DEFENSE LOGISTICS AGENCY
DEFENSE NATIONAL STOCKPILE CENTER
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IN REPLY
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U.S. Nuclear Regulatory Commission
Region 1, Nuclear Materials Safety Branch
Division of Nuclear Materials Safety
ATTN: Ms Betsy Ullrich
475 Allendale Road
King of Prussia, PA 19406-1415

SUBJECT: Radiological Characterization Survey, Curtis Bay, MD
License STC-133 04000341

Dear Ms. Ullrich:

As promised in our letter to you of August 8, 2006 (reference Control No. 138458), the Defense National Stockpile Center (DNSC) herein submits its Radiological Characterization Survey report for the DNSC Depot in Curtis Bay, MD. The report combines results of both radiological scoping and characterization surveys performed by the Oak Ridge Institute of Science and Education under the auspices of the Oak Ridge National Laboratory between June 2005 and July 2006. The data is germane to our request for approval of site specific Derived Concentration Guideline Levels for use at our Curtis Bay Depot.

Sincerely,

Michael J. Peculla

MICHAEL J. PECULLAN
Radiation Safety Officer

Attachment

138458
NMSS/RGNI MATERIALS-002

ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

September 15, 2006

Mr. Mike Pecullan
Defense Logistics Agency
Defense National Stockpile Center
8725 John J. Kingman Road, Suite 3229
Ft. Belvoir, VA 22060

SUBJECT: FINAL REPORT—RADIOLOGICAL CHARACTERIZATION SURVEY OF THE CURTIS BAY DEPOT, CURTIS BAY, MARYLAND

Dear Mr. Pecullan:

The Oak Ridge Institute for Science and Education (ORISE) is providing the enclosed report which details the Phase 1 and 2 radiological scoping surveys and characterization survey results performed during the periods June 13 through 22 and October 24 through 27, 2005; and May 1 through 19 and July 25 and 26, 2006 for the Defense National Stockpile Center's (DNSC) Curtis Bay Depot (CBD) in Curtis Bay, Maryland. Comments provided on the draft report have been incorporated.

Please contact me at 865.576.5073 or Scott Kirk at 865.574.0685 should you require any additional information.

Sincerely,

Timothy J. Vitkus
Senior Project Leader
Survey Projects

TJV

Enclosures

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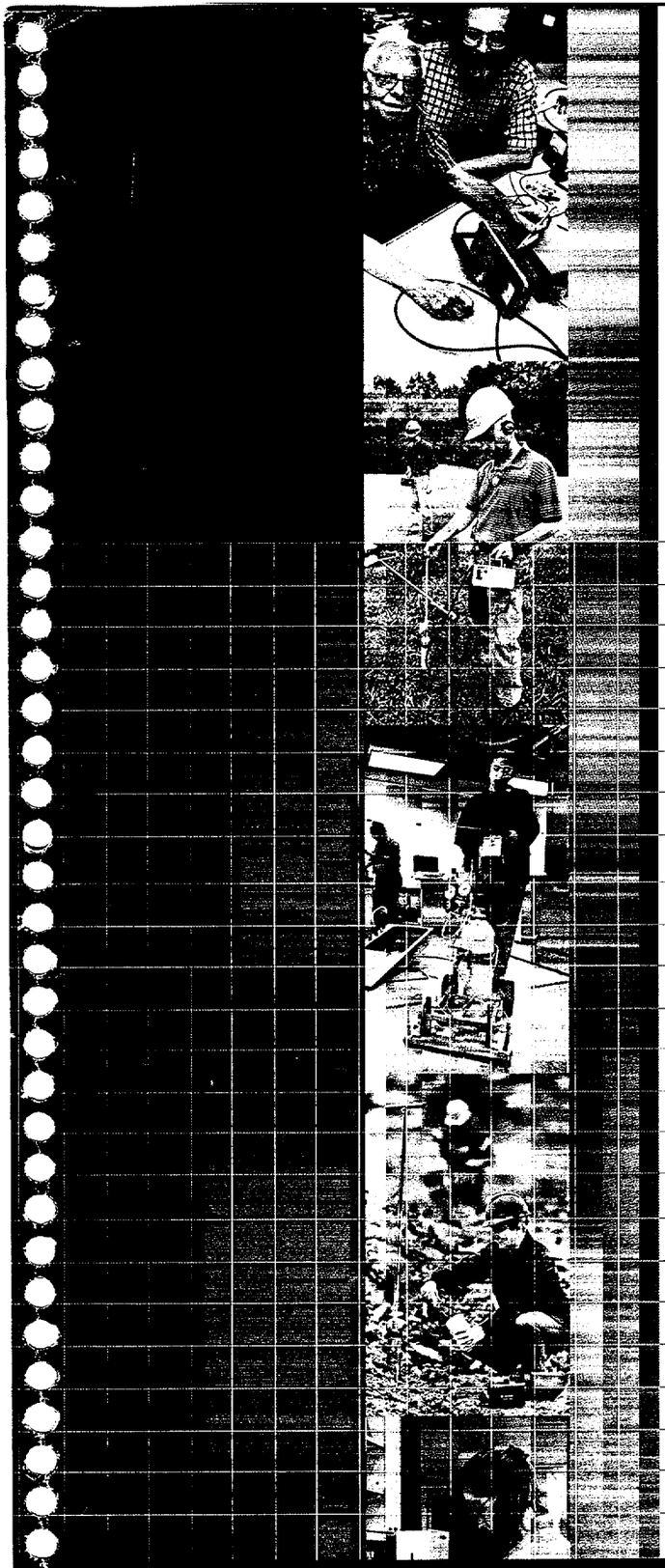

RADIOLOGICAL CHARACTERIZATION SURVEY OF THE CURTIS BAY DEPOT CURTIS BAY, MARYLAND

T. J. Vitkus

Prepared for the
Defense National Stockpile Center
of the
Defense Logistics Agency

ORISE

Oak Ridge Institute for Science and Education

RADIOLOGICAL CHARACTERIZATION SURVEY OF THE CURTIS BAY DEPOT CURTIS BAY, MARYLAND

Prepared by

T. J. Vitkus

Independent Environmental Assessment and Verification
Oak Ridge Institute for Science and Education
Oak Ridge, Tennessee 37831-0117

Prepared for the

Defense National Stockpile Center
of the
Defense Logistics Agency

FINAL REPORT

SEPTEMBER 2006

RADIOLOGICAL CHARACTERIZATION SURVEY
OF THE
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Prepared by: _____ Date: 9/5/2006
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TABLE OF CONTENTS

PAGE

LIST OF FIGURES

LIST OF FIGURES (Continued)

PAGE

LIST OF FIGURES (Continued)

PAGE

LIST OF FIGURES (Continued)

PAGE

LIST OF TABLES

PAGE

ABBREVIATIONS AND ACRONYMS

ε_i	instrument efficiency
ε_s	surface efficiency
ε_{total}	total efficiency
b_i	number of background counts in the interval
AEC	Atomic Energy Commission
AOC	area of concern
BKG	background
CBD	Curtis Bay Depot
cm	centimeter
cm^2	square centimeter
cpm	counts per minute
d'	index of sensitivity
DCGL	derived concentration guideline level
DLA	Defense Logistics Agency
DNSC	Defense National Stockpile Center
DOE	U.S. Department of Energy
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
GPS	global positioning system
GSA	General Services Administration
HSA	historical site assessment
ITP	Intercomparison Testing Program
MAPEP	Mixed Analyte Performance Evaluation Program
MDC	minimum detectable concentration
MDCR	minimum detectable count rate
MeV	million electron volts
m	meters
m^2	square meter
mg/cm^2	milligram per square centimeter
min	minute
mm	millimeter
NaI	sodium iodide
NIST	National Institute of Standards and Technology
NORM	naturally occurring radioactive material
NRC	U.S. Nuclear Regulatory Commission
NRIP	NIST Radiochemistry Intercomparison Program
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
pCi/g	picocuries per gram
s	second
TAP	total absorption peak
ThN	thorium nitrate

RADIOLOGICAL CHARACTERIZATION SURVEY
OF THE
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

INTRODUCTION AND SITE HISTORY

The land area that is currently the Curtis Bay Depot (CBD) in Curtis Bay, Maryland was originally a U.S. Army Depot built in 1918 on 798 acres of farmland. Additional acreage was acquired, increasing the site size to 815 acres. From 1918 to 1954 the site was used for receiving, shipping and storage, and as an ordnance depot (storing ammunition).

In 1946, a National Stockpile program was established as an attempt to mitigate dependence on foreign sources of vital materials during times of national emergencies. In the late 1950s, the Defense National Stockpile Center (DNSC) became a tenant at the CBD and began storing strategic materials (bulk ores, minerals, and metals). Included in the materials stored at the CBD were chromite, ferromanganese, and ferrochrome. Additional stored materials were thorium nitrate (mantle and reactor grades, average 47 percent thorium nitrate (ThN) by weight) in fiber and steel drums, monazite sands, and sodium sulfate—radioactive materials that required a U.S. Atomic Energy Commission (AEC), predecessor to the U.S. Nuclear Regulatory Commission (NRC), source material license (License STC-133).

Since the establishment of the CBD, there have been a number of land transfers reducing the footprint of the site and also changes in government agency caretakers. Approximately 37 acres were transferred to the U.S. Army Reserve Command between 1958 and 1966. The remaining 778 acres were excessed to the General Services Administration (GSA) which had assumed accountability for the facility. In 1966, GSA sold CBD land that included the area of an old burial site to Anne Arundel County for development into an industrial park (Bay Meadows Industrial Park). Material that was in this pit was removed in 1966 and transferred to an on-site burial area. In 1977, GSA notified NRC of its intention to excess empty warehouses on the site as part of a sale of U.S. Government land and buildings. In 1980, GSA sold approximately 87 acres to Anne Arundel County. This property had contained nine warehouses that were used to store thorium nitrate. The site was cleaned up and that portion released from the NRC license. The County eventually built a

detention center and ball fields on the property. In 1988, National Defense Stockpile responsibility was transferred from the GSA to the Defense Logistics Agency (DLA).

The DNSC of the DLA is now in the process of closing out many of its depots across the country and seeking to terminate its NRC license for those facilities. Although there have been a number of building and soil remedial actions at CBD over the past three decades, the CBD license was recently amended to conduct final site cleanup activities. All current site clean-up work at the CBD is sponsored by the DNA's DNSC and is being conducted as part of the U.S. Department of Energy (DOE)-Oak Ridge Operations approved Thorium Nitrate Stewardship and Disposition Program – Phase 4 – Decontamination & Decommissioning. This program is managed by the Oak Ridge National Laboratory (ORNL), per DOE Proposal Number # 1872-M171-A1. The initial phase of the cleanup activities has been completed as the DNSC recently removed ThN source material from the site—monazite sands and sodium sulfate had been previously removed. In conjunction with site cleanup, at the request of ORNL, the Oak Ridge Institute for Science and Education (ORISE) performed a historical site assessment (HSA) of the CBD in order to plan for future site investigations and eventual remediation activities (ORISE 2005a). Additionally, ORISE was tasked to conduct scoping and characterization surveys of the site to validate the results of the HSA and to provide radiological information for the development of a decontamination scope of work for areas of the site that have been identified with excessive residual radioactivity levels. The scoping survey was conducted in two phases during the periods of June 13 through 22 and October 24 through 27, 2005. Phase 1 included land areas, previously demolished building pads, and buildings deemed structurally sound for safe entry. Phase 2 included surveys of the floors and the resultant debris of those buildings that required partial deconstruction to allow for survey access. The deconstruction of 24 buildings at the site was completed by the DLA contractor, PIKA International, Inc., on October 14, 2005. The scoping survey results were provided in an earlier report (ORISE 2006a). The characterization survey was conducted during the period May 1 through 19, 2006 with additional data gap investigations conducted on July 25 and 26, 2006. This report combines the results of both the scoping and characterization surveys.

SITE DESCRIPTION

The CBD site is located approximately one mile south of Baltimore, Maryland in an industrialized area of Anne Arundel County, Maryland. The property currently consists of approximately 483 acres bounded on the north by the Army Reserve Facility and Curtis Creek, on the east by Curtis Creek, on the south by Furnace Creek, and on the west by Back Creek and the Anne Arundel County Facility. A 1,955-foot long dock belonging to the U.S. Army Reserve lies along Curtis Creek; a security fence encloses the facility. Figure 1 shows the site plot plan.

In general, the CBD terrain is mostly flat to gently hilly with large grassy, open areas, and some lightly wooded areas. A number of roads, mostly asphalt, traverse the site; there are approximately six miles of paved roads. Also noteworthy were the large stockpiles of various ores. Most of the stockpiled materials at CBD were raw ores with no history of radioactive material storage. Ores were primarily piled on concrete pads or directly on the ground. Some piles were covered to reduce erosion through weathering and oxidation. Many of these ore piles have been reduced in size or completely eliminated as materials are being removed from the site. There are two miles of railroad tracks that cross the site, a stream, and two leach fields—one in use. There are two wetland areas on the southwest and south sides of the site. Two former burial areas—for medical supplies and radioactive waste—and ordnance areas were also identified on the western sector of the site.

The site contains various structures (buildings and warehouses)—some functional, others that were in a serious state of disrepair and were partially deconstructed in the fall of 2005. A few buildings are surrounded by man-made berms of earth, that over the years since their construction have been vegetated with small trees and brush. A number of these buildings/warehouses have been used to store the thorium, generally in containers. There are five different building construction types ranging in size from 10 meters (m) by 30 m to as large as 73 m by 183 m. Construction is either a pitched roof building with transite or asphalt shingles, concrete floor, and terra cotta block walls; or constructed with a flat roof, wooden or concrete floor, and transite or terra cotta block walls. A number of the buildings have been demolished and only the concrete pad remains. Two of the buildings/warehouses were known to be contaminated, some were potentially contaminated, and the others have no known history of radioactive materials use.

There are two large warehouses on the site designated as Buildings 1021 and 1022 that measure 73 m by 183 m. Building 1021 has no history of radioactive material storage. Building 1022 is known to have formerly stored thorium and a "clean-up action" was noted in historical documentation. The remaining storage buildings, a number of which have stored radioactive materials, are designated according to groupings as A through I Line Buildings. Two additional building lines, J and K Lines, have been completely demolished. Lastly, Building 821 was a former change house and Building 825 housed machining and carpentry equipment, neither of which have had a history of radioactive material use. Table 1 provides a summary of the building nomenclature designation, current condition, and radioactive material use. Figure 1 shows the pad/building locations.

OBJECTIVES

The objectives of the radiological scoping and characterization surveys were to collect adequate field data for use in evaluating the radiological condition of land areas and buildings at the CBD site. The scoping survey data generated were used to validate the results of the HSA regarding classification of areas by radiological contamination potential, validating the radiological contaminants of concern (thorium and uranium or thorium only), determining whether contamination present warranted further evaluation, providing site reconnaissance for site-specific derived concentration guideline level (DCGL) modeling inputs, and providing input information for the development of the complete site characterization plan. The characterization survey activities were intended for confirming either the presence and extent or absence of suspect radiological anomalies identified during the scoping survey, conducting complete surveys of suspect areas that were not accessible for survey during the scoping survey, and conducting additional walkover surveys of land areas in preparation for final status survey sampling. Furthermore, all data generated will be used to provide estimates of the level of effort for decontamination and may serve as final status survey data in areas where no further action is warranted.

DOCUMENT REVIEW

ORISE reviewed the HSA during the preparation of the scoping and characterization survey plans that were implemented at the site.

PROCEDURES

A survey team from ORISE visited the CBD and performed visual inspections, measurement, and sampling activities. Survey activities were conducted in accordance with the ORISE Survey Procedures and Quality Assurance Manuals and site-specific survey plans (ORISE 2004; 2005b, c, and d; and 2006b).

ORISE divided the CBD site into three categories, based on contamination potential, as either Class 1, 2, or 3 in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (NRC 2000). A description of each is as follows:

Class 1: Buildings or land areas that have a significant potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiological surveys) that exceeds the expected $DCGL_W$.

Class 2: Buildings or land areas, often contiguous to Class 1 areas, that have a potential for radioactive contamination but at levels less than the expected $DCGL_W$.

Class 3: Remaining buildings and land areas that are expected to contain little or no residual contamination based on site operating history or previous radiological surveys.

Table 1 provides the classification for each pad/building on the site and Figure 2 shows pad/building and land area scoping survey classifications. Figure 3 shows characterization survey land area classifications. Because the buildings that were addressed during Phase 2 of the scoping survey were partially deconstructed, personnel safety concerns made remaining portions of the buildings inaccessible. However, the area made accessible for survey satisfied the nominal percentages discussed below. The scoping surveys involved a graded survey approach for all 50 of the remaining pads/buildings that was dependent upon the contamination potential and findings as the surveys progressed. The exterior land area scoping survey included limited surface scanning and sampling of land areas that concentrated efforts near roads, railroads, and around buildings. The characterization survey efforts concentrated on six buildings where contamination was identified or

required further investigation as well as extensive gamma scanning and soil sampling of the site's land areas.

BUILDING SURVEY PROCEDURES: CLASS 1

The following survey procedures were applicable to Class 1 pads/buildings where contamination had been previously identified or the potential existed for contamination based on operating history. Additional pads/buildings where residual surface activity was detected during the course of the surveys were also surveyed in this manner. None of the buildings requiring deconstruction were Class 1. Buildings initially designated as Class 1 were:

- B-911 and B-912
- F-731 and F-737

Reference Grid

ORISE established a grid system consisting of 10 m × 10 m grid blocks on the concrete pads or floors and lower walls (up to 2 m) in each Class 1 building. Areas of residual contamination were referenced to either a specific grid sub-division and coordinate or plotted on site drawings. The ceiling and upper walls (above 2 m) were not gridded. Measurements and samples collected on ungridded surfaces were referenced to the floor and/or lower wall grid coordinates or to prominent building features.

Surface Scans

Scans were performed using NaI scintillation detectors for direct gamma radiation and gas proportional detectors for direct alpha plus beta or beta radiation, coupled to ratemeters or ratemeter-scalers with audible indicators.

Scoping Survey

Concrete pads/floors and lower walls were scanned for alpha plus beta or beta and gamma radiation. Because the objective of the scoping survey was to validate the results of the HSA and

obtain data of the general radiation levels for future characterization survey planning, the scanning percent coverage of surfaces was highly variable. However, the minimum surface scan coverage was 25% of accessible surfaces, with several pads/building floors being scanned 100% for gamma and/or alpha plus beta radiation. The total area covered was dependent upon results as the survey progressed. Lower walls were also scanned for beta radiation in structurally sound buildings, with scanning concentrated in those areas where floor contamination was identified. Scans of accessible upper surfaces concentrated on horizontal surfaces where material may have accumulated. Because of difficulties encountered with accessing upper surfaces, the number of Phase 1 building upper surface locations judgmentally selected for survey was reduced from the planned 10 to 20 locations to three to nine locations. An area of 1 m^2 was scanned within each of these selected locations.

Additional areas were scanned, as necessary to delineate contamination boundaries, when residual contamination was detected. Particular attention was given to cracks and joints in the floor and walls, ledges, and other horizontal surfaces where material may have accumulated. Locations of elevated direct radiation were marked for further investigation. Identification of areas requiring additional investigation was based on instrument count rate action levels established at the site.

Characterization Survey

The floors of both Buildings B-911 and B-912 were found to be extensively contaminated during the scoping survey. Although there were localized areas on both building floors that were not contaminated, it was anticipated that it would be more beneficial to remediate the entire floor rather than expending resources to distinguish the limited uncontaminated areas. This decision was based on scoping survey surface scan results and 20 of 21 random-start/systematic measurements exceeding the Class 1 action level on the Building B-911 floor and 15 of 23 measurements exceeding the action level on the floor of Building B-912. The scoping survey floor data have been determined to be of sufficient quality and quantity for remedial action planning. Therefore, characterization activities in both structures concentrated on further evaluating wall and overhead surfaces and the B-911 exterior loading dock.

The B-911 loading dock was scanned 100% for alpha plus beta radiation. Approximately 25% of the soil beneath the loading dock was scanned for gamma radiation. The walls of both Building

B-911 and B-912 were scanned for beta radiation at a frequency of 100% for the initial one meter in height from the floor, from 50 to 100% for the one to two meter interval, and from 10 to 50% of the upper walls (greater than two meters) where contamination potential was less likely. Scan coverage was expanded as necessary to delineate contamination boundaries, when residual contamination was detected. The horizontal surfaces of overhead truss supports in both Building B-911 and B-912 were scanned for beta radiation at a frequency of 100%. Additionally, floor cracks and/or expansion joints were thoroughly scanned for indications of elevated gamma radiation.

Surface scans of Building F-731 included 100% alpha plus beta and gamma scan coverage of the floor and lower walls and 50% beta radiation surface scans of the upper walls and overhead trusses. The Building F-737 pad was scanned 100% for alpha plus beta radiation. Approximately 30% of the soil beneath the pad was scanned for gamma radiation.

Surface Activity Measurements

Initially, construction material-specific backgrounds were determined in areas of similar construction but without a history of radioactive material use. These construction material-specific measurements were used to correct pad/building direct measurement for background contributions. Direct measurements were made using gas proportional detectors coupled to ratemeter-scalers.

Scoping Survey

Direct measurements to quantify total beta activity levels, with supplementary measurements of total alpha activity, were performed within areas of residual contamination identified by surface scans, at contiguous locations to delineate contamination boundaries, and also at systematic locations. In cases where wide-spread contamination and/or multiple hot spots were identified, measurements were only made systematically. The number of direct measurements on pads or floor and lower wall surfaces within each Class 1 pad/building ranged from 17 to 27. On upper surfaces, direct measurements were performed within each of the three to nine areas that were selected for judgmental scanning. A smear sample, to determine removable gross alpha and gross beta activity levels, was collected from each building direct measurement location. Smear samples were not

collected from Class 1 pad measurement locations as these surfaces had been subject to weathering. Measurement locations are shown on Figures 4 through 9.

Characterization Survey

Surface activity measurements collected during the characterization phase of the project concentrated on the quantification of residual beta surface activity at any locations of elevated direct radiation that were not identified during the initial scoping survey, at which time surface scan coverage was less than 100%. Additionally, measurements were re-performed at a number of the scoping survey locations. Additional measurements were made as follows: 60 systematic wall or overhead surface locations in Building B-911; 64 systematic wall or overhead surface locations in Building B-912; 25 floor, wall, or overhead surface locations in Building F-731; and four locations on the Building F-737 pad. Figures 4 through 9 show measurement locations.

Miscellaneous Sampling

Soil samples (up to 60 cm in depth) were collected from two sub-floor locations, to evaluate sub-floor soil contamination, and from one location beneath the loading dock of Building B-911 (Figure 5). The first sub-floor location was selected within a floor crack exhibiting elevated gamma radiation levels. The second location was selected one meter to the west of the crack, where the floor was intact. A sample of dust from an overhead rafter in Building B-911 was collected to determine if low-level activity detected was the result of thorium contamination or due to ambient background interferences (Figure 5). A dust sample was also collected from the floor of Building F-731 to confirm contamination in the dust versus embedded in the concrete (Figure 8).

BUILDING SURVEY PROCEDURES: CLASS 2

The following procedures were used for the scoping and characterization surveys, as applicable, of Class 2 pads/buildings/building debris indicated in Table 1. Figure 2 illustrates the Class 2 pads/buildings. Pads/buildings or portions thereof, identified during the course of this investigation as containing residual contamination were reclassified as Class 1 and surveyed in accordance with the Class 1 procedures. Buildings initially designated as Class 2 were:

- A-921
- B-913
- F-734, F-735, and F-736
- G-721
- H-711, H-712, H-713, H-714, and H-715
- 1022

Reference Grid

Class 2 pads/buildings were not gridded. Measurements and samples collected in Class 2 areas were referenced to prominent features or general debris pile area and documented on site drawings.

Surface Scans

Scans were performed using NaI scintillation detectors for direct gamma radiation and gas proportional detectors for alpha plus beta or beta radiation, coupled to ratemeters or ratemeter-scalers with audible indicators.

Scoping Survey

Pads/building floors and lower walls were scanned for alpha plus beta or beta and gamma radiation. Up to 50% of the accessible Phase 1 scoping survey structure surfaces were scanned and in the case of Building B-913, 100% of the floor was scanned. Professional judgment was combined with a systematic approach during the Phase 1 surveys to select scan areas dependent upon visual inspections, historical records of spills or cleanups, and findings as the survey progressed. In buildings, upper walls and overhead structures were also scanned with emphasis on horizontal surfaces where residual contamination may have settled and accumulated when access could be achieved and if elevated activity was identified on the floor.

Phase 2 scan surveys of the Class 2 deconstructed buildings with concrete floors (F Line) involved scanning up to 100% of the building floor section made accessible by the deconstruction contractor. The amount of the total floor area available for each of these deconstructed buildings ranged from 30 to 60%. The wooden floors were required to be removed and staged in debris piles for all but

one (H-711) of the H Line buildings. Scans were conducted on approximately 75% of the accessible floor area of building H-711 and on 10 to 20% of the individual floor planks for the remaining H Line buildings. The floor of building H-715 had degraded to such an extent that it could not be removed intact and in fact had collapsed into the crawl space of the building. Therefore, the number of planks available for scan surveys was minimal. Deconstructed wall debris from the F and H Line buildings were also staged in piles and scanning covered 10 to 50% of the accessible wall debris surfaces.

Any locations of elevated direct radiation were investigated and, in some cases, required reclassification of the pad/building.

Characterization Survey

Characterization survey activities addressed Buildings B-913 and 1022 where contamination was either positively identified or suspected during the scoping survey. Although the floor of Building B-913 was scanned 100% during the scoping survey, 25% of the floor was re-scanned for alpha plus beta radiation to verify the scoping survey results. Fifty percent of the lower walls and upper surfaces were scanned for beta radiation. Approximately 85% of the loading dock of Building 1022 and 80% of the first 30 meters of interior floor surface adjacent to the loading dock were scanned for alpha plus beta radiation to further investigate suspect contamination on the loading dock.

Surface Activity Measurements

Surface activity measurements were made using gas proportional detectors coupled to ratemeter-scalers. The previously discussed construction material-specific background measurements were used to correct pad/building measurements for background contributions.

Scoping Survey

Direct measurements of total beta surface activity during Phase 1, with a number of supplementary alpha surface activity measurements, were made at a minimum of 10 to 30 locations on the Class 2 pad/building surfaces. The number of measurements correlated to the size of the pad/building and measurements were located systematically based on a random-start location. Additional

measurements were also made at any locations of suspected elevated direct radiation detected by surface scans.

Direct measurements for the Phase 2, Class 2 deconstructed buildings were made at 20 random-start/systematic locations on each F Line building pad and at five random locations on the wall debris. Direct measurements were made at 10 random-start/systematic locations on the building H-711 floor and at five random locations on the wall debris pile. For the remaining H Line buildings, excluding Building H-715, 10 and five random measurements were made on each floor and wall debris pile, respectively. Ten measurements were made on the H-715 debris piles, one on the floor and nine on the wall debris. Additional measurements were also made at judgmental locations when warranted by surface scans.

A smear sample, to determine removable gross alpha and gross beta activity levels, was collected from most direct measurement locations. Figures 10 through 22 show measurement locations.

Characterization Survey

Direct beta measurements were made at 19 overhead surface locations and on the lip of a drum that had been left within Building B-913 (Figure 12). There were no locations identified within the re-surveyed area of Building 1022 that required follow-up, investigative measurements.

Miscellaneous Sampling

A miscellaneous sample of humus-like material was collected from the Building 1022 loading dock where elevated direct radiation was detected (Figure 22).

BUILDING SURVEY PROCEDURES: CLASS 3

The following procedures were used for the survey of pads/buildings/building debris shown in Table 1 and Figure 2 as Class 3 structures. The following buildings were designated as Class 3:

- A-922
- C-1131, C-1132, C-1133, and C-1134

- D-1121, D-1122, D-1123, D-1124, and D-1125
- E-1111, E-1112, E-1113, E-1114, E-1115, and E-1116
- F-732 and F-733
- G-722, G-723, G-724, G-725, and G-726
- I-531, I-631, I-632, I-633, I-634, I-636, I-641, and I-634 Igloo
- 821, 825, and 1021

Reference Grid

Measurements and samples collected were referenced to prominent pad/building features or the general debris pile area and documented on site drawings.

Surface Scans

Scans were performed using NaI scintillation detectors for direct gamma radiation and gas proportional detectors for direct alpha plus beta or beta radiation, coupled to ratemeters or ratemeter-scalers with audible indicators.

Scoping Surveys

Pads/floors and lower walls were judgmentally scanned for alpha plus beta, or beta, and gamma radiation. Up to 25% of the accessible Phase 1, Class 3 surfaces were scanned.

Phase 2 scan surveys of the Class 3 deconstructed buildings with concrete floors (D, E, F and G Lines) involved scanning up to 100% of the building floor section made accessible by the deconstruction contractor. The amount of floor area available for each of these deconstructed buildings ranged from 15 to 40%. The wooden floors were removed and staged in debris piles for I Line buildings and the deconstructed walls also staged in separate debris piles for all deconstructed buildings. Scans were conducted on approximately 10 to 20% of the individual floor planks for the I Line buildings and 10 to 20% of the accessible surfaces in each of the deconstructed wall debris piles.

Locations of elevated direct radiation distinguishable from background were marked for further investigation.

Characterization Survey

The characterization survey activities focused on two Class 3 structures—Buildings D-1125 and G-723—based on the results of the scoping survey. The suspect results from the scoping survey required that 100% of the accessible surfaces—85 to 95% of the total area—be scanned for evidence of residual contamination.

Surface Activity Measurements

Measurements were made using gas proportional detectors coupled to ratemeter-scalers. The construction material-specific measurements were used to correct data for background contributions.

Scoping Survey

Direct measurements were made at 14 to 18 randomly generated or judgmental locations on Phase 1, Class 3 structures. Direct measurements for the Phase 2, Class 3 deconstructed buildings were made at 10 random and/or judgmental locations on each building pad or floor plank debris pile and at five random and/or judgmental locations on the wall debris. Measurements were made at 10 floor and five wall locations in the I-634 Igloo. A smear sample for determining removable surface activity levels was collected from representative Phase 1 building measurement locations and from all Phase 2 measurement locations. Figures 23 through 55 show measurement locations.

Characterization Survey

Direct measurements for beta activity were made at two judgmental locations on the Building D-1125 pad, one of which corresponded to a suspect location measured during the scoping survey, and at three judgmental locations on the Building G-723 pad representing the locations that were distinguishable from background during surface scans. Figures 32 and 42 show measurement locations.

Miscellaneous Sampling

A miscellaneous sample of the humus-like residue was collected from the D-1125 pad (Figure 32). The same material was present on the G-723 pad at two of three suspect locations. Although no sample was collected, investigations confirmed the elevated radiation was within the residue and not on the concrete of the pad.

EXTERIOR SURVEY PROCEDURES: CLASS 1

The following survey procedures were applicable to areas associated with locations where contamination previously was identified or where the potential existed for contamination due to operating history (Figures 2 and 3). Specifically, the land areas designated as Class 1 at the time of the characterization survey included the former radiological waste burial area, two-thirds of the B Line, a small area near Buildings 821/825, the southern F Line area, and a small G Line area. Many of the areas around buildings and roadways were partially cleared during the scoping surveys and most of the land areas, excluding woodlands and marshes were cleared and grubbed of overgrown vegetation, to provide access for the characterization survey activities. Class 1 areas represented approximately 5% of the total site land areas.

Reference Grid

A site grid system was not established. Measurement and sampling locations were referenced using a global positioning system (GPS) and/or referenced to prominent site features.

Surface Scans

Gamma scans were performed using NaI scintillation detectors coupled to ratemeters with audible indicators during the scoping survey. The characterization survey used NaI scintillation detectors coupled to ratemeter-scalers with audible indicators and a GPS system that enabled real time gamma count rate and position data capture under a subcontract with the Environmental Restoration Group, Inc.

Scoping Survey

Surface scans for direct gamma radiation were performed over approximately 100% of accessible surfaces out to a 5 to 10-meter perimeter of each Class 1 structure. A number of the structures on the F Line had collapsed wall debris that precluded complete scan coverage around the buildings. Locations of elevated direct gamma radiation were marked for further investigation and documented on site drawings (Figure 57).

Within the boundaries of the former radiological waste burial area, gamma scans were performed over the ground surface. Test pits were excavated within the burial area and gamma scans were performed of the sidewalls, pit bottoms, and suspect soils brought to the surface. The approximate depths of elevated gamma radiation zones detected were documented for further evaluation.

Characterization Survey

Gamma radiation scans were performed over 100% of the Class 1 land areas shown on Figure 3. These areas included most of the B Line, a small area near Buildings 821/825, the former radiological waste disposal area, the southern-most section of the F Line, and the small G Line area. Locations of elevated direct radiation were marked for further investigation.

Soil Sampling

Scoping Survey

Surface (0 to 15 cm) soil samples were collected from judgmental locations where elevated direct gamma radiation was detected by surface scans. Specific sampling locations corresponded to the area of maximum direct radiation within discrete areas of suspected contamination. When multiple areas were identified in any one survey zone—e.g. perimeter of a given building—samples were not collected from all areas, but from three to five areas that were representative of the range of gamma radiation encountered. Subsurface samples were collected where subsurface contamination was suspected within the burial area test pits. Twelve soil samples were collected from the Class 1 areas, 10 of which were collected from the subsurface strata of the disposal area. Figure 58 shows soil sampling locations.

Characterization Survey

Judgmental samples were collected from 17 locations where gamma radiation levels were distinguishable from background, as bounding samples that surrounded either prior scoping survey sampling locations where contamination was known to be present or characterization survey gamma activity levels were greater than two to three times the area background, or for subsurface investigation. These subsurface samples were collected from numerous locations to investigate whether contamination may have migrated below the initial 15 centimeters of soil.

Within the former radiological waste burial area, boreholes were advanced to collect subsurface soil samples at 12 random-start/systematic and two background locations using a Geoprobe™ continuous core sampler. Boreholes were advanced to depths up to 480 centimeters. Random-start/systematic samples were collected from 36 locations within the B Line Class 1 area to provide information on the radionuclide average concentrations, variability, and to evaluate the observed background gamma radiation variability observed.

Figures 58 through 60 show sampling locations.

EXTERIOR SURVEY PROCEDURES: CLASS 2

The following survey procedures were applicable to accessible, exterior land areas identified as Class 2 (Figures 2 and 3). Specifically, this included the bulk of the land area surrounding the A Line and B Line Buildings (excluding the Class 1, B Line area), the land area encompassing the F through I Line and the southern end of the E and D Lines, the land area where J and K Line Buildings formerly stood, and most roadways and current and former railroad lines that cross the site. Many of the areas around buildings and roadways were partially cleared during the scoping surveys and most of the land areas, excluding woodlands and marshes were cleared and grubbed of overgrown vegetation, to provide access for the characterization survey activities. Class 2 areas represented approximately 58% of the site.

Reference System

ORISE referenced survey results to prominent site features and/or GPS coordinates.

Surface Scans

Gamma scans were performed using NaI scintillation detectors coupled to ratemeters with audible indicators during the scoping survey. The characterization survey used NaI scintillation detectors coupled to ratemeter-scalers with audible indicators and a GPS system that enabled real time gamma count rate and position data capture under a subcontract with the Environmental Restoration Group, Inc.

Scoping Survey

Scans for gamma radiation were performed judgmentally around perimeters of Class 2 pads/buildings, along center lines and edges of roadways and railroad lines, and judgmental locations of remaining Class 2 land areas. Locations of elevated direct gamma radiation were marked for further investigation (Figure 57).

Characterization Survey

Class 2 scan coverage density began as 100% coverage near roadways, railroads, and around pads/buildings and then was gradually decreased in outlying areas. The overall gamma radiation scan coverage was 50 to 75% of the Class 2 land areas shown on Figure 3. Locations of elevated direct radiation were marked for further investigation.

Soil Sampling

Scoping Survey

Surface soil samples were collected from judgmental locations where elevated direct gamma radiation was detected above background. The number of samples was determined as the survey progressed. Definable areas—e.g. the land areas surrounding each building line, a specific road, etc.—where there are no distinct indications of residual contamination were sampled judgmentally at two to five locations. Twenty-four scoping survey samples were collected from Class 2 land areas. Figure 58 shows soil sampling locations.

Characterization Survey

Soil samples were collected from 30 judgmental locations where gamma radiation levels were distinguishable from the general area background level. Systematic soil samples were collected from 89 locations to provide the data for determining radionuclide average concentrations and variability across the site that will be used for the final status survey planning. Additional subsurface samples were also collected from suspect locations. Figures 61 through 64 show soil sampling locations.

EXTERIOR SURVEY PROCEDURES: CLASS 3

The remaining portions of the site that were not designated as either Class 1 or 2 as illustrated in Figure 2, were considered as Class 3 areas. Class 3 areas constituted 37% of the land area that included five distinct survey units as shown on Figure 3. Most of these land areas also required clearing and grubbing to ensure unencumbered access.

Reference System

ORISE referenced survey results to prominent site features and/or GPS coordinates.

Surface Scans

Gamma scans were performed using NaI scintillation detectors coupled to ratemeters with audible indicators during the scoping survey. The characterization survey used NaI scintillation detectors coupled to ratemeter-scalers with audible indicators and a GPS system that enabled real time gamma count rate and position data capture under a subcontract with the Environmental Restoration Group, Inc.

Scoping Survey

Gamma surface scans were performed judgmentally around roadways, railroad lines, and any pads/buildings. Locations of elevated direct gamma radiation were marked for further investigation (Figure 57).

Characterization Survey

Gamma radiation scans were performed over 30 to 50% of the Class 3 land areas shown on Figures 3. Locations of elevated direct radiation were marked for further investigation.

Soil Sampling

Scoping Survey

Sample locations and the number of samples ultimately collected were determined as the survey progressed. Locations of direct gamma radiation distinguishable from background in Class 3 areas were judgmentally selected for surface soil sampling. Six samples were collected. Figures 57 and 58 show areas of elevated gamma activity and soil sampling locations.

Characterization Survey

Soil samples were collected from 14 judgmental locations where gamma radiation levels were distinguishable from the general area background level. In addition, soil samples were collected from 51 randomly generated locations, a minimum of 10 samples per survey unit to provide the data for determining compliance with the release criteria. The number of samples required for each survey unit was calculated based on data generated during the scoping survey. Figures 66 through 70 show sampling locations.

EXTERIOR SURVEY PROCEDURES: BACKGROUND REFERENCE AREA

A background reference area was sampled during the characterization survey. The reference area selected was to the northeast of the site and is currently an Army Reserve facility, but formerly served as the Depot's administrative area. The background reference area is shown on Figure 3. Fifteen soil samples were collected from randomly generated locations (Figure 71). In addition, four railroad ballast samples were collected from an off-site railroad line (Figure 71).

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data were returned to ORISE's laboratory in Oak Ridge, Tennessee for analysis and interpretation. Samples were analyzed in accordance with the ORISE Laboratory Procedures Manual (ORISE 2006c). Soil and miscellaneous material samples were analyzed by gamma spectroscopy for thorium and uranium and results reported in units of picocuries per gram (pCi/g). Spectra were also reviewed for other identifiable photopeaks. Smears were analyzed for gross alpha and gross beta activity using a low background gas proportional counter. Smear data and direct measurements for total surface activity were converted to units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2). Additional information regarding survey and laboratory equipment and procedures is provided in Appendices A and B.

Proposed site-specific $DCGL_W$s for both Th-232 and U-238 on building surfaces and within soils have been developed using the RESRAD and RESRAD-BUILD computer codes and provided to the NRC for review and approval (ORISE 2006d). These DCGLs have accounted for all important decay products found in secular equilibrium, including, the slight natural contribution from U-235 and its decay products. The proposed above background $DCGL_W$s for structural surfaces are 400 dpm/100 cm^2 for Th-232 and its decay products and 800 dpm/100 cm^2 for natural U-238/235 and their decay products. Surface activity data are reported as above background net activity and are compared in this report with the proposed site-specific surface activity $DCGL_W$ for Th-232. Use of only the more restrictive Th-232 surface activity $DCGL_W$, rather than modifying the $DCGL_W$ to also account for any small percentage of natural uranium activity that may be present, will allow for simplification of the survey process yet provide an overall more conservative approach for determining future remediation requirements. Soil sample results are compared with the revised proposed above background DCGLs of 2.9 pCi/g for Th-232 and 2.2 pCi/g for U-238. Site soil analytical results are compared with the background reference area results and these $DCGL_W$s. Application of the unity rule to the net concentrations (i.e. background corrected) will be performed for final status survey planning in accordance with the equation:

$$\frac{Conc._{Th-232}}{DCGL_{Th-232}} + \frac{Conc._{U-238}}{DCGL_{U-238}} < 1$$

FINDINGS AND RESULTS

The findings and results are combined below for all site survey phases in accordance with the original area classification. Pads/buildings and land areas identified with residual contamination will be reclassified appropriately for future site remediation and survey activities.

PAD/BUILDING SURVEYS: CLASS 1

The results for the surveys of pads/buildings B-911, B-912, F-731, and F-737 are provided below.

Surface Scans

B-911 and B-912

Gamma scans of Buildings B-911 and B-912 identified that most of the floor areas exhibited generally elevated gamma radiation levels. There were numerous localized hot spots exhibiting count rates ranging from 20,000 to greater than 500,000 counts per minute (cpm) as compared to a general gamma radiation detector background of 3,000 to 4,000 cpm. Additionally, investigative gamma scans were performed along floor cracks and/or expansion joints and the floor wall interface in both buildings. These investigations determined that approximately 200 linear meters in B-911 and 20 linear meters in B-912 are contaminated.

Alpha plus beta/beta-only scans identified significant elevated radiation levels in Buildings B-911 and B-912 that covered most of the floors. Additionally, contamination was also identified at seven lower wall areas, five locations on the exterior dock, a gable vent, and suspect low-level contamination on several roof trusses in B-911. In B-912, lower wall contamination was identified at four locations and on two roof trusses.

F-731 and F-737

Gamma scans of F-731 and F-737 did not identify any locations of elevated direct gamma radiation. Alpha plus beta/beta scans identified localized, above background radiation levels on the pad/floor/lower wall surfaces. In F-731, contamination was confirmed at eight floor areas and two

lower wall locations. For F-737, scans identified three suspect locations of alpha plus radiation distinguishable from background during the scoping survey. These locations were confirmed during the characterization. The characterization survey positively identified four additional locations of residual contamination. One location of elevated gamma radiation was detected beneath the Building F-737 pad.

Surface Activity Levels

The results of the individual direct measurements and smear samples to quantify total and removable surface activity levels are provided in Table 2 and are summarized below for all surfaces.

Pads/Buildings	Removable/Total Beta Activity Range (dpm/100 cm^2)	Number of Measurements > 400 dpm/100 cm^2
B-911 and B-912	-6 to 170/ -340 to 620,000	89 of 188
F-731 and F-737	-2 to 24/-200 to 32,000	20 of 76

Figures 4 through 9 show each direct measurement location and a corresponding color-code, relative to the proposed DCGL. These data demonstrate that the structures were properly classified for characterization, residual activity levels are present in excess of the $DCGL_W$ that in most cases is not considered removable activity, and that the contamination is primarily on the pad/floor, with lesser quantities on wall and overhead surfaces.

Radionuclide Concentrations in Soil and Miscellaneous Samples

The results for the dust sample collected from the Building B-911 roof truss and the floor of F-731 are provided in Table 4. The semi-quantitative concentrations were 465 and 2,150 pCi/sample for Th-232, respectively. These data combined with the surface activity measurement made after the dust sample was collected demonstrate that the contamination is within the dust matrix, rather than embedded into the concrete for this area of the F-731 floor. Post-sampling scans demonstrated the same scenario for the roof truss in Building B-911, beta activity count rates were comparable to background after the dust was removed.

The results for the sub-floor soil samples collected from B-911 are provided in Table 6. The Th-232 concentrations ranged from 3.94 to 174 pCi/g and the U-238 concentrations ranged from 0.64 to 11.3 pCi/g. These results show that contamination has migrated through floor cracks to underlying soil, with depth of contamination of at least 60 cm. Additionally, the contamination has also migrated horizontally.

Other miscellaneous sample information that is applicable to many of the A, B, D, E, F, and G Line buildings relates to the consistent increase in gamma radiation levels observed when scanning near the terra cotta block walls or the wall debris. It was determined that the observed elevated direct radiation signature was a result of naturally occurring radioactive materials (NORM). Two samples of this material were collected from Class 3 building debris to verify the presence of the elevated NORM. The data are provided in Table 4. The terra cotta block was also suspected to have caused elevated activity air sampling results during the building deconstructions.

PAD/BUILDING SURVEYS: CLASS 2

The results for the surveys of pads/buildings A-921, B-913, F-734, F-735, F-736, G-721, H-711, H-712, H-713, H-714, H-715, and 1022 are provided below.

Surface Scans

B-913 and 1022

The scoping survey gamma scans identified two small locations of elevated gamma radiation on the floor of Building B-913. Visible oily stains were associated with both locations. Alpha plus beta/beta scans also identified these two locations with significant radiation levels and as a result, the scan coverage was increased to 100% of the floor in accordance with the Class 1 survey procedures. Alpha plus beta radiation distinguishable from background was identified at a single location on the north side loading dock of Building 1022. The activity at this location was noted to be associated with a humus-like residue that had concentrated in a low spot, a sample of which was collected, beta scans of the underlying concrete were negative for elevated direct radiation.

Because of these initial results, surface scan coverage was significantly expanded during characterization activities for these two buildings. The only additional finding was a drum with a contaminated rim that is stored in B-913.

Remaining Class 2 A, B, F, G, and H Line Pads/Buildings/Debris Piles

The scoping survey scans of the remaining Class 2 structures and debris piles did not identify any elevated direct gamma not associated with the terra cotta block or alpha plus beta/beta elevated radiation levels. There were no further characterization survey activities required for these structures.

Surface Activity Levels

The results of the individual direct measurements and smear samples to quantify total and removable surface activity levels are provided in Tables 2 and 3. The total activity results are summarized below for all surfaces.

Pads/Buildings	Total Beta Activity Range (dpm/100 cm^2)	Number of Measurements > 400 dpm/100 cm^2
A-921	-180 to 230	0 of 17
B-913	-220 to 190,000	3 of 55
F-734, F-735, and F-736	-150 to 140	0 of 65
G-721	-8 to 220	0 of 20
H-711, H-712, H-713, H-714, and H-715	-440 to 110	0 of 70
1022	-210 to 660	1[a] of 37

[a] Activity at this location was associated with a humus-like residue.

Figures 10 through 22 show each direct measurement location and a corresponding color-code, relative to the proposed DCGL. These data show the contamination identified in Building B-913 (two small areas shown on Figure 11) and the single location on the outside dock of Building 1022 associated with the accumulated residue (Figure 22). Removable activity for the Class 2 pad/building group ranged from 0 to 4,000 dpm/100 cm^2 and -5 to 2,900 dpm/100 cm^2 for gross

alpha and gross beta, respectively. The maximum removable activity for Class 2 structures, excluding the two smear samples collected from the two contaminated floor locations identified in Building B-913, were 20 dpm/100 cm^2 for alpha and 42 dpm/100 cm^2 for beta. These data demonstrate that most of the structures were properly classified for characterization (the B-913 floor and lower walls has been reclassified as Class 1), residual activity levels were present in excess of the $DCGL_W$ only in Building B-913.

Radionuclide Concentrations in Miscellaneous Samples

The radionuclide concentration results for Th-232 and U-238 in the humus-like miscellaneous sample collected from the Building 1022 loading dock are provided in Table 4. The concentrations were 1.02 and 1.6 pCi/g for Th-232 and U-238 respectively. A review of the gamma spectroscopy spectra identified Be-7 in the sample. Be-7 is continuously generated in the upper atmosphere and washes out during rainstorms, concentrates in the low spots on the pads, then is absorbed onto particulates present. The Be-7 concentration in the sample of material collected from the Building 1022 loading dock pad was 23.2 pCi/g. This same material was noted on numerous other building pads with similar results.

PAD/BUILDING SURVEYS: CLASS 3

The results for the surveys of pads/buildings A-922, C-1131, C-1132, C-1133, C-1134, D-1121, D-1122, D-1123, D-1124, D-1125, E-1111, E-1112, E-1113, E-1114, E-1115, E-1116, F-732, F-733, G-722, G-723, G-724, G-725, G-726, I-531, I-631, I-632, I-633, I-634, I-636, I-641, I-634 Igloo, 821, 825, and 1021 are provided below.

Surface Scans

D-1125 and G-723

Gamma scans did not identify any elevated direct radiation on these pads. The scoping survey alpha plus beta scans identified one location of suspect elevated radiation on the Building D-1125 pad and the G-723 pad loading dock, where radiation levels were considered distinguishable from background. Therefore, the scans were increased up to 50% coverage during the scoping survey

with no additional findings. The characterization surface scans covered 85 to 95% of the pads. The characterization scan results were negative for elevated alpha plus beta/beta radiation at the initial suspect location on the Building D-1125 pad. Elevated direct alpha plus beta radiation was detected near the eastern edge of the pad in a low spot where the same humus-like material was present that had been noted at other locations on the site; a sample was collected. The characterization scans of the Building G-723 pad identified alpha plus beta radiation distinguishable from background on the southern end of the pad, also associated with the humus-like material. The suspect location identified during the scoping survey on the loading dock was reinvestigated and confirmed.

Remaining Class 3 A, C, D, E, F, G, I Line, 1021, 821, and 825 Pads/Buildings/Debris Piles

Surface Scans

Gamma scans did not identify any elevated direct radiation levels associated with pads/buildings or debris piles, with the exception of the terra cotta block. Beta scans identified one location of elevated radiation on a piece of metal within the building G-722 wall debris pile. A sample of the metal was collected for gamma spectroscopy analysis to determine if the observed activity was the result of thorium or deposited radon-222 progeny that has been noted in the past on similar materials. Elevated levels of naturally occurring Pb-210 were identified with no indications of the presence of thorium. The remaining alpha plus beta/beta-only scans did not identify any other locations with radiation levels distinguishable from background.

Surface Activity Levels

Total and removable surface activity levels are provided in Tables 2 and 3 for the Phase 1 scoping and characterization surveys and Phase 2 scoping surveys, respectively and total beta activities are summarized below for each Class 3 building line according to classification. All surface activity data presented represents net surface activity values above background.

Pads/Buildings	Total Beta Activity Range (dpm/100 cm^2)	Number of Measurements > 400 dpm/100 cm^2
A-922	-380 to 230	0 of 15
C-1131, C-1132, C-1133, C-1134	-110 to 170	0 of 63
D-1121, D-1122, D-1123, D-1124, D-1125	-800 to 370	1[a] of 79
E-1111, E-1112, E-1113, E-1114, E-1115, E-1116	-250 to 250	0 of 94
F-732, F-733	-240 to 290	0 of 29
G-722, G-723, G-724, G-725, G-726	-190 to 510	2[b] of 76
I-531, I-631, I-632, I-633, I-634, I-636, I-641, Igloo	-320 to 220	0 of 120
821, 825, 1021	-140 to 270	0 of 40

[a]Activity at the location on the D-1125 pad was associated with a humus-like residue.

[b]Activity at two locations on the G-723 pad were associated with a humus-like residue.

Radionuclide Concentrations in Miscellaneous Samples

The radionuclide concentration results for Th-232 and U-238 in the humus-like miscellaneous sample collected from the Building D-1125 pad are provided in Table 4. The concentrations were 0.80 and 0.40 pCi/g for Th-232 and U-238 respectively. A review of the gamma spectroscopy spectra also identified Be-7 in the sample at a concentration of 18.9 pCi/g.

EXTERIOR SURVEYS: CLASS 1

Surface scan and soil sampling results for exterior Class 1 areas are described below. Figure 2 shows scoping survey land area classifications and Figure 3 shows characterization survey land area classifications. The characterization survey Class 1 areas included the former radiological waste burial area, the northern two-thirds of the B Line, the southern end of the F Line surrounding Buildings F-735 and F-736, an area of the southern G Line, and area adjacent to the Building 821 driveway.

Surface Scans

Scoping survey gamma radiation surface scans concentrated on transport routes across the site and the land areas surrounding buildings that had historically stored licensed material. These scan results were then used to further refine land area classifications for characterization. The scoping survey scans identified areas of elevated direct radiation on the B Line road across from Building B-912, an area adjacent to the Building 821 driveway, an area near the northwest corner of Building F-735, two areas south of Building F-736 on both the north and south sides of the F Line Road/Furnace Creek Road intersection, and an area west of Building G-726 on Furnace Creek Road. All of these areas had been initially classified as Class 2 areas at the time of the scoping survey, but were reclassified as Class 1 for the characterization survey. Scoping survey scans of the former radiological waste burial area surface did not identify any elevated direct gamma radiation. However, gamma scans of the test pits that were dug in the former radiological waste burial area did identify the presence of elevated gamma radiation levels associated with visible debris found within several of the pits.

The characterization surface scans significantly expanded on the limited scoping survey coverage within the four Class 1 areas shown on Figure 3. The characterization survey confirmed the scoping survey areas of concern (AOCs) as well as other, related locations identified in Class 2 areas that were immediately contiguous with the Class 1 survey area and AOC boundaries. These locations are discussed in the Exterior Surveys: Class 2 section below. There were numerous other distinguishable from background locations that were investigated. These investigations, including rescanning all and sampling many of the areas, did not result in the addition of any other AOCs, but identified gamma radiation background variations resulting from the presence of railroad cinders, residual ores, culverts, debris piles, different soil types, or vegetative cover. Figures 57 and 59 through 61 show overall scoping survey and characterization survey Class 1 area gamma scanning results.

Radionuclide Concentrations in Soil Samples

The concentrations of Th-232 and U-238 for individual scoping and characterization survey soil samples are provided in Tables 5 and 6. The table below provides a summary of the range of

activities for Class 1 areas at the time of the characterization survey. All radionuclide concentration data presented are gross data that have not been corrected for background contributions.

Area	Radionuclide Concentration (pCi/g)		
	Th-232	U-238	Number of Samples >2.9 net pCi/g Th-232
Class 1 Samples	0.28 to 453	0.10 to 29	25 of 168

The analytical results identified residual low-level Th-232 contamination to be present beginning between 0.5 to 2 meters depth in the former disposal area and potentially extending to depths in excess of 4 meters in some zones. Distributed areas of Th-232 contamination are also present, with a corresponding increase in the U-238 activity concentrations, in the area near the northwest corner of Building F-735, two areas on either side of the F Line Road/Furnace Creek Road intersection between Buildings F-736 and F-737, as well as several other associated, nearby isolated locations on the F Line Road. There are also localized strips of contamination present on the G Line Road, the B Line Road, and the Building 821/825 driveway. All such sample locations are shown and color coded on Figure 72. In addition to the contamination in the initial 15 cm soil thickness at these locations, the contamination was found to extend to a depth of 30 cm at the AOC at the northwest corner of Building F-735.

EXTERIOR SURVEYS: CLASS 2

Surface scan and soil sampling results for exterior Class 2 areas are described below. The initial scoping survey Class 2 areas are shown on Figure 2. There were four general characterization survey Class 2 areas that are illustrated on Figure 3.

Surface Scans

Scoping survey gamma scans of the land areas that had initially been designated as Class 2 also concentrated on transport routes across the site and the land areas surrounding buildings, or the

building footprints if demolished, that had historically stored licensed material. These scans identified numerous locations of elevated gamma radiation considered to be distinguishable from background. These locations, in addition to those discussed above in the Class 1 results section, were within several locations associated with the railroad tracks—two on the southeast, one to the northeast side, and two on the north of the site—on the edge of Yard Office Road near East Avenue, on East Avenue, and the former K Line (Figure 57). Each area was investigated further during the scoping survey with follow-up surface scans and judgmental sampling

The characterization surface scans significantly expanded on the limited scoping survey coverage within all Class 2 areas, with additional focus on suspect areas or areas similar from a historical use perspective to suspect areas. The characterization survey also independently identified the suspect areas noted above. Additionally, with the significantly expanded scope of the characterization survey surface scans, other anomalies were identified. These anomalies included small isolated locations on the west side of Patrol Bridge Road and due east of the C-1134 and C-1133 pads, the former Building K-611 footprint, the B Line road east of Building B-913, and on the rail spur bank next to Building I-632. There were numerous other areas that were investigated and determined to be false positives due to the presence of railroad ballast, ores, cinders, debris, and other similar type materials that locally impacted the ambient gamma radiation background. Figures 62 through 65 show the gamma scan results.

Radionuclide Concentrations in Soil Samples

The concentrations of Th-232 and U-238 for individual scoping and characterization survey judgmental and systematic soil samples are provided in Tables 5 and 6. The table below provides a summary of the range of activities for areas classified as Class 2 at the time of the characterization survey. All radionuclide concentration data presented are gross data that have not been corrected for background contributions.

Area	Radionuclide Concentration (pCi/g)		
	Th-232	U-238	Number of Samples >2.9 net pCi/g Th-232
Class 2 Samples	0.13 to 38.8	0.08 to 11.2	11 of 138

The analytical results for judgmental samples identified residual low-level Th-232 contamination to be present in the surface soil in five areas: the boundary of the AOCs at the F Line/Furnace Creek Road AOC (samples 348 and 349), the edge of Patrol Bridge Road (sample 151), the edge of Yard Office Road (samples 26, 299, and 300), the former Building K-611 footprint (sample 301), and across the B Line Road from Building B-913 (sample 302). An elevated soil sample containing uranium, although not associated otherwise with corresponding Th-232 contamination, was identified in the sample adjacent to Building I-632 (sample 341). Several other judgmental samples were also identified with elevated concentrations of Th-232/U-238, but were the result of natural concentrations in ores and railroad ballast. All such sample locations are shown and color coded on Figure 72. There were no indications of residual contamination in any of the Class 2 systematic samples.

EXTERIOR SURVEYS: CLASS 3

Surface scan and soil sampling results for exterior Class 3 areas are described below. The initial scoping survey Class 3 areas are shown on Figure 2. There were five characterization Class 3 survey units that are illustrated on Figure 3.

Surface Scans

Scoping survey gamma scans of the land areas that had initially been designated as Class 3 focused primarily on transport routes and the perimeters of pads/buildings. There were no areas of elevated direct radiation identified.

The subsequent characterization survey significantly expanded the scan coverage and identified several locations of direct gamma radiation distinguishable from background for further investigation. These investigations, which included follow-up gamma scans and judgmental sampling when indicated, identified three AOC within the Class 3 area designated as Survey Unit 4, one of which was also investigated during the scoping survey and was associated with railroad ballast. The remaining two locations were found within a former tin storage yard. The investigations of the elevated direct gamma radiation at the first location identified a small rock within the accompanying soil that when segregated was found to be the source of the anomaly. The second location was due to the presence of a large sand pile. The remaining scans and re-investigations identified several additional areas for judgmental sampling.

Radionuclide Concentrations in Soil Samples

The concentrations of Th-232 and U-238 for individual scoping and characterization survey judgmental and random soil samples are provided in Tables 5 and 6. The table below provides a summary of the range of activities for areas classified as Class 3 at the time of the characterization survey. All radionuclide concentration data presented are gross data that have not been corrected for background contributions.

Area	Radionuclide Concentration (pCi/g)		
	Th-232	U-238	Number of Samples >2.9 net pCi/g Th-232
Class 3 Samples	0.10 to 3.38	0.12 to 3.5	0 of 76

The analytical results for judgmental samples identified Th-232 and/or U-238 activity in three samples that were slightly above site backgrounds but were collected from either railroad ballast (sample 158 within Survey Unit 4)) or rail spur cinders (sample 344 with Survey Unit 2). The third sample (sample 149) was collected from the large sand pile in the storage yard of Survey Unit 4. Although the origin of the pile is not known at this time, the observed activity concentrations are not indicative of source material and the observed U-238 activity is likely a natural variant of

background. The investigation of a fourth area, (sample locations 148 and 408) discovered a small rock within the soil (miscellaneous sample 13) that caused the elevated direct radiation level. Table 4 provides semi-quantitative results showing elevated Th-232 and U-238 activity levels. The origin of the rock is not known and may be natural. The analytical results for all other judgmental and all random samples did not identify any indications of residual Th-232 or U-238 activity concentrations from licensed activities. Figure 72 provides a color-coded representation of these results.

BACKGROUND REFERENCE AREA

The results for background reference area and off site railroad ballast samples are provided in Table 5 and are summarized below.

Area	Radionuclide Concentration (pCi/g)	
	Th-232	U-238
Background Reference	0.50 to 1.32	0.34 to 1.21
Railroad Ballast	1.25 to 1.64	1.58 to 2.35

DISCUSSION OF RESULTS AND RECOMMENDATIONS

The contaminant of concern for the CBD is primarily thorium with the potential for lesser quantities of uranium. All scoping and survey characterization survey results for the vast majority of the pads/buildings (45 of 50) and land areas (>99%) satisfied the proposed $DCGL_W$s and supported either the initial survey classifications or provided sufficient data to revise the classification for final status surveys. However, the scoping and characterization surveys confirmed contamination on surfaces of the following pads/buildings: B-911 (extensive), B-912 (extensive/Class 1), B-913 (isolated), F-731 (isolated), F-737 (isolated), and G-723 (isolated). In addition to structural surface contamination, there is sub-floor soil contamination, due to migration of material through floor cracks, beneath Building B-911, and also contamination beneath the loading dock. Although not investigated, there is a potential for sub-floor soil contamination beneath Building B-912 should

material have migrated through the expansion joints which are intact. A complete discussion of each contaminated pad/building is provided below. Low-level contamination was also determined to be present on the overhead trusses in Buildings B-911 and B-912. The activity levels identified on Class 1 Buildings F-731 and F-737 surfaces were low-level, ranging from 410 to 32,000 dpm/100 cm^2, and were localized. The contamination in Class 2 Building B-913 was significant but localized to two small areas. The activity measured on the Class 3 structure, G-723, was limited to one location measuring 420 dpm/100 cm^2. Surveys did not identify any indications of residual activity on all the remaining pads/buildings or debris piles.

Contaminated surface soils were determined to be present over a broad area on the F Line road and at the juncture of the F Line Road with Furnace Creek Road. Contaminated subsurface (beginning at approximately one meter below the ground surface) soil is present within the former radiological waste disposal area. Other isolated AOCs were identified next to roadways or associated with current or former buildings. Each of these AOCs is discussed independently below.

BUILDING AOCS

Building AOC locations are shown on Figure 73.

Building B-911

The Building B-911 floor is extensively contaminated and will require remediation of the entire 1020 m^2 surface. The lower walls were also contaminated at four isolated locations over a total area of approximately 1 m^2. The four most northern overhead roof trusses were confirmed to have a removable contaminated dust layer covering approximately 60 linear meters. The gable vent on the north wall is also contaminated and should be removed.

Sub-floor soil contamination is expected to be extensive. There are approximately 200 linear meters of floor cracks/expansion joints with probable contamination that has penetrated to varying depths within the floor slab, dependent upon the width of the crack and integrity of the expansion joint. One of the cracks was investigated and sub-floor soil contamination found to extend at least through 60 cm in depth beneath the crack. Contamination was also confirmed within the initial 15 cm of soil at a distance of 1 meter from the crack. The extent of sub-floor soil and floor/wall

interface contamination will require investigation during the remediation of the structure. For initial planning assumptions, the best estimate is that 100 m^3—based on a 200 meter migration pathway, two meters wide, and 0.5 decreasing to 0.15 meters deep—of soil will require excavation. Approximately 60 m^3 of concrete would be removed to access the soils. The exterior loading dock is also contaminated over 1 to 2 m^2 and an initial area of approximately 0.5 m^2 of contaminated soil is beneath the loading dock. Because 100% of the soil beneath the loading dock has not been investigated, there is a potential for other similar isolated locations that can be investigated during remedial actions.

Building B-912

Similar to Building B-911, most of the 1020 m^2 floor surface of Building B-912 is contaminated and should be remediated. The integrity of the floor of this building was such that floor cracks had not developed. There are however approximately 20 linear meters of contaminated expansion joints, with possibility that sub-floor soil contamination may be present at these locations. Isolated contamination is present on the lower walls at four locations covering an area of 1 to 2 m^2. Two overhead trusses were also identified with low-level contamination at isolated locations.

Building B-913

Minimal, isolated contamination was identified on the floor. The total area was 0.2 m^2 associated with two locations. Additionally, a contaminated drum is present that will require removal.

Building F-731

The Building F-731 has numerous isolated locations of both fixed and removable contamination over approximately 10 m^2. The contamination in the southwest corner of the building was determined to be associated with a dust layer as determined by a sample of the dust (miscellaneous sample 11) and a surface activity measurement on the floor following removal of the dust. The contamination at the remaining floor locations is fixed and will require scabbling. Two 0.1 m^2 areas of contamination were identified on the lower west wall. No contamination was identified on the overhead surfaces.

Building F-737 Pad

There were eight isolated locations of residual contamination on the Building F-737 pad. The total area was approximately 2 m^2. There is also one area measuring approximately 5 m^2 of low-level sub-pad contamination.

Building G-723 Pad

There is one isolated location of suspect residual contamination on the Building G-723 pad. The total area was approximately 1 m^2.

SOIL AOCS

Soil AOC locations are shown on Figure 73.

AOC 1: Former Radiological Waste Burial Area

Low-level residual contamination was identified in a number of the subsurface samples collected from the burial area. In general, the contamination was associated with visible debris. Seven of the twelve boreholes showed residual Th-232 contamination present in at least one of the depth interval samples indicating that pockets of subsurface contamination remains beginning at between 0.5 to 2 meters in depth and extending in some cases past 4 meters in depth. The estimated volume of potentially impacted soil is 470 m^3 based on a weighted average depth of contamination over a 440 m^2 area. Actual volumes are expected to be less than this estimate. The maximum observed Th-232 concentration was approximately 20 pCi/g.

AOC 2: Patrol Bridge Road, South

AOC 2 is an isolated 1 m^2 area located to the west of Patrol Bridge Road and due east of the Building C-1134 and C-1133 pads on the southeast end of the site. The maximum observed Th-232 concentration was 94 pCi/g. The volume of contaminated soil is estimated to be 0.3 m^3.

AOC 3: Building F-735 Area

The area of soil contamination identified near the northwest corner of Building F-735 covers an area of approximately 200 m^2 to a depth of 0.3 meters. The total volume of soil is therefore estimated to be 60 m^3. The maximum observed Th-232 concentration was approximately 50 pCi/g.

AOC 4: Furnace Creek Road/F Line Road, South of Building F-736

The area of contamination is estimated to be 100 m^2 to a depth of 0.15 to 0.3 meters. The total volume of soil is 30 m^3 with a maximum observed Th-232 concentration of 84 pCi/g. Subsurface samples could only be collected to a depth of 20 cm due to interfering subsurface rock/ore.

AOC 5: Furnace Creek Road/F Line Road, North of Building F-737

This AOC is directly across the road from AOC 4 and measures approximately 60 m^2 in area. Subsurface samples could not be collected in the area due to large pieces of rock at the 15 centimeter depth. The volume estimate of 18 m^3 is therefore based on the results from other site locations where contamination was limited to the initial 0.3 meters. There are also several related small AOCs each measuring less than 5 m^2 within the contiguous area. The maximum observed Th-232 concentration was approximately 450 pCi/g.

AOC 6: Furnace Creek Road

AOC 6 is a narrow zone of contamination on the edge of Furnace Creek Road due west of Building G-726. The 80 m^2 area is contaminated at a maximum Th-232 concentration of approximately 8 pCi/g in the uppermost 0.15 meters. The corresponding volume of soil is 12 m^3.

AOC 7: B Line Road, Building B-913

AOC 7 is a small, isolated location east of Building B-913 in a lay down/parking area. The area is less than 2 m^2. Subsurface samples were not collected, although contamination depth is not expected to exceed the initial 0.3 meter depth interval. The estimated volume of soil is 0.6 m^3 with a maximum Th-232 concentration of approximately 40 pCi/g.

AOC 8: B Line Road, Building B-912

AOC 8 was identified as a narrow strip on the edge of the B Line road due east of Building B-912. The 20 m^2 area is contaminated to a depth of 0.15 meters with a maximum Th-232 concentration of approximately 18 pCi/g. The estimated impacted soil volume is 3 m^3.

AOC 9: Driveway, Building 821/825

AOC 9 measures approximately 5 m^2 in area and is located at the edge of the driveway that enters the Building 821/825 complex. The contamination is approximately 0.15 meters in depth with a maximum Th-232 concentration of approximately 20 pCi/g.

AOC 10: Building I-632

AOC 10 is approximately 5 m^2 in size with contamination extending to 0.15 meters. The identified contaminant was U-238 at a concentration of approximately 12 pCi/g. This was the only sample collected where the U-238 concentration was significantly elevated without a corresponding elevated activity concentration result for Th-232. Soil volume is estimated to be 0.75 m^3.

AOC 11: Building K-611 Footprint

AOC 11 was identified as a small 2 m^2 area with a Th-232 concentration of approximately 10 pCi/g. The estimated volume of soil is 0.3 m^3.

AOC 12: Yard Office Road

AOC 12 is located in the northern section of the site on Yard Office Road. The area is approximately 24 m^2 in size with a maximum Th-232 concentration of approximately 6 pCi/g. The depth of contamination is limited to 0.15 meters. The volume of impacted soil is therefore estimated to be 3.6 m^3.

Other Investigations

There were numerous exterior field investigations performed during the characterization survey for locations where the audible gamma radiation count rate data during the initial scans were determined to be distinguishable from the area-specific ambient gamma background or the gamma scanning data capture indicated anomalies. These follow-up investigations included rescanning, site reconnaissance, and collection of soil samples when warranted. These investigations coupled with the analytical results for soil samples, determined the following information. There were numerous other locations investigated within the former J and K Line area where AOC 11 was identified. However, in each case the Th-232 activity was below the proposed guideline, the accompanying corresponding U-238 activity, and the proximity of the area to ore piles coupled with the visual identification of ore residues throughout this portion of the property provided evidence that the remaining investigated locations were not impacted by licensed activities and are not included for further action within this AOC area. Several samples collected from railroad lines and spurs contained elevated concentrations of Th-232 and U-238 when compared with the reference area sample concentrations. However, the observed levels are common to ballast material and are comparable to similar ballast samples collected off-site. Other areas investigated also were the result of ore residues found throughout the site. As an example, sample 156 represented a visible spilled ore deposit identified on a railroad track. The Th-232 activity in this sample approached 8 pCi/g. Other similar ore deposits were noted throughout the site. Other miscellaneous anomalies were determined to be due to terra cotta debris, culverts, and cinders.

SUMMARY AND RECOMMENDATIONS

At the request of the Oak Ridge National Laboratory on behalf of the of the Defense Logistics Agency, the Oak Ridge Institute for Science and Education conducted radiological scoping and characterization surveys of the Curtis Bay Depot. Scoping surveys were performed in two phases during the periods June 13 through 22 and October 24 through 27, 2005. The characterization survey was performed from May 1 through 19, 2006 with additional data gap evaluations performed on July 25 and 26, 2006. The surveys included visual inspections and radiological surveys performed in accordance with area classification that included surface scans, total and removable surface

activity measurements, soil sampling, and miscellaneous material sampling. Figures 74 through 77 provide a photo record of many of the survey activities and results.

The results of the surveys overall validated the initial findings for building classifications provided in the historical site assessment. Extensive contamination was confirmed in Buildings B-911 and B-912. Of the remaining 48 pads/buildings that were surveyed, contamination was identified in four additional pads/buildings, two of which had been initially designated as Class 2 or 3. Soil area surveys identified 12 areas of contamination, including subsurface contamination within the former burial area. Thorium was the predominant licensed material identified in samples.

Recommendations for further site activities include remediation of the identified areas of concern and performance of final status surveys as applicable. The scoping survey building data and exterior soil area gamma scan data were collected to fulfill the requirements for final status survey data quantity and quality for those building and exterior areas where no further action is required. The applicable data will be evaluated further once the proposed site-specific DCGLs are approved and all final status survey components are completed.

FIGURES

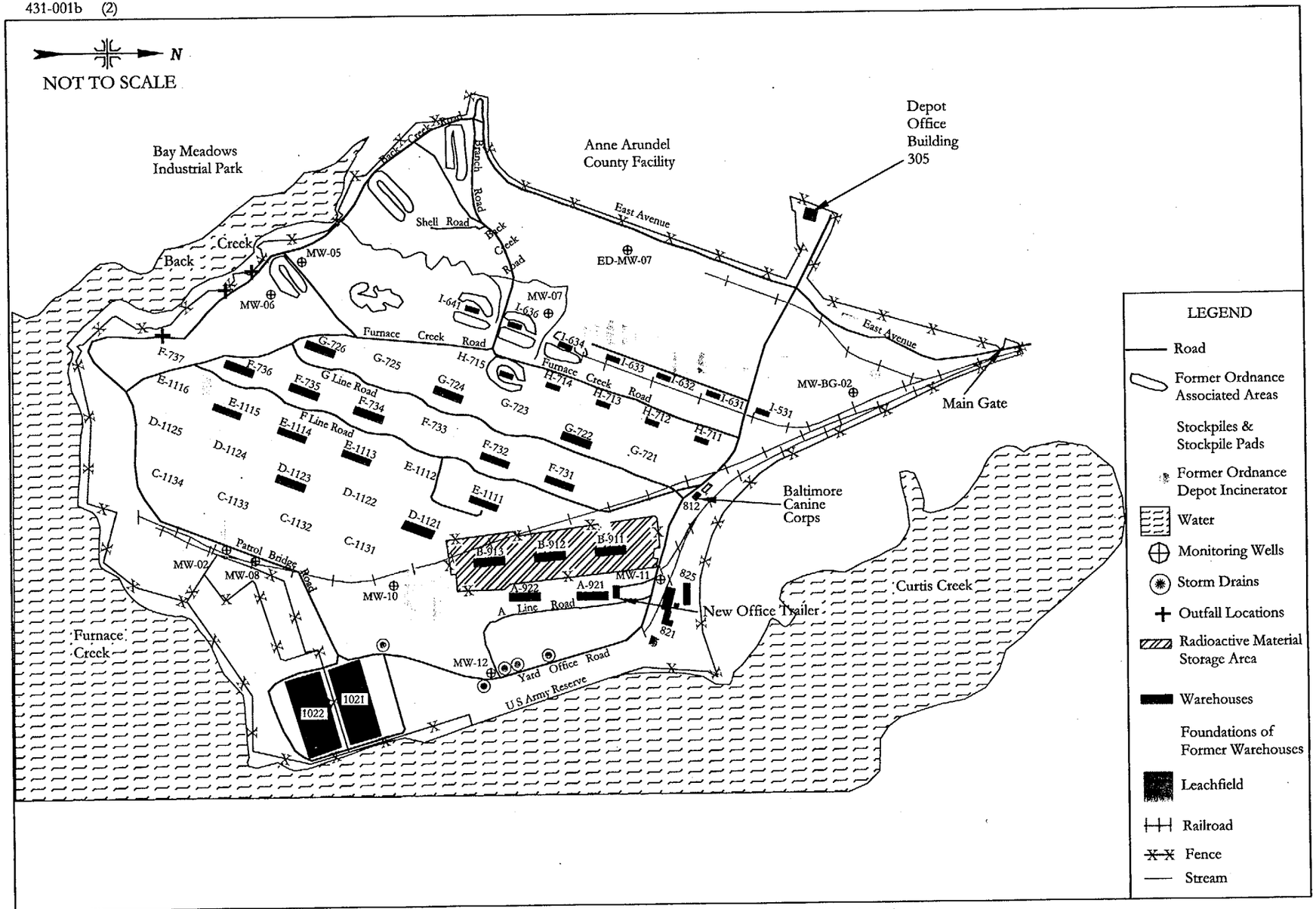


FIGURE 1: Curtis Bay Depot, Curtis Bay Maryland - Plot Plan

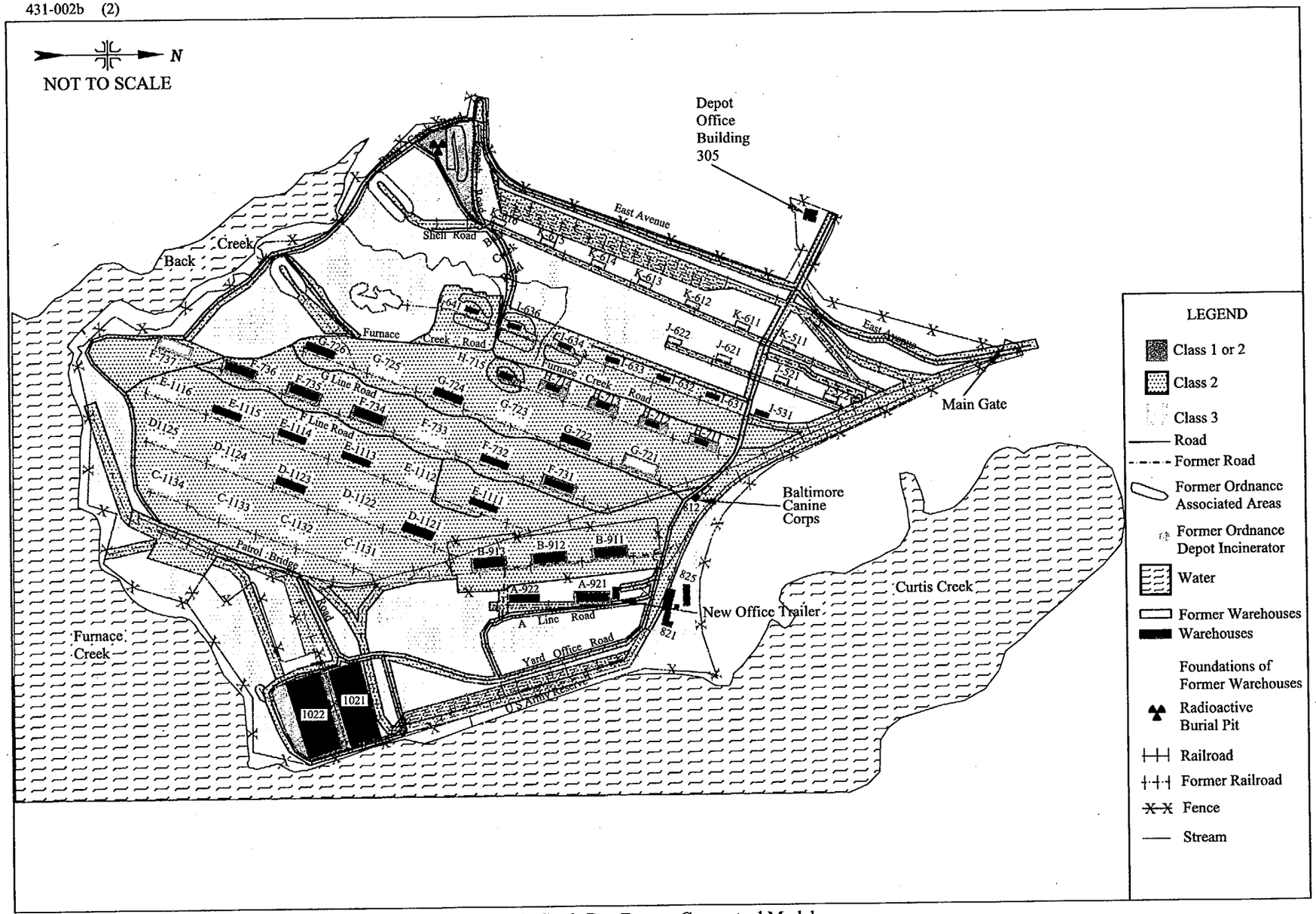


FIGURE 2: Curtis Bay Depot - Conceptual Model

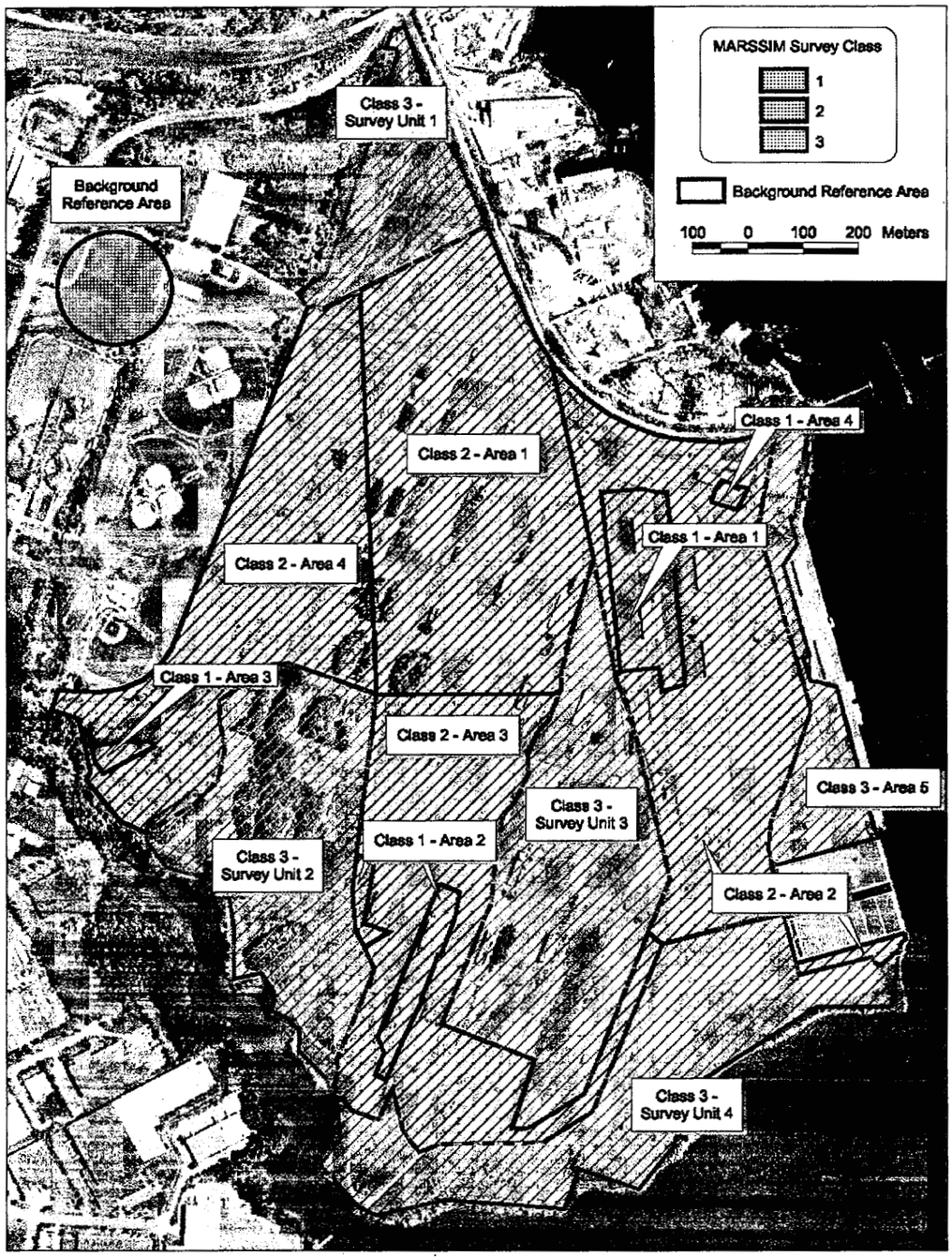


FIGURE 3: Curtis Bay Depot—Land Area Classification

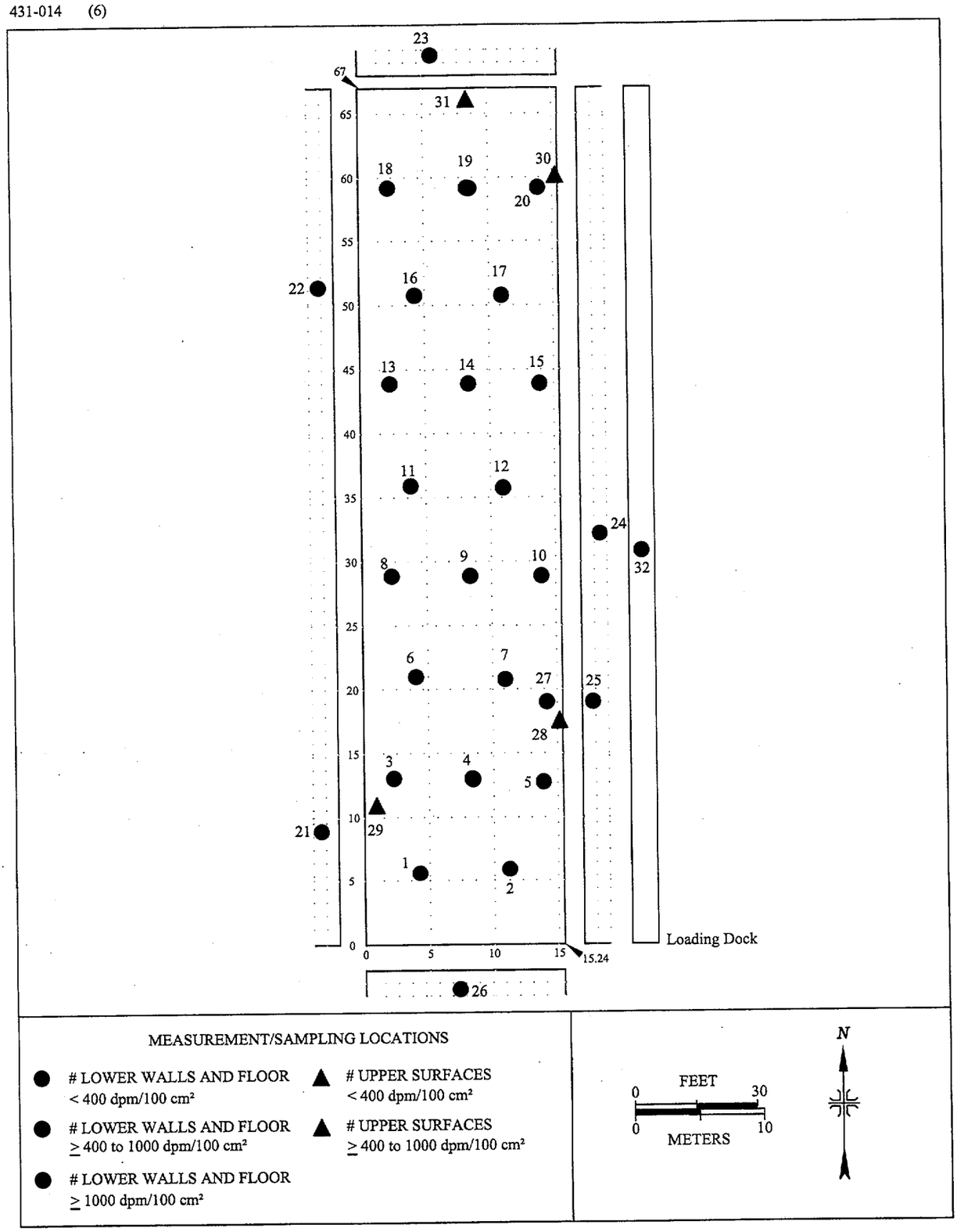


FIGURE 4: Building B-911 - Scoping Survey Measurement and Sampling Locations

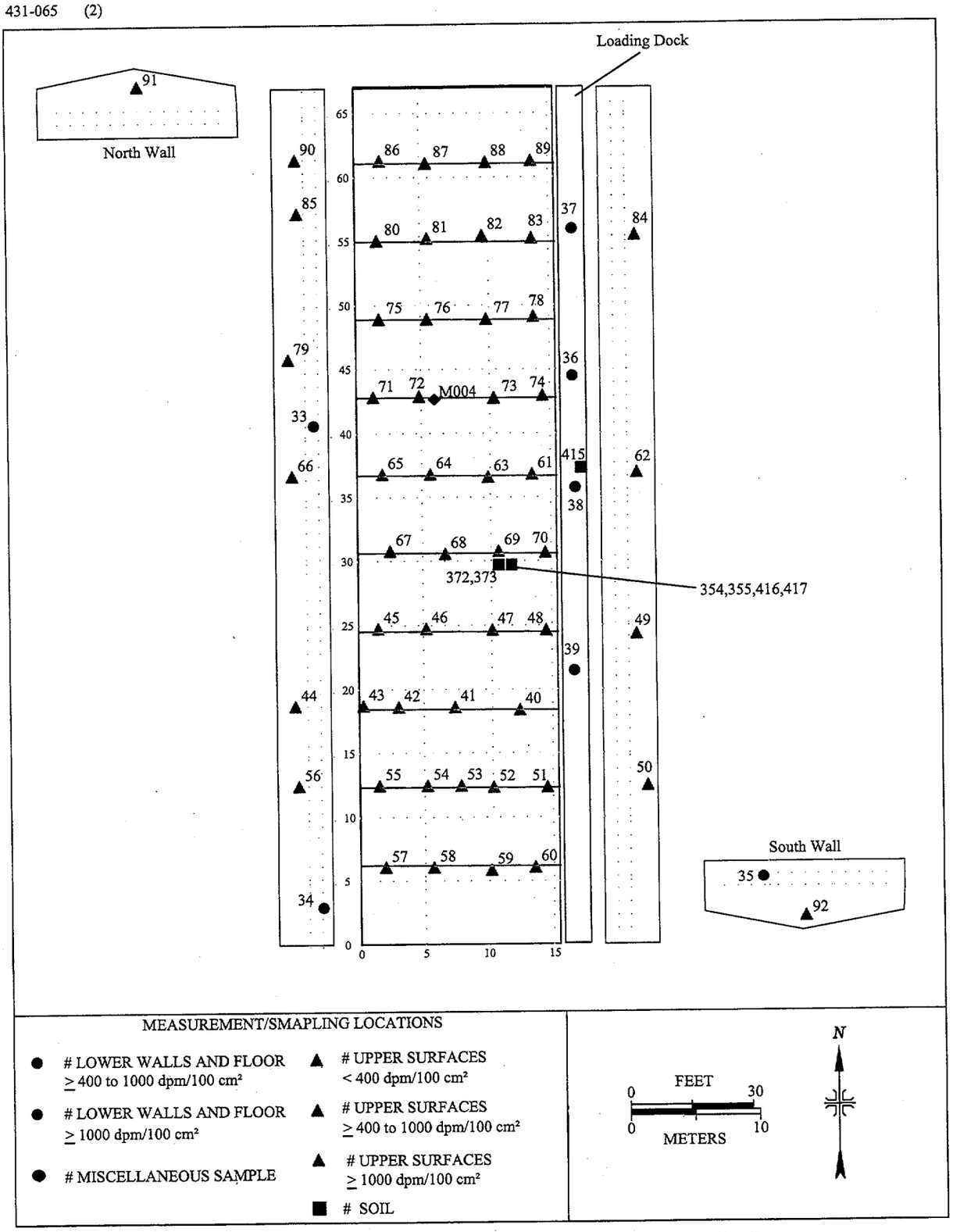


FIGURE 5: Building B-911 - Characterization Survey Measurement and Sampling Locations

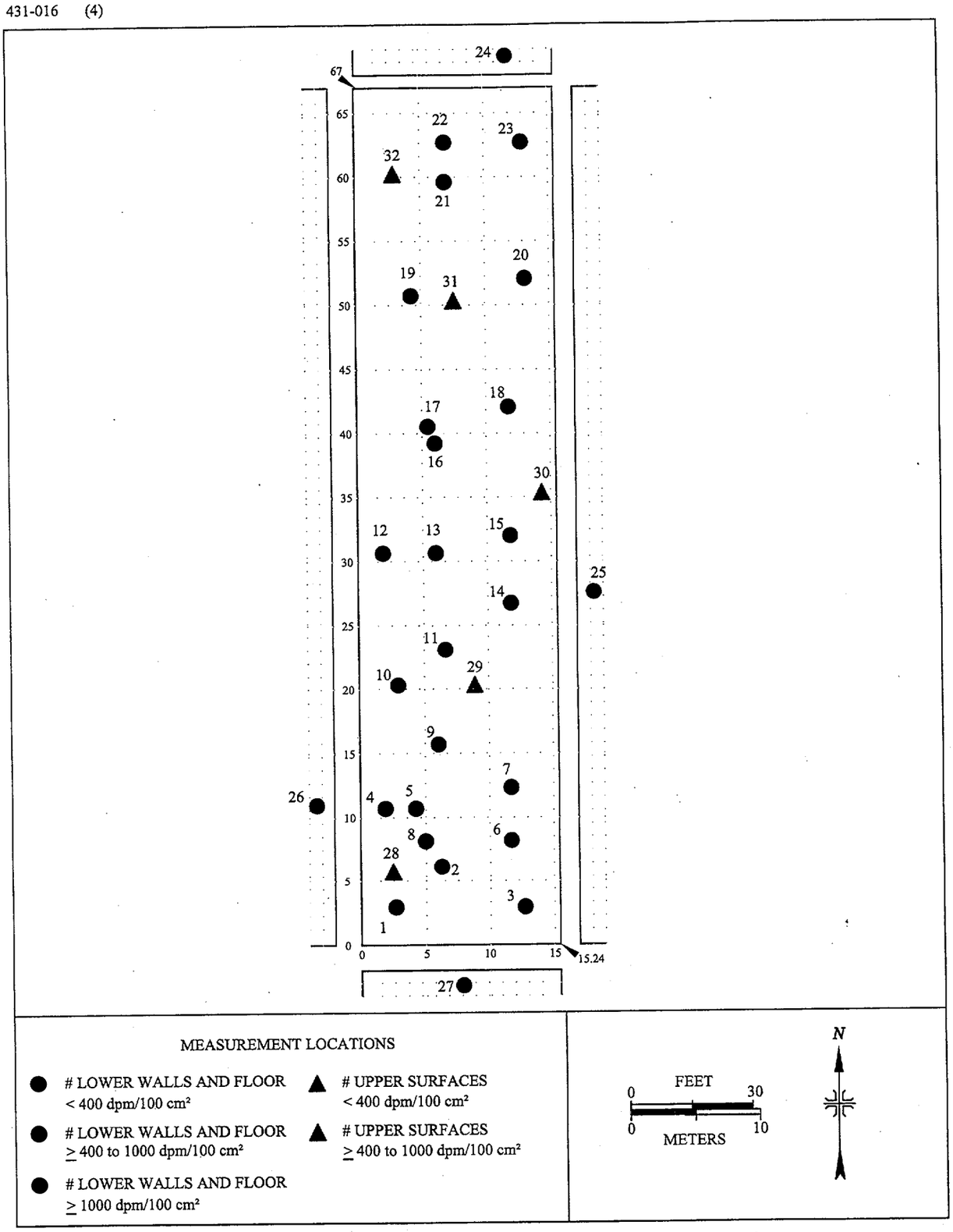


FIGURE 6: Building B-912 - Lower Surfaces Measurement Locations

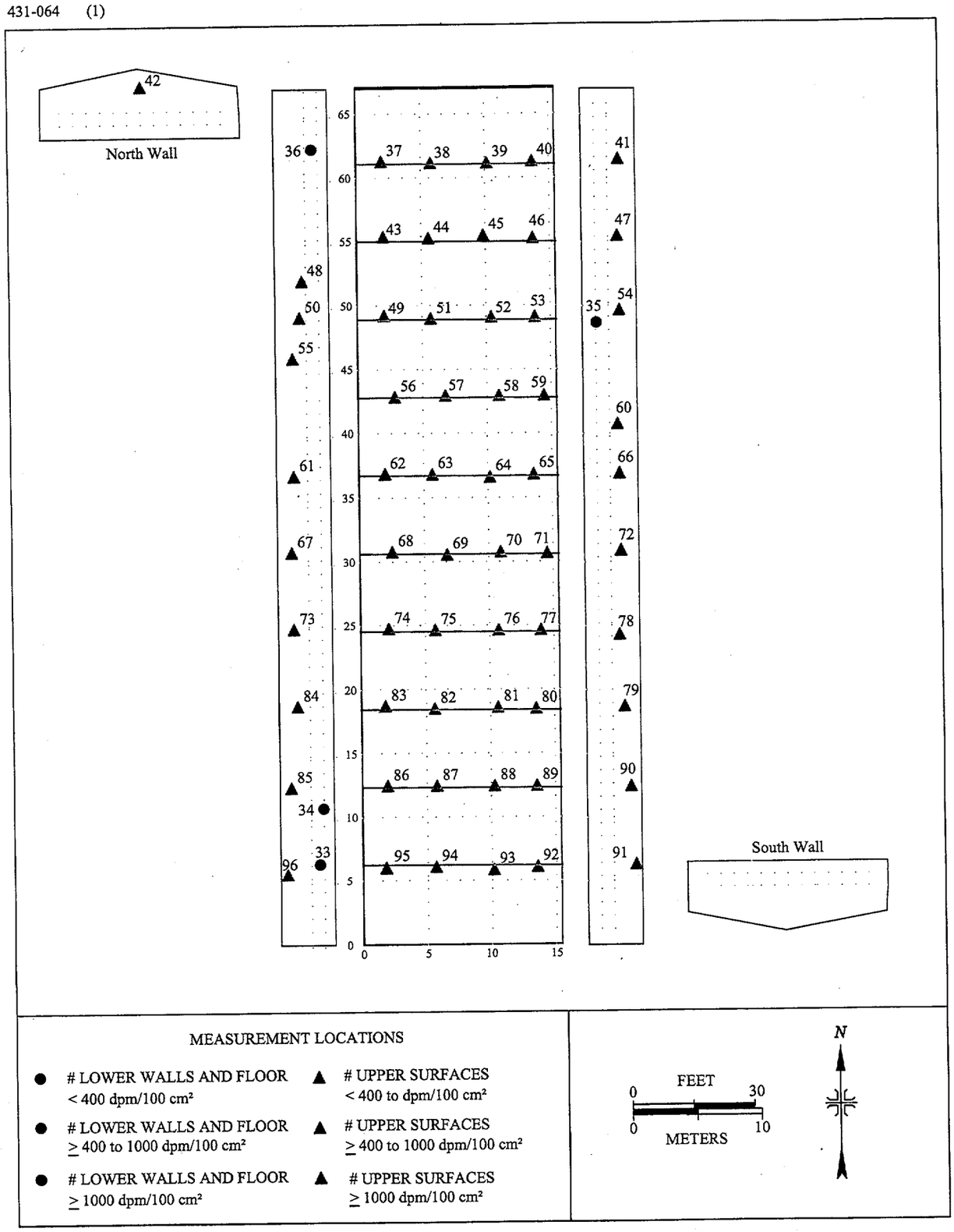


FIGURE 7: Building B-912 - Upper Surfaces Measurement Locations

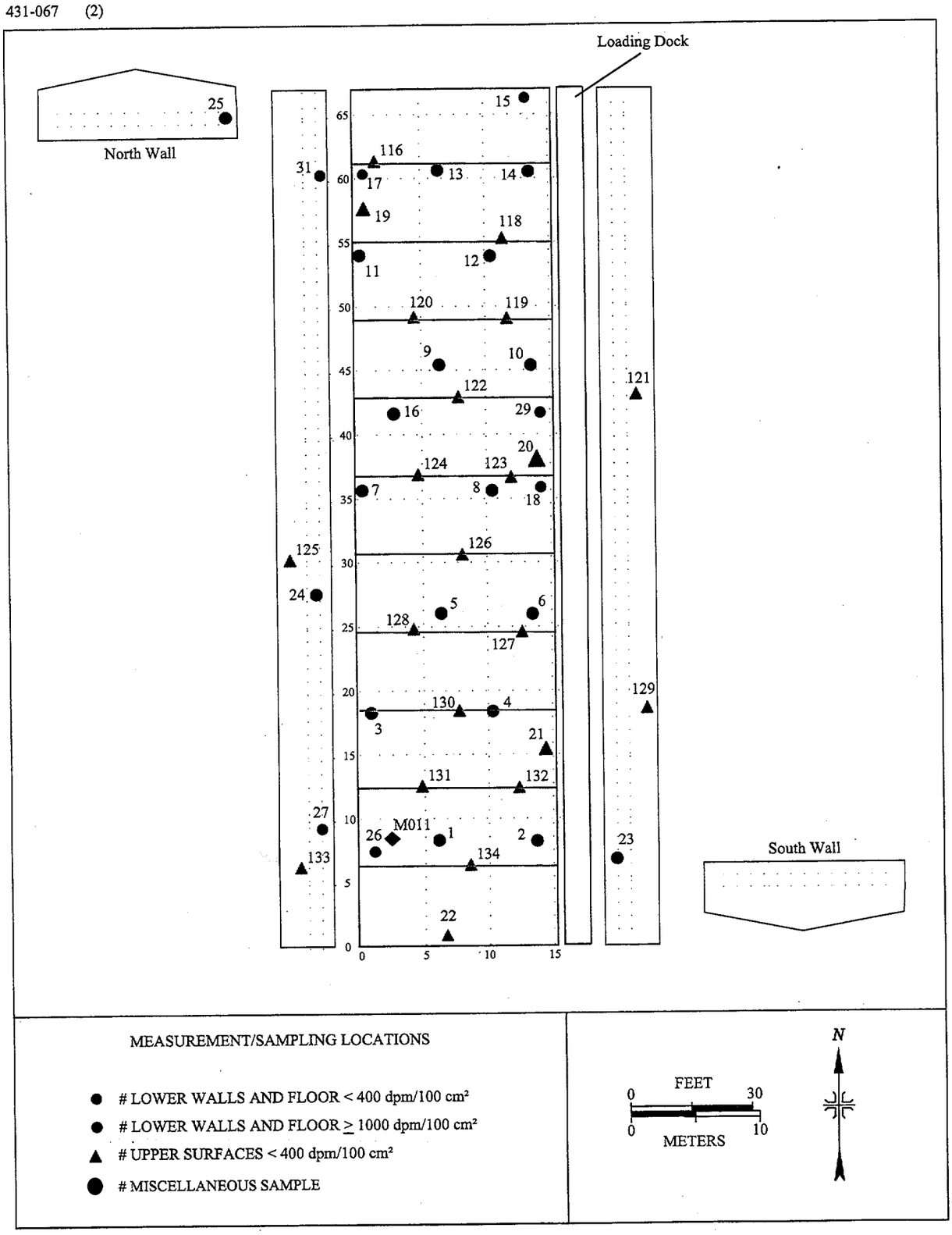


FIGURE 8: Building F-731 - Measurement and Sampling Locations

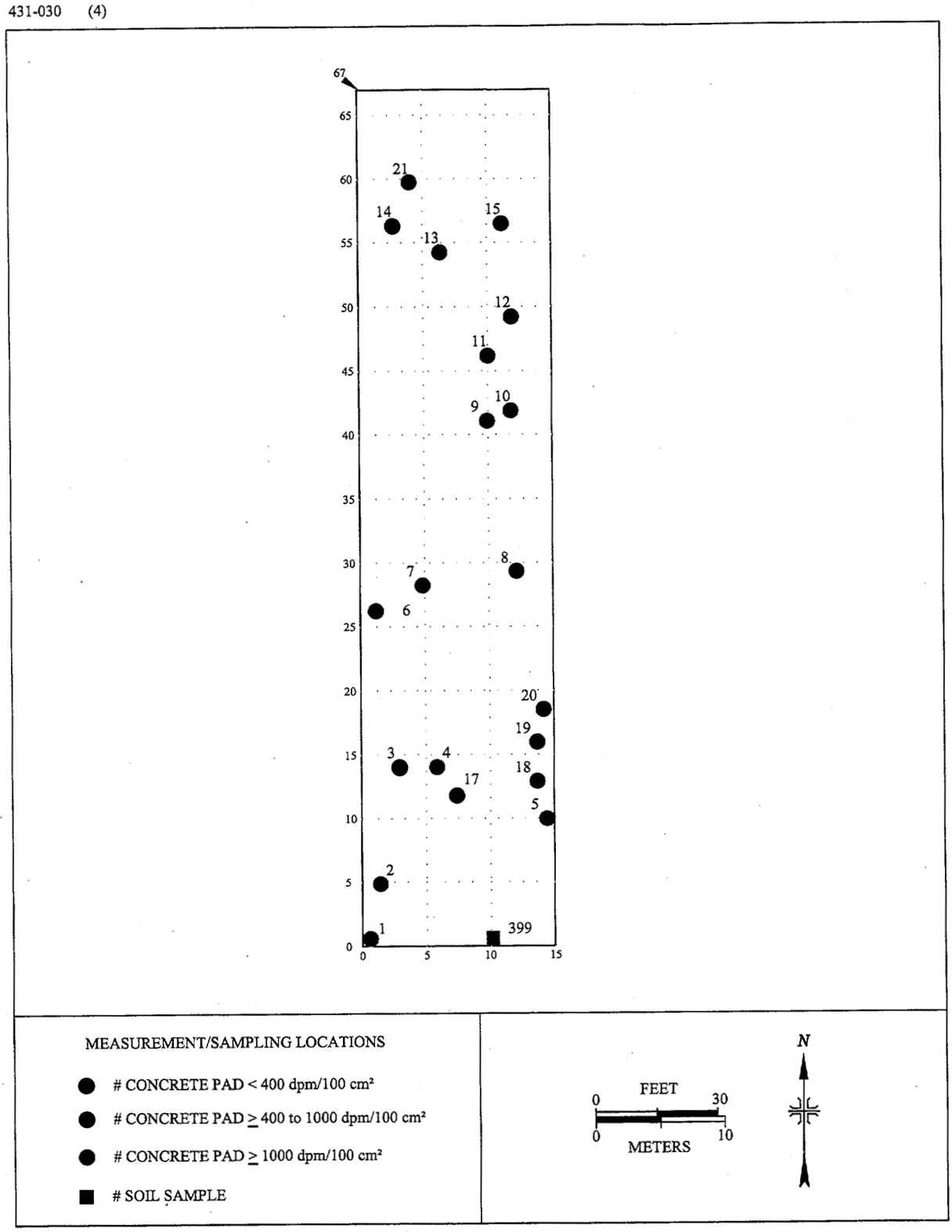


FIGURE 9: Building F-737 - Measurement and Sampling Locations

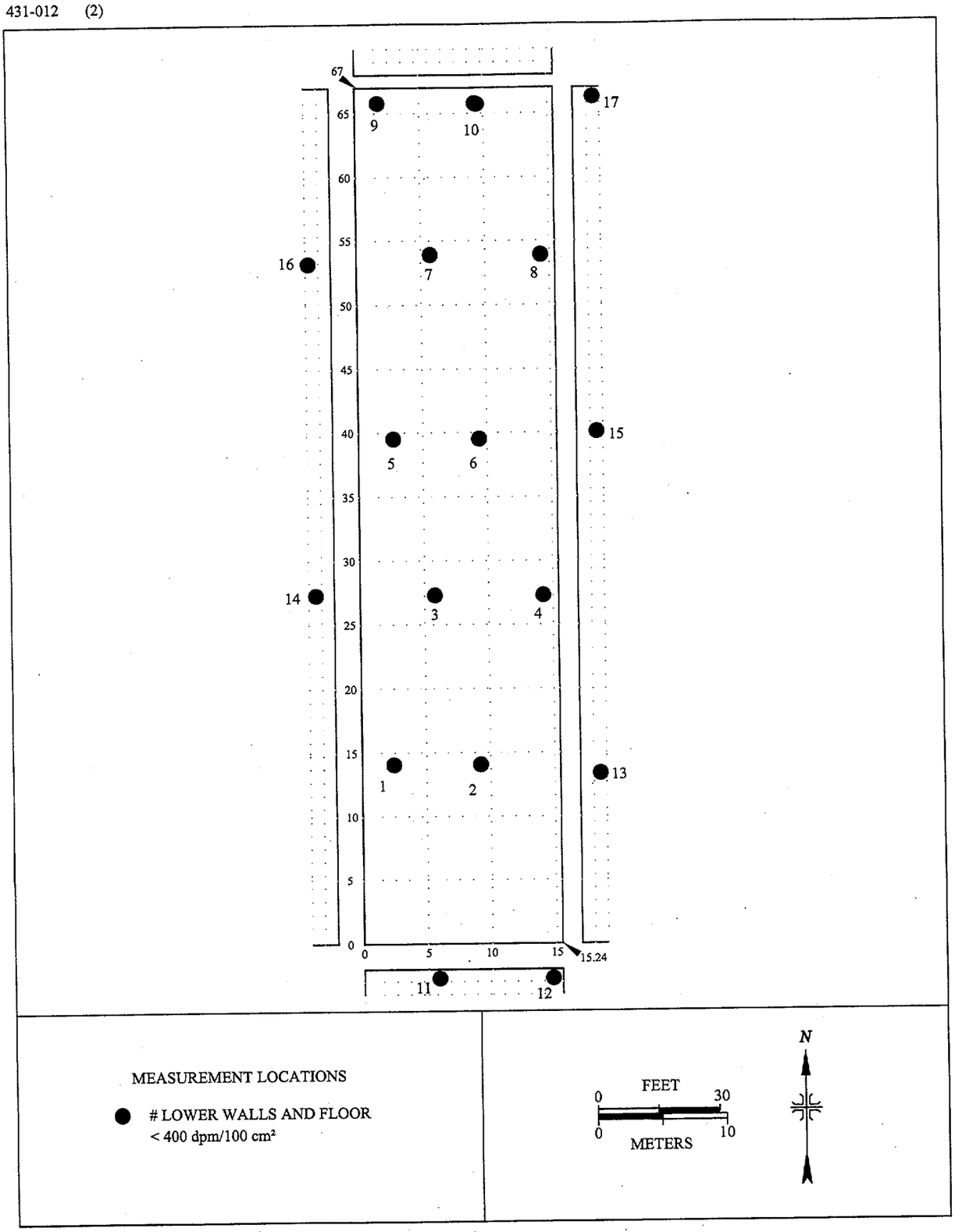


FIGURE 10: Building A-921 - Measurement Locations

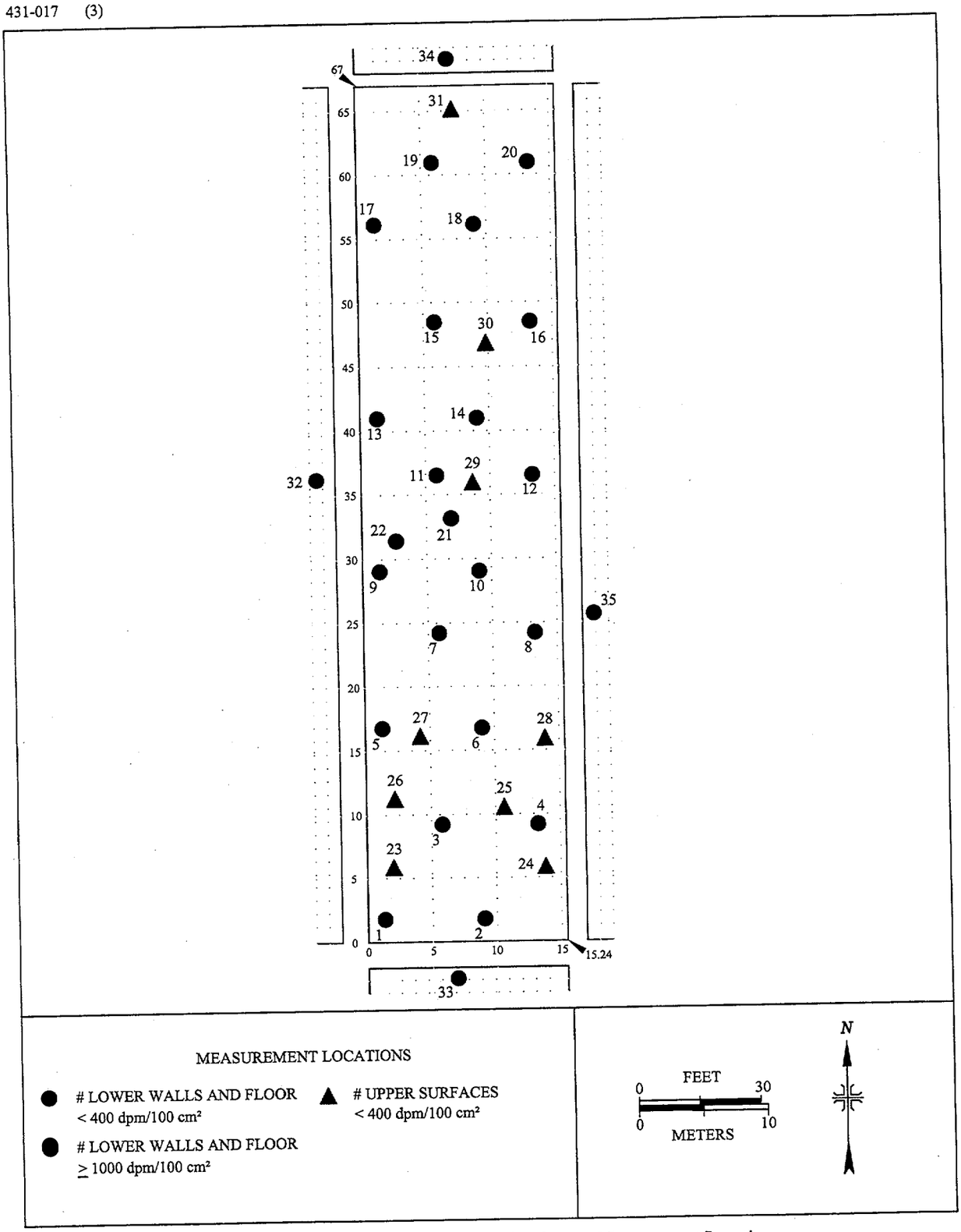


FIGURE 11: Building B-913 - Scoping Survey Measurement Locations

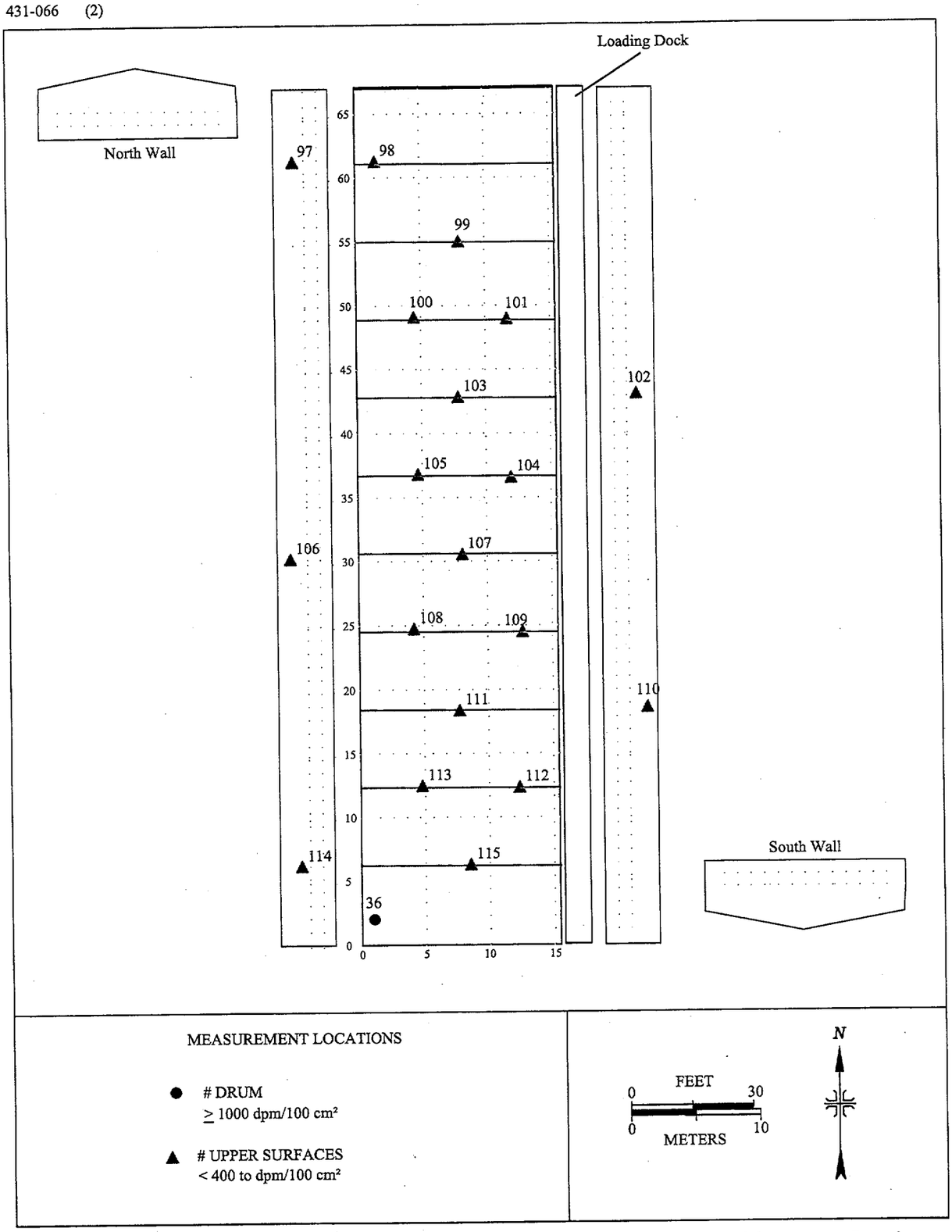


FIGURE 12: Building B-913 - Characterization Survey Upper Surfaces and Miscellaneous Measurement Locations

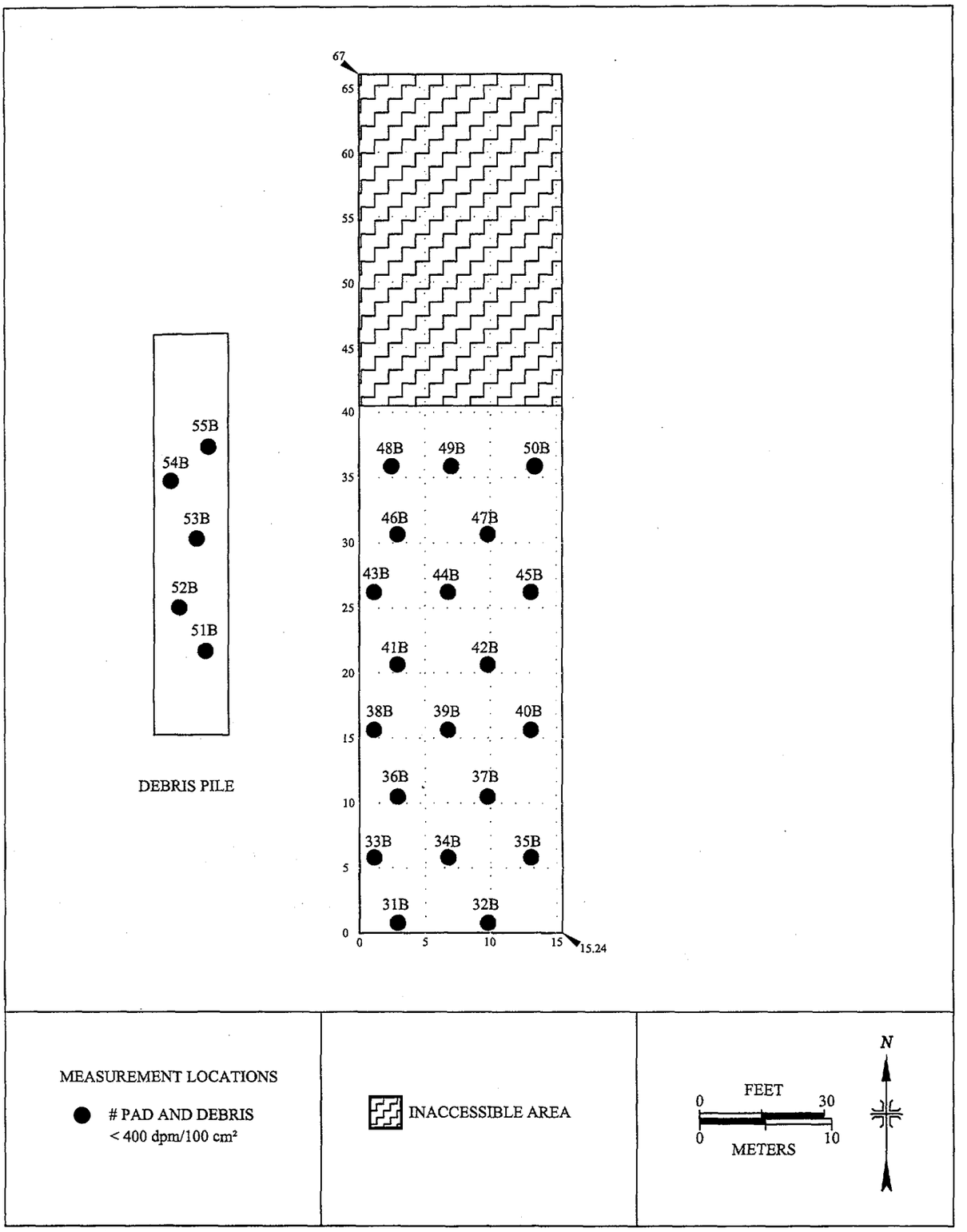


FIGURE 13: Building F-734 - Measurement Locations

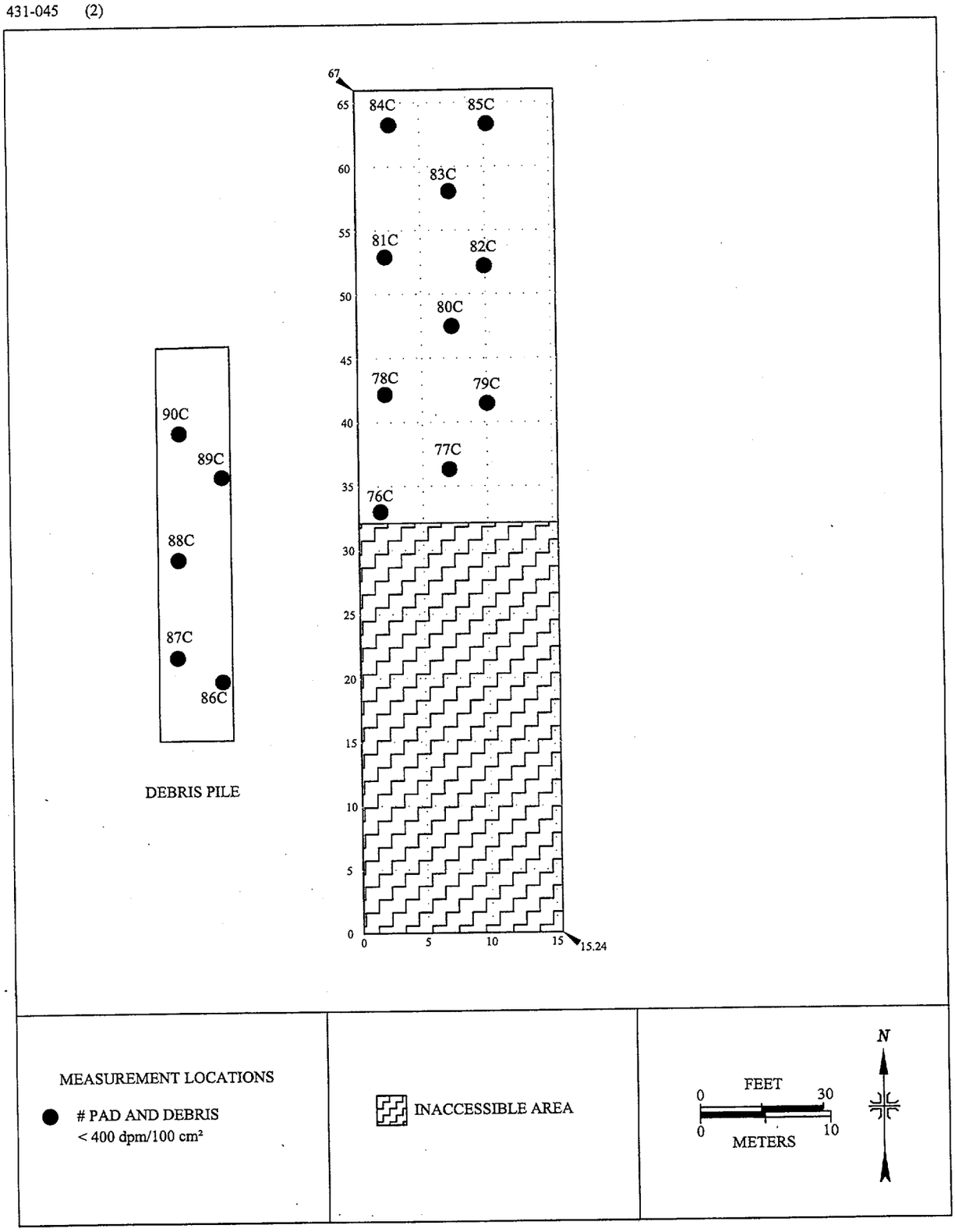


FIGURE 14: Building F-735 - Measurement Locations

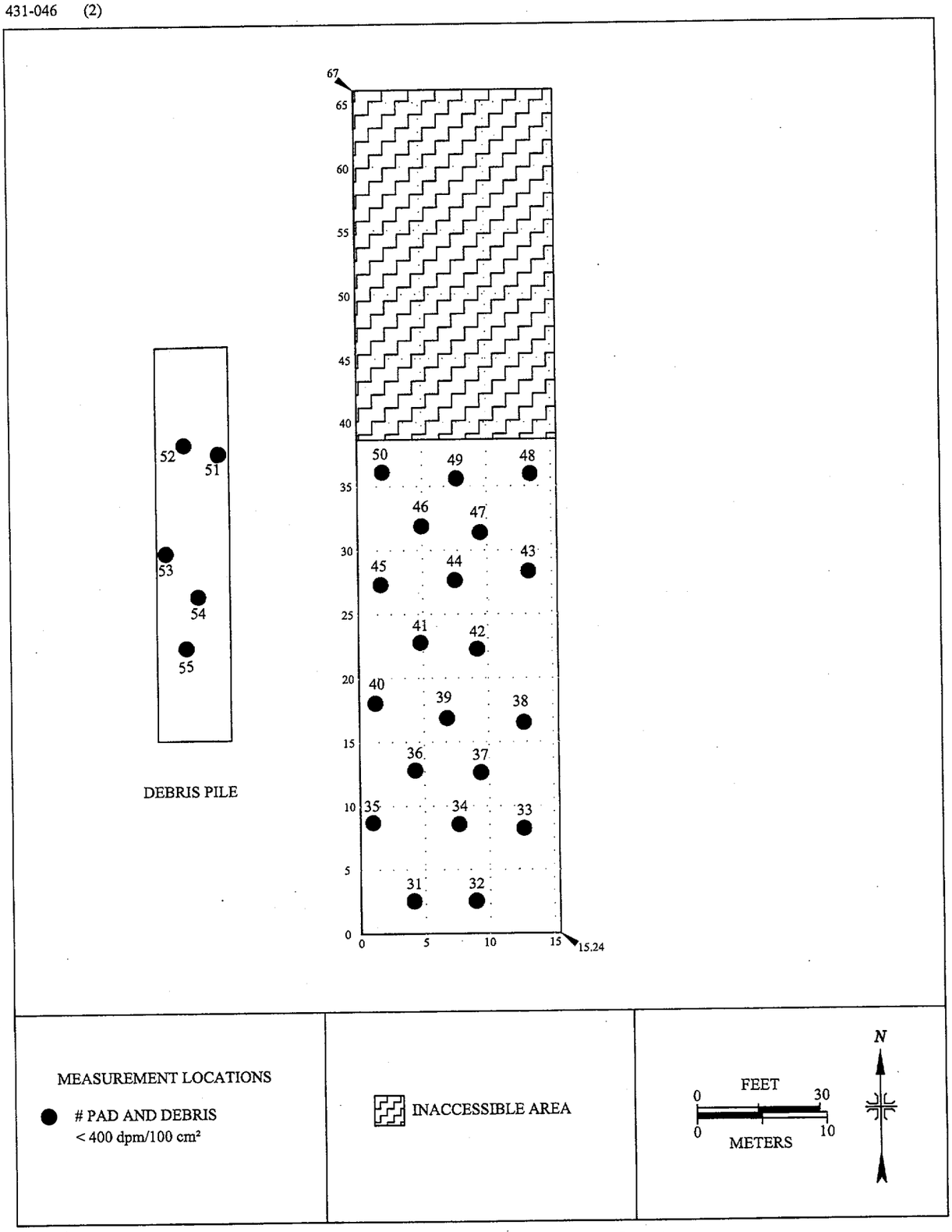


FIGURE 15: Building F-736 - Measurement Locations

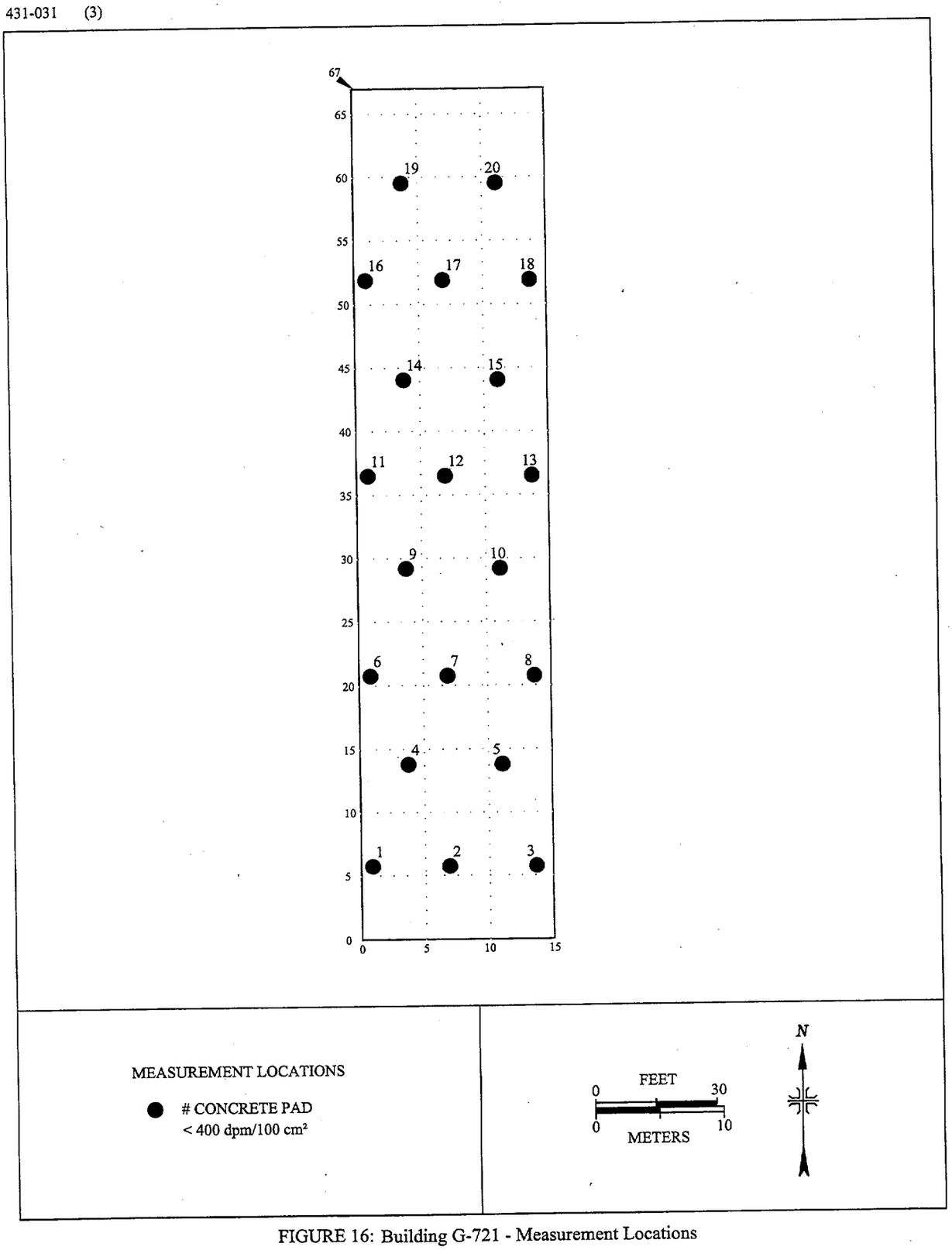


FIGURE 16: Building G-721 - Measurement Locations

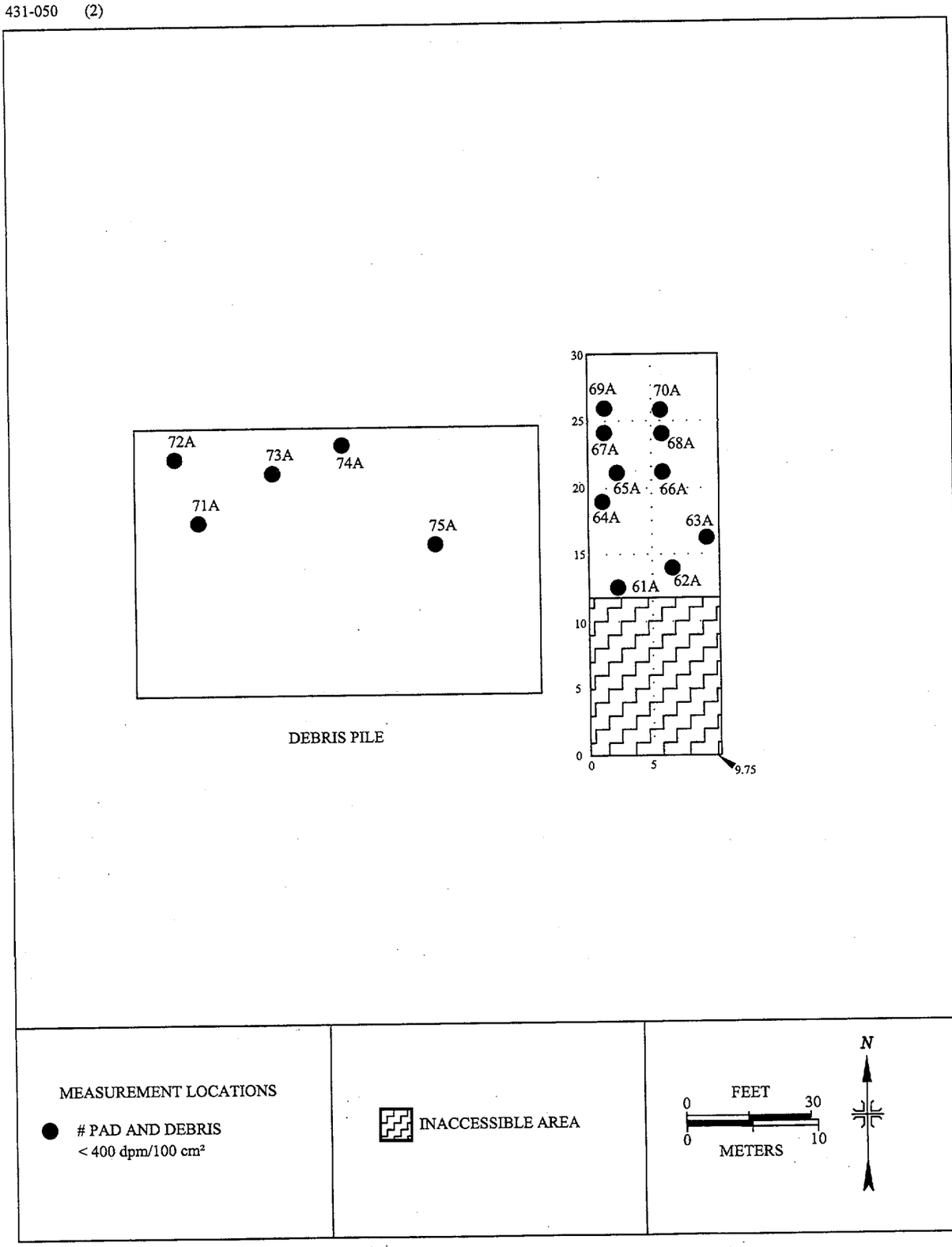


FIGURE 17: Building H-711 - Measurement Locations

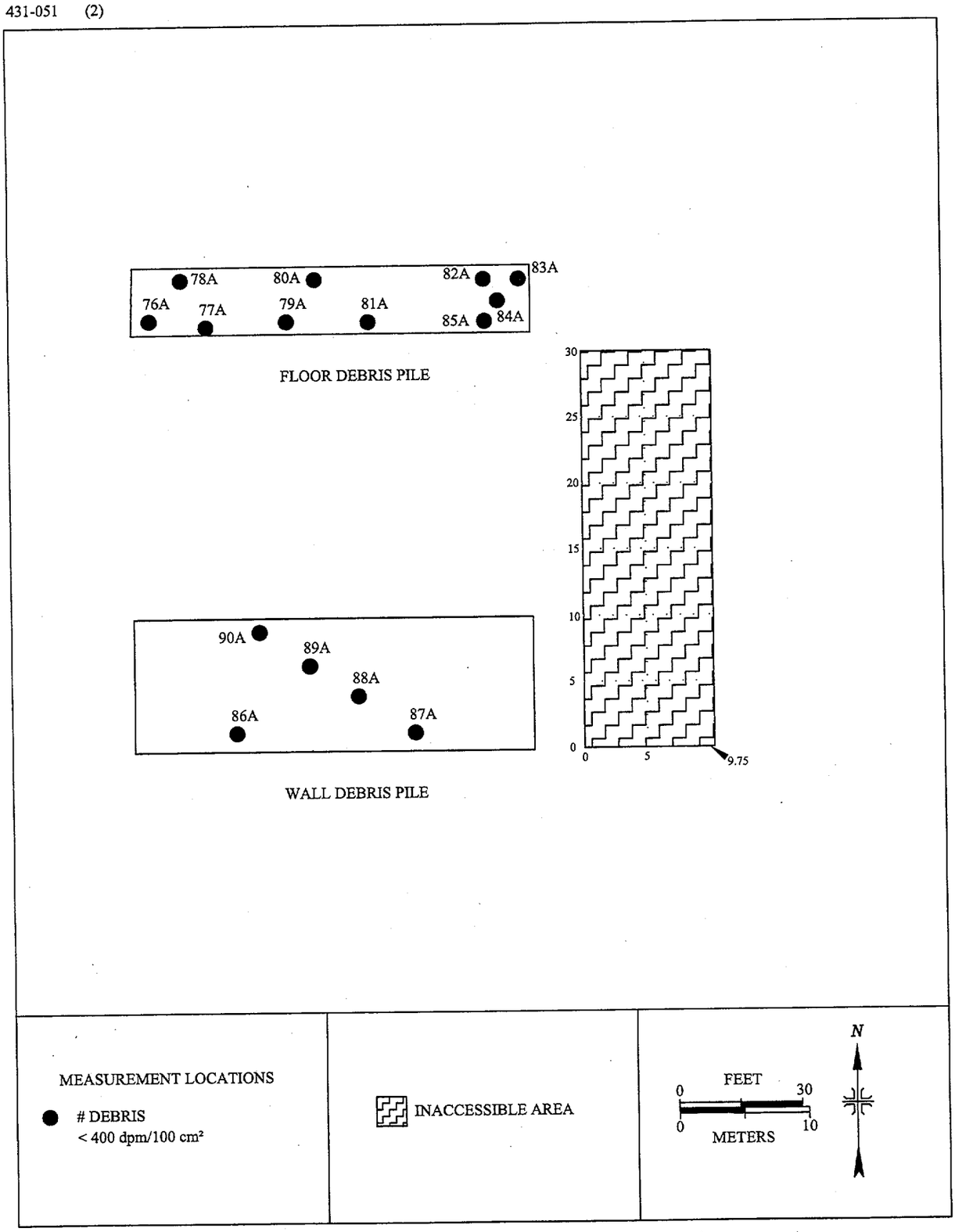


FIGURE 18: Building H-712 - Measurement Locations

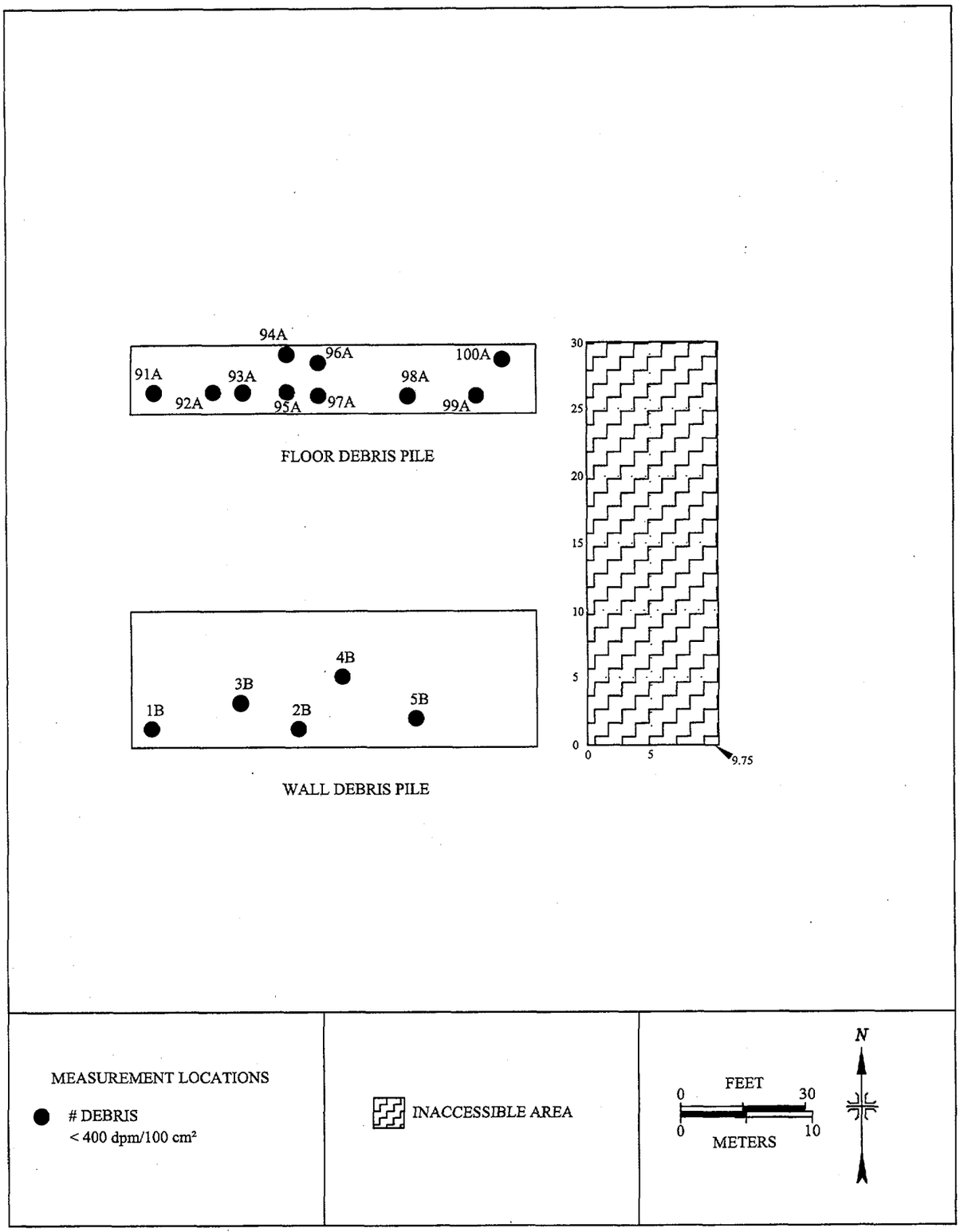


FIGURE 19: Building H-713 - Measurement Locations

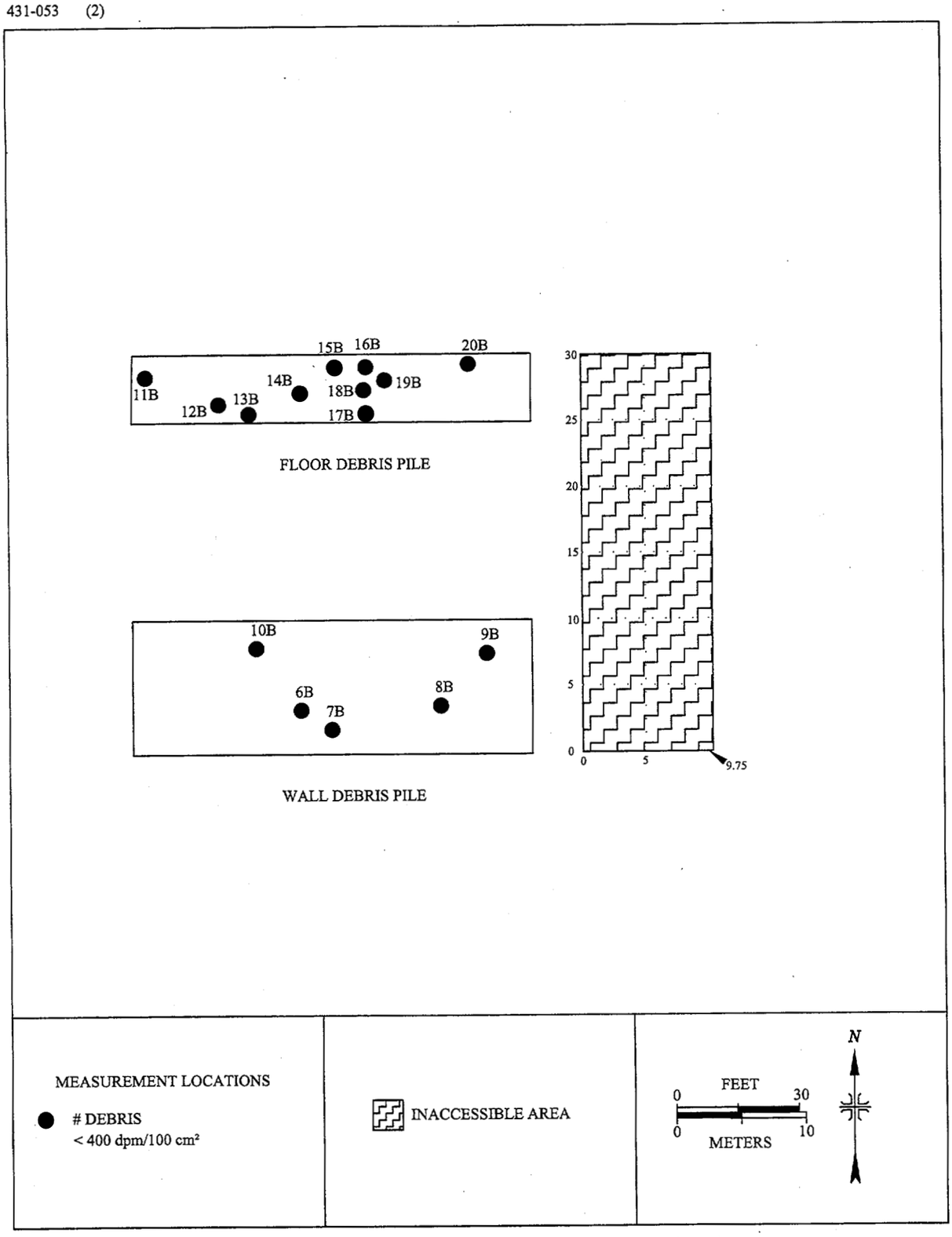


FIGURE 20: Building H-714 - Measurement Locations

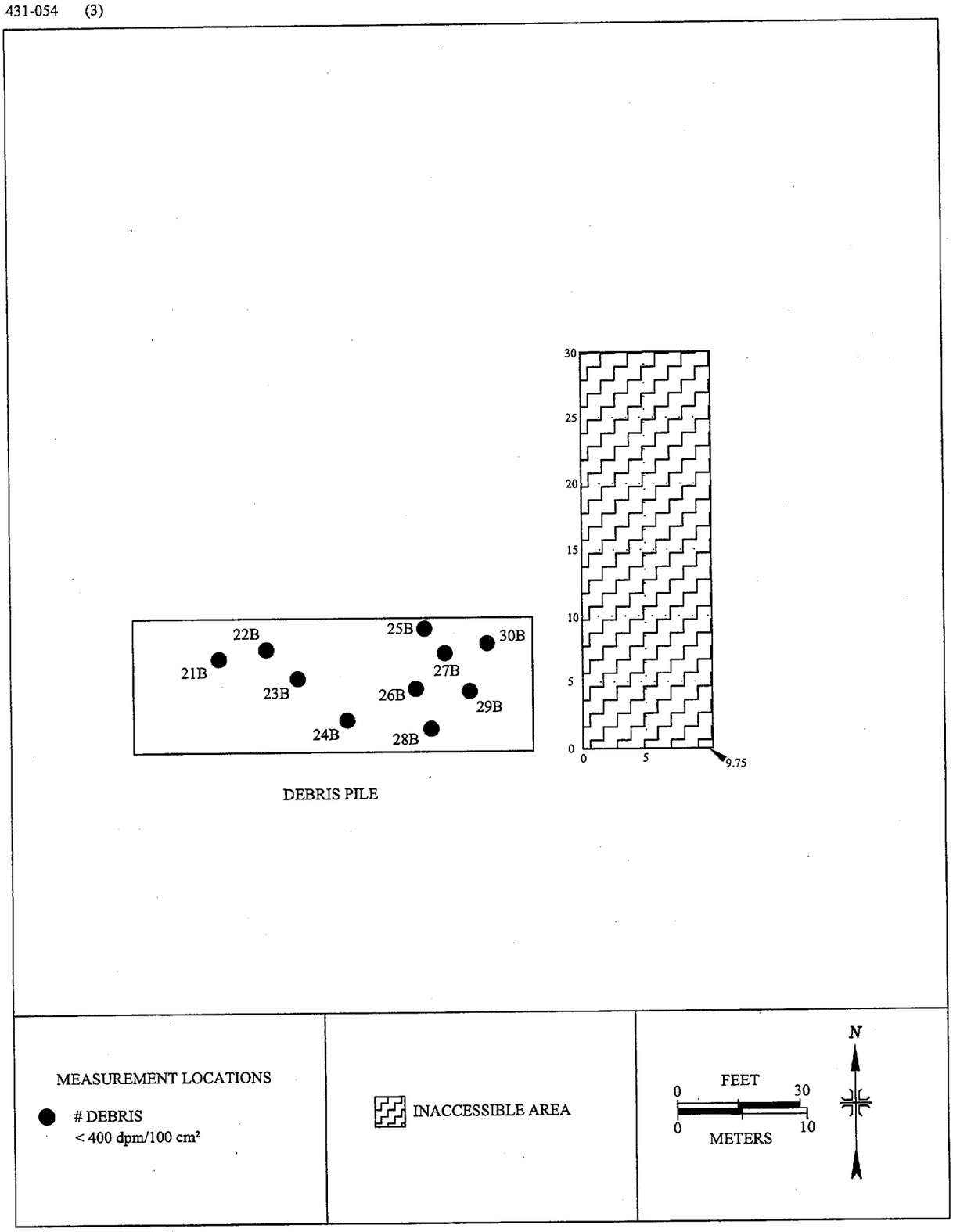


FIGURE 21: Building H-715 - Measurement Locations

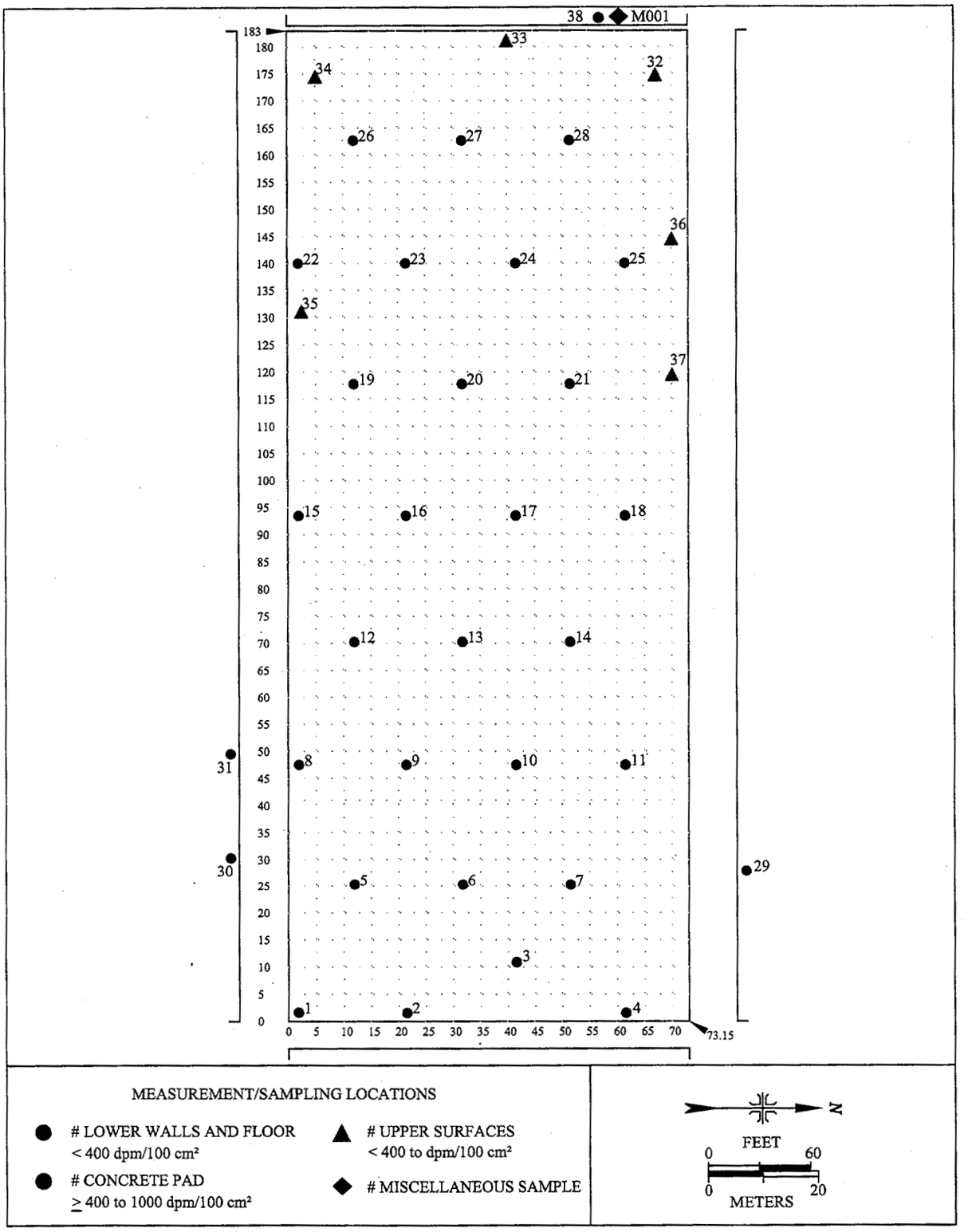


FIGURE 22: Building 1022 - Measurement and Sampling Locations

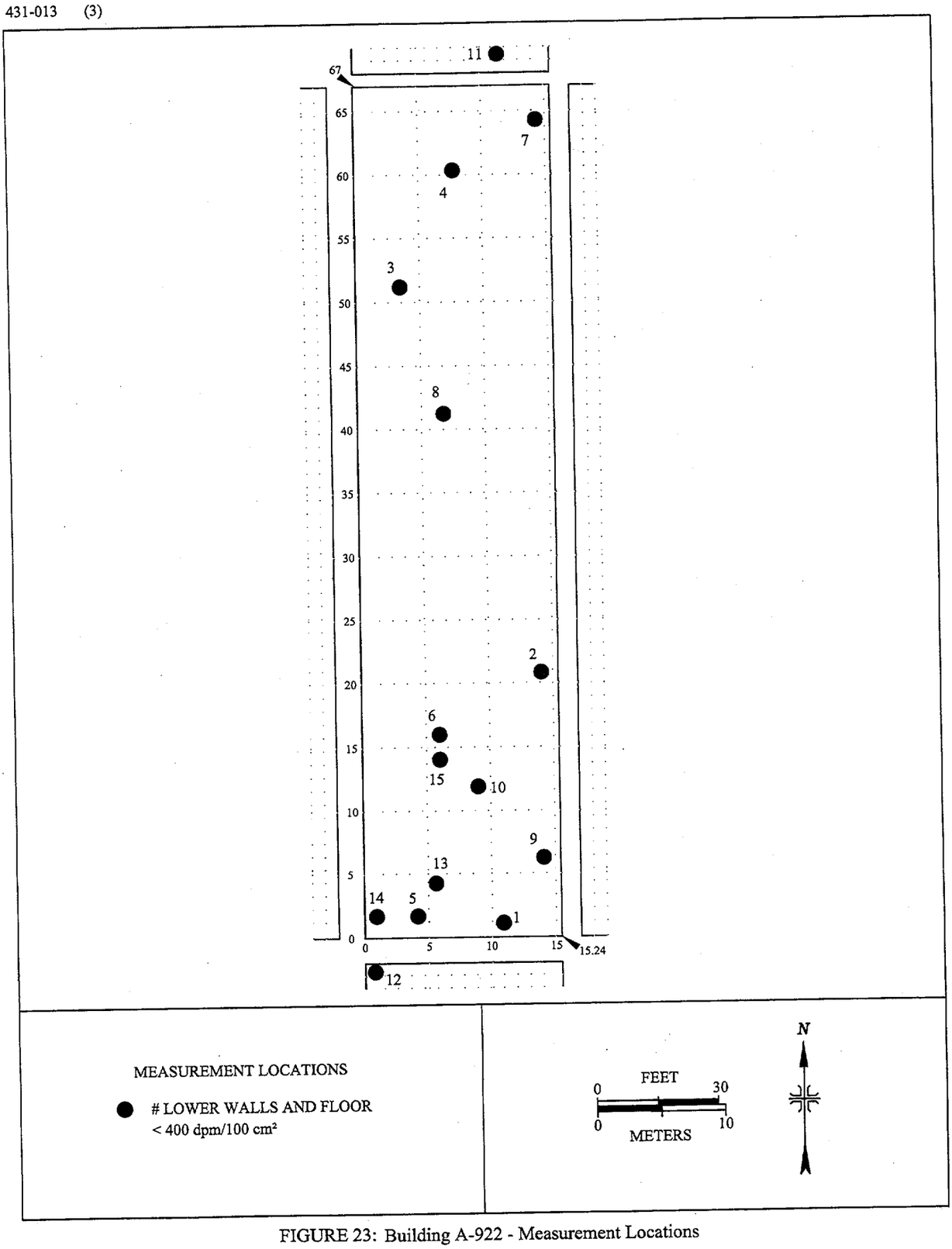


FIGURE 23: Building A-922 - Measurement Locations

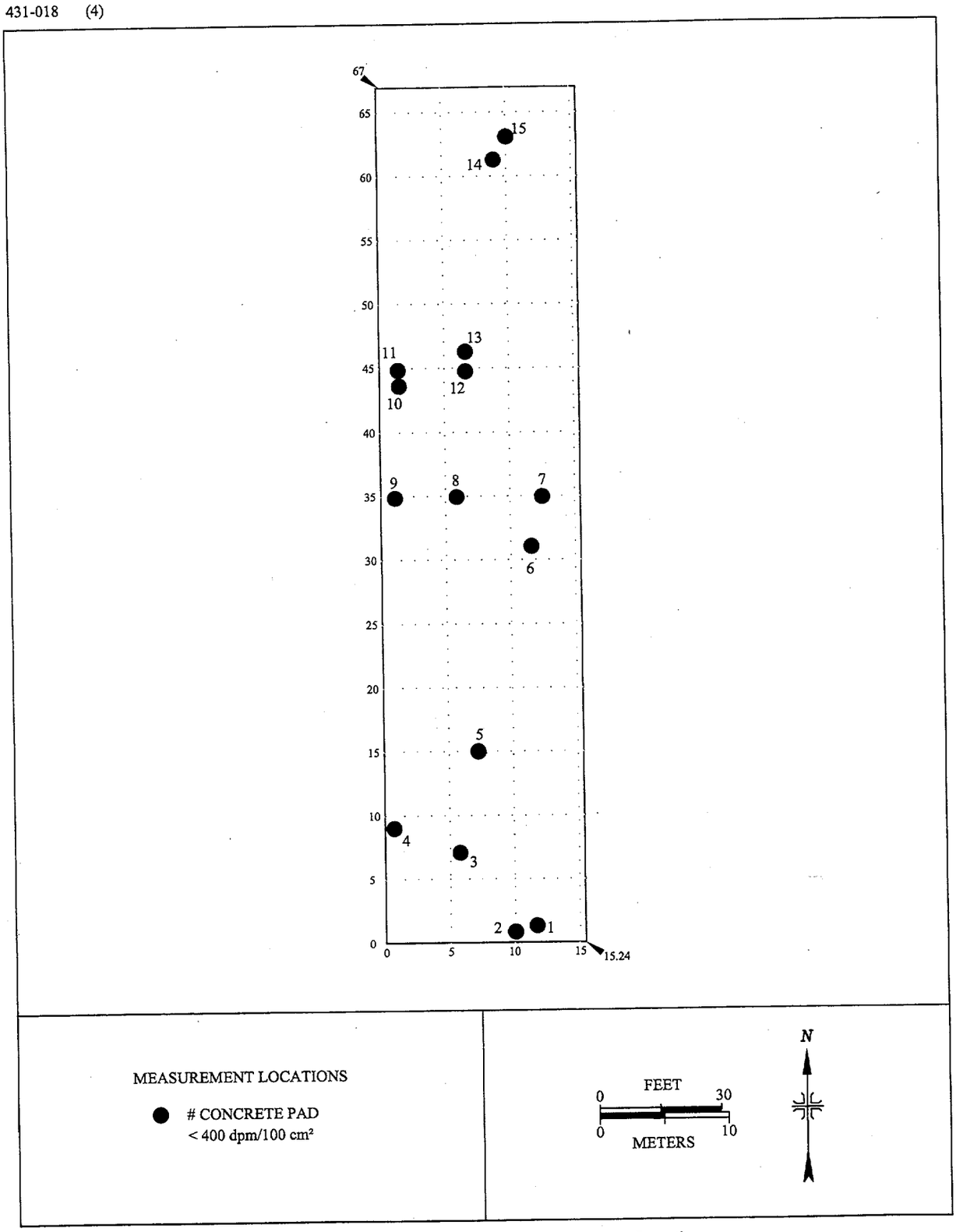


FIGURE 24: Building C-1131 - Measurement Locations

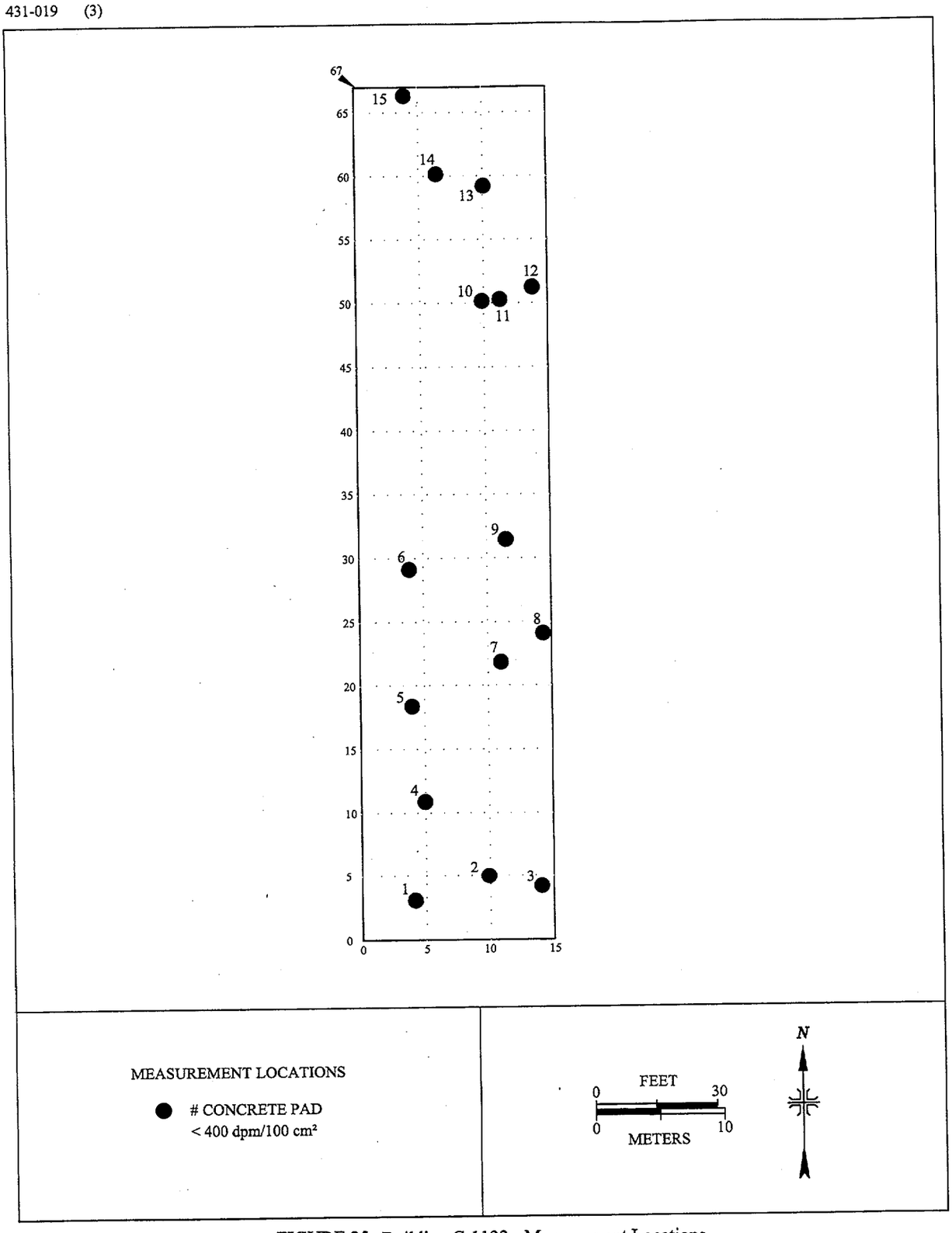


FIGURE 25: Building C-1132 - Measurement Locations

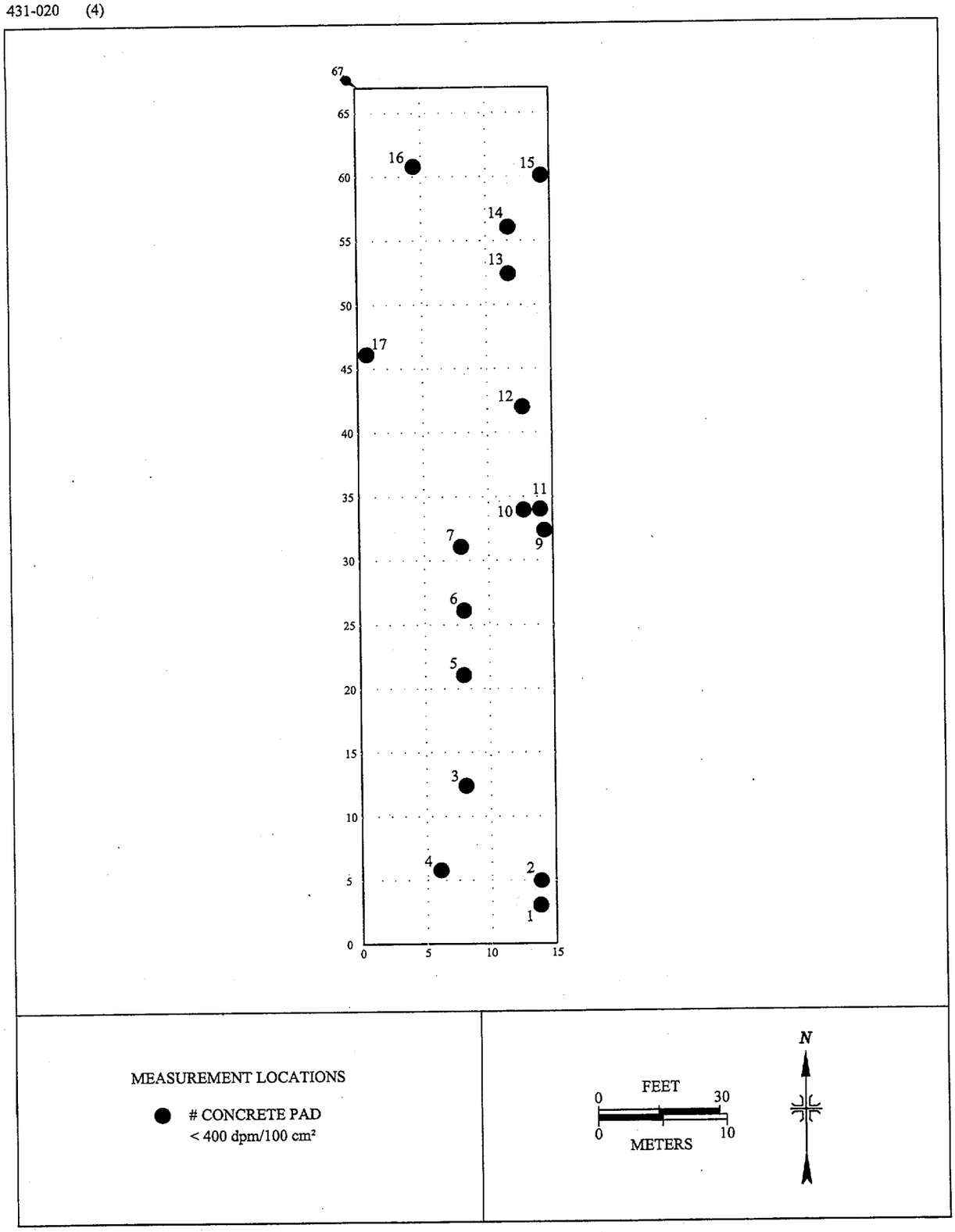


FIGURE 26: Building C-1133 - Measurement Locations

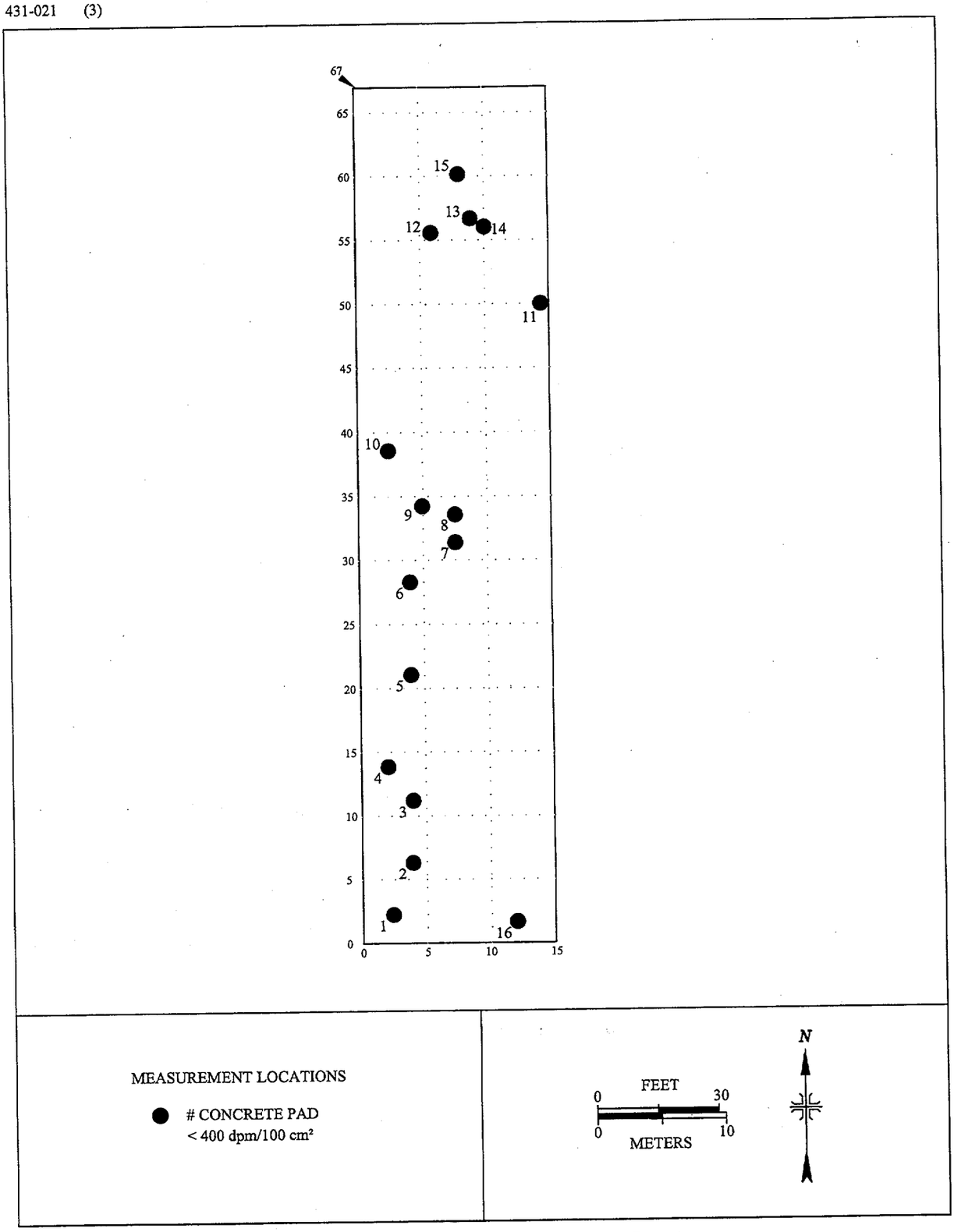


FIGURE 27: Building C-1134 - Measurement Locations

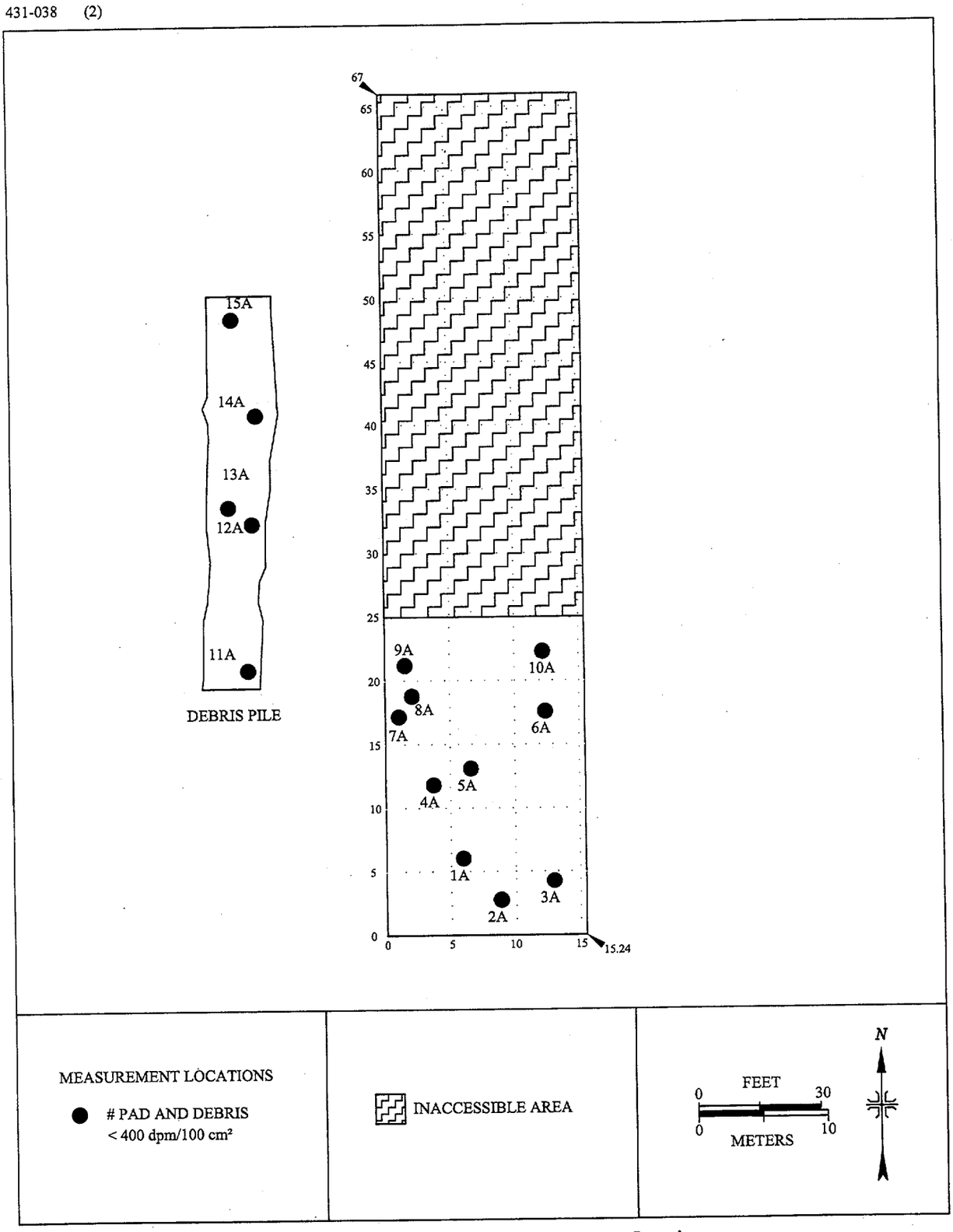


FIGURE 28: Building D-1121 - Measurement Locations

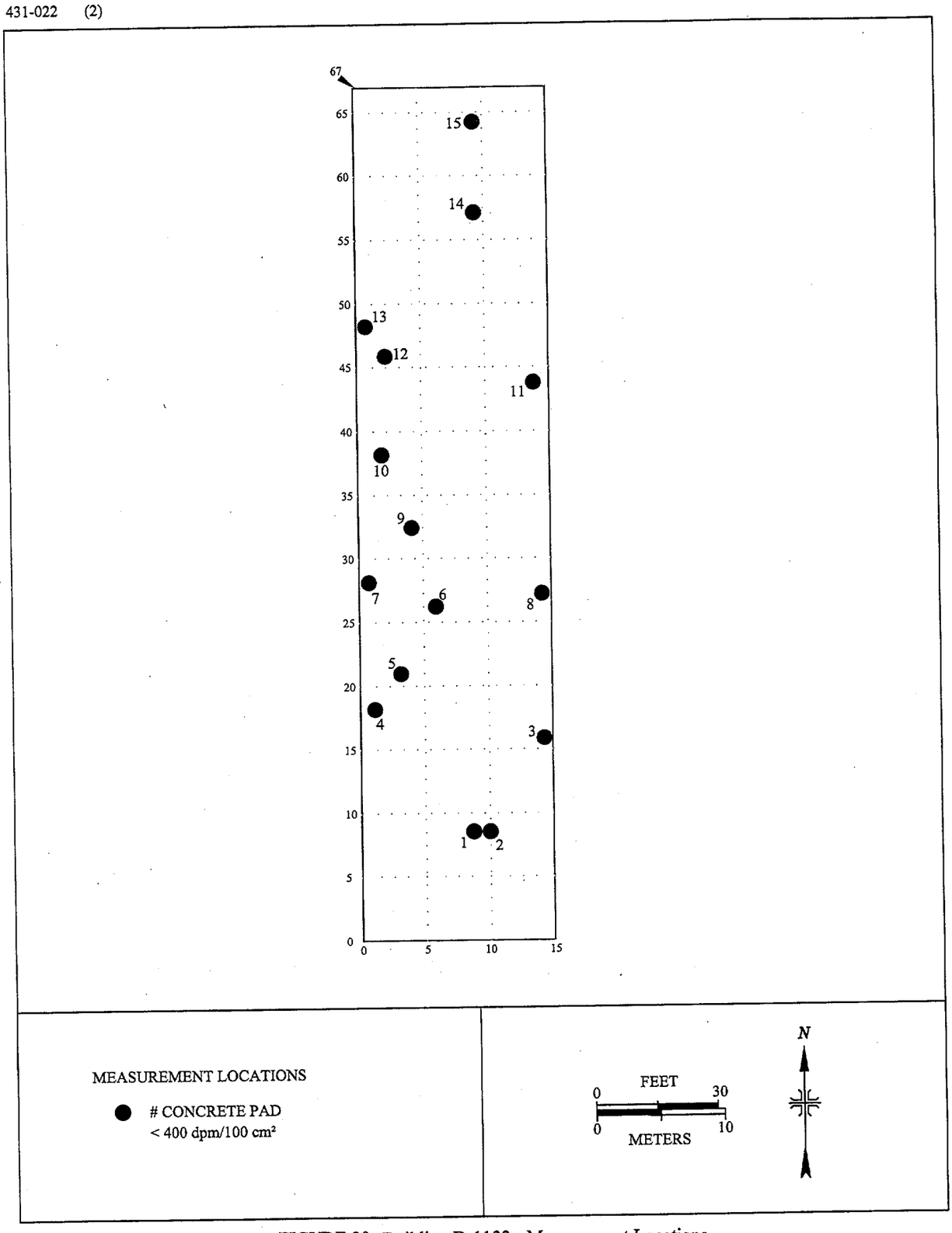


FIGURE 29: Building D-1122 - Measurement Locations

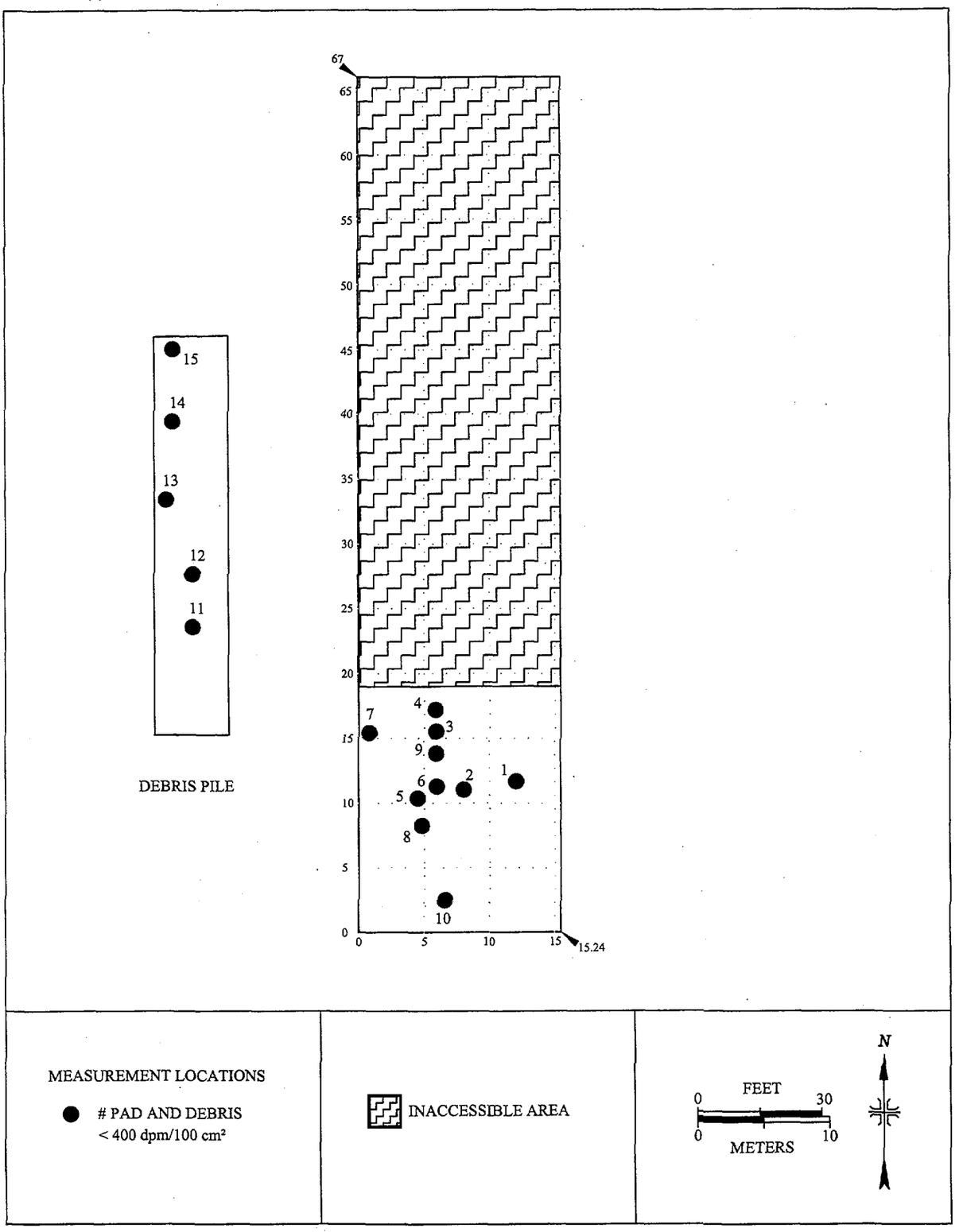


FIGURE 30: Building D-1123 - Measurement Locations

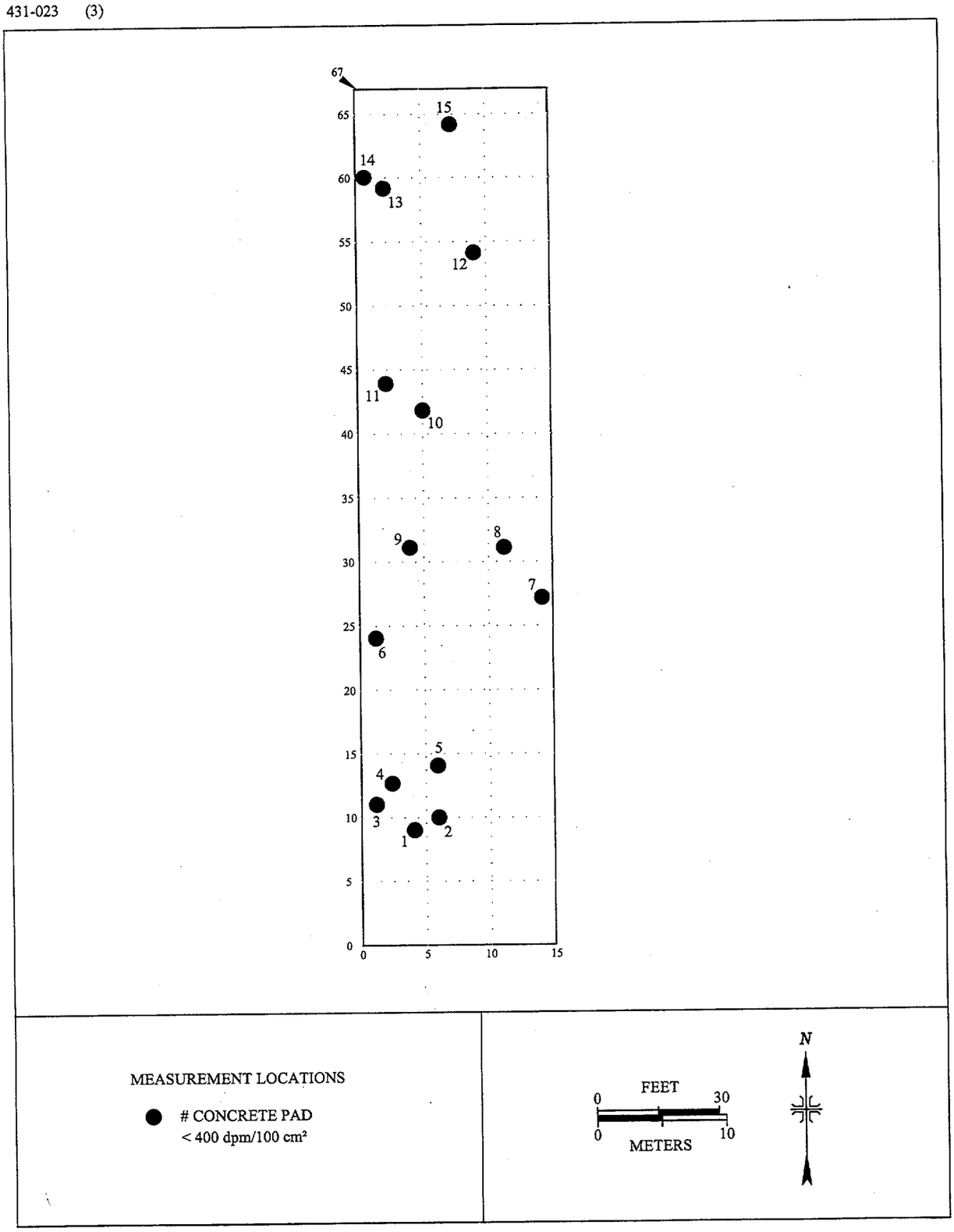


FIGURE 31: Building D-1124 - Measurement Locations

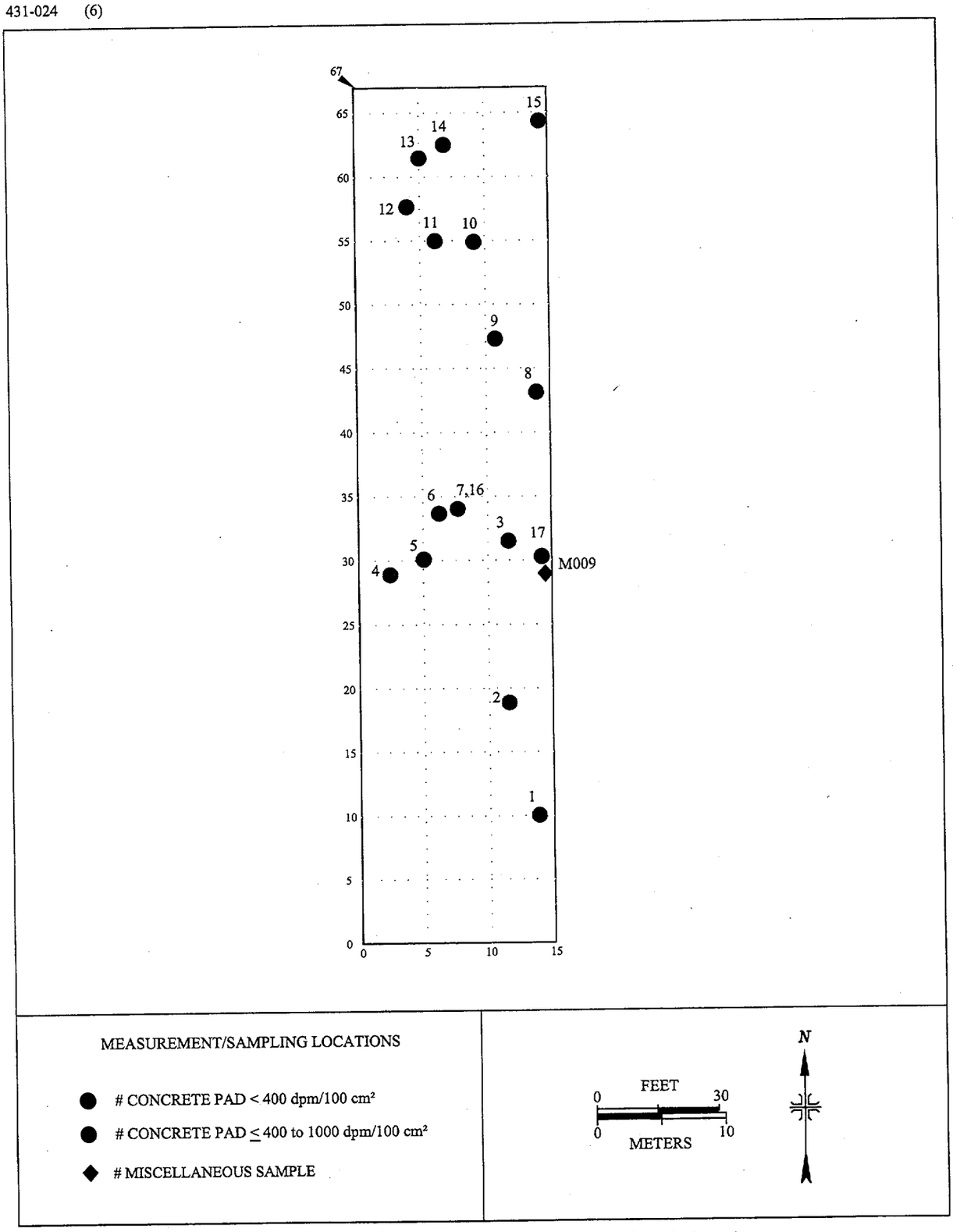


FIGURE 32: Building D-1125 - Measurement and Sample Locations

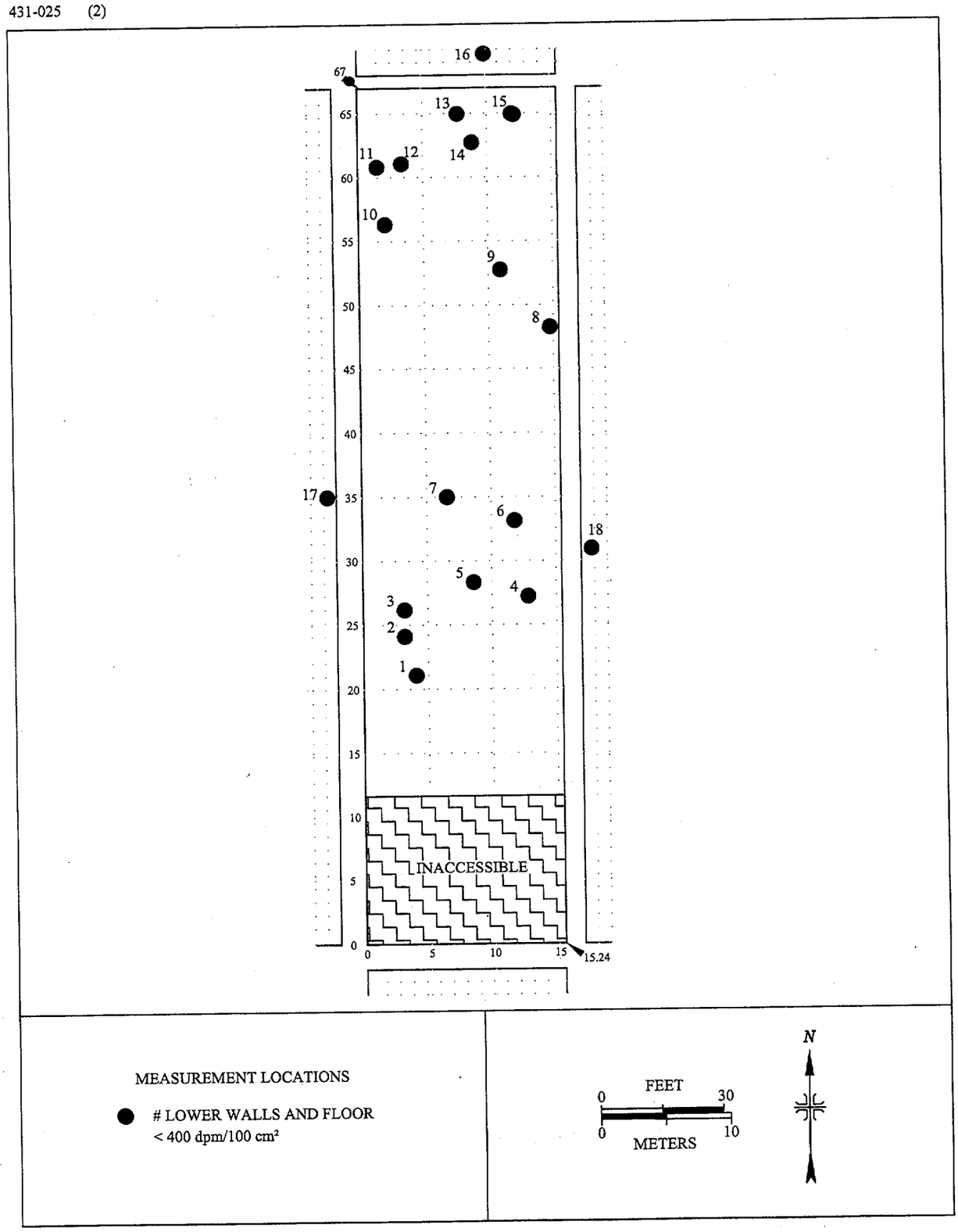


FIGURE 33: Building E-1111 - Measurement Locations

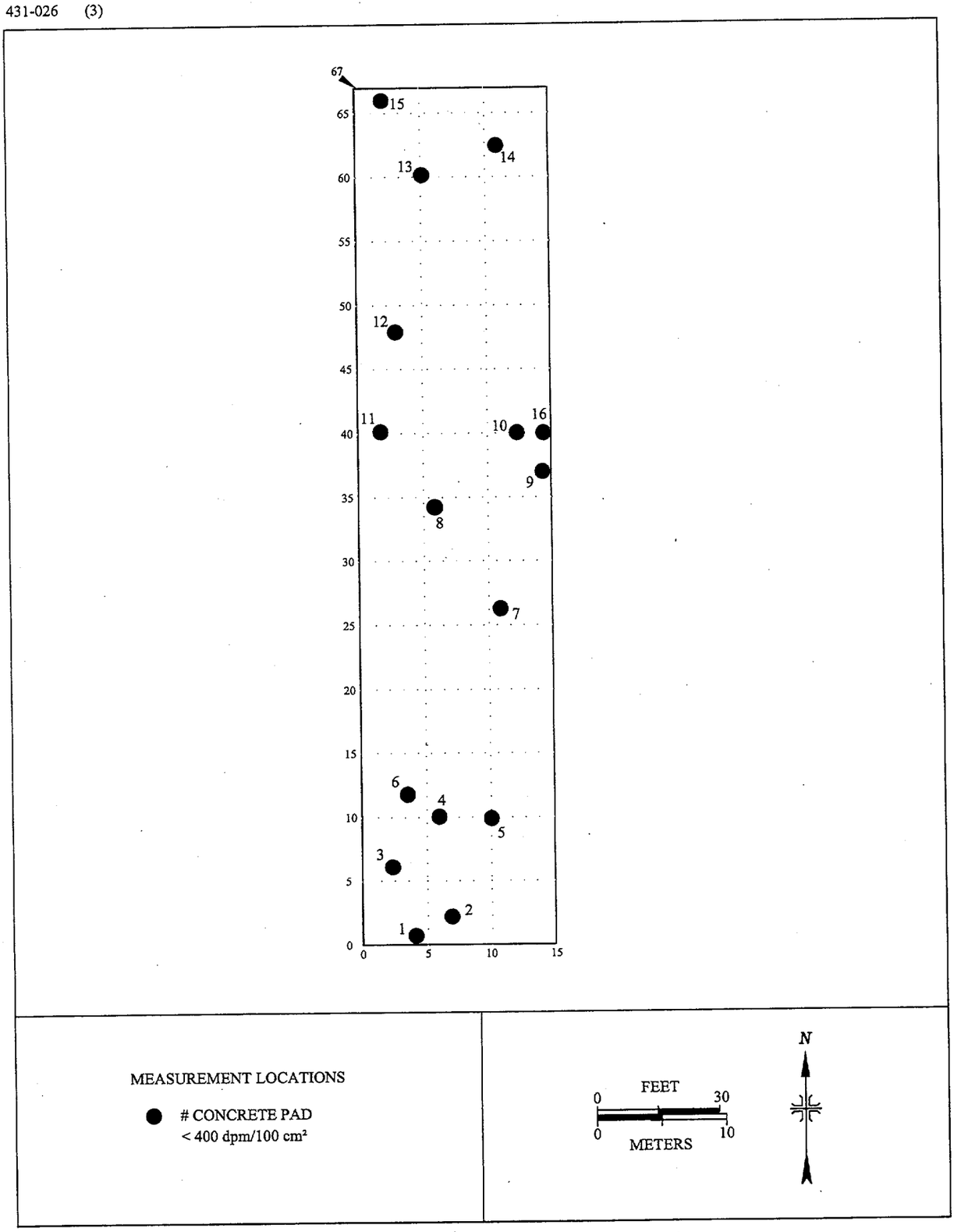


FIGURE 34: Building E-1112 - Measurement Locations

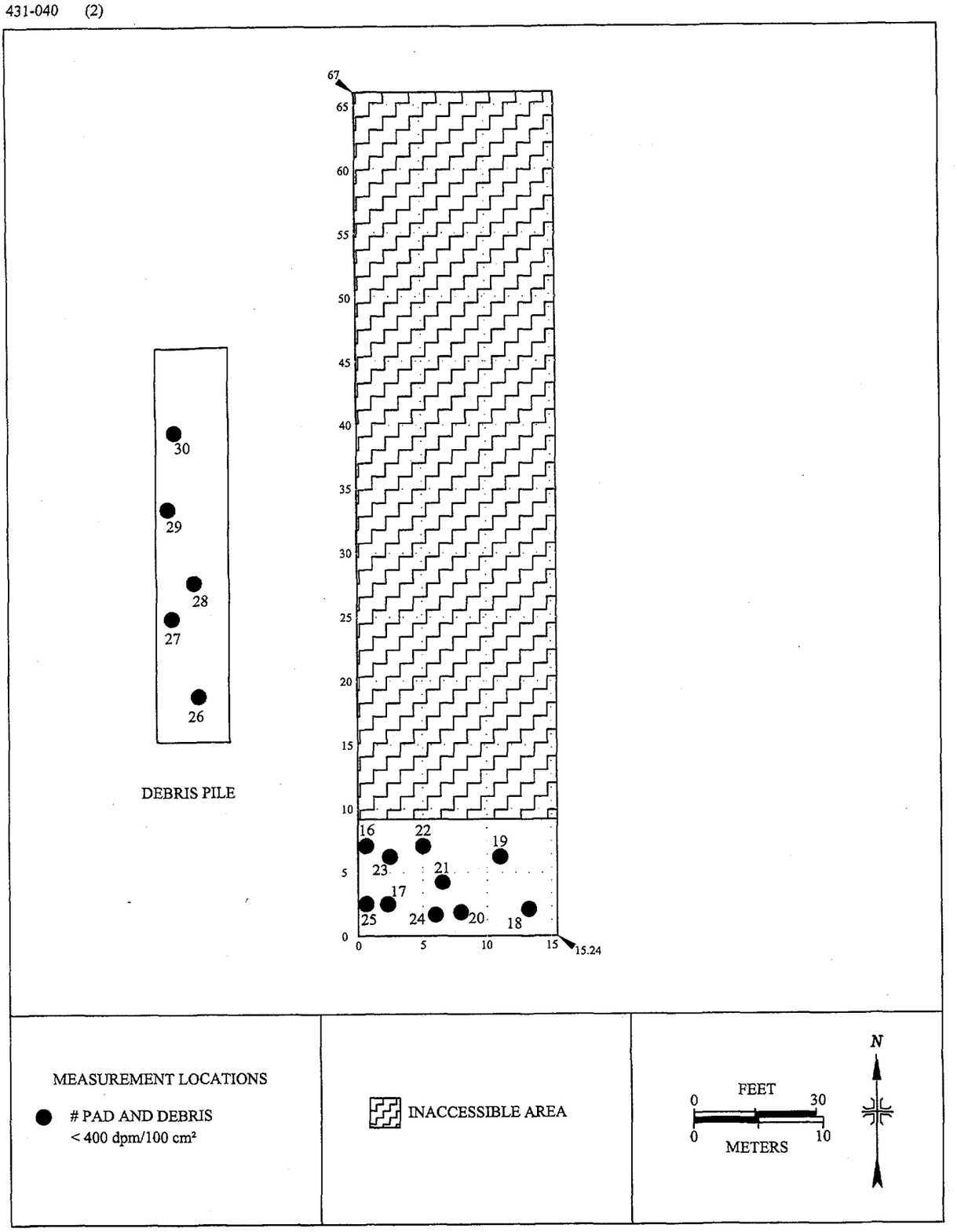


FIGURE 35: Building E-1113 - Measurement Locations

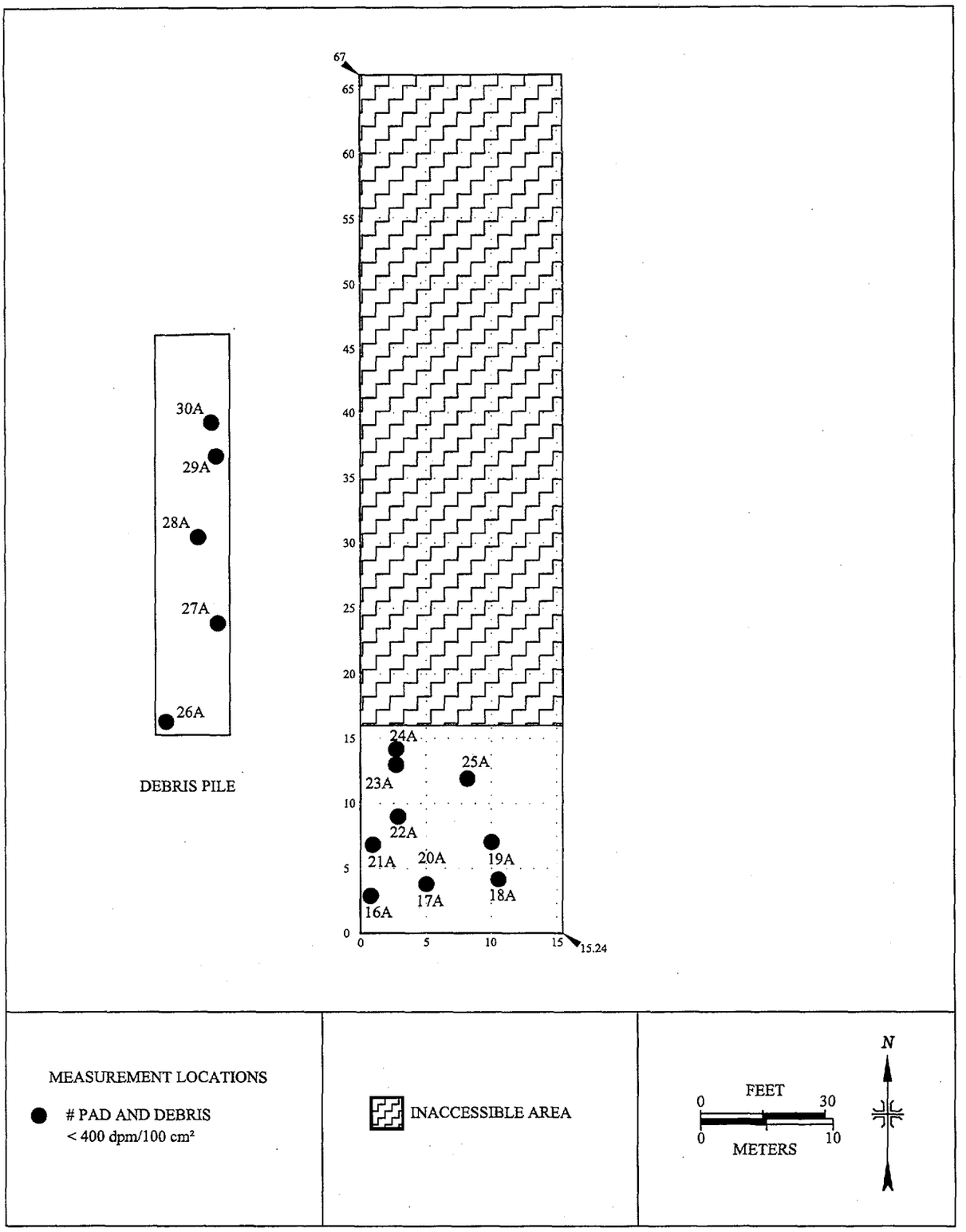


FIGURE 36: Building E-1114 - Measurement Locations

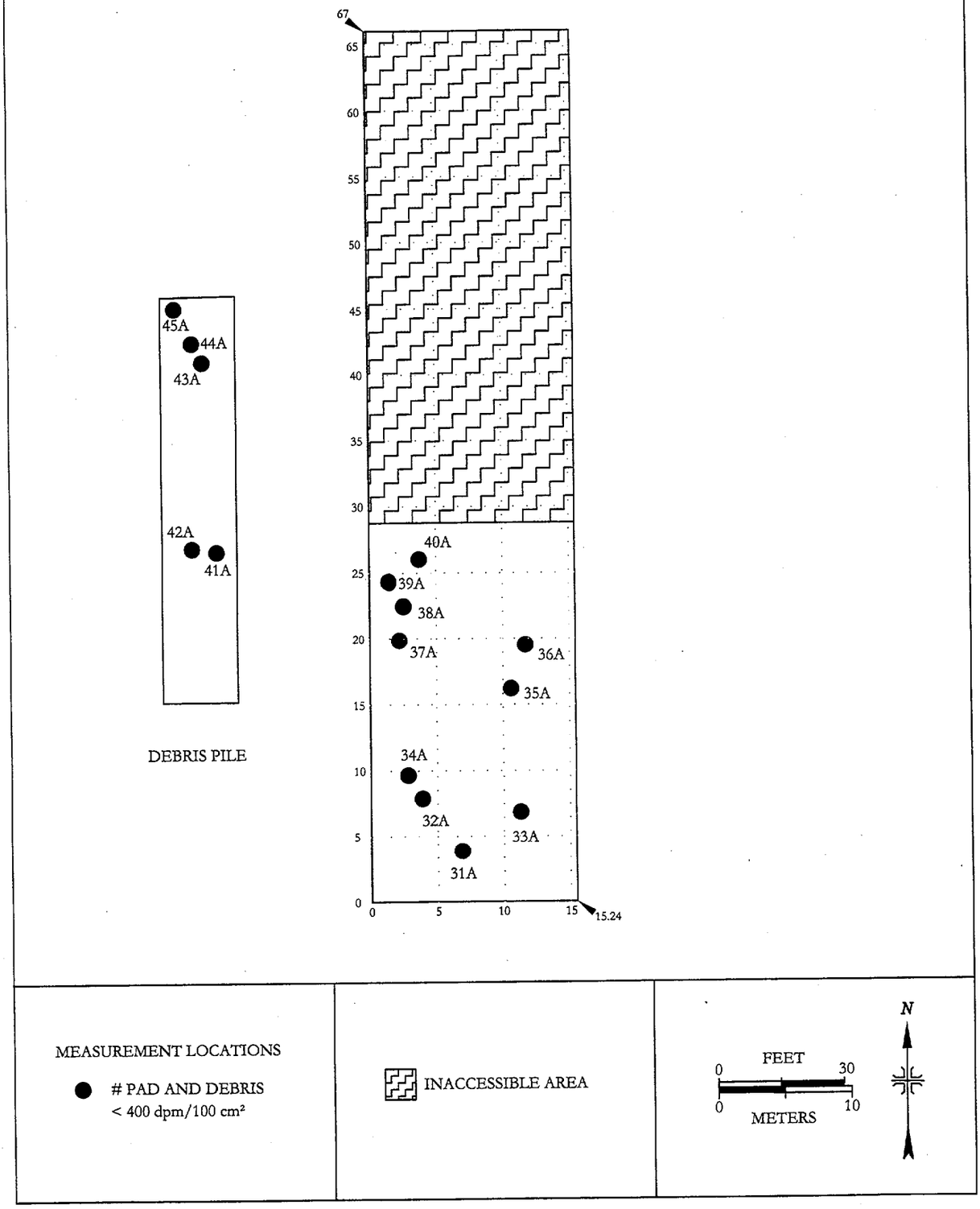


FIGURE 37: Building E-1115 - Measurement Locations

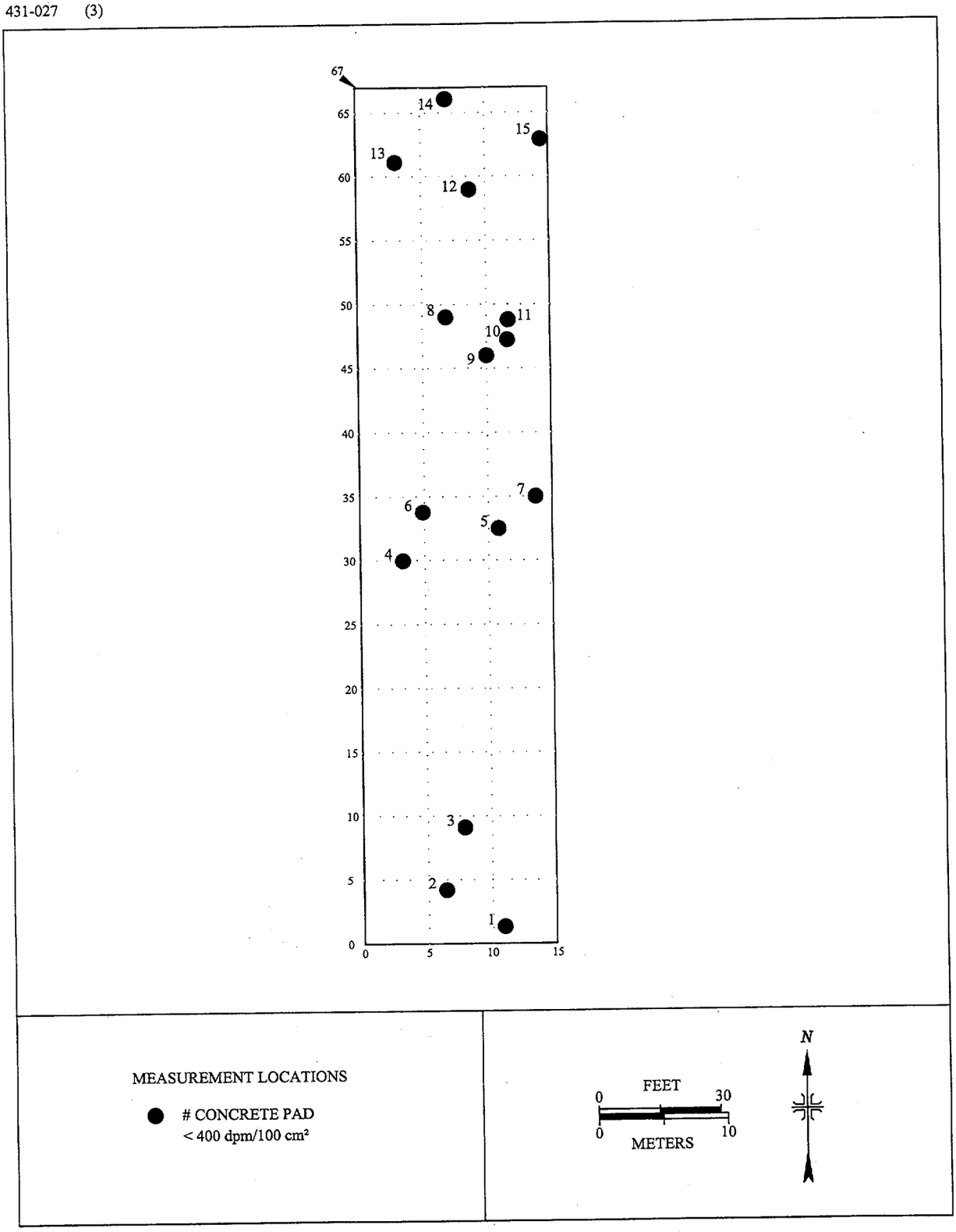


FIGURE 38: Building E-1116 - Measurement Locations

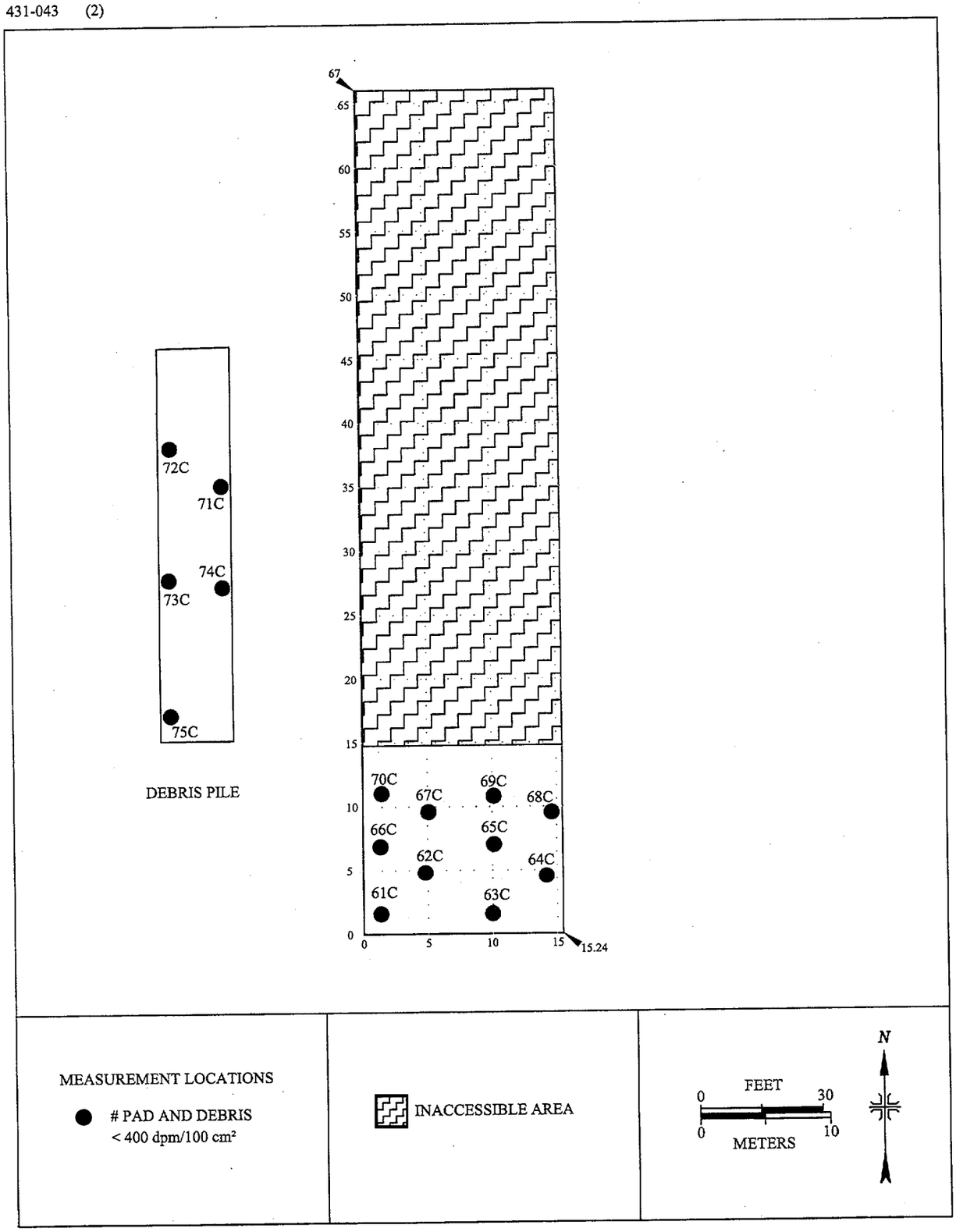


FIGURE 39: Building F-732 - Measurement Locations

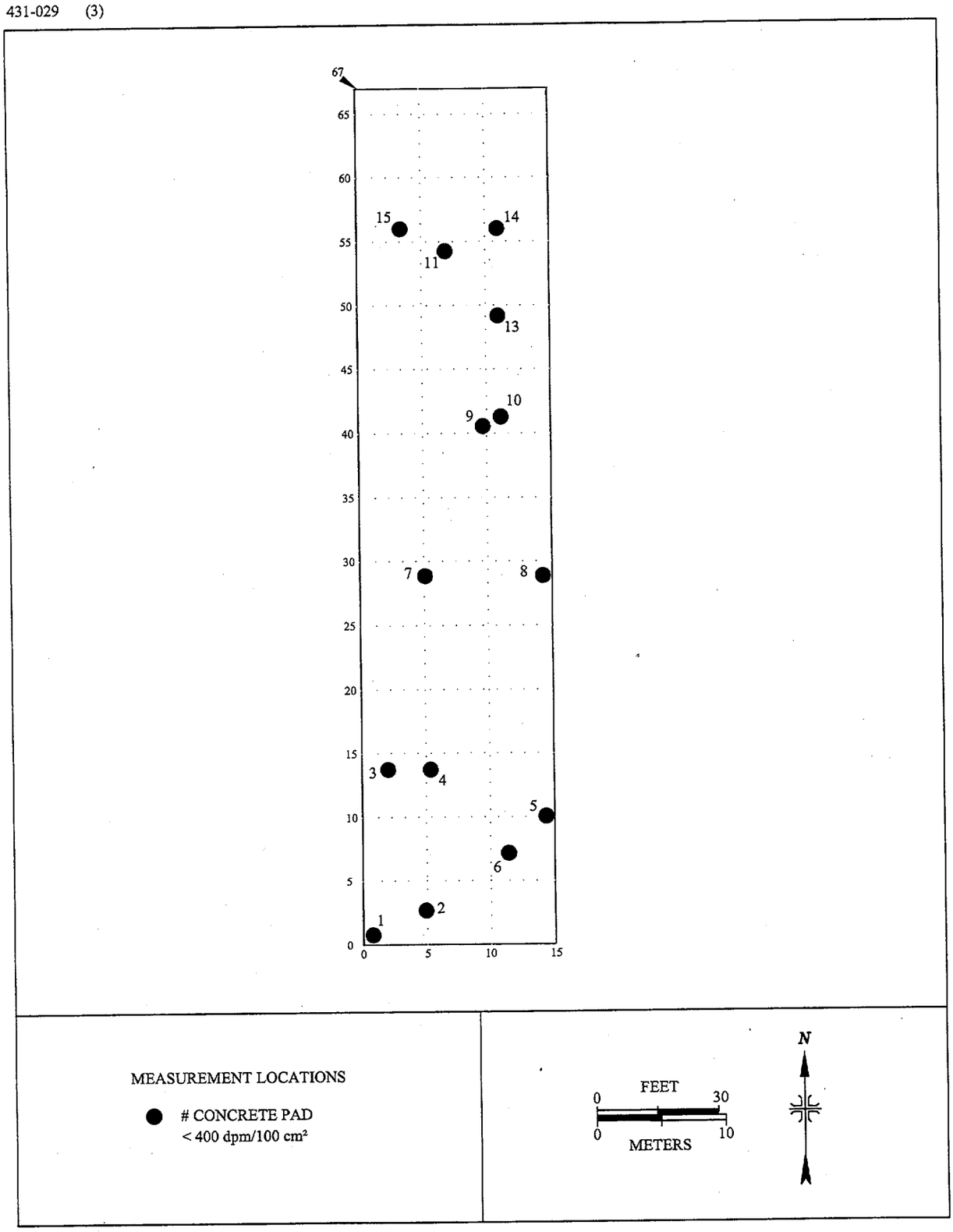


FIGURE 40: Building F-733 - Measurement Locations

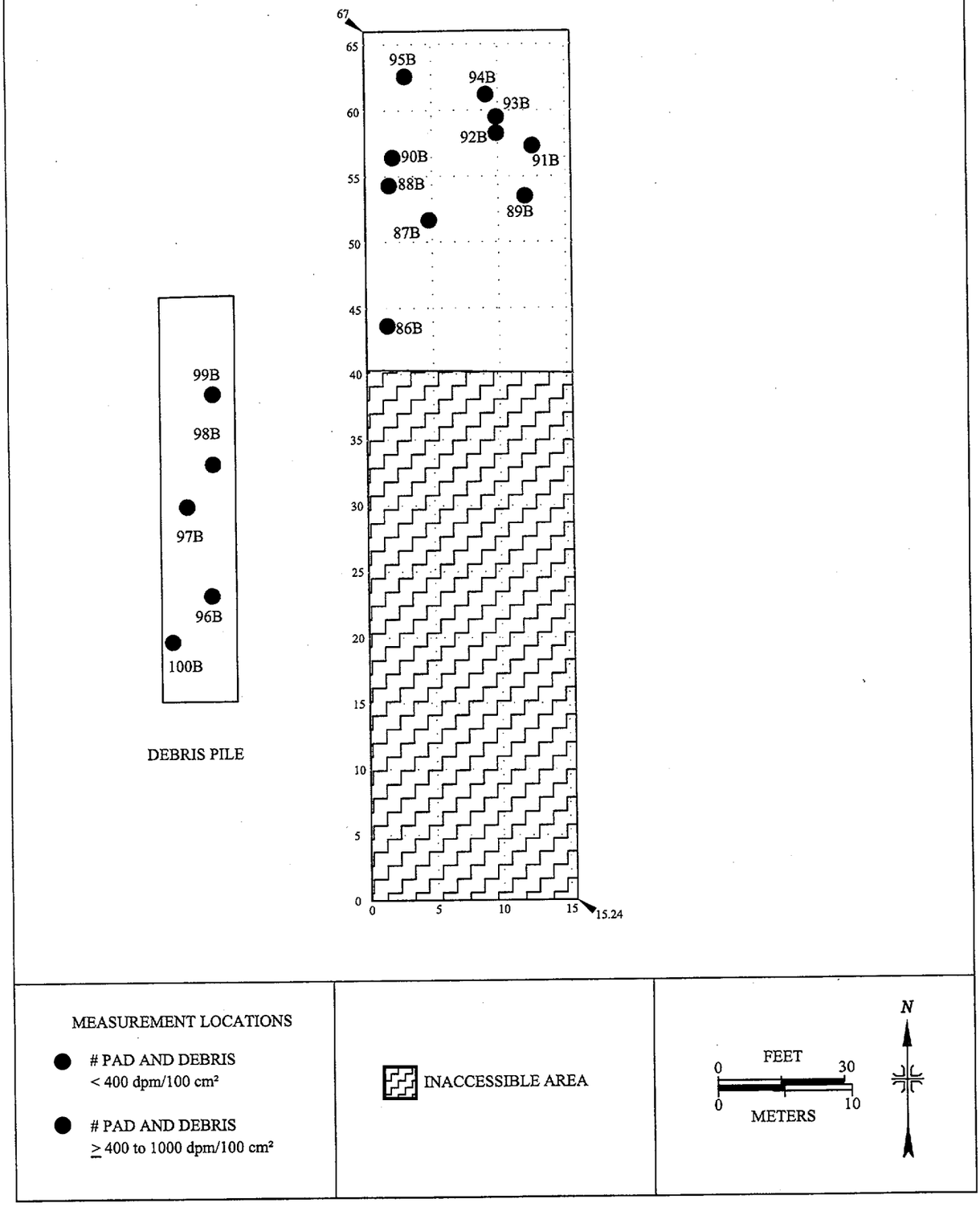


FIGURE 41: Building G-722 - Measurement Locations

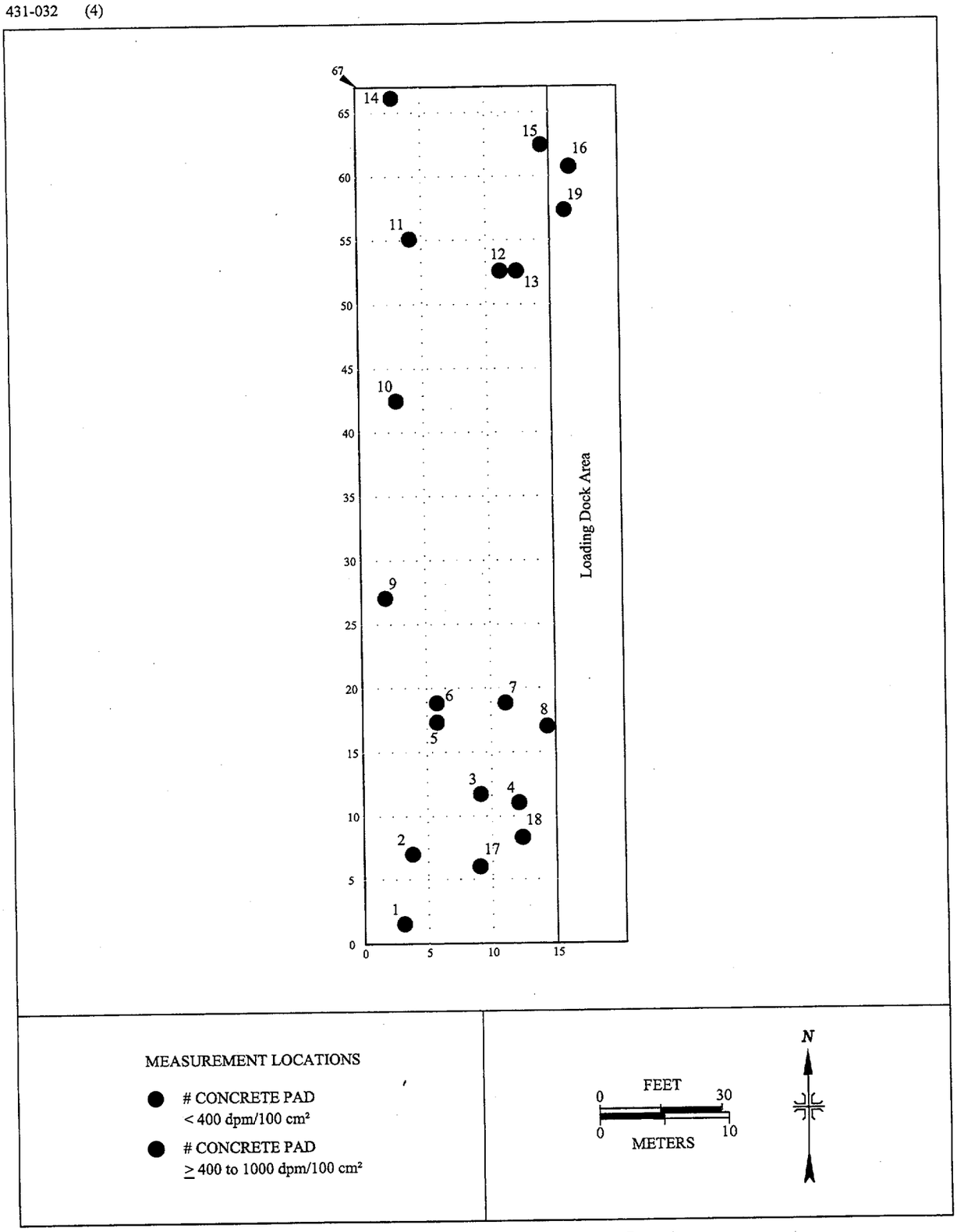


FIGURE 42: Building G-723 - Measurement Locations

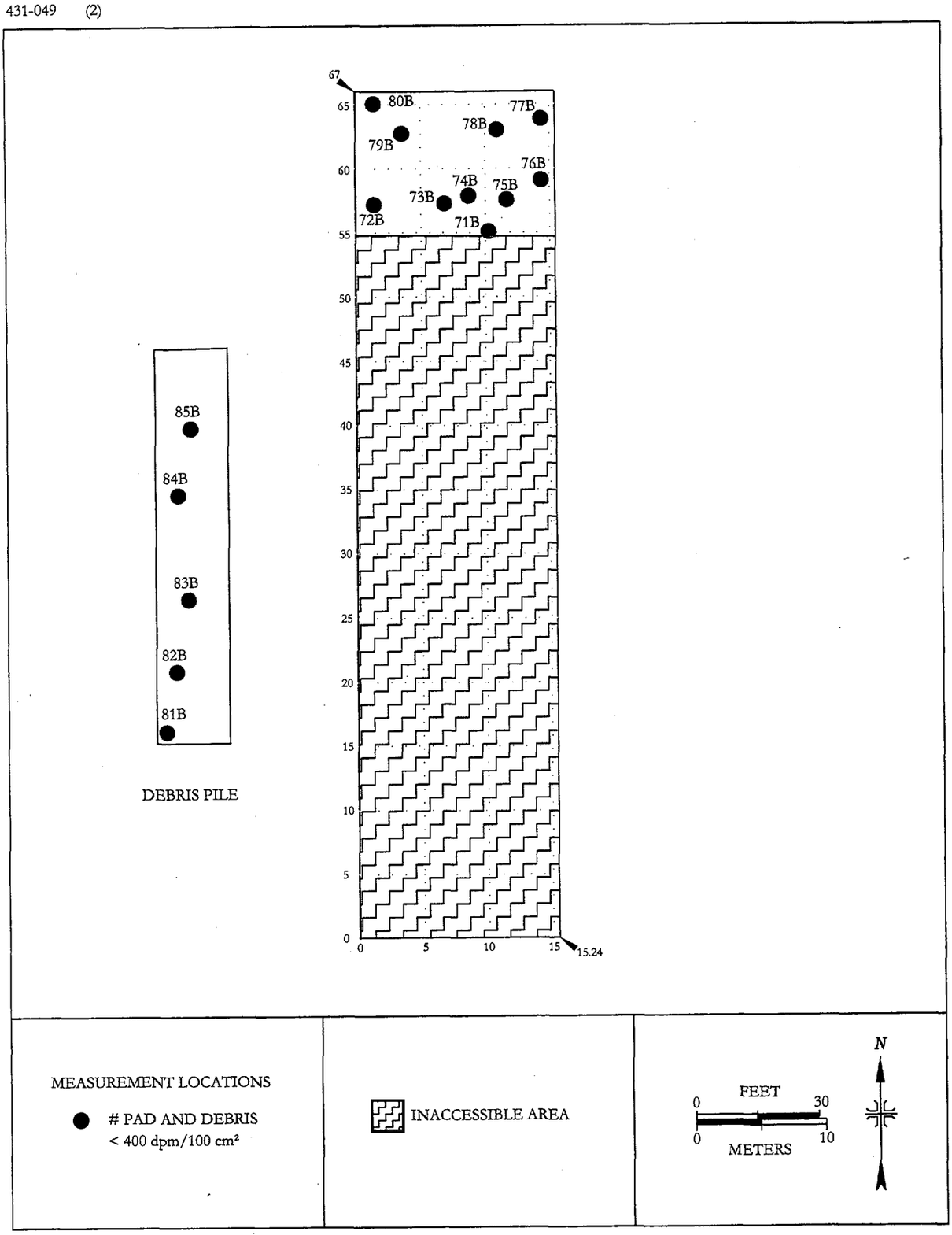


FIGURE 43: Building G-724 - Measurement Locations

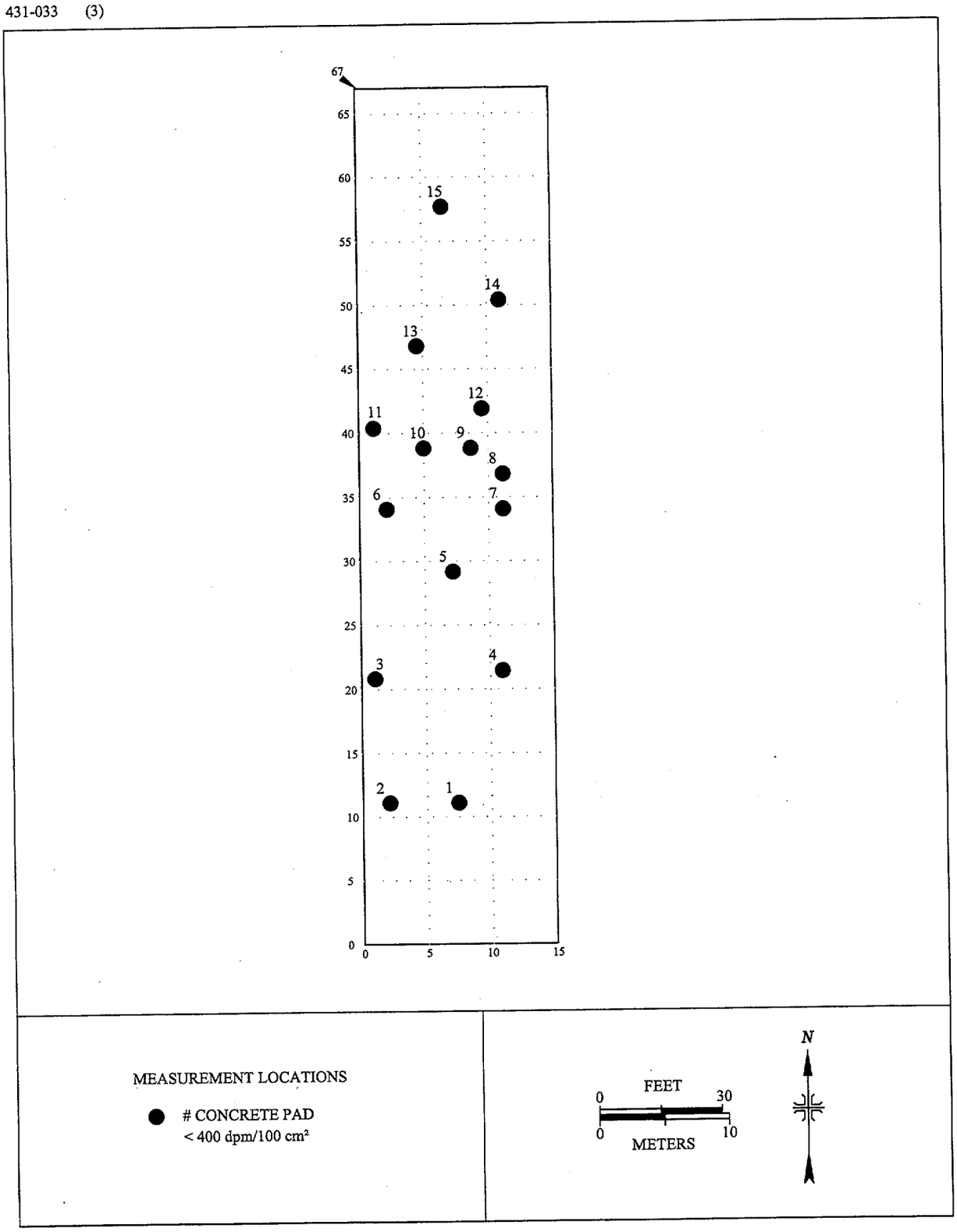


FIGURE 44: Building G-725 - Measurement Locations

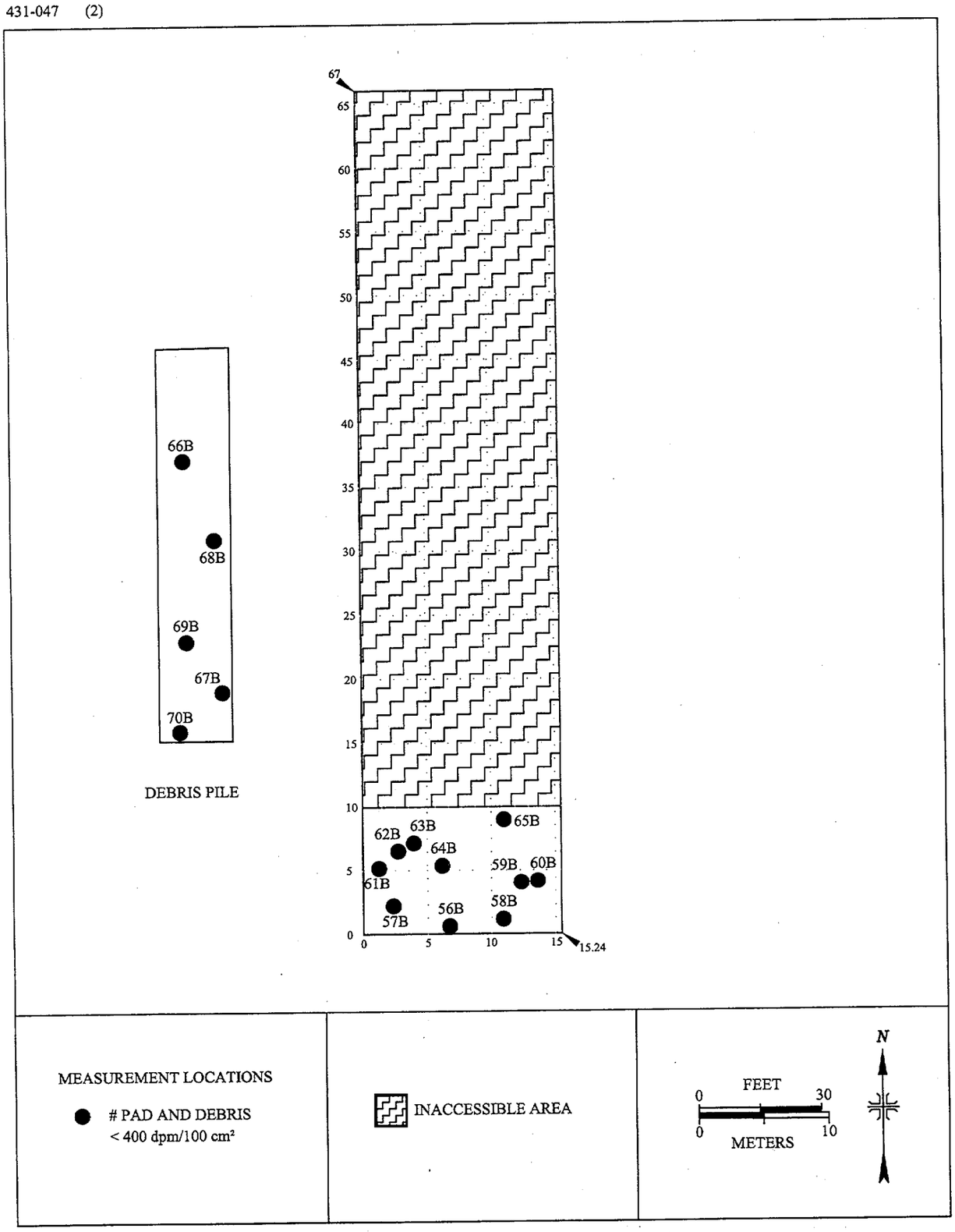


FIGURE 45: Building G-726 - Measurement Locations

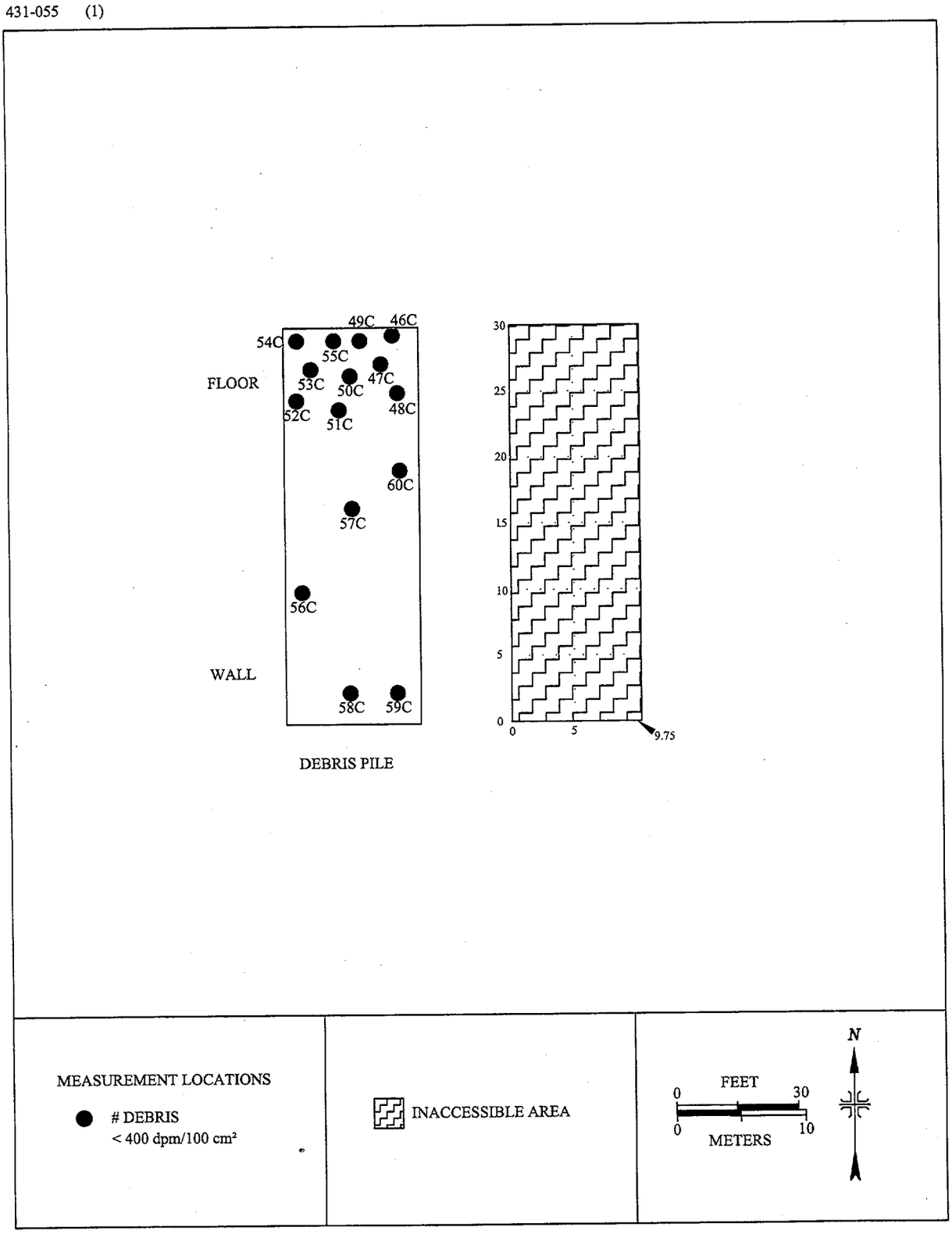


FIGURE 46: Building I-531 - Measurement Locations

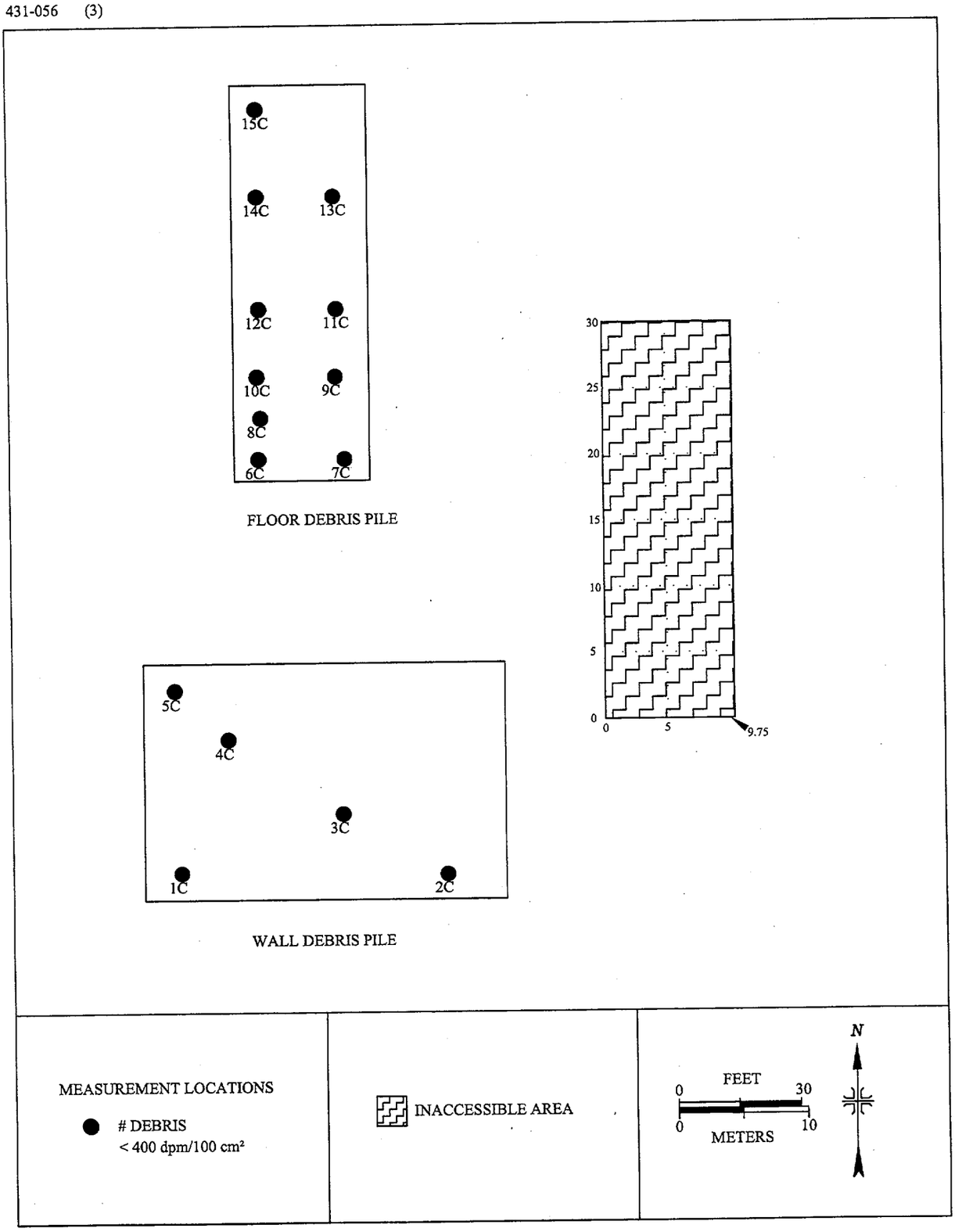


FIGURE 47: Building I-631 - Measurement Locations

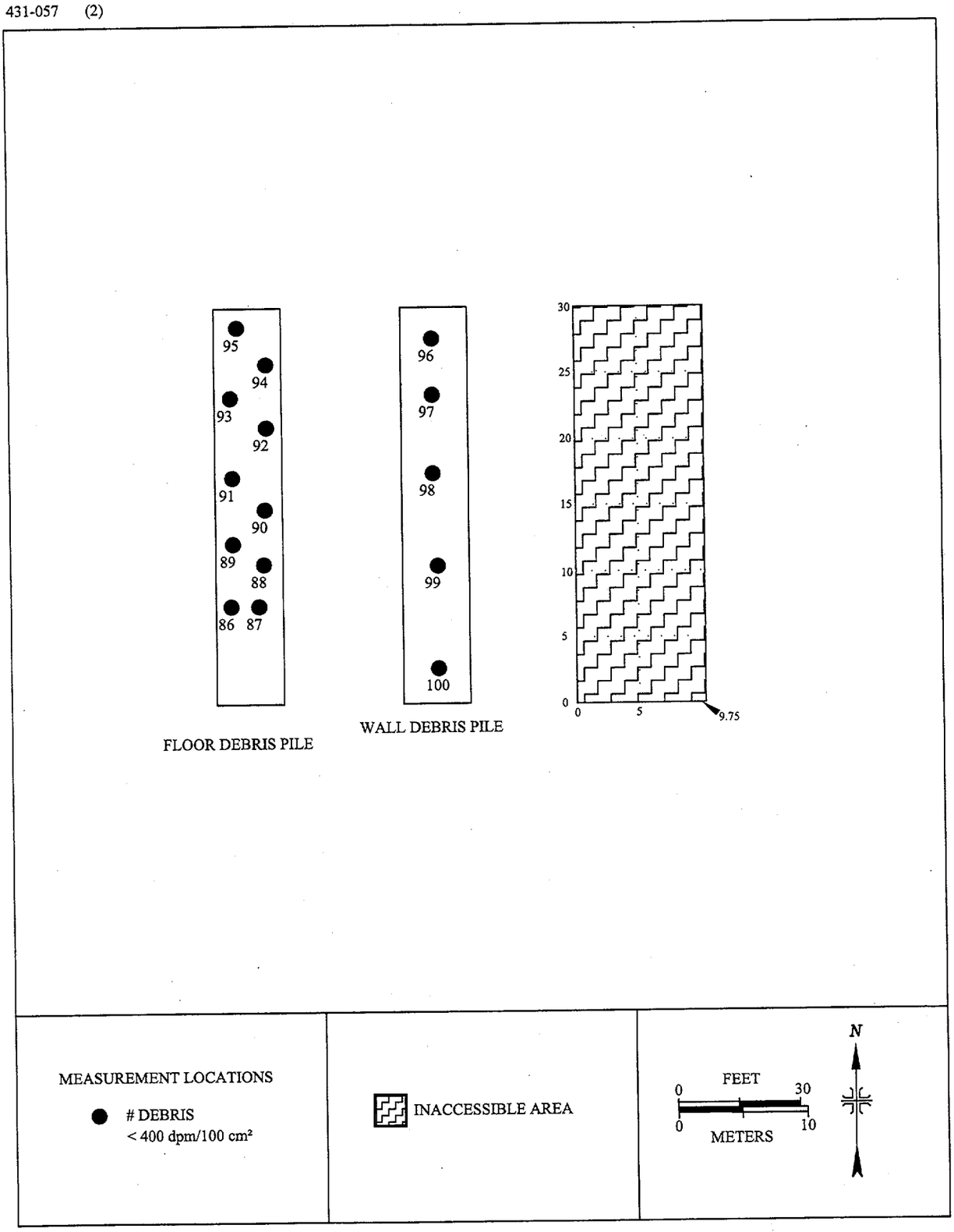


FIGURE 48: Building I-632 - Measurement Locations

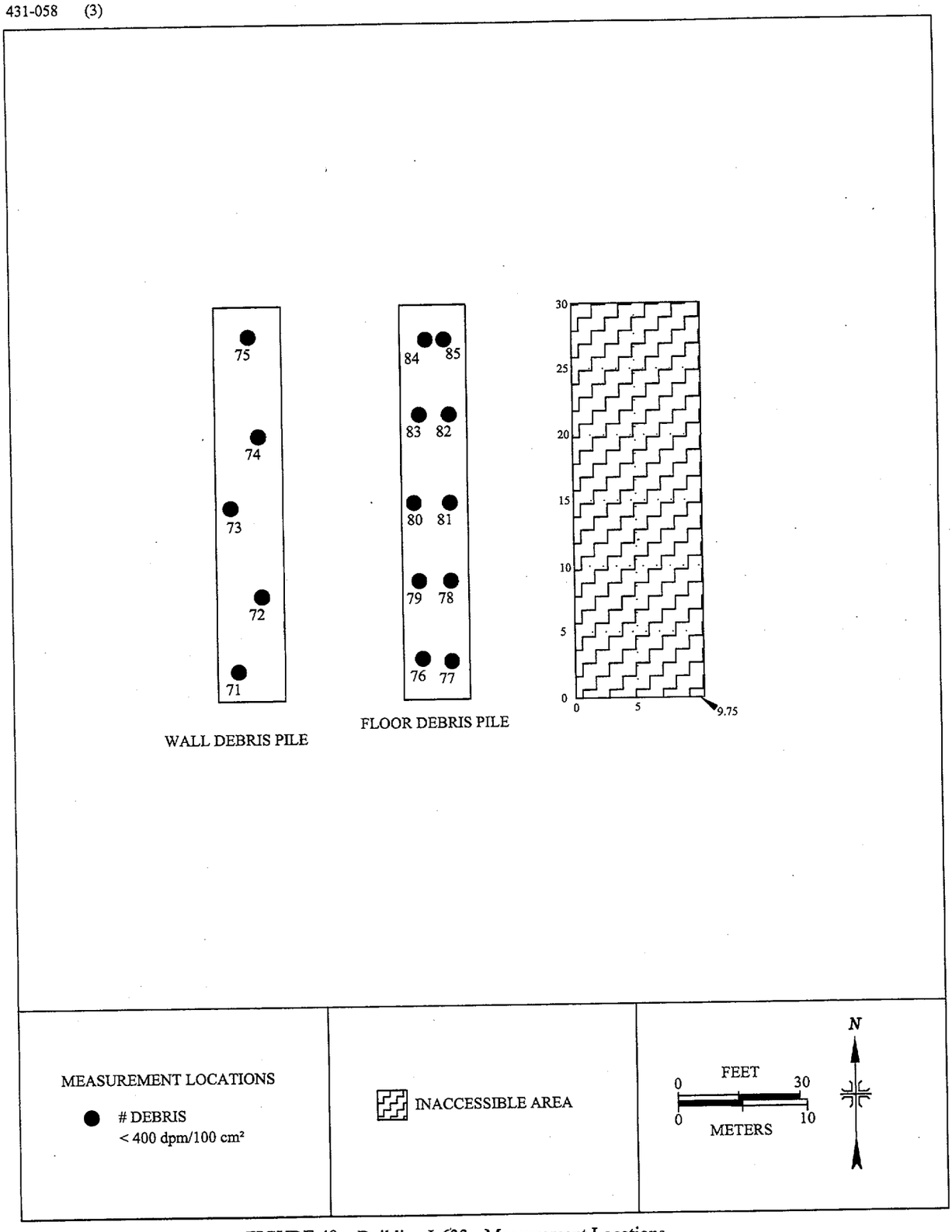


FIGURE 49: Building I-633 - Measurement Locations

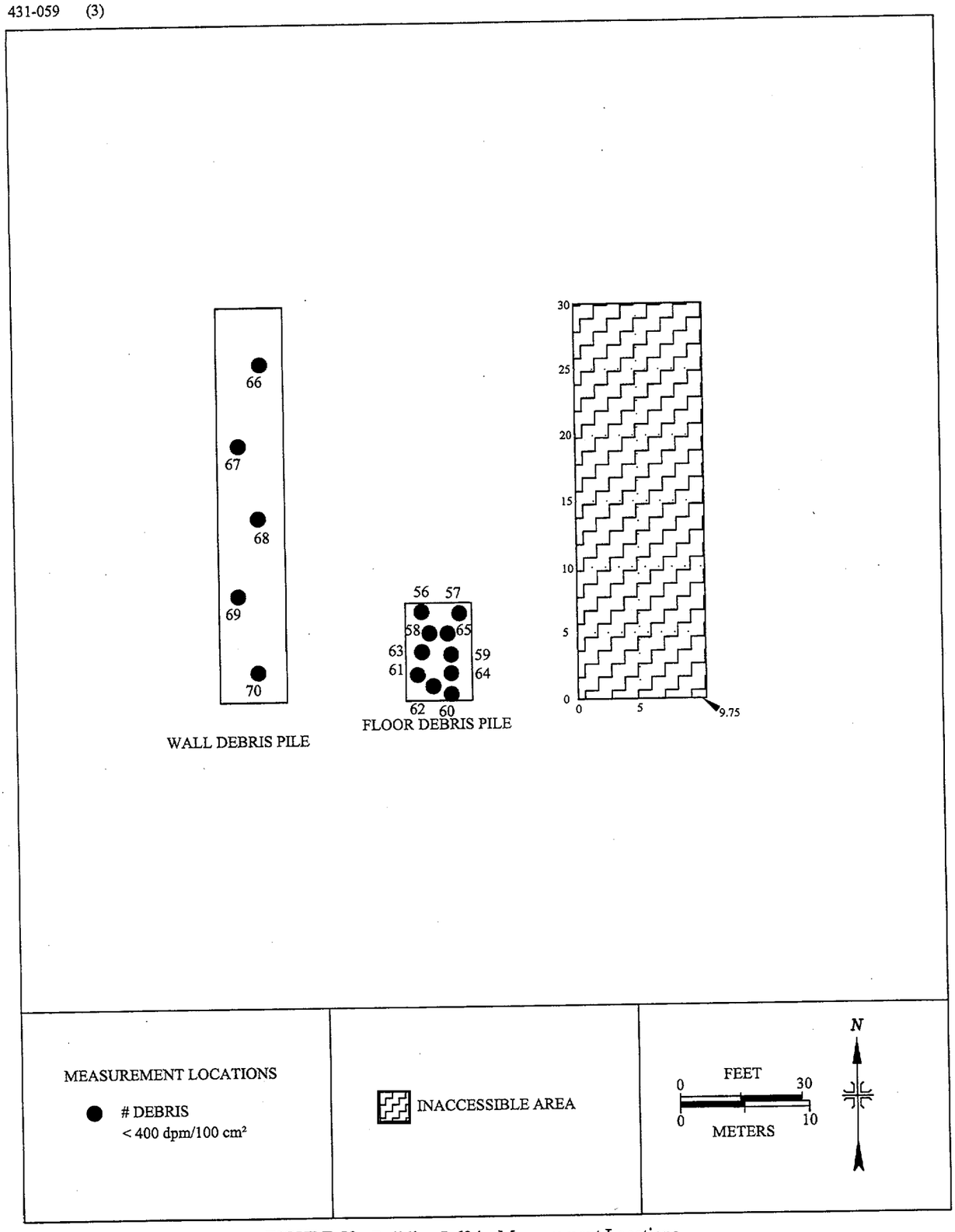
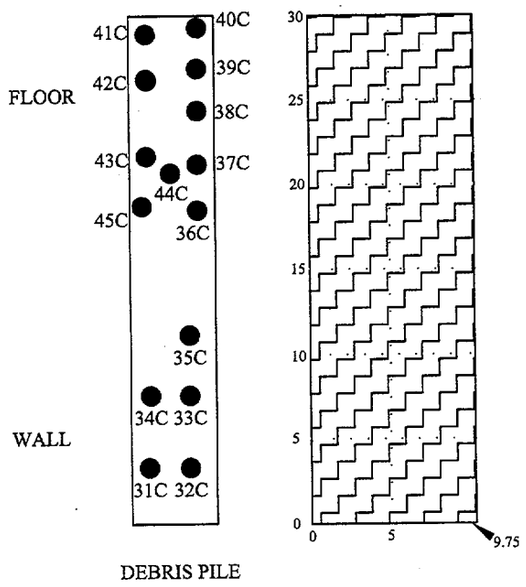


FIGURE 50: Building I-634 - Measurement Locations



MEASUREMENT LOCATIONS

● # DEBRIS
< 400 dpm/100 cm²

INACCESSIBLE AREA

FEET
0 30
0 10
METERS

N

FIGURE 51: Building I-636 - Measurement Locations

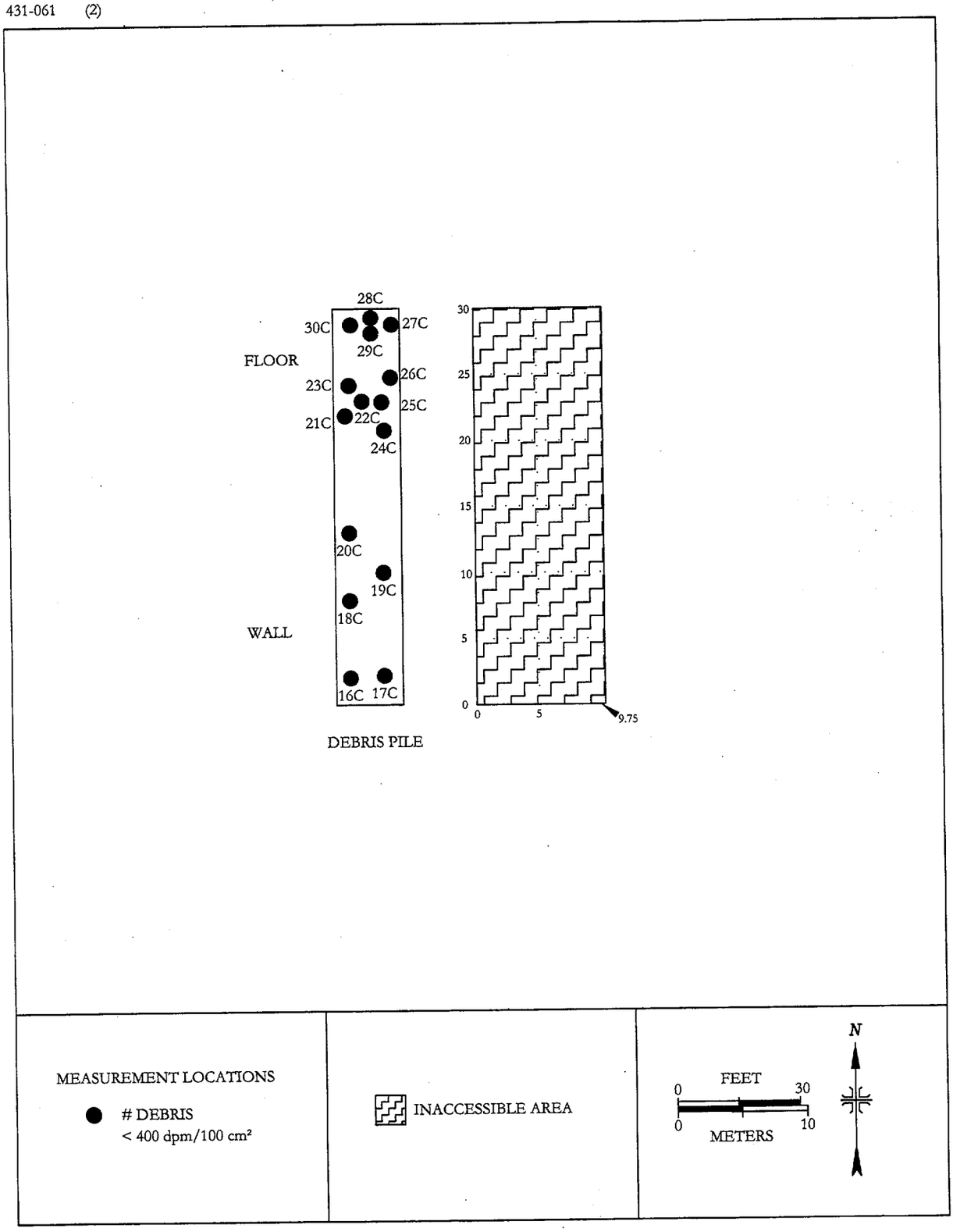


FIGURE 52: Building I-641 - Measurement Locations

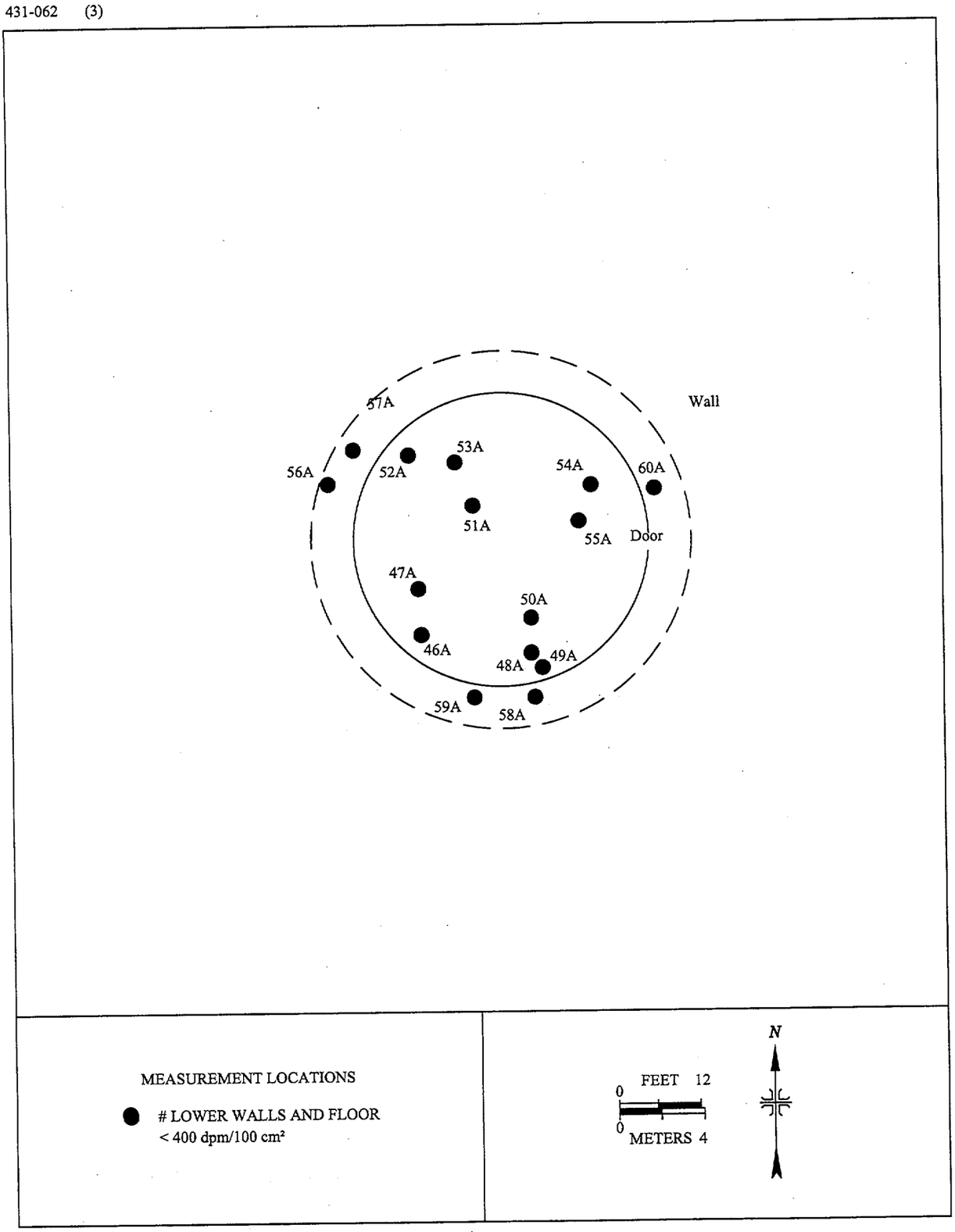
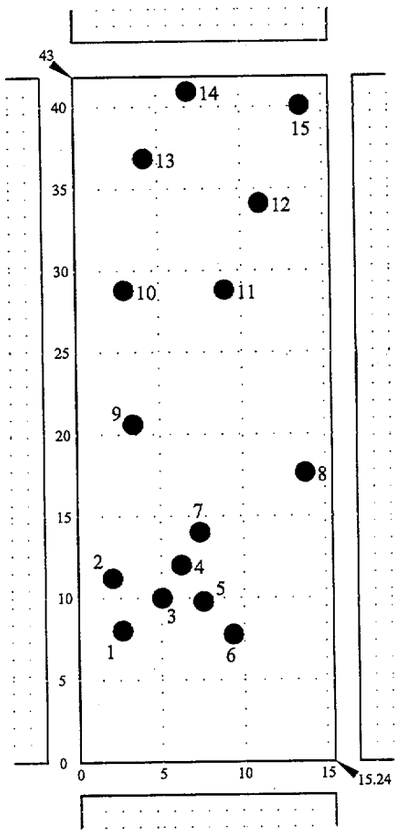


FIGURE 53: Building I-634 Igloo - Measurement Locations



MEASUREMENT LOCATIONS

● # LOWER WALLS AND FLOOR
< 400 dpm/100 cm²

FEET
0 30
0 10
METERS

N

FIGURE 54: Building 821 - Measurement Locations

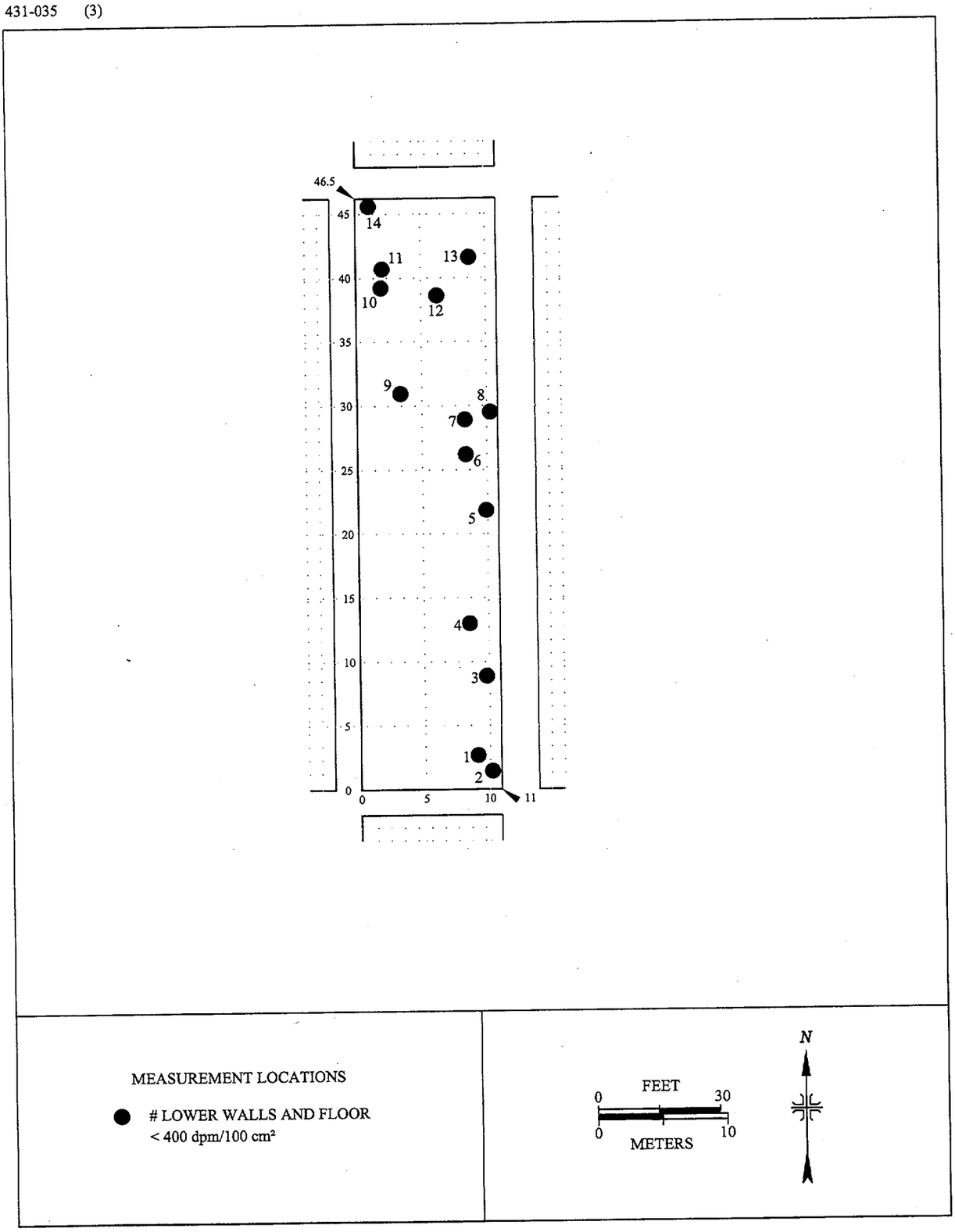


FIGURE 55: Building 825 - Measurement Locations

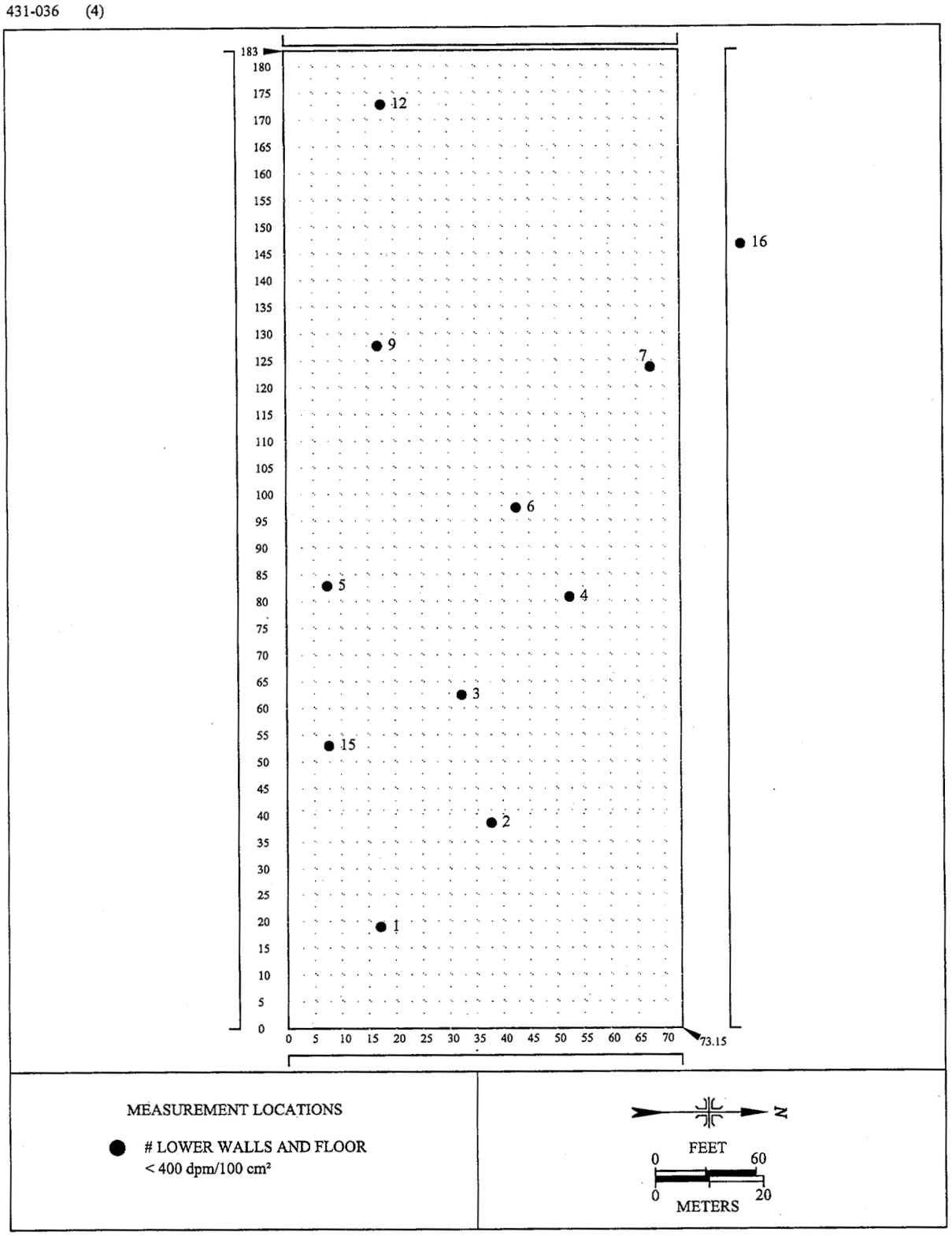


FIGURE 56: Building 1021 - Measurement Locations

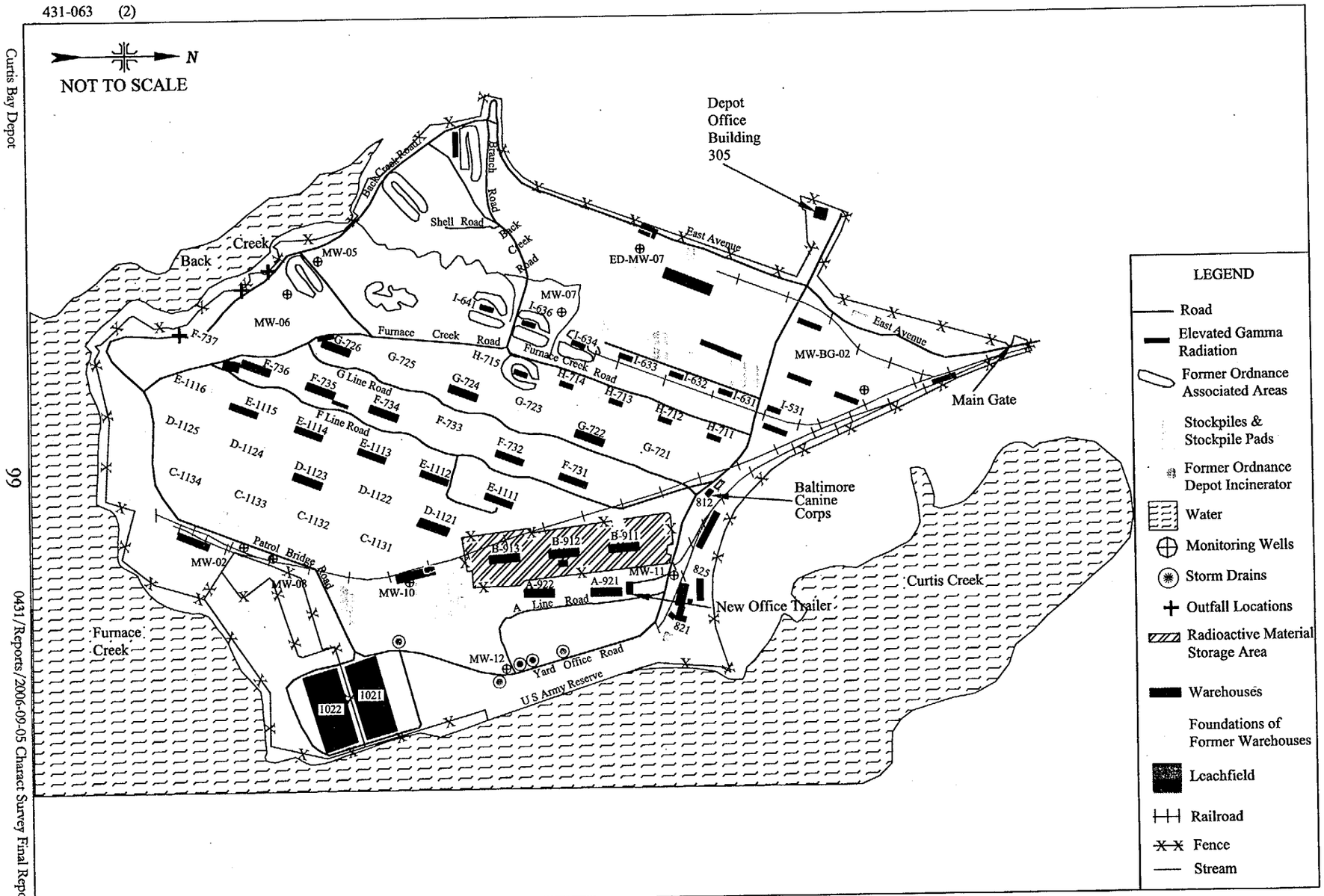


FIGURE 57: Curtis Bay Depot - Scoping Survey Locations of Elevated Gamma Radiation

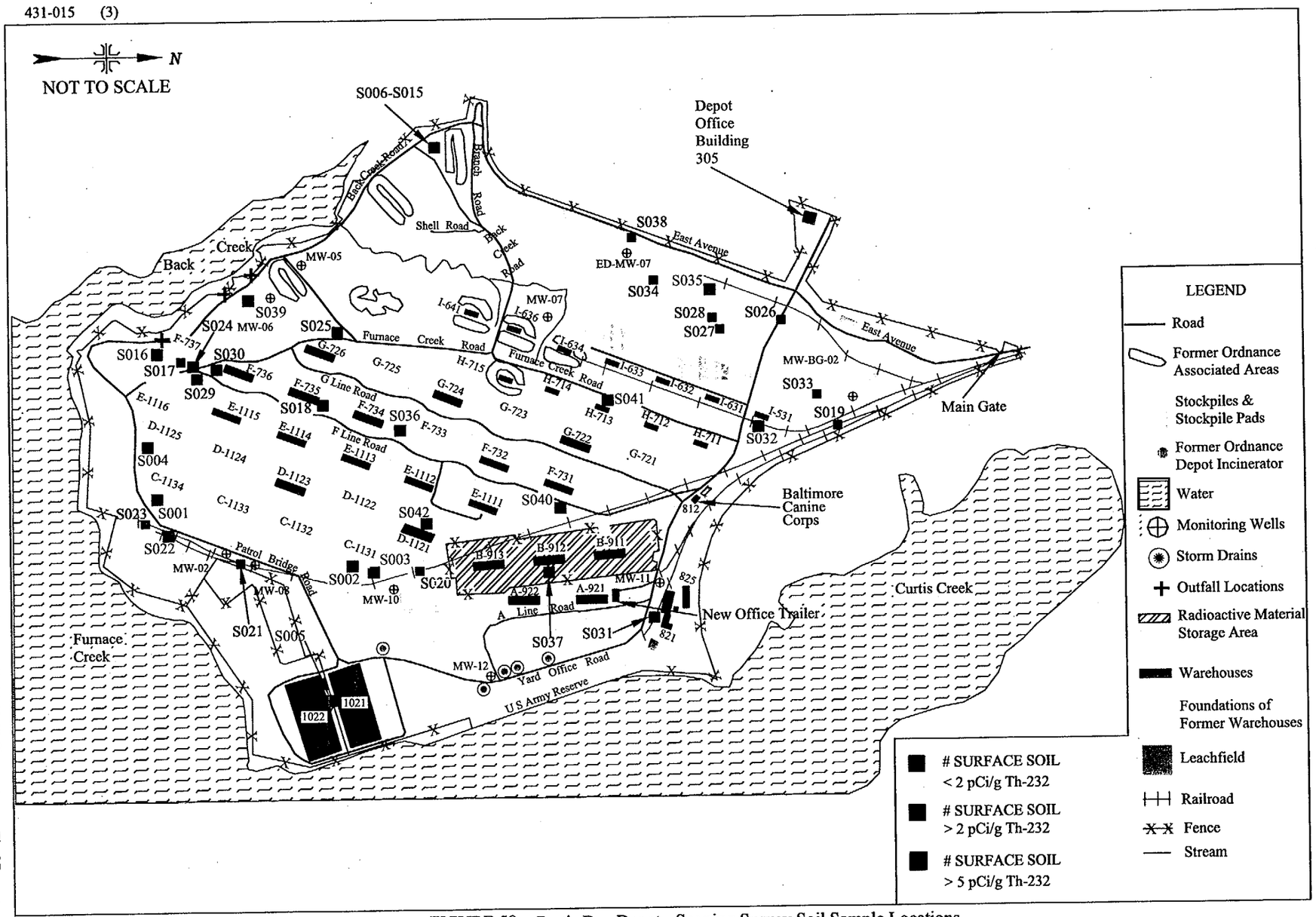


FIGURE 58: Curtis Bay Depot - Scoping Survey Soil Sample Locations

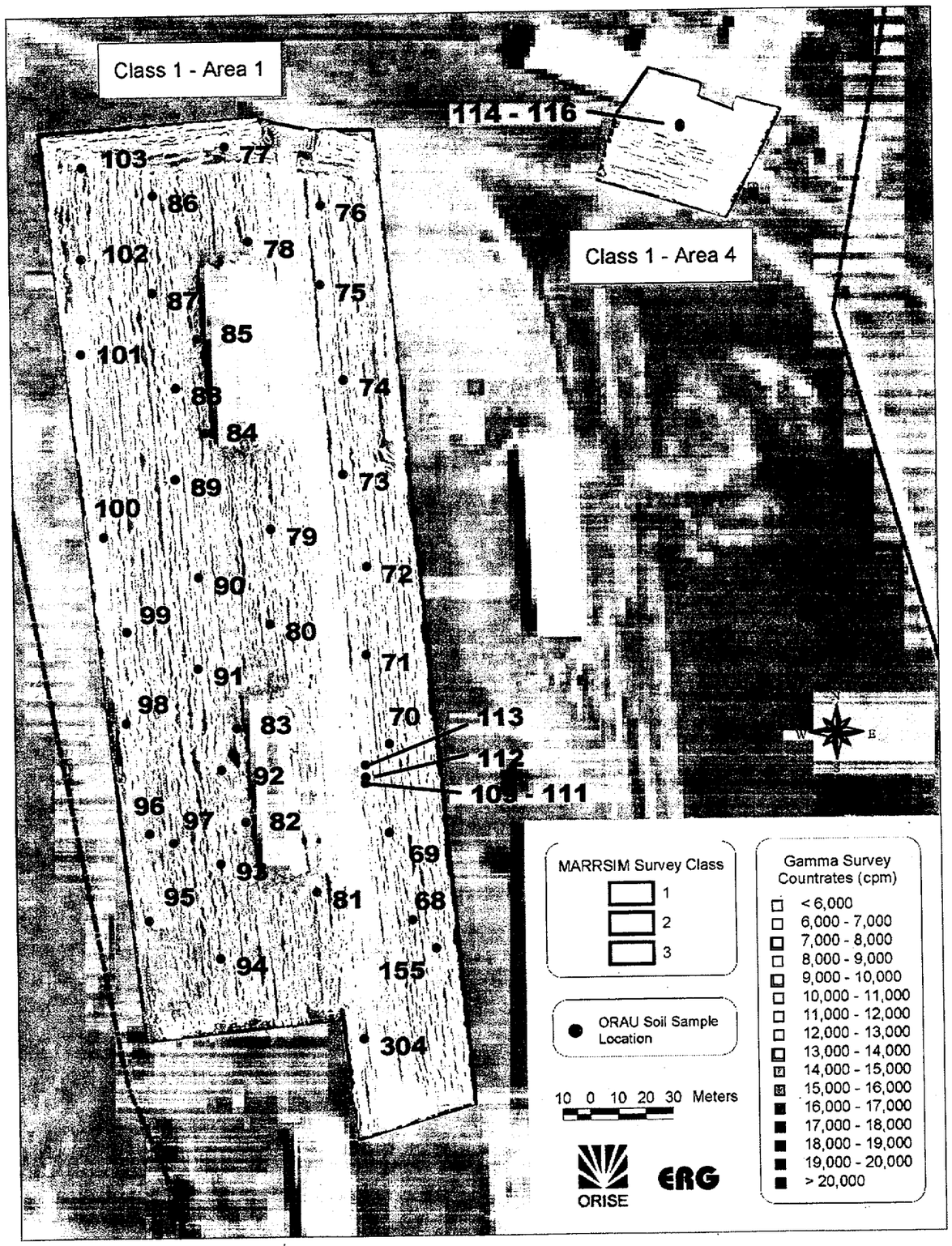


FIGURE 59: Class 1 Survey Areas 1 and 4—Sampling Locations and Gamma Scan Results

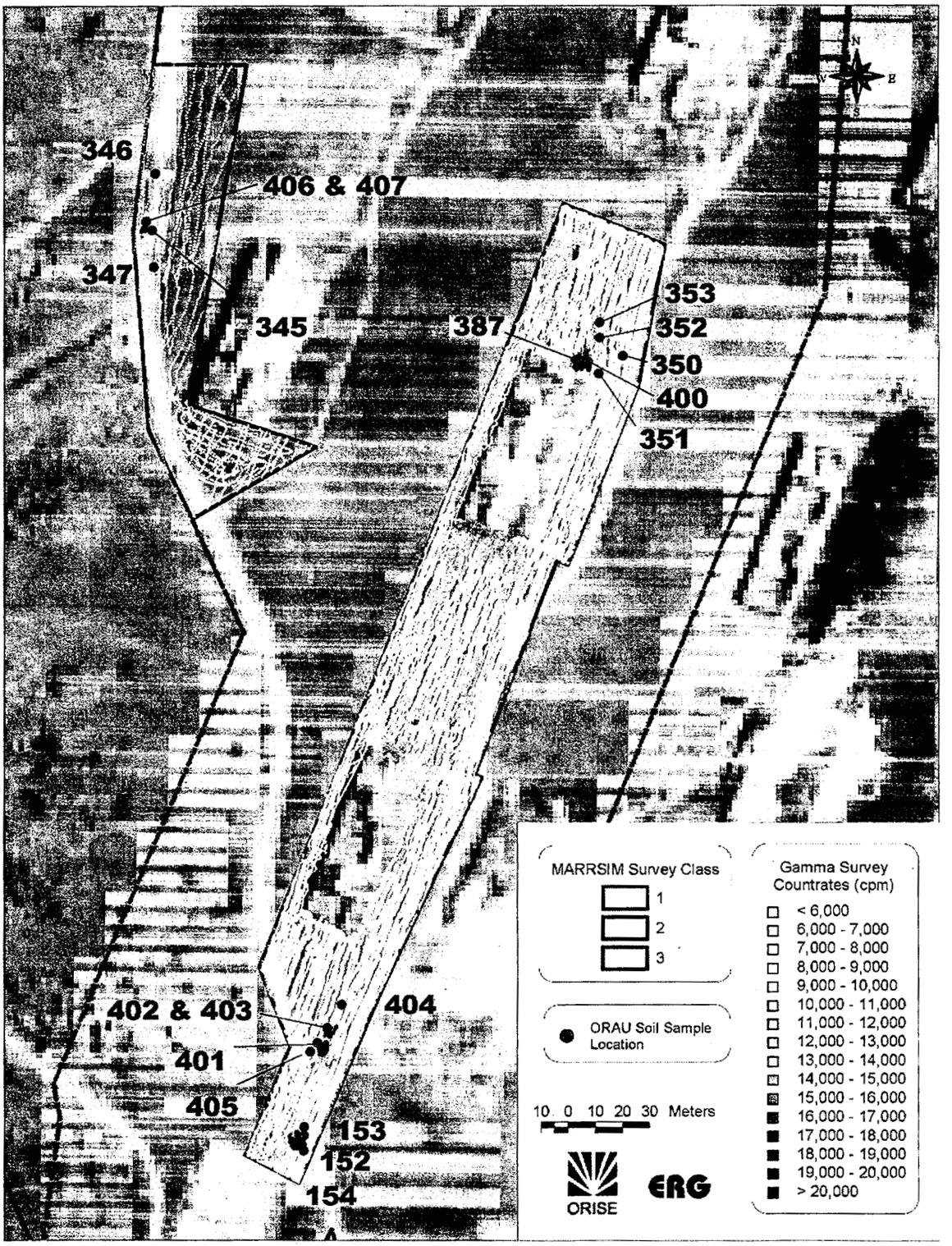
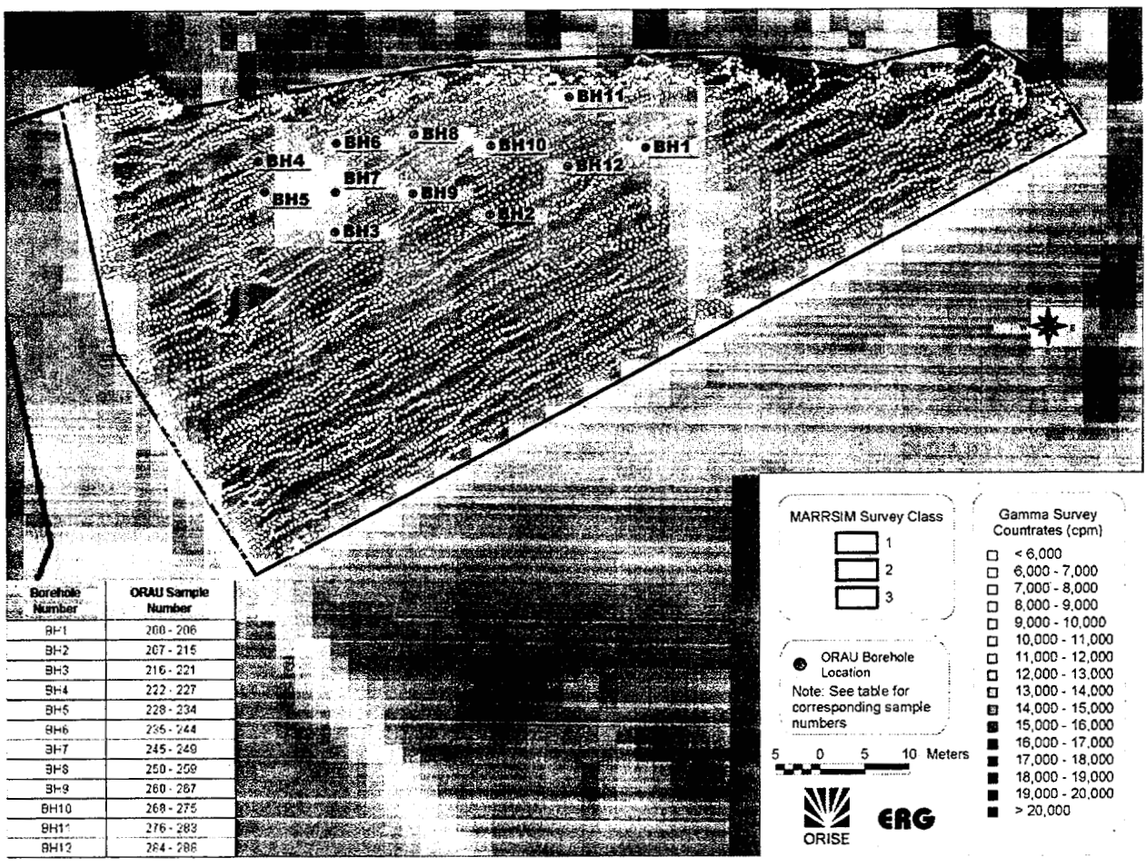


FIGURE 60: Class 1 Survey Area 2—Sampling Locations and Gamma Scan Results



Borehole Number	ORAU Sample Number
BH1	200 - 206
BH2	207 - 215
BH3	216 - 221
BH4	222 - 227
BH5	228 - 234
BH6	235 - 244
BH7	245 - 249
BH8	250 - 259
BH9	260 - 267
BH10	268 - 275
BH11	276 - 283
BH12	284 - 288

FIGURE 61: Class 1 Survey Area 3—Sampling Locations and Gamma Scan Results

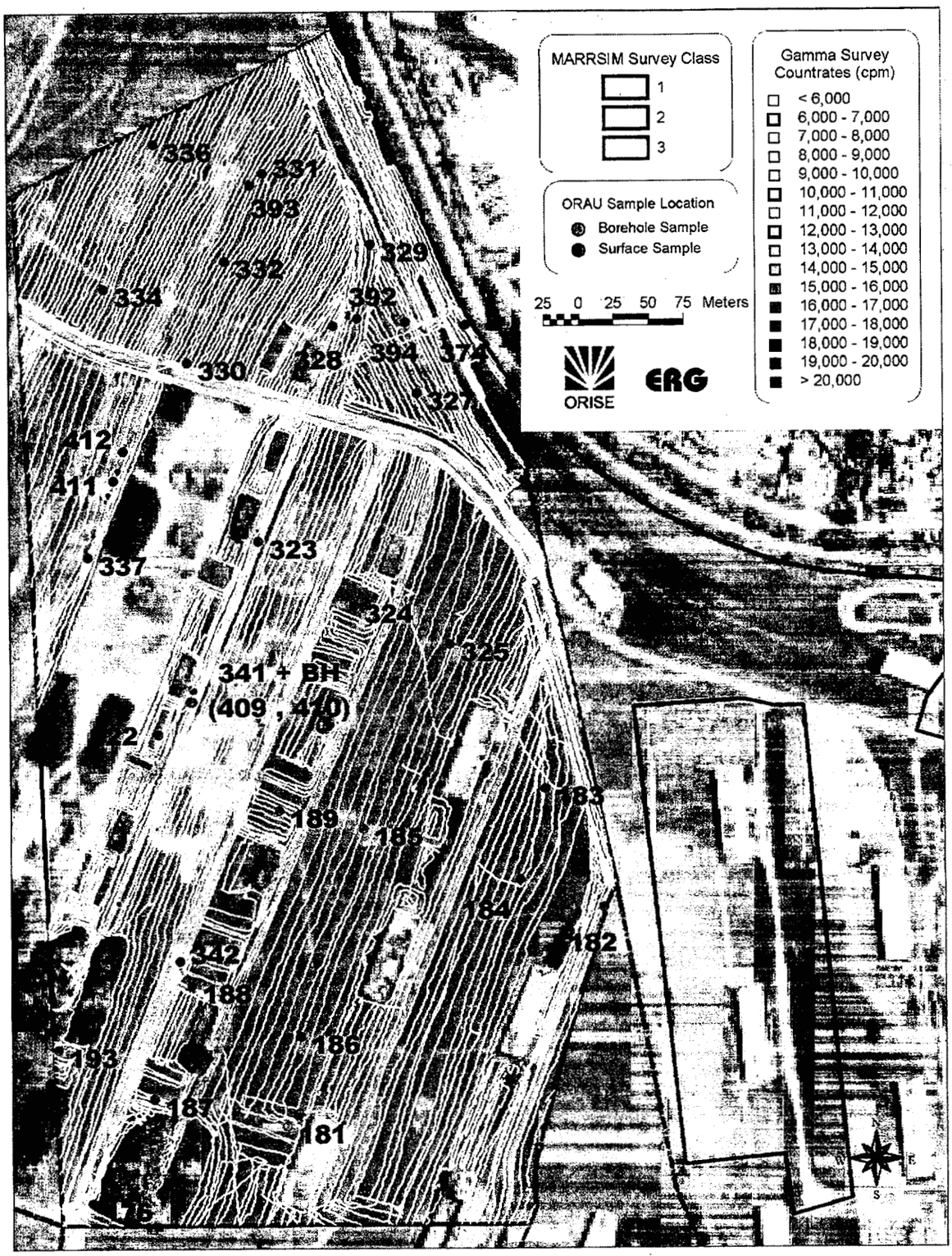


FIGURE 62: Class 2 Survey Area 1—Sampling Locations and Gamma Scan Results

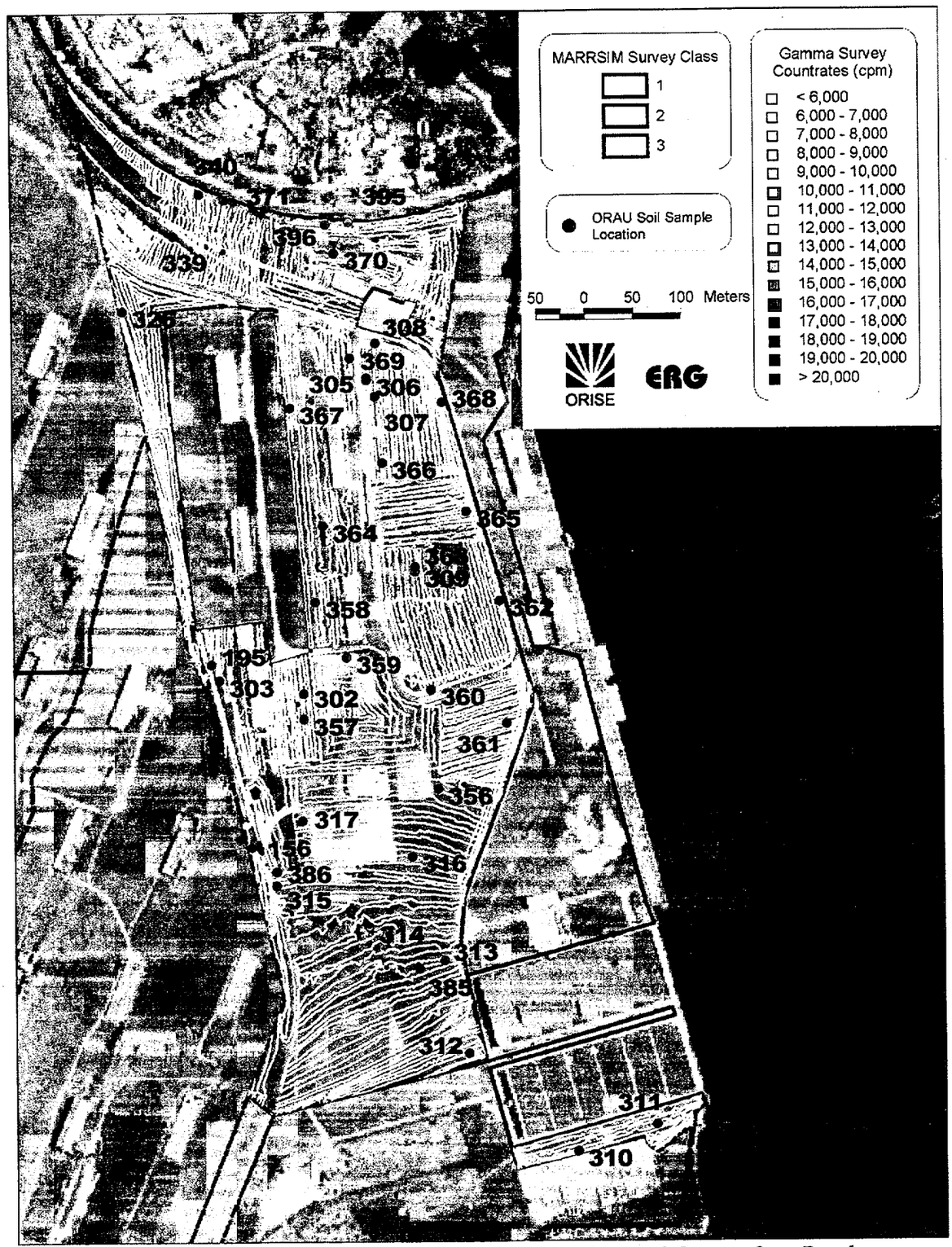


FIGURE 63: Class 2 Survey Area 2—Sampling Locations and Gamma Scan Results

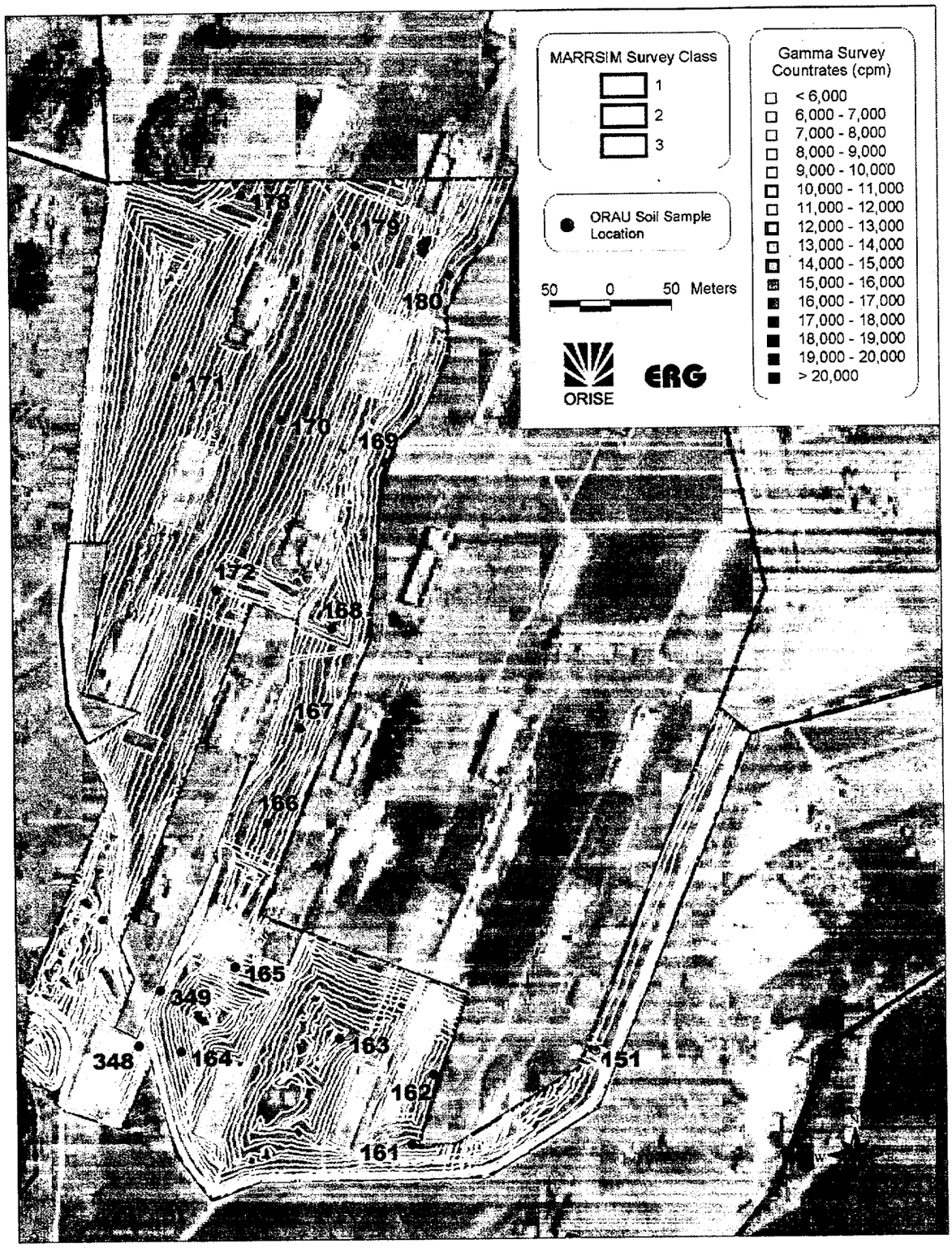


FIGURE 64: Class 2 Survey Area 3—Sampling Locations and Gamma Scan Results

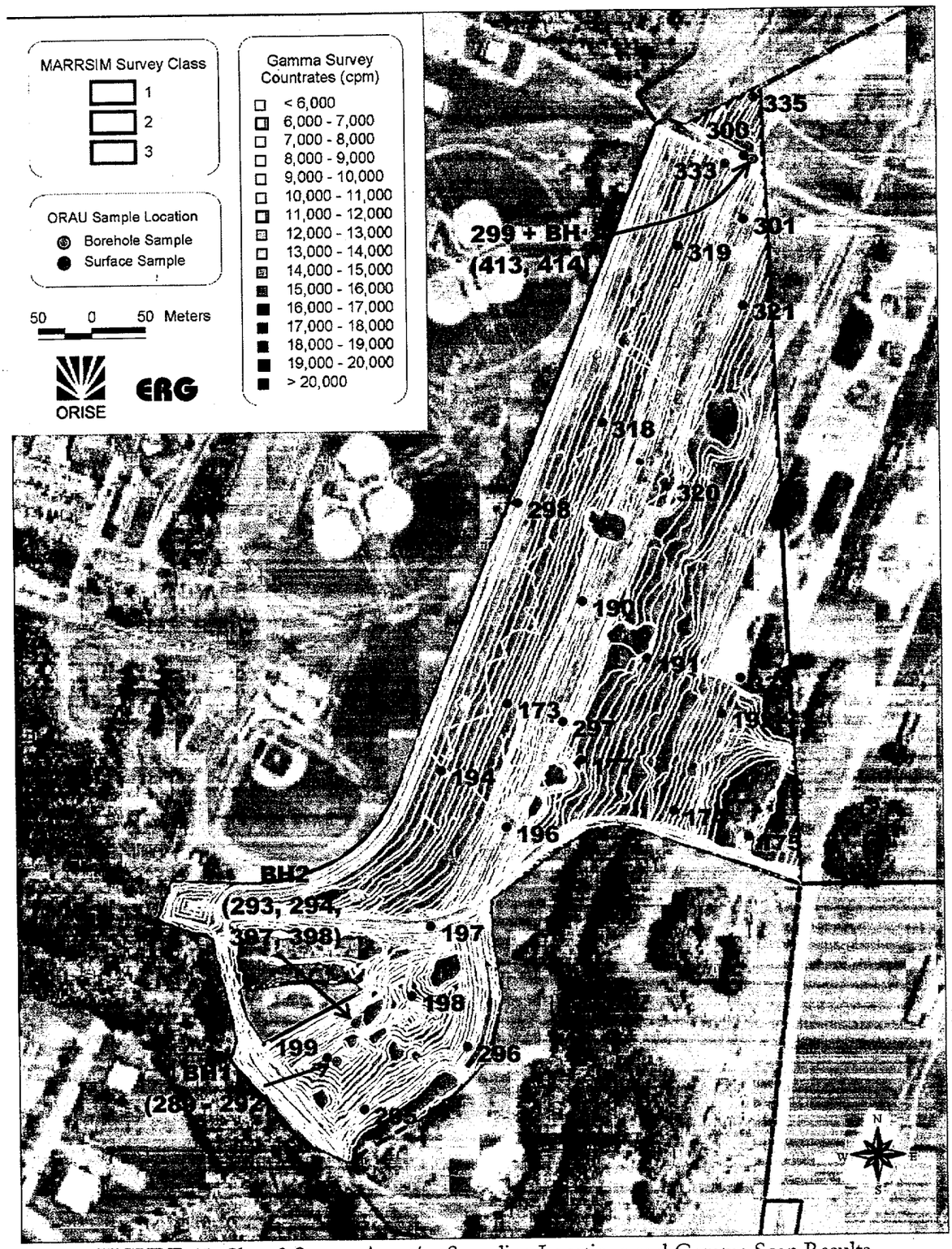


FIGURE 65: Class 2 Survey Area 4—Sampling Locations and Gamma Scan Results

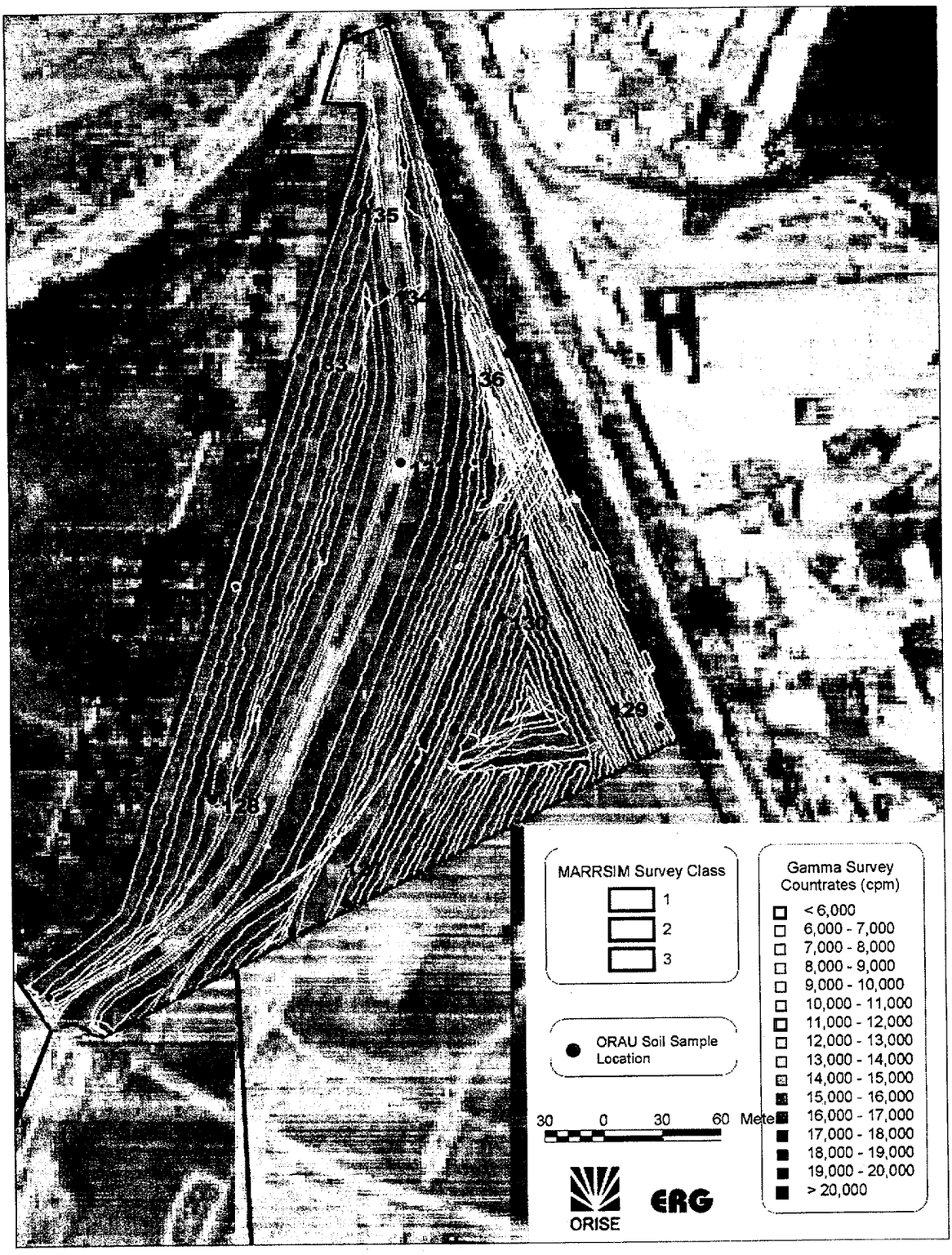


FIGURE 66: Class 3 Survey Unit 1—Sampling Locations and Gamma Scan Results

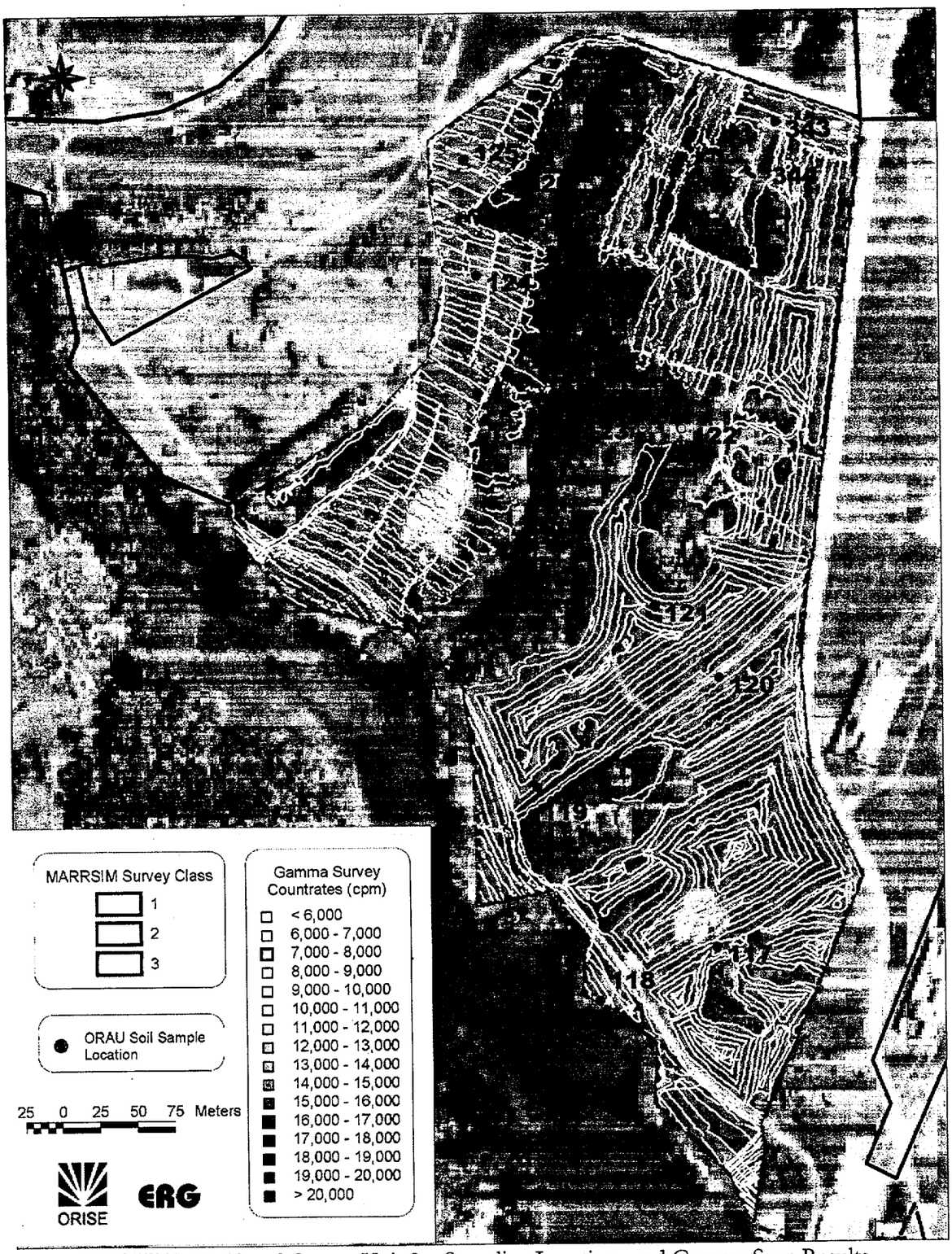


FIGURE 67: Class 3 Survey Unit 2—Sampling Locations and Gamma Scan Results

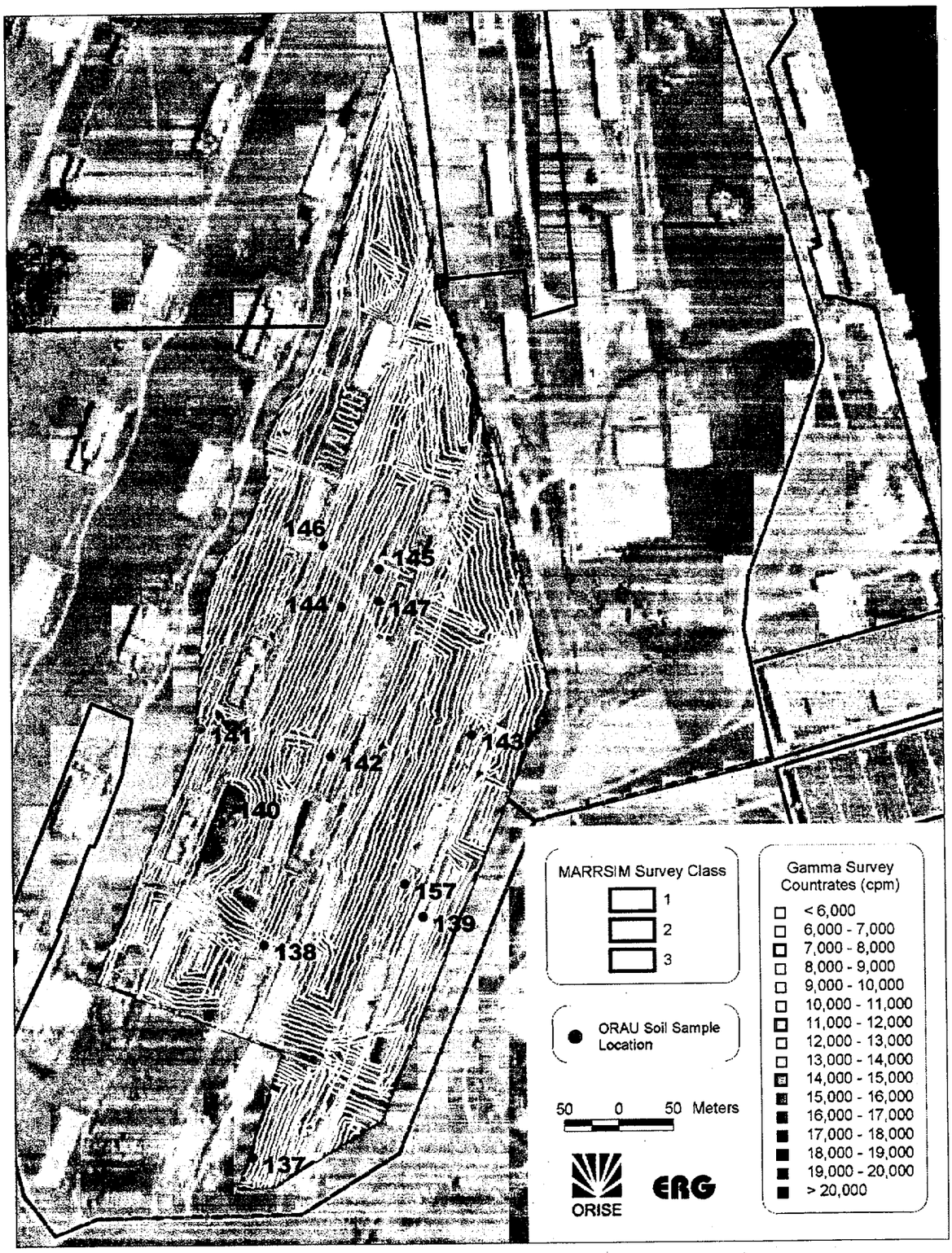


FIGURE 68: Class 3 Survey Unit 3—Sampling Locations and Gamma Scan Results

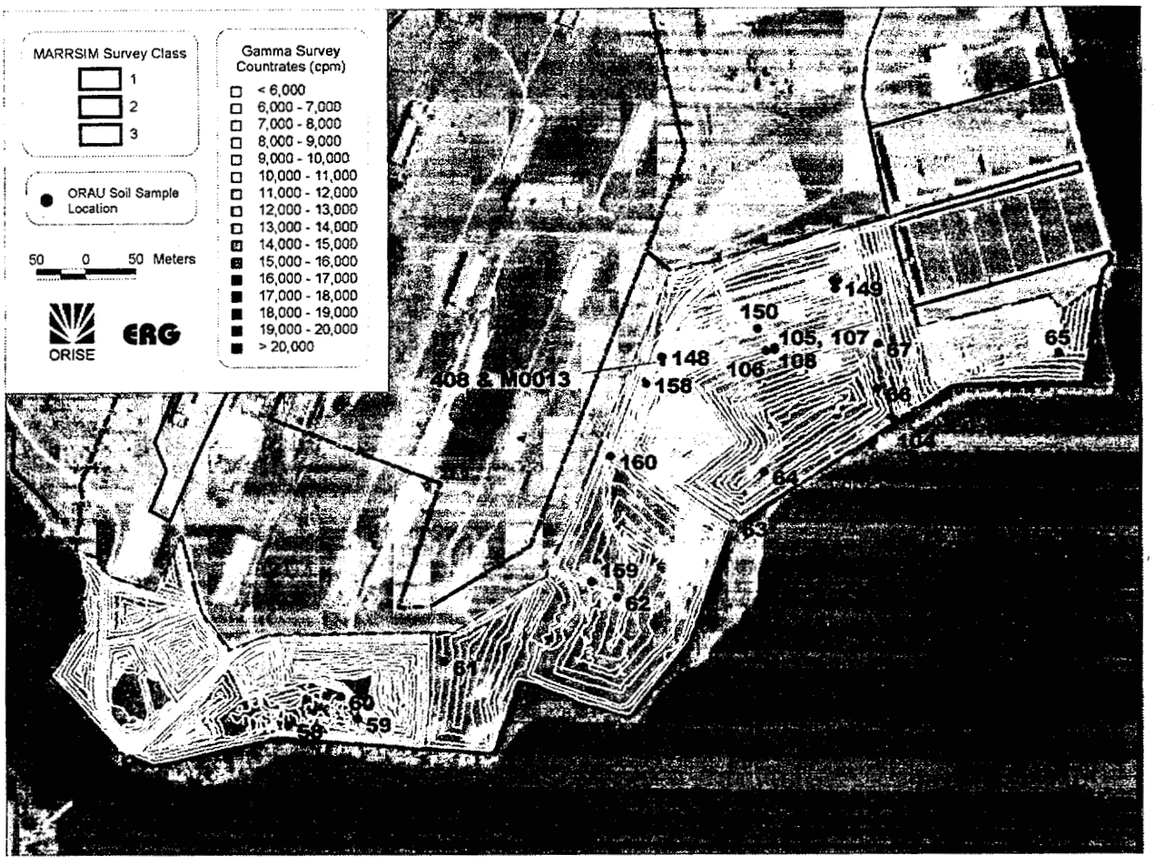


FIGURE 69: Class 3 Survey Unit 4—Sampling Locations and Gamma Scan Results

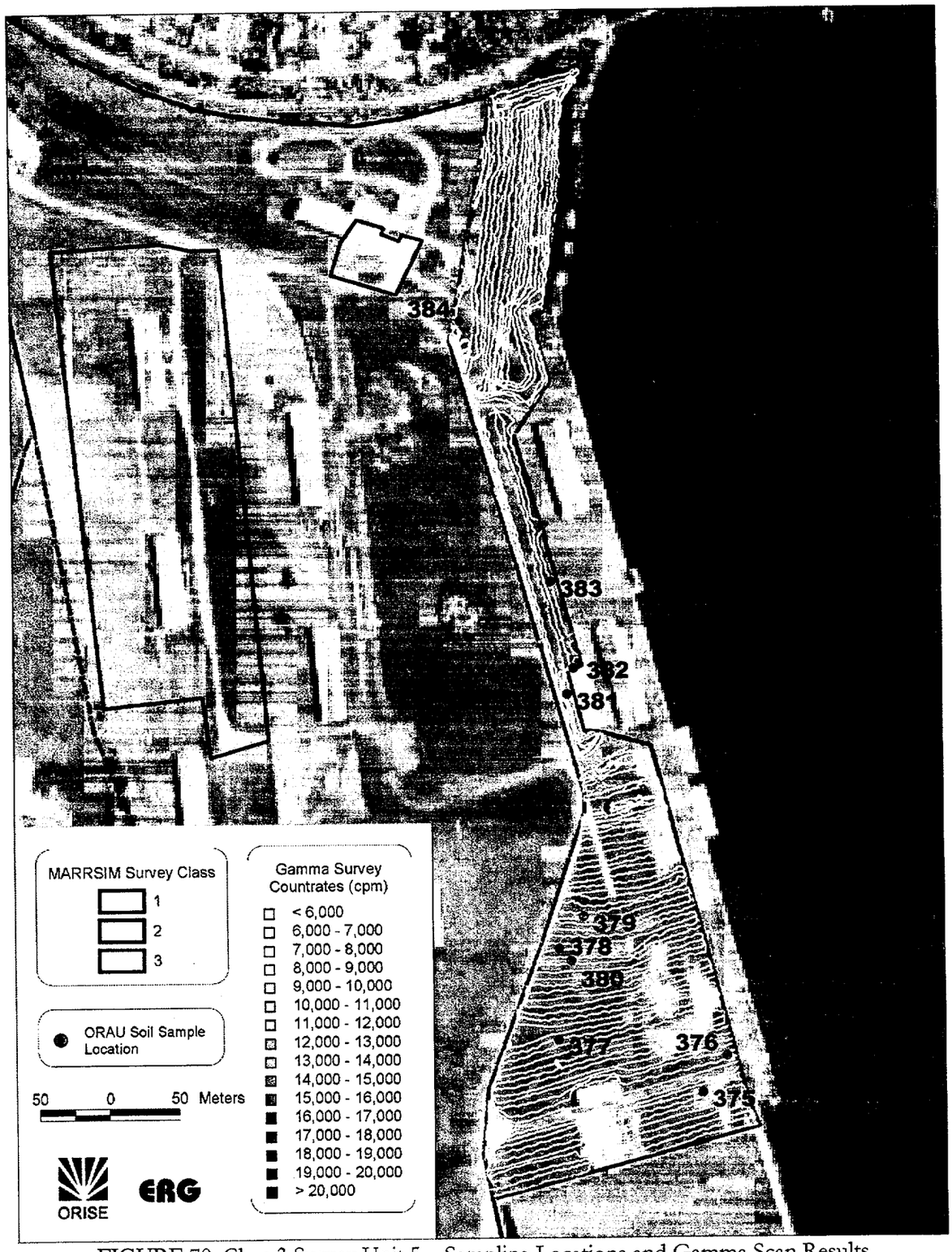


FIGURE 70: Class 3 Survey Unit 5—Sampling Locations and Gamma Scan Results

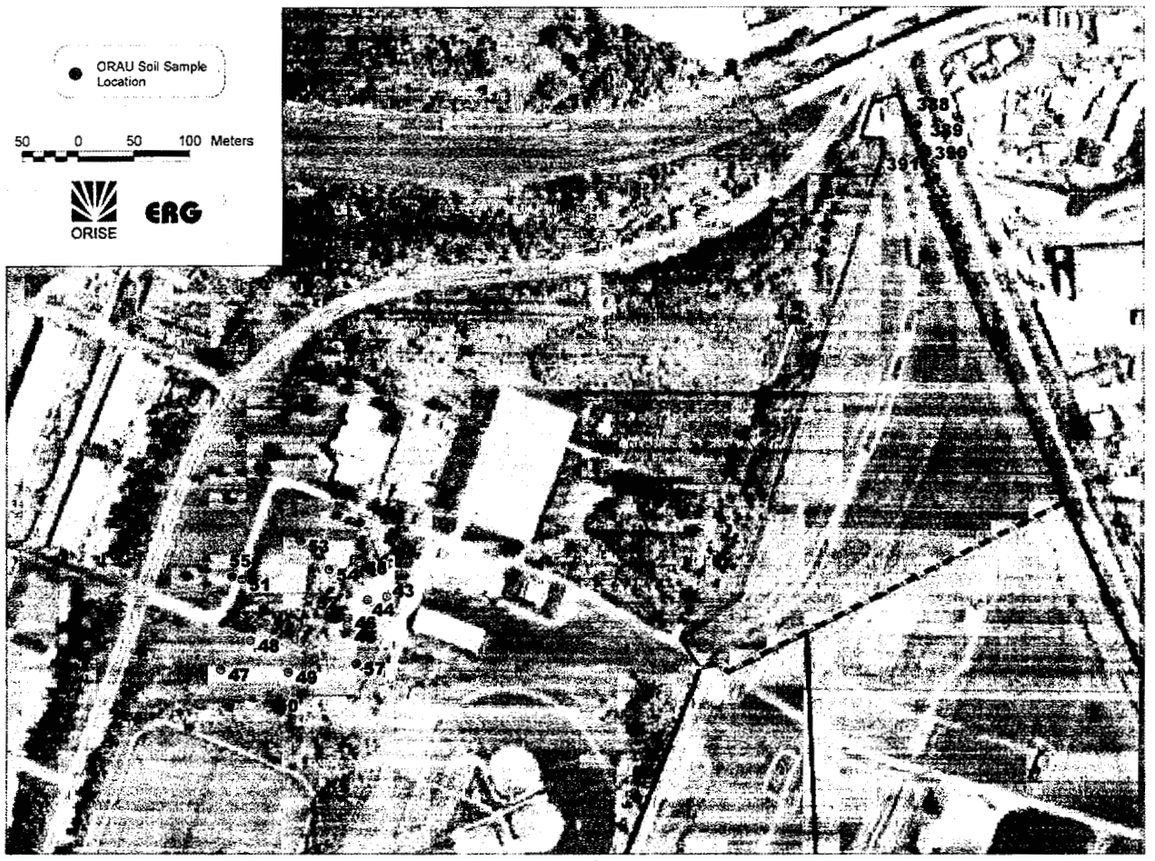
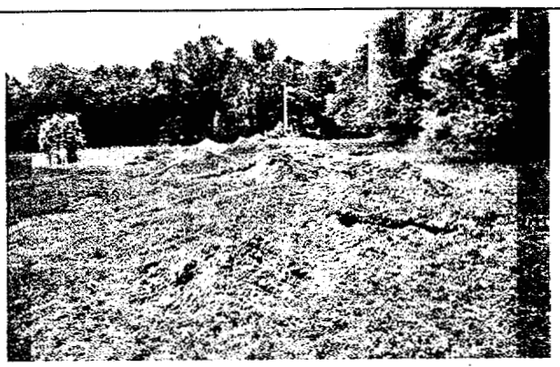


FIGURE 71: Background Reference Areas—Sampling Locations

FIGURE 72: Curtis Bay Depot—Overview of Characterization Soil Sampling Results

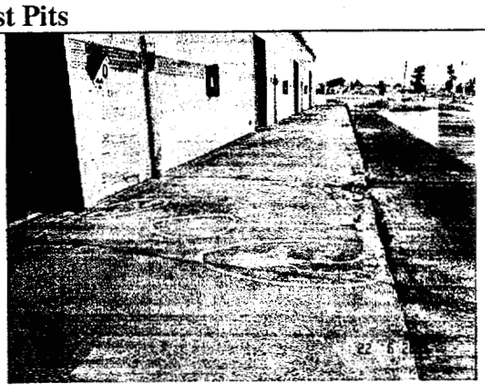
FIGURE 73: Curtis Bay Depot—Areas of Concern

Scoping Survey—Building Pad



Scoping Survey—Former Disposal Area Test Pits

Scoping Survey—Building B-911 Floor

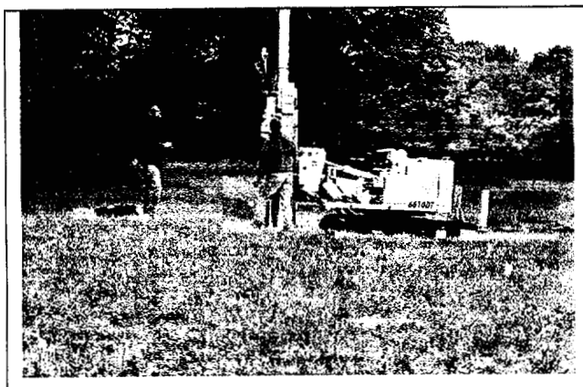


Scoping Survey—Building B-911 Loading Dock

Scoping Survey—Deconstructed Building

Scoping Survey—Deconstructed Building Wall Debris

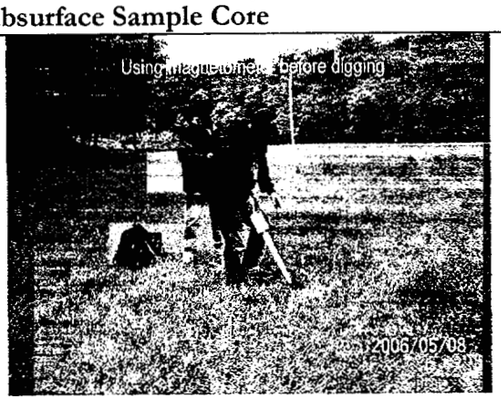
FIGURE 74: Scoping Survey



Characterization Survey—Former Disposal Area Subsurface Sampling

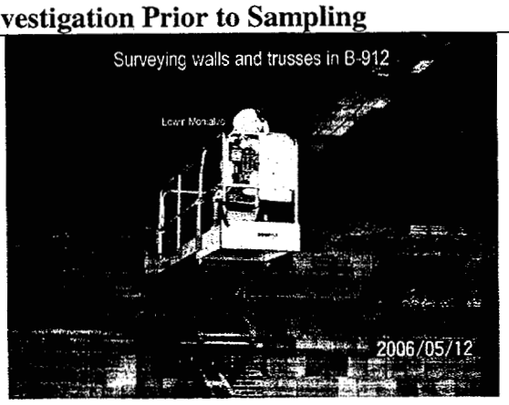
Characterization Survey—Evaluating Subsurface Sample Core

Characterization Survey—Class 2, Area 4 Gamma Scanning



Characterization Survey—MEC Investigation Prior to Sampling

Characterization Survey—Lower Wall Survey

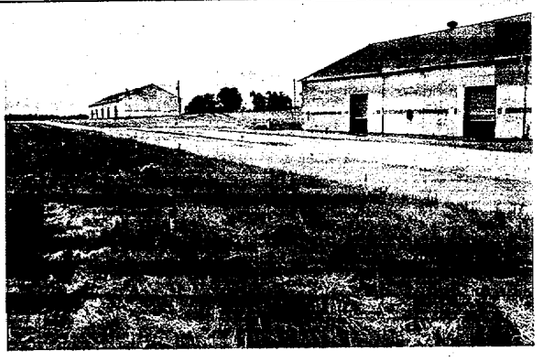


Characterization Survey—Overhead Surface Survey

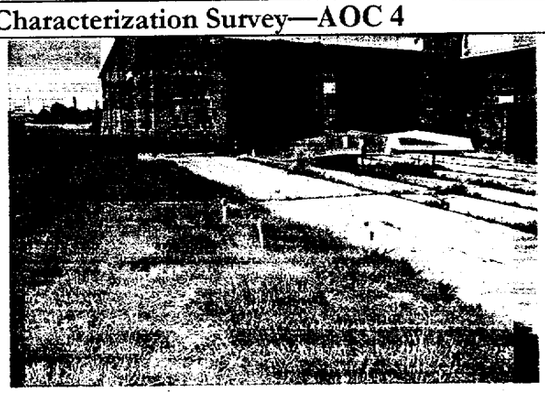
FIGURE 75: Characterization Survey Activities

Characterization Survey—AOC 5

Characterization Survey—AOC 4



Characterization Survey—B Line AOC 8



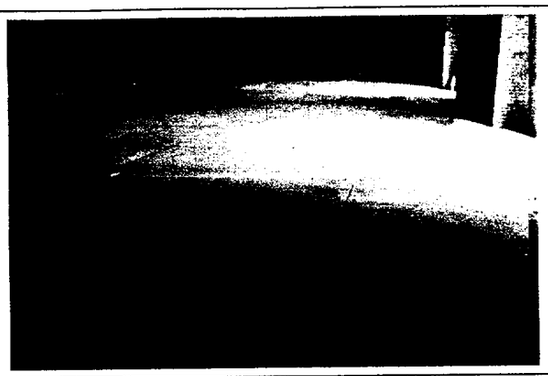
Characterization Survey—Building 821/825 AOC 9

Characterization Survey—C Line AOC 2

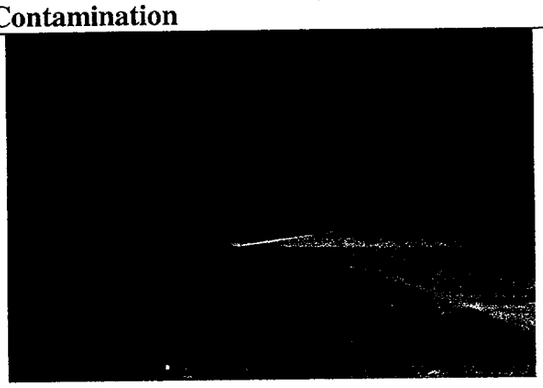
Characterization Survey—F-735 AOC 3

FIGURE 76: Characterization Survey AOCs

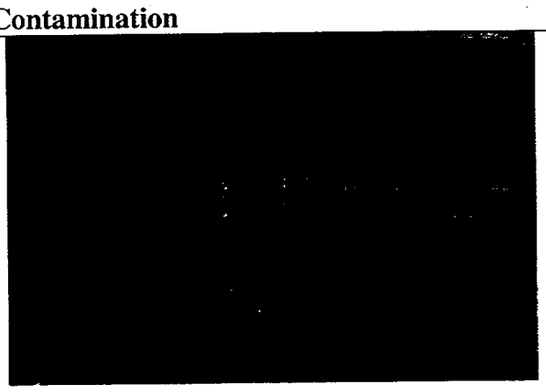
Characterization Survey—B-911 Wall Contamination



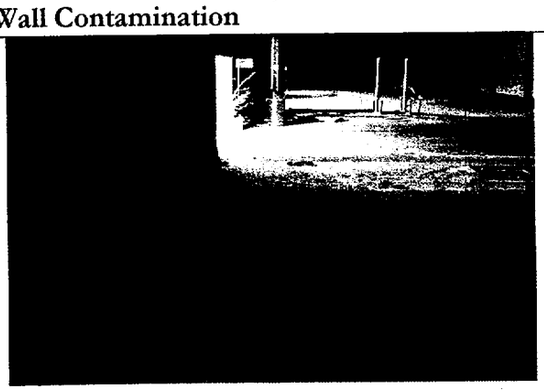
Characterization Survey—B-911 Floor Contamination



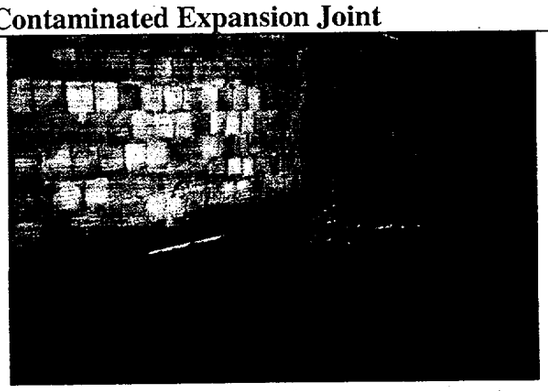
Characterization Survey—B-912 Floor and Wall Contamination



Characterization Survey—B-912 Contaminated Expansion Joint



Characterization Survey—F-731 Contaminated Floor



Characterization Survey—F-731 Contaminated Wall

FIGURE 77: Characterization Survey Building AOCs

TABLES

TABLE 1

BUILDING INFORMATION
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building Line Designation	Building ID	Condition/Survey Phase	History of Radioactive Material Use	Radioactive Material[a]	Building Classification
Warehouses	1021	Surveyed Phase 1	No	--[b]	3
73 m × 183 m	1022	Surveyed Phase 1	Yes	Th	2
A Line	A-921	Surveyed Phase 1	Yes	Th, MS	2
15 m × 67 m	A-922	Surveyed Phase 1	No		3
B Line	B-911	Surveyed Phase 1	Yes	Th, SS	1
15 m × 67 m	B-912	Surveyed Phase 1	Yes	Th	1
	B-913	Surveyed Phase 1	Yes	Th	2
C Line	C-1131	Surveyed Phase 1/Pad	No	--	3
15 m × 67 m	C-1132	Surveyed Phase 1/Pad	No	--	3
	C-1133	Surveyed Phase 1/Pad	No	--	3
	C-1134	Surveyed Phase 1/Pad	No	--	3
D Line	D-1121	Deconstructed	No	--	3
15 m × 67 m	D-1122	Surveyed Phase 1/Pad	No	--	3
	D-1123	Deconstructed	No	--	3
	D-1124	Surveyed Phase 1/Pad	No	--	3
	D-1125	Surveyed Phase 1/Pad	No	--	3
E Line	E-1111	Surveyed Phase 1	No	--	3
15 m × 67 m	E-1112	Surveyed Phase 1/Pad	No	--	3
	E-1113	Deconstructed	No	--	3
	E-1114	Deconstructed	No	--	3
	E-1115	Deconstructed	No	--	3
	E-1116	Surveyed Phase 1/Pad	No	--	3

TABLE 1 (Continued)

BUILDING INFORMATION
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building Line Designation	Building ID	Condition/Survey Phase	History of Radioactive Material Use	Radioactive Material[a]	Building Classification
F Line	F-731	Surveyed Phase 1	Yes	Th	1
15 m × 67 m	F-732	Deconstructed	No	--	3
	F-733	Surveyed Phase 1/Pad	No	--	3
	F-734	Deconstructed	Yes	Th	2
	F-735	Deconstructed	Yes	MS	2
	F-736	Deconstructed	Yes	MS	2
	F-737	Surveyed Phase 1/Pad	Yes	MS	1
G Line	G-721	Surveyed Phase 1/Pad	Yes	SS	2
15 m × 67 m	G-722	Deconstructed	No	--	3
	G-723	Surveyed Phase 1/Pad	No	--	3
	G-724	Deconstructed	No	--	3
	G-725	Surveyed Phase 1/Pad	No	--	3
	G-726	Deconstructed	No	--	3
H Line	H-711	Deconstructed	Yes	SS	2
10 m × 29 m	H-712	Deconstructed	Yes	SS	2
	H-713	Deconstructed	Yes	SS	2
	H-714	Deconstructed	Yes	SS	2
	H-715	Deconstructed	Yes	SS	2

TABLE 1 (Continued)

BUILDING INFORMATION
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building Line Designation	Building ID	Condition/Survey Phase	History of Radioactive Material Use	Radioactive Material[a]	Building Classification
I Line	I-531	Deconstructed	No	--	3
10 m × 29 m	I-631	Deconstructed	No	--	3
	I-632	Deconstructed	No	--	3
	I-633	Deconstructed	No	--	3
	I-634 Igloo	Surveyed Phase 2	No	--	3
	I-634	Deconstructed	No	--	3
	I-636	Deconstructed	No	--	3
	I-641	Deconstructed	No	--	3
800 series	821	Surveyed Phase 1	No	--	3
	825	Surveyed Phase 1	No	--	3

[a]Th = thorium nitrate, oxide, or hydroxide, MS = monazite sand, SS = sodium sulfate.
[b]-- = Not applicable.

TABLE 2

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
A-921 (2)					
1	F	--[e]	140	--	--
2	F	--	100	--	--
3	F	--	-8	--	--
4	F	--	150	--	--
5	F	--	160	--	--
6	F	--	95	--	--
7	F	--	130	--	--
8	F	--	160	--	--
9	F	--	230	--	--
10	F	--	150	--	--
11	LW	--	12	--	--
12	LW	--	-160	--	--
13	LW	--	-95	--	--
14	LW	--	-110	--	--
15	LW	--	-29	--	--
16	LW	--	-180	--	--
17	LW	--	-87	--	--
A-922 (3)					
1	F	--	230	1	-1
2	F	--	75	1	2
3	F	--	23	0	4
4	F	--	89	0	3
5	F	--	170	0	-4
6	F	--	75	0	3
7	F	--	45	0	1
8	F	--	29	0	-2
9	F	--	70	1	-4
10	F	--	-6	1	7
11	LW	--	-220	0	5
12	LW	--	-380	0	4
13	F	--	95	0	2
14	F	--	100	0	2
15	F	--	-12	0	8

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
B-911 (1)					
1/12B	F	--	270	13	9
2/13B	F	--	380	5	1
3/14B	F	--	840	0	6
4/15B	F	--	1,400	3	8
5/16B	F	--	620	0	1
6/18B	F	--	1,200	5	-6
7/17B	F	--	6,200	9	9
8/19B	F	--	180,000	5	5
9/20B	F	--	7,200	0	3
10/21B	F	--	3,700	3	3
11/22B	F	--	1,200	9	9
12/23B	F	--	11,000	13	8
13/24B	F	--	5,200	13	9
14/25B	F	--	30,000	13	6
15/26B	F	--	87,000	1	-1
16/27B	F	--	8,800	11	14
17/28B	F	--	13,000	14	7
18/29B	F	--	130,000	100	52
19/30B	F	--	620,000	150	49
20/31B	F	--	5,900	3	2
21/32B	LW	--	110	1	-1
22/33B	LW	--	430	1	1
23/34B	LW	--	620	0	6
24/35B	LW	--	110	0	3
25/36B	LW	--	64,000	340	170
26/37B	LW	--	-160	0	2
27/38B	F	--	140,000	91	58
28/39B	US	--	590	3	3
29/40B	US	--	320	0	4
30/41B	US	--	580	0	3
31/42B	US	--	940	1	-3
32/43B	F	--	66,000	16	7
33	LW	--	440	--	--
34	LW	--	900	--	--
35	LW	--	14,000	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
B-911 (1) (Continued)					
36	F	--	4,600	--	--
37	F	--	1,300	--	--
38	F	--	5,500	--	--
39	F	--	1,600	--	--
40	US	--	280	--	--
41	US	--	320	--	--
42	US	--	270	--	--
43	US	--	300	--	--
44	US	--	170	--	--
45	US	--	260	--	--
46	US	--	380	--	--
47	US	--	270	--	--
48	US	--	240	--	--
49	US	--	-26	--	--
50	US	--	-130	--	--
51	US	--	160	--	--
52	US	--	52	--	--
53	US	--	270	--	--
54	US	--	-83	--	--
55	US	--	33	--	--
56	US	--	-130	--	--
57	US	--	94	--	--
58	US	--	130	--	--
59	US	--	68	--	--
60	US	--	13	--	--
61	US	--	320	--	--
62	US	--	180	--	--
63	US	--	390	--	--
64	US	--	330	--	--
65	US	--	390	--	--
66	US	--	-24	--	--
67	US	--	110	--	--
68	US	--	370	--	--
69	US	--	340	--	--
70	US	--	280	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
B-911 (1) (Continued)					
71	US	--	310	--	--
72	US	--	420	--	--
73	US	--	450	--	--
74	US	--	300	--	--
75	US	--	430	--	--
76	US	--	470	--	--
77	US	--	510	--	--
78	US	--	-6	--	--
79	US	--	-140	--	--
80	US	--	400	--	--
81	US	--	330	--	--
82	US	--	350	--	--
83	US	--	380	--	--
84	US	--	270	--	--
85	US	--	13	--	--
86	US	--	320	--	--
87	US	--	440	--	--
88	US	--	280	--	--
89	US	--	230	--	--
90	US	--	120	--	--
91	US (vent)	--	4,600	--	--
92	US (vent)	--	380	--	--
B-912 (1)					
1/48	F	9	170	1	11
2/49	F	33	250	1	7
3/50	F	45	100	1	21
4/51	F	78	100,000	5	2
5/52	F	330	6,600	0	4
6/53	F	25	370	0	-3
7/54	F	39	480	9	14
8/55	F	18	37,000	1	11
9/56	F	39	390	3	-3
10/57	F	28	170	3	8
11/58	F	34	220	1	2
12/59	F	12,000	290,000	14	10

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
B-912 (1) (Continued)					
13/60	F	96	3,700	7	5
14/61	F	37	270	3	8
15/62	F	24	170	0	-1
16/63	F	10,000	97,000	3	17
17/64	F	6,500	110,000	5	4
18/65	F	27	240	0	3
19/66	F	5,800	43,000	18	7
20/67	F	96	85,000	0	6
21/68	F	120,000	66,000	22	15
22/69	F	21,000	28,000	0	4
23/70	F	950	15,000	9	2
24/71	LW	49	140	3	6
25/72	LW	58	-210	5	9
26/--	LW	33	420	--	--
27/73	LW	43	-110	3	3
28/74	US	--	660	5	18
29/75	US	--	350	11	5
30/76	US	--	330	3	6
31/77	US	--	470	3	4
32/78	US	--	250	9	1
33	LW	--	2,800	--	--
34	LW	--	2,200	--	--
35	LW	--	4,900	--	--
36	LW	--	2,300	--	--
37	US	--	90	--	--
38	US	--	170	--	--
39	US	--	190	--	--
40	US	--	210	--	--
41	US	--	180	--	--
42	US	--	-130	--	--
43	US	--	94	--	--
44	US	--	100	--	--
45	US	--	190	--	--
46	US	--	150	--	--
47	US	--	380	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
B-912 (1) (Continued)					
48	US	--	-340	--	--
49	US	--	200	--	--
50	US	--	120	--	--
51	US	--	210	--	--
52	US	--	190	--	--
53	US	--	200	--	--
54	US	--	180	--	--
55	US	--	-150	--	--
56	US	--	290	--	--
57	US	--	110	--	--
58	US	--	220	--	--
59	US	--	170	--	--
60	US	--	-170	--	--
61	US	--	-18	--	--
62	US	--	700	--	--
63	US	--	240	--	--
64	US	--	160	--	--
65	US	--	140	--	--
66	US	--	230	--	--
67	US	--	-160	--	--
68	US	--	290	--	--
69	US	--	200	--	--
70	US	--	160	--	--
71	US	--	-46	--	--
72	US	--	420	--	--
73	US	--	52	--	--
74	US	--	310	--	--
75	US	--	240	--	--
76	US	--	120	--	--
77	US	--	20	--	--
78	US	--	280	--	--
79	US	--	220	--	--
80	US	--	120	--	--
81	US	--	120	--	--
82	US	--	65	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
B-912 (1) (Continued)					
83	US	--	200	--	--
84	US	--	-61	--	--
85	US	--	310	--	--
86	US	--	250	--	--
87	US	--	270	--	--
88	US	--	170	--	--
89	US	--	280	--	--
90	US	--	-160	--	--
91	US	--	140	--	--
92	US	--	26	--	--
93	US	--	150	--	--
94	US	--	310	--	--
95	US	--	480	--	--
96	US	--	130	--	--
B-913 (2)					
1/16	F	--	140	0	7
2/17	F	--	130	1	-1
3/18	F	--	72	1	6
4/19	F	--	29	0	-2
5/20	F	--	-31	3	5
6/21	F	--	62	0	7
7/22	F	--	54	7	9
8/23	F	--	140	5	15
9/24	F	--	-17	11	10
10/25	F	--	-39	7	9
11/26	F	--	130	11	15
12/27	F	--	180	0	9
13/28	F	--	150	1	12
14/29	F	--	91	9	10
15/30	F	--	190	11	14
16/31	F	--	60	1	15
17/32	F	--	280	0	7
18/33	F	--	41	7	21
19/35	F	--	150	3	9
20/36	F	--	66	18	28

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
B-913 (2) (Continued)					
21/37	F	44,000	190,000	4,000	2,900
22/38	F	6,000	40,000	830	450
23/39	US	--	100	20	42
24/40	US	--	170	5	23
25/41	US	--	120	9	18
26/42	US	--	130	7	11
27/43	US	--	79	3	7
28/44	US	--	100	1	7
29/45	US	--	110	0	14
30/46	US	--	200	3	8
31/47	US	--	190	1	11
32/79	LW	87	23	1	-2
33/80	LW	94	19	0	3
34/81	LW	78	-91	1	-1
35/82	LW	76	68	1	4
36	Drum lip	--	5,800	--	--
97	US	--	140	--	--
98	US	--	-74	--	--
99	US	--	-50	--	--
100	US	--	8	--	--
101	US	--	-37	--	--
102	US	--	-220	--	--
103	US	--	-85	--	--
104	US	--	-100	--	--
105	US	--	-68	--	--
106	US	--	-12	--	--
107	US	--	-150	--	--
108	US	--	-66	--	--
109	US	--	-130	--	--
110	US	--	-150	--	--
111	US	--	-140	--	--
112	US	--	-52	--	--
113	US	--	-110	--	--
114	US	--	27	--	--
115	US	--	58	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
C-1131 (3)					
1	Pad	--	-75	--	--
2	Pad	--	35	--	--
3	Pad	--	41	--	--
4	Pad	--	33	--	--
5	Pad	--	43	--	--
6	Pad	--	6	--	--
7	Pad	--	79	--	--
8	Pad	--	-35	--	--
9	Pad	--	33	--	--
10	Pad	--	85	--	--
11	Pad	--	-60	--	--
12	Pad	--	-39	--	--
13	Pad	--	62	--	--
14	Pad	--	170	--	--
15	Pad	--	-41	--	--
C-1132 (3)					
1	Pad	--	-95	--	--
2	Pad	--	58	--	--
3	Pad	--	-14	--	--
4	Pad	--	60	--	--
5	Pad	--	60	--	--
6	Pad	--	-81	--	--
7	Pad	--	-27	--	--
8	Pad	--	-31	--	--
9	Pad	--	-35	--	--
10	Pad	--	-50	--	--
11	Pad	--	-52	--	--
12	Pad	--	50	--	--
13	Pad	--	10	--	--
14	Pad	--	-41	--	--
15	Pad	--	23	--	--
C-1133 (3)					
1	Pad	--	21	--	--
2	Pad	--	75	--	--
3	Pad	--	150	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
C-1133 (3) (Continued)					
4	Pad	--	46	--	--
5	Pad	--	-46	--	--
6	Pad	--	0	--	--
7	Pad	--	56	--	--
9	Pad	--	-110	--	--
10	Pad	--	39	--	--
11	Pad	--	-75	--	--
12	Pad	--	-83	--	--
13	Pad	--	-79	--	--
14	Pad	--	-39	--	--
15	Pad	--	-50	--	--
16	Pad	--	-54	--	--
17	Pad	--	-100	--	--
C-1134 (3)					
1	Pad	--	56	--	--
2	Pad	--	-10	--	--
3	Pad	--	-4	--	--
4	Pad	--	-12	--	--
5	Pad	--	-56	--	--
6	Pad	--	66	--	--
7	Pad	--	-56	--	--
8	Pad	--	-74	--	--
9	Pad	--	99	--	--
10	Pad	--	-35	--	--
11	Pad	--	37	--	--
12	Pad	--	72	--	--
13	Pad	--	17	--	--
14	Pad	--	60	--	--
15	Pad	--	2	--	--
16	Pad	--	-21	--	--
D-1122 (3)					
1	Pad	--	17	--	--
2	Pad	--	52	--	--
3	Pad	--	31	--	--
4	Pad	--	2	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
D-1122 (3) (Continued)					
5	Pad	--	6	--	--
6	Pad	--	41	--	--
7	Pad	--	2	--	--
8	Pad	--	-2	--	--
9	Pad	--	21	--	--
10	Pad	--	-10	--	--
11	Pad	--	-31	--	--
12	Pad	--	60	--	--
13	Pad	--	21	--	--
14	Pad	--	6	--	--
15	Pad	--	-10	--	--
D-1124 (3)					
1	Pad	--	-6	--	--
2	Pad	--	66	--	--
3	Pad	--	23	--	--
4	Pad	--	95	--	--
5	Pad	--	29	--	--
6	Pad	--	25	--	--
7	Pad	--	140	--	--
8	Pad	--	95	--	--
9	Pad	--	100	--	--
10	Pad	--	-50	--	--
11	Pad	--	-35	--	--
12	Pad	--	81	--	--
13	Pad	--	31	--	--
14	Pad	--	72	--	--
15	Pad	--	62	--	--
D-1125 (3)					
1	Pad	--	45	--	--
2	Pad	--	-50	--	--
3	Pad	--	-89	--	--
4	Pad	--	-160	--	--
5	Pad	--	-200	--	--
6	Pad	--	-240	--	--
7	Pad	--	370	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
D-1125 (3) (Continued)					
8	Pad	--	-48	--	--
9	Pad	--	56	--	--
10	Pad	--	-77	--	--
11	Pad	--	-45	--	--
12	Pad	--	33	--	--
13	Pad	--	-27	--	--
14	Pad	--	19	--	--
15	Pad	--	95	--	--
16/scoping location 7	Pad	--	-23	--	--
17	Pad	--	1200	--	--
E-1111 (3)					
1/32A	F	--	120	1	2
2/33A	F	--	140	0	2
3/34A	F	--	91	1	1
4/35A	F	--	-6	0	1
5/36A	F	--	35	0	-2
6/37A	F	--	43	1	-1
7/38A	F	--	-17	3	20
8/39A	F	--	-14	1	-1
9/40A	F	--	19	0	2
10/41A	F	--	130	0	1
11/42A	F	--	120	0	1
12/43A	F	--	120	1	2
13/44A	F	--	140	0	5
14/45A	F	--	150	0	-1
15/46A	F	--	200	0	3
16/47A	LW	--	72	0	1
17/48A	LW	--	-12	3	1
18/49A	LW	--	-130	0	1
E-1112 (3)					
1	Pad	--	29	--	--
2	Pad	--	-48	--	--
3	Pad	--	-2	--	--
4	Pad	--	-15	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
E-1112 (3) (Continued)					
5	Pad	--	19	--	--
6	Pad	--	4	--	--
7	Pad	--	50	--	--
8	Pad	--	-21	--	--
9	Pad	--	85	--	--
10	Pad	--	72	--	--
11	Pad	--	14	--	--
12	Pad	--	29	--	--
13	Pad	--	74	--	--
14	Pad	--	0	--	--
15	Pad	--	33	--	--
16	Pad	--	250	--	--
E-1116 (3)					
1	Pad	--	48	--	--
2	Pad	--	25	--	--
3	Pad	--	-2	--	--
4	Pad	--	14	--	--
5	Pad	--	85	--	--
6	Pad	--	-35	--	--
7	Pad	--	130	--	--
8	Pad	--	56	--	--
9	Pad	--	99	--	--
10	Pad	--	200	--	--
11	Pad	--	200	--	--
12	Pad	--	27	--	--
13	Pad	--	-14	--	--
14	Pad	--	21	--	--
15	Pad	--	140	--	--
F-731 (1)					
1/50A	F	--	160	0	24
2/51A	F	--	150	0	4
3/52A	F	--	310	1	-1
4/53A	F	--	160	3	-2
5/54A	F	--	320	3	22
6/55A	F	--	120	0	2

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
F-731 (1) (Continued)					
7/56A	F	--	240	0	1
8/57A	F	--	300	0	9
9/58A	F	--	-25	0	6
10/59A	F	--	160	0	11
11/60A	F	--	110	0	1
12/61A	F	--	100	0	2
13/62A	F	--	95	0	3
14/63A	F	--	120	0	20
15/64A	F	--	1,200	1	6
16/65A	F	--	1,400	0	-1
17/66A	F	--	1,400	3	3
18/67A	F	--	1,300	0	6
19/68A	US	--	-58	0	6
20/69A	US	--	-99	1	-2
21/70A	US	--	-97	0	2
22/71A	LW	--	-130	0	4
23/72A	LW	--	-200	1	6
24/73A	LW	--	-60	0	5
25/74A	LW	--	72	3	9
26	F	--	5,300	--	--
26-post sampling	F	--	170	--	--
27	LW	--	32,000	--	--
28	F	--	840	--	--
18 scoping location	F	--	1,100	--	--
29	F	--	2,300	--	--
16 scoping location	F	--	770	--	--
30	F	--	880	--	--
17 scoping location	F	--	1,200	--	--
31	LW	--	1,300	--	--
15 scoping location	F	--	120	--	--
116	US	--	-76	--	--
117	US	--	-200	--	--
118	US	--	6	--	--
119	US	--	15	--	--
120	US	--	-94	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
F-731 (1) (Continued)					
121	US	--	35	--	--
122	US	--	-55	--	--
123	US	--	26	--	--
124	US	--	-4	--	--
125	US	--	-150	--	--
126	US	--	2	--	--
127	US	--	-76	--	--
128	US	--	-50	--	--
129	US	--	-83	--	--
130	US	--	-66	--	--
131	US	--	-2	--	--
132	US	--	-18	--	--
133	US	--	-26	--	--
134	US	--	52	--	--
F-733 (3)					
1	Pad	--	290	--	--
2	Pad	--	120	--	--
3	Pad	--	150	--	--
4	Pad	--	-25	--	--
5	Pad	--	170	--	--
6	Pad	--	130	--	--
7	Pad	--	120	--	--
8	Pad	--	160	--	--
9	Pad	--	4	--	--
10	Pad	--	85	--	--
11	Pad	--	-33	--	--
13	Pad	--	-37	--	--
14	Pad	--	35	--	--
15	Pad	--	130	--	--
F-737 (1)					
1	Pad	--	140	--	--
2	Pad	--	-64	--	--
3	Pad	--	410	--	--
4	Pad	--	0	--	--
5	Pad	--	95	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
F-737 (1) (Continued)					
6	Pad	--	630	--	--
7	Pad	--	81	--	--
8	Pad	--	350	--	--
9	Pad	--	64	--	--
10	Pad	--	150	--	--
11	Pad	--	100	--	--
12	Pad	--	95	--	--
13	Pad	--	72	--	--
14	Pad	--	74	--	--
15	Pad	--	99	--	--
17	Pad	--	690	--	--
18	Pad	--	1,900	--	--
19	Pad	--	1,000	--	--
20	Pad	--	1,000	--	--
21	Pad	--	5,400	--	--
G-721 (2)					
1	Pad	--	-8	--	--
2	Pad	--	-2	--	--
3	Pad	--	110	--	--
4	Pad	--	72	--	--
5	Pad	--	52	--	--
6	Pad	--	150	--	--
7	Pad	--	72	--	--
8	Pad	--	170	--	--
9	Pad	--	140	--	--
10	Pad	--	160	--	--
11	Pad	--	120	--	--
12	Pad	--	130	--	--
13	Pad	--	99	--	--
14	Pad	--	17	--	--
15	Pad	--	95	--	--
16	Pad	--	89	--	--
17	Pad	--	66	--	--
18	Pad	--	140	--	--
19	Pad	--	190	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
G-721 (2) (Continued)					
20	Pad	--	220	--	--
G-723 (3)					
1	Pad	--	68	--	--
2	Pad	--	-2	--	--
3	Pad	--	-54	--	--
4	Pad	--	31	--	--
5	Pad	--	-140	--	--
6	Pad	--	4	--	--
7	Pad	--	-8	--	--
8	Pad	--	8	--	--
9	Pad	--	-31	--	--
10	Pad	--	14	--	--
11	Pad	--	-41	--	--
12	Pad	--	6	--	--
13	Pad	--	25	--	--
14	Pad	--	160	--	--
15	Pad	--	75	--	--
16	Pad	--	420	--	--
17	Pad	--	490	--	--
18	Pad	--	410	--	--
19	Pad	--	230	--	--
G-725 (3)					
1	Pad	--	-33	--	--
2	Pad	--	-29	--	--
3	Pad	--	33	--	--
4	Pad	--	6	--	--
5	Pad	--	14	--	--
6	Pad	--	-19	--	--
7	Pad	--	8	--	--
8	Pad	--	-19	--	--
9	Pad	--	25	--	--
10	Pad	--	-6	--	--
11	Pad	--	21	--	--
12	Pad	--	-14	--	--
13	Pad	--	0	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
G-725 (3) (Continued)					
14	Pad	--	81	--	--
15	Pad	--	-29	--	--
Bldg. 821 (3)					
1/75A	F	--	150	5	4
2/76A	F	--	95	0	5
3/77A	F	--	110	1	6
4/78A	F	--	-46	1	3
5/79A	F	--	68	0	1
6/80A	F	--	-31	0	11
7/81A	F	--	95	0	5
8/82A	F	--	110	0	1
9/83A	F	--	10	1	-1
10/84A	F	--	-8	0	3
11/85A	F	--	-58	1	1
12/86A	F	--	-31	0	3
13/87A	F	--	52	0	3
14/88A	F	--	8	1	7
15/89A	F	--	95	0	-2
Bldg. 825 (3)					
1/91A	F	--	140	0	7
2/92A	F	--	200	0	5
3/93A	F	--	200	0	5
4/94A	F	--	79	1	2
5/95A	F	--	25	1	14
6/96A	F	--	39	1	-4
7/97A	F	--	29	1	-1
8/98A	F	--	110	1	8
9/99A	F	--	83	1	1
10/100A	F	--	-39	0	3
11/8B	F	--	52	1	4
12/9B	F	--	29	0	-3
13/10B	F	--	62	0	-2
14/11B	F	--	100	5	-1
Bldg. 1021 (3)					
1	F	--	-33	--	--

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
Bldg. 1021 (3) (Continued)					
2	F	--	64	--	--
3	F	--	-140	--	--
4	F	--	-15	--	--
5	F	--	-140	--	--
6	F	--	-120	--	--
7	F	--	-2	--	--
9	F	--	2	--	--
12	F	--	39	--	--
15	F	--	270	--	--
16	LW	--	-56	--	--
Bldg. 1022 (2)					
1/1A	F	--	87	1	-1
2/2A	F	--	41	0	-2
3/3A	F	--	2	0	4
4/4A	F	--	110	0	3
5/5A	F	--	15	1	-5
6/6A	F	--	41	0	-4
7/7A	F	--	-39	3	-1
8/8A	F	--	50	1	3
9/9A	F	--	35	1	-3
10/10A	F	--	37	3	2
11/11A	F	--	77	0	-3
12/12A	F	--	-19	0	-2
13/13A	F	--	19	0	-1
14/14A	F	--	33	0	-2
15/15A	F	--	31	0	3
16/16A	F	--	68	1	8
17/17A	F	--	31	1	-3
18/18A	F	--	46	1	-3
19/19A	F	--	27	1	-1
20/20A	F	--	29	0	1
21/21A	F	--	120	1	-1
22/22A	F	--	140	0	5
23/23A	F	--	160	0	1
24/24A	F	--	46	1	4

TABLE 2 (Continued)

PHASE 1 SCOPING AND CHARACTERIZATION SURVEY
SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a, b]	Surface[c]	Total Activity[d] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
Bldg. 1022 (2) (Continued)					
25/25A	F	--	130	0	-1
26/26A	F	--	140	0	6
27/27A	F	--	180	0	10
28/28A	F	--	62	0	-2
29/29A	LW	--	120	3	2
30/30A	LW	--	20	5	4
31/31A	LW	--	-32	1	-4
32/1B	US	--	-85	0	5
33/2B	US	--	-210	0	-1
34/3B	US	--	-58	1	5
35/4B	US	--	-87	0	3
36/5B	US	--	190	0	-2
37/6B	US	--	-100	0	-3
38/7B	F	--	660	3	-1

[a]Refer to Figures 4 through 56 .
[b]Where two numbers are indicated, the first value is the measurement location identifier and the second number is the smear sample designation.
[c]F=floor, LW=lower wall, US=upper surface.
[d]Data represent net surface activity levels that have been corrected for background contributions.
[e]-- = Measurement or sampling not performed.

TABLE 3

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
D-1121 (3)					
1A	Pad	--[c]	-17	0	2
2A	Pad	--	-72	0	2
3A	Pad	--	-74	0	-3
4A	Pad	--	32	1	2
5A	Pad	--	-34	0	2
6A	Pad	--	-11	0	3
7A	Pad	--	74	1	8
8A	Pad	--	8	0	4
9A	Pad	--	120	0	-1
10A	Pad	--	28	1	-3
11A	Wall Debris	--	-66	3	-2
12A	Wall Debris	--	6	1	-2
13A	Wall Debris	--	19	0	15
14A	Wall Debris	--	170	0	2
15A	Wall Debris	--	8	0	9
D-1123 (3)					
1	Pad	--	0	1	1
2	Pad	--	130	0	-1
3	Pad	--	210	0	1
4	Pad	--	150	1	7
5	Pad	--	68	0	-3
6	Pad	--	200	1	-2
7	Pad	--	140	0	4
8	Pad	--	85	0	-2
9	Pad	--	70	3	-2
10	Pad	--	25	0	1
11	Wall Debris	--	130	0	3
12	Wall Debris	--	150	7	1
13	Wall Debris	--	98	5	10
14	Wall Debris	--	-180	1	7
15	Wall Debris	--	-800	1	9
E-1113 (3)					
16	Pad	--	83	1	3
17	Pad	--	-30	0	8
18	Pad	--	30	1	-4

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
E-1113 (3) (Continued)					
19	Pad	--	-11	1	-3
20	Pad	--	-43	0	3
21	Pad	--	-70	1	2
22	Pad	--	-130	0	11
23	Pad	--	-34	0	1
24	Pad	--	-38	3	6
25	Pad	--	2	0	-2
26	Wall Debris	--	85	1	7
27	Wall Debris	--	45	3	-3
28	Wall Debris	--	190	0	6
29	Wall Debris	--	-49	1	4
30	Wall Debris	--	45	0	8
E-1114 (3)					
16A	Pad	--	38	0	8
17A	Pad	--	0	0	1
18A	Pad	--	87	1	-2
19A	Pad	--	79	0	-3
20A	Pad	--	-4	0	6
21A	Pad	--	110	1	-1
22A	Pad	--	34	1	16
23A	Pad	--	89	1	2
24A	Pad	--	49	1	3
25A	Pad	--	38	0	1
26A	Wall Debris	--	53	0	7
27A	Wall Debris	--	-250	0	4
28A	Wall Debris	--	34	1	1
29A	Wall Debris	--	-51	1	3
30A	Wall Debris	--	-140	0	2
E-1115 (3)					
31A	Pad	--	-43	0	2
32A	Pad	--	-26	0	2
33A	Pad	--	25	0	-1
34A	Pad	--	38	1	4
35A	Pad	--	-38	1	6

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
E-1115 (3) (Continued)					
36A	Pad	--	-28	1	-3
37A	Pad	--	43	9	7
38A	Pad	--	11	0	1
39A	Pad	--	34	3	5
40A	Pad	--	28	0	-3
41A	Wall Debris	--	-120	3	-1
42A	Wall Debris	--	74	0	-2
43A	Wall Debris	--	-130	0	7
44A	Wall Debris	--	17	7	20
45A	Wall Debris	--	-170	0	6
F-732 (3)					
61C	Pad	--	-64	0	2
62C	Pad	--	-23	0	1
63C	Pad	--	9	0	10
64C	Pad	--	4	0	4
65C	Pad	--	36	0	-2
66C	Pad	--	34	0	1
67C	Pad	--	76	1	-3
68C	Pad	--	47	0	1
69C	Pad	--	13	1	1
70C	Pad	--	47	1	-2
71C	Wall Debris	--	-240	0	4
72C	Wall Debris	--	-15	0	1
73C	Wall Debris	--	72	1	16
74C	Wall Debris	--	170	0	9
75C	Wall Debris	--	140	0	6
F-734 (2)					
31B	Pad	--	26	0	2
32B	Pad	--	38	0	-1
33B	Pad	--	9	0	-3
34B	Pad	--	17	0	-3
35B	Pad	--	25	1	2
36B	Pad	--	13	1	2
37B	Pad	--	0	3	1

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
F-734 (2) (Continued)					
38B	Pad	--	8	0	5
39B	Pad	--	110	0	7
40B	Pad	--	68	0	2
41B	Pad	--	62	0	2
42B	Pad	--	40	0	2
43B	Pad	--	34	0	9
44B	Pad	--	-13	1	17
45B	Pad	--	91	0	7
46B	Pad	--	25	1	2
47B	Pad	--	81	3	8
48B	Pad	--	28	0	-2
49B	Pad	--	43	3	10
50B	Pad	--	91	0	4
51B	Wall Debris	--	-140	0	14
52B	Wall Debris	--	140	0	1
53B	Wall Debris	--	-57	1	4
54B	Wall Debris	--	-23	3	15
55B	Wall Debris	--	11	0	8
F-735 (2)					
76C	Pad	--	-85	1	7
77C	Pad	--	-91	0	8
78C	Pad	--	-100	0	15
79C	Pad	--	-120	1	3
80C	Pad	--	-53	5	2
81C	Pad	--	-79	0	5
82C	Pad	--	-100	0	-1
83C	Pad	--	-110	1	-1
84C	Pad	--	-93	1	-1
85C	Pad	--	-94	0	3
86C	Wall Debris	--	43	0	-1
87C	Wall Debris	--	-77	0	-1
88C	Wall Debris	--	25	1	5
89C	Wall Debris	--	0	0	-1
90C	Wall Debris	--	-53	0	-4

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
F-736 (2)					
31	Pad	--	-4	0	-2
32	Pad	--	45	0	-3
33	Pad	--	55	1	3
34	Pad	--	49	0	1
35	Pad	--	-23	0	1
36	Pad	--	47	1	-2
37	Pad	--	42	5	7
38	Pad	--	74	0	4
39	Pad	--	70	1	5
40	Pad	--	-21	5	-1
41	Pad	--	85	3	3
42	Pad	--	62	0	2
43	Pad	--	34	0	4
44	Pad	--	25	1	8
45	Pad	--	40	0	6
46	Pad	--	47	1	-3
47	Pad	--	62	3	12
48	Pad	--	-62	0	-3
49	Pad	--	-40	1	5
50	Pad	--	25	1	4
51	Wall Debris	--	57	0	12
52	Wall Debris	--	120	0	2
53	Wall Debris	--	34	1	7
54	Wall Debris	--	-150	3	18
55	Wall Debris	--	130	0	3
G-722 (3)					
86B	Pad	--	-13	1	5
87B	Pad	--	21	0	5
88B	Pad	--	-8	1	2
89B	Pad	--	36	0	8
90B	Pad	--	-40	0	1
91B	Pad	--	23	0	-1
92B	Pad	--	-49	1	8
93B	Pad	--	11	3	-1
94B	Pad	--	-51	0	10

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
G-722 (3) (Continued)					
95B	Pad	--	-15	0	14
96B	Wall Debris	--	42	0	3
97B	Wall Debris	--	89	0	2
98B	Wall Debris	--	96	0	-3
99B	Wall Debris	--	510	3	-2
100B	Wall Debris	--	190	1	4
G-724 (3)					
71B	Pad	--	120	1	7
72B	Pad	--	81	0	3
73B	Pad	--	180	0	17
74B	Pad	--	110	3	4
75B	Pad	--	170	0	1
76B	Pad	--	19	0	12
77B	Pad	--	59	0	2
78B	Pad	--	130	0	8
79B	Pad	--	130	0	7
80B	Pad	--	60	0	1
81B	Wall Debris	--	-190	0	-1
82B	Wall Debris	--	81	0	-1
83B	Wall Debris	--	140	0	3
84B	Wall Debris	--	-38	0	2
85B	Wall Debris	--	230	0	-1
G-726 (3)					
56B	Pad	--	140	1	1
57B	Pad	--	8	0	7
58B	Pad	--	53	0	5
59B	Pad	--	-2	0	8
60B	Pad	--	70	0	6
61B	Pad	--	-100	0	1
62B	Pad	--	21	1	3
63B	Pad	--	-89	0	25
64B	Pad	--	-72	1	1
65B	Pad	--	43	0	4
66B	Wall Debris	--	-150	0	-4

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
G-726 (3) (Continued)					
67B	Wall Debris	--	15	0	3
68B	Wall Debris	--	-43	0	-3
69B	Wall Debris	--	100	0	-2
70B	Wall Debris	--	110	0	-1
H-711 (2)					
61A	Floor	--	-32	3	3
62A	Floor	--	-76	1	3
63A	Floor	--	-23	1	15
64A	Floor	--	-79	5	5
65A	Floor	--	-89	3	-4
66A	Floor	--	-47	1	3
67A	Floor	--	-93	0	-1
68A	Floor	--	-51	0	4
69A	Floor	--	-36	1	7
70A	Floor	--	-91	1	3
71A	Wall Debris	--	-250	0	3
72A	Wall Debris	--	-250	1	1
73A	Wall Debris	--	11	0	7
74A	Wall Debris	--	36	1	3
75A	Wall Debris	--	-260	3	-1
H-712 (2)					
76A	Floor Debris	--	53	0	12
77A	Floor Debris	--	25	1	1
78A	Floor Debris	--	45	0	18
79A	Floor Debris	--	-30	0	-3
80A	Floor Debris	--	42	0	3
81A	Floor Debris	--	4	1	2
82A	Floor Debris	--	-13	0	4
83A	Floor Debris	--	-38	0	-2
84A	Floor Debris	--	15	3	5
85A	Floor Debris	--	62	0	3
86A	Wall Debris	--	-350	0	5
87A	Wall Debris	--	66	1	6
88A	Wall Debris	--	-93	0	2

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
H-712 (2) (Continued)					
89A	Wall Debris	--	-230	3	2
90A	Wall Debris	--	68	0	4
H-713 (2)					
91A	Floor Debris	--	13	1	2
92A	Floor Debris	--	30	0	-2
93A	Floor Debris	--	2	0	1
94A	Floor Debris	--	-40	1	3
95A	Floor Debris	--	8	0	14
96A	Floor Debris	--	-25	1	-1
97A	Floor Debris	--	-23	0	2
98A	Floor Debris	--	-42	3	5
99A	Floor Debris	--	-60	0	-2
100A	Floor Debris	--	-13	0	7
1B	Wall Debris	--	9	1	3
2B	Wall Debris	--	93	1	-1
3B	Wall Debris	--	110	0	2
4B	Wall Debris	--	-150	0	7
5B	Wall Debris	--	-220	1	2
H-714 (2)					
6B	Wall Debris	--	-120	0	2
7B	Wall Debris	--	-87	0	1
8B	Wall Debris	--	93	0	-2
9B	Wall Debris	--	72	0	1
10B	Wall Debris	--	-140	1	-1
11B	Floor Debris	--	-21	5	3
12B	Floor Debris	--	53	3	-3
13B	Floor Debris	--	38	0	10
14B	Floor Debris	--	-13	0	-2
15B	Floor Debris	--	-79	1	1
16B	Floor Debris	--	-15	0	-1
17B	Floor Debris	--	36	1	-3
18B	Floor Debris	--	13	0	-4
19B	Floor Debris	--	-19	0	-1
20B	Floor Debris	--	-6	0	5

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
H-715 (2)					
21B	Floor Debris	--	-120	0	3
22B	Wall Debris	--	-9	0	5
23B	Wall Debris	--	-45	0	-3
24B	Wall Debris	--	-210	1	12
25B	Wall Debris	--	-120	0	-2
26B	Wall Debris	--	-220	0	3
27B	Wall Debris	--	57	1	5
28B	Wall Debris	--	-440	1	2
29B	Wall Debris	--	-140	3	9
30B	Wall Debris	--	4	3	11
I-531 (3)					
46C	Floor Debris	--	-23	0	1
47C	Floor Debris	--	-42	1	17
48C	Floor Debris	--	-13	0	-1
49C	Floor Debris	--	15	0	11
50C	Floor Debris	--	-21	0	11
51C	Floor Debris	--	-77	1	8
52C	Floor Debris	--	-11	1	2
53C	Floor Debris	--	-34	0	1
54C	Floor Debris	--	-55	3	14
55C	Floor Debris	--	4	0	-3
56C	Wall Debris	--	91	1	-1
57C	Wall Debris	--	17	1	9
58C	Wall Debris	--	-59	1	4
59C	Wall Debris	--	-81	1	8
60C	Wall Debris	--	-30	0	4
I-631 (3)					
1C	Wall Debris	--	220	0	3
2C	Wall Debris	--	-220	0	-3
3C	Wall Debris	--	23	1	1
4C	Wall Debris	--	210	1	-1
5C	Wall Debris	--	-4	1	-2
6C	Floor Debris	--	8	1	-5

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
I-631 (3) (Continued)					
7C	Floor Debris	--	-26	3	-1
8C	Floor Debris	--	-38	3	-1
9C	Floor Debris	--	-140	0	1
10C	Floor Debris	--	-130	0	5
11C	Floor Debris	--	-6	7	2
12C	Floor Debris	--	-77	1	1
13C	Floor Debris	--	-38	3	10
14C	Floor Debris	--	-47	1	-1
15C	Floor Debris	--	-8	0	6
I-632 (3)					
86	Floor Debris	--	-6	0	1
87	Floor Debris	--	-110	0	2
88	Floor Debris	--	-51	1	4
89	Floor Debris	--	-4	0	-1
90	Floor Debris	--	-38	1	4
91	Floor Debris	--	160	1	-1
92	Floor Debris	--	-170	0	5
93	Floor Debris	--	-49	0	3
94	Floor Debris	--	-260	0	2
95	Floor Debris	--	60	1	7
96	Wall Debris	--	-270	0	-4
97	Wall Debris	--	93	0	5
98	Wall Debris	--	81	0	3
99	Wall Debris	--	60	0	1
100	Wall Debris	--	-32	0	6
I-633 (3)					
71	Wall Debris	--	-74	1	-1
72	Wall Debris	--	-130	1	1
73	Wall Debris	--	130	0	15
74	Wall Debris	--	-51	0	6
75	Wall Debris	--	120	3	1
76	Floor Debris	--	-26	0	16
77	Floor Debris	--	-47	0	7
78	Floor Debris	--	-40	1	22
79	Floor Debris	--	-13	0	1

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
I-633 (3) (Continued)					
80	Floor Debris	--	-96	0	3
81	Floor Debris	--	-38	0	-2
82	Floor Debris	--	32	0	-2
83	Floor Debris	--	-45	0	2
84	Floor Debris	--	-34	0	-2
85	Floor Debris	--	11	0	1
I-634 (3)					
56	Floor Debris	--	-62	0	1
57	Floor Debris	--	-120	0	5
58	Floor Debris	--	-15	3	2
59	Floor Debris	--	2	0	7
60	Floor Debris	--	-68	0	2
61	Floor Debris	--	-13	1	-2
62	Floor Debris	--	-200	1	4
63	Floor Debris	--	-36	3	20
64	Floor Debris	--	-36	0	6
65	Floor Debris	--	-94	0	5
66	Wall Debris	--	4	0	-1
67	Wall Debris	--	-2	3	6
68	Wall Debris	--	-64	3	-2
69	Wall Debris	--	-120	0	-1
70	Wall Debris	--	-11	3	4
I-636 (3)					
31C	Wall Debris	--	-53	0	4
32C	Wall Debris	--	-43	1	-1
33C	Wall Debris	--	-28	0	3
34C	Wall Debris	--	-62	1	-3
35C	Wall Debris	--	-87	0	2
36C	Floor Debris	--	-53	1	-2
37C	Floor Debris	--	2	1	8
38C	Floor Debris	--	-2	0	1
39C	Floor Debris	--	-40	0	5
40C	Floor Debris	--	9	1	-1
41C	Floor Debris	--	-23	0	-1
42C	Floor Debris	--	-32	0	1

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
I-636 (3) (Continued)					
43C	Floor Debris	--	-81	3	4
44C	Floor Debris	--	89	3	19
45C	Floor Debris	--	-4	5	5
I-641 (3)					
16C	Wall Debris	--	11	1	4
17C	Wall Debris	--	-77	0	-5
18C	Wall Debris	--	17	1	1
19C	Wall Debris	--	-34	0	2
20C	Wall Debris	--	9	0	-3
21C	Floor Debris	--	-23	1	3
22C	Floor Debris	--	-51	0	3
23C	Floor Debris	--	-62	1	5
24C	Floor Debris	--	-96	1	6
25C	Floor Debris	--	-15	0	-1
26C	Floor Debris	--	-62	0	8
27C	Floor Debris	--	-57	1	2
28C	Floor Debris	--	-85	3	-1
29C	Floor Debris	--	-76	0	11
30C	Floor Debris	--	-160	0	1
I-634 Igloo (3)					
46A	Floor	--	-66	3	-3
47A	Floor	--	-100	1	10
48A	Floor	--	-120	0	-3
49A	Floor	--	-120	0	6
50A	Floor	--	-110	0	1
51A	Floor	--	-110	0	10
52A	Floor	--	-150	1	6
53A	Floor	--	-72	1	5
54A	Floor	--	-180	1	16
55A	Floor	--	-110	1	4
56A	Wall	--	-160	5	5
57A	Wall	--	-120	0	12

TABLE 3 (Continued)

PHASE 2 SCOPING SURVEY SURFACE ACTIVITY LEVELS
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Building (Class) Measurement Location[a]	Surface	Total Activity[b] (dpm/100 cm^2)		Removable Activity (dpm/100 cm^2)	
		Alpha	Beta	Alpha	Beta
I-634 Igloo (3) (Continued)					
58A	Wall	--	-320	1	1
59A	Wall	--	-270	0	4
60A	Wall	--	-290	3	6

[a]Refer to Figures 4 through 56.
[b]Data represent net surface activity levels that have been corrected for background contributions.
[c]-- = Measurement or sampling not performed.

TABLE 4

RADIONUCLIDE CONCENTRATIONS IN MISCELLANEOUS SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

ESSAP Sample ID/Sample Type	Radionuclide Concentration (pCi/g)			
	K-40	Be-7	Th-232	U-238
M0001/Humus 1022	5.7 ± 2.3[a]	23.2 ± 2.9	1.02 ± 0.48	1.6 ± 1.7
M0006/Terra Cotta Block	16.3 ± 1.1	NA[b]	2.72 ± 0.30	2.53 ± 0.89
M0007/Terra Cotta Block	28.6 ± 1.7	NA	1.64 ± 0.21	2.04 ± 0.87
M0009/Humus D-1125	4.96 ± 0.71	18.9 ± 1.6	0.80 ± 0.18	0.40 ± 0.72
M0010/B Line Ore	16.51 ± 0.83	0.01 ± 0.29	0.42 ± 0.11	1.91 ± 0.39
M0011/F-731 Floor Dust[c]	230 ± 150	140 ± 220	2150 ± 270	180 ± 170
M0013/Rock SU4[c]	11,000 ± 18,000	NA	109,000 ± 16,000	69,000 ± 25,000
M0014/B-911 Truss Dust[c]	100 ± 120	NA	465 ± 84	-19 ± 85
	Pb-210			
M0008/Metal From G-722[c]	710 ± 100			

[a]Uncertainties represent the 95% confidence interval based on total propagated uncertainties.
[b]NA = Not applicable
[c]Qualitative data, units are pCi/sample.

TABLE 5

RADIONUCLIDE CONCENTRATIONS IN SCOPING SURVEY SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID/ Location (Depth)/Class[a]	Radionuclide Concentration (pCi/g)[b]			
	GPS Coordinate	Th-232	Th-228	U-238
1/C-Line (0 to 15 cm)/2	39°11.326N, 076°35.007W	1.81 ± 0.20[c]	1.77 ± 0.11	1.27 ± 0.52
2/C-Line (0 to 15 cm)/2	39°11.567N, 076°34.889W	1.72 ± 0.25	1.85 ± 0.13	2.38 ± 0.78
3/C-Line (residue top of pad)/2	--[d]	0.67 ± 0.19	0.54 ± 0.08	0.98 ± 0.74
4/D-Line (0 to 15 cm)/2	39°11.312N, 076°35.093W	1.70 ± 0.23	1.70 ± 0.12	1.49 ± 0.61
5/1021 Area (0 to 15 cm)/2	39°11.536N, 076°34.670W	0.77 ± 0.12	0.81 ± 0.07	1.07 ± 0.57
6/Disposal Area (150 cm)/1	--	1.71 ± 0.24	1.31 ± 0.12	1.39 ± 0.86
7/Disposal Area (60 cm)/1	--	0.45 ± 0.09	0.46 ± 0.04	0.30 ± 0.31
8/Disposal Area (135 cm)/1	--	0.42 ± 0.10	0.42 ± 0.04	0.37 ± 0.30
9/Disposal Area (90 cm)/1	--	0.40 ± 0.09	0.34 ± 0.04	0.32 ± 0.32
10/Disposal Area (135 cm)/1	--	1.57 ± 0.21	1.36 ± 0.10	0.43 ± 0.58
11/Disposal Area (90 cm)/1	--	0.54 ± 0.09	0.54 ± 0.04	0.53 ± 0.36
12/Disposal Area (120 cm)/1	--	7.05 ± 0.63	6.53 ± 0.38	1.38 ± 0.94
13/Disposal Area (90 cm)/1	--	0.67 ± 0.11	0.55 ± 0.05	0.50 ± 0.39

TABLE 5 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SCOPING SURVEY SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID/ Location (Depth)/Class[a]	Radionuclide Concentration (pCi/g)[b]			
	GPS Coordinate	Th-232	Th-228	U-238
14/Disposal Area (135 cm)/1	--	0.76 ± 0.15	0.61 ± 0.06	0.80 ± 0.66
15/Disposal Area (105 cm)/1	--	3.96 ± 0.37	3.48 ± 0.20	1.00 ± 0.60
16/F-Line (0 to 15 cm)/2	39°11.322N, 076°35.244W	1.21 ± 0.17	1.21 ± 0.09	0.58 ± 0.51
17/F-Line (0 to 15 cm)/2	39°11.357N, 076°35.228W	3.27 ± 0.35	3.06 ± 0.20	0.75 ± 0.80
18/F-Line (0 to 15 cm)/1	39°11.520N, 076°35.150W	46.7 ± 3.8	38.5 ± 2.2	2.90 ± 2.30
19/Railroad North (0 to 15 cm)/2	39°12.181N, 076°35.102W	2.33 ± 0.26	2.08 ± 0.14	2.18 ± 0.67
20/Railroad Southeast (0 to 15 cm)/2	39°11.644N, 076°34.879W	4.12 ± 0.40	3.97 ± 0.24	2.14 ± 0.94
21/Railroad South (0 to 15 cm)/2	39°11.436N, 076°34.887W	3.85 ± 0.42	3.80 ± 0.24	3.62 ± 0.80
22/Railroad South (0 to 15 cm)/2	39°11.337N, 076°34.942W	1.90 ± 0.26	1.82 ± 0.13	1.80 ± 0.81
23/Railroad South (0 to 15 cm)/2	39°11.321N, 076°34.951W	2.83 ± 0.29	2.64 ± 0.16	1.76 ± 0.57
24/F-Line (0 to 15 cm)/2	39°11.364N, 076°35.216W	453 ± 35	429 ± 24	29 ± 11
25/G-Line (0 to 15 cm)/2	39°11.545N, 076°35.261W	7.55 ± 0.67	7.55 ± 0.44	2.0 ± 1.0
26/Yard Office Rd-North/ (0 to 15 cm)/2	39°12.103N, 076°35.275W	4.49 ± 0.46	4.40 ± 0.28	1.07 ± 0.88
27/H-Line (0 to 15 cm)/3	39°12.023N, 076°35.218W	2.25 ± 0.25	2.13 ± 0.14	1.58 ± 0.71
28/H-Line (0 to 15 cm)/3	39°12.022N, 076°35.222W	3.38 ± 0.33	3.09 ± 0.19	2.09 ± 0.70

TABLE 5 (Continued)

RADIONUCLIDE CONCENTRATIONS IN SCOPING SURVEY SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID/ Location (Depth)/Class[a]	Radionuclide Concentration (pCi/g)[b]			
	GPS Coordinate	Th-232	Th-228	U-238
29/F-Line (0 to 15 cm)/2	39°11.378N, 076°35.207W	6.31 ± 0.58	6.30 ± 0.37	0.85 ± 0.80
30/F-Line (0 to 15 cm)/2	39°11.385N, 076°35.211W	13.1 ± 1.2	13.26 ± 0.79	2.52 ± 0.28[e]
31/Bldg. 821 (0 to 15 cm)/2	39°11.947N, 076°34.799W	19.6 ± 1.6	18.0 ± 1.0	1.27 ± 0.77[e]
32/Railroad North (0 to 15 cm)/2	39°12.072N, 076°35.116W	1.87 ± 0.24	1.69 ± 0.12	1.28 ± 0.77
33/J-Line (0 to 15 cm)/3	39°12.154N, 076°35.156W	2.06 ± 0.24	1.96 ± 0.12	1.98 ± 0.46
34/K-Line (0 to 15 cm)/3	39°11.950N, 076°35.335W	3.30 ± 0.35	3.10 ± 0.19	2.13 ± 0.72
35/K-Line (0 to 15 cm)/3	39°12.002N, 076°35.306W	1.68 ± 0.22	1.78 ± 0.12	1.67 ± 0.55
36/F-Line (0 to 15 cm)/2	39°11.610N, 076°35.100W	1.78 ± 0.22	1.78 ± 0.12	1.44 ± 0.60[e]
37/B-Line (0 to 15 cm)/2	39°11.815N, 076°34.876W	17.6 ± 1.5	16.80 ± 0.95	1.2 ± 1.3
38/East Ave. – East (0 to 15 cm)/3	39°11.918N, 076°35.423W	2.16 ± 0.23	1.95 ± 0.13	1.93 ± 0.60
39/Patrol Road-Southwest (0 to 15 cm)/3	39°11.450N, 076°35.318W	1.49 ± 0.19	1.34 ± 0.09	1.58 ± 0.53
40/F-Line (0 to 15 cm)/2	39°11.831N, 076°34.987W	0.72 ± 0.13	0.65 ± 0.06	1.12 ± 0.65
41/H-Line (0 to 15 cm)/2	39°11.880N, 076°35.142W	1.92 ± 0.26	1.84 ± 0.13	2.04 ± 0.83
42/D-Line (0 to 15 cm)/3	39°11.640N, 076°34.946W	0.77 ± 0.18	0.81 ± 0.07	1.14 ± 0.54

[a]Refer to Figure 58, classifications indicated may have been revised for the characterization survey.
[b]Radionuclide concentrations are gross values that include background contributions.
[c]Uncertainties represent the 95% confidence interval based on total propagated uncertainties.
[d]---=Coordinate not collected.
[e]Analytical results have been revised from those originally reported in the January 2006 Scoping Survey Report

TABLE 6

RADIONUCLIDE CONCENTRATIONS IN CHARACTERIZATION SOIL SAMPLES CURTIS BAY DEPOT CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Background Reference Area Samples				
43	39.20258N, 76.59180W	NA	0.72 ± 0.14[b]	0.73 ± 0.44
44	39.20255N, 76.59205W	NA	0.51 ± 0.13	0.34 ± 0.43
45	39.20234N, 76.59220W	NA	0.50 ± 0.09	0.74 ± 0.38
46	39.20240N, 76.59223W	NA	0.77 ± 0.16	0.83 ± 0.39
47	39.20196N, 76.59355W	NA	1.32 ± 0.20	0.92 ± 0.64
48	39.20220N, 76.59327W	NA	1.24 ± 0.22	1.10 ± 0.61
49	39.20195N, 76.59282W	NA	1.12 ± 0.16	0.97 ± 0.66
50	39.20172N, 76.59299W	NA	0.81 ± 0.15	1.21 ± 0.70
51	39.20270N, 76.59330W	NA	0.71 ± 0.10	0.74 ± 0.38
52	39.20256N, 76.59266W	NA	0.91 ± 0.16	1.18 ± 0.57
53	39.20302N, 76.59274W	NA	0.58 ± 0.13	0.49 ± 0.39
54	39.20279N, 76.59244W	NA	0.60 ± 0.12	0.84 ± 0.61
55	39.20272N, 76.59342W	NA	0.71 ± 0.14	0.79 ± 0.31
56	39.20285N, 76.59215W	NA	0.73 ± 0.13	0.69 ± 0.38
57	39.20203N, 76.59210W	NA	0.91 ± 0.13	0.95 ± 0.46
Background Railroad Ballast Samples				
388	39.20649N, 76.58639W	NA	1.36 ± 0.22	2.19 ± 0.64
389	39.20637N, 76.58633W	NA	1.64 ± 0.22	2.35 ± 0.68
390	39.20628N, 76.58626W	NA	1.25 ± 0.18	1.88 ± 0.62
391	39.20626N, 76.58624W	NA	1.27 ± 0.18	1.58 ± 0.49
Judgmental Samples				
104	39.19029N, 76.57822W	3/4	2.38 ± 0.24	2.11 ± 0.56
105	39.19093N, 76.57969W	3/4	0.28 ± 0.07	1.19 ± 0.36
106	39.19090N, 76.57971W	3/4	0.18 ± 0.04	0.15 ± 0.17
107	39.19093N, 76.57967W	3/4	0.10 ± 0.06	0.65 ± 0.29
108	39.19091N, 76.57961W	3/4	0.10 ± 0.04	0.03 ± 0.13
109	39.19697N, 76.58096W	1/1	13.3 ± 1.1	1.55 ± 0.85
110/109 @ 15 to 30 cm	39.19697N, 76.58096W	1/1	2.23 ± 0.24	1.08 ± 0.57
111/Bounding 31	39.19697N, 76.58095W	1/1	3.42 ± 0.34	0.69 ± 0.60
112/Bounding 31	39.19699N, 76.58092W	1/1	0.85 ± 0.12	0.92 ± 0.51
113/Bounding 31	39.19703N, 76.58094W	1/1	1.04 ± 0.16	0.64 ± 0.42
114/Bounding 31	39.19912N, 76.57962W	1/4	1.35 ± 0.17	0.76 ± 0.42
115/Bounding 109	39.19912N, 76.57963W	1/4	0.60 ± 0.12	0.56 ± 0.35
116/Bounding 109	39.19913N, 76.57965W	1/4	0.50 ± 0.13	0.66 ± 0.41
148	39.19078N, 76.58091W	3/4	0.23 ± 0.06	0.40 ± 0.28

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS IN CHARACTERIZATION SOIL SAMPLES CURTIS BAY DEPOT CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Judgmental Samples (Continued)				
408/148 resample	39.19078N, 76.58091W	3/4	0.66 ± 0.10	2.24 ± 0.56
149	39.19153N, 76.57898W	3/4	0.59 ± 0.18	3.5 ± 1.0
150	39.19110N, 76.57983W	3/4	0.92 ± 0.19	3.10 ± 0.74
151	39.18921N, 76.58231W	2/3	94.0 ± 7.5	11.2 ± 4.1
152	39.18943N, 76.58667W	1/2	1.44 ± 0.17	0.64 ± 0.37
153	39.18946N, 76.58667W	1/2	1.15 ± 0.14	0.86 ± 0.48
154	39.18938N, 76.58666W	1/2	1.85 ± 0.23	1.11 ± 0.73
155	39.19643N, 76.58063W	1/1	1.21 ± 0.16	1.41 ± 0.57
156	39.19410N, 76.58104W	2/2	7.98 ± 0.74	2.06 ± 0.81
157	39.19106N, 76.58229W	3/3	1.24 ± 0.16	1.25 ± 0.40
158	39.19062N, 76.58112W	3/4	3.36 ± 0.33	3.42 ± 0.75
159	39.18877N, 76.58176W	3/4	1.40 ± 0.20	1.14 ± 0.57
160	39.18992N, 76.58152W	3/4	1.40 ± 0.16	1.45 ± 0.49
297	39.19702N, 76.58959W	2/4	2.09 ± 0.22	1.21 ± 0.43
298	39.19885N, 76.59003W	2/4	2.32 ± 0.27	0.99 ± 0.46
299	39.20174N, 76.58752W	2/4	5.79 ± 0.51	1.44 ± 0.69
413/15 to 30 cm	39.20174N, 76.58752W	2/4	2.04 ± 0.23	1.10 ± 0.58
414/30 to 45 cm	39.20174N, 76.58752W	2/4	1.28 ± 0.22	1.64 ± 0.49
300	39.20177N, 76.58761W	2/4	4.21 ± 0.40	1.73 ± 0.70
301	39.20124N, 76.58764W	2/4	9.82 ± 0.89	2.0 ± 1.1
302	39.19544N, 76.58059W	2/2	38.8 ± 3.1	0.9 ± 1.3
303	39.19565N, 76.58150W	2/2	1.62 ± 0.18	0.79 ± 0.54
304	39.19613N, 76.58095W	1/1	1.52 ± 0.19	1.57 ± 0.54
305	39.19848N, 76.57986W	2/2	0.93 ± 0.18	1.21 ± 0.58
306	39.19846N, 76.57984W	2/2	0.98 ± 0.16	0.95 ± 0.55
307	39.19831N, 76.57972W	2/2	1.29 ± 0.17	1.32 ± 0.52
308	39.19880N, 76.57970W	2/2	1.21 ± 0.18	1.32 ± 0.62
309	39.19669N, 76.57922W	2/2	1.05 ± 0.15	0.74 ± 0.50
341/0 to 15 cm	39.19914N, 76.58592W	2/1	0.51 ± 0.21	11.7 ± 1.3
409/15 to 30 cm	39.19914N, 76.58592W	2/1	1.33 ± 0.19	2.41 ± 0.58
410/30 to 45 cm	39.19914N, 76.58592W	2/1	1.03 ± 0.18	2.80 ± 0.77
342	39.19739N, 76.58601W	2/1	3.18 ± 0.32	1.66 ± 0.78
343	39.19565N, 76.58764W	3/2	1.91 ± 0.21	1.42 ± 0.45
344	39.19537N, 76.58777W	3/2	2.87 ± 0.31	2.54 ± 0.70
345/0 to 15 cm	39.19246N, 76.58735W	1/2	7.94 ± 0.69	1.49 ± 0.80
406/15 to 30 cm	39.19246N, 76.58735W	1/2	0.90 ± 0.20	1.02 ± 0.56
407/30 to 45 cm	39.19246N, 76.58735W	1/2	1.22 ± 0.18	1.52 ± 0.50

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Judgmental Samples (Continued)				
346	39.19263N, 76.58734W	1/2	1.85 ± 0.26	1.65 ± 0.65
347	39.19232N, 76.58738W	1/2	1.70 ± 0.18	0.92 ± 0.44
348	39.18923N, 76.58665W	2/3	5.68 ± 0.52	1.45 ± 0.82
349	39.18965N, 76.58646W	2/3	5.37 ± 0.49	1.73 ± 0.83
350	39.19205N, 76.58538W	1/2	2.26 ± 0.25	1.76 ± 0.59
351	39.19199N, 76.58544W	1/2	1.22 ± 0.24	1.02 ± 0.80
352	39.19211N, 76.58548W	1/2	1.00 ± 0.16	0.71 ± 0.49
353	39.19216N, 76.58543W	1/2	2.55 ± 0.26	1.54 ± 0.68
385	39.19299N, 76.57915W	2/2	2.28 ± 0.25	1.91 ± 0.61
386	39.19387N, 76.58087W	2/2	2.33 ± 0.28	1.81 ± 0.59
387/ Location 18, 15 to 30 cm	39.19203N, 76.58546W	1/2	6.04 ± 0.58	1.1 ± 1.2
400/Location 18 30 to 45 cm	39.19203N, 76.58546W	1/2	1.31 ± 0.17	0.63 ± 0.52
392	39.20157N, 76.58469W	2/1	2.33 ± 0.27	2.55 ± 0.70
393	39.20242N, 76.58552W	2/1	2.46 ± 0.29	2.52 ± 0.61
394	39.20155N, 76.58424W	2/1	1.78 ± 0.24	1.75 ± 0.50
395	39.19994N, 76.58001W	2/2	2.48 ± 0.32	2.75 ± 0.92
396	39.19990N, 76.58034W	2/2	1.37 ± 0.18	1.00 ± 0.44
401	39.18974N, 76.58655W	1/2	83.7 ± 6.6	11.2 ± 3.0
402/0 to 15 cm	39.18979N, 76.58651W	1/2	11.9 ± 1.0	2.0 ± 1.3
403/15 to 20 cm	39.18979N, 76.58651W	1/2	2.02 ± 0.22	0.78 ± 0.44
404/401 Bounding	39.18987N, 76.58645W	1/2	1.48 ± 0.22	0.99 ± 0.59
405/401 Bounding	39.18971N, 76.58658W	1/2	1.38 ± 0.18	1.10 ± 0.54
411	39.20056N, 76.58658W	2/1	2.20 ± 0.28	2.04 ± 0.86
412	39.20069N, 76.58652W	2/1	2.29 ± 0.24	1.92 ± 0.61
B-Line Class 1 Area Systematic Samples				
.68	39.19652N, 76.58078W	1/1	0.83 ± 0.14	0.38 ± 0.43
69	39.19681N, 76.58085W	1/1	0.72 ± 0.11	0.86 ± 0.33
70	39.19710N, 76.58089W	1/1	0.42 ± 0.10	0.34 ± 0.23
71	39.19739N, 76.58093W	1/1	0.33 ± 0.10	0.28 ± 0.28
72	39.19768N, 76.58097W	1/1	0.63 ± 0.10	0.50 ± 0.32
73	39.19798N, 76.58102W	1/1	0.98 ± 0.13	0.94 ± 0.38
74	39.19829N, 76.58106W	1/1	1.54 ± 0.25	1.9 ± 1.0
75	39.19860N, 76.58110N	1/1	0.68 ± 0.10	0.42 ± 0.28
76	39.19886N, 76.58114W	1/1	1.56 ± 0.23	1.61 ± 0.72
77	39.19905N, 76.58151W	1/1	0.76 ± 0.14	0.88 ± 0.42
78	39.19874N, 76.58147W	1/1	1.01 ± 0.19	1.58 ± 0.77

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
B-Line Class 1 Area Systematic Samples (Continued)				
79	39.19780N, 76.58134W	1/1	1.15 ± 0.15	1.28 ± 0.49
80	39.19749N, 76.58131W	1/1	0.93 ± 0.20	1.38 ± 0.63
81	39.19661N, 76.58119W	1/1	0.85 ± 0.17	1.20 ± 0.57
82	39.19685N, 76.58138W	1/1	0.74 ± 0.13	0.46 ± 0.39
83	39.19715N, 76.58142W	1/1	0.82 ± 0.13	0.62 ± 0.38
84	39.19812N, 76.58156W	1/1	0.76 ± 0.13	1.02 ± 0.48
85	39.19842N, 76.58159W	1/1	0.70 ± 0.11	0.93 ± 0.33
86	39.19889N, 76.58184W	1/1	1.01 ± 0.19	1.23 ± 0.63
87	39.19857N, 76.58180W	1/1	1.09 ± 0.17	1.19 ± 0.51
88	39.19826N, 76.58175W	1/1	1.26 ± 0.17	1.25 ± 0.52
89	39.19796N, 76.58171W	1/1	0.89 ± 0.16	0.70 ± 0.45
90	39.19764N, 76.58166W	1/1	0.64 ± 0.11	0.78 ± 0.36
91	39.19734N, 76.58163W	1/1	0.62 ± 0.13	0.65 ± 0.41
92	39.19701N, 76.58159W	1/1	0.92 ± 0.15	1.33 ± 0.59
93	39.19670N, 76.58154W	1/1	1.19 ± 0.21	1.80 ± 0.67
94	39.19639N, 76.58150W	1/1	0.84 ± 0.16	2.14 ± 0.59
95	39.19651N, 76.58183W	1/1	0.73 ± 0.13	1.39 ± 0.50
96	39.19680N, 76.58188W	1/1	0.98 ± 0.14	1.21 ± 0.43
97	39.19677N, 76.58170W	1/1	0.59 ± 0.12	1.90 ± 0.40
98	39.19716N, 76.58193W	1/1	0.98 ± 0.14	0.97 ± 0.53
99	39.19746N, 76.58199W	1/1	1.30 ± 0.16	1.24 ± 0.36
100	39.19777N, 76.58203W	1/1	0.75 ± 0.11	0.67 ± 0.38
101	39.19837N, 76.58210W	1/1	0.69 ± 0.14	1.34 ± 0.44
102	39.19868N, 76.58213W	1/1	1.38 ± 0.20	1.30 ± 0.63
103	39.19898N, 76.58216W	1/1	0.82 ± 0.14	0.96 ± 0.48
Former Radiological Waste Burial Area Subsurface Samples				
Borehole #1				
200/0 to 30 cm	39.19472N, 76.59227W	1/3	0.51 ± 0.15	0.72 ± 0.46
201/30 to 60 cm	39.19472N, 76.59227W	1/3	0.64 ± 0.11	0.44 ± 0.40
202/60 to 90 cm	39.19472N, 76.59227W	1/3	0.76 ± 0.13	0.57 ± 0.39
203/90 to 120 cm	39.19472N, 76.59227W	1/3	0.54 ± 0.10	0.56 ± 0.43
204/120 to 150 cm	39.19472N, 76.59227W	1/3	0.65 ± 0.10	0.80 ± 0.35
205/150 to 180 cm	39.19472N, 76.59227W	1/3	0.68 ± 0.12	0.58 ± 0.37
206/180 to 210 cm	39.19472N, 76.59227W	1/3	1.26 ± 0.17	0.81 ± 0.42

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Borehole #1 (Continued)				
207/210 to 240 cm	39.19472N, 76.59227W	1/3	1.61 ± 0.29	1.92 ± 0.73
Borehole #2				
208/0 to 30 cm	39.19465N, 76.59243W	1/3	0.56 ± 0.14	0.58 ± 0.36
209/30 to 60 cm	39.19465N, 76.59243W	1/3	0.94 ± 0.16	0.86 ± 0.48
210/60 to 90 cm	39.19465N, 76.59243W	1/3	0.74 ± 0.13	0.71 ± 0.37
211/90 to 120 cm	39.19465N, 76.59243W	1/3	0.39 ± 0.08	0.39 ± 0.24
212/120 to 150 cm	39.19465N, 76.59243W	1/3	0.76 ± 0.14	0.69 ± 0.41
213/150 to 180 cm	39.19465N, 76.59243W	1/3	0.49 ± 0.10	0.53 ± 0.26
214/180 to 210 cm	39.19465N, 76.59243W	1/3	0.39 ± 0.08	0.24 ± 0.24
215/210 to 240 cm	39.19465N, 76.59243W	1/3	1.08 ± 0.18	1.06 ± 0.56
Borehole #3				
216/0 to 60 cm	39.19463N, 76.59260W	1/3	1.11 ± 0.16	0.83 ± 0.48
217/60 to 90 cm	39.19463N, 76.59260W	1/3	0.32 ± 0.08	0.29 ± 0.27
218/90 to 120 cm	39.19463N, 76.59260W	1/3	0.33 ± 0.09	0.45 ± 0.32
219/120 to 180 cm	39.19463N, 76.59260W	1/3	0.49 ± 0.10	0.37 ± 0.42
220/180 to 210 cm	39.19463N, 76.59260W	1/3	0.39 ± 0.10	0.61 ± 0.29
221/210 to 240 cm	39.19463N, 76.59260W	1/3	1.18 ± 0.20	1.31 ± 0.59
Borehole #4				
222/0 to 60 cm	39.19470N, 76.59279W	1/3	0.69 ± 0.14	0.54 ± 0.45
223/60 to 90 cm	39.19470N, 76.59279W	1/3	0.66 ± 0.11	0.71 ± 0.29
224/90 to 120 cm	39.19470N, 76.59279W	1/3	0.69 ± 0.11	0.80 ± 0.31
225/120 to 180 cm	39.19470N, 76.59279W	1/3	0.51 ± 0.11	0.75 ± 0.36
226/180 to 210 cm	39.19470N, 76.59279W	1/3	11.78 ± 0.98	1.7 ± 1.1
227/210 to 240 cm	39.19470N, 76.59279W	1/3	19.8 ± 1.6	1.8 ± 1.0
Borehole #5				
228/0 to 60 cm	39.19467N, 76.59269W	1/3	0.57 ± 0.10	0.72 ± 0.30
229/60 to 90 cm	39.19467N, 76.59269W	1/3	0.51 ± 0.11	0.46 ± 0.34

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Borehole #5 (Continued)				
230/90 to 120 cm	39.19467N, 76.59269W	1/3	1.31 ± 0.18	1.19 ± 0.56
231/195 to 240 cm	39.19467N, 76.59269W	1/3	3.50 ± 0.32	1.25 ± 0.66
232/240 to 300 cm	39.19467N, 76.59269W	1/3	3.80 ± 0.36	1.15 ± 0.62
233/300 to 330 cm	39.19467N, 76.59269W	1/3	0.39 ± 0.08	0.37 ± 0.24
234/330 to 360 cm	39.19467N, 76.59269W	1/3	0.29 ± 0.07	0.10 ± 0.23
Borehole #6				
235/0 to 60 cm	39.19472N, 76.59269W	1/3	0.98 ± 0.16	0.92 ± 0.46
236/60 to 90 cm	39.19472N, 76.59269W	1/3	0.86 ± 0.14	0.53 ± 0.46
237/90 to 120 cm	39.19472N, 76.59269W	1/3	0.45 ± 0.08	0.72 ± 0.30
238/120 to 180 cm	39.19472N, 76.59269W	1/3	0.54 ± 0.09	0.49 ± 0.33
239/180 to 210 cm	39.19472N, 76.59269W	1/3	0.39 ± 0.09	0.30 ± 0.32
240/210 to 240 cm	39.19472N, 76.59269W	1/3	0.36 ± 0.08	0.32 ± 0.30
241/240 to 270 cm	39.19472N, 76.59269W	1/3	0.40 ± 0.08	0.42 ± 0.33
242/270 to 300 cm	39.19472N, 76.59269W	1/3	0.61 ± 0.10	0.65 ± 0.30
243/300 to 330 cm	39.19472N, 76.59269W	1/3	1.36 ± 0.17	1.29 ± 0.49
244/330 to 360 cm	39.19472N, 76.59269W	1/3	0.56 ± 0.10	0.69 ± 0.31
Borehole #7				
245/0 to 60 cm	39.19467N, 76.59262W	1/3	0.66 ± 0.11	0.50 ± 0.45
246/60 to 90 cm	39.19467N, 76.59262W	1/3	0.59 ± 0.10	0.49 ± 0.29
247/90 to 120 cm	39.19467N, 76.59262W	1/3	0.76 ± 0.11	0.77 ± 0.34
248/180 to 240 cm	39.19467N, 76.59262W	1/3	4.12 ± 0.40	1.29 ± 0.81
249/300 to 360 cm	39.19467N, 76.59262W	1/3	7.01 ± 0.61	1.0 ± 1.0
Borehole #8				
250/20 to 60 cm	39.19473N, 76.59253W	1/3	0.71 ± 0.12	0.70 ± 0.37
251/60 to 90 cm	39.19473N, 76.59253W	1/3	0.48 ± 0.09	0.60 ± 0.29

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Borehole #8 (Continued)				
252/90 to 120 cm	39.19473N, 76.59253W	1/3	2.29 ± 0.23	0.94 ± 0.44
253/150 to 180 cm	39.19473N, 76.59253W	1/3	1.91 ± 0.21	0.81 ± 0.52
254/180 to 210 cm	39.19473N, 76.59253W	1/3	4.46 ± 0.41	0.82 ± 0.64
255/210 to 240 cm	39.19473N, 76.59253W	1/3	3.86 ± 0.39	0.70 ± 0.48
256/315 to 360 cm	39.19473N, 76.59253W	1/3	2.74 ± 0.27	1.22 ± 0.56
257/390 to 420 cm	39.19473N, 76.59253W	1/3	2.67 ± 0.27	1.01 ± 0.56
258/420 to 450 cm	39.19473N, 76.59253W	1/3	1.16 ± 0.18	0.88 ± 0.55
259/450 to 480 cm	39.19473N, 76.59253W	1/3	1.18 ± 0.19	0.73 ± 0.50
Borehole #9				
260/0 to 60 cm	39.19467N, 76.59254W	1/3	0.79 ± 0.12	0.56 ± 0.34
261/60 to 90 cm	39.19467N, 76.59254W	1/3	5.05 ± 0.48	1.15 ± 0.80
262/90 to 120 cm	39.19467N, 76.59254W	1/3	9.24 ± 0.78	1.64 ± 0.85
263/120 to 240 cm	39.19467N, 76.59254W	1/3	3.29 ± 0.33	0.89 ± 0.60
264/255 to 300 cm	39.19467N, 76.59254W	1/3	3.94 ± 0.38	1.08 ± 0.61
265/300 to 360 cm	39.19467N, 76.59254W	1/3	2.01 ± 0.25	0.88 ± 0.62
266/360 to 420 cm	39.19467N, 76.59254W	1/3	2.28 ± 0.26	0.79 ± 0.67
267/420 to 480 cm	39.19467N, 76.59254W	1/3	0.94 ± 0.14	0.74 ± 0.37
Borehole #10				
268/0 to 60 cm	39.19472N, 76.59244W	1/3	0.65 ± 0.10	0.92 ± 0.38
269/60 to 120 cm	39.19472N, 76.59244W	1/3	0.59 ± 0.11	0.50 ± 0.34
270/120 to 180 cm	39.19472N, 76.59244W	1/3	3.96 ± 0.39	1.50 ± 0.90
271/180 to 240 cm	39.19472N, 76.59244W	1/3	0.86 ± 0.13	0.73 ± 0.47
272/240 to 300 cm	39.19472N, 76.59244W	1/3	1.91 ± 0.21	0.54 ± 0.47

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Borehole #10 (Continued)				
273/300 to 360 cm	39.19472N, 76.59244W	1/3	3.20 ± 0.35	1.03 ± 0.82
274/360 to 390 cm	39.19472N, 76.59244W	1/3	2.49 ± 0.28	0.77 ± 0.61
275/390 to 435 cm	39.19472N, 76.59244W	1/3	0.28 ± 0.07	0.41 ± 0.29
Borehole #11				
276/0 to 90 cm	39.29477N, 76.59236W	1/3	0.79 ± 0.13	0.30 ± 0.39
277/90 to 120 cm	39.19477N, 76.59236W	1/3	0.73 ± 0.11	0.50 ± 0.30
278/120 to 160 cm	39.19477N, 76.59236W	1/3	1.89 ± 0.21	0.57 ± 0.56
279/160 to 200 cm	39.19477N, 76.59236W	1/3	3.52 ± 0.34	0.82 ± 0.72
280/200 to 240 cm	39.19477N, 76.59236W	1/3	5.10 ± 0.44	0.62 ± 0.64
281/240 to 280 cm	39.19477N, 76.59236W	1/3	1.86 ± 0.25	2.19 ± 0.70
282/280 to 320 cm	39.19477N, 76.59236W	1/3	1.86 ± 0.26	1.63 ± 0.74
283/320 to 360 cm	39.19477N, 76.59236W	1/3	1.61 ± 0.23	1.00 ± 0.69
Borehole #12				
284/0 to 90 cm	39.19470N, 76.59236W	1/3	0.70 ± 0.11	0.70 ± 0.43
285/90 to 120 cm	39.19470N, 76.59236W	1/3	0.63 ± 0.10	0.26 ± 0.38
286/120 to 180 cm	39.19470N, 76.59236W	1/3	1.31 ± 0.18	0.62 ± 0.51
287/180 to 240 cm	39.19470N, 76.59236W	1/3	2.76 ± 0.32	1.29 ± 0.92
288/240 to 320 cm	39.19470N, 76.59236W	1/3	1.55 ± 0.22	1.67 ± 0.45
Borehole-Background #1				
289/0 to 60 cm	39.19415N, 76.59196W	2/4	0.55 ± 0.11	0.71 ± 0.34
290/60 to 120 cm	39.19415N, 76.59196W	2/4	0.75 ± 0.14	0.65 ± 0.47
291/120 to 180 cm	39.19415N, 76.59196W	2/4	0.78 ± 0.14	0.98 ± 0.47
292/180 to 240 cm	39.19415N, 76.59196W	2/4	0.52 ± 0.10	0.35 ± 0.32

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Borehole-Background #2				
293/0 to 60 cm	39.19447N, 76.59174W	2/4	0.66 ± 0.13	0.83 ± 0.49
294/60 to 120 cm	39.19447N, 76.59174W	2/4	0.56 ± 0.12	0.58 ± 0.48
397/120 to 180 cm	39.19447N, 76.59174W	2/4	0.44 ± 0.09	0.31 ± 0.33
398/180 to 240 cm	39.19447N, 76.59174W	2/4	0.92 ± 0.15	0.65 ± 0.47
Class 2 Systematic Samples				
161	39.18852N, 76.58404W	2/3	0.68 ± 0.11	0.96 ± 0.40
162	39.18904N, 76.58380W	2/3	0.77 ± 0.16	0.65 ± 0.51
163	39.18930N, 76.58472W	2/3	0.68 ± 0.12	0.73 ± 0.39
164	39.18919N, 76.58620W	2/3	0.70 ± 0.13	0.83 ± 0.42
165	39.18983N, 76.58577W	2/3	0.46 ± 0.09	0.45 ± 0.29
166	39.19091N, 76.58546W	2/3	1.18 ± 0.21	1.24 ± 0.76
167	39.19162N, 76.58516W	2/3	1.44 ± 0.19	1.17 ± 0.60
168	39.19236N, 76.58480W	2/3	1.30 ± 0.20	1.40 ± 0.65
169	39.19360N, 76.58431W	2/3	1.52 ± 0.27	2.1 ± 1.0
170	39.19391N, 76.58530W	2/3	0.78 ± 0.19	1.60 ± 0.80
171	39.19423N, 76.58636W	2/3	1.31 ± 0.16	1.48 ± 0.59
172	39.19264N, 76.58594W	2/3	0.85 ± 0.15	1.01 ± 0.44
173	39.19717N, 76.59012W	2/4	0.52 ± 0.10	1.06 ± 0.42
174	39.19628N, 76.58836W	2/4	0.63 ± 0.12	0.73 ± 0.40
175	39.19607N, 76.58759W	2/4	0.55 ± 0.11	0.73 ± 0.48
176	39.19581N, 76.58670W	2/1	0.94 ± 0.15	1.23 ± 0.40
177	39.19670N, 76.58938W	2/4	0.73 ± 0.13	1.00 ± 0.49
178	39.19558N, 76.58575W	2/3	1.08 ± 0.17	1.60 ± 0.55
179	39.19521N, 76.58465W	2/3	0.45 ± 0.09	0.52 ± 0.33
180	39.19500N, 76.58377W	2/3	1.45 ± 0.23	2.3 ± 1.1
181	39.19633N, 76.58515W	2/1	0.62 ± 0.11	0.83 ± 0.34
182	39.19778N, 76.58253W	2/1	0.46 ± 0.10	0.61 ± 0.34
183	39.19855N, 76.58302W	2/1	0.87 ± 0.16	0.84 ± 0.45
184	39.19795N, 76.58325W	2/1	1.12 ± 0.15	1.21 ± 0.36
185	39.19827N, 76.58452W	2/1	0.76 ± 0.14	1.82 ± 0.38
186	39.19691N, 76.58505W	2/1	1.38 ± 0.20	1.98 ± 0.69
187	39.19649N, 76.58629W	2/1	1.28 ± 0.23	1.58 ± 0.75
188	39.19723N, 76.58599W	2/1	1.61 ± 0.25	1.34 ± 0.77
189	39.19838N, 76.58525W	2/1	1.20 ± 0.22	1.31 ± 0.81
190	39.19803N, 76.58939W	2/4	0.84 ± 0.14	1.11 ± 0.45
191	39.19756N, 76.58865W	2/4	0.68 ± 0.13	0.68 ± 0.61

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Class 2 Systematic Samples (Continued)				
192	39.19710N, 76.58783W	2/4	0.79 ± 0.14	1.00 ± 0.49
193	39.19680N, 76.58705W	2/1	1.56 ± 0.19	1.11 ± 0.51
194	39.19660N, 76.59084W	2/4	0.57 ± 0.10	0.64 ± 0.33
195	39.19580N, 76.58165W	2/2	0.62 ± 0.11	0.56 ± 0.36
196	39.19613N, 76.59016W	2/4	1.32 ± 0.20	0.50 ± 0.75
197	39.19529N, 76.59096W	2/4	1.35 ± 0.23	1.31 ± 0.69
198	39.19470N, 76.59113W	2/4	1.09 ± 0.19	1.70 ± 0.53
199	39.19418N, 76.59201W	2/4	0.54 ± 0.11	0.64 ± 0.41
295	39.19375N, 76.59161W	2/4	0.53 ± 0.11	0.79 ± 0.41
296	39.19428N, 76.59058W	2/4	0.82 ± 0.13	1.50 ± 0.50
310	39.19131N, 76.57727W	2/2	0.53 ± 0.10	0.70 ± 0.36
311	39.19157N, 76.57626W	2/2	0.43 ± 0.08	0.33 ± 0.21
312	39.19221N, 76.57853W	2/2	0.37 ± 0.12	0.92 ± 0.36
313	39.19307N, 76.57880W	2/2	0.27 ± 0.08	0.33 ± 0.28
314	39.19337N, 76.57979W	2/2	0.61 ± 0.12	0.97 ± 0.57
315	39.19374N, 76.58081W	2/2	0.90 ± 0.15	1.04 ± 0.55
316	39.19403N, 76.57927W	2/2	0.55 ± 0.11	0.42 ± 0.37
317	39.19436N, 76.58054W	2/2	0.93 ± 0.14	1.51 ± 0.42
318	39.19953N, 76.58917W	2/4	0.95 ± 0.15	0.94 ± 0.39
319	39.20101N, 76.58834W	2/4	0.81 ± 0.16	1.19 ± 0.52
320	39.19900N, 76.58845W	2/4	0.94 ± 0.16	0.98 ± 0.47
321	39.20052N, 76.58760W	2/4	1.04 ± 0.20	1.36 ± 0.74
322	39.19886N, 76.58625W	2/1	1.24 ± 0.24	1.42 ± 0.71
323	39.20012N, 76.58549W	2/1	2.04 ± 0.23	2.09 ± 0.75
324	39.19971N, 76.58469W	2/1	1.01 ± 0.17	1.43 ± 0.53
325	39.19947N, 76.58380W	2/1	0.87 ± 0.12	1.03 ± 0.33
326	39.19907N, 76.58270W	2/2	0.86 ± 0.14	1.27 ± 0.48
327	39.20109N, 76.58412W	2/1	0.74 ± 0.14	1.22 ± 0.47
328	39.20152N, 76.58489W	2/1	1.06 ± 0.15	0.98 ± 0.46
329	39.20205N, 76.58455W	2/1	0.91 ± 0.17	1.27 ± 0.66
330	39.20127N, 76.58609W	2/1	0.76 ± 0.14	0.57 ± 0.36
331	39.20250N, 76.58546W	2/1	1.16 ± 0.17	1.56 ± 0.59
332	39.20193N, 76.58579W	2/1	1.12 ± 0.21	1.70 ± 0.79
333	39.20170N, 76.58785W	2/4	1.04 ± 0.21	1.06 ± 0.68
334	39.20174N, 76.58677W	2/1	1.14 ± 0.17	1.58 ± 0.65
335	39.20226N, 76.58754W	2/4	1.18 ± 0.22	1.47 ± 0.72
336	39.20268N, 76.58639W	2/1	0.57 ± 0.14	1.01 ± 0.45

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Class 2 Systematic Samples (Continued)				
337	39.20000N, 76.58685W	2/1	1.21 ± 0.19	1.24 ± 0.61
338	39.19740N, 76.58762W	2/4	0.42 ± 0.09	0.42 ± 0.31
339	39.19977N, 76.58216W	2/2	0.91 ± 0.15	1.50 ± 0.64
340	39.20017N, 76.58188W	2/2	0.62 ± 0.12	1.02 ± 0.43
356	39.19467N, 76.57895W	2/2	0.67 ± 0.10	0.74 ± 0.29
357	39.19530N, 76.58053W	2/2	0.13 ± 0.05	0.35 ± 0.15
358	39.19639N, 76.58071W	2/2	0.76 ± 0.13	0.72 ± 0.35
359	39.19588N, 76.58005W	2/2	0.74 ± 0.11	0.97 ± 0.34
360	39.19559N, 76.57903W	2/2	0.23 ± 0.06	0.08 ± 0.22
361	39.19529N, 76.57817W	2/2	0.80 ± 0.12	1.07 ± 0.43
362	39.19643N, 76.57829W	2/2	0.46 ± 0.10	0.57 ± 0.28
363	39.19673N, 76.57921W	2/2	1.24 ± 0.22	1.44 ± 0.61
364	39.19710N, 76.58033W	2/2	0.78 ± 0.16	1.00 ± 0.58
365	39.19725N, 76.57866W	2/2	1.21 ± 0.19	1.79 ± 0.73
366	39.19769N, 76.57967W	2/2	0.74 ± 0.14	1.08 ± 0.44
367	39.19819N, 76.58075W	2/2	0.63 ± 0.09	0.62 ± 0.33
368	39.19826N, 76.57897W	2/2	0.68 ± 0.12	0.75 ± 0.42
369	39.19866N, 76.58000W	2/2	1.21 ± 0.19	1.04 ± 0.65
370	39.19963N, 76.58020W	2/2	0.55 ± 0.12	1.10 ± 0.51
371	39.20012N, 76.58152W	2/2	0.65 ± 0.12	0.37 ± 0.54
374	39.20154N, 76.58370W	2/1	0.90 ± 0.16	0.98 ± 0.40
Class 3 Survey Area SU1 Random Samples				
127	39.20264N, 76.58685W	3/1	1.26 ± 0.16	1.24 ± 0.49
128	39.20312N, 76.58765W	3/1	0.82 ± 0.16	1.22 ± 0.56
129	39.20331N, 76.58476W	3/1	0.56 ± 0.11	1.02 ± 0.26
130	39.20398N, 76.58590W	3/1	1.15 ± 0.19	1.40 ± 0.62
131	39.20435N, 76.58609W	3/1	0.66 ± 0.10	0.84 ± 0.42
132	39.20469N, 76.58653W	3/1	0.44 ± 0.11	0.64 ± 0.39
133	39.20517N, 76.58712W	3/1	0.70 ± 0.13	0.82 ± 0.46
134	39.20548N, 76.58667W	3/1	0.68 ± 0.13	0.86 ± 0.44
135	39.20586N, 76.58687W	3/1	0.67 ± 0.13	1.32 ± 0.49
136	39.20520N, 76.58589W	3/1	0.58 ± 0.11	0.83 ± 0.43
Class 3 Survey Area SU2 Random Samples				
117	39.19067N, 76.58803W	3/2	1.44 ± 0.20	2.00 ± 0.80
118	39.19034N, 76.58890W	3/2	0.75 ± 0.16	0.89 ± 0.51
119	39.19163N, 76.58941W	3/2	0.56 ± 0.10	0.49 ± 0.35
120	39.19230N, 76.58800W	3/2	0.93 ± 0.16	0.97 ± 0.52

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS IN CHARACTERIZATION SOIL SAMPLES CURTIS BAY DEPOT CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Class 3 Survey Area SU2 Random Samples (Continued)				
121	39.19273N, 76.58856W	3/2	0.64 ± 0.11	0.56 ± 0.53
122	39.19380N, 76.58836W	3/2	0.71 ± 0.10	0.55 ± 0.35
123	39.19380N, 76.58869W	3/2	0.72 ± 0.14	0.71 ± 0.44
124	39.19471N, 76.58998W	3/2	0.90 ± 0.16	1.13 ± 0.36
125	39.19541N, 76.59001W	3/2	0.77 ± 0.14	0.84 ± 0.43
126	39.19531N, 76.58966W	3/2	0.73 ± 0.16	1.21 ± 0.51
Class 3 Survey Area SU3 Random Samples				
137	39.18876N, 76.58385W	3/3	0.77 ± 0.13	0.77 ± 0.46
138	39.19054N, 76.58373W	3/3	1.03 ± 0.14	1.07 ± 0.40
139	39.19079N, 76.58203W	3/3	0.84 ± 0.14	0.94 ± 0.37
140	39.19173N, 76.58417W	3/3	1.98 ± 0.34	2.6 ± 1.6
141	39.19235N, 76.58441W	3/3	1.20 ± 0.22	1.16 ± 0.75
142	39.19213N, 76.58303W	3/3	0.98 ± 0.20	1.48 ± 0.80
143	39.19232N, 76.58159W	3/3	0.57 ± 0.12	0.79 ± 0.39
144	39.19338N, 76.58297W	3/3	1.04 ± 0.19	0.95 ± 0.56
145	39.19370N, 76.58250W	3/3	0.92 ± 0.16	0.91 ± 0.38
146	39.19389N, 76.58312W	3/3	1.10 ± 0.16	0.67 ± 0.49
147	39.19343N, 76.58250W	3/3	1.09 ± 0.16	1.14 ± 0.53
Class 3 Survey Area SU4 Random Samples				
58	39.18742N, 76.58521W	3/4	0.35 ± 0.07	0.40 ± 0.29
59	39.18749N, 76.58442W	3/4	0.33 ± 0.09	0.39 ± 0.27
60	39.18769N, 76.58461W	3/4	0.59 ± 0.11	0.65 ± 0.42
61	39.18802N, 76.58340W	3/4	0.48 ± 0.10	0.39 ± 0.28
62	39.18863N, 76.58141W	3/4	0.53 ± 0.11	0.58 ± 0.34
63	39.18931N, 76.58005W	3/4	0.21 ± 0.09	0.12 ± 0.23
64	39.18980N, 76.57977W	3/4	0.29 ± 0.07	0.31 ± 0.42
65	39.19092N, 76.57634W	3/4	0.38 ± 0.07	0.39 ± 0.25
66	39.19057N, 76.57845W	3/4	0.29 ± 0.08	0.39 ± 0.25
67	39.19098N, 76.57843W	3/4	0.33 ± 0.09	0.33 ± 0.30
Class 3 Survey Area SU5 Random Samples				
375	39.19365N, 76.57687W	3/5	0.36 ± 0.10	0.36 ± 0.32
376	39.19389N, 76.57669W	3/5	0.42 ± 0.12	0.22 ± 0.33
377	39.19398N, 76.57805W	3/5	0.34 ± 0.07	0.35 ± 0.22
378	39.19458N, 76.57806W	3/5	1.07 ± 0.17	0.99 ± 0.64
379	39.19479N, 76.57783W	3/5	0.52 ± 0.11	0.57 ± 0.36
380	39.19450N, 76.57792W	3/5	0.77 ± 0.13	1.13 ± 0.51
381	39.19626N, 76.57794W	3/5	0.77 ± 0.13	0.75 ± 0.40

TABLE 6 (Continued)

RADIONUCLIDE CONCENTRATIONS
IN CHARACTERIZATION SOIL SAMPLES
CURTIS BAY DEPOT
CURTIS BAY, MARYLAND

Sample ID	Location[a]	Class/ Area	Radionuclide Concentrations (pCi/g)	
			Th-232	U-238
Class 3 Survey Area SU5 Random Samples (Continued)				
382	39.19641N, 76.57795W	3/5	0.89 ± 0.19	1.33 ± 0.57
383	39.19697N, 76.57816W	3/5	0.81 ± 0.11	0.66 ± 0.35
384	39.19866N, 76.57918W	3/5	1.10 ± 0.17	1.81 ± 0.57
Building B-911 Sub-Floor				
354/0 to 15 cm	Floor Crack	NA	174 ± 14	11.3 ± 3.3
355/15 to 30 cm	Floor Crack	NA	37.9 ± 3.1	4.3 ± 2.4
416/30 to 45 cm	Floor Crack	NA	7.82 ± 0.72	1.6 ± 1.1
417/45 to 60 cm	Floor Crack	NA	6.78 ± 0.62	2.3 ± 1.0
372/0 to 15 cm	1 m from Floor Crack	NA	7.08 ± 0.62	0.64 ± 0.63
373/15 to 30 cm	1 m from Floor Crack	NA	3.94 ± 0.40	1.56 ± 0.85
415	Beneath Loading Dock	NA	35.4 ± 2.8	5.6 ± 1.6
Building F-737 Sub-Pad				
399	1 m N, 11 m E	NA	3.96 ± 0.39	0.75 ± 0.97

[a]Refer to Figures 5, 9, 59 through 71.
[b]Uncertainties are total propagated uncertainties at the 95% confidence interval.

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APPENDIX A

MAJOR INSTRUMENTATION

APPENDIX A

MAJOR INSTRUMENTATION

The display of a specific product is not to be construed as an endorsement of the product or its manufacturer by the author or his employer.

SCANNING INSTRUMENT/DETECTOR COMBINATIONS

Alpha plus Beta

Ludlum Floor Monitor Model 239-1
combined with
Ludlum Ratemeter-Scaler Model 2221
coupled to
Ludlum Gas Proportional Detector Model 43-37, Physical Area: 550 cm^2
(Ludlum Measurements, Inc., Sweetwater, TX)

Beta

Ludlum Ratemeter-Scaler Model 2221
coupled to
Ludlum Gas Proportional Detector Model 43-68, Physical Area: 126 cm^2
(Ludlum Measurements, Inc., Sweetwater, TX)

Gamma

Ludlum Pulse Ratemeter Model 12
(Ludlum Measurements, Inc., Sweetwater, TX)
coupled to
Victoreen NaI Scintillation Detector Model 489-55, Crystal: 3.2 cm x 3.8 cm
(Victoreen, Cleveland, OH)

Or

Ludlum Ratemeter-Scaler Model 2221
(Ludlum Measurements, Inc., Sweetwater, TX)
coupled to
Ludlum SPA-3 NaI Scintillation Detector Model 44-10, Crystal: 5.1 cm x 5.1 cm
(Ludlum Measurements, Inc., Sweetwater, TX)
coupled to
Trimble Navigation Pro-XRS Receiver and Data Logger
(Trimble Navigation Limited, Sunnyvale, CA)

DIRECT MEASUREMENT INSTRUMENT/DETECTOR COMBINATIONS

Alpha and Beta

Ludlum Ratemeter-Scaler Model 2221
coupled to
Ludlum Gas Proportional Detector Model 43-68, Physical Area: 126 cm^2
(Ludlum Measurements, Inc., Sweetwater, TX)

LABORATORY ANALYTICAL INSTRUMENTATION

Low Background Gas Proportional Counter
Model LB-5100-W
(Tennelec/Canberra, Meriden, CT)

High Purity Extended Range Intrinsic Detector
CANBERRA/Tennelec Model No: ERVDS30-25195
(Canberra, Meriden, CT)
Used in conjunction with:
Lead Shield Model G-11
(Nuclear Lead, Oak Ridge, TN) and
Multichannel Analyzer
DEC ALPHA Workstation
(Canberra, Meriden, CT)

High Purity Extended Range Intrinsic Detector
Model No. GMX-45200-5
(AMETEK/ORTEC, Oak Ridge, TN)
used in conjunction with:
Lead Shield Model SPG-16-K8
(Nuclear Data)
Multichannel Analyzer
DEC ALPHA Workstation
(Canberra, Meriden, CT)

High-Purity Germanium Detector
Model GMX-30-P4, 30% Eff.
(AMETEK/ORTEC, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-16
(Gamma Products, Palos Hills, IL) and
Multichannel Analyzer
DEC ALPHA Workstation
(Canberra, Meriden, CT)

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

PROJECT HEALTH AND SAFETY

The proposed survey and sampling procedures were evaluated to ensure that any hazards inherent to the procedures themselves were addressed in current job hazard analyses. Additionally, upon arrival on site, a walk-down of the site was performed to identify hazards present and a pre-job integrated safety management checklist was completed and discussed with field personnel and daily safety briefings were held. All survey and laboratory activities were conducted in accordance with ORISE health and safety and radiation protection procedures.

CALIBRATION AND QUALITY ASSURANCE

Calibration of all field and laboratory instrumentation was based on standards/sources, traceable to NIST.

Analytical and field survey activities were conducted in accordance with procedures from the following documents of the Oak Ridge Institute for Science and Education:

- Survey Procedures Manual (September 2004)
- Laboratory Procedures Manual (April 2006)
- Quality Assurance Manual (July 2005)

The procedures contained in these manuals were developed to meet the requirements of Department of Energy (DOE) Order 414.1C and the U.S. Nuclear Regulatory Commission *Quality Assurance Manual for the Office of Nuclear Material Safety and Safeguards* and contain measures to assess processes during their performance.

Quality control procedures include:

- Daily instrument background and check-source measurements to confirm that equipment operation is within acceptable statistical fluctuations.
- Participation in MAPEP, NRIP, and ITP Laboratory Quality Assurance Programs.
- Training and certification of all individuals performing procedures.

- Periodic internal and external audits.

Detectors used for assessing surface activity were calibrated in accordance with ISO-7503[1] recommendations. Total alpha and beta efficiencies (ε_{total}) were determined for each instrument/detector combination and consisted of the product of the 2π instrument efficiency (ε_i) and surface efficiency (ε_s): $\varepsilon_{total} = \varepsilon_i \times \varepsilon_s$. Beta total efficiencies were determined based on a beta energy multi-point calibration, development of instrument efficiency to beta energy calibration curves, and the calculation of the weighted efficiency representing the Th-232 decay series. Included in the weighted efficiency was an empirically determined correction for disequilibrium in the decay series that results from Rn-220 loss. A 3.8 mg/cm^2 density thickness mylar window was used on the beta detectors to block detector response contributions from alpha radiation.

Th-230 was selected as the alpha calibration source. The 2π alpha instrument efficiency (ε_i) factors were 0.41 and 0.42 for the gas proportional detectors. C-14, Tc-99, Tl-204, and Sr/Y-90 were selected as the beta calibration sources to represent the energy distribution of the detectable beta-emitters in the Th-232 decay series. The 2π interpolated ε_i factors for the detectable beta-emitters ranged from 0.19 to 0.60 for the gas proportional detectors. ISO-7503 recommends an ε_s of 0.25 for alpha emitters and also beta emitters with a maximum energy of less than 0.4 MeV and an ε_s of 0.5 for maximum beta energies greater than 0.4 MeV. The thorium series total weighted alpha efficiency ranged from 0.53 to 0.58. The total weighted beta efficiency for the beta detectors ranged from 0.41 to 0.42.

SURVEY PROCEDURES

Surface Scans

Structural surface scans were performed by passing the detectors slowly over the surface; the distance between the detector and the surface was maintained at a minimum—nominally about 1 cm. Pad/building/debris pile surfaces were scanned using either a floor monitor or small area (126 cm^2) hand-held gas proportional detectors. A NaI scintillation detector was used to scan for elevated gamma radiation throughout the pads/buildings/debris piles and the exterior grounds. The characterization survey included NaI detectors coupled to GPS units that enabled real-time

[1]International Standard. ISO 7503-1, Evaluation of Surface Contamination - Part 1: Beta-emitters (maximum beta energy greater than 0.15 MeV) and alpha-emitters. August 1, 1988.

recording in one-second intervals of position and gamma count rates. Identification of elevated radiation levels was based on increases in the audible signal from the recording and/or indicating instrument. Position and gamma count rate data files were down loaded from field data loggers for plotting on aerial photographs using commercially available software.

Beta surface scan minimum detectable concentrations (MDCs) were estimated using the calculational approach described in NUREG-1507.[2] The scan MDC is a function of many variables, including the background level. Additional parameters selected for the calculation of scan MDCs included a two-second observation interval, a specified level of performance at the first scanning stage of 95% true positive rate and 25% false positive rate, which yields a *d'* value of 2.32 (NUREG-1507, Table 6.1), and a surveyor efficiency of 0.5. The scanning instrument total efficiency (ε_{total}) for the hand-held gas proportional detectors was approximately 0.40.

The construction material-specific background levels ranged from 260 to 700 cpm for the gas proportional detectors. To illustrate an example for a hand-held gas proportional detector using a concrete background of 340 cpm, the minimum detectable count rate (MDCR) and scan MDC can be calculated as follows:

b_i = (340 cpm)(2 s)(1 min/60 s) = 11.3 counts,
MDCR = (2.32)(11.3 counts)^{½} [(60 s/min)/(2 s)] = 234 cpm,
$MDCR_{surveyor}$ = 234/(0.5)^{½} = 331 cpm

The scan MDC is calculated using the weighted total efficiency of 0.40.

$$ScanMDC = \frac{MDCR_{surveyor}}{(\varepsilon_s)(\varepsilon_i)} dpm/100\,cm^2$$

For the given background, the estimated scan MDC was 830 dpm/100 cm^2 for the hand-held gas proportional detector.

The scan MDCs for the NaI scintillation detector for Th-232 in soil ranged from 1.8 to 2.8 pCi/g, dependent upon detector type, as provided in NUREG-1507.

[2]NUREG-1507. Minimum Detectable Concentrations With Typical Radiation Survey Instruments for Various Contaminants and Field Conditions. US Nuclear Regulatory Commission. Washington, DC; June 1998.

Surface Activity Measurements

Measurements of total alpha and beta surface activity levels were performed using hand-held gas proportional detectors coupled to portable ratemeter-scalers. Count rates (cpm), which were integrated over one minute with the detector held in a static position, were converted to activity levels (dpm/100 cm^2) by dividing the count rate by the total static efficiency ($\varepsilon_i \times \varepsilon_s$) and correcting for the physical area of the detector. Construction material-specific background corrections were made for each surface type encountered for determining net count rates.

Surface activity measurements were performed on concrete, brick, terra cotta block, metal, and wood. The static beta MDC ranged from 150 to 250 dpm/100 cm^2 for the gas proportional detector. The physical surface area assessed by the gas proportional detector used was 126 cm^2.

Removable Activity Measurements

Smear samples for removable gross alpha and gross beta contamination were obtained from most measurement locations. Removable activity samples were collected using numbered filter paper disks, 47 mm in diameter. Moderate pressure was applied to the smear and approximately 100 cm^2 of the surface was wiped. Smears were placed in labeled envelopes with the location and other pertinent information recorded.

RADIOLOGICAL ANALYSIS

Gross Alpha/Beta

Smears were counted on a low-background gas proportional system for gross alpha and beta activity. The MDCs of the procedure were 9 dpm/100 cm^2 and 15 dpm/100 cm^2 for a 2-minute count time for gross alpha and gross beta, respectively.

Gamma Spectroscopy

Samples of soil and terra cotta block were dried, mixed, crushed, and/or homogenized as necessary, and a portion sealed in a 0.5-liter Marinelli beaker or other appropriate container. The quantity placed in the beaker was chosen to reproduce the calibrated counting geometry. The metal coupon cut from the G-722 debris pile and other miscellanous samples were placed directly in an air filter

geometry for semi-quantitative analysis. Net material weights were determined and the samples counted using intrinsic germanium detectors coupled to a pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. All total absorption peaks (TAP) associated with the radionuclides of concern were reviewed for consistency of activity. TAPs used for determining the activities of radionuclides of concern and the typical associated MDCs for a one-hour count time were:

Radionuclide	TAP (MeV)	MDC (pCi/g)
Th-232	0.911 from Ac-228*	0.11
U-238	0.063 from Th-234*	0.70
Pb-210	0.047	70 (pCi/sample)
Be-7	0.478	0.40

*Secular equilibrium assumed.

Spectra were also reviewed for other identifiable TAPs.

DETECTION LIMITS

Detection limits, referred to as minimum detectable concentration (MDC), were based on 3 plus 4.65 times the standard deviation of the background count [$3 + (4.65(BKG)^{1/2})$]. Because of variations in background levels, measurement efficiencies, and contributions from other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument.