ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

August 23, 2001

Mr. Todd Jackson
U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, Pennsylvania 19406

31-02892-06
030-34751

SUBJECT: FINAL REPORT—CONFIRMATORY SURVEY OF THE ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE CENTER, QUEENS, NEW YORK (DOCKET NO. 30-34751; RFTA NO: 00-012)

Dear Mr. Jackson:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) performed confirmatory radiological survey activities at the St. Albans Veterans Administration Extended Care Center in Queens, New York, during the period of February 26 through 28, 2001. Survey activities included document and data reviews, beta and gamma surface scans, surface activity measurements, and soil sampling.

Enclosed are three copies of the subject report which describes the survey procedures and results. If you have any questions, please direct them to me at (865) 576-0065 or Tim Vitkus at (865) 576-5073.

Sincerely,

Wade C. Adams
Project Leader/Health Physicist
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WCA:ar

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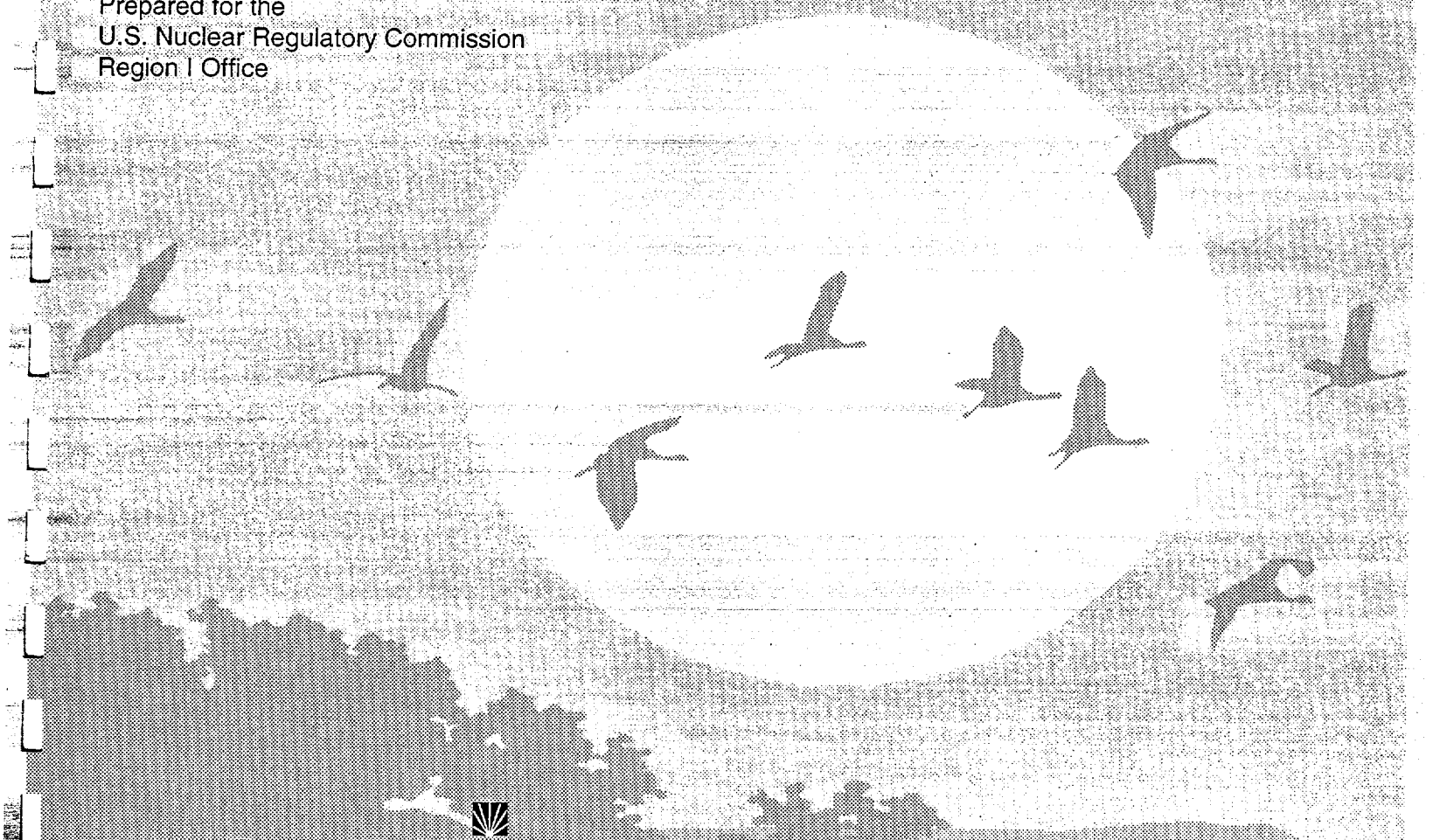
CONFIRMATORY SURVEY OF THE ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE CENTER QUEENS, NEW YORK

[Docket No. 30-34751, RFTA No. 00-012]

W. C. ADAMS

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



ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION
Environmental Survey and Site Assessment Program

ORISE 01-1075

CONFIRMATORY SURVEY OF THE ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE CENTER QUEENS, NEW YORK

Prepared by

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Prepared for the

U.S. Nuclear Regulatory Commission
Region I Office

FINAL REPORT

AUGUST 2001

CONFIRMATORY SURVEY
OF THE
ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE CENTER
QUEENS, NEW YORK

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ABBREVIATIONS AND ACRONYMS

ϵ_i	instrument efficiency
ϵ_s	source efficiency
AEC	Atomic Energy Commission
ASME	American Society of Mechanical Engineers
b_i	background counts in observation interval
BKG	background
cm	centimeter
cm^2	square centimeter
cpm	counts per minute
D&D	decontamination and decommissioning
DCGL	derived concentration guideline level
$DCGL_{EMC}$	derived concentration guideline level elevated measurement comparison
DOE	U.S. Department of Energy
dpm	disintegrations per minute
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
EML	Environmental Measurements Laboratory
ESSAP	Environmental Survey and Site Assessment Program
ha	hectare
ITP	Intercomparison Testing Program
m	meter
mm	millimeter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MAPEP	Mixed Analyte Performance Evaluation Program
MDC	minimum detectable concentration
MDCR	minimum detectable count rate
NaI	sodium iodide
NIST	National Institute of Standards and Technology
NRC	U.S. Nuclear Regulatory Commission
NRIP	NIST Radiochemistry Intercomparison Program
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram
QA/QC	quality assurance/quality control
S&W	Stone & Webster
SU	survey unit
USACE	U.S. Army Corps of Engineers
VA	Veterans Administration
VAECC	Veterans Administration Extended Care Center

CONFIRMATORY SURVEY
OF THE
ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE CENTER
QUEENS, NEW YORK

INTRODUCTION AND SITE HISTORY

The St. Albans Veterans Administration Extended Care Center (VAECC), located in Queens, New York, currently provides services for extended care, outpatient service, and various other operational and maintenance services. The Department of Veterans Affairs Medical Center in Brooklyn, which operates the VAECC, is in the process of decommissioning facilities formerly utilized for nuclear medicine activities by the U.S. Navy. The VAECC originally served as a U.S. Naval hospital prior to acquisition by the VA. During the period from 1956 through 1973, the U.S. Atomic Energy Commission (AEC), predecessor agency to the U.S. Nuclear Regulatory Commission (NRC), granted the Navy authority, under various licenses, to use radioactive materials for nuclear medicine purposes. Strontium-90 and tritium (H-3) were identified as the principal radionuclides used in the former nuclear medicine facilities at St. Albans—during the survey activities, C-14 was also identified as a radionuclide of concern. The Navy's license was terminated in 1973 (Weston 1999a).

A later review of formerly licensed facilities identified St. Albans as a site where residual contamination in excess of current standards may have been present. In 1993, the U.S. Army Corps of Engineers (USACE) was tasked with stabilizing the site, isolating the sewer lines, and sealing affected rooms. Subsequent characterization surveys of the nuclear medicine facilities were conducted by the Navy and the USACE, and in 1998, the NRC granted a license to the VA for the purpose of decontaminating and decommissioning (D&D) the facility. The USACE is facilitating the process to ultimately achieve a termination of the license.

The St. Albans facility consists of 15 buildings. Of these buildings, three were associated with the nuclear medicine activities as follows: Building 64, a boiler plant that houses an inactive incinerator; Building 90, where the primary nuclear medicine operations occurred; and, Building 91 (basement level only) which is used for storage, maintenance shops, audiology and speech diagnostics, and patient waiting lounges.

Surveys of the facilities have identified radioactive contamination in excess of the NRC release criteria. An historical assessment of operations in the nuclear medicine laboratory revealed the possibility of a spill of liquid Sr-90 in late 1962. Surveys identified elevated activity in laboratory areas, the ejector pit, and within laboratory drain systems. Additional characterization surveys, to supplement the 1998 characterization, were conducted from January to March 1999 in preparation for D&D activities. Some of the contamination was associated with piping that has been removed from the facility.

The NRC's Region I Office requested that the Oak Ridge Institute for Science and Education's (ORISE), Environmental Survey and Site Assessment Program (ESSAP) perform a confirmatory survey on various portions (survey units) at the St. Albans VAECC in Queens, New York.

SITE DESCRIPTION

The St. Albans facility is situated on 34 hectares (55 acres) at the intersection of 179th Street and Linden Boulevard in Queens, New York (Figures 1 and 2). The majority of the nuclear medicine activities occurred in Building 90 with Buildings 64 and 91 being support buildings. Building 91 connects via a hall to the Administration Building and Building 90 is located between Building 91 and the Administration Building (Figure 3).

Building 90, which contains the surveyed areas, consists of a main floor that houses the former nuclear medicine laboratory, ejector pit, bathrooms, and a basement that had been used for file storage (Figures 4 and 5). The basements of Building 91 and Building 90 are linked via a corridor. Building 91 houses audiometry, speech pathology, maintenance facilities, and personnel offices. The facility boiler plant for the VAECC is in Building 64 and it houses an inactive incinerator.

OBJECTIVES

The objectives of the confirmatory survey were to provide independent reviews and radiological data for use by the NRC in evaluating the adequacy and accuracy of the licensee's procedures and final status survey results, relative to the established derived concentration guideline level (DCGL) screening value for Sr-90.

DOCUMENT/DATA REVIEW

ESSAP has reviewed the background documentation, radiological data, and other relevant information forwarded to ESSAP by the NRC. ESSAP reviewed the characterization, decommissioning, and sampling work plans provided by Stone & Webster (S&W 1998, 2000a and b), the characterization and final status survey reports provided by Roy F. Weston, Inc. (Weston 1999a and b), the final decommissioning plan (Weston 2000a), and the draft justification for the Sr-90 DCGL (Weston 2000b). The review included documentation regarding the historical operation of the St. Albans facility to identify contamination potential. The review also encompassed a portion or all of the elements that the licensee implemented during decommissioning of the facility including: identification of the contaminants, DCGLs, classification of survey units (SU), survey and instrument calibration procedures, analytical procedures, and quality assurance/quality control (QA/QC) data management.

PROCEDURES

During the period of February 26 to 28, 2001, ESSAP performed confirmatory surveys of portions of the St. Albans Veterans Administration Extended Care Center in Queens, New York. The surveys were performed in accordance with a site-specific survey plan, submitted to and approved by the NRC, and the ORISE/ESSAP Survey Procedures and Quality Assurance Manuals (ORISE 2001 and 2000a and b).

SURVEY PROCEDURES

The following radiological survey procedures were used by ESSAP to conduct confirmatory survey activities on various building surfaces that had been evaluated by Weston and were to be released for unrestricted use. Weston used historical process knowledge and characterization survey findings to classify specific SUs as Class 1, Class 2, or Class 3 based on terminology available from the Multi-Agency Radiation Survey and Site Investigation Manual [MARSSIM (NRC 1997)].

A description of each is as follows:

Class 1: Areas that have a significant potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiological surveys).

Class 2: Areas contiguous to Class 1 that have a potential for radioactive contamination or known contamination, but are expected to be at contamination levels below the DCGL.

Class 3: Areas that are not expected to contain any residual contamination based on site operating history or previous radiological surveys.

ESSAP performed verification survey activities in each of the SUs for which Weston had provided data. The following Class 1 SUs were surveyed in the Building 90 basement area: SU001, SU002, SU004, and SU005. The Building 90 main floor consisted of Class 3 SU008.

Reference System

The 1 meter × 1 meter (m) grid established by Weston was used for referencing measurement and sampling locations (Figures 6 through 10). Measurement locations on ungridded surfaces were referenced to prominent building features or the existing grid.

Surface Scans

Interior Area Scan Surveys

Beta and gamma radiation surface scan coverage was performed on up to 100% of the accessible floor surfaces, 50% of the lower wall surfaces, and up to five percent of the upper wall and ceiling surfaces in the surveyed areas. Surface scans for beta radiation were performed on up to 100% of the area within each randomly selected grid block from which direct measurements were performed. Particular attention was given to cracks and joints in the areas where material may have accumulated. Limited beta scans were performed on exposed soil surfaces within the facility where drain lines had

been removed or subfloor soils otherwise exposed. A cursory gamma scan was also performed at various locations within the facility. Scans were performed using gas proportional and NaI scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators. Any locations of elevated direct beta or gamma radiation detected by surface scans were marked for further investigation that included additional surface scans, as deemed necessary to delineate contamination boundaries.

Exterior Area Scan Surveys

Scans for beta radiation were performed along door entrances and available asphalt or concrete surfaces. Cursory scans for gamma radiation were also performed on contiguous ground surfaces around the portion of the St. Albans facility (Building 90) that was being surveyed. Scans were performed using gas proportional and NaI scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators.

Surface Activity Measurements

Construction material specific backgrounds, performed in areas of similar construction but without a history of radioactive material use, were used to correct gross surface activity measurements. Construction material backgrounds were collected for the following materials: concrete and concrete block, sheetrock, glazed tile, and metal surfaces.

Direct measurements for alpha and beta surface activity were performed in 90 of the interior structural grid blocks in the surveyed areas and at two locations outside of the surveyed areas (Figures 6 through 10). Direct measurements were performed using gas proportional detectors coupled to ratemeter-scalers. Smear samples, for determining removable gross alpha, gross beta, H-3 and C-14 activity levels, were collected from each direct measurement location.

Soil Sampling

Ten soil samples—eight surface (0 to 15 cm) and two subsurface (15 to 30 cm)—were collected from eight locations within the excavated trenches in SU001 and SU005. At two of the surface sampling locations, elevated activity was detected—therefore, subsurface samples were collected. Sampling locations are shown on Figures 6 and 9b.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data were returned to ORISE's ESSAP laboratory in Oak Ridge, Tennessee for analysis and interpretation. Sample analyses were performed in accordance with the ORISE/ESSAP Laboratory Procedures Manual (ORISE 2000c). Soil samples were analyzed by wet chemistry analytical techniques for Sr-90 and the results reported in units of picocuries per gram (pCi/g). Soil samples were also analyzed by gamma spectroscopy to determine if any gamma emitting radionuclides, other than natural materials, were within the samples. Smears were analyzed for gross alpha and gross beta activity using a low-background gas proportional counter and for H-3 and C-14 using a liquid scintillation counter. Direct measurement data and smear data were converted to units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2). Additional information concerning major instrumentation, sampling equipment, and analytical procedures is provided in Appendices A and B.

FINDINGS AND RESULTS

DOCUMENT REVIEW

ESSAP's review of the background documentation, procedures, methods, and radiological data submitted by Stone & Webster and Weston to the NRC and forwarded to ESSAP were appropriate and appeared to adequately reflect the radiological status of the VAECC. Comments identified during these reviews were submitted to the NRC (ORISE 2000d).

SURFACE SCANS

Surface scans identified several areas of elevated direct beta radiation within each SU. These areas were marked for further investigation. Futher investigations indicated that these were small spots of elevated activity (less than or equal to 100 cm^2) and were not widespread. These locations were not remediated while ESSAP was on-site.

SURFACE ACTIVITY LEVELS

Total and removable surface activity levels for each survey unit are presented in Table 1 and summarized below for each survey unit.

Survey Unit 001 - Nuclear Medicine Laboratories

Twenty single-point direct measurements were performed in the four areas of SU001 that make up the Nuclear Medicine Laboratories (High Level Laboratory, Low Level Laboratory, Counting Room, and Ramp). Total beta surface activity levels ranged from -310 to 12,000 dpm/100 cm^2. Removable activity levels ranged from 0 to 3 dpm/100 cm^2 for alpha, -4 to 14 dpm/100 cm^2 for beta, -10 to 24 dpm/100 cm^2 for H-3, and -7 to 14 dpm/100 cm^2 for C-14.

Survey Unit 002 - Ejector Pit Room

Ten single-point direct measurements were performed in SU002. Total beta surface activity levels ranged from 14 to 5,400 dpm/100 cm^2. Removable activity levels ranged from 0 to 3 dpm/100 cm^2 for alpha, -6 to 3 dpm/100 cm^2 for beta, -9 to 21 dpm/100 cm^2 for H-3, and -5 to 8 dpm/100 cm^2 for C-14.

Survey Unit 004 - Men's Restroom

Ten single-point direct measurements were performed in SU004 and total beta surface activity levels ranged from -250 to 2,500 dpm/100 cm^2. Removable activity levels ranged from 0 to 1 dpm/100 cm^2 for alpha, -3 to 5 dpm/100 cm^2 for beta, -5 to 19 dpm/100 cm^2 for H-3, and -1 to 8 dpm/100 cm^2 for C-14.

Survey Unit 005 - Remaining Basement Areas

Forty single-point direct measurements were performed in SU005 which consisted of the Treatment Room, Controls & Records Room, Waiting Area, Mechanical Equipment Room, Control Room, TV Room (RT4B), and the associated hall/corrider. Total beta surface activity levels ranged from - 520 to 22,000 dpm/100 cm^2. Removable activity levels ranged from 0 to 5 dpm/100 cm^2 for alpha, -5 to 4 dpm/100 cm^2 for beta, -16 to 25 dpm/100 cm^2 for H-3, and -5 to 13 dpm/100 cm^2 for C-14.

Survey Unit 008 - Machine and Unassigned Space Rooms

Ten single-point direct measurements were performed in SU008 with total beta surface activity levels ranging from -360 to 4,400 dpm/100 cm^2. Removable activity levels ranged from 0 to 1 dpm/100 cm^2 for alpha, -4 to 3 dpm/100 cm^2 for beta, -21 to 25 dpm/100 cm^2 for H-3, and -6 to 7 dpm/100 cm^2 for C-14.

Exterior Areas

Two single-point direct measurements were performed in exterior areas outside of SU008. Total beta surface activity levels were 9 and 2,200 dpm/100 cm^2. Removable activity levels were 0 dpm/100 cm^2 for alpha, -2 and -1 dpm/100 cm^2 for beta, -1 and 17 for H-3, and -3 and 3 for C-14.

RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES

Radionuclide concentrations in the ten soil samples from the Nuclear Medicine Laboratory and corridor excavations ranged from 0.66 to 1.28 pCi/g for C-14 and from 0.20 to 37.8 pCi/g for Sr-90. The higher activity soil samples were collected from locations identified with beta activity surface scans. The gamma spectroscopy analysis did not indicate the presence of gamma emitting radionuclides other than those typically found in nature at expected background concentrations.

COMPARISON OF RESULTS WITH SITE-SPECIFIC RELEASE CRITERIA

Weston employed the alternate method described in MARSSIM Section 2.6.1; a direct comparison of each measurement result to the $DCGL_w$, to demonstrate compliance (NRC 1997). A degree of conservatism is built into this method, given that an elevated measurement criterion ($DCGL_{EMC}$) was not utilized. The NRC's Sr-90 screening level DCGL for structural surfaces of 8,700 dpm/100 cm^2 was used for data comparison (Weston 2000a and FR 1998).

Weston also submitted to the NRC a justification for a Sr-90 soil DCGL of 11 pCi/g which was approved by the NRC (Weston 2000b). A site specific DCGL for C-14 was not provided, however, the NRC interim screening value for C-14 soil surface contamination is 12 pCi/g (FR 1999).

There were four structural surface and two soil sampling locations identified with total surface activity levels or soil concentration above the DCGLs. The locations that exceeded the DCGL within the surveyed areas were not remediated while ESSAP was on-site. The following areas were identified as exceeding the DCGLs:

- SU001 - High Level Laboratory: Measurement locations 68 and 69 contain areas less than 100 cm^2 with beta contamination at 11,000 and 12,000 dpm/100 cm^2, respectively. Soil sample location 8 had a concentration of 37.8 pCi/g of Sr-90.
- SU001 - Counting Room: Soil sample location 5 had a concentration of 16.9 pCi/g of Sr-90.
- SU005 - TV Room (RT4B): Measurement location 48 contained an area less than 100 cm^2 with beta contamination at 17,000 dpm/100 cm^2. This room was apparently not surveyed by

Stone & Webster as ESSAP had not received any final status survey and observed that the area had not been gridded, that 75% of the floor space was inaccessible due to storage of excess hospital televisions, and the SU had been classified as Class 3.

- SU005 - Hall: Measurement location 53 contained an area less than 100 cm^2 with beta contamination at 22,000 dpm/100 cm^2.

SUMMARY

During the period February 26 through 28, 2001, at the request of the U.S. Nuclear Regulatory Commission's Region I Office, the Environmental Survey and Site Assessment Program of ORISE performed confirmatory radiological survey activities at the St. Albans Veterans Administration Extended Care Center, located in Queens, New York. Survey activities included beta and gamma surface scans, surface activity measurements, and soil sampling and analysis.

Surface scans identified residual beta activity on the floors and lower walls throughout the facility, but with a few exceptions, the activity levels were below the site DCGL screening levels for surface contamination. There were five locations identified with activity levels above the DCGL. There are no removable activity DCGLs, however an assumption is made that the fraction of removable surface contamination is equal to ten percent of the screening level (FR 1998). All removable activity levels were below ten percent of the DCGL screening levels for surface contamination.

It is ESSAP's opinion that surface activity measurements performed within the VAECC demonstrated that radiological contamination above the DCGL release criterion was not generally distributed on building surfaces—instead, locations of elevated direct radiation were determined to be discrete cases and not typical of widespread contamination. Other than these discrete locations, all remaining surface activity levels satisfied the site-specific DCGL approved by the NRC for unrestricted use of the facility. However, it should be noted that minimal survey activities were conducted in SU005 by Weston and ESSAP recommends that these areas be re-classified and re-surveyed since elevated residual activity exceeding the DCGL was found at two locations.

Surface scans identified two locations of residual beta activity on the ground surfaces within the Nuclear Medicine Laboratory drain pipe excavation that exceeded the Sr-90 soil DCGL. At both locations, a 0 to 15 cm and a 15 to 30 cm soil sample was collected. The 15 to 30 cm soil samples from both locations indicated that soil concentrations increased at those depths compared to the 0 to 15 cm soil concentrations.

FIGURES

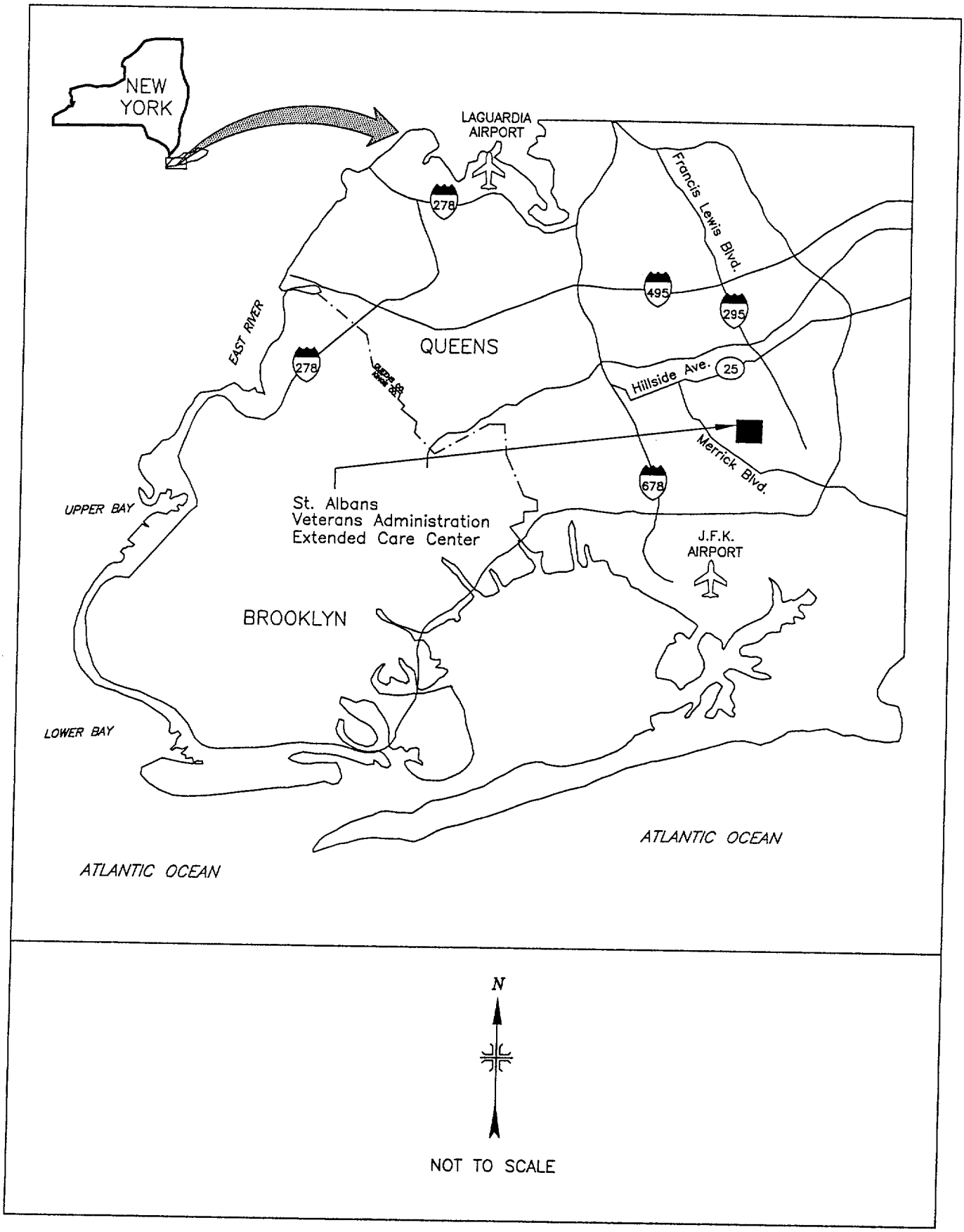

FIGURE 1: Queens County – Location of the St. Albans Veterans Administration Extended Care Center

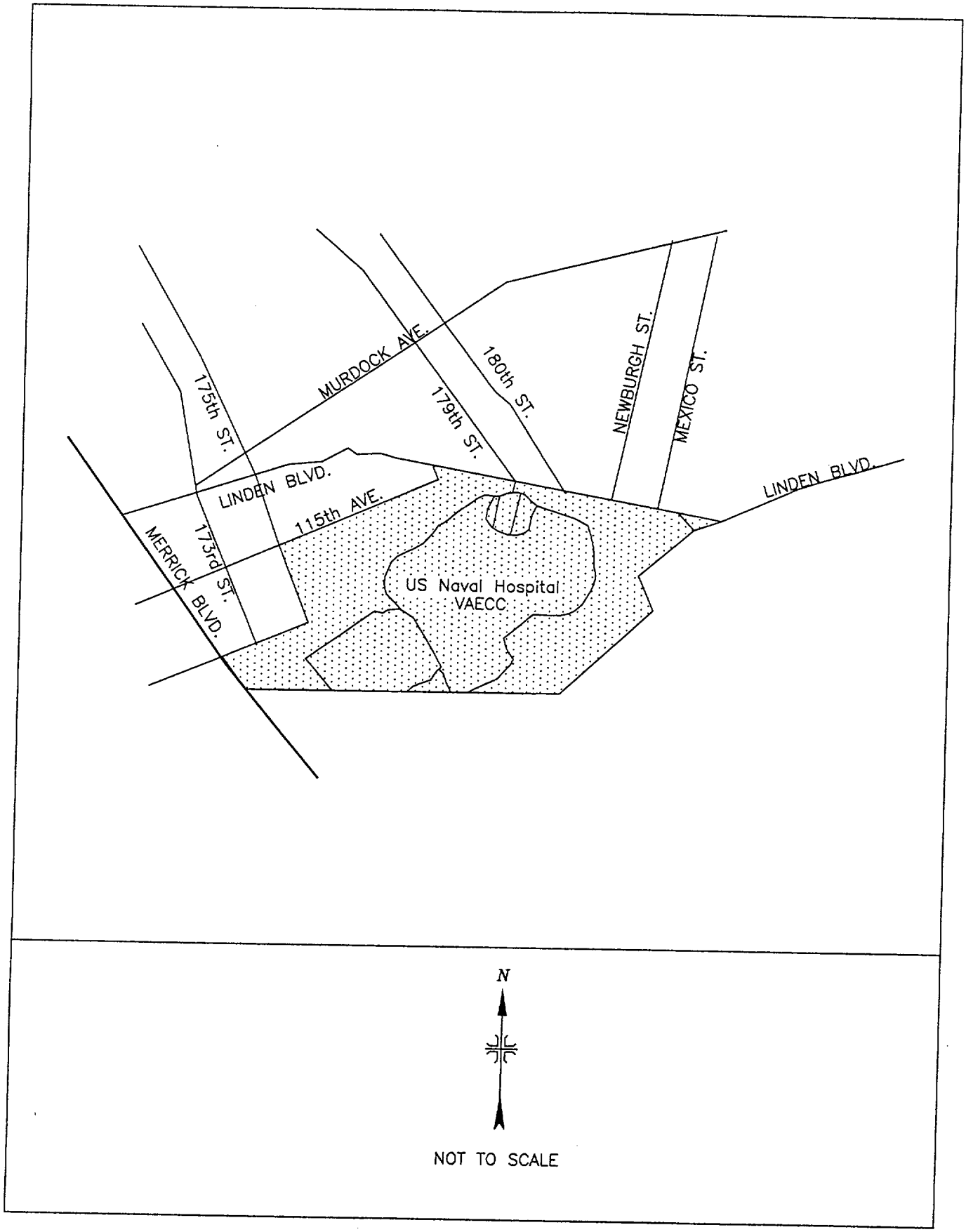

FIGURE 2: Street Plot – St. Albans Veterans Administration Extended Care Center (VAECC)

771-002 (1)

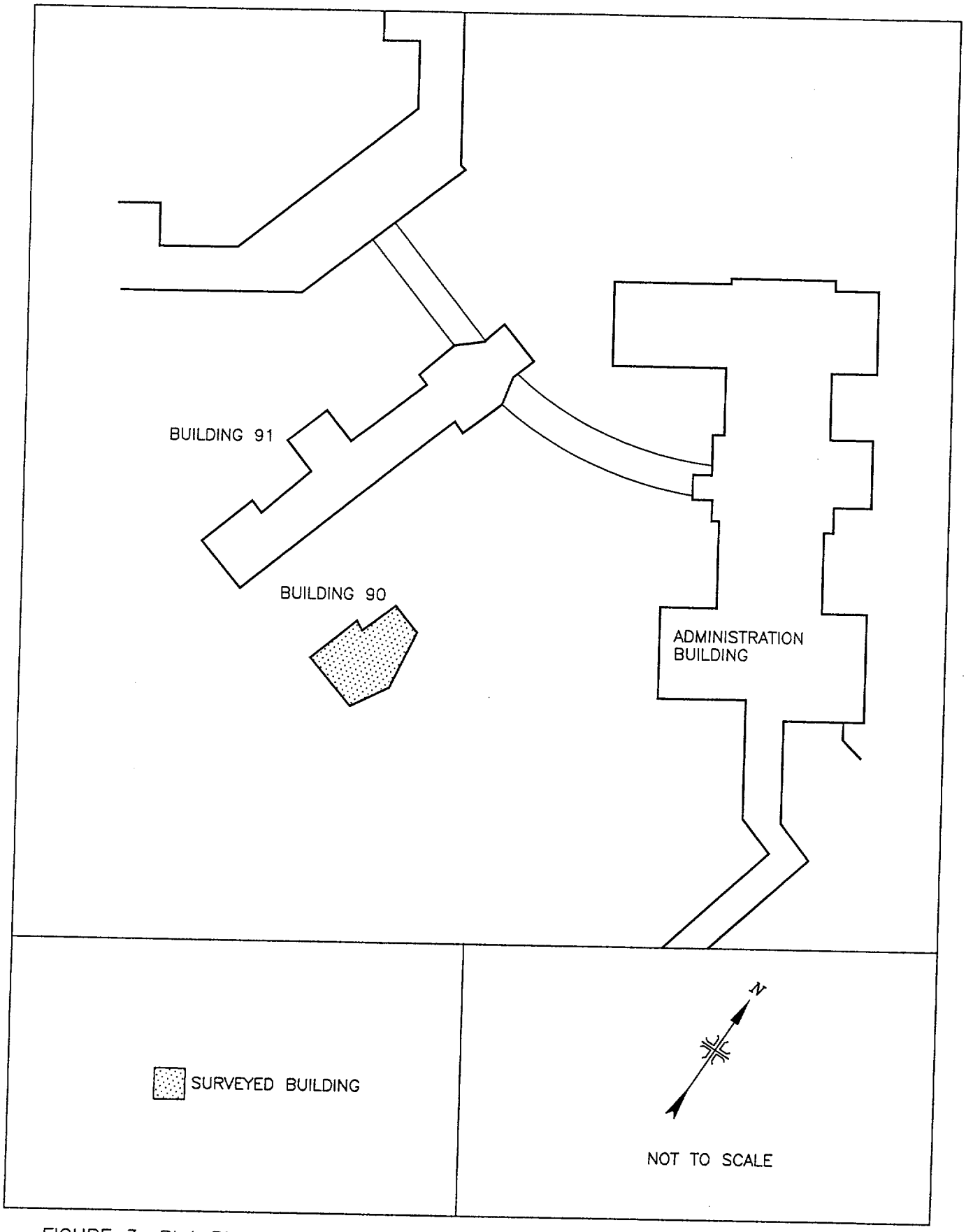

FIGURE 3: Plot Plan – St. Albans Veterans Administration Extended Care Center

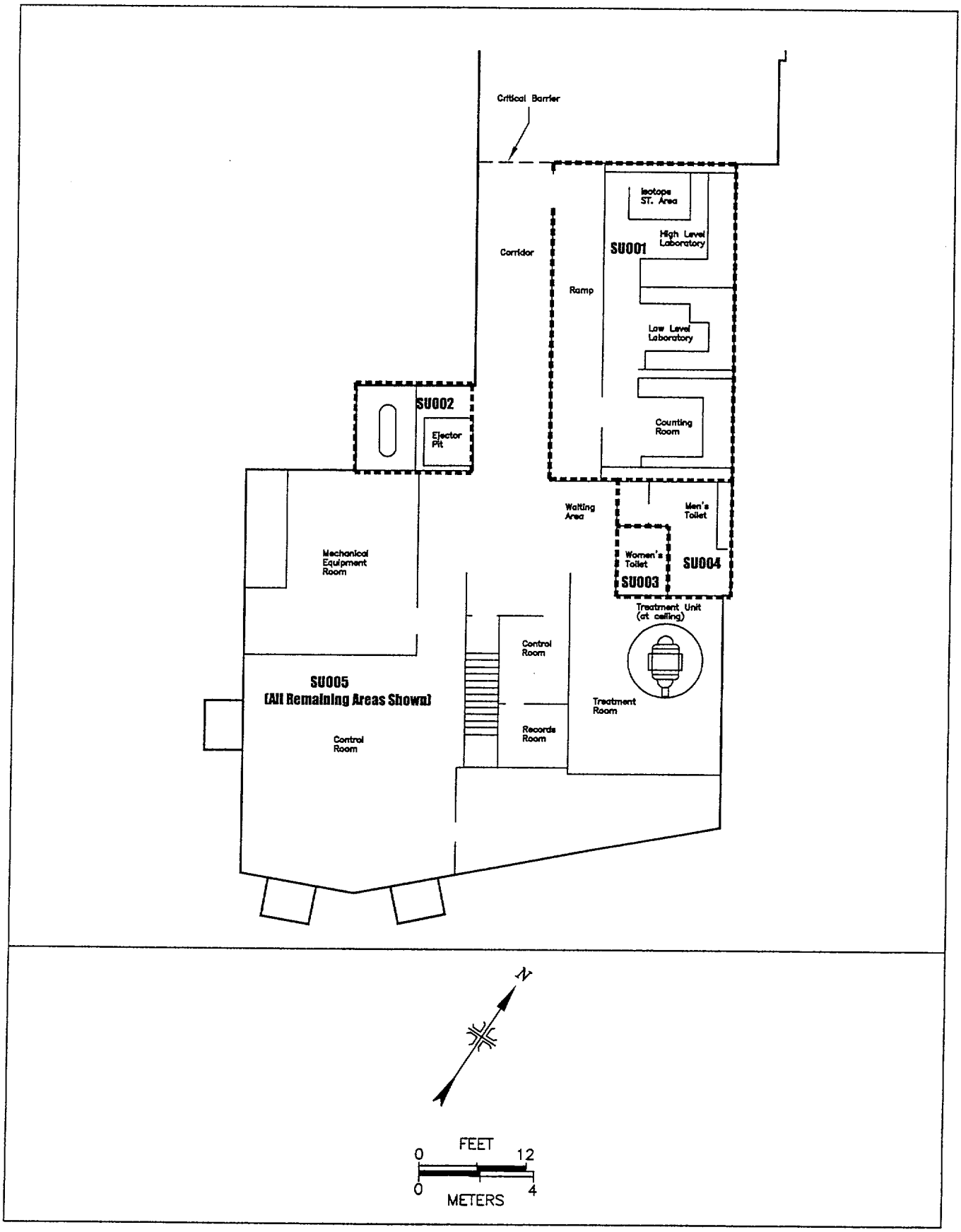

FIGURE 4: Building 90 Basement Level – Locations of SU001, SU002, SU003, SU004, and SU005

771-003 (2)

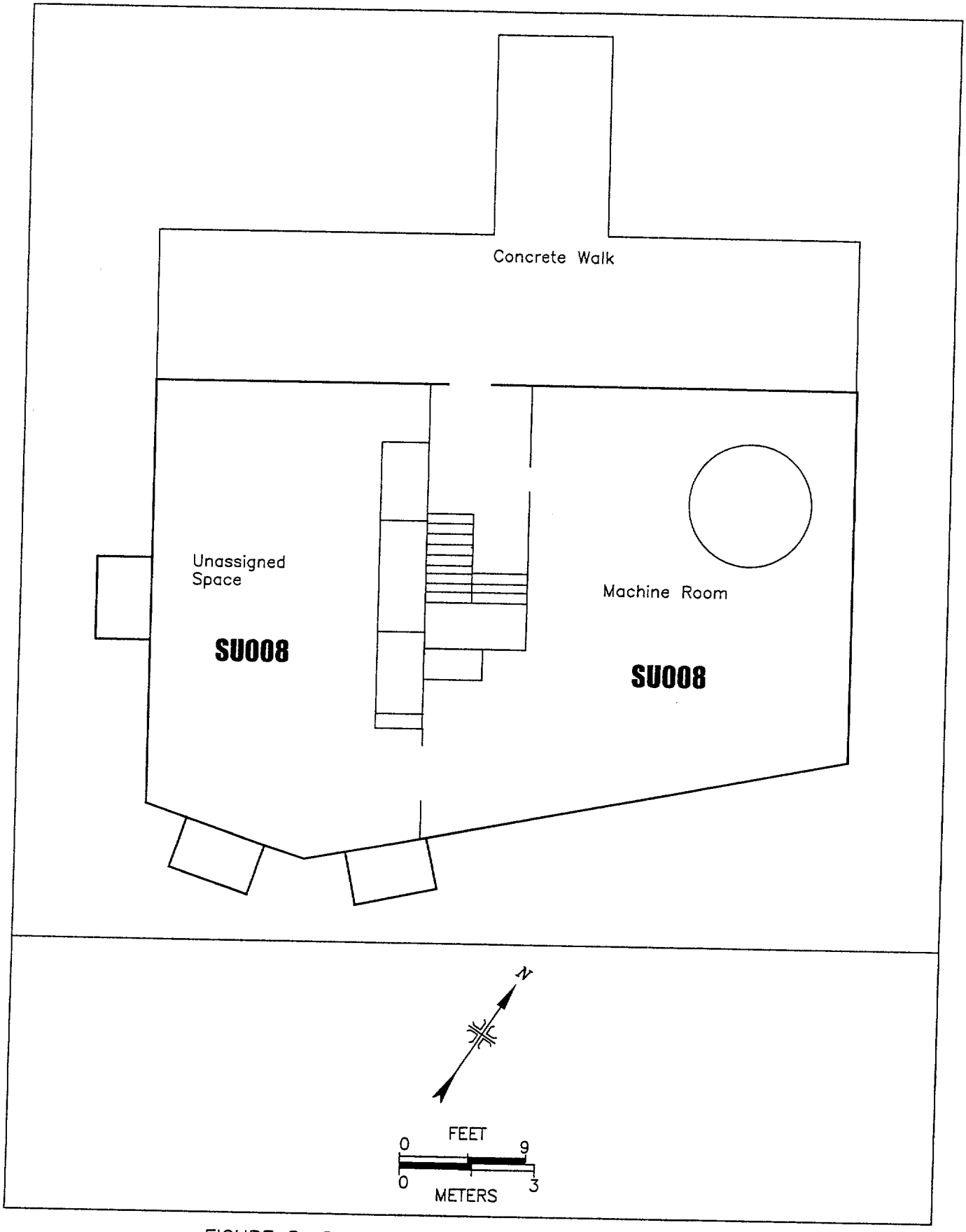

FIGURE 5: Building 90, Ground Floor – SU008

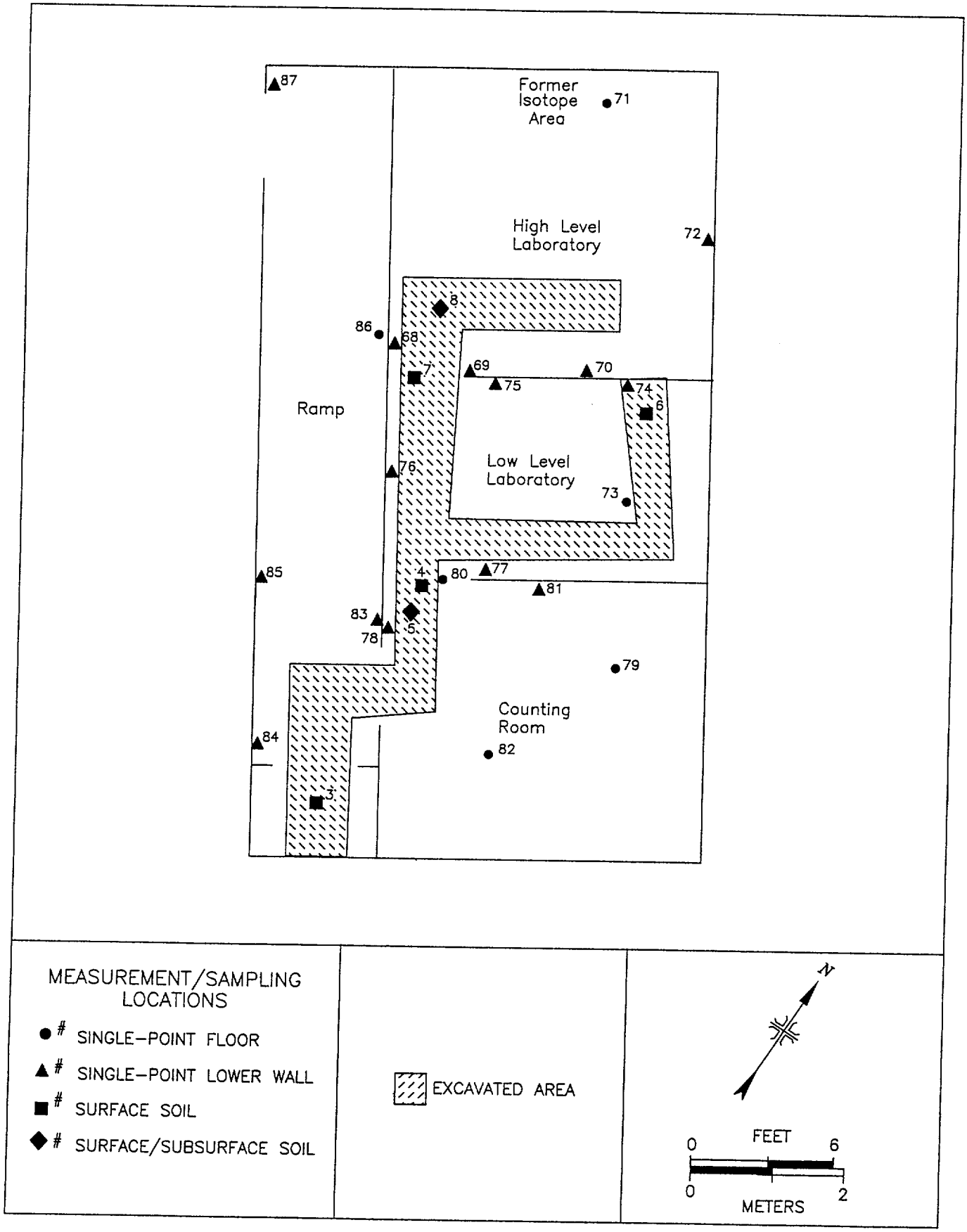

FIGURE 6: SU001 – Measurement and Sampling Locations

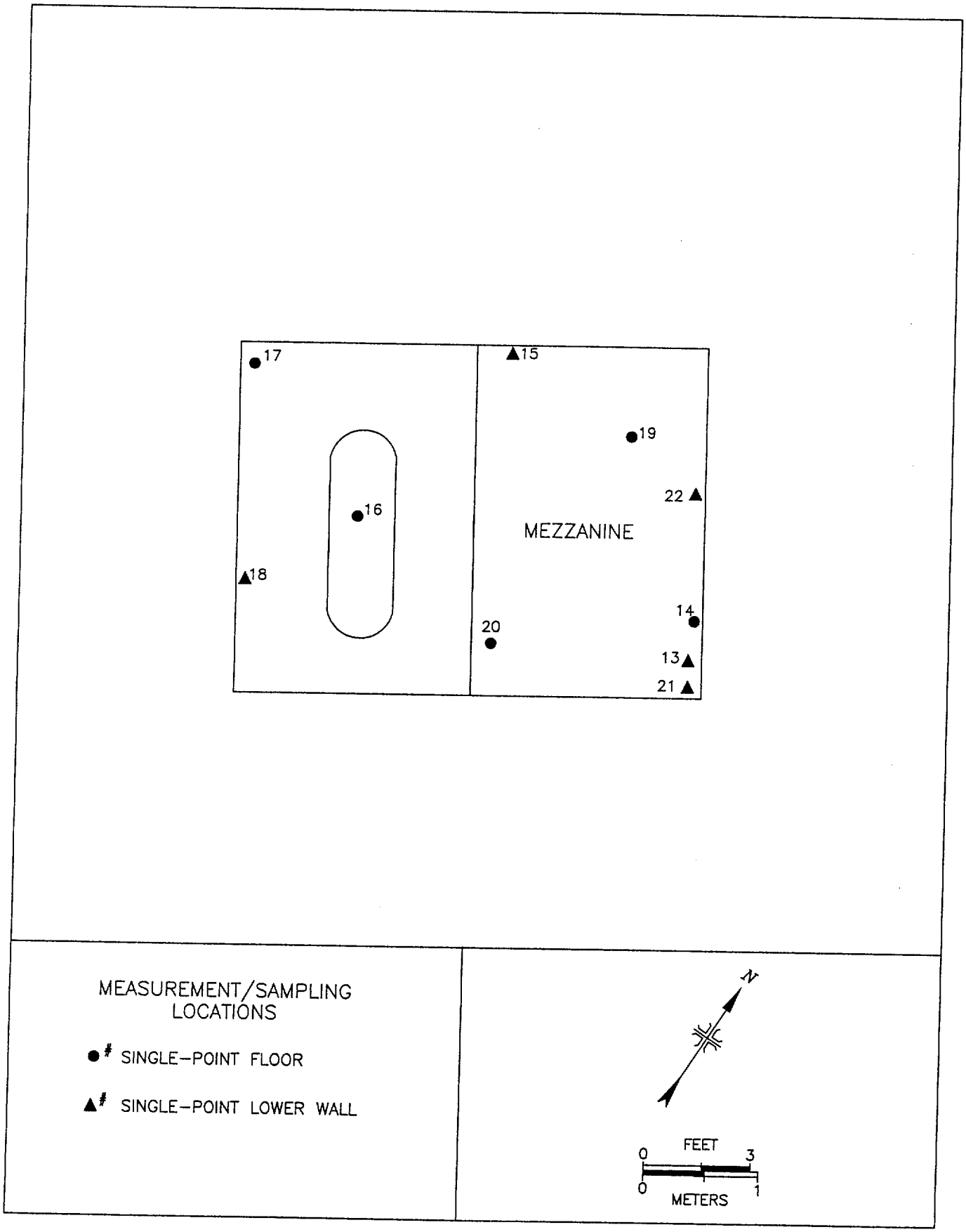

FIGURE 7: SU002 – Measurement and Sampling Locations

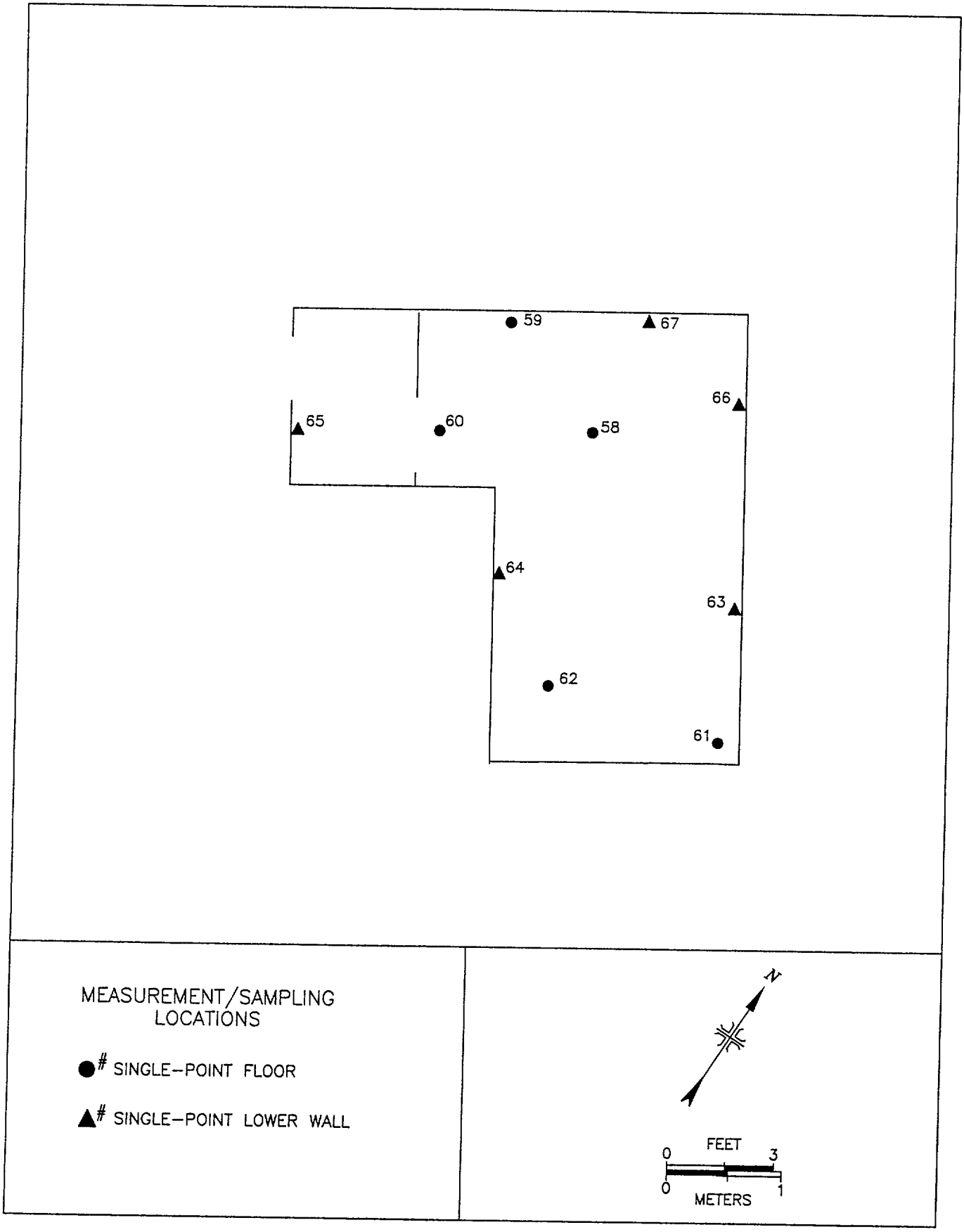

FIGURE 8: SU004 – Measurement and Sampling Locations

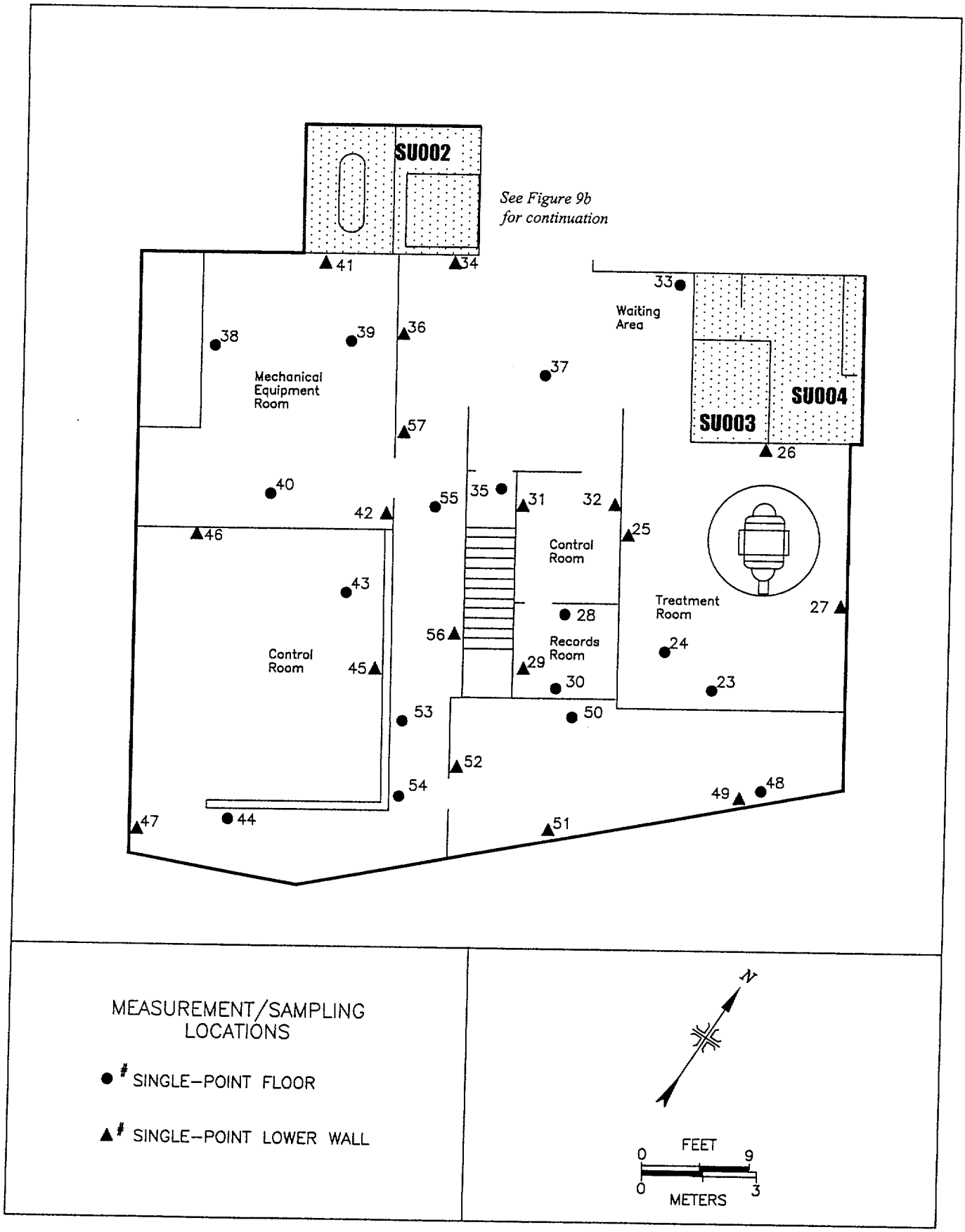

FIGURE 9a: SU005 – Measurement and Sampling Locations

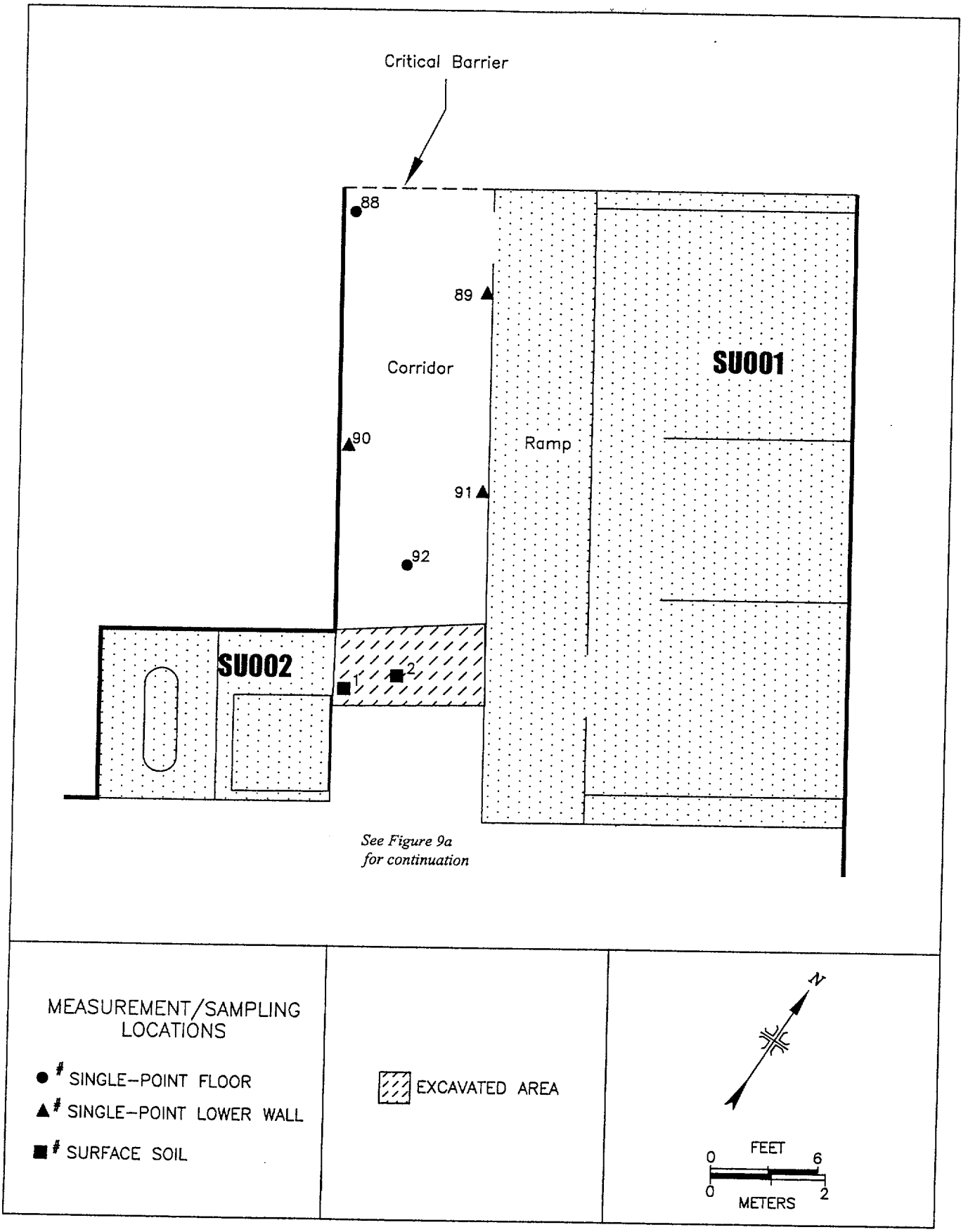

FIGURE 9b: SU005, Continuation – Measurement and Sampling Locations

771-012 (1)

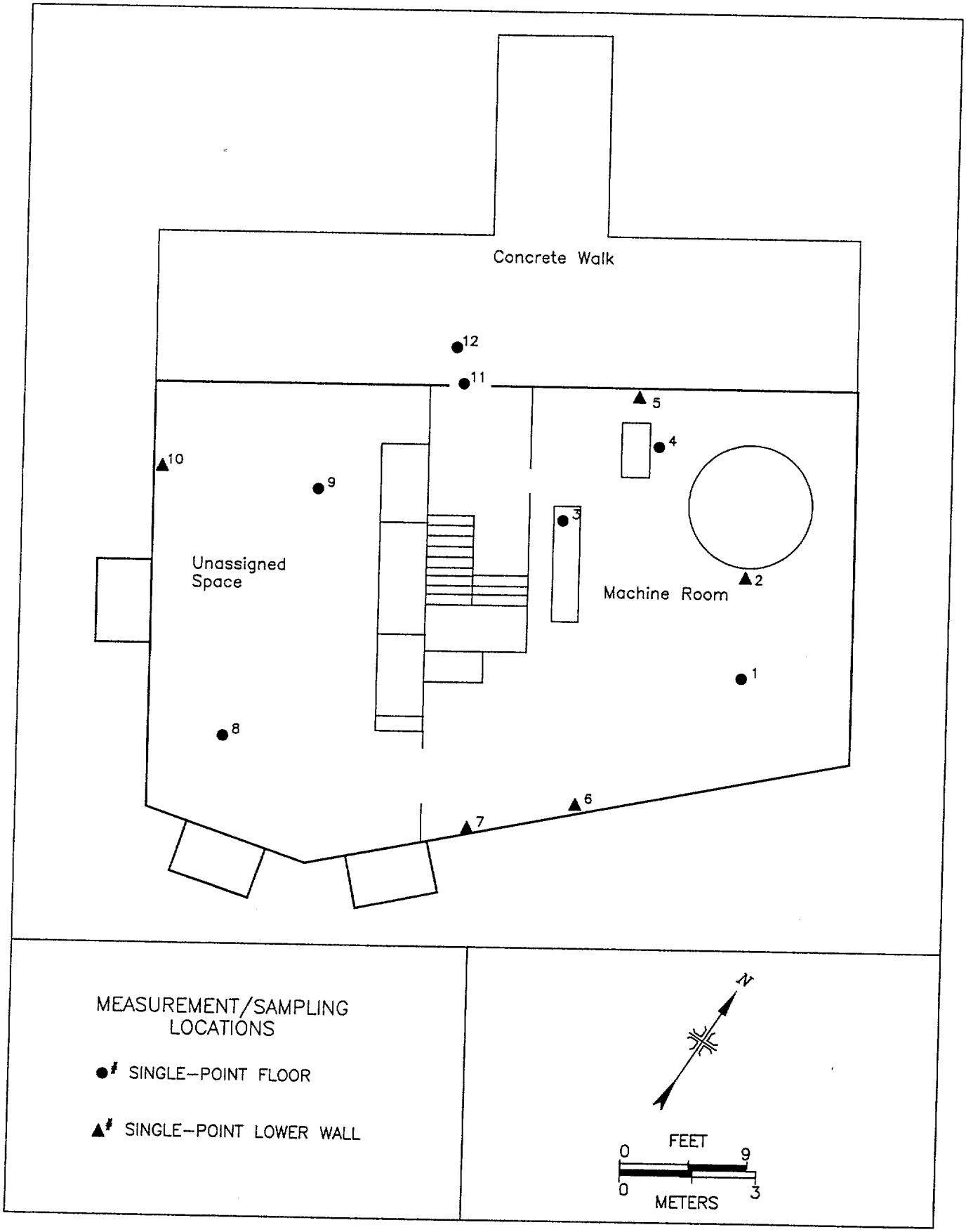

FIGURE 10: SU008 – Measurement and Sampling Locations

TABLES

TABLE 1

SURFACE ACTIVITY LEVELS
ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE FACILITY
QUEENS, NEW YORK

Survey Unit/ Location[a]	Total Beta Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)			
		Alpha	Beta	H-3	C-14
SU001 - High Level Laboratory					
68	11,000	0	-3	3 ± 23[b]	10 ± 12
69	12,000	1	1	21 ± 25	1 ± 12
70	4,800	0	8	-2 ± 23	13 ± 13
71	-140	3	-2	23 ± 25	6 ± 12
72	-310	0	-3	-7 ± 22	0 ± 12
SU001 - Low Level Laboratory					
73	940	0	1	1 ± 23	0 ± 12
74	4,800	0	-2	13 ± 24	9 ± 12
75	5,200	0	5	1 ± 23	-7 ± 11
76	-170	0	1	-7 ± 22	5 ± 12
77	3,600	0	6	14 ± 24	3 ± 12
SU001 - Counting Room					
78	6,500	0	3	18 ± 25	16 ± 13
79	2,400	1	14	6 ± 23	1 ± 12
80	7,400	0	-2	-3 ± 23	7 ± 12
81	3,400	0	6	-10 ± 22	3 ± 12
82	-140	0	-2	24 ± 25	9 ± 12
SU001 - Ramp					
83	2,900	0	4	4 ± 23	1 ± 12
84	3,200	0	2	20 ± 25	2 ± 12
85	6,900	3	9	1 ± 23	14 ± 13

TABLE 1 (Continued)

SURFACE ACTIVITY LEVELS
ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE FACILITY
QUEENS, NEW YORK

Survey Unit/ Location[a]	Total Beta Activity (dpm/100 cm²)	Removable Activity (dpm/100 cm²)			
		Alpha	Beta	H-3	C-14
SU001 - Ramp (Continued)					
86	-130	3	2	4 ± 23	-1 ± 12
87	6,400	0	-4	8 ± 24	2 ± 12
SU002 - Ejector Pit Room					
13	5,400	0	3	-5 ± 12	7 ± 12
14	1,200	0	-4	1 ± 23	-5 ± 11
15	300	3	-6	21 ± 25	4 ± 12
16	250	0	2	2 ± 23	2 ± 12
17	33	0	-1	-9 ± 22	3 ± 12
18	47	0	-3	5 ± 23	-2 ± 11
19	270	1	-3	-5 ± 22	8 ± 12
20	290	0	-1	16 ± 24	6 ± 12
21	79	0	-3	1 ± 23	2 ± 12
22	71	0	2	11 ± 24	2 ± 12
SU004 - Men's Restroom					
58	2,500	1	-1	4 ± 23	1 ± 12
59	83	1	3	3 ± 23	4 ± 12
60	-170	0	-3	4 ± 23	5 ± 12
61	-210	0	1	-5 ± 22	2 ± 12
62	-160	0	1	1 ± 23	-1 ± 12
63	700	0	4	12 ± 24	5 ± 12
64	580	0	5	19 ± 25	-1 ± 12

TABLE 1 (Continued)

SURFACE ACTIVITY LEVELS
ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE FACILITY
QUEENS, NEW YORK

Survey Unit/ Location[a]	Total Beta Activity (dpm/100 cm²)	Removable Activity (dpm/100 cm²)			
		Alpha	Beta	H-3	C-14
SU004 - Men's Restroom (Continued)					
65	630	0	-3	0 ± 23	6 ± 12
66	-250	0	2	-1 ± 23	8 ± 12
67	640	0	1	7 ± 24	2 ± 12
SU005 - Treatment Room					
23	1,900	0	-2	25 ± 25	13 ± 13
24	270	0	-2	8 ± 24	-4 ± 11
25	760	0	-3	-16 ± 21	12 ± 13
26	940	1	3	15 ± 24	1 ± 12
27	940	3	-1	16 ± 24	6 ± 12
SU005 - Control & Records Room					
28	210	0	-4	-5 ± 22	-1 ± 12
29	120	5	-1	-5 ± 22	9 ± 12
30	80	1	-1	-4 ± 22	3 ± 12
31	-270	0	-2	20 ± 25	1 ± 12
32	-520	0	-5	2 ± 23	1 ± 12
SU005 - Waiting Area					
33	-170	0	3	6 ± 23	2 ± 12
34	770	0	2	0 ± 23	4 ± 12
35	130	0	2	-11 ± 22	12 ± 13
36	850	0	-4	-2 ± 23	3 ± 12
37	-240	0	1	5 ± 23	6 ± 12

TABLE 1 (Continued)

SURFACE ACTIVITY LEVELS
ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE FACILITY
QUEENS, NEW YORK

Survey Unit/ Location[a]	Total Beta Activity (dpm/100 cm²)	Removable Activity (dpm/100 cm²)			
		Alpha	Beta	H-3	C-14
SU005 - Mechanical Equipment Room					
38	-76	0	-3	-7 ± 22	12 ± 13
39	300	1	3	9 ± 24	-3 ± 11
40	-73	0	-3	-1 ± 23	4 ± 12
41	-250	0	1	-13 ± 21	9 ± 12
42	150	0	-3	9 ± 24	-2 ± 11
SU005 - Control Room					
43	3,700	0	-1	7 ± 24	8 ± 12
44	730	0	-4	6 ± 23	-2 ± 11
45	-310	0	-3	5 ± 23	2 ± 12
46	-280	0	-1	-2 ± 23	4 ± 12
47	-290	0	2	24 ± 25	2 ± 12
SU005 - Room RT4B (TV Room)					
48	17,000	1	2	14 ± 24	11 ± 13
49	7,100	0	2	-10 ± 22	4 ± 12
50	-56	0	1	20 ± 25	2 ± 12
51	-420	0	-2	8 ± 24	6 ± 12
52	-250	1	4	16 ± 24	-5 ± 11
SU005 - Hall					
53	22,000	0	-2	21 ± 25	-2 ± 11
54	7,000	0	-3	13 ± 24	3 ± 12
55	5,100	1	-3	10 ± 24	2 ± 12

TABLE 1 (Continued)

SURFACE ACTIVITY LEVELS
ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE FACILITY
QUEENS, NEW YORK

Survey Unit/ Location[a]	Total Beta Activity (dpm/100 cm²)	Removable Activity (dpm/100 cm²)			
		Alpha	Beta	H-3	C-14
SU005 - Hall (Continued)					
56	100	0	1	-4 ± 22	4 ± 12
57	-110	0	-5	-1 ± 23	6 ± 12
SU005 - Corridor					
88	-100	3	0	15 ± 24	1 ± 12
89	150	2	0	14 ± 24	8 ± 12
90	390	2	0	9 ± 24	6 ± 12
91	250	2	0	25 ± 25	8 ± 12
92	-230	3	0	-9 ± 22	2 ± 12
SU008 - Machine Room					
1	-37	1	-2	3 ± 23	1 ± 12
2	-360	0	-1	22 ± 25	7 ± 12
3	150	0	-4	12 ± 24	-1 ± 12
4	4,400	0	3	-2 ± 23	7 ± 12
5	230	0	3	1 ± 23	-6 ± 11
6	89	1	-2	-21 ± 21	3 ± 12
7	-110	0	-3	25 ± 25	4 ± 12
SU008 - Unassigned Space					
8	59	0	-1	-12 ± 22	5 ± 12
9	-160	0	-3	-2 ± 23	5 ± 12
10	-56	0	-3	- 4 ± 22	6 ± 12

TABLE 1 (Continued)

SURFACE ACTIVITY LEVELS
ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE FACILITY
QUEENS, NEW YORK

Survey Unit/ Location[a]	Total Beta Activity (dpm/100 cm^2)	Removable Activity (dpm/100 cm^2)			
		Alpha	Beta	H-3	C-14
SU008 - Building Entrance Way					
11	2,200	0	-1	17 ± 25	3 ± 12
12	9	0	-2	-1 ± 23	-3 ± 11

[a]Refer to Figures 6 through 10.
[b]Uncertainties represent the 95% confidence levels based on total propagated uncertainties.

TABLE 2

RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. ALBANS VETERANS ADMINISTRATION EXTENDED CARE FACILITY
QUEENS, NEW YORK

Sample Location[a]	Radionuclide Concentration (pCi/g)	
	C-14	Sr-90
1	1.16 ± 0.84[b]	0.88 ± 0.49
2	0.74 ± 0.83	1.02 ± 0.50
3	1.28 ± 0.85	0.20 ± 0.41
4	1.26 ± 0.84	2.84 ± 0.58
5	1.28 ± 0.85	13.03 ± 0.99
5 (15 to 30 cm)	0.66 ± 0.83	16.9 ± 1.1
6	1.03 ± 0.83	0.79 ± 0.47
7	0.68 ± 0.83	2.54 ± 0.56
8	0.84 ± 0.83	31.4 ± 1.4
8 (15 to 30 cm)	0.66 ± 0.83	37.8 ± 1.6

[a]Refer to Figures 6 and 9b.
[b]Uncertainties represent the 95% confidence levels based on total propagated uncertainties.

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U.S. Nuclear Regulatory Commission (NRC). NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Washington, DC: NRC; December 1997.

APPENDIX A

MAJOR INSTRUMENTATION

APPENDIX A

MAJOR INSTRUMENTATION

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

DIRECT RADIATION MEASUREMENT

Instruments

Eberline Pulse Ratemeter
Model PRM-6
(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

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

Ludlum Gas Proportional Detector
Model 43-68
Physical Probe Area, 126 cm^2
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Victoreen NaI Scintillation Detector
Model 489-55
3.2 cm x 4 cm crystal
(Victoreen, Cleveland, OH)

LABORATORY ANALYTICAL INSTRUMENTATION

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

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

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

Tri-Carb Liquid Scintillation Analyzer
Model 1900CA
(Packard Instrument Co., Meriden, CT)

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

APPENDIX B
SURVEY AND ANALYTICAL PROCEDURES

PROJECT HEALTH AND SAFETY

All survey and laboratory activities were conducted in accordance with ORISE health and safety and radiation protection programs.

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 were used.

Analytical and field survey activities were conducted in accordance with procedures from the following documents of the Environmental Survey and Site Assessment Program:

- Survey Procedures Manual (September 2000)
- Laboratory Procedures Manual (June 2000)
- Quality Assurance Manual (March 2000)

The procedures contained in these manuals were developed to meet the requirements of DOE Order 414.1A 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 MAPEP, NRIP, ITP, and EML Laboratory Quality Assurance Programs.
- Training and certification of all individuals performing procedures.
- Periodic internal and external audits.

DETECTION LIMITS

Detection limits, referred to as minimum detectable concentration (MDC), were based on 3 plus 4.65 times the standard deviation of the background count [$3 + (4.65\sqrt{BKG})$]. When the activity was determined to be less than the MDC of the measurement procedure, the result was reported as the actual (positive or negative) value. Because of variations in background levels, measurement efficiencies, and contributions from other radionuclides in the vicinity of the measurement area, the detection limits may differ from measurement to measurement and instrument to instrument.

SURVEY PROCEDURES

Surface Scans

Surface scans were performed by passing the detectors slowly over the surface; the distance between the detectors and the surface was maintained at a minimum—nominally about 1 cm. A large surface area (550 cm^2), gas proportional floor monitor was used to scan the floors and some wall surfaces of the surveyed areas. Other surfaces were scanned using small area (126 cm^2) gas proportional 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:

Beta	-	gas proportional detector with ratemeter-scaler
Gamma	-	NaI scintillation detector with ratemeter

Scan minimum detectable concentrations (scan MDCs) were estimated using the calculational approach described in NUREG-1507.[1] The scan MDC is a function of many variables, including the background level. Typical beta background levels on floors and walls range from 800 to 1400 cpm for the large area gas proportional detectors and range from 250 to 450 cpm for the hand-held gas

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

proportional detectors. Additional parameters selected for the calculation of scan MDCs included a one-second observation interval, a specified level of performance at the first scanning stage of 95% true positive rate and 25% false positive rate, which yields a d' value of 2.32 (NUREG-1507, Table 6.1), and a surveyor efficiency of 0.5. The 2π scan beta instrument efficiency (ϵ_i) for the floor monitor and hand-held gas proportional detectors calibrated to Sr-90 was 0.44. To illustrate an example for the hand-held gas proportional, the minimum detectable count rate (MDCR) and scan MDC for beta activity can be calculated as follows:

b_i = (250 cpm)(1 s)(1 min/60 s) = 4.2 counts,

MDCR = (2.32)(4.2 counts)$^{1/2}$ [(60 s/min)/(1 s)] = 285 cpm,

$MDCR_{surveyor}$ = 169/(0.5)$^{1/2}$ = 403

The scan MDC is calculated assuming a source efficiency (ϵ_s) of 0.50 (for Sr-90):

$$Scan\ MDC = \frac{MDCR_{surveyor}}{(\epsilon_s)\ (\epsilon_i)}\ dpm/100\ cm^2$$

For the given background range, the estimated scan MDC for the hand-held gas proportional detector ranges from 1,830 to 2,450 dpm/100 cm^2. For the floor monitor, the estimated scan MDC range is from 3,270 to 4,320 dpm/100 cm^2.

Surface Activity Measurements

Measurements of total surface activity levels were performed using gas proportional detectors with portable ratemeter-scalers. Surface activity measurements were performed on floors, lower walls, upper walls and at locations of elevated direct radiation.

Count rates (cpm), which were integrated over one minute with the detector held in a static position, were converted to activity levels (dpm/100 cm^2) by dividing the net rate by the total efficiency ($\epsilon_i \times \epsilon_s$) and correcting for the active area of the detector. The 2π static beta instrument efficiency

factor (ϵ_i) was 0.57 for the gas proportional detectors calibrated to Sr-90 and the source efficiency factor (ϵ_s) was 0.50. The total beta efficiency factor for the gas proportional detectors was 0.29.

Because different building materials (poured concrete, brick, wood, steel, etc.) may have different background levels, average background count rates were determined for each material encountered in the surveyed area at a location of similar construction and having no known radiological history. The beta activity background count rates for the gas proportional detector averaged 503 cpm for concrete; 401 cpm for concrete block; 298 cpm for sheetrock and metal; and, 759 cpm for tile. The beta minimum detectable concentrations (MDC) were 294 dpm/100 cm^2 for concrete; 263 dpm/100 cm^2 for concrete block; 228 dpm/100 cm^2 for sheetrock and metal; and, 359 dpm/100 cm^2 for tile. The physical probe area for the gas proportional detectors was 126 cm^2.

Removable Activity Measurements

A smear sample for removable gross alpha, gross beta, H-3, and C-14 activity was collected from each direct measurement location. Removable gross alpha and gross beta activity levels were determined using numbered filter paper disks, 47 mm in diameter. Moderate pressure was applied to the smear and approximately 100 cm^2 of the surface was wiped. Smears were placed in labeled envelopes with the location and other pertinent information recorded. Typically, a separate set of wet smears (wet smears improve collection efficiency) would be collected for H-3 and C-14 analysis as per ESSAP procedures, however, this analysis was requested after the survey had been initiated when C-14 was mentioned as a possible contaminant while ESSAP was at the site.

ANALYTICAL PROCEDURES

Gross Alpha/Beta

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

Liquid Scintillation

Smears were counted in a liquid scintillation counter for low-energy beta activity to determine H-3 and C-14 activity—typical MDCs for the procedures are 42 and 21 dpm/100 cm^2, respectively.

Strontium-90

Soil samples are dissolved by a combination of potassium hydrogen fluoride and pyrosulfate fusions. The fusion cake is dissolved and strontium is coprecipitated on lead sulfate. The strontium is separated from residual calcium and lead by reprecipitating strontium sulfate from EDTA at a pH of 4.0. Strontium is separated from barium by complexing the strontium in DTPA while precipitating barium as barium chromate. The strontium is ultimately converted to strontium carbonate and counted on a low-background gas proportional counter. The typical MDC of the procedure is 0.8 pCi/g for a one hour count time.

Carbon-14

Soil samples are combusted by sending a portion of the sample, approximately one gram, through a stream of oxygen gas. The combusted products are then passed through a series of catalysts trapping the carbon-14 in a prescribed scintillation cocktail. Aliquots of the scintillation cocktail solution were analyzed in a liquid scintillation counter. The typical MDC of the procedure is 1.4 pCi/g for a one hour count time.

Gamma Spectrometry

Samples of soil were dried, mixed, crushed, and/or homogenized as necessary, and a portion sealed in a 0.5-liter Marinelli beaker or other appropriate container. The quantity placed in the beaker was chosen to reproduce the calibrated counting geometry. 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. Total absorption

peaks were reviewed to determine if any gamma emitting radionuclides were present, above typical background levels, within the samples.