UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

January 5, 1993

The Honorable Paul S. Sarbanes
United States Senate
Washington, DC 20510-2002

Dear Senator Sarbanes:

I am writing in response to your letter of November 30, 1992, regarding the radioactive contamination at the former U.S. Army Depot at Curtis Bay, Maryland. In your letter you expressed concern about the potential health and safety effects of the radioactive thorium nitrate at this facility and requested a report on the Nuclear Regulatory Commission's plans to remediate this site, including a schedule for the remediation. I share your concern for protecting residents in the Curtis Bay area and assure you that NRC is working to ensure that the site is remediated in a safe and timely manner.

At NRC's request, the Oak Ridge Institute for Science and Education (ORISE) conducted a radiological survey of warehouses and adjacent land, at the Curtis Bay Depot, in May 1992. NRC requested that ORISE perform the survey, because NRC recognized that radiological contamination at the site exceeded NRC's current criteria for unrestricted release of a site. The objective of this survey was to evaluate the extent of radiological contamination. In September 1992, ORISE reported the results of the survey in "Radiological Survey of Portions of the Curtis Bay Depot, General Services Administration, Baltimore, Maryland." A copy of this report is enclosed.

The ORISE survey revealed concentrations of total thorium in the soil ranging from background levels up to about 640 picocuries per gram. This same survey found the maximum exposure rate was 36 microRoentgen per hour (μR/hr) at one meter above the soil surface (about 28 μR/hr above background) at the location of highest soil concentration. This level of contamination exceeds NRC's current criteria for unrestricted use. Although the contamination could lead to small doses over an extended period of time, NRC believes that it does not pose an immediate threat to the public health and safety. If an individual worked outside on the site, at the point of maximum exposure, for an entire year (2000 hours), the person would receive about 56 mrem attributable to thorium at the site from past operations, which is below the maximum acceptable public dose limit of 100 mrem/yr contained in NRC's regulations (10 CFR Part 20).

It is important to recognize that, based on the ORISE survey, the radiological contamination at the site is not extensive. For example, the 36 μR/hr exposure rate was observed at only one location and the contamination is limited. Consequently, more realistic estimates of potential doses under current conditions would be expected to be much less than 56 mrem and the public dose limit of 100 mrem/yr.

NRC is presently working with the General Services Administration (GSA) and the Defense Logistics Agency (DLA) to ensure that the site is remediated in a

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safe and timely manner. The first step in addressing site remediation is to decide which agency, GSA or DLA, has responsibility for the remediation. GSA and DLA are currently determining which agency has responsibility for remediating the site. As you may know, GSA used this site to store National Defense Stockpile (NDS) thorium. In 1978, GSA sold a portion of the site to Anne Arundel County. In 1988, NDS responsibility was transferred to DLA, who continues to occupy the lands adjacent to the site in question.

NRC staff has been told that GSA and DLA will determine who is responsible for the remediation by the end of January 1993. After this determination has been made, the responsible agency will provide NRC with a conceptual remediation plan within six months. Work will then proceed on fully characterizing the site; developing, reviewing and approving a decommissioning plan; performing all necessary remediation activities; and surveying the site, to ensure that residual contamination levels do not exceed NRC's current criteria. NRC staff will provide you with a copy of the schedule, for the remediation of this site, as soon as it has been finalized.

As requested, NRC staff has coordinated this response with the responsible offices at GSA and DLA. If you have additional questions, or if you wish to discuss this matter further, please have your staff contact Dennis Rathbun, Director, Office of Congressional Affairs at (301) 504-1776.

Sincerely,

James M. Taylor
Executive Director
for Operations

Enclosure: ORISE Report on Curtis
Bay Depot dated September 1992

cc: Mr. Harold Quinn, Director
of Planning Staff, GSA
Ms. Marilyn S. Barnett
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Mr. Lawrence M. Ward, Deputy
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Dr. Katherine Farrell, Deputy
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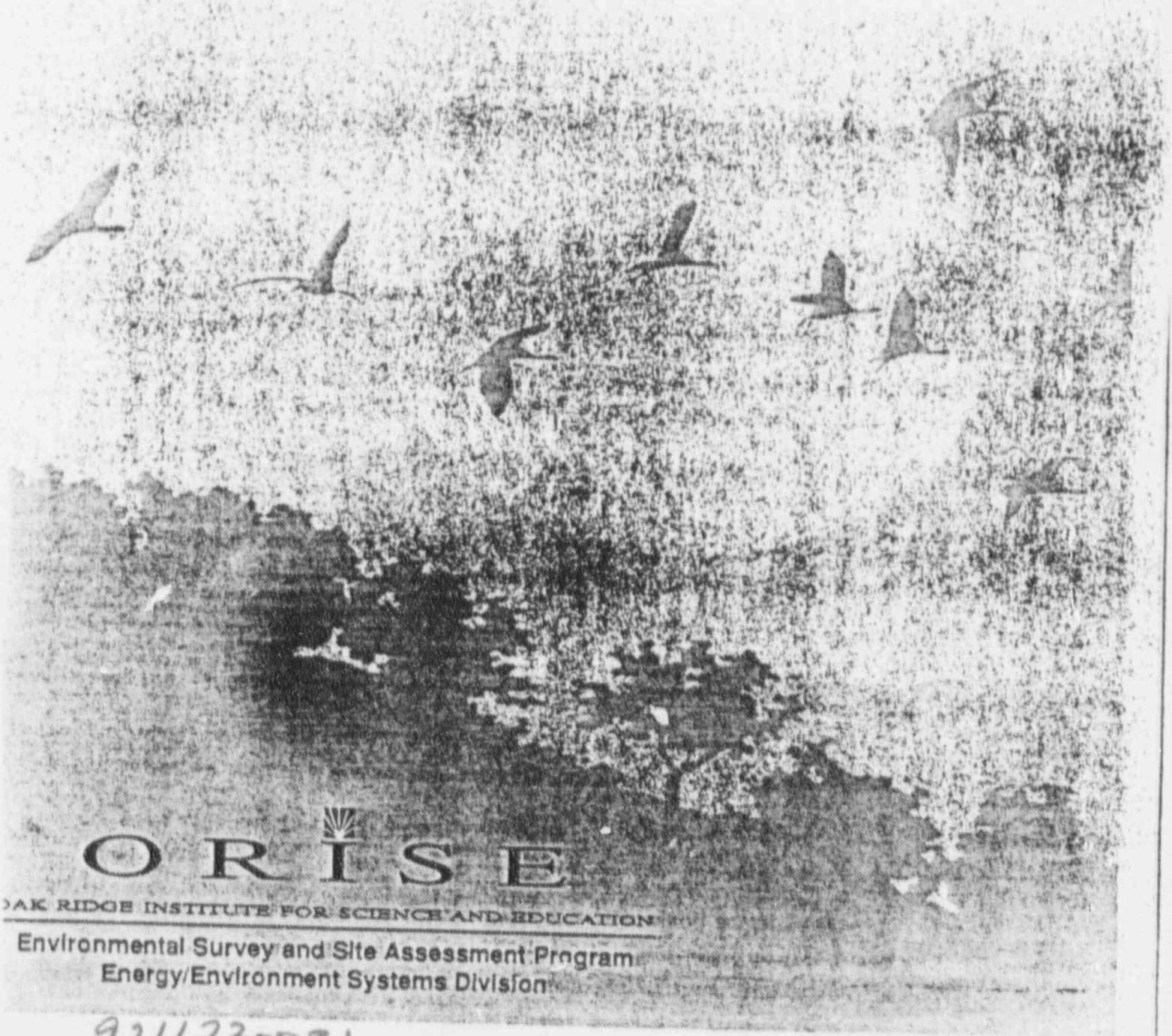
ENCLOSURE

RADIOLOGICAL SURVEY OF PORTIONS OF THE CURTIS BAY DEPOT GENERAL SERVICES ADMINISTRATION BALTIMORE, MARYLAND

W. C. ADAMS AND J. L. PAYNE

Prepared for the Division of Industrial and Medical Nuclear Safety
U.S. Nuclear Regulatory Commission
Region I Office



ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION
Environmental Survey and Site Assessment Program
Energy/Environment Systems Division

RADIOLOGICAL SURVEY OF PORTIONS OF THE CURTIS BAY DEPOT GENERAL SERVICES ADMINISTRATION BALTIMORE, MARYLAND

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Prepared for
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U.S. Nuclear Regulatory Commission
Region I Office

FINAL REPORT

SEPTEMBER 1992

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RADIOLOGICAL SURVEY
OF PORTIONS OF THE
CURTIS BAY DEPOT
GENERAL SERVICES ADMINISTRATION
BALTIMORE, MARYLAND

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (Continued) PAGE

LIST OF TABLES

RADIOLOGICAL SURVEY OF PORTIONS OF THE CURTIS BAY DEPOT GENERAL SERVICES ADMINISTRATION BALTIMORE, MARYLAND

INTRODUCTION AND SITE HISTORY

Prior to 1977, the General Services Administration (GSA) stored thorium nitrate (mantle and reactor grades, average 47% $Th(NO_3)$) in fiber and steel drums in warehouses at the Curtis Bay Depot (CBD) in Curtis Bay, Maryland, under U.S. Nuclear Regulatory Commission (NRC) license STC-133 (Docket No. 40-341). In 1977, GSA notified the NRC Region I Office of its intent to excess empty warehouses as part of a large sale of government land and buildings. Nine of these buildings (M-421 through M-424 and L-411 through L-415) are on land which was transferred to Anne Arundel County, Maryland.

An NRC survey, performed in 1977, identified residual contamination in the wood flooring of several warehouses.[1] Most of the contamination present was located in the tongue and groove joints and was uniformly deposited throughout the buildings. Decommissioning activities were performed by GSA and verified by NRC Region I in the summer and fall of 1977. Results of the NRC confirmatory survey indicated that fixed residual activity levels were less than 1,000 dpm/100 cm^2 for alpha contamination and less than 0.2 mrad/hr for beta-gamma.[2] Smear samples indicated that removable contamination levels were well below NRC guidelines of 200 dpm/100 cm^2. Results from the NRC confirmatory survey were in agreement with GSA's results and the warehouses were released under established guidelines for that period.[3] At that time, there were no soil contamination guidelines for thorium. Soil sample analyses performed in 1977, indicated that radionuclide concentrations above current criteria of 10 pCi/g of total thorium may exist in soil under Buildings L-412, L-413, L-414, M-421, M-422, and M-423.[4]

At the request of the NRC's Region I Office, the Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted a

radiological survey of warehouses L-411 through L-415 and M-421 through M-424, and adjacent land at the Curtis Bay Depot, to evaluate the current radiological status of the site.

SITE DESCRIPTION

Curtis Bay Depot is located at 710 Ordnance Road in Curtis Bay, a suburb of Baltimore, in the northeast corner of Anne Arundel County, Maryland (Figure 1). The facility is in an industrialized area, approximately 8 km (5 miles) northeast of the Baltimore-Washington International Airport (Figure 2). The land and warehouses included in the survey are located on a 2.5 hectare (8 acre) plot of land in the northwest section of the Curtis Bay Depot and separated from the depot property by a chain link security fence (Figures 3 and 4).

The interior surfaces (floors, walls, and ceilings) of the warehouses are of tongue and groove wood construction; exterior walls are covered with corrugated transite siding. Each building contains approximately 300 m^2 (3100 ft^2) of usable floor space. Brick pillars and wooden beams support the warehouses, creating a crawlspace which varies in headroom from 0.6 m (2 ft) to 3 m (9 ft) due to the natural terrain of the area. Concrete loading docks remain along the entire east side of buildings M-421 through M-424, but have been removed from buildings L-411 through L-415 to allow for the placement of the chain link fence which separates the property from the remainder of the Curtis Bay Depot property. Containers of thorium nitrate were unloaded from railcars at the loading docks and transferred into the buildings through one of two bay doors (Figure 5).

The warehouses included in the survey were constructed during World War I, and as a result of weathering, are in advanced stages of structural deterioration. Remediation activities performed in the warehouses, in 1977 by GSA, included the removal of various size areas of the floor and walls, as well as portions of subfloor joists and beams.

The land area around each building (out to 10 m) varied in degree of accessibility due to overgrown vegetation. The land has a varying degree of slope near each building. There are no paved roads within the area that was surveyed.

OBJECTIVE

The objective of the radiological survey was to provide sufficient data to enable the NRC to evaluate the radiological status of the site relative to guidelines.

DOCUMENT REVIEW

As part of the radiological activities, ESSAP reviewed the various documentation associated with the decommissioning.

PROCEDURES

During the period May 4 through May 7, 1992, ESSAP performed a radiological survey of nine warehouses and adjacent land at the Curtis Bay Depot. Survey activities were performed in accordance with a site-specific survey plan, submitted to and approved by the NRC Region I, using procedures and instruments described in the ESSAP Survey Procedures Manual and summarized in Appendices A and B.

SURVEY PROCEDURES - INTERIOR

Reference Grid

Measurement and sampling locations were referenced to building features (Figures 6 - 15).

Surface Scans

Accessible floors and lower walls (up to 2 m) were scanned for alpha, beta, and gamma activity using gas proportional, GM, and NaI scintillation detectors. Particular attention was given to cracks and joints in the floors and walls, ledges, and other locations where material may have

accumulated. All detectors were coupled to ratemeters or ratemeter-scalers with audible indicators. Locations of elevated direct radiation, identified by surface scans, were marked for further investigation.

Surface Activity Measurements

Measurements for beta activity levels, rather than alpha activity, provide a more accurate representation of thorium surface activity, due to conditions of the building surfaces (e.g. dusty, porous, or rough), which may selectively attenuate the alpha activity. Therefore, beta activity levels were used for comparison with the guideline values.

Direct measurements to determine total (fixed and removable) activity were performed in eight of the buildings at a minimum of 22 locations and a maximum of 30 locations, the number being dependent on the total accessible floor and wall surface area. Five direct measurements to determine total activity were performed in Building L-415 using GM detectors. The number of locations in Building L-415 were limited due to the inaccessibility to gas proportional equipment since all floor boards had been removed. A smear sample for determining removable activity was obtained from each direct measurement location.

Exposure Rate Measurements

Background exposure rate measurements at 1 m (3.3 feet) above the floor surface were obtained in 3 buildings of similar construction which did not have a history of radioactive material use. These buildings are located on-site and were identified as buildings K-511, K-611, and K-615 (Figure 6).

Exposure rate measurements were performed at 1 m (3.3 feet) above the floor using a NaI scintillation detector coupled with a ratemeter at 2 locations within each surveyed building (excluding Building L-415).

SURVEY PROCEDURES - EXTERIOR

Reference Grid

Measurement and sampling locations were referenced site and building features (Figures 16 - 25).

Surface Scans

Surface scans were performed in the crawlspaces and out to 10 m around each building using NaI scintillation detectors coupled to ratemeters with audible indicators. Areas of elevated direct radiation were marked for further investigation.

Exposure Rate Measurements

Background exposure rate measurements were made at 8 locations within 0.5 to 10 km of the site (Figure 16). Exposure rate measurements were also performed at each soil sampling location (Figures 17 - 25). All exposure rate measurements were taken at 1 m (3.3 ft) above the surface with a PIC or with NaI scintillation detectors coupled to ratemeters.

Soil Sampling

Background soil samples (0-15 cm) were collected from 8 locations within 0.5 to 10 km of the site (Figure 16). Surface soil samples (0-15 cm) were collected from 10 locations at each warehouse, 5 from around the exterior of the building and 5 from the crawlspace area. Sampling locations were selected at random and/or at locations of elevated direct radiation identified by surface scans. After surface soil samples were collected, direct radiation levels were monitored with a NaI detector to determine if contamination remained. Subsurface soil samples (depth >15 cm) were then collected at sampling locations where elevated radiation levels indicated possible subsurface residual activity. Surface and subsurface soil sampling locations were referenced to building features (Figures 17 - 25).

SAMPLE ANALYSIS AND DATA INTERPRETATION

All samples and field survey data were returned to ESSAP's Oak Ridge, TN facility for analyses and interpretation. Soil samples were analyzed individually by gamma spectrometry and results reported in pCi/g. Spectra were reviewed for the thorium decay series radionuclides and any other identifiable photopeaks. Smears were analyzed using a low-background gas proportional counter to determine gross alpha and gross beta activity and results were converted to units of dpm/100 cm^2. Direct measurements were converted to units of disintegrations per minute per 100 cm^2 (dpm/100 cm^2), and exposure rate measurements were converted to $\mu R/hr$. Appendices A and B describe the analytical instrumentation and procedures utilized. Results were compared to the current NRC guidelines which are provided in Appendix C.

FINDINGS AND RESULTS

DOCUMENT REVIEW

ESSAP's review of the documentation associated with the decommissioning indicated that there were no guidelines established for soil contamination during that period. However, soil analysis results, in the reviewed documentation, indicated that soil contamination above current guidelines remains at the site.[4]

INTERIOR SURVEY

Surface Scans

Surface scans of the floor, lower walls, and exposed subfloor support beams and joists identified locations of elevated direct radiation in 8 of the 9 warehouse buildings. All of the locations were small, isolated spots near edges where floor boards had been removed from previously remediated areas.

Surface Activity Levels

Direct measurements for total and removable surface activity are summarized in Tables 1 and 2. Total beta activity ranged from < 440 to 590,000 dpm/100 cm^2. Removable activity ranged from < 12 to 1,100 dpm/100 cm^2 for gross alpha and from < 15 to 730 dpm/100 cm^2 for gross beta. The location of highest total and removable activity was a subfloor joist in Building M-422.

Exposure Rates

Background exposure rates in buildings of similar construction ranged from 7 to 8 μR/hr (Table 3). Exposure rate measurements for the surveyed buildings ranged from 6 to 10 μR/hr (Table 1).

EXTERIOR SURVEY

Surface Scans

Gamma radiation scans of exterior surfaces identified locations of elevated contact radiation in the crawlspaces of 8 of the 9 buildings, with the exception being Building L-411.

Exposure Rates

Background exposure rates are presented in Table 4 and ranged from 3 to 5 μR/hr. Exposure rates obtained from soil sampling locations ranged from 5 to 36 μR/hr. The results of these measurements are presented in Tables 5-13.

Radionuclide Concentration in Soil Samples

Total thorium (Th-232 + Th-228) concentrations in background soil samples ranged from 0.6 to 1.8 pCi/g. These concentrations are typical of concentrations occurring in environmental soil samples (Table 2).

Concentrations of thorium in surface and subsurface samples taken on site are summarized in Tables 5-13. By comparison of the Th-232 to Th-228 concentrations, a review of the spectra indicated that the thorium decay series radionuclides were in equilibrium. Thorium concentrations from surface samples (0-15 cm) collected around the buildings ranged from 1.0 to 126 pCi/g. The highest soil sample concentration in samples from under the crawlspaces was from a sample collected next to the steps at the north end of the loading dock of Building M-424. Concentrations from surface samples collected from crawlspaces ranged from 0.8 to 640 pCi/g. The highest concentration in samples from under the crawl spaces was from a sample collected under the north end of the loading dock of Building M-421.

Subsurface soil samples (15-30 cm) were collected from 19 locations where direct gamma radiation levels increased at 15 cm depth. Three of these locations were further sampled from 30 to 45 cm due to increased gamma radiation levels at 30 cm depth. Thorium concentrations in subsurface soil samples ranged from 5.6 to 420 pCi/g.

COMPARISON OF RESULTS WITH GUIDELINES

The NRC guidelines for surface contamination, established for license termination or release of a facility for unrestricted use, are presented in Appendix C.[5] The primary surface contaminant of concern for this site is natural thorium.

The acceptable surface contamination levels for natural thorium are:

1,000 dpm/100 cm^2, total, averaged over 1 m^2
3,000 dpm/100 cm^2, total, maximum in 100 cm^2
200 dpm/100 cm^2, removable

As interpreted by the NRC, the average 1,000 dpm/100 cm^2 and maximum 3,000 dpm/100 cm^2 should apply to both alpha and beta measurements independently for surface contamination involving natural thorium.[6] ESSAP's experience has shown that beta measurements typically

provide a more accurate evaluation of thorium contamination on most building surfaces, due to problems inherent in measuring alpha contamination on rough, porous, painted, and/or dusty surfaces. Therefore, all direct measurements were performed for beta activity only.

Surface measurements for total activity identified surface contamination levels exceeding the NRC guideline for maximum activity in 8 of the 9 buildings. In two of the buildings L-414 and M-421, only one measurement exceeded the guideline. In buildings L-412, L-413, L-415, M-422, M-423, and M-424 the number of locations exceeding the guideline were 2, 3, 5, 9, 4, and 2, respectively. Removable activity exceeding 200 dpm/100 cm^2 was found in one location in M-421 and in 2 locations in M-422.

Interior exposure rates were all within the range of background radiation and therefore below the guideline level of 5 μR/h above background currently being used by the NRC for evaluating decommissionings.[7]

Soil concentrations for residual uranium and thorium wastes are presented in the NRC's Branch Technical Position on "Disposal or Onsite Storage of Thorium and Uranium Wastes from Past Operations" (see Appendix C). The applicable soil guidelines are therefore:

natural thorium (Th-232 + Th-228) with daughters present and in equilibrium.	10 pCi/g

The background concentrations for surface soil was determined by averaging the radionuclide concentrations from the background samples that were collected within the vicinity of the facility. The average background for natural thorium in the local vicinity was 1.2 pCi/g.

The NRC guidelines for natural thorium are expressed in terms of concentrations above normal background levels. The results in the data tables that indicate the NRC guidelines have been exceeded are those in excess of:

natural thorium (thorium isotopes plus background)	11.2 pCi/g

All sampling locations exceeding the guideline for thorium were in crawlspace areas or under or near the loading docks. At 27 locations, soil collected from the surface (0-15 cm) exceeded the guideline; at 15 of these locations, soil collected from 15-30 cm exceeded guidelines; and at 3 locations, samples collected from 30-45 cm exceeded 10 pCi/g above background.

SUMMARY

At the request of the Nuclear Regulatory Commission, Region I Office, the Environmental Survey and Site Assessment Program of Oak Ridge Institute for Science and Education performed a radiological survey of warehouses L-411 through L-415 and M-421 through M-424 of the Curtis Bay Depot, located in Baltimore, Maryland from May 4 through May 7, 1992. Building survey activities included alpha, beta, and gamma surface scans on lower wall and floor surfaces; total and removable activity measurements; and exposure rate measurements. Exterior survey activities included gamma surface scans around and under each building; exposure rate measurements; and surface and subsurface soil sampling.

Total surface activity levels exceeding guidelines were detected on the floors and subfloor beams and joists in 8 of the 9 warehouse buildings, with removable contamination exceeding guidelines in 2 of the buildings. Concentrations of thorium, exceeding guidelines, were detected in soil samples from 27 locations at 8 of the 9 buildings. At 15 of these 27 locations, thorium concentrations also exceeded guidelines in subsurface soil samples.

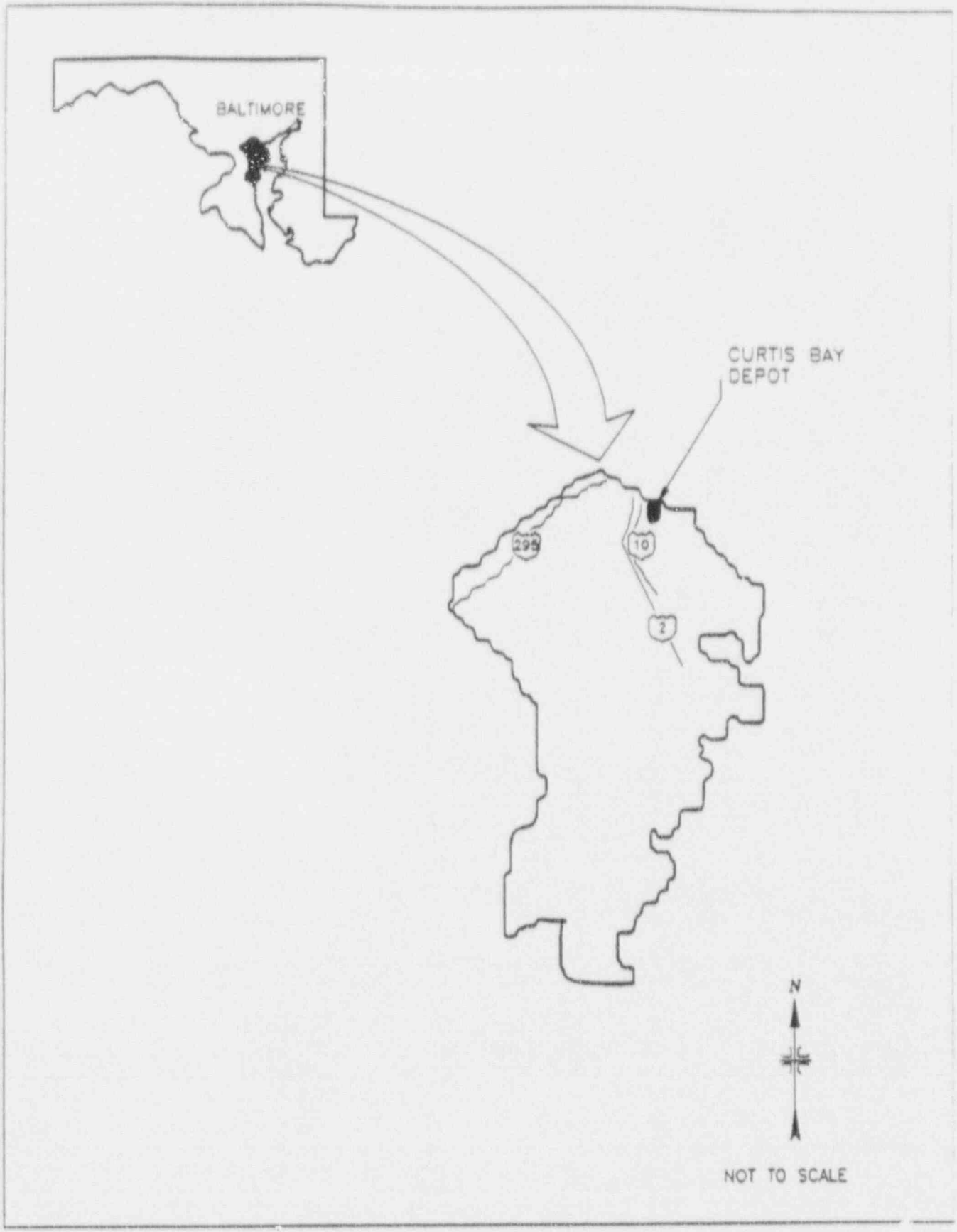

FIGURE 1: Anne Arundel County – Location of Curtis Bay Depot

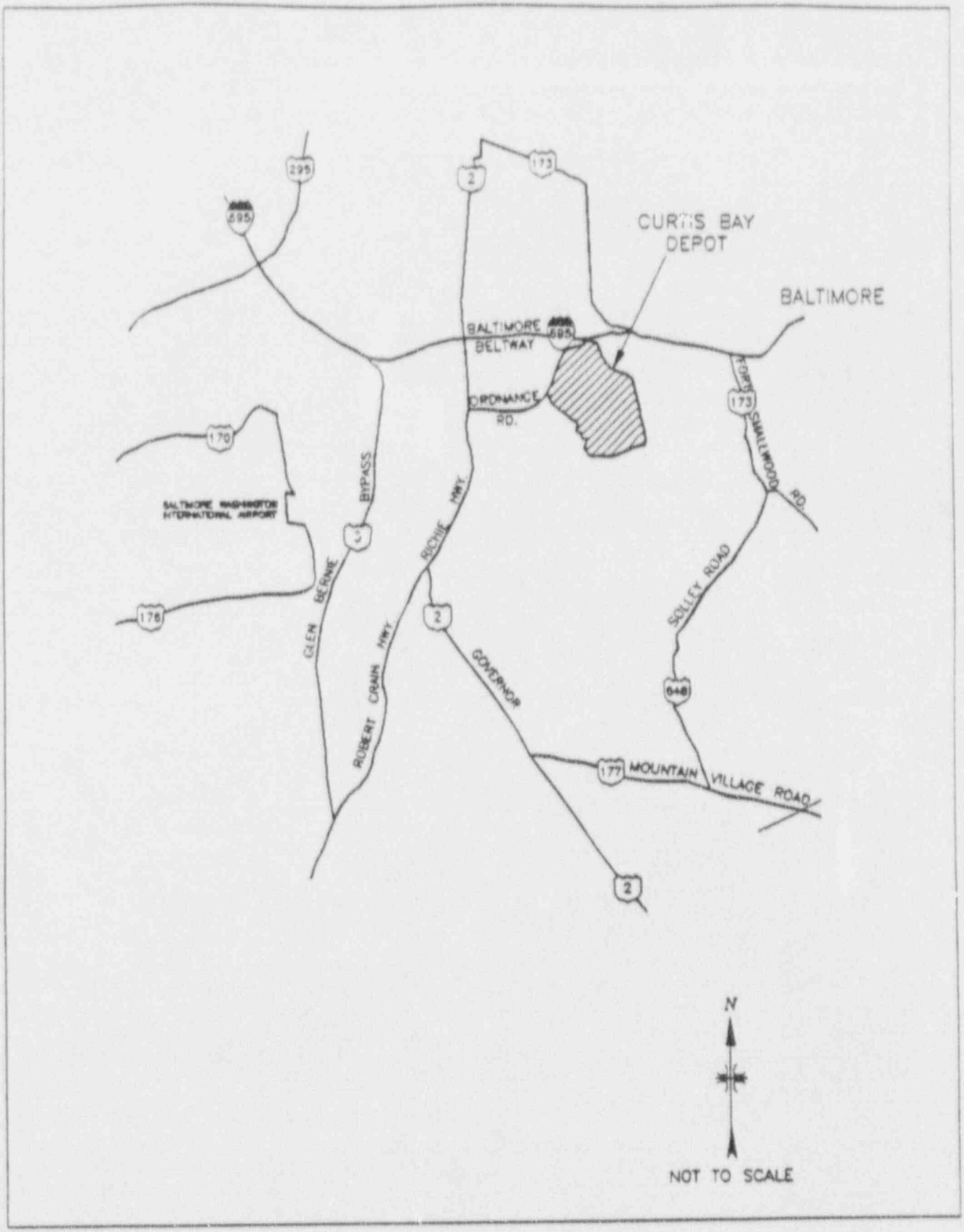

FIGURE 2: Baltimore, Maryland Area Showing Location of Curtis Bay Depot

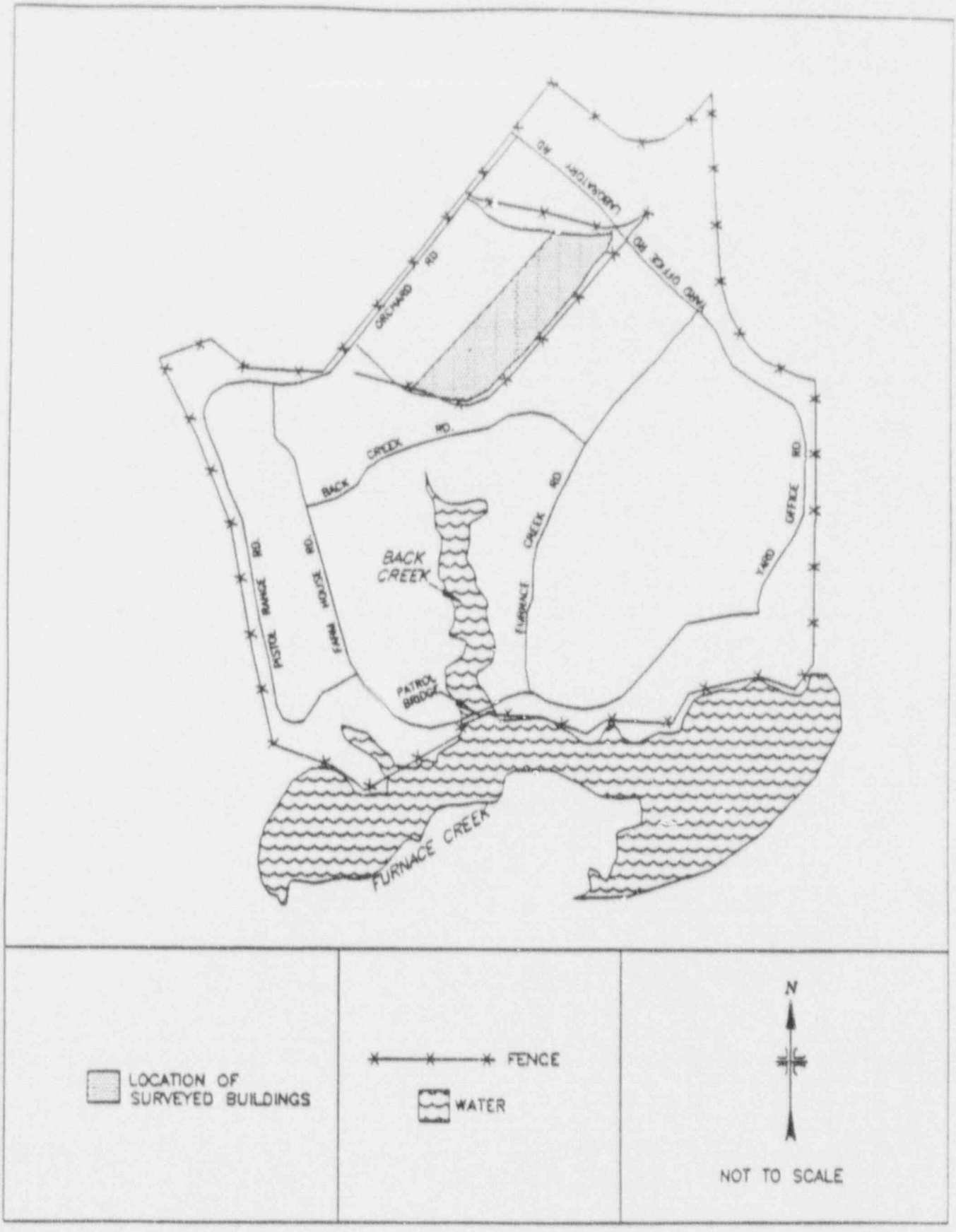

FIGURE 3: Curtis Bay Depot - Location of Surveyed Buildings

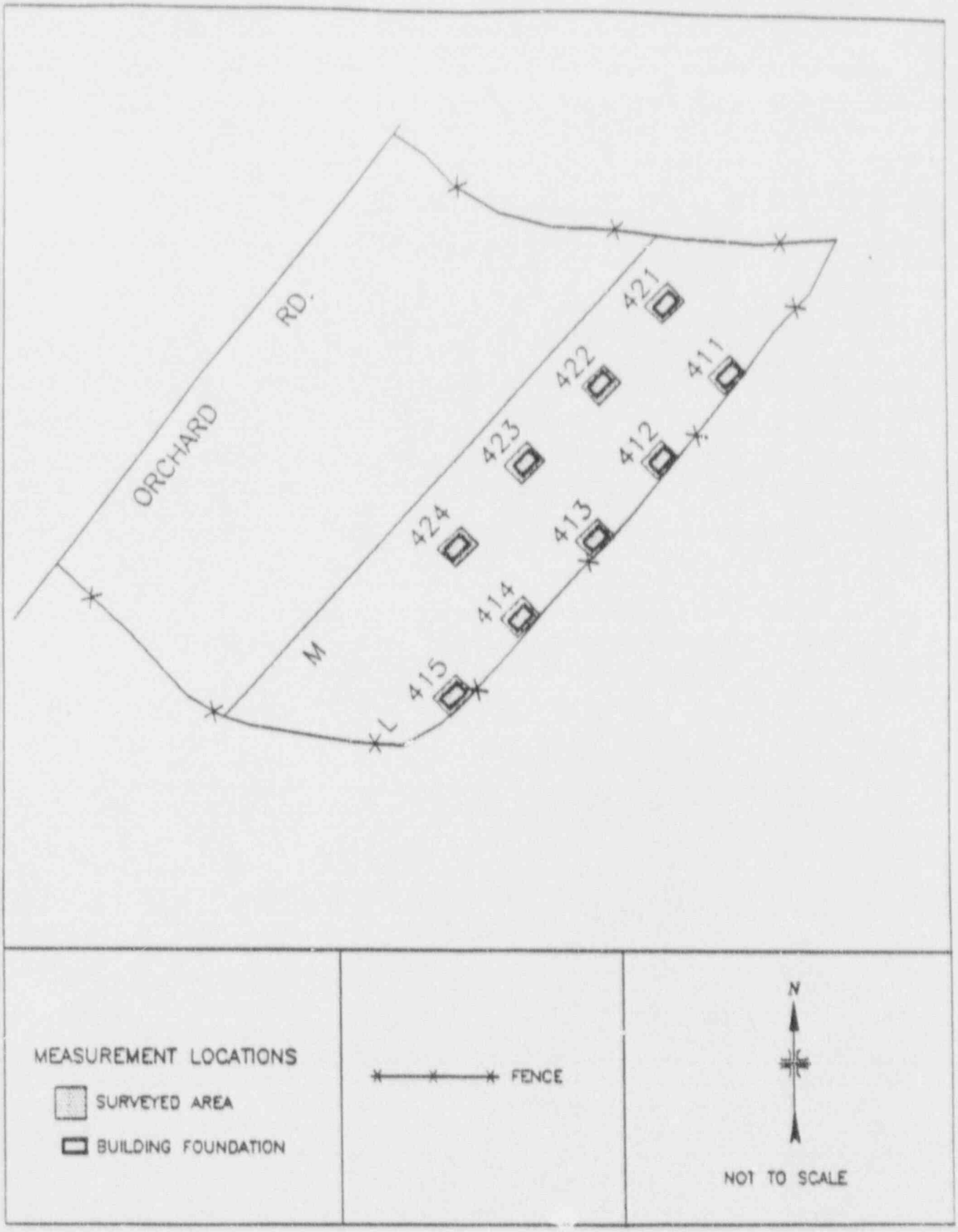

FIGURE 4: Curtis Bay Depot – Surveyed Areas

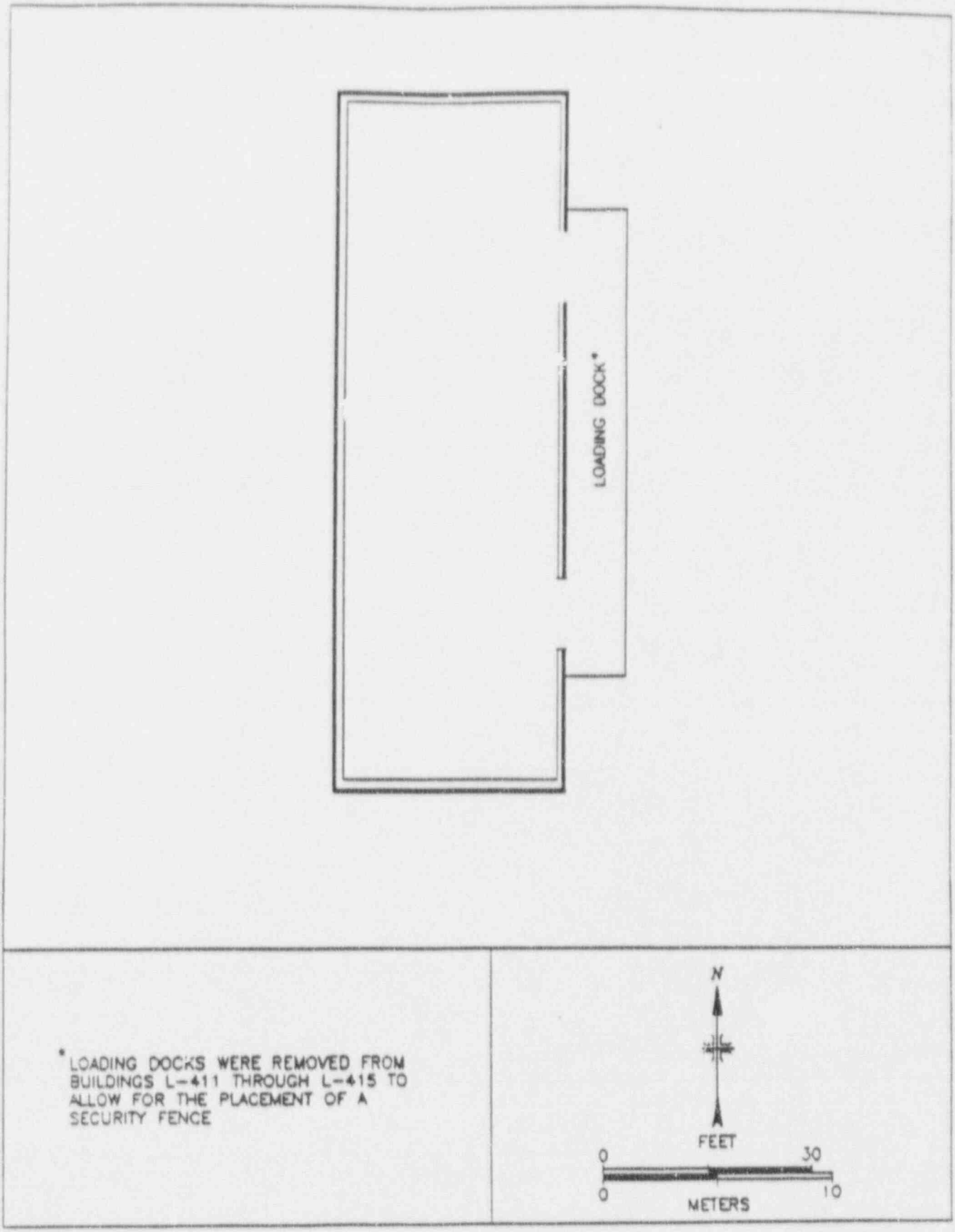

FIGURE 5: Standard Floor Plan of Curtis Bay Depot Warehouses

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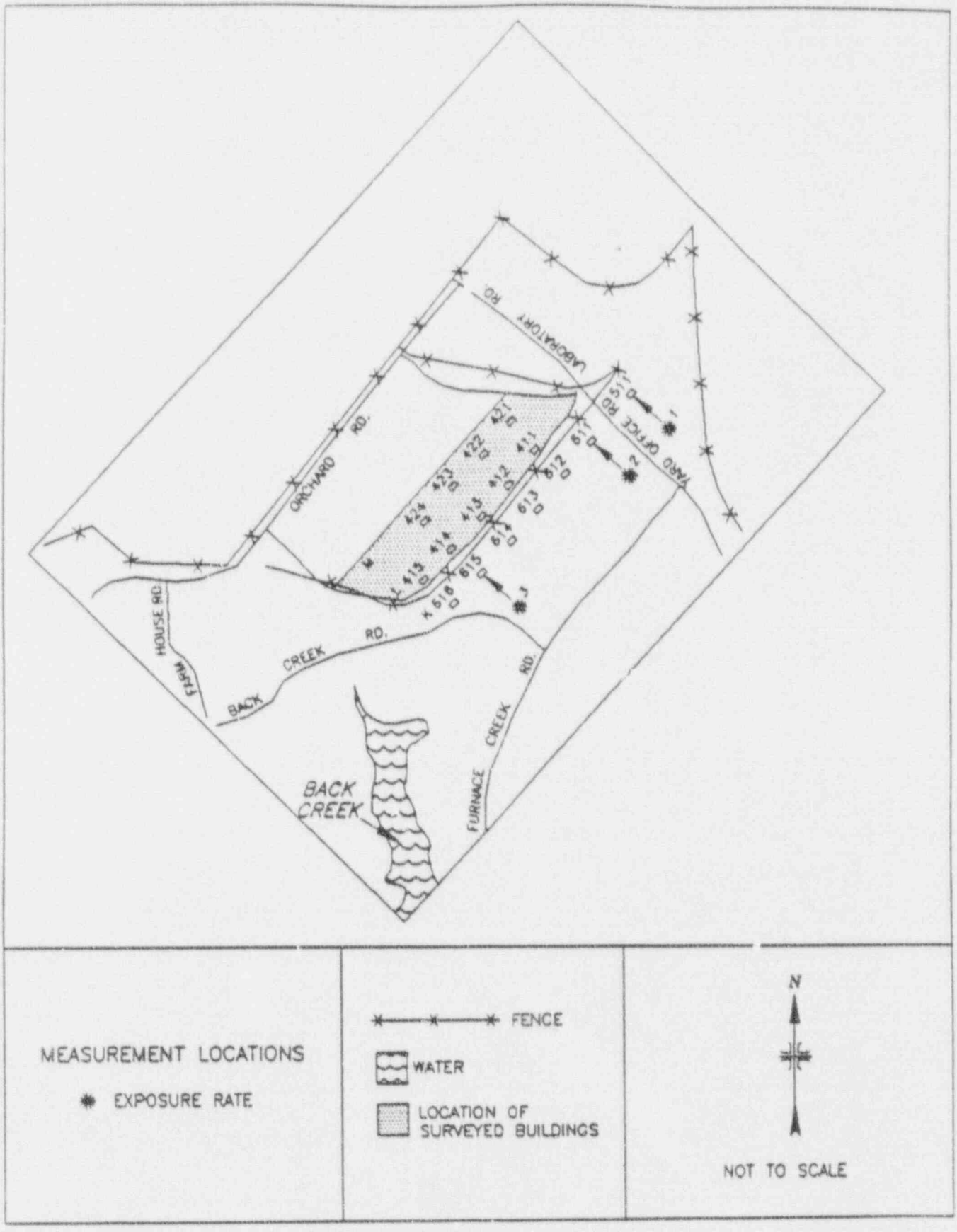

FIGURE 6: Curtis Bay Depot – Interior Background Exposure Rate Measurement Locations

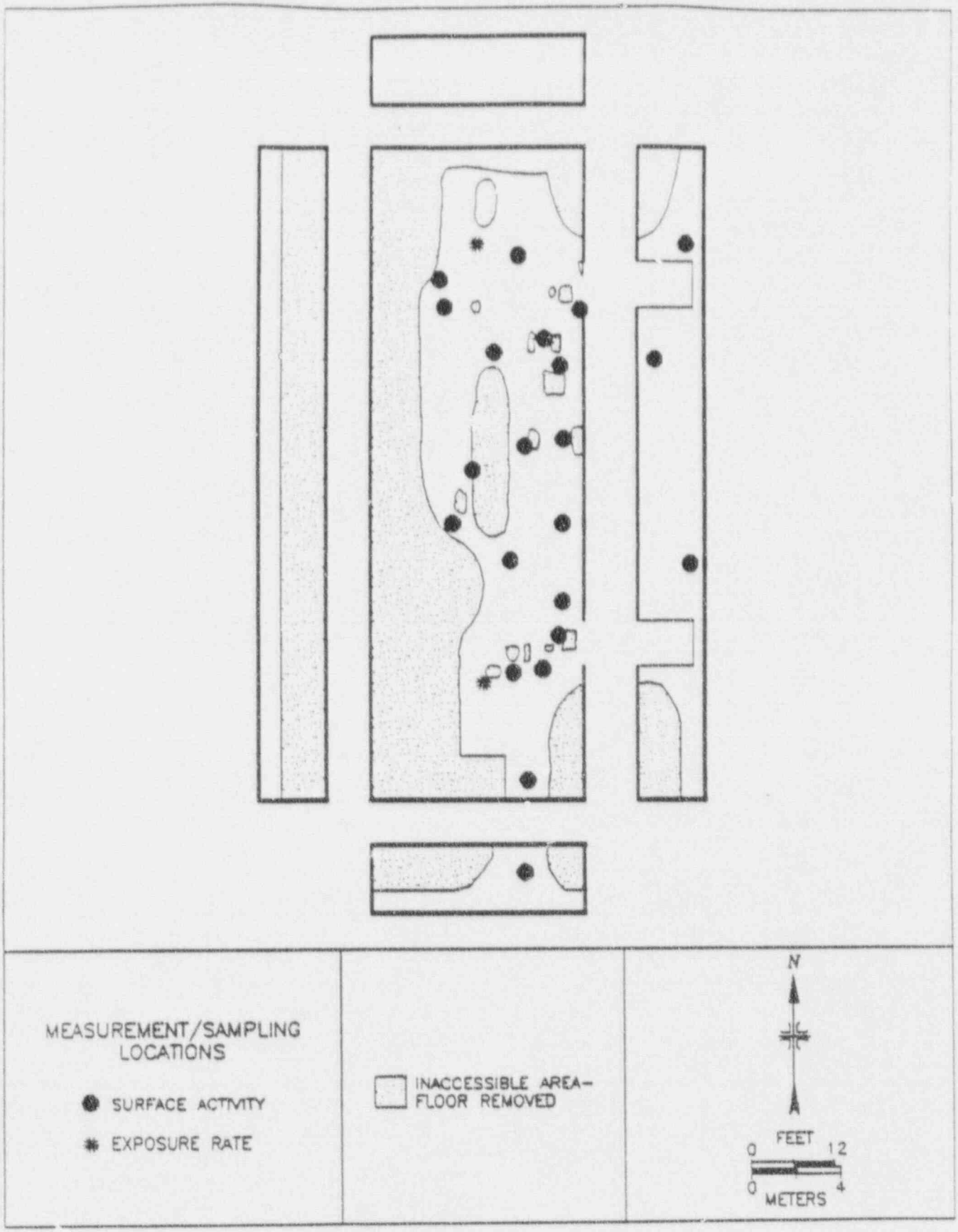

FIGURE 7: Building L-411 - Measurement and Sampling Locations

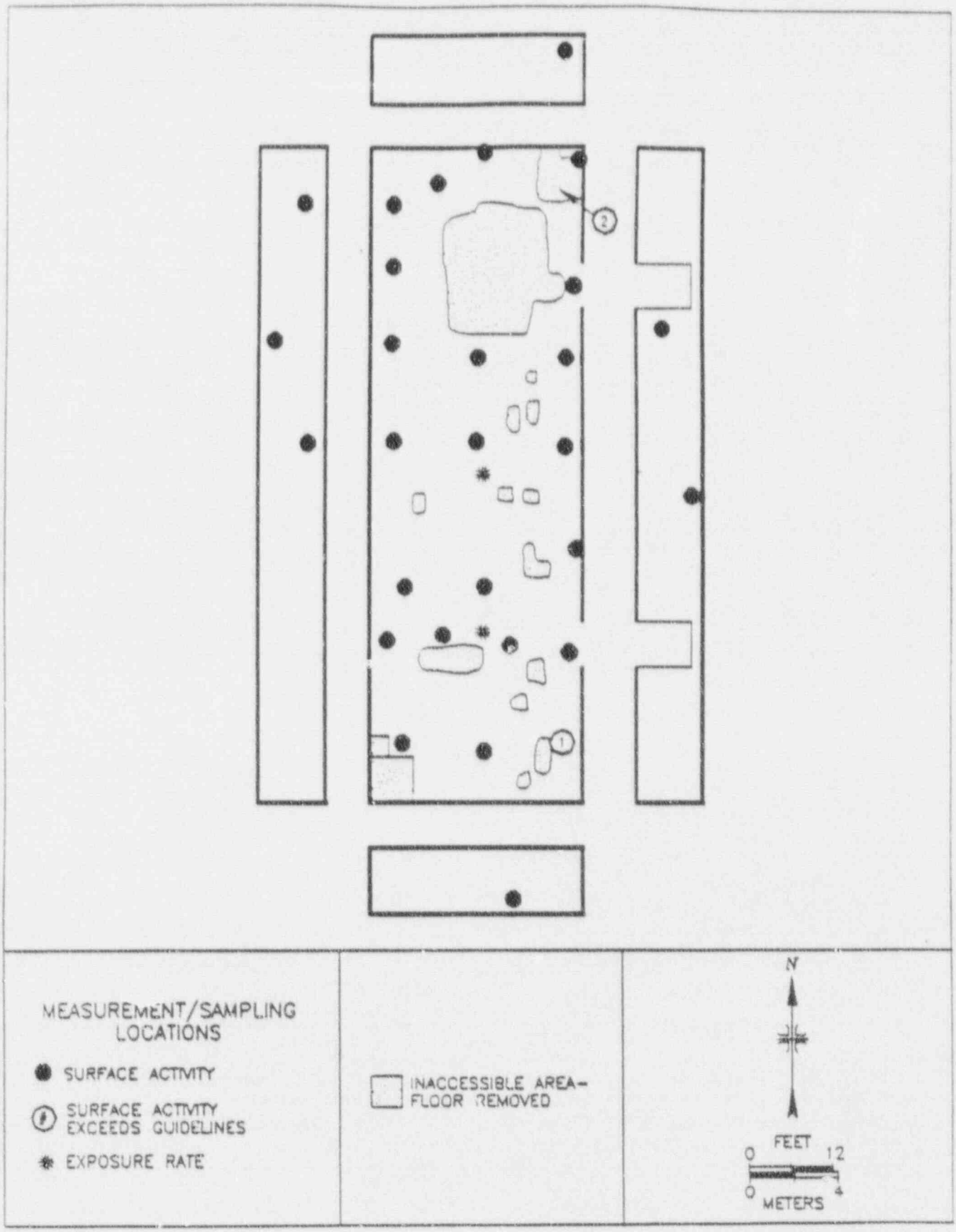

FIGURE 8: Building L--412 – Measurement and Sampling Locations

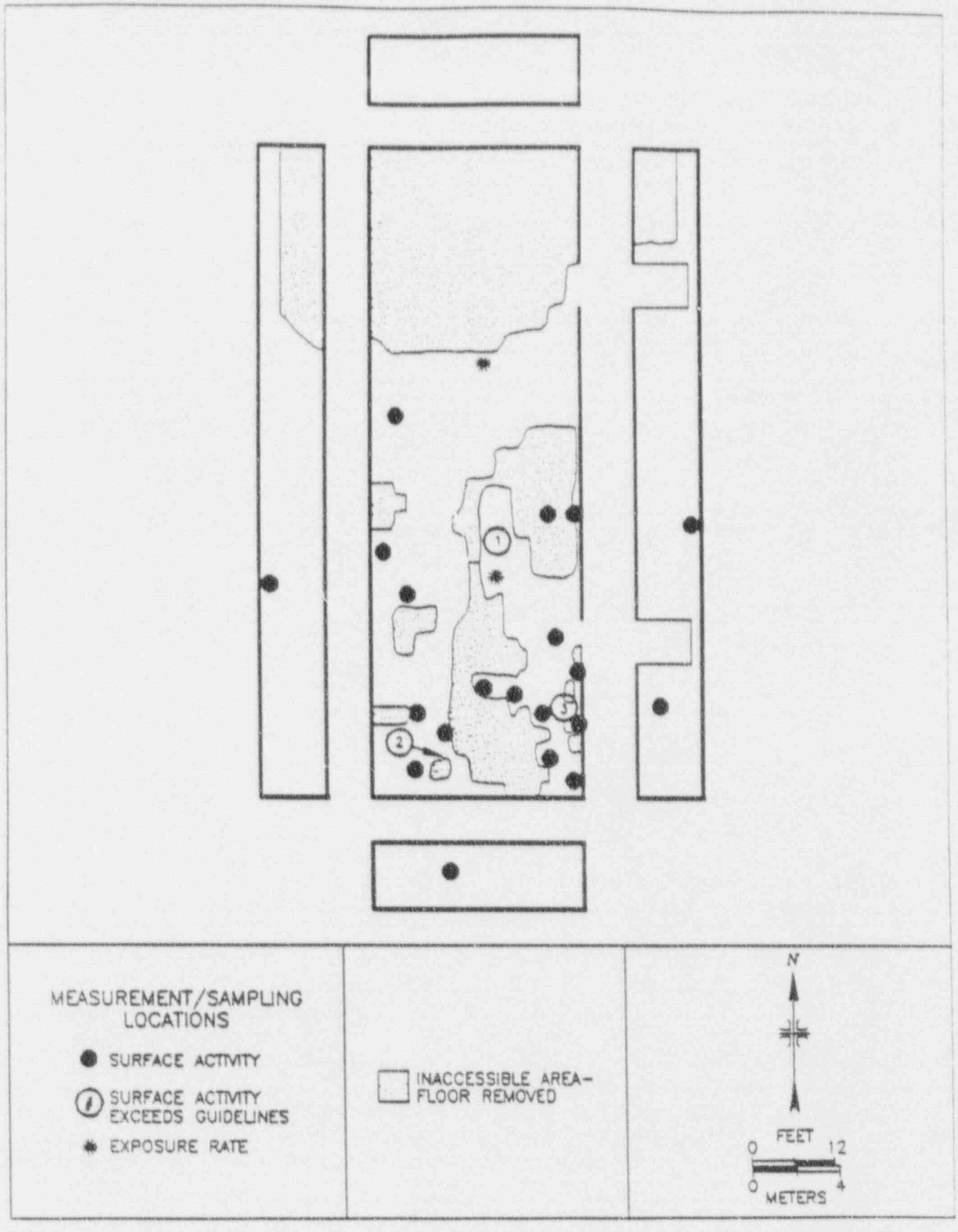

FIGURE 9: Building L-413 - Measurement and Sampling Locations

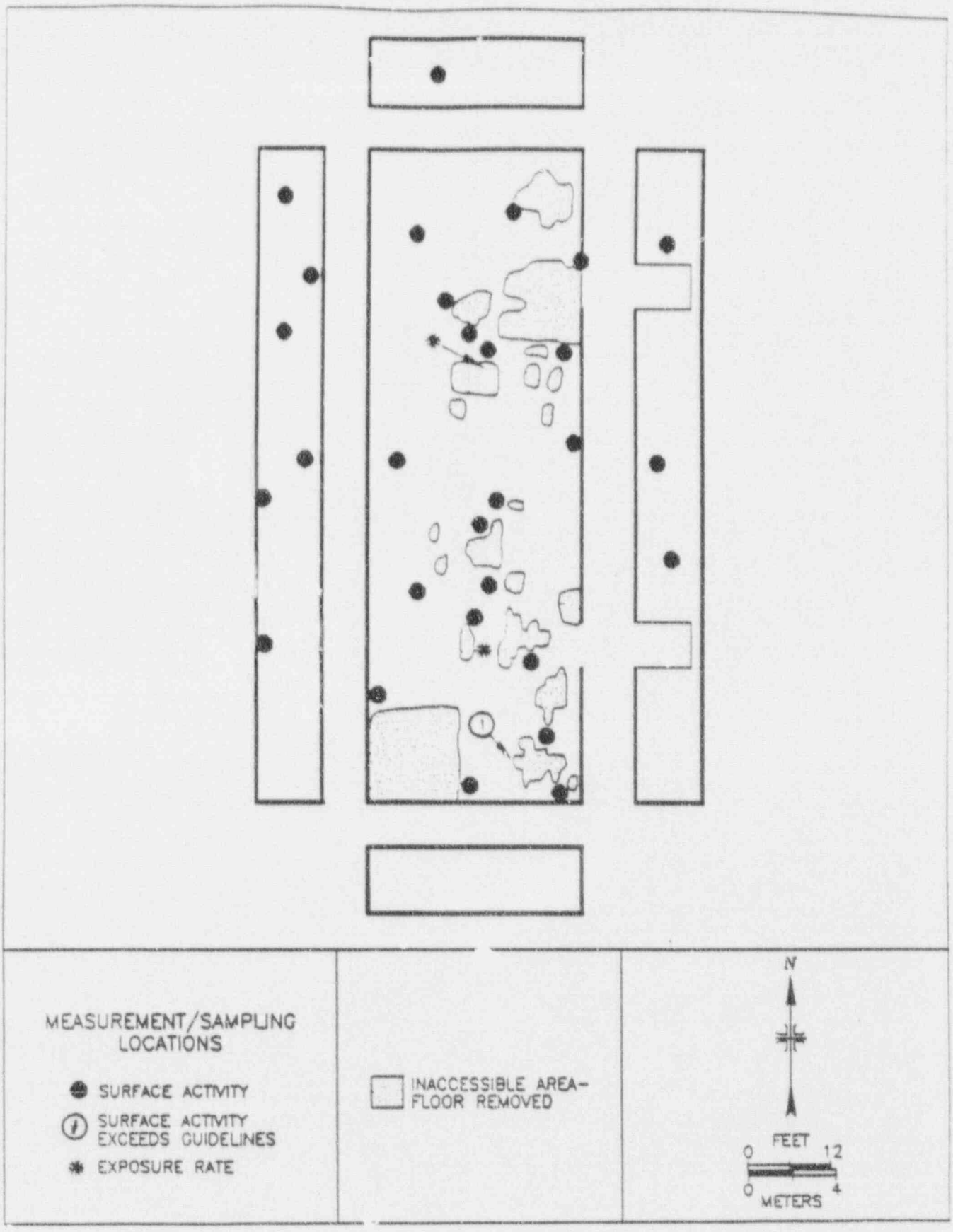

FIGURE 10: Building L-414 - Measurement and Sampling Locations

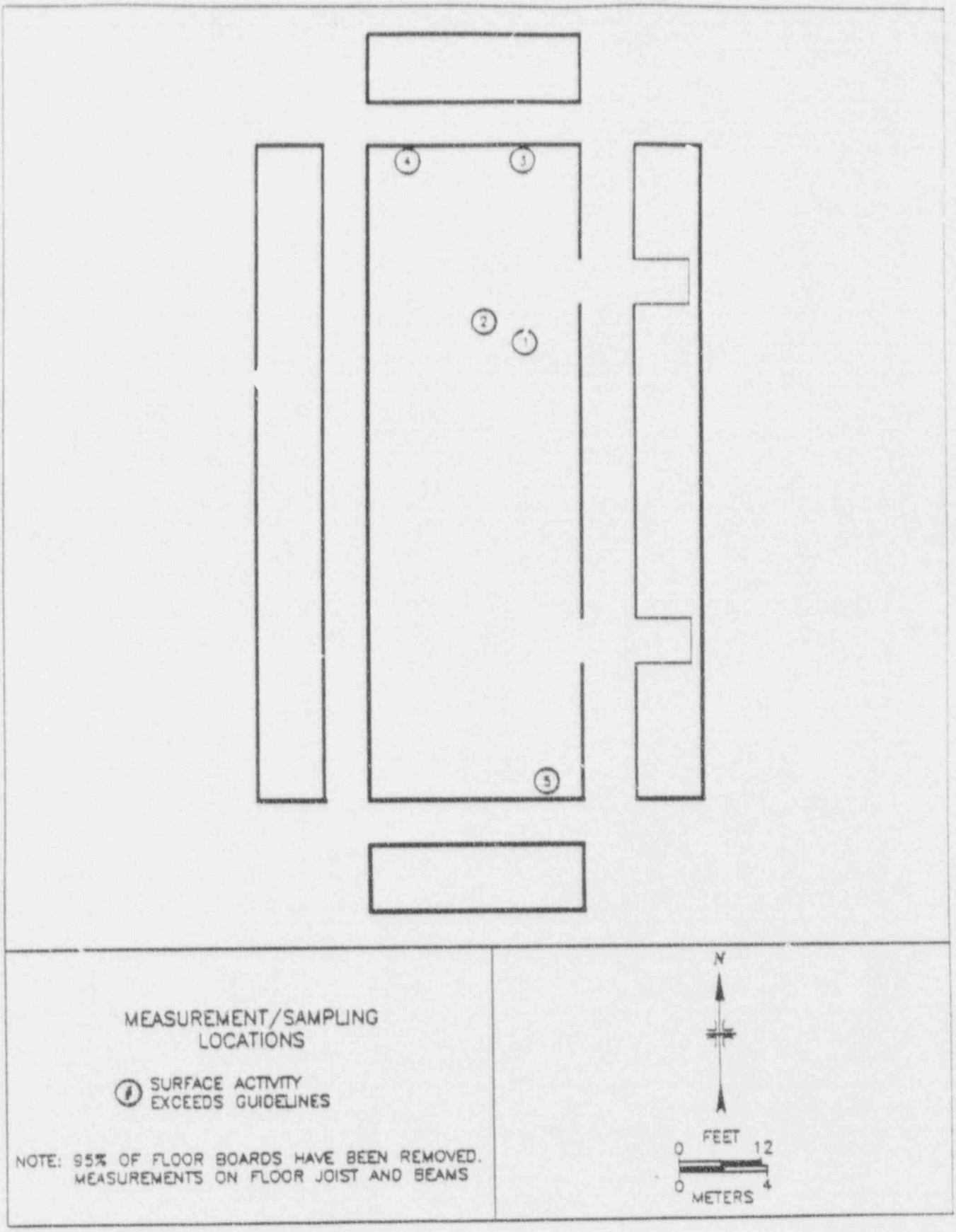

FIGURE 11: Building L-415 - Measurement and Sampling Locations

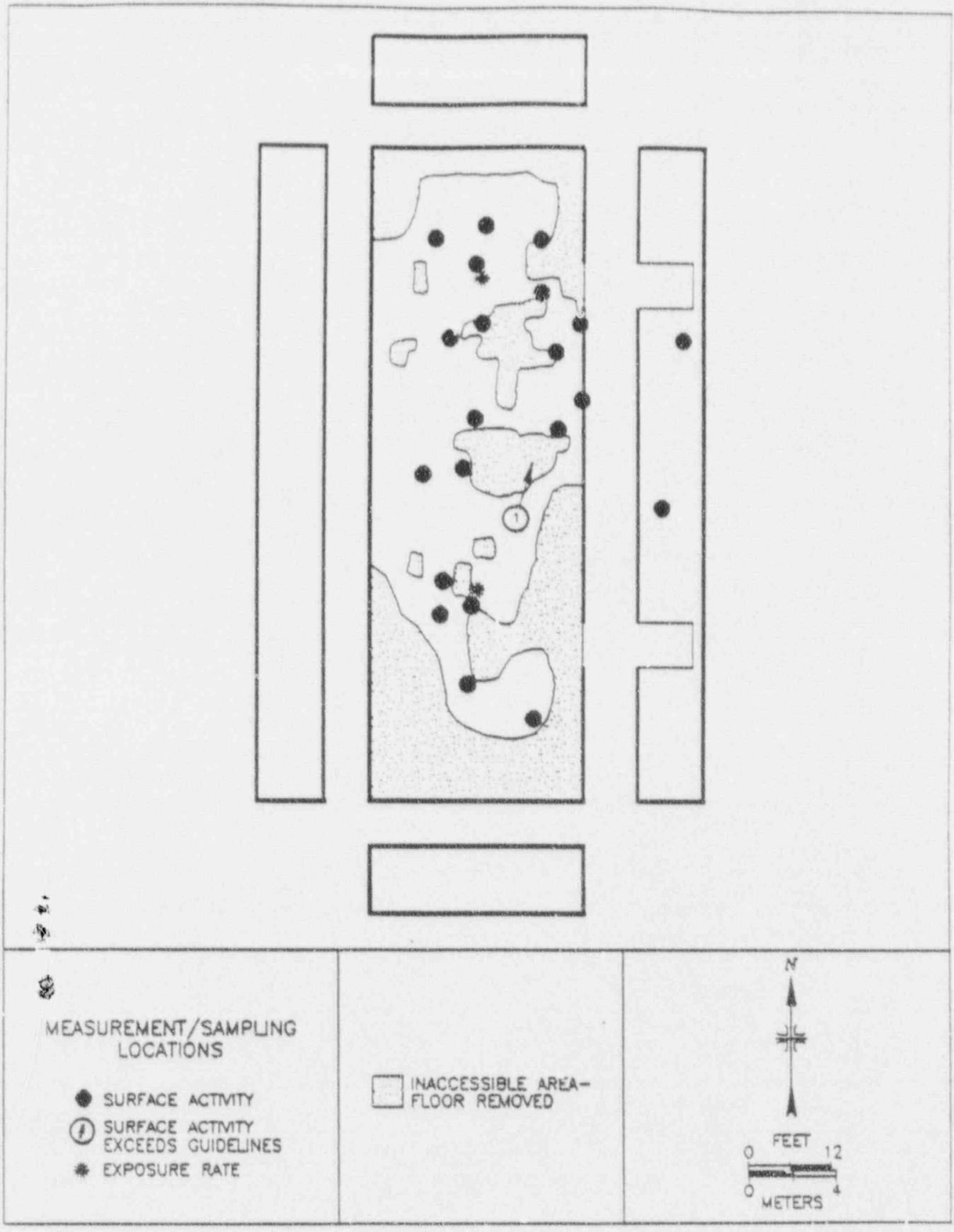

FIGURE 12: Building M-421 - Measurement and Sampling Locations

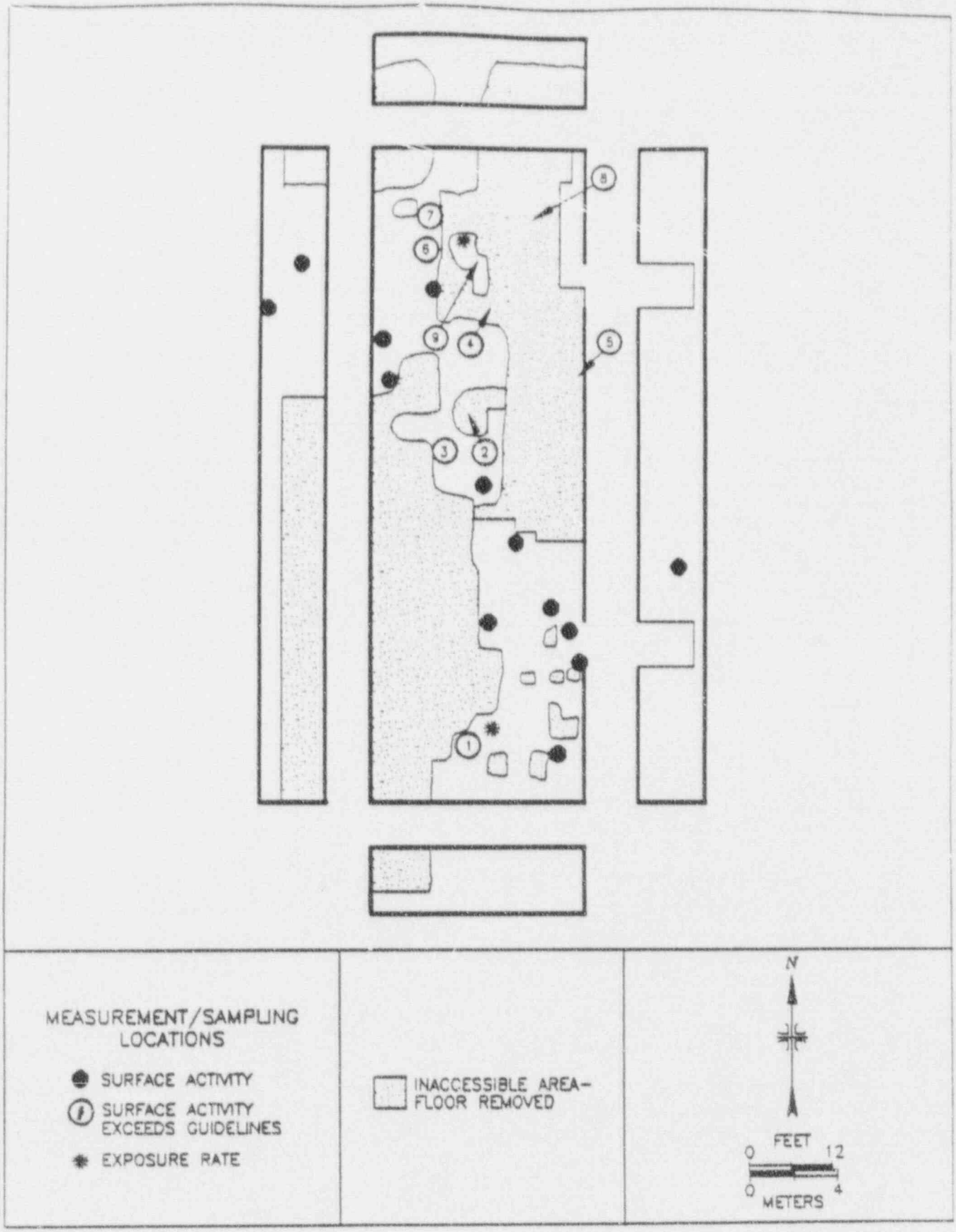

FIGURE 13: Building M-422 - Measurement and Sampling Locations

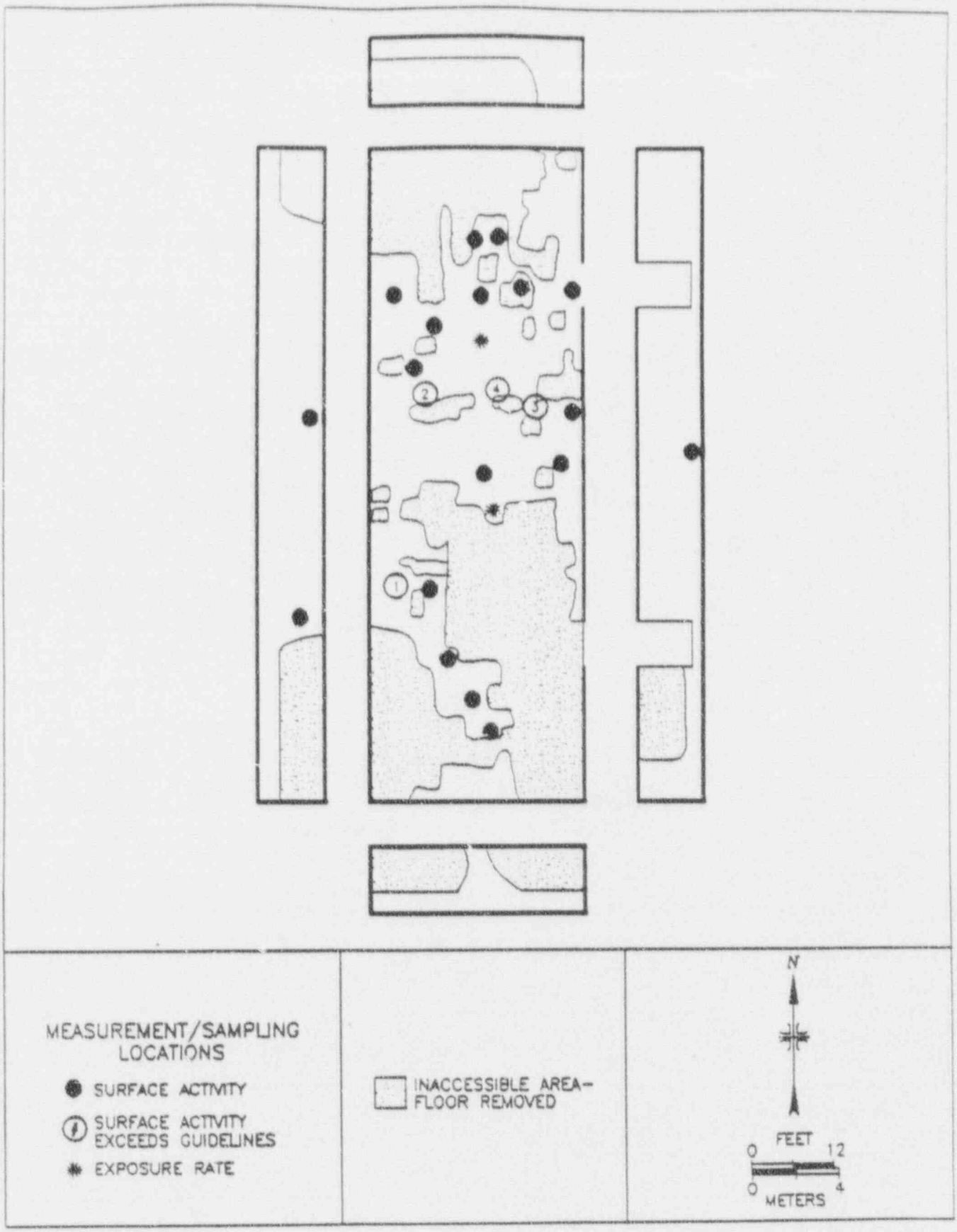

FIGURE 14: Building M-423 - Measurement and Sampling Locations

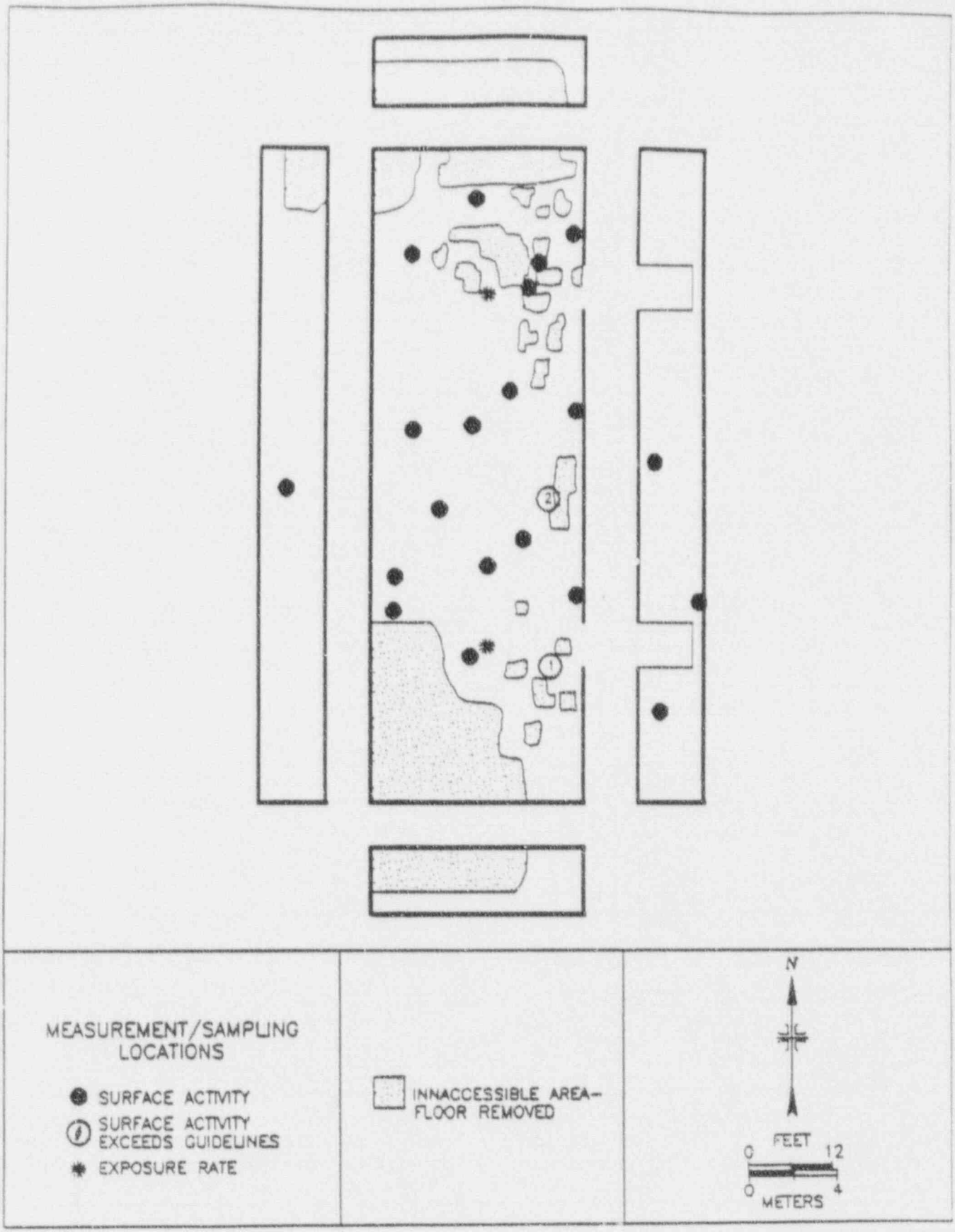

FIGURE 15: Building M-424 - Measurement and Sampling Locations

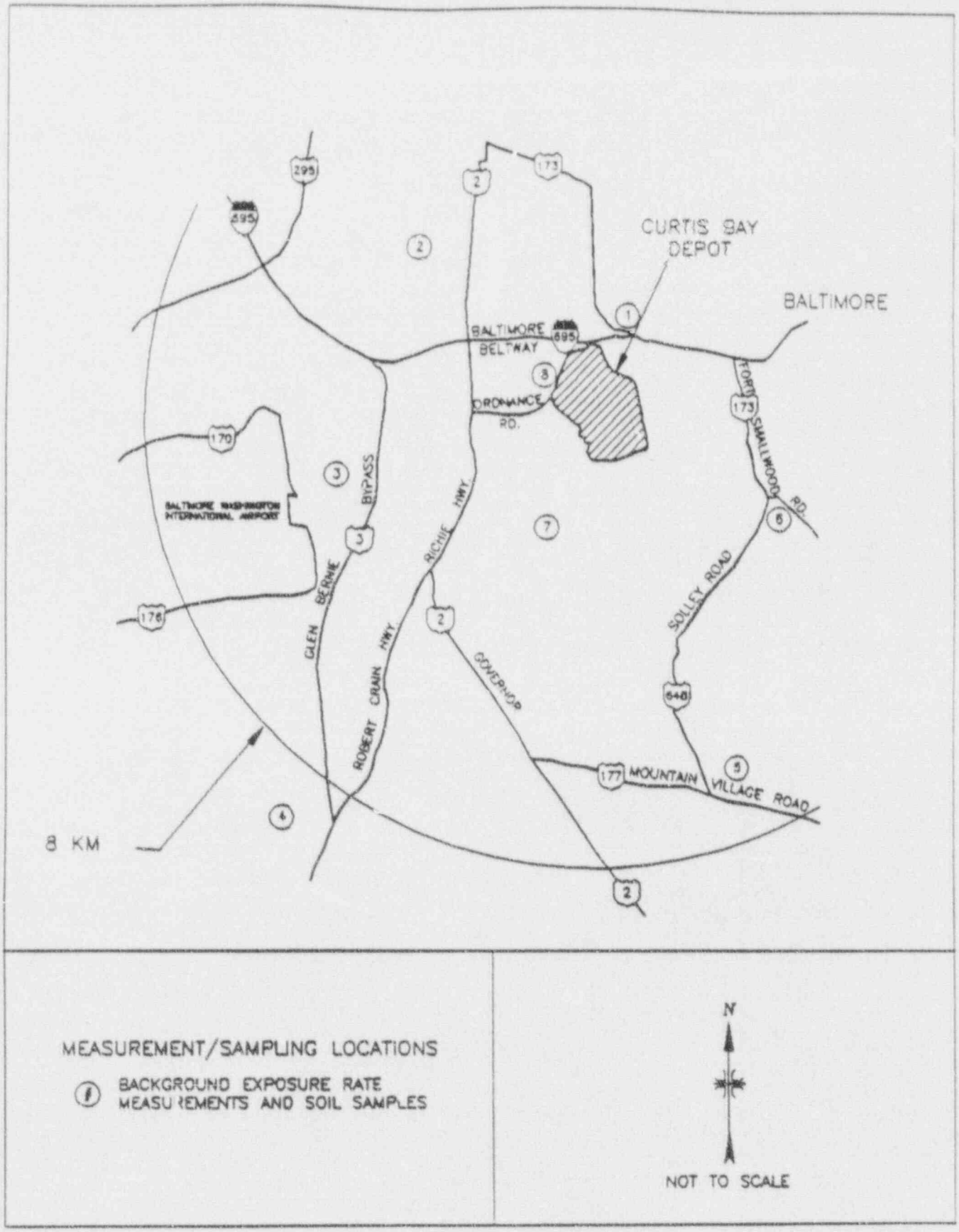

FIGURE 16: Curtis Bay Depot – Exterior Background Exposure Rate Measurement and Soil Sampling Locations

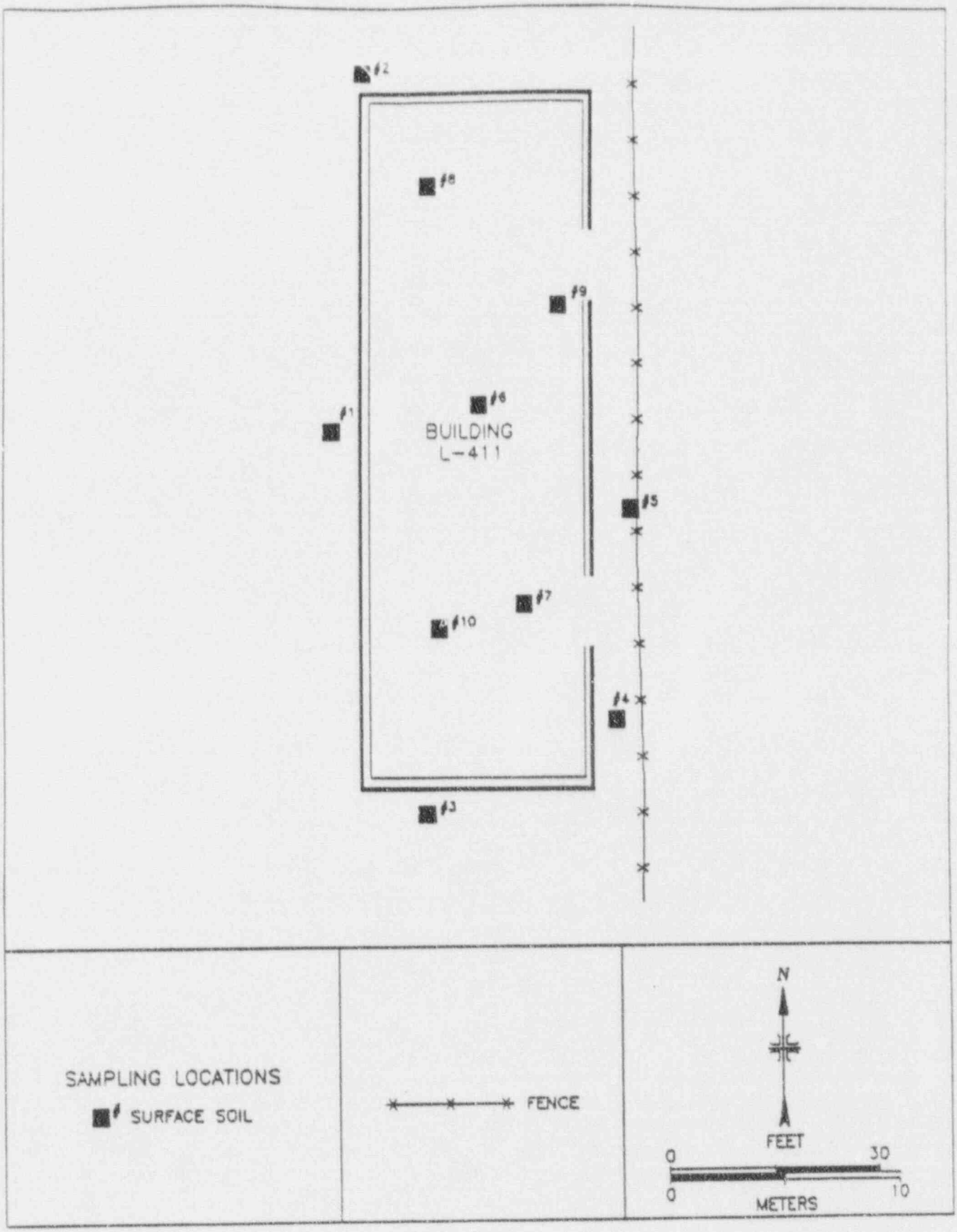

FIGURE 17: Building L-411 - Soil Sampling Locations

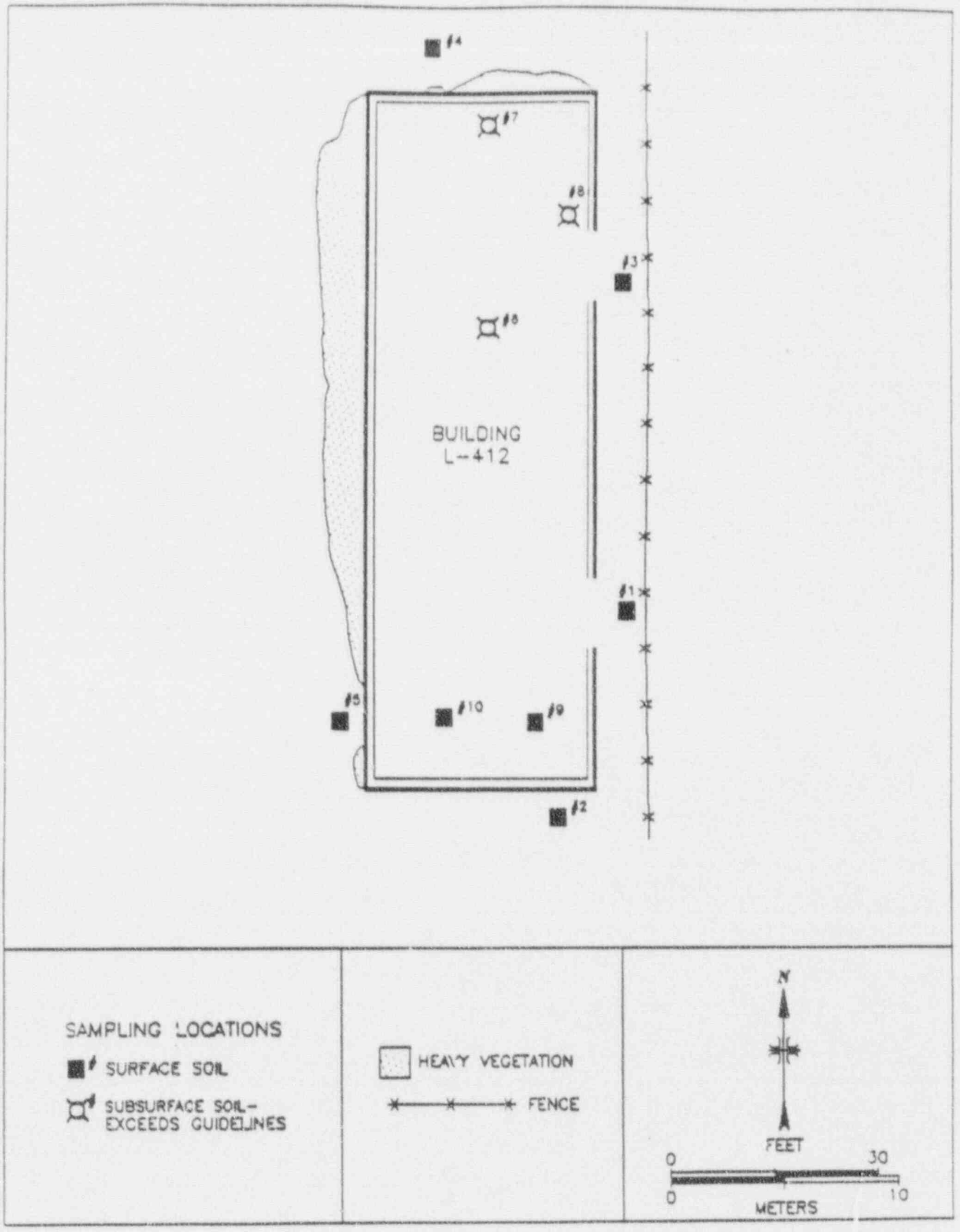

FIGURE 18: Building L-412 - Soil Sampling Locations

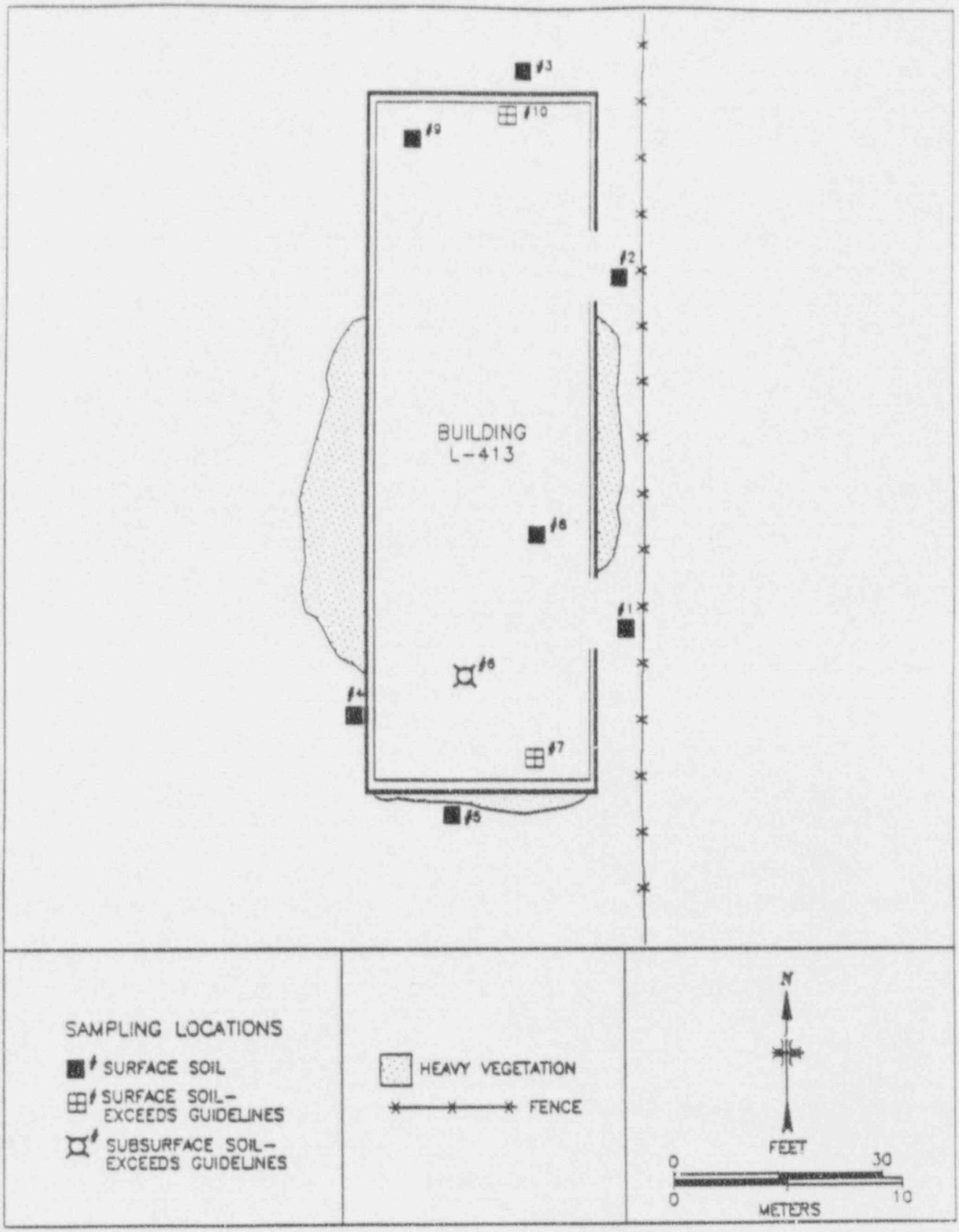

FIGURE 19: Building L-413 - Soil Sampling Locations

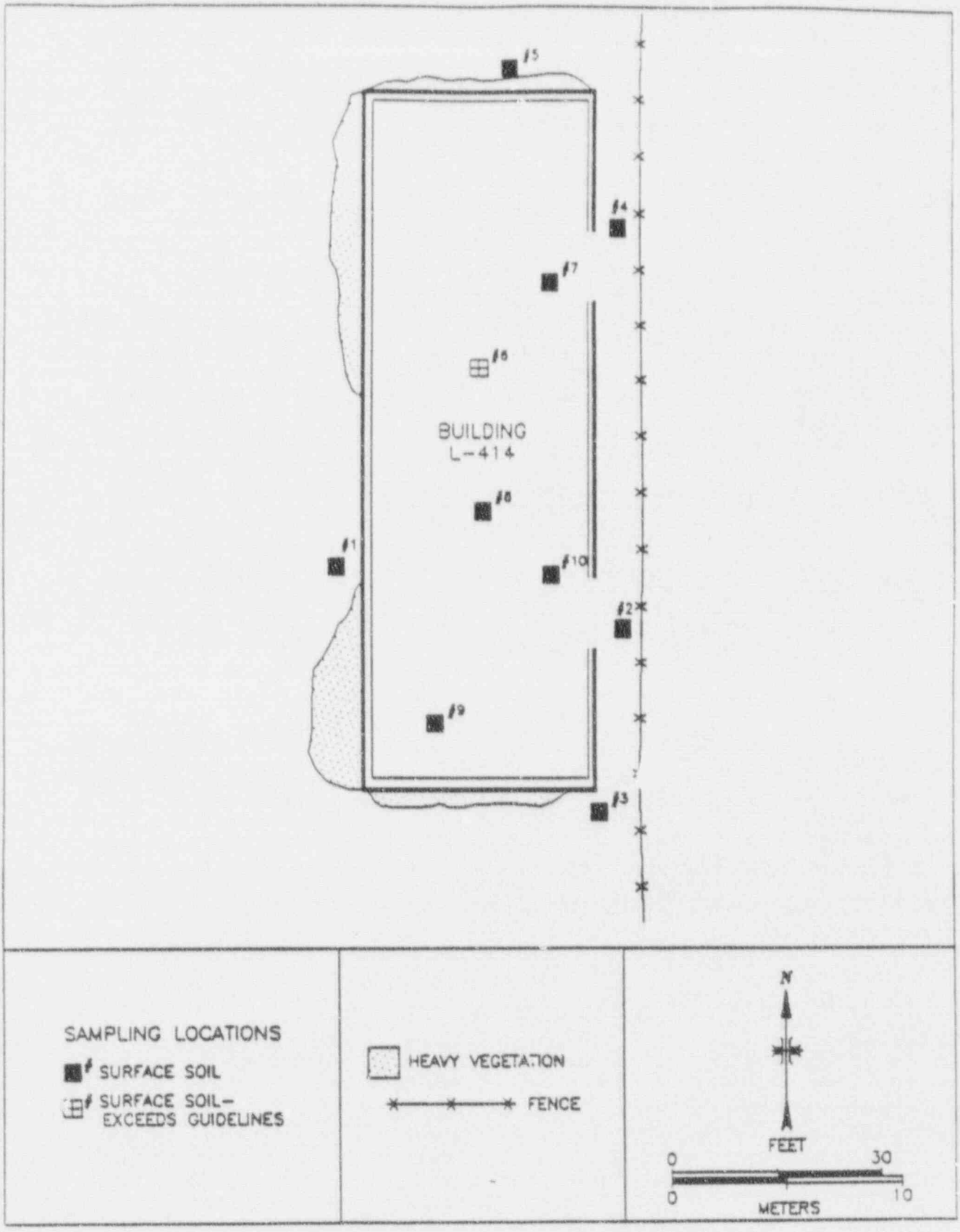

FIGURE 20: Building L-414 - Soil Sampling Locations

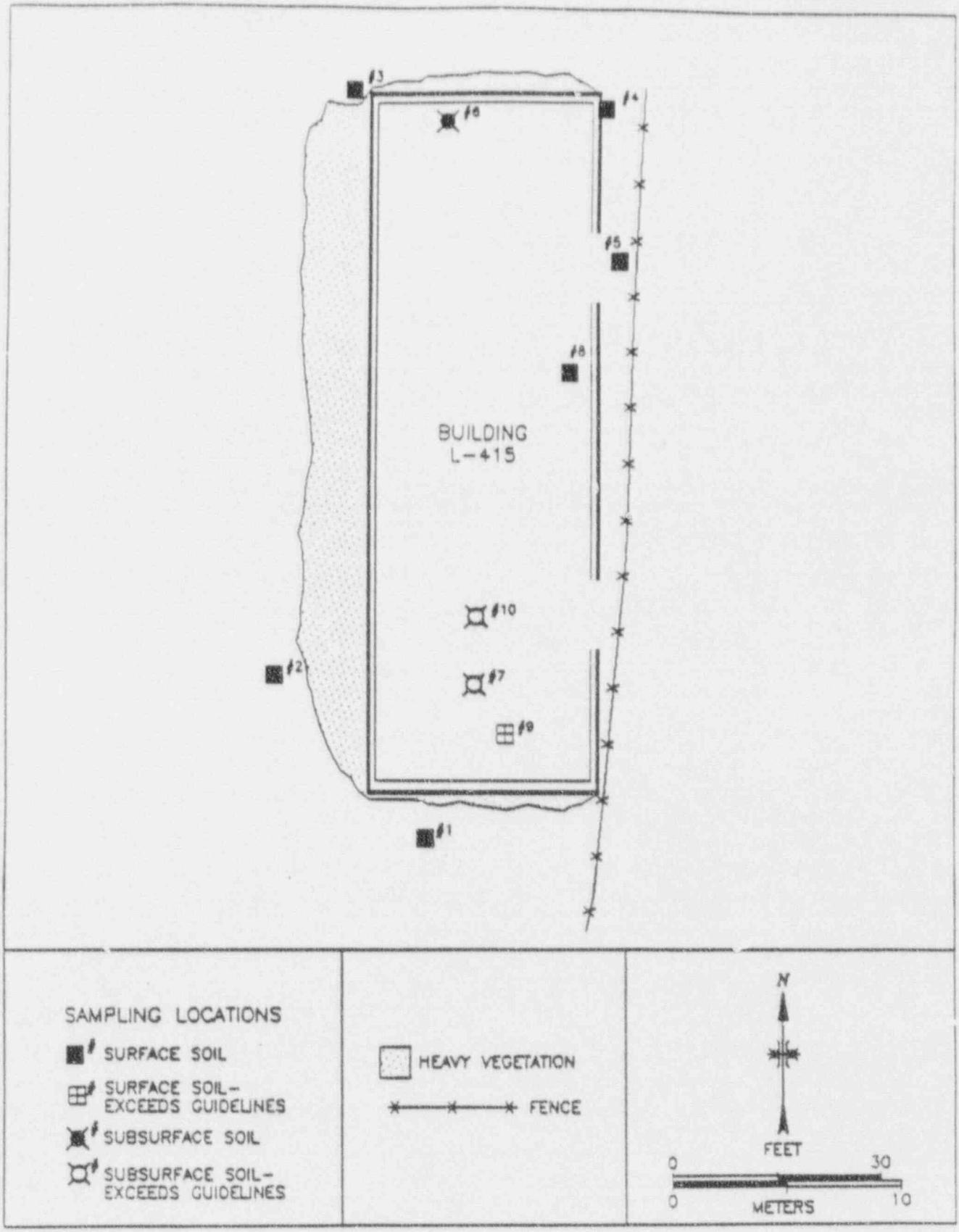

FIGURE 21: Building L-415 - Soil Sampling Locations

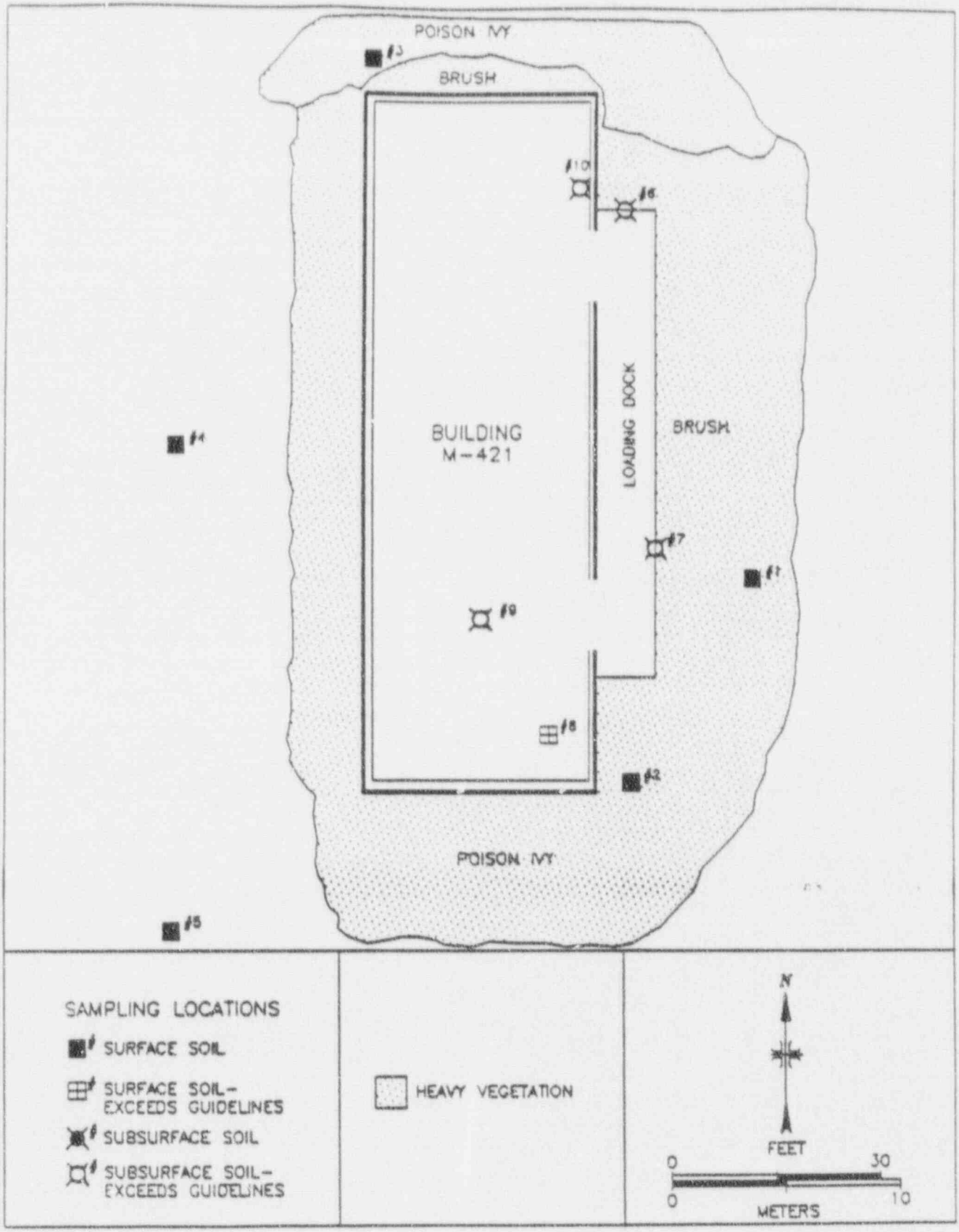

FIGURE 22: Building M-421 - Soil Sampling Locations

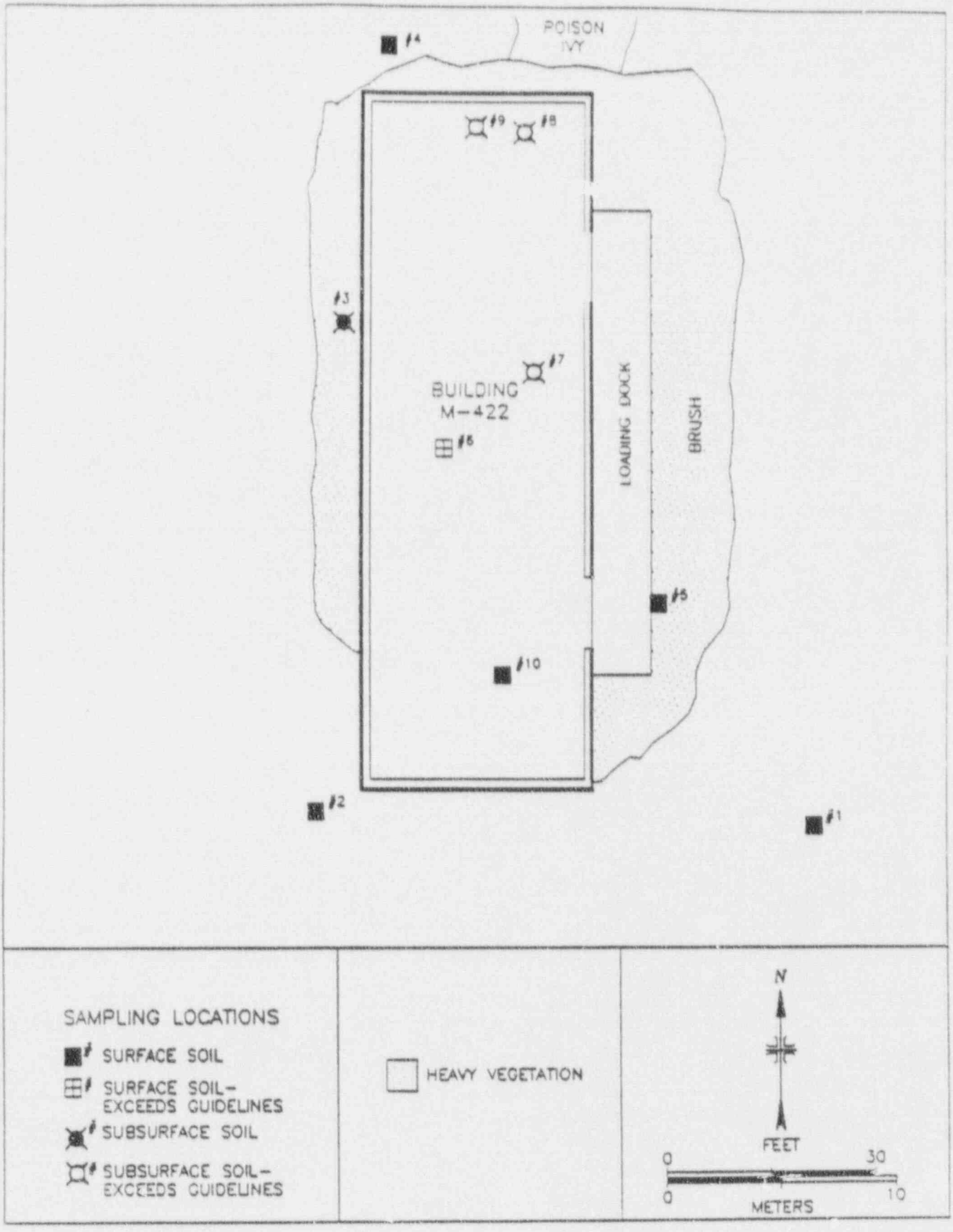

FIGURE 23: Building M-422 - Soil Sampling Locations

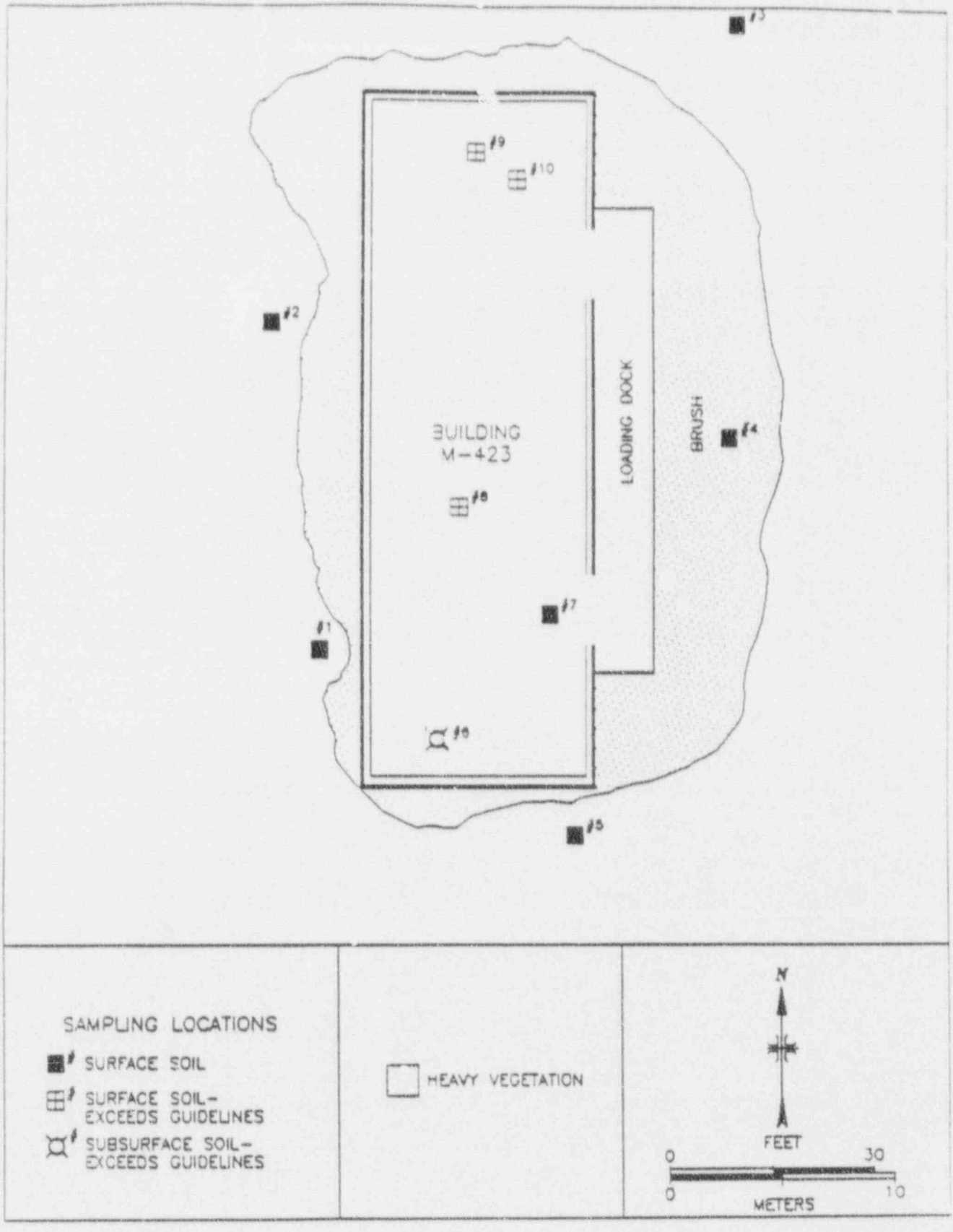

FIGURE 24: Building M-423 - Soil Sampling Locations

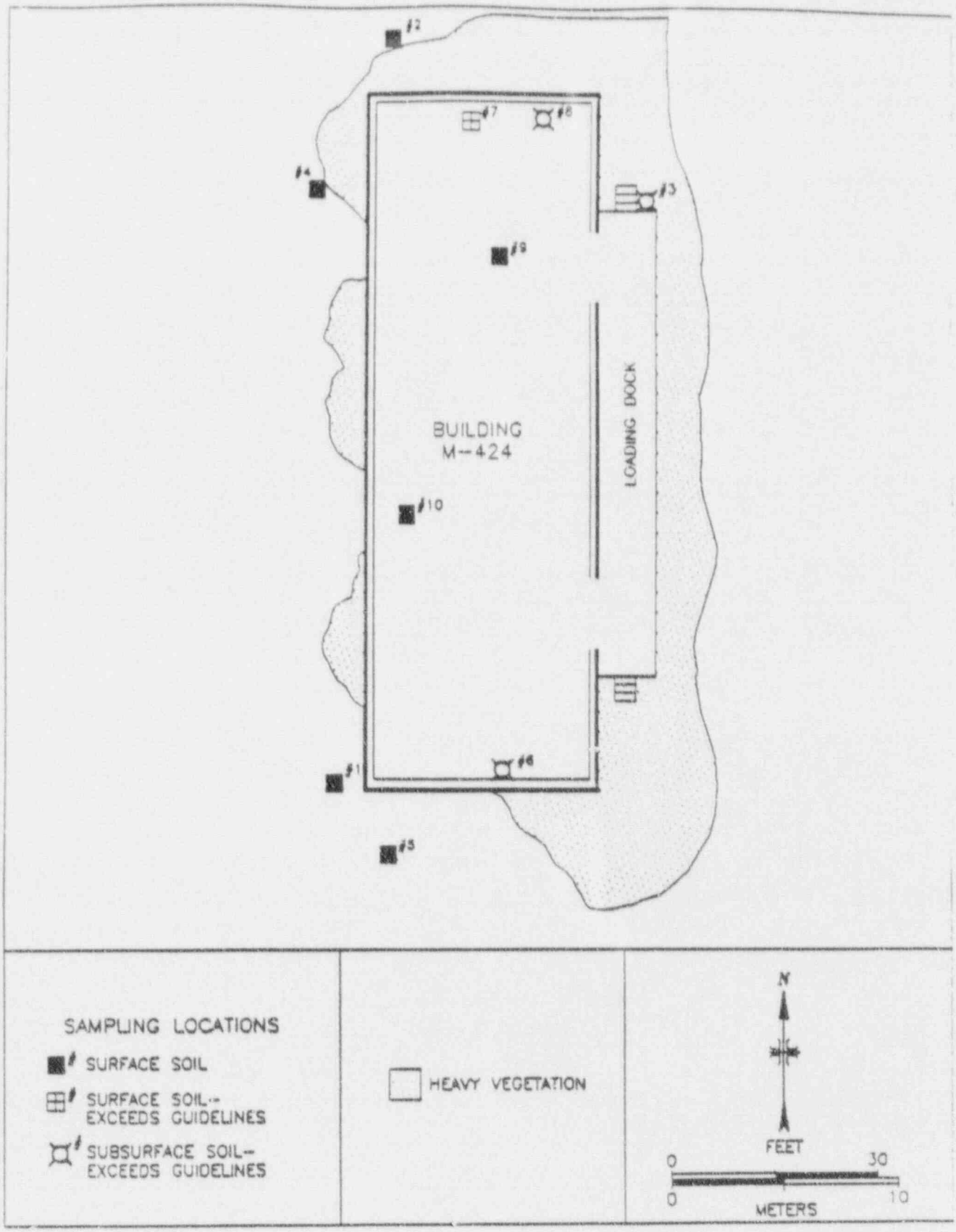

FIGURE 25: Building M--424 - Soil Sampling Locations

TABLE 1

SUMMARY OF SURFACE ACTIVITY AND EXPOSURE RATE MEASUREMENTS
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate[b] (μR/h) @ 1 m Above Surface	Number of Direct Measurement Locations		Range of Total[d] Activity (dpm/100 cm²)	Locations Exceeding Removable Criteria[e]	Range of Removable Activity (dpm/100 cm²)	
		Total	Exceeding Maximum Criteria[c]	Beta		Alpha	Beta
Building L-411	7	22	0	<440-770	0	<12	<15-15
Building L-412	7	30	2	<440-3,900	0	<12	<15
Building L-413	6-7	23	3	<440-12,000	0	<12	<15-16
Building L-414	6	30	1	<440-14,000	0	<12	<15
Building L-415	---	5	5	12,000-72,000	0	<12-70	<15-30
Building M-421	8-9	22	1	<440-400,000	1	<12-710	<15-470
Building M-422	8-10	22	9	<440-590,000	2	<12-1,100	<15-730
Building M-423	8-9	22	4	<440-12,000	0	<12	<15
Building M-424	7-8	22	2	<440-8,200	0	<12	<15-19

[a]Refer to Figures 7-15.
[b]Dash indicates measurement not performed.
[c]Maximum total contamination level for thorium is 3,000 dpm/100 cm².
[d]Total = fixed plus removable.
[e]Maximum removable contamination level is 200 dpm/100 cm².

TABLE 2

SURFACE ACTIVITY MEASUREMENTS EXCEEDING GUIDELINES
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Building/Location[a]		Total Beta Activity (dpm/100 cm²)	Removable Activity[b] (dpm/100 cm²)	
			Alpha	Beta
L-412	1	3,300	<12	<15
	2	3,900	<12	<15
L-413	1	12,000	---	---
	2	5,200	<12	<15
	3	3,200	<12	<15
L-414	1	14,000	<12	<15
L-415	1	72,000	70	18
	2	13,000	39	25
	3	65,000	62	30
	4	21,000	15	<15
	5	12,000	<12	<15
M-421	1	400,000	710	470
M-422	1	14,000	<12	<15
	2	590,000	1,100	730
	3	4,200	<12	<15
	4	73,000	39	21
	5	160,000	240	130
	6	7,900	15	15
	7	11,000	<12	18
	8	3,200	<12	<15
	9	4,400	<12	<15

TABLE 2 (CONTINUED)

SURFACE ACTIVITY MEASUREMENTS EXCEEDING GUIDELINES
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Building/Location[a]		Total Beta Activity (dpm/100 cm^2)	Removable Activity[b] (dpm/100 cm^2)	
			Alpha	Beta
M-423	1	11,000	<12	<15
	2	3,600	<12	<15
	3	12,000	<12	<15
	4	4,500	<12	<15
M-424	1	4,500	<12	<15
	2	8,200	<12	<15

[a]Refer to Figures 8-15.
[b]Dash indicates measurement not performed.

TABLE 3

INTERIOR BACKGROUND EXPOSURE RATES
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Measurement Location*	Exposure Rate (μR/h) @ 1 m Above Surface
Building K-511	8
Building K-611	8
Building K-615	7

*Refer to Figure 6.

TABLE 4

EXTERIOR BACKGROUND EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL CURTIS BAY DEPOT BALTIMORE, MARYLAND

Measurement Location*		Exposure Rate (μR/h) @ 1 m Above Surface	Total Thorium Concentration (pCi/g)[b]
1	Pennigton Ave at Ordnance Rd	8	1.4 ± 0.8
2	Brooklyn Park #1	7	1.4 ± 0.6
3	Lindale J.H.S.	7	1.8 ± 0.6
4	Randazzo Softball Park	7	1.0 ± 0.4
5	George Fox Middle School	6	0.6 ± 0.6
6	Solly Park	6	0.8 ± 0.4
7	Point Pleasant Elemenatry School	6	0.8 ± 0.4
8	Home Depot Parking Lot	7	1.6 ± 0.6

*See Figure 16.
[b]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 5

BUILDING L-411
EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate (μR/h) @ 1 m Above Surface	Sample Depth (cm)	Total Thorium Concentration (pCi/g)[b]
1	8	0-15	2.2 ± 0.6
2	8	0-15	3.0 ± 1.0
3	9	0-15	2.8 ± 0.8
4	9	0-15	3.8 ± 1.0
5	9	0-15	3.2 ± 1.0
6	9	0-15	2.0 ± 0.8
7	9	0-15	2.6 ± 1.0
8	8	0-15	2.6 ± 0.8
9	10	0-15	2.4 ± 0.8
10	9	0-15	1.8 ± 0.8

[a]Refer to Figure 17.
[b]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 6

BUILDING L-412
EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate (μR/h) @ 1 m Above Surface[b]	Sample Depth (cm)	Total Thorium Concentration (pCi/g)[c]
1	9	0-15	2.2 ± 0.8
2	11	0-15	7.8 ± 1.8
3	9	0-15	3.2 ± 0.8
4	9	0-15	4.6 ± 1.0
5	8	0-15	3.0 ± 1.0
6	16	0-15	56.8 ± 8.6
6	---	15-30	14.8 ± 2.6
7	16	0-15	526 ± 76
7	---	15-30	61.6 ± 9.2
8	16	0-15	66 ± 10
8	---	15-30	87 ± 13
8	---	30-45	18.8 ± 3.4
9	10	0-15	3.8 ± 1.0
10	10	0-15	3.4 ± 1.0

[a]Refer to Figure 18.
[b]Dash indicates measurement not performed.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 7

BUILDING L-413
EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate(μR/h) @ 1 m Above Surface[b]	Sample Depth (cm)	Total Thorium Concentration (pCi/g)[c]
1	9	0-15	2.8 ± 0.8
2	9	0-15	2.6 ± 0.8
3	8	0-15	2.6 ± 1.0
4	9	0-15	4.0 ± 1.2
5	9	0-15	3.4 ± 0.8
6	10	0-15	80 ± 12
6	---	15-30	25.6 ± 4.2
7	10	0-15	17.8 ± 3.0
8	10	0-15	5.0 ± 1.2
9	8	0-15	2.0 ± 0.8
10	9	0-15	14.6 ± 2.8

[a]Refer to Figure 19.
[b]Dash indicates measurement not performed.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 8

BUILDING L-414
EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate (μR/h) @ 1 m Above Surface	Sample Depth (cm)	Total Thorium Concentration (pCi/g)[b]
1	8	0-15	3.6 ± 1.0
2	7	0-15	1.8 ± 0.6
3	8	0-15	3.4 ± 1.0
4	8	0-15	2.4 ± 0.8
5	8	0-15	3.8 ± 1.0
6	7	0-15	14.0 ± 2.4
7	6	0-15	1.6 ± 0.6
8	6	0-15	0.8 ± 0.6
9	6	0-15	1.2 ± 0.4
10	5	0-15	1.0 ± 0.4

[a]Refer to Figure 20.
[b]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 9

BUILDING L-415
EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate (μR/h) @ 1 m Above Surface[b]	Sample Depth (cm)	Total Thorium Concentration (pCi/g)[c]
1	8	0-15	3.0 ± 1.0
2	6	0-15	1.8 ± 0.8
3	8	0-15	4.8 ± 1.2
4	9	0-15	4.2 ± 1.0
5	8	0-15	2.6 ± 0.4
6	8	0-15	8.4 ± 1.6
6	---	15-30	6.4 ± 1.2
7	8	0-15	45.4 ± 7.2
7	---	15-30	8.0 ± 1.4
8	6	0-15	5.6 ± 1.2
9	10	0-15	11.2 ± 2.2
10	7	0-15	12.2 ± 2.2
10	---	15-30	20.4 ± 3.4

[a]Refer to Figure 21.
[b]Dash indicates measurement not performed.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 10

BUILDING M-421
EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate (μR/h) @ 1 m Above Surface[b]	Sample Depth (cm)	Total Thorium Concentration (pCi/g)[c]
1	9	0-15	1.8 ± 0.6
2	9	0-15	4.6 ± 0.6
3	8	0-15	1.8 ± 1.0
4	7	0-15	1.8 ± 0.8
5	5	0-15	1.6 ± 0.6
6	36	0-15	648 ± 94
6	---	15-30	412 ± 60
7	13	0-15	11.6 ± 2.0
7	---	15-30	6.6 ± 1.4
8	13	0-15	7.4 ± 1.2
9	21	0-15	97 ± 14
9	---	15-30	11.6 ± 2.2
10	16	0-15	73 ± 11
10	---	15-30	43.4 ± 6.8

[a]Refer to Figure 22.
[b]Dash indicates measurements not performed.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 11

BUILDING M-422
EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate (μR/h) @ 1 m Above Surface[b]	Sample Depth (cm)	Total Thorium Concentration (pCi/g)[c]
1	13	0-15	4.0 ± 1.2
2	9	0-15	3.6 ± 1.0
3	8	0-15	5.6 ± 1.2
3	---	15-30	4.4 ± 1.0
4	9	0-15	3.8 ± 1.0
5	9	0-15	4.0 ± 1.0
6	13	0-15	12.4 ± 2.2
7	13	0-15	87 ± 13
7	---	15-30	59.2 ± 9.0
8	11	0-15	250 ± 36
8	---	15-30	15.6 ± 2.8
9	13	0-15	626 ± 92
9	---	15-30	130 ± 19
10	8	0-15	1.4 ± 0.6

[a]Refer to Figure 23.
[b]Dash indicates measurement not performed.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 12

BUILDING M-423
EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate (μR/h) @ 1 m Above Surface[b]	Sample Depth (cm)	Total Thorium Concentration (pCi/g)[c]
1	9	0-15	3.2 ± 1.0
2	7	0-15	1.8 ± 0.4
3	7	0-15	1.0 ± 0.8
4	10	0-15	3.6 ± 1.2
5	8	0-15	2.4 ± 0.8
6	16	0-15	158 ± 24
6	---	15-30	51.0 ± 8.0
6	---	30-45	18.2 ± 3.2
7	8	0-15	2.0 ± 0.6
8	10	0-15	11.6 ± 2.2
9	7	0-15	142 ± 20
10	8	0-15	35.0 ± 5.6

[a]Refer to Figure 24.
[b]Dash indicates measurement not performed.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 13

BUILDING M-424
EXPOSURE RATES AND THORIUM CONCENTRATIONS IN SOIL
CURTIS BAY DEPOT
BALTIMORE, MARYLAND

Location[a]	Exposure Rate (μR/h) @ 1 m above Surface[b]	Sample Depth (cm)	Total Thorium Concentration (pCi/g)[c]
1	8	0-15	3.4 ± 1.0
2	8	0-15	5.4 ± 1.2
3	11	0-15	126 ± 19
3	---	15-30	51.4 ± 8.0
4	8	0-15	4.6 ± 1.2
5	7	0-15	2.2 ± 0.6
6	12	0-15	136 ± 20
6	---	15-30	80 ± 12
6	---	30-45	50.4 ± 7.8
7	8	0-15	123 ± 18
8	8	0-15	192 ± 28
8	---	15-30	146 ± 22
9	7	0-15	1.6 ± 0.4
10	8	0-15	1.6 ± 0.6

[a]Refer to Figure 25.
[b]Dash indicates measurement not performed.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

REFERENCES

1. Letter from J. O'Reilly (U.S. Nuclear Regulatory Commission, Region I) to C. Brooks (General Services Administration), Reference: "Survey at Curtis Bay Depot," July 13, 1977.

2. Letter from R. McClintock (U.S. Nuclear Regulatory Commission, Region I) to W. Mosrie (General Services Administration), Reference: "Inspection 40-341/77-03," February 8, 1978.

3. "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," U.S. Nuclear Regulatory Commission, December 1975.

4. "Guidelines for Residual Concentration of Thorium and Uranium Wastes in Soil," U.S. Nuclear Regulatory Commission, October 1981.

5. "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," U.S. Nuclear Regulatory Commission, August 1987.

6. Memorandum from J. Hickey (U.S. Nuclear Regulatory commission, HQ) to D. Collins (U.S. Nuclear Regulatory Commission, Region II), Reference: "Interpretation of Thorium Surface Decontamination Limits", February 20, 1992.

7. "Policy and Guideline FC91-2, Standard Review Plan: Evaluating Decommissioning Plans for Licensees Under 10 CFR Parts 30, 40, and 70," U.S. Nuclear Regulatory Commission, August 1991.

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 authors or their employers.

DIRECT RADIATION MEASUREMENT

Instruments

Eberline Pulse Ratemeter
Model PRM-6
(Eberline, Santa Fe, NM)

Eberline "Rascal" Ratemeter-Scaler
Model PRS-1
(Eberline, Santa Fe, NM)

Ludlum Floor Monitor
Model 239-1
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Ludlum Ratemeter-Scaler
Model 2220
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Ludlum Ratemeter-Scaler
Model 2221
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Detectors

Eberline GM Detector
Model HP-260
Effective Area, 15.5 cm^2
(Eberline, Santa Fe, NM)

Ludlum Gas Proportional Detector
Model 43-37
Effective Area, 550 cm^2
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Ludlum Gas Proportional Detector
Model 43-68
Effective Area, 100 cm^2
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Reuter-Stokes Pressurized Ion Chamber
Model RSS-111
(Reuter-Stokes, Cleveland, OH)

Victoreen NaI Scintillation Detector
Model 489-55
3.2 cm x 3.8 cm Crystal
(Victoreen, Cleveland, OH)

LABORATORY ANALYTICAL INSTRUMENTATION

High Purity Extended Range Intrinsic Detectors
Model No: ERVDS30-25195
(Tenn Tec, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-11
(Nuclear Lead, Oak Ridge, TN) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

High-Purity Germanium Detector
Model GMX-23195-S, 23% Eff.
(EG&G ORTEC, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-16
(Gamma Products, Palos Hills, IL) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

High-Purity Germanium Coaxial Well Detector
Model GWL-110210-PWS-S, 23% Eff.
(EG&G ORTEC, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-16
(Applied Physical Technology, Atlanta, GA) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

High-Purity Intrinsic Germanium Detector
Model IGC25, 25% Eff.
(Princeton Gamma-Tech, Princeton, NJ)
Used in conjunction with:
Lead Shield
(Nuclear Data, Schaumburg, IL) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

Low Background Gas Proportional Counter
Model LB-5110
(Tennelec, Oak Ridge, TN)

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

SURVEY PROCEDURES

Surface Scans

Surface scans were performed by passing the probes slowly over the surface; the distance between the probe and the surface was maintained at a minimum - nominally about 1 cm. A large surface area, gas proportional floor monitor was used to scan the floors of the surveyed areas. Other surfaces were scanned using small area (15.5 cm^2 or 100 cm^2) hand-held detectors. Identification of elevated levels was based on increases in the audible signal from the recording and/or indicating instrument. Combinations of detectors and instruments used for the scans were:

Alpha-Beta	-	gas proportional detector with ratemeter-scaler
Beta	-	pancake GM detector with ratemeter-scaler
Gamma	-	NaI scintillation detector with ratemeter

Surface Activity Measurements

Measurements of total beta activity levels were primarily performed using gas proportional detectors, with alpha shields attached, coupled to portable ratemeters-scalers. Beta activity measurements were performed at locations of elevated direct radiation, inaccessible to gas proportional equipment, using GM detectors with ratemeters-scalers.

Count rates (cpm), which were integrated over 1 minute in a static position, were converted to activity levels (dpm/100 cm^2) by dividing the net rate by the 4π efficiency and correcting for the active area of the detector. The background count rates for the proportional and GM detectors averaged approximately 190 and 42 cpm, respectively. Beta efficiency factors ranged from 0.19 to 0.20 for the gas proportional detectors, with alpha absorber covers in place, and 0.24 to 0.26 for the GM detector. The effective area for the gas proportional, and GM detectors were 100 cm^2, and 15.5 cm^2, respectively. The alpha absorber covers consist of 2.0 mg/cm^2 mylar film which is placed in a frame that fits over the effective area of the gas proportional detector.

Removable Activity Measurements

Removable activity levels were determined using numbered filter paper disks, 47 mm in diameter. Moderate pressure was applied to the smear with two or three fingers, and approximately 100 cm^2 of the surface was wiped. Smears were placed in labeled envelopes with the location and other pertinent information recorded.

Exposure Rate Measurements

Measurements of gamma exposure rates were performed using a pressurized ionization chamber (PIC) or NaI scintillation detectors coupled to portable ratemeters. Count rates for the NaI scintillation detectors were converted to exposure rates (μR/h) by cross-comparison with a pressurized ionization chamber (PIC). Gamma scintillation detectors were used for measuring total gamma radiation levels at locations which were difficult to access with the PIC. These detectors were calibrated against the PIC by determining scintillation instrument count rates in exposure rate fields, representative of site conditions. The range of exposure rates encountered at the site was relatively narrow (only differing by a few μR/h). Rather than attempting to develop a calibration curve based on such a limited number of data points, a single calibration factor of 2.6 μR/h per 1,000 counts per minute was determined. This calibration factor was then used to convert gamma scintillation measurements to exposure rates.

Soil Sampling

Approximately 1 kg of soil was collected at each sample location. Collected samples were placed in a plastic bag, sealed, and labeled in accordance with ESSAP survey procedures.

ANALYTICAL PROCEDURES

Removable Activity

Smears were counted on a low background gas proportional system for gross alpha and gross beta activity.

Gamma Spectrometry

Soil samples were dried, mixed, and/or crushed then placed in an appropriate container, chosen to reproduce the calibrated counting geometry. 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. The energy peaks used for determination of total thorium were:

Th-232	0.911 MeV from Ac-228*
Th-228	0.583 MeV from Tl-208*

*Secular equilibrium assumed

Spectra were also reviewed for other identifiable photopeaks.

A review of gamma spectrometry data indicated that the thorium daughter products were in equilibrium. In secular equilibrium, Th-232 and Th-228 concentrations are equivalent. Therefore, the Th-232 results were doubled to provide total thorium concentrations.

UNCERTAINTIES AND DETECTION LIMITS

The uncertainties associated with the analytical data presented in the tables of this report represent the 95% confidence level for that data. These uncertainties were calculated based on both the gross sample count levels and the associated background count levels. When the net sample count was less than the 95% statistical deviation of the background count, the sample concentration was reported as less than the detection limit of the measurement procedures. 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. Additional uncertainties, associated with sampling and measurement procedures, have not been propagated into the data presented in this report.

CALIBRATION AND QUALITY ASSURANCE

Analytical and field survey activities were conducted in accordance with procedures from the following documents:

-Survey Procedures Manual Revision 6 (February 1991)
-Laboratory Procedures Manual Revision 6 (April 1991)
-Quality Assurance Manual Revision 4 (April 1991)

The procedures contained in these manuals were developed to meet the requirements of DOE Order 5700.6B for Quality Assurance and contain measures to assess processes during their performance.

Calibration of all field and laboratory instrumentation was based on standards/sources, traceable to NIST, when such standards/sources were available. In cases where they were not available, standards of an industry recognized organization was used. Calibration of pressurized ionization chambers was performed by the manufacturer.

Quality control procedures include:

- Daily instrument background and check-source measurements to confirm that equipment operation is within acceptable statistical fluctuations.

- Participation in EPA and EML laboratory Quality Assurance Programs.

- Training and certification of all individuals performing procedures.

- Periodic internal and external audits.

APPENDIX C

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE OR SPECIAL NUCLEAR MATERIAL

AND

GUIDELINES FOR RESIDUAL CONCENTRATIONS OF THORIUM AND URANIUM WASTES IN SOIL

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

U.S. Nuclear Regulatory Commission
Division of Fuel Cycle & Material Safety
Washington, D.C. 20555

August 1987

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces or premises, equipment, or scrap which are likely to be contaminated, but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement, shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to special circumstances such as razing of buildings, transfer from premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Fuel Cycle, Medical, Academic, and Commercial Use Safety, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

TABLE 1
ACCEPTABLE SURFACE CONTAMINATION LEVELS

Nuclides[a]	Average[b,c,f]	Maximum[b,d,f]	Removable[b,e,f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1,000 dpm $\beta\gamma$/100 cm^2

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h at 1 cm and 1.0 mrad/h at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Guidelines for Residual Concentrations of Thorium and Uranium Wastes in Soil

On October 23, 1981, the Nuclear Regulatory Commission published in the Federal Register a notice of Branch Technical Position on "Disposal or Onsite Storage of Thorium and Uranium Wastes from Past Operations." This document establishes guidelines for concentrations of uranium and thorium in soil, that will limit maximum radiation received by the public under various conditions of future land usage. These concentrations are as follows:

Material	Maximum Concentrations (pCi/g) for various options			
	1[a]	2[b]	3[c]	4[d]
Natural Thorium (Th-232 + Th-228) with daughters present and in equilibrium	10	50	---	500
Natural Uranium (U-238 + U-234) with daughters present and in equilibrium	10	--	40	200
Depleted Uranium:				
Soluble	35	100	---	1,000
Insoluble	35	300	---	3,000
Enriched Uranium:				
Soluble	30	100	---	1,000
Insoluble	30	250	---	2,500

[a]Based on EPA cleanup standards which limit radiation to 1 mrad/yr to lung and 3 mrad/yr to bone from ingestion and inhalation and 10 μR/h above background from direct external exposure.

[b]Based on limiting individual dose to 170 mrem/yr.

[c]Based on limiting equivalent exposure to 0.02 working level or less.

[d]Based on limiting individual dose to 500 mrem/yr and in case of natural uranium, limiting exposure to 0.02 working level or less.

PAUL S. SARBANES
MARYLAND

United States Senate

WASHINGTON, DC 20510-2002

November 30, 1992

Honorable Ivan Selin
Chairman
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Selin:

I have read with great concern recent press accounts of radioactive contamination at the former U.S. Army Depot at Curtis Bay, Maryland.

As you may be aware, according to these reports, this site was used by the Department of the Army for the storage of thorium nitrate, a radioactive material. In the late 1970's, it was declared surplus and released for "unrestricted use" by the General Services Administration, with the concurrence of the Nuclear Regulatory Commission. Anne Arundel County purchased the property in 1980 and recently discovered that the soil near the buildings where the thorium nitrate was stored is contaminated with levels of radioactive thorium which pose serious risks to public health and safety and exceeds current Federal criteria for release of property for "unrestricted use."

I am particularly concerned about ensuring that the contamination is cleaned up as quickly as possible. Potential exposure to any level of radiation is a very fearful prospect for citizens living near such a facility. The Department of the Army, the General Services Administration and the Nuclear Regulatory Commission clearly bear an important responsibility to assure that public health and safety are adequately protected from the activities which occurred at this facility. In this regard, I ask that you would provide me with a full and thorough report on your plans and schedule for addressing the radioactive contamination of this site. I have sent identical letters to each of the other Federal agencies involved with this matter and ask that you coordinate your responses.

I look forward to hearing from you.

Sincerely,

Paul Sarbanes

Paul S. Sarbanes
United States Senator

PSS/cas

CONGRESSIONAL CORRESPONDENCE SYSTEM
DOCUMENT PREPARATION CHECKLIST

This checklist is be submitted with each document (or group of Qs/As) sent for ing into the CCS.

1. BRIEF DESCRIPTION OF DOCUMENT(S) Ltr to Sen Salazar

2. TYPE OF DOCUMENT ✓ Correspondence ____ Hearings (Qs/As)

3. DOCUMENT CONTROL ____ Sensitive (NRC Only) X Non-Sensitive

4. CONGRESSIONAL COMMITTEE and SUBCOMMITTEES (if applicable)

____ Congressional Committee

____ Subcommittee

5. SUBJECT CODES

(a) _____

(b) _____

(c) _____

6. SOURCE OF DOCUMENTS

(a) ____ 5520 (document name _____

(b) ✓ Scan. (c) ____ Attachments

(d) ____ Rakey (e) ____ Other _____

7. SYSTEM LOG DATES

(a) 2/12/93 Date OCA sent document to CCS

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(c) _____ Date returned to OCA for additional information

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(e) _____ Date entered into CCS by _____

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8. COMMENTS

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