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Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the Tonawanda Sites, New York

U.S. Department of Energy

0489-0613.1

FIELD SAMPLING AND ANALYSIS PLAN FOR THE TOWN OF TONAWANDA LANDFILL

TONAWANDA, NEW YORK

SEPTEMBER 1994

prepared by
U.S. Department of Energy, Oak Ridge Operations Office, Formerly Utilized Sites Remedial Action Program

with technical assistance from
Science Applications International Corporation ESC-FUSRAP
under Contract No. DE-AC05-91OR21950

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LIST OF ACRONYMS AND ABBREVIATIONS

Am	americium
AEC	Atomic Energy Commission
BNI	Bechtel National, Inc.
cm	centimeter
COC	contaminant of concern
DOE	U.S. Department of Energy
DQO	data quality objective
EML	Environmental Measurements Laboratory
EPA	U.S. Environmental Protection Agency
ft	foot
FUSRAP	Formerly Utilized Sites Remedial Action Program
g	gram
hr	hour
in.	inch
msl	mean sea level
μR	microrad
NMPC	Niagara Mohawk Power Corporation
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
ORNL	Oak Ridge National Laboratory
pCi	picoCurie
PVC	polyvinyl chloride
QC	quality control
Ra	radium
SAIC	Science Applications International Corporation
TCLP	toxicity characteristic leaching procedure
Th	thorium
U	uranium

1. INTRODUCTION

In 1974, the Atomic Energy Commission (AEC), a predecessor of the U.S. Department of Energy (DOE), instituted the Formerly Utilized Sites Remedial Action Program (FUSRAP). This program is now managed by DOE to identify and clean up or otherwise control sites where residual radioactive contamination (exceeding current guidelines) remains from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy under FUSRAP. One of these sites is the Town of Tonawanda Landfill.

The Town of Tonawanda Landfill is located approximately 1.5 miles due north of the Linde Air Products uranium processing plant (Figure 1-1), and is listed as Solid Waste Facility No. 15S29 by the New York State Department of Environmental Conservation (NYSDEC). Municipal wastes were accepted at the landfill until December 1987, when the permit expired. NYSDEC subsequently issued permits for the disposal of construction and demolition wastes and yard wastes through October 1989, when the landfill was required to stop accepting all wastes. The Town of Tonawanda is seeking to close the landfill in accordance with the current Title 6 of the New York Code of Rules and Regulations (6NYCRR) Part 360. Because the landfill is known to contain radiological wastes, the closure plan and the detailed design of the closure must also be prepared under Title 6, Part 380 (MPI 1994).

1.1 SITE BACKGROUND

In the early 1900s, a quarry or borrow pit was located near the northwestern portion of the Town of Tonawanda Landfill. This quarry was reportedly abandoned at a depth of 60 feet (ft) when water was encountered; it was later filled with debris and noncombustibles from approximately 1945 to 1955. The exact size and location of the quarry is not known.

Landfill operations began at the site in the mid-1930s and continued through October 1989. Operations in the western half of the landfill ceased in 1961. From 1970 through 1982, the eastern portion of the landfill was used for the disposal of household waste, construction and demolition material, leaves, incinerator ash (from the incineration of sewage treatment plant sludge and municipal waste), and incinerator bypass (unburned municipal waste). The incinerator bypass was apparently the only source of biodegradable waste placed in the landfill between 1970 and 1982. It is estimated that 750 tons of bypass material were landfilled during this time period. From 1983 to 1989, it is estimated that 9,000 tons of nonbiodegradable household waste and construction and demolition waste and 2,300 tons per year of incinerator ash were landfilled.

It is suspected that radioactive material (waste by-products and uranium ore) from work performed at the Linde Air Products Division of Union Carbide, from 1945 through 1955, has made its way to the Town of Tonawanda Landfill (MPI 1994). In April 1990, DOE requested

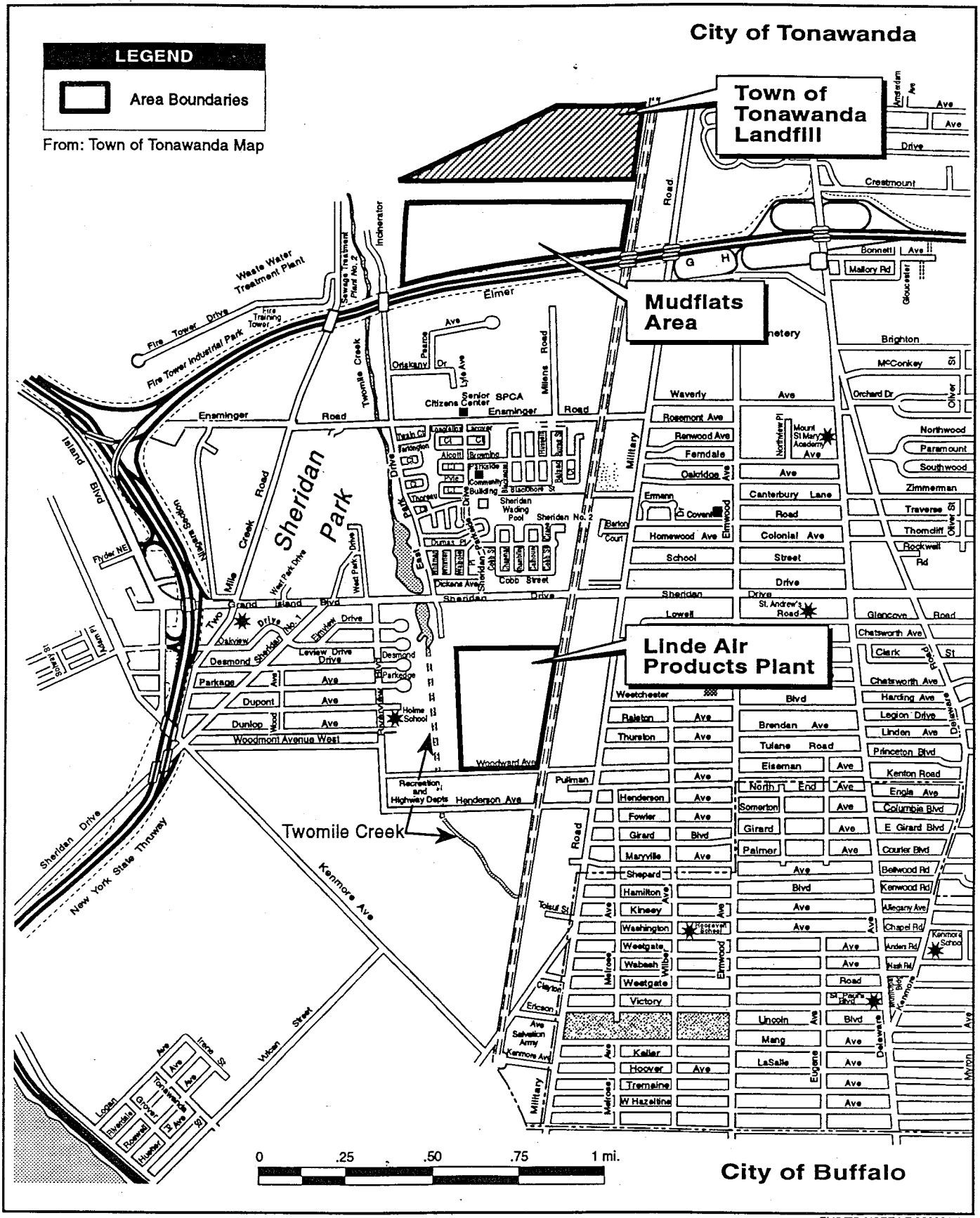

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Figure 1-1. General Site Location Map

a surface radiological survey be performed around the vicinity of the Linde site as a precaution to ensure that no residual radioactive materials exceeding current DOE guidelines were transported offsite. The results from this investigation showed elevated concentrations of radionuclides that might be expected to result from former processing activities at the Linde site. Based on these findings, DOE requested that Oak Ridge National Laboratory (ORNL) perform additional investigations at the landfill to confirm the results from the earlier investigation and to attempt to define the extent of contamination (ORNL 1992). It is suspected that the contamination identified may have resulted from the deposition of contaminated dredged stream sediments from Twomile Creek (MPI 1994). Figures 1-2 and 1-3 outline the area where the ORNL survey was performed.

The results from gamma walkover surveys performed over the landfill showed several areas where elevated activity levels exceeded background. The highest reading was 170 microrad per hour (μR/hr) in the northeast corner of the landfill. The results from the analysis of shallow soil samples collected from these locations showed surface soil in many locations exceeding DOE's cleanup guideline for radium (Ra) and thorium (Th) and the proposed total uranium (U) cleanup guideline of 60 picoCuries per gram (pCi/g), which equates to a cleanup guideline of 28.4 pCi/g for U-238. At two sampling locations, radiological contamination exceeded the maximum sampling depth of 76 centimeters (cm) (Figure 1-2).

More recently, EAD Metallurgical, Inc. released americium (Am)-241 to the sanitary sewers during the manufacturing of smoke detectors between 1977 and 1984. The americium was concentrated in waste water treatment plant sludge, which was incinerated in the Town of Tonawanda's sludge incinerator on Twomile Creek Road before being deposited in the eastern portion of the landfill (see Areas A, B, and C of Figure 1-4) (MPI 1994). The results from characterization efforts performed in 1988 revealed Am-241 contamination as deep as 7 feet below ground surface (Eberline 1988).

1.2 SITE DESCRIPTION

The landfill is approximately 55 acres in size, and is bounded on the north-northwest by a residential area within the City of Tonawanda; on the east by the Conrail property; on the south by a Niagara Mohawk Power Corporation (NMPC) right-of-way; and on the west by an inactive Town of Tonawanda waste incinerator facility. South of the NMPC right-of-way is a 115-acre tract of Town of Tonawanda land which is commonly referred to as the "mudflats" (Figures 1-1 and 1-3). Site access is presently gained by an old access/haul road that extends from East Park Drive across the NMPC property to the southwest corner of the site, and then easterly across the landfill to the east property boundary.

The site topography generally slopes from a high elevation of approximately 638 ft mean sea level (msl) at the east end of the landfill to a low elevation of 606 ft msl at the western end. The vegetation present at the site consists of low grasses, tall grasses, shrubs, and scattered

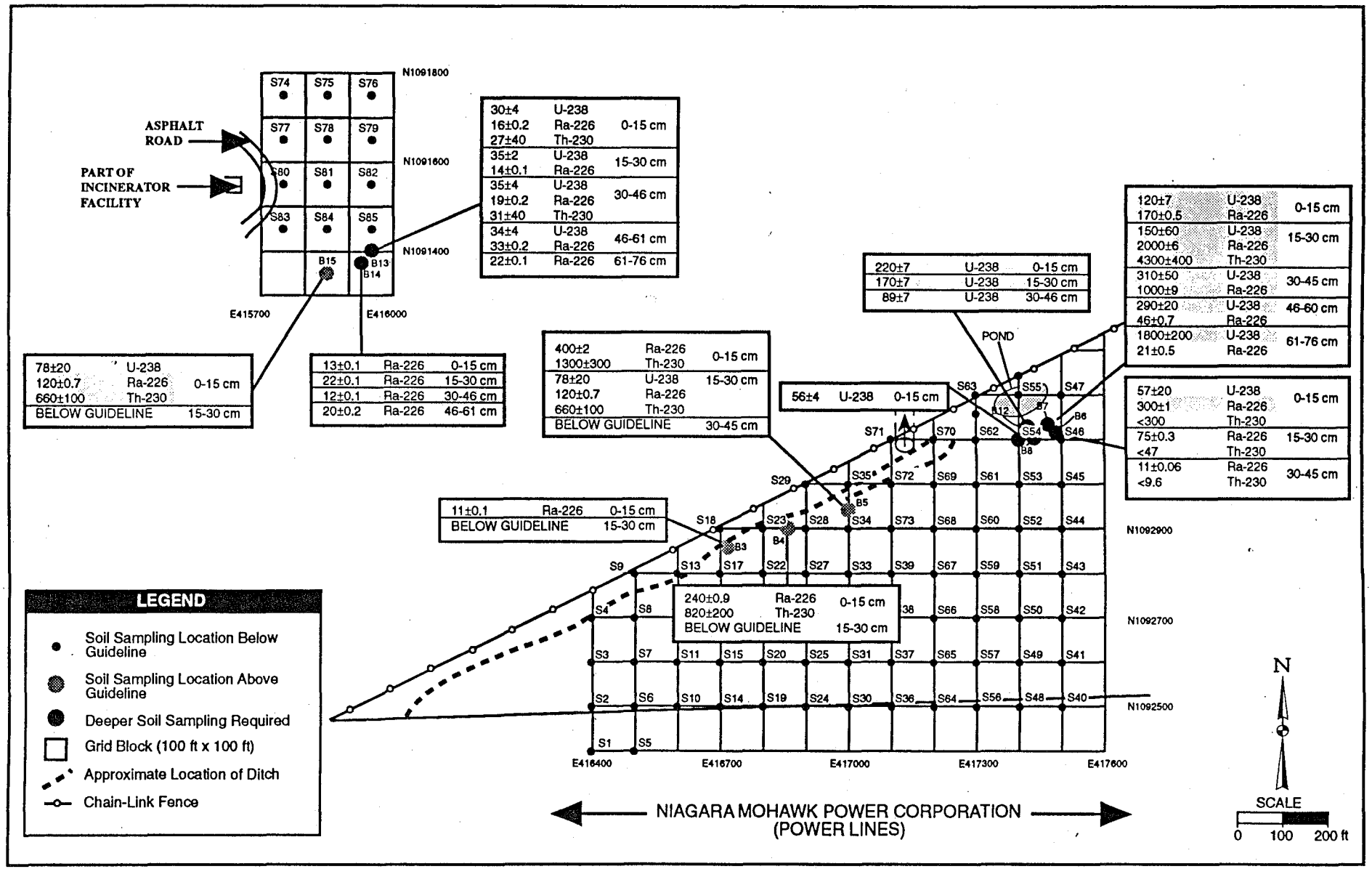
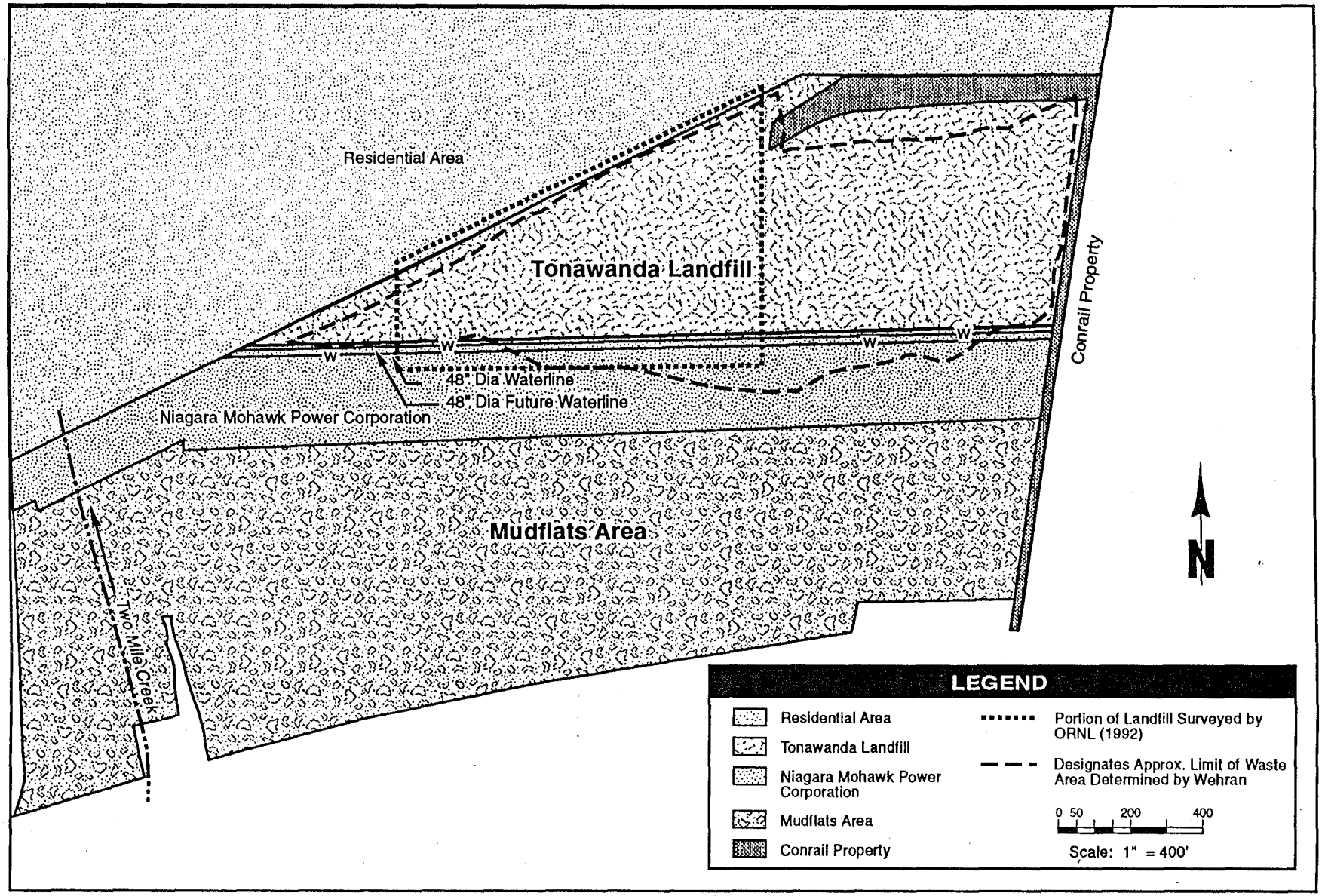


Figure 1-2. Shallow Soil Sampling Results from ORNL Survey



Source: MPI 1994

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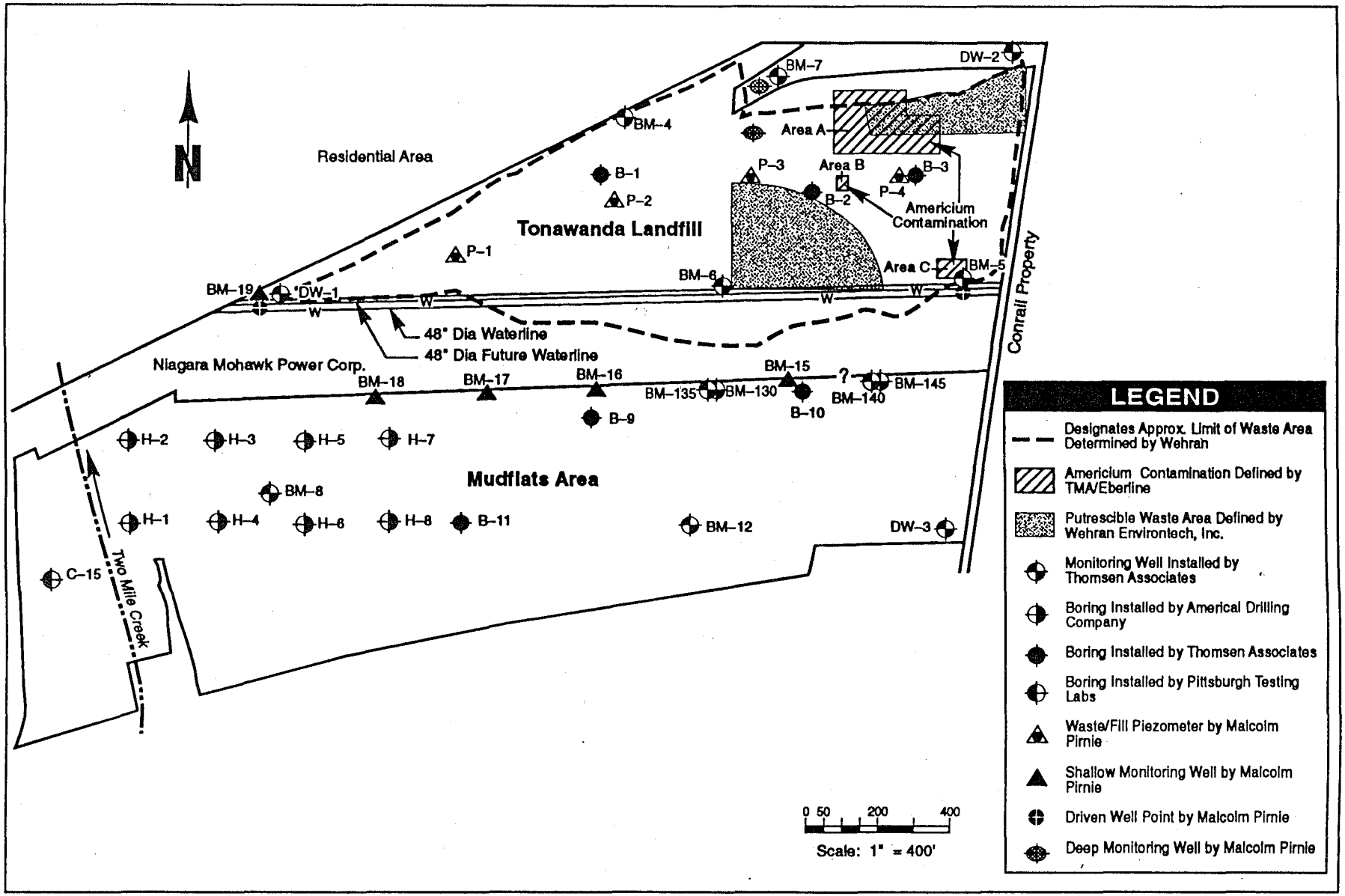
Figure 1-3. Land Use Map for the Tonawanda Landfill Area



Source: MPI 1994

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Figure 1-4. Map Summarizing Historical Investigations

trees. The existing cover material is reportedly thin topsoil or daily/intermediate cover (MPI 1994).

The NMPC right-of-way is utilized for several buried utilities, including two oil pipelines near the southern edge of the NMPC parcel, and a 48-inch (in.) Erie County Water Authority water main which is located approximately 30 ft south of the landfill property line.

1.3 PREVIOUS INVESTIGATIONS/EXISTING SITE CONDITIONS

Numerous field investigations have been performed at the Town of Tonawanda Landfill. The earliest investigation were performed in 1960 by American Drilling Company, when a total of nine soil borings were drilled in the mudflats area. The purpose of these borings is not currently known. In 1971, Pittsburgh Testing Labs drilled one soil boring in the west end of the mudflats area as part of a wastewater treatment plant study. Thomsen Associates later performed two separate investigations, the first of which was performed in 1983 and involved drilling, sampling, and installing 9 monitoring wells; completing 6 soil borings; and digging 10 test pits. This work was performed to meet the requirements of a permit renewal application for the landfill. Later in 1984, four additional downgradient groundwater monitoring wells were installed and sampled as part of a second investigation (MPI 1994).

A deep and shallow groundwater system are present in the overburden deposits. Based on information presented in Thomsen (1983), groundwater in the shallow aquifer flows from north to south and discharges into a depression in the mudflats area south of well cluster B13S/13D (see Figure 1-4). In several boreholes, it was found that the waste material was in direct contact with the shallow water table, which ranges from approximately 5 ft to 15 ft below ground surface. Groundwater in the deeper aquifer flows generally towards the north-northwest. This aquifer is encountered just above bedrock.

Investigations were performed by Wehran Envirotech, Inc. (1991), from October 1988 through January 1990. These investigations were related to landfill closure, and focused on delineating the edge of the waste material contained in the landfill. The results from this investigation showed that waste material encountered between the landfill and the northwest property boundary was composed of construction and debris waste, slag, incinerator ash, glass, metal, and plastic. Waste material and nonbiodegradable household waste were also identified in test trenches excavated in the NMPC right-of-way. No samples from either of these areas were found to be hazardous as defined by 6NYCRR Part 371, and the activity levels of ash samples collected from the northwest landfill boundary were within the background range (MPI 1994).

In early 1988, TMA/Eberline, Inc. performed fieldwork where the objective of the study was to characterize the horizontal and vertical extent of Am-241 contamination within the landfill. This fieldwork involved performing a gamma walkover survey and collecting shallow and deep soil samples. The results from this investigation identified three areas within the landfill which contain Am-241 contaminated waste/fill (Figure 1-4).

In 1990 and 1991, DOE had ORNL conduct radiological investigations in and around the landfill to determine the extent of uranium and daughter isotopes at the landfill that may have originated from Manhattan Engineer District (MED) related work at the Linde Plant. The results from the survey identified the presence of U-238, Ra-226, and/or Th-230 in soil with activity levels exceeding DOE guidelines (Figure 1-2).

1.4 CONTAMINANTS OF CONCERN

The results from initial characterization studies performed at the Town of Tonawanda Landfill were compared against background activity levels to identify the contaminants of concern (COCs) at the site. Based on this comparison, the radionuclides Ra-226, Th-230, U-238, Am-241, and their associated decay products were determined to be the primary contaminants of concern. While Am-241 is a COC for the landfill as a whole, the source of this contamination is unrelated to historical MED operations. Consequently, the proposed characterization activities are focused on further defining the nature and extent of Ra-226, Th-230, Th-232, and U-238 only. It currently is DOE's position that Am-241 waste will be remediated under FUSRAP only when it is commingled with FUSRAP waste.

1.5 PURPOSE AND SCOPE

The conclusions from a recent data sufficiency evaluation determined that there is need for additional characterization to determine the nature and extent of DOE contamination at the Town of Tonawanda Landfill. Deep soil sampling is needed to define the maximum depth of radiological contamination from those areas showing elevated activity levels based on historical gamma walkover survey and shallow soil sampling data. If deep zones of contamination are identified, additional deep soil sampling will be needed to define the extent of contamination. Surface water and sediment sampling data are needed to assess the concern of surface water being a significant pathway for contaminant migration. The data resulting from this additional sampling will allow definition of the maximum depth of radiological contamination, will more thoroughly evaluate the risk this site poses to the surrounding area, and will allow preliminary estimates of contaminated soil volume.

1.6 DATA QUALITY OBJECTIVES

The U.S. Environmental Protection Agency's (EPA's) data quality objectives (DQOs) procedure was utilized in the development of this document (EPA 1987, 1993). The first step in this process involved the evaluation of all available historical analytical data and background information about the site. Based on the conclusions from this evaluation, it was determined that additional deep soil, sediment, and surface water sampling is required to complete the characterization at the Tonawanda Landfill. Rather than attempting to define the exact number of data points needed to complete the characterization, a two-staged sampling program has been

proposed where the results from Stage 1 sampling will determine whether or not Stage 2 sampling is required. The analytical procedures to be run on the samples were selected based on soil cleanup guidelines.

The number and location of Stage 1 sampling points are presented in text, tables, and maps in Section 2.1.1. Stage 2 sampling is discussed in Section 2.1.2. EPA Level III (EPA 1987) equivalent data quality is proposed for all soil, sediment, groundwater, and surface water laboratory analyses, while Level I data quality is proposed for those analyses performed in the field, such as pH, temperature, conductivity, total organic vapor, alpha scan, and beta/gamma scan measurements.

2. FIELD INVESTIGATION APPROACH

The following sections outline the field activities proposed for Phase I site characterization activities at the Town of Tonawanda Landfill. All work will be conducted in compliance with Occupational Safety and Health Administration standards outlined in 29 Code of Federal Regulations 1926 and 1910.

2.1 PHASE I

In order to facilitate DOE's expedited site characterization approach, the Phase I sampling effort has been broken down into two separate stages. The Stage 1 sampling efforts will focus on defining the extent of contamination at those locations where previous investigations showed Ra-226, Th-230, and/or U-238 at levels above DOE guidelines. Other objectives of the Stage 1 sampling include identifying whether sediments in surface water drainages are contaminated, and determining whether contaminants are migrating offsite through surface water.

Stage 2 sampling activities will be determined in the field based on the results from field observations, downhole gamma logging, and field screening data collected during Stage 1. This stage will involve drilling as many as 15 additional deep boreholes and collecting as many as two additional surface water and sediment samples. The decision of whether to implement any of the Stage 2 sampling will be made by the Bechtel National, Inc. (BNI) and Science Applications International Corporation (SAIC) onsite representatives with the concurrence of the DOE Site Manager and the BNI and SAIC New York management team.

2.1.1 Stage 1

The following section outlines those field activities proposed for Stage 1. Reference is made to Tables 2-1, 2-2, and 2-3, which summarize the sampling activities to be performed; present the analyses to be performed on each sampling media; and present information regarding sample preservation, container, and holding time requirements.

2.1.1.1 Soil Sampling

A total of five deep boreholes are proposed to be drilled under Stage 1 activities. These boreholes are to be drilled to the depth of fill material using 6-1/4-in. outside diameter augers at the locations shown in Figure 2-1. Although it is not anticipated, drilling will continue below 25 ft only if the bottom of the fill material has not been reached at this depth. In this case, drilling will continue until the bottom of the fill material has been reached. Before the commencement of drilling, all proposed borehole locations will be cleared by all local utility companies (i.e., gas, water, sewer, electric, and telephone). During the drilling of each of these boreholes, soil samples are to be collected continuously using a split-spoon sampler. Following

Table 2-1. Stage 1 Sampling Activities and Frequency

Medium	Planned Activity	Approximate Number of Samples	Analysis	Analytical Support Level[a]
Soil	Drill five boreholes to a depth of up to 25 ft. Sample soil continuously throughout the depth of each borehole using a split-spoon sampler. Collect a total of three soil samples from each borehole for analytical testing.	15	Ra-226, Th-230, Th-232, U-238	III
	Collect one composite soil sample from the cuttings generated from each of the five boreholes (except TCLP VOA sample, which shall be collected as a grab sample).	5	TCLP Total	III
Sediment	Collect one sediment sample from the pond, surface water drainage, and storm sewer inlet.	3	Ra-226, Th-230, Th-232, U-238	III
Surface Water	Collect one surface water sample from the pond, surface water drainage, and storm sewer inlet.	3	Ra-226, Th-230, Th-232, U-238	III
	Collect one surface water sample from the pond, surface water drainage, and storm sewer inlet for characteristic sampling.	3	pH, Temperature, and Conductivity	I

[a] These levels are based on EPA 1987

Table 2-2. Stage 1 and 2 Analytical Parameters for Sampling Media

Parameter	Soil	Sediment	Surface Water
Ra-226	*	*	*
Th-230	*	*	*
Th-232	*	*	*
U-238	*	*	*
TCLP Total	*		
pH			*
Temperature			*
Conductivity			*

* analysis to be performed

Table 2-3. Stage 1 and 2 Preservatives, Containers, and Holding Times

Analyte/Test	Container	Quantity	Preservative	Holding Time
Soil/Sediment				
Radionuclides:				
Ra-226	Polypropylene wide-mouth jar[a]	1/500-ml	None	6 months
Th-230	Polypropylene wide-mouth jar	1/500-ml	None	6 months
Th-232	Polypropylene wide-mouth jar	1/500-ml	None	6 months
U-238	Polypropylene wide-mouth jar	1/500-ml	None	6 months
Chemicals:				
TCLP (Total)	Amber glass jar	1/500-ml[c]	4°C	varies[d]
Surface Water				
Radionuclides:				
Ra-226	Collapsible polyethylene container[b]	1/1-gal	HNO_3 to pH < 2	6 months
Th-230	Collapsible polyethylene container	1/1-gal	HNO_3 to pH < 2	6 months
Th-232	Collapsible polyethylene container	1/1-gal	HNO_3 to pH < 2	6 months
U-238	Collapsible polyethylene container	1/1-gal	HNO_3 to pH < 2	6 months

[a] Ra-226, Th-230, Th-232, and U-238 analyses can all be run on soil/sediment from one 500-ml polypropylene wide-mouth jar. No need to collect three separate sample jars.

[b] Ra-226, Th-230, Th-232, and U-238 analyses can all be run on surface water from one 1-gal sample bottle. No need to collect three separate sample bottles.

[c] Must be amber glass jar.

[d] Volatile organics - 14 days; BNAE organics, pesticides, herbicides - 14 days; mercury - 28 days; other metals - 180 days.

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September 28, 1994

U.S. Department of Energy
Oak Ridge Field Office
P.O. Box 2001
Oak Ridge, TN 37831-8758

Attention: Mr. Ronald E. Kirk
Site Manager - New York Sites

Subject: Contract DE-AC05-91OR21950
TONAWANDA - DELIVERABLE: FIELD SAMPLING AND ANALYSIS PLAN FOR THE TOWN OF TONAWANDA LANDFILL - FINAL

Dear Mr. Kirk:

Enclosed are four copies of the the subject report. By copy of this letter, three bound copies and one unbound copy of the report have been provided to BNI for records retention purposes.

If you have any questions or comments, please call me at 481-8552.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Kevin S. Ironside

Kevin S. Ironside
Project Manager
FUSRAP

KSI:TMP:sh

cc: L. Price, FSRD (w/o)
B. Seay, FSRD (w/o)
S. Oldham, FSRD (w/e)
P. Huber, BNI (w/2e)
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FIELD SAMPLING AND ANALYSIS PLAN FOR THE TOWN OF TONAWANDA LANDFILL

TONAWANDA, NEW YORK

SEPTEMBER 1994

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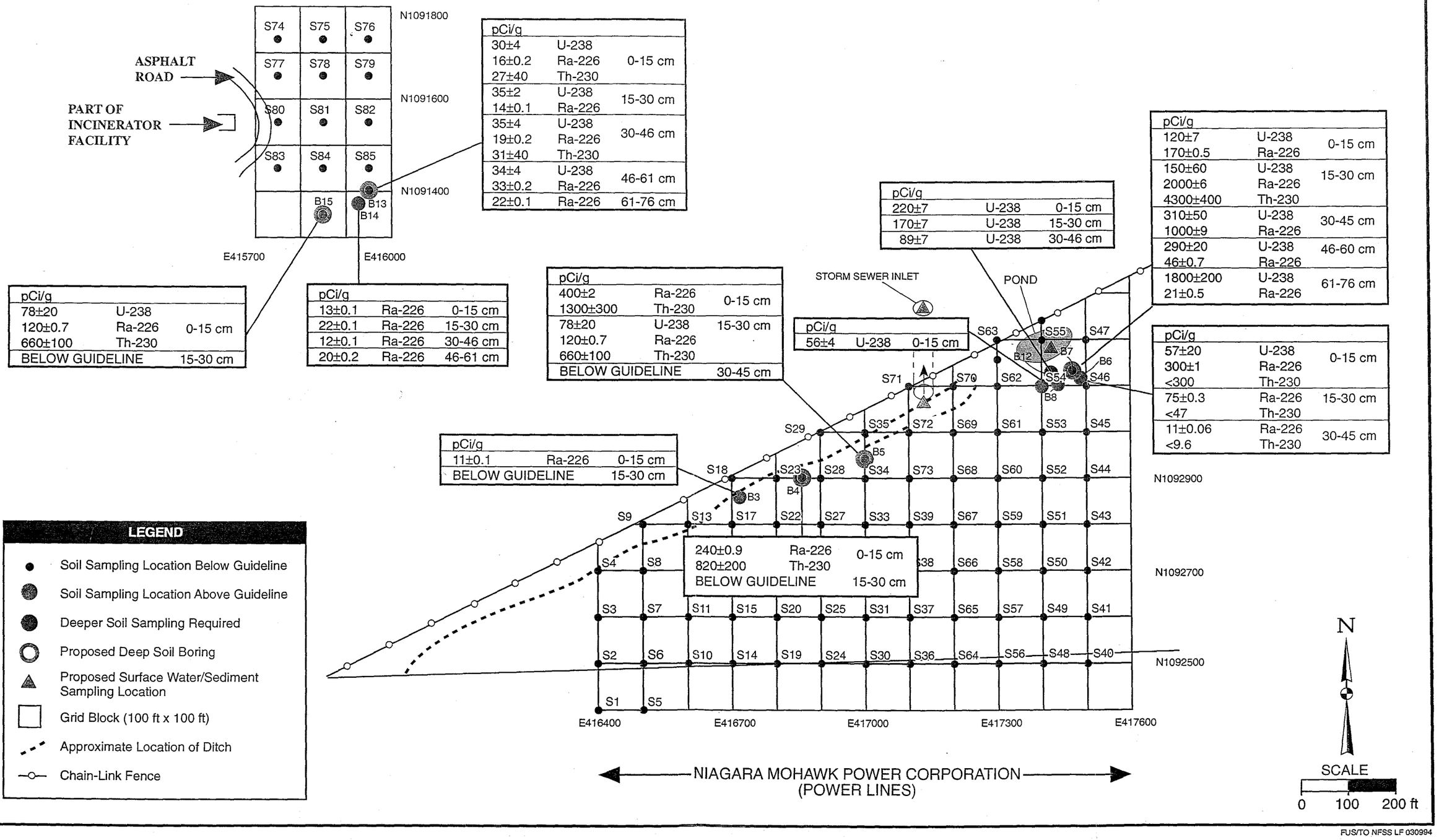

Figure 2-1. Map Showing Proposed Sampling Locations for Stage 1 Activities

American Society for Testing and Materials Procedure D-1586, a central mine equipment sampler may be used in place of the split-spoon sampler if >75 percent recovery can consistently be obtained. Each soil core sample will be surveyed using alpha and beta/gamma radiological monitoring instruments. This surveying will be performed by slowly passing the instrument probe over the surface of the sample. The results from these field screening and a detailed lithology description of the sample will be documented in a field logbook.

Approximately three representative samples of core material suspected of being contaminated will be selected for laboratory analysis. If possible, these should include soil material from both above and below the water table. These samples will be sent to the laboratory to be analyzed for Ra-226, Th-230, Th-232, and U-238. The analytical results provided by the laboratory will be accompanied by a Level III equivalent data package (see Tables 2-1 and 2-2). See Table 2-3 for sample bottle requirements, preservatives, and analytical holding times.

After the total depth of a borehole is reached, a downhole gamma survey will be performed using a gamma probe. The probe will be performed by first inserting a 4-in. diameter polyvinyl chloride (PVC) pipe into the borehole, then lowering the gamma probe through the PVC pipe to the bottom of the borehole. The probe will then be incrementally raised at 1-ft intervals. At each interval, the instrument will be allowed to stabilize before collecting a reading. The results from the survey will be logged in a bound notebook or sample log form. Before running the first downhole gamma survey, background measurements will be collected to define the range of natural background conditions. In an effort to draw a reliable correlation between downhole gamma counts and actual soil activity levels, soil from the first few intervals showing 2 times the highest background reading or greater will be analyzed in the field using gamma spectrometry. The results from the correlation will be used throughout the field sampling program to assist in defining zones of contamination. When the downhole gamma survey is complete, a tremie pipe will be used to grout the borehole closed as the augers are being removed. The grout will be comprised of Portland Type I/II cement mixed with approximately four to five percent bentonite powder. The location of each borehole will then be surveyed in by a professional surveyor.

One composite soil sample is to be collected from the cuttings generated from each borehole (total of five samples). These samples will be sent to the laboratory for toxicity characteristic leaching procedure (TCLP) (total) analysis. Any waste generated during this sampling will be handled in accordance with the procedures outlined in Section 7.

2.1.1.2 Sediment Sampling

As many as four sediment samples will be collected during the Stage 1 field investigations. The first sample will be collected from the small pond located near ORNL shallow soil sampling location S55 located in the north central portion of the landfill (see Figure 2-1). A second sample will be collected from the surface water drainage at the north end of the landfill, just upstream from where the drainage enters a subsurface drain pipe inlet. If a

sufficient volume of sediment is present, a third sample will be collected from the storm sewer inlet, immediately downstream from the subsurface drain pipe inlet (see Figure 2-1). A fourth sample will be collected from a background location, upstream from contamination sources. This background sampling location will be selected in the field.

All sediment samples will be sent to the laboratory to be analyzed for Ra-226, Th-230, Th-232, and U-238. The samples from the pond and drainage will be collected from 0.0 to 0.5 ft below the sediment surface using a hand scoop or dipper. The sediment sample from the storm sewer will be collected using a dredge sampler. The analytical results provided by the laboratory will be accompanied by a Level III equivalent data package (see Tables 2-1 and 2-2). See Table 2-3 for sample bottle requirements, preservatives, and analytical holding times. Any waste generated during this sampling will be handled in accordance with those procedures outlined in Section 7. Each sampling location will be surveyed by a professional surveyor.

2.1.1.3 Surface Water Sampling

Four surface water samples will be collected during the Stage 1 field investigations. The first sample will be collected from the small pond located in the northeast corner of the landfill. A second sample will be collected from the surface water drainage at the north end of the landfill, just upstream of where the drainage enters a subsurface drain pipe inlet. A third sample will be collected from the storm sewer inlet, immediately downstream from the subsurface drain pipe inlet (see Figure 2-1). A fourth sample will be collected from a background location, upstream from contamination sources. This background sampling location will be selected in the field.

All samples will be sent to the laboratory to be analyzed for Ra-226, Th-230, Th-232, and U-238. These samples are to be collected using either the bottle submersion, dipper, or bailer method. The analytical results provided by the laboratory shall be accompanied by a Level III equivalent data package (see Tables 2-1 and 2-2). See Table 2-3 for sample bottle requirements, preservatives, and analytical holding times.

A sample of the surface water from the same sampling location will be collected for pH, temperature, and conductivity measurements. These measurements will be made in the field using field instruments. Any waste generated during this sampling will be handled in accordance with those procedures outlined in Section 7. Each sampling location will be surveyed by a professional surveyor.

2.1.2 Stage 2

As discussed earlier in this section, Stage 2 sampling activities will be determined in the field based on the results from downhole gamma logging data collected during Stage 1. This stage will involve the drilling and sampling of as many as 15 additional deep boreholes and the collection of as many as two additional surface water and sediment samples. This additional sampling will be performed in the identical manner as outlined in Section 2.1. Stage 2 sampling

will only be implemented when the results from gamma logging suggests the presence of DOE radiological contamination at a depth greater than 5 feet. The total number of Stage 2 boreholes to be drilled and sampled will be determined by the BNI and SAIC onsite representatives with the concurrence of the DOE Site Manager and the BNI and SAIC New York management team. Evaluation of the field data will be performed as soon as the data for each borehole are available. Assuming that it takes one day to drill each borehole and that a one-day turnaround is required for field laboratory analysis, evaluation of the first borehole data should begin while the third borehole is being dug. By implementing this process, the field team should have instructions for any additional boreholes (beyond borehole five) associated with boreholes 1 through 3 when the fifth borehole is completed. Tables 2-2, 2-3, and 2-4 outline the data quality requirements, analyses to be performed, sample bottle and preservation requirements, and analytical holding times.

2.2 PHASE II

Depending on the results from the sampling performed under Phase I, it may be necessary to perform additional characterization before remediation. If this is the case, this Sampling and Analysis Plan will be amended to outline details of the Phase II sampling.

Table 2-4. Stage 2 Supplemental Sampling Activities and Frequency

Medium	Planned Activity	Approximate Number of Samples	Analysis	Analytical Support Level[a]
Soil	Drill as many as 15 supplemental boreholes to a depth of up to 25 ft. Sample soil continuously throughout the depth of each borehole using a split-spoon sampler. Collect approximately three soil samples from each borehole for analytical testing.	9	Ra-226, Th-230, Th-232, U-238	III
	Collect one composite soil sample from the cuttings generated from each of the five boreholes (except TCLP VOA sample, which shall be collected as a grab sample).	3	TCLP Total	III
Sediment	Collect as many as two supplemental sediment samples.	2	Ra-226, Th-230, Th-232, U-238	III
Surface Water	Collect as many as two supplemental surface water samples.	2	Ra-226, Th-230, Th-232, U-238	III
	Collect as many as two supplemental surface water samples.	2	pH, Temperature, and Conductivity	I

[a] These levels are based on EPA 1987

3. ANALYTICAL PROCEDURES

A summary of the analytical techniques and laboratory methods to be performed on soil/sediment and water samples is presented in Tables 3-1, 3-2, and 3-3. These analytical procedures meet the minimum detection limit requirements needed to address the DQOs outlined in Section 1.6. For this investigation, TMA/Eberline will be performing the radiological analyses, while the Weston Laboratory will be performing the TCLP analyses.

3.1 QUALITY CONTROL

Quality Control (QC) activities are described in detail in the Design Basis (BNI 1994), which describes the blanks, splits, duplicates, and other QC samples required to monitor field and laboratory performance.

3.2 SAMPLE HANDLING, PACKAGING, AND SHIPPING

Sample collection, handling, and chain-of-custody will be conducted according to FUSRAP procedures which are consistent with *A Compendium of Superfund Field Operations Methods* (EPA 1987). The samples will be packed in vermiculite or "bubble wrap" to minimize the potential for breaking and will be shipped to the laboratory for analysis. Samples will be packed in Blue Ice® (when appropriate), and shipped by overnight mail to the laboratory on the same day they are collected (BNI 1994).

Table 3-1. Radiological Analytical Methods for Soil/Sediment

Parameter	Analytical Technique	Laboratory Method Number	
		Sample Preparation	Sample Analysis
Ra-226	Gamma Spectrometry	QAP-001[a]	QAP-011
Th-230	Alpha Spectrometry	QAP-005	QAP-018
Th-232	Gamma Spectrometry	QAP-001	QAP-011
U-238	Gamma Spectrometry	QAP-001	QAP-011

[a] QAP - TMA/Eberline Corporation Quality Assurance Procedure; modified Environmental Measurements Laboratory (EML)

Table 3-2. TCLP Analytical Methods for Soil/Sediment

Parameter	Sample Extraction	Sample Analysis
VOCs	1311	8240
Metals	1311	6010
BNAEs	1311	8270
Pesticides	1311	8080
Herbicides	1311	8150

Table 3-3. Analytical Methods for Water

Parameter	Analytical Technique	Laboratory Method Number	
		Sample Preparation	Sample Analysis
Ra-226	Alpha Spectroscopy	QAP-006[a]	QAP-018
Th-230	Alpha Spectroscopy	QAP-005[a]	QAP-018
Th-232	Gamma Spectroscopy	QAP-001[a]	QAP-011
U-238	Alpha Spectroscopy	QAP-005[a]	QAP-018

[a] QAP - TMA/Eberline Corporation Quality Assurance Procedure; modified Environmental Measurement Laboratory

4. FIELD NOTEBOOKS AND DOCUMENTATION

All sampling personnel will keep indelible black ink records of field activities daily in bound field notebooks and on appropriate bound forms. Samplers will record weather conditions, sampling locations and depths, types of samples collected, analyses required, date and time of sampling, chain-of-custody identification numbers and procedures, field measurements, and names of sampling personnel.

Documentation of radiological sampling and measurement activities is specified by internal procedures, including procedures that detail documentation required for all sampling and survey activities (e.g., field sampling collection forms, geological logs, etc.). All field documentation, analytical data, and reports generated from this data will be assigned a document control number and submitted to Project Document Control Center as a permanent record. See the Design Basis (BNI 1994) for further details on documentation requirements.

5. DECONTAMINATION

Decontamination will be conducted as necessary to ensure that personnel and equipment leaving a controlled area meet DOE guidelines for release. Before beginning field sampling activities, all drilling and sampling equipment will be decontaminated using the following methods:

Large Equipment Decontamination:

1) Remove soil adhering to augers, drill rod, and other equipment by scraping, brushing, or wiping.
2) Thoroughly pressure wash equipment with potable water and a nonphosphatic laboratory grade detergent (i.e., Liquinex) using a steam cleaner.
3) Thoroughly rinse equipment with potable water using a steam cleaner.
4) Air dry.
5) Wrap equipment in plastic sheeting to keep it clean before use.

Sampling Equipment Decontamination:

1) Remove soil adhering to equipment by scraping, brushing, or wiping.
2) Thoroughly pressure wash equipment with potable water and a nonphosphatic laboratory grade detergent (i.e., Liquinex) using a steam cleaner.
3) Rinse with potable water using a steam cleaner.
4) Rinse with isopropyl alcohol.
5) Rinse thoroughly with deionized water.
6) Air dry.
7) Wrap equipment in plastic sheeting or aluminum foil before use.

All sampling equipment will be decontaminated between samples and all drilling equipment will be decontaminated between boreholes.

6. QUALITY ASSURANCE

Quality assurance samples will be collected during the field sampling program in the manner and frequency outlined in the Design Basis (BNI 1994).

7. HANDLING OF INVESTIGATION-DERIVED WASTE

All waste soil generated during field activities will be handled in accordance with BNI waste disposal procedures (BNI 1993).

8. HEALTH AND SAFETY

All field operations will be performed under the guidance and direction of the onsite Health and Safety Officer, who will implement the health and safety requirements outlined in BNI 1994a.

9. REFERENCES AND BIBILIOGRAPHY

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