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Bechtel

Oak Ridge Corporate Center
151 Lafayette Drive
P.O. Box 350
Oak Ridge, Tennessee 37831-0350

Telephone: (423) 220-2000

Job No. 14501, FUSRAP Project
DOE Contract No. DE-AC05-91OR21949
Code: 7330/WBS: 134

JUL 26 1996

U.S. Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, TN 37831-8723

Attention: David G. Adler, Site Manager
Former Sites Restoration Division

Subject: SLAPS Vicinity Properties - Publication of PRAR

Dear Mr. Adler:

Enclosed is a copy of the subject document, which is being published in accordance with your instructions (CCN 141008). All comments received on the previous draft of this document have been incorporated.

This document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that the information submitted was properly gathered and evaluated. To the best of my knowledge and belief, they are true, accurate, and complete.

If you have any questions, please call me at 241-2192.

Sincerely,

K. Albin
Project Manager - FUSRAP

EBS:gms:LR_1768a.DOC
Enclosure: Publication of PRAR

cc: B. Atkin, w/a
S. K. Oldham, w/a

Concurrence: For D. Stair @ B. Johnson @ D. Hughel B. Fogelman

ACTION REQ'D ☐ YES ☐ NO DUE DATE _____

RESPONSE TO CHRON NO. _____

☐ FFA ☐ Permit ☐ Milestone ☐ OcR ☐ CCN ☐ CAR ☐ Mid-

DOE/OR/21949-396

Formerly Utilized Sites Remedial Action Program (FUSRAP)
Contract No. DE-AC05-91OR21949

Post-Remedial Action Report for Remedial Action Conducted in St. Louis, Missouri, During Calendar Year 1994

July 1996

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DOE/OR/21949-396

POST-REMEDIAL ACTION REPORT

FOR REMEDIAL ACTION CONDUCTED IN ST. LOUIS, MISSOURI

DURING CALENDAR YEAR 1994

JULY 1996

Prepared for

United States Department of Energy

Oak Ridge Operations Office

Under Contract No. DE-AC05-91OR21949

By

Bechtel National, Inc.
Oak Ridge, Tennessee

Bechtel Job No. 14501

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FIGURES

TABLES

ACRONYMS

AEC	Atomic Energy Commission
BNI	Bechtel National, Inc.
DAC	derived air concentration
DCG	derived concentration guide
DOE	U.S. Department of Energy
FUSRAP	Formerly Utilized Sites Remedial Action Program
IVC	independent verification contractor
MDA	minimum detectable activity
MED	Manhattan Engineer District
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
PIC	pressurized ionization chamber
PPE	personal protective equipment
SLAPS	St. Louis Airport Site
TN	Thermo NUtech

UNITS OF MEASURE

cm	centimeter
dpm	disintegrations per minute
ft	foot
g	gram
h	hour
in.	inch
km	kilometer
L	liter
m	meter
μCi	microcuries
ml	milliliter
μR	microroentgen
mrem	millirem
pCi	picocurie
s	second
yr	year

1.0 INTRODUCTION

1.1 BACKGROUND

This report describes the interim remedial action conducted at the St. Louis Airport Site (SLAPS) vicinity properties in Hazelwood and Berkeley, Missouri (Figure 1-1), from October through December 1994. These remedial activities were performed as part of the U.S. Department of Energy (DOE) Formerly Utilized Sites Remediation Action Program (FUSRAP).

FUSRAP was established to identify and clean up or otherwise control sites where radioactive contamination exceeding current DOE 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.

The objectives of FUSRAP are to

- identify and assess sites used to support former Manhattan Engineer District (MED) and Atomic Energy Commission (AEC) nuclear development activities and other sites with conditions that Congress has authorized DOE to remedy;
- decontaminate, remove, or otherwise control contamination at sites where contamination has been found to be above DOE guidelines;
- dispose of or stabilize all residues generated during remedial action in an environmentally acceptable manner; and
- certify the sites, to the extent possible, for future use without radiological restrictions.

...FUSRAP currently has 46 sites in 14 states.

The primary legislation authorizing FUSRAP is the Atomic Energy Act of 1954. FUSRAP was established in 1974, and major remedial actions began at FUSRAP sites in 1981. Administered by the Former Sites Restoration Division of DOE's Office of Environmental Management, FUSRAP currently includes 46 sites in 14 states.

Bechtel National, Inc. (BNI) is the project management contractor for FUSRAP. Thermo NUtech [(TN) formerly Thermo Analytical] is the radiological support subcontractor for laboratory analyses. Oak Ridge Institute for Science and Education (ORISE), the FUSRAP independent verification contractor (IVC), performed independent designation and verification

surveys and has issued interim reports of its post-remedial action survey results (ORISE 1995a, b, c, d). ORISE will provide final reports for each property after this post-remedial action report is issued.

1.2 HISTORY

SLAPS was acquired by MED in 1946 and operated until 1966 to store uranium processing wastes from the Mallinkrodt Chemical Company in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were generated between 1942 and the late 1950s. The waste materials were purchased by Continental Mining and Milling Company of Chicago in 1966 and subsequently transported to 9200 Latty Avenue for storage under an AEC license. During transit, some of these materials spilled onto the roadway, right-of-ways, and properties bordering the haul roads, and the materials collected primarily in the drainage ditches. The haul roads used for transport included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue (Figure 1-1).

SLAPS was acquired by MED and operated from 1946 to 1966 to store waste materials that were generated during uranium processing ... at the Mallinkrodt Chemical Company in downtown St. Louis.

The Latty Avenue site was assigned to DOE by Congress in 1984. During a radiological survey of the haul roads in 1985, Oak Ridge National Laboratory (ORNL) identified areas with elevated gamma exposure rates and/or concentrations of thorium-230 in soil (DOE 1987). Thorium-230 was the primary contaminant, with lesser amounts of radium-226 and uranium-238. Sampling results indicated that most of the contamination was in the stormwater drainage ditches adjacent to the haul roads. As a result, the properties along the haul roads were designated in 1986 for remedial action under FUSRAP.

During transit, some of these materials spilled onto the roadway, right-of-ways, and contiguous properties...remedial action was conducted between October and December 1994 at six of the vicinity properties that border haul roads.

Site characterization activities were performed from 1986 to 1989 to delineate contamination boundaries (DOE 1990). Additional boundary delineations and waste classification activities were performed, and remedial action was conducted between October and December 1994 at six of the vicinity properties that border haul roads.

1.3 FACILITY DESCRIPTION

SLAPS is located north of the Lambert-St. Louis International Airport in St. Louis County, Missouri, approximately 24 km (15 miles) northwest of downtown St. Louis. The vicinity properties remediated during 1994 are located 0.7 to 1.6 km (0.4 to 1 mile) to the northeast of SLAPS within the cities of Hazelwood and Berkeley. The properties were assigned a numerical identifier corresponding to the St. Louis County tax map locator numbering system. The properties remediated during 1994 were 19, 20, 41, 43, 44, and 45, as shown in Figure 1-1.

SLAPS is located north of the Lambert-St. Louis International Airport in St. Louis County, Missouri, approximately 24 km (15 miles) northwest of downtown St. Louis.

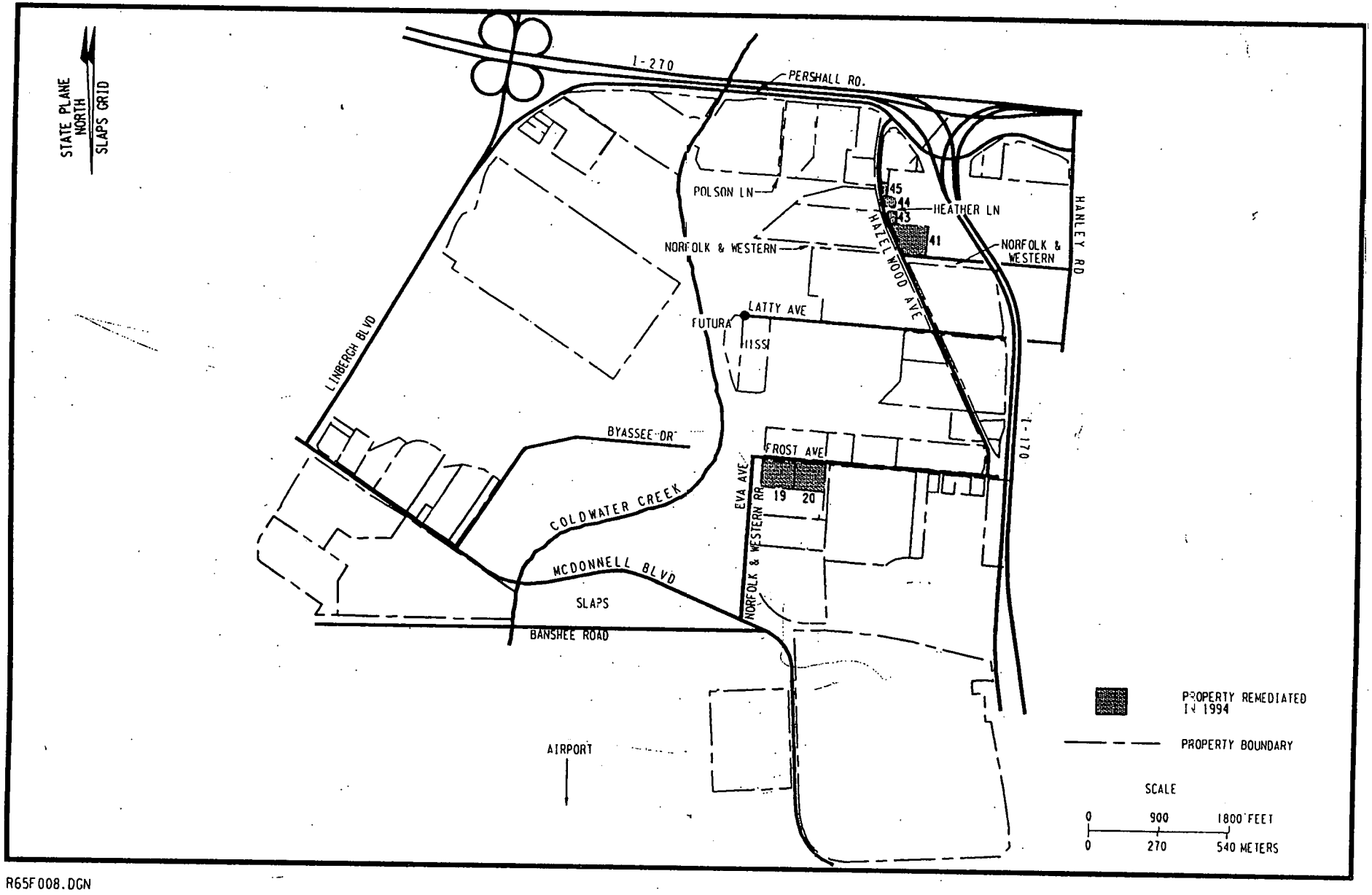

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Figure 1-1
SLAPS Vicinity Properties Remediated in 1994

2.0 REMEDIAL ACTION GUIDELINES

The radioactive contamination standards and guidelines governing the cleanup of residual radioactive material and management of the resulting wastes and residues are included in DOE Order 5400.5, "Radiation Protection of the Public and Environment," and in various site-specific guidelines. The DOE standards and guidelines for the SLAPS vicinity properties are listed in Table 2-1.

2.1 BASIC DOSE LIMITS

The basic limit for the annual radiation dose (excluding radon) received by an individual member of the general public is 100 mrem/yr above background. In implementing this limit, DOE applies as-low-as-reasonably achievable (ALARA) principles to set site-specific guidelines.

2.2 COMPLIANCE WITH GUIDELINES

The primary method used to verify compliance with DOE remedial action guidelines is the measurement of radionuclide concentrations (in pCi/g) in soil samples. Comparison of sample concentrations with the criteria for individual radionuclides is often sufficient to demonstrate compliance with DOE guidelines. However, when a mixture of radionuclides occurs that approaches the guideline limits, compliance may be demonstrated by a comparison of the sum of the ratios of the soil concentration of each radionuclide to the allowable limit for the radionuclide. The sum of ratios should not exceed 1.

For radium and thorium, these concentration guidelines are listed in DOE Order 5400.5 at levels above naturally occurring background concentrations. For uranium, soil cleanup goals are derived from exposure models based on appropriate land use scenarios and pathways. The uranium concentration guideline in soil at the SLAPS VPs is 50 pCi/g, calculated to ensure that the dose to members of the public does not exceed the basic dose limit of 100 mrem/yr above background (Fiore to Price 1990). Surface contamination guidelines are based on DOE Order 5400.5.

Basic dose limits (in mrem/yr) and limits for surface contamination concentrations (in dpm/100 cm^2) and residual radioactivity (in pCi/g) are set at levels above background. Thus, background levels may also be used as indicators that remedial action has attained cleanup objectives. A secondary method to confirm that remedial action has restored the site to its original or similar condition is a comparison of post-remedial exposure rates with background exposure rates. The background gamma radiation exposure rate for the St. Louis area is 9.4 μR/h, as measured by TN/BNI in the post-remedial action survey. The background exposure rate was independently verified by ORISE and reported as the external gamma radiation exposure rate.

Table 2-1

Summary of DOE Guidelines for Residual Radioactive Contamination

Requirement	Value
Soil contamination as measured in activity concentration (pCi/g) above background	
Radium-226 Thorium-230 Thorium-232	5 pCi/g, averaged over the first 15 cm of soil below the surface; and 15 pCi/g when averaged over any 15-cm-thick soil layer below the surface (DOE 5400.5)
Uranium	50 pCi/g, any depth (Fiore to Price 1990)
Surface contamination (dpm/100 cm^2) limit for thorium-230 and decay products[a] (DOE Order 5400.5)	
Fixed (direct)[b]	100 dpm/100 cm^2
Removable (transferable)[b]	20 dpm/100 cm^2

[a]As used in this table, dpm refers to the rate of emission by radioactive material determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors.

[b]The measured values may be averaged over 1 square meter to meet fixed and removable criteria provided the maximum value in any 100 square centimeter does not exceed three times the fixed and removable criteria.

3.0 REMEDIAL ACTION

This section describes the interim remedial action conducted at the SLAPS vicinity property sites from October though December 1994 and specifically addresses:

- coordination among DOE, BNI, TN, and ORISE;
- remediation/decontamination activities; and
- contamination control during remedial action.

Remedial activities included the decontamination of structures and the excavation of contaminated soil. The excavated areas were backfilled, graded, and reseeded. Radioactively contaminated waste resulting from remedial action was shipped to a licensed disposal facility.

3.1 COORDINATION

Coordination among DOE, BNI, TN, and ORISE was critical to the timely and efficient decontamination of the vicinity properties.

After each property was remediated, the radiological support subcontractor performed post-remedial action surveys to determine whether the remedial action was completed. ORISE performed final independent verification surveys of the remediated areas and has provided interim post-remedial action verification reports (ORISE 1995a,b,c,d).

ORISE performed final independent verification surveys of the remediated areas and verified ... that remediation was completed.

3.2 REMEDIATION/DECONTAMINATION ACTIVITIES

Before remedial action began on the properties, additional characterization surveys were performed to delineate more accurately the boundaries of radioactive contamination and to classify the waste to be generated during remediation. As remediation was completed, external gamma exposure rate measurements were taken within each 6-m by 16-m (20-ft by 52.5-ft) grid with a pressurized ionization chamber (PIC) to confirm that the external gamma radiation exposure rates do not greatly exceed background.

3.3.1 Occupational Exposure

The primary potential exposure pathways for personnel during remediation activities were inhalation and ingestion of radioactively contaminated dust particles during excavation and loading of the soil.

During remediation, workers wore lapel air samplers, and particulate air monitoring devices were placed in the areas being remediated. The airborne concentrations were compared with the applicable guideline, derived air concentrations (DACs). The DAC is 7.0×10^{-12} μCi/ml (0.007 pCi/L) (10 CFR 835) for occupational exposures to airborne thorium-230. All samples were determined to be well below the guideline for thorium-230. The results ranged from less than the minimum detectable activity (<MDA) to 1.6×10^{-13} μCi/ml. MDAs ranged from 4.4×10^{-14} μCi/ml to 3.0×10^{-13} μCi/ml.

3.3.2 Exposure to the General Public

The primary potential exposure pathways for members of the general public were inhalation and ingestion of radioactively contaminated airborne dust particles generated during the remediation. The potential for dust migration was minimized by maintaining adequate moisture with a fine mist of water during remediation operations and implementing safe work practices and procedures.

A high-volume air sampler was used for air particulate sampling adjacent to areas being remediated to verify that no member of the public was exposed to radioactivity above the current standards and criteria. These guidelines were established to protect members of the general public and the environment against undue risks from radiation. The limits expressed in DOE Order 5400.5 are derived concentration guides (DCGs). The filters were collected daily and counted after sufficient time was allowed for radon progeny decay. Concentrations of radionuclides measured by area air samplers ranged from <MDA to 4.6×10^{-14} μCi/ml. MDAs ranged from 2.4×10^{-15} μCi/ml to 3.2×10^{-14} μCi/ml. The DCG is 4.0×10^{-14} μCi/ml (0.00004 pCi/L) for thorium-230. The maximum concentration of radionuclides slightly exceeded the DCG for thorium-230. Because the DCG is based on chronic year-round inhalation and the removal action lasted only a few months, this slight exceedance is not a significant concern. Furthermore, there were no actual receptors from the general public in the immediate work area to be exposed.

A high-volume air sampler was used for air particulate sampling adjacent to areas being remediated to verify that no member of the general public was exposed to radioactivity above the current standards ...

on the culvert and headwalls were also used to confirm that the contaminated soil had been removed.

In addition to surveys and sampling, independent verification was performed by ORISE. Verification activities include a scintillation scan of gamma activity over the grid, exposure rate measurements at each soil sampling point, survey of surface contamination on the culvert, and verification soil samples. After independent verification was complete, the excavation was backfilled with clean material.

3.3 CONTAMINATION CONTROL DURING REMEDIAL ACTION

During remedial action at the vicinity properties, engineering and administrative controls were used to protect remediation workers and members of the public from potential exposure to radiation in excess of applicable standards. Additionally, personal protective equipment (PPE) was used for protection of remediation workers. When conditions warranted, additional protective clothing and equipment, such as hoods and respirators, were used. These controls are outlined in the health and safety plan for the site (BNI 1993). Measures were also taken to minimize the potential for migration of radioactive material to adjacent, uncontaminated areas of the site. Before field activities began, the field crew completed site-specific training and reviewed applicable work-controlling documents.

Fugitive dust emissions were controlled to minimize health and safety risks to site workers and the public from radioactive material. Dust-control measures were implemented during excavation, loading, and transport of radioactive materials to prevent the spread of contamination. Dust-control techniques included curtailing activities during unusually windy conditions, employing dust-suppression techniques such as water sprays, and constructing environmental barriers such as silt fences and tarpaulins. Ambient air monitoring was also conducted at the excavation sites.

Fugitive dust emissions were controlled to minimize health and safety risks to site workers and the public from radioactive material.

Workers exiting controlled areas were subjected to a radiological survey (frisk) at the control point by a health physics technician with a hand-held Geiger-Mueller radiation detection instrument. A frisk is a search for radioactive material that may have been transferred onto the clothing or skin of individuals inside the work area. PPE worn by the workers that was suspected or known to be contaminated was packaged and shipped to a licensed disposal facility. All equipment was surveyed and, if above the DOE release criteria, decontaminated before it was removed from the controlled area.

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4.0 POST-REMEDIAL ACTION MEASUREMENTS

To confirm that no radioactivity exceeding DOE guidelines remained in the remediated areas, surveys were performed as remedial actions were being completed, and soil samples were collected and analyzed. The surveys included direct surface measurements on structures in the areas being remediated and external gamma exposure rates.

In Tables 4-1 through 4-3, use of the "less than" (<) notation in reporting survey results indicates that radioactivity was not present at levels that were quantifiable with the instruments and techniques used. Each "less than" value represents the lower limit of the quantitative capacity of the instrument and technique. The limit depends on various factors, including the surface area of the detector for direct and transferrable measurements, the type of detector used, the counting time, and the background count rate. The actual level of radioactivity is less than the value preceded by the "less than" symbol (the minimum level that was quantifiable with the instruments and techniques used).

4.1 BACKGROUND SAMPLES AND SURVEYS

During the radiological characterization conducted in 1990 (DOE 1990), ORNL collected soil samples from three remote background locations in the general vicinity of the properties to be remediated to determine the naturally occurring concentrations of radium-226, thorium-230, thorium-232, uranium-234, uranium-235, and uranium-238. The activity of naturally occurring radionuclides ranges from 0.9 pCi/g to 1.3 pCi/g. Background exposure rates from external gamma radiation (9.4 μR/h) were measured during post-remedial action surveys. The IVC also measured area background exposure rates during independent verification (9 to 10 μR/h). Background data present typical conditions for the areas unaffected by the transportation of material from SLAPS and serve as a frame of reference for evaluating the data from the grids of the vicinity properties. The grid data are presented in Tables 4-1 through 4-3. The background sampling locations are shown in Figure 4-1, and the grid locations are shown in Figures 4-2 through 4-5.

4.2 SOIL SAMPLING

To confirm that contamination above DOE guidelines was removed from the vicinity properties remediated during this interim action, samples were collected and analyzed for radium-226, thorium-230, thorium-232, uranium-234, uranium-235, and uranium-238. The concentrations of each contaminant in the samples were nearly indistinguishable from background (Table 4-1).

To confirm that contamination above the DOE guidelines was removed from the properties remediated, soil samples were collected and analyzed ...

Table 4-1

Soil Sampling Results at the SLAPS Vicinity Properties

Grid No.	Sample ID	Uranium-234 (pCi/g)	Uranium-235 (pCi/g)	Uranium-238 (pCi/g)	Radon-226 (pCi/g)	Thorium-230 (pCi/g)	Thorium-232 (pCi/g)
1	134-41-003	0.9	0.04	0.94	1.3	1.3	1.2
2	134-41-004	1.50	0.08	1.30	1.46	2.26	1.39
3	134-41-005	1.50	*<0.14	1.50	1.79	3.65	1.04
4	134-43-010	2.10	0.12	8.80	1.80	2.60	1.30
5	134-41-011	1.20	0.06	1.70	1.40	1.90	0.97
6	134-41-012	1.30	0.04	1.30	1.60	1.90	1.50
7	134-41-013	1.40	<0.07	1.60	1.30	3.70	1.30
8	134-41-014	1.10	<0.07	1.70	1.30	2.70	0.85
9	134-43-015	1.40	*<0.07	1.10	1.80	2.20	0.96
10	134-19-020	1.00	*<0.04	0.91	1.10	2.30	0.91
11	134-19-021	1.10	<0.07	1.10	0.72	3.30	0.68
12	134-19-031	0.82	<0.09	0.92	0.75	1.60	0.61
13	134-19-032	1.40	<0.09	1.20	1.60	1.60	1.20
14	134-19-039	0.77	<0.09	0.95	1.20	2.60	0.82
15	134-19-043	0.65	<0.08	0.77	1.50	3.30	1.00
16	134-19-042	0.92	<0.12	1.10	0.90	2.90	1.10
17	134-20-040	1.00	0.08	1.40	1.10	2.50	1.00
18	134-20-044	0.75	0.10	0.96	0.80	3.20	1.10
19	134-20-045	1.00	0.10	0.89	0.60	4.10	1.50
20	134-19-046	1.10	<0.04	0.85	0.80	3.90	0.81
21	134-44-047	0.97	*<0.13	0.89	1.60	3.70	0.99
22	134-44-051	1.60	<0.09	1.50	1.60	3.40	1.10
23	134-44-052	1.10	<0.22	2.30	0.79	6.60	1.30
23	134-44-23A-01	0.73	0.10	0.96	1.30	2.90	0.70
23	134-44-23A-02	2.10	0.04	1.90	1.30	1.40	0

Table 4-1

(continued)

Grid No.	Sample ID	Uranium-234 (pCi/g)	Uranium-235 (pCi/g)	Uranium-238 (pCi/g)	Radon-226 (pCi/g)	Thorium-230 (pCi/g)	Thorium-232 (pCi/g)
23	134-44-23A-03	0.98	<0.05	1.50	1.00	1.40	0.43
23	134-44-23A-04	1.10	<0.08	1.00	0.68	2.40	0.75
24	134-45-053	8.1	0.3	8.6	2	3.1	1.1
25	134-45-054	1.4	0.06	1.4	1.3	2.2	0.59
26	134-45-055	1.3	0.05	1.1	1.7	2.4	0.7
	Avg. background	1.1	0.1	1.1	0.9	1.3	1.0

*The "less than" (<) notation indicates that the radioactive contamination was below the detection limit of the analytical technique and/or the detection instrument. Therefore, the actual concentration of radioactivity in a sample is less than the reported value preceded by the "less than" symbol.

Table 4-2

External Gamma Radiation Exposure Rates at the SLAPS Vicinity Properties

Grid No.	Survey Number	Exposure Rate (μR/h)
1	134PIC01	10.4
2	134PIC02	10.0
3	134PIC02	10.4
4	134PIC02	10.4
5	134PIC03	9.9
6	134PIC03	9.8
7	134PIC03	9.9
8	134PIC03	9.9
9	134PIC03	10.1
10	134PIC05	7.5
11	134PIC05	7.2
12	134PIC05	7.2
13	134PIC05	8.6
14	134PIC05	8.4
15	134PIC05	8.4
16	134PIC05	8.4
17	134PIC04	9.3
18	134PIC05	8.4
19	134PIC05	8.3
20	134PIC05	7.7
21	134PIC06	9.6
22	134PIC06	10.5
23	134PIC06	10.4
24	134PIC06	10.1
25	134PIC06	10.1
26	134PIC06	10.1
Background		9.4 μR/h

Table 4-3

Radiological Survey Results at the SLAPS Vicinity Properties

Location	Direct Surface Contamination		Transferable Contamination	
	Alpha Sample Activity Range (dpm/100 cm^2)	Beta/Gamma Sample Activity Range (dpm/100 cm^2)	Alpha Sample Activity Range (dpm/100 cm^2)	Beta/Gamma Sample Activity Range (dpm/100 cm^2)
Property 44				
North wall culvert				
1) East wall grid	<30 - 35	<249 - 361	<2	<36
2) West wall grid	<30 - 35	<249 - 284	<2	<36
Concrete pad N. culvert				
1) West	26	594	<2	<48
2) Middle	<19	774	<2	<48
3) East	36	542	<2	<48
4) Pipe	26	361	<2	<48
Property 43				
South wall culvert				
1) Culvert bottom 1 ft	<30	852	<2	<40
2) Culvert bottom 2 ft	<30	594	<2	<40
3) West wall grid	<30	<249	<2	<40
4) East wall grid	<30 - 35	<249 - 284	<2 - 3	<40
DOE Guideline	100	5000	20	1000

NOTE: Use of the "less than" (<) notation in reporting survey results indicates that radioactivity was not present at levels that were quantifiable with the instruments and techniques used.

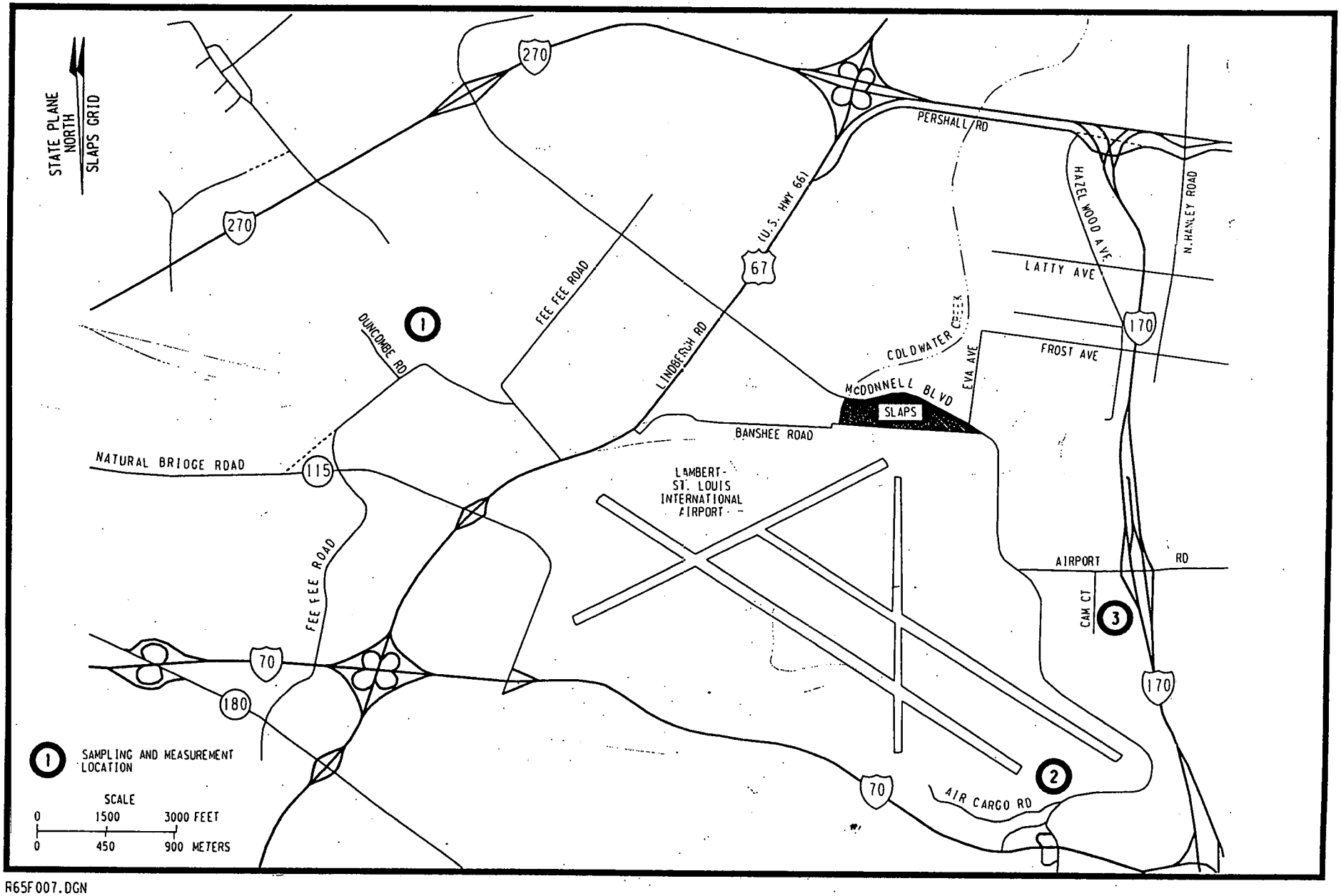

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Figure 4-1
Background Sampling Locations

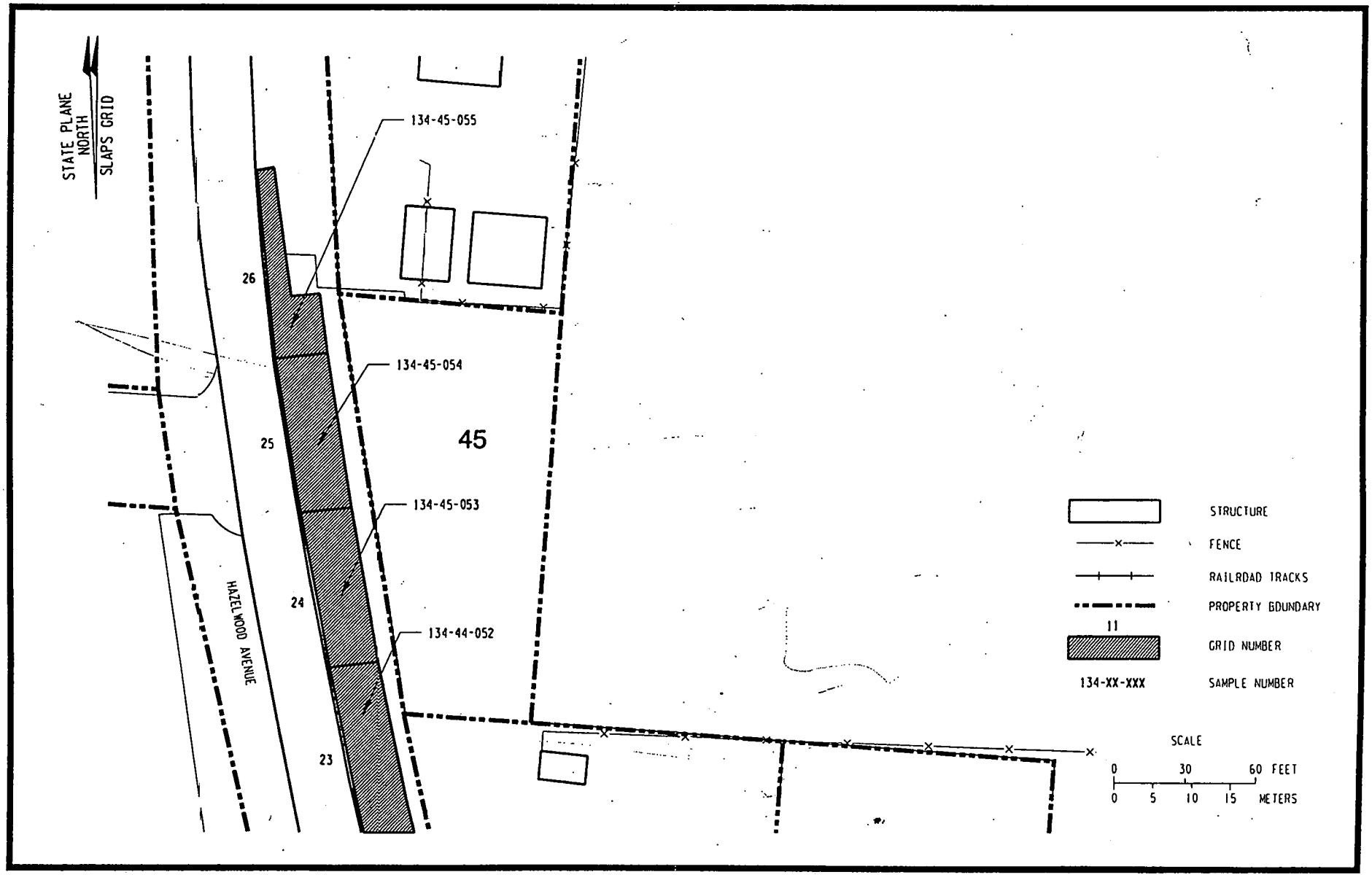

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Figure 4-2
Post-Remedial Action Sampling Locations
at Vicinity Property 45

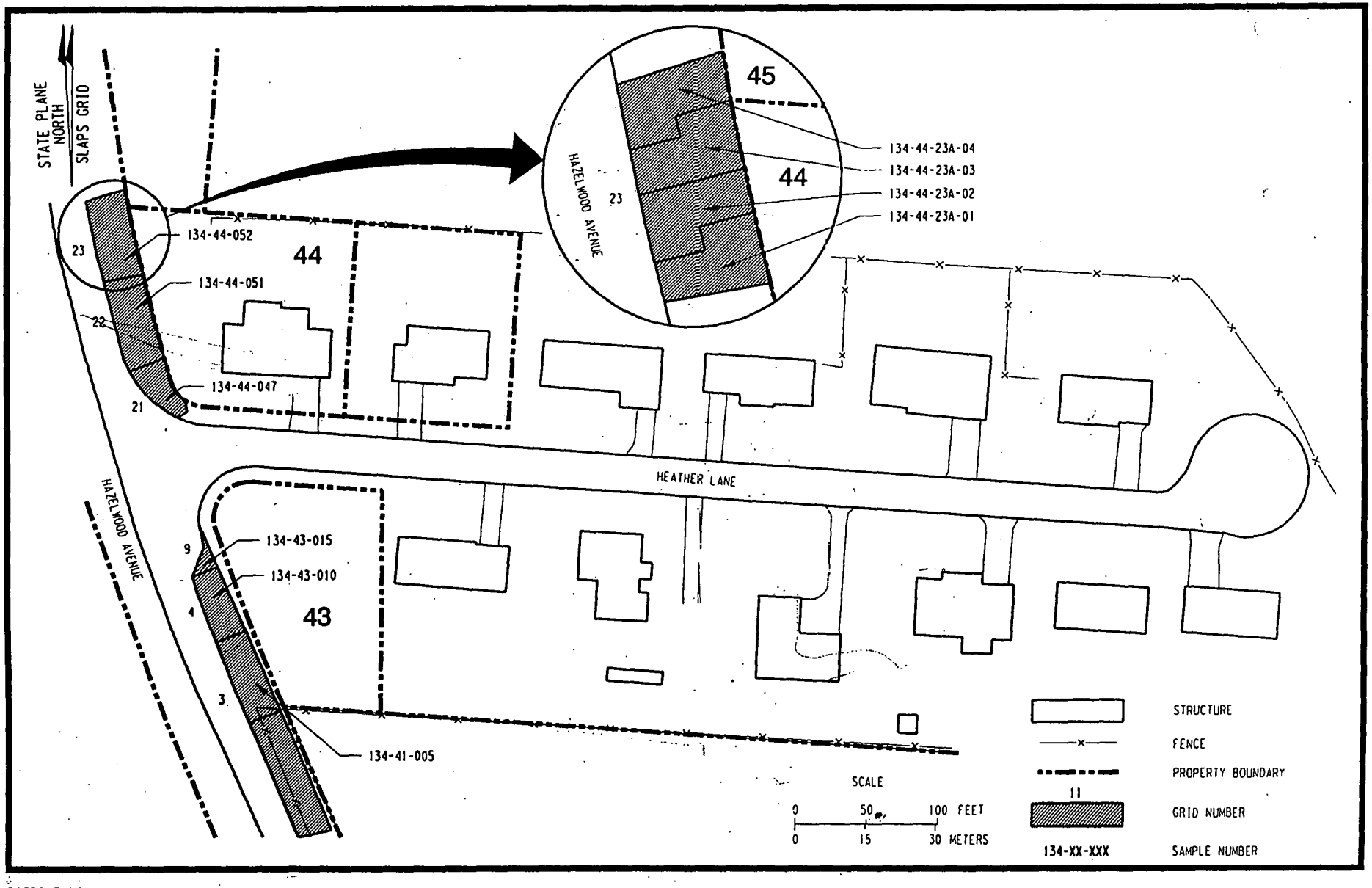

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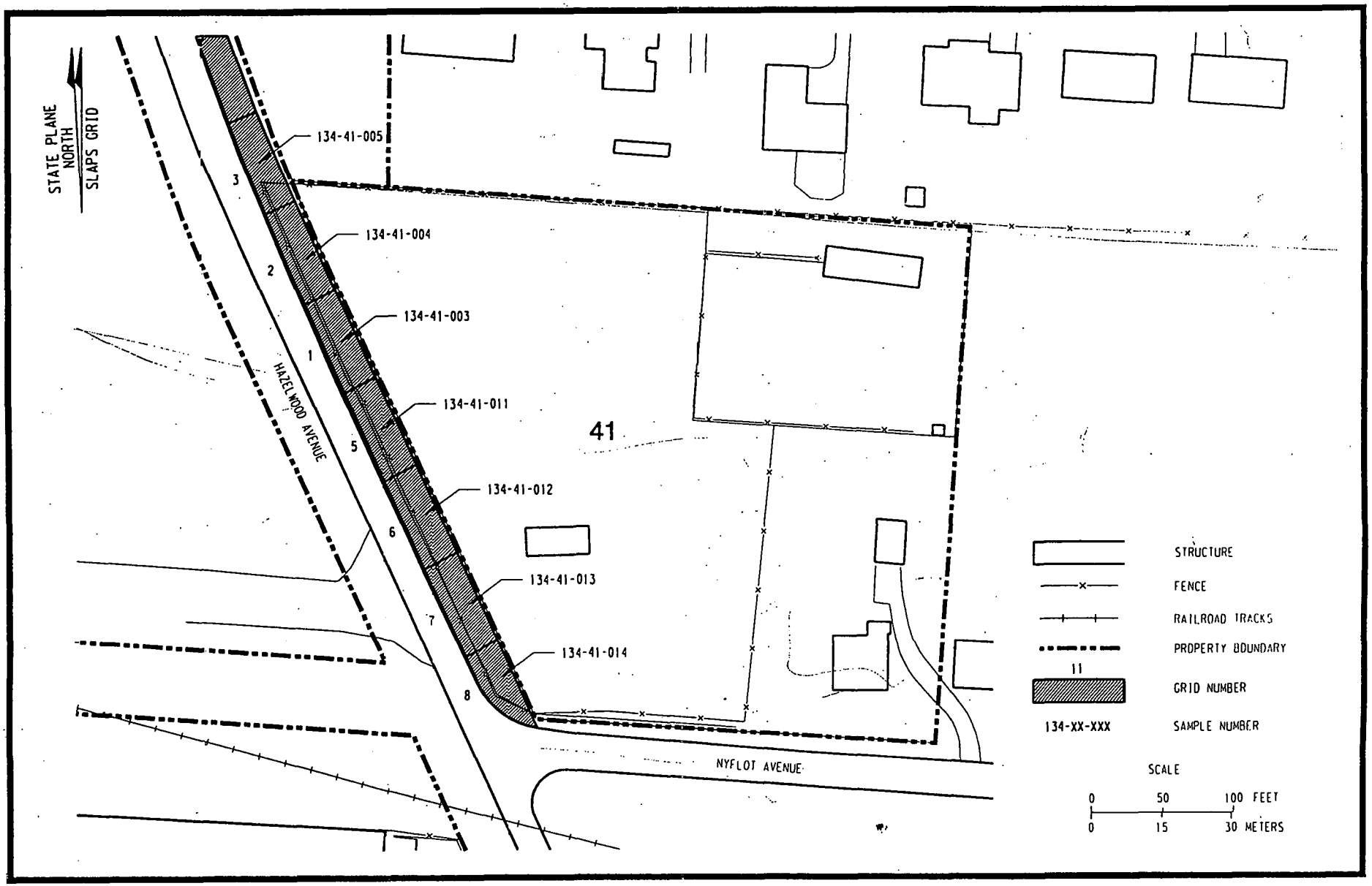
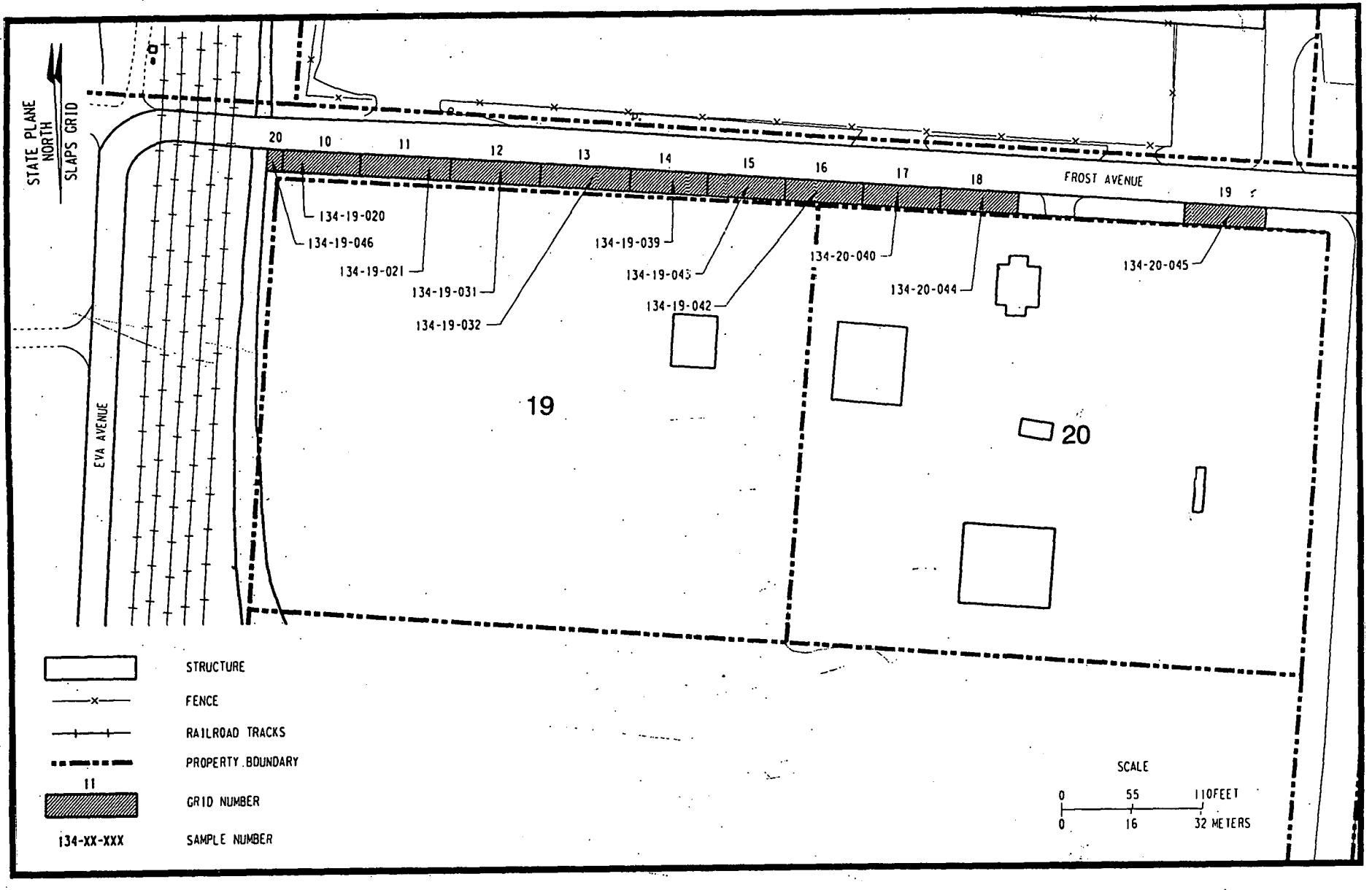
Figure 4-3
Post-Remedial Action Sampling Locations
at Vicinity Properties 43 and 44



R65F002.DGN

Figure 4-4
Post-Remedial Action Sampling Locations
at Vicinity Property 41



R65F004.DGN

Figure 4-5
Post-Remedial Action Sampling Locations
at Vicinity Properties 19 and 20

Because data from the characterization and boundary delineation sampling indicated that contamination was limited to the area immediately adjacent to the road, 6-m by 16-m (20-ft by 52.5-ft) grids were established along the roadway for use in taking post-remedial action samples and measurements. Thirty locations within each grid were sampled from the surface down to 15 cm (6 in.) below the surface and composited into one sample. Figures 4-2 through 4-5 show the locations of the grids on the vicinity properties.

The DOE guidelines for residual radioactivity for radium-226, thorium-232, and thorium-230 combined in soil at the sites are 5 pCi/g above background when averaged over the first 15 cm (6 in.) of soil below the surface, and 15 pCi/g above background when averaged over any 15-cm- (6-in.-) thick soil layer below the surface layer. These guidelines do not include naturally occurring background radioactivity in soils near the site. The site-specific guideline for the remediation of uranium-238 was 50 pCi/g (Fiore to Price 1990). Site-specific guidelines were developed based on the reasonable exposure pathways that could be hypothesized for the site to ensure that the annual radiation dose (excluding radon) received by an individual member of the general public is less than 100 mrem per year. All sample results from the vicinity properties were well below the release criteria.

4.3 EXTERNAL GAMMA RADIATION EXPOSURE RATE SURVEY

The results of the post-remedial action external gamma radiation exposure rate surveys are presented in Table 4-2. The external gamma exposure rate was measured 1 m (3.3 ft) above the ground surface in the center of each survey grid block. Readings taken at this height provide an estimate of the potential exposure from external gamma radiation resulting from residual radioactivity to the critical body organs.

External gamma exposure rates were recorded using a PIC. Exposure rates measured on the vicinity properties ranged from 7.2 to 10.5 μR/h (including background), comparable to the average background reading of 9.4 μR/h.

4.4 POST-REMEDIAL ACTION SURVEYS OF DIRECT AND TRANSFERABLE SURFACE CONTAMINATION

After the properties were remediated, the radiological support subcontractor analyzed the samples that were collected and conducted post-remedial action surveys. Survey techniques used during the post-remediation and verification surveys included measurements of direct and transferable surface contamination (where appropriate), walkover gamma scans, and exposure rate measurements. The survey techniques are described in the site post-remedial action survey plan, which is included as Appendix A of this report. The IVC performed independent verification surveys of the remediated areas using comparable survey techniques. The IVC survey data were included in separate reports issued by ORISE (ORISE 1995a, b, c, d).

Sampling and surveys were conducted to confirm that no residual radioactive material above DOE guidelines (see Table 2-1) remain at the site. Measurements of direct (nontransferable) and transferable contamination were taken, where needed, on the metal culvert and concrete headwalls in accordance with the post-remedial action survey plan.

Direct surface contamination is the total amount of radioactive contamination on a surface; therefore, a survey of direct surface contamination quantifies both the transferable and permanently fixed contamination. Transferable contamination is the removable component of the total surface contamination; it is the portion of contamination that could potentially be transferred to clothing or skin upon contact.

To quantify direct surface contamination, radiation detection instrumentation is placed directly on the surface to measure the radioactivity emitted from a known surface area. Direct alpha radiation is measured with an alpha scintillation detector connected to a scaler, an instrument that counts the number of radioactive disintegrations (decays) detected in a specified amount of time. Direct beta/gamma radiation measurements are obtained with a Geiger-Mueller detector attached to a scaler. Both alpha and beta/gamma radiation measurements were taken. Where physical features permitted, five measurements were taken (in the corners and the center of 1-m^2 areas).

At a minimum, removable contamination was measured in locations that exhibited direct readings above transferrable guidelines for removable contamination. Removable alpha activity was determined by wiping a 100-cm^2 (16-$in.^2$) area with a dry medium and measuring the alpha emissions with an alpha scintillation counter. MDAs of the instruments used in the surface contamination survey are reported as critical values that must be exceeded before a sample can be said to contain any material above background levels. Instrument-specific MDAs for direct alpha, direct beta/gamma, transferable alpha, and transferable beta/gamma are tabulated with less-than symbols and during the survey reported as 19 to 30 dpm, 249 to 307 dpm, 2 dpm, and 36 to 48 dpm, respectively.

The results for post-remedial action surveys of direct and transferable contamination ... are all well below applicable DOE guidelines.

The results for post-remedial action surveys of direct and transferable contamination are well below applicable DOE guidelines (Table 4-3). Post-remedial action surveys were conducted on all culverts, retaining walls, and other structures on the vicinity properties where remedial action was performed.

4.5 IVC VERIFICATION

The IVC reviewed field data results and supporting documentation for remedial action at the vicinity properties; visual inspections, independent measurements, and sampling of remediated areas on properties 19, 20, 41, and 43 were performed to ensure that areas with contamination exceeding site guidelines had undergone decontamination and that residual activity levels were in compliance with the established guidelines. In addition, the IVC analyzed a post-remedial action sample from property 20, grid 19, and property 41, grid 4, for confirmatory analysis. The IVC also verified the radiological status of properties 44 and 45 through reviews of data and analysis of representative samples collected during post-remedial action sampling.

Although the post-remedial action composite sample from property 44, grid 23, was well below the guideline for subsurface soil, the level of radioactivity in the sample was slightly elevated relative to the post-remedial action results from other sampling locations. To verify the adequacy of the composite sampling techniques, the Missouri Department of Natural Resources requested that four additional composite samples from grid 23 be analyzed. These results were well below the applicable guidelines.

5.0 POST-REMEDIAL ACTION STATUS

The post-remedial action survey data indicate that all areas of the SLAPS vicinity properties that were remediated in 1994 are now in compliance with applicable DOE standards and criteria for cleanup of residual radioactive contamination. After reviewing post-remedial action measurements, survey procedures, and quality assurance data, the IVC has confirmed that these properties were decontaminated to the radiological guidelines established for the site.

Radiological conditions at the sites were determined, based on DOE review, to be in compliance with DOE criteria and standards to protect health, safety, and the environment.

After completing verification activities, the IVC notified DOE-Headquarters, Division of Facility and Site Decommissioning, and DOE-Oak Ridge Operations, Former Sites Restoration Division, of its findings and recommendations. DOE reviewed the data and determined that the remedial action was successful. Radiological conditions at the site were determined, based on this review, to be in compliance with DOE decontamination criteria and standards to protect health, safety, and the environment.

During remediation of SLAPS vicinity properties 19, 20, 41, 43, 44, and 46, approximately 285 m (930 ft) of drainageways along the east side of Hazelwood Avenue, extending 46 m (150 ft) north of Heather Lane to Nyflot Avenue, and along Frost Avenue just east of Eva Avenue were remediated. Surface contamination was cleaned from the metal culvert and concrete headwalls under Heather Lane. A total of 906 m^3 (1,185 yd^3) of contaminated material was removed and disposed of in a licensed disposal facility. Average costs of these remedial activities including excavation, transportation, disposal, and restoration varied from $600 to $1,000 per cubic yard.

REFERENCES

Bechtel National, Inc., 1993. *Health and Safety Plan for the St. Louis Site, St. Louis, Missouri*, 116/134/140/153-HSP, Oak Ridge, Tenn. (November).

U.S. Department of Energy (DOE), 1987. *Radiological and Limited Chemical Characterization Report for the St. Louis Airport Site*, DOE/OR/21949-163, Oak Ridge, Tenn. (August).

DOE, 1990. *Radiological Characterization Report for FUSRAP Properties in the St. Louis, Missouri Area*, DOE/OR/21949-203, Oak Ridge, Tenn. (August).

DOE Order 5400.5. Radiation Protection of the Public and the Environment.

Fiore, J. J., to L. K. Price, 1990. Subject: Uranium Cleanup Guidelines for St. Louis, Missouri, FUSRAP sites, November 6, 1990, BNI CCN 072982.

Oak Ridge Institute for Science and Education (ORISE), 1995a. *Verification Survey of Properties 19 and 20, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri*, CCN 131026, Oak Ridge, Tenn. (June).

ORISE, 1995b. *Verification Survey of Property 41, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri*, CCN 131027, Oak Ridge, Tenn. (June).

ORISE, 1995c. *Verification Survey of Property 43, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri*, CCN 131025, Oak Ridge, Tenn. (June).

ORISE, 1995d. *Verification Survey of Properties 44 and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri*, CCN 131028, Oak Ridge, Tenn. (June).

10 CFR 835. Occupational Radiation Protection.

GLOSSARY

ALARA (as low as reasonably achievable) - This phrase is used to describe an approach to radiation protection to control or manage exposures (both individual and collective to the work force and the general public) and releases of radioactive material to the environment as low as social, technical, economic, practical, and public policy considerations permit. As used by DOE, ALARA is not a dose limit but a process with the objective of attaining dose levels as far below the applicable limits as practicable.

Alpha - See **Radiation.**

Background radiation - Background radiation refers to naturally occurring radiation emitted from either cosmic (e.g., from the sun) or terrestrial (e.g., from the earth) sources. Exposure to this type of radiation is unavoidable, and its level varies greatly depending on the geographic location. For example, because of naturally occurring radiation alone, New Jersey typically receives 100 mrem/yr, Colorado receives about 300 mrem/yr, and some areas in South America receive up to 7,000 mrem/yr. Naturally occurring terrestrial radionuclides include uranium, radium, potassium, and thorium (see **Radionuclide**). The dose levels do not include the concentrations of naturally occurring radon inside buildings.

Beta-gamma - See **Radiation.**

Centimeter - A centimeter (cm) is a metric unit of measurement for length; 1 inch is equal to 2.54 cm; 1 foot is equal to approximately 30 cm.

Contamination - Contamination is used generally to mean a concentration of one or more radioactive materials that exceeds naturally occurring levels. Contamination may or may not exceed the DOE cleanup guidelines.

Curie - The curie, symbolized by Ci, is the unit for quantity of radioactivity. It is the quantity of radioactive material in which 3.7×10^{10} atoms are transformed per second, or disintegrate per second. For health physics, as well as for many other purposes, the curie is a very large amount of activity. For convenience, sub-multiples of the curie, as listed below, are therefore used:

1 microcurie (μCi) = .000001 Ci (E-6 Ci), and
1 picocurie (pCi) = .000000000001 Ci (E-12 Ci).

Disintegrations per minute - Disintegrations per minute (dpm) is the measurement indicating the amount of radiation being released from a substance per minute. See **Curie.**

Exposure rate - Exposure rate is the rate at which radiation imparts energy to the air. Exposure is typically measured in microroentgens (μR), and exposure rate is typically expressed as μR/h. The dose to the whole body can be approximated by multiplying the exposure rate by the number of hours of exposure. For example, if an individual were exposed to gamma radiation at a rate of 11 μR/h for 168 h/week (continuous exposure) for 52 weeks/year, the whole-body dose on an annual basis would be 100 mrem (1 mrem = 1,000 μR).

Gamma - See **Radiation**.

Gram - A gram (g) is a metric unit of weight. There are 454 g in 1 pound and 28 g in 1 ounce.

Low-Level Radioactive Waste - radioactive material that is not high-level radioactive waste, spent fuel, or 11(e)2 (by-product material).

Meter - A meter (m) is a metric unit of length; 1 m is equal to approximately 39 inches.

Microroentgen - A microroentgen (μR) is a unit used to measure radiation exposure. For further information, see **Exposure rate**.

Mixed Waste - Mixed waste satisfies the definition of low-level radioactive waste in the Low-Level Radioactive Waste Policy Amendments Act of 1985 and contains hazardous waste that either (1) is listed as a hazardous waste in Subpart D of 40 CFR 261 or (2) causes the low-level waste to exhibit any of the hazardous waste characteristics identified in Subpart C of 40 CFR 261.

Picocurie - See **Curie**.

Radiation - There are three primary types of radiation: alpha, beta, and gamma. Alpha radiation travels less than an inch in air before it stops and cannot penetrate the outer layers of human skin. Alpha radiation is of concern only if it is ingested or inhaled into the body. Beta radiation can penetrate the outer layers of skin but cannot reach the internal organs. Gamma radiation, the most penetrating type, can usually reach the internal organs.

Radionuclide - Radioactive elements are also referred to as radionuclides. For example, uranium-235 and uranium-238 both are radionuclides.

Remedial action - Remedial action is a general term used to mean "cleanup of contamination that exceeds DOE guidelines." It refers to any action required so that a property can be certified as being in compliance with applicable guidelines. In practice, this may require removing grass and soil, cutting trees, and removing asphalt. Remedial action also includes restoring remediated properties to as close to their original conditions as possible.

Uranium - Uranium is a naturally occurring radioactive element. The principal use of uranium when refined is for the production of fuel for nuclear reactors. Uranium in its natural form is not suitable for use as a nuclear fuel source.

APPENDIX A
SLAPS VP Post-Remedial Action Survey Plan

SAINT LOUIS AIRPORT SITE VICINITY PROPERTIES
POST-REMEDIAL ACTION SURVEY PLAN

PURPOSE

The purpose of this plan is to describe the methodologies that the Formerly Utilized Sites Remedial Action Program (FUSRAP) will use for radiological surveys, sampling, and analysis to document the final condition of the St. Louis Airport Site Vicinity Properties (SLAPS VP) as free of radioactive contamination above the release standards of the Department of Energy (DOE) Order 5400.5 (reference 1). Nothing herein is intended to compromise the Independent Verification Contractor's (IVC) independence; the purpose is to document the Prime Management Contractor's (PMC's) plans to conduct post-remedial action surveying/sampling and our understanding of how we will coordinate with the IVC. Specifically, the following SLAPS VPs will be addressed in this plan: 19, 20, 41, 43, 44, and 45 (see Figure 1 Locations of the Haul Roads Vicinity Properties). This plan addresses the DOE protocol for verification and certification of sites under FUSRAP (reference 2).

Bechtel National, Inc. (BNI) will be the FUSRAP remedial action contractor, and the Oak Ridge Institute for Science and Education (ORISE) will act as the IVC.

REFERENCES

(1) DOE Order 5400.5, Radiation Protection of the Public and Environment, Washington, D.C.

(2) DOE, 1990, Verification and Certification Protocol for the Office of Environmental Restoration FUSRAP and D&D Program, Revision 3, November.

(3) DOE/OR/20722-203, Radiological Characterization Report for FUSRAP Properties in the St. Louis, Missouri, Area, August 1990.

(4) ThermoAnalytical (TMA), Health Physics Operational Procedures Manual

A) 3C.2 "Determination of Background"
B) 3B.1 "Delineation of Survey Areas in Open Land"
C) 3B.3 "Gamma Ray Exposure Rate Surveys at 1-Meter in Open and Enclosed Areas"
D) 3A.2 "Direct Surface Contamination Survey"
E) 3A.3 "Transferable Surface Contamination Survey"
F) 4A.1 "Systematic and Bias Surface Soil Sampling (Radiological)"

(5) BNI, 1993, Instruction Guide for Post-Remediation Survey of Soil, 191-IG-032, Revision 0.

(6) BNI, 1992, Instruction Guide for Decontamination of Field Sampling Equipment at FUSRAP Sites, 191-IG-011, Revision 5

(7) BNI, 1993, Instruction Guide for Surface Water and Sediment Sampling Activities, 191-IG-028, Revision 0.

(8) BNI, 1994, How to Ship Samples from a FUSRAP Site, PI R4.7, Revision 2.

(9) DOE/OR-868, Remedial Action Work Plan for the St. Louis Airport Site, July 1986.

(10) BNI, 1993, Health and Safety Plan for the St. Louis Site, Rev. 0.

(11) CCN 072892, Fiore to Price, Subject: Uranium Cleanup Guidelines for St. Louis, Mo, FUSRAP Sites, Nov. 6, 1990.

(12) DOE/OR/20722-163, Radiological and Limited Chemical Characterization Report for the St. Louis Airport Site, Aug. 1987.

(13) DOE/CH/8901, A Manual For Implementing Residual Radioactive Material Guidelines, June 1989.

BACKGROUND

Manhattan Engineer District acquired SLAPS in 1946 and used it from 1946 until 1966 to store residuals from the St. Louis Downtown Site. The residuals included pitchblende raffinate residues, radium-bearing residues, barium sulfate cake, Colorado raffinate residues, and contaminated scrap. In 1966, these residuals were purchased by Continental Mining and Milling Company of Chicago, removed from SLAPS, and placed in storage at Latty Avenue under an AEC license. In the process of transporting the residues from SLAPS to Latty Avenue, some of the material was spilled from the trucks onto the roadside and ditches. The areas where the residue was spilled during transport or which were contaminated by environmental transport are called the SLAPS Vicinity Properties.

RESIDUAL CONTAMINATION GUIDELINES

The source of contamination of the designated properties was residues from the processing of uranium bearing ores.

The applicable residual contamination guidelines are as follow (see reference 1):

Radionuclide	Soil Concentration Above Background
Radium-226 Thorium-230 Thorium-232	5 pCi/g, averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over any 15-cm-thick soil layer below the surface layer (use the larger of Th-230 or Ra-226 only).
Uranium-238	50 pCi/g, any depth.

The residual contamination guidelines for fixed and transferable radioactive contamination (dpm/100 cm^2) are as follow (reference 1):

Radionuclide	Average	Maximum	Removable
Thorium-230	100	300	20

DECONTAMINATION ACTIVITIES

The designated St. Louis Airport Site properties addressed in this plan are: 19, 20, 41, 43, 44, and 45 (see design drawings 134-DD433-C01, 134-DD433-C02, 134-DD433-C03, 134-DD433-C04, 134-DD433-C05, and 134-DD433-C06).

All areas of contamination are along roadsides, in ditches, and exterior to any buildings. Contaminated structures such as fences, culverts, and utility poles/pipelines may be encountered during excavation.

Real Estate Instruments shall be in place for all properties remediated.

At a minimum, remediation of the site will consist of excavation of soil exceeding the site specific criteria and decontamination of structures exceeding the DOE guidelines for fixed and transferable radioactive contamination.

Verification surveys and sampling will focus on confirming that soil, and structures buried within the soil which remain after remedial action, do not contain radioactive contamination at concentrations exceeding applicable guidelines. To the extent necessary, equipment used during the decontamination activity will be cleaned and surveyed for surficial contamination prior to release.

Areas where remediation activities will be conducted will include, but not be limited to, those identified in the site characterization report (reference 3) and the following design drawings: 134-DD433-C01, 134-DD433-C02, 134-DD433-C03, 134-DD433-C04, 134-DD433-C05, and 134-DD433-C06.

The design drawings (see above) delineate those general areas that will be excavated. Those areas of radioactive contamination include the ditch lines along the vicinity properties and additional areas near by (within approximately six meters [20 feet] of the curb).

POST-REMEDIATION SURVEYS AND SAMPLING

Following remediation, the FUSRAP Radiological Support Subcontractor (ThermoAnalytical, TMA) will perform post-remedial action surveys and sampling to determine the completeness of the removal action and to document that the site now complies with the applicable criteria and can be released for use without radiological restrictions.

Survey Equipment

The recommended equipment for use by FUSRAP for boundary delineation includes:

- Gamma Scintillation Detector (Eberline SPA-3 or equivalent), or low range/high range HP-270 or equivalent
- Long-Range Alpha Detector System (LRADS)

The recommended equipment for use by FUSRAP for Post-RA verification includes:

- Gamma Scintillation Detector (Eberline SPA-3 or equivalent), or low range/high range HP-270 or equivalent
- Reuter-Stokes Pressurized Ion Chamber (PIC)

The recommended equipment for use by FUSRAP for release of equipment and materials from the site includes:

- Alpha Scintillation detector (Eberline AC-3 or equivalent)
- Beta/Gamma Pancake GM detector (7 mg/cm^2 mylar shielded (Eberline HP-210 or equivalent)
- Alpha Scintillation Counter (Eberline SAC-4 or equivalent)

The same type calibration sources (i.e., same radionuclide) and methods for instrument calibration will be used by Bechtel and ORISE to insure compatibility and reproducibility of survey results.

Long-Range Alpha Detector System Description

Long-Range Alpha Detector technology measures radioactivity by measuring the amount of air ionization caused by alpha particles. Alpha particles are both short range and high energy (ionize air well) and thus tend to create much ionization near the source of the radiation. The LRAD surface soil monitor is a large, flat box whose open end is placed on top of the soil to be measured. An electric field is created between the detector and the soil with ions created above the soil being collected by the electric field. The collected ions create an electric current which is measured by the electrometer and is proportional to the strength of the alpha source present. LRADS system is rugged enough that it would be mounted on a vehicle, such as a tractor, and could measure one square meter at a time.

At the SLAPS VP's, the LRADS system will undergo a field demonstration to survey for alpha emitters within the boundaries of contamination. This system would be vehicle mounted and thus fully mobile. Additional discrete sampling will be performed within the contaminated areas by griding the areas and collecting/compositing 25 samples per 100 m^2.

Background Measurements

Prior to performing post-remedial action surveys, TMA will obtain site-specific instrument background measurements from three remote background locations in the general vicinity of the site (0.5 to 3 miles) according to TMA procedure 3C.2 (reference 12A). The location for background measurements will be selected by Bechtel and TMA, and background measurements will be made at each location by TMA and ORISE. TMA and ORISE will utilize background concentrations for radionuclides in soil that were established for the St. Louis area and reported in Radiological and Limited Chemical Characterization Report for SLAPS (reference 12).

Surveys

After completion of excavation of the contaminated soils, TMA shall conduct post-remedial action surveys to verify satisfactory decontamination of the area. A survey grid shall be established at the site, conforming to the specifications in TMA procedure 3B.1 (reference 4B) and the "Instruction Guide for Post-Remediation Radiological Survey of Soil" (191-IG-032, reference 5), and surveys shall be conducted in each square of a suggested 6 m by 16 m grid (approximately 100 m^2). Due to the shape of the areas involved in this remedial action (about 6 meter wide by hundreds of meters long ditches) a grid of 6 m by 16 m was recommended rather than the standard 10 m by 10 m (see Figure 2). When deviating from the 6 m by 16 m grid (due to small irregularities in width of contamination), total area should be kept to 100 m^2 or less.

After all visible loose dirt has been removed, structures (utility poles, culverts, etc.) formerly in the contaminated area will be surveyed for release.

TMA will measure external gamma radiation exposure at a height of 1 m in the center of each survey grid block as required by 191-IG-032 (reference 5) using methods in accordance with TMA procedure 3B.3 (reference 4C).

Soil Sampling

TMA shall also collect post-remedial action soil samples to verify satisfactory remediation of the area. Samples shall be collected from an approximately 100 m^2 grid (suggested 6m by 16m) as directed in 191-IG-032, and TMA procedure 4A.1 (reference 4F, 5). Point Sources ("Hot Spots") will be taken into account by using the averaging criteria contained in "A Manual for Implementing Residual Radioactive Material Guidelines" (reference 13). Based on current estimates of anticipated areas of excavation, a minimum of 36 composite samples will be collected. Composite samples will be collected by taking individual samples (25 per 100 m^2) from each sample grid and compositing these individual samples into one composite sample for that grid. ORISE may collect splits concurrently.

Samples from each grid square shall be collected using properly decontaminated sampling equipment (reference 6).

TMA samples shall be handled using the sample custody and labeling methodology described for sediment samples in the "Instruction Guide for Surface Water and Sediment Sampling Activities" 191-IG-028 (reference 7) and the sample surveying, packaging, and shipping methodology in PI R4.7 "How to Ship Samples from a FUSRAP Site" (reference 8).

Samples shall be shipped to the TMA laboratory in Oak Ridge, TN prepared using the C. Sills technique and analyzed using alpha spectroscopy (Isotopic U, Isotopic Th, and Ra-226). A 24 hour (one day) turn around time shall be requested.

Safety and Health

Safety and health risks associated with tasks described herein have been identified and addressed by the *Health and Safety Plan for the St. Louis Site.*

The work will be performed under a Hazardous Work Permit specific to the survey activities.

Quality Assurance/Quality Control

QA/QC field duplicate samples and measurements shall be collected at a frequency of one additional sample/measurement for each 20 collected.

Rinse blanks from decontaminated sampling equipment shall be collected at the rate of one rinse per day of sampling. Rinse blanks shall be collected according to the recommendations in 191-IG-028 (reference 7).

Data Quality Objectives

The detection limit for total thorium by alpha spectroscopy shall be less than 2 pCi/g (half criterion) and the detection limits for thorium-230 and thorium-232 shall each be less than 1 pCi/g. Quality indicator goals shall be as follows: Precision, $\pm$ 2 sigma; completeness, 75%; Accuracy, $\pm$ 25%). QA/QC samples are discussed in the previous section.

BECHTEL/ORISE COORDINATION

Bechtel is the contractor responsible for completing the remedial action. To define the areas for remediation, Bechtel used data collected by ORNL during designation, as well as supplemental information obtained by Bechtel as part of pre-RA planning and scoping activities.

Bechtel will have responsibility for excavation of contaminated soil. Upon completion of these activities Radiological Site Support (RSS) will perform post-RA survey, then ORISE will commence verification of the remediation of the property. The result of this walkover survey shall be used to determine whether there are areas requiring additional remediation. This survey is expected to include all areas previously identified as being contaminated on the designated properties. Bechtel will assist ORISE in this survey by interfacing with property owners in advance to secure their approval for property access.

Bechtel will initiate remediation concurrent with ORISE verification activities, to the extent that remediation does not interfere with verification. Bechtel will provide ORISE access to remediation results as they become available. The Bechtel Site Superintendent will notify ORISE when remediation of an area is complete, and ORISE will perform independent verification surveys of the area. ORISE may collect soil sample splits concurrent with Bechtel sampling efforts.

Measurements taken by Bechtel and ORISE at identical locations should agree within the 95 percent confidence interval for the analytical methods used (reference 2). For consistency and ease of data comparison, Bechtel and ORISE shall utilize the same type of calibration techniques, calibration sources, and survey techniques in conducting the surveys. Bechtel and ORISE shall utilize the previously established SLAPs survey grid across the decontaminated areas and shall conduct their surveys referring to that grid.

Once it has been established that the site meets radiological criteria as determined by direct measurements and analytical results, Bechtel will proceed (at risk) to restore the site to the condition agreed upon by the property owner(s).

Bechtel will provide final verified sample results to ORISE as soon as they are available. Bechtel will prepare a post-remedial action report (PRAR) for DOE review (copy to ORISE) within 3 months following demobilization, and then begin the Certification Docket (Certification Docket will not be completed until after remediation of additional SLAPS vicinity properties). ORISE will issue a verification report to DOE (copy to Bechtel) within 4 months following demobilization (reference 2).

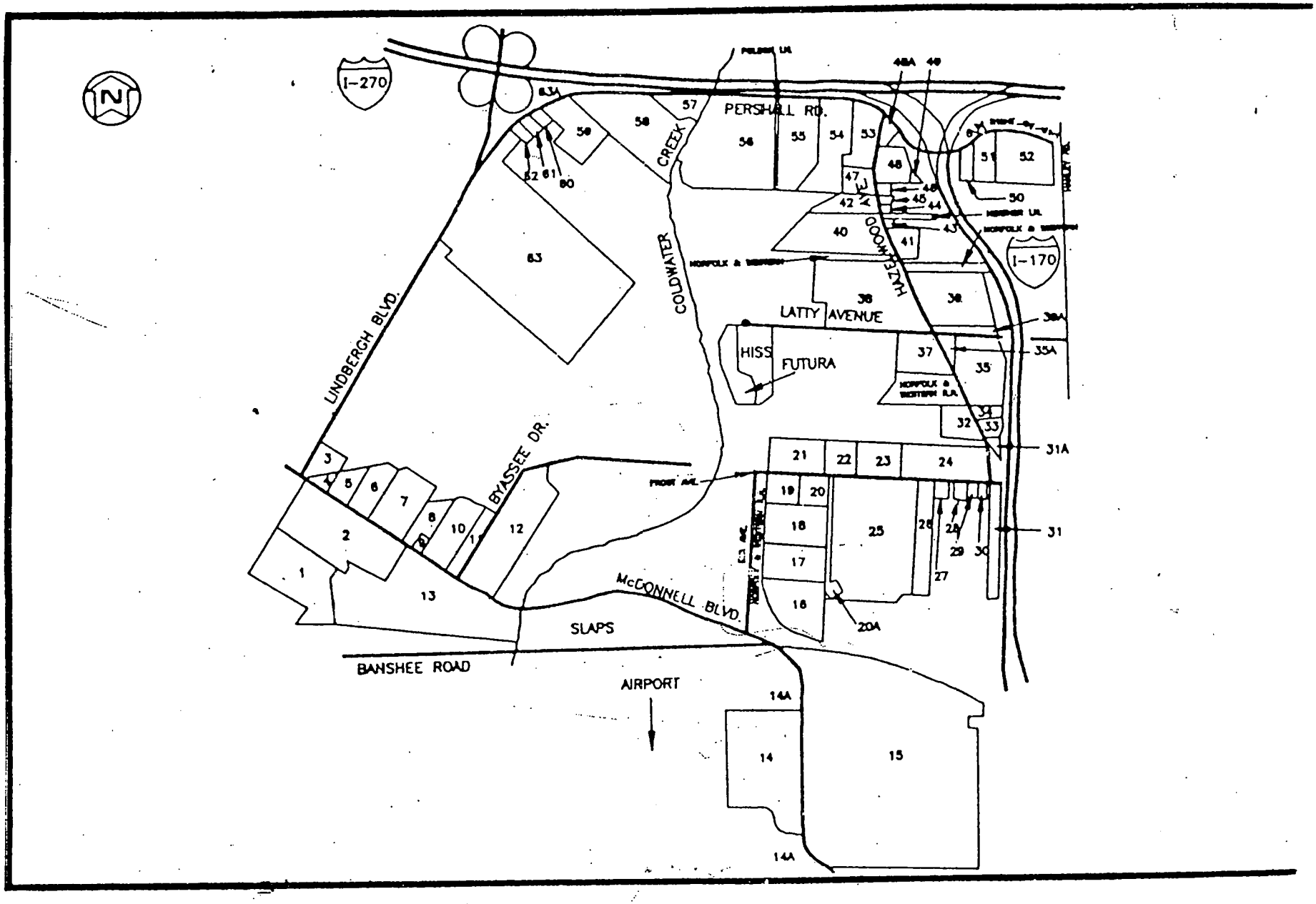


FIGURE 1 LOCATIONS OF THE HAUL ROADS VICINITY PROPERTIES

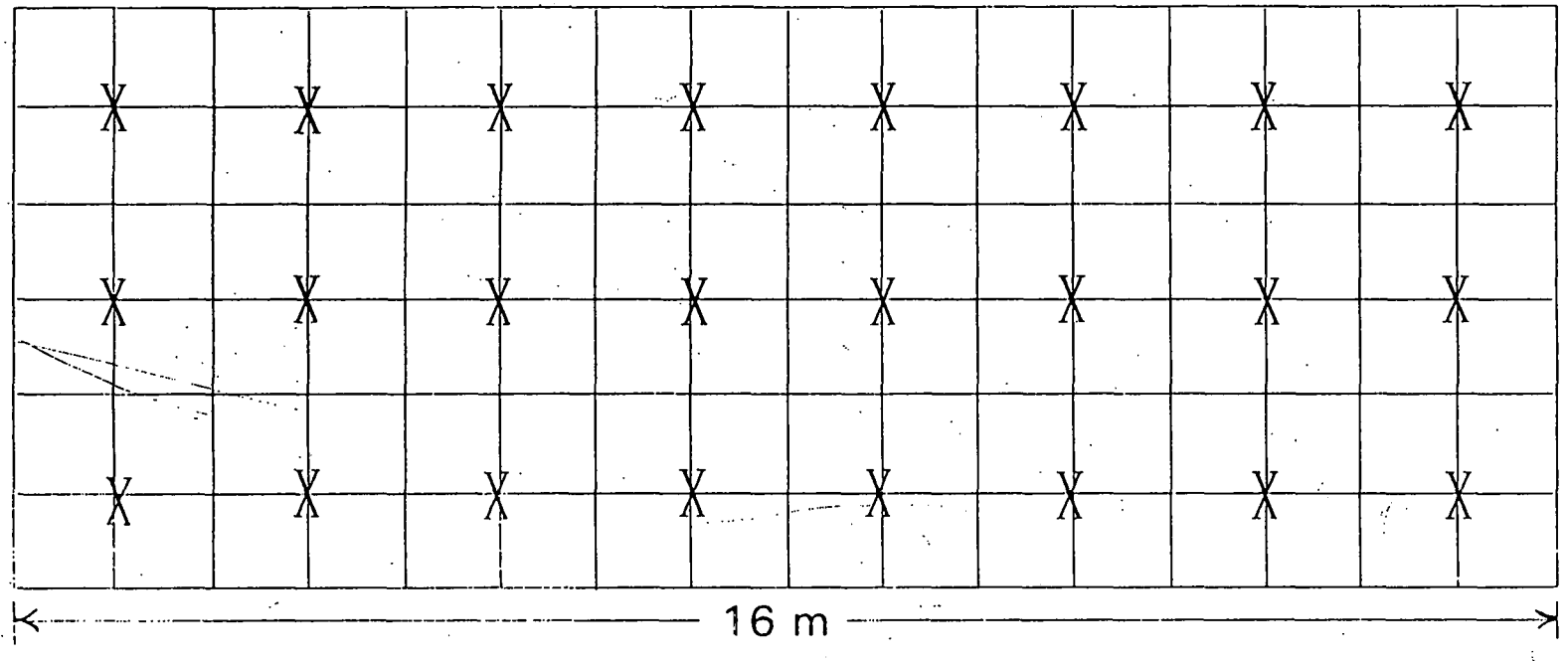


Figure 2. Example Survey Grid
6 meter X 16 meter grid (96 m^2)
X - Sample Points

APPENDIX B
Remedial Action and Waste Management Summary

REMEDIAL ACTION/WASTE MANAGEMENT SUMMARY

WBS 134

SITE SLAPS VPs

OWNERS Vasquez, Granicke, Kurtz, Lakenburger Florea

ADDRESS 9040 Frost, 8834 & 8841 Heather Lane, 3553 Douglas Road, 8823 Nyflot Avenue

CITY, STATE Hazelwood & Berkeley, Missouri

REMEDIATION AUTHORITY

- ☒ NEPA/CERCLA
- ☐ SUPERFUND
- ☐ RCRA

ACTION	DATE	RESPONSIBLE ENTITY	DOCUMENT
DESIGNATION	1990	DOE	Designation Letter
CHARACTERIZATION	1987	ORNL	Characterization Report
CHARACTERIZATION	1990	BNI	Characterization Report
FINAL RA	1994 & 1995	BNI	Post Remedial Action Report

TOTAL VOLUME 1185 yd^3

To Remain In Situ N/A
Volume Reduction N/A
Net Disposal 1185 yd^3

Documentation Used: N/A

TYPE OF WASTE FOR NET DISPOSAL:

REGULATORY	**VOLUME**	**DISPOSAL SITE**
☒ LLRW	1185 yd^3	Envirocare of Utah
PHYSICAL		
☐ BUILDING RUBBLE		
☒ SOIL	1185 yd^3	Envirocare of Utah
☐ LIQUID		
☐ OTHER _____		

TREATMENT TECHNOLOGIES APPLIED AT THE SITE:

Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the St. Louis Site, Missouri

U.S. Department of Energy