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CONFIRMATORY SURVEY OF THE CIMARRON CORPORATION MIXED OXIDE FUEL FABRICATION PLANT CRESCENT, OKLAHOMA

J. D. BERGER AND L. F. FRIEDMAN

Environmental Survey and Site Assessment Program
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FINAL REPORT
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CONFIRMATORY SURVEY
OF THE
CIMARRON CORPORATION
MIXED OXIDE FUEL FABRICATION PLANT
CRESCENT, OKLAHOMA

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INTRODUCTION AND SITE HISTORY

The Cimarron Corporation Plant, formerly known as the Sequoyah Fuels Corporation Cimarron Plant, in Crescent, Oklahoma, was operated by Kerr-McGee for the manufacture of slightly (about 3%) enriched uranium and mixed oxide (uranium and plutonium) reactor fuels. The plant consisted of two major facilities - the Uranium Plant and the Mixed Oxide Plant. The Mixed Oxide Plant was in operation from 1970 until 1975, under AEC/NRC License Number SNM-1174, Docket Number 70-1193. The possession limits of special nuclear, byproduct, and source materials authorized for the Mixed Oxide Plant were 360 kg of plutonium in any form (including associated americium), 2 g of Pu-238 as a sealed calibration source, and 700 kg of natural uranium in any form.

Decommissioning of the Mixed Oxide facility began in 1979. All process equipment was removed and decontamination initiated. The decontamination and followup radiological surveys were completed in mid 1989 and a report, describing the activities and the final radiological status of the facility, was provided to the Nuclear Regulatory Commission (NRC). At the request of the NRC, Region III Office, the Environmental Survey and Site Assessment Program of Oak Ridge Associated Universities conducted a survey of the Mixed Oxide Plant to confirm that the facility meets the guidelines established for decommissioning.

FACILITY DESCRIPTION

The plant is located on an approximately 450 hectare site in Logan County, Oklahoma, about 8 kilometers south of the town of Crescent (Figures 1 and 2). The Mixed Oxide Plant occupies an area of approximately 0.8 ha, surrounded by a chain-link security fence. There is one 2400 m^2 building, which consisted of manufacturing, maintenance, office, and laboratory areas. Building construction is of precast concrete exterior roof and wall panels with a poured concrete floor.

There is a basement section in the fuel processing area (north end of building) and a penthouse section, containing HVAC equipment and other utilities and services, above the central portion of the building. The main floor of the facility is basically single story to story-and-a-half with an above-ceiling space for services. Equipment has been removed and surfaces washed, scraped, stripped, chipped, and/or scrabbled. Some inner walls and sections of flooring have been removed. Subfloor drains were also removed and soil excavated, where appropriate.

The below-ground liquid waste collection system has been removed, along with associated piping.

PROCEDURES

Objective

The objective of the survey was to confirm that the decontamination and decommissioning efforts by the licensee were effective in satisfying the established project guidelines and that the supporting documentation developed by Cimarron Corporation provides an accurate and complete description of the radiological status of the site.

Document Review

As part of the confirmatory activities, ORAU reviewed the survey reports and other supporting documentation prepared by Cimarron Corporation for the Mixed Oxide Plant.[1] Data and survey results presented in these reports were compared to the established release guidelines.

Survey Procedures

During the periods of August 25-31, 1988, and October 12-31, 1989, the Environmental Survey and Site Assessment Program (ESSAP) of ORAU conducted an independent radiological survey of the site. The survey was performed in accordance with a plan, developed by ORAU and submitted to the NRC for NMSS and Region III approval.

Background Measurement

Six background locations (Figure 3) were selected in the vicinity of the plant during the visit in August 1988. Exposure rate measurements one meter above the ground were taken at each location with a pressurized ionization chamber (PIC). Surface soil samples were taken at each of the six sites and analyzed for uranium-235 and -238, plutonium-238 and -239/240, and americium-241.

Gridding

The existing ten-meter exterior reference grid was extended to include areas outside and adjoining the fence. A one-meter grid was installed on the floors and lower walls inside the building. The exterior grid is shown on Figure 4; interior grids are indicated on Figures 5 to 56.

Surface Scans

Building surfaces were scanned using gas proportional and ZnS scintillation alpha detectors and thin NaI(T1) (low-energy) gamma scintillation detectors. Floors and lower walls received 100% scans; upper walls, ceilings, and other overhead surfaces were randomly scanned with efforts concentrated at locations of highest contamination potential and suspect surfaces, as determined as the survey progressed. Scans of outside soil areas were performed using gamma scintillation detectors; outside paved areas and exterior building surfaces at exits were scanned with alpha scintillation detectors. Locations of elevated activity levels were noted for further investigation.

Exposure Rate Measurements

Ten exposure-rate measurements were made inside the facility with a pressurized ionization chamber (PIC). Exterior exposure-rate measurements were made at each location where a soil sample was taken using a NaI(T1) detector, which had been cross-calibrated with a PIC.

Measurement of Surface Activity

Measurements of activity on interior building surfaces were performed in randomly selected grid blocks on the floors and lower walls. Measurements for total alpha and beta-gamma activity were performed systematically at the center and four points midway between the center and corners of the block. Smears for removable activity were performed at the location in each grid block where the highest direct reading was obtained. Single-point measurements for total and removable alpha and beta-gamma activity were performed on upper walls, ceilings and other overhead surfaces, equipment and at locations identified by surface scans. Surface activity was also measured at 71 locations on exterior surfaces (Figures 57 to 59). Where surface activity levels exceeded 100 dpm/100 cm^2 on single-point measurements the area surrounding the measurement was scanned to determine the contamination level when averaged over 1 m^2.

Measurement of Radionuclide Activity in Soil

Seventy-three surface soil samples were systematically collected at the intersection of the exterior grid lines. Three soil samples were also taken at locations of elevated gamma activity identified by scans (Figure 60). Fifteen shallow (to about 1.5 m) boreholes were drilled (Figure 61) and 62 samples were collected from these boreholes. Soil samples were collected at outfalls of surface drainage systems (Figure 62).

Miscellaneous Samples

Thirty-seven soil samples were taken from sub-floor excavations within the building and from drums of excavated soil stored within the building. Forty samples of paint from walls, thirteen samples of concrete from exterior walls and sidewalks, scrapings of surface material from several exterior surfaces, and three samples of roof gravel were also collected.

Sample Analysis and Interpretation

Smears were analyzed for gross alpha and gross beta activity. Paint and concrete samples were analyzed by alpha spectroscopy to determine the concentrations of uranium and plutonium isotopes. Soil and sediment samples (interior and exterior) were analyzed by gamma spectroscopy for uranium and americium-241. The latter was used as an indicator for further investigation, because it is frequently associated with plutonium. Soil samples were also composited, by room (interior) or area (exterior), and analyzed for plutonium. Exterior surface scrapings were analyzed by alpha spectroscopy. Gravel samples from the roof of the building were analyzed for uranium and plutonium isotopes. Additional information concerning major instrumentation, sampling equipment, and analytical procedures is provided in Appendices A and B. Results of the independent measurement were compared to the NRC guidelines (Appendix C).

FINDINGS AND RESULTS

Document Review

The documentation developed by the licensee was thorough and adequately described in the post decontamination status of the facility. Radiological data demonstrated that the residual activity levels satisfied the established decommissioning guidelines.

Independent Survey

Background and Baseline Levels

Background exposure rates and baseline soil concentrations from the vicinity of the Mixed Oxide facility are presented in Table 1. Exposure rates ranged from 9 μR/h to 10 μR/h, at 1 m from the surface. Radionuclide concentration ranges were: U-235, <0.1 to <0.2 pCi/g; U-238, <0.3 to 0.9 pCi/g; Pu-238, <0.1 pCi/g; Pu-239/240, <0.1 pCi/g; and Am-241, <0.1 pCi/g. These levels are typical of radiation rates and radioactivity concentrations normally occurring in the environment.

Building Interior Survey

Surface scans of building interior surfaces identified areas of residual activity exceeded guideline levels in 24 rooms. With exception of a wall common to Rooms 110, 123,and 124, these areas were small and isolated and the licensee conducted additional decontamination without significant effort. The wall required more extensive attention and the residual contamination was eliminated by complete demolition of the wall. Table 2 lists these locations of elevated activity levels and the initial and followup measurement results. In each case the further remediation was effective in reducing the levels to within the guideline values.

Final activity measurements on surfaces are summarized in Table 3. Total alpha activity measurements ranged from <13 to 230 dpm/100 cm^2; average 1 m^2 grid block alpha activity ranged from 13 to 70 dpm/100 cm^2. Beta-gamma activity levels were not measured at most locations because the nature of the anticipated contaminants was such that the alpha activity would be the controlling factor and gamma scans did not identify elevated gamma radiation levels. For those locations which were measured, the highest beta-gamma activity level was 880 dpm/100 cm^2 with 212 dpm/100 cm^2 removable. (The Loading Dock area was considered an exterior surface and is discussed later).

Exposure rates within the facility ranged from 7.5 to 11.6 μR/h; these levels are in good agreement with the range of background gamma exposure rates (9 to 10 μR/h).

Activity levels in interior paint and concrete samples are presented in Table 4. Ranges of activity were: U-234, 1.3 to 44.4 pCi; U-235, 0.1 to 3.5 pCi; U-238, <.6 to 20.0 pCi; Pu-238, <0.1 to 2.9 pCi; and Pu-239/240, <0.1 to 12.7 pCi. Maximum levels of total uranium and plutonium in these samples are 63.8 pCi and 13.6 pCi, respectively.

Radionuclide concentrations in soil samples from subfloor excavations are summarized in Table 5. U-235 concentrations ranged from 0.1 to <0.5 pCi/g, U-238 from <0.1 to 1.6 pCi/g, and Am-241 from <0.1 to 10.0 pCi/g. Plutonium 239/240 levels in individual or composited samples ranged

from 0.006 to 2.04 pCi/g. Samples from barrels of soil in Room 124 contained U-235 levels of 0.1 pCi/g, U-238 from 0.4 to 0.7 pCi/g, and Am-241 from <0.1 to 231 pCi/g (Table 6). The sample with a positive level of Am-241 was also analyzed for plutonium and found to contain 50.3 pCi/g of Pu-238 and 458.9 pCi/g of Pu-239/240.

Exterior Survey

Gamma scans of the exterior property identified two isolated locations of elevated contact gamma radiation. These locations, shown on Figure 60, were inside the excavation made for the purpose of removing piping to the liquid collection tank system. Results of gamma measurements and soil sampling are presented in Table 7. The licensee performed further remediation and the followup sampling indicated residual plutonium-238 and plutonium-239/240 activities of 10.4 pCi/g and 99.3 pCi/g, respectively.

Radionuclide concentrations in soil samples from grid intersections and random borehole locations are presented in Table 8. Ranges of concentrations were: U-235, 0.1 to 1.5 pCi/g; U-238, 0.2 to 7.7 pCi/g; Pu-238, 0.005 to 0.02 pCi/g (composite); and Pu-239/240, 0.005 to 0.09 pCi/g (composite).

Table 9 summarizes the results of measurements and sampling at surface drainage outfalls. Total alpha and beta-gamma surface activity levels ranged to 60 dpm/100 cm^2 and 1900 dpm/100 cm^2, respectively; removable alpha and beta activity was a maximum of 3 dpm/100 cm^2 and 8 dpm/100 cm^2, respectively. Gamma radiation was 8 to 10 μR/h. Samples from the outfall contained U-235 levels from 0.1 to 0.8 pCi/g, U-238 from 1.4 to 5.0 pCi/g, Am-241 from <0.2 to <0.3 pCi/g, Pu-238 from 0.01 to 0.06 pCi/g, and Pu-239/240 from 0.01 to 0.7 pCi/g.

Direct measurements on the building exterior and other outside surfaces identified areas of elevated total alpha and beta activity. One of these areas was on the Loading Dock; this area was remediated and final measurement (see Table 3) indicated total alpha and beta-gamma levels of 220 dpm/100 cm^2 and 1100 dpm/100 cm^2, respectively. Table 10 presents the results of direct

measurements at other outside locations. Alpha activity ranged to 6500 dpm/100 cm^2; beta-gamma activity ranged to 3500 dpm/100 cm^2. Maximum removable levels were 58 dpm/100 cm^2 alpha and 15 dpm/100 cm^2 beta. Because the activity was suspected to be windblown uranium from the adjacent Uranium Plant, several samples of surfaces with elevated direct measurements were analyzed for uranium and plutonium content. The results, presented in Table 11, confirm that the activity is predominantly uranium.

Measurements inside the sanitary drain system are presented in Table 12. Maximum total alpha and beta-gamma activity levels were 30 dpm/100 cm^2 and 560 dpm/100 cm^2, respectively. Removable activity ranged to 7 dpm/100 cm^2 alpha and 78 dpm/100 cm^2 beta. No elevated gamma levels were noted.

Exposure rates at 1 m above the surface throughout the Mixed Oxide Facility property ranged from 7 to 11 μR/h.

COMPARISON OF SURVEY RESULTS WITH GUIDELINES

Appendix C presents the general NRC surface contamination guidelines for release of formerly licensed facilities for unrestricted use. Plutonium has been identified as the major potential contaminant on building interior surfaces, the guidelines applicable to plutonium are:

100 alpha dpm/100 cm^2, averaged over 1 m^2 area
300 alpha dpm/100 cm^2, maximum in a 100 cm^2 area
200 alpha dpm/100 cm^2, removable

All individual final measurement were below the 300 dpm/100 cm^2 maximum level and there was no removable activity in excess of 20 dpm/100 cm^2. Several single measurements were noted to have activity levels between 100 and 300 dpm/100 cm^2; however, the surface areas of these locations were small and averaging throughout the contiguous 1 m^2 results in activity levels below the 100 dpm/100 cm^2 guideline.

Contamination levels on some exterior surfaces exceeded the plutonium guideline levels. Further analyses indicated that the contaminant was predominantly uranium - likely windblown from the adjacent Uranium Plant. The NRC guidelines for uranium are:

5,000 dpm/100 cm^2, averaged over 1 m^2 area

15,000 dpm/100 cm^2, maximum in a 100 cm^2 area

1,000 dpm/100 cm^2, removable

Activity levels on exterior surfaces satisfied these guidelines.

Exposure rates throughout the site were typically in the range of background levels. The highest exposure rate measured at 1 m above the surface was 13 μR/h, which is 3 μR/h above the range (9 to 10 μR/h) in background rates. Exposure rates are therefore well within the guideline value of 10 μR/h above background (see Appendix C).

Residual soil activity guidelines for this site are:

Total uranium	30 pCi/g
Total plutonium	25 pCi/g
Total Americium-241	30 pCi/g

One drum of excavated soil (#124-5) contained total plutonium and Am-241 concentrations in excess of these guideline values; however, samples of residual subfloor soil were well below the guideline levels. Outside the building, one sample from the piping excavation contained residual total plutonium activity of approximately 110 pCi/g. A nearby sample from that same excavation and samples from 10 m grid intersections and random boreholes were well within the guideline plutonium value, thus averaging would result in meeting the guideline. Assuming an activity ratio for U-234/U-235 of 21 (typical for low enrichment uranium) a U-235 concentration above 1.36 pCi/g would indicate that the total uranium exceeds the 30 pCi/g guideline. Samples from grid locations 20E, 212N (2) and 30E, 220N (1) contained U-235 concentrations above 1.0 pCi/g (1.5 pCi/g and 1.3 pCi/g, respectively). Using the activity ratio of 21, the total uranium (U-234,

U-235, and U-238) in samples from these locations is estimated as:

20E, 212N (surface)	37.3 pCi/g
(30-45 cm)	37.6 pCi/g
30E, 220N	36.3 pCi/g

Although these levels are slightly above the guideline value, other samples from the adjacent areas contain much lower concentrations, and the average levels are therefore expected to be well within the guideline.

SUMMARY

At the request of the U.S. Nuclear Regulatory Commission, Region III, Environmental Survey and Site Assessment Program of Oak Ridge Associated Universities conducted an independent radiological survey of the Mixed Oxide Facility at the Cimarron Corporation Plant. The survey included surface alpha, beta-gamma, and gamma scans, measurement of direct and removable contamination levels, exposure rate measurements, and determination of radionuclide concentrations in soil, concrete, and paint samples.

Initial measurements identified several areas of residual surface activity exceeding guideline levels. These areas were addressed by the licensee, and resurveys indicated that the additional cleanup was effective in meeting the established limits. Based on the results of the confirmatory survey it is ORAU's opinion that the decontamination efforts have been successful in satisfying the guideline levels and that the licensee's documentation adequately and accurately describes the final radiological status of the site.

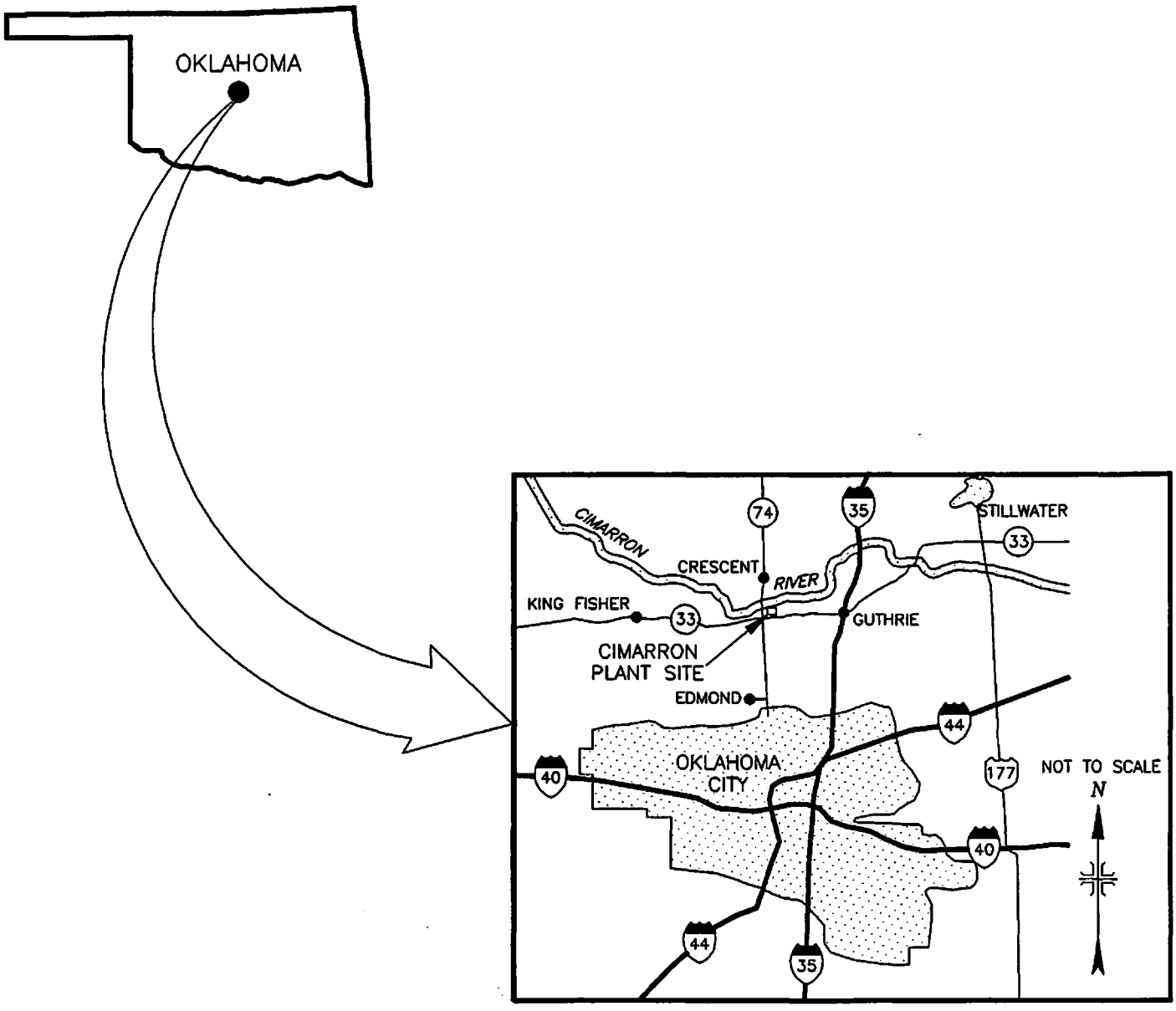

FIGURE 1: Map Indicating Location of the Cimarron Corporation Mixed Oxide Plant

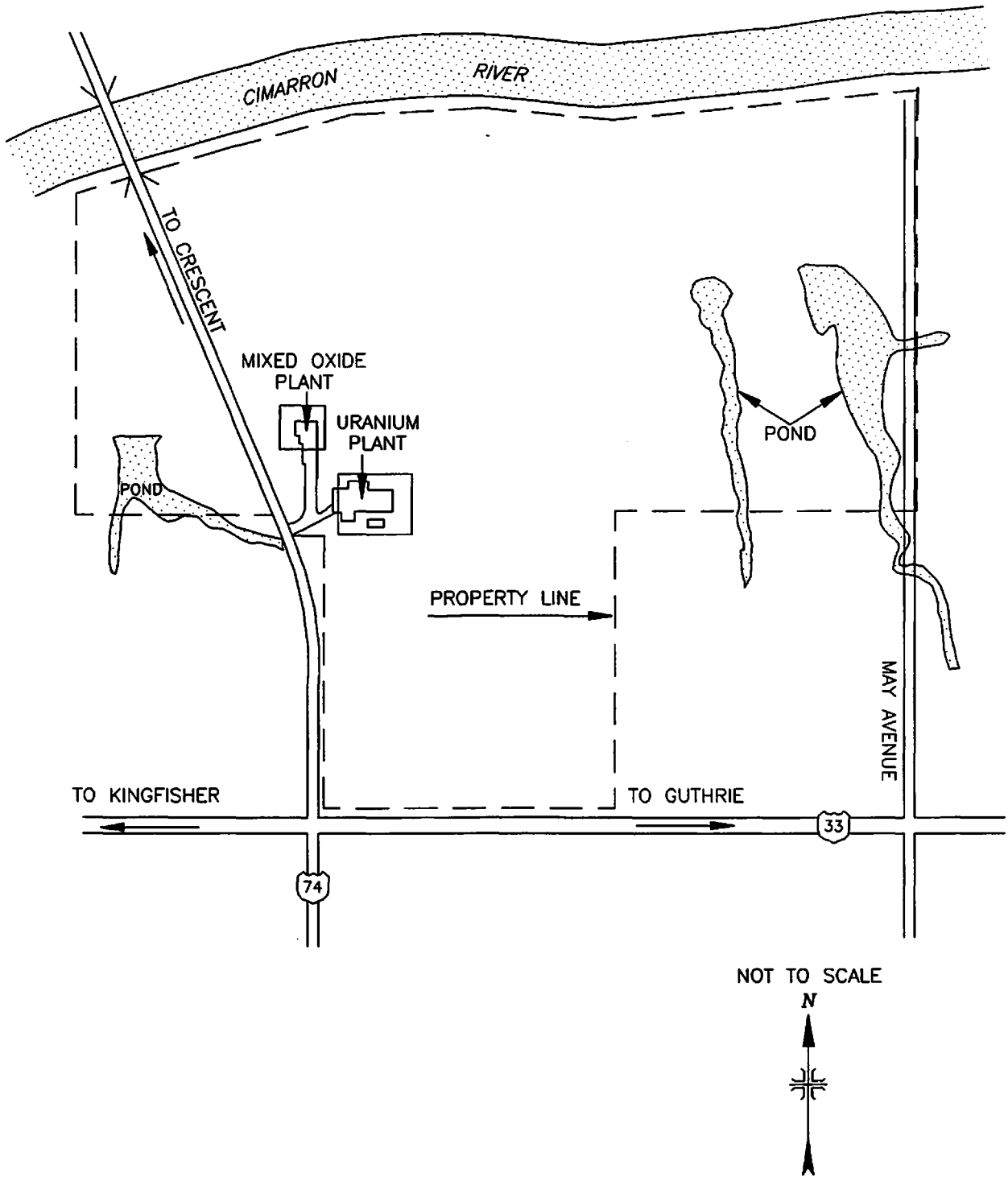

FIGURE 2: Plot Plan of the
Cimarron Corporation Plant Site

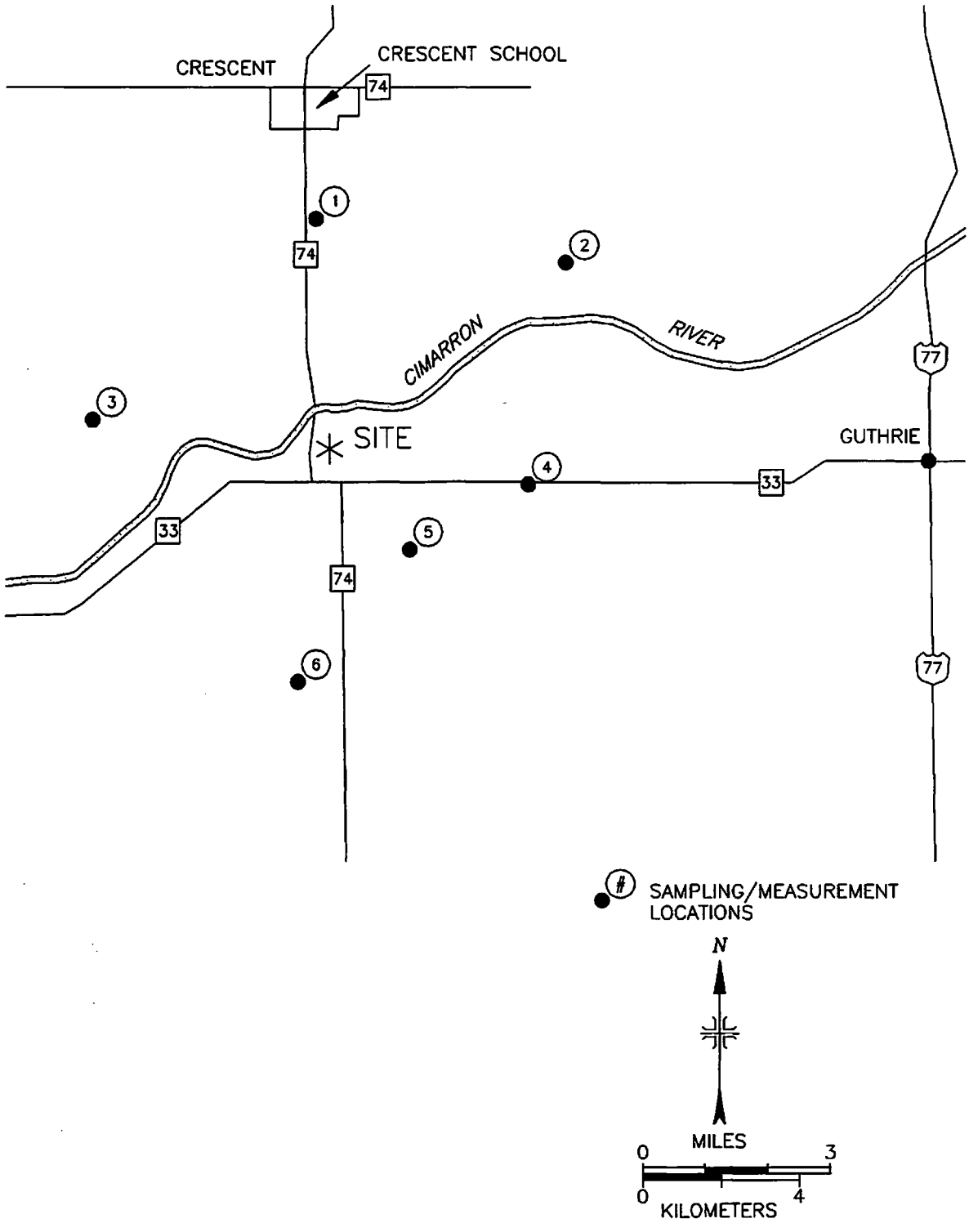

FIGURE 3: Locations of Background Radiation Measurements and Baseline Samples

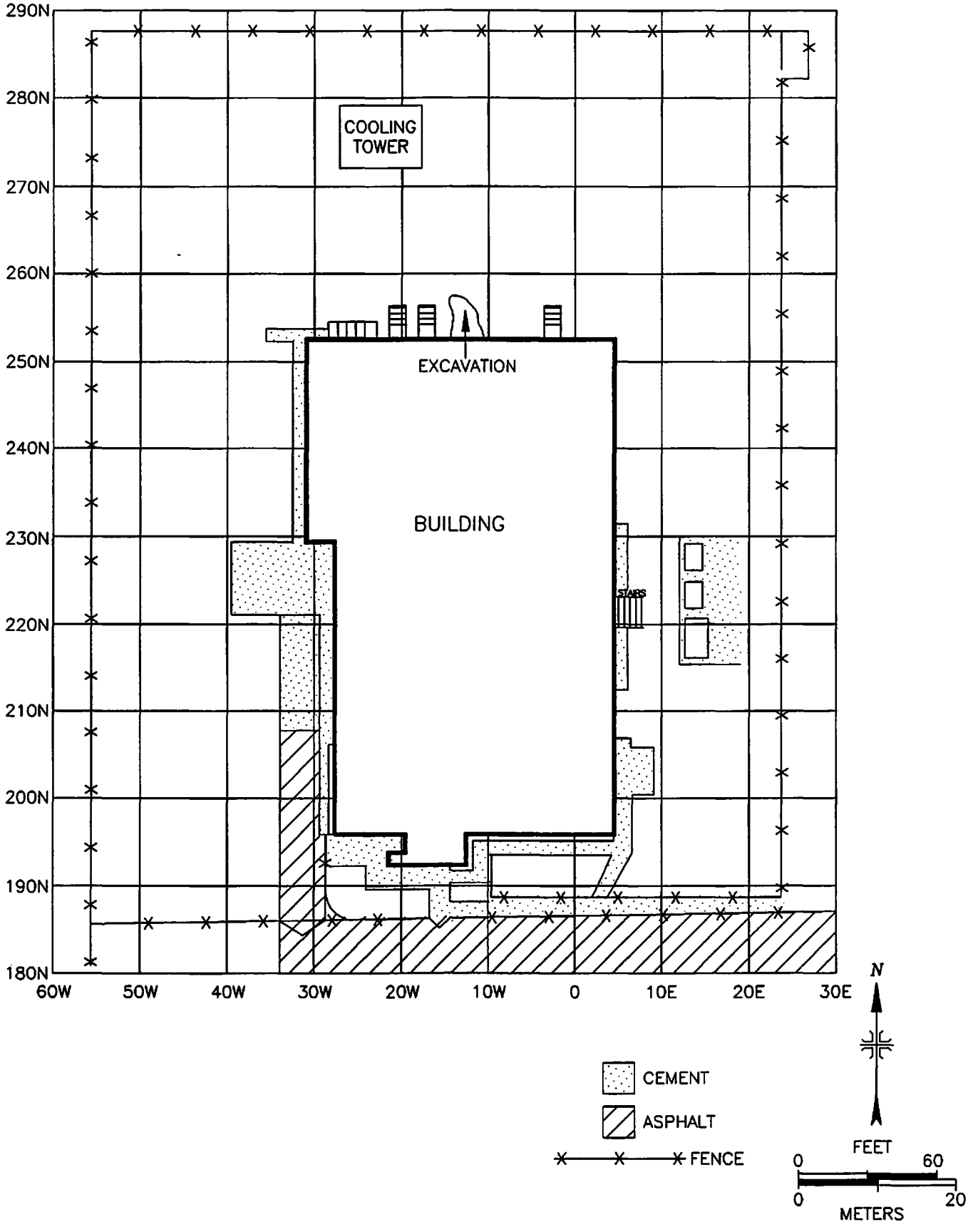

FIGURE 4: Mixed Oxide Plant Indicating Grid System for Reference of Exterior Measurements and Sampling

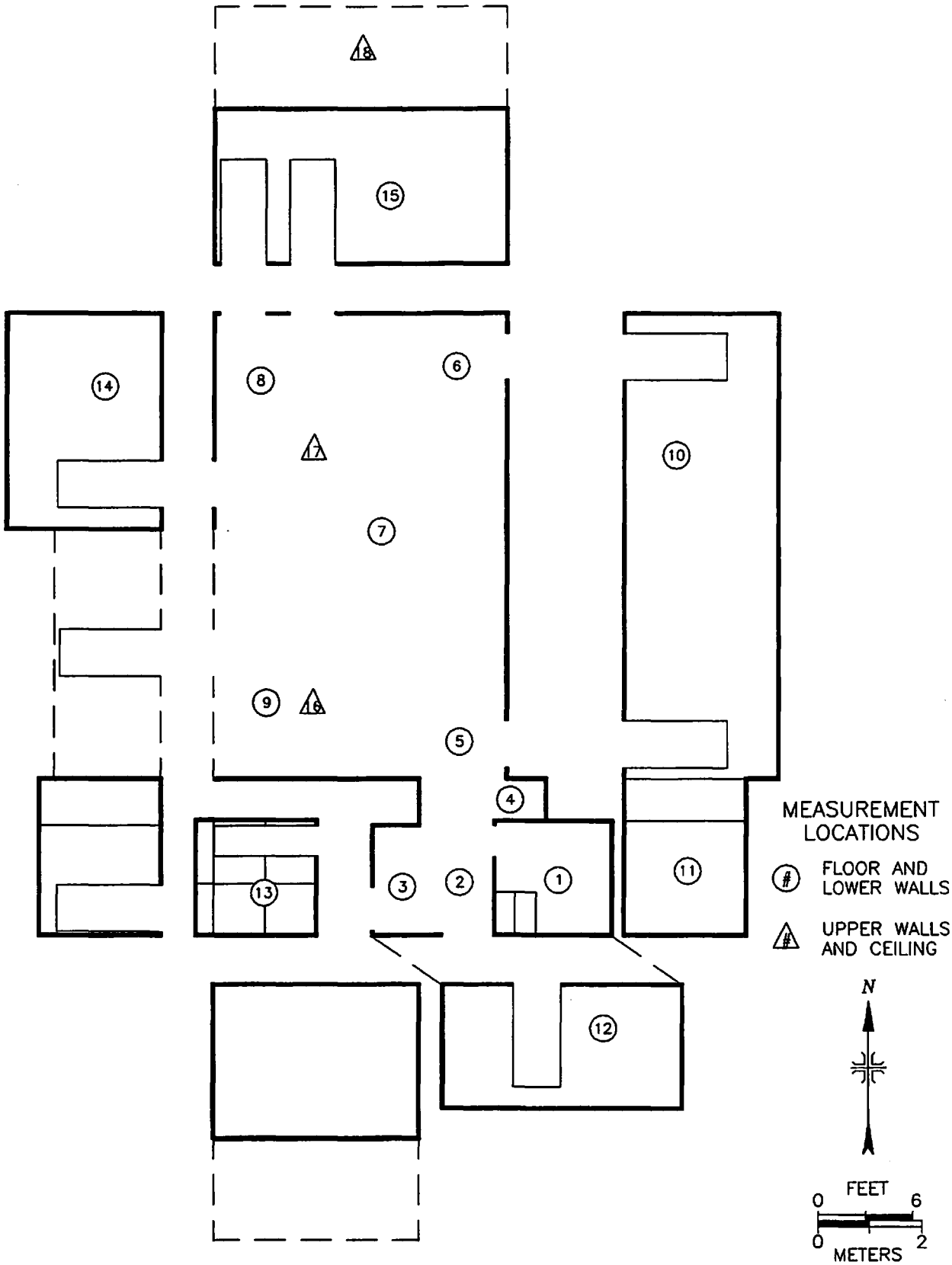

FIGURE 5: Room 100 and Vestibule Floor Plan Showing Measurement Locations

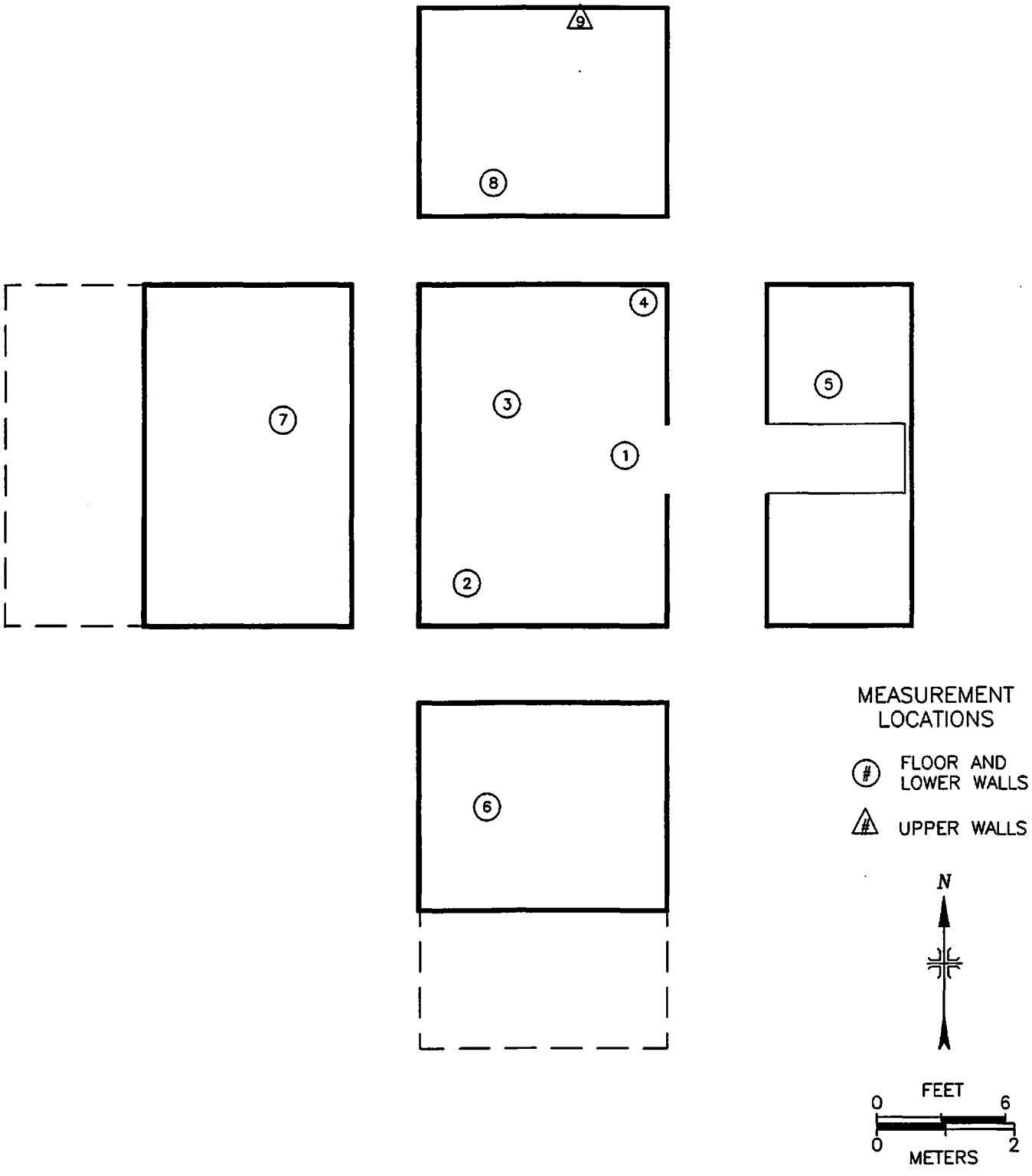

FIGURE 6: Room 101 Floor Plan Showing Measurement Locations

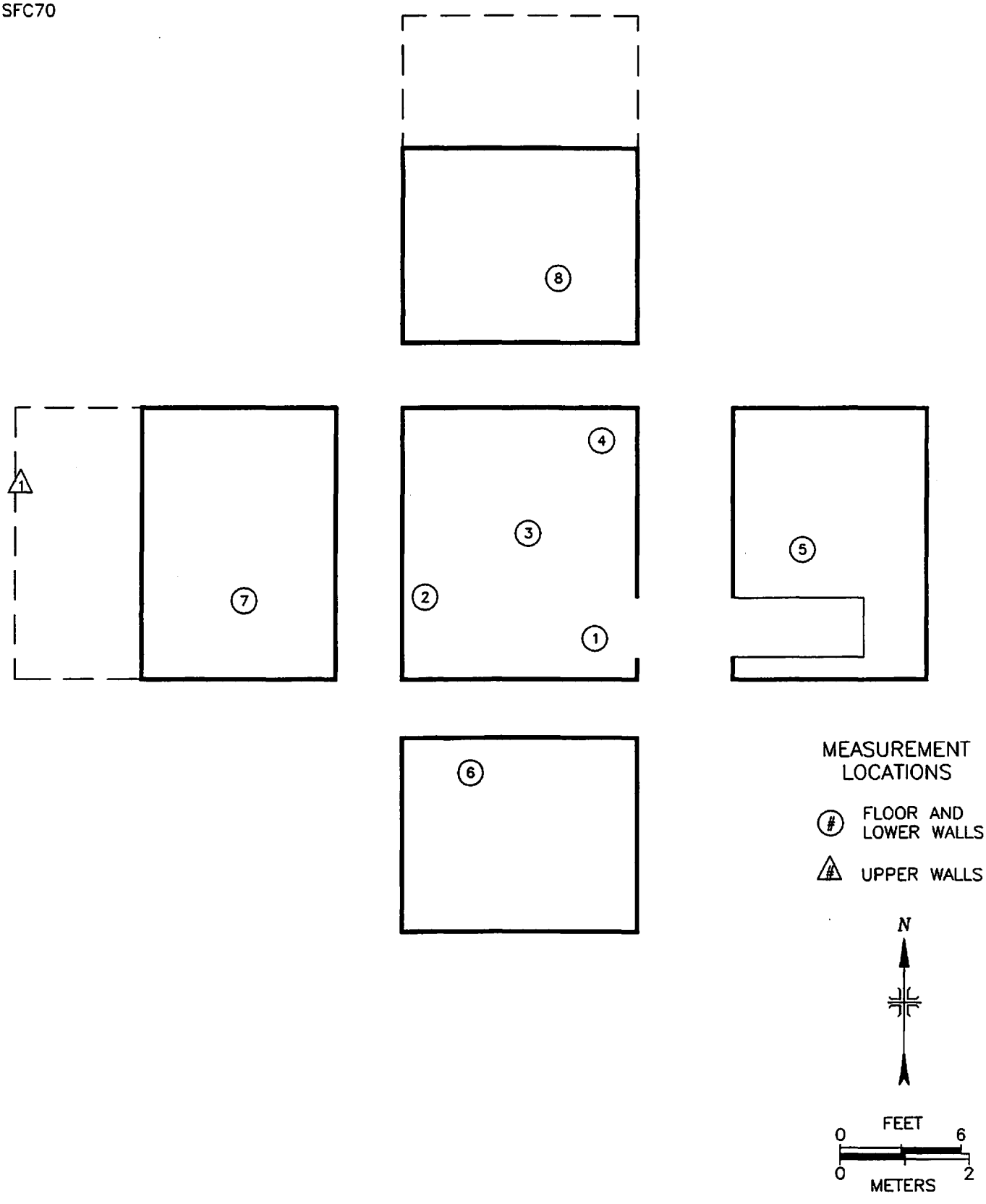

FIGURE 7: Room 102 Floor Plan Showing Measurement Locations

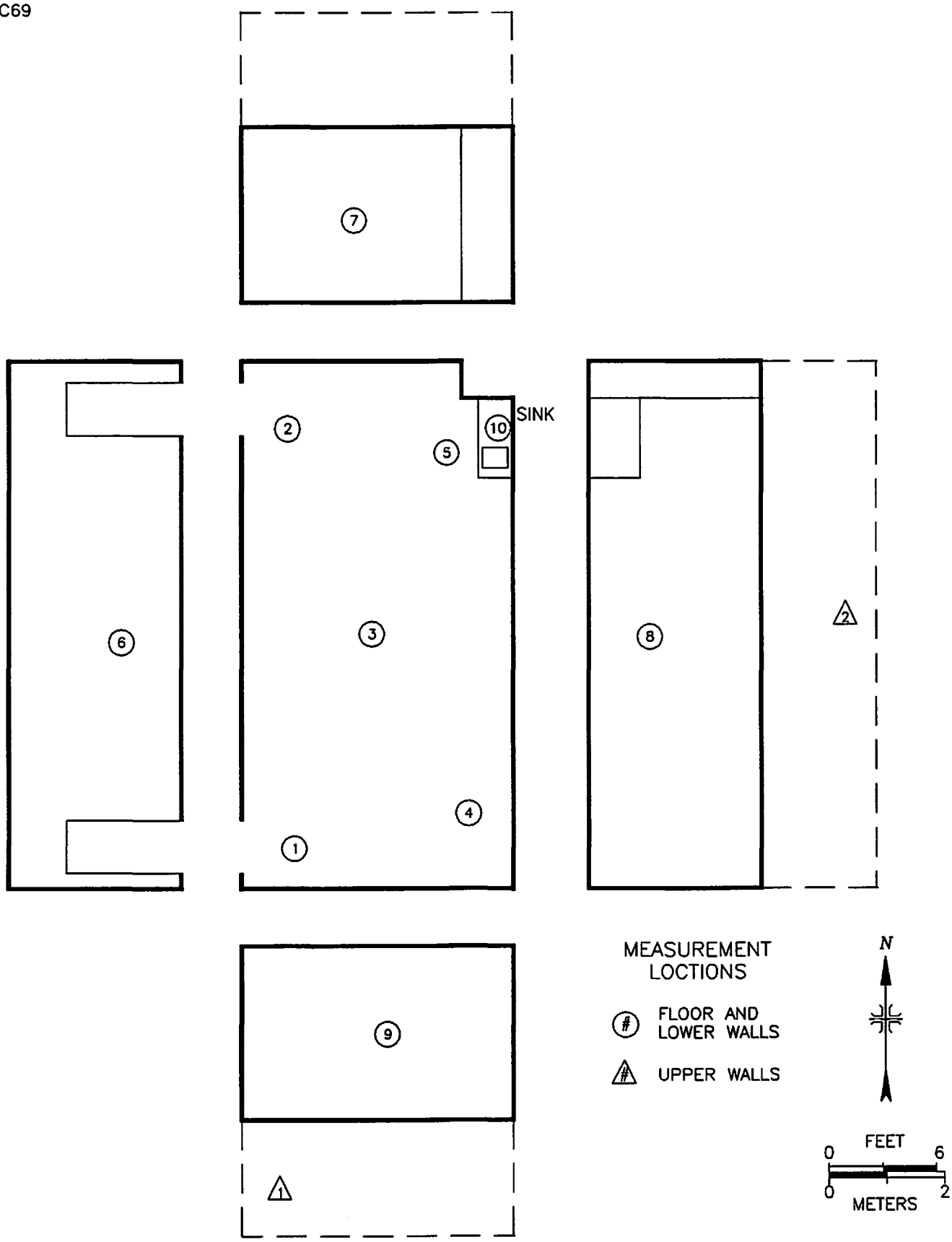

FIGURE 8: Room 103 Floor Plan Showing Measurement Locations

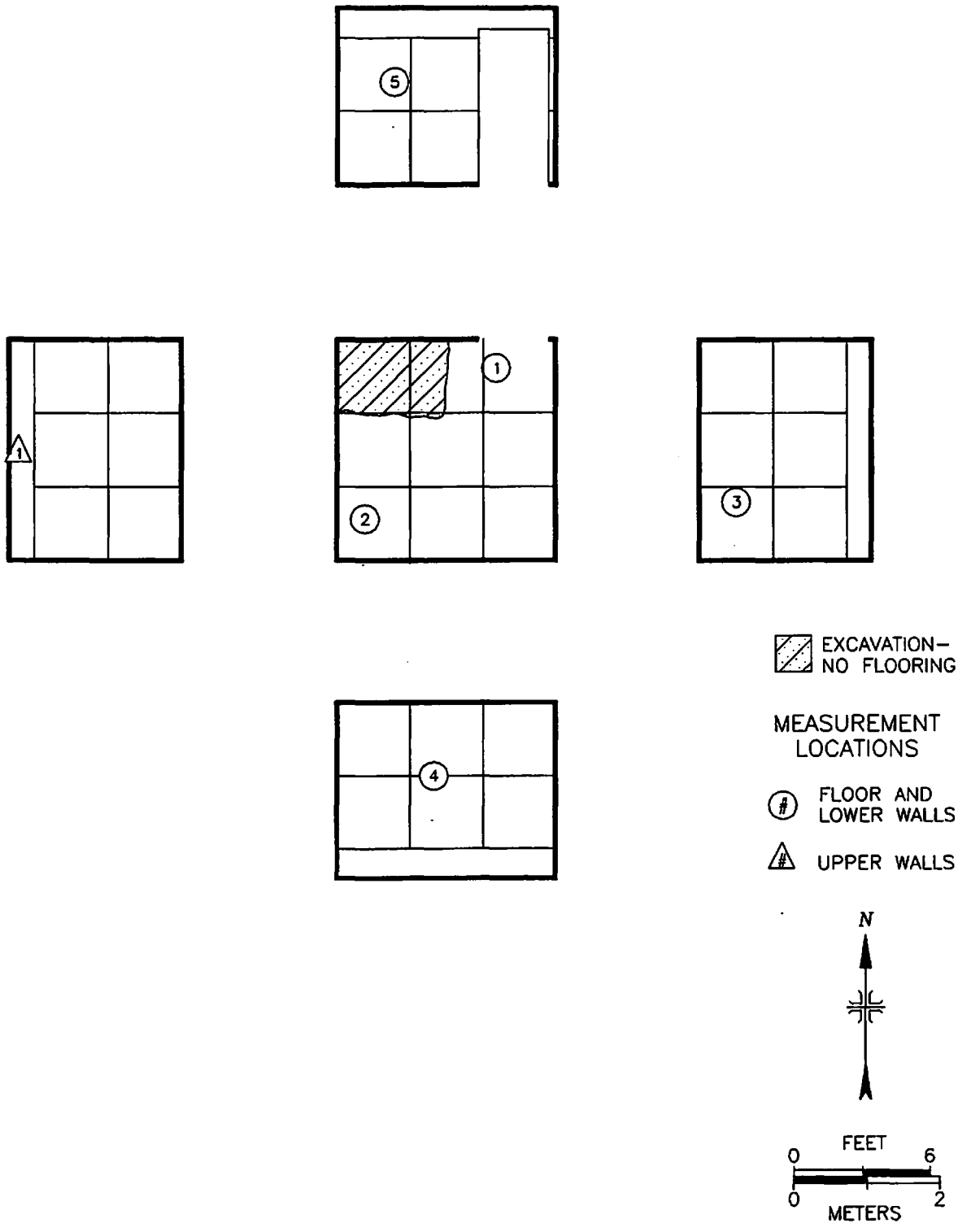

FIGURE 9: Room 106 (Laundry Room) Floor Plan Showing Measurement Locations

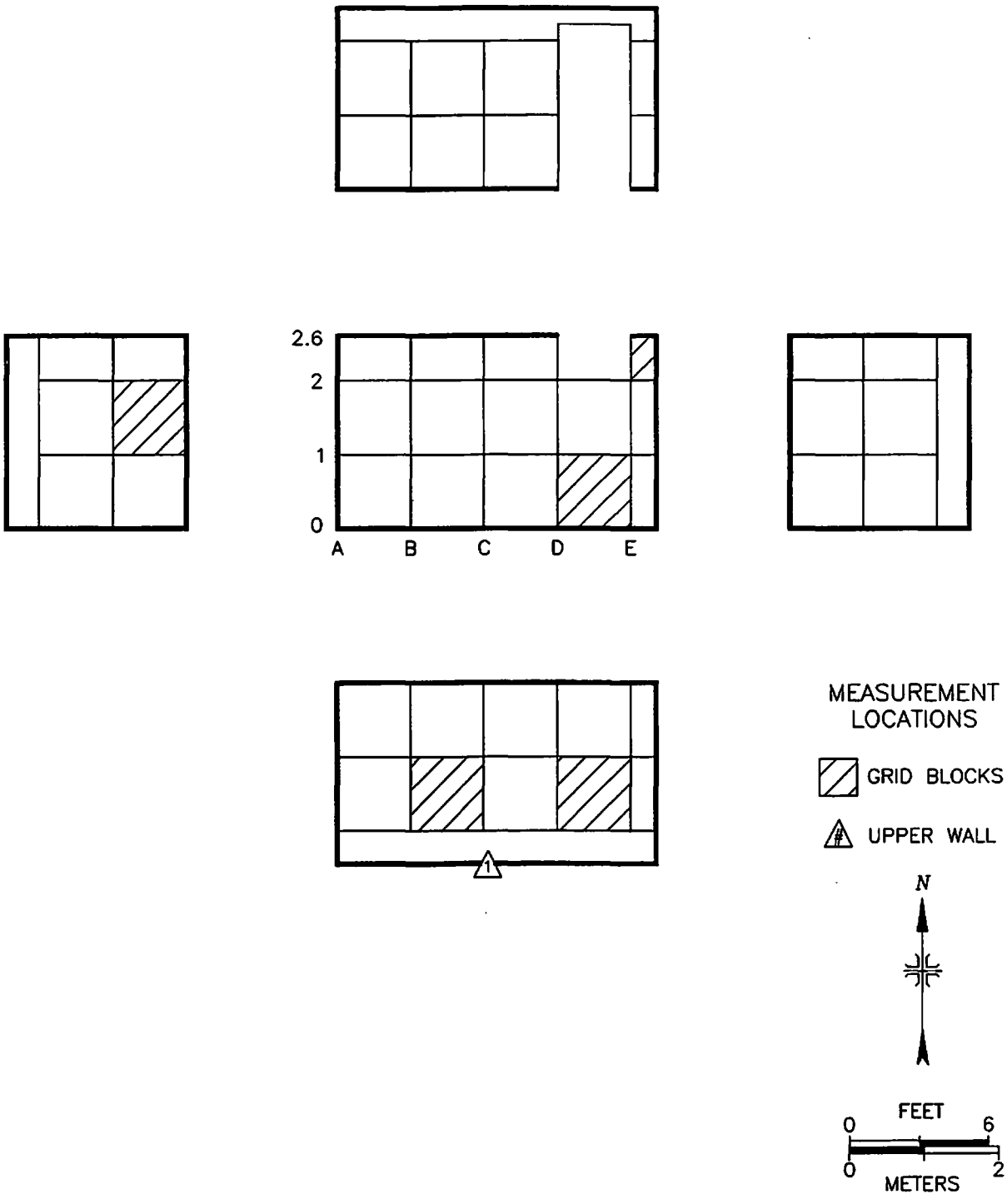

FIGURE 10: Room 108 (Instrument Room) Showing Measurement Locations

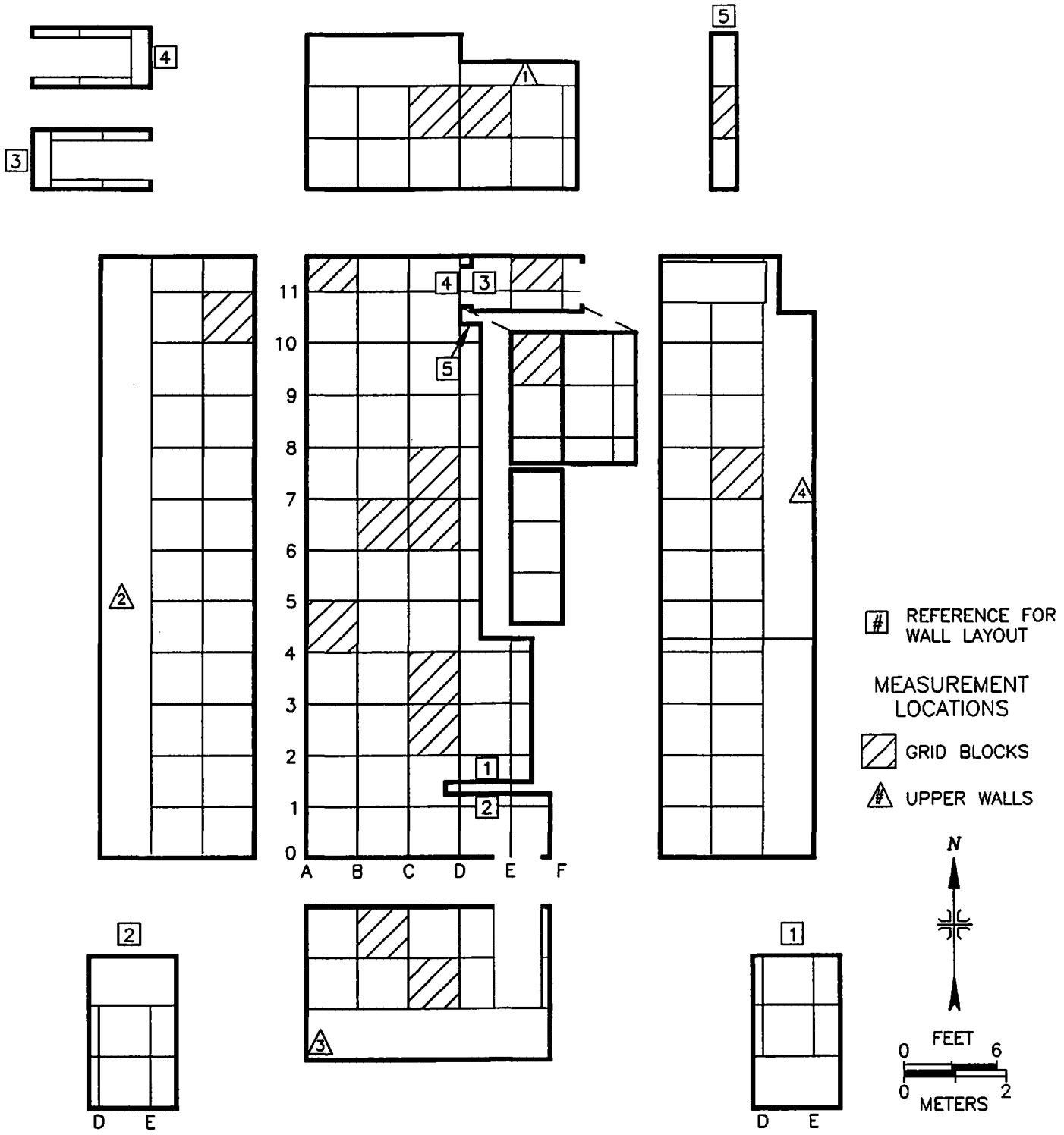

FIGURE 11: Rooms 104 and 107 Floor Plan Showing Measurement Locations

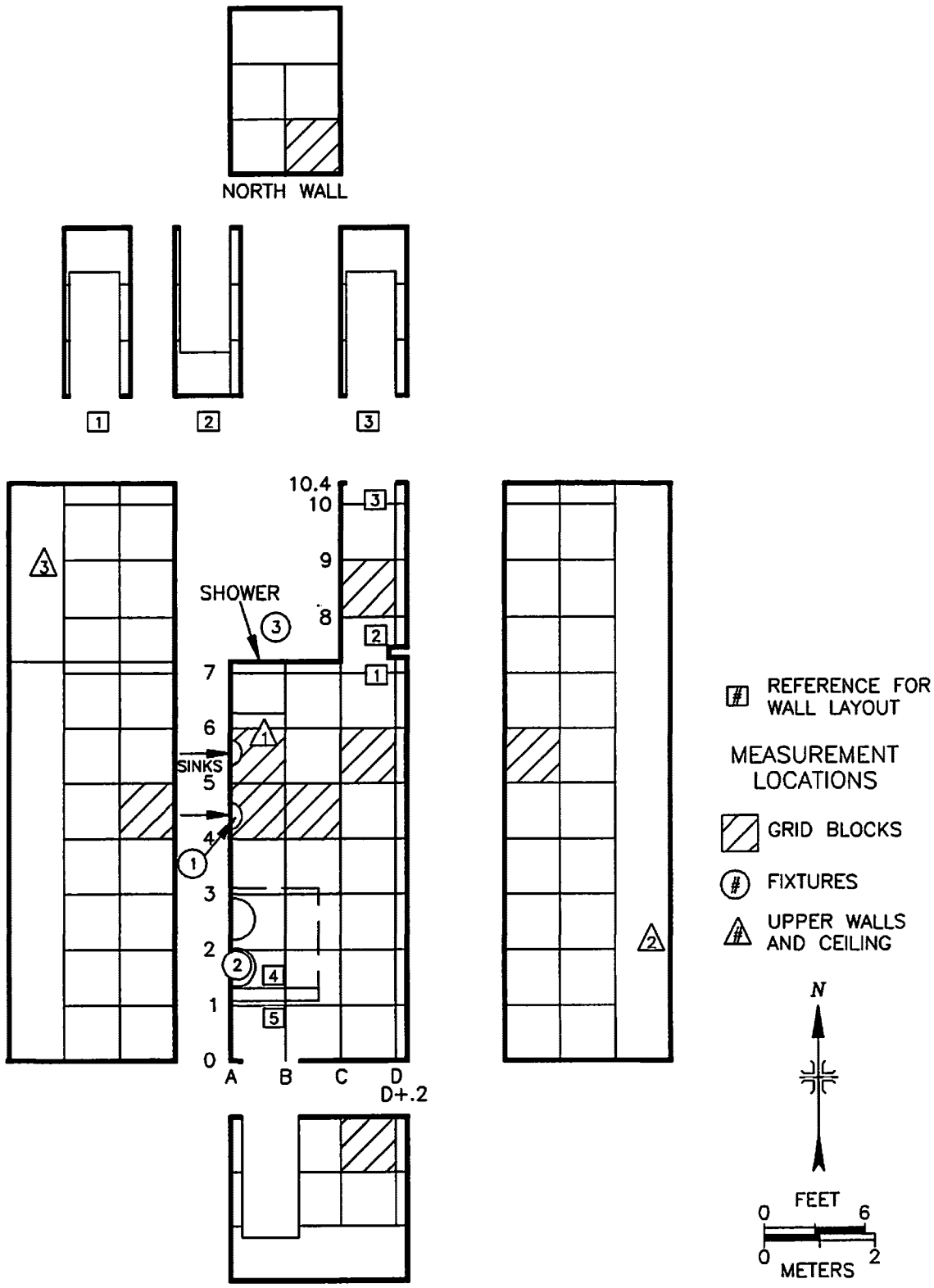

FIGURE 12: Room 105 (Women's Room) and Room 111 (Airlock) Floor Plan Showing Measurement Locations

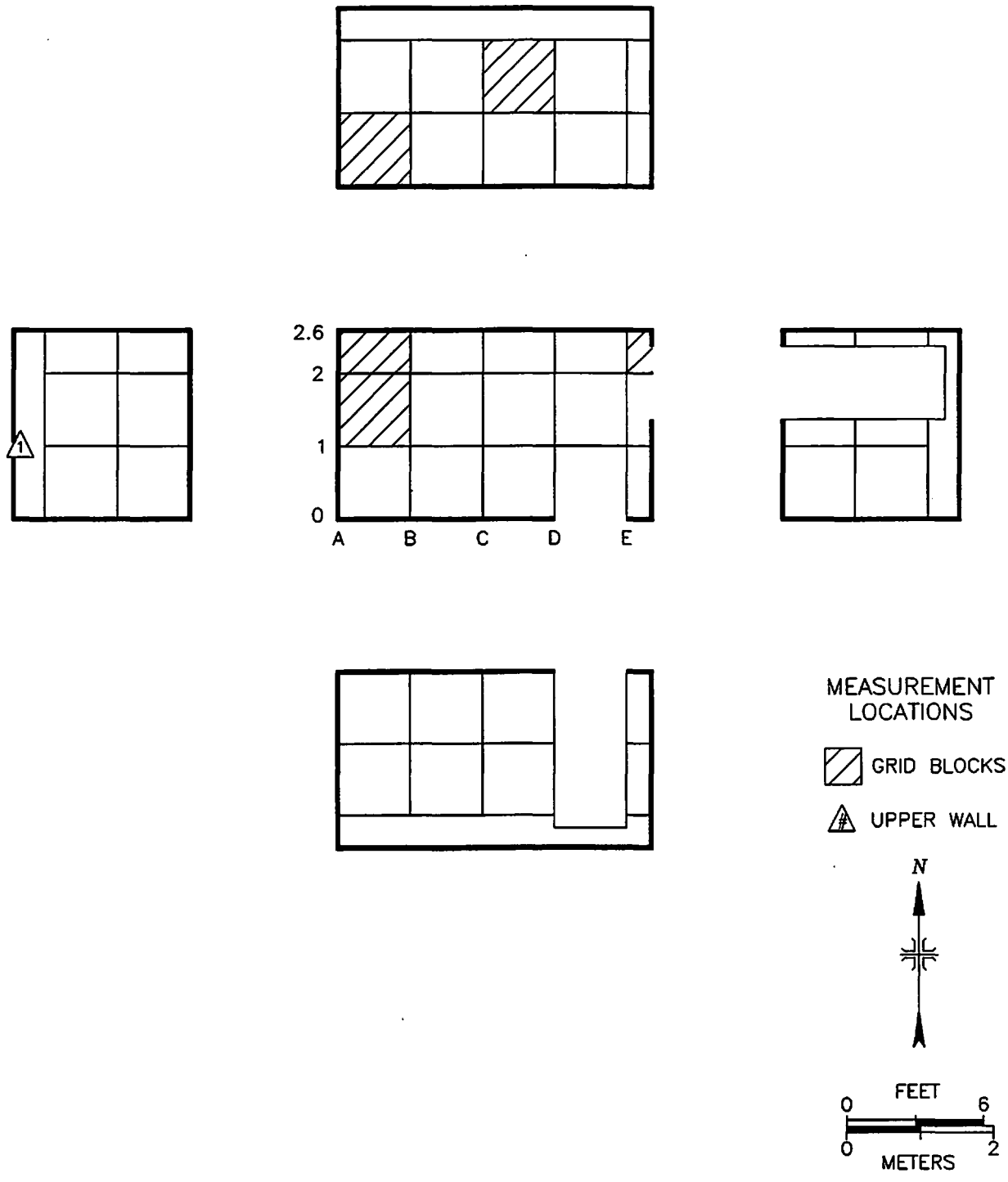

FIGURE 13: Room 109 (Health Physics) Floor Plan Showing Measurement Locations

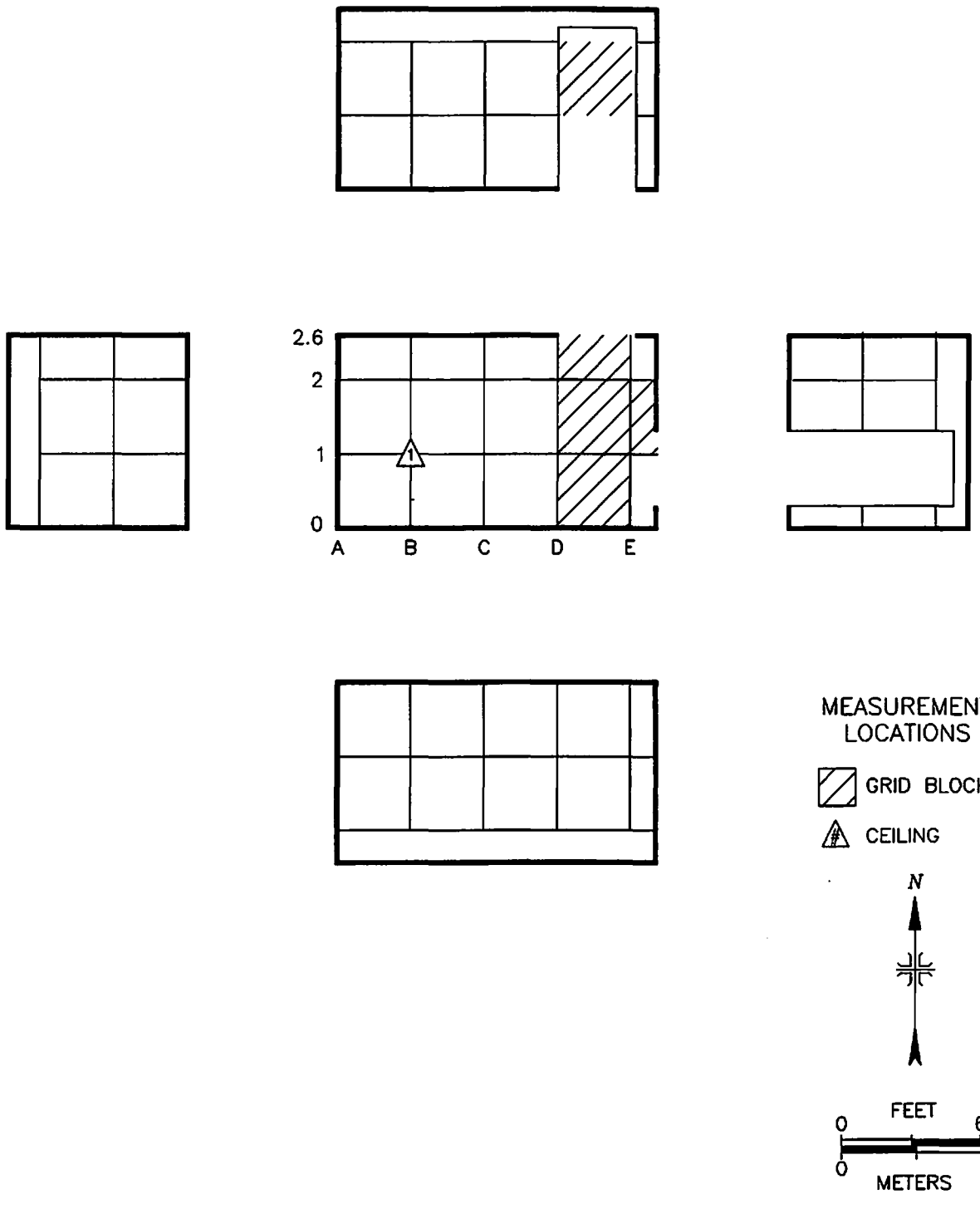

FIGURE 14: Room 110 Floor Plan Showing Measurement Locations

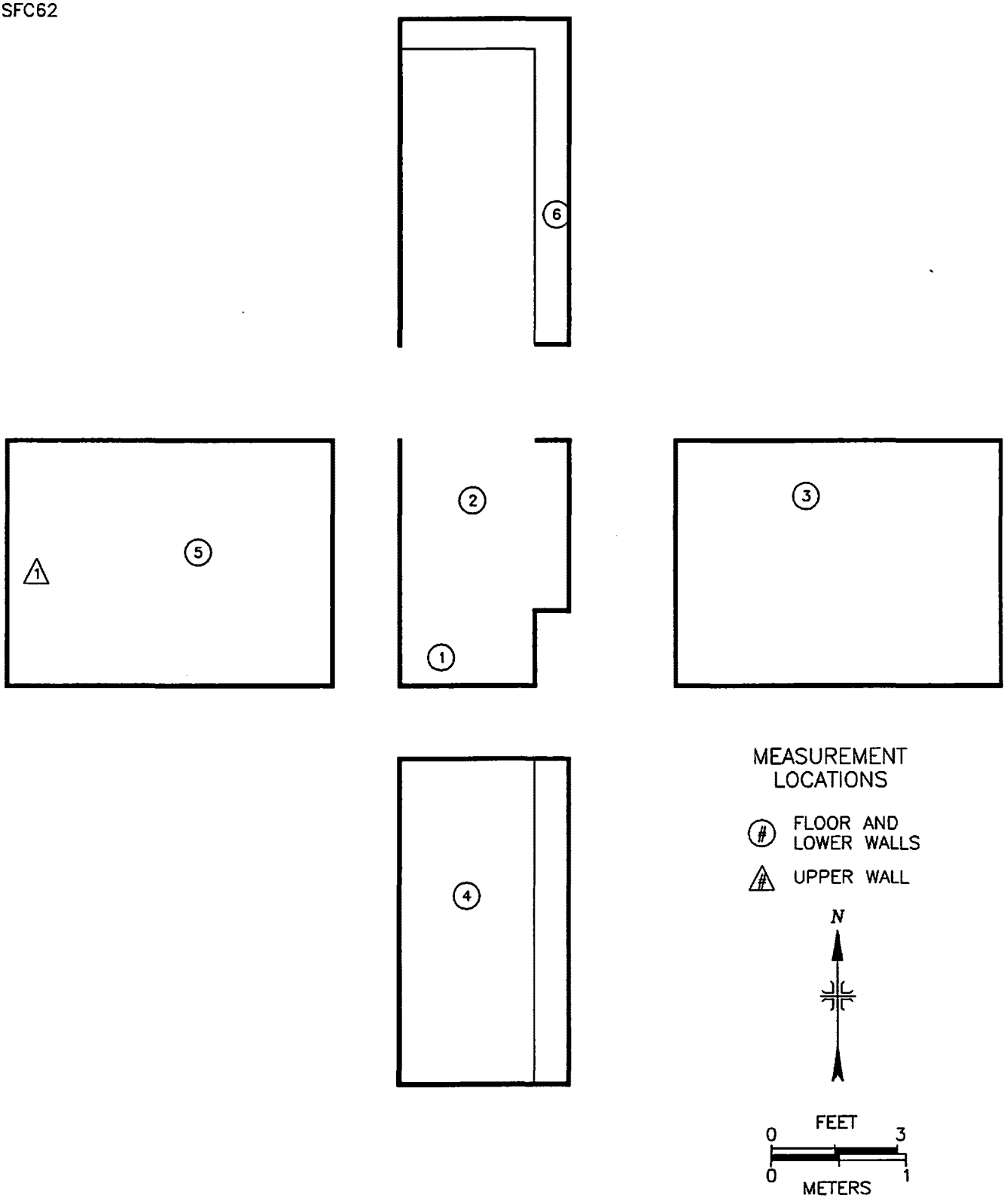

FIGURE 15: Room 112 Floor Plan Showing Measurement Locations

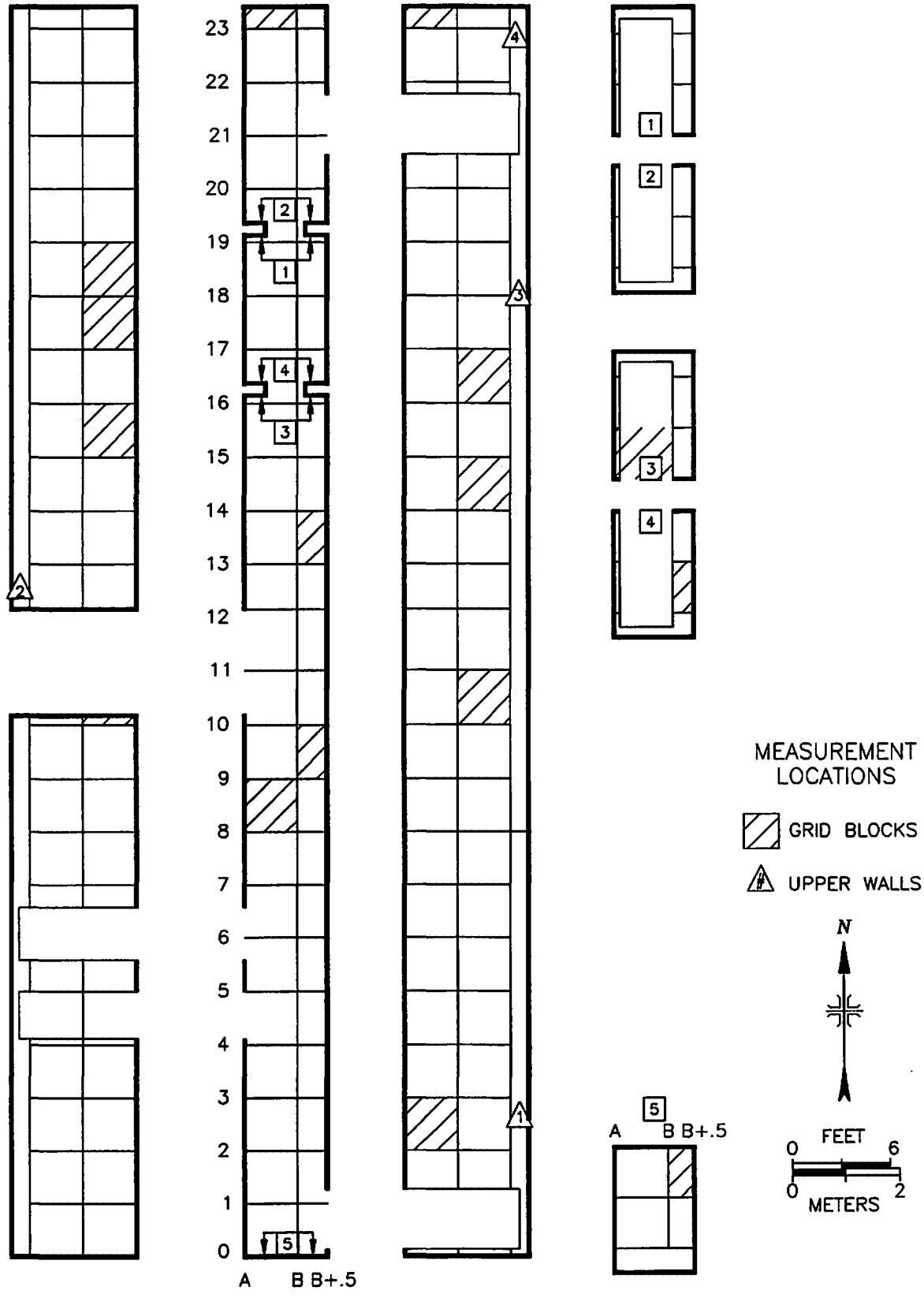

FIGURE 16: Rooms 113/115 (North/South Corridor and Airlock) Floor Plan Showing Measurement Locations

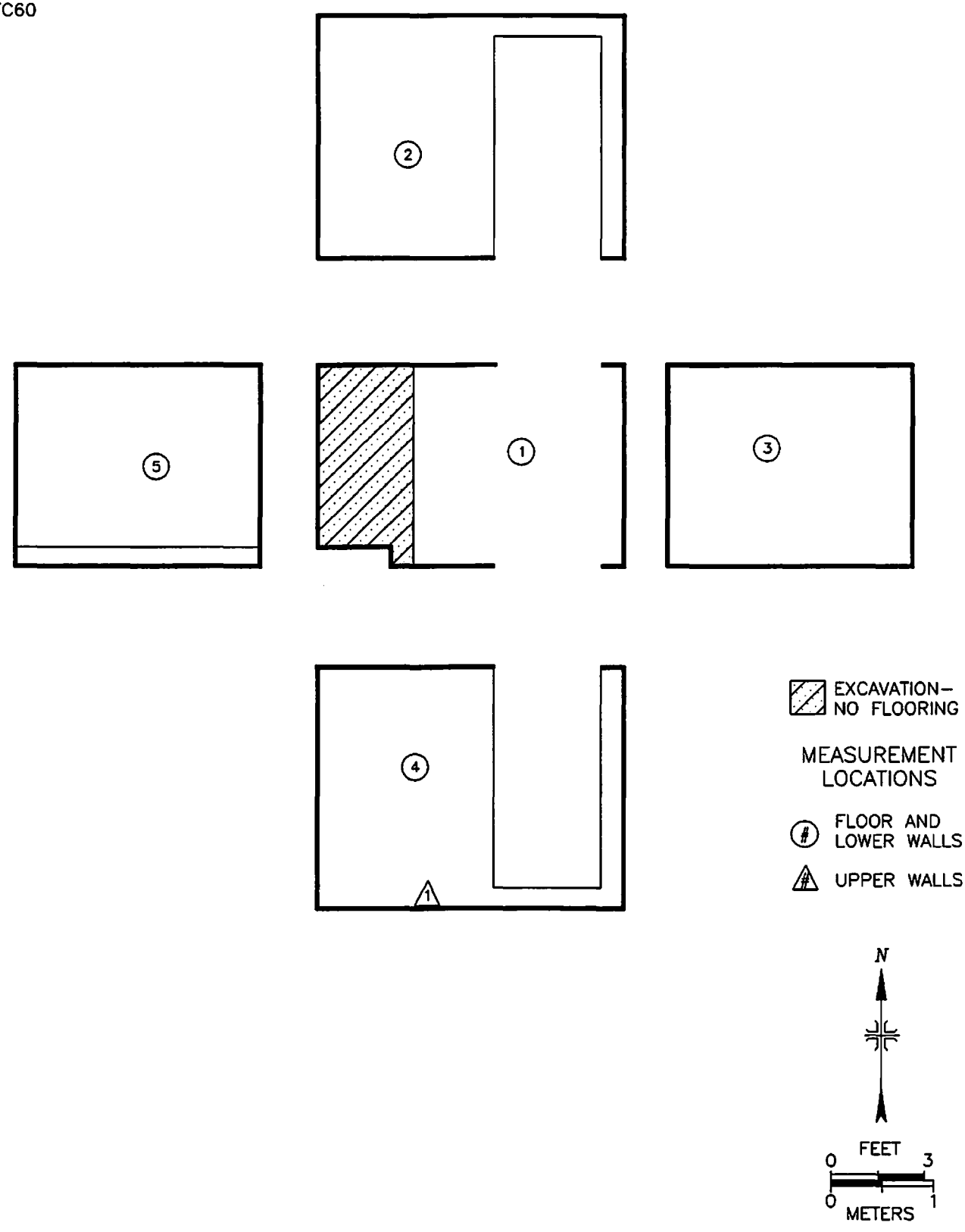

FIGURE 17: Room 114 (Decon Room) Floor Plan Showing Measurement Locations

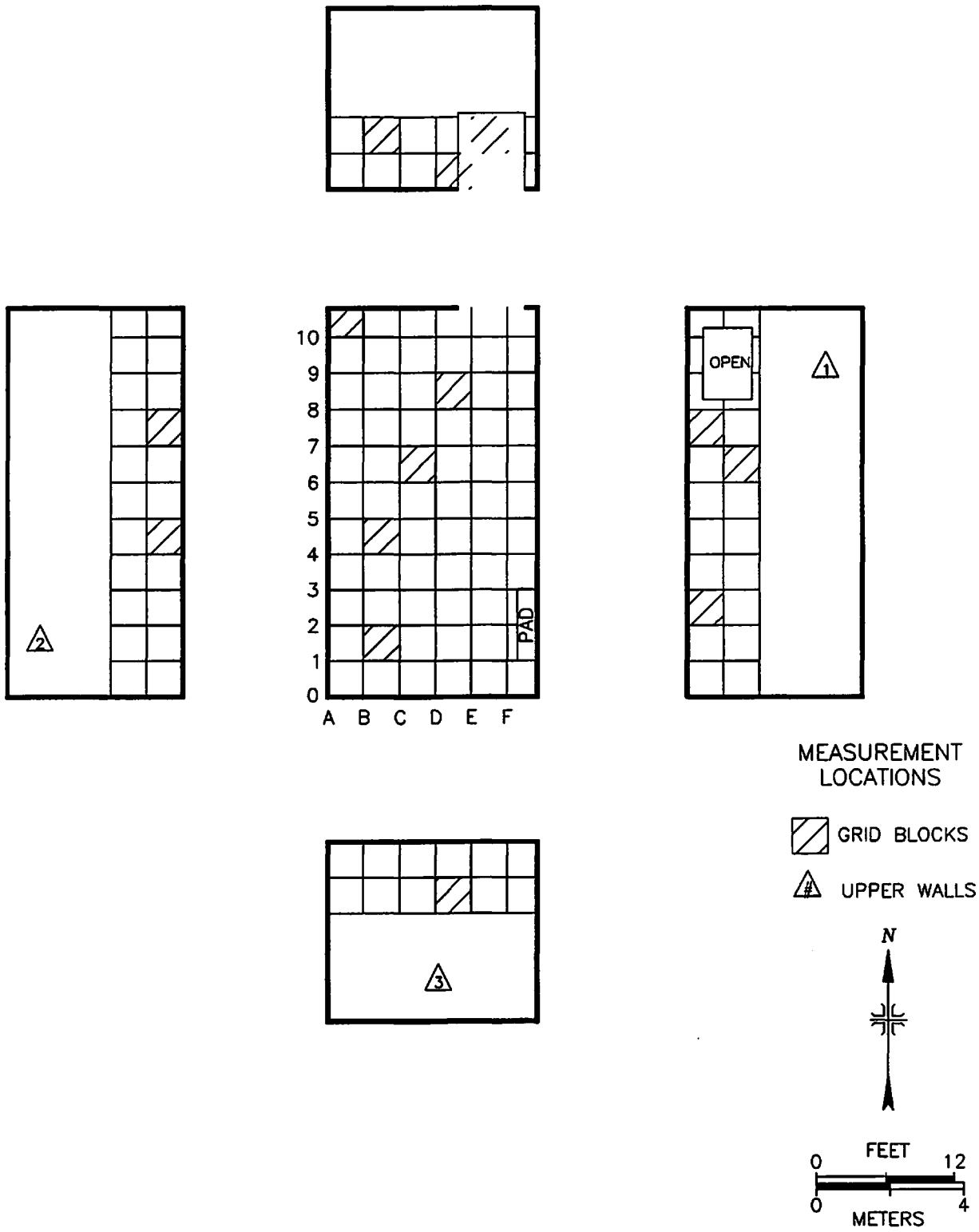

FIGURE 18: Room 116 (Maintenance) Floor Plan Showing Measurement Locations

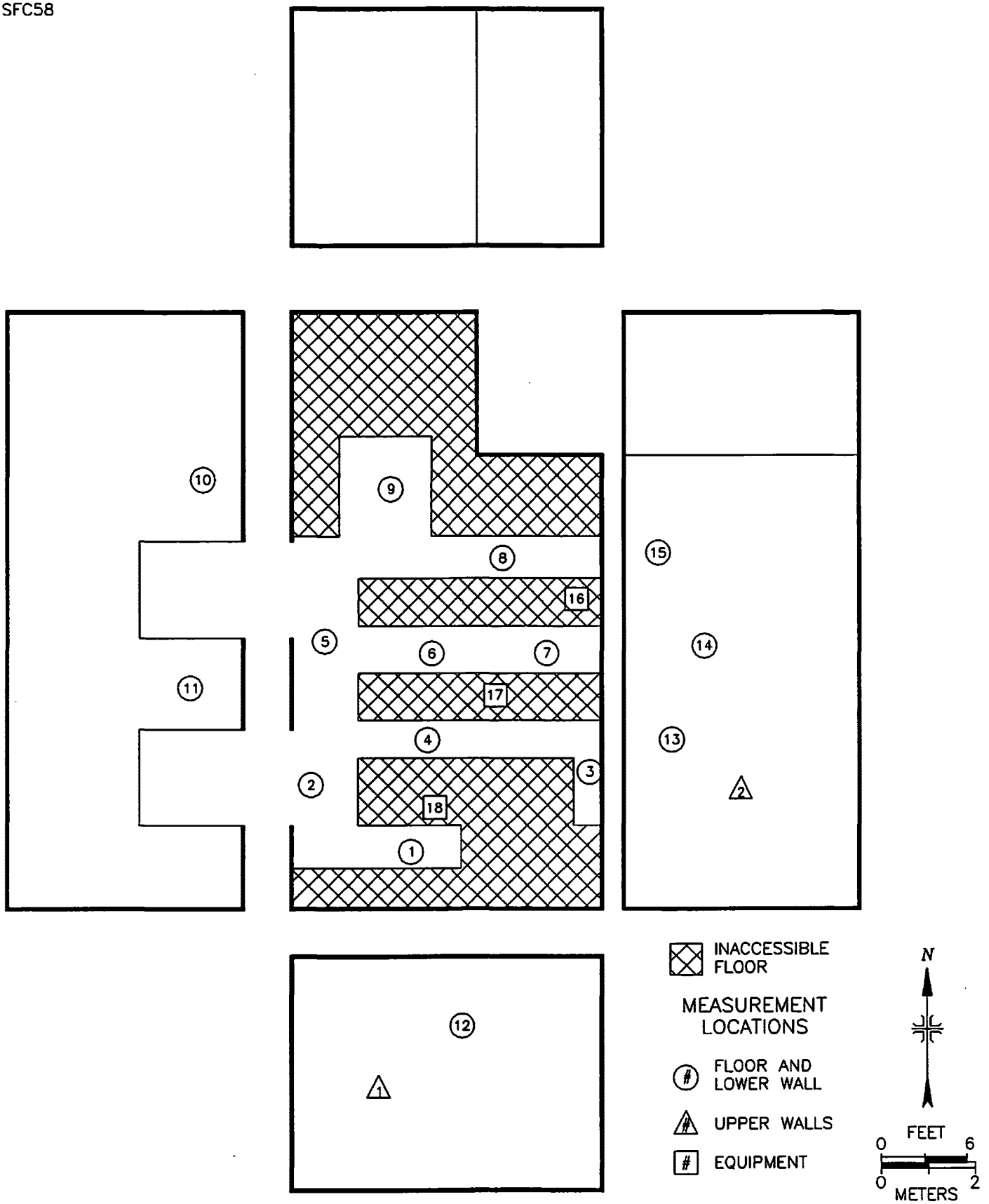

FIGURE 19: Room 117 (Mechanical Room) Floor Plan Showing Measurement Locations

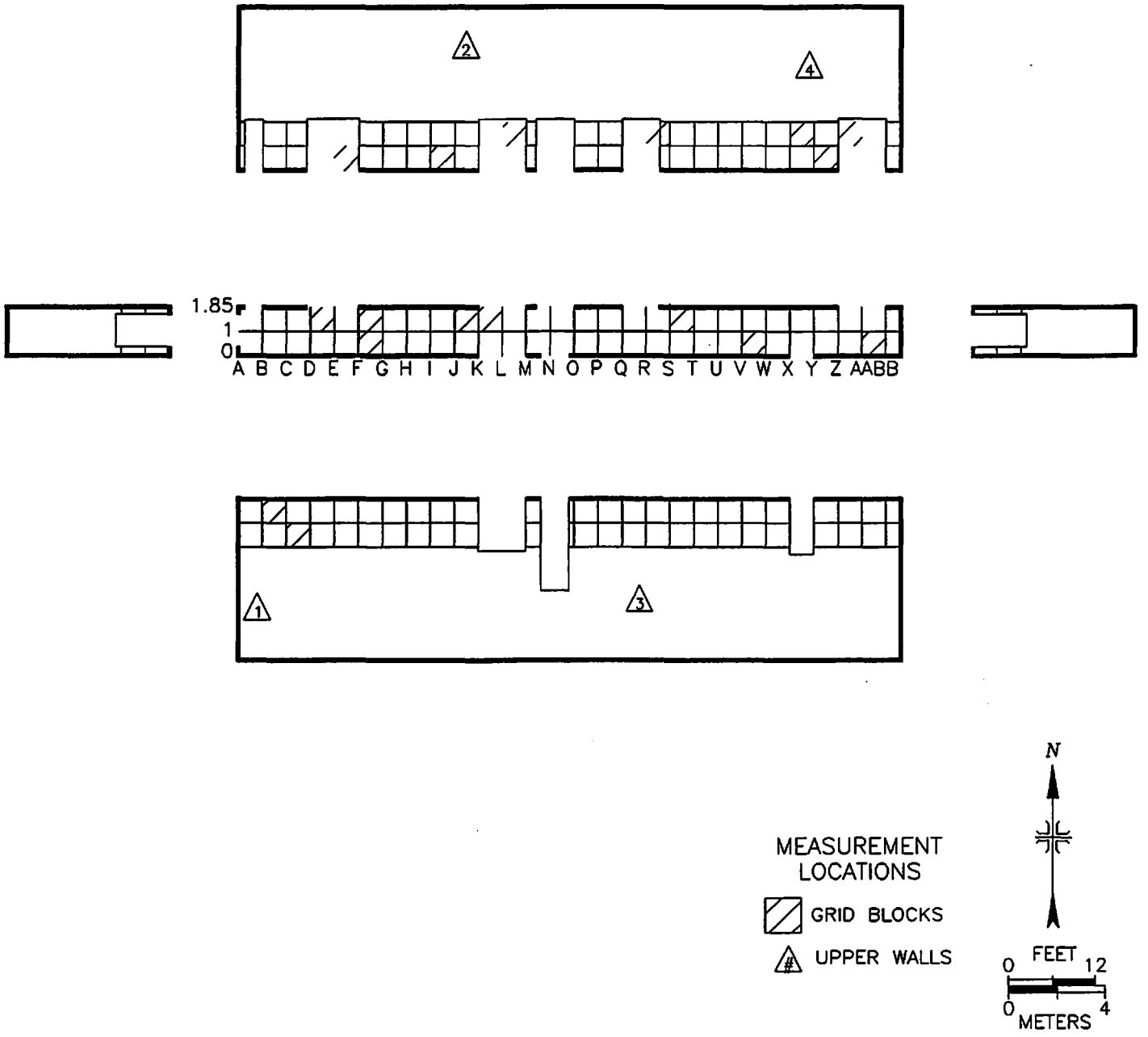

FIGURE 20: Room 118 (East/West Corridor) Floor Plan Showing Measurement Locations

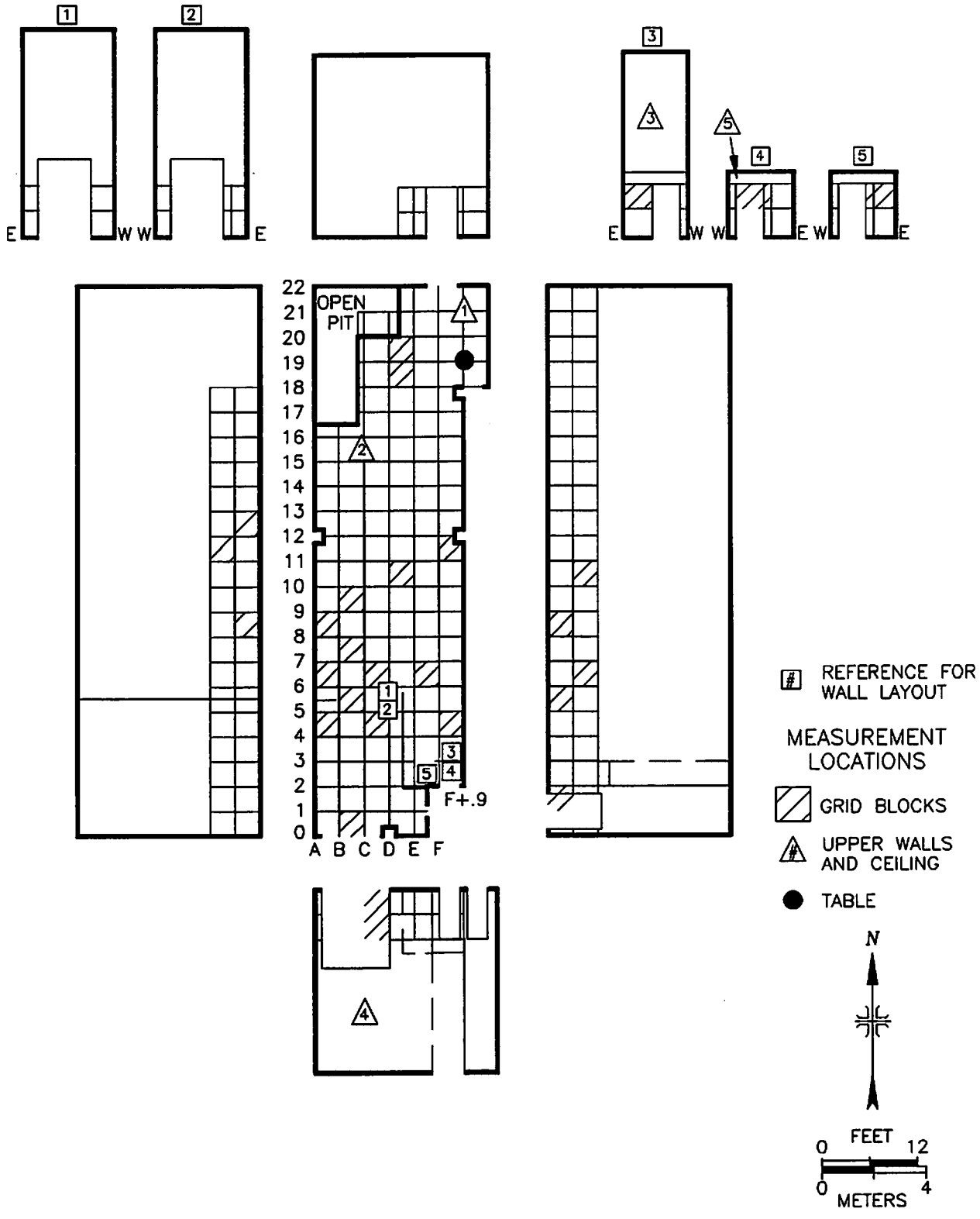

FIGURE 21: Rooms 119, 120, and 121 Floor Plan Showing Measurement Locations

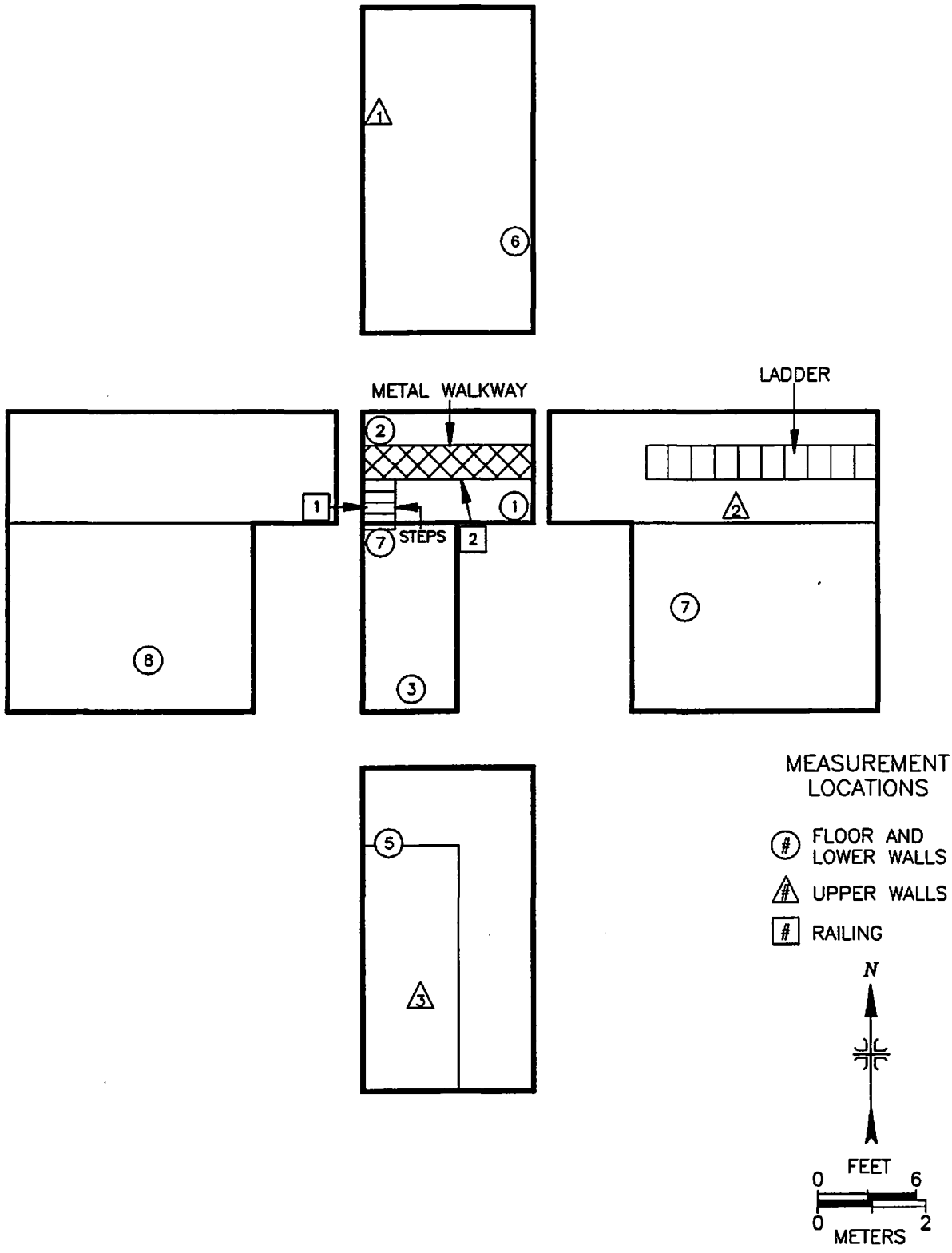

FIGURE 22: Pit Room 121 Floor Plan Showing Measurement Locations

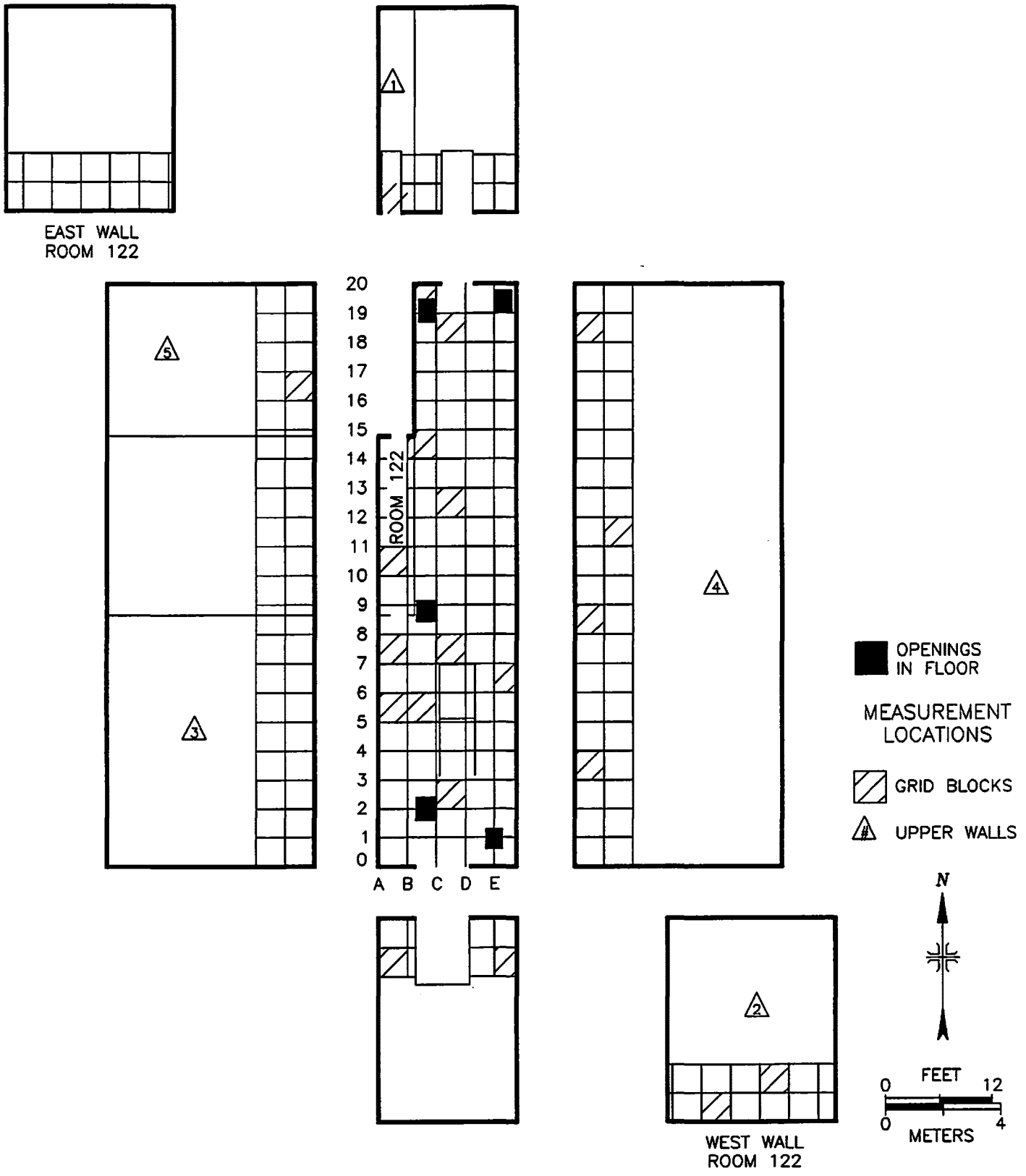

FIGURE 23: Rooms 122/123 Floor Plan Showing Measurement Locations

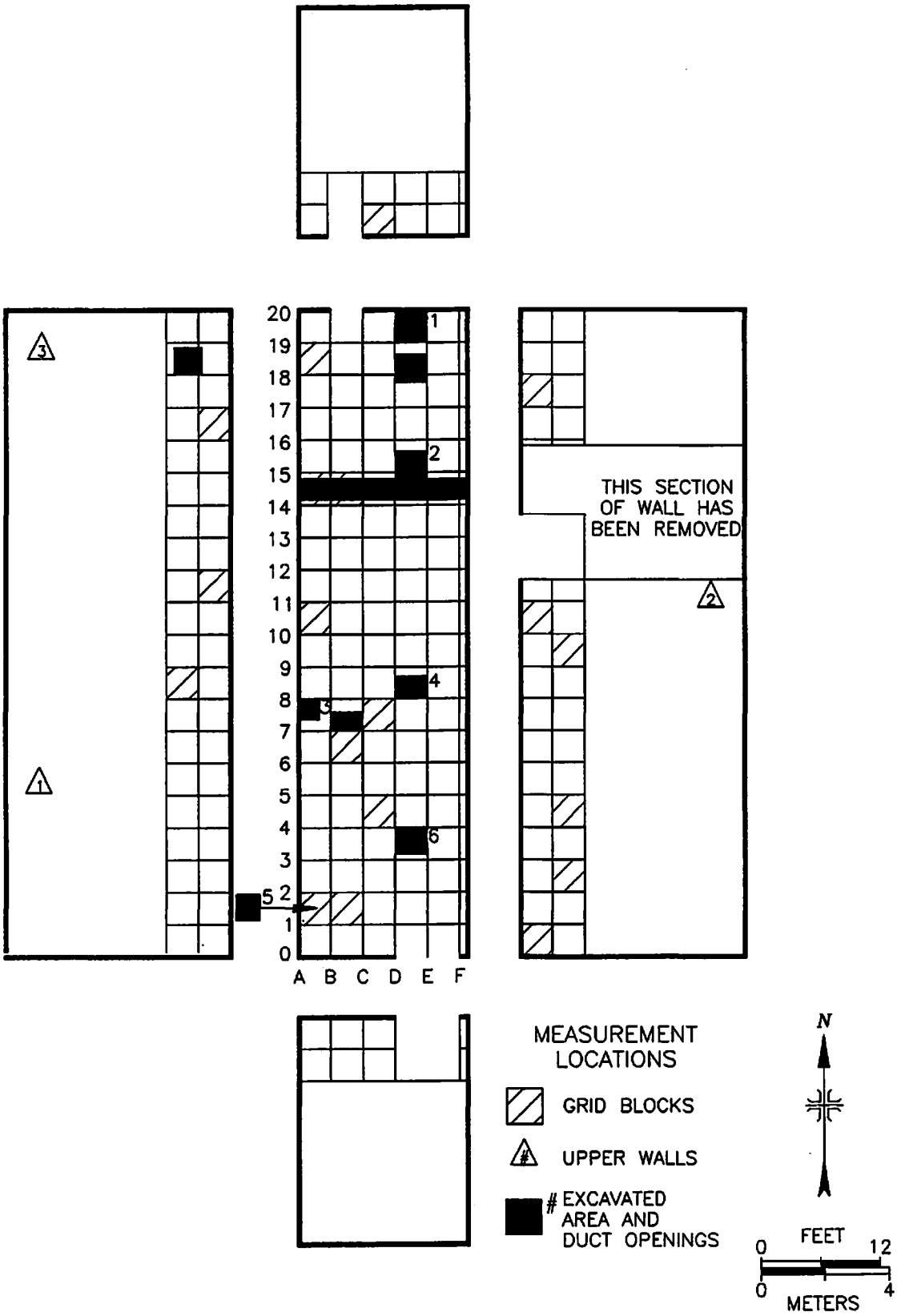

FIGURE 24: Room 124 Floor Plan Showing Measurement Locations

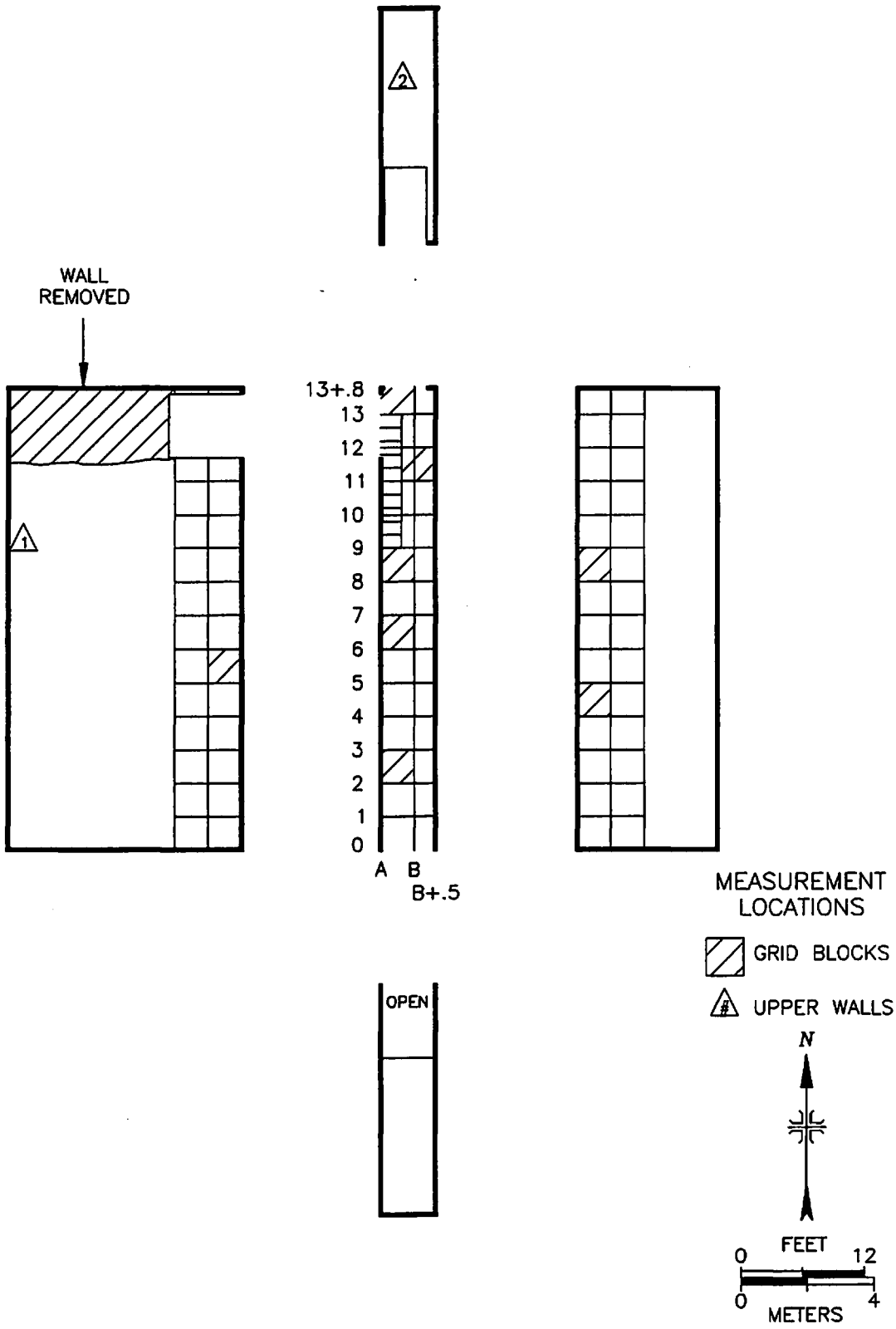

FIGURE 25: Room 125 (Corridor) Floor Plan Showing Measurement Locations

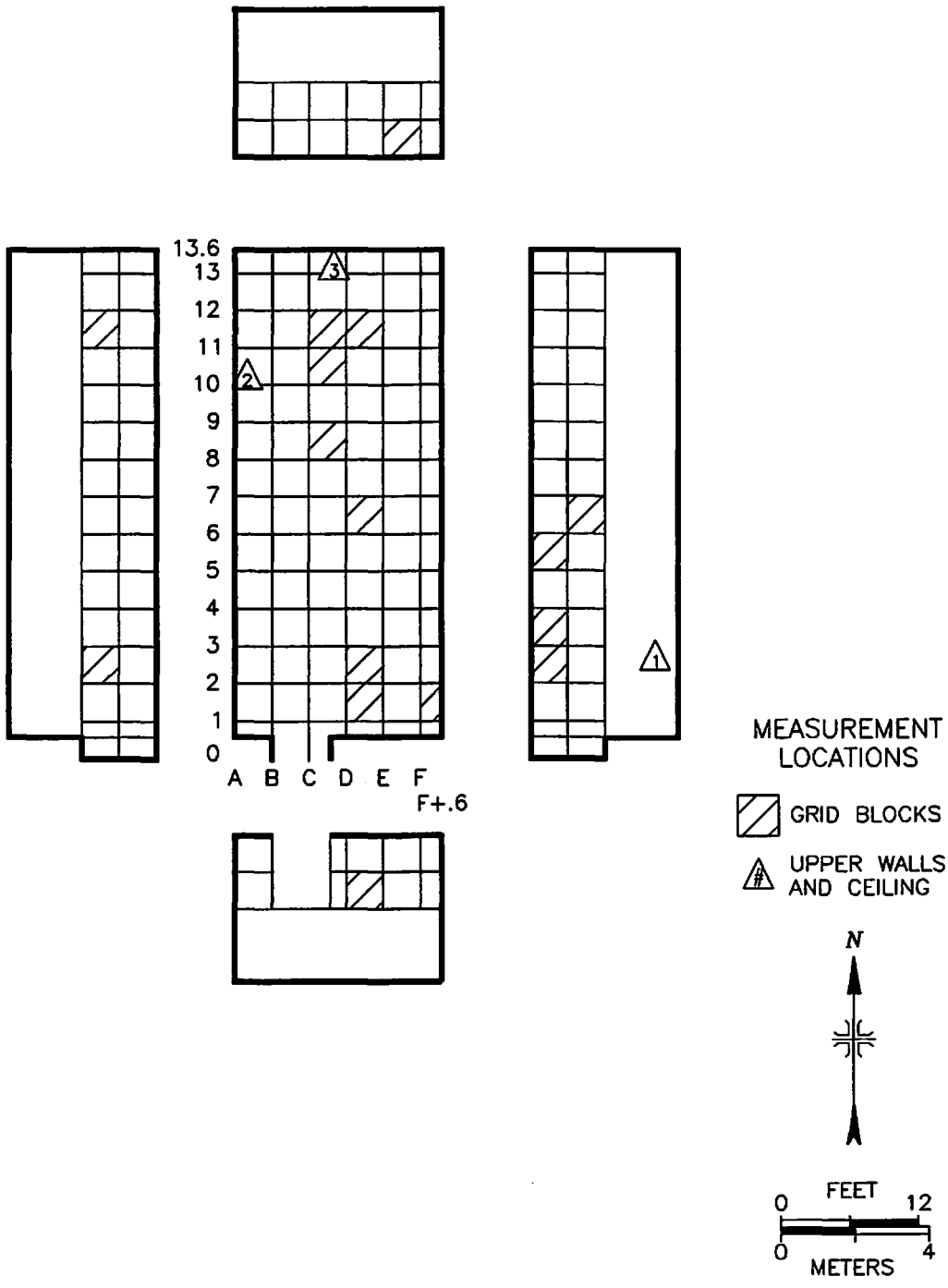

FIGURE 26: Room 126 (Vault) Floor Plan Showing Measurement Locations

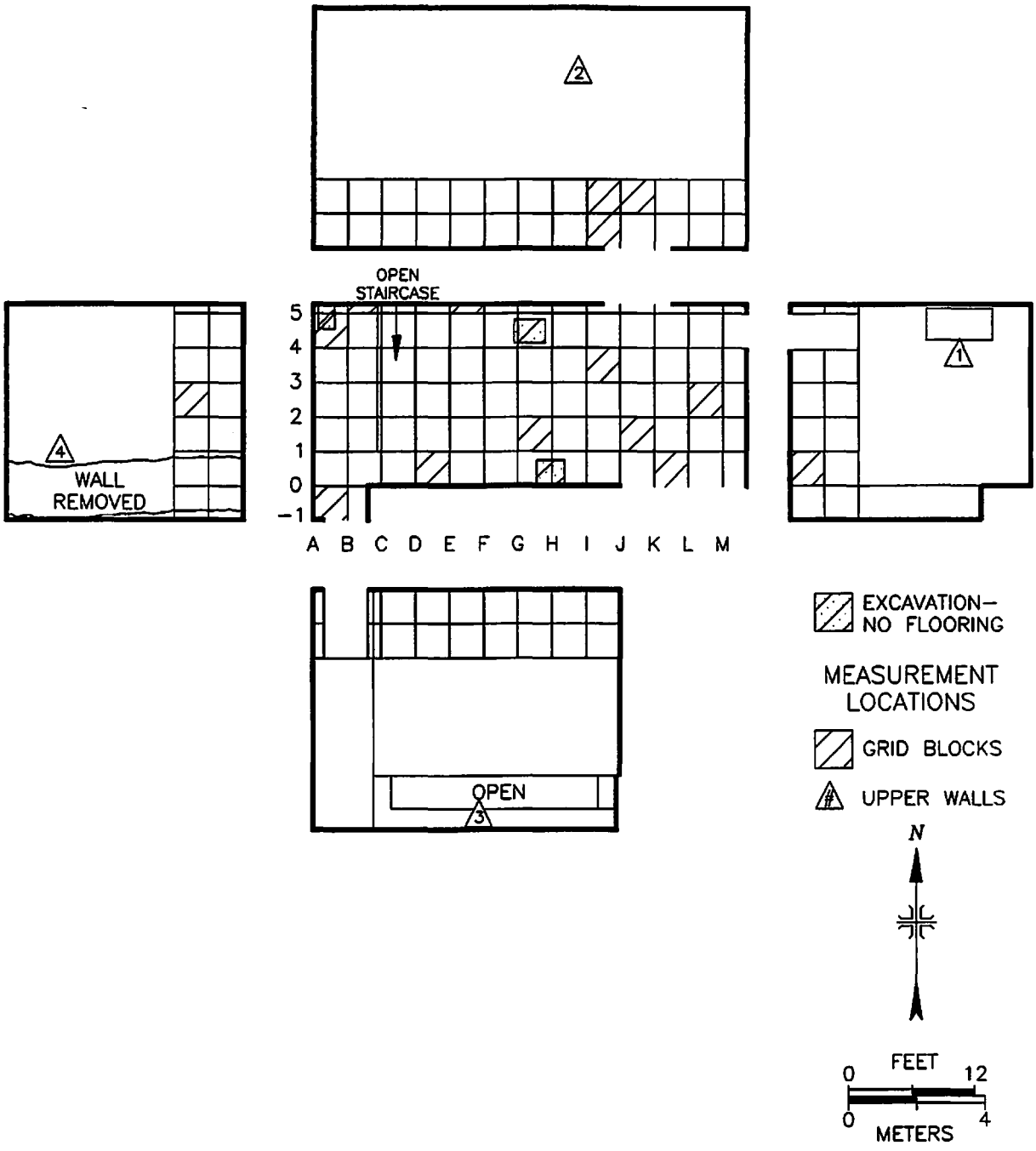

FIGURE 27: Room 127 Floor Plan Showing Measurement Locations

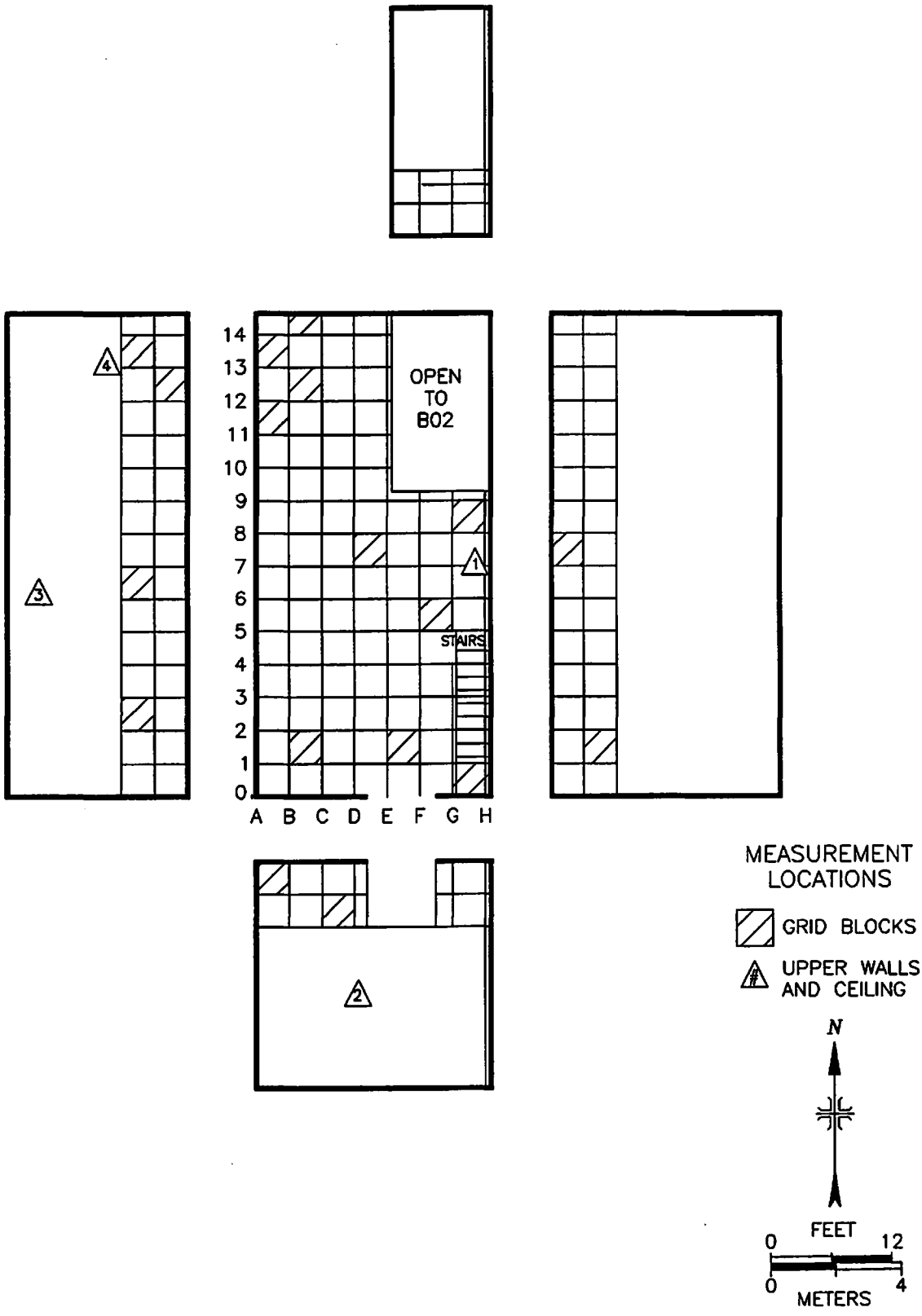

FIGURE 28: Room 128 Floor Plan Showing Measurement Locations

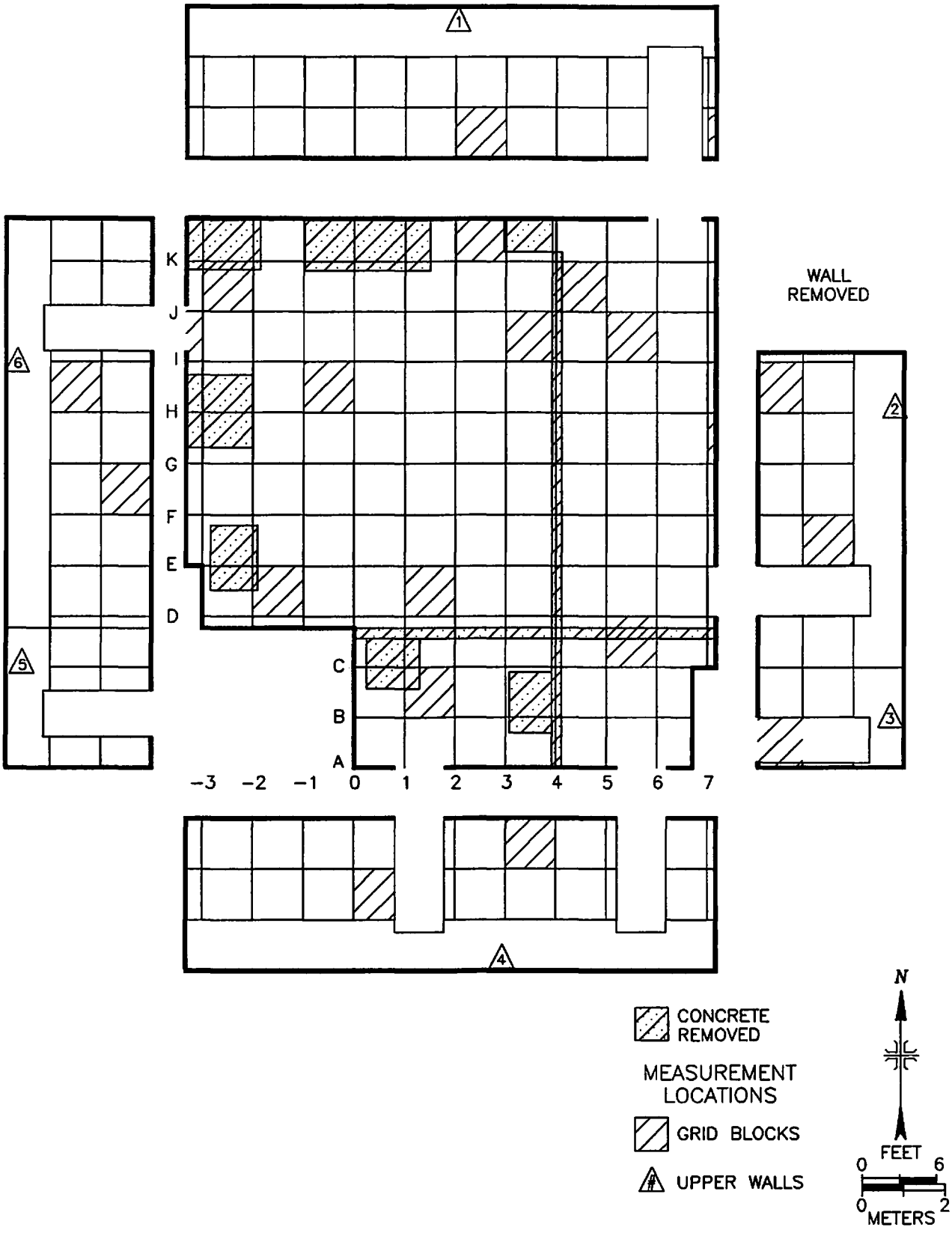

FIGURE 29: Room 129 (General Lab) Floor Plan Showing Measurement Locations

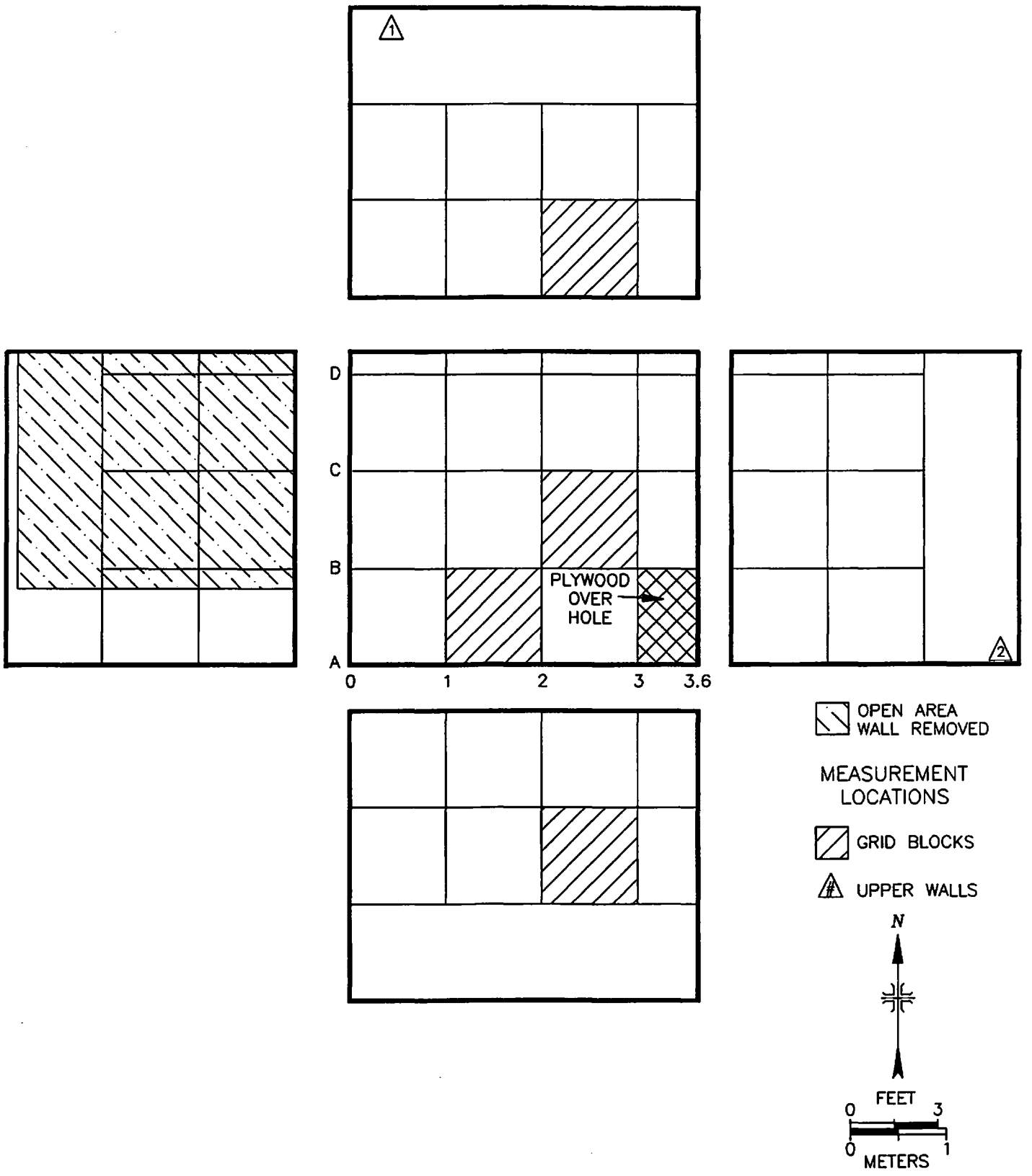

FIGURE 30: Room 130 Floor Plan Showing Measurement Locations

SFC47

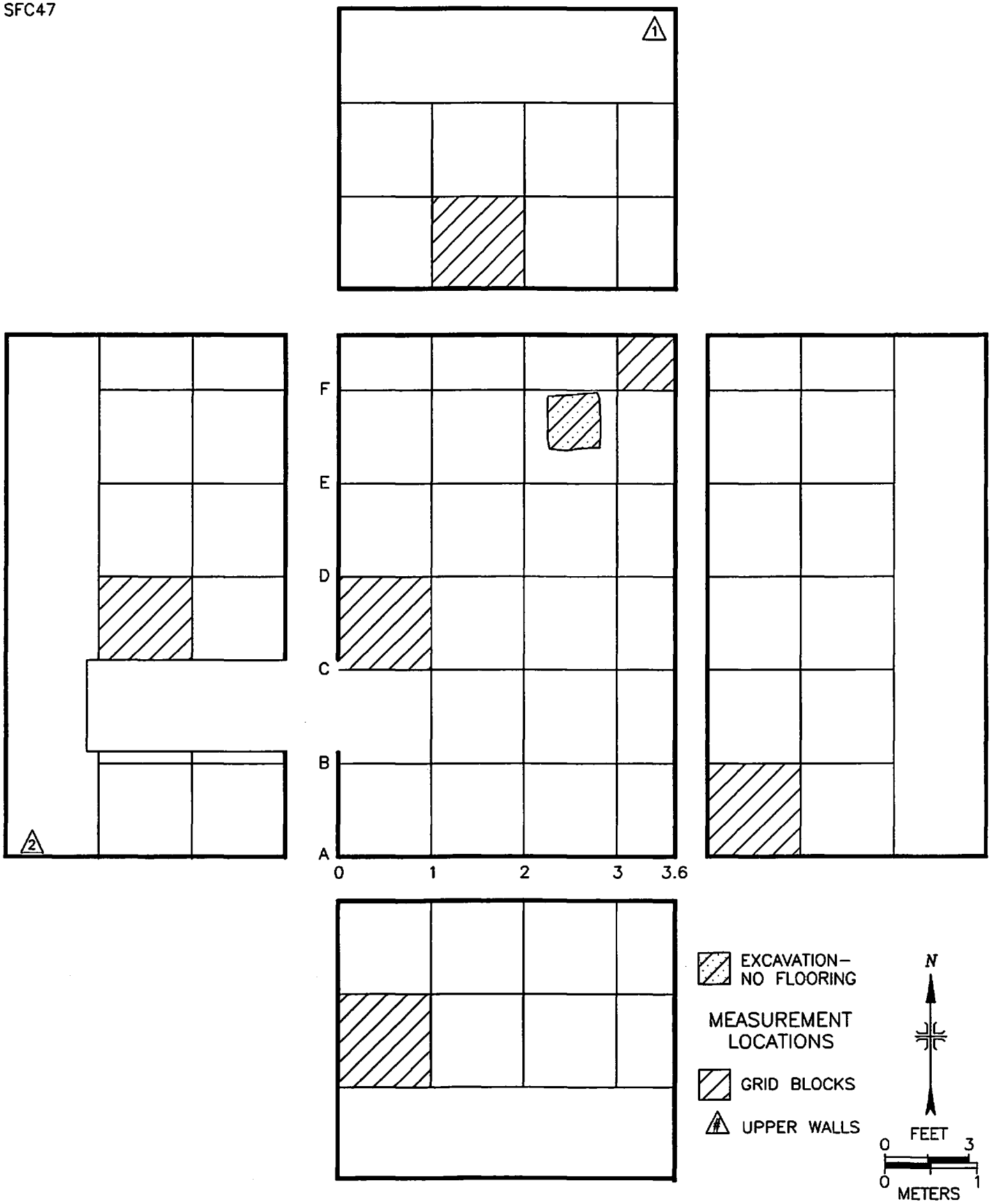

FIGURE 31: Room 131 Floor Plan Showing Measurement Locations

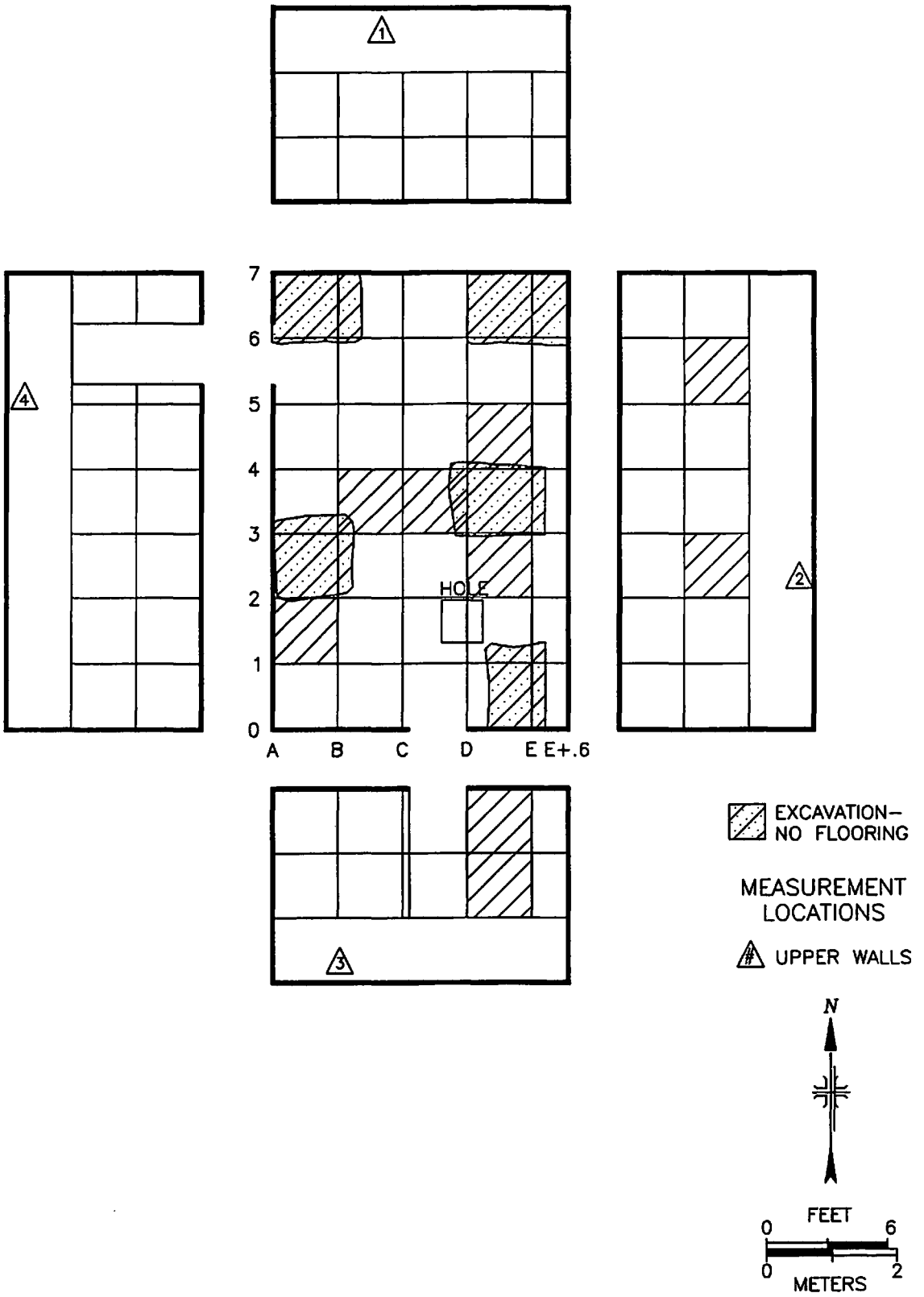

FIGURE 32: Room 132 Floor Plan Showing Measurement Locations

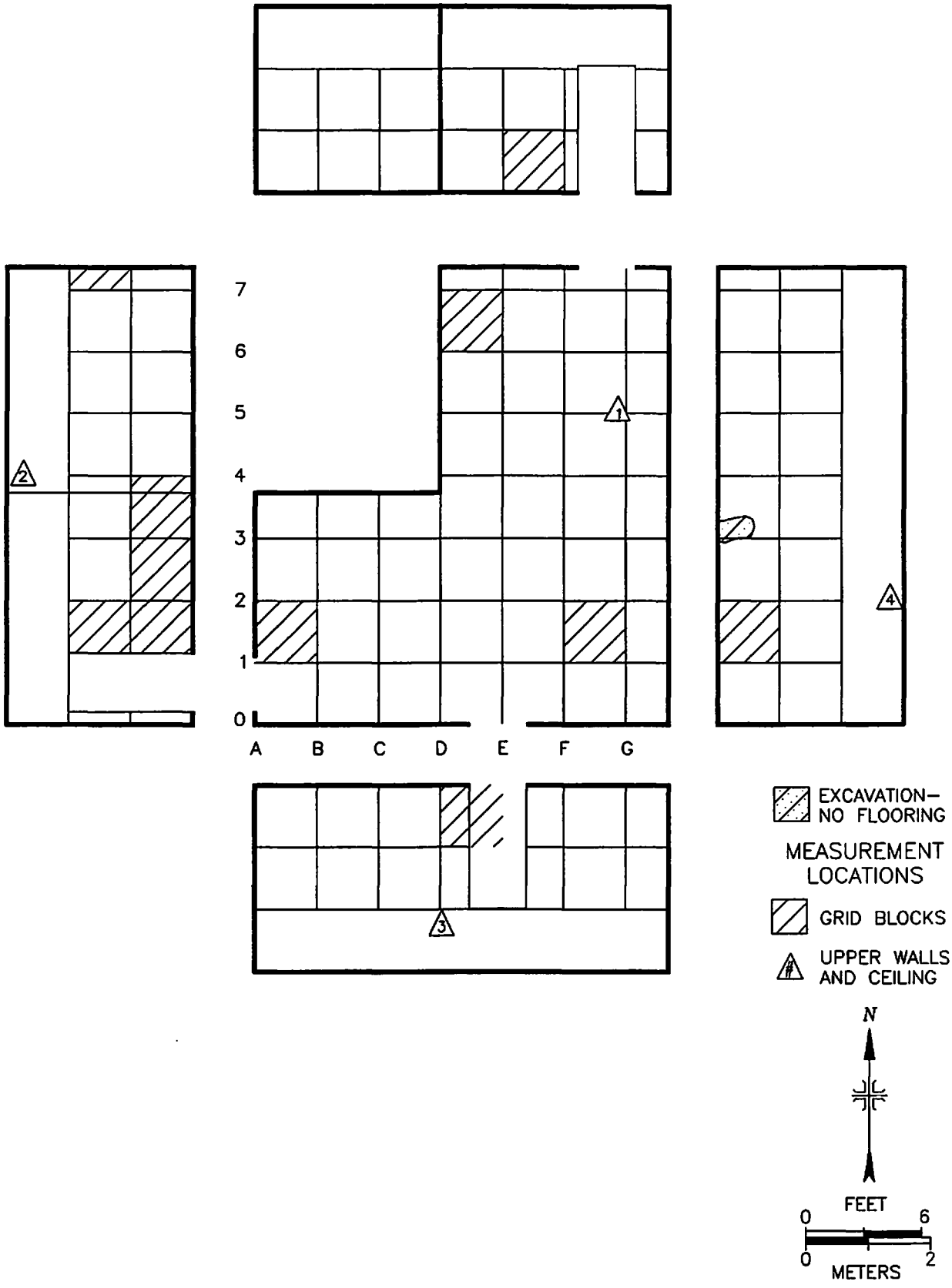

FIGURE 33: Room 133 Floor Plan Showing Measurement Locations

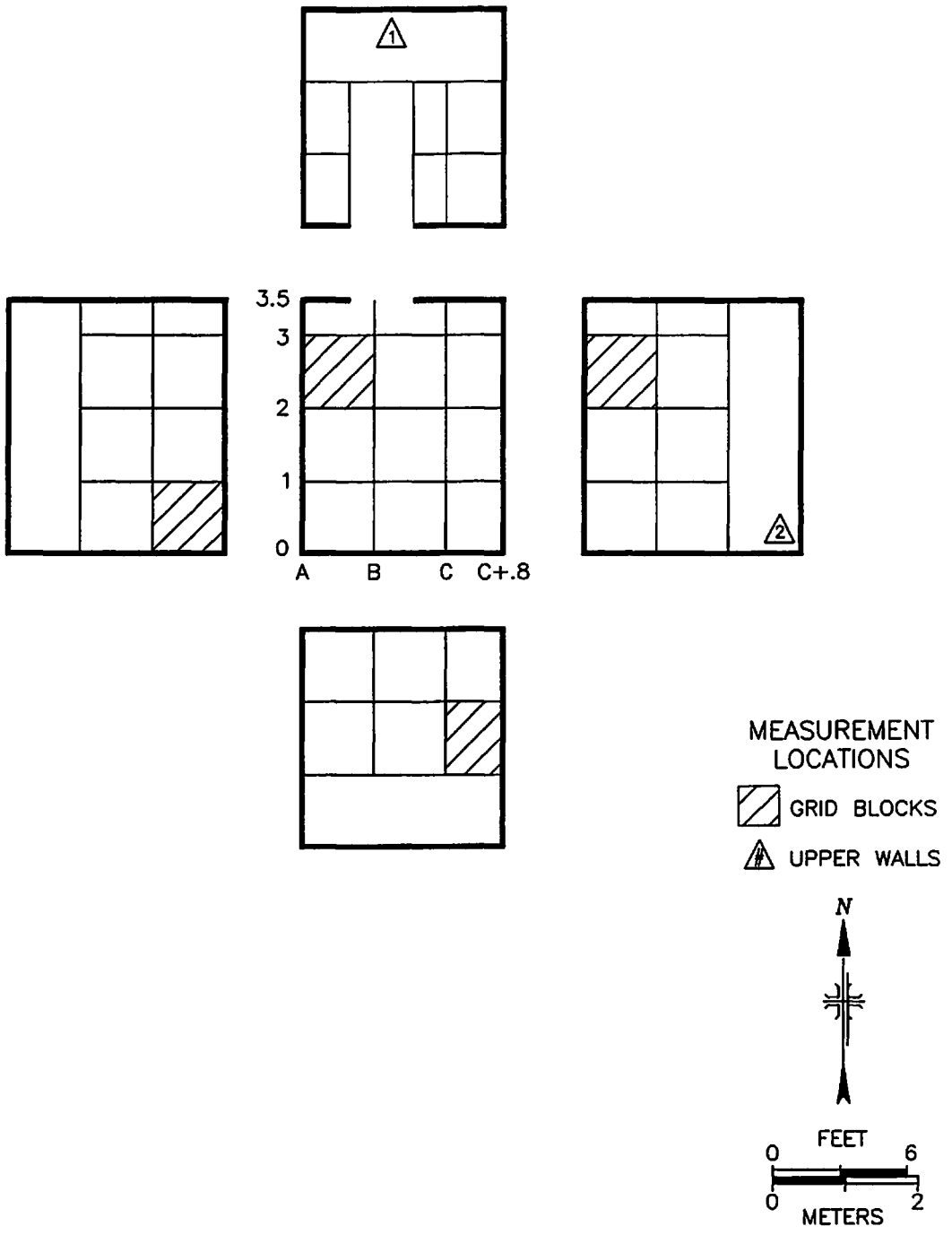

FIGURE 34: Room 134 Floor Plan Showing Measurement Locations

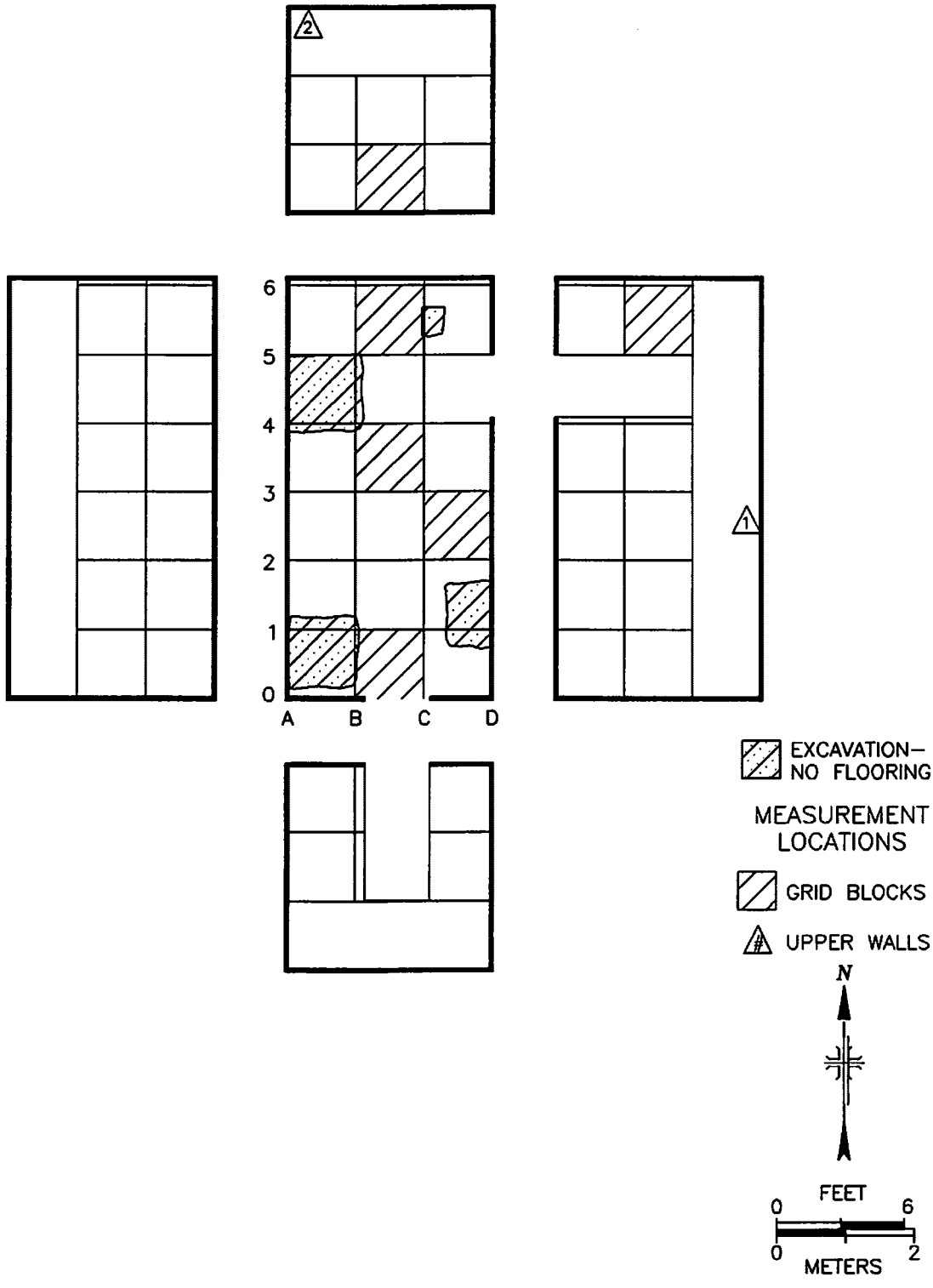

FIGURE 35: Room 135 Floor Plan Showing Measurement Locations

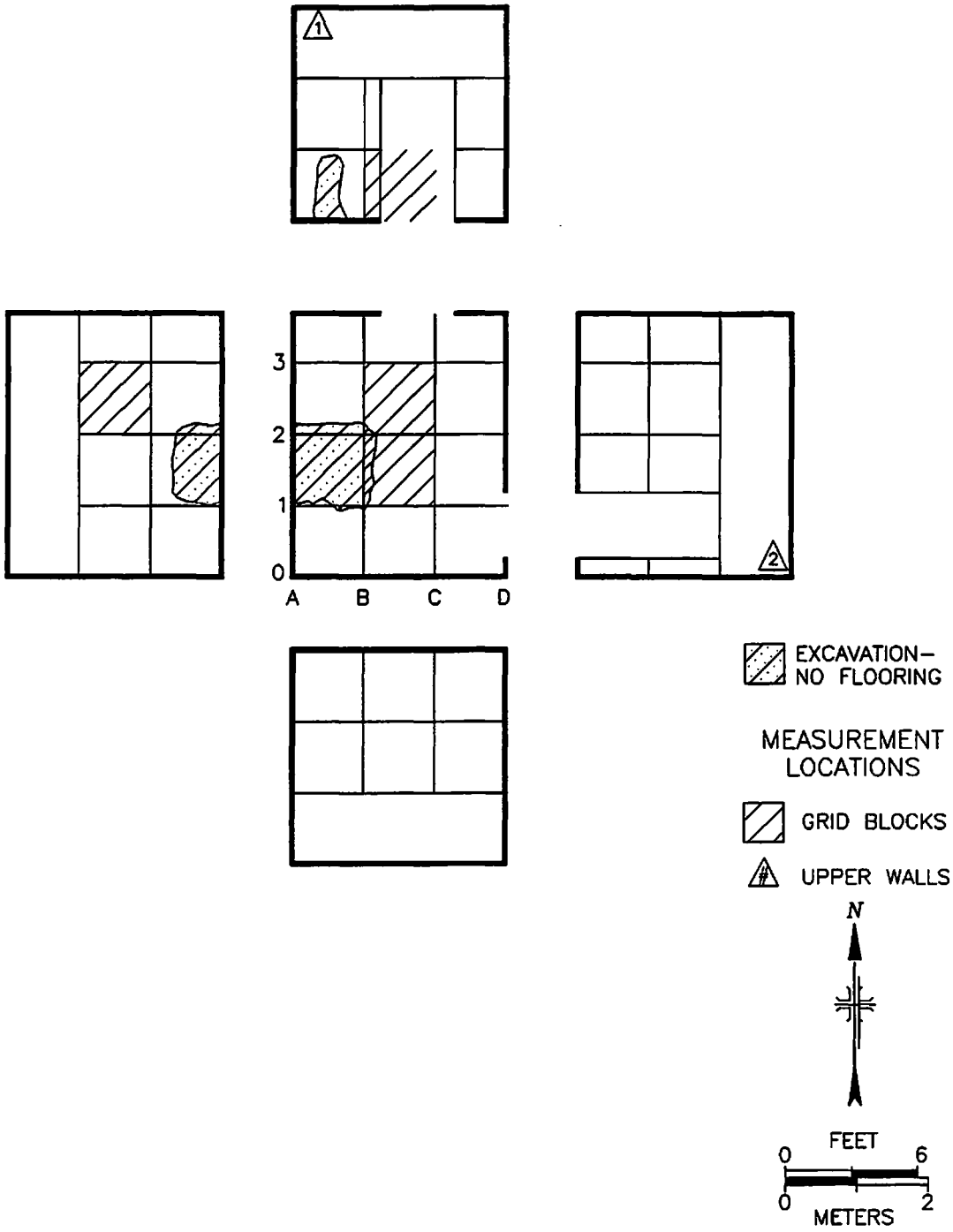

FIGURE 36: Room 136 Floor Plan Showing Measurement Locations

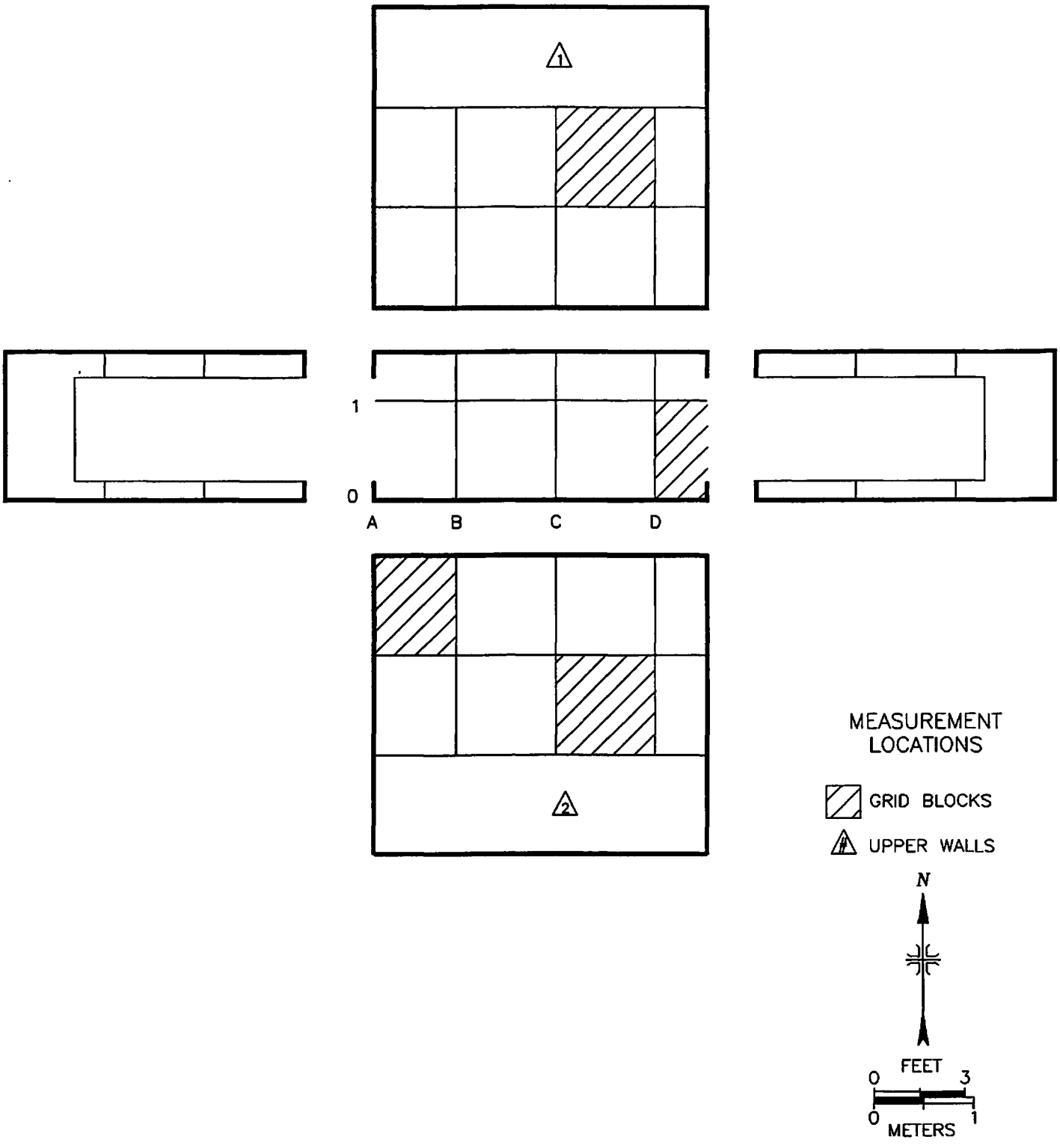

FIGURE 37: Room 137 Floor Plan Showing Measurement Locations

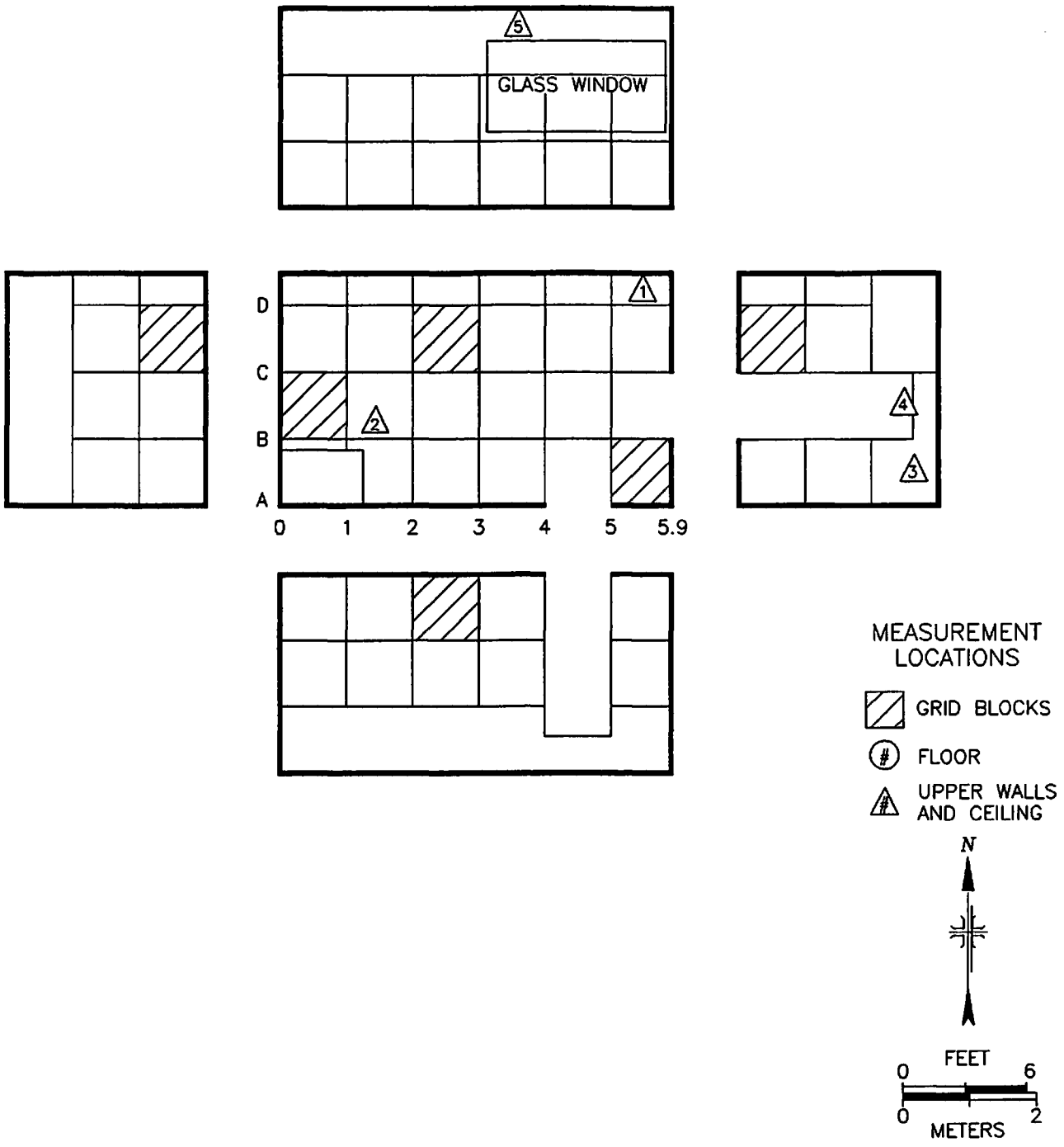

FIGURE 38: Room 138 Floor Plan Showing Measurement Locations

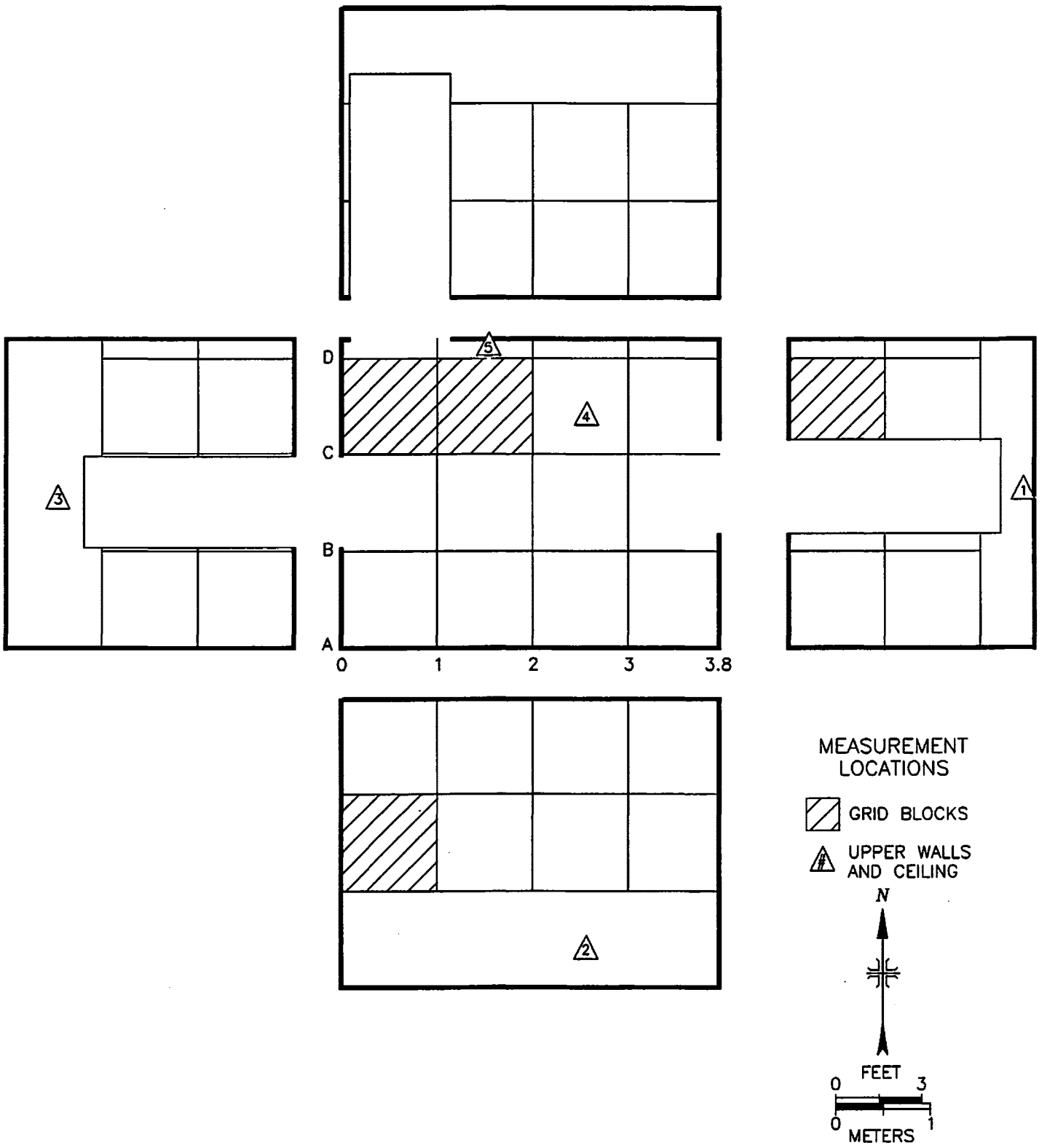

FIGURE 39: Room 139 Floor Plan Showing Measurement Locations

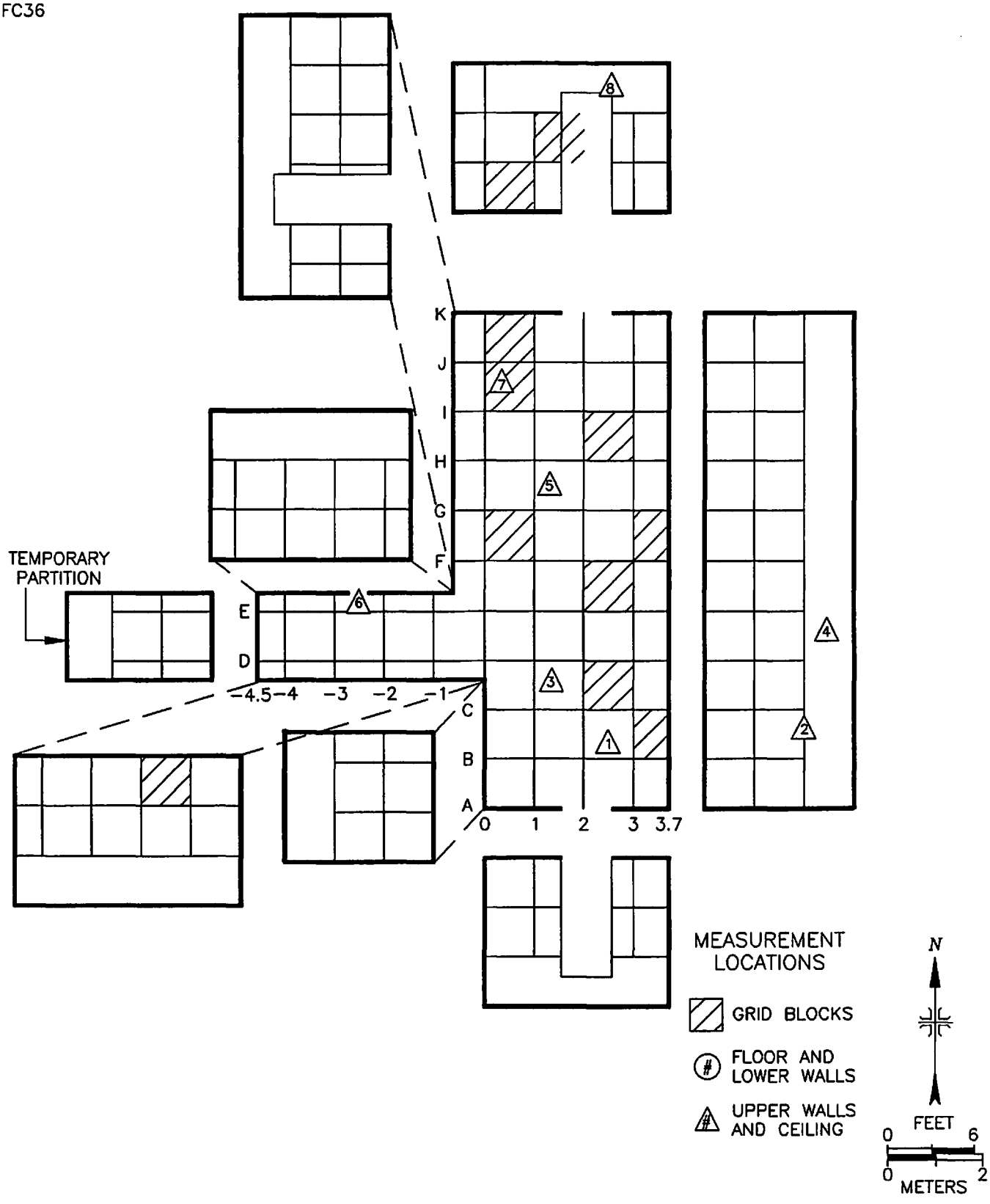

FIGURE 40: Room 140 Floor Plan Showing Measurement Locations

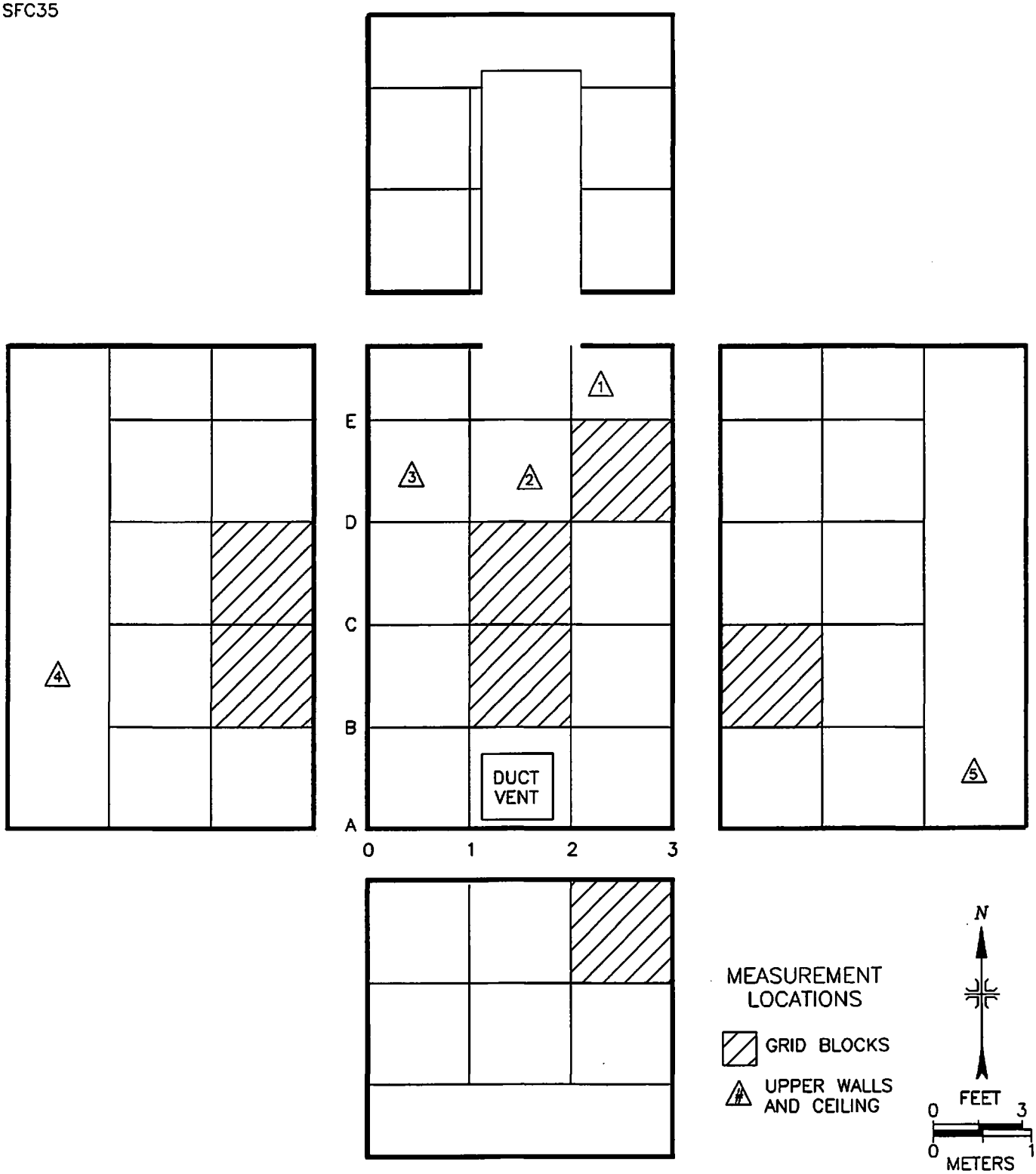

FIGURE 41: Room 141 Floor Plan Showing Measurement Locations

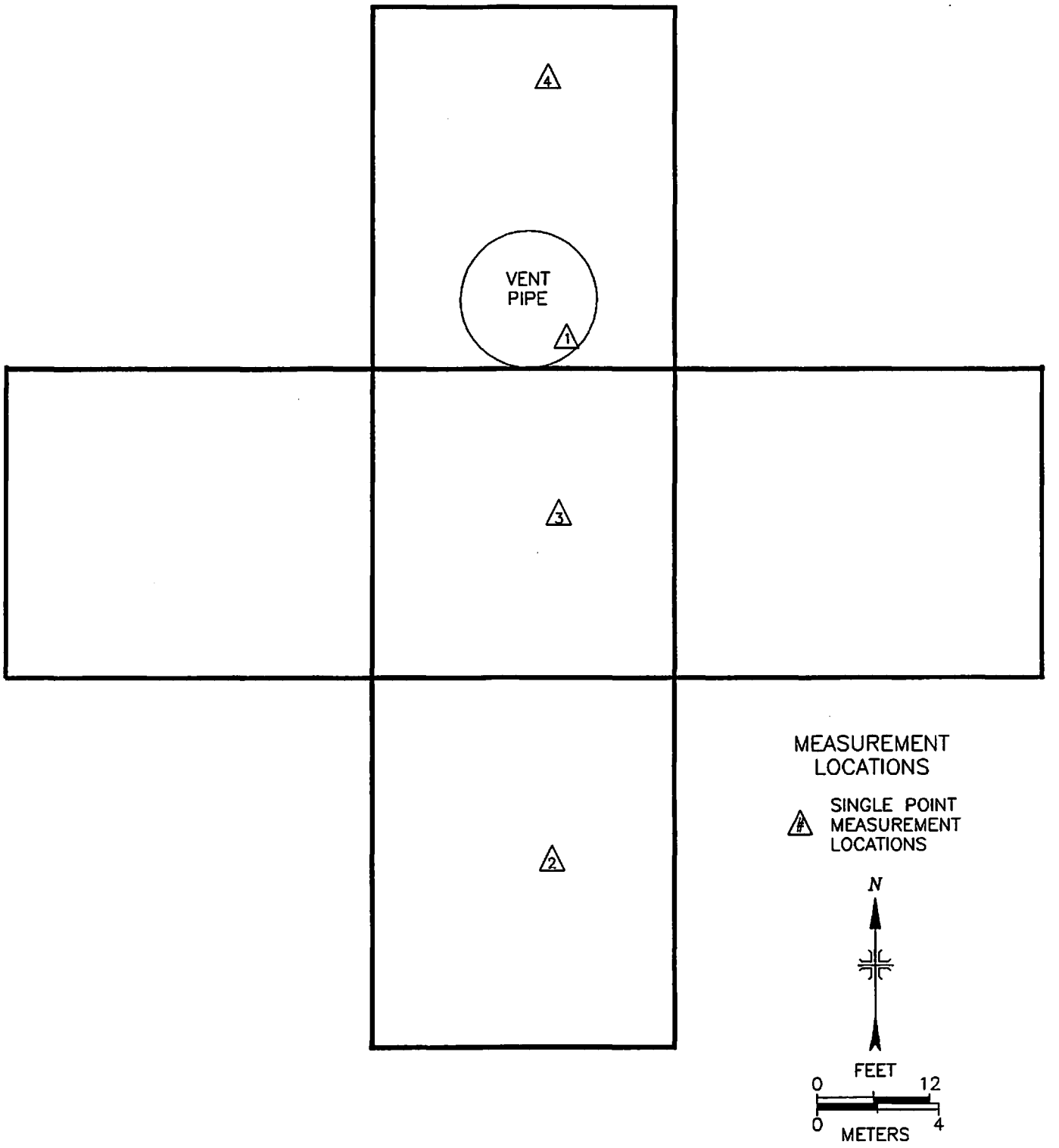

FIGURE 42: Room 141 Air Exhaust Vent Showing Measurement Locations

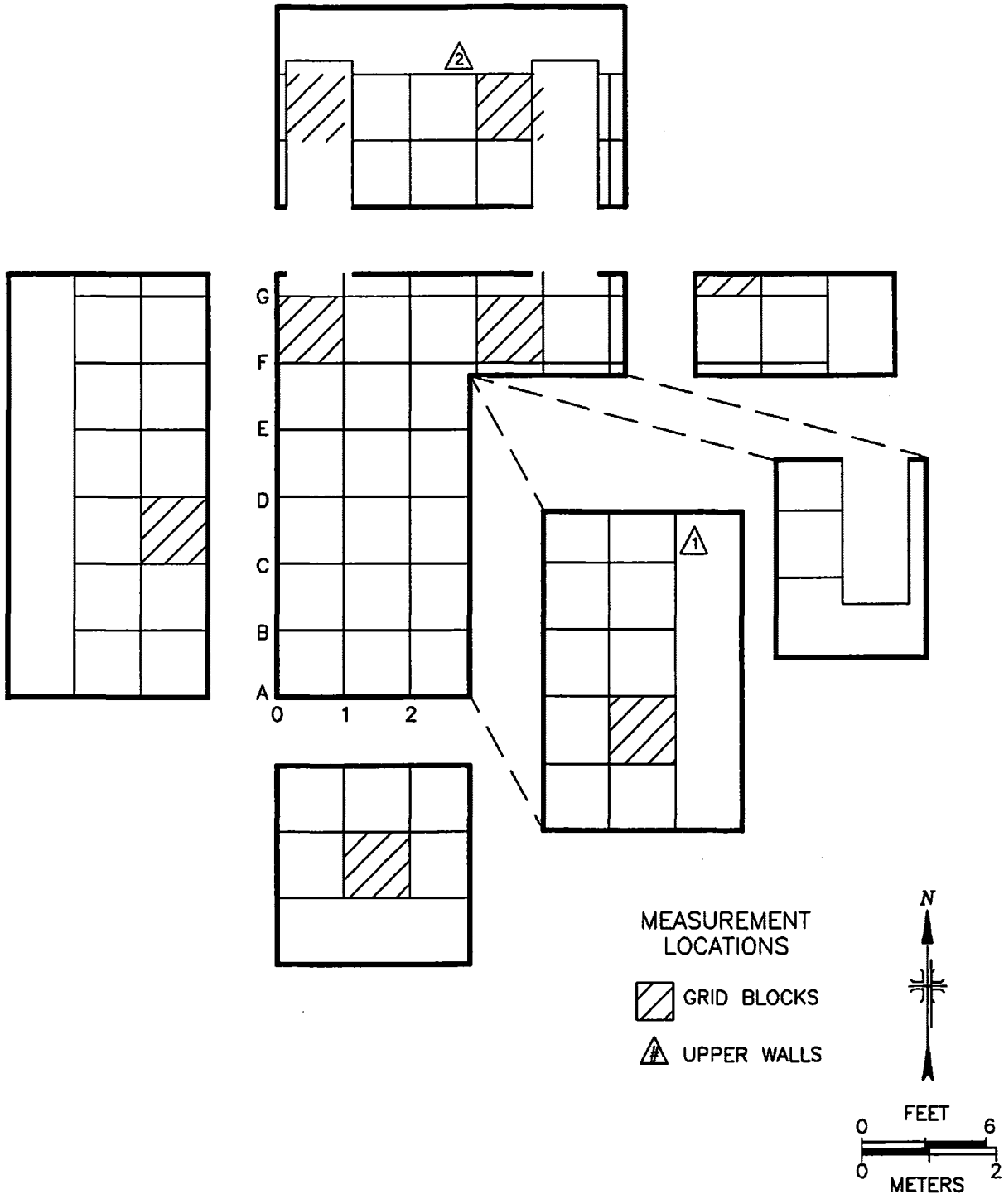

FIGURE 43: Room 142 Floor Plan Showing Measurement Locations

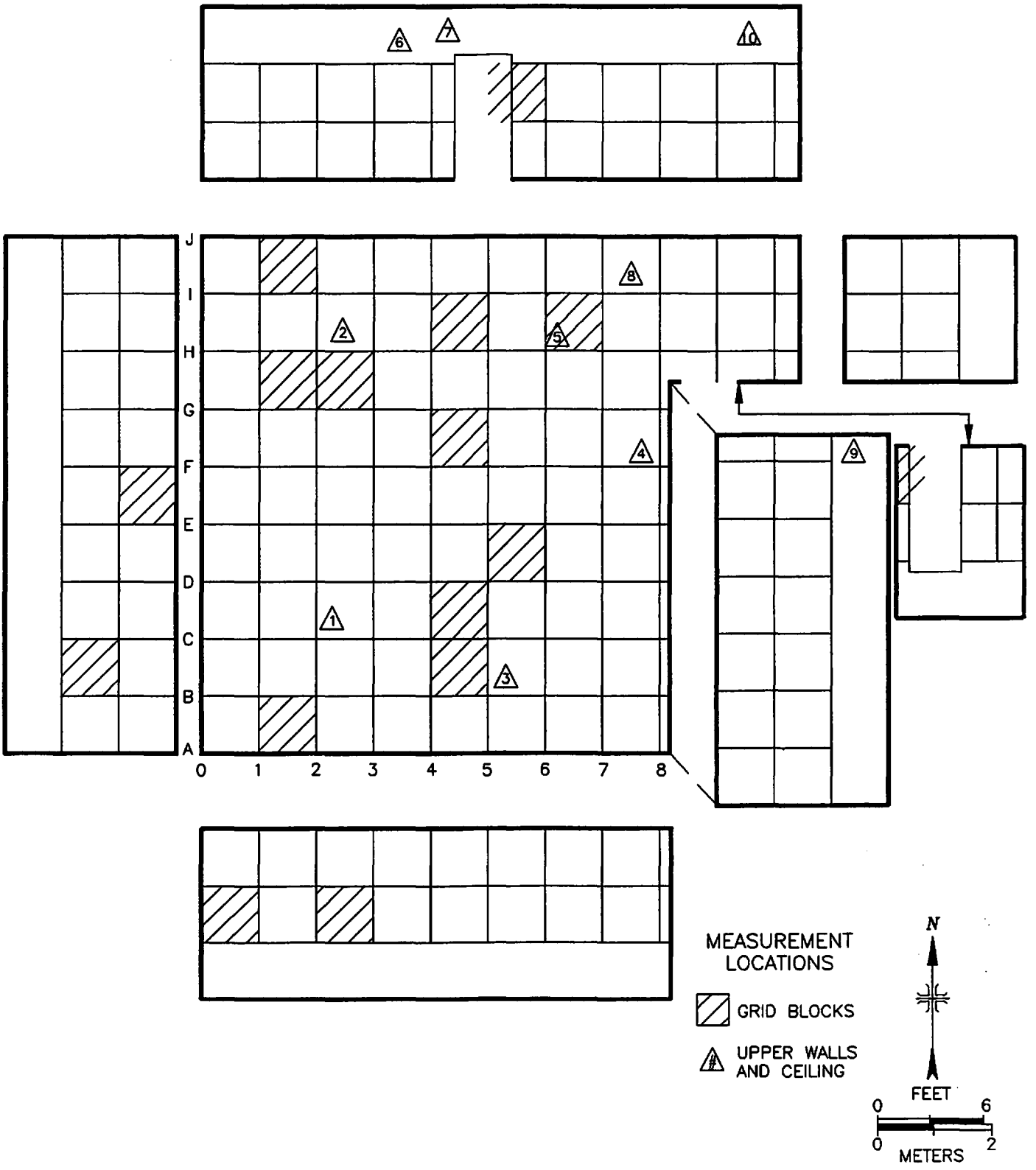

FIGURE 44: Room 143 Floor Plan Showing Measurement Locations

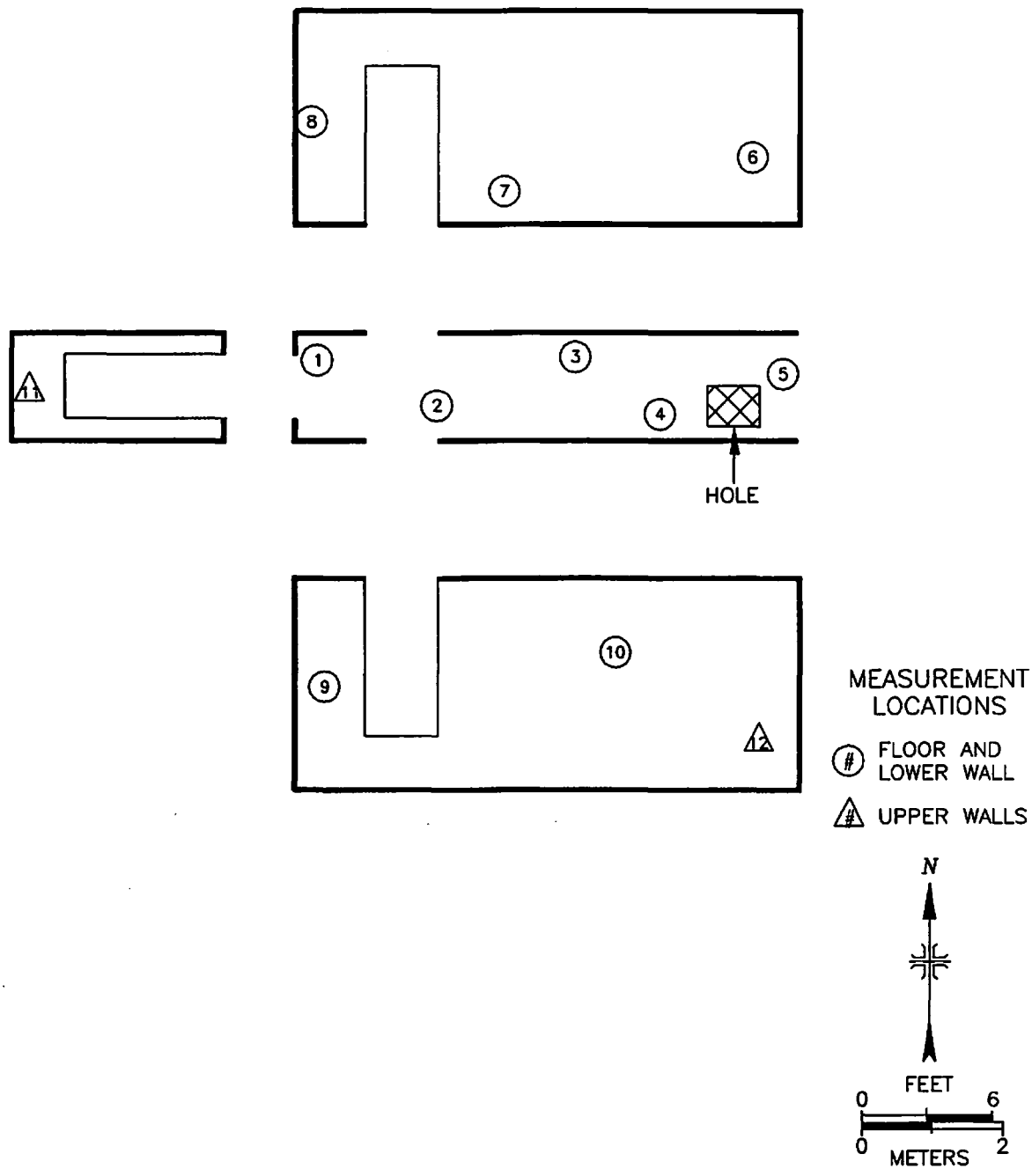

FIGURE 45: Corridor Between Rooms 138 and 143 Showing Measurement Locations

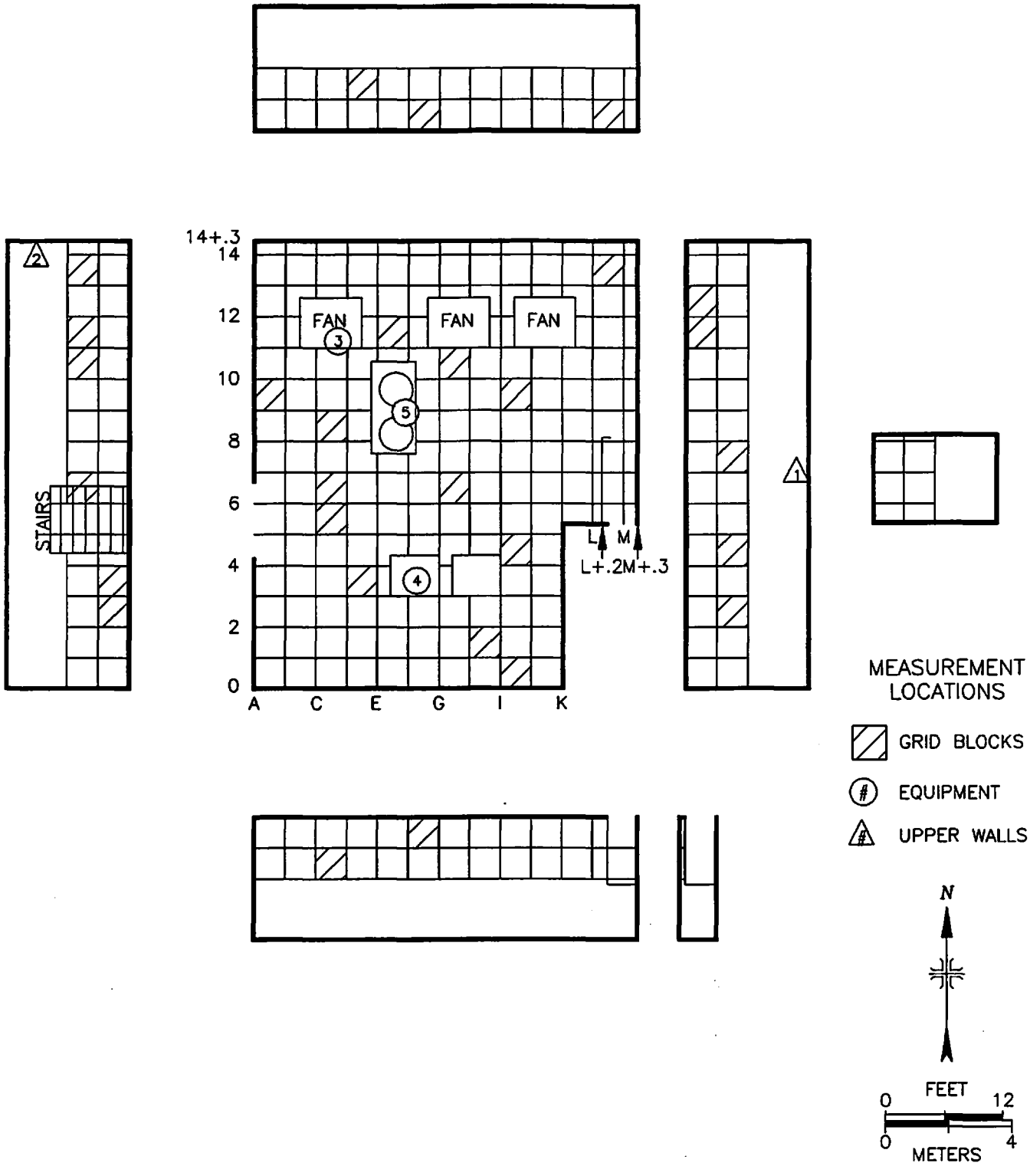

FIGURE 46: Room 201 (Exhaust A) Floor Plan Showing Measurement Locations

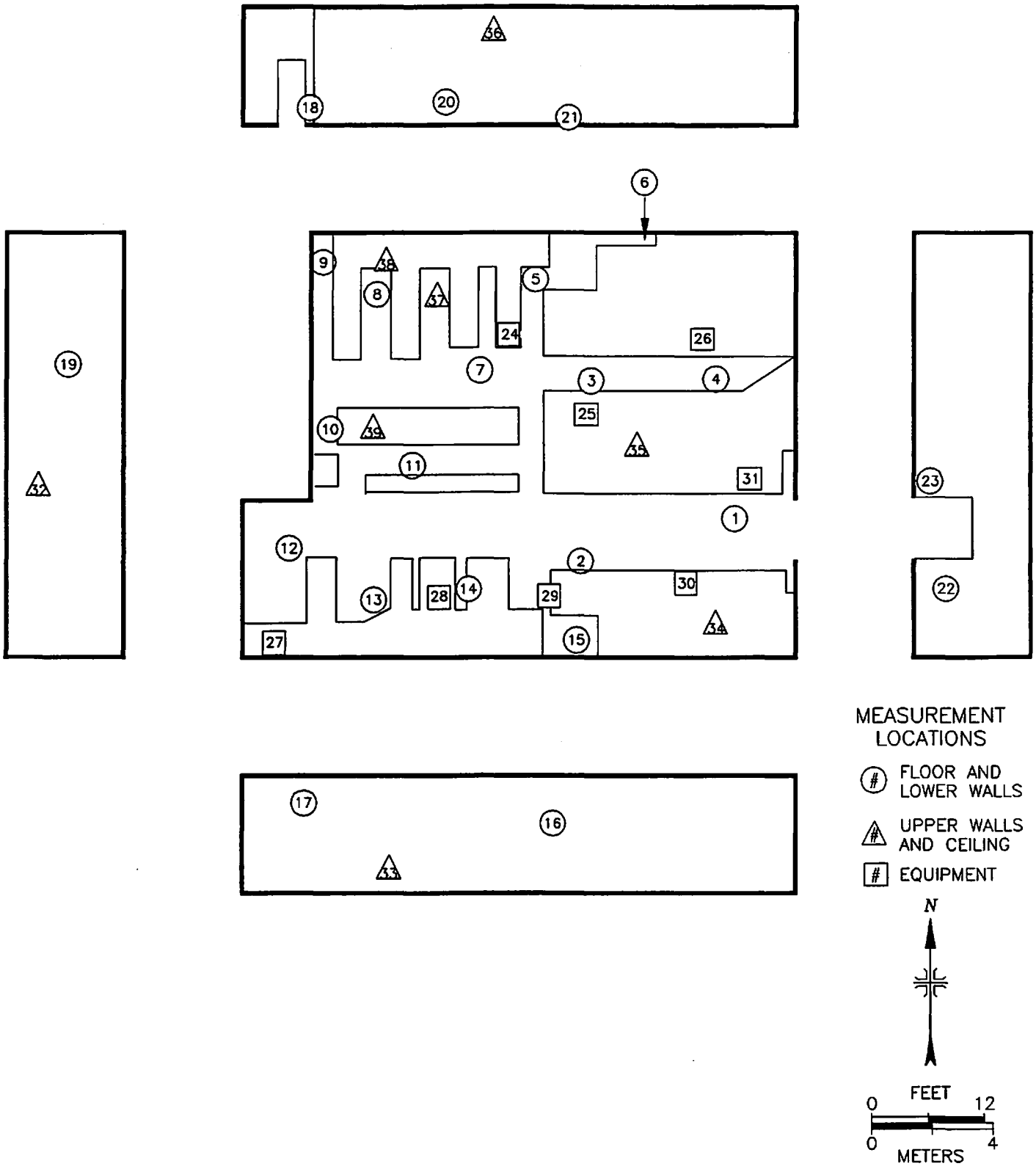

FIGURE 47: Room 202 (Supply Air Fan Room) Floor Plan Showing Measurement Locations

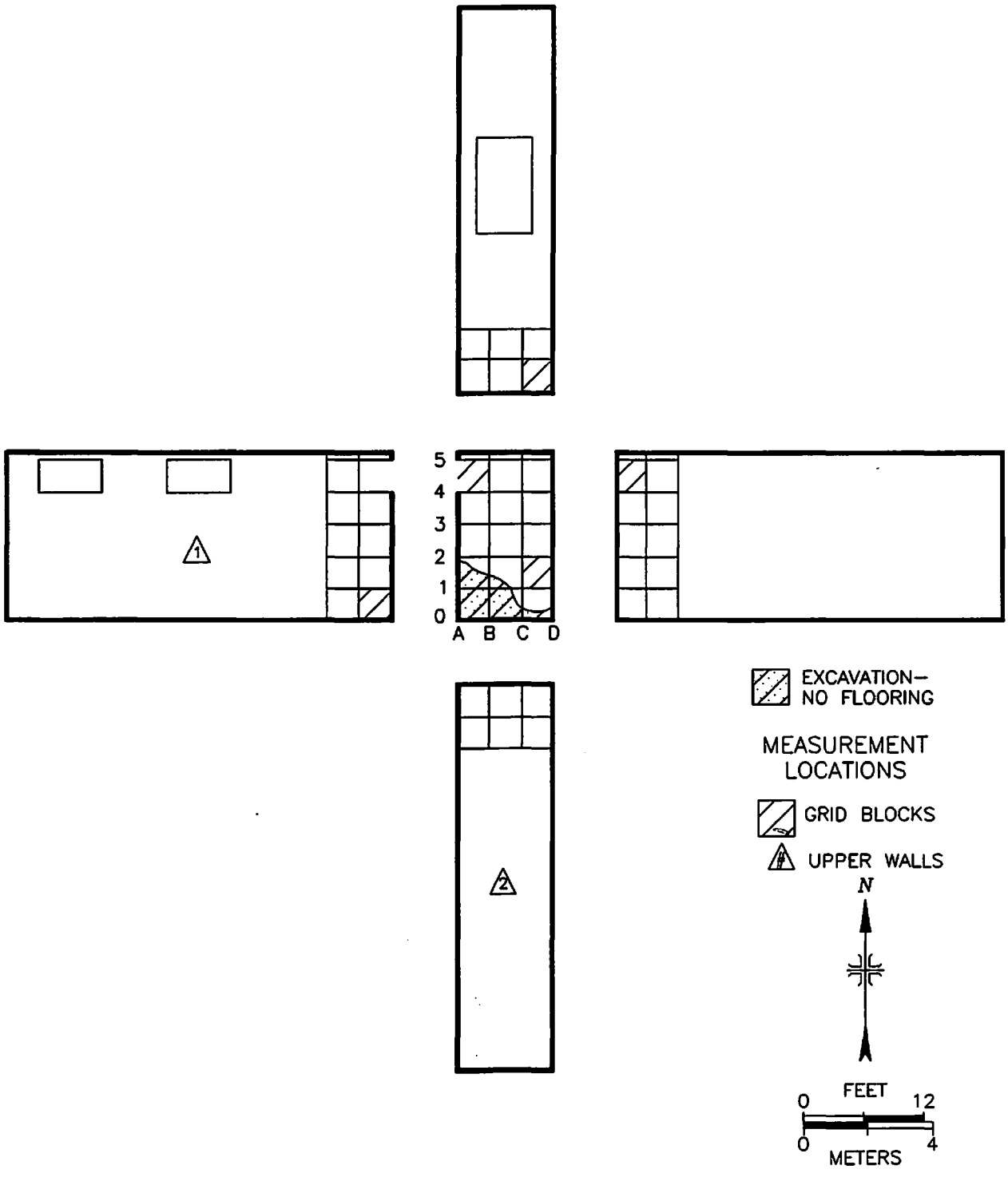

FIGURE 48: Room B1A Floor Plan Showing Measurement Locations

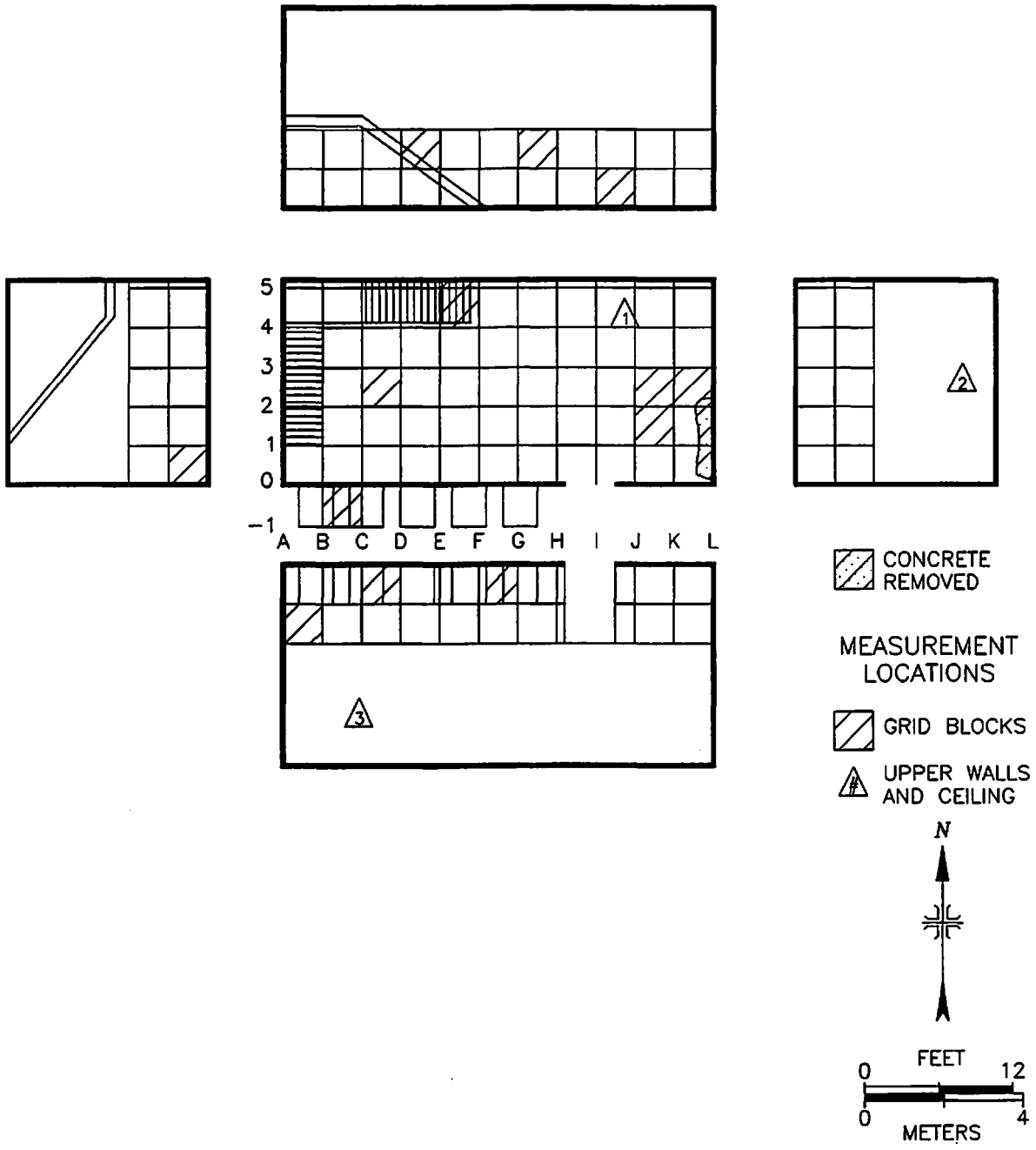

FIGURE 49: Room B01 Floor Plan Showing Measurement Locations

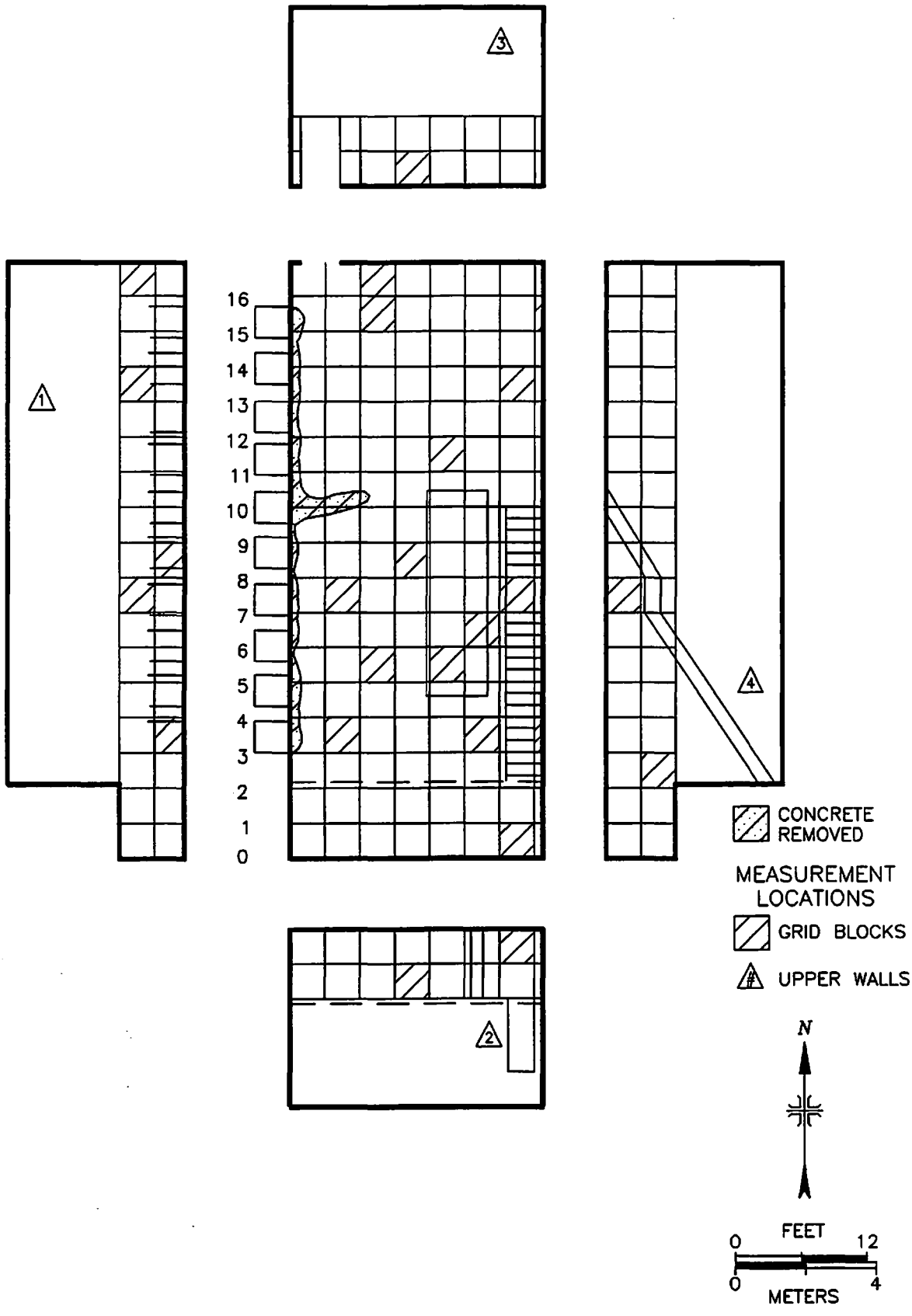

FIGURE 50: Room B02 Floor Plan Showing Measurement Locations

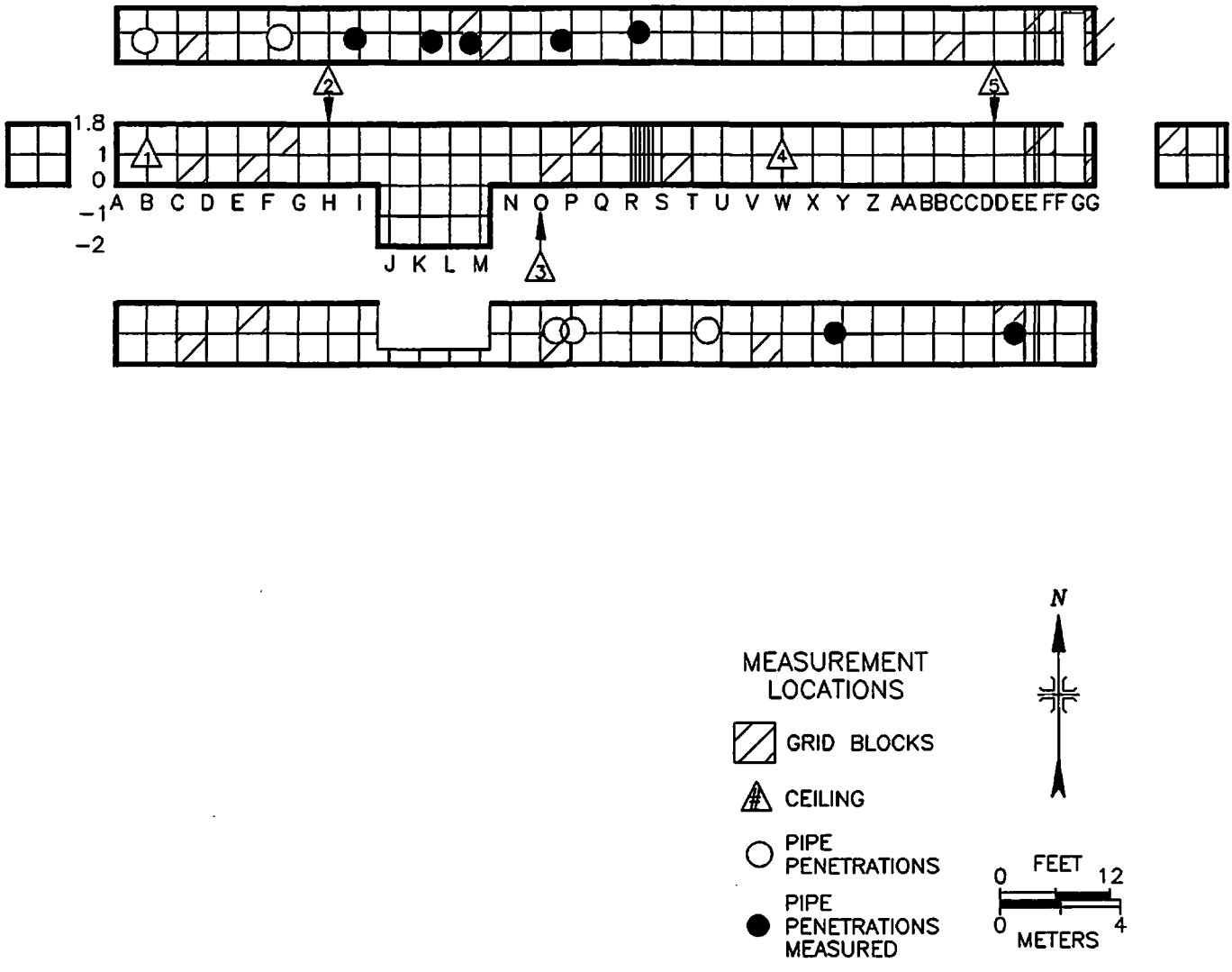

FIGURE 51: Tunnel Floor Plan Showing Measurement Locations

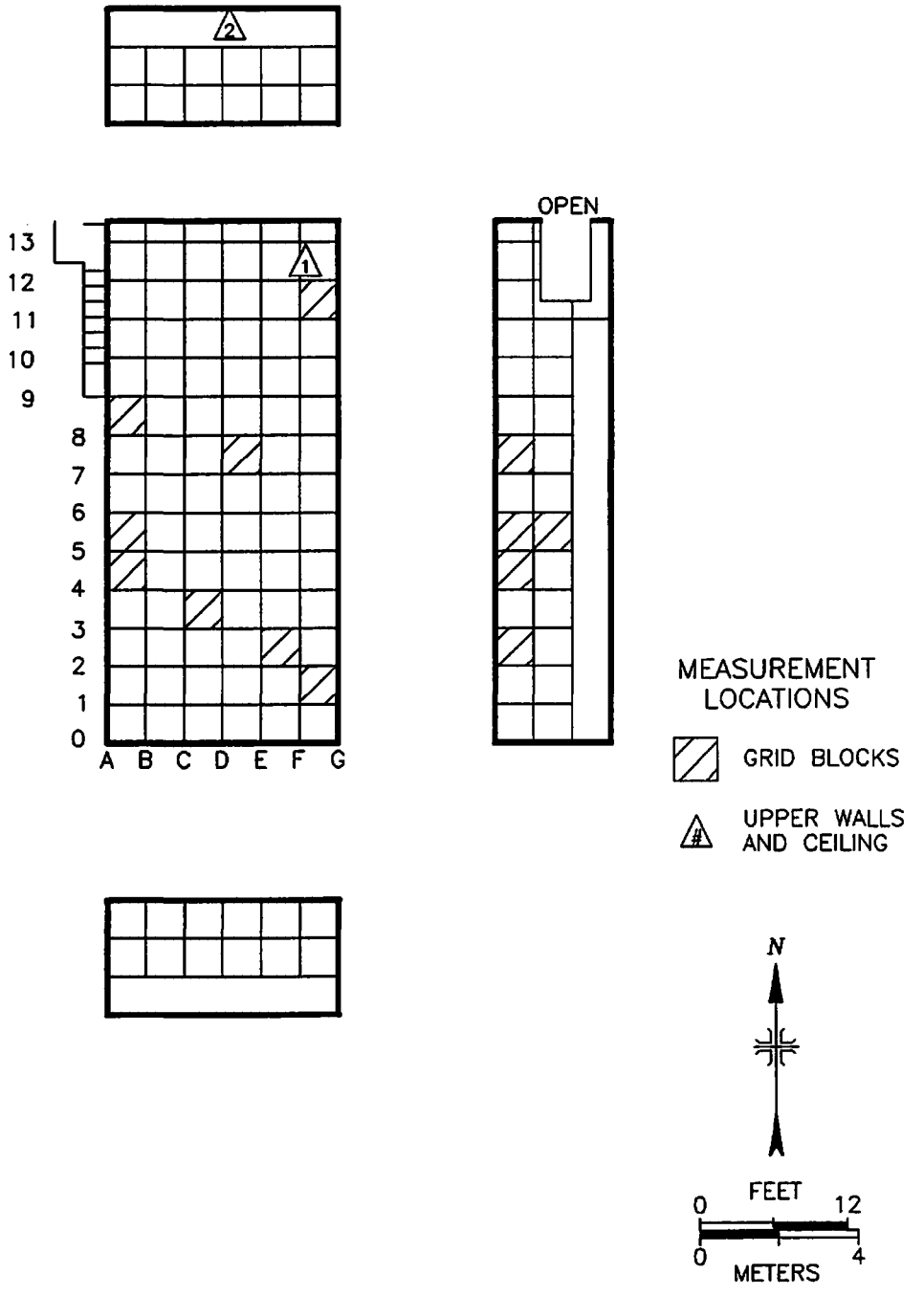

FIGURE 52: Vault Roof Cold Chemical Storage Room Floor Plan Showing Measurement Locations

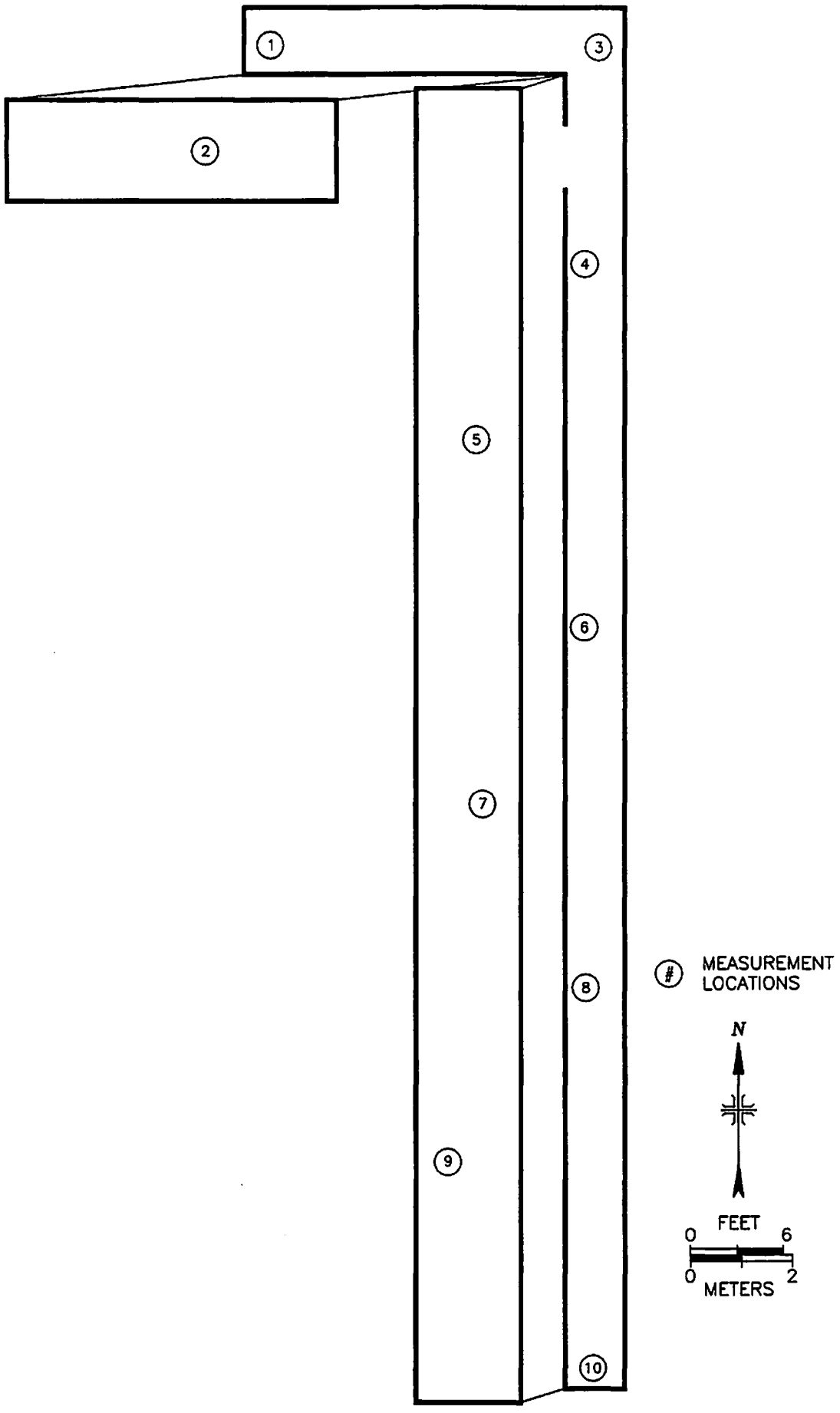

FIGURE 53: Vault Room Ledge Showing Measurement Locations

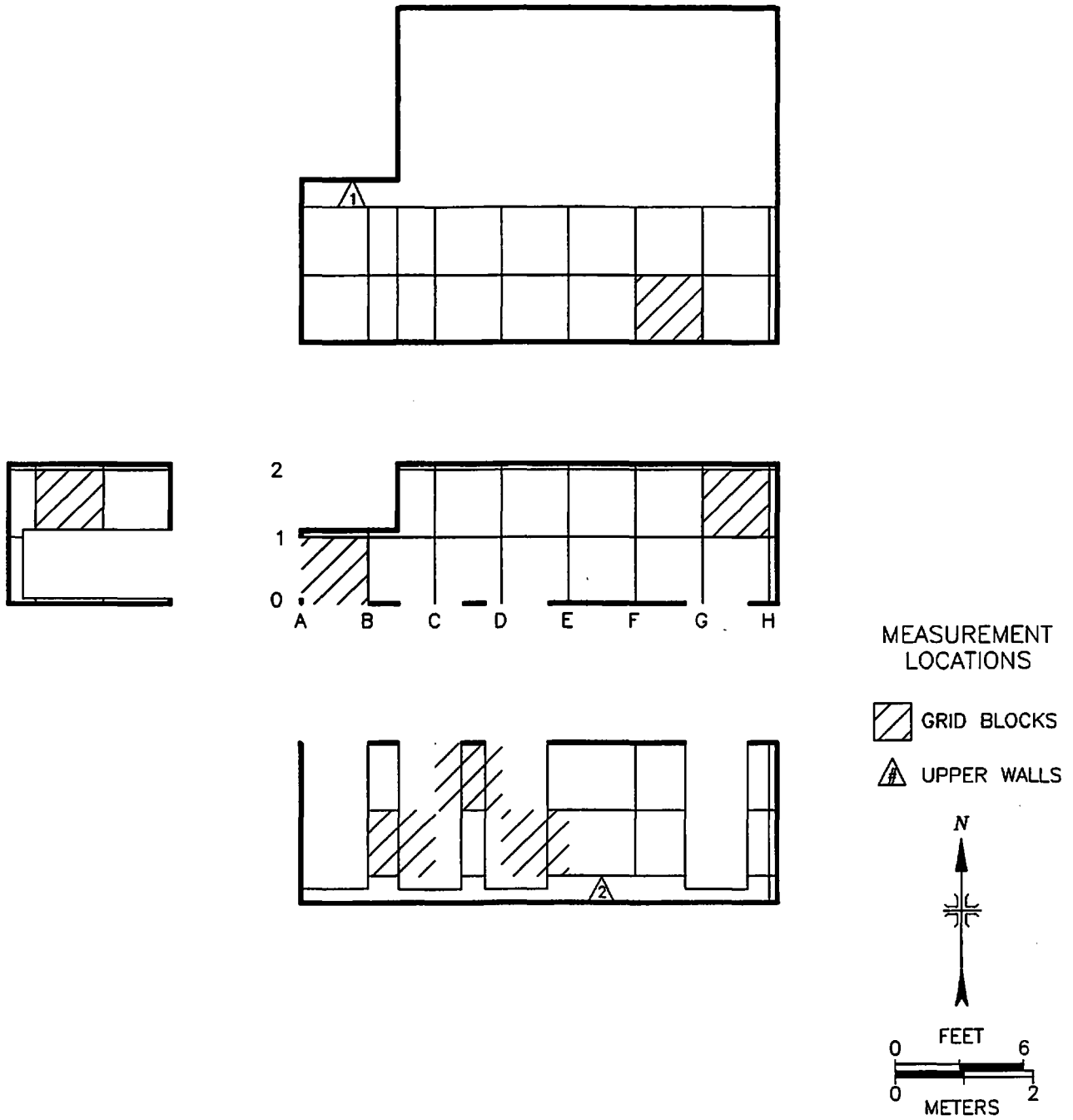

FIGURE 54: HP Corridor Floor Plan Showing Measurement Locations

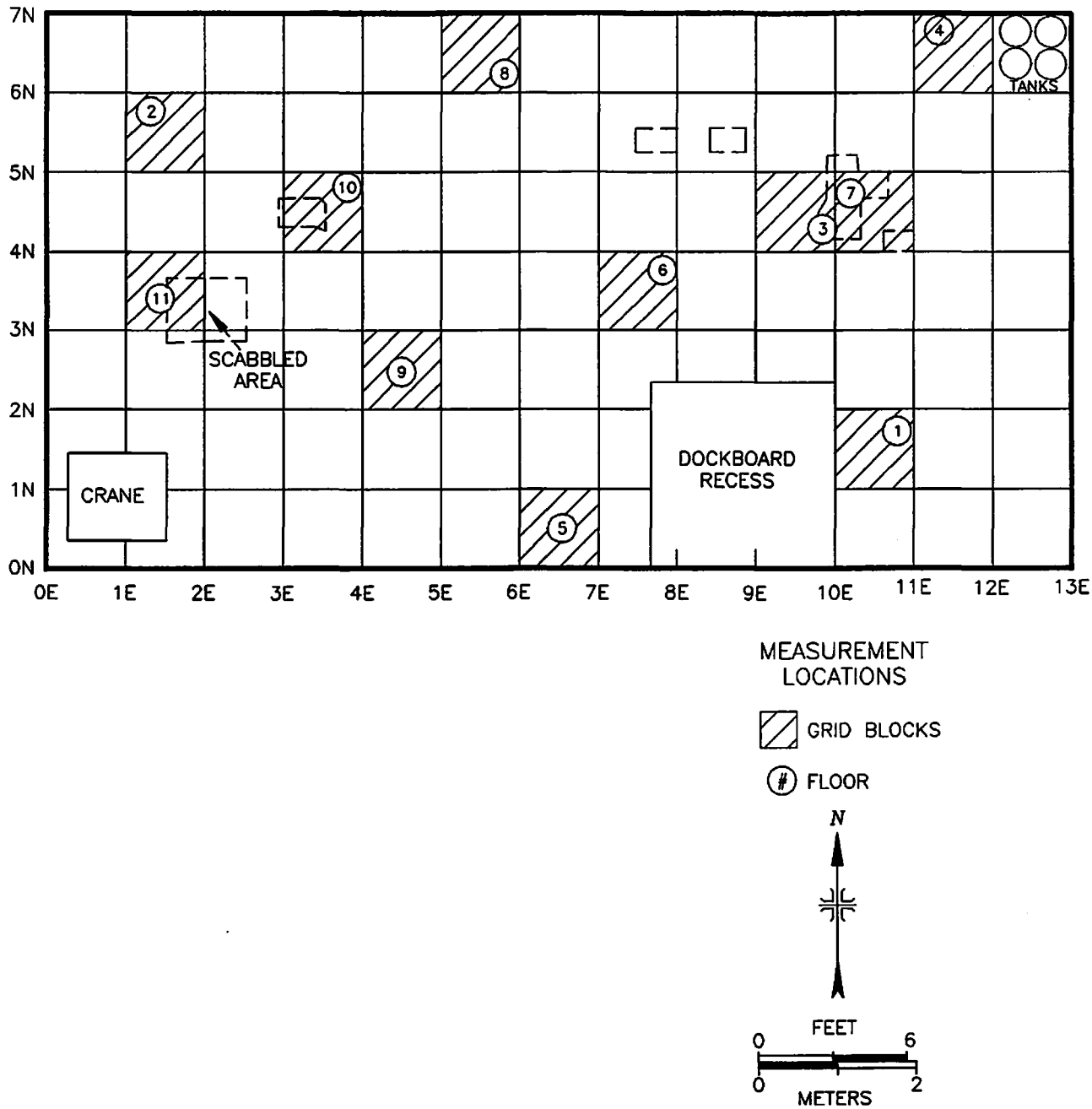

FIGURE 55: Loading Dock Floor Plan Showing Measurement Locations

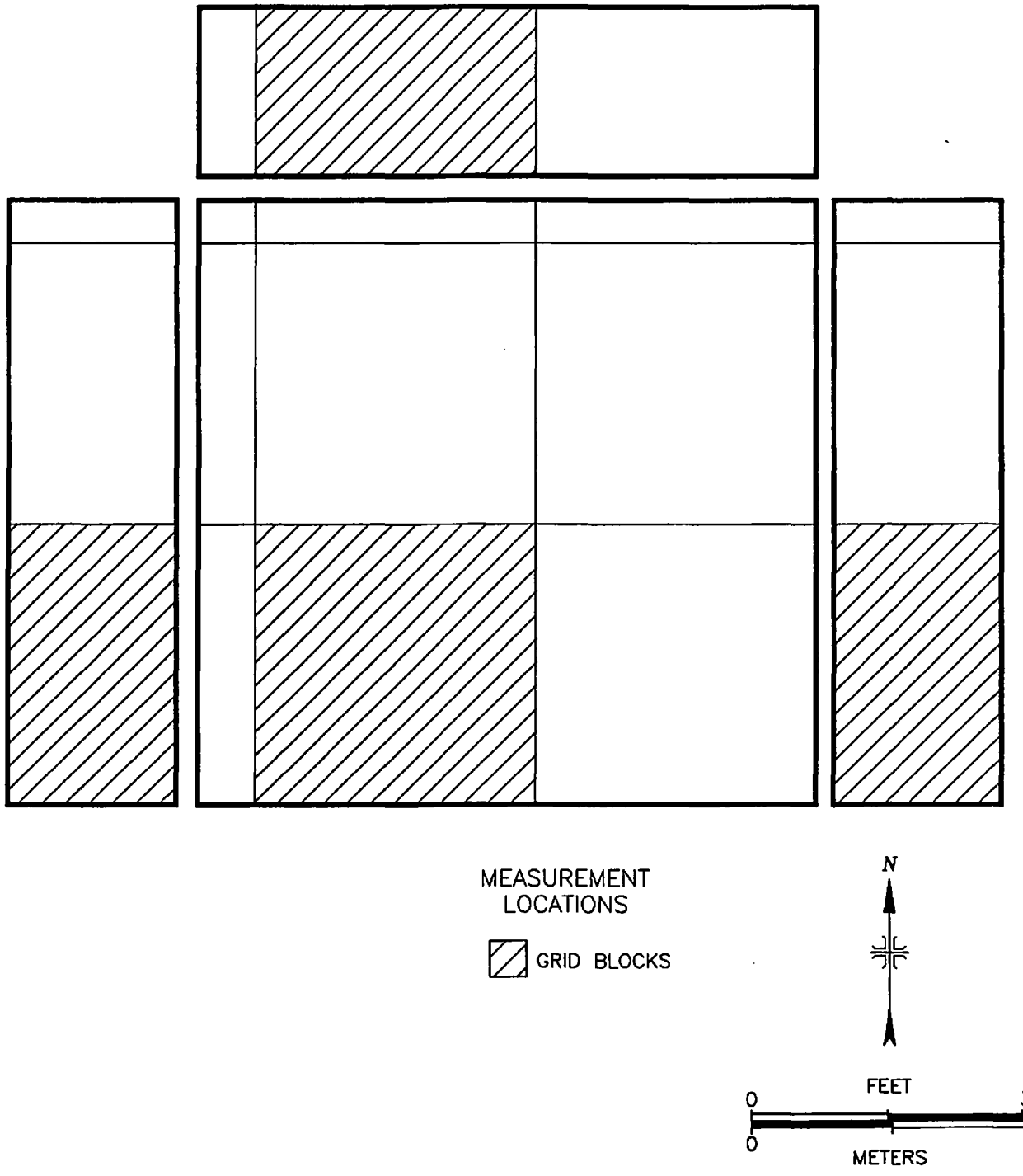

FIGURE 56: Loading Dock Dockboard Recess Showing Measurement Locations

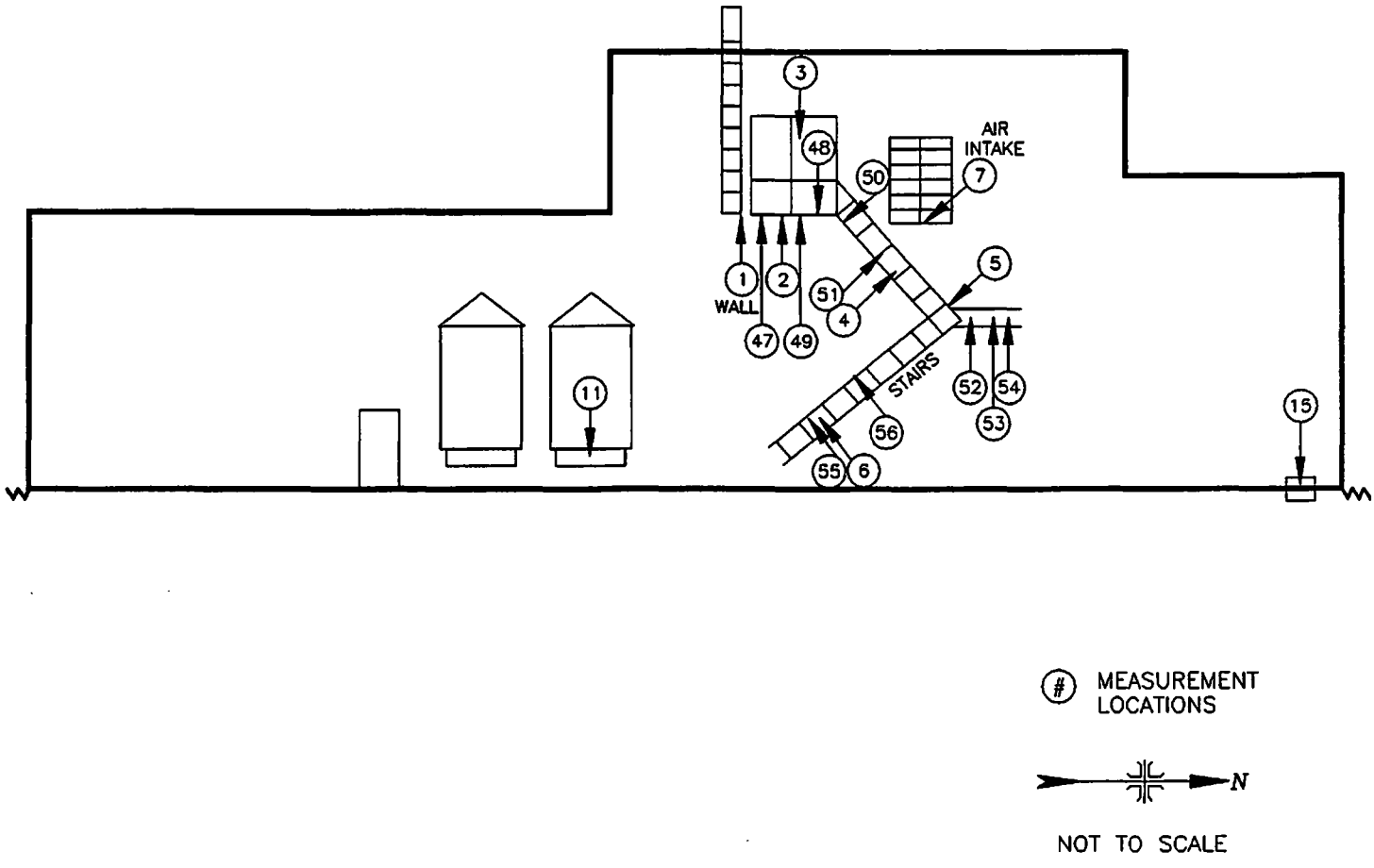

FIGURE 57: Building Exterior (East Side) Showing Measurement Locations

SFC17c

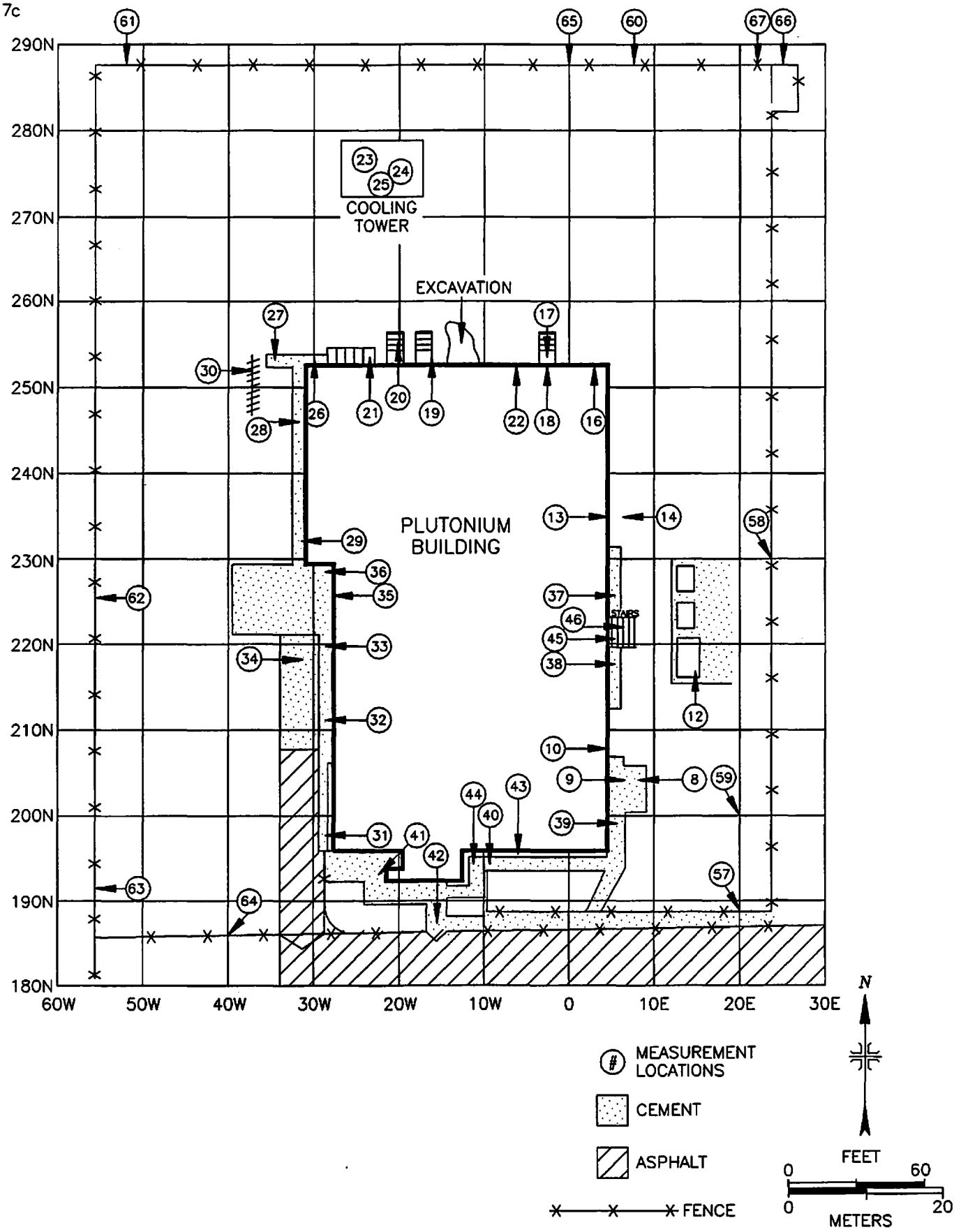

FIGURE 58: Building Exterior Showing Measurement Locations on the Building, Walkways and Miscellaneous Surfaces

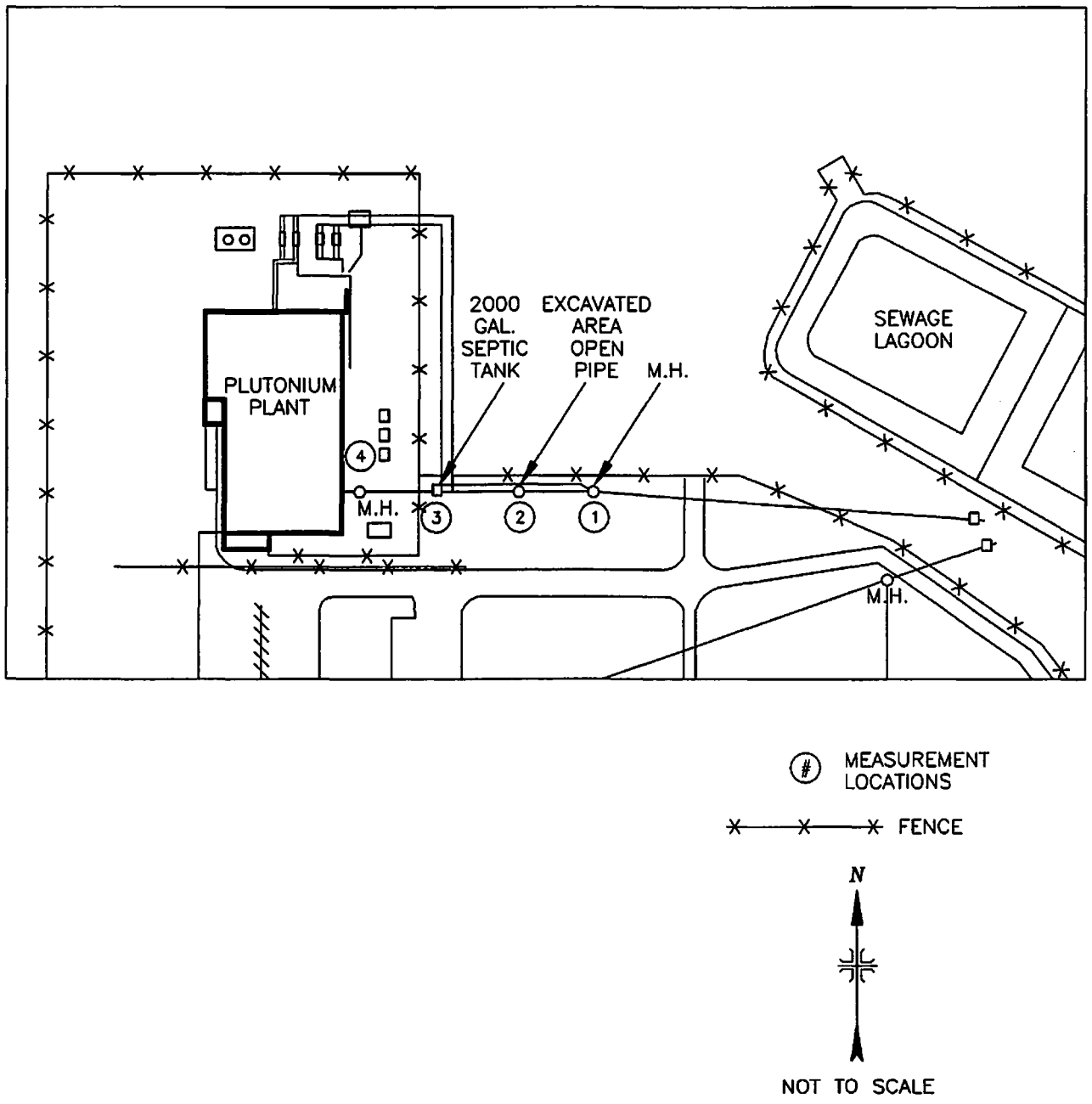

FIGURE 59: Measurement Locations Along the Sanitary Drain System

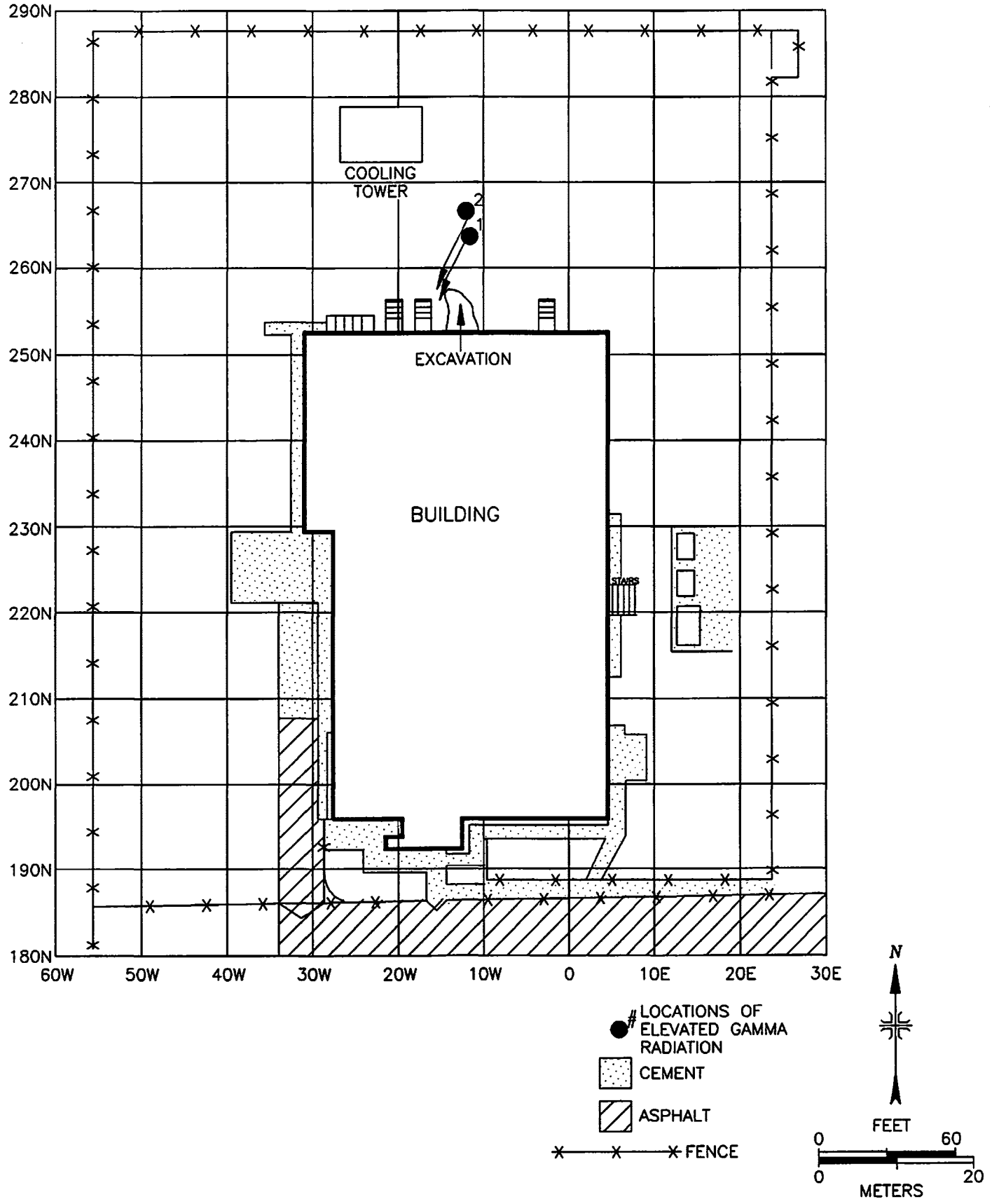

FIGURE 60: Sampling Locations from Areas Identified by Gamma Scans

SFC17b

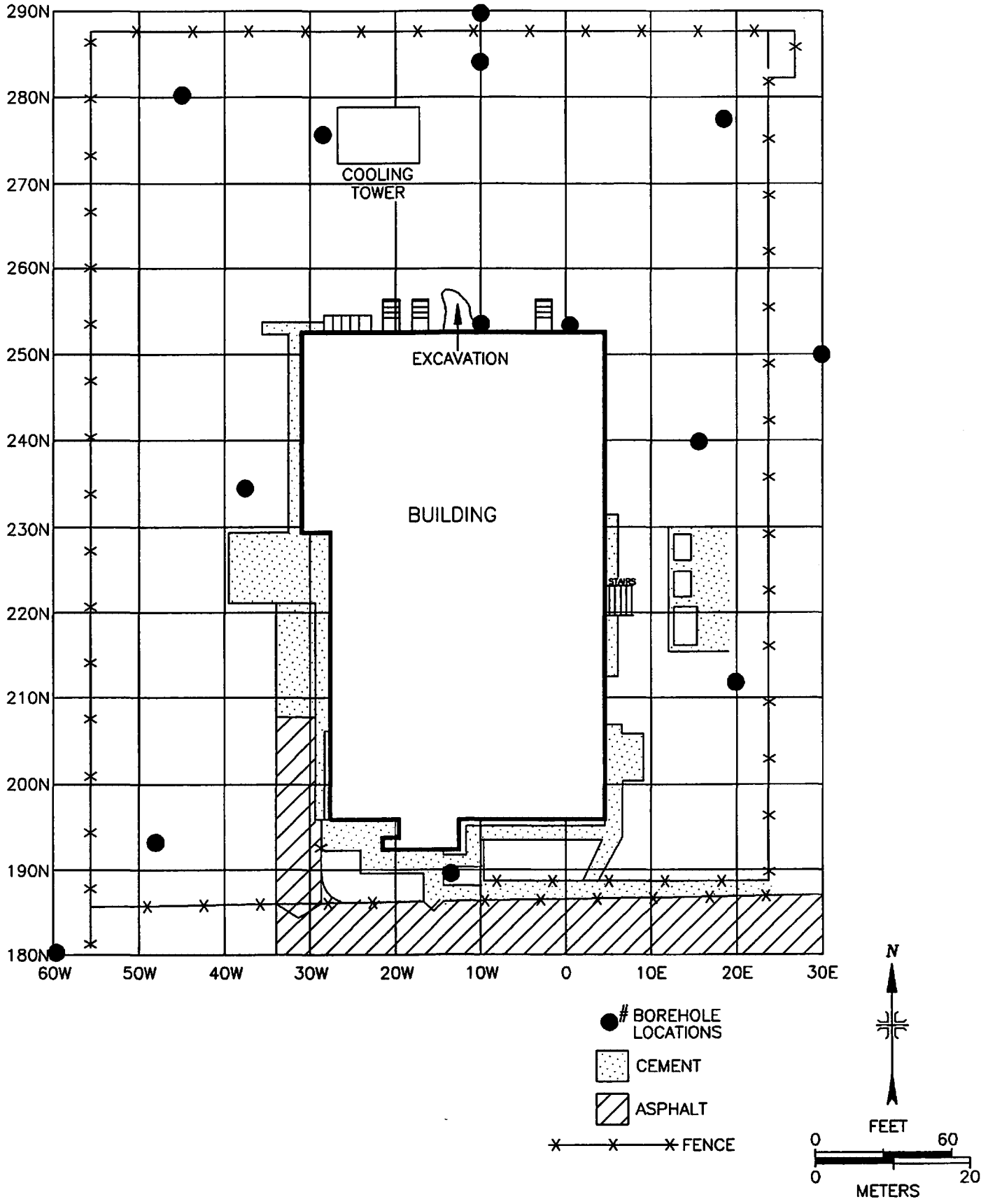

FIGURE 61: Locations of Shallow Boreholes for Subsurface Soil Sampling

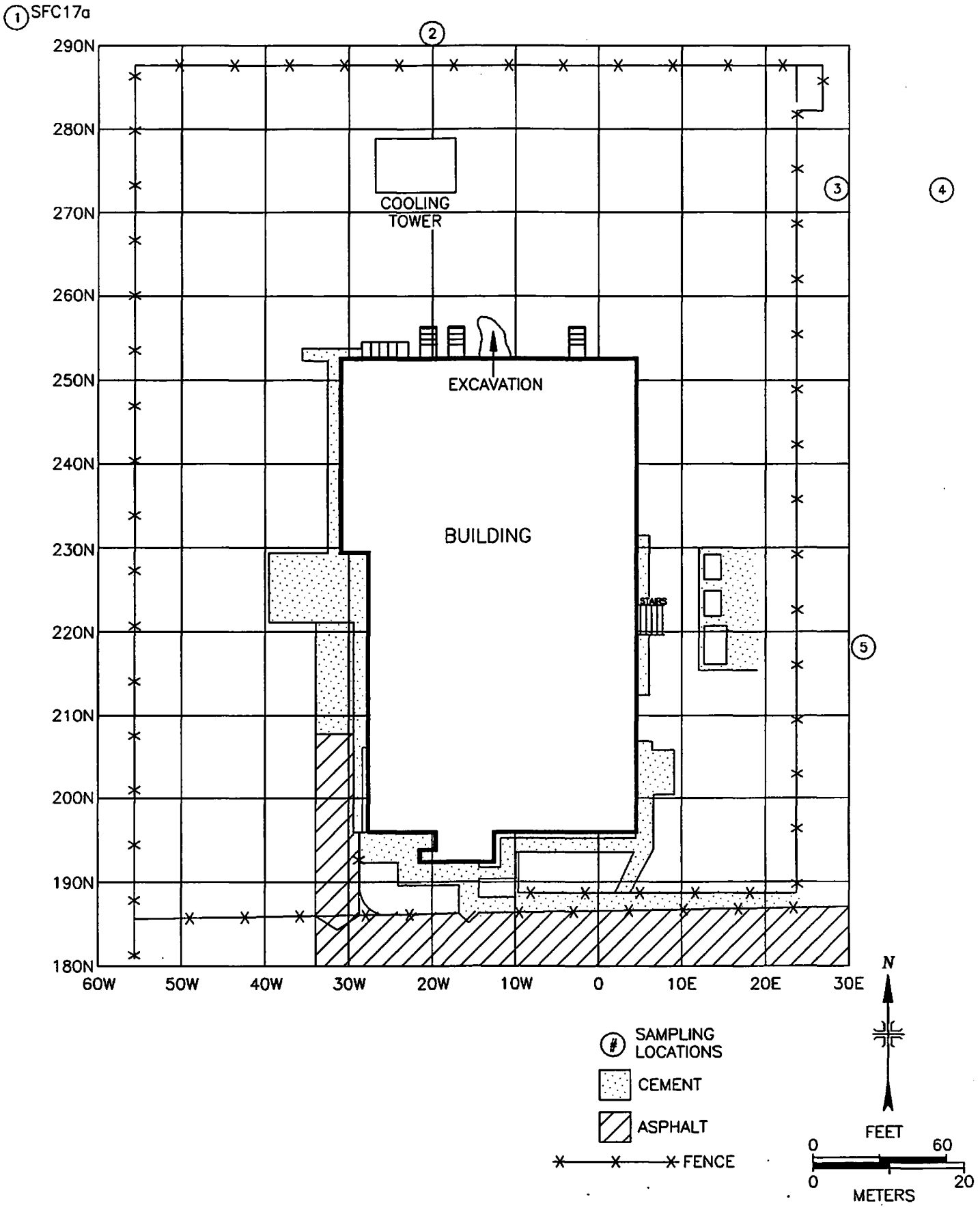

FIGURE 62: Sampling Locations from Surface Drainage Outfalls

TABLE 1

BACKGROUND RADIATION LEVELS AND BASELINE RADIONUCLIDE CONCENTRATIONS IN SOIL MIXED OXIDE FACILITY CIMARRON CORPORATION PLANT CRESCENT, OKLAHOMA

Location[a]	Exposure Rate (μR/h) at 1 m above ground surface	Radionuclide Concentration (pCi/g)				
		U-235	U-238	Pu-238	Pu-239/240	Am-241
1	10	<0.1	0.7 ± 0.4	<0.1	<0.1	<0.1
2	9	<0.1	<0.3	<0.1	<0.1	<0.1
3	9	0.1 ± 0.1	0.4 ± 0.5	<0.1	<0.1	<0.1
4	10	<0.2	0.9 ± 0.2	<0.1	<0.1	<0.1
5	10	0.1 ± 0.1	0.8 ± 0.7	<0.1	<0.1	<0.1
6	10	<0.2	<0.5	<0.1	<0.1	<0.1
Range	9-10	<0.1 - <0.2	<0.3 - 0.9	<0.1	<0.1	<0.1

[a]Refer to Figure 3.
[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.

TABLE 2

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS AT LOCATIONS
INITIALLY EXCEEDING GUIDELINES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Initial / Follow-up	TOTAL CONTAMINATION Alpha (dpm/100 cm^2)	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2)	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)
ROOM 106					
N.E. Corner	Initial	440	610	<3	<6
	Follow-up	85	---[a]	<3	<6
ROOM 109					
E+0.2,0.8,0.1	Initial	1700	<350	<3	<6
	Follow-up	40	---	---	---
ROOM 110					
B,26,0.8	Initial	890	1900	3	<6
	Follow-up	WALL REMOVED			
N/S CORRIDOR #113 AND AIRLOCK #115	Initial	910	1500	3	8
A,20,0.5	Follow-up	<24	---	<3	<6
B+.5,14.5,1.1	Initial	1500	<350	3	<6
	Follow-up	<24	---	<3	<6
B+.5,12,1.7	Initial	2500	3600	117	21
	Follow-up	<24	---	<3	<6
ROOM 116					
E,6	Initial	---	---	---	---
	Follow-up	50	560	<3	<6

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS AT LOCATIONS
INITIALLY EXCEEDING GUIDELINES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Initial / Follow-up	TOTAL CONTAMINATION Alpha (dpm/100 cm^2)	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2)	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)
ROOM 118					
C+.2,0,1	Initial	800	810	<3	<6
	Follow-up	<28	---	<3	<7
X,0	Initial	---	---	---	---
	Follow-up	130	580	<3	<6
P,1	Initial	---	---	---	---
	Follow-up	110	420	<3	<6
ROOM 120					
N.W. Corner	Initial	470	---	---	---
	Follow-up	62	---	---	---
ROOM 123					
A,6,1	Initial	530	470	3	<6
	Follow-up	90	<350	<3	<6
E,1	Initial	420	530	<3	<6
	Follow-up	85	---	5	<6
D,6	Initial	1500	4500		
Door Handle	Follow-up	HANDLE REMOVED			

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS AT LOCATIONS
INITIALLY EXCEEDING GUIDELINES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Initial / Follow-up	TOTAL CONTAMINATION Alpha (dpm/100 cm^2)	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2)	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)
ROOM 123 (Cont'd)					
E+.8,9,0.1	Initial	1500	1200	<3	10
	Follow-up	53	---	<3	<6
E+.8,18&19,0	Initial	5400	9400	---	---
	Follow-up	WALL REMOVED			
E+.8,7.5,1.8	Initial	580	<350	128	17
	Follow-up	<28	<350	3.1	<6
ROOM 124					
A,9,1	Initial	2200	3100	---	---
	Follow-up	WALL REMOVED			
A,18,1	Initial	5800	3200	---	---
	Follow-up	WALL REMOVED			
F+.1,15,1	Initial	12000	12000	---	---
	Follow-up	WALL REMOVED			
F+.1,10,1	Initial	490	1900	<3	<6
	Follow-up	<24	---	<3	<6

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS AT LOCATIONS
INITIALLY EXCEEDING GUIDELINES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Initial / Follow-up	TOTAL CONTAMINATION Alpha (dpm/100 cm^2)	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2)	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)
ROOM 124 (Cont'd)					
F+.1,9,1	Initial	1900	3300	7	<6
	Follow-up	76	---	<3	<6
F+.1,2,0	Initial	370	1100	<3	7
	Follow-up	<24	---	<3	14
ROOM 126					
A,10	Initial	2700	6400	7	<6
	Follow-up	23	<420	<3	<6
ROOM 133					
D,6.2,1.1	Initial	---	---		
	Follow-up	<24	---	<3	<6
D+.6,0,1.4	Initial	---	---		
	Follow-up	68	---	<3	<6
ROOM 134					
A+.8,3.5,1.3	Initial	---	---		
	Follow-up	85	---	<3	<6
ROOM B01					
A,0	Initial	420	1400	<3	12
	Follow-up	130	---	---	---

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS AT LOCATIONS
INITIALLY EXCEEDING GUIDELINES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Initial / Follow-up	TOTAL CONTAMINATION Alpha (dpm/100 cm^2)	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2)	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)
ROOM B01 (Cont'd)					
7+1,0,1	Initial	560	<350	3	<6
	Follow-up	30	---	---	---
G,0	Initial	640	750	<3	<6
	Follow-up	120	---	---	---
ROOM B02					
A,7	Initial	29000	25000	5	<6
	Follow-up	50	---	---	---
A,12	Initial	280	<350	<3	<6
	Follow-up	80	---	---	---
A,6	Initial	560	440	3	<6
	Follow-up	40	---	<3	9
A,0	Initial	960	1500	<3	<6
	Follow-up	40	---	<3	<6
C,0	Initial	1100	970	<3	<6
	Follow-up	110	---	---	---

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS AT LOCATIONS
INITIALLY EXCEEDING GUIDELINES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Initial / Follow-up	TOTAL CONTAMINATION Alpha (dpm/100 cm^2)	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2)	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)
ROOM B02 (Cont'd)					
C,1	Initial	380	<350	<3	<6
	Follow-up	230	---	---	---
G,7	Initial	720	<350	<3	<6
	Follow-up	150	---	---	---
H+.2,2,0	Initial	1500	2400	<3	<6
	Follow-up	<28	---	---	---
D,4	Initial	1700	<350	<3	<6
	Follow-up	50	---	---	---
F,5	Initial	1900	<350	<3	<6
	Follow-up	190	---	---	---
RM. MECH. TUNNEL					
DD,0,1	Initial	1500	640	9	<6
	Follow-up	34	---	<3	<6
Y,0,.7	Initial	490	<350	3	<6
	Follow-up	<24	---	<3	<6

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS AT LOCATIONS
INITIALLY EXCEEDING GUIDELINES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Initial / Follow-up	TOTAL CONTAMINATION Alpha (dpm/100 cm^2)	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2)	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)
RM. MECH. TUNNEL (Cont'd)					
Q,1.8,.5	Initial	740	610	5	<6
	Follow-up	93	---	<3	<6
O,1.8,.5	Initial	1100	<350	5	12
	Follow-up	68	---	3	<6
L,1.8,.4	Initial	600	<350	<3	<6
	Follow-up	42	---	<3	8
K,1.8,.2	Initial	17000	23000	5	<6
	Follow-up	25	---	<3	<6
I,1.8,.5	Initial	850	<350	<3	<6
	Follow-up	25	---	<3	<6
HP CORRIDOR					
G+.8,2.1,1	Initial	550	530	<3	<6
	Follow-up	<24	---	<3	<6
ROOM 201					
K,.8,2	Initial	---	---	---	---
	Follow-up	<21	---	<3	<6

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS AT LOCATIONS
INITIALLY EXCEEDING GUIDELINES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Initial / Follow-up	TOTAL CONTAMINATION Alpha (dpm/100 cm^2)	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2)	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)
ROOM 201 (Cont'd)					
H+.5,0,1.8	Initial	---	---	---	---
	Follow-up	42	---	<3	<6
A,7.5,.5	Initial	---	---	---	---
	Follow-up	74	---	<3	<6
C+.5,11.3	Initial	---	---	---	---
	Follow-up	21	---	<3	7
F+.8,10.3	Initial	---	---	---	---
	Follow-up	74	---	<3	<6
ROOM B1A (83)					
B,0,0	Initial	---	---	---	---
	Follow-up	<24	---	<3	<6
S."I" BEAM	Initial	---	---	---	---
	Follow-up	110	---	<3	<6
S."I" BEAM	Initial	---	---	---	---
	Follow-up	25	---	<3	<6

TABLE 2 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS AT LOCATIONS
INITIALLY EXCEEDING GUIDELINES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Initial / Follow-up	TOTAL CONTAMINATION Alpha (dpm/100 cm^2)	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2)	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)
ROOM B1A (B3) (Cont'd)					
C,1	Initial	---	---	---	---
	Follow-up	<24	---	<3	<6
C,3	Initial	---	---	---	---
	Follow-up	<24	---	<3	<6
B,2	Initial	---	---	---	---
	Follow-up	<24	---	<3	<6
A,1,0.5	Initial	---	---	---	---
	Follow-up	<24	---	<3	<6
N."I" BEAM	Initial	---	---	---	---
	Follow-up	68	---	<3	<6
C,5.2,0	Initial	---	---	---	---
	Follow-up	25	---	<3	<6

[a]Dash indicates measurement not performed.

TABLE 3

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 100 & VESTIBULE	5								
Floors and Lower Walls[b]		15	N/A[c]	<24-34	N/A	N/A	<3-7	<6-12	0
Upper Walls and Ceiling[b]		3		<24	N/A	N/A	<3-3	<6	0
ROOM 101[b]	6								
Floors and Lower Walls[b]		8	N/A	<28-50	N/A	N/A	<3-3	<6	0
Upper Walls and Ceiling[b]		1	N/A	30	N/A	N/A	<3	7	0
ROOM 102[b]	7								
Floors and Lower Walls[b]		8	N/A	<28-90	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		1	N/A	<28	N/A	N/A	<3	<6	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 103	8								
Floors and Lower Walls[b]		9	N/A	<24-25	N/A	N/A	<3- 3	<6	0
Upper Walls and Ceiling[b]		2	N/A	<24-42	N/A	N/A	<3	<6	0
Sink[b]		1	N/A	<24	N/A	N/A	<3	<6	0
ROOM 106	9								
Floors and Lower Walls[b]		5	N/A	<28- 85	N/A	610	<3- 3	<6	0
Upper Walls and Ceiling[b]		1	N/A	40	N/A	N/A	<3	<6	0
ROOM 108	10								
Floors and Lower Walls		5	28	<21- 64	N/A	N/A	<3	<6-8	0
Upper Walls and Ceiling[b]		1	N/A	25	N/A	N/A	9	<6	0
ROOM 104 & 107	11								
Floors and Lower Walls		16	<18	<18- 32	N/A	N/A	<3- 3	<6-7	0
Upper Walls and Ceiling[b]		4	N/A	<21- 32	N/A	N/A	<3	<6	0
Misc. Surfaces[b]		3	N/A	<21- 74	N/A	N/A	<3- 7	<6-10	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION Alpha (dpm/100 cm^2) Highest Grid Block Avg.	TOTAL CONTAMINATION Alpha (dpm/100 cm^2) Range of Measurements	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2) Highest Grid Block Avg.	TOTAL CONTAMINATION Beta-Gamma (dpm/100 cm^2) Range of Measurements	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta Range (dpm/100 cm^2)	Number of Measurements or Grid Blocks Exceeding Criteria
ROOM 105 & AIRLOCK #111	12								
Floors and Lower Walls		9	23	<18-32	N/A	N/A	<3-3	<6-19	0
Upper Walls and Ceiling[b]		3	N/A	<24-42	N/A	N/A	<3	<6	0
Misc. Surfaces[b]		3	N/A	<24-34	N/A	N/A	<3	<6- 9	0
ROOM 109	13								
Floors and Lower Walls		5	30	<28- 70	N/A	N/A	<3	<6- 7	0
Upper Walls and Ceiling[b]		1	N/A	51	N/A	N/A	5	<6	0
Floor[b]		1	N/A	40	N/A	N/A	NO SMEAR		
ROOM 110	14								
Floors and Lower Walls		4	<28	<28- 50	N/A	N/A	<3	<6- 7	0
Upper Walls and Ceiling[b]		1	N/A	<24	N/A	N/A	<3	<6	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 112	15								
Floors and Lower Walls[b]		6	N/A	<24- 68	N/A	N/A	<3- 3	<6	0
Upper Walls and Ceiling[b]		1	N/A	<24	N/A	N/A	<3	<6	0
ROOM 113/115	16								
Floor and Lower Walls		16	30	<28- 100	N/A	N/A	<3	<6- 8	0
Upper Walls and Ceiling[b]		4	N/A	<24	N/A	N/A	<3	<6	0
Lower Wall[b]		3	N/A	<24	N/A	N/A	<3	<6	0
ROOM 114	17								
Floors and Lower Walls[b]		5	N/A	<24- 25	N/A	N/A	<3	<6- 9	0
Upper Walls and Ceiling[b]		1	N/A	<24	N/A	N/A	<3	<6	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 116	18								
Floor and Lower Walls		14	32	<21- 64	N/A	N/A	<3	<6- 7	0
Upper Walls and Ceiling[b]		3	N/A	<24- 34	N/A	N/A	<3	<6	0
Floor[b]		1	N/A	50		560	<3	<6	0
ROOM 117	19								
Floors and Lower Walls[b]		18	N/A	<24- 34	N/A	N/A	<3	<6- 9	0
Upper Walls and Ceiling[b]		2	N/A	<24	N/A	N/A	<3	<6	0
ROOM 118	20								
Floors and Lower Walls		18	61	<21- 170	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		4	N/A	<18- 62	N/A	N/A	<3- 18	<6- 8	0
Floor[b]		2	N/A	110- 130		420- 580	<3	<6	0
Lower Wall[b]		1	N/A	<28		N/A	<3	7	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 119	21								
Floor and Lower Walls		2	<13	<13- 23	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		1	N/A	42	N/A	N/A	<3	<6	0
ROOM 120	21								
Floors and Lower Walls		7	24	<13- 36	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		1	N/A	21	N/A	N/A	<3	<6	0
Lower Wall[b]		1	N/A	62	N/A	N/A	NO SMEAR		
ROOM 121	21								
Floors and Lower Walls		19	13	<13- 41	N/A	N/A	<3- 3	<6-17	0
Upper Walls and Ceiling[b]		3	N/A	<21- 21	N/A	N/A	<3	<6	0
Marble Table[b]		1	N/A	53	N/A	N/A	<3	<6	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 121 PIT	22								
Floor and Lower Walls[b]		8	N/A	<21- 53	N/A	N/A	<3- 3	<6	0
Upper Walls and Ceiling[b]		3	N/A	<21	N/A	N/A	<3	<6	0
Railings[b]		2	N/A	<21	N/A	N/A	<3- 3	<6	0
ROOM 122/123	23								
Floors and Lower Walls		22	40	<28- 60	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		5	N/A	<18- 36	N/A	N/A	<3- 3	<6	0
Floor[b]		1	N/A	85	N/A	N/A	5	<6	0
Lower Wall[b]		5	N/A	<28- 90	N/A	N/A	<3- 5	<6	0
ROOM 124	24								
Duct Openings[b]		6	N/A	30- 110	N/A	N/A	<3- 10	<6-14	0
Floors and Lower Walls		19	56	<28- 210	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		4	N/A	36- 62	N/A	N/A	<3	<6	0
Lower Wall[b]		6	N/A	<24- 76	N/A	N/A	<3	<6-14	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 125	25								
Floor and Lower Walls		8	29	<18- 62	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		2	N/A	<24- 34	N/A	N/A	<3- 7	<6-12	0
Stairs[b]		3	N/A	<24- 76	N/A	N/A	<3	<6	0
ROOM 126	26								
Floors and Lower Walls		16	37	<18- 45	N/A	N/A	<3- 7	<6-12	0
Upper Walls and Ceiling[b]		3	N/A	36- 98	N/A	N/A	<3	<6	0
Floor[b]		1	N/A	23	<420		<3	<6	0
ROOM 127	27								
Floor and Lower Walls		16	44	<28- 120	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		4	N/A	<21- 64	N/A	N/A	<3	<6	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 128	28								
Floors and Lower Walls		18	41	<13- 77	N/A	N/A	<3- 13	<6-113	0
Upper Walls and Ceiling[b]		4	N/A	<21- 42	N/A	N/A	<3- 3	<6	0
Railing[b]		1	N/A	95	N/A	N/A	<3	<6	0
ROOM 129	29								
Floor and Lower Walls		21	54	<28- 90	N/A	N/A	<3- 5	<6- 16	0
Upper Walls and Ceiling[b]		6	N/A	<21- 74	N/A	N/A	<3	<6	0
ROOM 130	30								
Floor and Lower Walls		4	59	<18- 110	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		2	N/A	<21- 21	N/A	N/A	<3	<6	0
ROOM 131	31								
Floors and Lower Walls		6	23	<18- 50	N/A	N/A	<3- 5	<6- 9	0
Upper Walls and Ceiling[b]		2	N/A	<21	N/A	N/A	<3	<6	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 132	32								
Floor and Lower Walls		9	41	<18- 50	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		4	N/A	<21	N/A	N/A	<3	<6- 12	0
ROOM 133	33								
Floor and Lower Walls		11	42	<21- 95	N/A	N/A	<3- 3	<6- 8	0
Upper Walls and Ceiling[b]		4	N/A	<21- 32	N/A	N/A	<3	<6	0
Lower Walls[b]		2	N/A	<24- 68	N/A	N/A	<3	<6	0
ROOM 134	34								
Floors and Lower Walls		4	<21	<21- 53	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		2	N/A	<21	N/A	N/A	<3	<6- 14	0
Lower Walls[b]		1	N/A	85	N/A	N/A	<3	<6	1
ROOM 135	35								
Floor and Lower Walls		6	41	<18- 59	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		2	N/A	<21- 21	N/A	N/A	<3	<6	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 136	36								
Floor and Lower Walls		4	21	<21- 64	N/A	N/A	<3- 3	<6	0
Upper Walls and Ceiling[b]		2	N/A	<21- 21	N/A	N/A	<3- 3	<6	0
ROOM 137	37								
Floors and Lower Walls		4	32	<21- 64	N/A	N/A	<3- 3	<6	0
Upper Walls and Ceiling[b]		2	N/A	51	N/A	N/A	<3	<6	0
ROOM 138	38								
Floor and Lower Walls		6	<21	<21- 42	500	<370 - 700	<2 - 8	<5 - 10	0
Upper Walls and Ceiling[b]		5	N/A	<21- 53	N/A	<370 - 820	<2 - 4	<5	0
ROOM 139	39								
Floor and Lower Walls		4	30	<21- 74	480	<370 - 790	<2- 5	<5	0
Upper Walls and Ceiling[b]		5	N/A	<21- 32	N/A	<370 - 790	<2	<5 - 12	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM 140	40								
Floors and Lower Walls		11	42	<21 - 95	600	<370 - 880	<2	<5 - 11	0
Upper Walls, Ceiling, and Equipment[b]		8	N/A	<21 - 74	N/A	<370 - 450	<2 - 5	<5 - 10	0
ROOM 141	41&42								
Floor and Lower Walls		8	46	<20 - 60	<430	<430 - 600	<2	<5	0
Upper Walls and Ceiling[b]		5	N/A	<21	N/A	<370 - 520	<2 - 7	<5	0
Air Exhaust Vent[b]		4	N/A	<20 - 50	N/A	<430	<2	<5	0
ROOM 142	43								
Floor and Lower Walls		8	36	<18- 68	N/A	N/A	<3- 3	<6	0
Upper Walls and Ceiling[b]		2	N/A	<24- 25	N/A	N/A	<3	<6	0
ROOM 143	44								
Floors and Lower Walls		16	<21	<21 - 53	550	<370 - 820	<2 - 5	<5 - 12	0
Upper Walls and Ceiling[b]		10	N/A	<21	N/A	<370 - 640	<2 - 7	<5	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION Alpha (dpm/100 cm^2) Highest Grid Block Avg.	Alpha Range of Measurements	Beta-Gamma (dpm/100 cm^2) Highest Grid Block Avg.	Beta-Gamma Range of Measurements	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	Number of Measurements or Grid Blocks Exceeding Criteria
ROOM 138/143 CORRIDOR	45								
Floor and Lower Walls[b]		10	N/A	<24 -102	N/A	N/A	<3 - 7	<6 - 212	0
Upper Walls and Ceiling[b]		2	N/A	<24 - 25	N/A	N/A	<3 - 3	<6	0
ROOM 201	46								
Floor and Lower Walls		29	44	<21- 140	N/A	N/A	<3- 12	<6 - 7	0
Upper Walls and Ceiling[b]		5	N/A	<21- 120	N/A	N/A	<3	<6	0
Lower Walls[b]		3	N/A	<21- 74	N/A	N/A	<3	<6	0
Equipment[b]		2	N/A	21- 74	N/A	N/A	<3	<6 - 7	0
ROOM 202	47								
Floor and Lower Walls[b]		23	N/A	<28 -110	N/A	N/A	<3 - 9	<6 - 69	0
Upper Walls and Ceiling[b]		8	N/A	<28 - 40	N/A	N/A	<3 - 3	<6 - 7	0
Equipment[b]		8	N/A	<28 - 60	N/A	N/A	<3 - 3	<6 - 9	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
ROOM B1A (B3)	48								
Floors and Lower Walls		5	38	<28 - 80	N/A	N/A	<3	<6 - 7	0
Upper Walls[b]		2	N/A	95 -230	N/A	N/A	<3	<6	0
Floor[b]		3	N/A	<24	N/A	N/A	<3	<6	0
Lower Walls[b]		3	N/A	<24 - 25	N/A	N/A	<3	<6	0
"I" Beams[b]		3	N/A	25 -110	N/A	N/A	<3	<6	0
ROOM B01	49								
Floors and Lower Walls		13	60	<28 -100	N/A	N/A	<3	<6	0
Upper Walls and Ceiling[b]		3	N/A	36 -125	N/A	N/A	<3 - 3	<6	0
Floor[b]		2	N/A	120 -130	N/A	N/A	NO SMEAR		0
Lower Walls[b]		1	N/A	30	N/A	N/A	NO SMEAR		0
ROOM B02	50								
Floors and Lower Walls		25	70	<21 -140	N/A	N/A	<3 - 5	<6 - 9	0
Upper Walls and Ceiling[b]		4	N/A	<21 - 85	N/A	N/A	<3 - 3	<6	0
Floor[b]		8	N/A	40 -230	N/A	N/A	NO SMEAR		0
Lower Walls[b]		2	N/A	<28 - 40	N/A	N/A	NO SMEAR		0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION Alpha (dpm/100 cm^2) Highest Grid Block Avg.	Alpha Range of Measurements	Beta-Gamma (dpm/100 cm^2) Highest Grid Block Avg.	Beta-Gamma Range of Measurements	REMOVABLE CONTAMINATION Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	Number of Measurements or Grid Blocks Exceeding Criteria
TUNNEL	51								
Floors and Lower Walls		22	44	<28 - 140	N/A	N/A	<3 - 3	<6 - 7	0
Upper Walls and Ceiling[b]		5	N/A	<21 - 32	N/A	N/A	<3	<6 - 9	0
Pipe Protrusions[b]		7	N/A	<24 - 93	N/A	N/A	<3 - 3	<6 - 8	0
VAULT ROOF AND LEDGE	52&53								
Floors and Lower Walls		13	54	<18 - 152	N/A	N/A	<3 - 12	<6 - 13	0
Upper Walls and Ceiling[b]		2	N/A	<24 - 34	N/A	N/A	<3 - 3	<6 - 7	0
Ledge[b]		10	N/A	<18 - 107	N/A	N/A	<3 - 3	<6 - 13	0
HP CORRIDOR	54								
Floors and Lower Walls		7	32	<18 - 95	N/A	N/A	<3	<6 - 8	0
Upper Walls and Ceiling[b]		2	N/A	<24 - 34	N/A	N/A	<3	<6	0
Lower Walls[b]		1	N/A	<24	N/A	N/A	<3	<6	0
LOADING DOCK	55								
Floor		11	61	<21 - 220	710	<370 - 1,100	<2	<5	0

TABLE 3 (continued)

SUMMARY OF FINAL BUILDING INTERIOR SURFACE ACTIVITY MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location	Figure	Number of Measurements or Grid Blocks Surveyed[a]	TOTAL CONTAMINATION				REMOVABLE CONTAMINATION		Number of Measurements or Grid Blocks Exceeding Criteria
			Alpha (dpm/100 cm^2)		Beta-Gamma (dpm/100 cm^2)				
			Highest Grid Block Avg.	Range of Measurements	Highest Grid Block Avg.	Range of Measurements	Alpha Range (dpm/100 cm^2)	Beta Range (dpm/100 cm^2)	
DOCK BOARD RECESS	56								
Floors		1	30	30	560	560	<2	<5	0
Walls		3	<21	<21	510	<370 - 1,000	<2	<5 - 10	0
GUIDELINE		N/A	100	300	N/A	N/A	20	N/A	

[a]Single point measurements taken on upper walls and ceilings unless otherwise indicated. Includes followup measurements described in Table 2.
[b]Single point measurements only, no grid block average was determined.
[c]N/A - Indicates not applicable.

TABLE 4

RADIONUCLIDE LEVELS IN INTERIOR PAINT
AND CONCRETE SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling Location	Sample[a] Type	Radionuclide Content (pCi)				
		U-234	U-235	U-238	Pu-238	Pu-239/240
Room 100	P	10.8 ± 1.8[b]	0.4 ± 0.5	5.1 ± 1.3	<0.1	1.3 ± 0.5
Room 101	P	5.0 ± 1.1	0.3 ± 0.4	1.5 ± 0.9	0.5 ± 0.1	0.1 ± 0.1
Room 102	P	7.1 ± 1.3	0.9 ± 0.8	3.6 ± 0.9	0.2 ± 0.2	0.1 ± 0.2
Room 103	P	4.3 ± 0.6	0.4 ± 0.2	2.8 ± 0.5	<0.1	<0.1
Room 104	P	3.1 ± 1.0	0.1 ± 0.1	1.9 ± 0.9	0.9 ± 0.3	4.8 ± 0.6
Room 105	P	2.1 ± 1.0	0.1 ± 0.5	2.2 ± 0.9	<0.1	0.1 ± 0.2
Room 106	P	2.6 ± 1.0	0.1 ± 0.6	2.9 ± 1.0	1.7 ± 0.6	0.1 ± 0.1
Room 107	P	7.1 ± 1.3	0.3 ± 0.4	2.9 ± 0.7	0.9 ± 0.4	12.7 ± 1.4
Room 108	P	3.4 ± 0.9	0.4 ± 1.0	3.9 ± 1.0	<0.1	0.3 ± 0.3
Room 109	P	2.0 ± 0.8	0.2 ± 0.3	2.2 ± 0.8	<0.1	<0.1
Room 110	P	2.8 ± 0.9	0.1 ± 0.2	2.4 ± 0.8	<0.1	0.5 ± 0.3
Room 111	P	4.2 ± 1.0	0.3 ± 0.4	3.2 ± 0.8	<0.3	0.3 ± 0.6
Room 112	P	4.4 ± 0.8	0.2 ± 0.3	1.8 ± 0.5	<0.1	0.3 ± 0.2
Room 113	P	3.3 ± 0.9	0.3 ± 0.6	3.1 ± 0.7	<0.3	0.3 ± 0.3
Room 114	P	4.4 ± 1.0	0.3 ± 0.4	3.4 ± 0.9	<0.1	5.9 ± 1.3

TABLE 4 (Continued)

RADIONUCLIDE LEVELS IN INTERIOR PAINT
AND CONCRETE SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling Location	Sample[a] Type	Radionuclide Content (pCi)				
		U-234	U-235	U-238	Pu-238	Pu-239/240
Room 115	P	5.4 ± 1.6	0.9 ± 0.7	3.4 ± 1.1	2.9 ± 0.9	2.2 ± 0.7
Room 116	C	6.6 ± 1.1	0.1 ± 0.3	6.5 ± 1.0	<0.1	<0.1
Room 117	P	5.1 ± 0.7	0.2 ± 0.2	2.2 ± 0.5	0.1 ± 0.2	0.1 ± 0.2
Room 118	P	4.1 ± 1.1	0.3 ± 0.5	3.9 ± 1.1	<0.2	2.5 ± 0.8
Room 119	P	4.0 ± 0.9	0.3 ± 0.4	3.1 ± 0.8	0.4 ± 0.4	3.8 ± 1.1
Room 120	P	6.2 ± 1.3	0.6 ± 0.6	3.7 ± 1..0	<0.1	<0.1
Room 121	P	2.2 ± 0.6	0.2 ± 0.3	1.6 ± 0.5	0.3 ± 0.3	2.1 ± 0.5
Room 122	P	4.9 ± 1.1	0.3 ± 0.4	2.2 ± 0.7	0.2 ± 0.3	0.2 ± 0.2
Room 123	P	5.0 ± 2.6	0.2 ± 1.0	3.8 ± 2.2	<0.2	0.5 ± 0.5
Room 124	C	4.5 ± 0.8	0.3 ± 0.3	4.8 ± 0.8	<0.1	0.2 ± 0.2
Room 125	P	6.3 ± 1.4	0.5 ± 0.5	5.5 ± 1.2	0.9 ± 0.5	6.5 ± 1.2
Room 126	C	1.3 ± 0.4	0.1 ± 0.1	1.7 ± 0.4	<0.1	0.1 ± 0.1
Room 127	C	20.3 ± 3.0	0.8 ± 0.8	20.0 ± 3.0	1.1 ± 1.4	0.5 ± 1.6
Room 128	C	17.7 ± 2.7	1.0 ± 0.7	16.7 ± 2.7	0.2 ± 0.2	1.5 ± 0.7
Room 129	P	1.4 ± 0.7	0.1 ± 0.4	1.2 ± 0.6	<0.1	<0.1

TABLE 4 (Continued)

RADIONUCLIDE LEVELS IN INTERIOR PAINT
AND CONCRETE SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling Location	Sample[a] Type	Radionuclide Content (pCi)				
		U-234	U-235	U-238	Pu-238	Pu-239/240
Room 130	P	1.8 ± 0.6	0.1 ± 0.4	1.6 ± 0.6	<0.1	0.3 ± 0.2
Room 131	P	5.6 ± 1.4	0.4 ± 0.5	4.4 ± 1.1	---[c]	---
Room 132	P	3.5 ± 0.9	0.1 ± 0.3	2.8 ± 0.5	0.1 ± 0.2	0.1 ± 0.1
Room 133	P	2.7 ± 0.7	0.3 ± 0.3	1.3 ± 0.5	0.1 ± 0.2	0.2 ± 0.2
Room 134	P	7.8 ± 1.5	0.2 ± 0.4	3.2 ± 0.9	0.2 ± 0.4	0.6 ± 0.6
Room 135	P	55.5 ± 4.1	3.5 ± 1.3	4.8 ± 1.3	0.2 ± 0.4	0.9 ± 0.6
Room 136	P	1.8 ± 0.4	0.1 ± 0.2	1.3 ± 0.3	0.1 ± 0.1	0.1 ± 0.1
Room 137	P	2.3 ± 0.6	0.2 ± 0.2	1.5 ± 0.4	<0.1	<0.1
Room 140	P	3.0 ± 0.9	0.3 ± 0.3	2.2 ± 0.7	0.1 ± 0.3	0.3 ± 0.3
Room 142	P	3.0 ± 1.0	0.3 ± 0.4	2.5 ± 0.8	0.1 ± 0.2	0.2 ± 0.2
HP Corridor	P	5.8 ± 1.2	0.3 ± 0.4	1.6 ± 0.7	<0.1	<0.1
Hall Between 138/143	P	2.7 ± 1..0	0.1 ± 0.3	1.3 ± 0.7	0.1 ± 0.2	<0.1
Room B01	C	3.6 ± 0.8	0.1 ± 0.3	3.1 ± 0.7	0.1 ± 0.2	0.3 ± 0.2
Room B1A	C	0.9 ± 0.2	0.1 ± 0.1	0.6 ± 0.2	0.1 ± 0.1	0.2 ± 0.1

TABLE 4 (Continued)

RADIONUCLIDE LEVELS IN INTERIOR PAINT
AND CONCRETE SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling Location	Sample[a] Type	Radionuclide Content (pCi)				
		U-234	U-235	U-238	Pu-238	Pu-239/240
Room B02	C	2.4 ± 0.6	0.2 ± 0.2	2.4 ± 0.6	0.2 ± 0.2	0.2 ± 0.2
Mechanical Tunnel	C	1.8 ± 0.4	0.1 ± 0.1	1.7 ± 0.4	0.1 ± 0.1	0.1 ± 0.1
Vault Roof	C	1.9 ± 0.5	0.2 ± 0.2	1.9 ± 0.5	0.2 ± 0.1	0.2 ± 0.1
Room 201	C	8.3 ± 1.3	0.3 ± 0.3	10.4 ± 1.4	0.1 ± 0.3	0.1 ± 0.3
Room 202	P	3.8 ± 0.4	0.1 ± 0.1	1.4 ± 0.3	0.1 ± 0.1	0.2 ± 0.1

[a]P:Paint, C:Concrete.
[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.
[c]Dash indicates analysis not performed.

TABLE 5

RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES FROM EXCAVATIONS INSIDE THE BUILDING MIXED OXIDE FACILITY CIMARRON CORPORATION CRESCENT, OKLAHOMA

Location	Radionuclide Concentration (pCi/g) U-235	U-238	Pu-239/240	Am-241	Composite[a] Pu-239/240
Rm 106	0.2 ± 0.1[c]	0.9 ± 0.8	---[b]	2.3 ± 0.3	N/A
Rm 114	0.1 ± 0.1	1.6 ± 0.9	---	10.0 ± 0.1	N/A
Rm 104	0.1 ± 0.1	0.7 ± 0.5	(0.7 ± 2.5) E-2	<0.2	N/A
Rm 124	<0.4	0.7 ± 0.5	N/A	<0.1	(15.8 ± 5.2) E-2
Rm 124	0.1 ± 0.1	0.4 ± 0.5	2.04 ± 0.27	0.8 ± 0.2	N/A
Rm B01A	0.1 ± 0.1	1.4 ± 0.7	(5.8 ± 4.9) E-2	<0.2	N/A
Rm B01	<0.4	1.5 ± 1.1	(7.1 ± 5.6) E-2	<0.2	(8.8 ± 6.8) E-2
Rm 136	<0.4	<0.9	---	<0.2	N/A
Rm 138	0.2 ± 0.1	1.5 ± 0.8	(0.6 ± 2.0) E-2	<0.2	N/A
Rm 136	0.1 ± 0.1	1.0 ± 0.6	---	<0.2	N/A
Rm 135	0.1 ± 0.1	1.2 ± 0.8	N/A	<0.2	(4.5 ± 4.6) E-2

TABLE 5 (Cont'd)

RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES FROM EXCAVATIONS INSIDE THE BUILDING MIXED OXIDE FACILITY CIMARRON CORPORATION CRESCENT, OKLAHOMA

Location	Radionuclide Concentration (pCi/g) U-235	U-238	Pu-239/240	Am-241	Composite[a] Pu-239/240
Rm 135	0.1 ± 0.1	<0.9	N/A	<0.1	N/A
Rm 132	0.1 ± 0.1	0.4 ± 0.6	N/A	<0.2	(9.9 ± 6.2) E-2
Rm 132	0.1 ± 0.1	1.1 ± 0.7	N/A	<0.2	N/A
Rm 132	0.4 ± 0.3	0.5 ± 0.5	N/A	<0.1	N/A
Rm 132	0.1 ± 0.1	0.5 ± 0.4	N/A	<0.2	N/A
Rm 132	<0.4	<0.9	N/A	<0.1	N/A
Rm 140	0.1 ± 0.1	0.2 ± 0.2	N/A	<0.1	(8.4 ± 6.6) E-2
Rm 140	0.1 ± 0.1	0.9 ± 0.9	N/A	<0.1	N/A
Rm 140	<0.5	0.6 ± 0.7	N/A	<0.2	N/A
Rm 140	0.1 ± 0.1	0.9 ± 0.7	N/A	<0.2	N/A
Rm 140	0.1 ± 0.1	<1.0	N/A	<0.2	N/A

RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES FROM EXCAVATIONS INSIDE THE BUILDING MIXED OXIDE FACILITY CIMARRON CORPORATION CRESCENT, OKLAHOMA

Location	Radionuclide Concentration (pCi/g)				
	U-235	U-238	Pu-239/240	Am-241	Composite[a] Pu-239/240
Rm 140	0.1 ± 0.0	0.8 ± 0.7	N/A	<0.2	N/A
Rm 129	0.1 ± 0.1	<0.9	N/A	<0.2	(7.9 ± 5.5) E-2
Rm 129	0.0 ± 0.0	1.1 ± 0.7	N/A	<0.1	N/A
Rm 129	<0.4	0.5 ± 0.5	N/A	<0.1	N/A
Rm 129	0.1 ± 0.1	0.4 ± 0.5	N/A	<0.1	N/A
Rm 129	<0.5	0.6 ± 0.5	N/A	<0.2	N/A
Rm 129	<0.5	1.0 ± 0.8	N/A	<0.2	N/A
Rm 129	0.0 ± 0.0	<0.9	N/A	<0.1	N/A
Rm 124	0.0 ± 0.1	0.4 ± 0.6	N/A	<0.1	N/A

[a]Samples from the Room were composited for analysis.
[b]Dash indicates analysis not performed.
[c]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.

TABLE 6

RADIONUCLIDE CONCENTRATIONS IN SAMPLES FROM BARRELS OF EXCAVATED SOIL MIXED OXIDE FACILITY CIMARRON CORPORATION CRESCENT, OKLAHOMA

Location	Radionuclide Concentration (pCi/g)				
	U-235	U-238	Am-241	Pu-238	Pu-239/240
Barrel #124-1	0.1 ± 0.1[a]	0.7 ± 0.6	<0.2	---[b]	---
Barrel #124-2	0.1 ± 0.1	0.7 ± 1.3	<0.2	---	---
Barrel #124-3	0.1 ± 0.1	0.7 ± 0.5	<0.2	---	---
Barrel #124-4	0.1 ± 0.1	0.4 ± 0.6	<0.1	---	---
Barrel #124-5	0.1 ± 0.1	0.9 ± 0.9	231 ± 1.6	50.3 ± 1.3	458.9 ± 3.9

[a]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.
[b]Dash indicates analyses not performed.

TABLE 7

SUMMARY OF LOCATIONS OF ELEVATED GAMMA EXPOSURE RATES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

Location[a]	EXPOSURE RATE 1 meter μR/h	EXPOSURE RATE contact μR/h	Radionuclide Concentration (pCi/g) U-235	U-238	Pu-238	Pu-239/240	Am-241
1 PRE DECON	12	32	243.8 ± 3.9[b]	1404 ± 13	---[c]	---	<2.0
PRE DECON	12	32	241.6 ± 3.8	1260 ± 12	---	---	<2.2
POST DECON	12	18	0.4 ± 0.4	4.1 ± 0.7	10.4 ± 0.4	99.3 ± 1.4	<0.2
2	13	12	0.3 ± 0.2	2.3 ± 1.0	0.01 ± 0.03	0.15 ± 0.08	---

[a]Refer to Figure 60.
[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.
[c]Dash indicates analysis not performed.

TABLE 8

URANIUM AND PLUTONIUM CONCENTRATIONS IN SOIL SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling[a] Location	Depth (cm)	Uranium Concentrations (pCi/g) U-235	Uranium Concentrations (pCi/g) U-238		Plutonium Concentrations (pCi/g) Pu-238	Plutonium Concentrations (pCi/g) Pu-239/240
60W, 180N	Surface	0.2 ± 0.2[b]	2.1 ± 1.3	Composite 11	(0.6 ± 2.0) E-2	(0.6 ± 2.6) E-2
" "	15- 30	0.3 ± 0.1	1.6 ± 0.9	" "		
" "	30- 45	0.2 ± 0.1	1.9 ± 1.3	" "		
" "	45- 60	0.2 ± 0.1	2.4 ± 1.1	" "		
" "	60- 75	0.1 ± 0.1	1.2 ± 1.1	" "		
" "	75-100	0.3 ± 0.1	1.5 ± 1.1	" "		
60W, 190N	Surface	0.2 ± 0.1	2.1 ± 1.0	" "		
60W, 200N	Surface	0.3 ± 0.1	1.9 ± 1.2	" "		
60W, 210N	Surface	0.2 ± 0.1	0.9 ± 1.3	" "		
60W, 220N	Surface	0.2 ± 0.1	1.9 ± 1.1	" "		
60W, 230N	Surface	0.2 ± 0.1	1.9 ± 1.2	" "		
60W, 240N	Surface	0.2 ± 0.1	1.0 ± 1.0	" "		
60W, 250N	Surface	0.4 ± 0.4	2.2 ± 1.0	" "		
60W, 260N	Surface	0.2 ± 0.1	1.9 ± 1.1	" "		
60W, 280N	Surface	0.2 ± 0.1	2.8 ± 1.5	" "		
60W, 290N	Surface	0.2 ± 0.1	<1.6	" "		
50W, 180N	Surface	0.2 ± 0.1	1.5 ± 1.1	Composite 9	(0.5 ± 1.8) E-2	(0.5 ± 1.8) E-2
50W, 190N	Surface	0.1 ± 0.1	<1.4	" "		
50W, 200N	Surface	0.2 ± 0.1	1.1 ± 0.9	Composite 6	(0.7 ± 2.9) E-2	(0.7 ± 2.9) E-2
50W, 210N	Surface	0.2 ± 0.1	1.3 ± 0.9	" "		
50W, 220N	Surface	0.2 ± 0.1	0.7 ± 0.9	" "		
50W, 230N	Surface	0.2 ± 0.1	1.7 ± 1.2	Composite 5	(1.2 ± 2.9) E-2	(1.2 ± 2.9) E-2
50W, 240N	Surface	0.1 ± 0.1	2.2 ± 0.9	" "		
50W, 250N	Surface	0.2 ± 0.1	1.1 ± 0.6	" "		
50W, 260N	Surface	0.2 ± 0.1	1.5 ± 0.9	" "		
50W, 270N	Surface	0.1 ± 0.1	2.8 ± 1.2	Composite 1	(1.5 ± 3.6) E-2	(9.0 ± 6.2) E-2
50W, 280N	Surface	0.1 ± 0.1	1.2 ± 0.9	" "		

TABLE 8 (Cont'd)

URANIUM AND PLUTONIUM CONCENTRATIONS IN SOIL SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling[a] Location	Depth (cm)	Uranium Concentrations (pCi/g) U-235	U-238		Plutonium Concentrations (pCi/g) Pu-238	Pu-239/240
48W, 193N	Surface	0.2 ± 0.1	1.5 ± 1.1	Composite 11	(0.6 ± 2.0) E-2	(0.6 ± 2.6) E-2
" "	15-30	0.3 ± 0.3	0.8 ± 0.8	" "		
" "	30-45	0.3 ± 0.1	2.7 ± 1.1	" "		
" "	45-60	0.1 ± 0.1	0.8 ± 0.8	" "		
" "	60-75	0.1 ± 0.1	1.9 ± 1.0	" "		
" "	75-90	0.1 ± 0.1	1.1 ± 1.1	" "		
45W, 280N	Surface	0.1 ± 0.1	1.4 ± 1.1	Composite 11	(0.6 ± 2.0) E-2	(0.6 ± 2.6) E-2
" "	15- 30	0.2 ± 0.1	1.0 ± 0.9	" "		
" "	30- 45	0.1 ± 0.1	0.9 ± 1.0	" "		
" "	45- 60	0.1 ± 0.1	1.9 ± 0.6	" "		
" "	60- 75	0.2 ± 0.1	1.6 ± 0.9	" "		
" "	75- 90	0.1 ± 0.1	1.2 ± 1.0	" "		
40W, 180N	Surface	0.2 ± 0.1	0.8 ± 1.0	Composite 9	(0.5 ± 1.8) E-2	(0.5 ± 1.8) E-2
40W, 190N	Surface	0.2 ± 0.1	1.3 ± 0.3	" "		
40W, 200N	Surface	0.2 ± 0.1	1.6 ± 1.0	Composite 6	(0.7 ± 2.9) E-2	(0.7 ± 2.9) E-2
40W, 210N	Surface	0.2 ± 0.4	0.8 ± 0.7	" "		
40W, 220N	Surface	0.1 ± 0.1	2.0 ± 1.0	" "		
40W, 230N[c]	Surface	0.2 ± 0.1	1.7 ± 0.9	Composite 5	(1.2 ± 2.9) E-2	(1.2 ± 2.9) E-2
40W, 240N	Surface	0.1 ± 0.1	1.6 ± 0.9	" "		
40W, 250N	Surface	0.1 ± 0.1	1.1 ± 0.6	" "		
40W, 260N	Surface	0.2 ± 0.1	1.3 ± 0.8	Composite 1	(1.5 ± 3.6) E-2	(9.0 ± 6.2) E-2
40W, 270N	Surface	0.1 ± 0.1	0.7 ± 0.8	" "		
40W, 280N	Surface	0.5 ± 0.6	0.2 ± 1.3	" "		
38W, 234N[d]	Surface	0.3 ± 0.1	1.9 ± 1.0	Composite 11	(0.6 ± 2.0) E-2	(0.6 ± 2.6) E-2
38W, 234N	45- 60	0.1 ± 0.1	0.9 ± 0.6	" "		

TABLE 8 (Cont'd)

URANIUM AND PLUTONIUM CONCENTRATIONS IN SOIL SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling[a] Location	Depth (cm)	Uranium Concentrations (pCi/g) U-235	U-238		Plutonium Concentrations (pCi/g) Pu-238	Pu-239/240
30W, 260N	Surface	0.2 ± 0.1	0.7 ± 0.8	Composite 2	(0.7 ± 3.2) E-2	(0.7 ± 2.4) E-2
30W, 270N	Surface	0.2 ± 0.1	1.7 ± 1.0	" "		
30W, 280N	Surface	0.2 ± 0.1	2.8 ± 1.5	" "		
30W, 290N	Surface	0.2 ± 0.1	1.9 ± 1.0	" "		
29W, 276N	Surface	0.1 ± 0.1	1.7 ± 1.1	Composite 11	(0.6 ± 2.0) E-2	(0.6 ± 2.6) E-2
29W, 276N	45- 60	0.1 ± 0.1	1.7 ± 1.0	" "		
29W, 276N	75- 90	0.2 ± 0.1	1.0 ± 0.8	" "		
20W, 190N	Surface	0.2 ± 0.4	3.2 ± 0.9	Composite 2	(0.7 ± 3.2) E-2	(0.7 ± 2.4) E-2
20W, 260N	Surface	0.6 ± 0.5	1.3 ± 0.6	" "		
20W, 270N	Surface	0.2 ± 0.1	1.1 ± 0.9	" "		
20W, 280N	Surface	0.2 ± 0.1	2.6 ± 1.1	" "		
15W, 190N	Surface	0.3 ± 0.1	1.5 ± 0.8	Composite 12	(0.7 ± 3.1) E-2	(2.1 ± 3.7) E-2
" "	45- 60	0.2 ± 0.1	1.4 ± 1.0	" "		
" "	90-105	0.1 ± 0.1	1.9 ± 1.0	" "		
" "	165-180	0.2 ± 0.1	1.0 ± 0.3	" "		
10W, 190N	Surface	0.2 ± 0.1	2.0 ± 0.9	Composite 10	(0.7 ± 2.9) E-2	(2.6 ± 3.6) E-2
10W, 252N	Surface	0.2 ± 0.1	1.8 ± 0.8	" "		
" "	45- 60	0.1 ± 0.1	1.5 ± 0.8	" "		
" "	75- 90	0.1 ± 0.1	1.1 ± 0.7	" "		
10W, 260N	Surface	0.2 ± 0.1	2.2 ± 0.8	Composite 3	(0.7 ± 2.9) E-2	(1.3 ± 2.6) E-2
10W, 270N	Surface	0.1 ± 0.1	2.0 ± 0.9	" "		
10W, 280N	Surface	0.1 ± 0.1	2.3 ± 1.0	" "		
10W, 285N	Surface	0.2 ± 0.1	1.6 ± 0.9	Composite 11	(0.6 ± 2.0) E-2	(0.6 ± 2.6) E-2
" "	45- 60	0.3 ± 0.1	2.6 ± 1.6	" "		
" "	60- 75	0.2 ± 0.1	1.3 ± 1.2	" "		

TABLE 8 (Cont'd)

URANIUM AND PLUTONIUM CONCENTRATIONS IN SOIL SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling[a] Location	Depth (cm)	Uranium Concentrations (pCi/g) U-235	U-238		Plutonium Concentrations (pCi/g) Pu-238	Pu-239/240
10W, 290N	Surface	0.2 ± 0.1	1.8 ± 1.2	" "		
" "	15- 30	0.2 ± 0.1	2.0 ± 1.1	" "		
" "	30- 45	0.2 ± 0.1	2.1 ± 1.2	" "		
" "	45- 60	0.4 ± 0.9	2.6 ± 1.0	Composite 11	(0.6 ± 2.0) E-2	(0.6 ± 2.6) E-2
" "	60- 75	0.3 ± 0.1	2.1 ± 1.0	" "		
" "	75- 90	0.2 ± 0.1	<1.9	" "		
0, 190N	Surface	0.3 ± 0.1	1.7 ± 1.0	Composite 10	(0.7 ± 2.9) E-2	(2.6 ± 3.6) E-2
0, 252N	Surface	0.1 ± 0.1	2.2 ± 0.8	" "		
" "	45- 60	0.1 ± 0.1	<1.3	" "		
" "	75- 90	0.2 ± 0.1	1.7 ± 0.7	" "		
" "	135-150	0.2 ± 0.1	1.7 ± 0.7	" "		
0, 260N	Surface	0.1 ± 0.1	1.4 ± 1.1	Composite 3	(0.7 ± 2.9) E-2	(1.3 ± 2.6) E-2
0, 270N	Surface	0.2 ± 0.4	3.2 ± 0.8	" "		
0, 280N	Surface	0.2 ± 0.1	1.9 ± 1.0	" "		
8E, 218N	Surface	0.3 ± 0.1	1.8 ± 1.0			
" "	30- 45	0.4 ± 0.4	4.1 ± 1.5			
" "	75- 90	0.2 ± 0.1	1.5 ± 1.0			
10E, 180N	Surface	0.2 ± 0.3	<1.5			
10E, 190N	Surface	0.4 ± 0.4	<1.3	Composite 10	(0.7 ± 2.9) E-2	(2.6 ± 3.6) E-2
10E, 200N	Surface	0.3 ± 0.1	2.0 ± 1.1	Composite 8	(1.2 ± 3.2) E-2	(1.2 ± 2.3) E-2
10E, 210N	Surface	0.4 ± 0.5	1.7 ± 1.1	" "		
10E, 220N	Surface	0.2 ± 0.1	2.3 ± 1.0	" "		
10E, 230N	Surface	0.4 ± 0.1	2.2 ± 1.1	Composite 7	(2.0 ± 3.7) E-2	(0.7 ± 2.9) E-2
10E, 240N	Surface	0.3 ± 0.1	1.5 ± 1.2	" "		
10E, 250N	Surface	0.2 ± 0.1	1.3 ± 0.9	" "		

TABLE 8 (Cont'd)

URANIUM AND PLUTONIUM CONCENTRATIONS IN SOIL SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling[a] Location	Depth (cm)	Uranium Concentrations (pCi/g) U-235	U-238		Plutonium Concentrations (pCi/g) Pu-238	Pu-239/240
10E, 260N	Surface	0.2 ± 0.1	1.7 ± 1.2	Composite 4	(1.9 ± 3.3) E-2	(1.9 ± 2.8) E-2
10E, 270N	Surface	0.3 ± 0.4	0.9 ± 1.1	" "		
10E, 280N	Surface	0.3 ± 0.4	1.4 ± 1.3	" "		
15E, 240N	Surface	0.4 ± 0.4	2.1 ± 1.0			
" "	45- 60	0.2 ± 0.5	2.1 ± 1.2	Composite 12	(0.7 ± 3.1) E-2	(2.1 ± 3.7) E-2
" "	90-105	0.3 ± 0.1	1.6 ± 1.1	" "		
" "	135-150	0.4 ± 0.5	1.6 ± 0.9	" "		
18E, 277N	Surface	0.2 ± 0.1	2.7 ± 1.2			
" "	45- 60	0.3 ± 0.1	2.4 ± 1.0	Composite 12	(0.7 ± 3.1) E-2	(2.1 ± 3.7) E-2
" "	90-105	0.9 ± 0.5	2.0 ± 1.0	" "		
" "	135-150	0.6 ± 0.5	2.4 ± 1.4	" "		
20E, 190N	Surface	0.2 ± 0.1	2.3 ± 0.8	Composite 10	(0.7 ± 2.9) E-2	(2.6 ± 3.6) E-2
20E, 200N	Surface	0.8 ± 0.9	1.1 ± 0.8	Composite 8	(1.2 ± 3.2) E-2	(1.2 ± 2.3) E-2
20E, 210N	Surface	0.3 ± 0.1	2.0 ± 1.1	" "		
20E, 212N	Surface	1.5 ± 0.6	4.3 ± 1.9			
" "	30- 45	1.5 ± 0.5	4.6 ± 1.0			
" "	75- 90	0.6 ± 0.6	2.0 ± 1.0			
20E, 220N	Surface	0.2 ± 0.1	1.5 ± 0.8	Composite 8	(1.2 ± 3.2) E-2	(1.2 ± 2.3) E-2
20E, 230N	Surface	0.3 ± 0.6	2.3 ± 1.1	Composite 7	(2.0 ± 3.9) E-2	(0.7 ± 2.9) E-2
20E, 240N	Surface	0.4 ± 0.2	1.5 ± 1.2	" "		
20E, 250N	Surface	0.2 ± 0.1	1.3 ± 1.2	" "		
20E, 260N	Surface	0.3 ± 0.4	<1.7	Composite 4	(1.9 ± 3.3) E-2	(1.9 ± 2.8) E-2
20E, 270N	Surface	0.8 ± 0.7	2.8 ± 1.1	" "		
20E, 280N	Surface	0.2 ± 0.1	1.9 ± 1.0	" "		
20E, 290N	Surface	0.1 ± 0.1	1.6 ± 1.0	" "		

TABLE 8 (Cont'd)

URANIUM AND PLUTONIUM CONCENTRATIONS IN SOIL SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling[a] Location	Depth (cm)	Uranium Concentrations (pCi/g) U-235	U-238		Plutonium Concentrations (pCi/g) Pu-238	Pu-239/240
30E, 180N	Surface	0.5 ± 0.3	2.5 ± 0.8			
30E, 200N	Surface	0.5 ± 0.5	6.4 ± 2.0			
30E, 220N	Surface	1.3 ± 0.6	7.7 ± 1.2			
30E, 250N	Surface	0.3 ± 0.1	2.5 ± 1.2			
" "	15- 30	0.2 ± 0.6	1.4 ± 1.1			
" "	30- 45	0.6 ± 0.5	3.2 ± 1.1			
" "	45- 60	0.3 ± 0.1	2.1 ± 1.1	Composite 12	(0.7 ± 3.1) E-2	(2.1 ± 3.7) E-2
" "	60- 75	0.3 ± 0.1	1.6 ± 1.0			
" "	75-100	0.2 ± 0.2	1.6 ± 1.1			
30E, 270N	Surface	0.2 ± 0.1	0.7 ± 1.1			

[a]Refer to Figure 61.
[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.
[c]Also contains 0.8 ± 0.1 pCi/g of Am-241.
[d]Also contains 4.6 ± 0.1 pCi/g of Am-241.

TABLE 9

DRAINAGE OUTFALL SAMPLES AND MEASUREMENTS
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

LOCATION[a] NO.	Alpha (dpm/100 cm^2)	Beta (dpm/100 cm^2)	Contact Gamma (μR/h)	REMOVABLE CONTAMINATION Alpha (dpm/100 cm^2)	REMOVABLE CONTAMINATION Beta (dpm/100 cm^2)	RADIONUCLIDE CONCENTRATIONS (pCi/g) U-235	U-238	Am-241	Pu-238	Pu-239/240
1 Inside	<28	1900	8-11	3	<6	0.2 ± 0.1[b]	2.5 ± 1.3	<0.3	0.06 ± 0.06	0.7 ± 0.1
2	<28	390	8-10	<3	<6	0.1 ± 0.1	1.4 ± 1.0	<0.2	0.01 ± 0.03	0.09 ± 0.06
3	<28	<350	8-10	<3	<6	0.8 ± 0.5	5.0 ± 0.9	<0.3	0.01 ± 0.03	0.01 ± 0.04
4 On Screen	60	<350	9	<3	<6	0.1 ± 0.1	2.5 ± 0.8	<0.2	0.02 ± 0.07	0.01 ± 0.05
5	<28	<350	9-10	<3	8	0.3 ± 0.1	3.1 ± 1.0	<0.3	0.01 ± 0.02	0.01 ± 0.02

[a]Refer to Figure 62.
[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.

TABLE 10

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS ON THE BUILDING EXTERIOR, WALKWAYS AND MISCELLANEOUS SURFACES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

	TOTAL CONTAMINATION		REMOVABLE CONTAMINATION	
LOCATION[a]	Alpha (dpm/100 cm^2)	Beta-Gamma (dpm/100 cm^2)	Alpha (dpm/100 cm^2)	Beta (dpm/100 cm^2)
1	6500	3700	58	9
2	200	530	<3	<6
3	40	<350	3	<6
4	160	<350	<3	<6
5	110	<350	<3	<6
6	240	440	<3	<6
7	<28	<350	5	<6
8	290	<350	5	<6
9	230	<350	5	<6
10	<28	<350	5	7
11	70	530	7	7
12	40	<350	<3	<6
13	<28	<350	3	<6
14	120	470	<3	<6
15	40	470	<3	<6
16	220	<350	<3	8
17	110	<350	<3	<6
18	30	<350	5	<6
19	40	<350	<3	<6
20	40	<350	<3	<6
21	50	530	3	<6
22	<28	<350	<3	<6
23	<28	<350	<3	<6
24	<28	610	<3	13
25	80	<350	<3	<6
26	30	780	<3	<6
27	30	690	<3	<6
28	110	<350	<3	<6
29	80	1000	<3	<6
30	70	<350	<3	<6
31	110	670	<3	<6
32	140	1200	<3	9
33	130	720	<3	<6
34	90	<350	<3	<6
35	<28	<350	<3	<6
36	40	<350	<3	<6
37	160	1500	<3	<6

TABLE 10 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS ON THE
BUILDING EXTERIOR, WALKWAYS AND MISCELLANEOUS SURFACES
MIXED OXIDE FACILITY
CIMARRON CORPORATION PLANT
CRESCENT, OKLAHOMA

	TOTAL CONTAMINATION		REMOVABLE CONTAMINATION	
LOCATION[a]	Alpha (dpm/100 cm^2)	Beta-Gamma (dpm/100 cm^2)	Alpha (dpm/100 cm^2)	Beta (dpm/100 cm^2)
38	2500	3500	<3	<6
39	100	<350	<3	<6
40	130	1000	<3	<6
41	40	<350	3	<6
42	100	610	<3	<6
43	60	<350	<3	<6
44	140	<350	3	<6
45	490	1700	<3	8
46	1800	2900	3	<6
47	2000	1800	7	<6
48	2400	1900	3	<6
49	600	1700	<3	8
50	230	550	<3	<6
51	240	<420	<3	<6
52	410	820	<3	<6
53	660	1200	<3	7
54	380	790	<3	12
55	310	<420	<3	<6
56	500	420	3	<6
57	250	470	<3	10
58	200	610	3	<6
59	200	<350	<3	8
60	270	<350	<3	<6
61	50	440	<3	<6
62	860	<350	18	15
63	220	390	<3	<6
64	240	<350	<3	<6
65	170	<350	3	<6
66	130	<350	<3	<6
67	1100	---[b]	<3	<6
68	1200	1100	18	<6
69	310	<420	<3	7

[a]Refer to Figures 57 and 58.
[b]Dash indicates measurement not performed.

TABLE 11

RADIONUCLIDE CONCENTRATIONS IN MISCELLANEOUS EXTERIOR SAMPLES
MIXED OXIDE FACILITY
CIMARRON CORPORATION
CRESCENT, OKLAHOMA

Sampling Location	Radionuclide Concentration (pCi/g)				
	U-234	U-235	U-238	Pu-238	Pu-239/240
paint/beneath east stairway	6062 ± 89[a]	356 ± 27	540 ± 90	0.15 ± 0.15	0.52 ± 0.17
concrete/beneath east stairway	476 ± 9	22 ± 3	15 ± 2	0.01 ± 0.02	0.14 ± 0.05
concrete/loading dock sidewalk	4.55 ± 0.24	0.26 ± 0.08	1.06 ± 0.12	0.01 ± 0.01	0.13 ± 0.04
gravel/roof	0.46 ± 0.18	0.12 ± 0.11	0.51 ± 0.17	<0.01	0.01 ± 0.02
gravel/roof	0.45 ± 0.09	0.01 ± 0.03	0.49 ± 0.09	0.05 ± 0.03	<0.01
gravel/roof	0.86 ± 0.12	0.02 ± 0.03	0.38 ± 0.08	0.01 ± 0.02	<0.01
fence section	115.4 ± 1.8	5.67 ± 0.52	35.2 ± 1.0	0.04 ± 0.04	0.15 ± 0.07

[a]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.

TABLE 12

SUMMARY OF SURFACE ACTIVITY MEASUREMENT AT LOCATIONS IN THE SANITARY DRAIN SYSTEM MIXED OXIDE FACILITY CIMARRON CORPORATION PLANT CRESCENT, OKLAHOMA

	TOTAL CONTAMINATION		EXPOSURE RATE	REMOVABLE CONTAMINATION	
LOCATION[a]	Alpha (dpm/100 cm^2)	Beta-Gamma (dpm/100 cm^2)	Gamma μR/h	Alpha (dpm/100 cm^2)	Beta (dpm/100 cm^2)
1	<28	<350	8 - 10	7	78
2	<28	<350	9 - 10	<3	20
3 In Pipe	30	<350	7 - 8	<3	<6
Box Bottom	30	560	7 - 8	<3	<6
4	30	<350	8 - 9	<3	<6

[a]Refer to Figure 59.

REFERENCES

1. Cimarron Corporation, Request for Plutonium Plant Release From NRC Licensing, July 27, 1989, and associated supporting survey data.

APPENDIX A

MAJOR SAMPLING AND ANALYTICAL EQUIPMENT

APPENDIX A

MAJOR SAMPLING AND ANALYTICAL EQUIPMENT

The display or description of a specific product is not to be construed as an endorsement of that product or its manufacturer by the authors or their employer.

A. Direct Radiation Measurements

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

Eberline PRM-6
Portable Ratemeter
(Eberline, Santa Fe, NM)

Eberline Alpha ZnS Scintillation Detector
Model AC-3-7 or AC-3-8
(Eberline, Santa Fe, NM)

Eberline Beta-Gamma "Pancake" Detector
Model HP-260
(Eberline, Santa Fe, NM)

Ludlum Alpha-Beta Floor Monitor
Model 239-1
(Ludlum Measurements, Sweetwater, TX)

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

Ludlum Ratemeter-Scaler
Model 2200
(Ludlum Measurements, Sweetwater, TX)

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

Victoreen Beta-Gamma "Pancake" Detector
Model 489-110
(Victoreen, Cleveland, OH)

Victoreen NaI Scintillation Detector
Model 489-55
(Victoreen, Cleveland, OH)

Ludlum Proportional Detector
Model 43-68
(Ludlum Measurements, Sweetwater, TX)

BICRON NaI Scintillation Detector
Model G5, "FIDLER"
(Bicron Corp., Newbury, Ohio)

B. **Laboratory Analyses**

Automatic low-background Alpha-Beta Counter
Model LB5110-2080
(Tennelec, Oak Ridge, TN)

High-Purity Germanium Detector
Model GMX-23195-S, 23% efficiency
(EG&G ORTEC, Oak Ridge, TN)

Used in conjunction with:
Lead Shield, G-16
(Gamma Products, Inc., Palos Hills, IL)

Multichannel Analyzer
ND-66/MicroVax
(Nuclear Data, Schaumburg, IL/Digital Equipment Corp., Maynard, MA)

Alpha Spectrometry System
Tennelec Electronics
(Tennelec, Oak Ridge, TN)

Solid State Surface Barrier Detectors
(EG&G ORTEC, Oak Ridge, TN)
(Tennelec, Oak Ridge, TN)

Multichannel Analyzer
Model ND-66
(Nuclear Data, Schaumburg, IL)

APPENDIX B

MEASUREMENT, SAMPLING, AND ANALYTICAL PROCEDURES

APPENDIX B

MEASUREMENT, SAMPLING, AND ANALYTICAL 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 (0.4 in). Identification of elevated levels was based on increases in the audible signal from the recording or indicating instrument. Combinations of detectors and instruments used for the scans were:

Alpha
Ludlum Model 43-68 gas proportional detector with Ludlum
Model 2221 ratemeter-scaler

Large area gas proportional detector with Ludlum Model 2220 ratemeter-scaler

Gamma
Victoreen NaI scintillation detector with Eberline PRM-6 ratemeter

Bicron "FIDLER" scintillation detector with Ludlum Model 2221 ratemeter-scaler

Alpha and Beta-Gamma Measurements

Measurements of total alpha and beta-gamma radiation activity levels were performed using Ludlum Model 2221 portable ratemeter-scalers with Model 43-68 thin-window proportional detectors, Eberline Model PRS-1 portable ratemeter-scalers with Model AC3-7 alpha scintillation detectors or Model HP-260 thin-window "pancake" GM detectors. Count rates (cpm) were converted to disintegration rates (dpm/100 cm^2) by dividing the net rate by the 4 π efficiency and correcting for the active area of the detector. Effective window areas were 59 cm^2 for the ZnS detectors, 15 cm^2

for the alpha scintillation detectors, and 100 cm^2 for the proportional detectors. Background count rates from 1-2 cpm for alpha detectors, 40-47 cpm for GM "pancake" detectors, and 1-4 cpm for proportional detectors with voltage settings in the alpha region.

Removable Activity Measurement

Smear measurements were performed using numbered filter paper disks, 47 mm in diameter. Approximately 100 cm^2 was wiped applying moderate pressure. Smears were counted on a low-background alpha/beta gas-proportional counter at the Oak Ridge laboratory.

Exposure Rate Measurements

Measurements of gamma exposure rates were performed using Eberline PRM-6 portable ratemeters with Victoreen Model 489-55 gamma scintillation probes containing 3.2 cm (1.25 in) x 3.8 cm (1.50 in) NaI(T1) scintillation crystals. Count rates were converted to exposure rates (μR/h) by cross-calibrating with a Reuter Stokes Model RSS-111 pressurized ionization chamber. Count rates obtained from the Bicron "FIDLER" were used for reference purposes only and therefore were not converted to exposure rate measurements.

Soil Sampling

Approximately 1 kg of soil was collected at each sample location. Surface samples were collected from 0-15 cm.

Subsurface samples were collected at various depths as accessible.

Interior samples from excavations were collected from accessible exposed soil surfaces and from subfloor excavations. Samples were also collected from barrels of excavated soil.

Miscellaneous Sampling

Concrete and paint samples were taken by chipping or scraping material from approximately 100 cm^2 of surface.

Soil Sample Analysis

Gamma Spectroscopy

Soil samples were dried, mixed, and a portion sealed in 0.5 liter (0.53 qt) Marinelli beaker. The quantity placed in each beaker was chosen to reproduce the calibrated counting geometry and ranged from 600 to 900 g (1.3 to 2.0 lb) of soil. Net soil weights were determined and the samples counted using high-purity intrinsic germanium detectors coupled to a Nuclear Data 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. Energy peaks of particular interest were: U-235, 0.144 MeV; U-238, 0.093 MeV from Th-234 and 1.001 MeV from Pa-234 m; and Am-241, 0.059 Mev. Spectra were also reviewed for the presence of other photopeaks.

Alpha Spectroscopy

Groups of soil samples were composited for isotopic uranium and plutonium analyses. Portions of 5 to 10 original samples were combined and homogenized. Aliquots of these mixtures were dissolved by pyrosulfate fusion and precipitated by barium sulfate. The barium sulfate precipitate was redissolved and the specific elements of interest were individually separated by liquid-liquid extraction. The radionuclides were then precipitated with a cerium flouride carrier and counted using surface barrier detectors (ORTEC), alpha spectrometers (Tennelec), and an ND-66 Multichannel Analyzer (Nuclear Data).

Concrete, Paint and Miscellaneous Sample Analysis

Concrete and paint samples were ground to a fine consistency and analyzed for uranium and plutonium as previously described for soil. A section of the perimeter fence was washed with acid and the washing was analyzed in the same manner.

Uncertainties and Detection Limits

The uncertainties associated with the analytical data presented in the tables of this report, represent the 95% confidence levels for that data. These uncertainties were calculated based on both the gross ample count levels and the associated background count levels. When the net sample count was less than the statistical deviation of the background count, the sample concentration was reported as less than the detection limit of the procedures. Because of variation in background levels, detector efficiencies, and the effects of other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument.

Calibration and Quality Assurance

The Environmental Survey and Site Assessment Program conducted the survey and analytical activities according to laboratory and field survey procedures specified in manuals developed specifically for the Oak Ridge Associated Universities' Environmental Survey and Site Assessment Program to meet the requirements of ANSI/ASME NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities". The specific manuals and procedures applicable to this survey were the "Quality Assurance Manual", December 1988, Revision 2: the "Survey Procedures Manual," August 1988, Revision 4; and the "Laboratory Procedures Manual," August 1988, Revision 4.

With the exception of the measurements conducted with portable gamma scintillation survey meters, instruments were calibrated with NIST-traceable standards. The calibration procedures for the portable gamma instruments are performed by comparison with an NIST calibrated pressurized ionization chamber.

Quality control procedures on all instruments included daily background and check-source measurements to confirm equipment operation within acceptable statistical fluctuations. The ORAU laboratory participates in the EPA and EML Quality Assurance Programs.

APPENDIX C

GUIDELINES FOR DECONTAMINATION AND DECOMMISSIONING OF THE CIMARRON CORPORATION MIXED OXIDE FUEL FABRICATION PLANT

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 of 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 and Material Safety, USNRC, 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	1000 dpm/100 cm^2	3000 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.	5000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1000 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 RADIONUCLIDES IN SOIL

External Radiation

The gamma level in air at one meter above ground level is not to exceed 10 μR/h (above background) for a diffuse source area and is not to exceed 20 μR/h (above background) for a discrete area.

Concentrations in Soil

Concentrations of residual radionuclides were established by the NRC to assure that the does to the body from inhalation would not exceed 1 mrad/y, above background, to the bone. These dose criteria are consistent with those recommended by EPA for residual transuranic contamination of soil. On the basis of these dose criteria, the guidelines for radionuclides in soil the Cimarron Corporation site were determined to be:

Plutonium	25 pCi/g
Americium-241	30 pCi/g
Total Uranium (enriched in U-35)	30 pCi/g

When mixtures of radionuclides are present, the sum of the ratios of individual radionuclide concentrations to their respective guideline levels must be less than or equal to 1.