
Concrete Floor at Track	58	-550	0	1
Concrete Floor at Track Intersect	59	-620	0	3
Window Ledge at 8 m	27B	8,300	9	1
Top of Room at 3 m	28B	4,000	3	-3
Crane Rail I-beam at 8 m	29B	21,000	3	4
I-beam at 5 m	30B	5,200	0	1
I-beam at 7 m	31B	12,000	0	3
I-beam at 5 m	32B	10,000	1	-1
Crane Stand at 5 m	33B	6,100	1	-1
Sidewalk at Cafeteria	15E[b]	5,700	--	--
Sidewalk at Cafeteria	16E[b]	4,400	--	--
Sidewalk at Cafeteria	17E[b]	3,800	--	--

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a]Refer to Figures 14 and 15.

[b]No smear sample collected.

TABLE 4

**SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDINGS 4 AND 9
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK**

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Brick Floor	82A	490	1	4
Equipment Pedestal	83A	550	0	-4
Concrete Floor	84A	-56	1	-2
South Wall at 0.25 m	85A	59	7	-1
Roller Furnace	86A	500	0	2
Brick Floor	87A	310	3	3
Concrete Floor	88A	44	0	4
Press	89A	-110	3	-4
South Wall at 1 m	90A	-220	0	7
Concrete Floor	91A	-260	3	5
Concrete Floor	92A	-330	1	-3
Loading Dock	93A	280	3	4
Concrete Floor	94A	-450	0	-3
Stairs	95A	-240	3	-5
Furnace	96A	130	1	4
Concrete Floor	97A	-210	0	-3
Brick Floor	98A	16,000	24	32
Brick Floor	99A	5,200	11	12
Brick Floor	100A	13,000	14	20
Roller Furnace	43B	210	1	3
Brick Floor	44B	11,000	26	110
Brick Floor	--[b]	23,000	--	--
Brick Floor	45B	190	0	1
Platform	46B	1,500	0	-4
Furnace	47B	3,300	3	2
Brick Floor	48B	390	1	2
Concrete Floor	49B	47	0	-4
Misc. Equipment	50B	1,300	1	1

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figures 16 and 17.

[b]No smear sample collected.

TABLE 4 (Continued)

**SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDINGS 4 AND 9
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK**

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
North Wall at 1.5 m	51B	230	0	-2
Pit	52B	-440	1	-1
I-beam at 1.5 m	53B	110	3	-3
Brick Floor	54B	5,300	9	9
Air Duct	55B	210	3	14
Concrete Floor	56B	-85	0	-1
Furnace Hood at 4 m	34B	6,300	0	1
Crane Rail I-beam at 7 m	35B	88	5	2
Roof Truss at 10 m	36B	5,000	0	2
Light at 7m	37B	650	3	-2
Roof Truss at 10 m	38B	9,800	7	-1
Roof Truss at 10 m	39B	180	3	-2
Roof Truss at 10 m	40B	1,700	1	-4
Crane Rail I-beam at 7 m	41B	740	0	-2
Light at 7 m	42B	2,300	1	-1

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a]Refer to Figures 16 and 17.
[b]No smear sample collected.

TABLE 5

**SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 6
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK**

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
South Wall at 1 m	7	-24	1	-2
South Wall at 1 m	8	100	1	1
Metal Floor Plate	50C	30,000	1	-1
Metal Floor Plate	51C	810	3	5
Concrete Floor	52C	-330	1	4
Concrete Floor	53C	4,200	0	2
Brick Floor	54C	0	1	2
Brick Floor	55C	780	0	15
Brick Floor	62C	-480	0	2
Concrete Floor	65C	1,000	0	2
Metal Floor Plate	66C	680	0	4
Brick Floor	67C	320	0	3
Metal Floor Plate	68C	1,200	0	2
Brick Floor	69C	1,200	1	-2
Brick Floor	70C	440	1	-2
Brick Floor	71C	740	0	-1
Brick Floor	72C	1,600	1	-3
Metal Floor Plate	73C	350	1	-1
Metal Floor Plate	74C	970	0	4
Metal Floor Plate	75C	450	0	1
Metal Floor Plate	80C	1,900	7	3
Concrete Floor	81C	1,900	1	9
Concrete Floor	82C	2,200	0	-3
Concrete Floor	83C	2,400	7	4
Metal Floor Plate	85C	420	5	-2
Metal Floor Plate	86C	920	1	1
Brick Floor	87C	1800	1	2
Concrete Floor	88C	1500	0	-1
Brick Floor	89C	860	1	4
Concrete Floor	90C	250	0	-1

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figure 18.

TABLE 6

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 8
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
West Wall	1	10,000	7	9
Saw Horse	--[b]	62,000	--	--
West Wall	2	8,000	11	10
I-beam at 4 m	3	64,000	3	2
Electric Box at 5 m	4	39,000	20	19
I-beam at 3 m	5	29,000	13	46
Furnace Support at 3 m	6	30,000	27	35
Equipment, 10" Rolling Mill - Side	60	8,800	1	1
Equipment, 10" Rolling Mill - Base	61	4,600	0	7
Equipment, 10" Rolling Mill - Side	62	10,000	1	-2
Equipment, 10" Rolling Mill - Side	63	3,000	1	-1
Concrete Floor	64	5,500	5	-2
Equipment, 10" Cooling Bed	65	510	1	2
Concrete Floor	66	960	1	2
Equipment, 10" Cooling Bed	67	1,400	1	4
Equipment, 10" Cooling Bed	68	660	0	-2
Concrete Floor	69	4,200	3	-3
Concrete Floor	70	6,000	0	-1
Equipment, 10" Cooling Bed	71	740	1	4
Equipment, 10" Cooling Bed	72	980	1	-1
Brick Floor	73	2,000	0	-1
Concrete Floor	74	5,300	3	7
Brick Floor	75	54,000	54	40
Concrete Floor	76	1,500	7	8
Equipment, 16" Cooling Bed	77	850	0	6
Metal Floor Plate	78	5,600	0	2
Metal Floor Plate	79	870	1	21
Metal Floor Plate	80	1,600	5	5
Metal Floor Plate	81	890	1	1
Metal Floor Plate	82	3,000	1	-2
Equipment, 16" Cooling Bed, Roller	85	1,200	1	-4

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figure 19.
[b]No smear sample collected.

TABLE 6 (Continued)

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 8
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Concrete Floor	86	2,400	3	7
Concrete Floor	87	4,800	3	4
Equipment, 16" Cooling Bed, Tray	88	5,600	3	4
Metal Floor Plate	89	6,300	1	6
Metal Floor Plate	90	7,600	3	10
Metal Floor Plate	91	5,800	3	6
Furnace Interior	92	2,500	0	-3
Conveyor	93	14,000	3	16
Furnace - Top	94	4,200	3	1
Furnace - Side	95	690	1	-1
Conveyor	96	16,000	5	12
Conveyor	97	260	3	7
Stair to 16" Cooling Bed	98	1,300	0	-2
Metal Floor Plate	99	19,000	22	17
Metal Floor Plate	100	22,000	20	23
Equipment, 16" Cooling Bed, Tray	1C	16,000	7	9
Concrete Floor	2C	5,900	11	10
Concrete Floor	3C	1,700	3	2
Equipment, 16" Cooling Bed, Tray	4C	16,000	20	19
Motor	SC	29,000	13	46
Metal Floor Plate	6C	13,000	27	35
Furnace - Top	7C	19,000	5	9
Metal Floor Plate	8C	2,900	1	-2
Furnace - Top	9C	18,000	9	6
Concrete Floor	10C	35,000	74	120
Metal Floor Plate	1lC	38,000	14	16
Equipment, 16" Cooling Bed	l2C	20,000	18	9
Concrete Floor	13C	3,300	7	2
Concrete Floor	14C	7,300	7	4
Equipment, 16" Cooling Bed	15C	18,000	22	17
Metal Floor Plate	16C	24,000	37	33
Metal Floor Plate	17C	23,000	13	25
Metal Floor Plate	18C	26,000	22	17

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a]Refer to Figure 19.
[b]No smear sample collected.

TABLE 6 (Continued)

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 8
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Motor Mount	19C	33,000	22	23
Motor	20C	24,000	26	31
Equipment, 16” Rolling Mill	21C	10,000	7	5
Equipment, 16” Rolling Mill	22C	40,000	24	15
Equipment, 16” Rolling Mill	23C	36,000	18	27
Wood Platform - Step	24C	14,000	9	8
Metal Basin	25C	7,000	16	18
Lip of Platform	26C	20,000	7	10
Wood Platform	27C	25,000	27	15
Metal Floor Plate	28C	20,000	14	19
Grating	29C	26,000	14	20
Gear Shaft	30C	13,000	5	2
Furnace-Top	31C	13,000	14	16
Metal Floor Plate	32C	5,200	1	-2
Concrete Floor	33C	4,800	11	9
Concrete Floor	34C	5,600	7	2
Metal Floor Plate	35C	20,000	5	11
Furnace	36C	1,400	0	2
Wood Platform	37C	15,000	13	37
Wood Platform	38C	3,300	3	1
Wood Shelf	39C	21,000	5	7
Concrete Floor	40C	6,600	5	6
Bench	41C	11,000	5	11
Furnace Door	42C	5,900	3	5
Concrete Floor	43C	12,000	5	8
Press	44C	12,000	0	-2
Metal Floor Plate	45C	17	0	1
Metal Floor Plate	46C	110	1	-2
Rolling Mill	47C	870	0	1
Rolling Mill	48C	2,300	0	-3
Metal Floor Plate	49C	450	0	1
Metal Floor Plate	56C	990	0	5
Wood Platform	57C	8,100	7	11

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a]Refer to Figure 19.
[b]No smear sample collected.

TABLE 6 (Continued)

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 8
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Wood Platform	58C	16,000	13	18
Wood Platform	59C	14,000	22	20
Concrete Footer	60C	13,000	37	95
Wood Platform	61C	7,000	7	5
Metal Floor Plate	63C	5,700	5	4
Wood Platform	64C	7,400	26	19
Concrete Floor	76C	3,600	0	1
Concrete Floor	77C	6,600	0	4
Concrete Floor	78C	12,000	5	3
Concrete Floor	79C	1,300	3	20
Concrete Floor	84C	6,700	1	1
Concrete Floor	91C	550	5	2
Concrete Floor	92C	860	0	-4
Concrete Floor	93C	3,100	0	1
Concrete Floor	94C	3,800	3	6
Concrete Floor	95C	6,100	9	8
Concrete Floor	96C	5,100	5	6
Metal Floor Plate	97C	2,500	0	3
Vat	98C	16,000	1	3
Concrete Floor	99C	15,000	5	11
I-beam at 1 m	100C	12,000	1	-2
Brick Floor	1E[b]	200	--	--
Brick Floor	2E[b]	500	--	--
Concrete Floor at Track	3E[b]	840	--	--
Concrete Floor	4E[b]	430	--	--
Concrete Floor at Track	5E[b]	860	--	--
Metal Floor Plate	6E[b]	2,300	--	--
Metal Floor Plate	7E[b]	1,600	--	--
Concrete Floor	8E[b]	6,700	--	--
Frame for Tank	9E[b]	5,000	--	--
Metal Floor Plate	10E[b]	2,000	--	--

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figure 19.
[b]No smear sample collected.

TABLE 6 (Continued)

**SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 8
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK**

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Concrete Floor	11E[b]	3,800	--	--
Metal Floor Plate	12E[b]	2,300	--	--
Metal Floor Plate	13E[b]	2,300	--	--
Metal Floor Plate	14E[b]	430	--	--
North Wall	15E[b]	16,000	--	--

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a]Refer to Figure 19.
[b]No smear sample collected.

TABLE 7

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 24, NORTH SECTION
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Concrete Floor	57B	-240	1	-1
Concrete Floor	58B	-230	0	-2
Concrete Floor	59B	-370	3	4
Concrete Floor	60B	-390	0	-2
Concrete Floor	61B	-360	1	-1
Concrete Floor	62B	-390	3	2
I-beam at 1.5 m	63B	-240	0	1
Concrete Floor	64B	-390	0	1
Concrete Floor	65B	-240	1	1
Ledge	668	120	0	-2
Concrete Floor	67B	-300	0	1
Concrete Floor	68B	-290	0	2
Concrete Floor	69B	-200	0	1
Concrete Floor	708	-260	0	6
Concrete Floor	71B	-90	0	1
Concrete Floor	72B	-240	1	1
Concrete Floor	738	-240	0	-3

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figure 20.

TABLE 8

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 24, SOUTH SECTION
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Concrete Floor	74B	-210	0	-2
Concrete Floor	75B	-140	1	-3
Concrete Floor	76B	-190	0	1
Concrete Floor	77B	-270	3	3
Concrete Floor at Expansion Joint	78B	-320	0	2
Concrete Floor	79B	-160	0	14
East Wall at 1.5 m	80B	-610	0	7
Trench Cover	81B	170	1	1
Concrete Floor	82B	-200	0	-1
Concrete Floor	83B	-190	0	3
Concrete Floor	84B	-220	0	-2
Concrete Floor	85B	-40	3	3
Concrete Floor	86B	-100	3	5
Concrete Floor at Expansion Joint	87B	-100	5	2
Electric Box	88B	150	1	11
Concrete Floor	89B	200	0	-1
Concrete Floor	90B	-130	3	14
Concrete Floor	91B	19,000	27	20
Concrete Floor	92B	230	0	7
Concrete Floor	93B	4,300	0	1
Concrete Floor	94B	100	3	5
Concrete Floor	1D	190	0	-3
Concrete Floor	2D	130	1	1
Concrete Floor	3D	1,100	5	-2
Rail Track	4D	4,200	1	2
Concrete Floor	SD	-510	5	4
Concrete Floor	6D	-650	1	1

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figures 21 through 24.

TABLE 8 (Continued)

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 24, SOUTH SECTION
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Concrete Floor	7D	250	5	4
Concrete Floor	8D	350	7	2
Concrete Floor	9D	-60	1	1
Pit	10D	4,100	1	15
Concrete Floor	11D	360	0	3
Concrete Floor	12D	750	0	1
Concrete Floor	13D	20,000	3	4
Concrete Floor	14D	6,600	1	5
Concrete Floor	15D	12,000	3	8
Concrete Floor	I 6D	40,000	5	-1
Concrete Floor	17D	99,000	65	80
Concrete Floor	18D	36,000	3	5
Concrete Floor	19D	12,000	1	1
Concrete Floor	20D	19,000	5	1
Concrete Floor	21D	18,000	9	31
Concrete Floor	22D	11,000	1	6
Concrete Floor	23D	8,500	0	-1
Concrete Floor	24D	-140	0	4
Concrete Floor	25D	-20	1	4
Concrete Floor	26D	18,000	5	-2
Concrete Floor	27D	13,000	3	-5
Concrete Floor	28D	1,200	1	-4
Concrete Floor	29D	830	0	3
Concrete Floor	30D	23,000	0	4
Concrete Floor	31D	21,000	3	2
Concrete Floor	32D	19,000	1	2
Concrete Floor	33D	14,000	0	1

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figures 21 through 24.

TABLE 8 (Continued)

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 24, SOUTH SECTION
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Concrete Floor	34D	11,000	0	1
Concrete Floor	35D	610	3	2
Concrete Floor	36D	870	3	4
Concrete Floor	37D	7,700	1	-1
Concrete Floor	38D	15,000	22	7
Concrete Floor	39D	5,900	0	-1
Concrete Floor	40D	8,800	1	6
Concrete Floor	41D	10,000	0	4
Concrete Floor	42D	6,600	0	-5
Concrete Floor	43D	6,700	1	-1
Concrete Floor	44D	2,500	0	-1
Concrete Floor	45D	31,000	13	10
Concrete Floor	46D	3,500	1	5
Concrete Floor	47D	6,600	1	2
Concrete Floor	48D	24,000	0	1
Concrete Floor	49D	26,000	0	-3
Concrete Floor	SOD	26,000	0	3
Concrete Floor	51D	31,000	1	-2
Concrete Floor	52D	14,000	1	-3
Concrete Floor	53D	10,000	3	8
Concrete Floor	54D	1,400	1	-3
I-beam (above 2 m)	56D	8,100	3	2
I-beam (above 2 m)	57D	12,000	26	21
Roll-Up Door (above 2 m)	58D	150	1	3
I-beam (above 2 m)	59D	14,000	5	3
Electric Box (above 2 m)	60D	66,000	16	22
I-beam, Top of Kiln (above 2 m)	61D	2,600	0	3

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figures 21 through 24.

TABLE 8 (Continued)

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 24, SOUTH SECTION
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
I-beam 1W at 1.5 m	62D	60	0	-2
I-beam 2W at 2 m	63D	2,800	5	4
I-beam 4W at 2 m	64D	15,000	7	11
I-beam SW at 2 m	65D	8,800	7	7
I-beam 6W at 2 m	66D	15,000	13	14
I-beam 7W at 1.5 m	67D	7,100	3	1
I-beam 9W at 1.5 m	68D	13,000	11	3
I-beam 12W at 1.5 m	69D	9,800	1	5
I-beam 13W at 1.5 m	70D	7,300	9	14
I-beam 7E at 1.5 m	71D	6,000	0	2
I-beam 2E at 1.2 m	72D	20,000	1	9
I-beam lE at 1.5 m	73D	6,900	1	3

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a]Refer to Figures 21 through 24.

TABLE 9

SUMMARY OF SURFACE ACTIVITY LEVELS
FOR BUILDING 35
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location Description[a]	Location #	Total Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)	
			Alpha	Beta
Concrete Floor	1A	-210	3	-1
Concrete Floor	2A	-270	1	-2
Concrete Floor	3A	-200	0	-4
Floor Drain	4A	85	0	3
Concrete Floor	5A	-290	0	2
Floor Drain	6A	120	0	-1
Concrete Floor	7A	-380	0	-2
Concrete Floor	8A	-260	0	-3
Misc. Equipment	9A	-26	0	-3
Concrete Floor	10A	-260	1	-3
I-beam at 1.5 m	11A	-250	0	-1
West Wall at 1 m	12A	-760	0	-4
West Wall at 1 m	13A	-640	0	-2
Workbench	14A	100	0	-2
South Wall at 1.5 m	15A	-44	0	2
South Wall at 1 m	16A	-160	1	-1
East Wall at 1 m	17A	-270	1	1
I-beam at 1.5 m	18A	-230	0	-1
East Wall at 0.5 m	19A	-230	0	-4
East Wall at 1 m	20A	-720	0	4
North Wall at 4 m	14B	-59	0	-5
Crane Rail I-beam at 5 m	15B	180	1	2
Crane Center at 6 m	16B	-59	0	2
Crane Rail at 5m	17B	290	1	-5
Roof Truss at 7 m	18B	650	0	-4

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a]Refer to Figures 25 and 26.

TABLE 10

SUMMARY OF EXPOSURE RATES
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location	Number of Measurements	Exposure Rate Range (mR/h at 1 meter)
Interior		
Building 1	5	6 to 12
Building 2	17	5 to 12
Building 3	20	5 to 11
Building 4/9	5	5 to 10
Building 6	7	5 to 12
Building 8	8	6 to 50
Building 24, South Section	5	5 to 9
Building 35	5	5 to 8
Exterior		
Excised Property	131	3 to 50
All Remaining Property	129	3 to 25

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

TABLE 11

RADIONUCLIDE CONCENTRATIONS IN SEDIMENT SAMPLES GUTERL SPECIALTY STEEL CORPORATION LOCKPORT, NEW YORK

Location	Sample ID[a]	Radionuclide Concentration (pCi/g wet weight)				
		Sample Quantity (g)	Ra-226	Th-232	U-235	U-238
Building 3	3	1290	<0.1	<0.1	0.2 ± 0.1[b]	3.8 ± 0.1
Building 3	4	341	0.2 ± 0.1	<0.1	1.3 ± 0.4	29.9 ± 12.5
Building 3	5	1545	0.1 ± 0.1	0.5 ± 0.1	0.3 ± 0.1	7.8 ± 1.9
Building 8	6	1272	0.2 ± 0.1	1.2 ± 0.2	3.6 ± 0.4	96.8 ± 7.6
Building 8	7	875	0.1 ± 0.1	0.7 ± 0.1	3.9 ± 0.4	90.2 ± 7.3
Oil/Water Separator	8	1296	0.2 ± 0.1	0.2 ± 0.1	0.3 ± 0.1	9.6 ± 2.2

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a] Refer to Figures 28 and 31.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

TABLE 12

RADIONUCLIDE CONCENTRATIONS IN SOIL
INTERIOR LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
Building 2					
343	781	1.0 ± 0.2	1.0 ± 0.3[b]	<0.3	<10 (2.8 ± 1.2)[c]
344	907	0.7 ± 0.2	0.7 ± 0.2	<0.3	<6.6 (<1.3)
345	749	1.1 ± 0.2	1.1 ± 0.3	0.6 ± 0.3	12.0 ± 5.2
346	816	1.3 ± 0.4	<1.0	0.2 ± 0.4	<16 (5.3 ± 1.7)
347	896	0.8 ± 0.2	1.0 ± 0.2	<0.3	<6.8 (6.8 ± 1.1)
348	790	0.8 ± 0.2	<0.4	0.2 ± 0.2	<9.2 (3.3 ± 0.9)
349	993	0.7 ± 0.1	0.7 ± 0.2	<0.2	<5.4 (1.8 ± 0.6)
350	1,001	0.4 ± 0.1	<0.6	<0.4	<8.9 (1.1 ± 0.8)
351	798	0.8 ± 0.3	0.8 ± 0.3	0.4 ± 0.3	< 16 (6.1 ± 1.3)
352	797	0.5 ± 0.1	1.0 ± 0.3	0.4 ± 0.3	11.6 ± 5.8
353	774	0.4 ± 0.1	2.3 ± 0.4	4.4 ± 0.6	113 ± 15
354	716	0.8 ± 0.2	<0.6	1.9 ± 0.5	56 ± 12
526 Subfloor	* [d]	<480	119,000 ± 11,000	<1300	<18,000
527 Subfloor	*[d]	<350	14,200 ± 1600	<900	15,000
553	927	8.4 ± 0.7	1.9 ± 0.3	0.9 ± 0.3	13.4 ± 4.1
Building 3					
355	1,179	0.2 ± 0.1	<.3	0.2 ± 0.2	3.5 ± 3.0
356	775	<0.2	<0.2	<0.2	<5.9 (1.7 ± 0.8)
357	905	0.7± 0.1	1.1 ± 0.2	0.6 ± 0.3	17.6 ± 4.8
358	1,035	<0.3	1.3 ± 0.3	4.0± 0.7	98 ± 17
359	776	0.5 ± 0.1	0.6 ± 0.2	0.5 ± 0.2	<11 (5.2 ± 1.3)
360	957	<0.2	<0.5	14.1 ± 1.4	374 ± 30
361	902	<0.2	<0.3	0.8 ± 0.3	22.9 ± 5.8
362	879	1.1 ± 0.2	0.8 ± 0.4	0.5±0.3	16.4 ± 8.4
363	930	<0.2	1.0 ± 0.3	1.4 ± 0.5	43.6 ± 9.3
364	957	<0.2	1.0 ± 0.3	1.3 ± 0.5	33.6 ± 9.2
365	821	0.9 ± 0.2	1.0 ± 0.2	2.7 ± 0.4	58.1 ± 9.4

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a] Refer to Figures 27 through 32.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the

[d] Semi-quantitative data, results are total activity. Sample collected was piece of a slag-like material.

TABLE 12 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SOIL
INTERIOR LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
Building 3 (Continued)					
366	715	0.7± 0.2	2.3 ± 0.5	2.1 ± 0.5	63 ± 14
367	724	0.7 ± 0.2	0.8 ± 0.2	0.2 ± 0.2	<9.3 (3.4 ± 1.4)
368	883	0.4 ± 0.1	<0.4	<0.2	<6.0 (<1.0)
369	1,019	0.3 ± 0.1	0.6 ± 0.1	0.4 ± 0.2	14.7 ± 3.7
370	879	<0.4	<0.4	10.3 ± 1.2	264 ± 27
371	1,014	<0.3	<0.5	33.6 ± 2.7	850 ± 53
372	1,083	<0.2	<0.3	12.3 ± 1.1	338 ± 24
373	985	<0.2	<0.3	2.6 ± 0.5	64 ± 12
374	695	<0.3	<0.4	18.7 ± 1.9	444 ± 39
375	818	<0.8	<1.1	60.4 ± 5.1	6,020 ± 290
376	938	<3.0	<3.4	796 ± 53	41,600 ± 1900
550	1,184	<0.3	<0.3	64.6 ± 4.3	1595 ± 76
551	1,002	0.7 ± 0.1	0.6 ± 0.1	0.2 ± 0.1	5.4 ± 2.1
552 Subfloor (0 to 4 cm)	999	<0.3	78.5 ± 7.3	1.9 ± 0.6	90 ± 11
549 Subfloor (4 to 25 cm)	775	0.7 ± 0.1	27.0 ± 2.5	<0.4	<6.6 (3.7 ± 1.3)
Building 4					
528 (Residue)	505	0.3 ± 0.1	0.4 ± 0.2	4.4 ± 0.5	274 ± 19
529 Subfloor Soil	707	0.6 ± 0.1	0.6 ± 0.1	<0.1	<3.0 (1.8 ± 0.4)
530 (Residue)	490	0.6 ± 0.1	0.4 ± 0.2	6.8 ± 0.7	140.2 ± 13.4)
531 Subfloor Soil	883	0.4 ± 0.1	0.4 ± 0.1	<0.1	<4.1 (1.9 ± 0.6)
Building 6					
1	768	<0.5	58.2 ± 5.7	<1.6	50 ± 30
5	705	<0.2	<0.4	0.8 ± 0.3	24.2 ± 7.8
475	806	0.5 ± 0.1	<0.4	<0.2	<9.1 (1.2 ± 0.9)

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 27 through 32.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the

[d] Semi-quantitative data, results are total activity. Sample collected was piece of a slag-like material.

TABLE 12 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SOIL
INTERIOR LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
Building 6 (Continued)					
476	1,151	<0.5	68.7 ± 6.6	7.8 ± 1.6	297 ± 32
477	920	0.5 ± 0.1	<0.4	<0.3	<8.1 (1.7 ± 11)
478	724	<0.4	<0.6	<.04	< 12 (<2.1)
479	693	<0.2	0.4 ± 0.2	<0.3	<9.5 (3.9 ± 1.4)
480	687	0.5 ± 0.1	0.7 ± 0.2	<0.3	<8.1 (4.8 ± 1.4)
481	664	<0.3	1.1 ± 0.3	1.8 ± 0.6	39 ± 10
482	613	0.7 ± 0.2	1.4 ± 0.4	0.7 ± 0.4	17 ± 11
483	896	0.2 ± 0.1	0.6 ± 0.2	0.2 ± 0.1	6.6 ± 3.9
484	737	<0.3	8.7 ± 1.1	10.9 ± 1.3	272 ± 29
486	804	0.4 ± 0.2	0.7 ± 0.3	<0.4	<11 (1.5 ± 1.5)
487	735	0.6 ± 0.1	<0.4	<0.3	<10 (1.1 ± 0.8)
488	488	0.6 ± 0.2	0.9 ± 0.4	<0.4	<12 (1.6 ± 1.4)
489	788	<0.2	2.1 ± 0.4	0.8 ± 0.3	26.5 ± 7.8
490	771	<0.3	0.6 ± 0.3	<0.4	<12.7 (<1.7)
491	1,030	<0.2	0.6 ± 0.2	0.7 ± 0.3	13.4 ± 6.1
493	742	0.6 ± 0.2	0.5 ± 0.2	<0.3	<8.5 (1.4 ± 1.0)
494	637	0.5 ± 0.1	1.7 ± 0.4	2.2 ± 0.5	61 ± 12
495	674	<0.4	36.7 ± 3.6	1.2 ± 0.9	54 ± 14
Building 8					
2	829	<2.2	<2.8	213 ± 15	25,200 ± 1200
3	1,120	<0.7	213 ± 20	84.4 ± 6.1	2,520 ± 130
4	633	<2.1	<2.3	238 ± 17	9,300 ± 460
435	1,135	<0.1	<0.1	0.6 ± 0.2	17.7 ± 4.8
436	808	0.5 ± 0.1	0.6 ± 0.2	<0.2	<5.6 (0.8 ± 0.8)
437	1,215	<0.2	2.0 ± 0.4	5.1 ± 0.8	151 ± 17
438	846	<0.2	1.0 ± 0.3	4.5 ± 0.7	132 ± 11
439	939	<0.2	<0.4	1.7 ± 0.4	41.1 ± 8.6

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a] Refer to Figures 27 through 32.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the

[d] Semi-quantitative data, results are total activity. Sample collected was piece of a slag-like material.

TABLE 12 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SOIL
INTERIOR LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
Building 8 (Continued)					
440	924	<.02	<0.3	9.2 ± 0.9	251 ± 21
441	841	0.5 ± 0.2	<0.6	0.5 ± 0.3	13.0 ± 7.1
442	953	<0.2	0.4 ± 0.2	1.3 ± 0.4	35.0 ± 7.7
443	735	<0.2	0.8 ± 0.2	0.5 ± 0.2	12.8 ± 4.9
444	1,018	<0.5	2.5 ± 0.6	142.6 ± 9.5	4,200 ± 200
445	1,141	<0.7	5.4 ± 0.9	78.5 ± 5.5	2,470 ± 130
446	1,139	<1.1	<1.7	275±18	10,250 ± 480
447 (0 to 15 cm)	1,100	<1.2	<1.4	187± 13	9,720 ± 450
539 (15 to 30 cm)	1,130	<0.1	0.7 ± 0.1	25.2 ± 1.7	660 ± 31
448 (0 to 15 cm)	652	0.7 ± 0.3	2.8 ± 0.6	26.2 ± 2.1	722 ± 47
538 (15 to 20 cm)	692	1.0 ± 0.3	1.1± 0.2	18.0 ± 1.4	430 ± 26
450	725	<0.3	<0.5	17.6 ± 1.7	471 ± 38
451 (0 to 15 cm)	1,105	<1.4	9.2 ± 1.8	348 ± 23	14,680 ± 680
536 (15 to 30 cm)	367	1.3 ± 0.2	1.3 ± 0.3	10.4 ± 0.9	238 ± 19
537 (30 to 45 cm)	404	1.6 ± 0.2	1.7 ± 0.3	1.8 ± 0.3	36.9 ± 7.4
452	1,136	<0.6	30.3 ± 3.0	128.5 ± 8.6	4,970 ± 230
453	1,025	<0.8	3.5 ± 0.8	103.7 ± 7.2	3,270 ± 170
454	1,087	<0.1	<0.1	0.6 ± 0.2	29.6 ± 6.6
455	865	<0.2	<0.3	2.1 ± 0.5	57 ± 12
456	1,049	<0.2	1.4 ± 0.3	36.5 ± 2.7	1,028 ± 56
457	1,142	<0.7	<1.0	0.9 ± 0.3	26.5 ± 7.1
458 (0 to 15 cm)	1,196	-3.00000	-1.00000	164± 11	5,400 ± 260

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 27 through 32.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the

[d] Semi-quantitative data, results are total activity. Sample collected was piece of a slag-like material.

TABLE 12 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SOIL
INTERIOR LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
Building 8 (Continued)					
532 (15 to 30 cm)	522	1.3 ± 0.2	1.5 ± 0.2	4.3 ± 0.4	84.8 ± 7.8
533 (30 to 45 cm)	597	0.8 ± 0.1	1.0 ± 0.2	1.6 ± 0.3	37.2 ± 6.1
459	582	<0.3	1.2 ± 0.4	7.4 ± 1.0	194 ± 24
460	1,137	<0.7	<0.9	280 ± 18	9,350 ± 430
461	1,232	<0.5	<0.7	39.4 ± 3.1	1,144 ± 67
462	1,107	<0.3	1.3 ± 0.5	26.6 ± 2.2	692 ± 45
463	726	<0.6	<0.8	158 ± 11	3,980 ± 200
464	884	<0.7	<0.8	156 ± 10	5,990 ± 280
465	992	<0.2	0.8 ± 0.2	0.6 ± 0.4	21.3 ± 7.8
466	995	<0.3	10.3 ± 1.2	2.6 ± 0.7	49 ± 16
467	676	<0.4	12.0 ± 1.5	38.8 ± 3.2	1,133 ± 71
468	872	0.8 ± 0.2	4.4 ± 0.6	4.2 ± 0.6	116 ± 15
469	826	<0.6	7.4 ± 1.0	14.9 ± 1.7	736 ± 53
470	1,154	<0.3	20.7 ± 2.1	10.5 ± 1.4	332 ± 31
471	830	<0.3	5.2 ± 0.8	15.2 ± 1.4	486 ± 37
472	1,016	<2.0	442 ± 41	7.2 ± 3.0	158 ± 53
473	758	0.4 ± 0.1	0.5 ± 0.2	0.2 ± 0.2	<5.9 (2.0 ± 0.9)
474	802	<0.3	0.9 ± 0.3	<0.5	<15 (4.4 ± 1.6)
485	751	0.5 ± 0.1	<0.4	0.5 ± 0.3	12.5 ± 5.6
492	616	<0.6	15.1 ± 1.9	25.6 ± 2.5	730 ± 58
497	1,034	<0.5	7.6 ± 1.1	27.5 ± 2.4	763 ± 53
498	827	0.2 ± 0.1	<0.4	1.2 ± 0.3	32.1 ± 6.2
534 (0 to 15 cm)	886	<0.2	1.3 ± 0.4	128.8 ± 8.4	3260 ± 150
535 (15 to 30 cm)	469	1.0 ± 0.3	<0.5	13.8 ± 1.2	313 ± 22

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 27 through 32.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the

[d] Semi-quantitative data, results are total activity. Sample collected was piece of a slag-like material.

TABLE 12 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SOIL
INTERIOR LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Location	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
Building 8 (Continued)					
540 (0 to 15 cm)	855	0.7 ± 0.4	1.9 ± 0.6	221 ± 15	5610 ± 260
541 (15 to 30cm)	526	1.5 ± 0.4	1.4 ± 0.3	1.8 ± 0.3	38.2 ± 7.4
542 (30 to 45 cm)	603	1.0 ± 0.1	1.2 ± 0.2	1.2 ± 0.3	23.5 ± 5.7
Building 24					
543 (25 to 30 cm)	676	0.7 ± 0.1	0.9 ± 0.2	1.5 ± 0.2	37.4 ± 4.9
544 (30 to 45 cm)	546	1.2 ± 0.3	1.2 ± 0.3	0.5 ± 0.2	14.9 ± 6.6
545 (15 to 30cm)	567	1.1 ± 0.1	1.2 ± 0.2	0.2 ± 0.2	8.4 ± 3.6
546 (10 to 15 cm)	418	1.7 ± 0.2	1.7 ± 0.3	1.2 ± 0.3	24.9 ± 4.8
547 (15 to 30cm)	436	1.4 ± 0.3	1.3 ± 0.3	<0.4	<7.3 (3.4 ± 0.9)
548 (30 to 45 cm)	537	1.0 ± 0.1	1.2 ± 0.2	0.3 ± 0.2	<6.2 (4.8 ± 1.0)

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a] Refer to Figures 27 through 32.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

[d] Semi-quantitative data, results are total activity. Sample collected was piece of a slag-like material.

TABLE 13

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL
EXTERIOR SYSTEMATIC LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
0N, 0E	987	<0.2	0.5 ± 0.2[b]	<0.3	<8.3 (4.3 + 1.1)[c]
5N, 125E	921	0.2 ± 0.1	<0.5	<0.3	<7.1(1.6 ± 0.9)
5N, 145E	900	0.2 ± 0.1	<0.2	<0.2	<4.8 (0.4 ± 0.6)
15N, 155E	907	<0.3	<0.4	<0.4	<8.0 (1.6 ± 1.0)
15N, 165E	825	0.8 ± 0.2	1.0± 0.3	<0.4	<6.0 (2.1 ± 1.3)
20N, 122E	728	<0.1	<0.3	<0.2	<4.6 (0.5 ± 0.7)
25N, 175E	759	0.8 ± 0.2	0.7 ± 0.3	<0.3	<7.7 (1.4 ± 1.2)
35N, 155E	850	0.3 ± 0.1	0.3 ± 0.1	<0.2	<6.0 (2.8 ± 0.8)
35N, 175E	1164	0.1±0.1	<0.2	<0.1	<2.4 (<0.5)
35N, 185E	867	<0.2	<0.3	<0.2	<6.2 (0.6 ± 0.7)
40N, 0E	939	<0.1	<0.1	<0.1	<2.4 (<0.5)
40N, 122E	1141	<0.1	<0.3	0.2 ± 0.2	<5.5 (1.3 ± 0.5)
45N, 185E	775	0.6± 0.1	<0.4	<0.2	<8.6 (3.1 ± 1.1)
45N. 195E	939	0.4±0.1	<0.4	<0.3	<7.8 (1.3 ± 1.0)
55N, 155E	790	0.6 ± 0.1	1.2 ± 0.3	0.6 ± 0.3	<9.2 (6.4 ± 1.6)
55N, 175E	880	0.5 ± 0.1	<0.3	0.2 ± 0.2	<5.0 (2.2 ± 0.8)
55N, 185E	936	0.6 ± 0.1	0.6± 0.2	<0.2	<4.4 (2.0 ± 0.7)
55N, 195E	792	0.7 ± 0.1	0.9 ± 0.2	<0.2	<5.9 (1.8 ± 1.0)
60N, 124E	877	0.4± 0.1	<0.4	0.5±0.4	6.5 ±4.0
65N, 5E	1214	<0.1	0.2 ± 0.1	<0.2	<5.8 (1.2 ± 0.7)
65N, 25E	856	0.2 ± 0.1	0.4 ± 0.1	0.2 ± 0.2	6.4 ± 2.6
65N, 185E	796	0.7 ± 0.2	0.8 ± 0.2	<0.3	<9.3 (3.4 ± 1.2)
65N, 195E	1077	0.4 ± 0.1	0.5 ± 0.2	<0.2	4.3 ± 3.1
70N, 45E	789	0.5 ± 0.2	1.3 ± 0.3	1.1 ± 0.4	24.8 ± 9.6
75N. 15E	1230	0.2± 0.1	0.4± 0.1	0.4±0.2	9.2± 3.8
75N, 155E	831	<0.3	1.0 ± 0.3	0.7 ± 0.4	9.2 ± 6.9
75N, 175E	1086	0.6 ± 0.1	<0.3	<0.2	<4.5 (1.8 ± 0.5)

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33 through 34.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 13 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL
EXTERIOR SYSTEMATIC LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
75N, 185E	843	1.3 ± 0.3	1.4 ± 0.3	<0.6	<13.0 (2.5 ± 1.0)
75N, 195E	850	0.9 ± 0.2	0.9 ± 0.2	<0.3	<6.5 (2.8 ± 1.0)
75N, 205E	667	0.8 ± 0.2	1.2 ± 0.3	<0.4	17.4 ± 9.4
80N, 0E	736	0.6 ± 0.2	0.8 ± 0.3	<0.5	<15 (2.0 ± 0.8)
85N, 5E	1253	0.3 ± 0.1	0.5 ± 0.1	<0.2	<4.8 (1.7 ± 0.6)
85N, 185E	737	0.5 ± 0.1	0.9 ± 0.2	<0.2	6.4 ± 3.4
85N, 195E	1147	0.5 ± 0.1	0.6 ± 0.2	<0.3	<7.9 (1.6 ± 0.9)
85N, 205E	684	0.5 ± 0.2	0.5 ± 0.2	<0.4	<9.6 (1.9 ± 0.9)
95N, 15E	1552	<0.1	<0.1	0.2 ± 0.1	10.2 ± 3.0
95N, 155E	744	0.5 ± 0.2	0.9 ± 0.3	<0.5	<15 (2.6 ± 1.1)
95N, 175E	544	1.0 ± 0.2	<0.6	<0.3	5.2 ± 5.1
95N, 185F	679	1.1 ± 0.2	1.4 ± 0.3	0.3 ± 0.3	12.0 ± 6.1
95N, 195F	901	0.2 ± 0.1	<0.3	<0.2	<4.2 (0.5 ± 0.8)
95N, 205E	967	0.6 ± 0.1	0.9 ± 0.2	0.4 ± 0.2	6.7 ± 4.2
105N, 165F	544	0.9 ± 0.2	<0.7	<0.5	<11 (7.2 ± 1.8)
105N, 195E	835	<0.1	<0.2	<0.1	<2.9 (<0.7)
105N, 205E	958	0.5 ± 0.1	0.7 ± 0.2	<0.3	<7.4 (2.0 ± 0.8)
115N, 15E	936	<0.2	<0.4	<0.3	<9.9 (<1.5)
115N, 155E	878	0.5 ± 0.1	0.4 ± 0.2	<0.4	<12 (<1.5)
115N, 175E	1162	0.4 ± 0.1	0.4 ± 0.1	0.2 ± 0.1	2.8 ± 2.3
115N, 185E	946	0.4 ± 0.1	0.6 ± 0.2	0.5 ± 0.2	14.0 ± 4.7
115N, 195E	702	1.0 ± 0.2	0.6 ± 0.3	0.9 ± 0.3	19.8±7.0
115N, 205E	873	<0.2	0.5 ± 0.2	<0.3	<8.6 (1.6 ± 1.0)
120N, 0E	580	<0.1	0.2 ± 0.1	<0.2	<4.8 (0.9 ± 0.7)
125N, 25E	259	<0.3	<0.6	0.9 ± 0.6	28 ± 13
125N, 165E	866	0.5 ± 0.2	<0.7	<0.5	<11 (1.8 ± 1.1)
125N. 185E	548	0.9 ± 0.2	0.7 ± 0.3	<0.4	<9.9 (2.4 ± 1.4)

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a] Refer to Figures 33 through 34.
[b] Uncertainties are total propagated uncertainties at the 95% confidence level.
[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 13 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL
EXTERIOR SYSTEMATIC LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
125N, 195E	611	3.0 ± 0.7	1.2 ± 0.4	0.6 ± 0.5	<18 (7.2 ± 1.9)
125N, 205E	893	0.4 ± 0.1	0.5 ± 0.2	<0.4	<7.6 (1.9 ± 0.9)
128N, 115E	837	0.4± 0.1	0.6 ± 0.2	0.2 ± 0.2	8.0 ± 4.7
135N, 155E	730	1.1 ± 0.2	1.2 ± 0.3	<0.3	<11 (1.9 ± 1.2)
135N, 175E	1153	0.3 ± 0.1	<0.5	0.9 ± 0.3	21.1 ± 6.3
135N, 185E	524	<0.3	<0.4	<0.3	<8.7 (0.4 ± 1.0)
135N, 195E	643	<0.3	0.8 ± 0.3	<0.3	<7.0 (1.5 ± 1.2)
135N, 205E	919	0.6 ± 0.1	<0.3	0.3 ± 0.2	4.4 ± 2.6
140N, 20E	568	<0.1	<0.2	<0.1	<3.0 (0.6 ± 0.5)
145N, 165E	596	0.7 ± 0.1	1.1 ± 0.3	0.7 ± 0.3	<9.7 (7.1 ± 1.4)
145N, 185E	639	1.0 ± 0.2	0.9 ± 0.3	<0.3	<6.9 (<1.2)
145N, 195E	712	0.6 ± 0.1	<0.3	<0.3	<6.8 (1.4 ± 1.0)
145N, 205E	522	2.1 ± 0.3	1.5 ± 0.4	<0.5	<11 (3.7 ± 1.7)
150N, 112E	891	<0.2	0.4 ± 0.2	1.2 ± 0.4	34.6 ± 7.7
155N, 155E	808	0.4 ± 0.1	0.5 ± 0.2	<0.2	<5.4 (1.7 ± 0.6)
155N, 175E	1164	0.2 ± 0.1	<0.4	<0.3	5.5 ± 3.9
155N, 185E	985	<0.1	<0.2	<0.2	<4.6 (0.1 ± 0.4)
155N, 195E	659	<0.2	0.9 ± 0.2	<0.3	<7.9 (2.3 ± 1.0)
155N, 205E	638	1.1 ± 0.2	1.0 ± 0.3	<0.3	<8.8 (1.8 ± 1.3)
160N, 0E	508	0.3 ± 0.1	0.6 ± 0.2	<0.2	<4.6 (1.4 ± 0.8)
160N, 82E	814	0.5 ± 0.1	1.3 ± 0.3	0.8 ± 0.3	14.6 ± 6.3
165N, 165E	521	0.5 ± 0.2	<0.5	0.8 ± 0.4	20.7 ± 9.1
165N, 185E	851	0.2 ± 0.1	<0.3	<0.2	<4.0 (1.2 ± 0.8)
165N, 195E	697	0.7 ± 0.2	<0.7	0.3 ± 0.4	<15 (8.7 ± 1.8)
165N, 205E	857	0.7 ± 0.2	1.1 ± 0.3	<0.3	<8.4 (2.5 ± 1.3)
170N, 118E	1059	0.2 ± 0.1	0.5 ± 0.1	<0.2	<5.4(2.8 ± 0.7)
175N, 175E	1535	<0.1	<0.2	<0.2	<4.4 (0.4 ± 0.3)

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a] Refer to Figures 33 through 34.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 13 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL
EXTERIOR SYSTEMATIC LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
175N, 185e	697	0.3 ± 0.2	0.7 ± 0.2	<0.4	<9.8 (1.0 ± 0.9)
175N. 195E	907	0.6 ± 0.2	0.8 ± 0.2	0.7 ± 0.5	18.5 ± 7.8
175N, 205E	1051	0.6 ± 0.1	0.6 ±0.2	0.2 ± 0.2	<6.9 (1.2 ± 0.9)
178N, 95E	959	0.4 ± 0.1	0.5 ± 0.2	<0.2	0.7 ± 0.6
180N, 20E	1071	0.2 ± 0.1	<0.3	<0.2	<6.1 (0.8 ± 0.7)
180N, 80E	754	0.5 ± 0.2	<0.7	0.5 ± 0.3	3.6 ± 1.1
185N, 165E	501	<0.3	0.8 ± 0.3	0.7 ± 0.4	13 ± 11
185N, 185E	1204	0.3 ± 0.1	0.5 ± 0.1	<0.2	3.6 ± 2.6
185N, 195E	891	0.6 ± 0.1	<0.7	<0.4	<12 (2.3 ± 1.4)
185N, 205E	702	1.0 ± 0.3	1.2 ± 0.3	<0.5	<15 (2.8±1.9)
190N, 122E	819	0.4±0.1	0.8 ± 0.2	0.4 ± 0.3	15.3 ± 7.5
195N, 75E	663	0.3 ± 0.1	0.5 ± 0.2	<0.2	2.4 ± 1.0
195N, 95E	1023	0.4± 0.1	0.6 ± 0.2	<0.2	3.1 ± 1.0
195N, 175E	1356	0.2 ± 0.1	0.4 ± 0.1	<0.2	<5.5 (1.3 ± 0.5)
195N, 185E	1349	0.2 ± 0.1	<0.3	<0.2	<5.1 (0.9 ± 0.5)
195N, 195E	926	0.4 ± 0.1	<0.2	<0.2	<4.1 (0.7 ± 0.6)
195N, 205E	1164	0.3 ± 0.1	0.4 ± 0.1	<0.2	<3.9 (0.9 ± 0.5)
200N, 0E	816	0.6 ± 0.1	0.8 ± 0.3	<0.3	<9.3 (2.8 ± 1.2)
205N, 165E	558	0.5 ± 0.2	0.7 ± 0.3	<0.5	< 13 (2.0 ± 0.9)
205N, 185E	1435	0.2 ± 0.1	<0.2	<0.1	<2.9 (<0.4)
205N. 195E	710	0.4 ± 0.1	0.5 ± 0.2	<0.3	<8.5 (2.1 ± 1.3)
205N,205E	1497	<0.1	0.2 ± 0.1	<0.1	<4.2 (0.4 ± 0.4)
210N, 118E	929	<0.2	0.4 ± 0.2	<0.3	1.3 ± 0.6
215N, 75E	702	0.5 ± 0.1	0.7 ± 0.2	<0.3	1.4 ± 0.9
215N, 95E	730	<0.2	0.4 ± 0.2	<0.2	1.2 ± 0.9
215N, 135E	897	0.2 ± 0.1	0.4± 0.2	<0.2	1.5 ± 0.8
215N, 155E	787	0.6 ± 0.1	0.8 ± 0.2	<0.2	<6.2 (1.2 ± 0.7)

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a] Refer to Figures 33 through 34.
[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 13 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL
EXTERIOR SYSTEMATIC LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
215N, 175E	1414	0.2± 0.1	0.4 ± 0.1	<0.1	<3.5 (0.6 ± 0.3)
215N, 185E	1509	<0.1	0.2 ± 0.1	<0.1	<2.8 (0.4 ± 0.3)
215N, 195E	1035	<0.1	<0.2	<0.2	<5.7 (0.8 ± 0.6)
215N,205E	401	0.7 ± 0.2	<0.7	<0.5	<11 (2.7±1.2)
220N, 20E	770	0.7 ± 0.2	0.8 ± 0.3	<0.5	<9.9 (1.4 ± 1.2)
240N, 80E	750	0.6 ± 0.2	0.7 ± 0.2	<0.4	<12 (<1.9)
240N, 160E	627	<0.2	<0.4	<0.2	<6.2 (<1.0)
240N, 200E	832	0.7 ± 0.2	0.7 ± 0.2	<0.3	<7.1 (1.2 ± 0.9)
241N, 0E	954	0.4 ± 0.1	0.4 ± 0.1	<0.2	<6.3 (<0.9)
260N, 20E	681	0.6 ± 0.2	0.9 ± 0.2	<0.3	<5.8 (0.7 ± 0.9)
260N, 140E	1222	0.4 ± 0.1	1.0 ± 0.2	0.4 ± 0.2	5.4 ± 3.0
260N, 180E	940	0.4 ± 0.1	0.5 ± 0.2	<0.4	<7.8 (2.2 ± 0.8)
280N, 80E	1187	0.5 ± 0.1	0.5 ± 0.2	0.2 ± 0.2	<7.0 (2.0 ± 0.7)
280N, 120E	1090	0.6 ± 0.1	0.6 ± 0.2	0.2 ± 0.2	<6.9 (2.4 ± 0.8)
280N, 160E	1115	0.2± 0.1	<0.2	<0.2	<5.6 (0.8±0.7)
280N, 200E	785	0.6 ± 0.1	<0.4	<0.2	<5.4 (<0.9)
300N, 20E	778	<0.2	0.7 ± 0.2	<0.3	<7.4 (1.9 ± 1.1)
300N, 60E	964	0.4 ± 0.1	<0.5	<0.4	<5.3 (1.5 ± 0.8)
300N, 100E	834	0.7 ± 0.1	1.1 ± 0.3	2.6 ± 0.5	51 ± 11
300N, 140E	1108	0.3 ± 0.1	0.8 ± 0.2	0.5 ± 0.3	13.2 ± 4.6
300N, 180E	610	0.8 ± 0.2	1.0 ± 0.4	<0.4	<7.6 (2.4 ± 1.6)
320N, 40E	732	0.6 ± 0.1	0.6 ± 0.2	0.3 ± 0.2	11.5 ± 4.2
320N, 80E	1174	0.5 ± 0.1	0.6 ± 0.2	0.3 ± 0.2	4.6 ± 3.9
320N, 120E	1003	<0.2	0.4 ± 0.1	0.2 ± 0.2	7.8 ± 4.6
320N, 160E	792	0.7 ± 0.1	<0.4	<0.3	<6.4 (2.4 ± 1.1)
320N, 200E	732	0.6 ± 0.2	<0.7	<0.5	< 11 (2.2 ± 1.3)
340N, 20E	517	<0.3	1.0 ± 0.3	<0.4	<12 (5.1 ± 1.7)

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33 through 34.
[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 13 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL
EXTERIOR SYSTEMATIC LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
340N, 60E	988	<0.2	0.5 ± 0.2	<0.3	<7.8 (1.4 ± 0.7)
340N, 100E	686	0.5 ± 0.2	<0.8	1.4 ± 0.5	36.2 ± 9.6
340N, 140E	766	0.5 ± 0.1	0.9 ± 0.2	0.3 ± 0.2	<7.7 (3.4 ± 1.1)
340N, 180E	821	<0.2	<0.3	<0.2	<4.2 (0.9 ± 0.7)
359N, 0E	686	0.5 ± 0.1	0.8 ± 0.3	<0.3	<9.6 (0.8 ± 1.0)
359N, 40E	852	<0.3	<0.5	<0.3	<12 (1.8 ± 0.8)
359N, 80E	755	0.4 ± 0.1	0.7 ± 0.2	<0.3	<8.0 (1.2 ± 0.9)
359N, 120E	728	0.6 ± 0.1	0.9 ± 0.2	<0.3	<6.6 (1.8 ± 0.9)
359N, 160E	785	1.4 ± 0.4	1.4 ± 0.4	<0.6	<14 (2.1 ± 1.3)
359N, 200E	839	0.6 ± 0.1	0.9 ± 0.2	<0.3	<8.2 (2.0 ± 1.3)
240N, 280W	649	0.5 ± 0.1	0.5 ± 0.1	0.1 ± 0.1	5.2 ± 1.8
260N, 20W	1040	0.4 ± 0.1	0.7 ± 0.2	<0.2	<4.4 (1.2 ± 0.6)
260N, 100W	775	0.5 ± 0.2	0.7 ± 0.2	<0.3	<10 (1.1 ± 1.2)
260N, 140W	911	0.5±0.1	<0.4	<0.3	<11 (0.8 ± 0.8)
260N, 180W	1027	<0.1	0.2 ± 0.1	<0.2	<3.9 (1.6 ± 0.7)
260N, 260W	750	0.6 ± 0.1	0.5 ± 0.1	0.9 ± 0.2	18.2 ± 2.9
260N, 300W	658	0.8 ± 0.2	0.5 ± 0.1	0.2 ± 0.2	<4.9
262N, 60W	925	0.4 ± 0.1	0.6 ± 0.2	<0.2	<6.6 (<1.1)
280N, 0W	939	0.6 ± 0.2	0.9 ± 0.3	0.3 ± 0.3	<13 (3.3 ± 1.2)
280N, 40W	742	0.5 ± 0.1	0.7 ± 0.3	<0.3	<9.3 (2.5 ± 1.2)
280N, 80W	795	0.9 ± 0.2	1.2 ± 0.3	0.5 ± 0.3	<9.0 (5.9 ± 1.5)
280N, 160W	776	<0.2	<0.5	<0.3	<7.3 (0.9 ± 1.0)
280N, 200W	800	<0.1	<0.3	<0.2	<5.8 (< 0.9)
280N, 240W	613	0.5 ± 0.1	0.8 ± 0.1	0.3 ± 0.1	5.0 ± 2.1
280N, 280W	723	0.4 ± 0.1	0.4 ± 0.1	0.2 ± 0.1	<4.9
280N, 338W	490	0.6 ± 0.1	0.7 ± 0.2	0.2 ± 0.2	5.1 ± 2.4
283N, 120W	992	0.2± 0.1	<0.2	<0.2	<4.9 (2.1 ± 0.7)

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33 through 34.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 13 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL
EXTERIOR SYSTEMATIC LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
300N,20W	738	0.7 ± 0.2	<0.8	<0.5	<13 (2.8 ± 1.2)
300N, 60W	648	0.4 ± 0.1	0.5 ± 0.2	<0.2	<5.6 (1.5 ± 0.8)
300N, 100W	891	0.4 ± 0.1	<0.4	0.5 ± 0.3	8.6 ± 3.8
300N, 140W	1058	0.6 ± 0.1	0.9 ± 0.3	1.3 ± 0.4	32.3 ± 7.6
300N, 180W	1003	<0.1	<0.2	<0.2	<5.8 (<0.7)
300N, 220W	877	0.3 ± 0.1	0.4 ± 0.1	0.2 ± 0.1	4.5 ± 2.4
300N, 260W	767	0.4 ± 0.1	0.5 ± 0.1	0.2 ± 0.1	4.9 ± 2.0
300N, 300W	618	0.3 ± 0.1	0.6 ± 0.1	0.1 ± 0.1	<5.1 (1.6 ± 0.5)
320N, 0W	796	0.4 ± 0.1	0.5 ± 0.2	<0.2	<6.0 (1.8 ± 1.1)
320N, 40W	633	0.5 ± 0.1	<0.4	<0.3	<7.7 (2.3 ± 0.9)
320N, 80W	814	0.6 ± 0.2	<0.7	<0.4	<10 (2.2 ± 1.0)
320N, 120W	815	0.3 ± 0.1	<0.2	0.3 ± 0.2	<4.0 (1.3 ± 0.7)
320N, 160W	999	0.5 ± 0.1	0.7 ± 0.2	0.3 ± 0.2	< 12 (3.3 ± 1.2)
320N, 200W	767	0.5 ± 0.1	0.6 ± 0.2	<0.3	<8.6 (2.6 ± 1.2)
320N, 240W	700	0.5 ± 0.1	0.5 ± 0.1	0.2 ± 0.2	6.9 ± 2.9
320N, 280W	723	0.6 ± 0.1	0.8 ± 0.1	0.3 ± 0.1	6.5 ± 2.3
320N, 320W	644	0.6 ± 0.1	0.5 ± 0.1	<0.2	2.0 ± 2.7
340N, 20W	758	0.5 ± 0.1	<0.5	<0.3	<11 (5.0 ± 1.4)
340N, 60W	697	0.6 ± 0.1	0.8 ± 0.2	<0.4	<11 (4.4 ± 1.3)
340N, 100W	929	0.4 ± 0.1	0.5 ± 0.3	0.3 ± 0.2	7.4 ± 4.5
340N. 140W	964	0.8 ± 0.2	<0.5	<0.4	<12 (<1.6)
340N, 180W	981	0.4 ± 0.1	0.3 ± 0.1	<0.2	<5.7 (2.6 ± 0.8)
340N, 220W	567	0.4 ± 0.1	0.6 ± 0.1	0.6 ± 0.2	13.5 ± 3.2
340N, 260W	742	0.5 ± 0.1	0.5 ± 0.1	0.4 ± 0.1	10.2 ± 2.8
340N. 300W	698	0.7 ± 0.2	0.8 ± 0.2	0.3 ± 0.2	5.2 ± 2.9
357N, 120W	781	1.5 ± 0.4	<0.7	<0.5	<11(1.9 ± 1.1)
359N, 40W	632	0.7 ± 0.2	0.8 ± 0.3	0.3 ± 0.2	<9.7 (4.8 ± 1.5)

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33 through 34.
[b] Uncertainties are total propagated uncertainties at the 95% confidence level.
[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the

TABLE 13 (Continued)

**RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL
EXTERIOR SYSTEMATIC LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK**

Grid Coordinates[a]	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
359N, 80W	702	0.6 ± 0.1	0.8 ± 0.2	<0.3	<6.3 (2.5 ± 1.1)
359N, 160W	750	0.8 ± 0.2	0.7 ± 0.3	<0.3	<8.3 (<1.5)
359N, 200W	737	0.7 ± 0.2	0.8 ± 0.2	<0.3	<8.5 (2.6 ± 1.3)
360N, 240W	967	0.6 ± 0.1	0.6 ± 0.2	0.8 ± 0.3	12.4±8.0
360N, 280W	827	0.6 ± 0.2	0.4 ± 0.3	<0.4	<11 (2.4 ± 1.0)
360N, 320W	736	0.6 ± 0.1	0.5 ± 0.1	0.2 ± 0.1	1.9 ± 1.4
380N, 140W	683	0.6 ± 0.2	0.8 ± 0.4	<0.3	<8.9 (1.0 ± 1.1)
380N, 180W	714	0.6 ± 0.1	0.9 ± 0.3	<0.3	<8.2 (1.8 ± 1.3)
380N, 220W	842	0.4 ± 0.1	0.7 ± 0.2	1.0 ± 0.3	22.6 ± 6.9
380N, 260W	784	0.6 ± 0.1	0.7 ± 0.2	<0.2	<6.0 (3.1 ± 0.9)
380N, 300W	800	0.5 ± 0.1	0.6 ± 0.1	0.2 ± 0.1	3.6 ± 1.9
400N, 120W	579	0.7 ± 0.1	0.8 ± 0.3	<0.3	<8.3 (1.0 ± 0.9)
400N, 160W	755	<0.3	0.7 ± 0.2	<0.3	<8.2 (1.0 ± 0.9)
400N, 200W	1014	0.4 ± 0.1	<0.4	0.3 ± 0.2	7.3 ± 3.3
400N, 240W	861	0.7 ± 0.1	<0.6	0.3 ± 0.3	<9.9 (3.2 ± 1.2)
400N, 280W	775	0.5 ± 0.2	<0.5	<0.4	<10 (2.3 ± 1.3)
400N, 320W	723	0.5 ± 0.1	0.6 ± 0.1	<0.1	<3.9
420N. 140W	596	0.8 ± 0.3	0.9 ± 0.3	<0.5	<12 (<2.3)
420N, 180W	583	0.5 ± 0.2	<0.6	<0.4	<13 (2.8 ± 1.7)
420N, 220W	864	0.4 ± 0.1	0.5 ± 0.2	0.2 ± 0.2	9.1 ± 6.7
420N, 260W	879	0.5 ± 0.1	0.6 ± 0.2	0.4 ± 0.2	<15.5 ± 4.9
420N, 300W	707	0.6 ± 0.1	0.5 ± 0.1	0.1 ± 0.1	2.8 ± 2.4
420N, 340W	536	0.9 ± 0.2	0.6 ± 0.2	0.2 ± 0.2	<5.5 (1.1 ± 0.6)
440N, 320W	653	0.5 ± 0.1	0.5 ± 0.1	0.2 ± 0.1	<3.5

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33 through 34.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 14

**RADIONUCLIDE CONCENTRATIONS IN SOIL
EXTERIOR LOCATIONS OF ELEVATED ACTIVITY
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK**

Grid Coordinates[a]	Depth (cm)	Sample Quantity	Radionuclide Concentration (pCi/g)			
			Ra-226	Th-232	U-235	U-238
62N, 58E	0-15	688	<0.4	<0.9	5.9 ± 0.9[b]	108.5 ± 5.8
70N,124E	0-15	1040	<0.3	<0.4	33.3 ± 2.5	912 ± 51
70N, 124E	15-30	928	<0.9	<1.2	137.1 ± 9.4	3,640 ± 190
79N,26E	0-15	682	0.7±0.2	3.8 ± 0.7	2.0 ± 0.7	48 ± 19
82N, 26E	0-15	663	1.0± 0.3	39.5 ± 3.8	6.8 ± 1.3	238
83N, 26E	15-30	461	<2.8	307 ± 30	6.6 ± 6.1	320 ± 150
85N, 124E	0-15	1082	<0.5	95.1 ± 8.9	2.4 ± 1.2	185 ± 25
85N, 124E	15-30	924	<0.3	17.9 ± 1.8	3.3 ± 0.7	138 ± 18
89N, 10E	0-15	834	<0.2	7.8 ± 1.0	0.6 ± 0.4	23.4 ± 9.2
90N, 24E	0-15	843	<0.3	6.1 ± 0.8	3.5 ± 0.7	86 ± 15
90N, 24E	15-30	651	0.5 ± 0.2	1.3 ± 0.4	1.5 ± 0.6	45 ± 10
94N, 26E	0-15	795	<0.3	19.6 ± 2.1	3.0 ± 0.9	91 ± 17
94N, 26E	15-30	699	0.7 ± 0.1	<0.6	<0.3	<9.1(1.6 ± 1.5)[c]
101N, 188E	0-15	934	4.3 ± 0.6	2.3±0.7	<0.9	17±16
105N, 116E	0-15	911	<0.5	4.3 ± 0.8	35.3 ± 3.0	2,660 ± 140
105N, 116E	15-30	774	<0.5	1.4 ± 0.4	11.1 ± 1.4	736 ± 57
105N, 186E	0-15	941	1.3 ± 0.2	0.8 ± 0.3	<0.5	<10 (2.2 ± 1.2)
106N, 184E	0-15	875	0.3 ± 0.1	<0.3	0.8 ± 0.3	16.8 ± 6.2
106N, 184E	15-30	876	0.9 ± 0.3	39.1 ± 3.8	1.9 ± 0.8	59 ± 19
106N, 185E	0-15	412	<6.9	<8.7	341 ± 32	44,400 ± 2,200
111N,199E	0-15	608	<1.1	<1.5	433 ± 29	13,020 ± 600
116N,18E	0-15	1152	<0.2	1.7 ± 0.4	11.0 ± 13	266 ± 25
134N, 80E	0-15	846	<0.3	<0.6	13.2 ± 1.4	329 ± 30
135N, 75E	0-15	683	<1.7	<2.1	299 ± 20	8,770 ± 430
135N, 75E	15-30	563	<0.6	<0.9	109.5 ± 7.6	2,750 ± 140
168N, 26E	0-15	161	<5.3	<5.4	1,079 ± 76	54,800 ± 2,700
201N, 185E	0-15	1159	0.4±0.2	11.6 ± 1.2	10.9 ± 1.1	279 ± 21
272N, 108E	0-15	887	<3.7	<4.3	293 ± 23	23,500 ± 1,100

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 14 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SOIL
EXTERIOR LOCATIONS OF ELEVATED ACTIVITY
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Depth (cm)	Sample Quantity	Radionuclide Concentration (pCi/g)			
			Ra-226	Th-232	U-235	U-238
276N, 119E	0-15	809	<0.3	33.5 ± 3.3	11.4 ± 1.5	343 ± 29
276N, 119E	15-30	825	0.4 ± 0.2	83 ± 1.0	8.1 ± 0.9	218 ± 19
278N, 145W	0-15	737	0.7 ± 0.2	1.9 ± 0.3	3.1 ± 0.5	84 ± 11
285N, 115E	0-15	870	0.5 ± 0.1	1.2 ± 0.3	1.8 ± 0.4	35.3 ± 7.9
289N, 144W	15-30	720	<0.6	<0.9	118.0 ± 8.1	3,050 ± 160
289N, 144W	0-15	1032	<1.5	<2.0	246 ± 18	6,970 ± 370
296N, 88E	0-15	1006	<0.7	13.0 ± 2.2	48.1 ± 4.7	1,196 ± 98
296N, 88E	15-30	736	<0.4	8.6 ± 1.1	17.6 ± 1.8	397 ± 38
297N, 126W	0-15	1237	<0.1	0.4 ± 0.1	1.0 ± 0.3	23.1 ± 5.8
297N, 126W	15-30	1175	<0.7	<1.0	61.7 ± 5.4	1,860 ± 120
306N, 139W	0-15	936	<0.4	1.1 ± 0.5	16.9 ± 1.8	615 ± 43
306N, 139W	15-30	858	1.1 ± 0.2	1.1 ± 0.3	9.3 ± 1.0	241 ± 21
306N, 94E	0-15	654	0.6 ± 0.3	4.9 ± 0.9	15.5 ± 1.7	397 ± 38
306N, 94E	15-30	707	<0.4	5.4 ± 0.8	19.8 ± 1.8	465 ± 40
326N, 205W	0-15	614	0.4 ± 0.2	5.5 ± 0.9	0.9 ± 0.5	17.8 ± 9.5
345N, 208W	0-15	883	0.4 ± 0.1	<0.3	8.2 ± 0.7	182 ± 13
379N, 199W	0-15	779	1.1 ± 0.3	8.7 ± 0.9	0.5 ± 0.3	6.5 ± 4.9
379N, 199W	15-30	685	1.5 ± 0.2	21.8 ± 2.1	0.3 ± 0.4	12.8 ± 6.1
395N, 204W	0-15	781	1.4 ± 0.2	11.0 ± 1.1	0.7 ± 0.2	17.0 ± 4.0
405N, 215W	0-15	817	21.0 ± 1.8	1.2 ± 0.3	0.3 ± 0.3	<8.6 (5.2 ± 1.5)

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33 through 34.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 15

RADIONUCLIDE CONCENTRATIONS IN SOIL
EXTERIOR BOREHOLE LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Depth (cm)	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
			Ra-226	Th-232	U-235	U-238
107N, 184E	0-15	904	<0.2	<0.3	0.2 ± 0.2[b]	3.8 ± 4.7
107N, 184E	15-60	438	0.6 ± 0.1	1.0 ± 0.3	1.6 ± 0.4	35.9 ± 8.5
107N, 184E	60-120	309	1.2 ± 0.3	<0.9	<0.7	10.4 ± 8.4
168N, 24E	0-15	931	<0.1	<0.3	<0.2	<6.9 (0.9 ± 0.7)
168N, 24E	15-60	166	0.5 ± 0.1	<0.4	<0.3	<7.4 (1.5 ± 0.8)
168N, 24E	60-120	646	0.6 ± 0.2	0.8 ± 0.3	<0.4	<9.0 (3.2 ± 0.7)
200N, 184E	0-15	967	0.3 ± 0.2	11.5 ± 1.2	10.4 ± 1.1	225 ± 21
200N, 184E	15-60	681	0.9 ± 0.3	2.9 ± 0.6	2.4 ± 0.6	30 ± 12
200N, 184E	60-120	382	1.0 ± 0.2	1.2 ± 0.4	0.3 ± 0.3	<11 (5.7 ± 0.8)
224N, 160E	0-15	1076	1.0 ± 0.1	1.3 ± 0.2	<0.2	<5.8 (2.0 ± 0.5)
224N, 160E	15-60	193	2.1 ± 0.3	2.6 ± 0.4	<0.4	<9.2 (3.3 ± 0.5)
224N, 160E	60-120	817	1.2 ± 0.2	1.2 ± 0.3	<0.3	<9.4 (1.5 ± 0.7)
224N, 160E	120-180	169	1.0 ± 0.2	<0.6	<0.3	<9.5 (1.7 ± 0.6)
275N, 146E	0-15	816	0.8 ± 0.3	1.9 ± 0.4	1.4 ± 0.6	83 ± 15
275N, 146E	15-60	418	1.1 ± 0.2	1.4 ± 0.4	0.8 ± 0.3	33 ± 12
275N, 146E	60-120	148	0.6 ± 0.2	1.0 ± 0.3	0.3 ± 0.4	9.0 ± 8.7
277N, 84E	0-15	1328	<0.1	0.3 ± 0.1	0.2 ± 0.1	<5.1(0.7 ± 0.4)
277N, 84E	15-60	932	0.4 ± 0.1	0.5 ± 0.1	<0.2	<5.9 (1.5 ± 0.5)
277N, 84E	60-120	536	0.4 ± 0.1	0.5 ± 0.2	<0.2	<5.3 (2.1 ± 0.4)
289N, 87E	0-15	717	<0.7	23.0 ± 2.6	34.7 ± 3.1	828 ± 62
289N, 87E	15-60	440	<0.3	6.0 ± 0.8	10.3 ± 1.2	268 ± 26
290N, 76E	0-15	783	0.8 ± 0.1	0.8 ± 0.2	0.2 ± 0.3	8.5 ± 4.7
290N, 76E	15-60	403	0.7 ± 0.1	<0.4	<0.3	<8.1 (3.7 ± 0.6)
290N, 76E	60-120	194	0.2 ± 0.1	<0.3	<0.3	<7.4 (1.1 ± 0.5)
290N, 98E	0-15	924	0.5 ± 0.1	0.6 ± 0.3	1.1 ± 0.4	32 ± 11
290N,98E	15-60	419	<0.3	1.2 ± 0.3	1.7 ± 0.5	24 ±12
290N, 98E	60-120	142	0.7 ± 0.2	1.2 ± 0.3	1.1 ± 0.3	25 ± 12
291N, 120E	0-15	1039	<0.2	<0.4	<0.4	<11 (4.3 ± 0.7)
291N, 120E	15-60	160	0.5 ± 0.2	<0.6	0.6 ± 0.3	12 ± 10
291N, 120E	60-120	449	0.7 ± 0.2	<0.6	<0.4	< 11 (2.4 ± 0.6)
291N, 154E	0-15	490	0.4 ± 0.1	3.4 ± 0.5	0.3 ± 0.3	9.1 ± 6.3
291N, 154E	15-60	361	1.0 ± 0.2	7.2 ± 0.9	<0.5	<11 (8.7± 1.1)

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33 and 34.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 15 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SOIL
EXTERIOR BOREHOLE LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Depth (cm)	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
			Ra-226	Th-232	U-235	U-238
291N, 154E	60-120	452	0.7 ± 0.1	1.2 ± 0.3	<0.3	<9.4 (1.4 ± 0.6)
291N, 154E	120-180	201	0.2±0.1	<0.5	<0.4	-<9.4 (0.7± 0.5)
303N, 112E	0-15	762	0.8 ± 0.1	1.2 ± 0.3	0.8 ± 0.3	18.9 ± 6.0
303N, 112E	15-60	381	1.0 ± 0.2	1.7 ± 0.4	1.1 ± 0.4	12.5 ± 8.5
303N, 112E	60-120	177	0.9 ± 0.2	1.3 ± 0.4	<0.4	<14 (6.0 ± 0.8)
304N,118E	0-15	873	<0.7	<1.1	105.7 ± 7.6	3110 ± 160
304N, 126E	0-15	804	<0.2	1.3 ± 0.3	3.6 ± 0.6	79 ± 13
304N, 126E	15-60	376	0.6 ± 0.2	1.9 ± 0.4	2.6 ± 0.4	79 ± 13
304N, 126E	60-120	132	<0.4	<0.8	0.8 ± 0.5	79 ± 13
310N, 84E	0-15	819	0.6 ± 0.2	1.0 ± 0.3	0.9 ± 0.4	14.6 ± 8.7
310N, 84E	15-60	694	0.7 ± 0.2	0.7 ± 0.3	<0.3	<11 (5.4 ± 1.0)
310N, 84E	60-120	799	0.6 ± 0.2	<0.6	<0.4	<11 (1.9 ± 0.9)
310N, 118E	0-15	936	<0.2	1.0 ± 03	1.0 ± 0.4	30.2 ± 8.4
310N, 118E	15-60	849	0.8 ± 0.1	1.1 ± 0.3	0.4 ± 0.4	14.8 ± 5.3
310N, 118E	60-120	423	0.6 ± 0.1	0.6 ± 0.2	0.5 ± 0.3	11.2 ± 6.4
311N, 13E	0-15	713	0.9 ± 0.2	2.7 ± 0.4	0.3 ± 0.4	<9.3 (5.8 ± 1.9)
311N, 13E	15-60	363	0.8 ± 0.2	0.5 ± 0.3	0.2 ± 0.3	<9.4 (3.8 ± 1.3)
311N, 13E	60-120	778	0.4 ± 0.1	0.7 ± 0.2	<0.3	<7.4 (0.5 ± 0.7)
311N, 13E	0-15	896	0.5 ± 0.1	4.7 ± 0.2	11.2 ± 0.4	288.4 ± 9.7
312N, 65E	15-60	579	0.5 ± 0.1	1.2 ± 0.3	1.5 ± 0.3	37.2 ± 8.5
312N, 65E	60-120	928	0.3 ± 0	0.4 ± 0.1	<0.2	<4.7 (1.4 ± 0.3)
313N, 64E	0-15	955	0.4 ± 0.3	6.7 ± 0.7	16.4 ± 1.2	397 ± 29
313N, 64E	15-60	525	0.5 ± 0.2	2.0 ± 0.3	3.3 ± 0.4	89 ± 15
313N, 64E	60-120	178	<0.2	2.3 ± 0.5	5.6 ± 0.6	159 ± 18
272N, 79W	0-15	888	<0.3	<0.5	14.6 ± 1.3	428 ± 29
272N, 79W	15-60	668	<0.3	0.8 ± 0.3	18.0 ± 1.6	471 ± 34
272N, 79W	60-120	454	0.4 ± 0.1	<0.3	3.4 ± 0.5	85 ± 10
272N, 79W	120-180	805	<0.3	<0.5	1.3 ± 0.4	23 ± 10
282N, 87W	0-15	1194	<0.2	<0.4	12.2 ± 1.2	343 ± 26
282N, 87W	15-60	678	1.0 ± 0.2	0.8 ± 0.3	4.6 ± 0.7	118 ± 14
282N, 87W	60-120	452	0.6 ± 0.2	<0.6	1.2 ± 0.3	34.7 ± 8.2

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33 and 34.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 15 (Continued)

**RADIONUCLIDE CONCENTRATIONS IN SOIL
EXTERIOR BOREHOLE LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK**

Grid Coordinates[a]	Depth (cm)	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
			Ra-226	Th-232	U-235	U-238
282N, 87W	120-180	511	0.5 ± 0.1	<0.4	0.3 ± 0.2	11.9 ± 5.4
282N, 165W	0-15	817	0.3 ± 0.1	0.4 ± 0.1	<0.2	<4.4 (1.5 ± 0.8)
282N, 165W	15-60	343	0.6 ± 0.1	0.9 ± 0.3	0.9 ± 0.3	21.0 ± 8.8
282N, 165W	60-120	156	1.2±0.2	1.2 ± 0.4	0.9 ± 0.3	22 ± 10
284N, 147W	0-15	837	<0.2	0.7 ± 0.2	0.9 ± 0.3	15.6 ± 6.9
284N, 147W	15-60	391	<0.2	0.7 ± 0.3	0.4 ± 0.3	7.7 ± 5.6
284N, 147W	60-120	725	0.6 ± 0.1	0.7 ± 0.2	<0.2	5.0 ± 4.4
284N, 147W	120-180	173	<0.2	0.4 ± 0.2	0.5 ± 0.2	10.7 ± 7.6
290N, 126W	0-15	977	0.5 ± 0.1	0.5 ± 0.2	0.6 ± 0.3	20.3 ± 6.7
290N, 126W	15-60	176	0.5 ± 0.2	<0.5	2.6 ± 0.5	73 ± 12
290N, 126W	60-120	390	1.4 ± 0.2	1.5 ± 0.3	0.4 ± 0.3	15.1 ± 7.2
290N, 126W	120-180	166	0.7 ± 0.2	0.9 ± 0.3	0.6 ± 0.3	< 14 (12.8 ± 1.6)
299N, 43W	0-15	1136	0.5 ± 0.1	0.7 ± 0.2	1.9 ± 0.4	28.0 ± 1.8
299N, 43W	15-60	566	<0.5	<0.7	93.1 ± 6.6	2,830 ± 140
299N, 43W	60-120	641	<0.1	0.8 ± 0.2	2.2 ± 0.3	50.2 ± 8.1
299N, 43W	120-180	836	0.5 ± 0.1	<0.4	2.7 ± 0.4	64 ± 12
299N,43W	180-210	298	<0.3	0.6 ± 0.4	17.7 ± 1.6	415 ± 33
304N, 80W	0-15	750	0.7±0.4	19.5 ± 2.1	<1.0	<13 (<3.6)
304N, 80W	15-60	319	0.6 ± 0.2	2.5 ± 0.6	<0.4	< 11 (3.0 ± 1.4)
304N, 80W	60-120	338	1.5 ± 0.3	1.5 ± 0.4	0.4 ± 0.4	12.8 ± 8.6
304N, 80W	120-180	467	0.8 ± 0.2	1.0 ± 0.3	0.5 ± 0.3	9.0 ± 7.5
304N, 158W	0-15	841	<0.3	<0.5	17.1 ± 1.6	425 ± 35
304N, 158W	15-60	572	<1.0	<1.3	525 ± 35	17,780 ± 810
304N, 158W	60-120	478	<0.8	<1.1	262 ± 18	6,970 ± 330
304N, 158W	120-180	535	<0.3	<0.4	4.6 ± 0.7	121 ± 17
304N, 158W	0-15	758	0.5 ± 0.2	0.8 ± 0.3	<0.4	< 15 (2.4 ± 1.3)
319N, 145W	15-60	813	<0.3	0.8 ± 0.2	8.2 ± 1.0	223 ± 23
31914, 145W	60-120	191	1.2 ± 0.3	<0.8	31.3 ± 2.6	819 ± 56
319N, 145W	120-180	390	<0.3	1.0 ± 0.3	0.5 ± 0.2	11.3 ± 7.4
325N, 177W	0-15	1272	<0.4	<0.5	63.8 ± 2.0	1,843 ± 49
325N, 177W	15-60	249	0.2 ± 0.1	0.7 ± 0.3	1.1 ± 0.4	31.7 ± 8.9
325N, 177W	60-120	198	0.4 ± 0.1	0.7 ± 0.1	1.1 ± 0.2	35.1 ± 4.1
342N, 121W	0-15	587	1.3 ± 0.2	1.7 ± 0.4	<0.4	<14 (3.6 ± 1.8)

Source: *Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.* T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).

[a] Refer to Figures 33 and 34.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

TABLE 15 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SOIL
EXTERIOR BOREHOLE LOCATIONS
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Grid Coordinates[a]	Depth (cm)	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
			Ra-226	Th-232	U-235	U-238
342N, 121W	15-60	137	<0.5	<1.0	<0.7	<21 (5.3 ± 1.7)
342N, 121W	60-120	794	0.7 ± 0.2	1.1 ± 0.3	<0.5	<14 (1.2 ± 1.1)
358N, 19W	0-15	732	<0.4	<0.5	6.0 ± 0.9	142 ± 24
358N, 19W	15-60	459	0.6 ± 0.1	0.9 ± 0.1	5.2 ± 0.3	136.3 ± 6.5
358N, 19W	60-120	768	0.6 ± 0.1	0.8 ± 0.3	2.3 ± 0.5	48 ± 13
358N, 19W	120-180	277	0.5 ± 0.2	0.6 ± 0.3	1.0 ± 0.4	31 ± 13
362N, 197W	0-15	960	0.7± 0.2	2.0 ± 0.3	0.6 ± 0.4	8.0 ± 7.4
362N, 197W	15-60	174	1.1 ± 0.2	3.2 ± 0.5	1.3 ± 0.4	19 ± 16
362N, 197W	60-120	79[d]	<0.5	3.2 ± 1.2	<0.8	<35 (5.7 ± 2.5)
362N, 197W	120-180	192	1.0 ± 0.2	5.5 ± 0.8	0.9 ± 0.5	27 ± 12
402N, 186W	0-15	833	0.7 ± 0.3	17.1 ± 1.8	<0.9	18 ± 10
402N, 186W	15-60	175	<0.4	15.8 ± 1.8	<0.8	<17 (15.2 ± 1.8)
402N, 186W	60-120	523	0.8 ± 0.2	3.1 ± 0.5	0.3 ± 0.3	<11 (6.2 ± 0.9)
402N, 186W	120-180	159	1.2 ± 0.3	6.8 ± 0.9	<0.6	9.8 ± 7.6
410N,189W	0-15	435	<2.0	371 ± 35	<5.4	<75 (20 ± 10)
410N, 189W	15-60	423	0.7 ± 0.3	13.1 ± 1.5	<0.7	<14 (5.5 ± 2.7)
410N, 189W	60-120	488	0.8 ± 0.3	17.4 ± 1.9	<1.2	<19 (1.7 ± 2.8)
410N, 189W	120-180	876	0.9 ± 0.2	3.9 ± 0.6	<0.5	<8.6 (2.5 ± 1.7)
412N, 191W	0-15	667	0.9 ± 0.2	2.9 ± 0.4	<0.4	<8.4 (6.5 ± 1.9)
412N, 191W	15-60	467	1.8 ± 0.2	5.1 ± 0.6	0.5 ± 0.3	10.7 ± 4.9
412N, 191W	60-120	475	1.2 ± 0.2	1.9 ± 0.4	<0.5	<12 (3.1 ± 1.4)
412N, 191W	120-180	510	0.9 ± 0.1	1.3 ± 0.3	<0.3	<7.5 (0.9 ± 0.9)

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figures 33 and 34.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

which case the Th-234 (63 keV) result was included in parenthesis.

[d] Sample had insufficient volume for an appropriate geometry. Values are semi-quantitative.

TABLE 16

RADIONUCLIDE CONCENTRATIONS IN SOIL
EXTERIOR CLASS 3 AREA
GUTERL SPECIALTY STEEL CORPORATION
LOCKPORT, NEW YORK

Sample ID[a]	Sample Quantity (g)	Radionuclide Concentration (pCi/g)			
		Ra-226	Th-232	U-235	U-238
253	675	0.7 ± 0.1[b]	<0.4	<0.3	<5.6 (0.4 ± 0.7)[c]
254	951	0.5 ± 0.1	0.6 ± 0.2	<0.2	<4.6 (<0.9)
255	844	0.2 ± 0.1	<0.4	<0.3	<7.5 (<1.1)
256	831	0.5 ± 0.1	<0.4	<0.2	<7.9 (<1.0)
257	663	<0.2	0.9 ± 0.2	<0.3	<5.8 (1.9 ± 1.0)
258	929	0.6 ± 0.1	0.4 ± 0.2	<0.3	<5.8 (1.7±1.1)
259	1039	0.3 ± 0.1	<0.3	<0.2	<6.5 (<0.9)
260	1004	0.5 ± 0.1	<0.3	<0.2	<5.9 (1.1 ± 0.8)
261	964	2.1 ± 0.2	0.9 ± 0.2	<0.3	<6.9(1.4 ± 0.9)
262	961	0.7 ± 0.1	0.5 ± 0.2	<0.2	<4.8 (0.7± 0.5)
263	595	1.5 ± 0.2	0.9 ± 0.2	<0.3	4.6 ± 4.1
264	993	5.3 ± 0.5	1.9 ± 0.5	<0.8	<15 (5.7 ± 2.1)
265	567	0.8 ± 0.1	0.5 ± 0.2	<0.2	<4.9 (0.9 ± 0.8)
266	864	0.5 ± 0.1	0.6 ± 0.2	<0.3	<7.5 (1.6 ± 0.7)
267	1225	<0.1	<0.2	<0.1	<3.7 (<0.6)
268	843	<0.3	<0.4	<0.3	<8.8 (1.4 ± 0.9)
269	547	0.8 ± 0.2	<1.0	<0.6	<13 (1.6 ± 2.0)
270	939	9.7 ± 0.9	2.2 ± 0.6	<0.7	<15 (8.8 ± 2.4)

Source: ***Radiological Survey of the Guterl Specialty Steel Corporation, Lockport, New York.*** **T.J. Vitkus, Oak Ridge Institute for Science and Education, December 1999 (ORISE 99-1699).**

[a] Refer to Figure 35.

[b] Uncertainties are total propagated uncertainties at the 95% confidence level.

[c] Pa-234m (1001 keV) peak was used to determine activity except where values were less than the MDC in which case the Th-234 (63 keV) result was included in parenthesis.

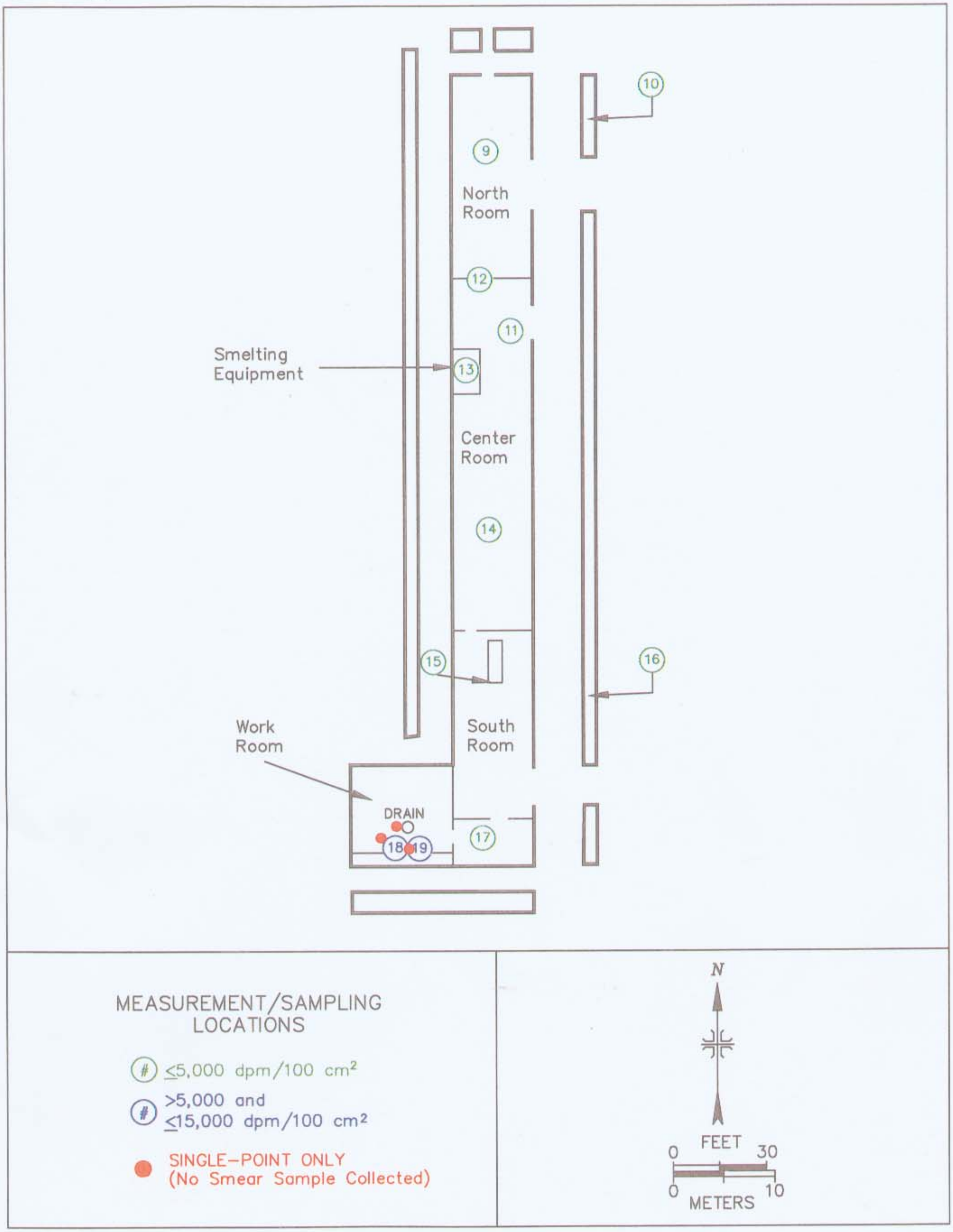


FIGURE 11: Building 1, Floors, Lower Walls, and Equipment – Direct Measurement and Sampling Locations

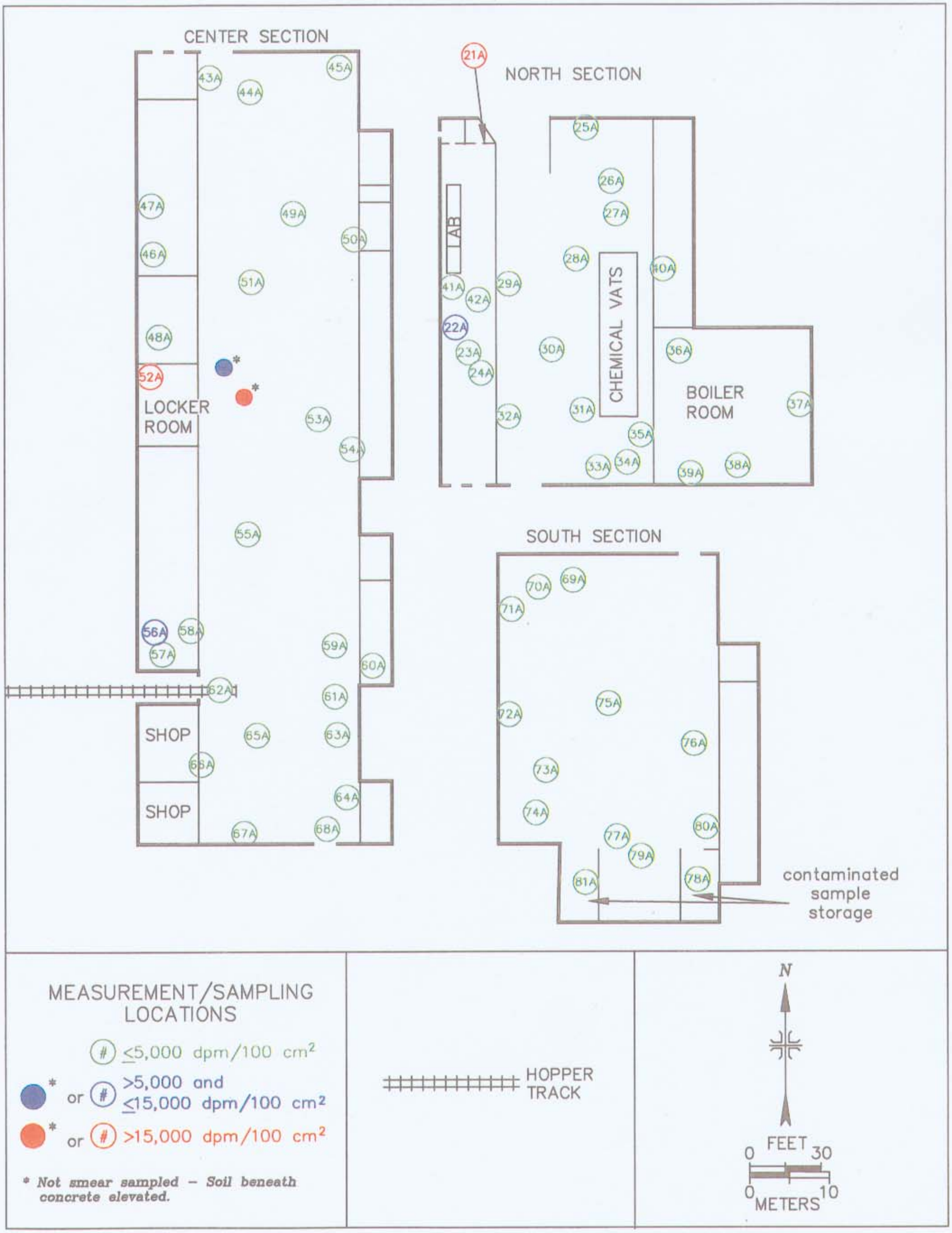


FIGURE 12: Building 2, Floor, Lower Walls, and Equipment — Direct Measurement and Sampling Locations

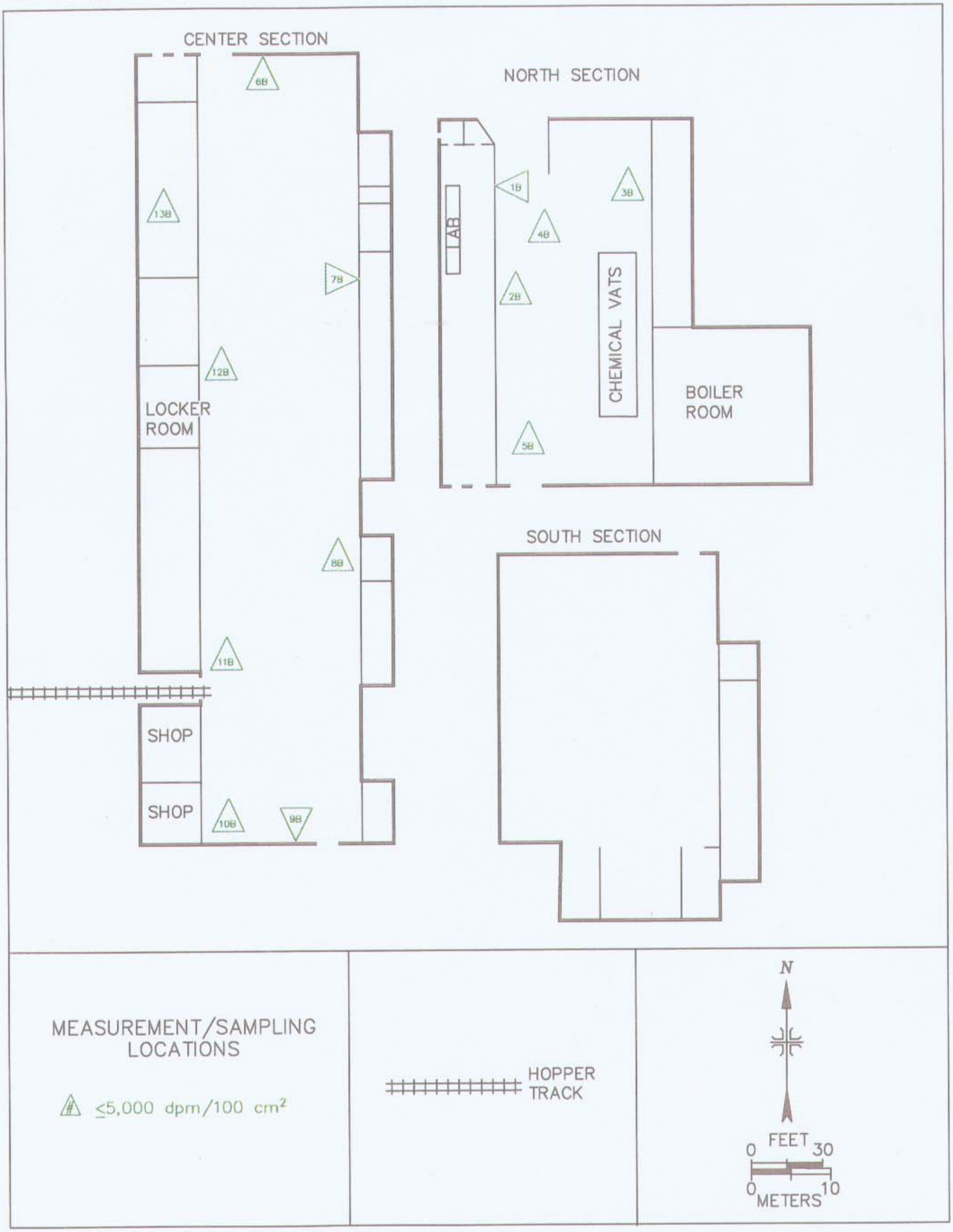


FIGURE 13: Building 2, Upper Surfaces − Direct Measurement and Sampling Locations

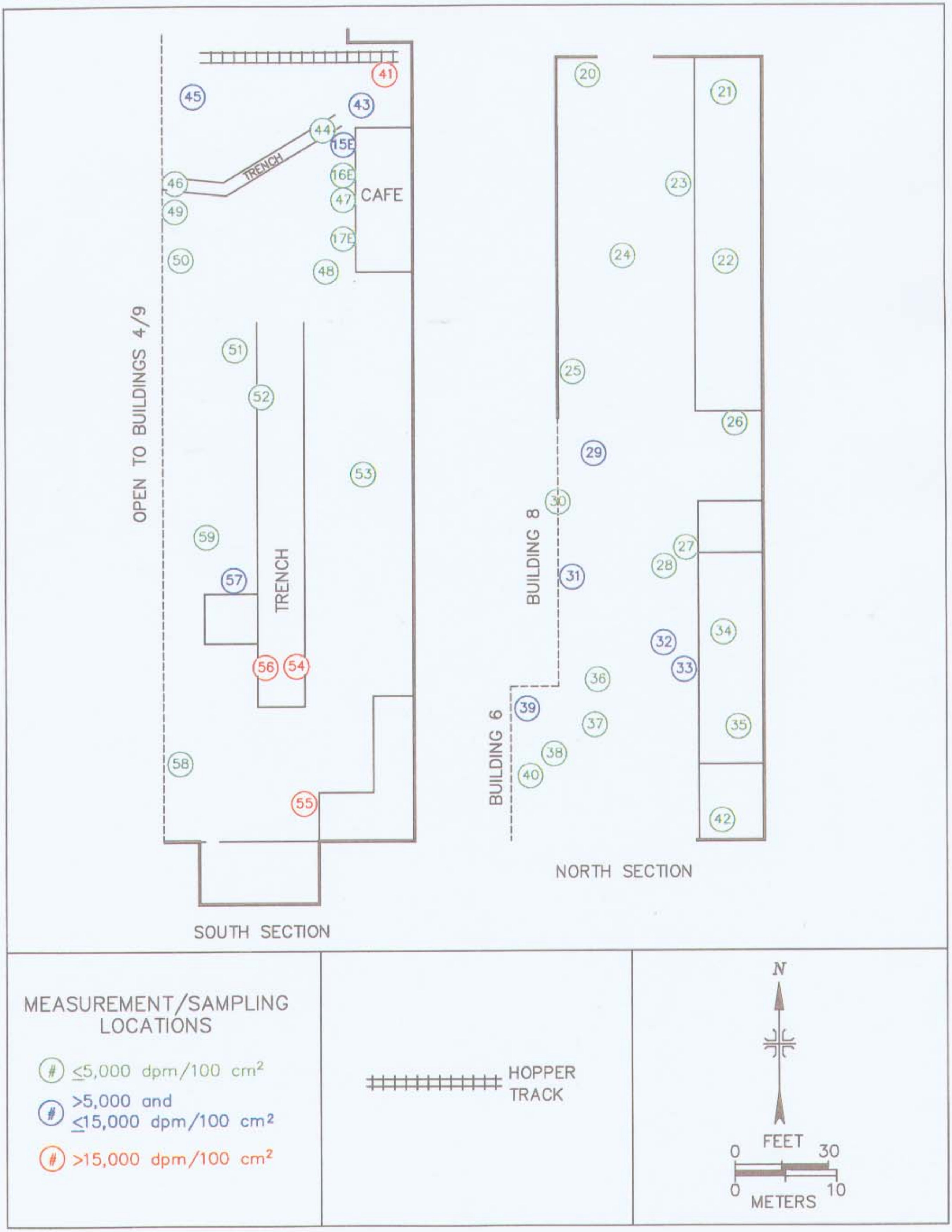


FIGURE 14: Building 3, Floors, Lower Walls, and Equipment – Direct Measurement and Sampling Locations

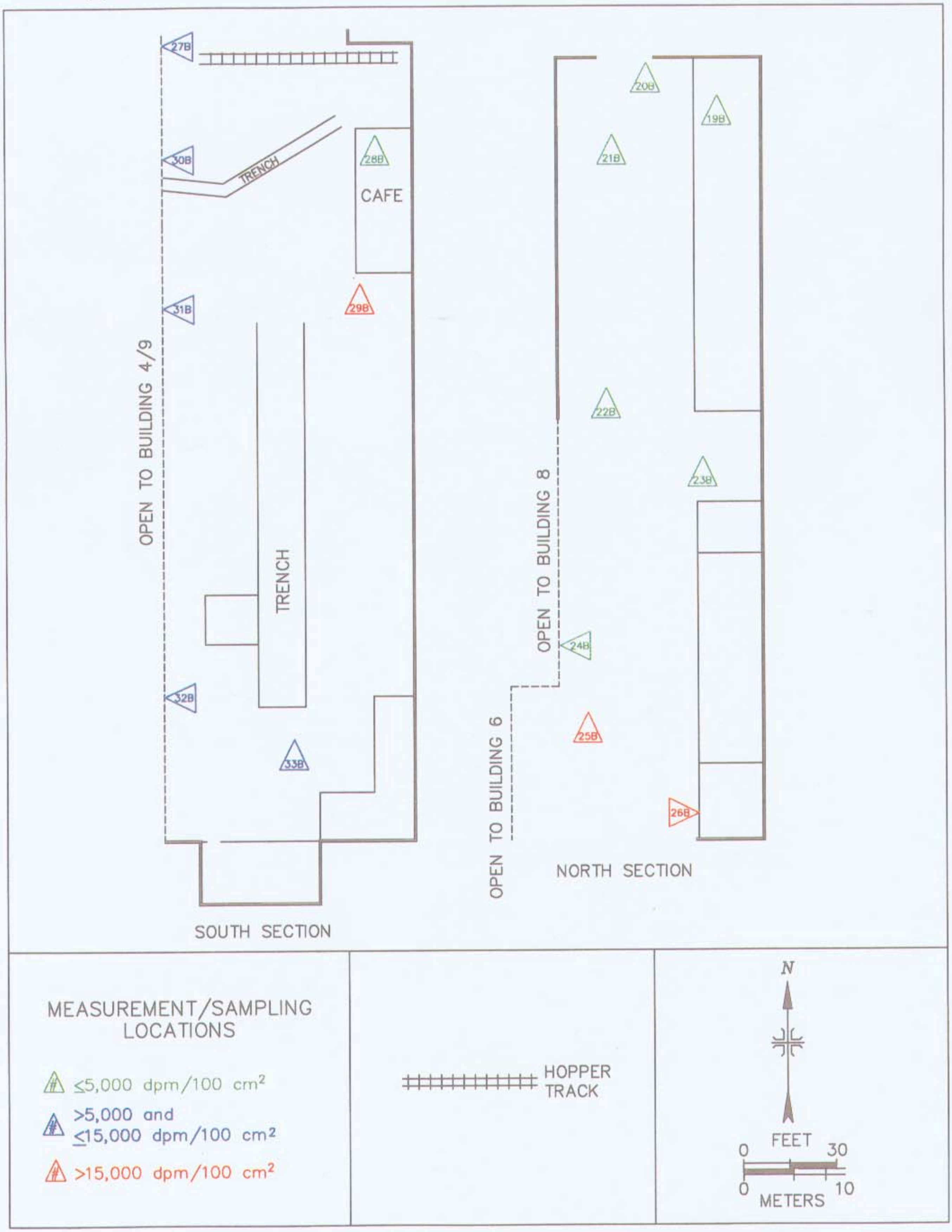


FIGURE 15: Building 3, Upper Surfaces – Direct Measurement and Sampling Locations

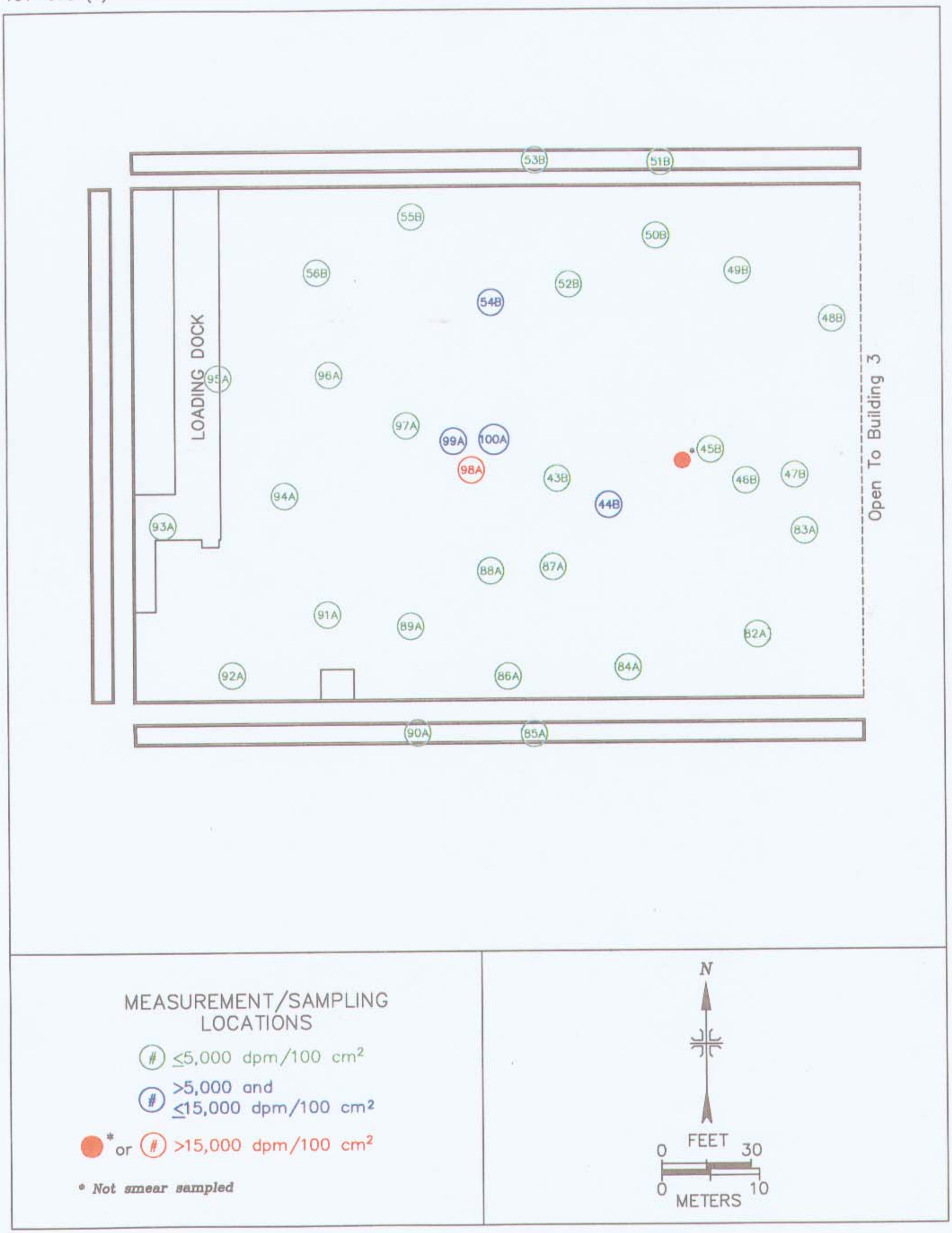


FIGURE 16: Building 4 and 9, Floors, Lower Walls, and Equipment – Direct Measurement and Sampling Locations

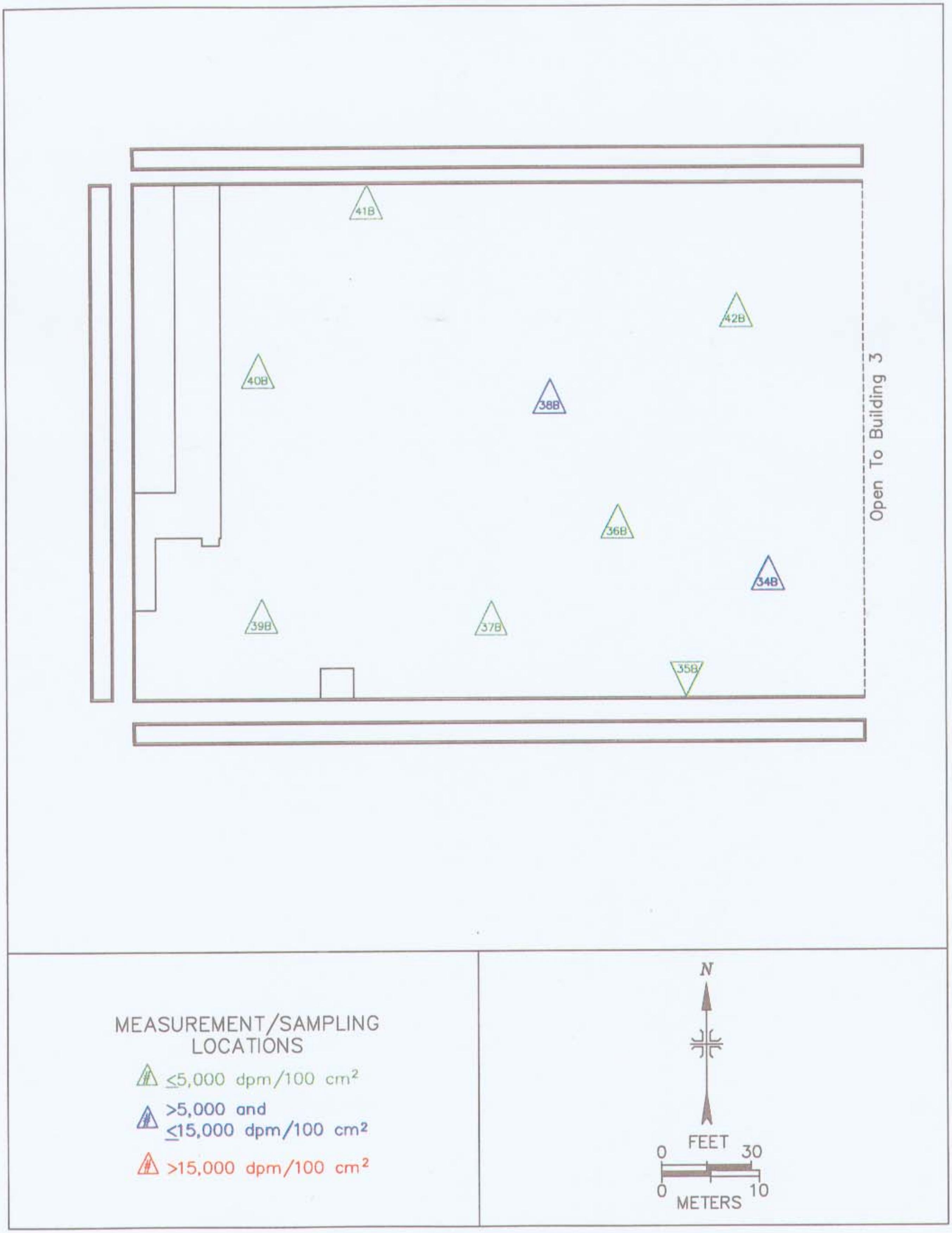


FIGURE 17: Building 4 and 9, Upper Surfaces – Direct Measurement and Sampling Locations

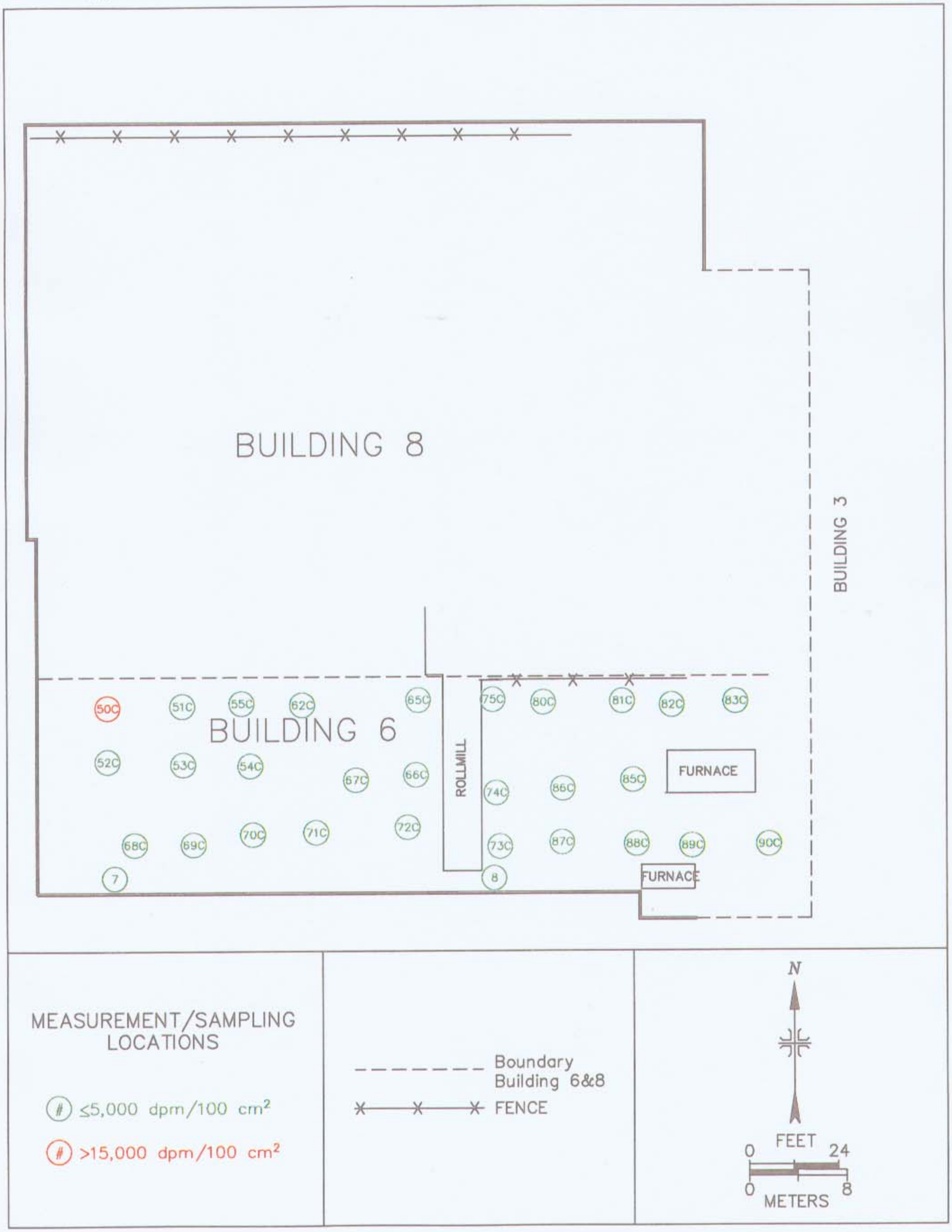


FIGURE 18: Building 6, Floors, Lower Walls, and Equipment – Direct Measurement and Sampling Locations

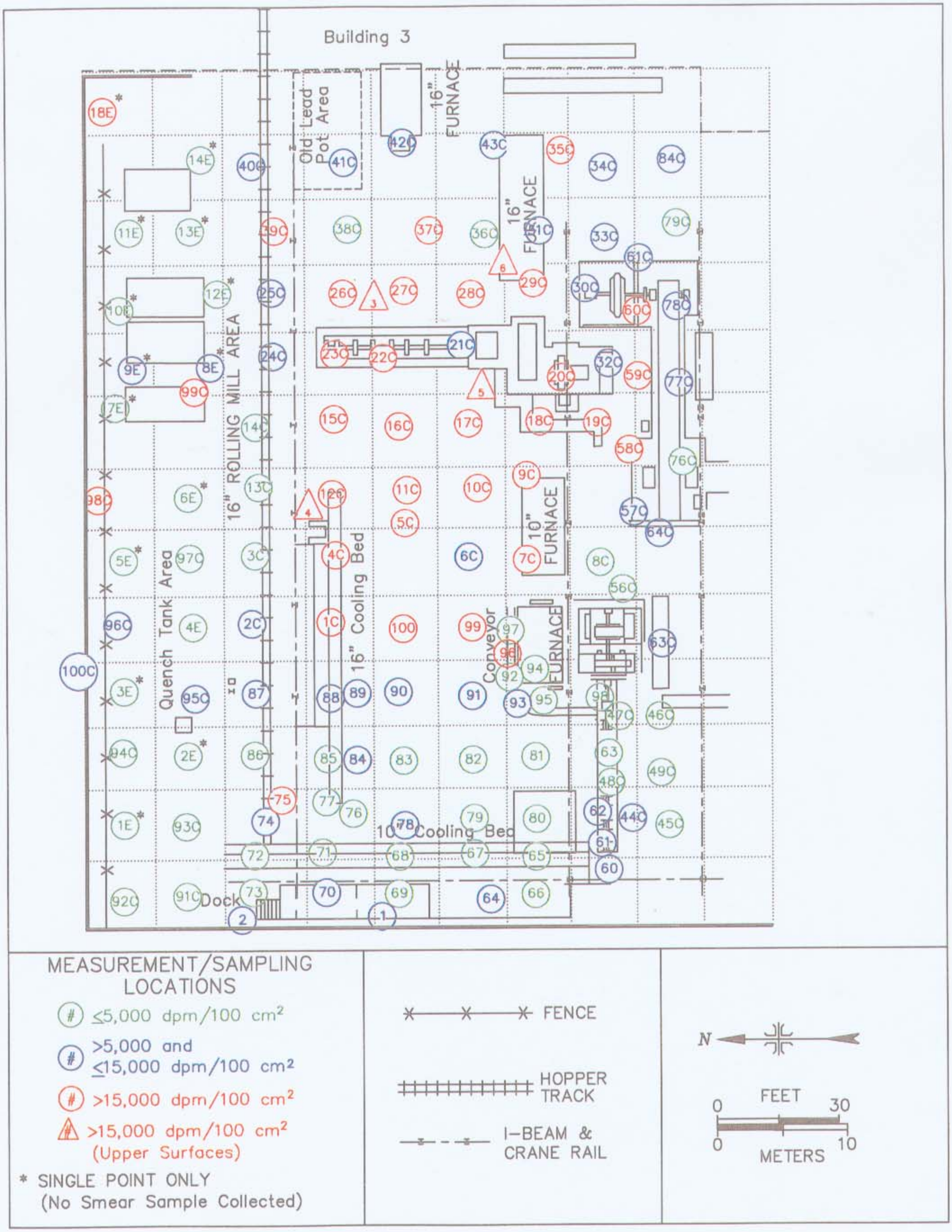
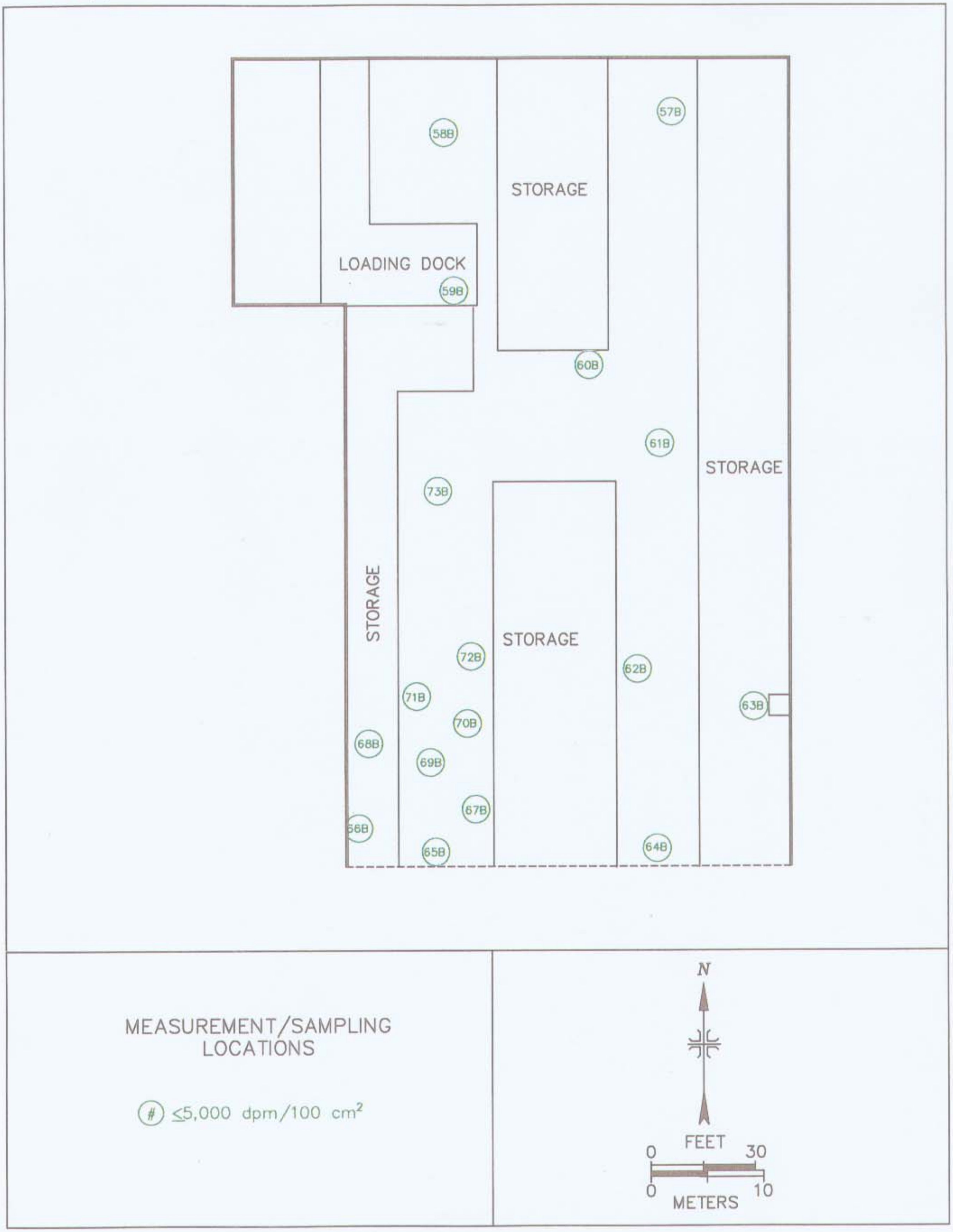


FIGURE 19: Building 8, Floors, Lower Walls, and Equipment – Direct Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

(#) ≤5,000 dpm/100 cm²

FIGURE 20: Building 24, North Area, Floor, Lower Walls, and Equipment – Direct Measurement and Sampling Locations

401–033 (x)

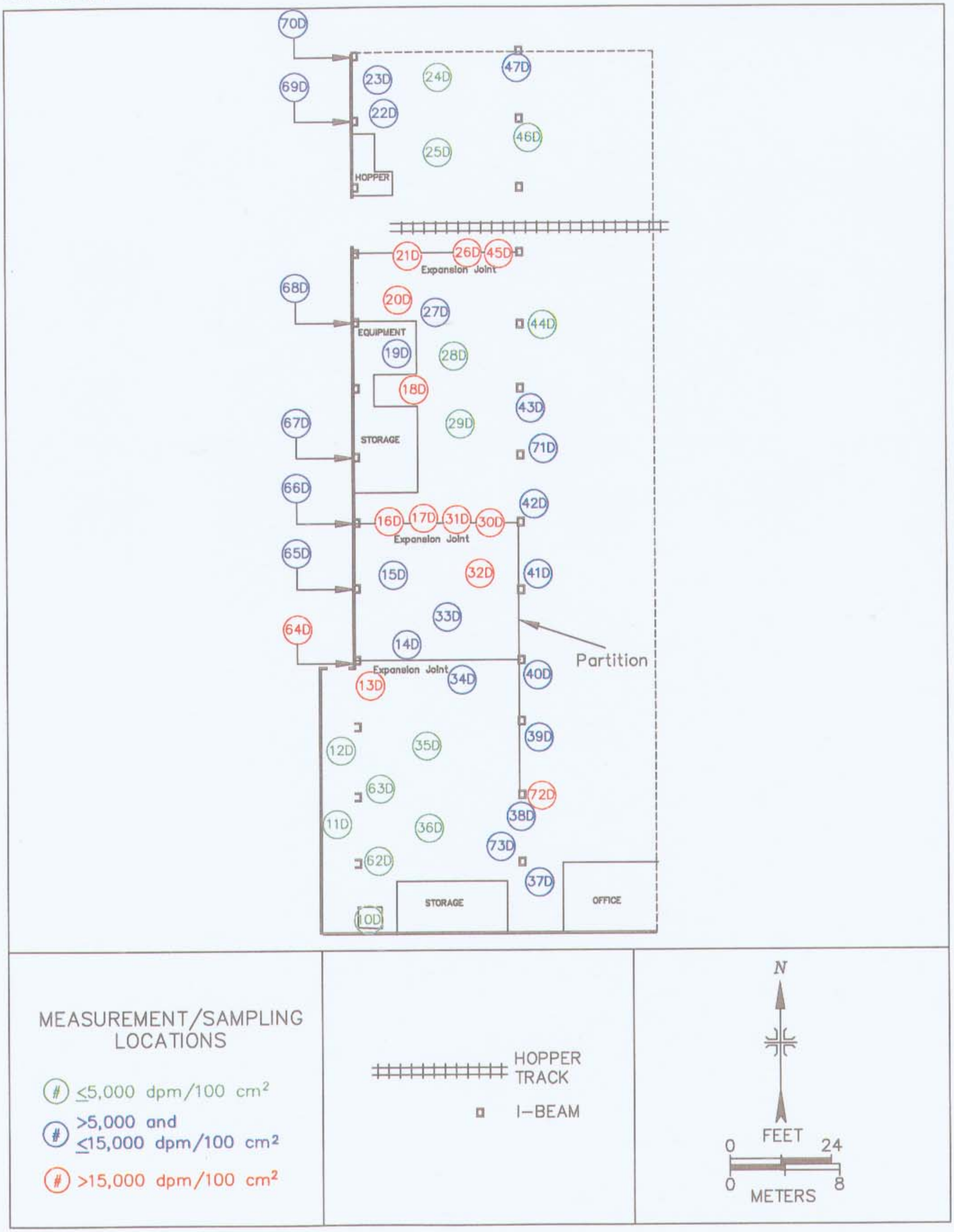


FIGURE 21: Building 24, Southwest Area, Floors, Lower Walls, and Equipment – Direct Measurement and Sampling Locations

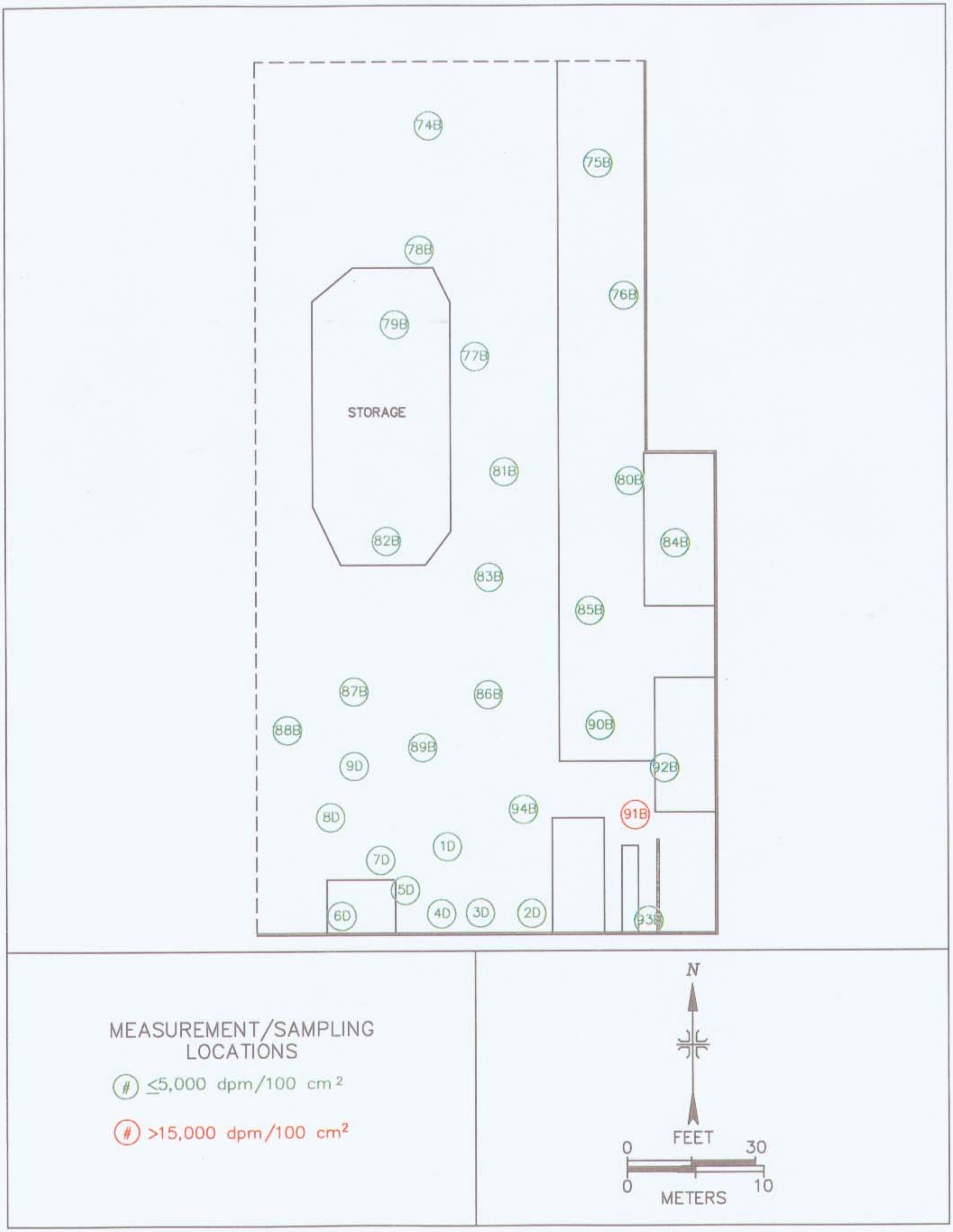


FIGURE 22: Building 24, Southeast Area, Floors, Lower Walls, and Equipment — Direct Measurement and Sampling Locations

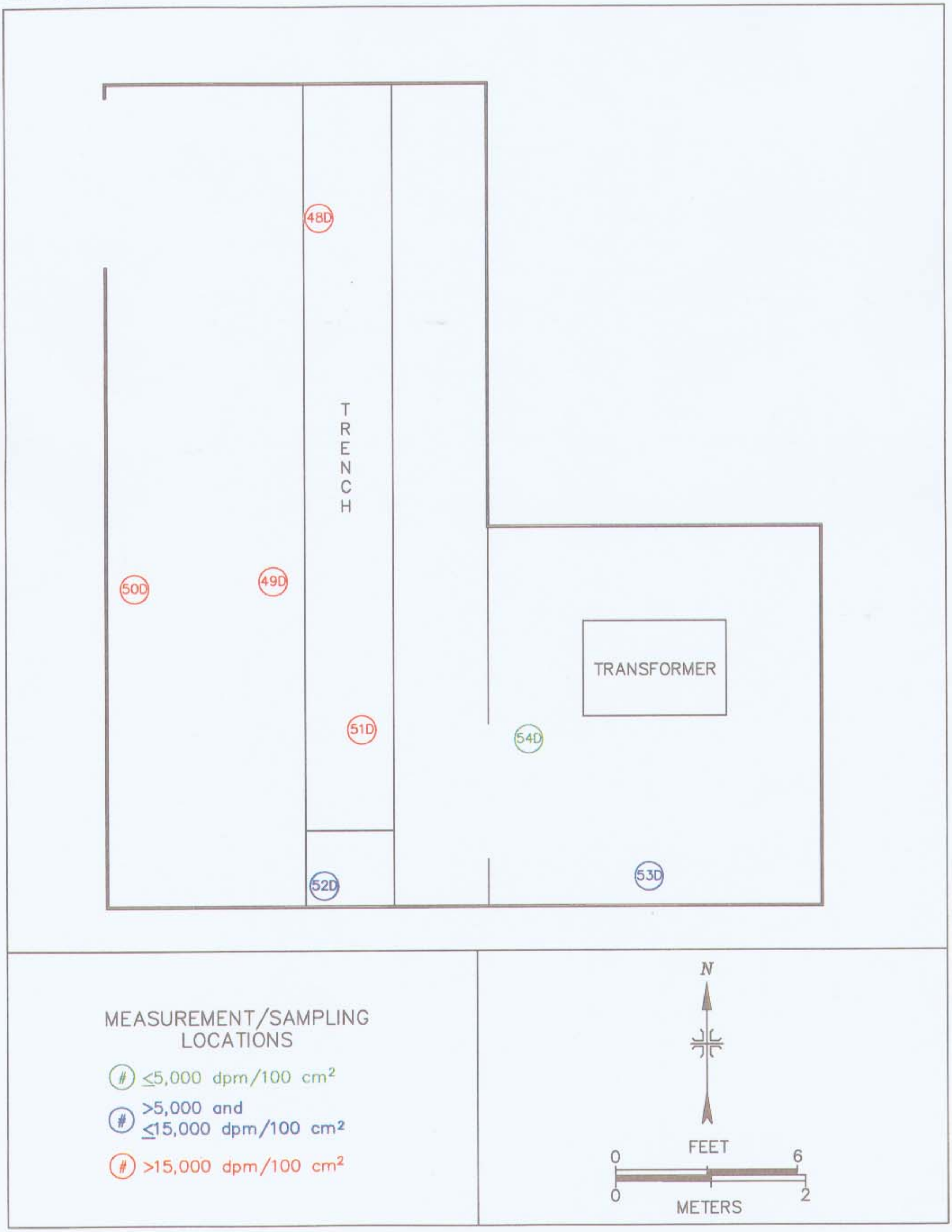


FIGURE 23: Building 24, Southeast Storage Room, Floors, Lower Walls, and Equipment – Direct Measurement and Sampling Locations

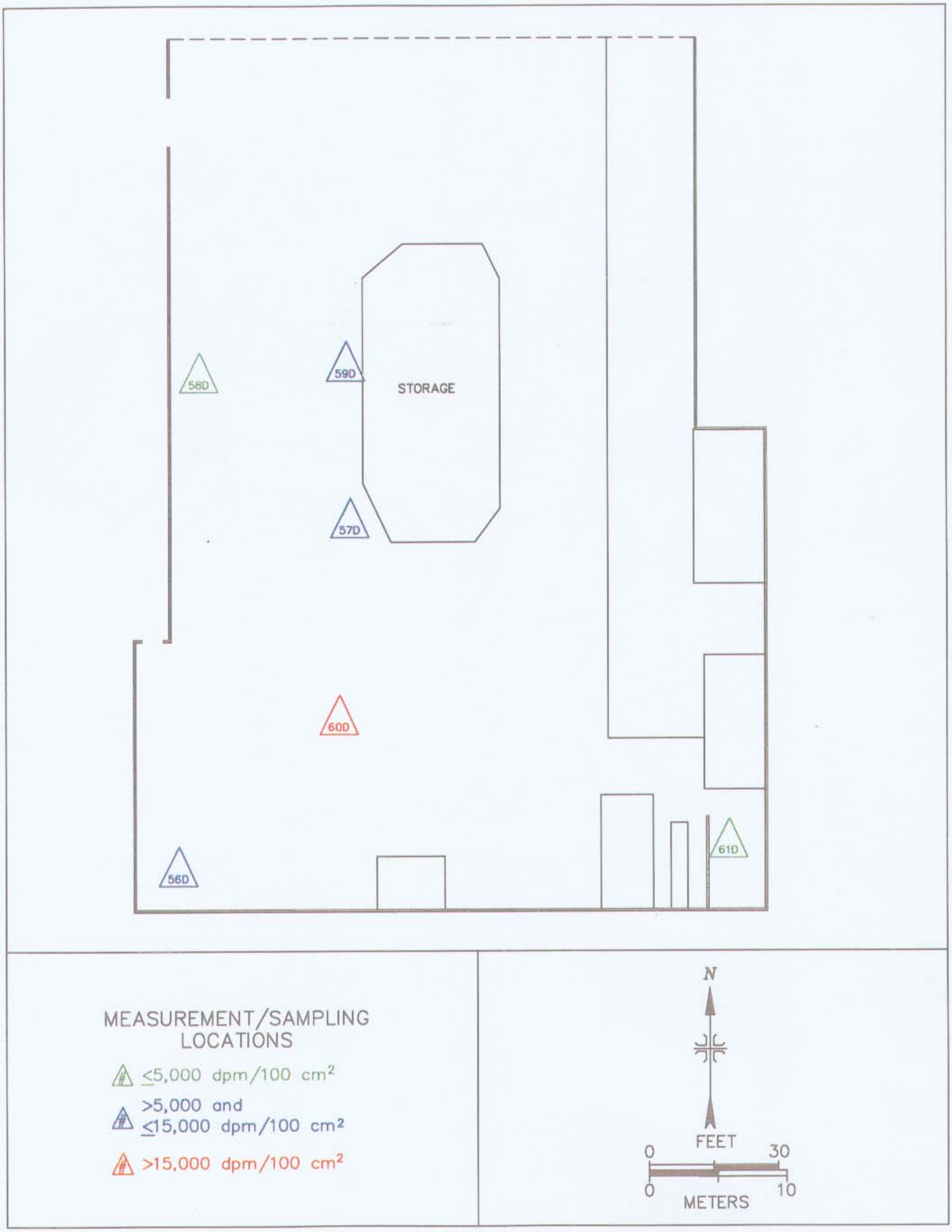


FIGURE 24: Building 24, Upper Surfaces – Direct Measurement and Sampling Locations

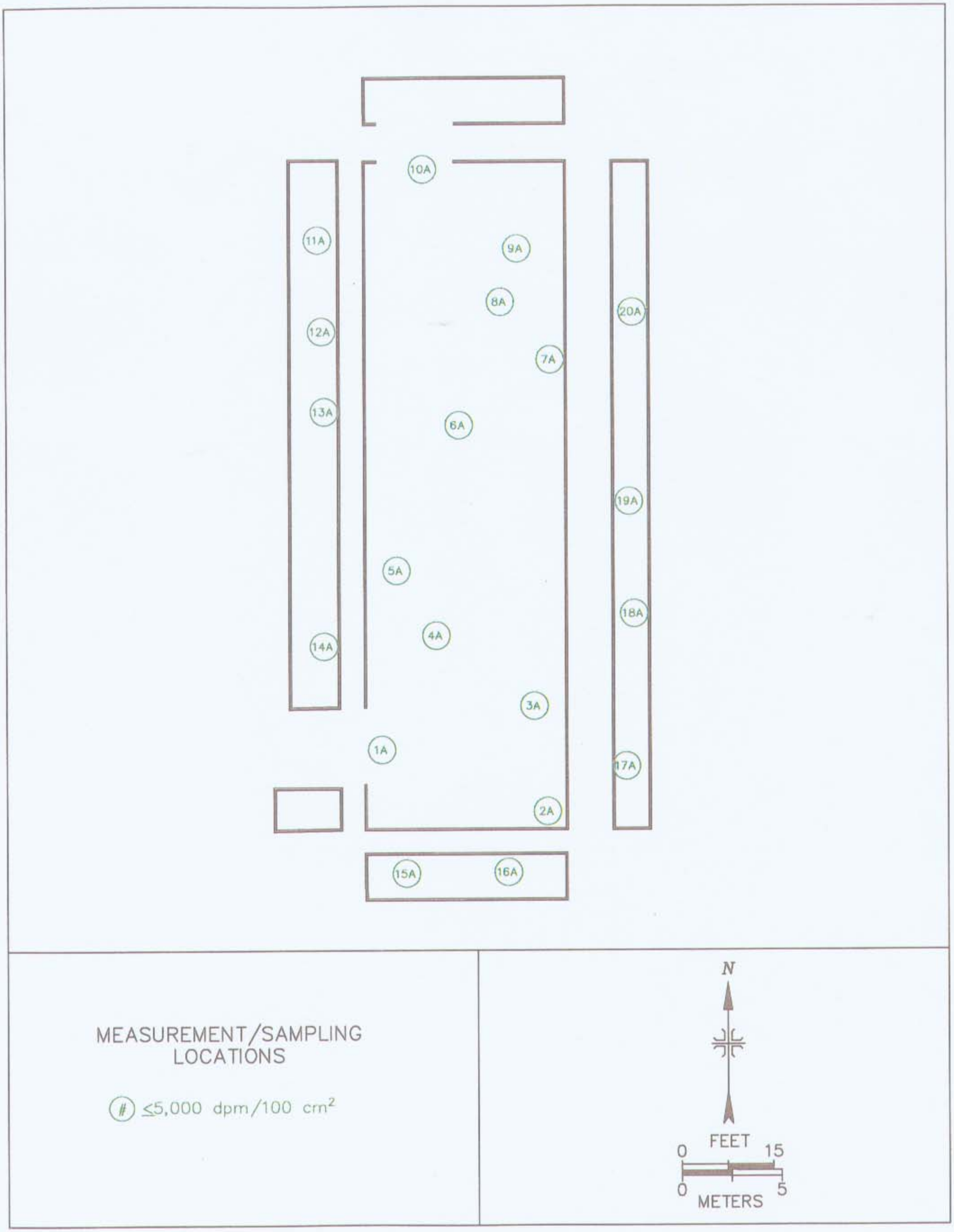


FIGURE 25: Building 35, Floor, Lower Walls, and Equipment – Direct Measurement and Sampling Locations

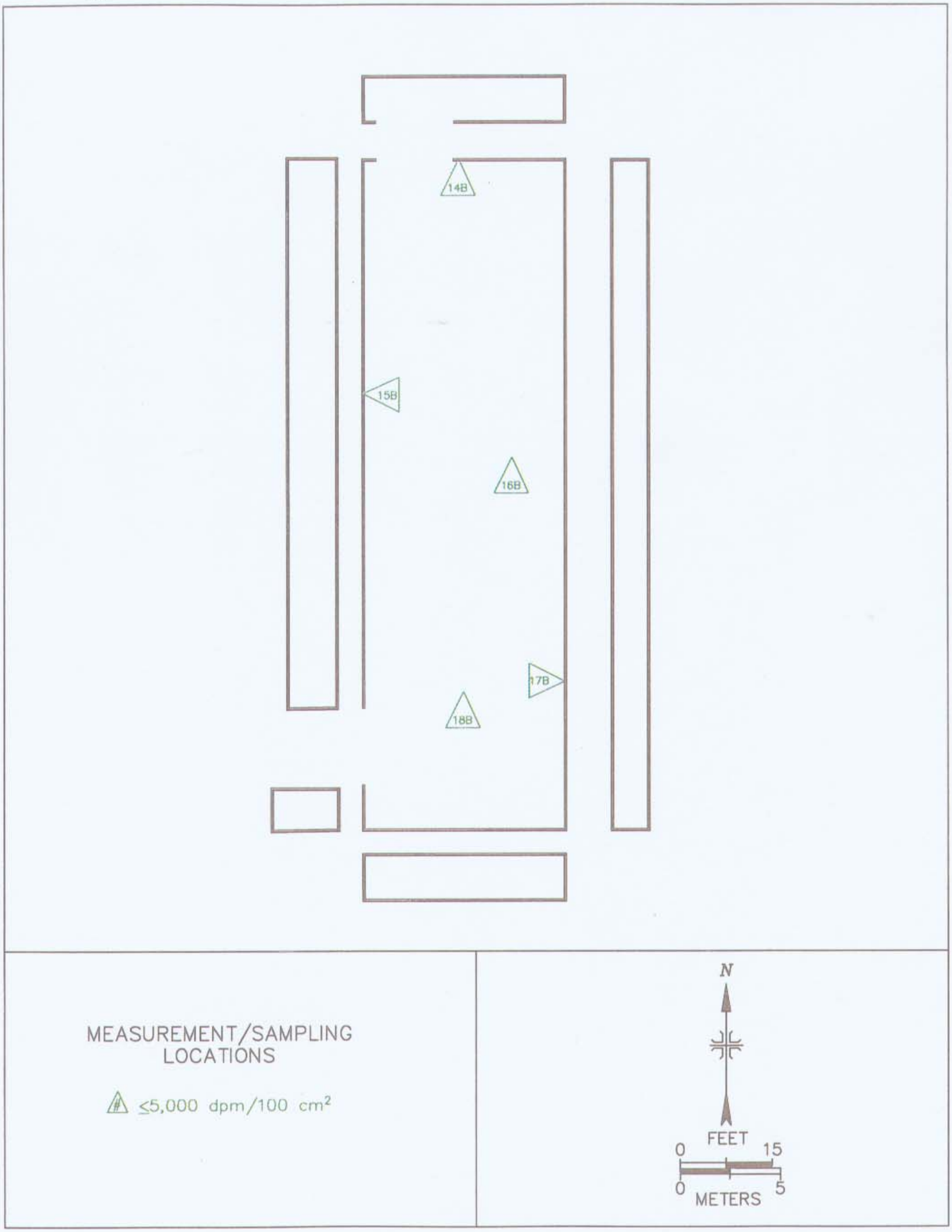


FIGURE 26: Building 35, Upper Surfaces – Direct Measurement and Sampling Locations

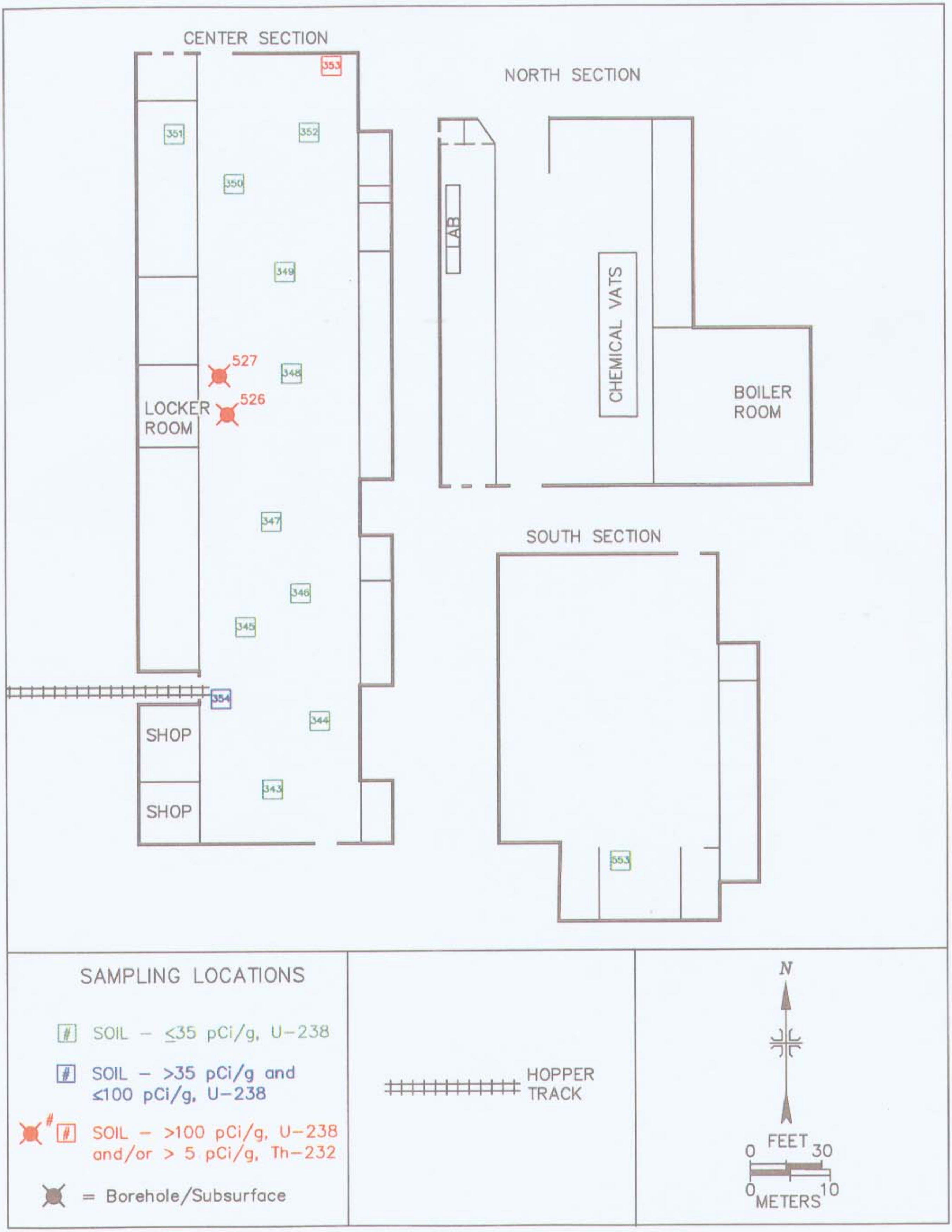


FIGURE 27: Building 2 - Sampling Locations

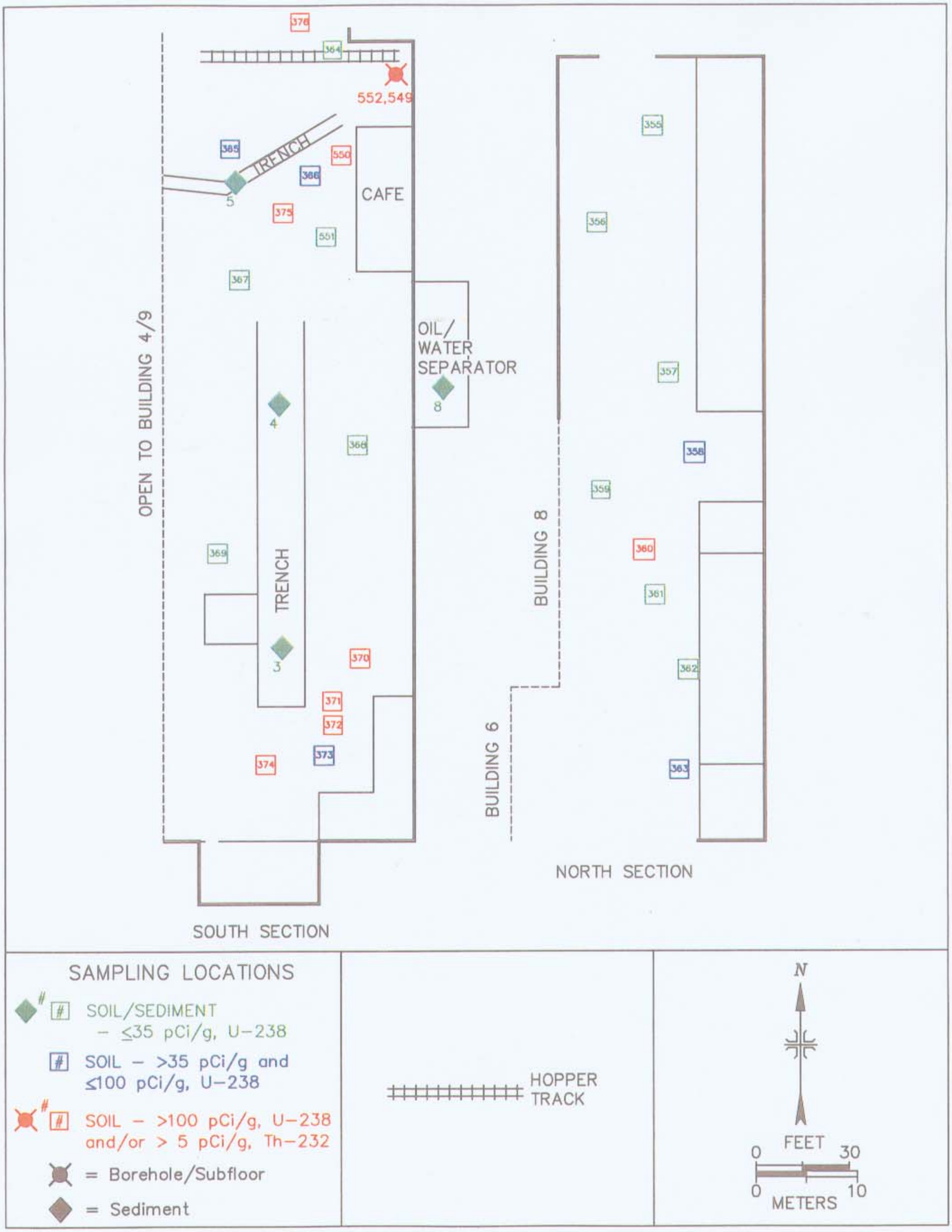


FIGURE 28: Building 3 – Sampling Locations

FIGURE 29: Building 4 and 9 – Sampling Locations

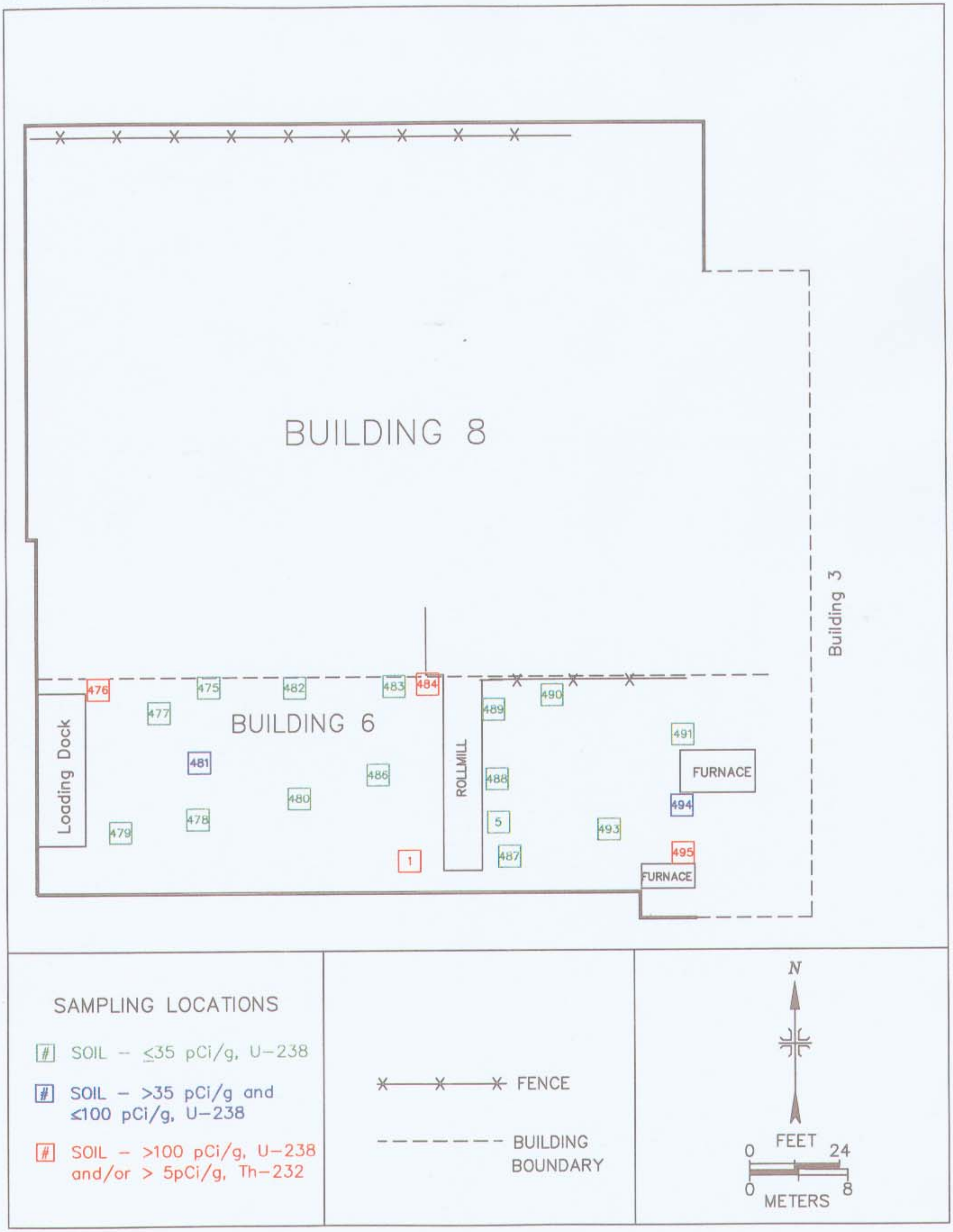


FIGURE 30: Building 6 - Sampling Locations

401-038 (1)

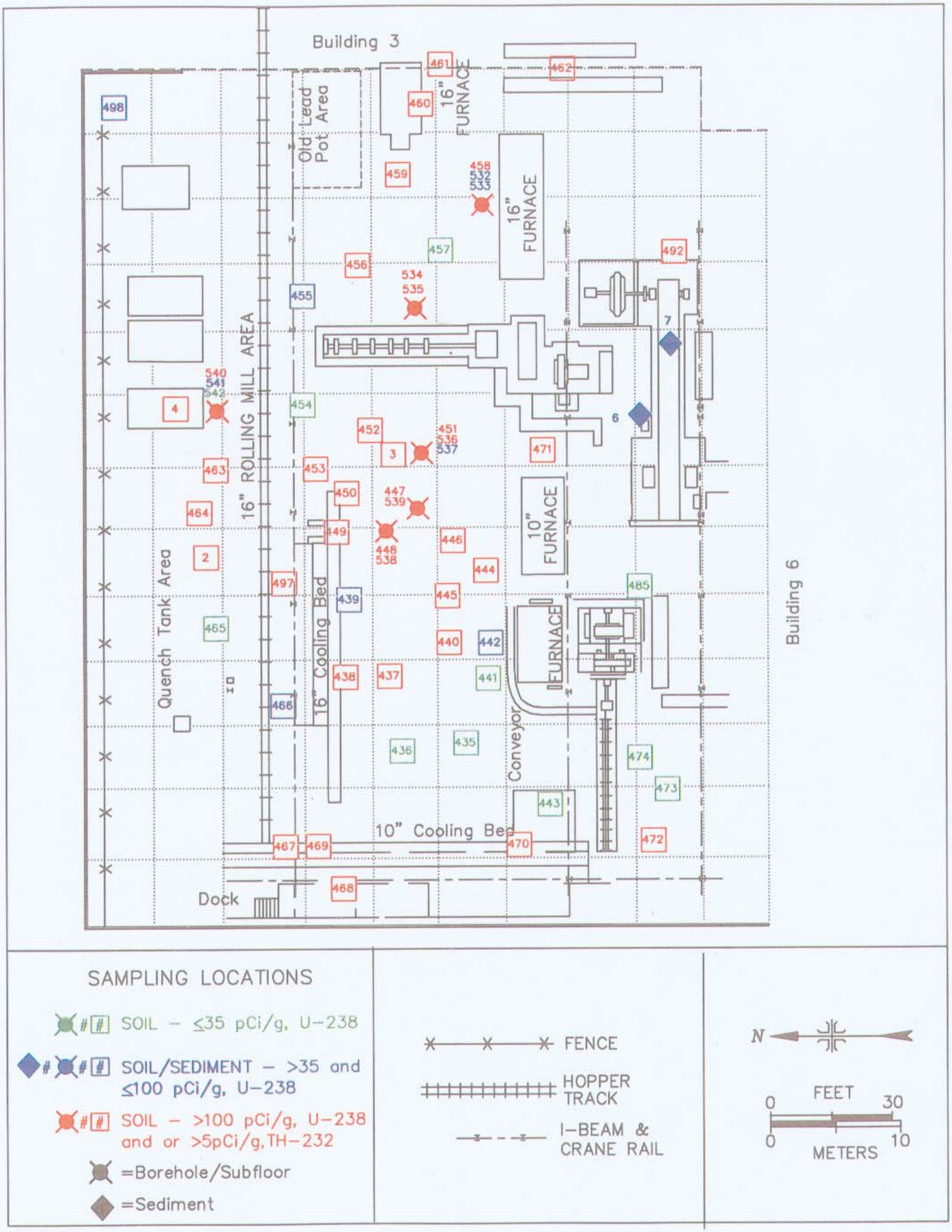


FIGURE 31: Building 8 – Sampling Locations

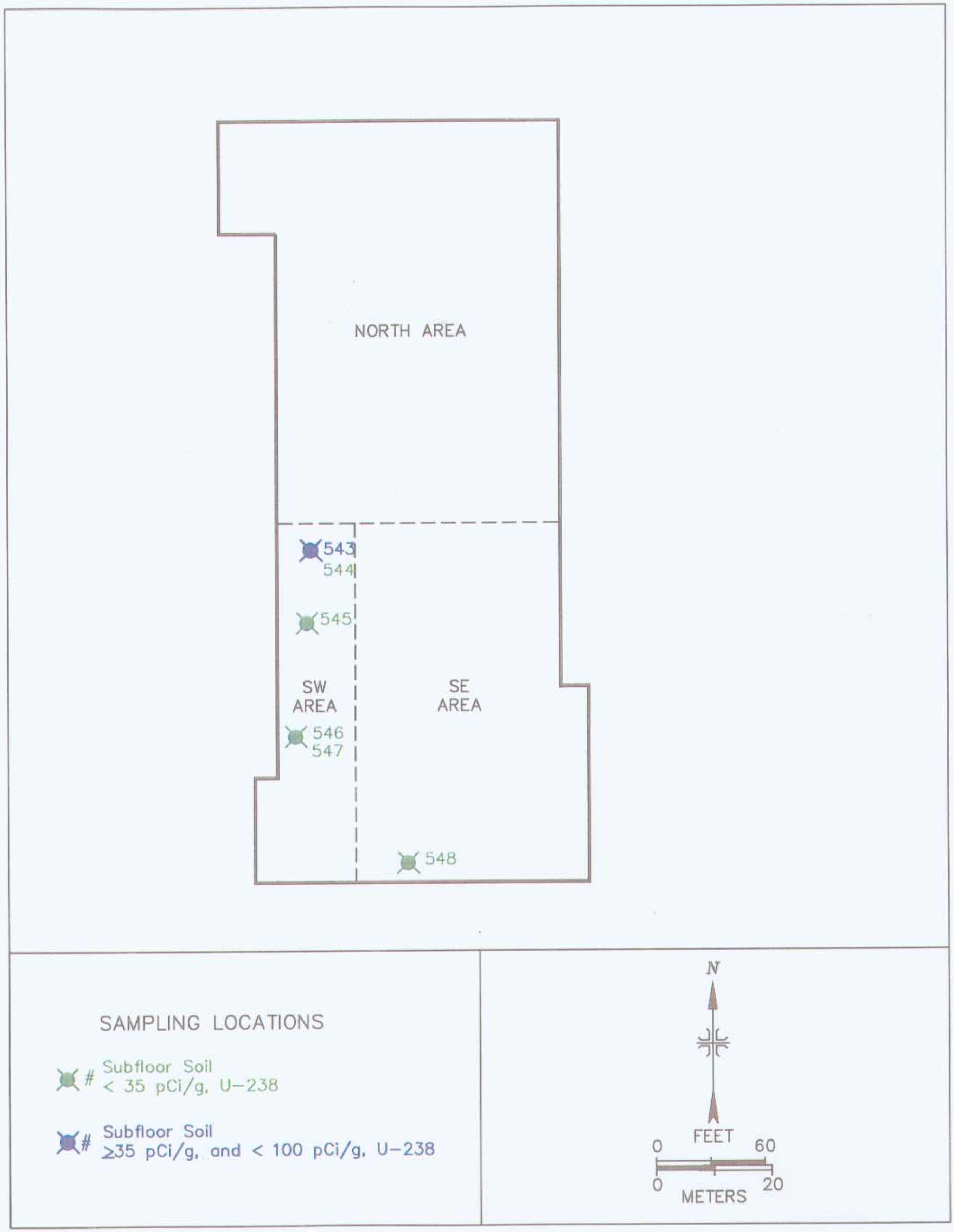


FIGURE 32: Building 24 − Sampling Locations

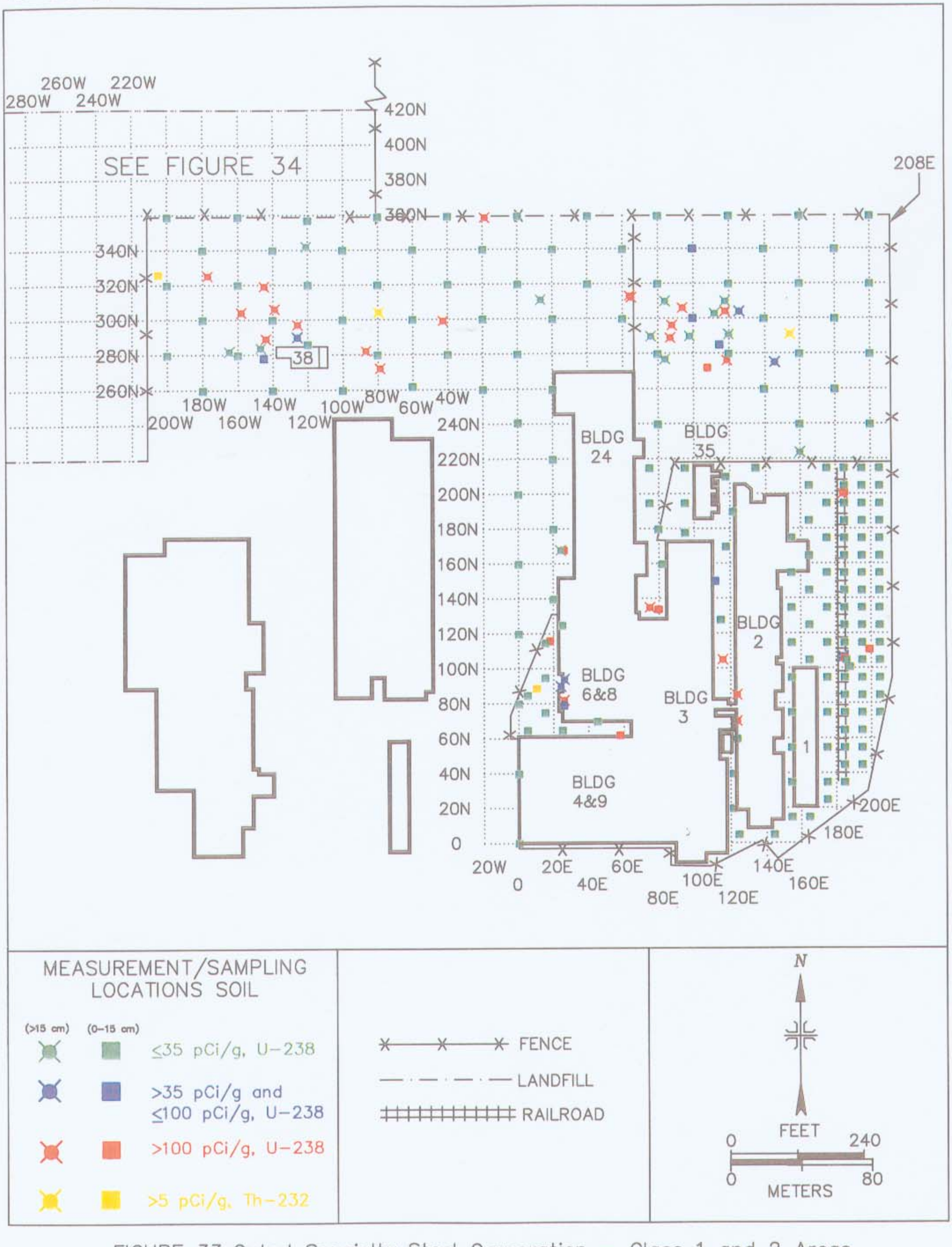


FIGURE 33: Guterl Specialty Steel Corporation — Class 1 and 2 Areas Measurement and Sampling Locations

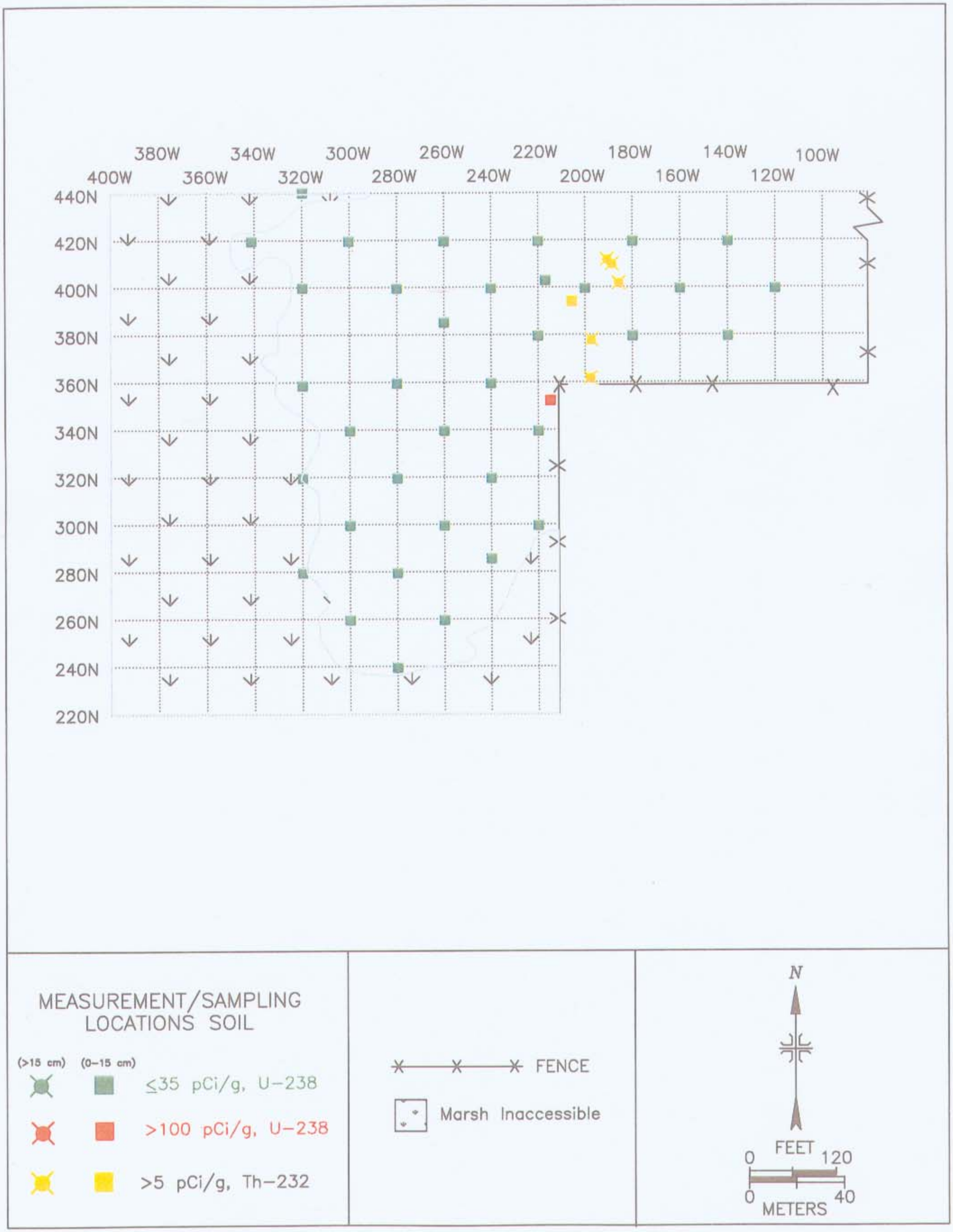


FIGURE 34: Landfill Area — Measurement and Sampling Locations

401-030 (1)

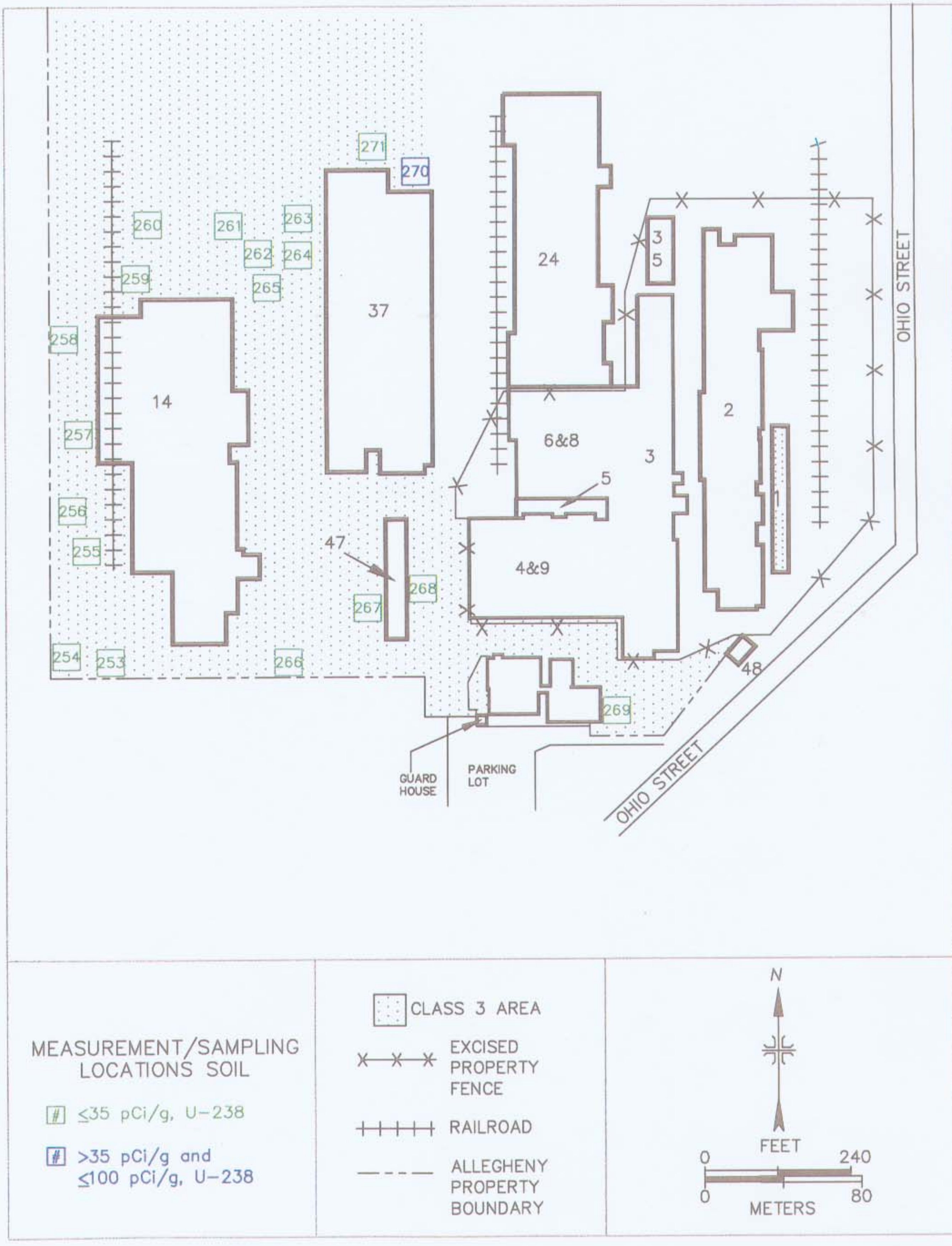


FIGURE 35: Exterior Class 3 Area – Sampling Locations

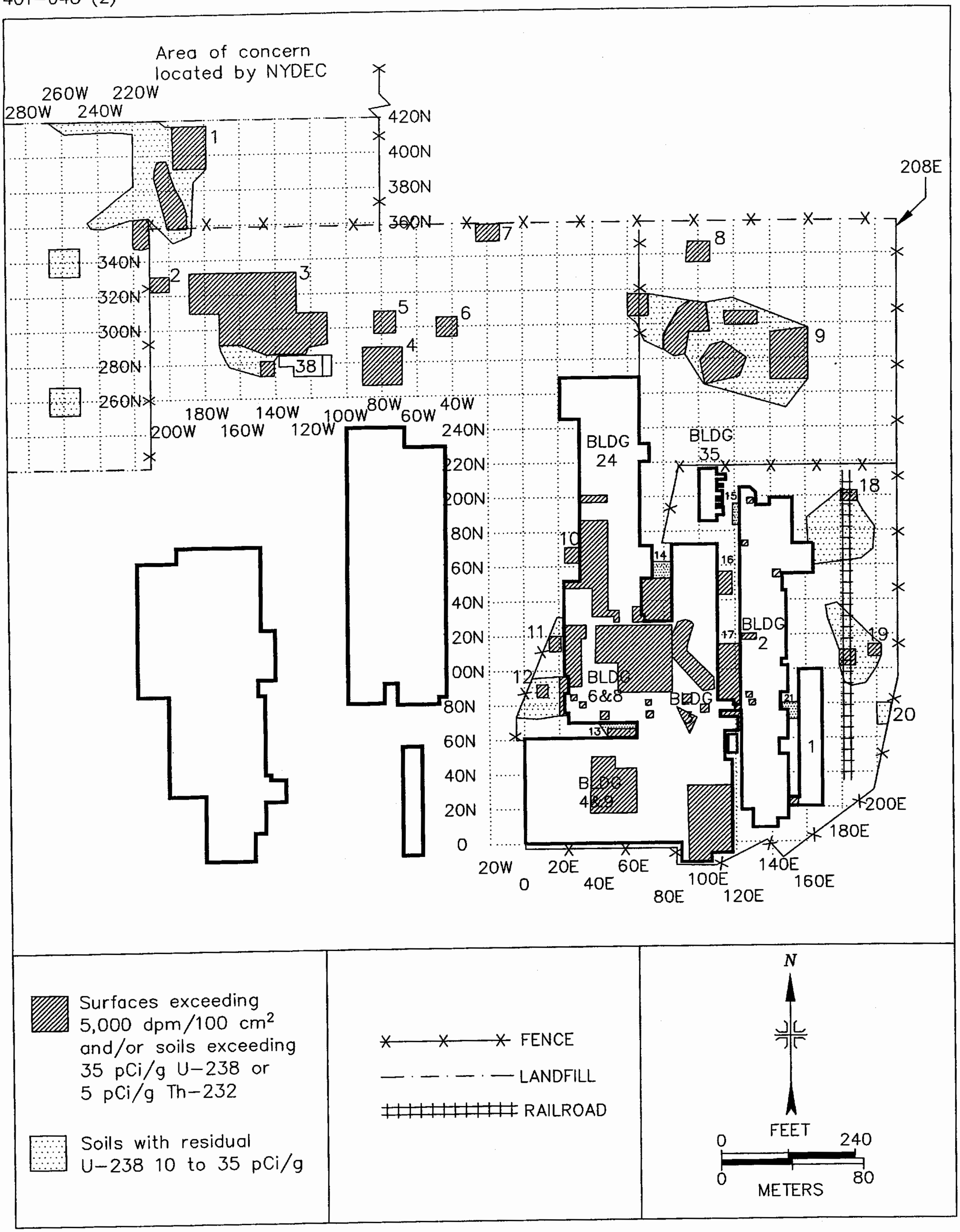


FIGURE 36: Guterl Specialty Steel Corporation — Impacted Areas

ATTACHMENT 3
Radiation Survey Equipment

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Attachment 3 - Instrumentation

Canberra In Situ Object Counting System (ISOCS)

- **Immediate, accurate, nuclide specific results for field measurement of any object or surface**
- **Sourceless detector specific calibrations generated by software as the sample is being counted – simply enter source/collimator/detector position dimensions**
- **Calibrations generated for any object/surface that can be approximated by plane, cylinder, box, sphere, well/Marinelli or pipe**
- **Mobile detector positioning device includes 25 mm and 50 mm collimators and backshields, and accommodates any detector orientation**

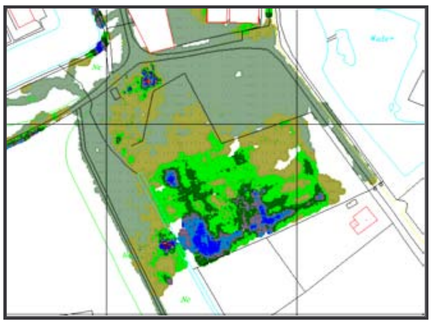
The Canberra ISOCS System

An ISOCS system consists of the following major components:

- **An "ISOCS Characterized" Germanium Detector**
- **A versatile set of Shields and Collimators on a Cart.**
- **An InSpector 2000 Portable Spectroscopy Workstation.**
- **An IBM-compatible Laptop PC running Genie 2000 software.**
- **ISOCS *In Situ* Calibration Software.**

GPS Survey System

The Trimble combination system was developed for performing walkover and static surveys. The SAMS (or other similar instruments) contains a 3-inch × 3-inch NaI(Tl) detector with built-in high voltage supply, preamplifier, amplifier, analog-to-digital converter, pulse analyzer, and computer-controlled hardware and software. It can perform on-site dose-rate measurements, and radioisotope identification and quantification.



The Trimble combination system logs gamma measurement data from a scintillation detector carried six inches above the ground surface and GPS position information from a portable backpack system. The results are presented in tabular and graphical formats. The position information is accurate to 0.5 meter. The 3-inch × 3-inch NaI(Tl) detector will be setup with a ^{137}Cs specific window and a broad gamma window to detect ^{226}Ra photons and x-rays. The Trimble software can collect data as frequently as one measurement per second. The spatial density depends on the walking speed. By adjusting the count time, concentrations of approximately 5-50 pCi/g of ^{137}Cs might be detected, depending on conditions. The ^{137}Cs count rate can be converted to pCi g^{-1} concentration values. The broad window count rate can be reported in count rate or dose rate units.

Ludlum Model 12 Ratemeter

COMPATIBLE DETECTORS: G-M, proportional, scintillation
METER DIAL: 0 - 500 cpm, 0 - 2.5 kV, BAT TEST (*others available*)
MULTIPLIERS: × 1, × 10, × 100, × 1000
LINEARITY: Reading within plus or minus 10 percent of true value with detector connected
CONNECTOR: Series “C” (*others available*)
AUDIO: Built in unimorph speaker with ON/OFF switch (*greater than 60 dB at 2 feet*)
CALIBRATION CONTROLS: Accessible from front of instrument (*protective cover provided)*
HIGH VOLTAGE: Adjustable from 200 – 2500 volts (*can be read on meter*)
DISCRIMINATOR: Adjustable from 2 – 60 mV
RESPONSE: Toggle switch for FAST (4 s) or SLOW (22 s) from 10 percent to 90 percent of final reading
RESET: Push-button to zero meter
POWER: 2 each D cell batteries (*housed in sealed compartment that is externally accessible*)
BATTERY LIFE: Typically 600 hours with alkaline batteries (*battery condition can be checked on meter*)
METER: 2.5" (6.4 cm) arc, 1 mA analog type
CONSTRUCTION: Cast and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 6.5 inches (16.5 cm) height × 3.5 inches (8.9 cm) width × 8.5 inches (21.6 cm) length
WEIGHT: 3.5 lbs (1.6 kg) including batteries

Ludlum Model 19A MicroR Meter

WORKING ENVIRONMENT: Splash proof shields for outdoor use
INDICATED USE: Low level gamma survey
DETECTOR: 1-inch × 1-inch sodium iodide NaI(Tl) scintillator
SENSITIVITY: Typically 175 cpm $(\mu R\ h^{-1})^{-1}$ (^{137}Cs gamma)
ENERGY RESPONSE: Energy dependent
METER DIAL: 0 – 500 $\mu R\ h^{-1}$ dual colored logarithmic scale, BAT TEST
ALARM: Indicated by red lamp and audible tone (Alarm audio overrides the audio ON/OFF switch)
LIGHT: Push-button to activate
LINEARITY: Reading within ± 10 percent of true value
AUDIO: Built in unimorph speaker with ON/OFF switch (greater than 60 dB at 2 feet)
CALIBRATION CONTROLS: All calibration controls are internal
RESPONSE: Dependent on number of counts present (typically not greater than 7 seconds from 10 percent to 90 percent of final reading)
RESET: Push-button to zero meter
POWER: 2 each "D" cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: Typically 600 h with alkaline batteries (battery condition can be checked on meter)
METER: 2.5 inches (6.4 cm) arc, 1 mA analog type
CONSTRUCTION: Cast and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 7.8 inches (19.8 cm) height × 3.5 inches (8.9 cm) width × 8.5 inches (21.6 cm) length
WEIGHT: 4.5 pounds (2.1 kg) including batteries

Ludlum Model 193-6 MicroR Meter

- ***4 Ranges***
- ***Automatically Adjusting Alarm Setting***
- ***Micro-processor based***
- ***6" X 1" Plastic Gamma Scintillator***
- ***Total Counting Range from 0 - 5,000 µR/hr***

INDICATED USE: General purpose survey with alarm capabilities
DETECTOR: 6"(15.2cm) diameter X 1"(2.5cm) thick plastic scintillation detector
SENSITIVITY: Typically 2000 cpm/mR/hr (137Cs gamma)
METER DIAL: 0 - 1 µR/hr, BAT TEST (others available)
MULTIPLIERS: X1, X10, X100, X1000
LINEARITY: Reading within ±10% of true value
ALARM: The Model 193 has a dual action alarm.
1. A fixed alarm point can be set at any point from 10% of full scale to full scale, and is indicated by a constant audible tone, and the lamp turning on.
2. A quick deviation alarm that is based on background radiation levels. When the instrument is turned on, it takes an 8 second measurement of background radiation levels and determines a deviation alarm setting. If the radiation level exceeds this setting, the alarm audio will beep every 1/8 second, and the lamp will flash.
AUDIO: Built in unimorph speaker with ON/OFF switch (greater than 60 dB at 2 feet)
CALIBRATION CONTROLS: Accessible from front of instrument (protective cover provided)
RESPONSE: Toggle switch for FAST (4 seconds) or SLOW (22 seconds) from 10% to 90% of final reading
RESET: Pushbutton to zero the meter, and also re-accumulate background data and recalculate the alarm point.
POWER: 2 each "D" cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: Typically 600 hours with alkaline batteries (battery condition can be checked on meter)
METER: 2.5" (6.4cm) arc, 1 mA analog type
CONSTRUCTION: Cast and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: -20°F(-29°C) to 140°F(60°C)
OVERALL LENGTH: 51"(129.5 cm)
WEIGHT: 8.5 lbs(3.9 kg) including batteries

Ludlum Model 43-89 Alpha/Beta Scintillator

INDICATED USE: Alpha-beta survey
SCINTILLATOR: ZnS(Ag) adhered to 0.010-inch thick plastic scintillation material
WINDOW: Typically 1.2 mg cm^{-2} aluminized Mylar
WINDOW AREA: Active – 125 cm^2; Open – 100 cm^2
EFFICIENCY (4π geometry): Typically 16 percent – ^{239}Pu; 5 percent – ^{99}Tc; 16 percent – $^{90}S/^{90}Y$
BACKGROUND: Alpha - Less than 3 cpm; Beta - Typically 300 cpm or less (10 $\mu R\ h^{-1}$ field)
NON-UNIFORMITY: Less than 10 percent
CROSS TALK: Alpha to Beta - Less than 10 percent; Beta to Alpha - Less than 1 percent
COMPATIBLE INSTRUMENTS: Model 2224, 2360, 2929
TUBE: 1.5 inches (3.8cm) diameter magnetically shielded photomultiplier
OPERATING VOLTAGE: Typically 500 - 1200 volts
DYNODE STRING RESISTANCE: 100 megohms
CONNECTOR: Series C (others available)
CONSTRUCTION: Aluminum housing with beige polyurethane enamel paint
TEMPERATURE RANGE: -4° F(-20° C) to 122° F(50° C)
SIZE: 5.5 inches (13.9 cm) height × 4 inches (10.2 cm) width × 12.3 inches (33 cm) length
WEIGHT: 1.5 lb (0.7kg)

Ludlum Model 44-9 Pancake G-M Detector

INDICATED USE: Alpha beta gamma survey; Frisking
DETECTOR: Pancake type halogen quenched G-M
WINDOW: 1.7 ± 0.3 mg cm^{-2} mica
WINDOW AREA: Active – 15 cm^2; Open – 12 cm^2
EFFICIENCY (4π geometry): Typically 5 percent – ^{14}C; 22 percent – $^{90}Sr/^{90}Y$; 19 percent – ^{99}Tc; 32 percent – ^{32}P; 15 percent – ^{239}Pu
SENSITIVITY: Typically 3300 cpm $(mR\ h^{-1})^{-1}$ (^{137}Cs gamma)
ENERGY RESPONSE: Energy dependent
DEAD TIME: Typically 80 µs
COMPATIBLE INSTRUMENTS: General purpose survey meters, ratemeters, and scalers
OPERATING VOLTAGE: 900 volts
CONNECTOR: Series C (*others available*)
CONSTRUCTION: Aluminum housing with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 1.8 inches (4.6 cm) height × 2.7 inches (6.9 cm) width × 10.7 inches (27.2 cm) length
WEIGHT: 1 lb (0.5kg)

Ludlum Model 44-10 Gamma Scintillator

INDICATED USE: High energy gamma detection
SCINTILLATOR: 2-inch (5.1-cm) diameter × 2-inch (5.1-cm) thick NaI(Tl) scintillator
SENSITIVITY: Typically 900 cpm $(\mu R\ h^{-1})^{-1}$ (^{137}Cs)
ENERGY RESPONSE: Energy dependent
COMPATIBLE INSTRUMENTS: General purpose survey meters, ratemeters, and scalers
TUBE: 2-inch (5.1cm) diameter magnetically shielded photomultiplier
OPERATING VOLTAGE: Typically 500 – 1200 volts
DYNODE STRING RESISTANCE: 60 megohms
CONNECTOR: Series C (others available)
CONSTRUCTION: Aluminum housing with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 2.6 inches (6.6 cm) diameter × 11 inches (27.9 cm)length
WEIGHT: 2.3 pounds (1.1kg)

Ludlum Model 2221, Scaler/Ratemeter Single Channel Analyzer

INDICATED USE: Field analysis
COMPATIBLE DETECTORS: G-M, proportional, scintillation
CONNECTOR: Series “C” (others available)
AUDIO: Built in unimorph speaker with volume control (greater than 60 dB at 2 feet, full volume)
AUDIO DIVIDE: Thumb switch for 1, 10, or 100 events-per-click
AUDIO JACK: For optional headset
METER DIAL: 0 - 500 cpm; 50 - 500k cpm logarithmic scale (others available)
MULTIPLIERS: × 1, × 10, × 100, × 1k, and LOG for logarithmic scale
LINEARITY: Reading within ± 10% of true value with detector connected
DIGITAL DISPLAY: 6-digit LCD display with 0.5" (1.3 cm) digits
LCD BACKLIGHT: Activated by LAMP switch
DIGITAL RATEMETER: Provides a digital display of count rate when selector switch is in Dig. Rate position
SCALER: Used in conjunction with timer to allow for gross counting with range from 0 - 999999 counts when
selector switch is in Scaler position (controlled by COUNT and HOLD buttons)
TIMER: Switch selectable divisions of 0.1, 0.5, 1, 2, 5, 10 minutes or CONT (continuous) for manual timing
CALIBRATION CONTROLS: Accessible from front of instrument (protective cover provided)
HIGH VOLTAGE: Adjustable from 200 - 2400 volts (can be checked on display)
THRESHOLD: Adjustable from 100 - 1000 (can be checked on display)
WINDOW: Adjustable from 0 - 1000 above threshold setting (can be turned on or off)
GAIN: Adjustable from 1.5 - 100 mV at threshold setting of 100
OVERLOAD: Senses detector saturation. Indicated by “------” on LCD display and meter going to full scale (adjustable depending on detector selected)
RESPONSE: Toggle switch for FAST (4 seconds) or SLOW (22 seconds) from 10% to 90% of final reading
RESET: Push-button to zero meter
POWER: 4 each “D” cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: Typically 250 hours with alkaline batteries (battery condition can be checked on digital display)
METER: 2.5" (6.4 cm) arc, 1 mA analog type
CONSTRUCTION: Milled and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: -4° F (-20° C) to 122° F (50° C)
May be certified for operation from -40° F (-40° C) to 150° F (65° C)
SIZE: 9" (22.9 cm) height × 4.3" (10.9 cm) width × 10" (25cm) length including handle
WEIGHT: 5.5 lbs (2.5kg) including batteries

Ludlum Model 2224 Alpha/Beta Scaler/Ratemeter

INDICATED USE: Simultaneous alpha, beta counting and discrimination
COMPATIBLE DETECTORS: Proportional and dual phosphor scintillation detectors
CONNECTOR: Series C (others available)
AUDIO: Built in unimorph speaker with volume control (greater than 60 dB at 2 feet, full volume)
AUDIO DIVIDE: Selectable dual or individual click-per-event for alpha and beta counts and divisions of 1, 10, 100, or 1000 events-per-click (beta counts only)
METER: 2.5 inches (6.4 cm) arc, 1 mA analog type
METER DIAL: 0 – 500 cpm, 0 – 2 kV, BAT OK, OL(overload)
MULTIPLIERS: × 1, × 10, × 100, × 1000
LINEARITY: Reading within ± 10 percent of true value with detector connected
SCALER: 6 digit LCD display with 0.25-inch (0.64-cm) digits, overflow arrow, and colons to indicate when a count is in process
COUNT: Push-button to initiate scaler count
COUNT TIME: Internally selected times of 0.1, 0.5, 1, or 2 minutes
SELECTOR SWITCH: Toggle switch to select alpha and beta, alpha only, or beta only
HIGH VOLTAGE: Adjustable from 200 – 2000 volts (can be read on meter)
HIGH VOLTAGE ADJUST: Accessible from front of instrument (protective cover provided)
THRESHOLD: Internal control allows adjustment from 2 mV – 15 mV for beta, and 40 mV – 700 mV for alpha
WINDOW (Beta only): Internal control allows adjustment from beta threshold up to the alpha threshold setting
OVERLOAD: Senses detector saturation. Indicated by red lamp on meter and meter going to full scale (adjustable depending on detector selected)
RESPONSE: Will vary according to number of counts present. Typically 2 s – 11 s from 10 percent to 90 percent of final reading
POWER: 2 each D cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: Greater than 350 hours with alkaline batteries (battery condition can be checked on meter)
CONSTRUCTION: Cast and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 6.5 inches (16.5 cm)height × 3.5 inches (8.9 cm) width × 8.5 inches (21.6 cm) length
WEIGHT: 3.5 lbs(1.6 kg) including batteries

Ludlum Model 2241 Digital Survey Meter

INDICATED USE: General purpose survey, gross counting
COMPATIBLE DETECTORS: G-M, proportional, scintillation
CONNECTOR: Series C (others available on request)
AUDIO: Built in unimorph speaker with ON/OFF switch (greater than 60 dB at 2 feet)
ALERT/ALARM: Indicated by enunciator on display and audible tone
DISPLAY: 4 digit LCD display with 0.5-inch (1.3-cm) high digits, separate enunciators for display units, alert, alarm, low battery, detector overload, counting overflow, and scaler counting
BACKLIGHT: Push-button to activate
RATEMETER: Can display in R/hr, Sv/hr, cpm, or cps when control switch is in RATEMETER position
DISPLAY RANGE: Auto ranging from 0.0 μR h^{-1} – 9999 R h^{-1}; 0.000 μSv h^{-1} – 9999 Sv t^{-1}; 0 cpm – 999k cpm;
or 0 cps – 100 kcps
LINEARITY: Reading within ± 10 percent of true value with detector connected
SCALER: Activated by push-button in handle (count time adjustable from 1 to 9999 s in 1-s intervals)
CALIBRATION CONTROLS: Accessible from front of instrument (protective cover provided)
HIGH VOLTAGE: Adjustable from 200 volts – 2500 volts
DISCRIMINATOR: Adjustable from 2 mV – 100 mV
OVERLOAD: Indicated by OVERLOAD on display (adjustable depending on detector selected)
RESET: Push-button to zero display, acknowledge and/or reset alarm
POWER: 2 each D cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: Typically 200 h with alkaline batteries (low battery indicated on display)
CONSTRUCTION: Cast and drawn aluminum with beige polyurethane enamel paint
TEMPERATURE RANGE: –4° F (–20° C) to 122° F (50° C)
SIZE: 6.5 inches (16.5cm) height × 3.5 inches (8.9cm) width × 8.5 inches (21.6cm) length
WEIGHT: 3.5 lbs (1.6kg) including batteries

Ludlum Model 2360 Survey Meter

- ***Data Logger***
- ***Simultaneous alpha, beta or alpha/beta Counting***
- ***6 Digit LCD Scaler***
- ***May be repackaged with PDA interface and laptop for listing location codes of survey points, controlling counts, and reporting data***
- ***Alpha Only, Beta Only, or Alpha/Beta Counts***
- ***Series "C" connector***

INDICATED USE: Alpha, beta discrimination, and data logging
COMPATIBLE DETECTORS: Proportional and dual phosphor scintillation detectors
DATA LOGGER: Capable of logging individual data points with the following identifiers for each point:

alpha and beta sample counts sample number
date/time stamp scaler count time
10 character location identifier

LOGGING PUSHBUTTON: Located in the handle; used to activate scaler and/or log a count
CALIBRATION DUE DATE: An internal date that disables the instrument if overdue
LINEARITY: Reading within plus or minus 10% of true value with detector connected
SCALER: 6 digit LCD with 0.25" digits, overflow arrow, and colons to indicate when a count is in process
COUNT TIME: Switch selectable times of 0.1, 0.5, 1, 2, 5, 10, and 60 minutes, or PDA to allow for a specific count time to be set from a PDA.
SELECTOR SWITCH: Toggle switch to select alpha+beta, alpha only, or beta only, or PDA to set internal selector
HIGH VOLTAGE: Adjustable from 200 - 2000 volts (*Can be read on the meter*), or can be adjusted by PDA
THRESHOLD: Internal control adjusts from 2 - 15 mV for beta, and 40 - 700 mV for alpha
WINDOW: Internal control allows for adjustment from the beta threshold up to the alpha threshold setting (*Beta only*)
RESPONSE: Will vary according to the number of counts present. Typically 2 - 11 seconds from 10% - 90% of final reading
POWER: 2 each "D" cell batteries (*housed in compartment accessible from front of instrument*)
BATTERY LIFE: Greater than 8 hours (*battery condition can be checked on meter*)
TEMPERATURE RANGE: -4° F(-20° C) to 122° F(50° C)
May be certified for operation from -40° F(-40° C) to 150° F(65° C)

Thermo Electron Corporation HandECount Alpha/Beta Sample Counter

- **Alpha/Beta Sensitive**
- **Selectable Units of Measurement**
- **Stores Measurement Results**
- **Color Display**
- **Built-in Calibration Routine**
- **True Portability**
- **Optional 8 Hour Battery Operation**
- **Alarms**
- **Decay-Corrected Source Library**
- **Internal Clock**

The HandECount is a battery or AC powered sample counter used for determining the alpha and beta radiation present in a sample. The instrument uses a PalmTM PDA with a color touch screen as the user interface and to record all results. All data may be retrieved to a PC via a conduit program.

The HandECount sample counting system provides simultaneous alpha and beta measurements. This system is controlled by a Palm handheld computer platform and operating system which communicates with our standard modular detector board to perform all counting operations. The Palm's built-in informative color screen, intuitive controls, internal clock and powerful database capabilities provide numerous cost-effective advantages over custom built systems.

The HandECount system incorporate a 2" dual phosphor scintillator coupled to a sliding drawer mechanism accommodating a 2" diameter (47 mm) sample. The drawer uses a height adjustable sampling area to permit use with different sample types. To activate the counting process, the sample drawer myst be slid all the way back where is makes contact with a switch. The enclosure is made from a durable plastic which will withstand rugged handling. The built-in handle in combination with the battery operation option, facilitate true portability for feld usage up to eight hours between battery charges.

Berkeley Nucleonics Model 935 Portable Surveillance and Measurement System (SAMS)

The SAMS contains a 2-inch × 2-inch NaI (Tl) detector with built-in high voltage supply, preamplifier, amplifier, analog-to-digital converter, multichannel analyzer, and computer-controlled hardware and software. It is capable of performing onsite gamma spectroscopy, dose-rate measurements, and radioisotope identification and quantification.

ATTACHMENT 4
Field Forms and Logs

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EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY

WATER LEVEL DATA SUMMARY

PROJECT: ______________________________

LOCATION: ______________________________

CLIENT: ______________________________

SURVEY DATUM: ______________________________

MEASURING DEVICE: ______________________________

JOB NUMBER ______________________________

DATE ______________________________

MEASURED BY ______________________________

WELL NUMBER	TIME (Military)	MEASURING POINT		DEPTH TO WATER (FT)	ELEVATION OF WATER (FT)	COMMENTS
		Description	Elevation (FT)			

Rev. 10/93

Water Level Data/100209beaco

HTW DRILLING LOG

1. COMPANY NAME	2. DRILLING SUBCONTRACTOR	HOLE NO.: SHEET OF SHEETS
3. PROJECT	4. LOCATION	
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION	
	9. SURFACE ELEVATION	
	10. DATE STARTED	11. DATE COMPLETED
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED	
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h

HTW DRILLING LOG

HOLE NO.:

PROJECT | INSPECTOR

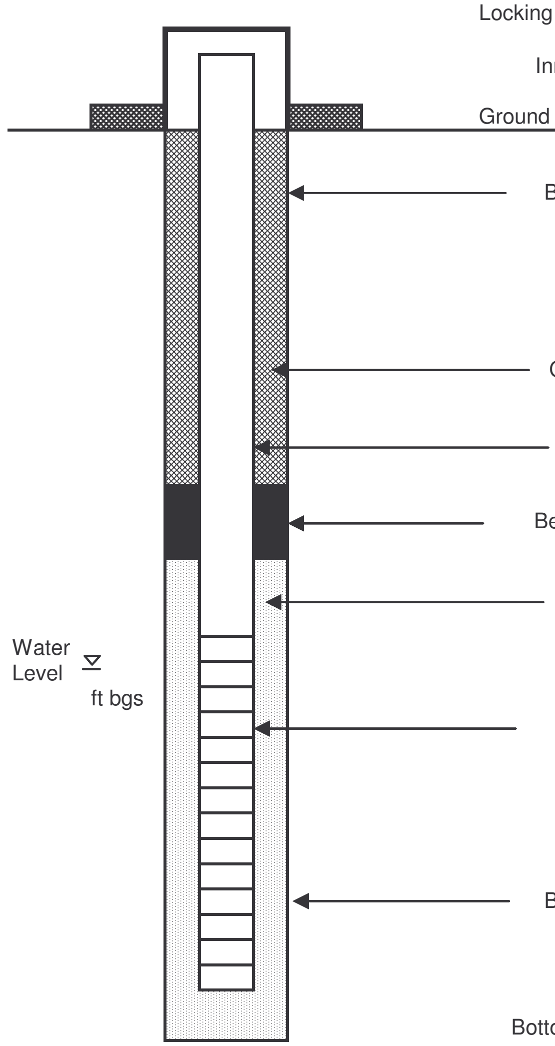
ELEV. a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	ANALYTICAL SAMPLE NO. f	BLOW COUNTS g	REMARKS h

PROJECT HOLE NO.

EarthTech
A Tyco International Ltd. Company

Overburden Well Diagram **Well No.**

Project: Guterl Steel RI	Location: Lockport, NY	Page 1 of 1		
Earth Tech Project No.:	Subcontractor:	Water Levels		
Surface Elevation: Ft	Driller:	Date	Time	Depth
Top of PVC Casing Elevation: Ft	Well Permit No.:			
	Earth Tech Rep.:			
Datum: NGVD 1988	Date of Completion:			



Locking protective stickup with concrete pad, three bollards

Inner casing stickup ________ ft to ________ ft

Ground Surface

Borehole diameter ________ inches

Cement-bentonite grout from ________ ft to ________ ft

Riser Pipe from ________ ft to ________ ft

Bentonite seal from ________ ft to ________ ft

Filter pack from ________ ft to ________ ft

Sand Size ________

Well screen from ________ ft to ________ ft

Diameter ________ inches
Slot size ________ inches
Type ________

Borehole diameter ________ inches

Bottom Cap at ________ ft

Bottom of Borehole at ________ ft

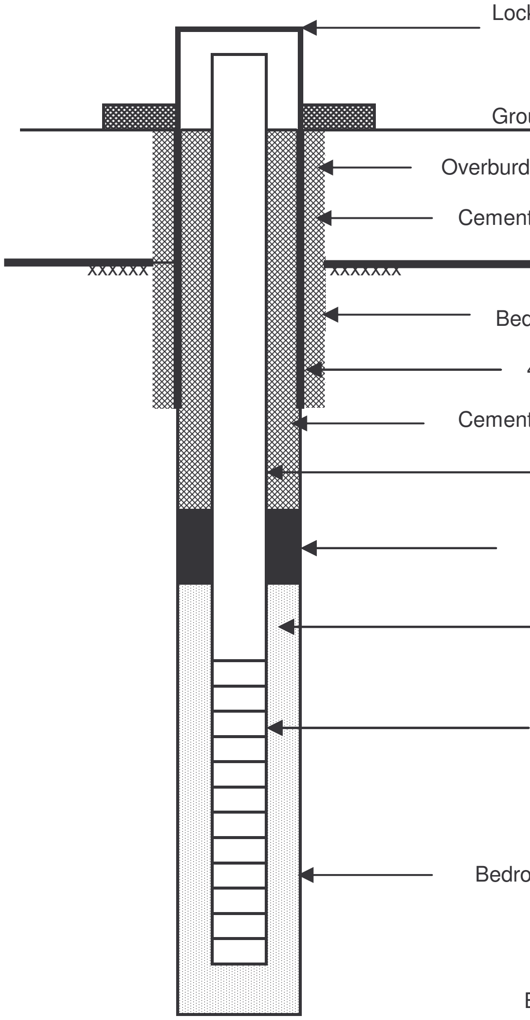
Note: All measurements based on ground surface at 0.0 feet. (+) above grade. (-) below grade.

(NOT TO SCALE)

EarthTech
A Tyco International Ltd. Company

Bedrock Well Diagram **Well No.**

Project: Guterl Steel RI	Location: Lockport, NY	Page 1 of 1		
Earth Tech Project No.:	Subcontractor:	Water Levels		
Surface Elevation: Ft	Driller:	Date	Time	Depth
Top of PVC Casing Elevation: Ft	Well Permit No.:			
	Earth Tech Rep.:			
Datum: NGVD 1988	Date of Completion:			



Locking protective stickup with concrete pad

Inner casing stickup ______ ft to ______ ft

Ground Surface

Overburden borehole diameter ______ inches (ID)

Cement-bentonite grout from ______ ft to ______ ft

Top of Bedrock ______ ft bgs

Bedrock socket diameter ______ inches

4-inch ID steel casing ______ ft to ______ ft

Cement-bentonite grout from ______ ft to ______ ft

Riser Pipe from ______ ft to ______ ft

Bentonite seal from ______ ft to ______ ft

Filter pack from ______ ft to ______ ft

Sand Size ______

Well screen from ______ ft to ______ ft

Diameter ______ inches
Slot size ______ inches
Type ______

Bedrock borehole diameter ______ inches

Bottom Cap at ______ ft

Bottom of Borehole at ______ ft

Note: All measurements based on ground surface at 0.0 feet. (+) above grade. (-) below grade.

(NOT TO SCALE)

EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY

Monitoring Well Development Log

Date Started (yr/mo/day) ____________ Date Completed (yr/mo/day) ____________

Field Personnel ____________________

Site Name ____________________

Earth Tech Job # ____________________

Well ID # ____________________

_____ Upgradient _____ Downgradient

Weather Conditions ____________________

Air Temperature ____________________ ºF

Total Well Depth (TWD) = ____________________ 1/100 ft

Depth to Ground Water (DGW) = ____________________ 1/100 ft

Length of Water Column (LWC) = TWD - DGW = ____________________ 1/100 ft

1 Casing Volume (OCV) = LWC x ________ = ____________________ gallons

5 Casing Volumes = ____________________ gallons

Method of Well Development ____________________

____

Total Volume of Water Removed ____________________ gallons

Date/Time	Discharge Rate (gpm)	Volume Purged (gallons)	Water Temperature (ºC)	pH	Eh	Specific Conductivity (μmhos/cm)	Turbidity/Color	Sand Content (%)	Remarks

COMMENTS/OBSERVATIONS: ____________________

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

GROUNDWATER SAMPLING LOG

Date (mo/day/yr) ____________

Field Personnel ____________

Site Name ____________

Earth Tech Job # ____________

Well ID # ____________

_______ Upgradient _______ Downgradient

Weather Conditions ____________

Air Temperature ____________ ° F

Total Depth (TWD) Below Top of Casing = ____________ 1/100 ft

Depth to Groundwater (DGW) Below Top of Casing = ____________ 1/100 ft

Length of Water Column (LWC) = TWD - DGW = ____________ 1/100 ft

1 Casing Volume (OCV) = LWC x 0.163 = ____________ gal

3 Casing Volumes = ____________ gal

Method of Well Evacuation: Peristaltic Pump

Method of Sample Collection: Peristaltic Pump/Teflon Tubing

Total Volume of Water Removed ____________ gal

Casing Diameter ____________ inches

Casing Material ____________

Measuring Point Elevation ____________ 1/100 ft

Height of Riser (above land surface) ____________ 1/100 ft

Land Surface Elevation ____________ 1/100 ft

Screened Interval (below land surface) ____________ 1/100 ft

Container	Analysis (Method)	# Bottles	Preservative	Dup - MS/MSD
VOA 40 mL glass	TCL VOCs (8260B)	3	HCL, 4°C	

FIELD ANALYSES

VOLUME PURGED (gallons)								
TIME (Military)								
Depth to Groundwater Below Top of Casing (ft)								
Drawdown (ft)								
pH (S.U.)								
Sp. Cond. (mS/cm)								
Turbidity (NTUs)								
Dissolved Oxygen (mg/L)								
Water Temperature (°C)								
ORP (mV)								

Physical appearance at start: Color ________ Odor ________ Sheen/Free Product ____________

Physical appearance at sampling: Color ________ Odor ________ Sheen/Free Product ____________

COMMENTS/OBSERVATIONS ____________________________

Slug Test Data

Location ________________________ Geologic Unit __________ Well Number _________ Sheet _______ of _____

Field Team Member Signature

(Print name and title, then sign)

Test Method: ___ Slug Injection or ___ Slug Withdrawal Slug Dimensions or volume _______________

Well Construction Details (attach diagram): ____

Test Started __________________ Test Stopped _______________ Test ID ____________________________________

Method of Water-Level Measurement: ____

Comments: ____

____

____

Time of Measurement	**Elapsed Time** (minutes)	**Depth to Water** (feet)	**Time of Measurement**	**Elapsed Time** (minutes)	**Depth to Water** (feet)

☐ Check here if continued on the back of this sheet.

Borehole and Monitoring Well Decommissioning/Abandonment

Project:		**Job No:**
Location:		**Installation No:**
Client:		**Type of Installation:**
Contractor:		**Boring No:**
Driller:	**Certification No:**	**Location:**
Earth Tech Representative:		**Abandonment Date(s):**

Abandonment Information:
Location with respect to the replacement well or borehole (if any):
Open depth (in feet below ground surface) of well/borehole before grouting:
Casing or items left in borehole by depth, description, composition, and size (if applicable):
Description and total quantity of grout used initially:
Description and daily quantities of grout used to compensate for settlement:
Water or mud level (in feet below ground surface) prior to grouting and date measured:

Attach to this form the following items:
1. Copy of borehole log
2. Copy of construction diagram for abandoned well (if applicable)

IDW MANAGEMENT FORM

COMPANY ____________________ PROJECT ____________________

SITE NAME ____________________ LOCATION ____________________

CONTAINER NUMBER	MEDIA DESCRIPTION	MEDIA ORIGIN	DATE FILLED	DATE SAMPLED	DATE DISPOSED	COMMENTS