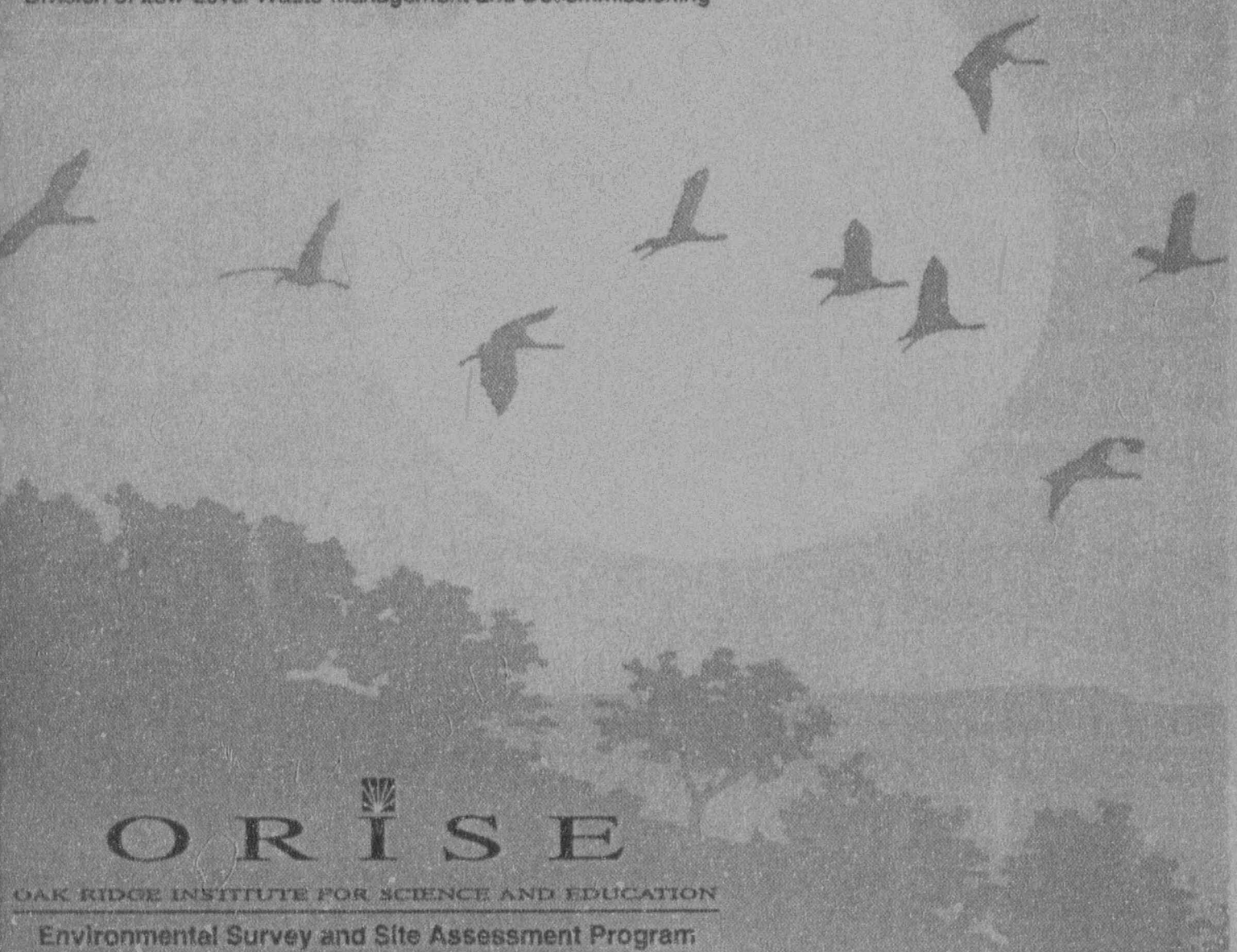


**CONFIRMATORY SURVEY
OF THE B-SOUTH AREA, BUILDING L,
UNIT 3 FUEL VAULT AREA,
AND AFFECTED OUTDOOR AREAS
UNC NAVAL PRODUCTS
MONTVILLE, CONNECTICUT
[DOCKET 70-371]**

A. J. ANSARI AND J. L. PAYNE

Prepared for the
U.S. Nuclear Regulatory Commission
Division of Low-Level Waste Management and Decommissioning



ORISE

OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

Environmental Survey and Site Assessment Program
Energy/Environment Systems Division

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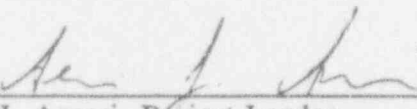
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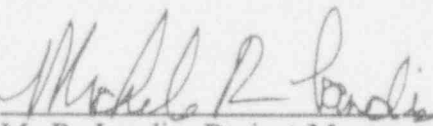
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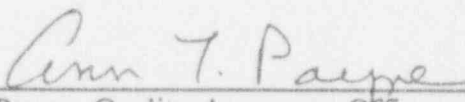
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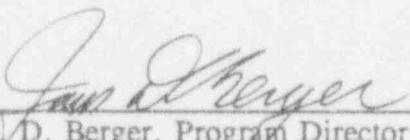
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TABLE OF CONTENTS

	<u>PAGE</u>
List of Figures	ii
List of Tables	ix
Abbreviations and Acronyms	x
Introduction and Site History	1
Site Description	2
Objectives	4
Document Review	4
Procedures	4
Sample Analysis and Data Interpretation	7
Findings and Results	8
Comparison of Results with Guidelines	11
Summary	13
References	154
Appendices:	
Appendix A: Major Instrumentation	
Appendix B: Survey and Analytical Procedures	
Appendix C: "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source or Special Nuclear Materials" and "Guidelines for Residual Concentrations of Thorium and Uranium Wastes in Soil."	

LIST OF FIGURES

	<u>PAGE</u>
FIGURE 1: Map of New London County, Connecticut, Showing Location of UNC Naval Products Facility	14
FIGURE 2: Layout of the UNC Naval Products Property	15
FIGURE 3: Layout of UNC Naval Products Facility	16
FIGURE 4: Plot Plan of B-South and Building L, Unit 3 Fuel Vault Areas	17
FIGURE 5: Layout of UNC Naval Products Facility Showing Locations of Outdoor Areas Surveyed	18
FIGURE 6: Plot Plan of B-South and Building L—Areas Surveyed in Phase 1	19
FIGURE 7: Plot Plan of B-South and Building L—Areas Surveyed in Phase 2	20
FIGURE 8: Plot Plan of B-South and Building L—Areas Surveyed in Phase 3	21
FIGURE 9: Plot Plan of B-South and Building L—Areas Surveyed Phase 4	22
FIGURE 10: Unit 1 Main Room, Lower Walls and Floor—Measurement and Sampling Locations	23
FIGURE 11: Unit 1 Main Room, Upper Walls—Measurement and Sampling Locations	24
FIGURE 12: Unit 1, Upper Wall and Ceiling—Measurement and Sampling Locations	25
FIGURE 13: Unit 1, Press Pit, Lower Walls, Floor and Upper Walls—Measurement and Sampling Locations	26
FIGURE 14: Unit 1, Press Pit Stairs, Lower Walls, Floor, Upper Walls, and Ceiling—Measurement and Sampling Locations	27
FIGURE 15: Unit 1 Elevator Pit, Lower Walls and Floor—Measurement and Sampling Locations	28
FIGURE 16: Unit 1 Control Room, Lower Walls and Floor—Measurement and Sampling Locations	29

LIST OF FIGURES (Continued)

		<u>PAGE</u>
FIGURE 17:	Unit 1 Control Room, Upper Walls—Measurement and Sampling Locations	30
FIGURE 18:	Unit 1 Quality Control (QC) Room, Lower Walls and Floor—Measurement and Sampling Locations	31
FIGURE 19:	Unit 1 Quality Control (QC) Room, Upper Walls—Measurement and Sampling Locations	32
FIGURE 20:	Unit 1 Argon Room, Lower Walls and Floor—Measurement and Sampling Locations	33
FIGURE 21:	Unit 1 Argon Room, Upper Walls and Ceiling—Measurement and Sampling Locations	34
FIGURE 22:	Unit 1 Die Assembly, Lower Walls and Floor—Measurement and Sampling Locations	35
FIGURE 23:	Unit 1 Die Assembly, Upper Walls—Measurement and Sampling Locations	36
FIGURE 24:	Unit 1 Hafnium Weigh Room, Lower Walls and Floor—Measurement and Sampling Locations	37
FIGURE 25:	Unit 1 Hafnium Weigh Room, Upper Walls—Measurement and Sampling Locations	38
FIGURE 26:	Unit 1 Locker Room and Shower, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	39
FIGURE 27:	Unit 1 Vestibule, Lower Walls and Floor—Measurement and Sampling Locations	40
FIGURE 28:	Unit 1 Vestibule, Upper Walls—Measurement and Sampling Locations	41
FIGURE 29:	Unit 2 Main Room, Lower Walls and Floor—Measurement and Sampling Locations	42
FIGURE 30:	Unit 2 Main Room, Upper Walls and Ceiling—Measurement and Sampling Locations	43

LIST OF FIGURES (continued)

		<u>PAGE</u>
FIGURE 31:	Unit 2 Press Pit, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	44
FIGURE 32:	Unit 2 Press Pit Stairs and Elevator Pit, Lower Walls and Floor—Measurement and Sampling Locations	45
FIGURE 33:	Unit 2 Control and S-Box Rooms, Lower Walls and Floor—Measurement and Sampling Locations	46
FIGURE 34:	Unit 2 Control, S-Box and Locker Rooms, Upper Walls and Ceiling—Measurement and Sampling Locations	47
FIGURE 35:	Unit 2 A-B Space, Lower Walls and Floor—Measurement and Sampling Locations	48
FIGURE 36:	Unit 2 A-B Space, Upper Walls and Ceiling—Measurement and Sampling Locations	49
FIGURE 37:	Unit 2 Argon Room, Lower Walls and Floor—Measurement and Sampling Locations	50
FIGURE 38:	Unit 2 Argon Room, Upper Walls and Ceiling—Measurement and Sampling Locations	51
FIGURE 39:	Unit 2 Locker Room, Lower Walls and Floor—Measurement and Sampling Locations	52
FIGURE 40:	Unit 2 Shower, Lower Walls and Floor—Measurement and Sampling Locations	53
FIGURE 41:	Units 1 and 2 Hallway, Lower Walls, Floor and Upper Walls—Measurement and Sampling Locations	54
FIGURE 42:	Raw Fuel Vault, Lower Walls, Floor, Upper Walls and Ceiling—Measurement and Sampling Locations	55
FIGURE 43:	Raw Fuel Vault Column, Lower Walls and Upper Walls—Measurement and Sampling Locations	56
FIGURE 44:	Scrap Vault, Lower Walls, Floor, Upper Walls and Ceiling—Measurement and Sampling Locations	57

LIST OF FIGURES (continued)

		<u>PAGE</u>
FIGURE 45:	Pack Assembly, Lower Walls and Floor—Measurement and Sampling Locations	58
FIGURE 46:	Pack Assembly, Upper Walls and Ceiling—Measurement and Sampling Locations	59
FIGURE 47:	Metallurgy Lab, Sample Preparation, Lower Walls, Floor, Upper Walls, and Ceiling—Measurement and Sampling Locations	60
FIGURE 48:	Metallurgy Lab, Reading Area, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	61
FIGURE 49:	Metallurgy Lab, Reading Area Ceiling—Measurement and Sampling Locations	62
FIGURE 50:	Metallurgy Lab, Wash Room, Lower Walls and Upper Walls—Measurement and Sampling Locations	63
FIGURE 51:	Metallurgy Lab, Records Storage, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	64
FIGURE 52:	Metallurgy Lab Office, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	65
FIGURE 53:	Metallurgy Lab Supply Storage, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	66
FIGURE 54:	Chemistry Lab, Main Area, Lower Walls and Floor—Measurement and Sampling Locations	67
FIGURE 55:	Chemistry Lab, Upper Walls and Ceiling—Measurement and Sampling Locations	68
FIGURE 56:	Chemistry Lab Mass Spectrometer Room, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	69
FIGURE 57:	Chemistry Lab, C-Lab 1, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	70
FIGURE 58:	Chemistry Lab, C-Lab 2, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	71

LIST OF FIGURES (continued)

		<u>PAGE</u>
FIGURE 59:	Chemistry Lab, C-Lab 3, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	72
FIGURE 60:	Chemistry Lab Spectroscopy Room, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	73
FIGURE 61:	Chemistry Lab, ISAF A Darkroom, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	74
FIGURE 62:	Chemistry Lab, ISAF B, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	75
FIGURE 63:	Chemistry Lab, ISAF C, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	76
FIGURE 64:	Sectioning Main Area, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	77
FIGURE 65:	Sectioning Main Area, Ceiling—Measurement and Sampling Locations	78
FIGURE 66:	Sectioning, Locker Room—Measurement and Sampling Locations	79
FIGURE 67:	Old Decon, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	80
FIGURE 68:	Old Decon, Ceiling—Measurement and Sampling Locations	81
FIGURE 69:	New Decon, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	82
FIGURE 70:	New Decon, Ceiling—Measurement and Sampling Locations	83
FIGURE 71:	New Decon, Drum Scan Room, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	84
FIGURE 72:	B-South Mens' Room—Measurement and Sampling Locations	85
FIGURE 73:	B-South, Ladies' Room—Measurement and Sampling Locations	86

LIST OF FIGURES (continued)

		<u>PAGE</u>
FIGURE 74:	Basement, HP Office, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	87
FIGURE 75:	Basement, Radwaste Storage Area—Measurement and Sampling Locations	88
FIGURE 76:	Basement, Radwaste Area, Lower Walls, Floor, and Upper Walls—Measurement and Sampling Locations	89
FIGURE 77:	Basement, Radwaste Area, Ceiling—Measurement and Sampling Locations	90
FIGURE 78:	Basement, Radwaste Stairs—Measurement and Sampling Locations	91
FIGURE 79:	Basement, Radwaste Area, Columns—Measurement and Sampling Locations	92
FIGURE 80:	L-Building Fuel Vault, Lower Walls and Floor—Measurement and Sampling Locations	93
FIGURE 81:	L-Building Fuel Vault, Upper Walls and Ceiling—Measurement and Sampling Locations	94
FIGURE 82:	L-Building Fuel Vault, Storage Shelf Unit—Measurement and Sampling Locations	95
FIGURE 83:	L-Building Unit III Entry, Lower Walls and Floor—Measurement and Sampling Locations	96
FIGURE 84:	L-Building, Unit III Hall Area, Lower Walls and Floor—Measurement and Sampling Locations	97
FIGURE 85:	L-Building Chem Lab Part A, Lower Walls and Floor—Measurement and Sampling Locations	98
FIGURE 86:	L-Building Chem Lab Part B, Lower Walls and Floor—Measurement and Sampling Locations	99
FIGURE 87:	L-Building Chem Lab Part C, Lower Walls and Floor—Measurement and Sampling Locations	100
FIGURE 88:	Incinerator Pad—Measurement and Sampling Locations	101

LIST OF FIGURES (continued)

		<u>PAGE</u>
FIGURE 89:	Septic Field 1—Measurement and Sampling Locations	102
FIGURE 90:	Septic Field 1, Grid Block E-10—Measurement and Sampling Locations	103
FIGURE 91:	Septic Field 1, Grid Block C-9—Measurement and Sampling Locations	104
FIGURE 92:	Septic Field 1, Grid Block E-6—Measurement and Sampling Locations	105
FIGURE 93:	Septic Field 1, Grid Block F-3—Measurement and Sampling Locations	106
FIGURE 94:	Septic Field 1, Grid Block A-6—Measurement and Sampling Locations	107
FIGURE 95:	Septic Field 1, Grid Block A-4—Measurement and Sampling Locations	108
FIGURE 96:	Septic Field 1, Grid Block A-3—Measurement and Sampling Locations	109
FIGURE 97:	Septic Field 1, Grid Block B-2—Measurement and Sampling Locations	110
FIGURE 98:	Septic Field 1, Grid Block C-3—Measurement and Sampling Locations	111
FIGURE 99:	Septic Field 1, Grid Block C-2—Measurement and Sampling Locations	112
FIGURE 100:	Septic Field 1, Grid Block C-1—Measurement and Sampling Locations	113
FIGURE 101:	Map of UNC Leach Field—Measurement and Sampling Locations . . .	114

LIST OF TABLES

	PAGE
TABLE 1: Summary of Surface Activity Measurements	115
TABLE 2: Exposure Rate Measurements for Interior Areas	132
TABLE 3: Uranium Concentrations in Soil Samples from the B-South Area Excavations	137
TABLE 4: Exposure Rate Measurements for Affected Outdoor Areas	140
TABLE 5: Uranium Concentrations in Soil Samples from the Incinerator Pad	141
TABLE 6: Uranium Concentrations in Soil Samples from the Septic Field	143
TABLE 7: Uranium Concentration in Soil Samples from the Leach Field Dry Wells	150
TABLE 8: Uranium Concentrations in Soil Samples from the Leach Field Boreholes	152

ABBREVIATIONS AND ACRONYMS

ASME	American Society of Mechanical Engineers
cm ²	square centimeter
cpm	counts per minute
dpm/100 cm ²	disintegrations per minute/100 square centimeters
EML	Environmental Measurement Laboratory
EPA	Environmental Protection Agency
ESSAP	Environmental Survey and Site Assessment Program
ft	foot
GM	Geiger-Mueller
km	kilometer
m	meter
m ²	square meter
MDA	minimum detectable activity
NaI	Sodium Iodide
NIST	National Institute for Standards Technology
NRC	Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
PIC	Pressurized Ionization Chamber
μR/h	microrentgen per hour
UNC	United Nuclear Corporation
ZnS	Zinc Sulfide

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INTRODUCTION AND SITE HISTORY

United Nuclear Corporation (UNC) Naval Products fabricated reactor fuel elements for the Naval Reactors program at the Montville, Connecticut facility under U.S. Nuclear Regulatory Commission (NRC) License SNM-368. The license authorized the fabrication of unclad fuel components, encapsulation of the fuel with corrosion resistant materials, assemblage of these into larger components or into reactor cores, and laboratory activities necessary to support these operations. The radioactive materials utilized were fully enriched, unirradiated uranium and uranium source materials.

The Montville facility was built in 1957-1959, with small additions in 1961 and 1966. A major expansion, Building M, was completed in 1969. All operations in these areas were limited to clad fuel. Following authorization by the Atomic Energy Commission (predecessor to the NRC) in 1972, UNC constructed four additional buildings. Building A was completed in early 1973 and operations there were also limited to clad fuel. Building B was completed in September of 1973 and was used for the initial forming and encapsulation of the uranium bearing materials. Building C was completed in May of 1973 and contains the main office and clerical support staff. Buildings D, R, S, and T are used for inspection and bulk storage of non-uranium bearing materials. Construction of Building L was completed in 1990; however, installation of uranium processing equipment was never completed.

In March of 1990, UNC was notified by the U.S. Government that certain contracts were being terminated. As a result of that action, UNC initiated decontamination and decommissioning efforts at the Montville facility in the summer of 1990, while concurrently completing work on existing contracts. The facility was divided into affected and unaffected areas by the licensee, consistent with recommendations of NUREG/CR-5849. UNC's decontamination and

buildings consist of D, R, S, T, H Buildings, Carpentry Building, Compressor Building, West Pump House, Security Towers, and Security Gate House. In these areas, designated as unaffected, unencapsulated fuel had never been used or stored. There is no record of any major incidents or fires involving release of radioactive materials in these areas. However, there had been incidents of machine misoperations involving encapsulated fuel in the manufacturing area. In every case, the contamination, if any, was confined to the machine and/or component. Four such "incident" areas have been identified. These are the Hot Roll room in Building B North, Warm Roll room, Vapor Grit Blast room, and the Welding area in Building A.

At the request of the U.S. Nuclear Regulatory Commission, ESSAP performed a confirmatory radiological survey of the indoor unaffected areas at the UNC facility during the period of February 8 through 11, 1993. The procedures and results of that survey are included in this report. During the same period, the Electrode Grind room in Building A, designated as an affected area, was surveyed. The procedures and results of that survey are also provided in this report.

SITE DESCRIPTION

The 251 acre UNC site is located in the northeast corner of the town of Montville, New London County, Connecticut (Figure 1). Only a small portion of the site is occupied by the UNC facility. The Central Vermont Railroad has a right-of-way along the Thames River at the eastern edge of the UNC site. The plant is served by a spur from the railroad and has car and truck access from State Highway 32. The site is bounded on the north by the Thames River, on the east by the railroad and the Thames River, and on the south and west by private property (Figure 2).

The Montville facility was built in 1957-59, with small additions in 1961 and 1966 (Figure 3). A major expansion, Building M (4,700 m²) was completed in 1969. All operations in this building were limited to clad fuel. Following authorization by the Atomic Energy Commission (predecessor to NRC) in 1972, UNC constructed four additional buildings. Building A

Building B-South, consisting of approximately 3,650 m² of floor space, contained 3 major areas for the radiologically controlled production and support operations involving exposed fuel (Figure 4). Unit 2 contained fully enclosed equipment used to shape the process material into components, and additional equipment to perform inspection and testing. Decommissioning activities included the removal of equipment, process exhaust ducting, drywall partitions, and partial removal of epoxy floor covering. A floor drain was also excavated from the main room. All remaining surfaces were cleaned and decontaminated. Unit 1 was used to weigh fuel and fabricate fuel components. Additional activities performed in Unit 1 included x-ray and dimensional measuring of fabricated materials, and cleaning and assembling special tooling and equipment. Decommissioning activities in Unit 1 were similar to those in Unit 2. The support function areas included the Metallurgical Laboratory, Chemistry and Spectroscopy Laboratory, Sectioning Area, Pack Assembly, Old and New Decon Areas, and Raw Fuel and Scrap Vaults. These areas were used for quality control, laboratory analysis, inspection, assembly and packaging, and storage of fuel and waste products. Decommissioning activities in these areas was similar to Units 1 and 2 with more extensive removal of subfloor process drain lines.

Unit 3 Fuel Vault area in Building L, which consists of approximately 400 m² of total floor space (Figure 4), was used to store uranium fuel. In addition, small quantities of uranium were transferred into glove boxes for quality control operations. Decommissioning activities in the Unit 3 Fuel Vault area included the removal of all equipment (with the exception of the storage shelves which were cleaned) and cleaning and decontamination of all remaining surfaces.

The approximate locations of outdoor areas included in the decommissioning effort, the Incinerator Pad (400 m²), the Septic Field (6800 m²), and the Leach Field (2200 m²) are shown in Figure 5 (detailed drawings of these areas are shown in Figures 88, 89, and 101). Decommissioning activities in these areas included the removal of a concrete pad from the Incinerator Pad area, removal of the overburden soil and dispersal piping from the Septic Field, and removal of sludge accumulation from the Leach Field drywells.

OBJECTIVES

The objectives of the confirmatory process are to provide independent document reviews and radiological data, for use by the NRC in evaluating the adequacy and accuracy of the licensee's radiological survey data, relative to established guidelines.

DOCUMENT REVIEW

The radiological status reports, provided by United Nuclear Corporation Naval Products, were reviewed by ESSAP as part of the confirmatory activities. Analytical procedures and methods utilized by the licensee were reviewed for adequacy and appropriateness. The data were reviewed for accuracy, completeness, and compliance with applicable NRC guidelines.

PROCEDURES

During the period from April 1, 1991 through November 10, 1992, ESSAP performed confirmatory surveys of the B-South Area and the Building L, Unit 3 Fuel Vault Area in 4 phases (Figures 6 through 9). Also included in confirmatory activities were three affected outdoor areas: the Incinerator Pad, the Septic Field, and the Leach Field Drywells. The surveys were conducted in accordance with survey plans, submitted to and approved by the NRC Region I Office.¹⁻³

SURVEY PROCEDURES: INTERIOR

Reference Grid

A 1 m x 1 m alphanumeric reference grid system was established by UNC on floors and lower walls (up to 2 m) in all areas of B-South, and on the upper walls and ceilings in Pack Assembly, the Chemistry Lab, the Basement Radwaste Storage Areas, Old and New Decon, Sectioning main area, and the Scrap and Raw Fuel Vaults. A 2 m x 2 m reference grid was established on

all remaining surfaces in B-South and Unit 3 Fuel Vault area in Building L (Figures 10 through 87). Measurement and sampling locations were referenced to these grids.

Surface Scans

All floor and lower wall surfaces were scanned for gamma, alpha, and beta activity using NaI scintillation and gas proportional detectors. All detectors were coupled to ratemeter-scalers with audible indicators. Locations of elevated activity were marked for further investigation.

Surface Activity Measurements

Measurements for total and removable alpha and beta activity were performed in randomly selected grid blocks on all gridded surfaces in each of the areas surveyed. Measurements were performed in 820 grid blocks in the B-South area and 70 grid blocks in Unit 3 Fuel Vault area including the Fuel Vault storage shelves. Direct measurements in 1 m² grid blocks were performed at the center and at four points equidistant from the center and grid block corners. Direct measurements in 2 m² grid blocks were performed at the center and at four points one quarter of the distance from the center to the grid block corners. Direct measurements in the Fuel Vault storage shelves were performed at the center of the rear surface and at four points equidistant from the center and the ends of the shelf on the top and bottom surfaces. Direct measurements were performed using ZnS scintillation and GM detectors, coupled with ratemeter-scalers. A smear sample for determining removable activity was obtained for each set of five direct measurements, at the location corresponding to the highest alpha activity. A total of 890 smears were collected. Measurement and sampling locations for total and removable activity are illustrated in Figures 10 through 87.

Exposure Rate Measurements

Exposure rate measurements were performed at 1 m above the floor at 83 locations using a pressurized ionization chamber (PIC). Measurement locations are shown in Figures 10 through 87. Three of these measurements, performed in the Control Room and the Locker Room of

Unit 2 and in the entry hall of the Unit 3 Fuel Vault area, were approved by the NRC site representative to be used as background exposure rates.

Soil Sampling

Thirty-nine surface soil samples were collected from excavations throughout the B-South Area. Five boreholes were sampled to a depth of 45 cm. Sampling locations are indicated on Figures 10, 18, 29, 44, 45, 47, 48, 64, 67, 74, and 76.

Miscellaneous Sampling

Seventy-nine paint samples (100 cm²) were collected from locations throughout the B-South and Unit 3 Fuel Vault areas. Sampling locations are indicated on Figures 10 through 87.

SURVEY PROCEDURES: EXTERIOR

Reference Grid

A 1 m x 1 m alphanumeric reference grid system was established by UNC in the Incinerator Pad area (Figure 88). A 10 m x 10 m alphanumeric reference grid system was established by UNC in the Septic Field (Figure 89). This system was further divided numerically to identify pipe excavation trenches. A 5 m x 5 m numeric reference grid system was established by UNC in the Leach Field area (Figure 101).

Surface Scans

Surface scans for gamma activity were performed in the Incinerator Pad area and the Septic Field. Scans for gamma activity were performed at the bottom of each drywell in the Leach Field. All scans were performed using NaI scintillation detectors, coupled to ratemeters with audible indicators. Areas of elevated direct radiation, suggesting the presence of surface or near surface contamination, were marked for further investigation.

Exposure Rate Measurements

Background exposure rate measurements were made at 8 locations within 0.5 to 10 km of the site using a PIC. The background exposure rate was established during an ESSAP survey of this facility in May 1993.⁴

Exposure rate measurements were performed at 1 m above the surface at 3 locations in the Incinerator Pad area, 6 locations in the Septic Field, and 3 locations in the Leach Field using a PIC. Measurement locations are shown in Figures 88, 89, and 101.

Soil Sampling

Background soil samples were collected from 8 off-site locations within 0.5 to 10 km of the site during the ESSAP survey of May 1993.⁴

Sixteen surface and 10 subsurface soil samples were collected from the Incinerator Pad area (Figure 88). One hundred twenty-five surface soil samples were collected from 11 randomly selected grid blocks in the Septic Field (Figures 90 through 100). Three additional surface soil samples were collected from locations of elevated surface activity identified from surface scans (Figure 89). Twenty-four soil samples were collected from the Leach Field Drywells, 1 composite sample from the bottom of each well and 1 sample from one of the existing holes in the drywell wall, created at various depths in each well during UNC decommissioning activities. Additionally, 17 subsurface samples from the Leach Field, collected by UNC, were provided to ESSAP for confirmatory analysis.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data were returned to ESSAP in Oak Ridge for analyses and interpretation. Smears were analyzed for gross alpha and gross beta activity. Soil and miscellaneous samples (paint and concrete) were analyzed by alpha spectrometry and/or gamma spectrometry; alpha spectra were reviewed for U-234, U-235, and U-238; gamma spectra were reviewed for radionuclides of

interest (U-235 and U-238) and any other identifiable photopeaks. Soil sample results were reported in picocuries/gram (pCi/g). Total uranium concentrations were calculated based on a U-234 to U-235 ratio of 41 to 1, as established by the licensee, except for the Incinerator Pad area where an isotopic ratio of 30 to 1 was used by the licensee. Paint samples, direct measurement data, and smear data were converted to disintegrations per minute per 100 cm² (dpm/100 cm²). Exposure rates were reported in μ R/h.

Additional information concerning major instrumentation, sampling equipment, and analytical procedures is provided in Appendices A and B. Results were compared to the applicable NRC guidelines which are provided in Appendix C.

FINDINGS AND RESULTS

DOCUMENT REVIEW

ESSAP reviewed the licensee's radiological survey data and comments were provided to the NRC.⁵⁻¹⁰ In ESSAP's opinion, the documents provide an adequate description of the radiological condition of the facility relative to the NRC guidelines for release to unrestricted use.

INTERIOR SURVEY

Surface Scans

Surface scans for alpha, beta, and gamma activity performed on the floors, lower walls, and equipment identified 3 locations of elevated gamma activity in the Unit 1 Main Room. The locations were identified as imbedded bolts which UNC remediated prior to completion of confirmatory activities. A survey of the 3 locations indicated that decontamination efforts were effective.

Surface Activity Levels

Results of total and removable surface activity levels are summarized in Table 1. Total activity measurements ranged from <40 dpm/100 cm² to 2000 dpm/100 cm² for alpha and <1400 dpm/100 cm² to 3300 dpm/100 cm² for beta. The highest grid block averages were 610 dpm/100 cm² and 2500 dpm/100 cm² for alpha and beta, respectively. Removable activity ranged from <12 dpm/100 cm² to 25 dpm/100 cm² for alpha and <15 dpm/100 cm² to 28 dpm/100 cm² for beta.

Exposure Rate Measurements

Background exposure rates ranged from 11 to 12 μ R/h and averaged 12 μ R/h (Table 2).

Exposure rate measurements are summarized in Table 2. The 3 measurement locations designated as background, ranged from 11 μ R/h to 12 μ R/h. The remaining measurements ranged from 10 μ R/h to 15 μ R/h. Exposure rates of 15 μ R/h were measured in Unit 1 Argon Room and Unit 3 Fuel Vault.

Uranium Concentrations in Soil Samples

Uranium concentrations in soil samples collected from interior locations are presented in Table 3. Concentrations of U-235, U-238, and total uranium ranged from <0.1 to 0.3 pCi/g, 0.3 to 2.1 pCi/g, and 4.5 to 31 pCi/g, respectively. The highest total uranium concentration was from a sample collected in the Pack Assembly area. Following further remediation by UNC, ESSAP resampled the location. Maximum concentrations of U-235, U-238, and total uranium from follow-up samples in the Pack Assembly area were 0.2 pCi/g, 1.2 pCi/g, and 9.6 pCi/g, respectively.

Miscellaneous Samples

Results of total uranium analysis for the 79 paint samples indicated a maximum activity level of 630 dpm/100 cm² from the sample collected in the Control Room in Unit 2.

EXTERIOR SURVEY

Surface Scans

Gamma scans of the Incinerator Pad area and Septic Field identified 1 location of elevated surface radiation in grid block I,9 of the Incinerator Pad. Gamma scans of the Leach Field Drywell bottoms did not identify any locations of elevated surface radiation.

Exposure Rate Measurements

Background exposure rates for outdoor areas, determined during the ESSAP survey of May 1993, ranged from 10 to 12 μ R/h and averaged 11 μ R/h.⁴

Exposure rate measurements for outdoor areas are presented in Table 4. Exposure rates ranged from 9 to 11 μ R/h in the Incinerator Pad area, from 11 to 12 μ R/h in the Septic Field, and from 11 to 13 μ R/h in the Leach Field.

Uranium Concentrations in Soil Samples

Total uranium concentration in background soil samples, determined during the ESSAP survey of May 1993, ranged from 3.2 to 5.6 pCi/g.⁴

Uranium concentrations in soil samples collected from the Incinerator Pad area, the Septic Field, and the Leach Field are presented in Tables 5 through 8, respectively. Following the ESSAP survey, further remediation of these areas was performed by UNC. During the ESSAP survey of the UNC facility in February 1993, additional samples were collected from the recently

remediated locations and the data were provided to the NRC.¹¹ In Tables 5 through 8, the most recent data are listed. ESSAP data, obtained prior to the most recent remediation efforts, are provided in the footnotes, where applicable.

Concentrations of U-235, U-238, and total uranium in samples collected from the Incinerator Pad area ranged from 0.1 to 1.3 pCi/g, 0.2 to 3.2 pCi/g, and 3.3 to 42 pCi/g, respectively. The sample with the highest concentration was collected in Grid Block I,9 (Figure 88). Concentrations of U-235, U-238, and total uranium in samples collected from the Septic Field ranged from 0.1 to 1.5 pCi/g, 0.5 to 3.9 pCi/g, and 4.7 to 65 pCi/g, respectively. The sample with the highest total uranium concentration was collected in Grid Block A3 (Figure 96). Uranium concentrations from samples collected in Leach Field Drywells ranged from 0.1 to 2.2 pCi/g for U-235, 0.5 to 2.1 pCi/g for U-238, and 1.5 to 71 pCi/g for total uranium, with the highest concentration in a sample collected from the north side of Well 8, approximately 1.8 m (6 ft) from the bottom. Concentrations of U-235, U-238, and total uranium in Leach Field subsurface samples, collected by UNC and provided to ESSAP for confirmatory analysis, ranged from 0.1 to 0.3 pCi/g, 0.5 to 3.0 pCi/g, and 4.7 to 16.0 pCi/g, respectively.

COMPARISON OF RESULTS WITH GUIDELINES

The NRC guidelines for surface contamination and residual concentrations of radionuclides in soil, established for license termination or release of a facility for unrestricted use are presented in Appendix C. The primary contaminant of concern at this site is enriched uranium.

The surface contamination guidelines for uranium are:¹²

- 5,000 α dpm/100 cm², total, averaged over a 1 m² area
- 15,000 α dpm/100 cm², total, maximum in a 100 cm² area
- 1,000 α dpm/100 cm², removable

Surface activity measurements for total and removable activity in all interior areas surveyed were within these guidelines. The surface contamination levels in the paint samples were all within the 1,000 dpm/100 cm² criterion.

The soil concentration guideline for enriched uranium is 30 pCi/g.¹³

Analyses of soil samples collected from interior excavations identified one location in the Pack Assembly area which exceeded this guideline. Further remediation by the UNC was effective in reducing the concentration of uranium to within the 30 pCi/g guideline in the Pack Assembly area.

In the Incinerator Pad area, the total uranium concentrations at two locations exceeded the 30 pCi/g criterion. The highest total concentration (at grid block I,9) was 42 pCi/g.

Total uranium concentrations were above 30 pCi/g at 6 locations in the Septic Field (Table 6). However, provisions to the application of this guideline have been made in the Attachment A of the licensee's Decommissioning Plan which was approved by the NRC.¹⁴ These provisions allow for 54 pCi/g of total uranium, averaged over a 100 m² grid, and a maximum of 108 pCi/g at any one location within a 100 m² grid block in the Septic Field. The total uranium concentrations in all samples from the Septic Field were within the criteria set forth in the licensee's Decommissioning Plan.

In Leach Field Drywells, among samples collected from side openings at various depths in wells 4, 6, 7, 8, 9, 10, 11, and one composite sample from the bottom of Well 9, the total uranium concentrations were above 30 pCi/g at 8 locations (Table 7). At these locations, total uranium concentrations ranged from 34 to 71 pCi/g. All subsurface samples from the Leach Field, collected by UNC and provided to ESSAP for confirmatory analysis, were within the 30 pCi/g criterion.

The NRC guideline for exposure rate at 1 m above the surface is 5 μ R/h above background.¹⁴ All interior and exterior exposure rates were within this limit.

SUMMARY

At the request of the NRC Region I Office, from April 1991 to November 1992, the Environmental Survey and Site Assessment Program of ORISE performed confirmatory surveys of the B-South area, Building L, Unit 3 Fuel Vault area, and the affected outdoor areas at United Nuclear Corporation Naval Products. The interior surveys consisted of alpha, beta, and gamma scans of the floor and lower wall surfaces, measurements of total and removable activity, exposure rate measurements, and soil and paint sampling. Exterior survey activities included gamma surface scans, exposure rate measurements, and soil sampling.

Total and removable surface activity measurements were all below the guideline values. Interior and exterior exposure rate measurements were all within the 5 μ R/h above background criterion. Regarding the surface activity and exposure rate guidelines, the results of ESSAP survey are consistent with licensee's conclusion that the facility meets the requirements for release for unrestricted use.

In the Septic Field, total uranium concentrations in soil were within the guideline values. ESSAP survey identified a number of locations in the Incinerator Pad area and the Leach Field Drywells at which the total uranium concentration in soil exceeded the guideline values. The highest concentration of total uranium was 42 pCi/g in the Incinerator Pad area (grid I,9) and 71 pCi/g in Leach Field Drywells (Well #8).

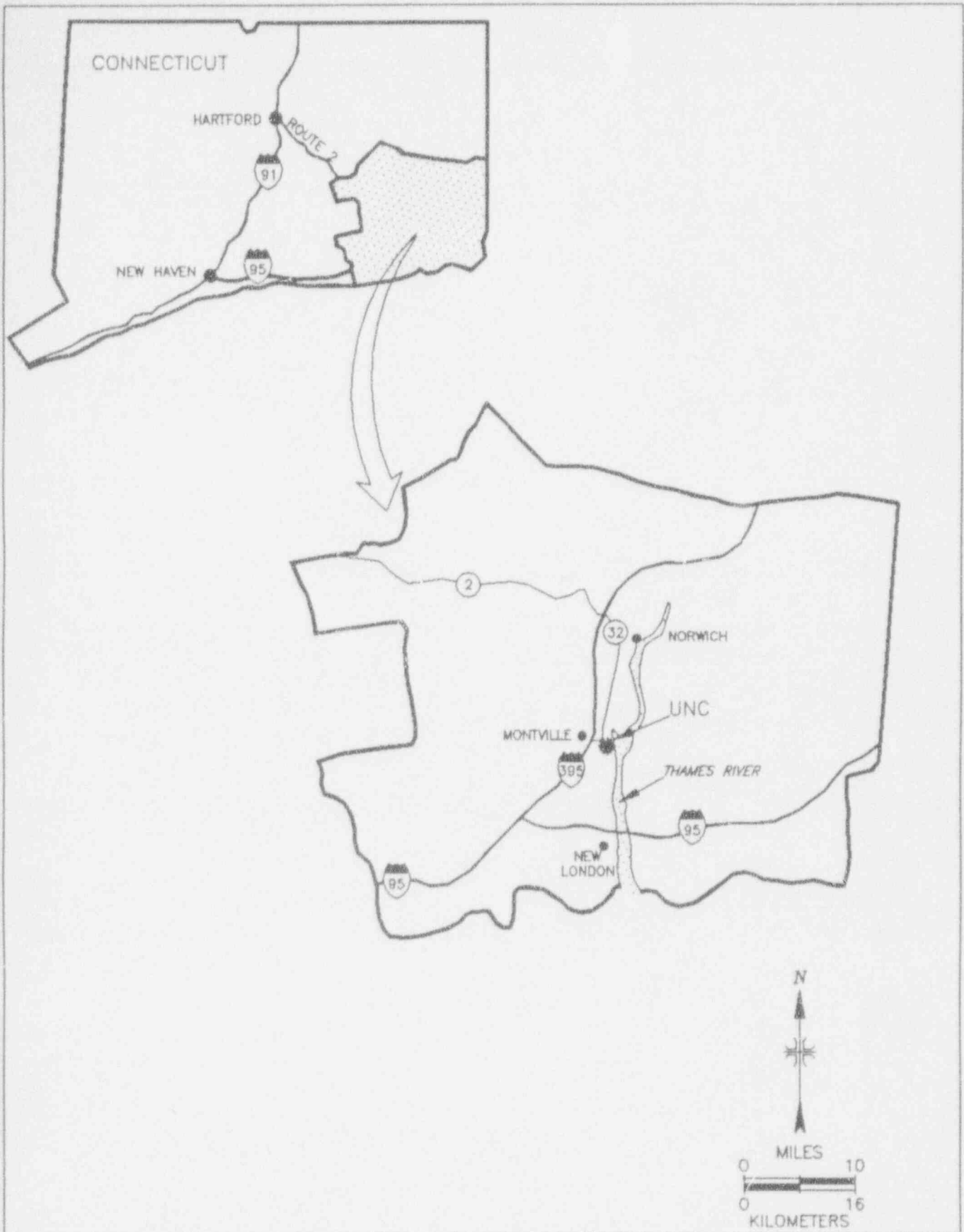


FIGURE 1: Map of New London County, Connecticut, Showing Location of UNC Naval Products Facility

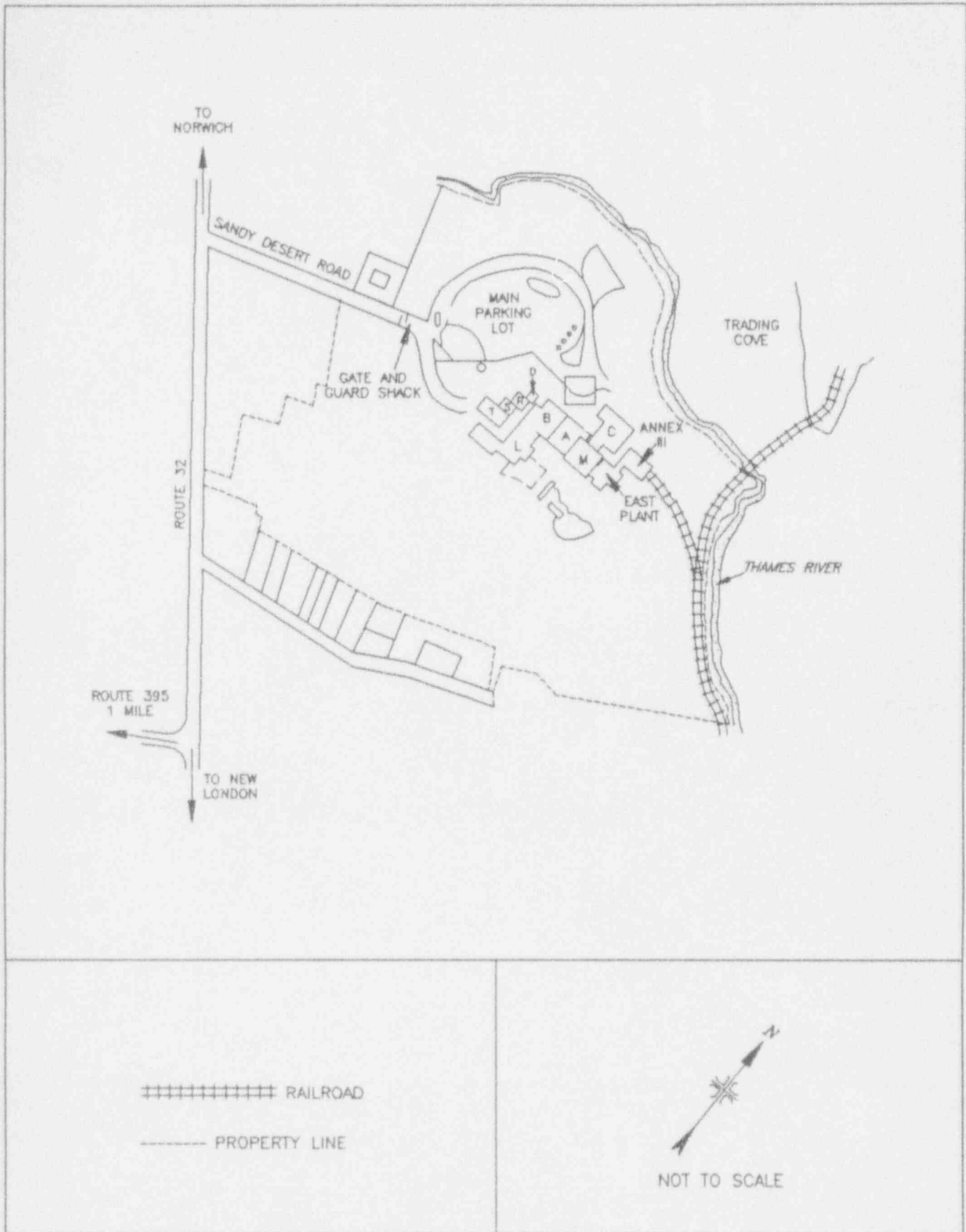


FIGURE 2: Layout of the UNC Naval Products Property

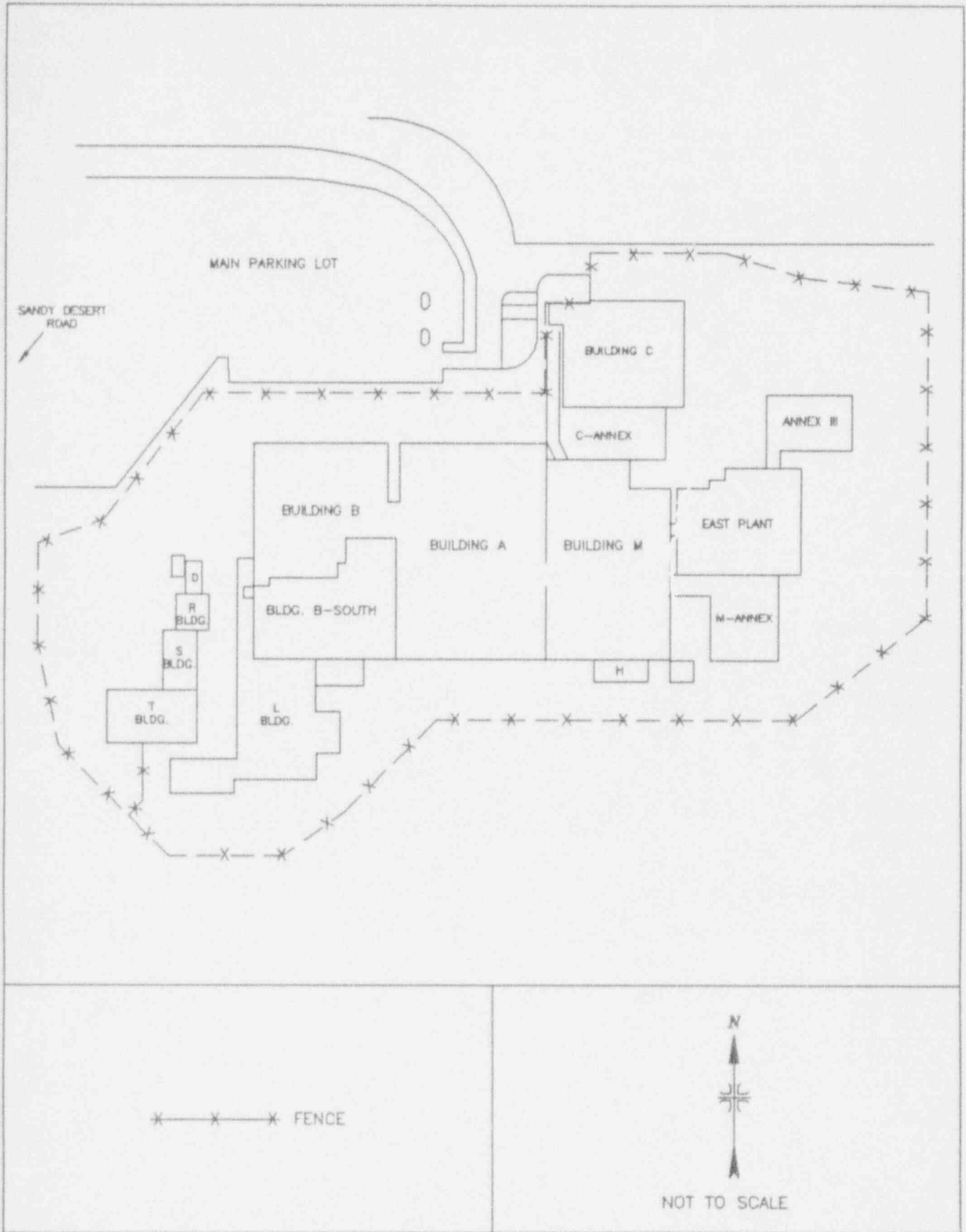


FIGURE 3: Layout of UNC Naval Products Facility

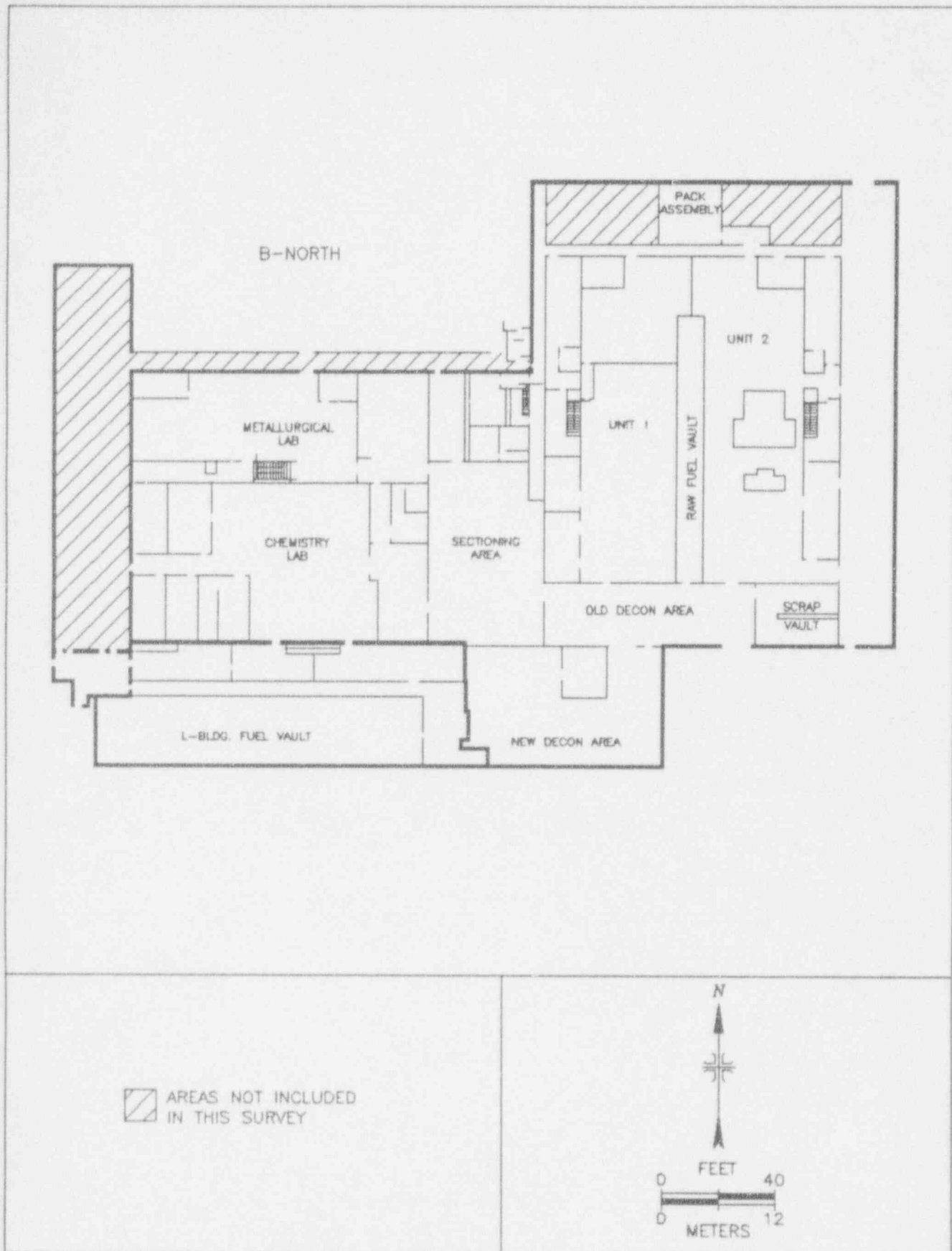


FIGURE 4: Plot Plan of B-South and Building L, Unit 3 Fuel Vault Areas

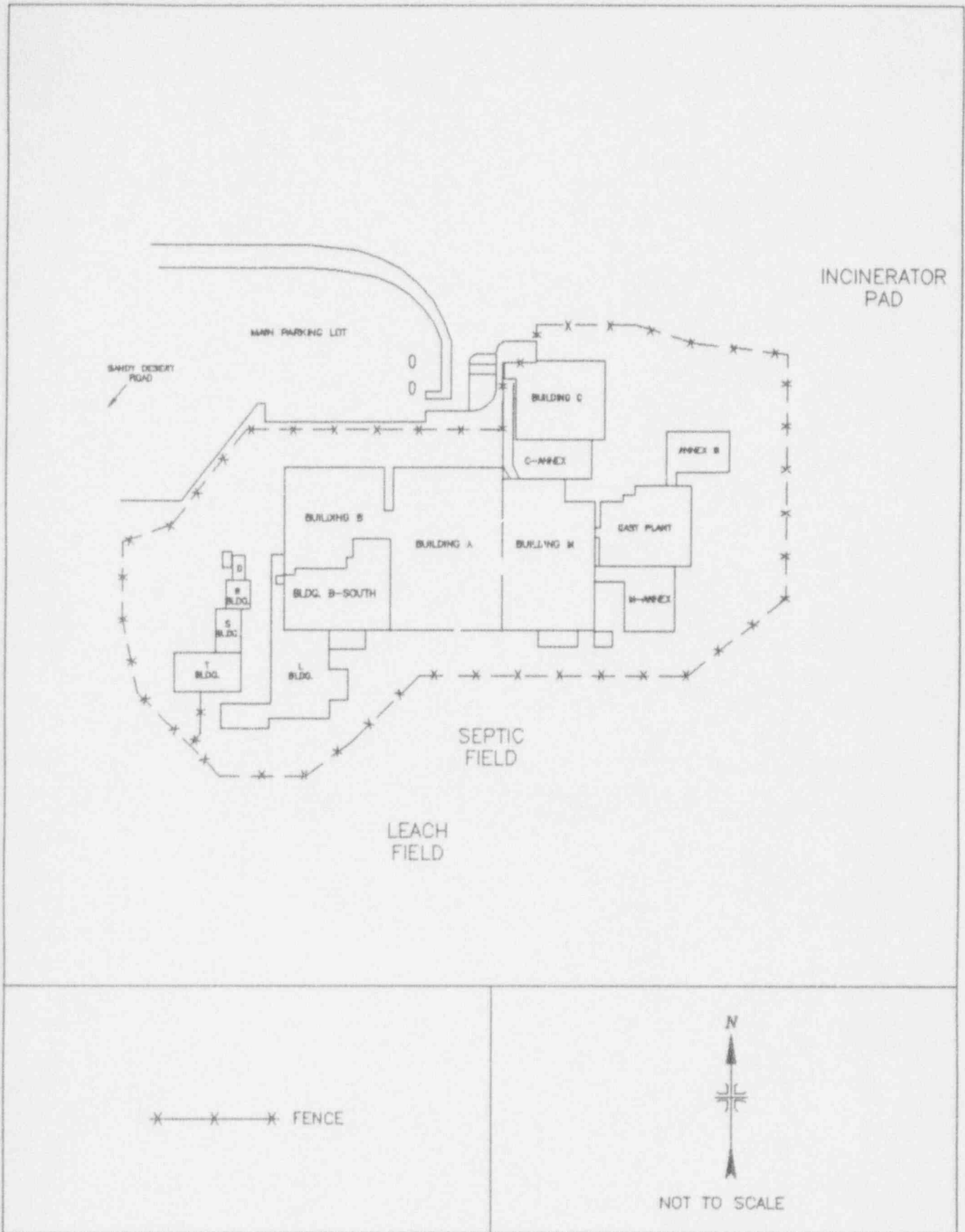


FIGURE 5: Layout of UNC Naval Products Facility Showing Locations of Outdoor Areas Surveyed

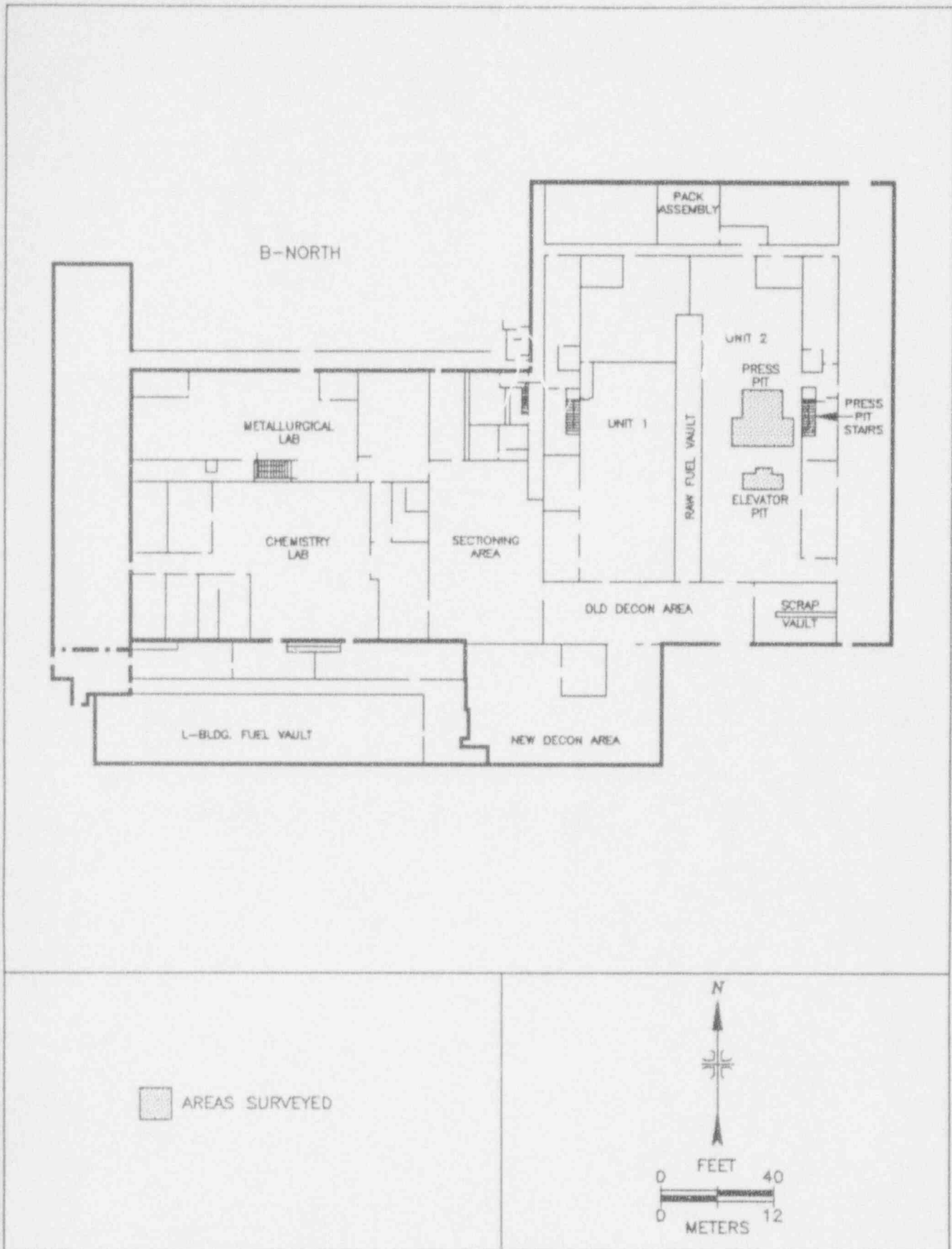


FIGURE 6: Plot Plan of B-South and Building L - Areas Surveyed in Phase 1

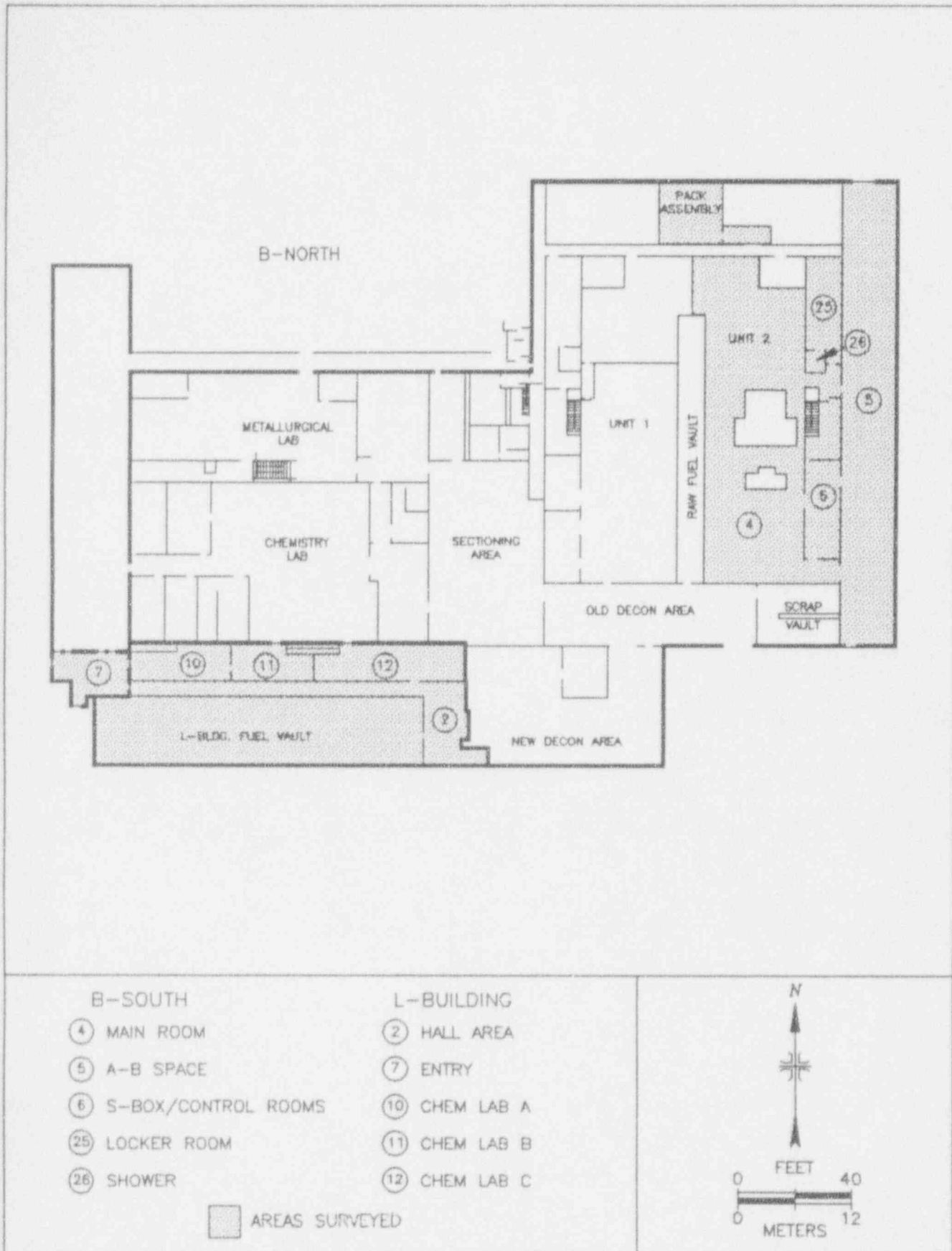


FIGURE 7: Plot Plan of B-South and Building L - Areas Surveyed in Phase 2

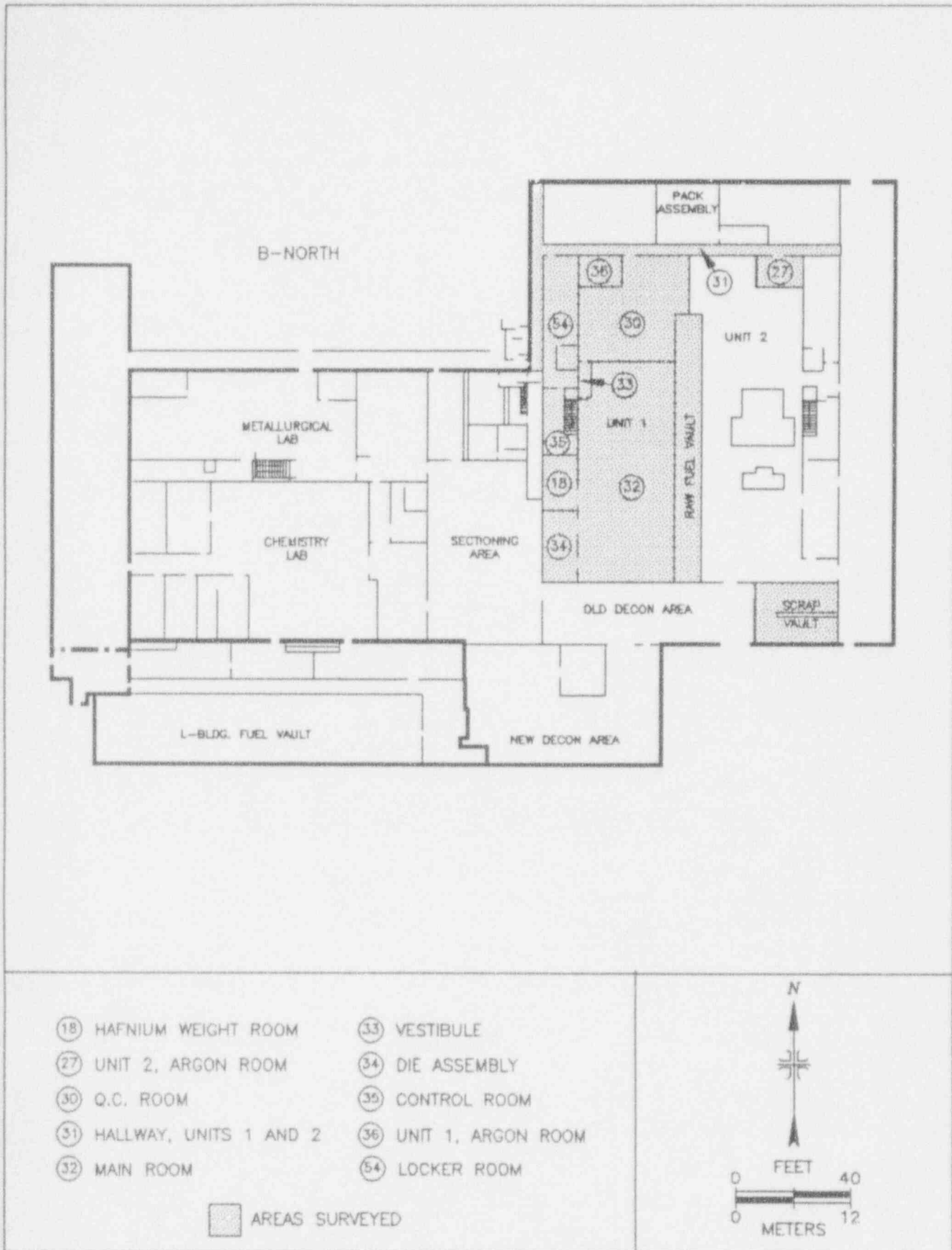


FIGURE 8: Plot Plan of B-South and Building L - Areas Surveyed in Phase 3

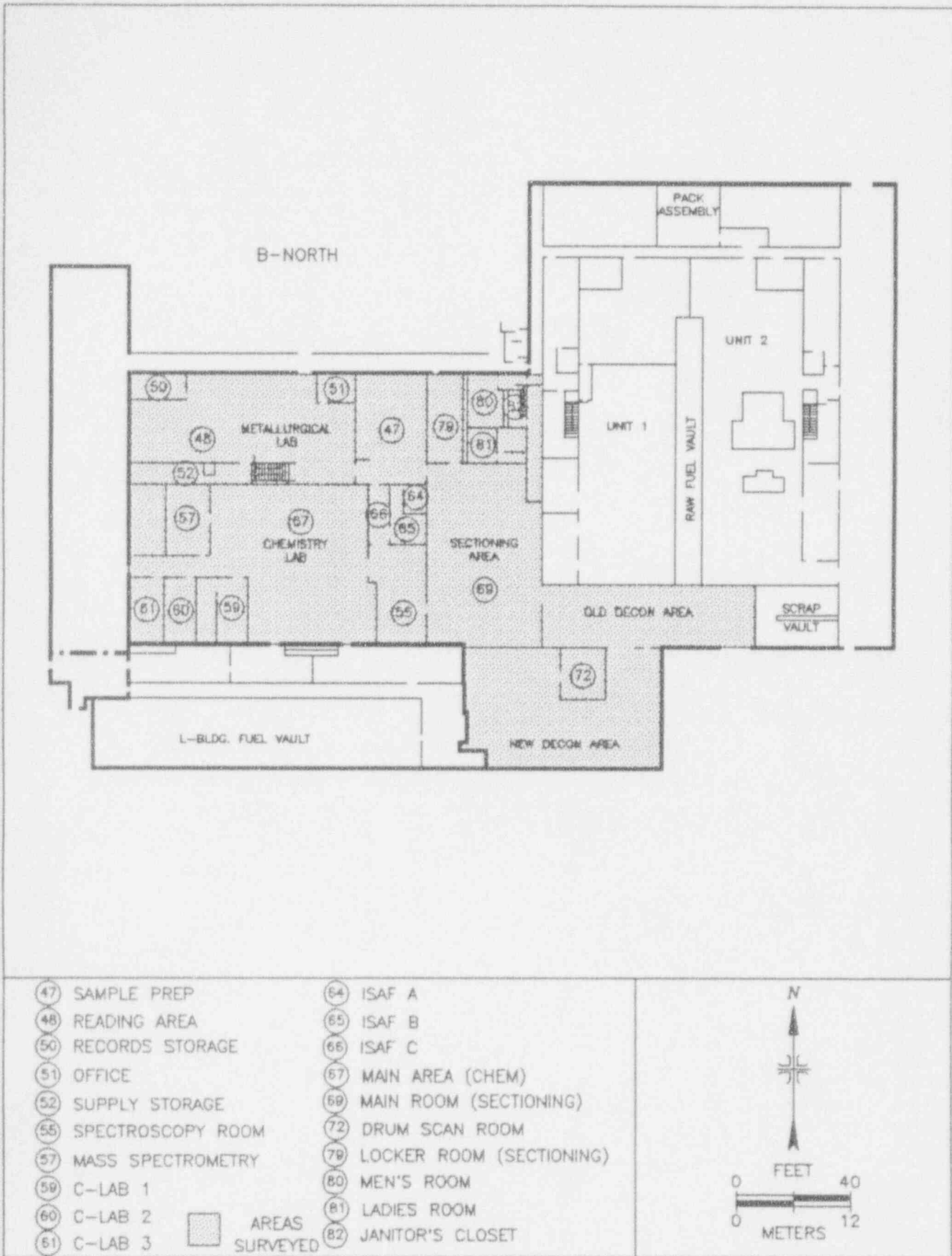


FIGURE 9: Plot Plan of B-South and Building L - Areas Surveyed in Phase 4

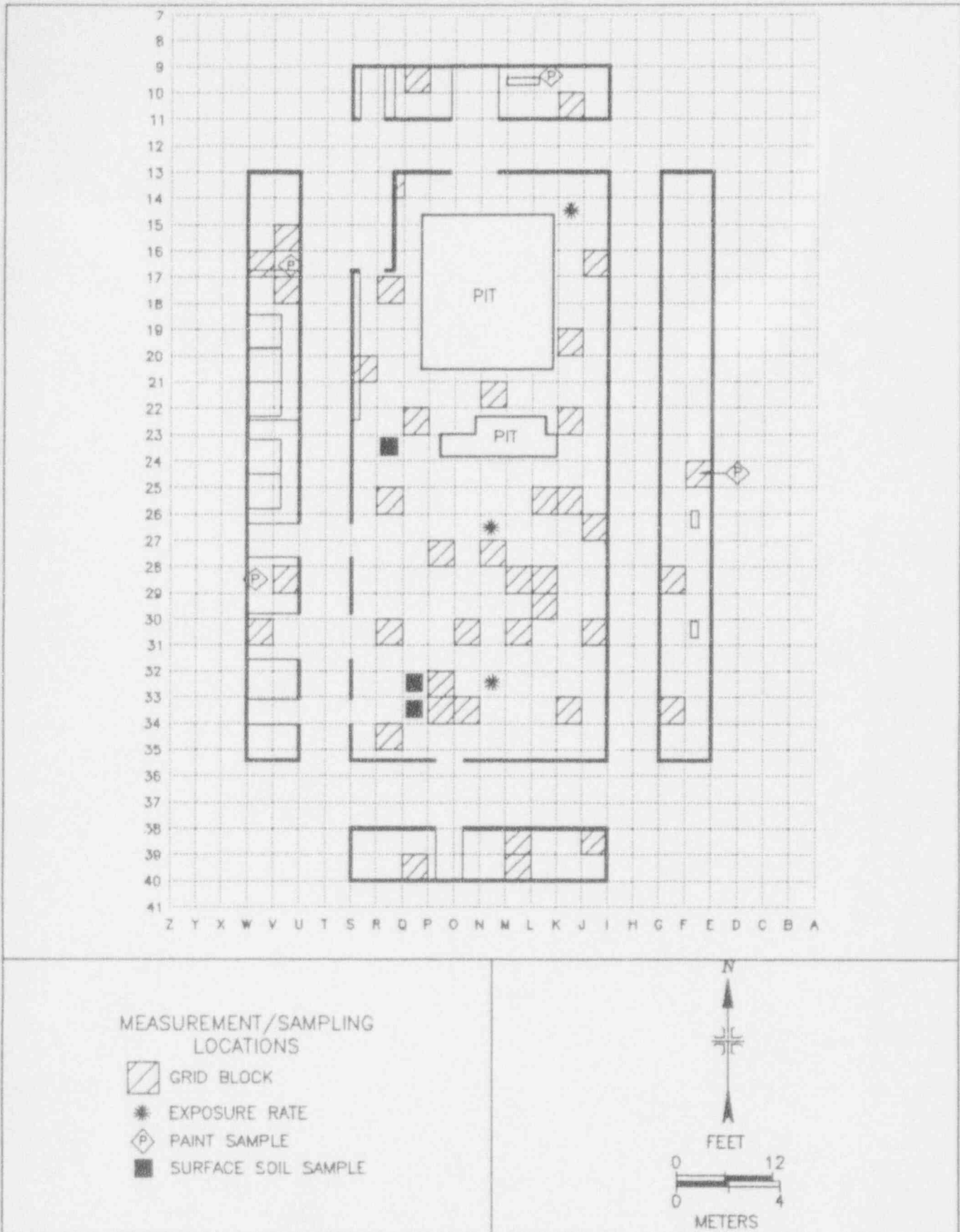


FIGURE 10: Unit 1 Main Room, Lower Walls and Floor – Measurement and Sampling Locations

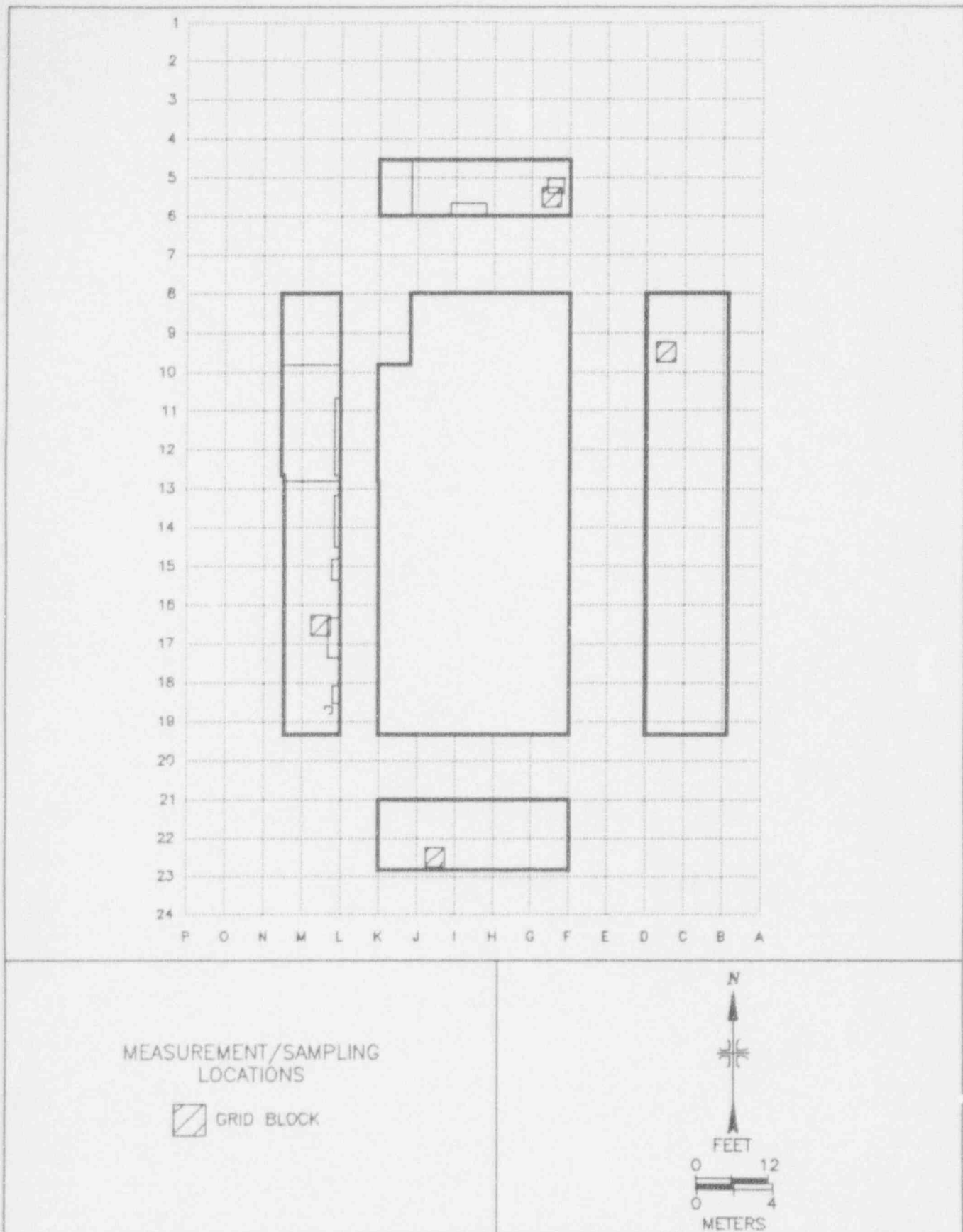


FIGURE 11: Unit 1 Main Room, Upper Walls – Measurement and Sampling Locations

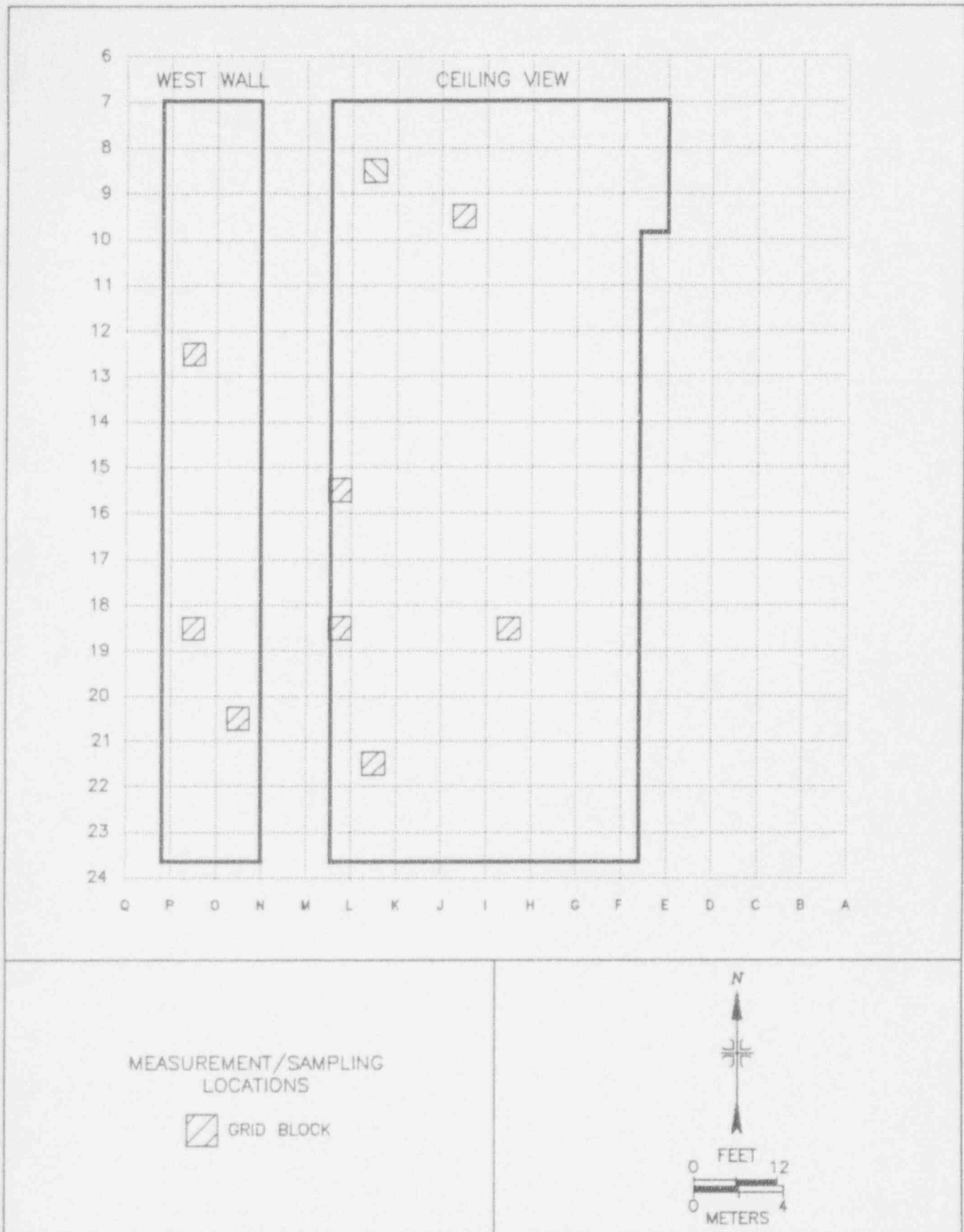


FIGURE 12: Unit 1, Upper Wall and Ceiling – Measurement and Sampling Locations

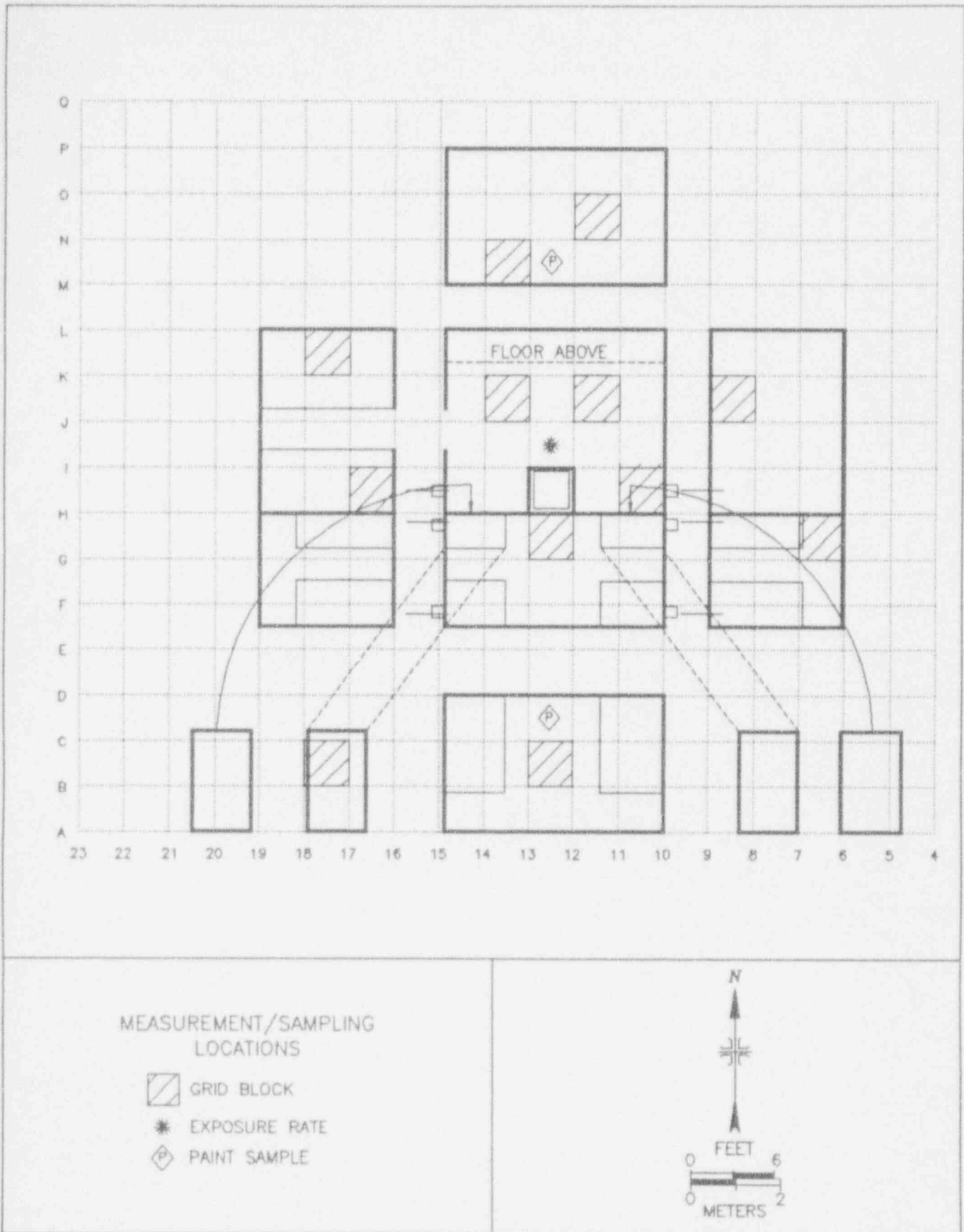
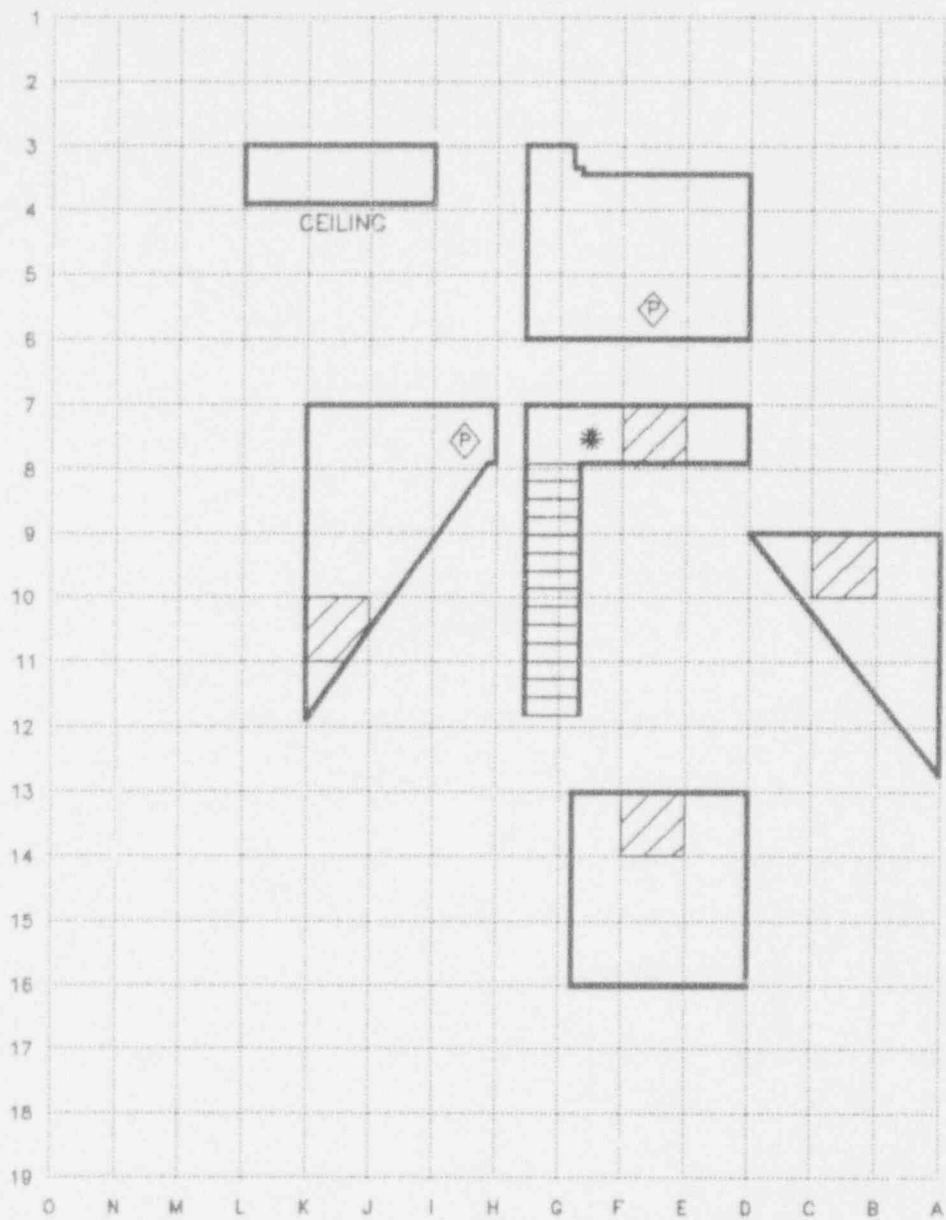


FIGURE 13: Unit 1 Press Pit, Lower Walls, Floor and Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS




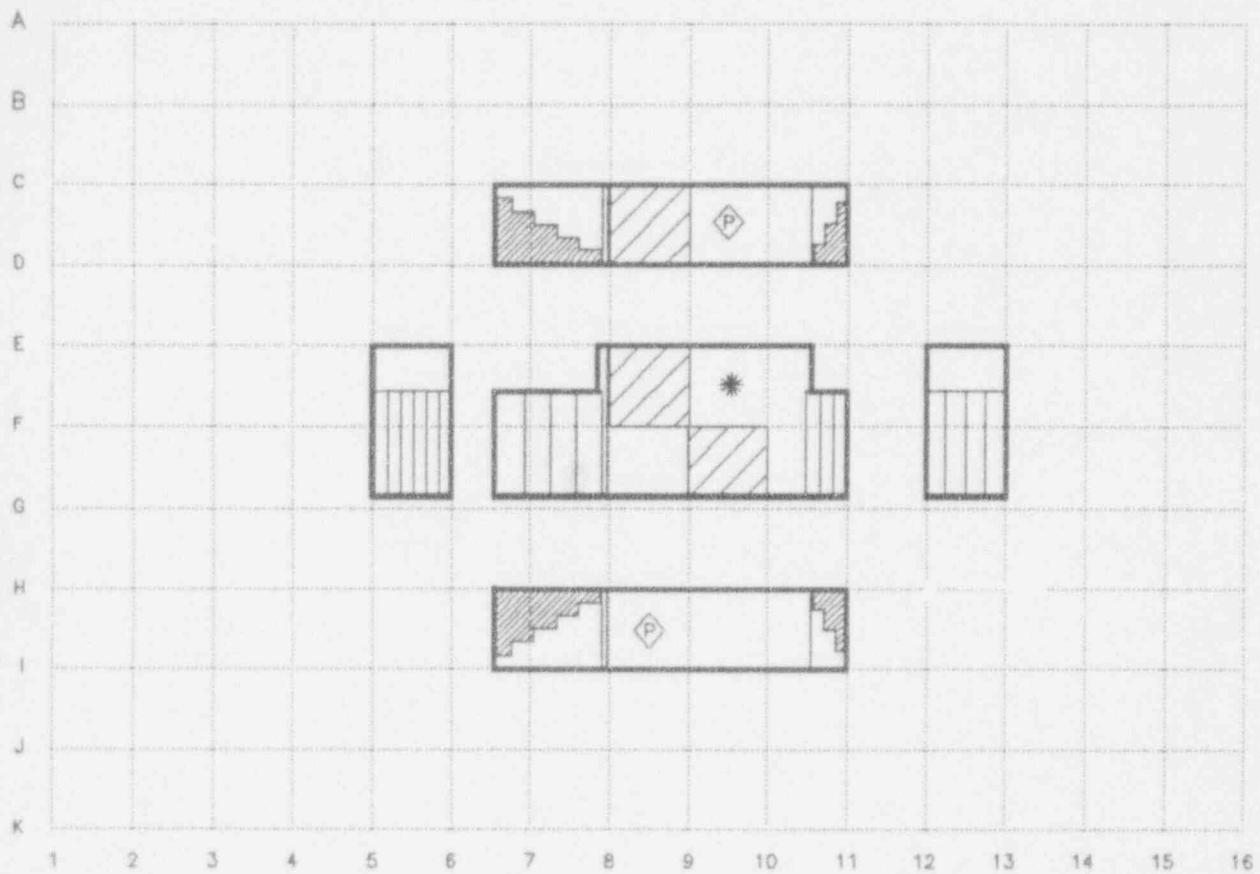



-  GRID BLOCK
-  EXPOSURE RATE
-  PAINT SAMPLE



FIGURE 14: Unit 1 Press Pit Stairs, Lower Walls, Floor, Upper Walls and Ceiling –
Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

-  GRID BLOCK
-  EXPOSURE RATE
-  PAINT SAMPLE

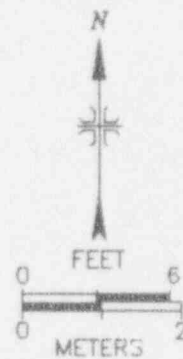
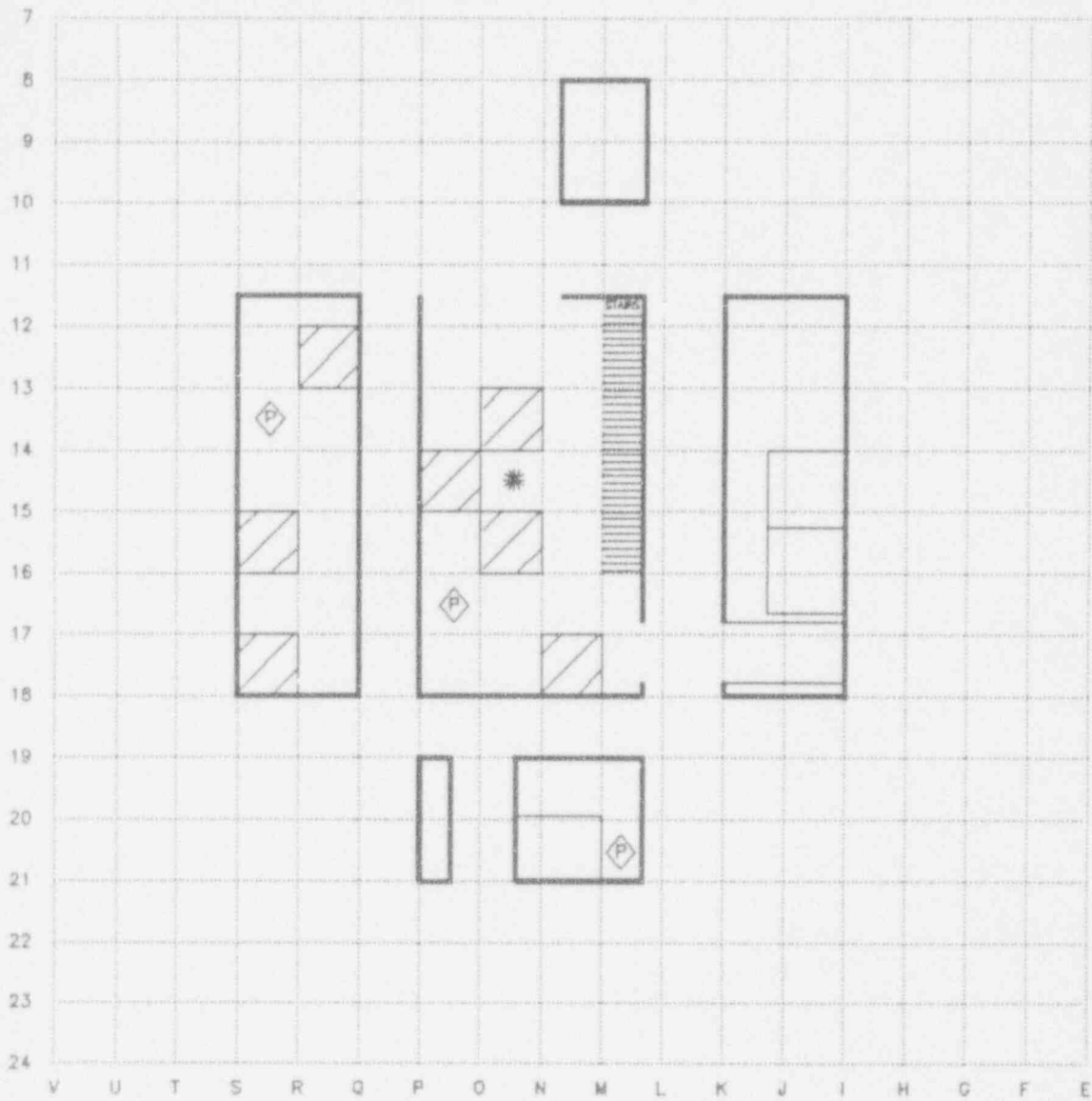


FIGURE 15: Unit 1 Elevator Pit, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS




-  GRID BLOCK
-  EXPOSURE RATE
-  PAINT SAMPLE



FIGURE 16: Unit 1 Control Room, Lower Walls and Floor — Measurement and Sampling Locations

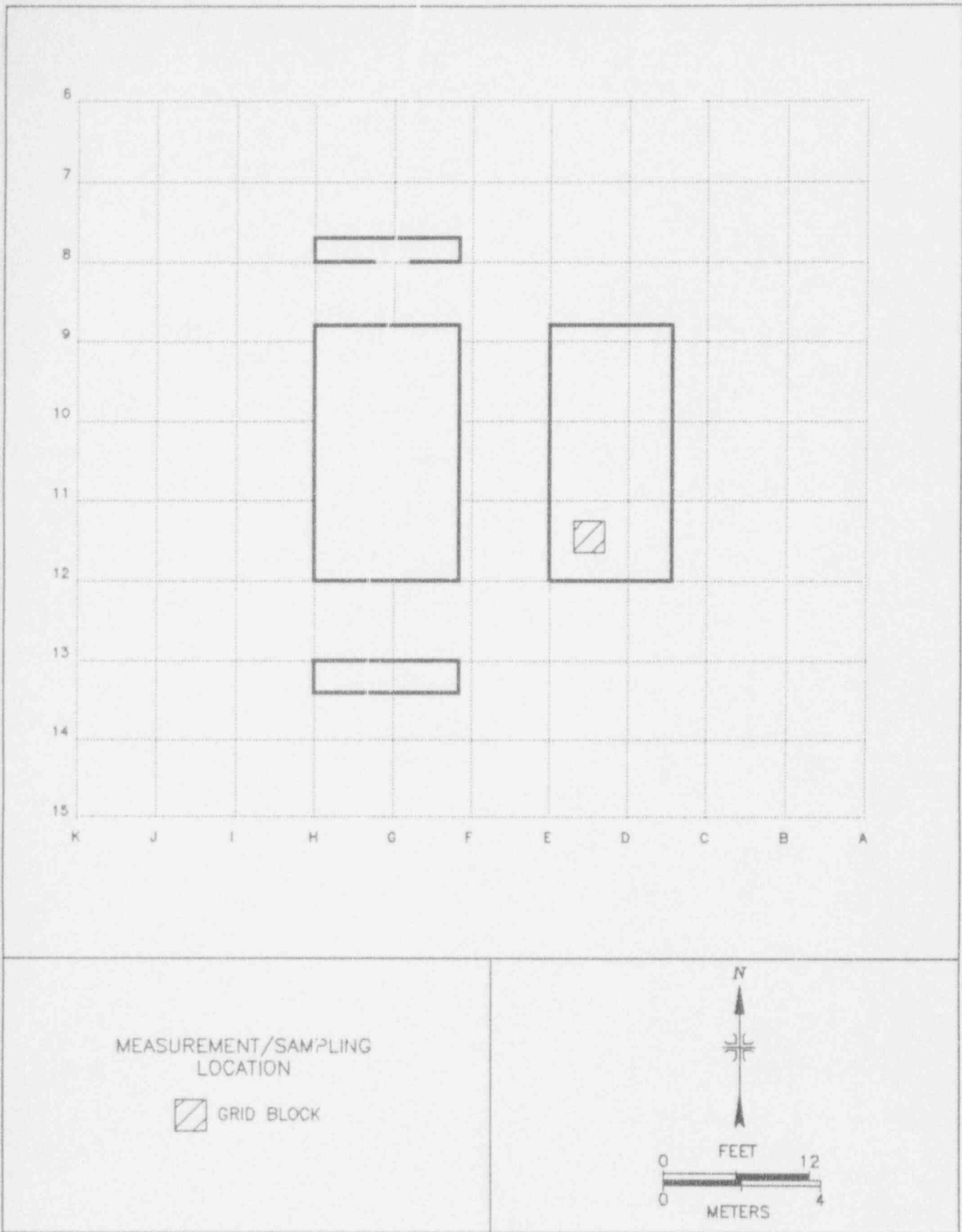


FIGURE 17: Unit 1 Control Room, Upper Walls – Measurement and Sampling Location.

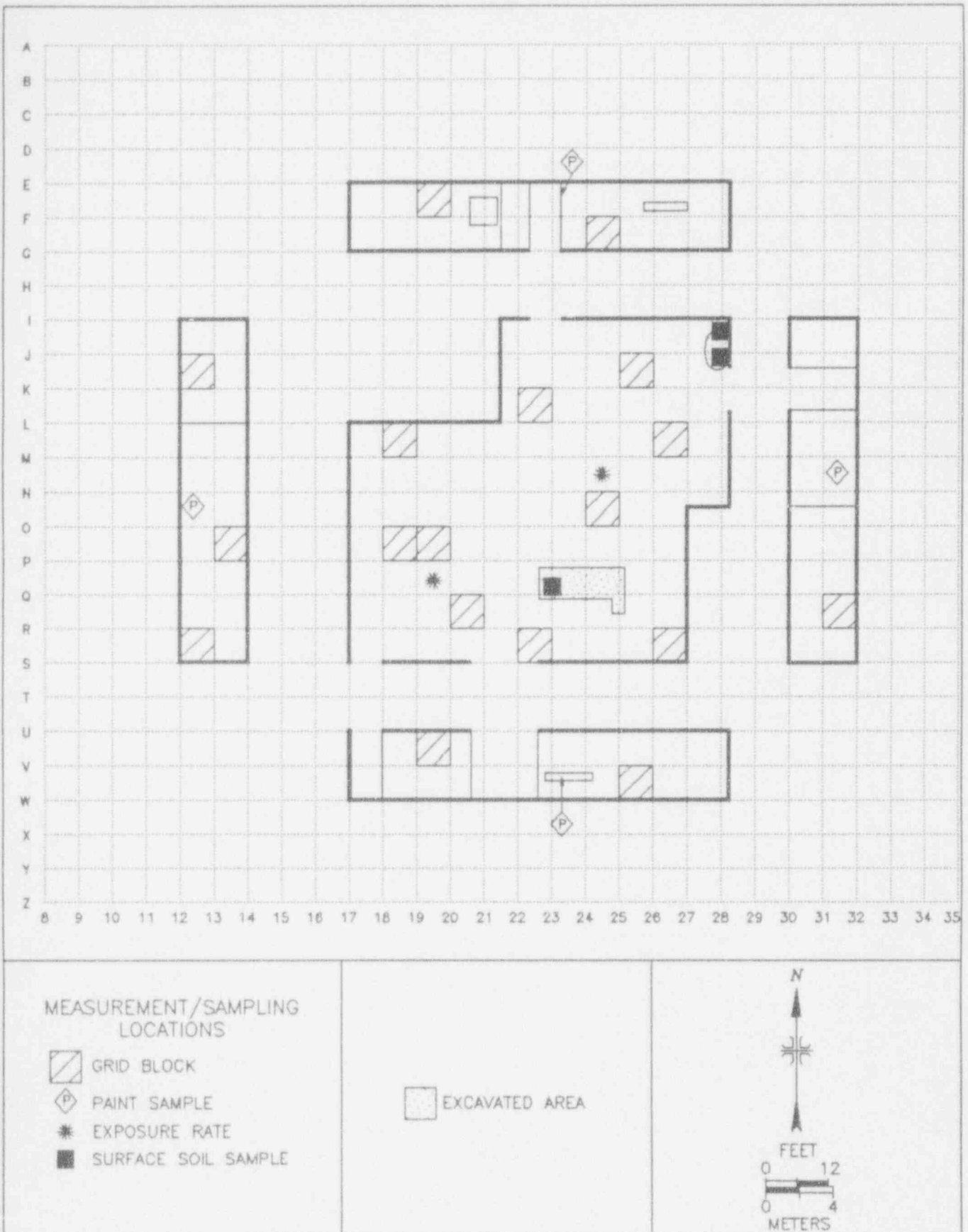


FIGURE 18: Unit 1 Quality Control (QC) Room, Lower Walls and Floor – Measurement and Sampling Locations

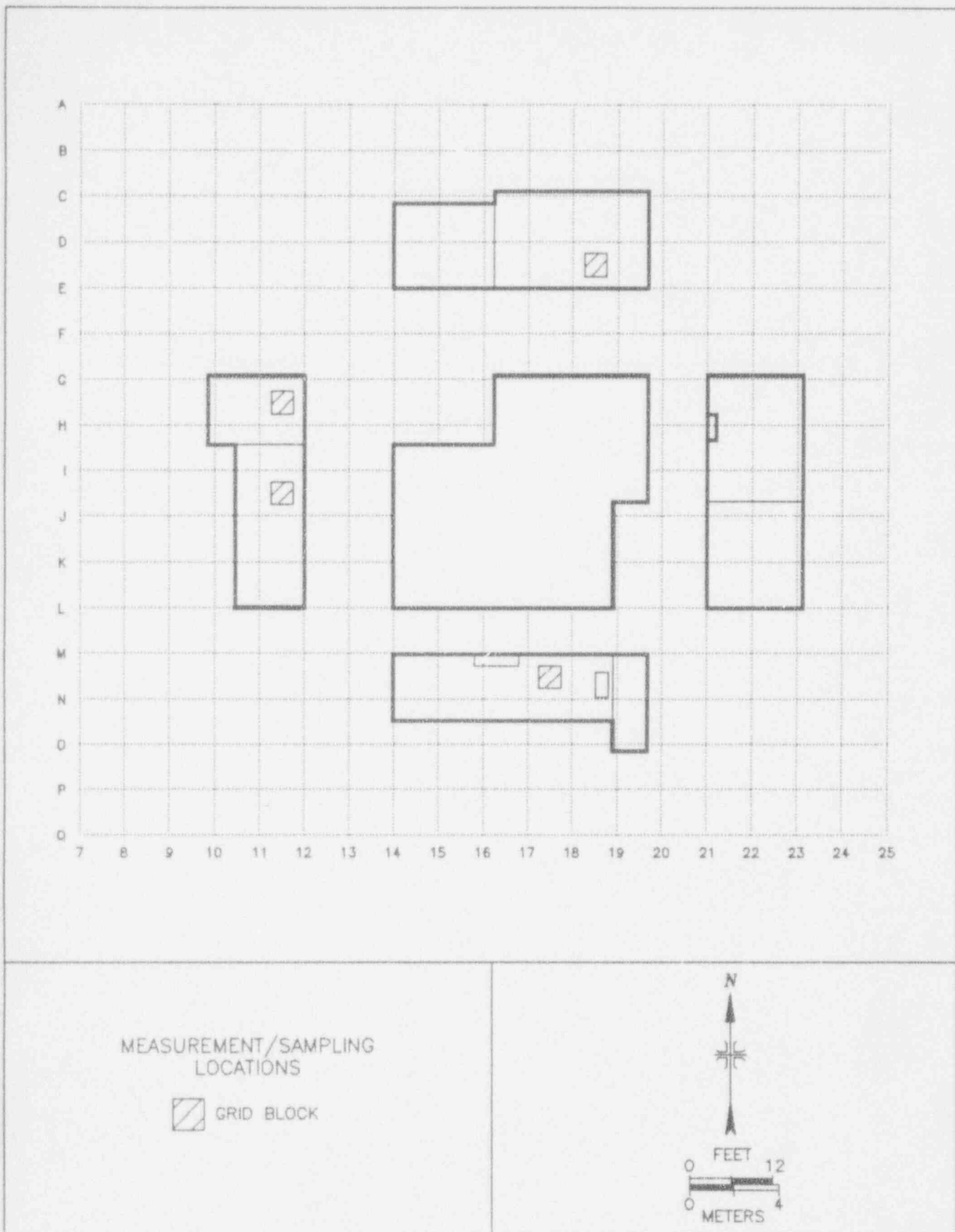
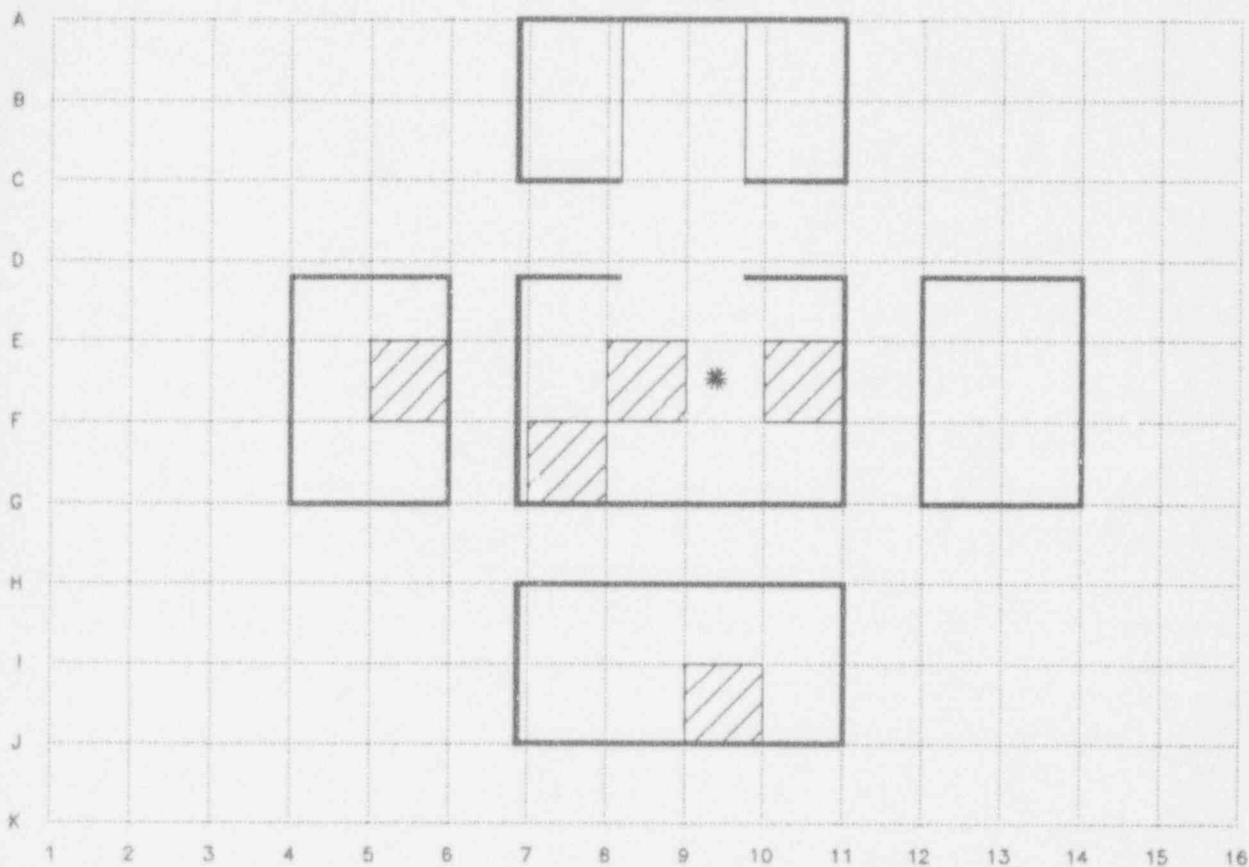


FIGURE 19: Unit 1 Quality Control (QC) Room, Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS



GRID BLOCK



EXPOSURE RATE

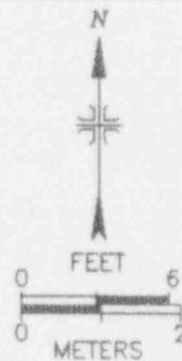


FIGURE 20: Unit 1 Argon Room, Lower Walls and Floor – Measurement and Sampling Locations

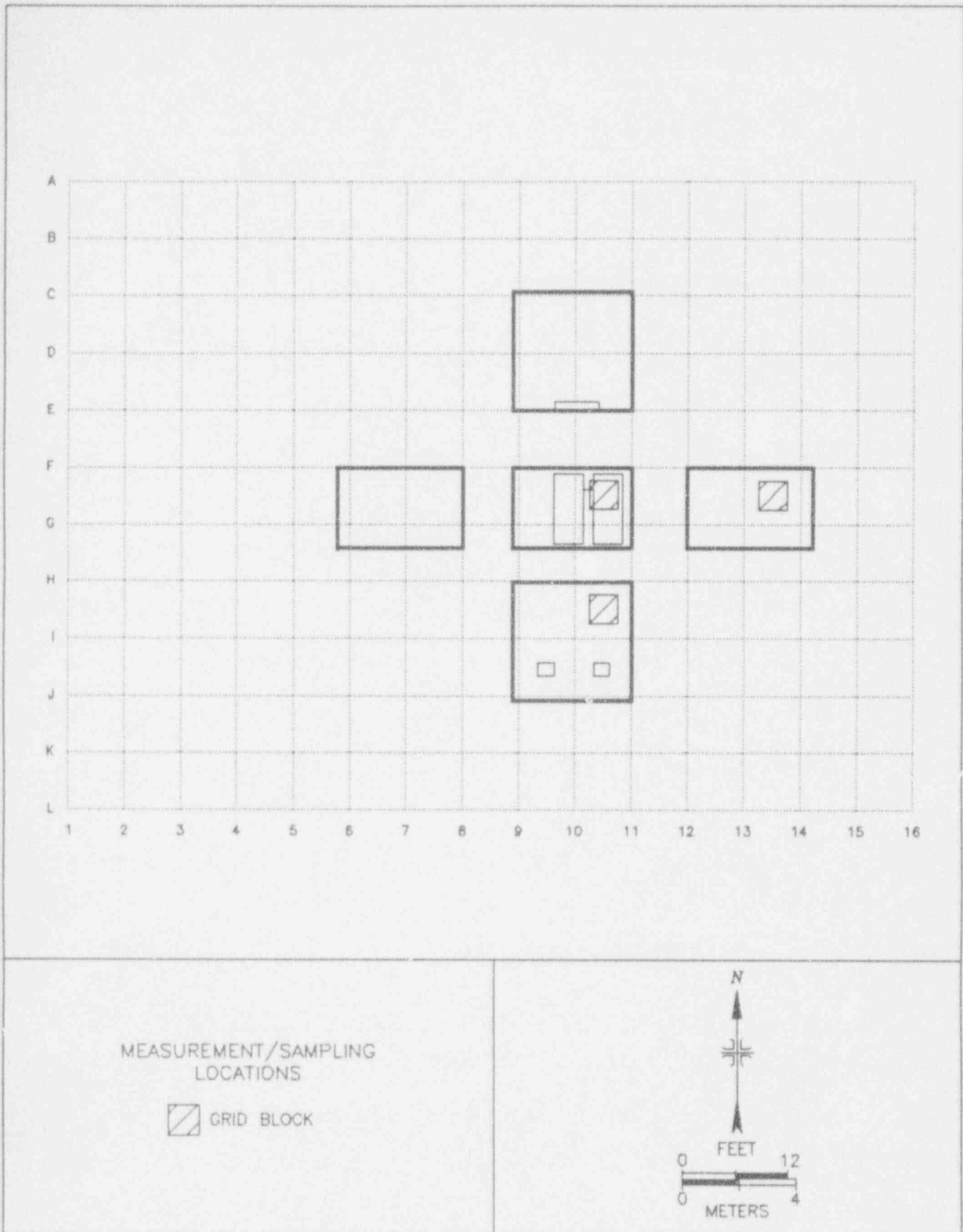
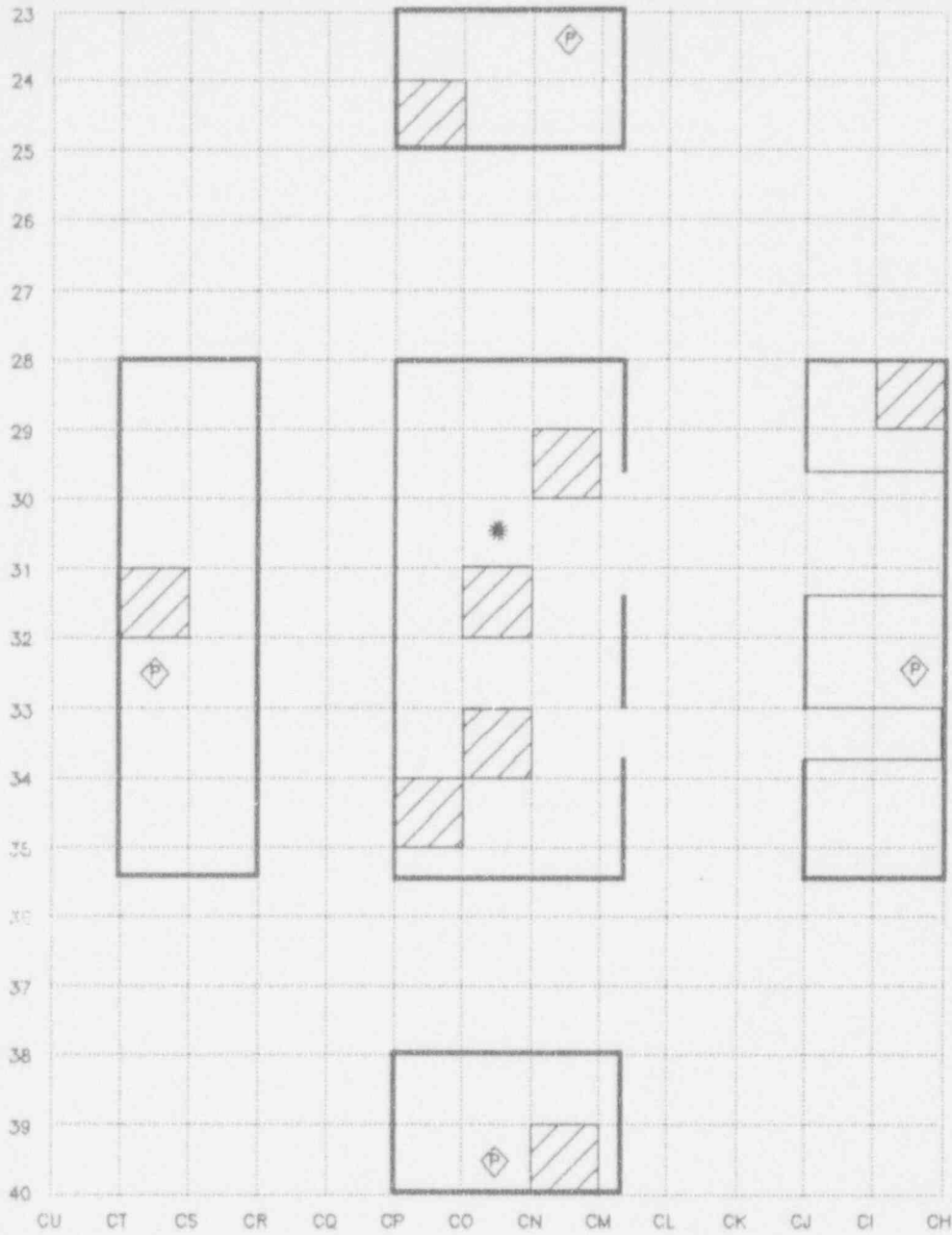


FIGURE 21: Unit 1 Argon Room, Upper Walls and Ceiling - Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS




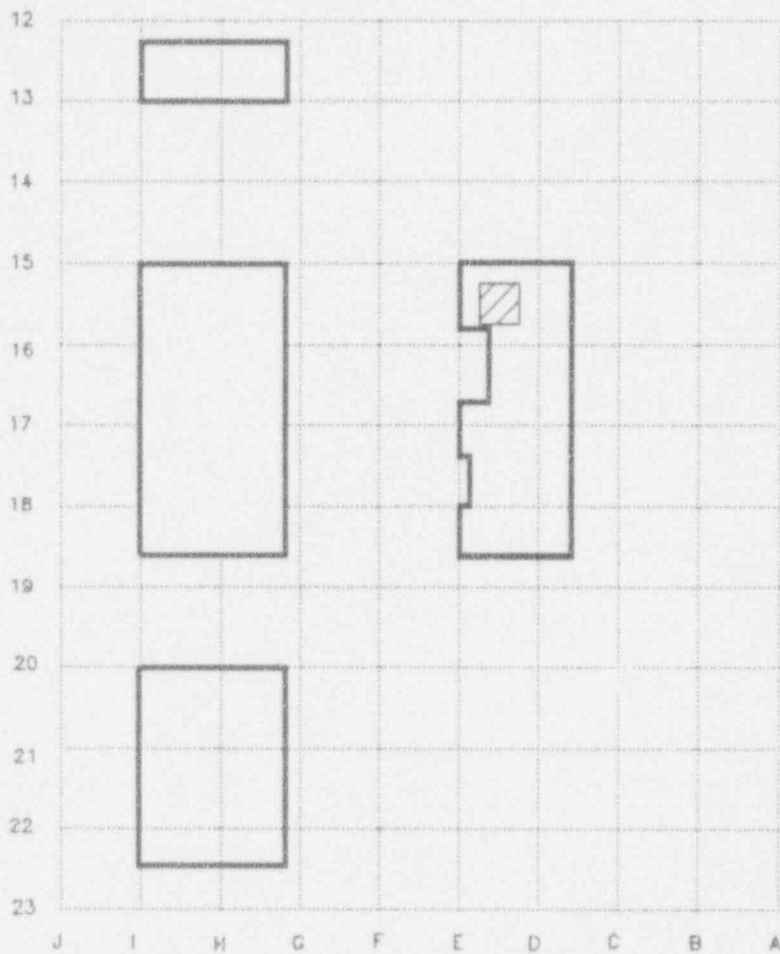
-  GRID BLOCK
-  EXPOSURE RATE
-  PAINT SAMPLE



FIGURE 22: Unit 1 Die Assembly, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS


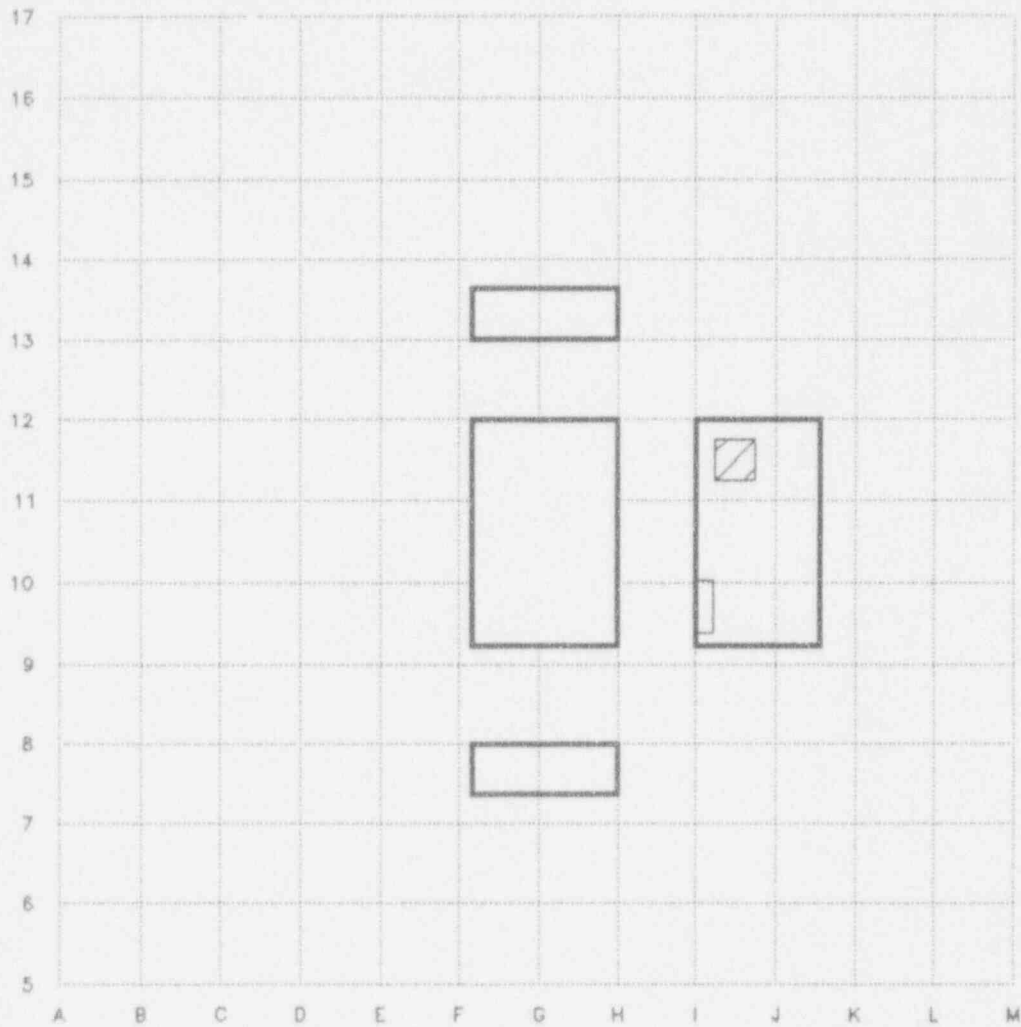
 GRID BLOCK



FIGURE 23: Unit 1 Die Assembly, Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

 GRID BLOCK

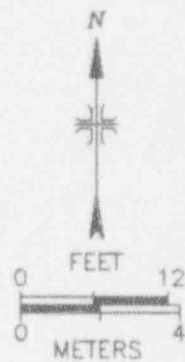
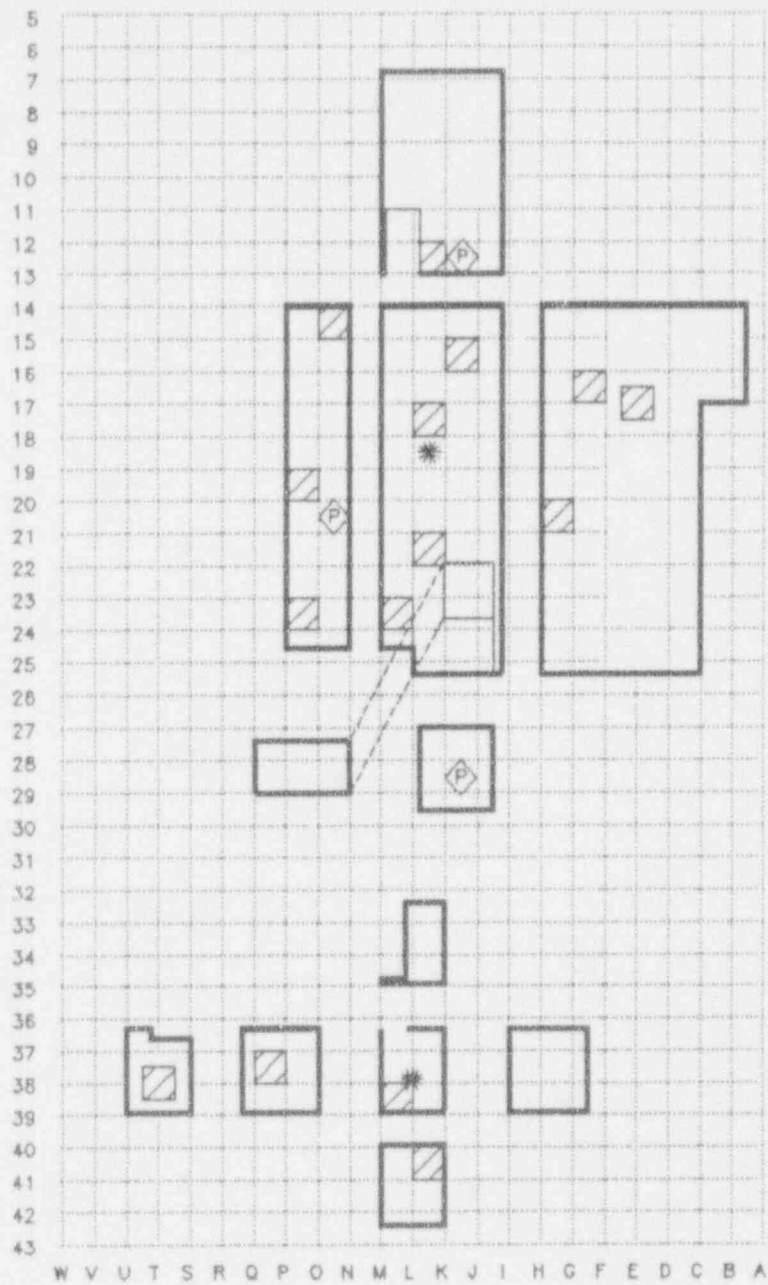


FIGURE 25: Unit 1 Hafnium Weigh Room, Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS




-  GRID BLOCK
-  EXPOSURE RATE
-  PAINT SAMPLE



FIGURE 26: Unit 1 Locker Room and Shower, Lower Walls, Floor and Upper Walls – Measurement and Sampling Locations

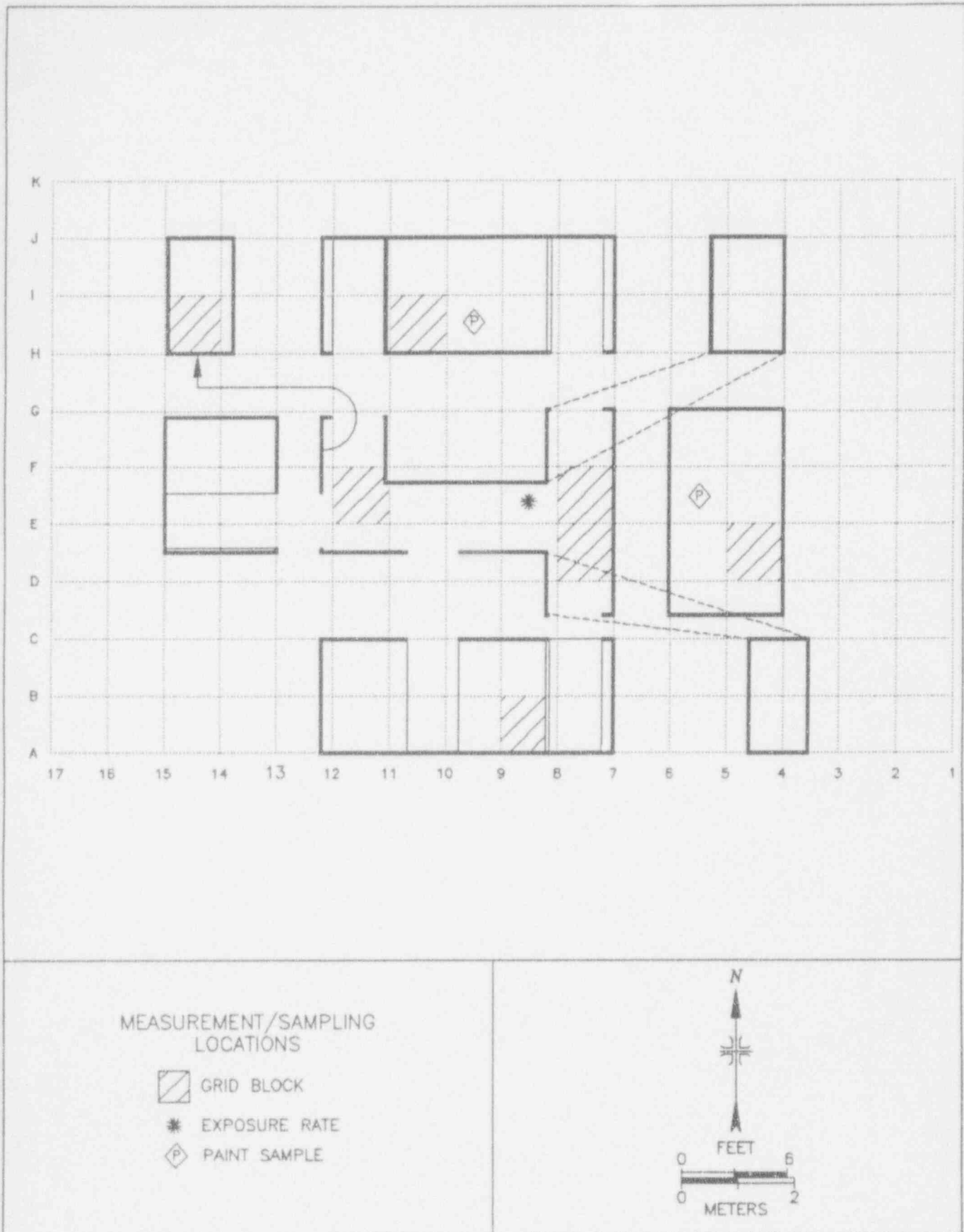
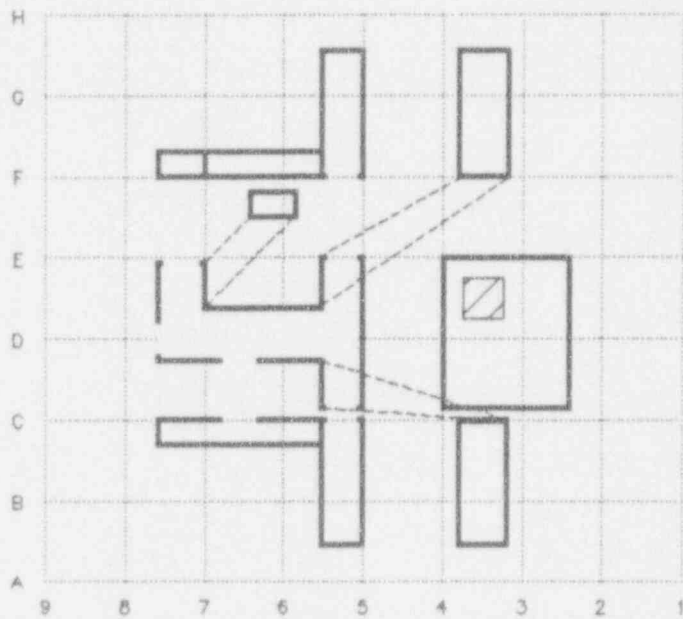


FIGURE 27: Unit 1 Vestibule, Lower Walls and Floor - Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

 GRID BLOCK



FIGURE 28: Unit 1 Vestibule, Upper Walls – Measurement and Sampling Locations

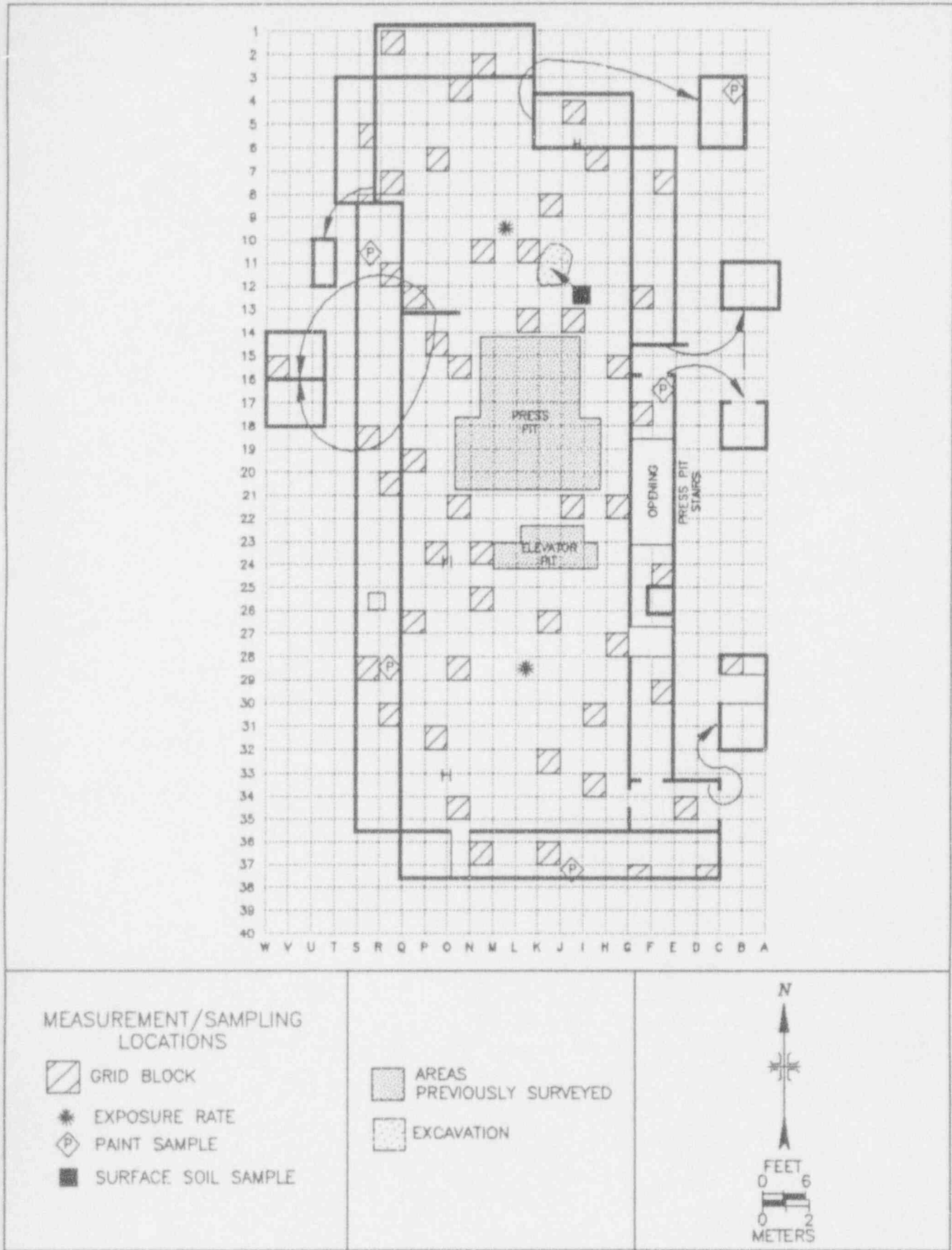


FIGURE 29: Unit 2 Main Room, Lower Walls and Floor – Measurement and Sampling Locations

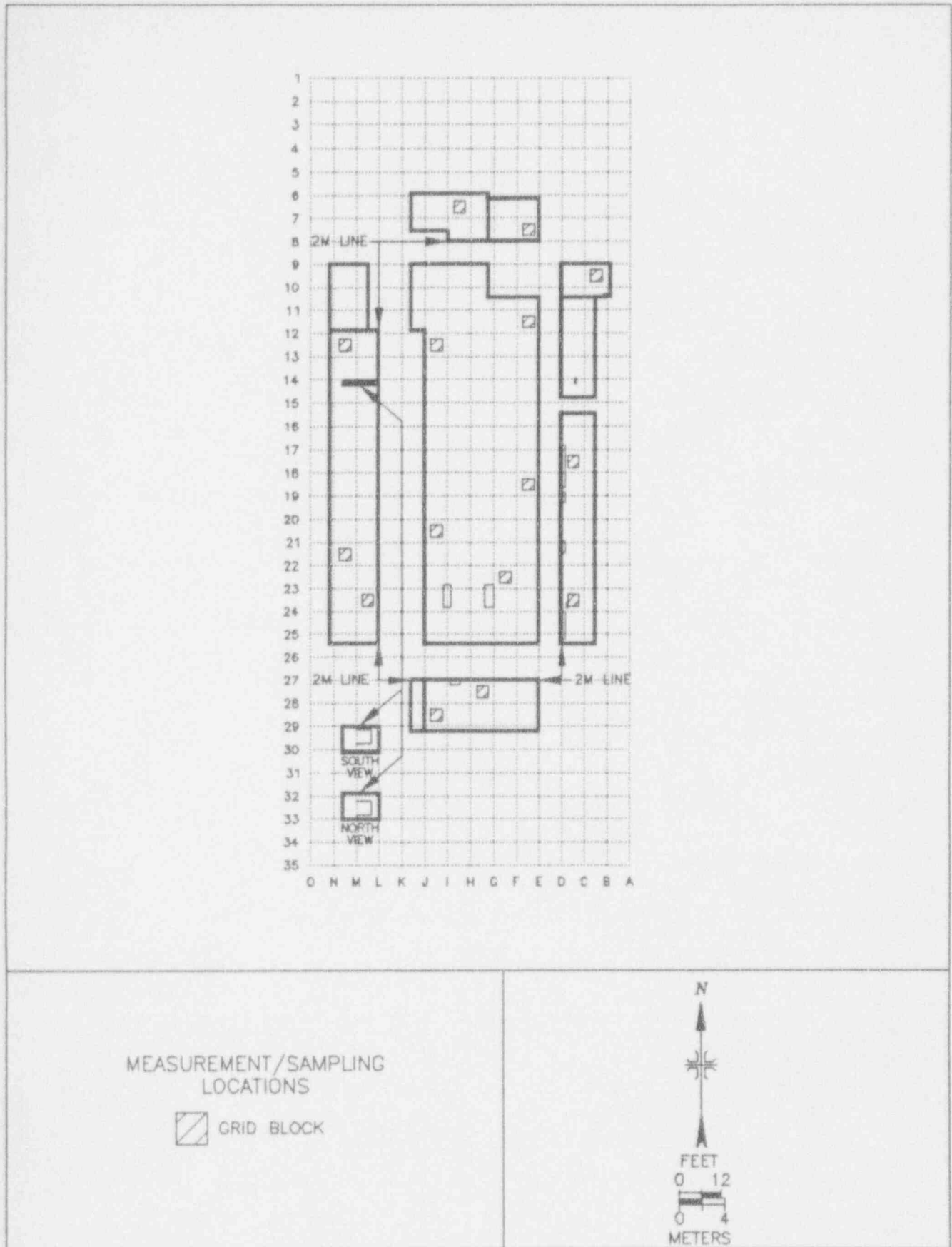


FIGURE 30: Unit 2 Main Room, Upper Walls and Ceiling - Measurement and Sampling Locations

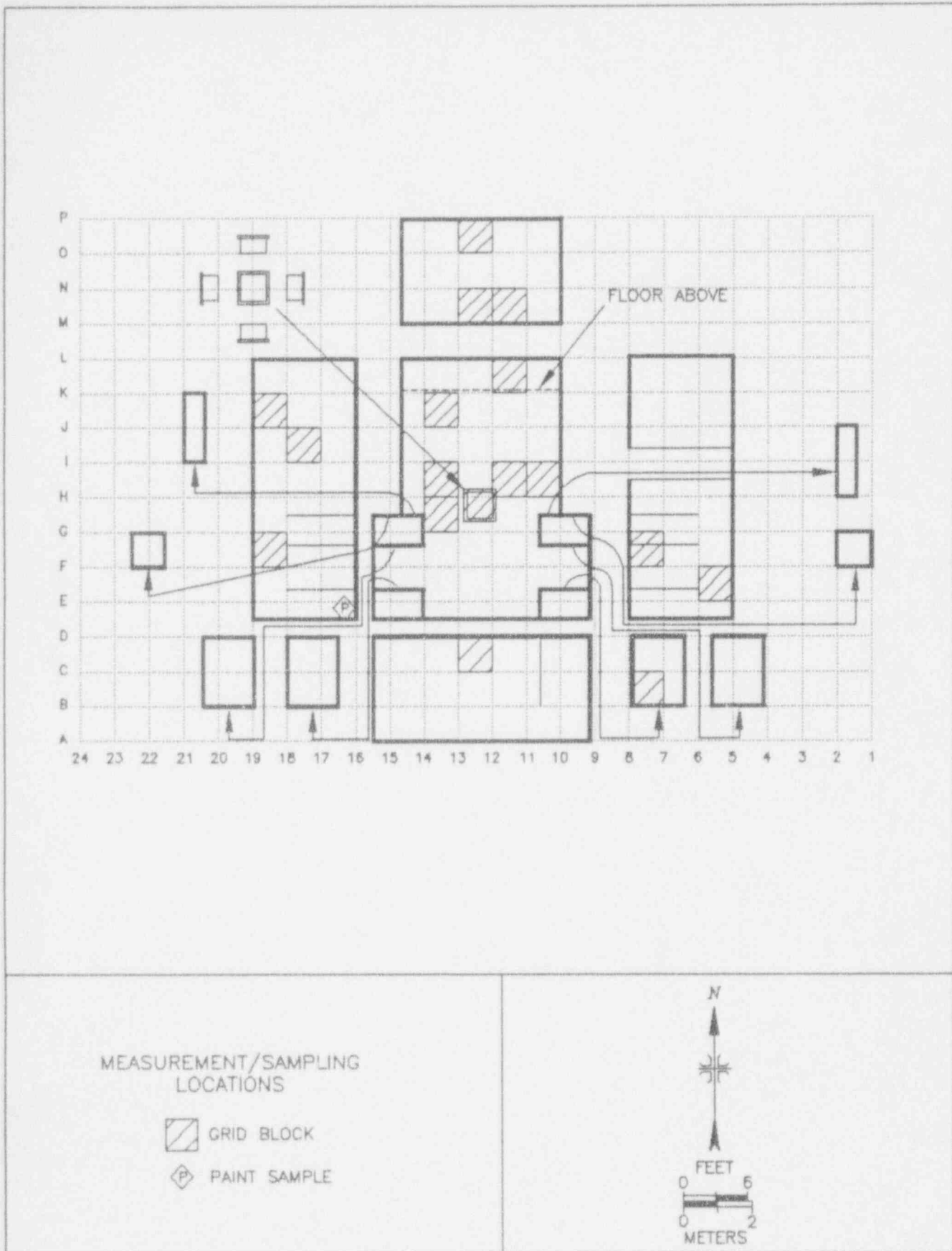


FIGURE 31: Unit 2 Press Pit, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations

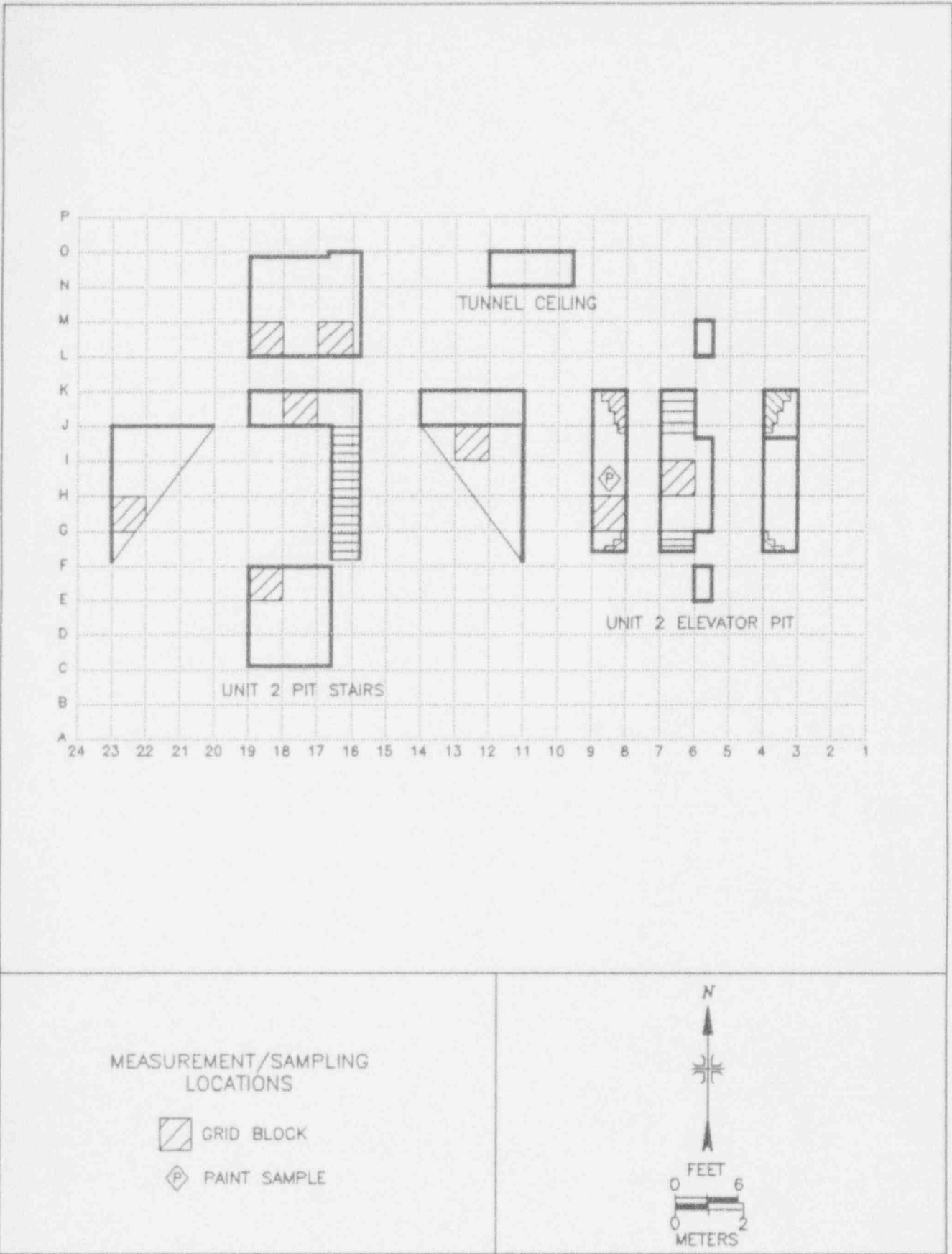
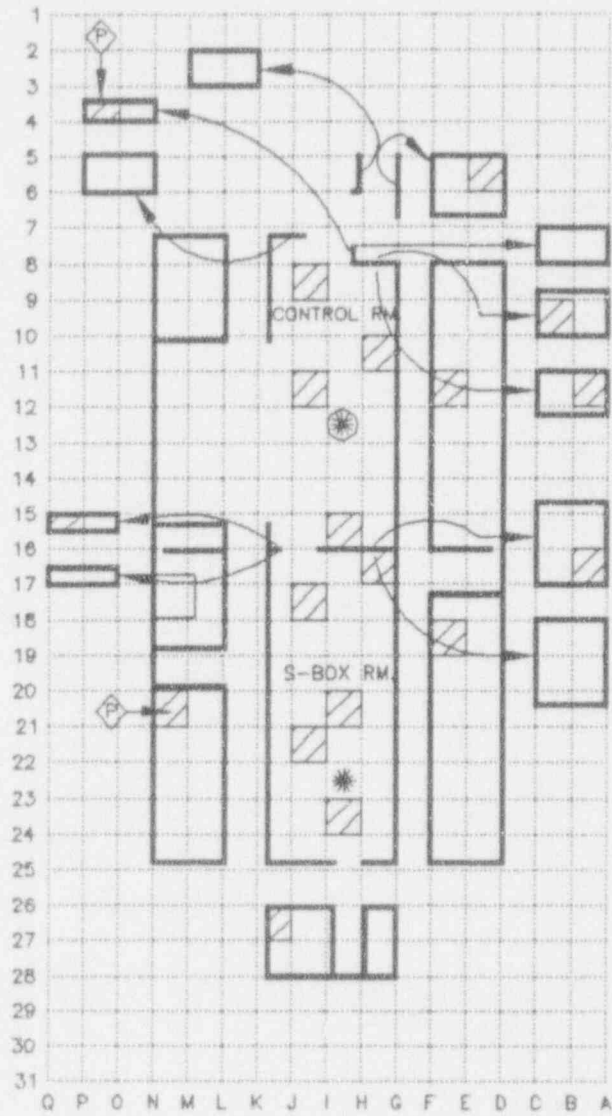


FIGURE 32: Unit 2 Press Pit Stairs and Elevator Pit, Lower Walls and Floor — Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS





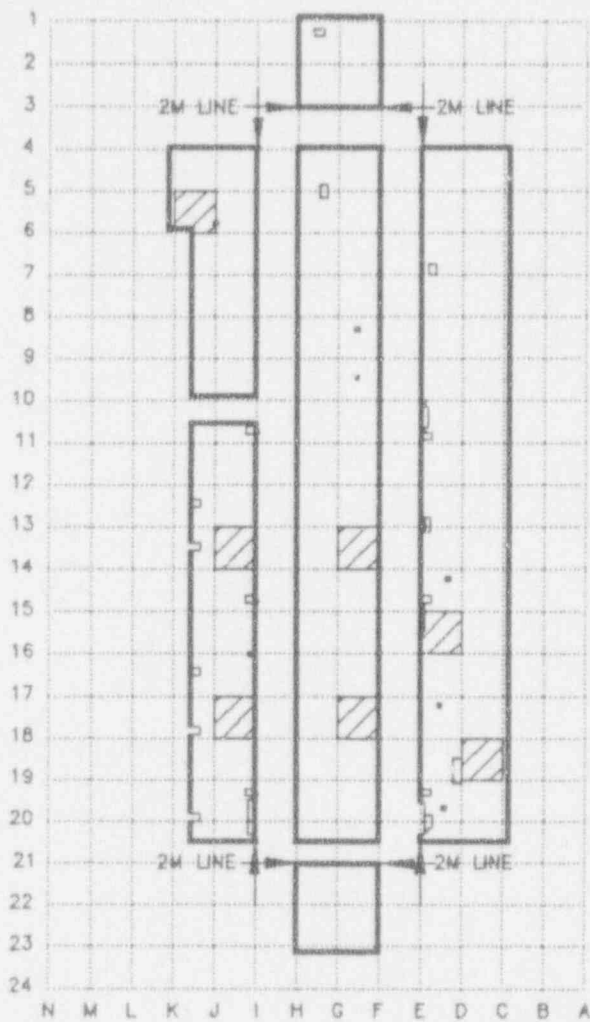
-  GRID BLOCK
-  EXPOSURE RATE
-  BACKGROUND EXPOSURE RATE
-  PAINT SAMPLE



FIGURE 33: Unit 2 Control and S-Box Rooms, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS


 GRID BLOCK



FIGURE 34: Unit 2 Control, S-Box, and Locker Rooms, Upper Walls and Ceiling - Measurement and Sampling Locations

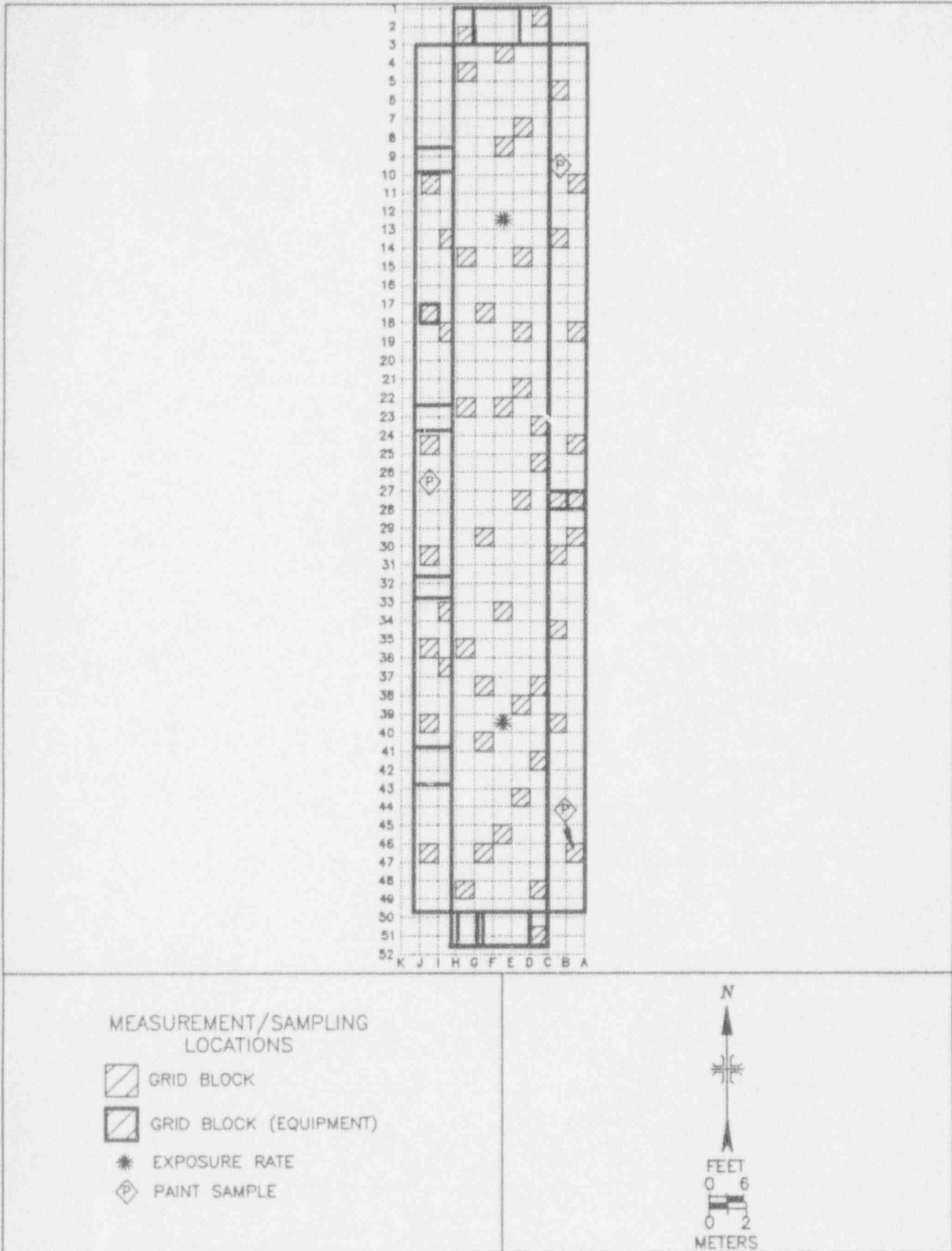
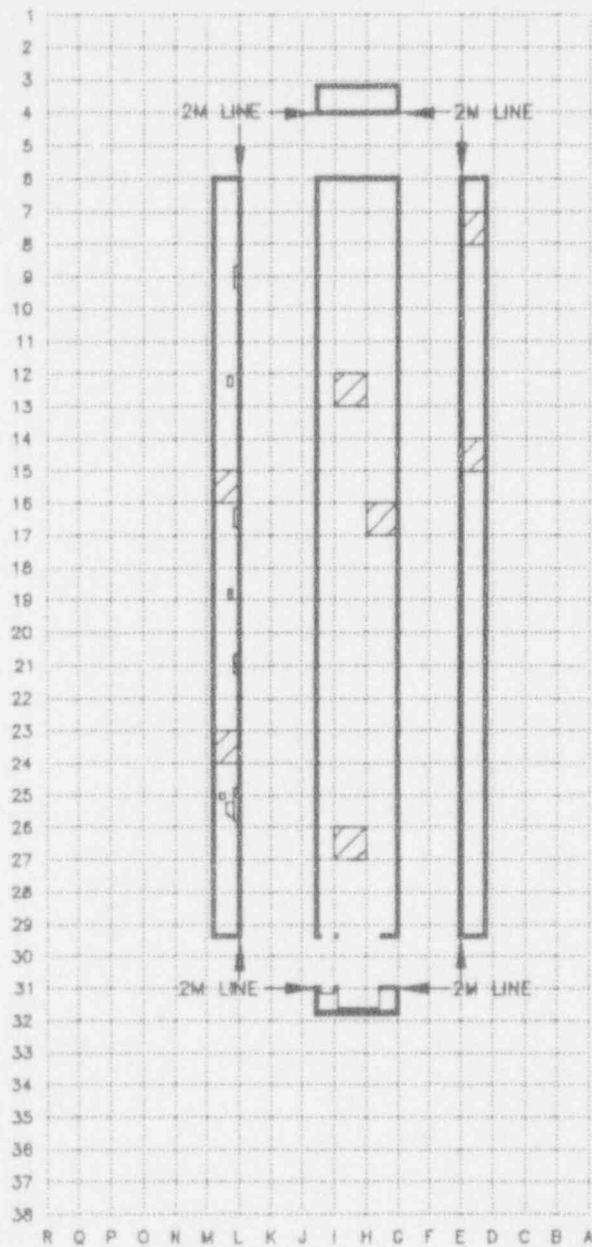


FIGURE 35: Unit 2 A-B Space, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS


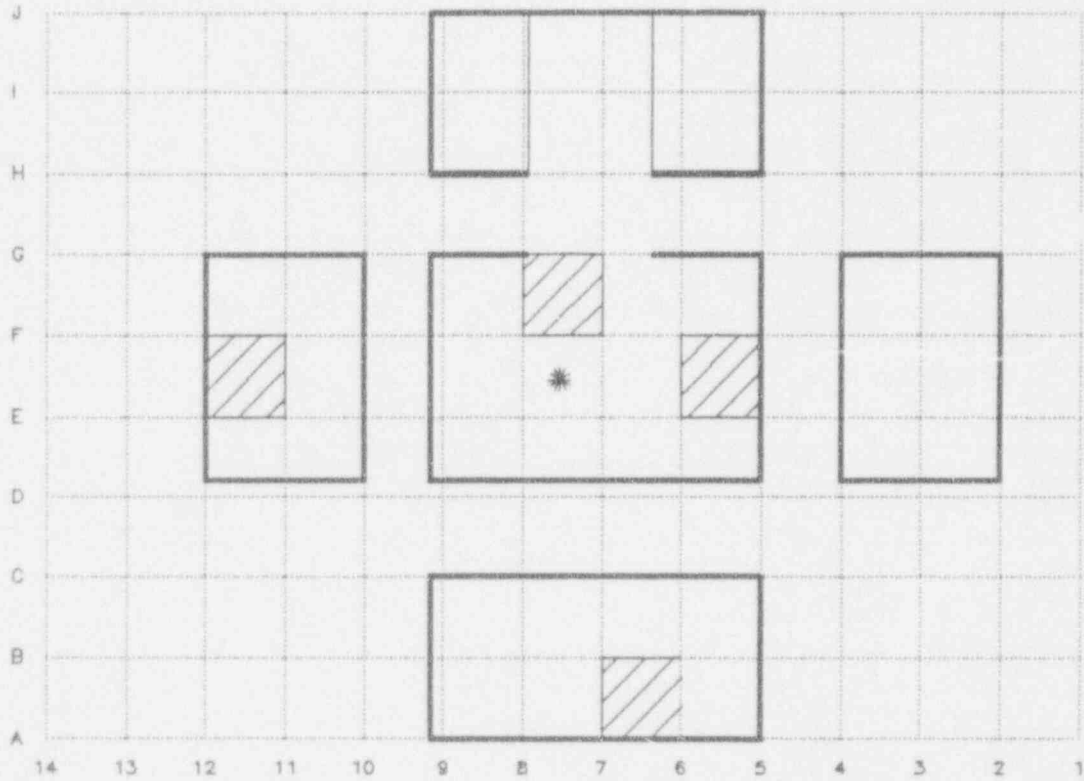
 GRID BLOCK



FIGURE 36: Unit 2 A-B Space, Upper Walls and Ceiling – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS



GRID BLOCK



EXPOSURE RATE

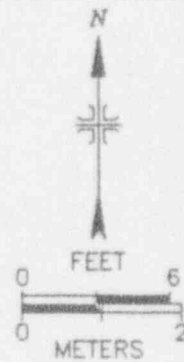


FIGURE 37: Unit 2 Argon Room, Lower Walls and Floor – Measurement and Sampling Locations

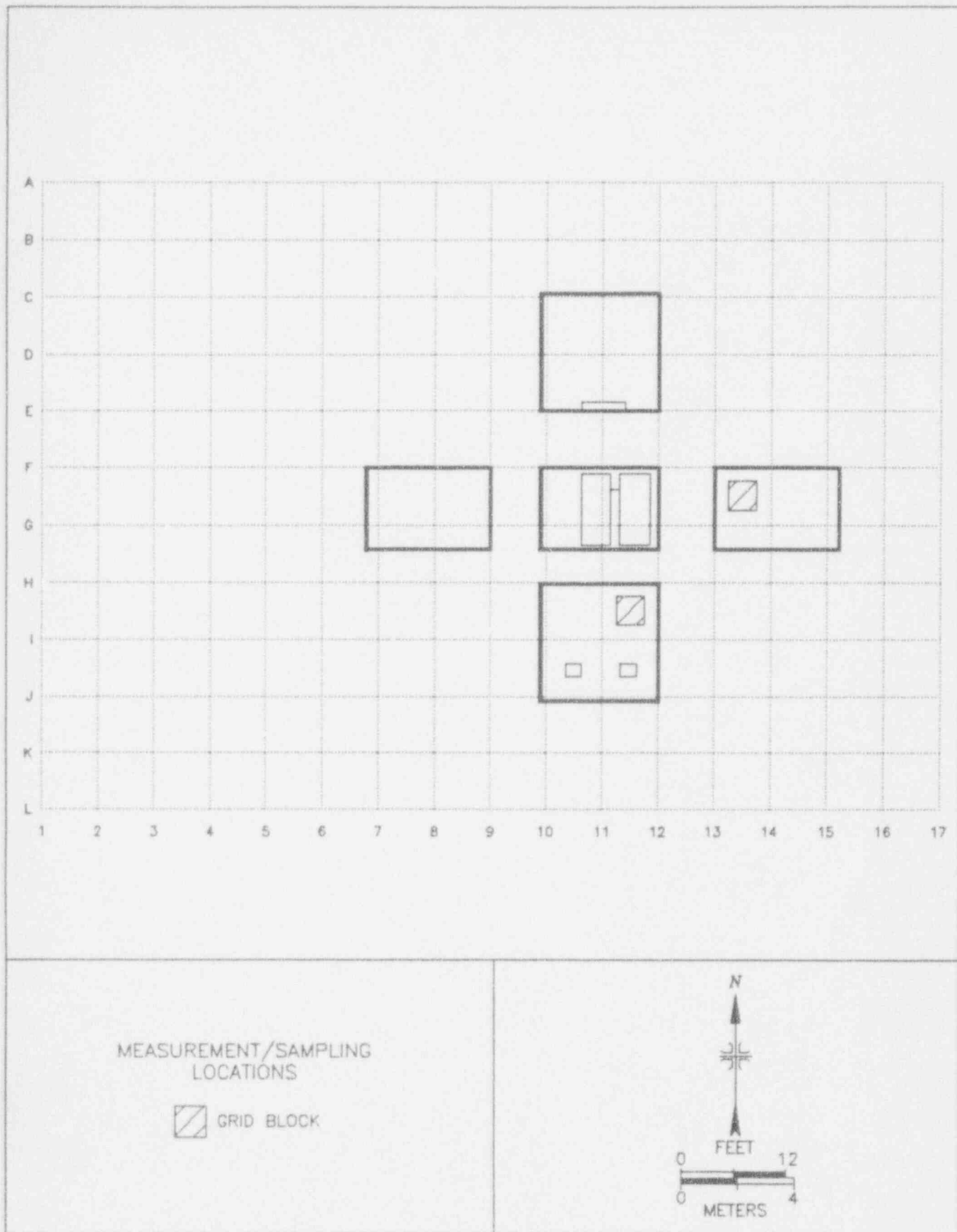
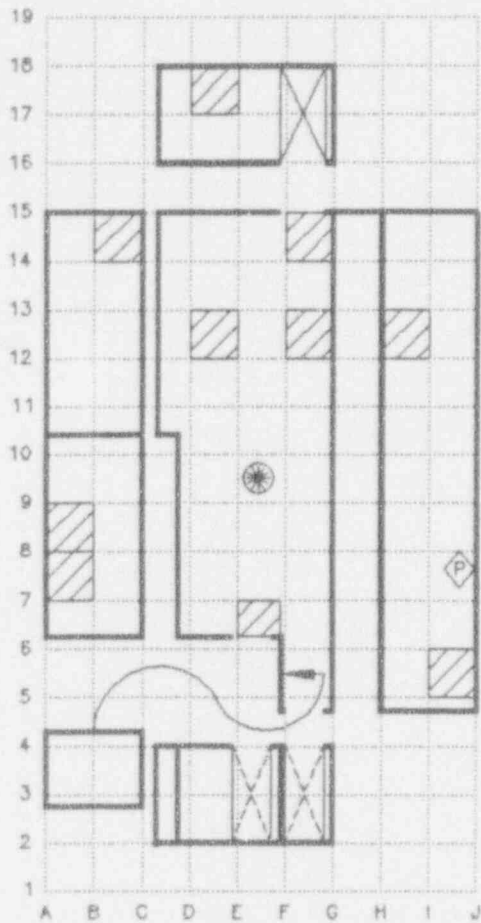





FIGURE 38: Unit 2 Argon Room, Upper Walls and Ceiling – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

-  GRID BLOCK
-  BACKGROUND EXPOSURE RATE
-  PAINT SAMPLE

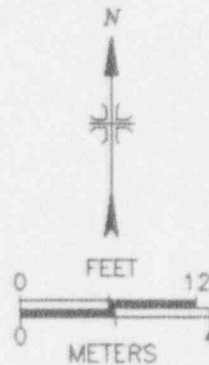
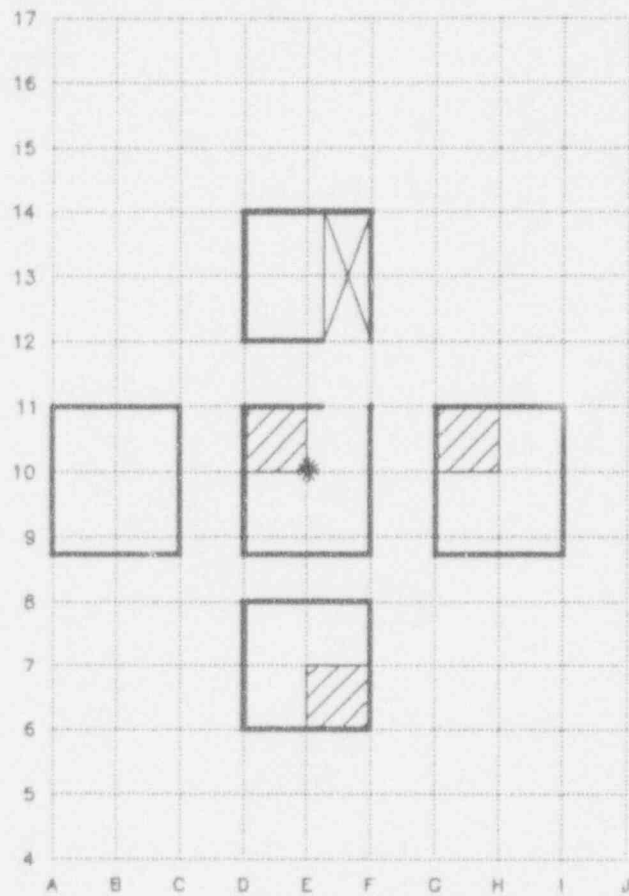


FIGURE 39: Unit 2 Locker Room, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS



GRID BLOCK



EXPOSURE RATE

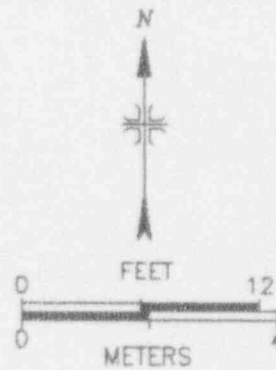


FIGURE 40: Unit 2 Shower, Lower Walls and Floor – Measurement and Sampling Locations

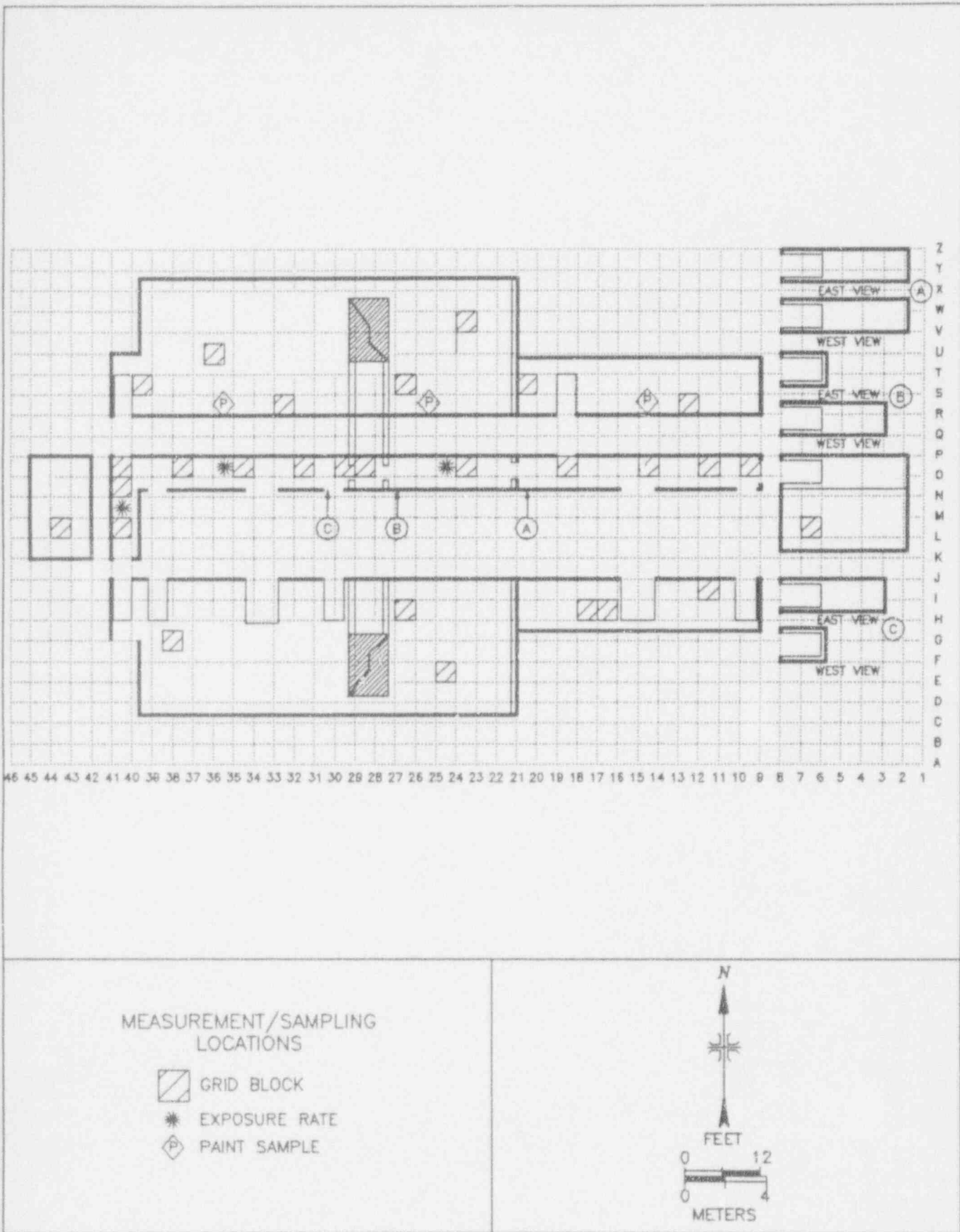


FIGURE 41: Units 1 and 2 Hallway, Lower Walls, Floor and Upper Walls - Measurement and Sampling Locations

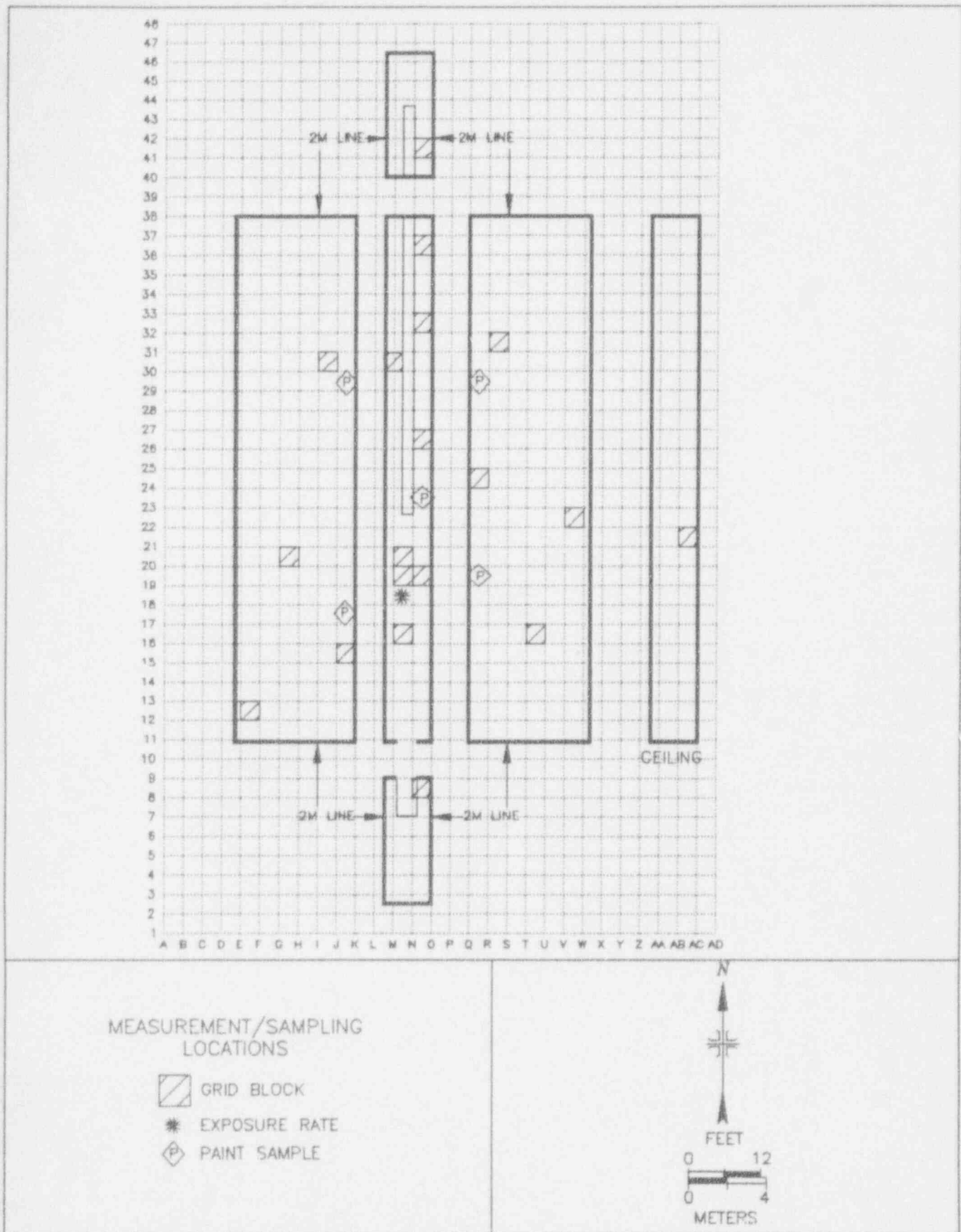


FIGURE 42: Row Fuel Vault, Lower Walls, Floor, Upper Walls and Ceiling — Measurement and Sampling Locations

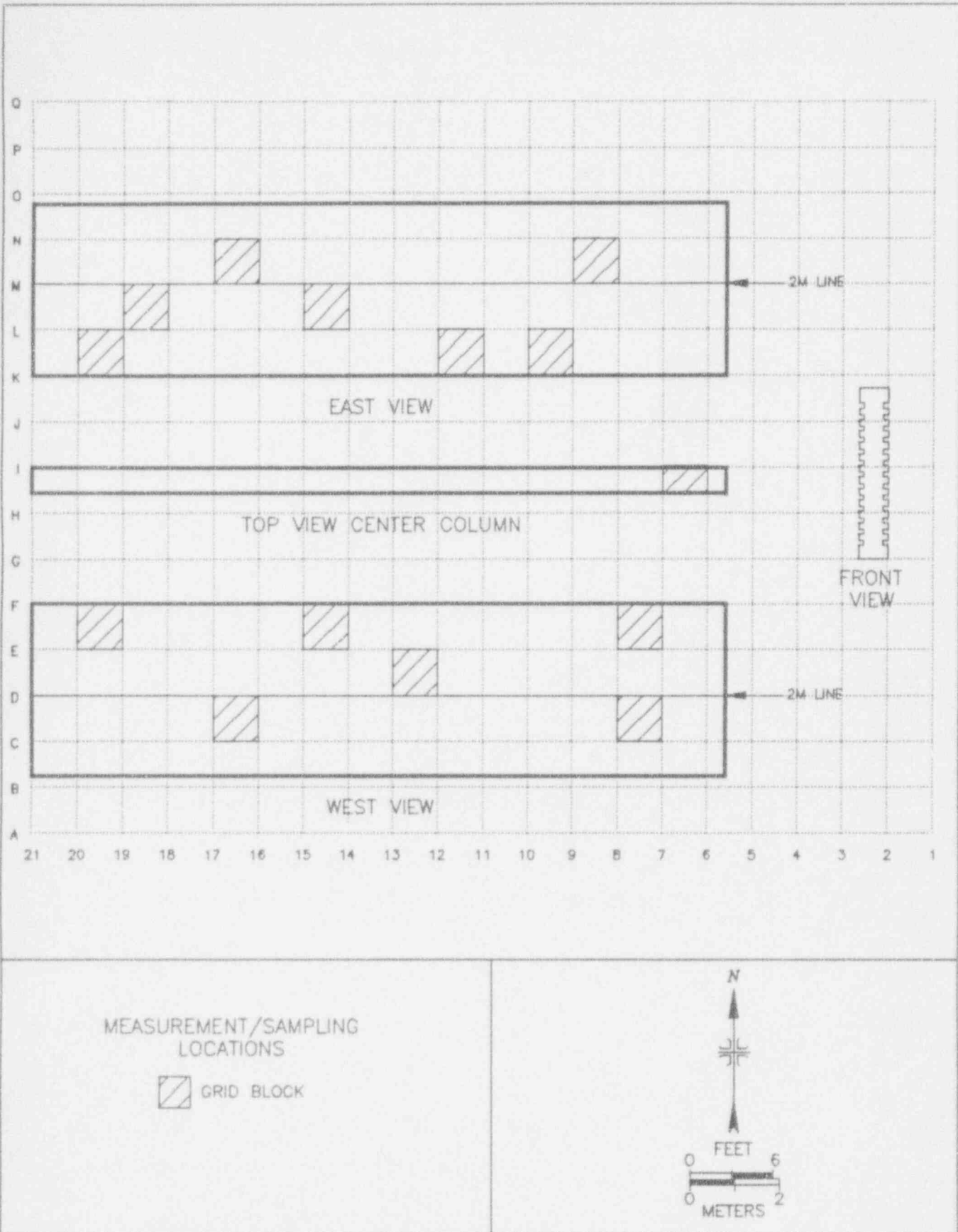
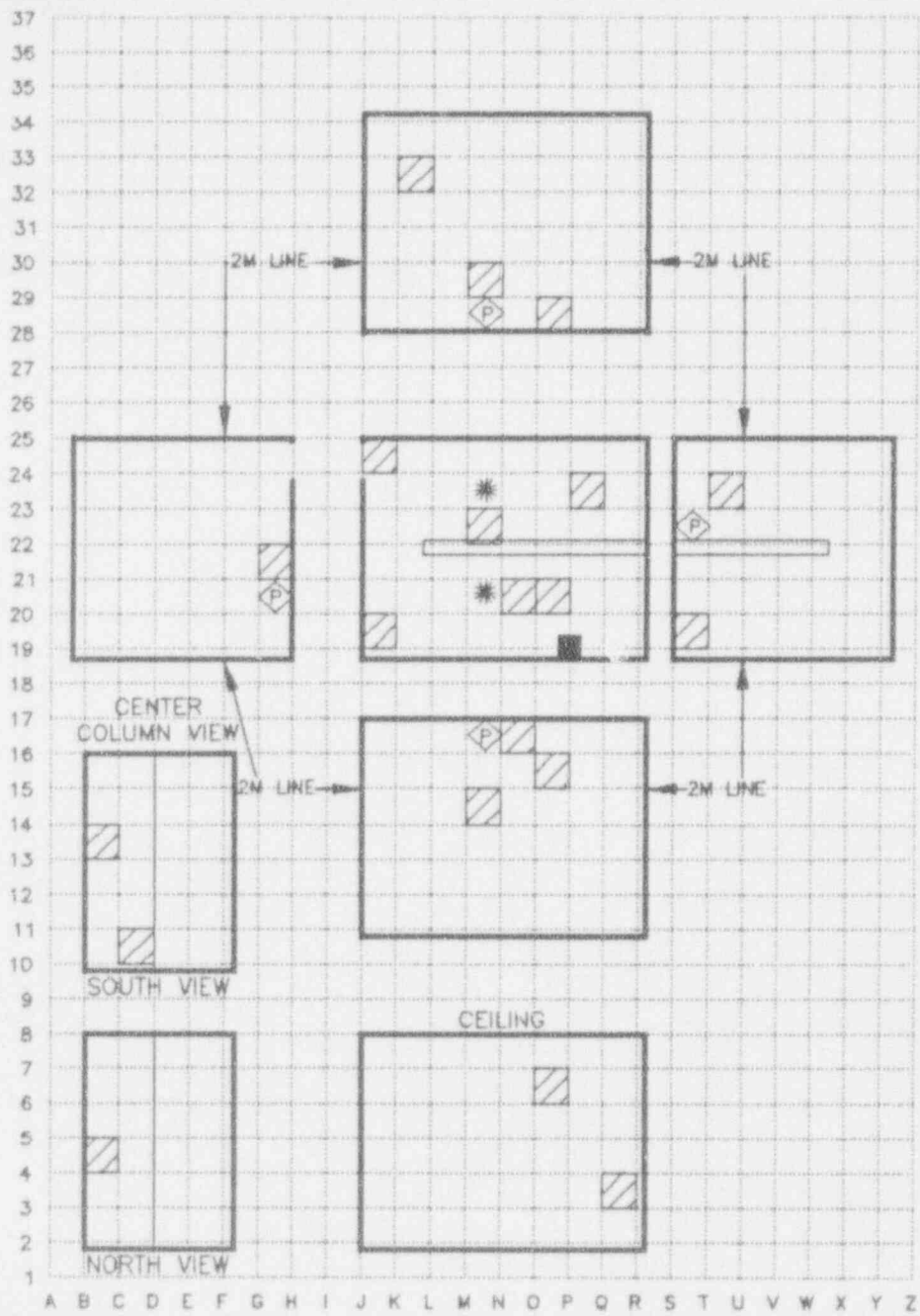


FIGURE 43: Raw Fuel Vault Column, Lower Walls and Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS





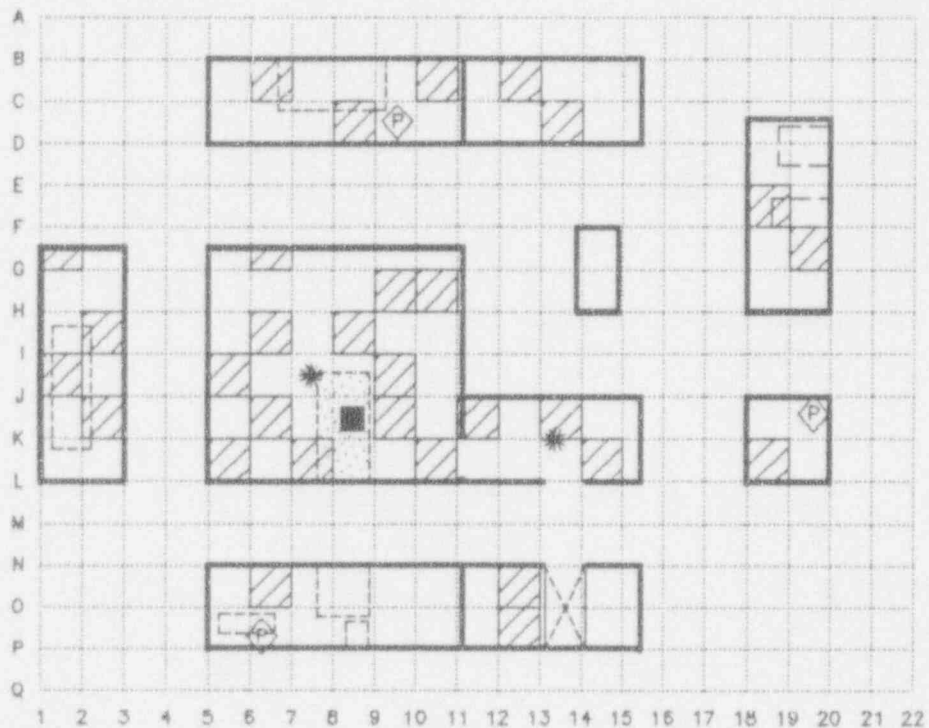




-  GRID BLOCK
-  EXPOSURE RATE
-  PAINT SAMPLE
-  SURFACE SOIL SAMPLE





FIGURE 44: Scrap Vault, Lower Walls, Floor, Upper Walls and Ceiling – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

-  GRID BLOCK
-  SURFACE SOIL SAMPLE
-  EXPOSURE RATE
-  PAINT SAMPLE

-  EXCAVATION
-  PASS THROUGH

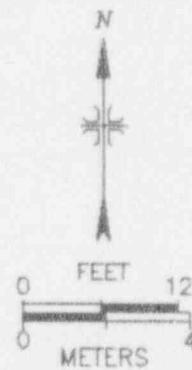


FIGURE 45: Pack Assembly, Lower Walls and Floor — Measurement and Sampling Locations

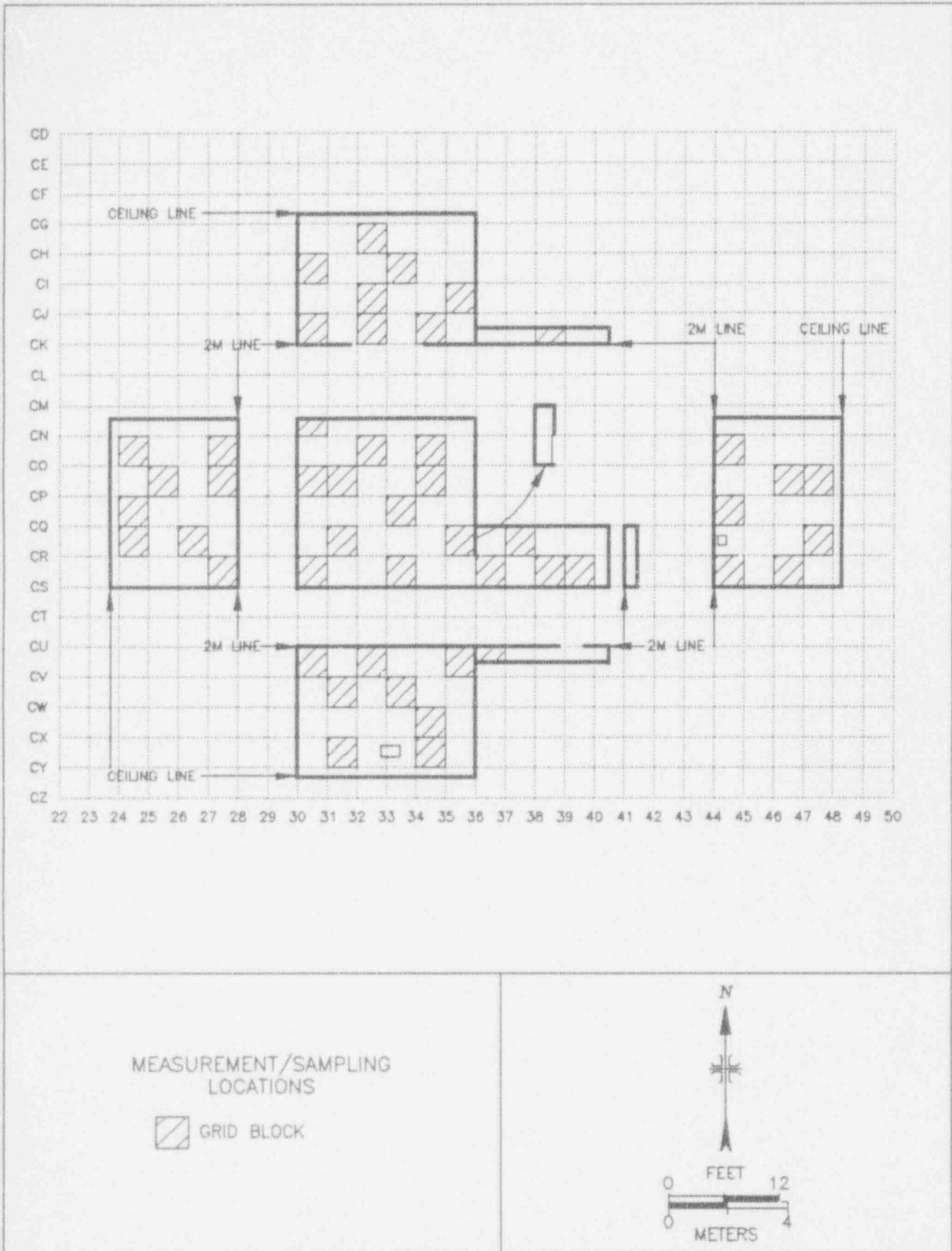
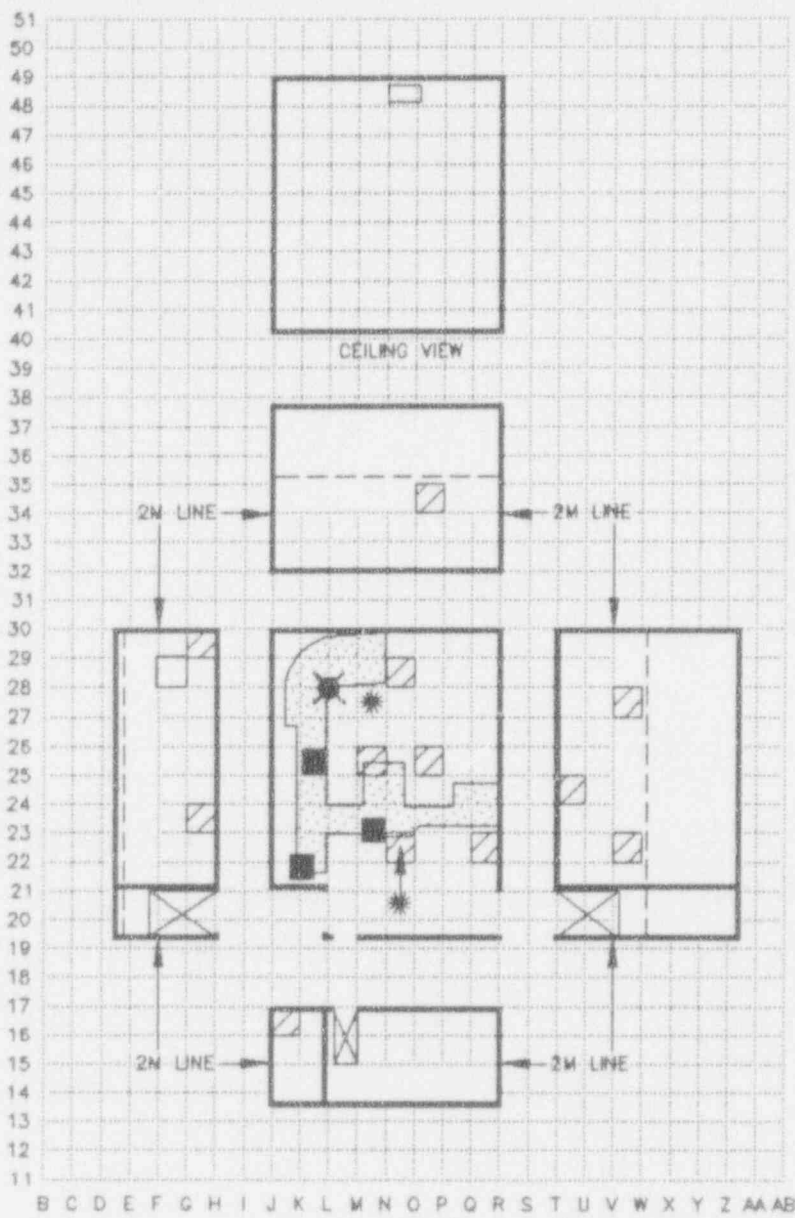


FIGURE 46: Pack Assembly, Upper Walls and Ceiling – Measurement and Sampling Locations











<p>MEASUREMENT/SAMPLING LOCATIONS</p> <ul style="list-style-type: none">  GRID BLOCK  EXPOSURE RATE  SURFACE SOIL SAMPLE  SUBSURFACE SOIL SAMPLE 	<ul style="list-style-type: none">  SUSPENDED CEILING  EXCAVATED AREA 	<p style="text-align: center;">N</p>  <p style="text-align: center;">FEET 0 6</p>  <p style="text-align: center;">METERS 0 2</p>
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FIGURE 47: Metallurgy Lab, Sample Preparation, Lower Walls, Floor, Upper Walls, and Ceiling - Measurement and Sampling Locations

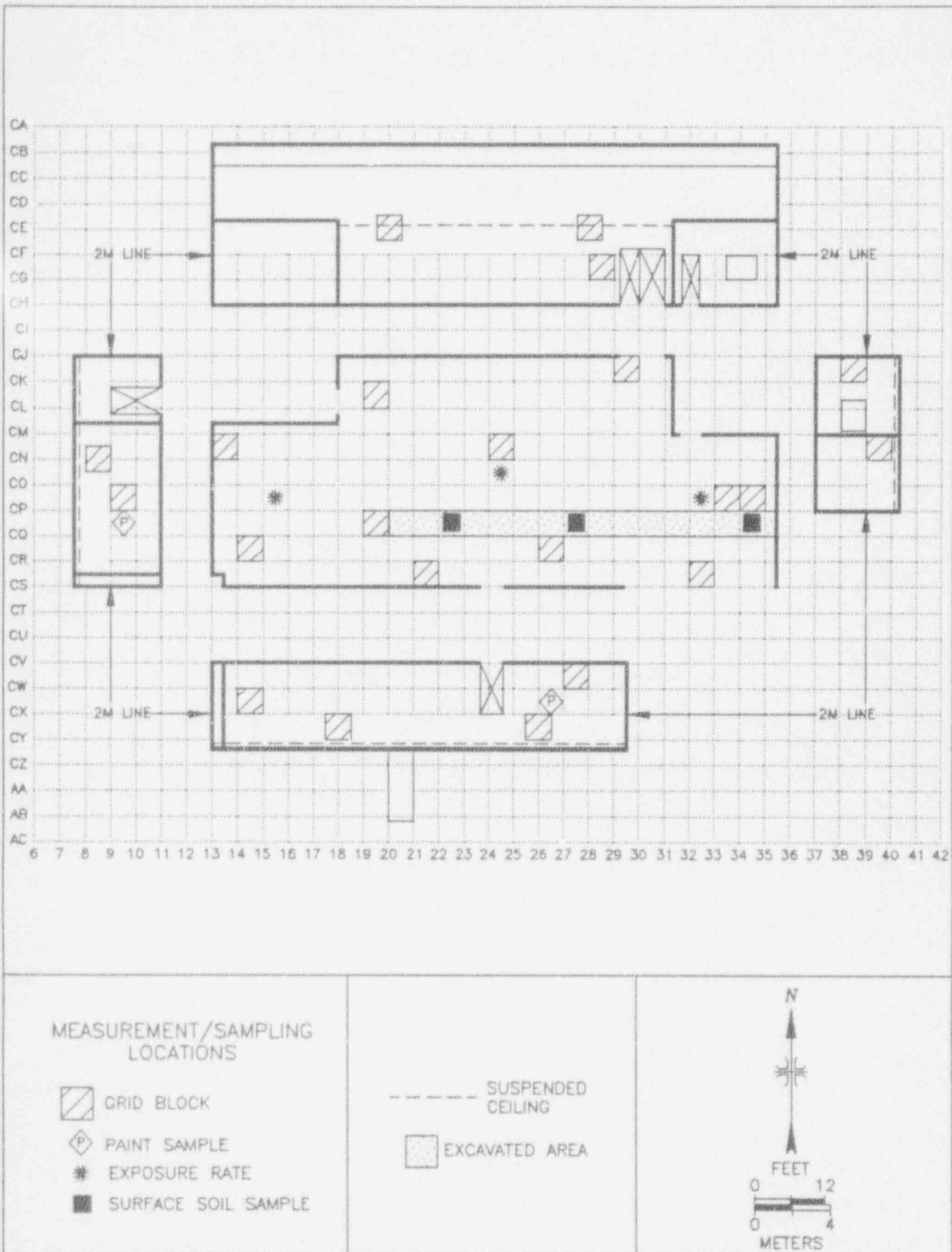
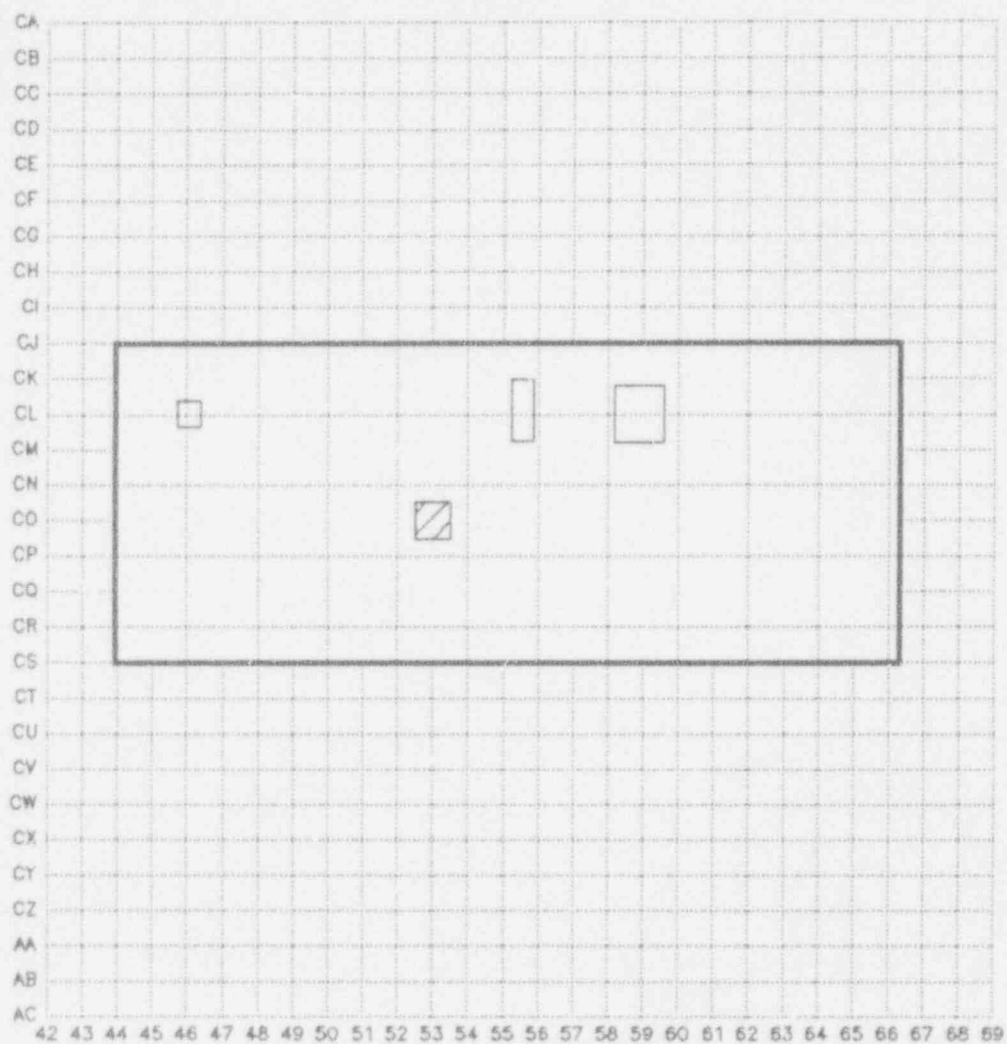


FIGURE 48: Metallurgy Lab, Reading Area, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations

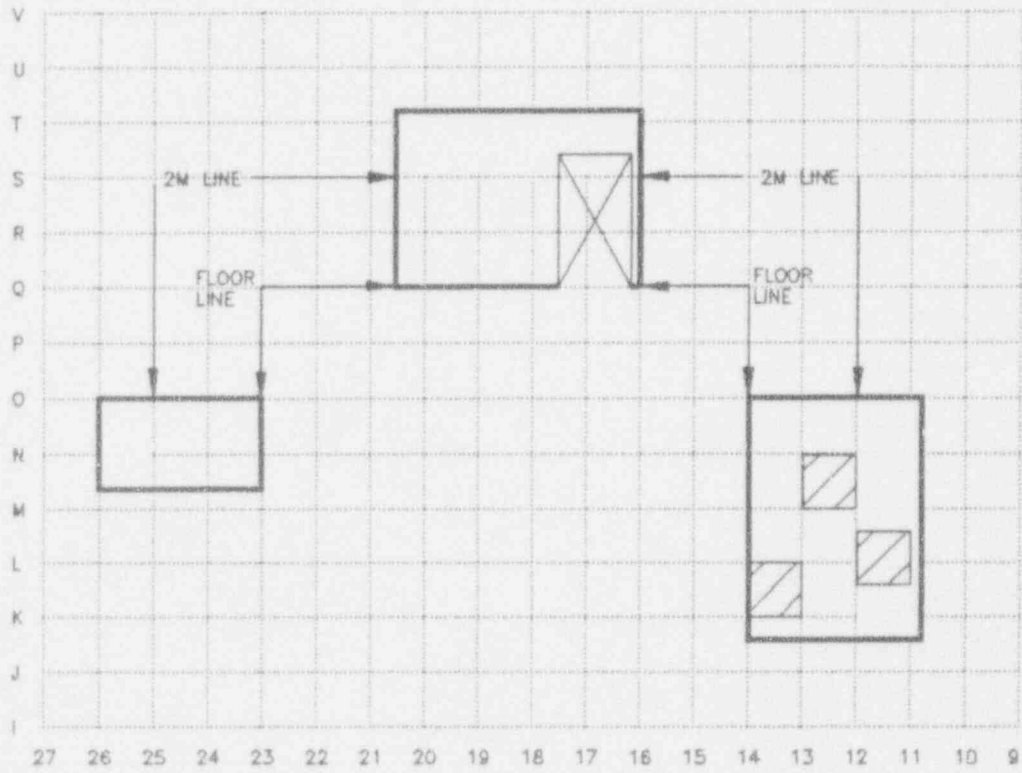


MEASUREMENT/SAMPLING
LOCATION


 GRID BLOCK



FIGURE 49: Metallurgy Lab, Reading Area Ceiling – Measurement and Sampling Location



MEASUREMENT/SAMPLING
LOCATIONS

 GRID BLOCK

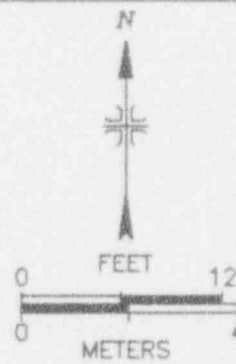


FIGURE 50: Metallurgy Lab, Wash Room, Lower Walls and Upper Walls – Measurement and Sampling Locations

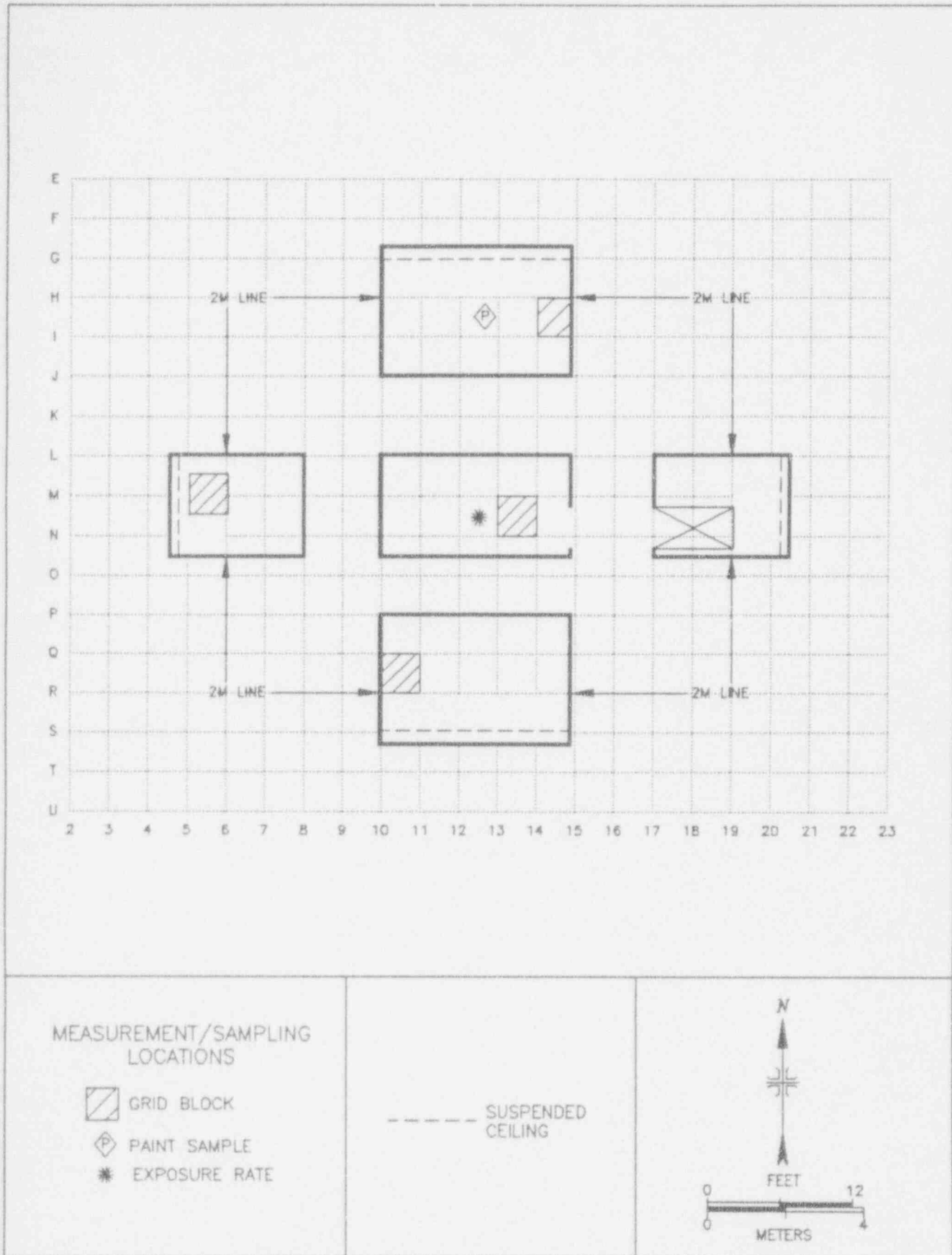


FIGURE 51: Metallurgy Lab, Records Storage, Lower Walls, Floor, and Upper Walls - Measurement and Sampling Locations

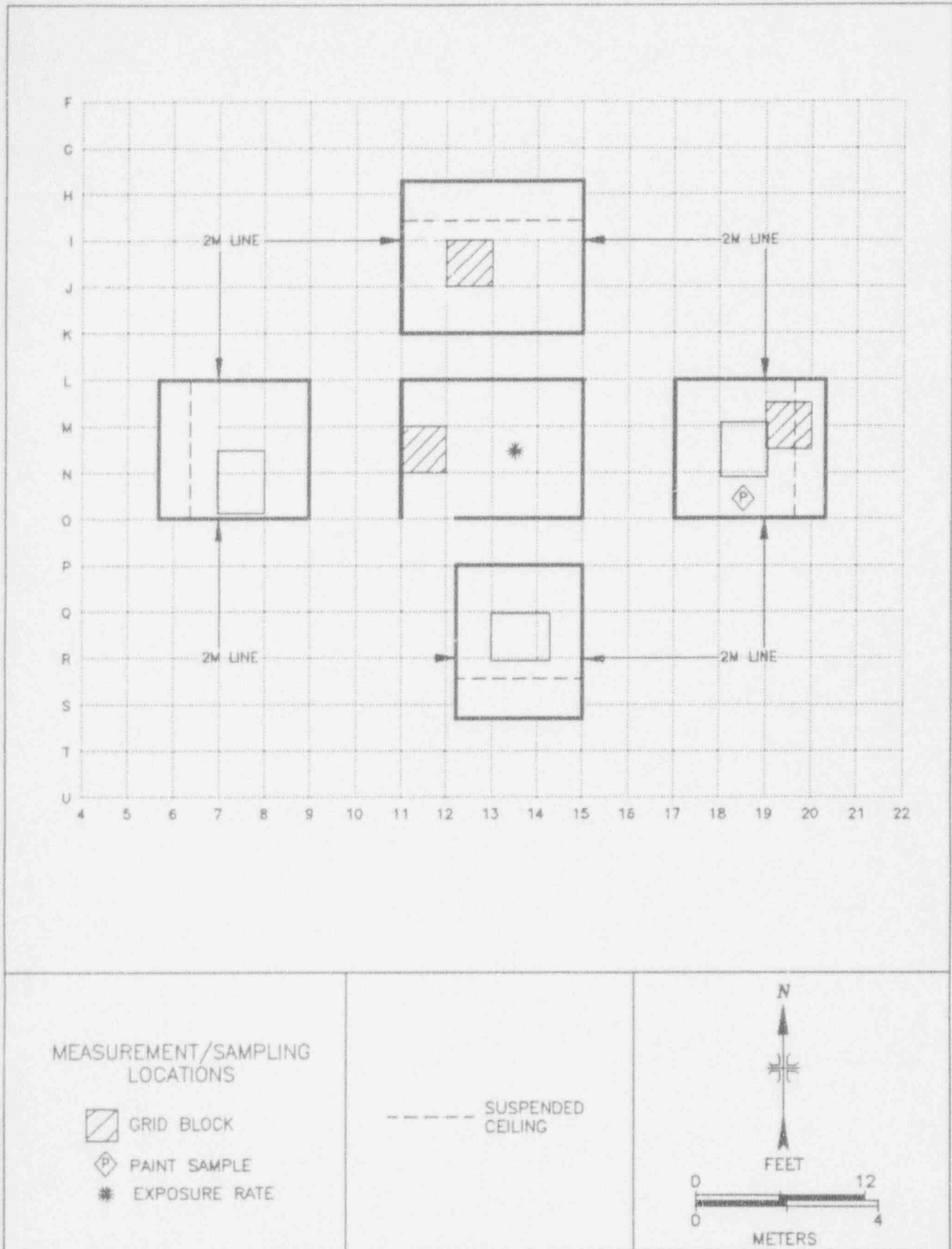
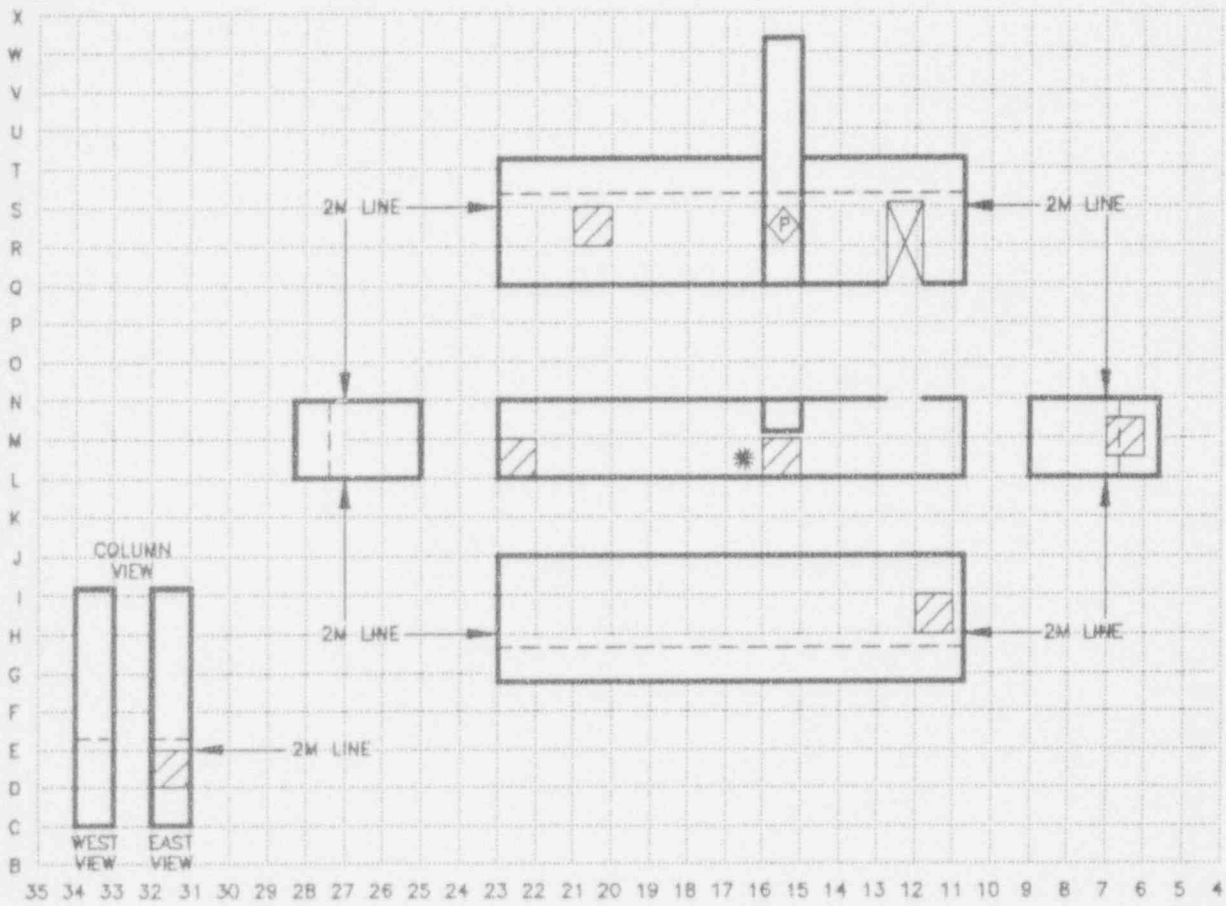





FIGURE 52: Metallurgy Lab Office, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

-  GRID BLOCK
-  PAINT SAMPLE
-  EXPOSURE RATE

----- SUSPENDED CEILING



FIGURE 53: Metallurgy Lab Supply Storage, Lower Walls, Floor, and Upper Walls - Measurement and Sampling Locations

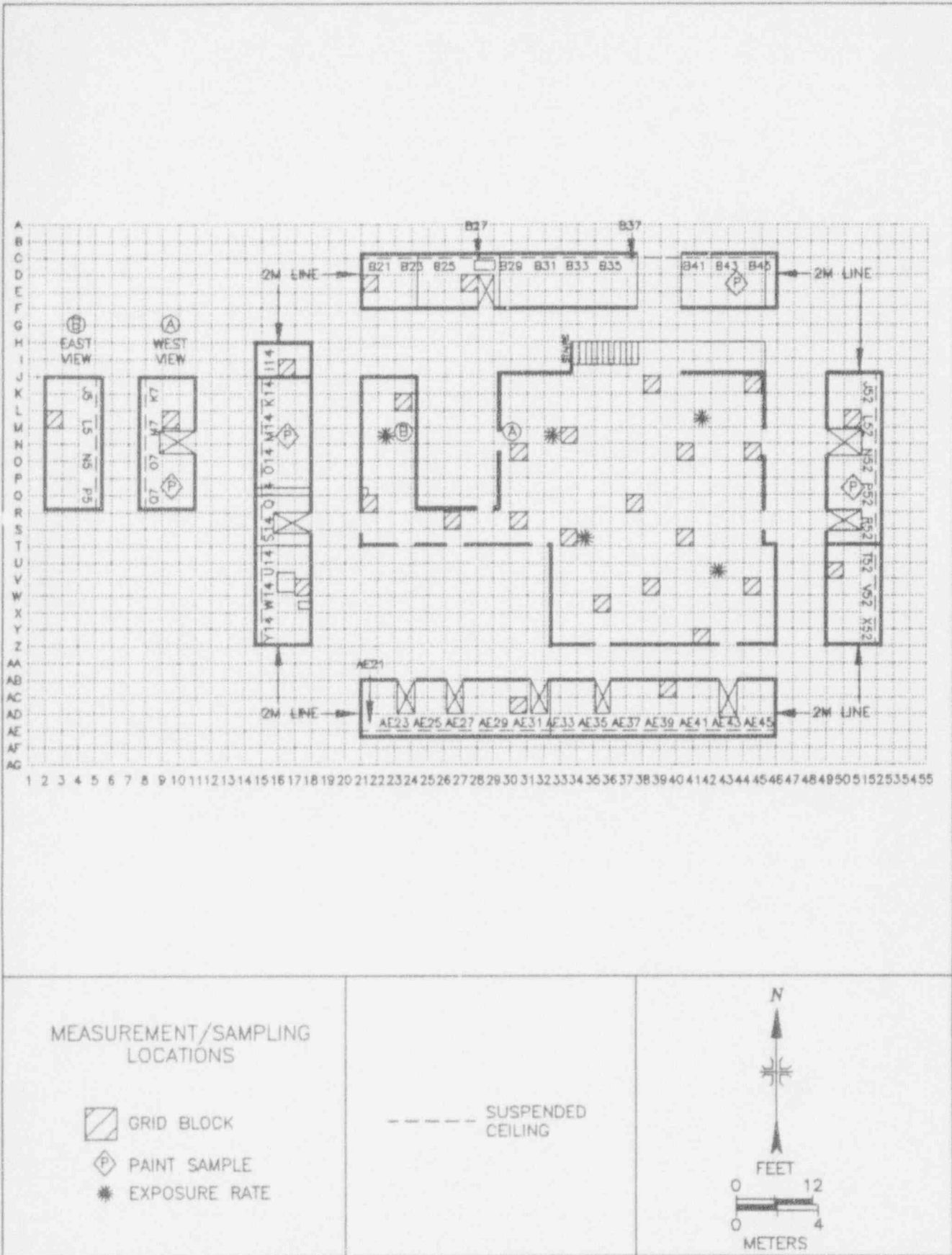
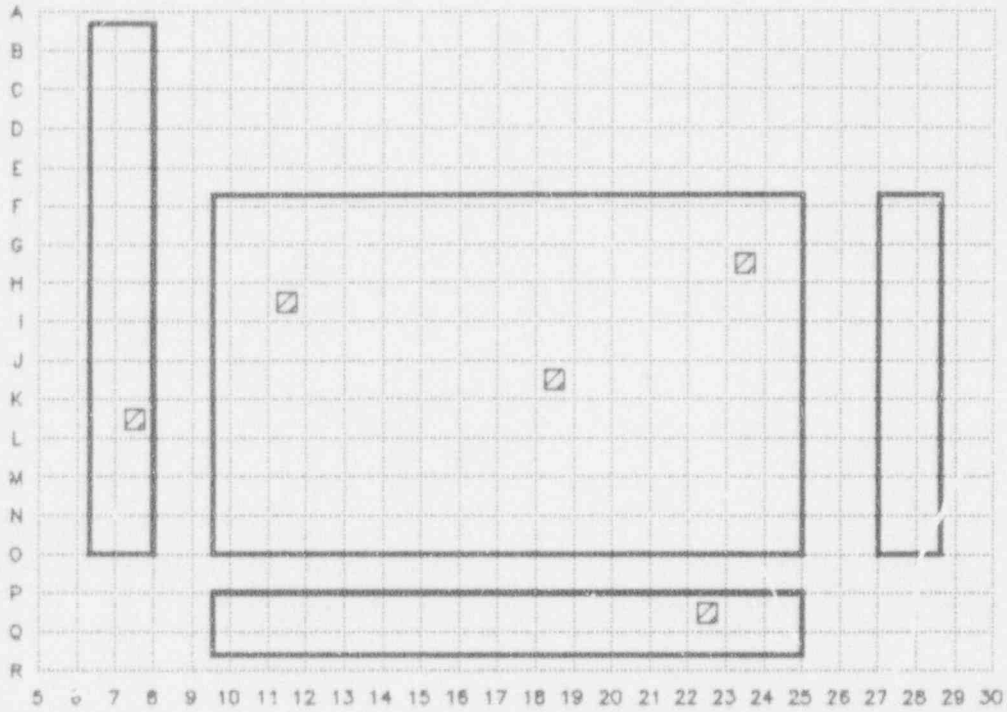


FIGURE 54: Chemistry Lab, Main Area, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

 GRID BLOCK



FIGURE 55: Chemistry Lab, Upper Walls and Ceiling – Measurement and Sampling Locations

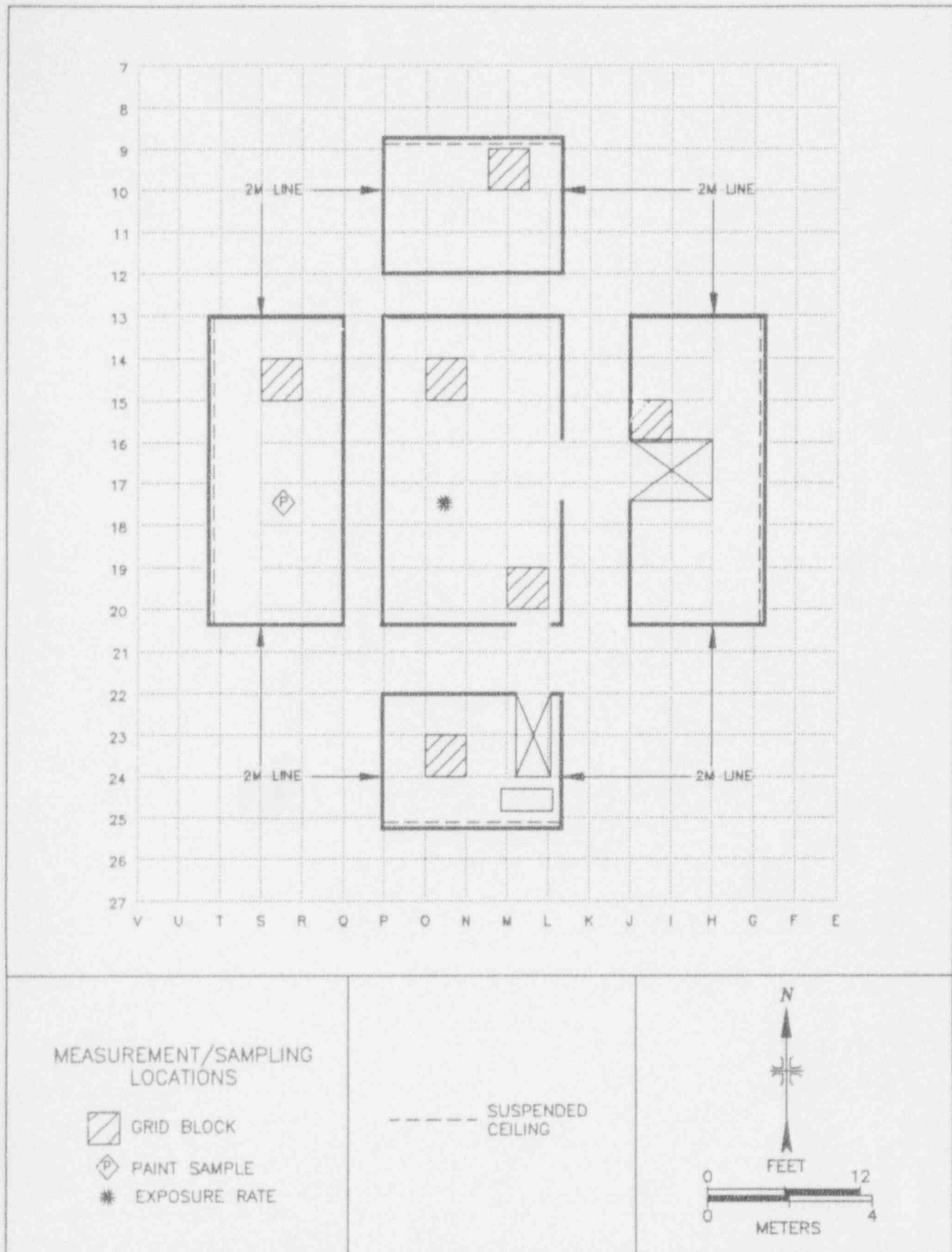
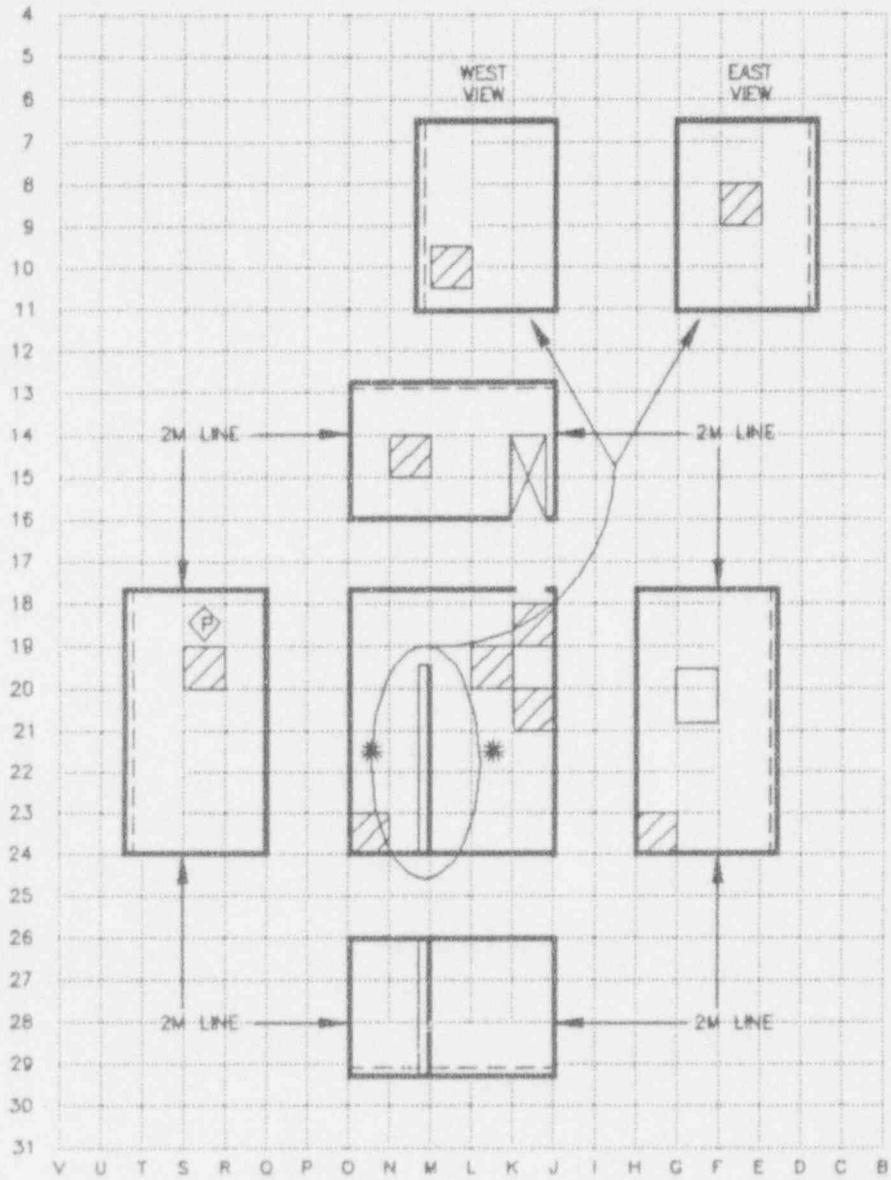





FIGURE 56: Chemistry Lab Mass Spectrometer Room, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

-  GRID BLOCK
-  EXPOSURE RATE
-  PAINT SAMPLE

 SUSPENDED CEILING

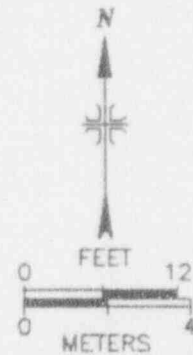


FIGURE 57: Chemistry Lab, C-Lab 1, Lower Walls, Floor, and Upper Walls - Measurement and Sampling Locations

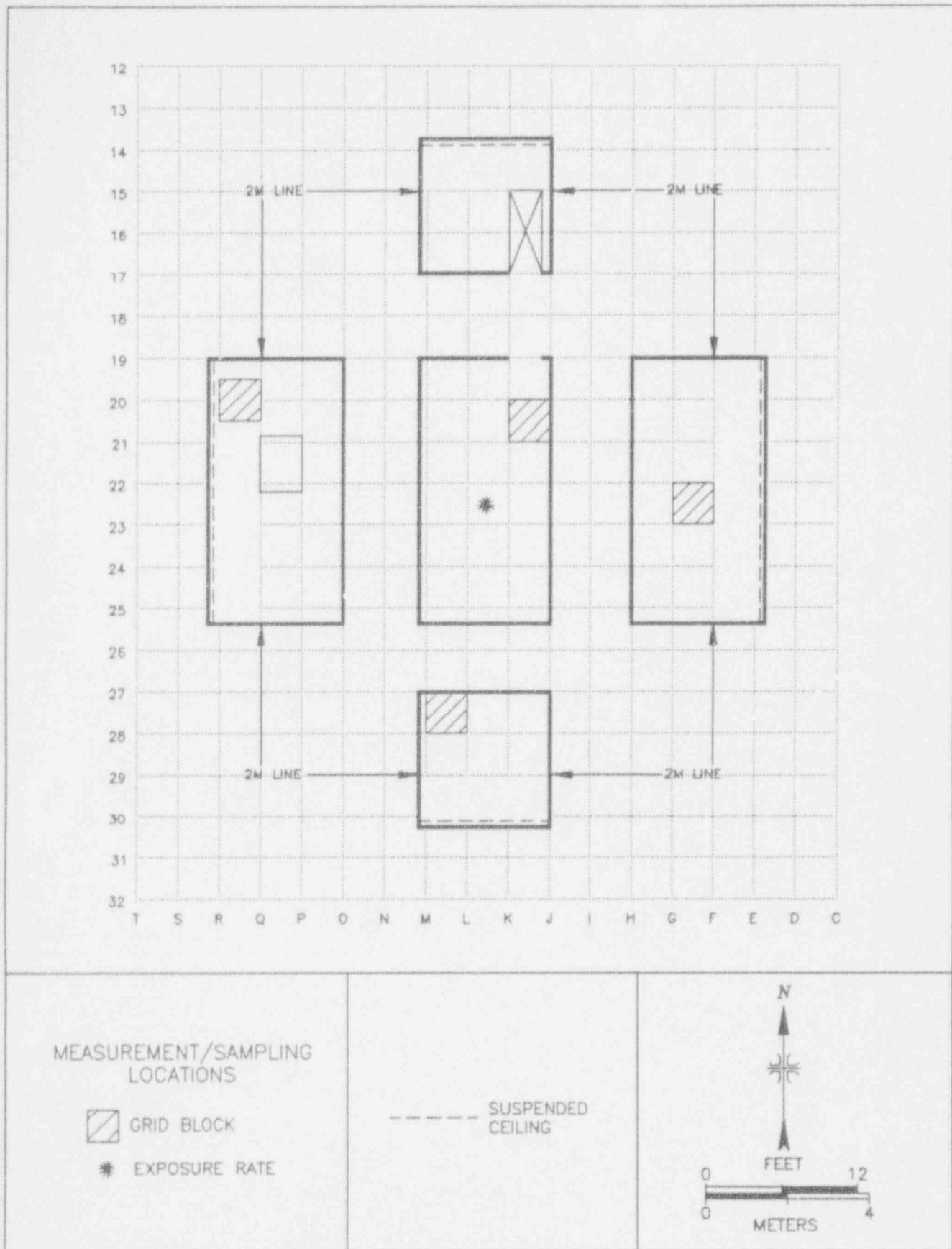


FIGURE 58: Chemistry Lab, C-Lab 2, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations

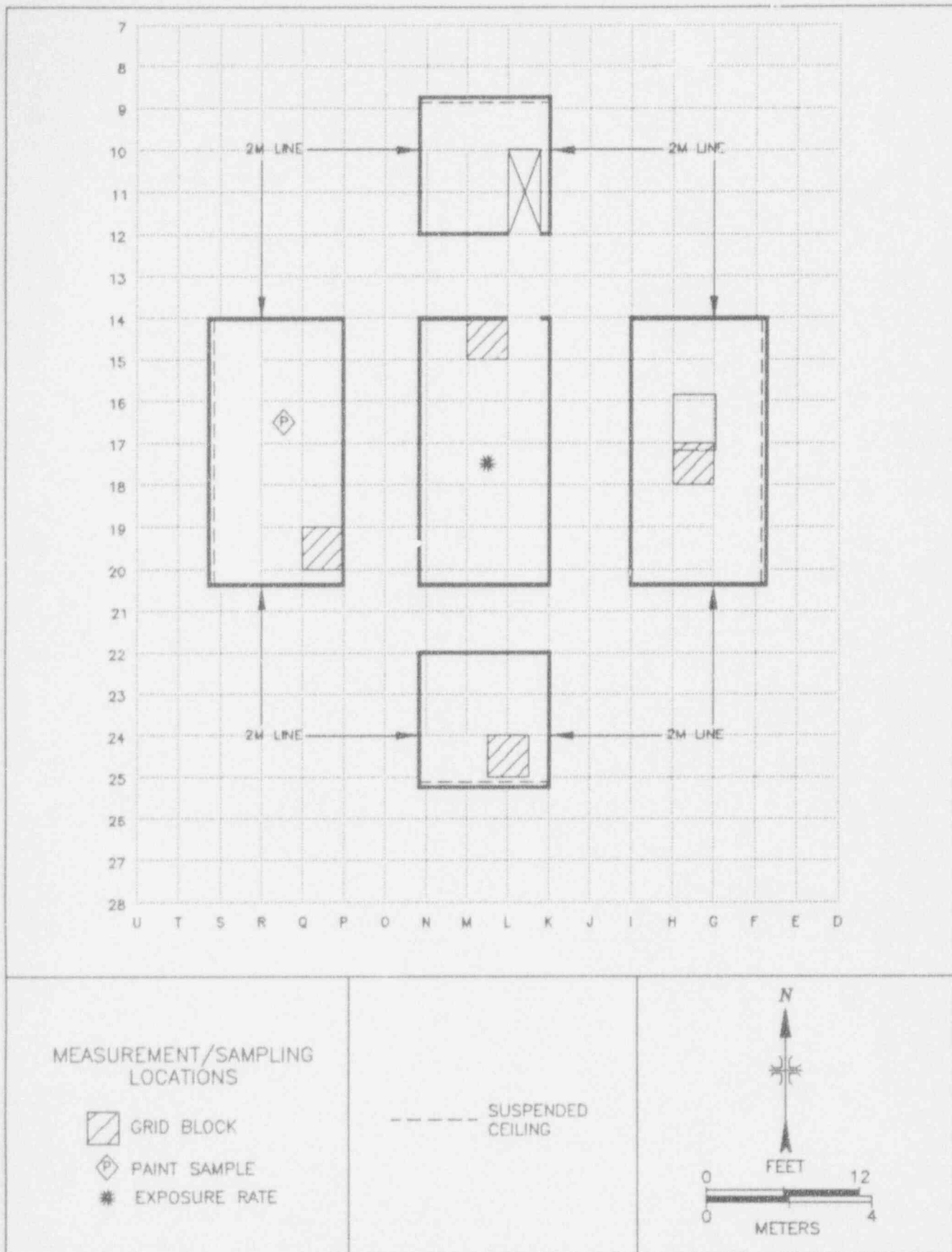


FIGURE 59: Chemistry Lab, C-Lab 3, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations

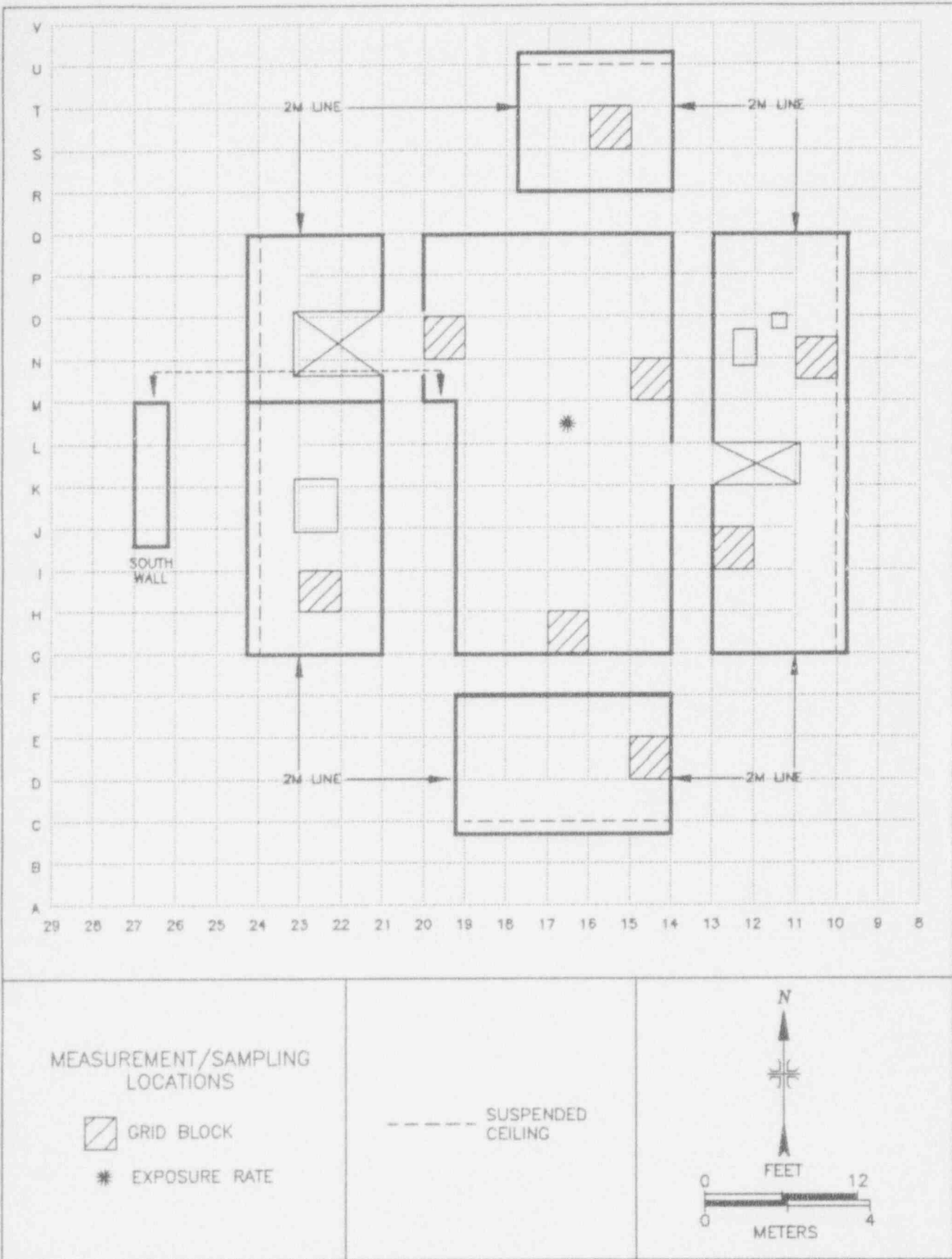
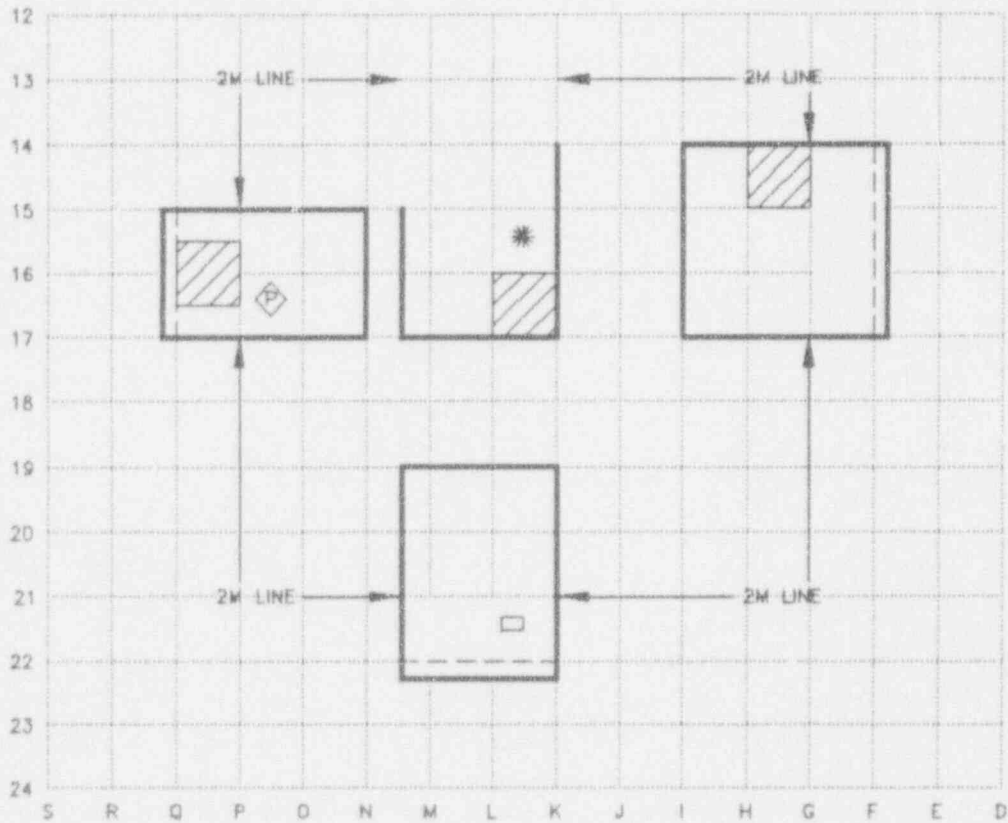


FIGURE 60: Chemistry Lab Spectroscopy Room, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

-  GRID BLOCK
-  PAINT SAMPLE
-  EXPOSURE RATE

----- SUSPENDED
CEILING

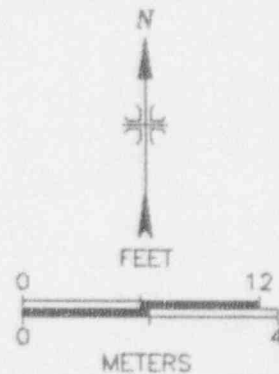


FIGURE 61: Chemistry Lab, ISAF A Darkroom, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations

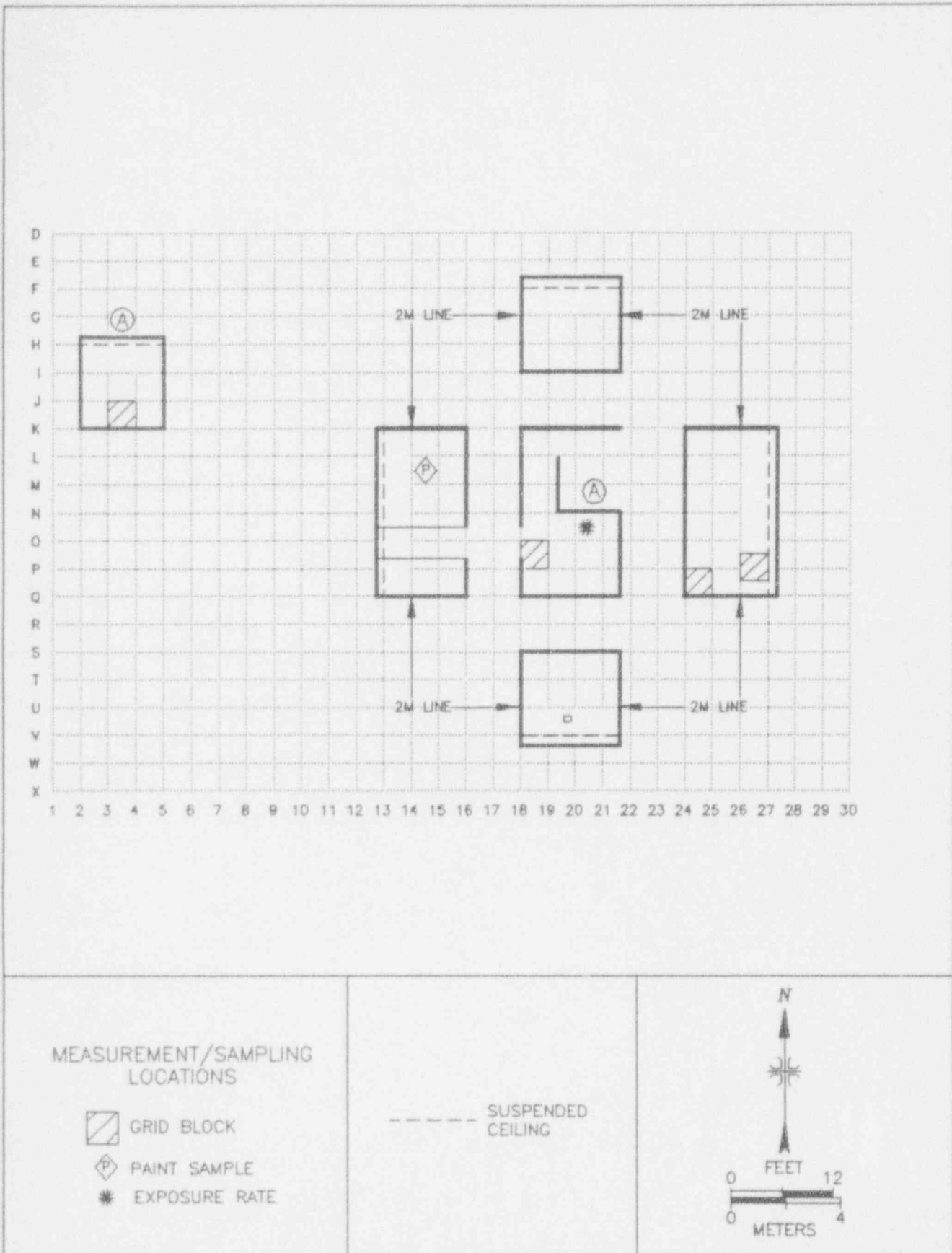
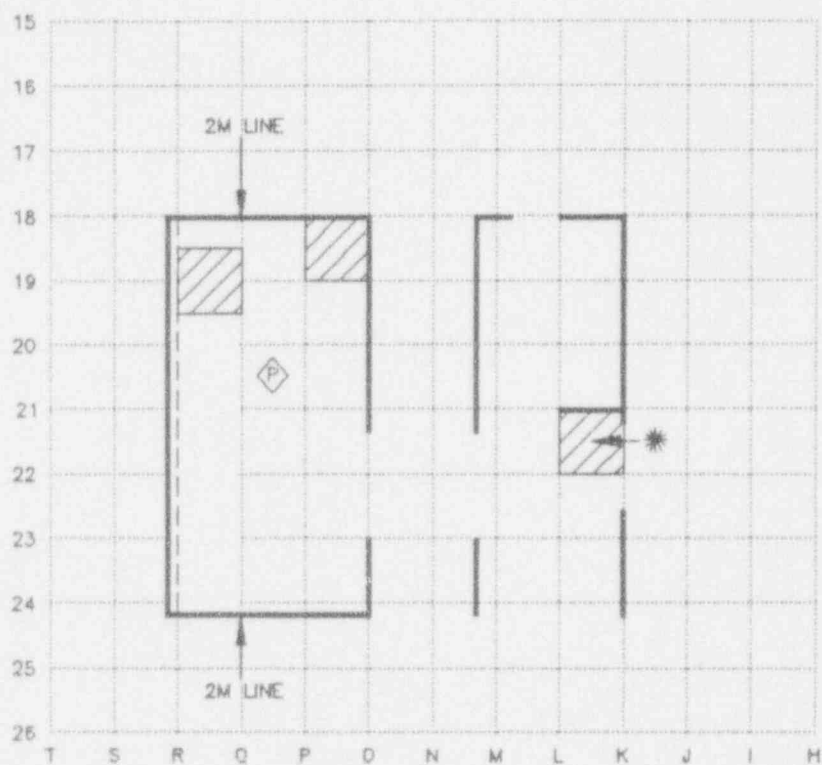



FIGURE 62: Chemistry Lab, ISAF B, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

-  GRID BLOCK
-  PAINT SAMPLE
-  EXPOSURE RATE

----- SUSPENDED
CEILING



FIGURE 63: Chemistry Lab, ISAF C, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations

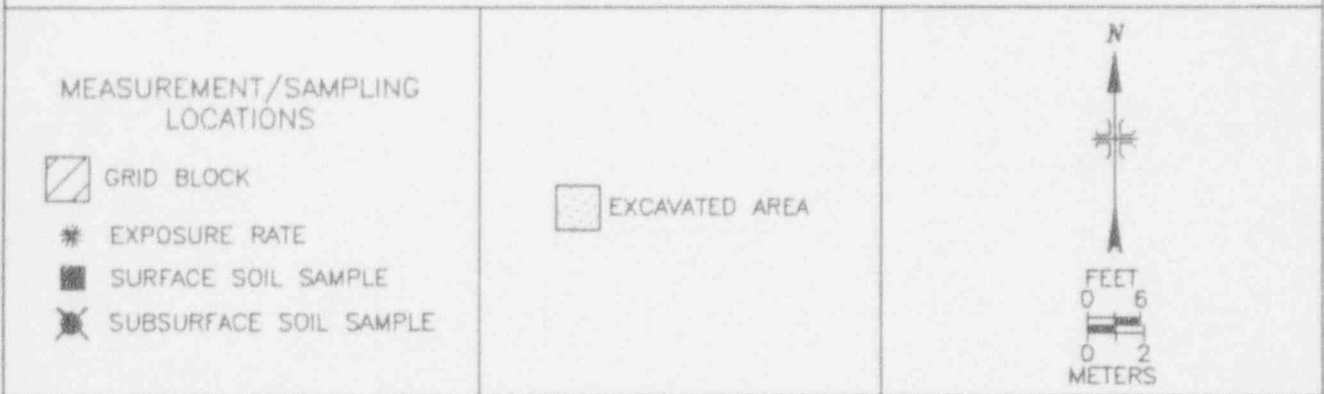
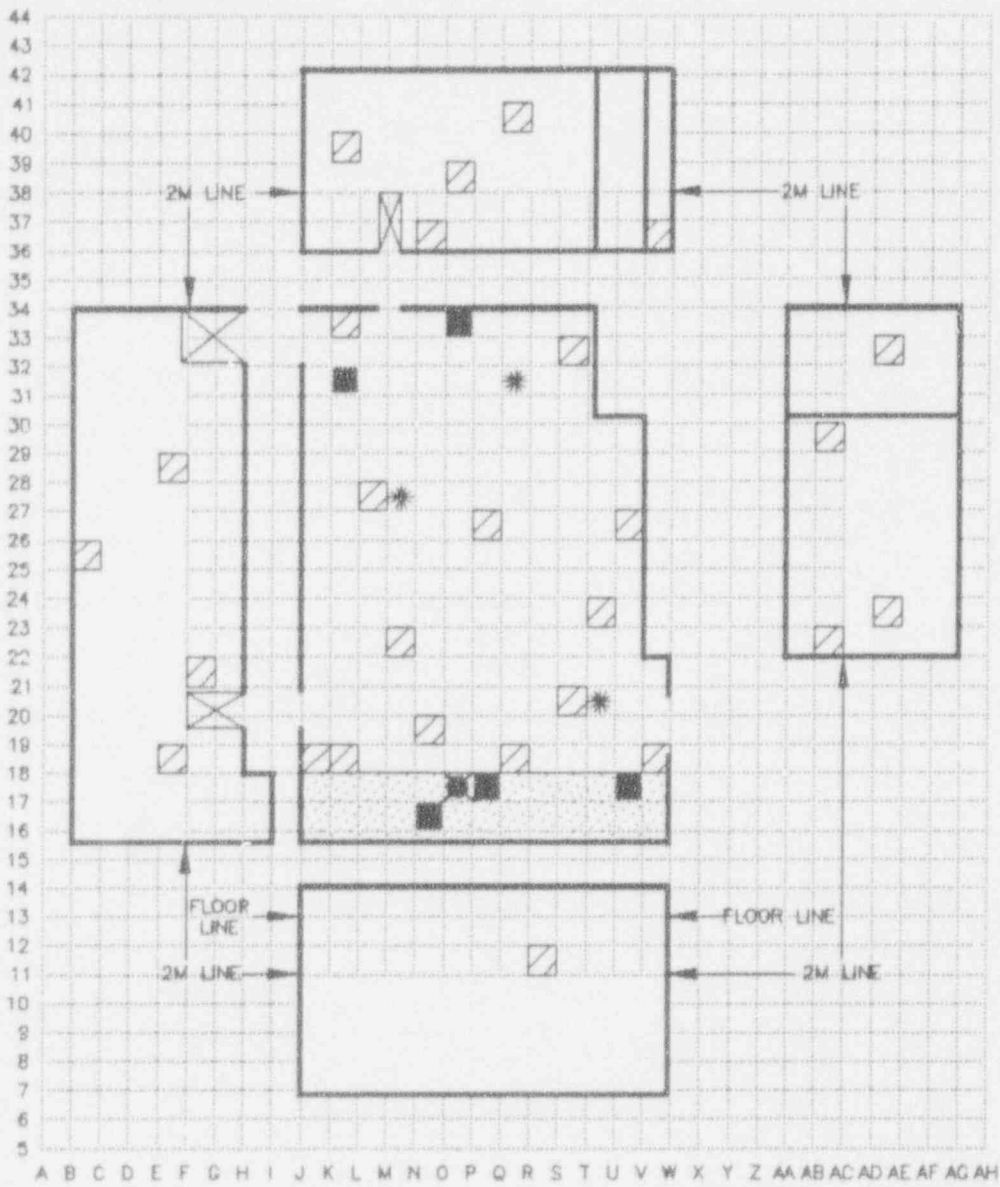
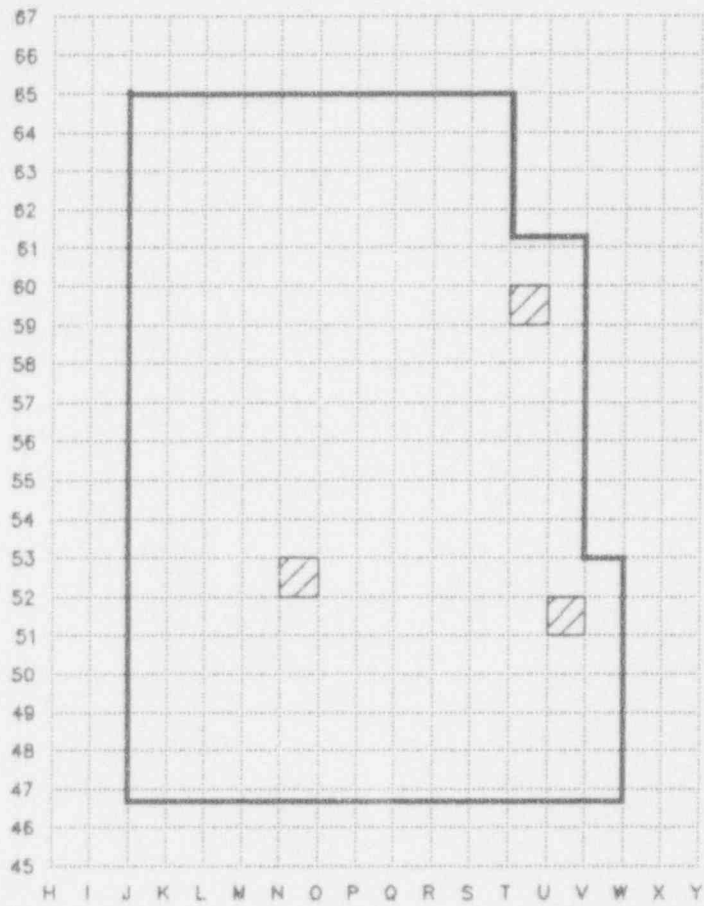


FIGURE 64: Sectioning Main Area, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

 GRID BLOCK



FIGURE 65: Sectioning Main Area Ceiling – Measurement and Sampling Locations

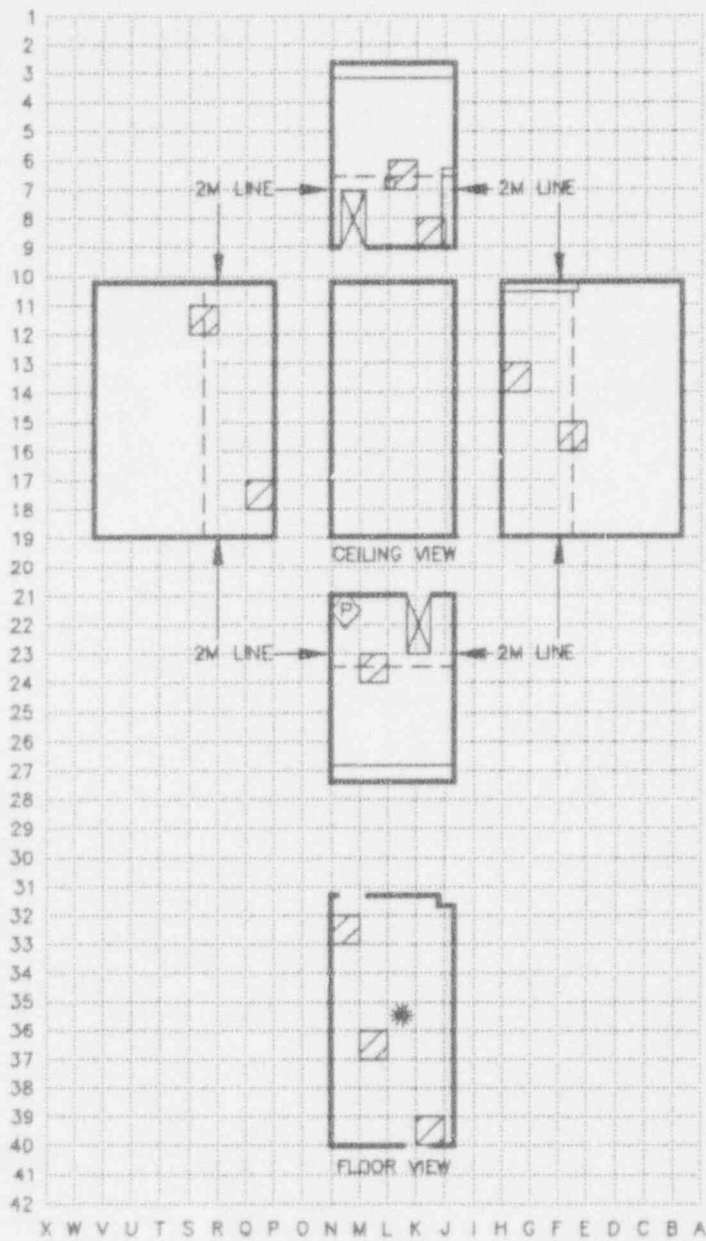
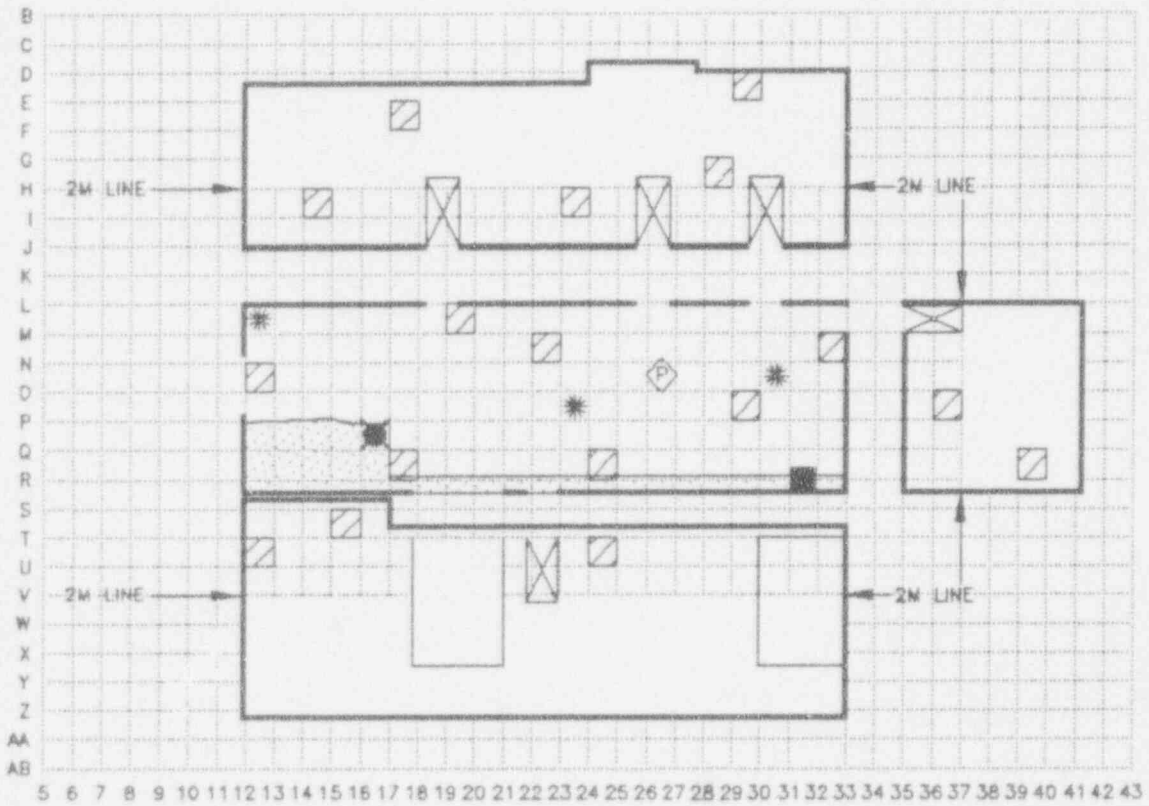







FIGURE 66: Sectioning, Locker Room – Measurement and Sampling Locations



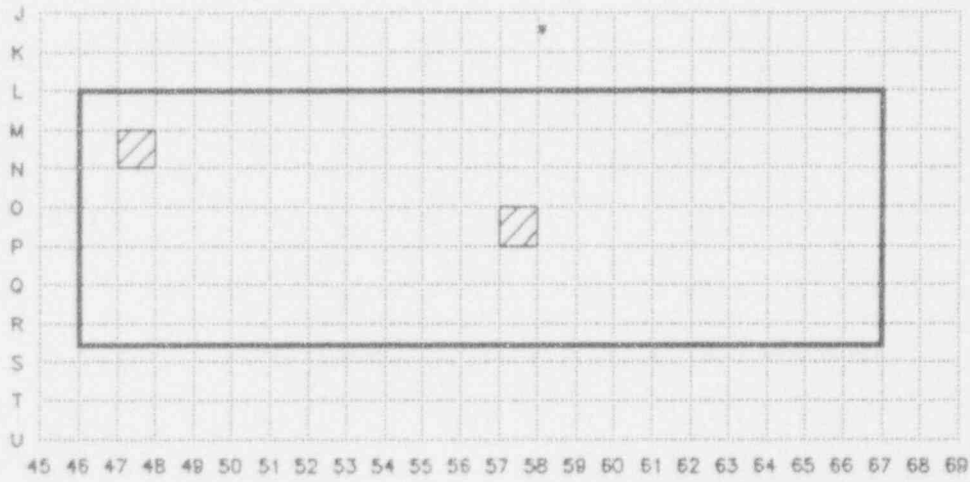
MEASUREMENT/SAMPLING LOCATIONS

-  GRID BLOCK
-  PAINT SAMPLE
-  EXPOSURE RATE
-  SURFACE SOIL SAMPLE
-  SUBSURFACE SOIL SAMPLE

 EXCAVATED AREA



FIGURE 67: Old Decon, Lower Walls, Floor and Upper Walls - Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS


 GRID BLOCK



FIGURE 68: Old Decon, Ceiling – Measurement and Sampling Locations

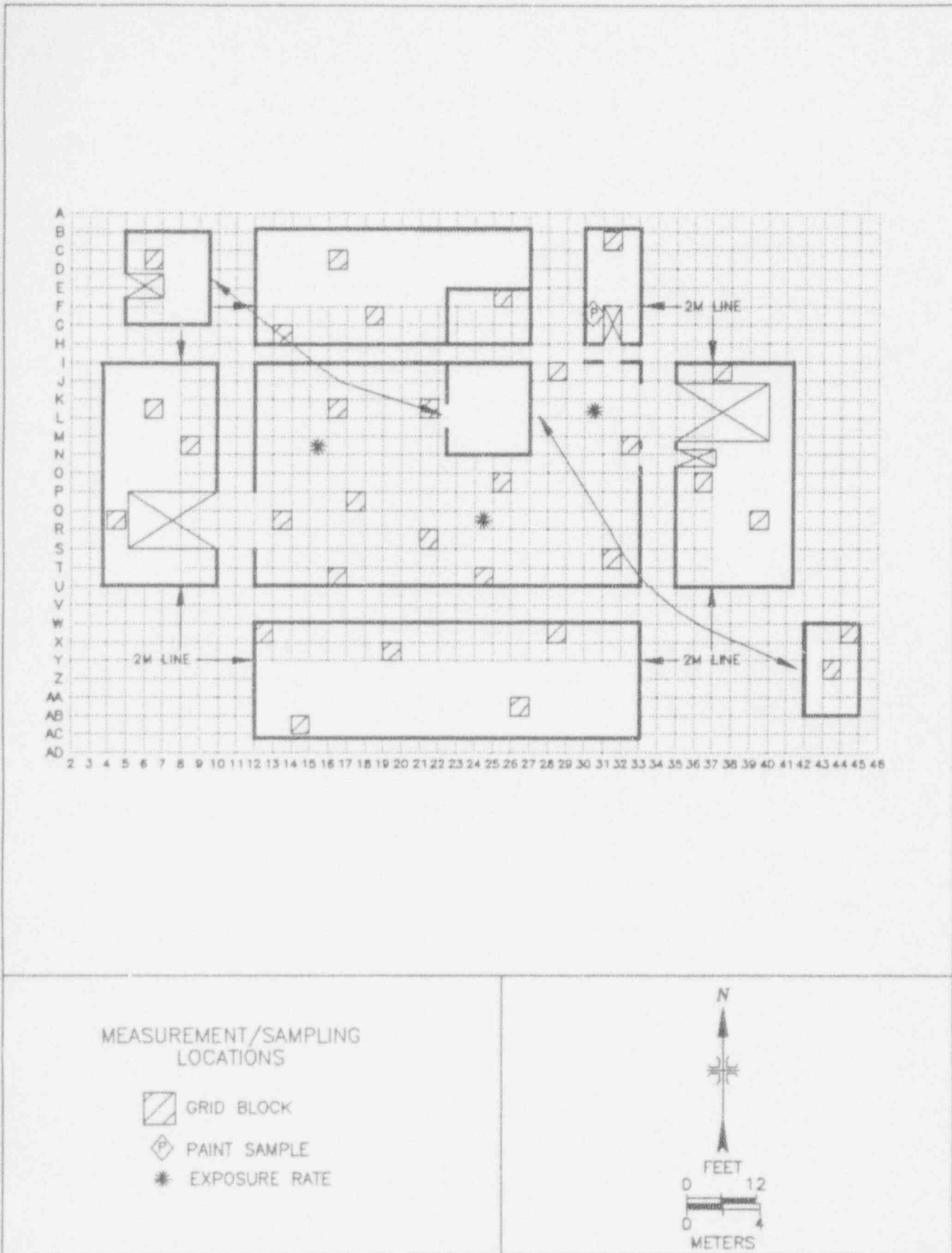
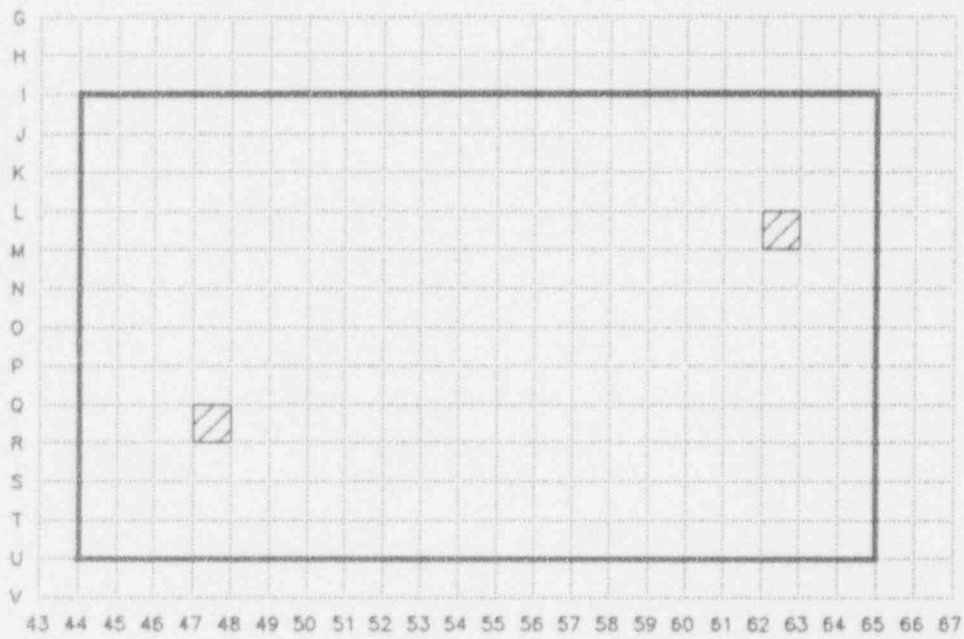


FIGURE 69: New Decon, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

 GRID BLOCK

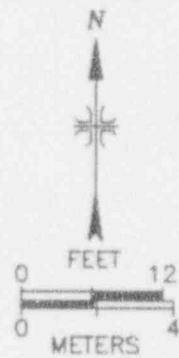
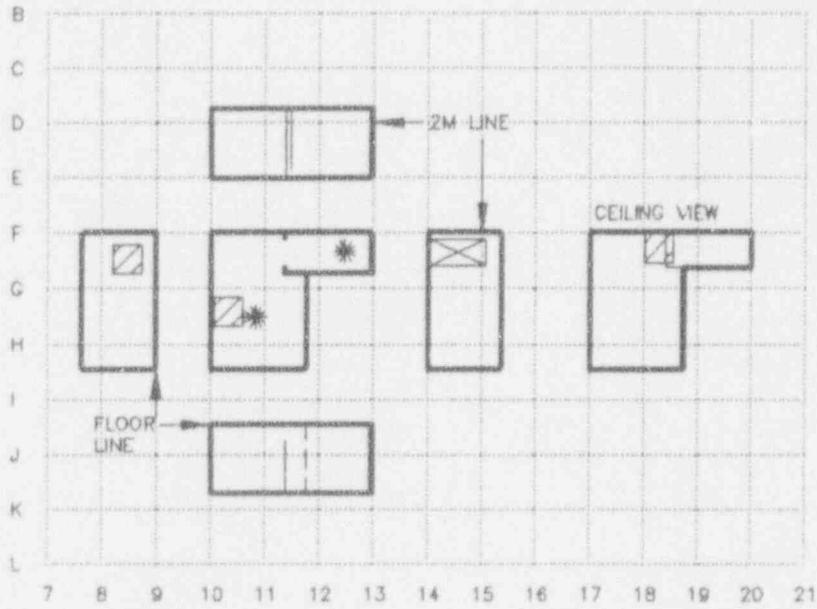




FIGURE 70: New Decon, Ceiling – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

-  GRID BLOCK
-  EXPOSURE RATE

----- SUSPENDED CEILING

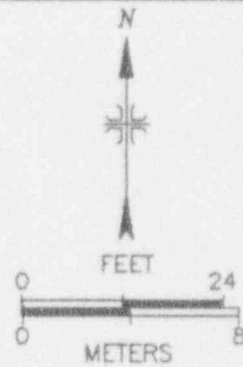
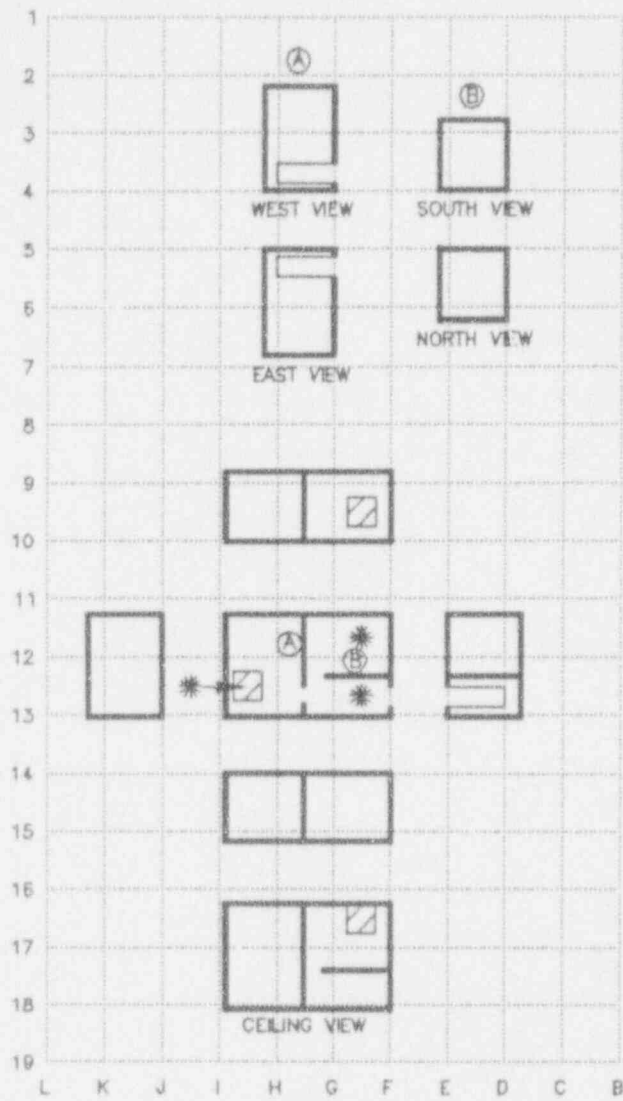




FIGURE 72: B-South Mens' Room - Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

-  GRID BLOCK
-  EXPOSURE RATE

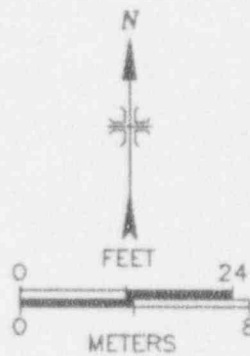


FIGURE 73: B-South, Ladies' Room - Measurement and Sampling Locations

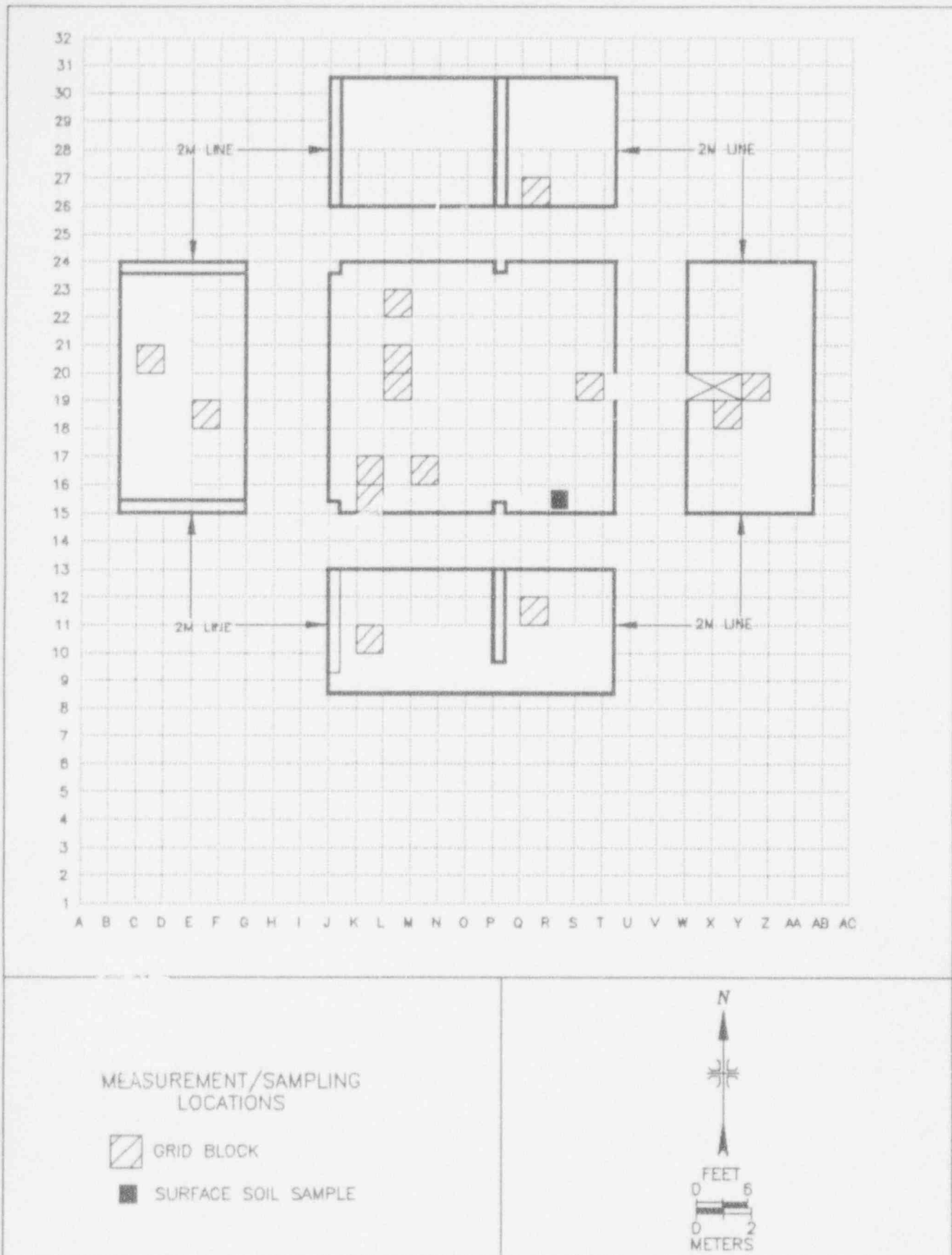


FIGURE 74: Basement, HP Office, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations

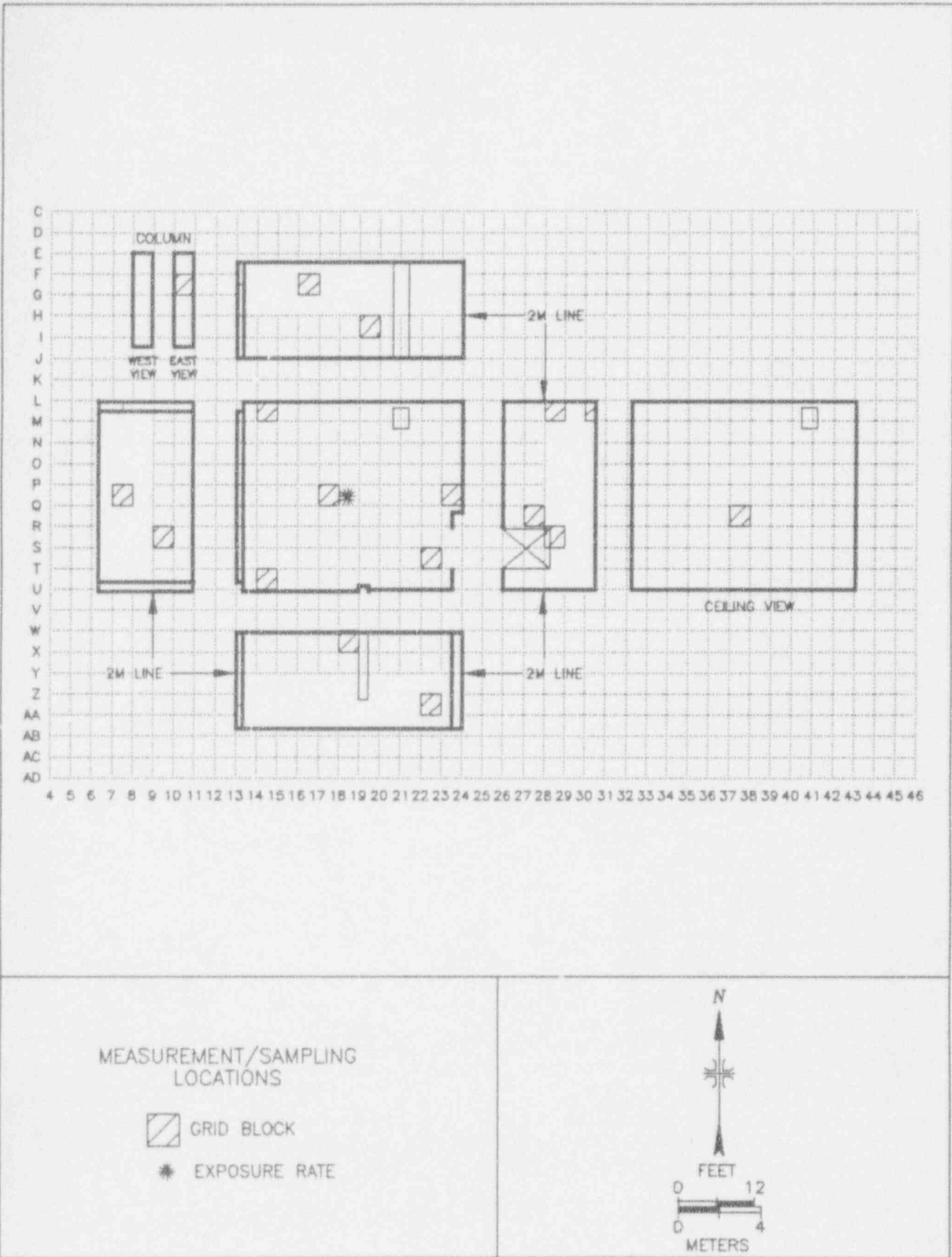


FIGURE 75: Basement, Radwaste Storage Area – Measurement and Sampling Locations

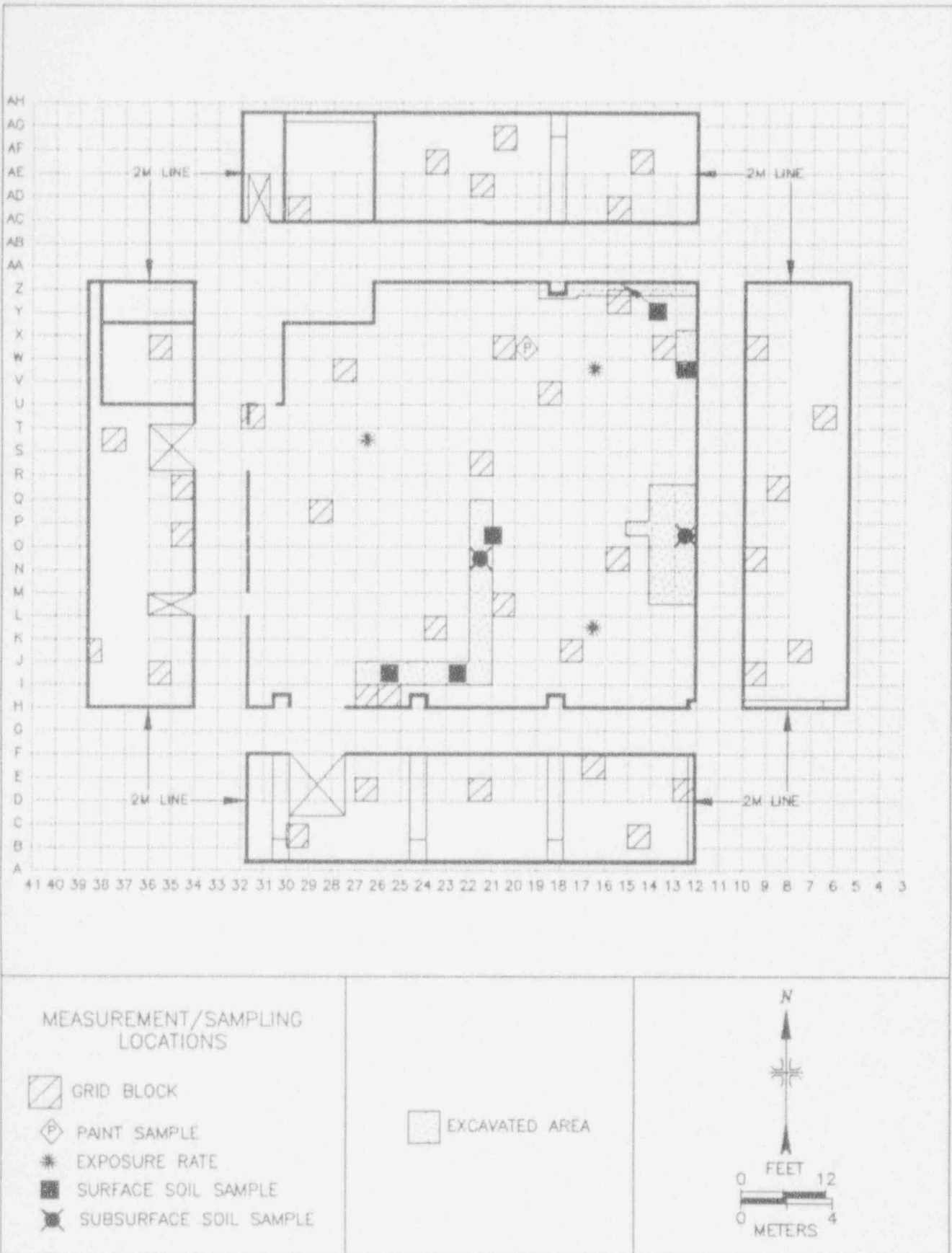
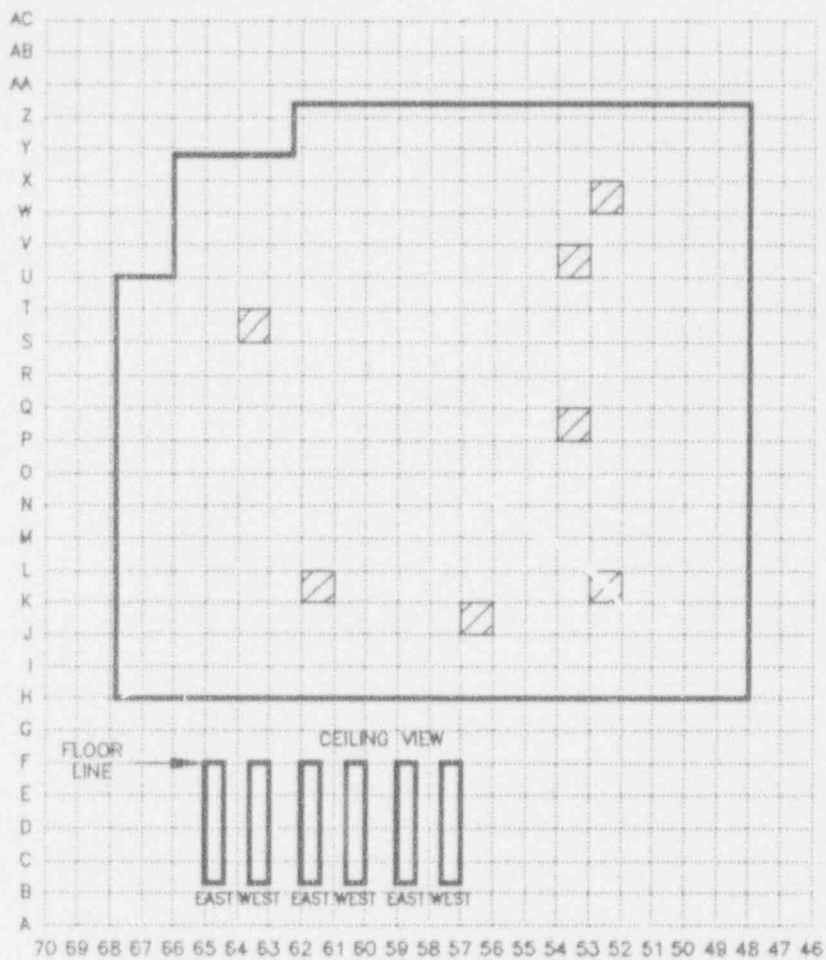


FIGURE 76: Basement, Radwaste Area, Lower Walls, Floor, and Upper Walls – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS


 GRID BLOCK



FIGURE 77: Basement, Radwaste Area Ceiling – Measurement and Sampling Locations

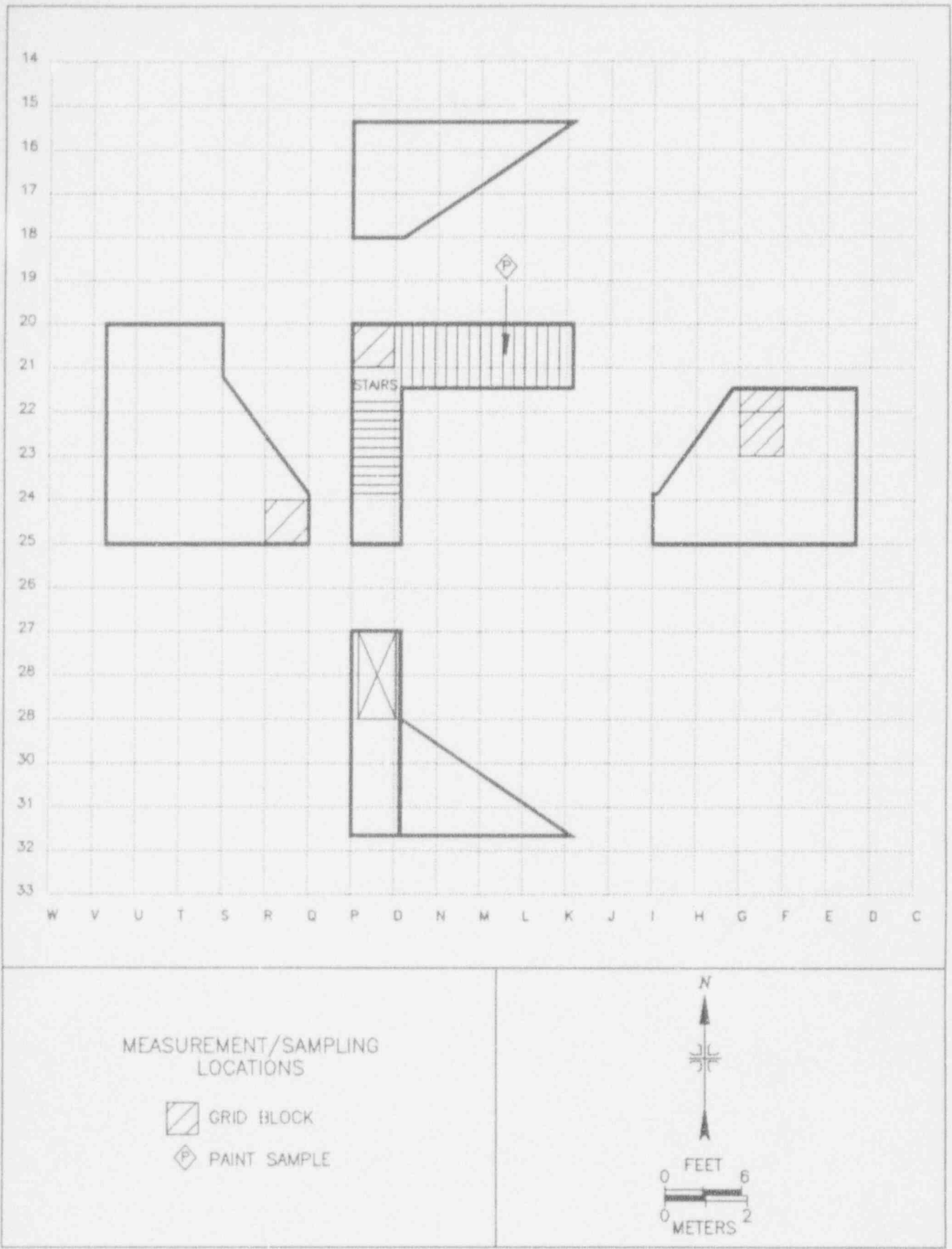


FIGURE 78: Basement, Radwaste Stairs – Measurement and Sampling Locations

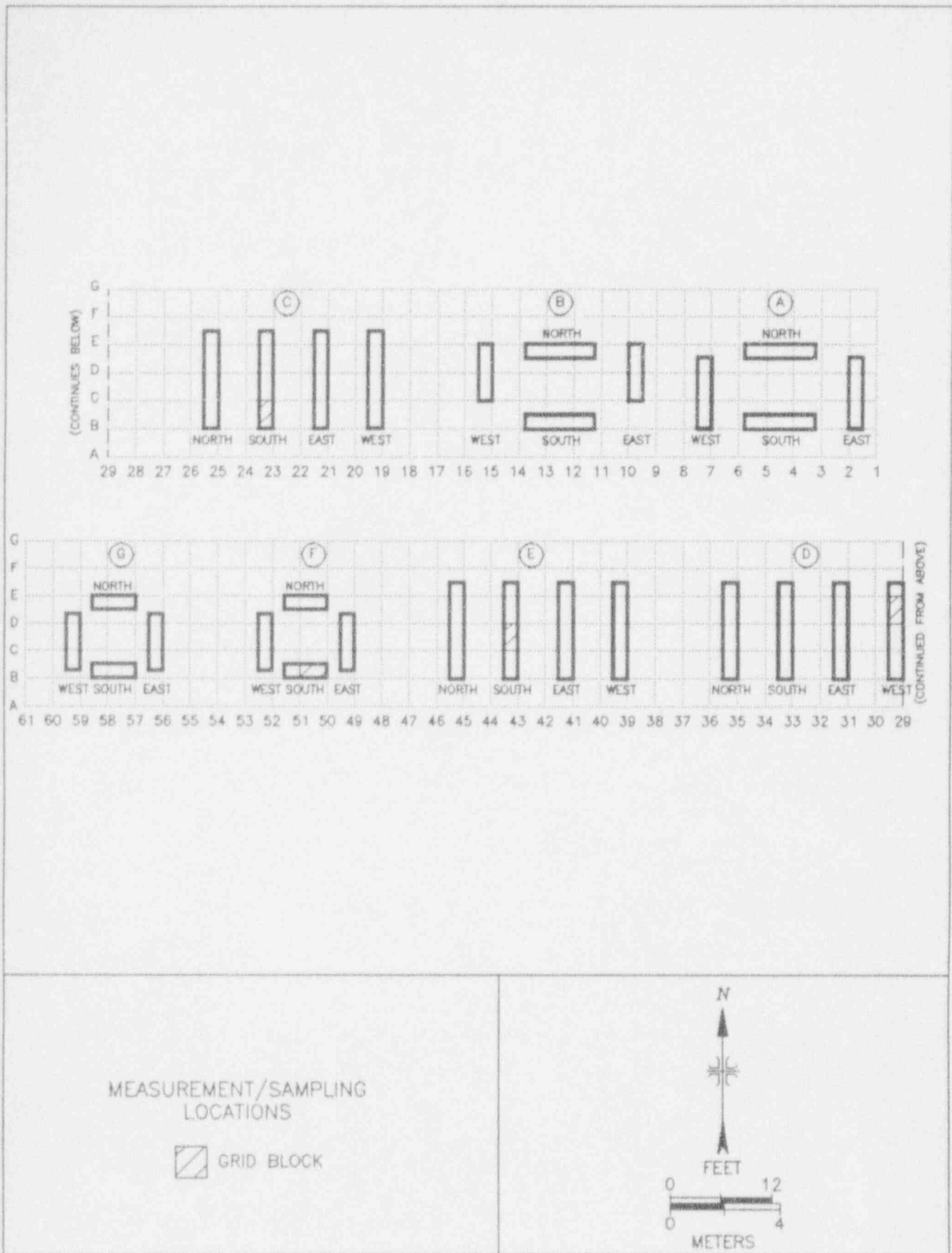
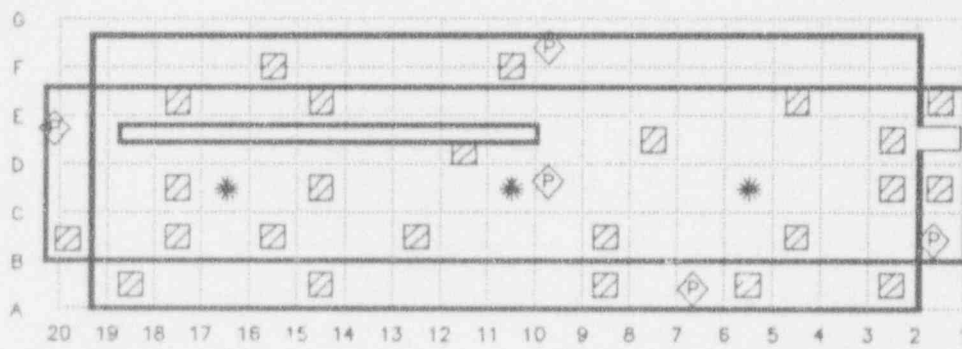


FIGURE 79: Basement, Radwaste Area Columns – Measurement and Sampling Locations

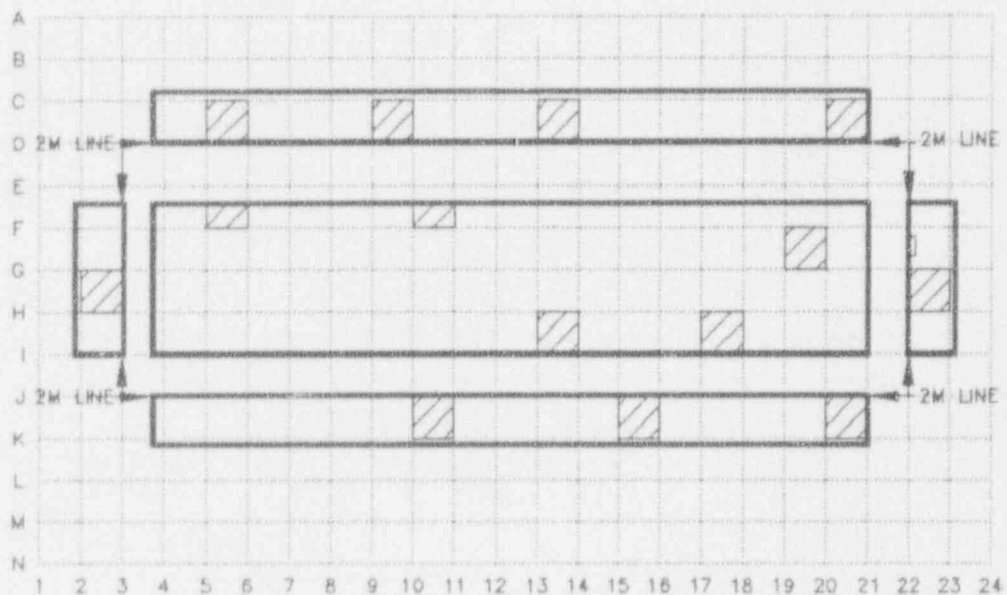


MEASUREMENT/SAMPLING LOCATIONS

-  GRID BLOCK
-  EXPOSURE RATE
-  PAINT SAMPLE



FIGURE 80: L-Building Fuel Vault, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

 GRID BLOCK



FIGURE 81: L-Building Fuel Vault, Upper Walls and Ceiling - Measurement and Sampling Locations

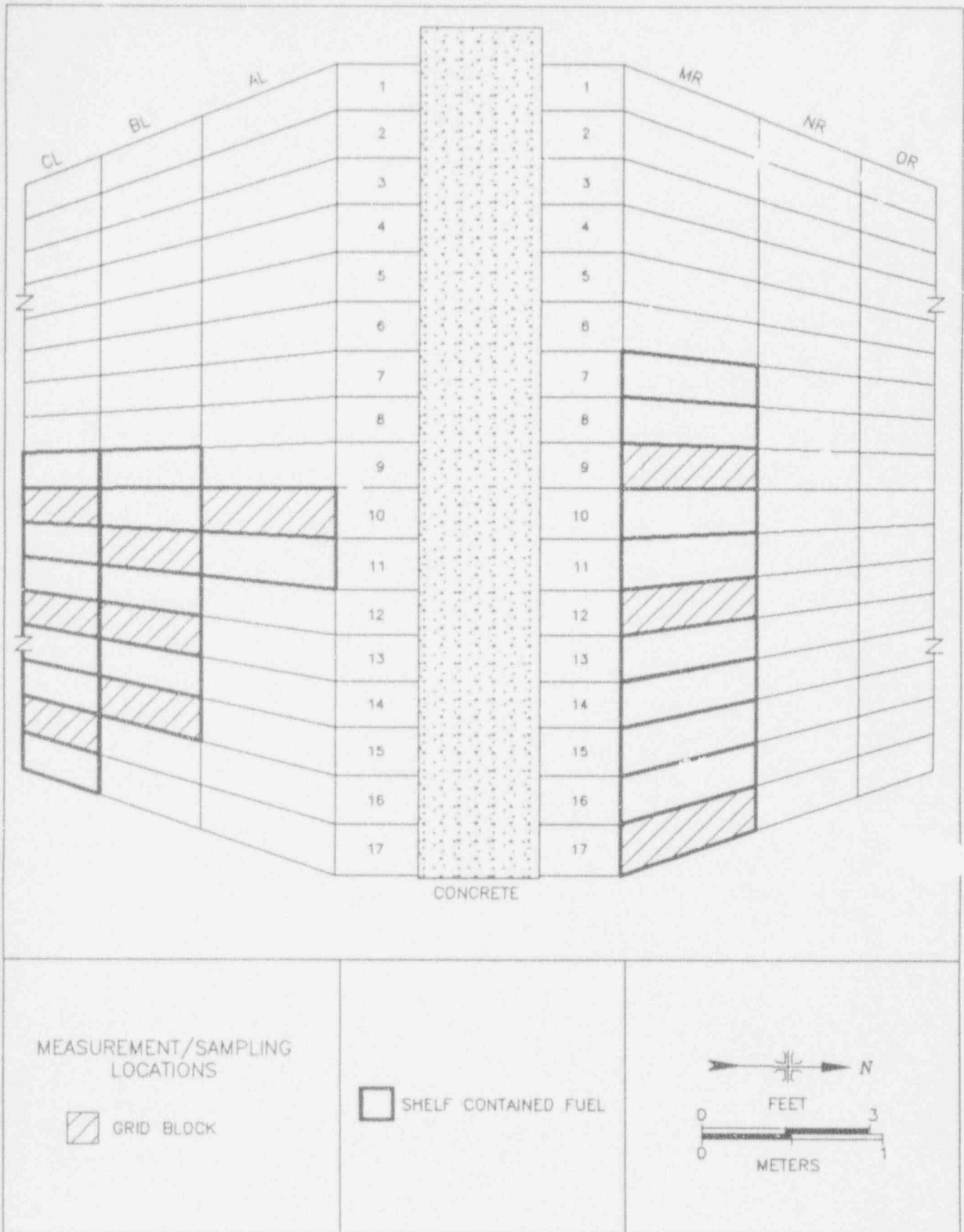
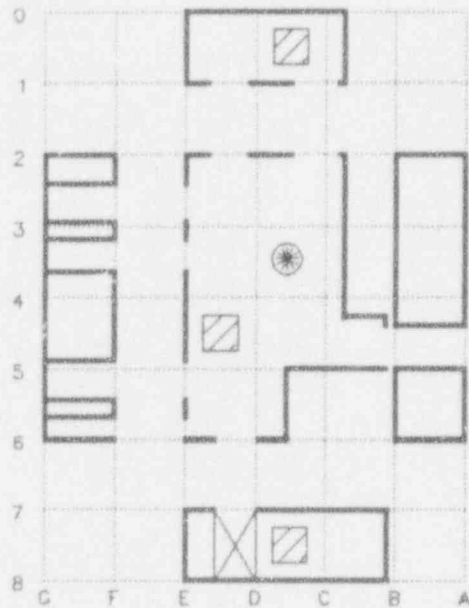


FIGURE 82: L-Building Fuel Vault Storage Shelf Unit - Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS



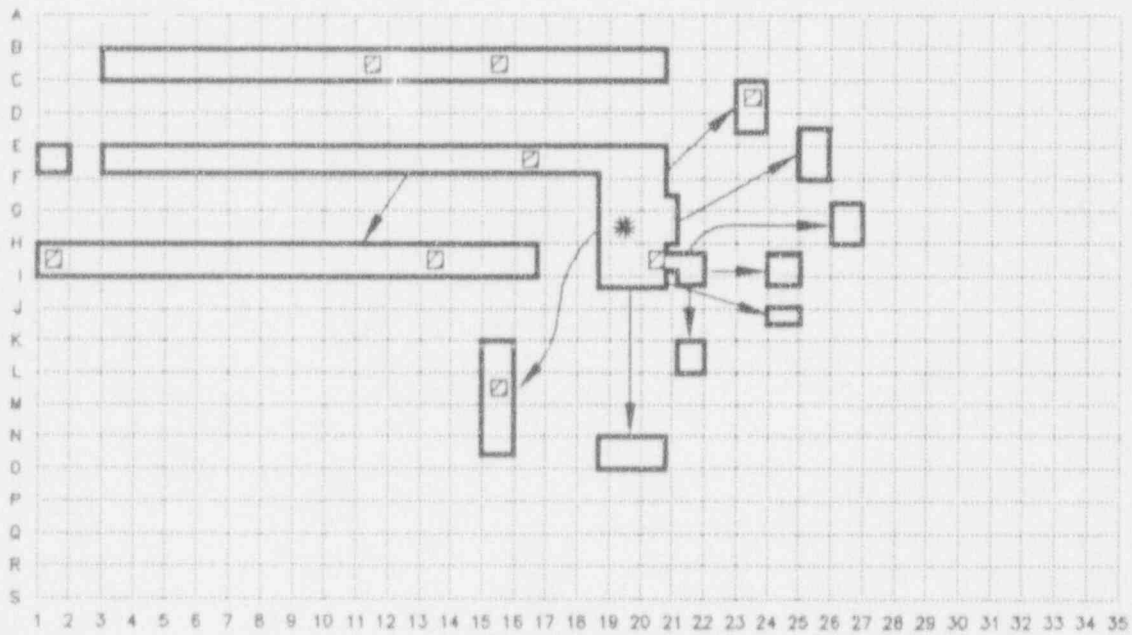
GRID BLOCK



EXPOSURE RATE (BACKGROUND)



FIGURE 83: L-Building Unit III Entry, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS



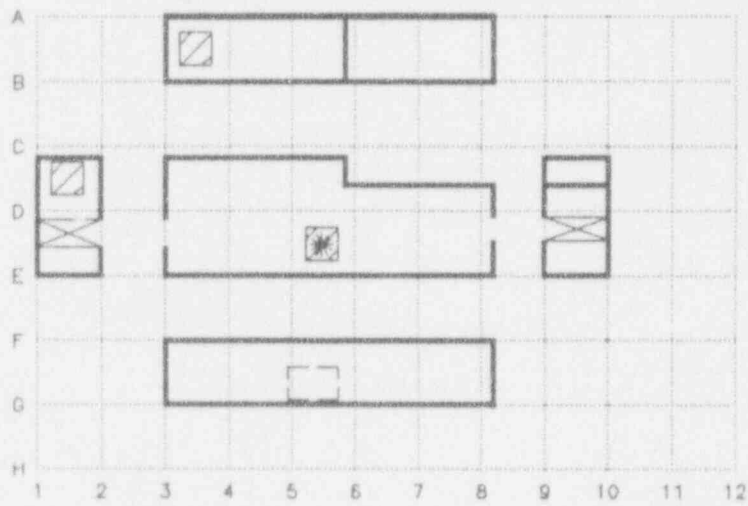
GRID BLOCK



EXPOSURE RATE



FIGURE 84: L-Building, Unit III Hall Area, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS



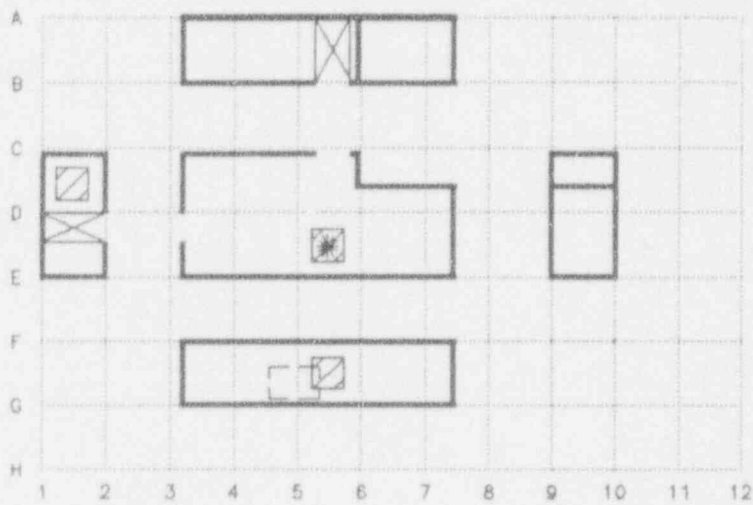
-  GRID BLOCK
-  EXPOSURE RATE



FIGURE 85: L-Building Chem Lab Part A, Lower Walls and Floor – Measurement and Sampling Locations



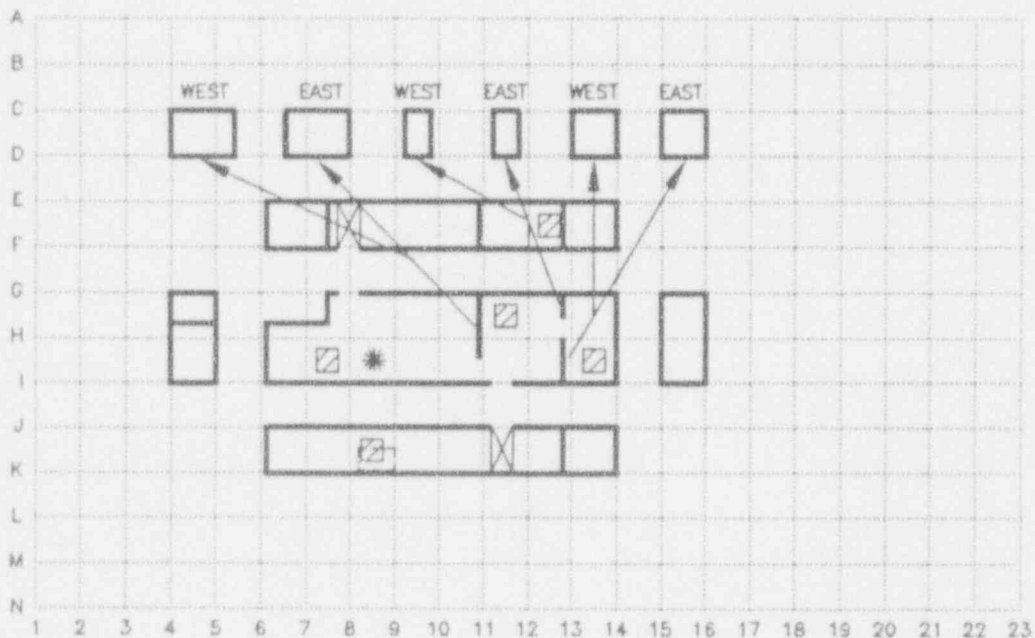
MEASUREMENT/SAMPLING
LOCATIONS

 GRID BLOCK

 EXPOSURE RATE



FIGURE 86: L-Building Chem Lab Part B, Lower Walls and Floor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

 GRID BLOCK

 EXPOSURE RATE



FIGURE 87: L-Building Chem Lab Part C, Lower Walls and Floor -- Measurement and Sampling Locations

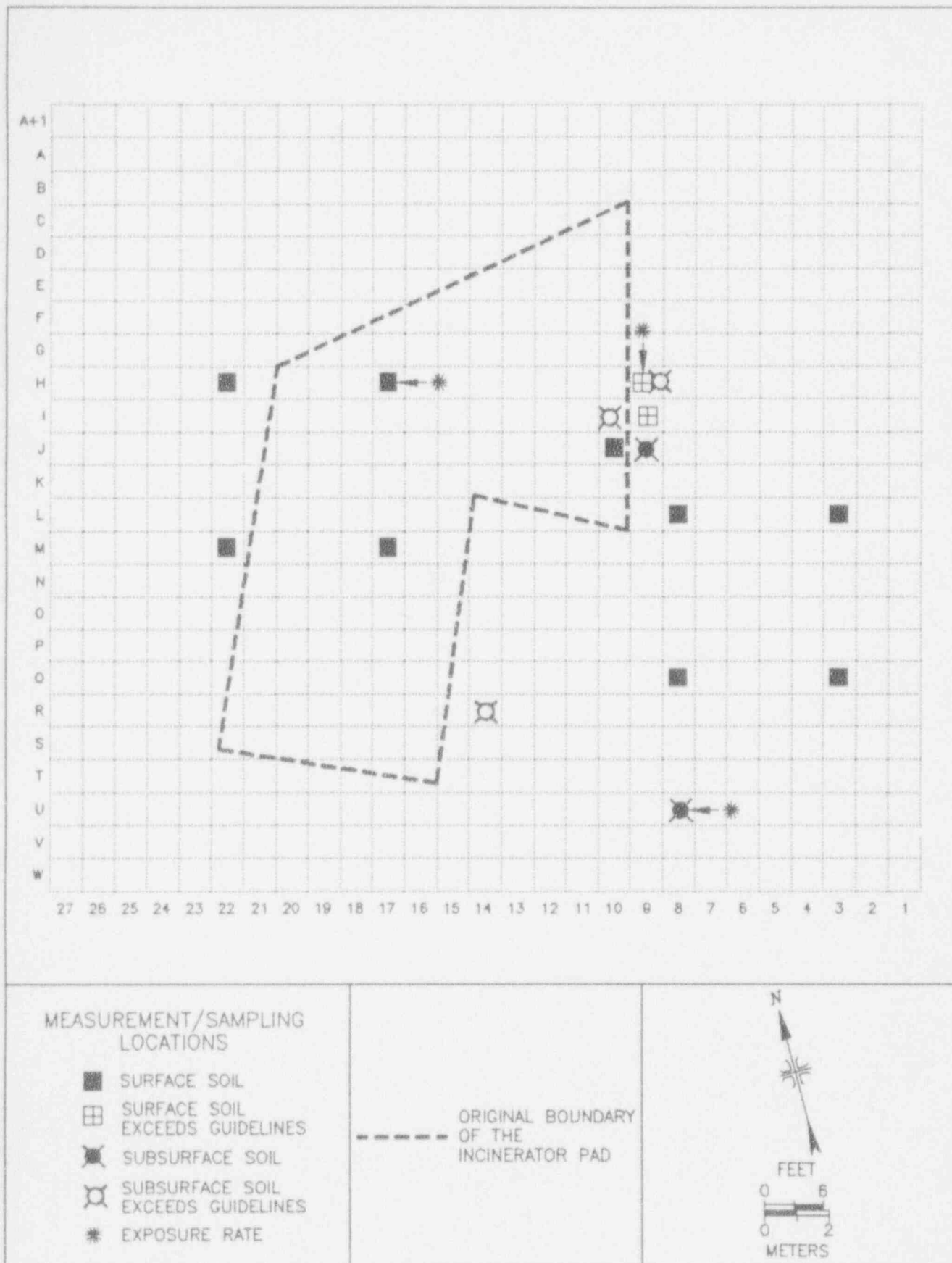


FIGURE 88: Incinerator Pad - Measurement and Sampling Locations

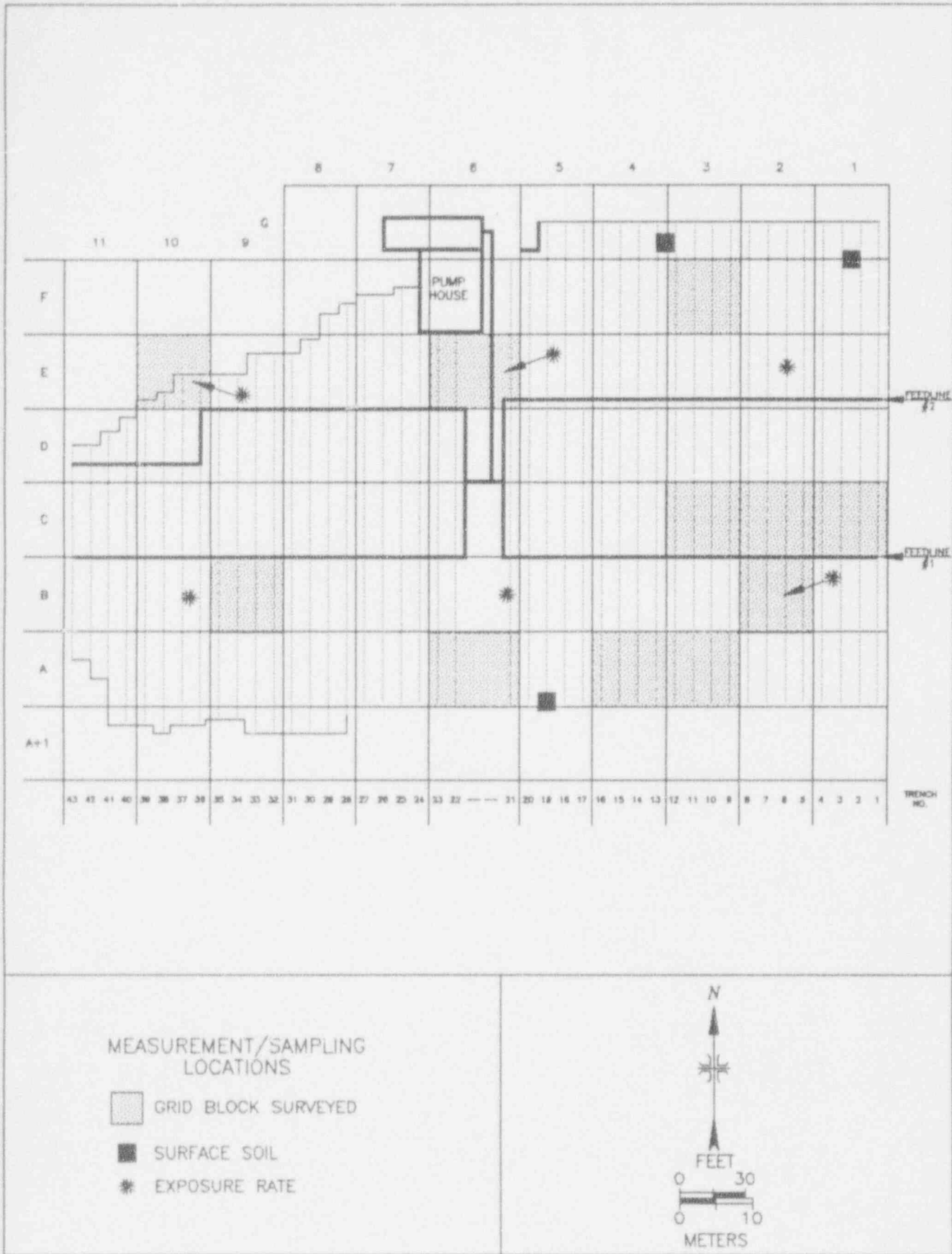
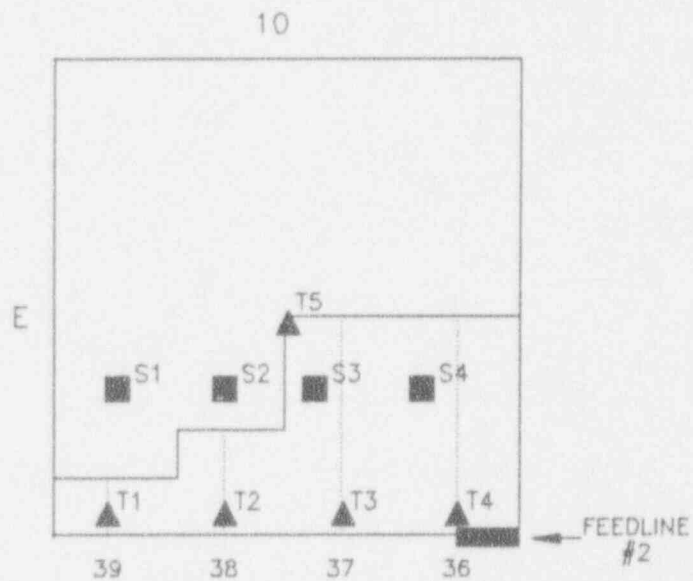


FIGURE 89: Septic Field 1 – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

- SURFACE SOIL
- ▲ TRENCH SAMPLE

TRENCH

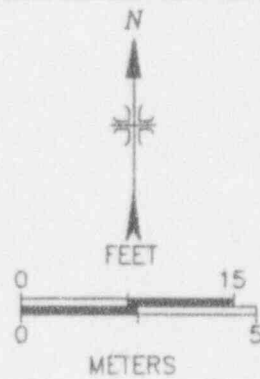
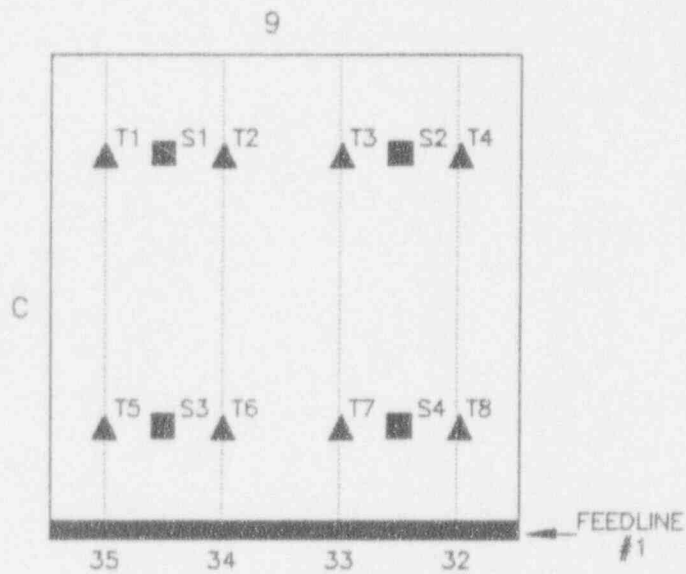


FIGURE 90: Septic Field 1, Grid Block E-10 – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

- SURFACE SOIL
- ▲ TRENCH SAMPLE

TRENCH

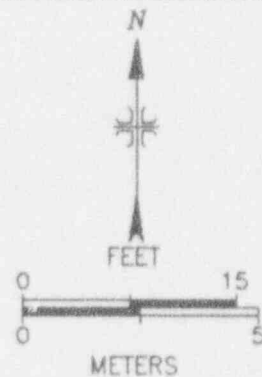


FIGURE 91: Septic Field 1, Grid Block C-9 – Measurement and Sampling Locations

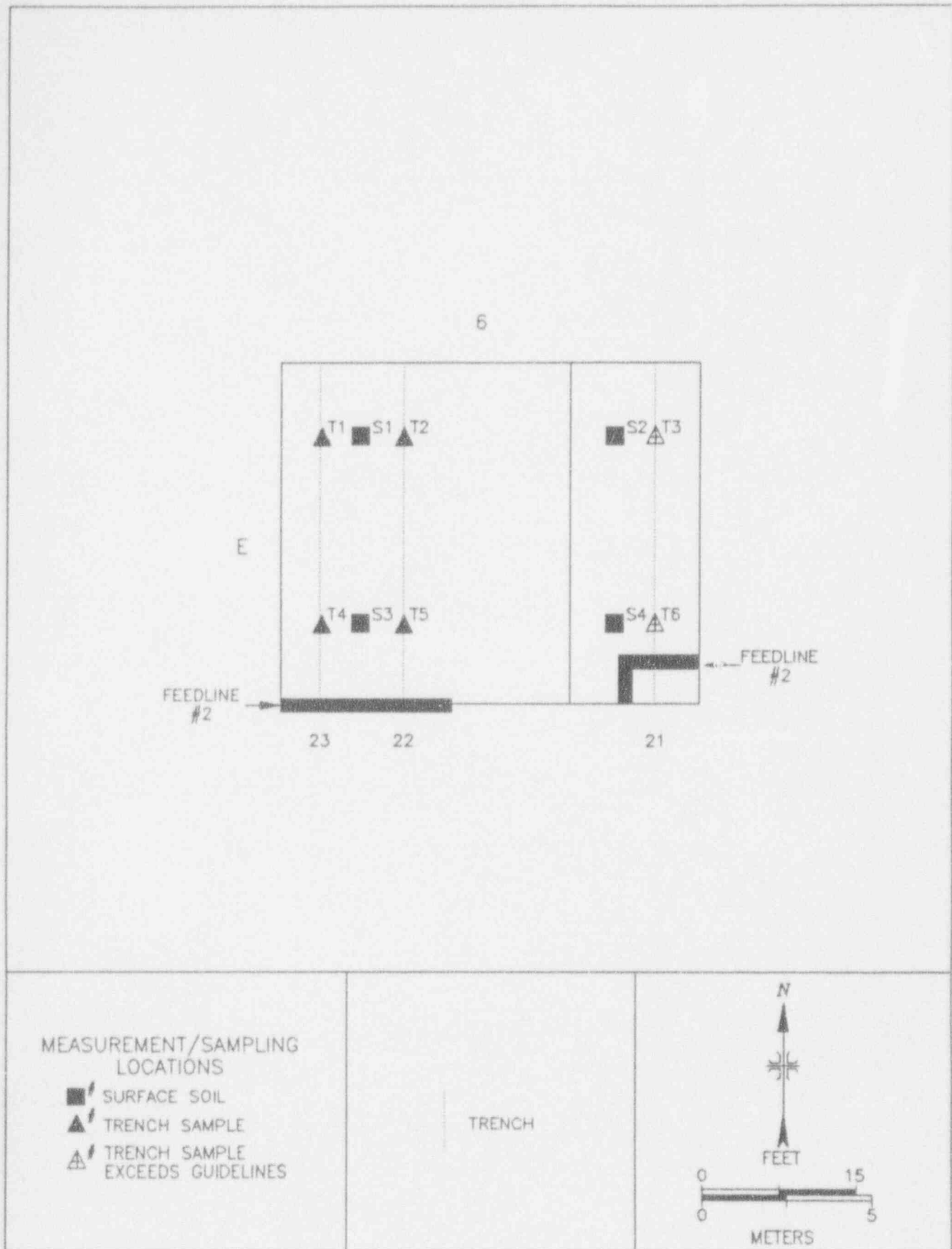
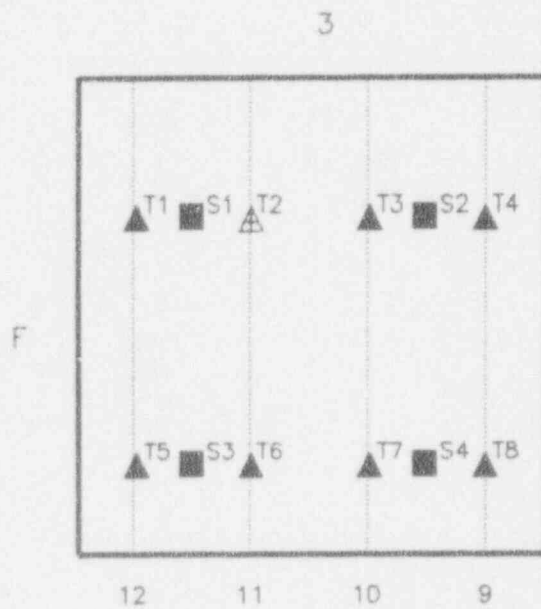


FIGURE 92: Septic Field 1, Grid Block E-6 – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

- SURFACE SOIL
- ▲ TRENCH SAMPLE
- △ TRENCH SAMPLE
EXCEEDS GUIDELINES

— TRENCH

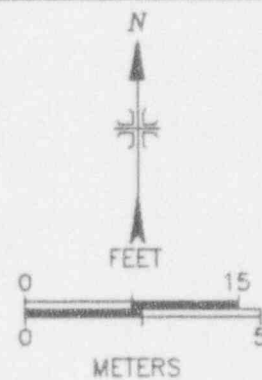


FIGURE 93: Septic Field 1, Grid Block F-3 — Measurement and Sampling Locations

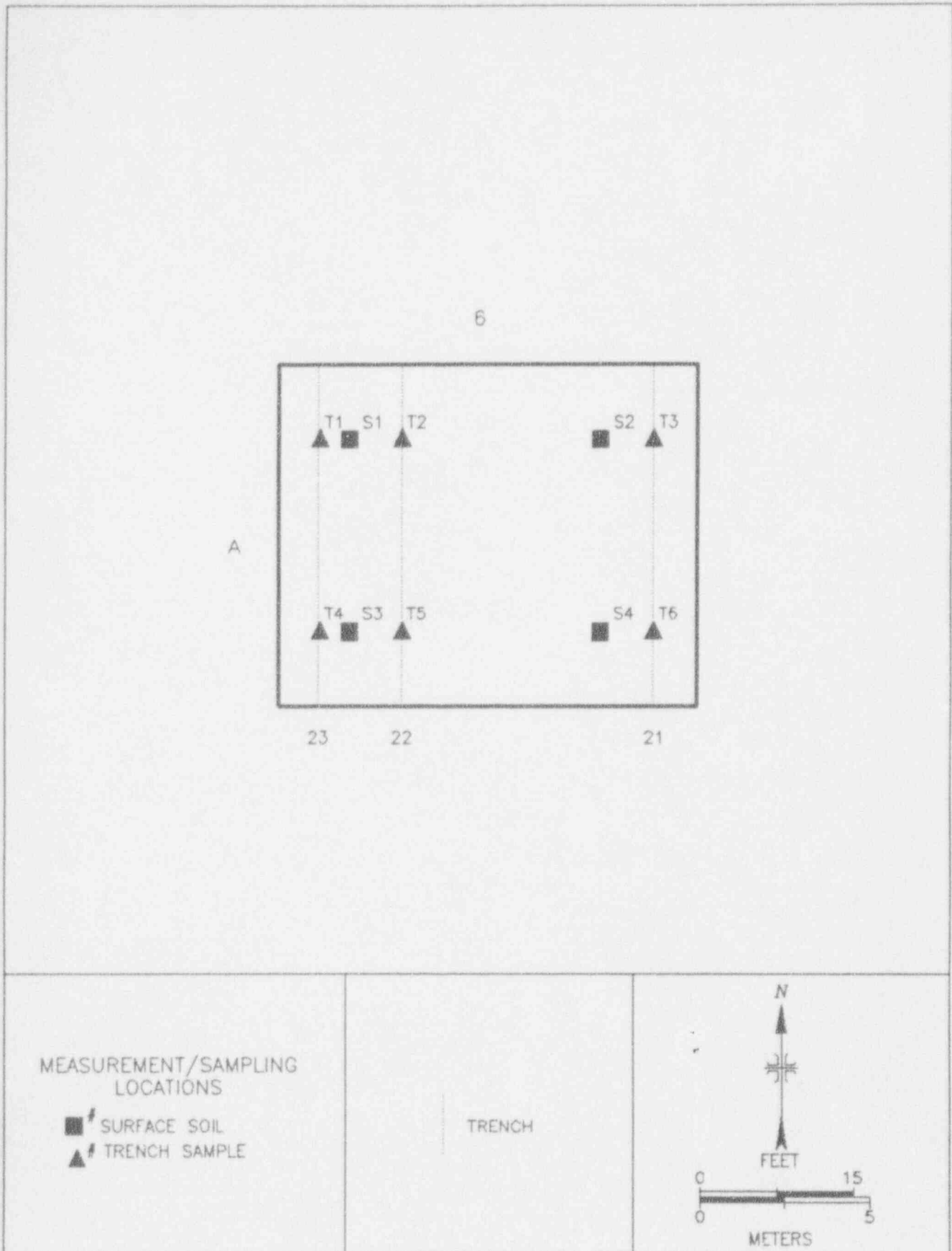
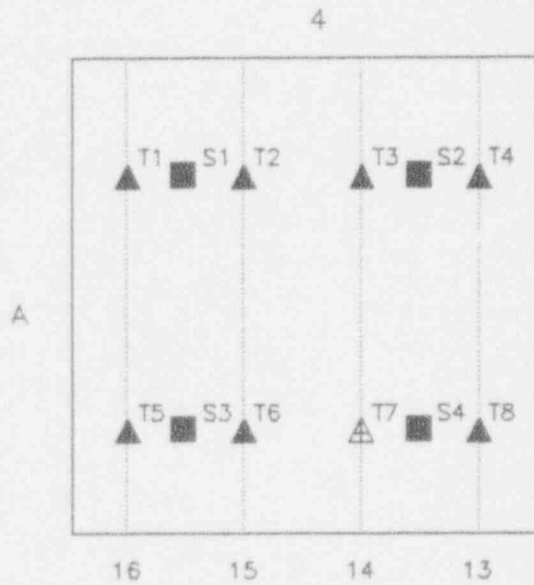


FIGURE 94: Septic Field 1, Grid Block A-6 -- Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

- SURFACE SOIL
- ▲ TRENCH SAMPLE
- ▲ TRENCH SAMPLE EXCEEDS GUIDELINES

TRENCH

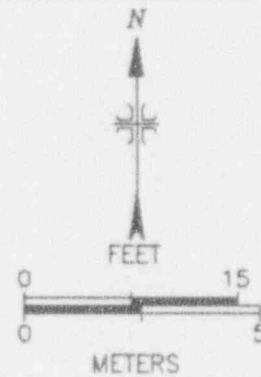


FIGURE 95: Septic Field 1, Grid Block A-4 - Measurement and Sampling Locations

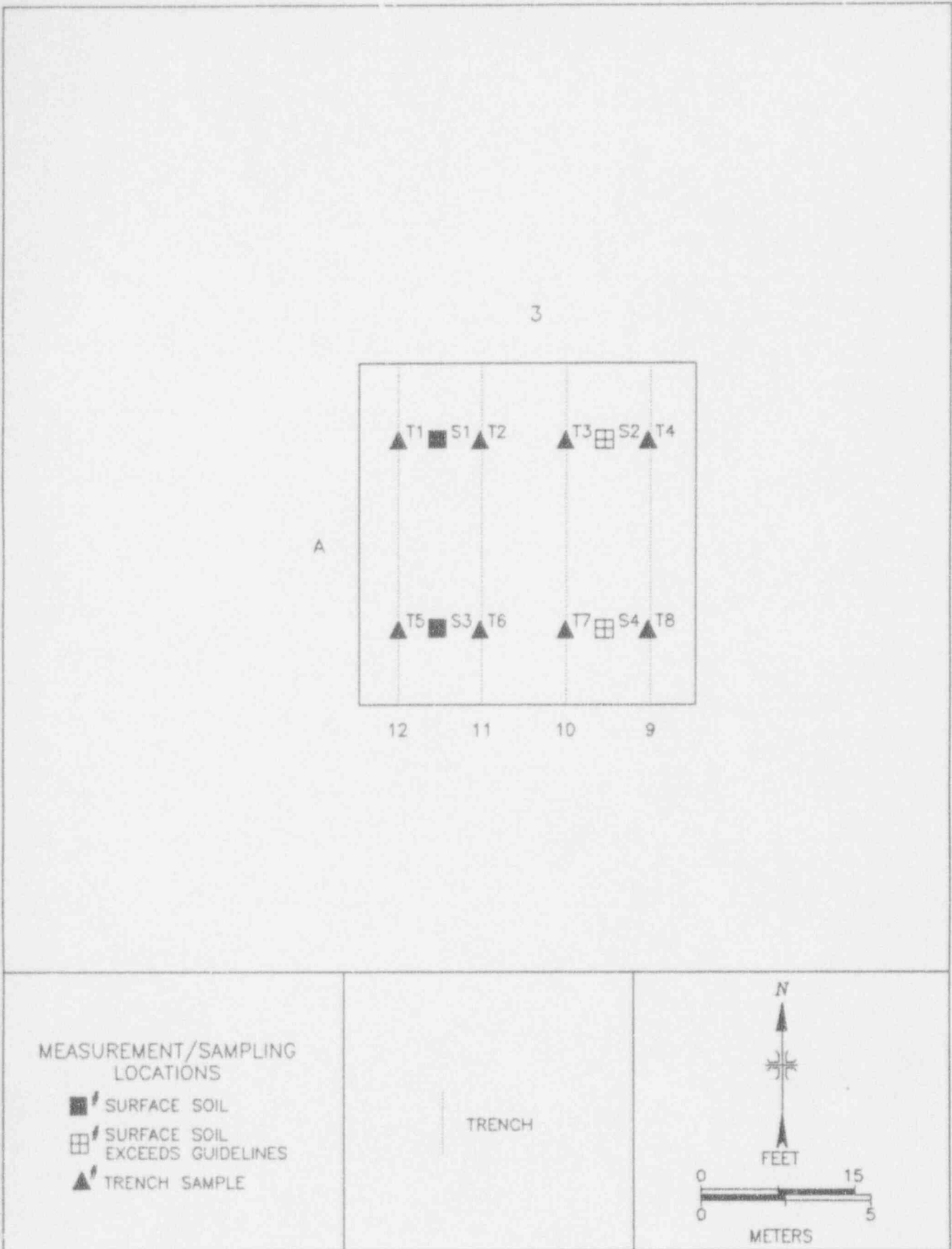
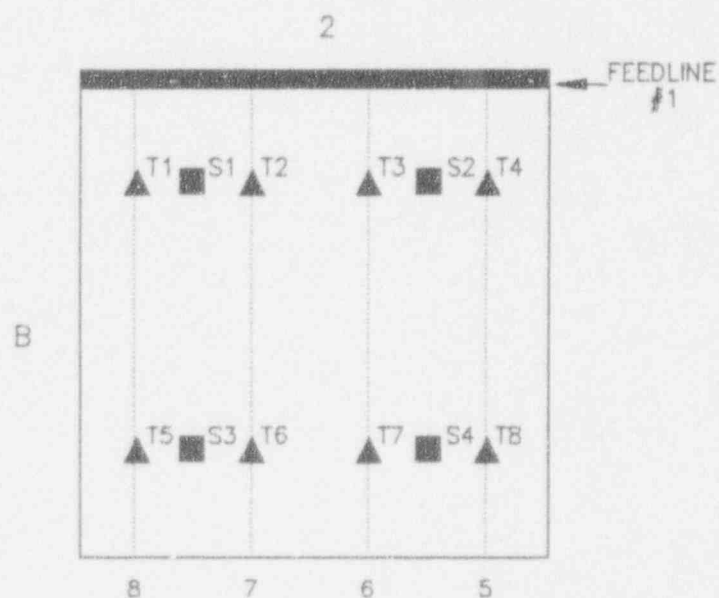


FIGURE 96: Septic Field 1, Grid Block A-3 – Measurement and Sampling Locations



MEASUREMENT/SAMPLING
LOCATIONS

- SURFACE SOIL
- ▲ TRENCH SAMPLE

TRENCH

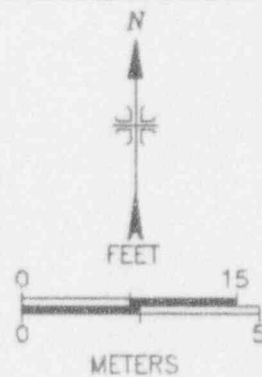


FIGURE 97: Septic Field 1, Grid Block B-2 -- Measurement and Sampling Locations

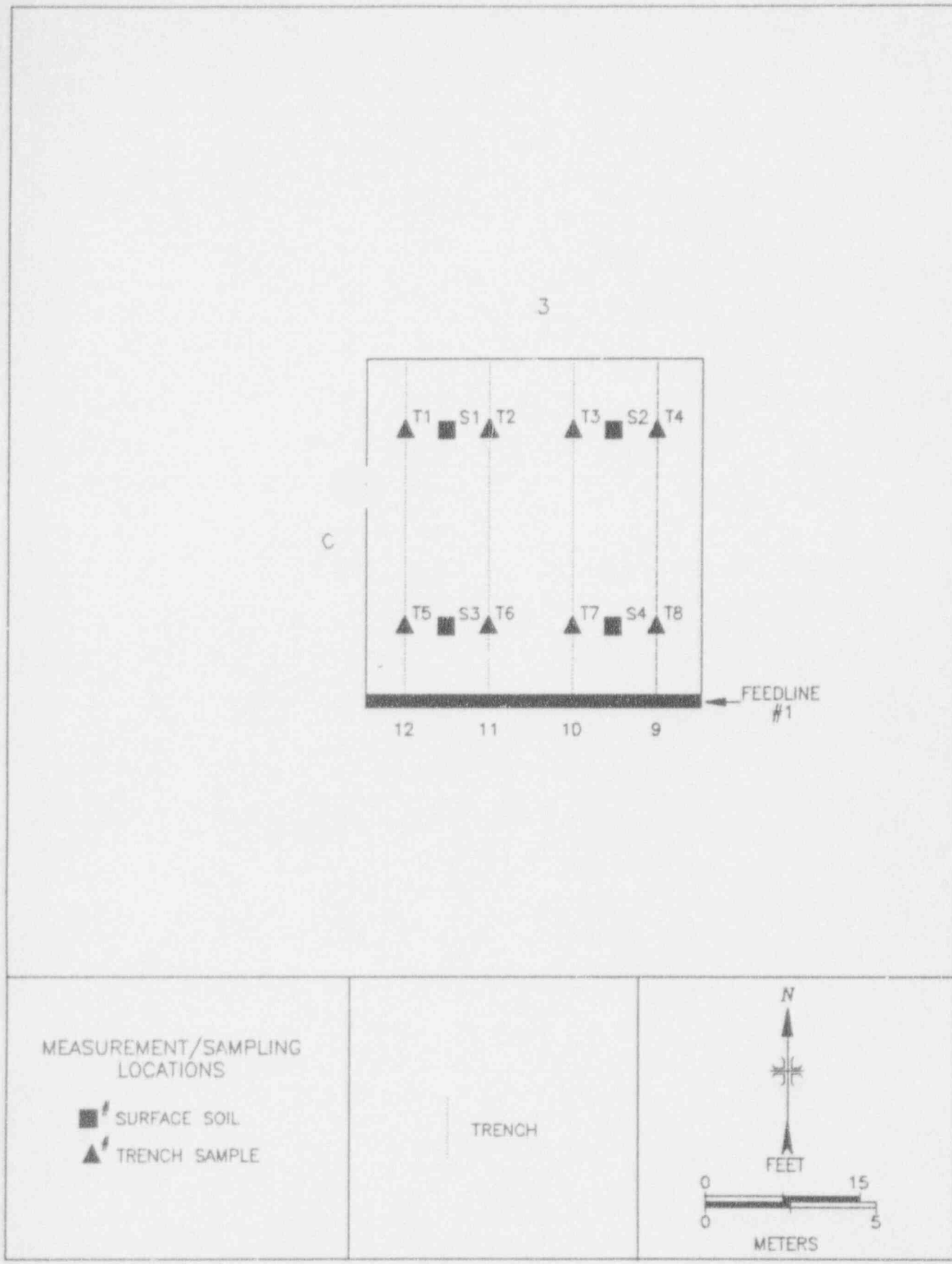


FIGURE 98: Septic Field 1, Grid Block C-3 – Measurement and Sampling Locations

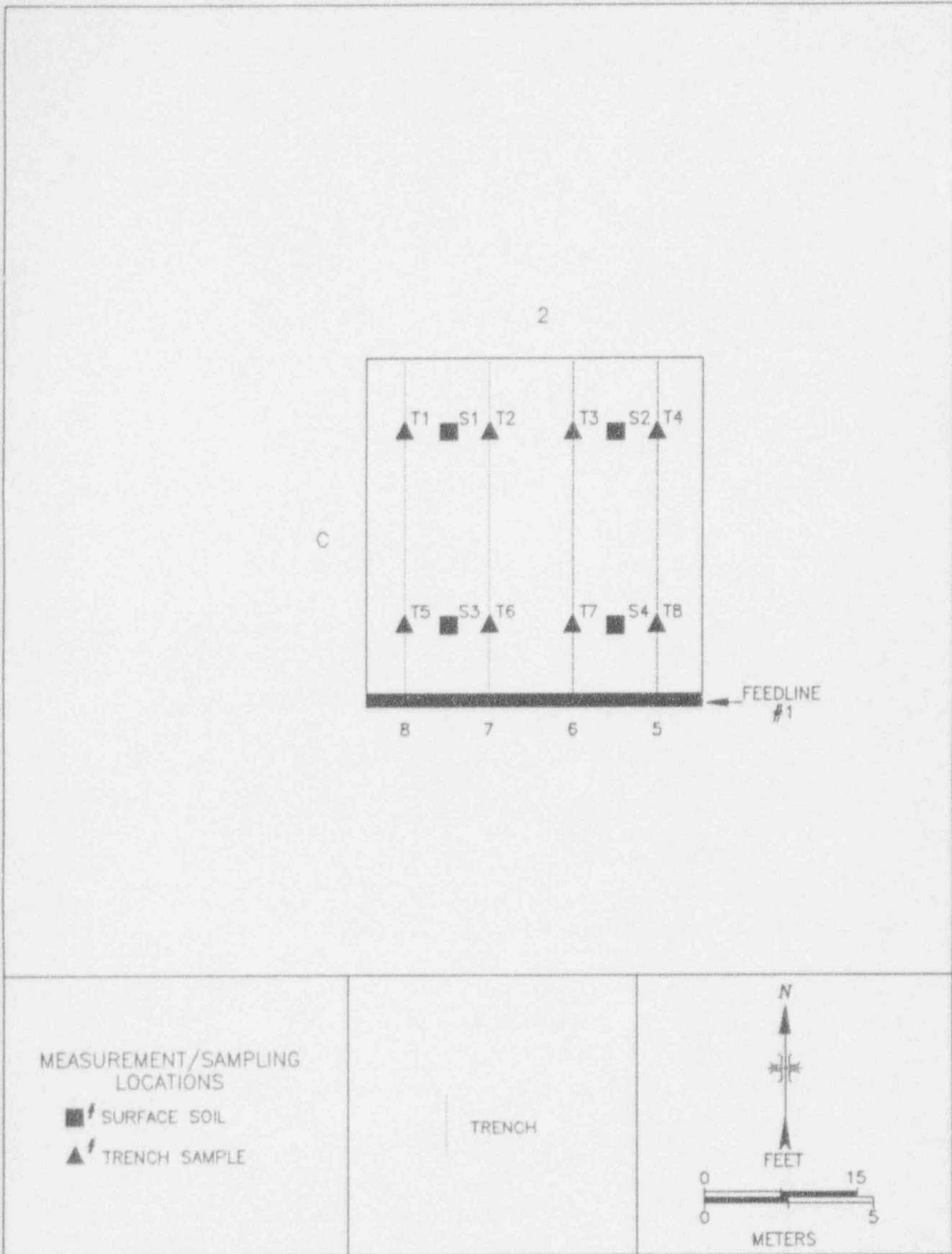


FIGURE 99: Septic Field 1, Grid Block C-2 - Measurement and Sampling Locations

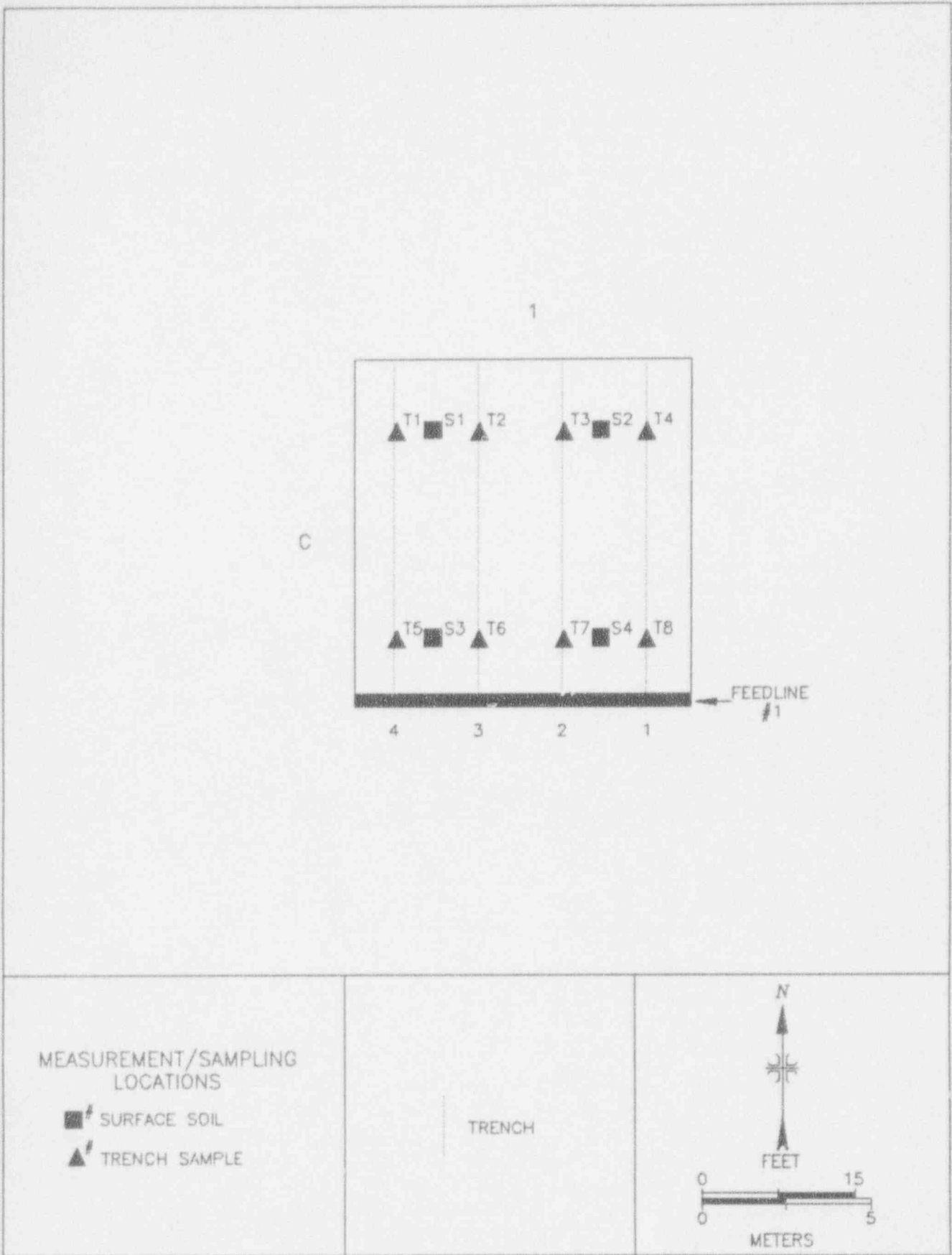


FIGURE 100: Septic Field 1, Grid Block C-1 -- Measurement and Sampling Locations

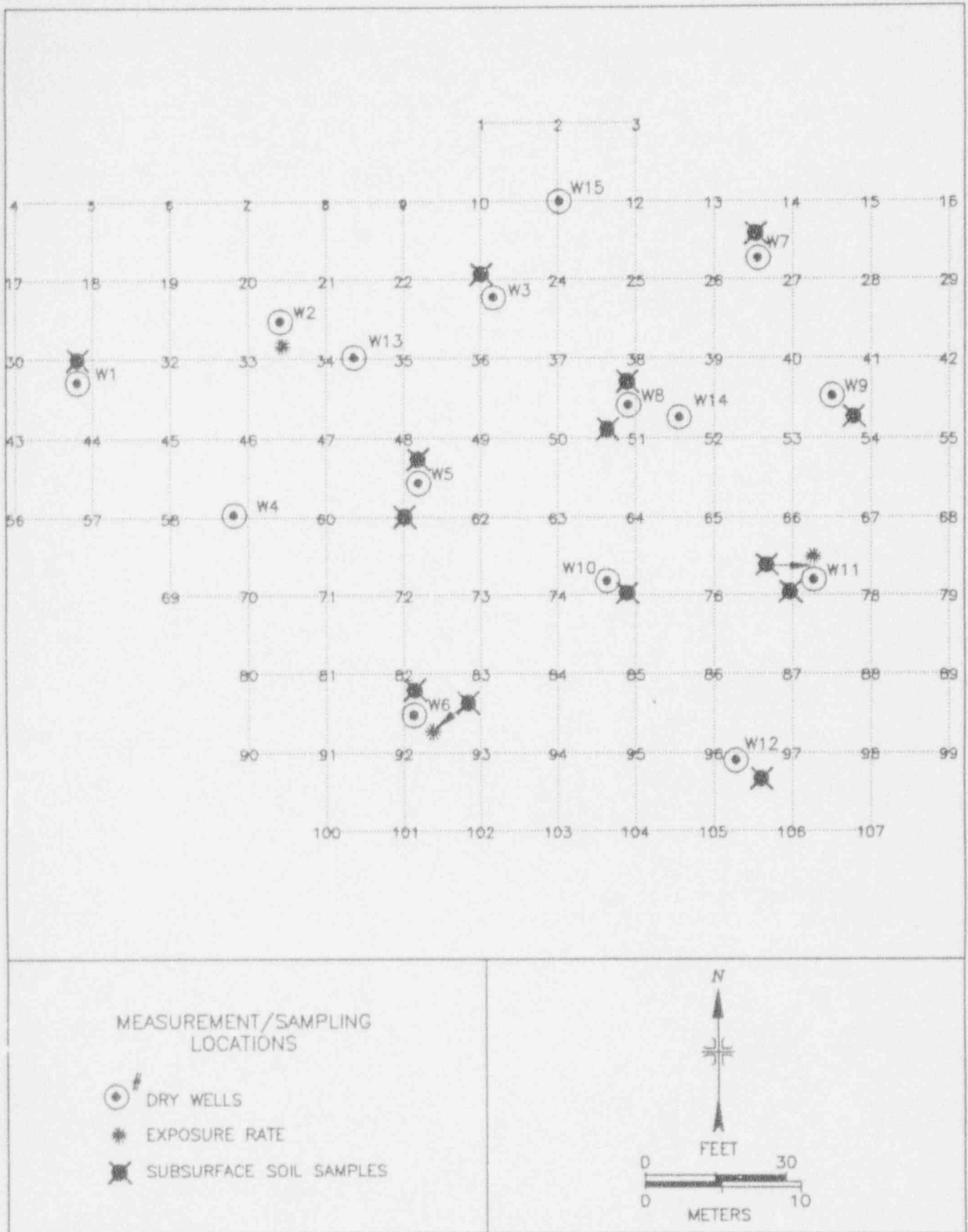


FIGURE 101: Map of UNC Leach Field – Measurement and Sampling Locations

TABLE 1
SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
B-SOUTH AREA AND BUILDING L
UNIT 3 FUEL VAULT AREA
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Unit 1								
Main Room								
Lower Walls and Floor	10	40	<140 - 620	<2000	<140 - 380	<2000	<12 - 23	<15
Upper Walls and Ceiling	11 and 12	6	<140 - 720	<2000	<140 - 250	<2000	<12	<15
Press Pit								
Lower Walls and Floor	13	11	<160	<2000	<160	<2000	<12	<15
Upper Walls and Ceiling	13	1	<160	<2000	<160	<2000	<12	<15
Press Pit Stairs								
Lower Walls and Floor	14	3	<160	<2000	<160	<2000	<12	<15
Upper Walls and Ceiling	14	1	<1600	<2000	<160	<2000	<12	<15

TABLE 1 (Continued)

**SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
B-SOUTH AREA AND BUILDING L
UNIT 3 FUEL VAULT AREA
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT**

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Unit 1 (Continued)								
Elevator Pit								
Lower Walls and Floor	15	3	<140-470	<2000	<140	<2000	<12	<15
Control Room								
Lower Walls and Floor	16	7	<140-210	<2000	<140	<2000	<12-25	<15
Upper Walls and Ceiling	12 and 17	2	<130	<2000	<130	<2000	<12	<15
QC Room								
Lower Walls and Floor	18	18	<140-260	<2000	<140	<2000	<12-25	<15
Upper Walls and Ceiling	19	4	<140-190	<2000	<140	<2000	<12	<15
Argon Room								
Lower Walls and Floor	20	5	<140-210	<2000-2300	<140	<2000	<12	<15
Upper Walls and Ceiling	21	3	<130	<2000	<130	<2000	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Unit 1 (Continued)								
Die Assembly								
Lower Walls and Floor	22	8	<140-320	<2000	<140	<2000	<12	<15
Upper Walls and Ceiling	12 and 23	3	<140	<2000	<140	<2000	<12	<15
Hafnium Weigh Room								
Lower Walls and Floor	24	7	<130	<2000	<130	<2000	<12	<15
Upper Walls and Ceiling	12 and 25	3	<130	<2000	<130	<2000	<12	<15
Locker Room								
Lower Walls and Floor	26	10	<130-620	<2000	<130	<2000	<12	<15
Upper Walls and Ceiling	26	2	<140	<2000	<140	<2000	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Unit 1 (Continued)								
Shower								
Lower Walls and Floor	26	3	<130-200	<2000-2900	<130	<2000-2300	<12	<15
Upper Walls and Ceiling	26	1	<140	<2000	<140	<2000	<12	<15
Vestibule								
Lower Walls and Floor	27	7	<140-360	<2000	<140	<2000	<12	<15
Upper Walls and Ceiling	28	2	<140	<2000	<140	<2000	<12	<15
Unit 2								
Main Room								
Lower Walls and Floor	29	51	<130-490	<2000-3000	<130-210	<2000	<12	<15
Upper Walls and Ceiling	30	15	<130	<2000	<130	<2000	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Unit 2 (Continued)								
Press Pit								
Lower Walls and Floor	31	12	< 80-160	< 1400	< 80	< 1400	< 12-13	< 15
Upper Walls and Ceiling	31	4	< 80	< 1400	< 80	< 1400	< 12	< 15
Press Pit Stairs								
Lower Walls and Floor	32	6	< 70-150	< 1400	< 70	< 1400	< 12	< 15
Elevator Pit								
Lower Walls and Floor	32	3	< 70-140	< 1400	< 70	< 1400	< 12	< 15
S-Box/Control Rooms								
Lower Walls and Floor	33	19	< 130-270	< 2000-2200	< 130	< 2000	< 12	< 15
Upper Walls and Ceiling	34	6	< 130	< 2000	< 130	< 2000	< 12	< 15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Unit 2 (Continued)								
A-B Space								
Lower Walls and Floor	35	53	<100-2000	<2100	<100-610	<2100	<12	<15-16
Upper Walls and Ceiling	36	7	<130	<2000	<130	<2000	<12	<15
Argon Room								
Lower Walls and Floor	37	4	<140-210	<2000	<140	<2000	<12	<15
Upper Walls and Ceiling	38	2	<140	<2000	<140	<2000	<12	<15
Shower and Locker Rooms								
Lower Walls and Floor	39 and 40	13	<40-180	<2000-2900	<40-50	<2000-2500	<12	<15
Upper Walls and Ceiling	34	1	<130	<2000	<130	<2000	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Unit 1 & 2 Common Areas								
Hallway								
Lower Walls and Floor	41	24	<140-170	<2000	<140	<2000	<12	<15
Upper Walls and Ceiling	41	4	<140	<2000	<140	<2000	<12	<15
Raw Fuel Vault								
Lower Walls and Floor	42	14	<130-590	<2000	<130-410	<2000	<12	<15
Upper Walls and Ceiling	42	5	<140-140	<2000	<140	<2000	<12-17	<15
Raw Fuel Vault Columns								
Lower Walls and Floor	43	9	<130-180	<2000	<130	<2000	<12	<15
Upper Walls and Ceiling	43	5	<130	<2000	<130	<2000	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Unit 1 & 2 Common Areas (Continued)								
Scrap Vault								
Lower Walls and Floor	44	17	<130-300	<2000	<130	<2000	<12	<15
Upper Walls and Ceiling	44	3	<130	<2000	<130	<2000	12	<15
Support Areas								
Pack Assembly								
Lower Walls and Floor	45	30	<100-420	<2100	<100-160	<2100	<12	<15
Upper Walls and Ceiling	46	48	<100-160	<2100	<100	<2100	<12	<15-16
Metallurgy Lab. Sample Preparation								
Lower Walls and Floor	47	9	<150-1000	<2100	<150-300	<2100	<12	<15-20
Upper Walls and Ceiling	47	3	<130	<2100	<130	<2100	<12	<15-16

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Support Areas (Continued)								
Metallurgy Lab. Reading Area								
Lower Walls and Floor	48	16	<130-160	<2100-2900	<130-150	<2100	<12	<15-15
Upper Walls and Ceiling	48 and 49	7	<130	<2100	<130	<2100	<12	<15
Metallurgy Lab. Wash Room								
Lower Walls and Floor	50	2	<130-750	<2100	<240	<2100	<12	<15
Upper Walls and Ceiling	50	1	<130	<2100	<130	<2100	<12	<15
Metallurgy Lab. Records Storage								
Lower Walls and Floor	51	3	<150-540	<2100	<150	<2100	<12	<15-18
Upper Walls and Ceiling	51	1	<130	<2100	<130	<2100	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Metallurgy Lab. Office								
Lower Walls and Floor	52	2	<150-260	<2100	<150	<2100	<12	<15
Upper Walls and Ceiling	52	1	<150	<2100	<150	<2100	<12	<15
Metallurgy Lab. Supply Storage								
Lower Walls and Floor	53	5	<180	<2200-2200	<180	<2200	<12	<15
Upper Walls and Ceiling	53	1	<180	<2200	<180	<2200	<12	<15
Chemistry Lab. Main Area								
Lower Walls and Floor	54	27	<150-280	<2100-2800	<150	<2100	<12	<15-21
Upper Walls and Ceiling	55	5	<130	<2100	<130	<2100	<12	<15-21
Chemistry Lab. Mass Spec Room								
Lower Walls and Floor	56	5	<180-190	<2200-2500	<180	<2200	<12	<15
Upper Walls and Ceiling	56	1	<180	<2200	<180	<2200	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Support Areas (Continued)								
Chemistry Lab. C-Lab 1								
Lower Walls and Floor	57	8	<180-320	<2200	<180	<2200	<12	<15-22
Upper Walls and Ceiling	57	1	<180	<2200	<180	<2200	<12	<15
Chemistry Lab. C-Lab 2								
Lower Walls and Floor	58	3	<180-390	<2200	<180	<2200	<12	<15
Upper Walls and Ceiling	58	1	<180	<2200	<180	<2200	<12	<15
Chemistry Lab. C-Lab 3								
Lower Walls and Floor	59	3	<180	<2200	<180	<2200	<12	<15
Upper Walls and Ceiling	59	1	<180	<2200	<180	<2200	<12	<15
Chemistry Lab. Spectroscopy Room								
Lower Walls and Floor	60	7	<130	<2100	<130	<2100	<12	<15-15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Support Areas (Continued)								
Upper Walls and Ceiling	60	1	<130	<2100	<130	<2100	<12	<15
Chemistry Lab. ISAF A								
Lower Walls and Floor	61	2	<130	<2100	<130	<2100	<12	<15
Upper Walls and Ceiling	61	1	<130	<2100	<130	<2100	<12	<16
Chemistry Lab. ISAF B								
Lower Walls and Floor	62	3	<130	<2100	<130	<2100	<12	<15
Upper Walls and Ceiling	62	1	<130	<2100	<130	<2100	<12	<15
Chemistry Lab. ISAF C								
Lower Walls and Floor	63	2	<130-160	<2100	<130	<2100	<12	<15
Upper Walls and Ceiling	63	1	<130-180	<2100	<130	<2100	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Support Areas (Continued)								
Sectioning. Main Room								
Lower Walls and Floor	64	19	<130-240	<2100	<130	<2100	<12	<15-16
Upper Walls and Ceiling	64 and 65	11	<130	<2100	<130	<2100	<12	<15
Sectioning. Locker Room								
Lower Walls and Floor	66	6	<130	<2100	<130	<2100	<12	<15-19
Upper Walls and Ceiling	66	4	<130-140	<2100-2400	<130	<2100	<12	<15
Old Decon								
Lower Walls and Floor	67	13	<130-220	<2100	<130	<2100	<12	<15-28
Upper Walls and Ceiling	67 and 68	6	<130	<2100	<130	<2100	<12	<15-18
New Decon								
Lower Walls and Floor	69	21	<130-160	<2100-2500	<130	<2100	<12	<15-25

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Support Areas (Continued)								
Upper Walls and Ceiling	69 and 70	11	<130	<2100	<130	<2100	<12	<15-15
Drum Scan Room								
Lower Walls and Floor	71	4	<130	<2100-2400	<130	<2100	<12	<15-15
Upper Walls and Ceiling	71	1	<130-290	<2100	<130	<2100	<12	<15
B-South Men's Room								
Lower Walls and Floor	72	2	<180	<2200	<180	<2200	<12	<15
Upper Walls and Ceiling	72	1	<180	<2200	<180	<2200	<12	<15
B-South Women's Room								
Lower Walls and Floor	73	2	<180	<2200-3300	<180	<2200-2200	<12	<15
Upper Walls and Ceiling	73	1	<180	<2200	<180	<2200	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Support Areas (Continued)								
Basement HP Office								
Lower Walls and Floor	74	11	<130-140	<2100-2500	<130	<2100	<12	<15-15
Upper Walls and Ceiling	74	3	<130	<2100	<130	<2100	<12	<15
Basement Rad Waste Storage								
Lower Walls and Floor	75	10	<130-160	<2100-2400	<130	<2100	<12	<15
Upper Walls and Ceiling	75	7	<180	<2200	<180	<2200	<12	<15
Basement Rad Waste Area								
Lower Walls and Floor	76	29	<150-1700	<2100-2500	<180	<2100	<12	<15-26
Upper Walls and Ceiling	76 and 77	16	<180-270	<2200-2200	<180	<2200	<12	<15-19
Basement Stairs								
Lower Walls and Floor	78	4	<130	<2100	<130	<2100	<12	<15-15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Support Areas (Continued)								
Basement Columns								
Lower Walls and Floor	79	3	< 130-270	< 2100-2400	< 130	< 2100	< 12	< 15
Upper Walls and Ceiling	79	1	< 130	< 2100	< 130	< 2100	< 12	< 15
Building L								
Fuel Vault								
Lower Walls and Floor	80	24	< 50-130	< 2100	< 130	< 2100	< 12	< 15
Upper Walls and Ceiling	81	14	< 130-200	< 2000	< 130	< 2000	< 12	< 15
Fuel Vault Storage Drawers								
Lower Walls and Floor	82	10	< 140-890	< 2000	< 140-260	< 2000	< 12-21	< 15
Unit 3 Entry								
Lower Walls and Floor	83	3	< 130	< 2000	< 130	< 2000	< 12	< 15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
 B-SOUTH AREA AND BUILDING L
 UNIT 3 FUEL VAULT AREA
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location	Figure Number	Number of Grid Block Measurements	Range of Total Activity (dpm/100 cm ²)				Range of Removable Activity (dpm/100 cm ²)	
			Single Measurement		Grid Block Average		Alpha	Beta
			Alpha	Beta	Alpha	Beta		
Building L (Continued)								
Unit 3 Hall								
Lower Walls and Floor	84	8	<50	<2100	<50	<2100	<12	<15
Chemistry Lab A								
Lower Walls and Floor	85	3	<130	<2000	<130	<2000	<12	<15
Chemistry Lab B								
Lower Walls and Floor	86	3	<130	<2000	<130	<2000	<12	<15
Chemistry Lab C								
Lower Walls and Floor	87	5	<130	<2000	<130	<2000	<12	<15

TABLE 2
EXPOSURE RATE MEASUREMENTS
FOR INTERIOR AREAS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Figure Number	Exposure Rate at 1 m above surface (μ R/h)
Unit 1		
Main Room	10	12
Main Room	10	11
Main Room	10	11
Press Pit	13	14
Press Pit Stairs	14	13
Elevator Pit	15	12
Control Room	16	13
Q.C. Room	18	14
Q.C. Room	18	14
Argon Room	20	15
Die Assembly	22	12
Hafnium Weigh Room	24	12
Locker Room	26	13
Shower	26	13
Vestibule	27	13
Unit 2		
Main Room	29	14
Main Room	29	12
Press Pit	31	13

TABLE 2 (Continued)

EXPOSURE RATE MEASUREMENTS
FOR INTERIOR AREAS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Figure Number	Exposure Rate at 1 m above surface (μ R/h)
Unit 2 (Continued)		
Elevator Pit	32	12
S-Box Room	33	13
Control Room*	33	12
A-B Space	35	13
A-B Space	35	12
Argon Room	37	14
Locker Room*	39	12
Shower	40	13
Unit 1 and 2 Common Areas		
Hallway	41	11
Hallway	41	13
Hallway	41	13
Raw Fuel Vault	42	12
Scrap Vault	43	13
Scrap Vault	43	12
Support Areas		
Pack Assembly		
Pack Assembly (Room 3A)	45	13
Pack Assembly (Room 3)	45	13

TABLE 2 (Continued)

EXPOSURE RATE MEASUREMENTS
FOR INTERIOR AREAS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Figure Number	Exposure Rate at 1 m above surface (μ R/h)
Metallurgy Lab		
Sample Preparation	47	11
Sample Preparation	47	11
Reading Area	48	12
Reading Area	48	11
Reading Area	48	12
Records Storage	51	12
Office	52	12
Supply Storage	53	13
Chemistry Lab		
Main Area	54	12
Main Area	54	11
Main Area	54	11
Main Area	54	11
Main Area	54	12
Mass Spectrometer Room	56	12
C-Lab 1	57	13
C-Lab 1	57	12
C-Lab 2	58	13
C-Lab 3	59	12
Spectroscopy Room	60	12

TABLE 2 (Continued)

EXPOSURE RATE MEASUREMENTS
FOR INTERIOR AREAS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Figure Number	Exposure Rate at 1 m above surface (μ R/h)
Chemistry Lab (Continued)		
ISAF A	61	12
ISAF B	62	13
ISAF C	63	12
Sectioning		
Main Room	64	12
Main Room	64	13
Main Room	64	13
Locker Room	66	14
Old Decon	67	12
Old Decon	67	12
Old Decon	67	13
New Decon	69	11
New Decon	69	10
New Decon	69	11
Drum Scan Room	71	13
B-South		
Men's Room	72	14
Men's Room	72	13
Women's Room	73	14
Women's Room	73	13

TABLE 2 (Continued)

EXPOSURE RATE MEASUREMENTS
FOR INTERIOR AREAS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Figure Number	Exposure Rate at 1 m above surface (μ R/h)
B-South (Continued)		
Women's Room	73	14
Basement		
H.P. Office	74	14
Radwaste Storage Area	75	14
Radwaste Area	76	14
Radwaste Area	76	14
Radwaste Area	76	14
L-Building		
Fuel Vault	80	13
Fuel Vault	80	13
Fuel Vault	80	15
Unit 3 Entry*	83	11
Unit 3 Hall	84	12
Chem Lab A	85	14
Chem Lab B	86	11
Chem Lab C	87	13

*Per consultation with the NRC site representative, these measurements were taken as background exposure rates.

TABLE 3

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE B-SOUTH AREA EXCAVATIONS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Uranium Concentration (pCi/g) ^a		
	U-235	U-238	Total Uranium ^b
Unit 1			
D and V Trench North	0.1 ± 0.1	0.4 ± 0.5	4.6
D and V Trench South	0.1 ± 0.1	1.1 ± 0.7	5.3
North Side of Column B9	0.2 ± 0.1	1.8 ± 0.8	10
South Side of Column B9	0.2 ± 0.1	1.0 ± 0.5	9.4
West Side of Column C9	<0.1	0.6 ± 0.7	<4.8
Unit 2			
Main Room	0.1 ± 0.1	1.5 ± 0.3	5.7
Pack Assembly^c			
North End	0.2 ± 0.1	1.2 ± 0.7	9.6
South End	0.1 ± 0.1	1.0 ± 0.8	5.2
Metallurgy Lab			
Sample Preparation			
J,22	0.1 ± 0.1	1.3 ± 0.8	5.5
M,23	0.1 ± 0.1	1.9 ± 0.8	6.1
K,26	0.1 ± 0.1	1.0 ± 0.8	5.2
L, 28 ^d , 0-15 cm	0.1 ± 0.1	1.6 ± 0.8	5.8
L,28 ^d , 15-30 cm	0.1 ± 0.1	1.7 ± 0.7	5.9
L,28 ^d , 30-45 cm	0.2 ± 0.1	1.7 ± 0.8	10

TABLE 3 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE B-SOUTH AREA EXCAVATIONS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Uranium Concentration (pCi/g)*		
	U-235	U-238	Total Uranium ^b
Reading Area			
CP, 22	0.1 ± 0.1	2.0 ± 1.0	6.2
CP, 27	0.1 ± 0.1	1.0 ± 9.8	5.2
CP, 34	0.1 ± 0.1	1.3 ± 0.9	5.5
Sectioning			
Main Room			
0,17 ^d , 0-15 cm	0.1 ± 0.6	2.1 ± 0.9	6.3
0,17 ^d , 15-30 cm	0.2 ± 0.1	1.0 ± 0.9	9.4
0,17 ^d , 30-45 cm	0.1 ± 0.1	2.0 ± 1.0	6.2
0,33	0.1 ± 0.1	1.1 ± 0.8	5.3
N,16	0.1 ± 0.1	0.8 ± 0.6	5.0
P,17	0.2 ± 0.1	1.0 ± 1.0	9.4
U,17	0.1 ± 0.1	0.5 ± 0.6	4.7
K, 32	0.1 ± 0.1	1.0 ± 0.7	5.2
Old Decon			
R,31	0.1 ± 0.1	1.1 ± 0.7	5.3
P,16 ^d , 0-15 cm	0.1 ± 0.1	1.4 ± 0.8	5.6
P,16 ^d , 15-30 cm	0.3 ± 0.1	1.8 ± 0.8	14
P,16 ^d , 30-45 cm	0.1 ± 0.1	1.7 ± 0.7	5.9
P,16	0.1 ± 0.1	0.5 ± 0.7	4.7

TABLE 3 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE B-SOUTH AREA EXCAVATIONS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Uranium Concentration (pCi/g) ^a		
	U-235	U-238	Total Uranium ^b
Basement			
1,30	0.1 ± 0.1	1.3 ± 0.7	5.5
J,26	0.1 ± 0.1	0.3 ± 0.6	4.5
I,22	0.1 ± 0.1	1.3 ± 0.8	5.5
P,20	0.3 ± 0.1	2.0 ± 1.0	15
O,12 ^d , 0-15 cm	0.1 ± 0.1	0.9 ± 0.8	5.1
O,12 ^d , 15-30 cm	0.1 ± 0.1	0.4 ± 0.6	4.6
O,12 ^d , 30-45 cm	0.1 ± 0.1	0.6 ± 0.6	4.8
O,12	0.1 ± 0.1	0.6 ± 0.6	4.8
N,21 ^d , 0-15 cm	0.1 ± 0.1	1.0 ± 0.6	5.2
N,21 ^d , 15-30 cm	0.1 ± 0.1	1.7 ± 0.8	5.9
N, 21 ^d , 30-45 cm	0.1 ± 0.1	1.9 ± 1.0	6.1
Y,15	0.1 ± 0.1	1.0 ± 0.7	5.2
V,12	0.1 ± 0.1	1.2 ± 0.7	5.4
Basement H.P Office			
R,16	0.1 ± 0.1	1.0 ± 0.6	5.2

^aUncertainties represent the 95% confidence level, based only on counting statistics.

^bTotal uranium concentrations are calculated based on a U-234 to U-235 ratio of 41 to 1 which was established by UNC.

^cThe concentration values listed here are from the more recent samples. The total uranium concentration in the initial sample was 31 pCi/g.

^dThree samples collected from horizontal boreholes (parallel to cement floor) at 15 cm (6 in) depth intervals.

TABLE 4

**EXPOSURE RATE MEASUREMENTS
FOR AFFECTED OUTDOOR AREAS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT**

Location	Figure Number	Exposure Rate at 1 m above surface (μ R/h)
Incinerator Pad		
H,9	88	11
H + 0.5, 17.5	88	9
U8	88	9
Septic Field		
B,2	89	11
B,6	89	12
B,10	89	12
E,2	89	11
E,6	89	12
E,10	89	12
Leach Field		
Well #11	101	11
Well #2	101	11
Well #6	101	13

TABLE 5

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE INCINERATOR PAD
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Uranium Concentrations (pCi/g) ^a		
	U-235	U-238	Total Uranium ^b
Surface Samples			
L,3	0.3 ± 0.1	2.2 ± 1.3	12
L,8	0.2 ± 0.1	2.3 ± 1.2	8.5
Q,3	0.2 ± 0.1	3.2 ± 1.4	9.4
Q,8	0.1 ± 0.1	3.0 ± 0.9	6.1
H,17	0.4 ± 0.1	3.1 ± 1.2	16
H,22	0.3 ± 0.1	1.2 ± 1.4	11
M,17	0.1 ± 0.1	0.2 ± 0.8	3.3
M,22	0.5 ± 0.1	1.2 ± 0.5	17
I,9	1.3 ± 0.2	1.8 ± 0.9	42 ^c
J,10	0.2 ± 0.1	1.9 ± 0.7	8.1
H, 9 + 0.1	0.8 ± 0.1	1.5 ± 0.9	26
Borehole Samples^d			
J,9, 0-15 cm	0.3 ± 0.1	1.5 ± 0.9	11
J,9, 15-30 cm	0.2 ± 0.1	1.8 ± 0.7	8.0
J,9, 30-45 cm	0.2 ± 0.1	2.0 ± 1.0	8.2
I,10, 0-15 cm	0.5 ± 0.1	1.7 ± 0.4	17 ^c
I,10, 15-30 cm	0.5 ± 0.1	2.0 ± 1.0	18
I,10, 30-45 cm	0.4 ± 0.1	0.7 ± 0.9	13
H,9, 0-15 cm	0.9 ± 0.2	3.0 ± 1.2	31 ^c
H,9, 15-30 cm	0.3 ± 0.1	1.2 ± 0.7	11
H,9, 30-45 cm	0.2 ± 0.1	1.1 ± 0.8	7.3

TABLE 5 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE INCINERATOR PAD
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Uranium Concentrations (pCi/g) ^a		
	U-235	U-238	Total Uranium ^b
Borehole Samples (continued)			
U,8, 0-15 cm	0.2 ± 0.1	2.2 ± 0.9	8.4
U,8, 15-30 cm	0.1 ± 0.1	1.0 ± 0.8	4.1
U,8, 30-45 cm	0.1 ± 0.1	0.7 ± 0.6	3.8
R,14, 0-15 cm	0.1 ± 0.1	1.1 ± 0.7	4.2 ^c
R,14, 15-30 cm	0.3 ± 0.1	2.0 ± 1.0	11
R,14, 30-45 cm	0.1 ± 0.1	2.4 ± 0.9	5.5

^aUncertainties represent the 95% confidence level, based only on counting statistics.

^bTotal uranium concentrations are calculated based on a U-234 to U-235 ratio of 30 to 1 which was established by the licensee for the Incinerator Pad area.

^cThese concentration values are from soil samples taken during ESSAP follow-up survey of this area in February 1993. Prior to recent remediations by UNC, the total uranium concentrations at I9, I10, H9, and R14 were 140, 68, 91, and 44 pCi/g.

^dSamples collected from vertical boreholes at 15 cm (6 in) intervals

TABLE 6

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE SEPTIC FIELD
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location ^b	Uranium Concentrations (pCi/g) ^a		
	U-235	U-238	Total Uranium ^c
A-4,S1	0.1 ± 0.1	1.3 ± 0.9	5.5
A-4,S2	0.1 ± 0.1	1.4 ± 0.8	5.6
A-4,S3	0.3 ± 0.1	2.7 ± 1.0	15
A-4,S4	0.1 ± 0.1	1.6 ± 0.9	5.8
A-4,T1	0.3 ± 0.1	2.0 ± 1.0	15
A-4, T2	0.3 ± 0.1	2.0 ± 1.0	15
A-4,T3	0.4 ± 0.1	1.9 ± 0.9	19
A-4,T4	0.4 ± 0.1	2.0 ± 1.0	19
A-4,T5	0.4 ± 0.1	1.1 ± 0.7	18
A-4,T6	0.3 ± 0.1	1.5 ± 0.8	14
A-4,T7	0.7 ± 0.2	3.6 ± 1.7	33
A-4,T8	0.3 ± 0.1	1.2 ± 0.7	14
A-3,S1	0.1 ± 0.1	2.3 ± 1.0	6.5
A-3,S2	1.5 ± 0.1	1.9 ± 1.1	65
A-3,S3	0.3 ± 0.9	1.0 ± 0.7	14
A-3,S4	1.2 ± 0.7	1.6 ± 0.8	52
A-3,T1	0.4 ± 0.1	1.6 ± 1.0	18
A-3,T2	0.3 ± 0.1	1.8 ± 0.9	14
A-3,T3	0.6 ± 0.2	1.3 ± 0.8	27
A-3,T4	0.4 ± 0.1	1.9 ± 0.9	19
A-3,T5	0.3 ± 0.1	1.9 ± 0.8	15

TABLE 6 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE SEPTIC FIELD
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location ^b	Uranium Concentrations (pCi/g) ^a		
	U-235	U-238	Total Uranium ^c
A-3,T6	0.3 ± 0.1	1.1 ± 0.9	14
A-3,T7	0.2 ± 0.1	2.6 ± 0.9	11
A-3,T8	0.1 ± 0.1	0.9 ± 0.6	5.1
A-6,S1	0.2 ± 0.1	1.8 ± 0.9	10
A-6,S2	0.2 ± 0.1	1.4 ± 0.8	9.8
A-6,S3	0.2 ± 0.1	1.7 ± 0.8	10
A-6,S4	0.2 ± 0.1	0.9 ± 0.9	9.3
A-6,T1	0.1 ± 0.1	1.7 ± 0.7	5.9
A-6,T2	0.4 ± 0.1	2.0 ± 1.0	19
A-6,T3	0.1 ± 0.1	1.2 ± 0.7	5.6
A-6,T4	0.1 ± 0.1	0.5 ± 0.5	4.7
A-6,T5	0.5 ± 0.1	3.0 ± 1.0	24
A-6,T6	0.1 ± 0.1	1.5 ± 0.7	5.7
B-2,S1	0.1 ± 0.1	2.0 ± 1.0	6.2
B-2,S2	0.2 ± 0.1	1.4 ± 0.9	9.8
B-2,S3	0.1 ± 0.1	1.7 ± 0.7	5.9
B-2,S4	0.1 ± 0.1	1.1 ± 0.8	5.3
B-2,T1	0.6 ± 0.1	2.2 ± 1.0	27
B-2,T2	0.2 ± 0.1	2.3 ± 0.8	11
B-2,T3	0.5 ± 0.1	2.0 ± 1.0	23
B-2,T4	0.4 ± 0.1	2.5 ± 1.0	19

TABLE 6 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE SEPTIC FIELD
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location ^b	Uranium Concentrations (pCi/g) ^a		
	U-235	U-238	Total Uranium ^c
B-2,T5	0.6 ± 0.1	2.0 ± 1.0	27
B-2,T6	0.4 ± 0.1	2.4 ± 1.0	19
B-2,T7	0.3 ± 0.1	2.5 ± 0.9	15
B-2,T8	0.2 ± 0.1	1.2 ± 0.8	9.6
C-1,S1	0.1 ± 0.1	1.9 ± 0.8	6.1
C-1,S2	0.1 ± 0.1	1.1 ± 1.0	5.3
C-1,S3	0.1 ± 0.1	1.9 ± 1.1	6.1
C-1,S4	0.2 ± 0.1	2.0 ± 0.9	10
C-1,T1	0.4 ± 0.1	1.7 ± 0.9	19
C-1,T2	0.2 ± 0.1	2.9 ± 1.0	11
C-1,T3	0.2 ± 0.1	1.7 ± 0.7	10
C-1,T4	0.3 ± 0.1	1.6 ± 0.6	14
C-1,T5	0.2 ± 0.1	1.9 ± 0.8	10
C-1,T6	0.5 ± 0.1	3.9 ± 1.2	25
C-1,T7	0.2 ± 0.1	2.3 ± 1.0	11
C-1,T8	0.3 ± 0.1	2.3 ± 1.0	15
C-2,S1	0.1 ± 0.1	2.5 ± 0.9	6.7
C-2,S2	0.1 ± 0.1	1.0 ± 0.7	5.2
C-2,S3	0.1 ± 0.1	1.8 ± 0.9	6.0
C-2,S4	0.1 ± 0.1	1.8 ± 0.8	6.0
C-2,T1	0.2 ± 0.1	2.5 ± 1.0	11

TABLE 6 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE SEPTIC FIELD
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location ^b	Uranium Concentrations (pCi/g) ^a		
	U-235	U-238	Total Uranium ^c
C-2,T2	0.1 ± 0.1	1.8 ± 0.9	6.0
C-2,T3	0.3 ± 0.1	0.7 ± 0.5	13
C-2,T4	0.3 ± 0.1	2.9 ± 1.1	16
C-2,T5	0.3 ± 0.1	2.5 ± 1.0	15
C-2,T6	0.3 ± 0.1	1.5 ± 0.9	14
C-2,T7	0.4 ± 0.1	1.5 ± 0.8	18
C-2,T8	0.3 ± 0.1	1.8 ± 1.0	14
C-3,S1p	0.2 ± 0.1	2.3 ± 1.1	11
C-3,S2	0.1 ± 0.1	1.7 ± 0.9	5.9
C-3,S3	0.2 ± 0.1	1.5 ± 0.7	9.9
C-3,S4	0.1 ± 0.1	1.4 ± 0.8	5.6
C-3,T1	0.3 ± 0.1	1.6 ± 0.8	14
C-3,T2	0.4 ± 0.1	2.5 ± 1.1	19
C-3,T3	0.3 ± 0.1	1.5 ± 0.8	14
C-3,T4	0.2 ± 0.1	3.1 ± 1.2	12
C-3,T5	0.3 ± 0.1	1.8 ± 0.9	14
C-3,T6	0.3 ± 0.1	1.9 ± 0.8	15
C-3,T7	0.5 ± 0.1	2.4 ± 1.1	23
C-3,T8	0.2 ± 0.1	2.4 ± 1.1	11
C-9,S1	0.1 ± 0.1	2.4 ± 1.0	6.6
C-9,S2	0.1 ± 0.1	1.8 ± 0.9	6.0

TABLE 6 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE SEPTIC FIELD
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location ^b	Uranium Concentrations (pCi/g) ^a		
	U-235	U-238	Total Uranium ^c
C-9,S3	0.3 ± 0.1	2.3 ± 1.2	15
C-9,S4	0.1 ± 0.1	3.6 ± 1.4	7.8
C-9,T1	0.3 ± 0.1	<1.0	<14
C-9,T2	0.4 ± 0.1	1.9 ± 1.1	19
C-9,T3	0.2 ± 0.1	1.5 ± 0.9	9.9
C-9,T4	0.2 ± 0.1	2.5 ± 1.1	11
C-9,T5	0.2 ± 0.1	1.4 ± 0.8	9.8
C-9,T6	0.4 ± 0.1	<1.5	<18
C-9,T7	0.4 ± 0.1	1.6 ± 0.9	18
C-9,T8	0.3 ± 0.1	2.2 ± 0.8	15
E-6,S1	0.2 ± 0.1	3.0 ± 0.9	11
E-6,S2	0.2 ± 0.1	2.6 ± 1.3	11
E-6,S3	0.2 ± 0.1	2.1 ± 0.9	11
E-6,S4	0.2 ± 0.1	1.9 ± 0.8	10
E-6,T1	0.3 ± 0.1	2.4 ± 1.1	15
E-6,T2±	0.1 ± 0.1	2.4 ± 1.0	6.6
E-6,T3	0.9 ± 0.2	1.9 ± 1.0	40
E-6,T4	0.2 ± 0.1	1.7 ± 0.9	10
E-6,T5	0.1 ± 0.1	1.7 ± 0.7	5.9
E-6,T6	0.8 ± 0.1	2.5 ± 0.9	36
E-10,S1	0.3 ± 0.1	2.2 ± 0.8	15

TABLE 6 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE SEPTIC FIELD
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location ^b	Uranium Concentrations (pCi/g) ^a		
	U-235	U-238	Total Uranium ^c
E-10,S2	0.2 ± 0.1	1.1 ± 0.8	9.5
E-10,S3	0.4 ± 0.1	2.2 ± 1.0	19
E-10,S4	0.4 ± 0.1	1.7 ± 1.0	19
E-10,T1	0.6 ± 0.1	1.9 ± 0.7	27
E-10,T2	0.4 ± 0.1	2.6 ± 0.8	19
E-10,T3	0.4 ± 0.1	2.9 ± 1.0	20
E-10,T4	0.4 ± 0.1	1.7 ± 0.9	19
E-10,T5	0.4 ± 0.1	3.1 ± 1.2	20
F-3,S1	0.1 ± 0.1	2.0 ± 1.1	6.2
F-3,S2	0.3 ± 0.1	1.4 ± 0.8	14
F-3,S3	0.1 ± 0.1	2.1 ± 0.9	6.3
F-3,S4	0.1 ± 0.1	0.6 ± 0.6	4.8
F-3,T1	0.5 ± 0.1	2.6 ± 1.1	24
F-3,T2	0.8 ± 0.2	3.0 ± 0.9	37
F-3,T3	0.2 ± 0.1	1.6 ± 0.9	10
F-3,T4	0.3 ± 0.1	2.3 ± 0.8	15
F-3,T5	0.6 ± 0.1	2.7 ± 0.9	28
F-3,T6	0.2 ± 0.1	2.3 ± 0.7	11
F-3,T7	0.3 ± 0.1	0.5 ± 0.6	13
F-3,T8	0.2 ± 0.1	1.8 ± 1.0	10
G-1	0.2 ± 0.1	1.2 ± 0.7	9.6

TABLE 6 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
 FROM THE SEPTIC FIELD
 UNITED NUCLEAR CORPORATION
 NAVAL PRODUCTS
 MONTVILLE, CONNECTICUT

Location ^b	Uranium Concentrations (pCi/g) ^a		
	U-235	U-238	Total Uranium ^c
G-3	0.2 ± 0.1	1.0 ± 0.9	9.4
A5	0.1 ± 0.1	1.0 ± 0.7	5.2

^aUncertainties represent the 95% confidence level, based only on counting statistics.

^bRefer to Figures 89 through 100.

^cTotal uranium concentrations are calculated based on U-234 to U-235 ratio of 41 to 1.

TABLE 7

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE LEACH FIELD DRY WELLS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Dry Well ^a #	Direction and Depth of Soil Sample ^b	Uranium Concentrations (pCi/g) ^c			
		U-234	U-235	U-238	Total Uranium ^d
1	Bottom Composite	1.4 ± 0.3	0.1 ± 0.1	0.7 ± 0.2	2.2
1	West @ 10 Feet	0.7 ± 0.2	0.1 ± 0.1	0.7 ± 0.2	1.5
2	Bottom Composite	5.0 ± 0.5	0.1 ± 0.1	0.5 ± 0.2	5.6
2	East @ 9 Feet	11 ± 0.8	0.5 ± 0.2	0.9 ± 0.2	12
3	Bottom Composite	2.2 ± 0.3	0.1 ± 0.1	0.9 ± 0.2	3.2
3	Northeast @ 6 Feet	4.0 ± 0.4	0.1 ± 0.1	0.9 ± 0.2	5.0
4	Bottom Composite	17 ± 0.8	0.4 ± 0.2	0.8 ± 0.2	18
4	South @ 7 Feet	58 ± 1.6	2.2 ± 0.4	1.1 ± 0.3	63
5	Bottom Composite	7.2 ± 0.4	0.1 ± 0.1	1.5 ± 0.2	8.8
5	West @ 11 Feet	11 ± 0.5	0.4 ± 0.1	1.7 ± 0.2	13
6	Bottom Composite	22 ± 0.8	0.5 ± 0.2	0.8 ± 0.2	23
6	South @ 11 Feet	36 ± 1.3	0.8 ± 0.3	1.4 ± 0.3	38
7	Bottom Composite	16 ± 0.8	0.4 ± 0.2	1.7 ± 0.3	18
7	South @ 6 Feet	31 ± 0.9	0.9 ± 0.2	2.0 ± 0.2	34
8	Bottom Composite	5.5 ± 0.4	0.2 ± 0.1	1.4 ± 0.2	7.1
8	North @ 6 Feet	67 ± 1.4	1.4 ± 0.3	2.1 ± 0.3	71

TABLE 7 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM LEACH FIELD DRY WELLS
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Dry Well #	Direction and Depth of Soil Sample ^b	Uranium Concentrations (pCi/g) ^c			
		U-234	U-235	U-238	Total Uranium ^d
9	Bottom Composite	36 ± 1.0	0.4 ± 0.1	1.6 ± 0.2	38
9	West @ 9 Feet	46 ± 1.1	1.7 ± 0.3	2.0 ± 0.2	50
10	Bottom Composite	5.6 ± 0.4	0.1 ± 0.1	1.6 ± 0.2	7.3
10	Southeast @ 9 Feet	32 ± 0.9	0.7 ± 0.2	2.0 ± 0.2	34
11	Bottom Composite	14 ± 0.7	0.4 ± 0.1	1.4 ± 0.2	16
11	West @ 4 Feet	40 ± 0.9	0.8 ± 0.2	2.0 ± 0.2	43
12	Bottom Composite	12 ± 0.8	0.1 ± 0.1	1.0 ± 0.2	13
12	East @ 6 Feet	23 ± 1.0	0.6 ± 0.2	0.9 ± 0.2	24

^a Refer to Figure 101.

^b One composite sample was collected from the bottom of each well. The other was collected from one of the existing holes in the drywell wall, created at various depths in each well by the UNC.

^c Uncertainties represent the 95% confidence level, based on counting statistics.

^d Uranium concentrations from alpha spectrometry analysis.

TABLE 8

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE LEACH FIELD BOREHOLES*
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Uranium Concentrations (pCi/g) ^b		
	U-235	U-238	Total Uranium ^c
W1; 1'N 14-18;36-37	0.1 ± 0.1	1.3 ± 0.9	5.5
W3; 1'N 14-20;65-67	0.1 ± 0.1	<0.8	<5.0
W5; 1'N 6-12;183-185	0.2 ± 0.1	1.4 ± 0.8	9.8
W5; 8'SW 0-6;190-192	0.1 ± 0.1	2.1 ± 1.0	6.3
W7; 1'N 14-20;95-97	0.2 ± 0.1	1.2 ± 1.0	9.6
W8; 8'SW 0-6;160-162	0.3 ± 0.1	1.7 ± 0.9	14
W11; 1'N 6-12;271-273	0.2 ± 0.1	0.9 ± 0.8	9.3
W11; 1'N 12-14;274	0.3 ± 0.1	1.6 ± 0.8	14
W9; 4'SE 6-12;143-145	0.3 ± 0.1	3.0 ± 1.3	16
W6; 1'N 12-14;254	0.1 ± 0.1	2.1 ± 1.0	6.3
W10; 4'SE 0-6;324-326	0.1 ± 0.1	2.2 ± 0.9	6.4
W10; 4'SE 4-20;331-333	0.1 ± 0.1	1.6 ± 0.8	5.8
W6; 4'SE 14-18;265-266	0.2 ± 0.1	1.7 ± 0.9	10

TABLE 8 (continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
FROM THE LEACH FIELD BOREHOLES^a
UNITED NUCLEAR CORPORATION
NAVAL PRODUCTS
MONTVILLE, CONNECTICUT

Location	Uranium Concentrations (pCi/g) ^b		
	U-235	U-238	Total Uranium ^c
W8; 8'SW 12-14;166	0.2 ± 0.1	1.7 ± 0.8	10
W11; 8'SW 14-18;286-287	0.3 ± 0.1	1.5 ± 1.0	14
W12; 4'SE 12-14;340	0.1 ± 0.1	0.5 ± 0.4	4.7
W8; 1'N 14-20;156-158	0.1 ± 0.1	1.0 ± 0.8	5.2

These samples were collected by UNC and provided to ESSAP for confirmatory analysis.

^aUncertainties represent the 95% confidence level, based only on counting statistics.

^cTotal uranium concentrations are calculated based on a U-234 to U-235 ratio of 41 to 1.

REFERENCES

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2. Oak Ridge Institute for Science and Education, "Revised Confirmatory Survey Plan for Unit 1, Unit 2 Argon Room, Raw Fuel Vault, and Scrap Vault, UNC Naval Products:, May 18, 1992.
3. Oak Ridge Institute for Science and Education, "Confirmatory Radiological Survey Plan: Septic Field 1, Incinerator Pad, Remaining Affected Areas of Structures (Books 3, 3A, and 3B)", October 28, 1992.
4. Oak Ridge Institute for Science and Education, "Confirmatory Survey of Building B-South Roof, Building L Support Areas, Pumphouse South and Septic Tank, and the Unaffected Outdoor Areas, UNC Naval Products, Montville, Connecticut." Draft Report, August 1993.
5. Letter from J. D. Berger (ORISE) to S. Soong (NRC), Reference: "UNC Naval Products Decommissioning Plan and Septic Field Sampling Results", October 12, 1990.
6. Letter from M. R. Landis (ORISE) to J. Roth (NRC), Reference: "UNC Naval Products, Final Decontamination and Decommissioning Surveys/Books 1 and 2", March 30, 1992.
7. Letter from M. R. Landis (ORISE) to J. Roth (NRC), Reference: "UNC Naval Products, Revised Data Sheets", April 15, 1992.
8. Letter from M. R. Landis (ORISE) to J. Roth (NRC), Reference: "UNC Naval Products, Final Decontamination and Decommissioning Surveys/Books 3 and 3A", October 16, 1992.
9. Letter from J. D. Berger (ORISE) to J. Roth (NRC), Reference: "Final Survey Report, Septic Field 1 and Incineration Pad, UNC Naval Products", October 26, 1992.
10. Letter from J. D. Berger (ORISE) to J. Roth (NRC), Reference: "UNC Naval Products, Final Decontamination and Decommissioning Surveys/Book 3B", October 28, 1992.
11. Letter from A. Ansari (ORISE) to J. Roth (NRC), Reference: "Preliminary data, Additional Soil Samples from Septic Field 1 and the Incinerator Pad, UNC Naval Products," February 24, 1993.

REFERENCES (Continued)

12. U.S. Nuclear Regulatory Commission, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Materials," August 1987.
13. U.S. Nuclear Regulatory Commission, "Disposal or Onsite Storage of Thorium and Uranium Wastes from Past Operations", 46 FR 52061, Washington, D. C., October 23, 1981.
14. Letter from R. J. Gregg (UNC) to J. H. Austin (NRC), Reference: Attachment A of UNC Decommissioning Plan, May 22, 1992.
15. U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, "Review Plan: Evaluating Decommissioning Plans for Licenses Under 10 CFR Parts 30, 40, and 70", Washington, D.C., 1991.

APPENDIX A
MAJOR INSTRUMENTATION

APPENDIX A

MAJOR INSTRUMENTATION

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

DIRECT RADIATION MEASUREMENT

Instruments

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

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

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

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

Detectors

Eberline GM Detector
Model HP-260
Effective Area, 15.5 cm²
(Eberline, Santa Fe, NM)

Eberline ZnS Scintillation Detector
Model AC-3-7
Effective Area, 59 cm²
(Eberline, Santa Fe, NM)

Ludlum Gas Proportional Detector

Detectors (Continued)

Model 43-37

Effective Area, 550 cm²

(Ludlum Measurements, Inc.,
Sweetwater, TX)

Ludlum Gas Proportional Detector

Model 43-68

Effective Area, 100 cm²

(Ludlum Measurements, Inc.,
Sweetwater, TX)

Reuter-Stokes Pressurized Ion Chamber

Model RSS-111

(Reuter-Stokes, Cleveland, OH)

Victoreen NaI Scintillation Detector

Model 489-55

3.2 cm x 3.8 cm Crystal

(Victoreen, Cleveland, OH)

LABORATORY ANALYTICAL INSTRUMENTATION

Alpha Spectrometry System

Tennelec Electronics Model

(Tennelec, Oak Ridge, TN)

Used in conjunction with:

Surface Barrier Detectors

(EG&G ORTEC, Oak Ridge, TN) and

Multichannel Analyzer

3100 Vax Workstation

(Canberra, Meriden, CT)

High Purity Extended Range Intrinsic Detectors

Model No: ERVDS30-25195

(Tennelec, Oak Ridge, TN)

Used in conjunction with:

Lead Shield Model G-11

(Nuclear Lead, Oak Ridge, TN) and

Multichannel Analyzer

3100 Vax Workstation

(Canberra, Meriden, CT)

LABORATORY ANALYTICAL INSTRUMENTATION (Continued)

High-Purity Germanium Detector
Model GMX-23195-S, 23% Eff.
(EG&G ORTEC, Oak Ridge, TN)
Used in conjunction with:

Lead Shield Model G-16
(Gamma Products, Palos Hills, IL) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

Low Background Gas Proportional Counter
Model LB-5100-W
(Oxford, Oak Ridge, TN)

APPENDIX B
SURVEY AND ANALYTICAL PROCEDURES

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

SURVEY PROCEDURES

Surface Scans

Surface scans were performed by passing the probes slowly over the surface; the distance between the probe and the surface was maintained at a minimum - nominally about 1 cm. A large surface area, gas proportional floor monitor was used to scan the floors of the surveyed areas. Other surfaces were scanned using small area (15.5 cm², 0.59 cm², or 100 cm²) hand-held detectors. Identification of elevated levels was based on increases in the audible signal from the recording and/or indicating instrument. Combinations of detectors and instruments used for the scans were:

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

Surface Activity Measurements

Measurements of total alpha and total beta activity levels were primarily performed using ZnS scintillation and/or GM detectors with ratemeters-scalers.

Count rates (cpm), which were integrated over 1 minute in a static position, were converted to activity levels (dpm/100 cm²) by dividing the net rate by the 4π efficiency and correcting for the active area of the detector. The alpha activity background countrates for the ZnS scintillation detectors averaged 1 cpm for each detector. Alpha efficiency factors ranged from 0.16 - 0.20 for the ZnS scintillation detectors. The beta activity background count rates for the GM detectors averaged 45 cpm. Beta efficiency factors ranged from 0.15 - 0.17 for the GM detector. The effective windows for the ZnS scintillation and GM detectors were 59 cm², and 15.5 cm², respectively.

Removable Activity Measurements

Removable activity levels were determined using numbered filter paper disks, 47 mm in diameter. Moderate pressure was applied to the smear and approximately 100 cm² of the surface was wiped. Smears were placed in labeled envelopes with the location and other pertinent information recorded.

Exposure Rate Measurements

Measurements of gamma exposure rates were performed at 1 m above the surface, using a pressurized ionization chamber (PIC).

Miscellaneous Samples

Soil Sampling

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

Paint Sampling

Paint samples were collected by scraping material from approximately 100 cm² of the surface area.

ANALYTICAL PROCEDURES

Removable Activity

Gross Alpha/Beta

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

Miscellaneous Samples

Gamma Spectrometry

Samples of soil were dried, mixed, crushed, and/or homogenized as necessary, and a portion sealed in 0.5-liter Marinelli beaker or other appropriate container. The quantity placed in the beaker was chosen to reproduce the calibrated counting geometry. Net material weights were determined and the samples counted using intrinsic germanium detectors coupled to a pulse height analyzer system. Background and Compton stripping, peak search, peak identification,

and concentration calculations were performed using the computer capabilities inherent in the analyzer system. Energy peaks used for determination of radionuclides of concern were:

U-235 0.186 MeV

U-238 0.063 MeV from Th-234* (or 1.001 MeV from Pa-234 m)*

*Secular equilibrium assumed.

Spectra were also reviewed for other identifiable photopeaks.

Alpha Spectrometry

Soil, paint, and concrete samples were crushed, homogenized and analyzed for isotopic uranium. Samples were dissolved by potassium fluoride and pyrosulfate fusion and the elements of interest were precipitated with barium sulfate. Barium sulfate precipitate was redissolved and the specific elements of interest were individually separated by liquid-liquid extraction and re-precipitated with a cerium fluoride carrier. The precipitate was then counted using surface barrier and ion implanted detectors (ORTEC), alpha spectrometers (Tennelec and Canberra), and a multichannel analyzer (Nuclear Data).

UNCERTAINTIES AND DETECTION LIMITS

The uncertainties associated with the analytical data presented in the tables of this report represent the 95% confidence level for that data based only on counting statistics. Additional uncertainties, associated with sampling and measurement procedures, have not been propagated into the data presented in this report.

Detection limits, referred to as minimum detectable activity (MDA), were based on 2.71 plus 4.66 times the standard deviation of the background count. When the activity was determined to be less than the MDA of the measurement procedure, the result was reported as less than MDA. Because of variations in background levels, measurement efficiencies, and contributions from other radionuclide in samples, the detection limits differ from sample to sample and instrument to instrument.

CALIBRATION AND QUALITY ASSURANCE

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

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

- Survey Procedures Manual, Revisions 6 and 7
- Laboratory Procedures Manual, Revisions 6 and 7
- Quality Assurance Manual, Revisions 4 and 5

The procedures contained in these manuals were developed to meet the requirements of DOE Order 5700.6B (later 5700.6C) and ASME NQA-1 for Quality Assurance and contain measures to assess processes during their performance.

Quality control procedures include:

- Daily instrument background and check-source measurements to confirm that equipment operation is within acceptable statistical fluctuations.
- Participation in EPA and EML laboratory Quality Assurance Programs.
- Training and certification of all individuals performing procedures.
- Periodic internal and external audits.

APPENDIX C

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

AND

GUIDELINES FOR RESIDUAL CONCENTRATIONS OF
THORIUM AND URANIUM WASTES IN SOIL

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

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

August 1987

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

1. The licensee shall make a reasonable effort to eliminate residual contamination.
2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.
3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces or premises, equipment, or scrap which are likely to be contaminated, but are such size, construction, or location as to make the surface inaccessible for purposes of measurement, shall be presumed to be contaminated in excess of the limits.
4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to special circumstances such as razing of buildings, transfer from premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:
 - a. Provide detailed specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.
 - b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.
5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Fuel Cycle, Medical, Academic, and Commercial Use Safety, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

- a. Identify the premises.
- b. Show that reasonable effort has been made to eliminate residual contamination.
- c. Describe the scope of the survey and general procedures followed.
- d. State the findings of the survey in units specified in the instruction.

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

TABLE 1
ACCEPTABLE SURFACE CONTAMINATION LEVELS

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

^aWhere surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

^bAs 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.

^cMeasurements 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.

^dThe maximum contamination level applies to an area of not more than 100 cm².

^eThe amount of removable radioactive material per 100 cm² 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.

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

Guidelines for Residual Concentrations of Thorium and Uranium Wastes in Soil

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

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

^aBased on EPA cleanup standards which limit radiation to 1 mrad/yr to lung and 3 mrad/yr to bone from ingestion and inhalation and 10 μ R/h above background from direct external exposure.

^bBased on limiting individual dose to 170 mrem/yr.

^cBased on limiting equivalent exposure to 0.02 working level or less.

^dBased on limiting individual dose to 500 mrem/yr and in case of natural uranium, limiting exposure to 0.02 working level or less.