GENERAL ATOMICS

March 22, 2001
CAL/696-3342

VIA EXPRESS MAIL SERVICE

ATTN: Dr. Ronald Rogus (in Duplicate)
State of California
Department of Health Services
Radiologic Health Branch Mail Stop 178
601 North 7th Street
Sacramento, CA 95814-0208

Subject: **Radioactive Materials License No. 0145-37: Request to Release Certain Portions of General Atomics' Facility to Unrestricted Use and Delete them from License: Namely, Building 30 - Phase V**

and

Ms. Mary Adams
Licensing Section 1/Licensing Branch
Division of Fuel Cycle Safety
and Safeguards, NMSS
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: **Docket No. 70-734; SNM-696: Request to Release Certain Portions of General Atomics' Facility to Unrestricted Use and Delete them from License: Namely, Building 30 - Phase V**

Dear Dr. Rogus and Ms. Adams:

As you are aware, General Atomics (GA) is continuing its efforts to decontaminate, as appropriate, and obtain the release to unrestricted use of selected facilities and land areas on its San Diego Site. GA has recently completed the Final Radiological Survey of rooms associated with GA's Building 30/31 complex. As you know, the Building 30/31 complex is being released in phases. Phases I, II and III have been released to unrestricted use by both the NRC and the State of California. Phase IV is in the process of being surveyed by GA. Phase V has recently been completed and is the subject of this letter. Please see the enclosed figure titled "Building 30/31 Complex (Phases I, II, III, IV & V)," which shows each of the "phases."

The Building 30 - Phase V area is located in the Building 30 portion of the complex. Building 30 was the location of the former Linear Accelerator Facility (LINAC). Building 30 - Phase V consists of Rooms 114A, 114, 113, 108B, 113A, 119, 120, 122, and 123 the North Tunnel and adjacent soil areas north and south of Room 113A. This area occupies ~ 6,950 ft² (~645 m²).

NMSSO / Public

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The LINAC was a 100 MeV Linear Electron Accelerator that was operated in these rooms from 1961 until 1978. Some activation (mainly Eu-152, Eu-154 and Co-60) of the concrete walls and ceiling occurred as a result of these operations.

In addition to the accelerators, two nuclear reactor assemblies were operated in Room 123. One of these assemblies was a sub-critical assembly and the other was a critical assembly, both of which contained enriched uranium. Both of these reactor assemblies were last operated in early 1973. They were disassembled and the fuel was removed from the site before the end of that year. In 1989, a 15 MeV accelerator was installed in Room 114 and was used to irradiate gemstones. This accelerator was operated at 10 MeV so there was very little activation of structural materials at this low energy level. This accelerator was shut down in 1992.

Characterization surveys detected radioactive contamination levels above the release criteria in rooms 114, 113, 113A, and 123. The contamination was identified as Co-60, Eu-152, and Eu-154 which was due to neutron activation. The radioactivity was found in both the concrete and in the associated rebar located in the shield walls separating rooms 114 and 113 and rooms 113 and 113A . In Room 113A, Co-60 activation was found in the ceiling, floor, and side walls. In Room 123, the west wall was activated to levels above the NRC and the State of California approved release criteria for Eu-152 and Eu-154. In addition, several small spots of U-235 contamination were found on the floor in Room 123. After decontamination, which included both the disposal of activated concrete as radioactive waste and decontamination of the concrete by other means, a final radiological survey was performed.

This report documents the results of extensive and comprehensive radiological measurements completed in the rooms and soil areas which comprise Building 30 Phase V to demonstrate that these rooms and soil areas meet the approved criteria for release to unrestricted use. Accordingly, GA hereby requests that Building 30 - Phase V, as described in the enclosed report, be released to unrestricted use and deleted from GA's State and NRC radioactive and special nuclear material licenses, respectively.

The history of use of the Phase V rooms and areas in Building 30 involves both NRC and State licensed material. The radioactive contamination found during the radiologic surveys is attributable mainly to activation products (State licensed radioactive material), although some uranium contamination was detected in Room 123. In previous NRC/State/GA coordination meetings, it was decided that the lead regulatory agency for the Building 30/31 complex would be determined on a room-by-room basis. In this instance, it appears that Phase V falls into the jurisdiction of the State. However, GA suggests that this be discussed at the NRC/State/GA meeting to be held on Friday, April 6, 2001.

If you should have any questions regarding this information, please contact Paul R. Maschka at (858) 455-2959, Laura Q. Gonzales at (858) 455-2758, or me at (858) 455-2823.

Your assistance in responding to our request is very much appreciated.

Very truly yours,

Laura Q Gonzales for

Keith E. Asmussen, Ph.D., Director
Licensing, Safety and Nuclear Compliance

Enclosed Figure: "Building 30/31 Complex showing Phases I, II, III, IV, and V"

Enclosure: Report titled: "General Atomics' Final Radiological Survey Report of Building 30 - Phase V Rooms for Release to Unrestricted Use" dated March 2001

cc: Dr. D. Blair Spitzberg, Chief, NMSS Branch 3, Region IV
Mr. Wayne L. Britz, Fuel Cycle Inspector, NRC Region IV
Mr. Emilio Garcia, Fuel Cycle Inspector, NRC Region IV
Ms. Kathleen Henner, State of CA, Brea, CA
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FINAL RADIOLOGICAL SURVEYS OF THE BUILDING 30 - PHASE V ROOMS FOR RELEASE TO UNRESTRICTED USE

Prepared by: Paul R. Maschka, Phil Poole,
Steve Finchum, Richard Stowell,
and Laura Gonzales

March 2001

GENERAL ATOMICS

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INTRODUCTION

General Atomics (GA) is continuing its efforts directed at decontaminating, as appropriate, and obtaining the release to unrestricted use of selected laboratories and facilities on its San Diego Site. GA has recently completed the Final Surveys for a group of rooms in Building 30, the former Linear Accelerator Facility (LINAC). These rooms which consist of Rooms 114A, 114, 113, 108B, 113A, 119, 120, 122, and 123 the North Tunnel and adjacent soil areas north and south of Room 113A have been designated as Building 30 - Phase V.

The LINAC was a 100 MeV Linear Electron Accelerator that was operated in these rooms from 1961 until 1978. Some activation (mainly Eu-152, Eu-154 and Co-60) of the concrete walls and ceiling occurred as a result of these operations.

In addition to the accelerators, two nuclear reactor assemblies were operated in Room 123. One of these assemblies was a sub-critical assembly and the other was a critical assembly, both of which contained enriched uranium. Both of these reactor assemblies were last operated in early 1973. They were disassembled and the fuel was removed from the site before the end of that year. In 1989, a 15 MeV accelerator was installed in Room 114 and was used to irradiate gemstones. This accelerator was operated at not greater than 10 MeV, so there was very little activation of structural materials at this low energy level. This accelerator was shut down in 1992.

Characterization surveys detected radioactive contamination levels above the release criteria in rooms 114, 113, 113A, and 123. The contamination was identified as Co-60, Eu-152, and Eu-154 which was due to neutron activation. The radioactive materials were found in both the concrete and in the rebar located in the shield walls separating rooms 114 and 113 and rooms 113 and 113A . In Room 113A, Co-60 activation was found in the ceiling, floor, and side walls. In Room 123 the west wall was activated to levels above the NRC and the State of California approved release criteria with Eu-152 and Eu-154. In addition, several spots of U-235 contamination was found in the floor in Room 123. After decontamination, which included both the removal of activated concrete (for disposal as radioactive waste) and/or decontamination of the concrete by other means, a final radiological survey was performed.

This report documents the results of extensive and comprehensive radiological measurements completed in the Building 30 Phase V rooms to demonstrate that these rooms meet the approved criteria for release to unrestricted use. The Phase V rooms consist of Rooms 114A, 114, 113, 108B, 113A, 119, 120, 122, and 123 and the North Tunnel. It also includes surveys completed on the adjacent soil areas north and south of room 113A. The total area to be released to unrestricted use is ~ 6,950 ft^2 (~645 m^2). Accordingly, GA is requesting that the "Phase V" rooms and the exposed soil areas as described in this report be released to unrestricted use.

SITE DESCRIPTION

GA's Main Site and Sorrento Valley Site are shown in Figure 1. A layout of the Building 30/31 Complex is shown in Figure 2, including a description of the uses of the various rooms as they were during LINAC operations. Figure 3 shows Building 30 and the various Phases: I, II, III, IV, and V. The rooms and soil areas comprising "Phase V" are shown in Figure 4 and are summarized in the following table.

Building 30 Phase V Rooms		
Room #	**ft²**	**m²**
114A	~180	~17
114	~677	~62
113	~869	~81
108B	~204	~19
113A	~1117	~104
119	~482	~45
120	~625	~58
122	~216	~20
North Tunnel (NT)	~63	~6
123	~616	~57
113A North soil area	~605	~56
113A South soil area	~1296	~120
TOTAL	~ 6950	~ 645

PREVIOUS ACTIVITIES (HISTORY OF USE) AND CLASSIFICATION

The 100 MeV linear electron accelerator (LINAC) was operated in this building until 1978 (See figure 2). The LINAC consisted of two in-line accelerators which could be operated independently at 25 and 75 MeV, respectively. The two accelerators could be connected in tandem and could operate at up to 100 MeV. The layout of the accelerator facility is shown in Figure 2. The accelerators were located in Rooms 114A and 114. A shield wall in the west end of room 114 separated what had been the two accelerator rooms. The single section accelerator located in the west end of the room (Room 114A) could direct the electron beam into that room and into Room 118. The three-section accelerator was located in room 114. The electron beam could be directed to operating positions called "ports" in rooms 114, 119, 113, 113A, and 123. The primary use of the accelerator was

nuclear physics research, production of high energy neutrons, radiation processing of semiconductors and gemstones, sterilization of medical products, testing of electronic circuits and components, and production of radioisotopes. Room 120 was a detector room that contained a large liquid scintillator. Room 122 was the location of the control consoles for the critical assembly called the Accelerator Pulsed Fast Assembly (APFA), a sub-critical reactor assembly, and a neutron generator all of which had been located in Room 123.

Room 114A The single section accelerator was located in this room. It was used for radiation processing of semiconductors and gemstones. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of irradiating samples. This room was classified as an **unaffected area** because radioactive contamination was not expected or likely.

Room 114 This room contained the three-section accelerator. It was used for the production of radioisotopes, for the gamma irradiation of various materials, for nuclear physics experiments, and for the production of positrons. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples. This room was classified as an **unaffected area** because radioactive contamination was not expected or likely. The east wall was a shield wall separating Rooms 114 and 113. This wall was classified as **suspect affected** because it had a higher potential for becoming activated.

Room 113 This room was used for testing electronic circuits and components. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples. This room was classified as an **unaffected area** because radioactive contamination was not expected or likely. The east and west walls were shield walls separating Rooms 114 and 113 and Rooms 113 and 113A. These walls were classified as **suspect affected** because they had a higher potential for becoming activated.

Room 108B This area was the main entrance to the accelerator. The door was made of 6' thick concrete mounted on a railroad track. The electron beam was not directed at this door. This room was classified as an **unaffected area** because radioactive contamination was not expected or likely.

Room 113A This room was used for nuclear physics research and production of high energy neutrons. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples. Depleted uranium targets, in sealed canisters, were used for creation of high energy neutrons. This room was classified as a **suspect affected area** because of the potential for contamination.

Room 119 This room was used for nuclear physics research. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples. This room was classified as an **unaffected area** because radioactive contamination was not expected or likely.

Room 120 This room was about three feet below grade on the north and east sides, and had a sloping walkway on the west side leading into Room 119. The room had a concrete floor and concrete walls up about four feet. The upper walls and the roof were made of sheet metal. The room contained a large liquid scintillator. The LINAC beam was not directed into this room; only the scattered radiation from a "target" entered the scintillator by means of a beam pipe from room 113A. Since the LINAC beam did not enter this room there was very little chance of activation of the building materials. The metal walls and roof had been removed a number of years ago along with the scintillator tubes and the lead and paraffin shielding materials. All that remained of this room was the 4' high concrete wall and the floor. This room was classified as an **unaffected area** because radioactive contamination was not expected or likely.

Room 122 This room was the control room for the split-bed sub-critical reactor assembly, the Accelerator Pulsed Fast Reactor Assembly , and a neutron generator, all of which were located in Room 123. Beta/gamma emitters and positron emitters were examined and stored in this room for short periods of time. This room was classified as an **unaffected area** because radioactive contamination was not expected or likely.

North Tunnel (NT) This area is the rear entrance into room 113A. It was normally closed by means of a four foot thick concrete shield door. Due to the location of the door at the end of the tunnel there was very little chance of activation of the door materials. The concrete shield door was removed some years ago. This room was classified as an **unaffected area** because radioactive contamination was not expected or likely.

Room 123 This room was used for nuclear physics research. This room had contained two experimental reactor assemblies, a sub-critical split-bed assemble and an Accelerator Pulsed Fast Assembly which was a critical assembly. Both of these units contained enriched uranium up to 93% enriched U-235. These units were removed in 1972. After the reactor assemblies were removed a neutron generator producing 14 MeV neutrons was operated in this cell. The neutron generator was aimed at the south wall. This room was classified as a **suspect affected area**.

CRITERIA FOR RELEASE TO UNRESTRICTED USE

Facilities and Equipment

U.S. NRC's and State of California's criteria for releasing facilities and equipment to unrestricted use are shown in Tables 1 and 2, respectively. Based on process knowledge, the potential contaminants were mixed activation products from accelerator operations, and depleted and/or enriched uranium from research activities.

The characterization surveys identified the following isotopes: Eu-152, Eu-154, Co-60, and enriched uranium. The applicable guidelines for residual surface activity levels for these contaminants are:

Gamma/Beta Emitters (i.e., Co-60) and Uranium
5,000 dpm α/100cm², averaged over a 1 m² area
15,000 dpm α/100cm², maximum in a 100 cm² area if the average over 1 m² is met.
1,000 dpm α/100cm², removable activity

Exposure Rate Guideline
The guideline value for exposure rates measured at 1 m above the surface, is 10 μR/hr above background levels.

Soil Release Criteria
The soil release criteria, which also apply to concrete rubble, asphalt rubble and gravel, are provided below. The release criteria (which are concentrations above background levels) for radionuclides detected in the Phase V Rooms are as follows:

Enriched Uranium (U-234 and U-235)	30 pCi/g
Depleted Uranium	35 pCi/g
Co-60	8 pCi/g
Eu-152	11 pCi/g
Eu-154	10 pCi/g

The U-235 concentrations determined by gamma spectroscopy will be used to ensure that concentrations of enriched uranium are below the given limit. The ratio of U-234 to U-235 is conservatively assumed to be ~ 30:1 and applies for these rooms based on the previous use of high enriched uranium.

If more than one radionuclide is detected, the sum of the fractions of the concentrations, calculated as follows, must be less than or equal to one (1):

$$\sum_{i=1}^{n} \frac{C_i}{L_i} < 1$$

Where: C_i = The average soil concentration of radionuclide i
L_i = The maximum soil limit for i (pCi/g).

INSTRUMENTATION

Table 3 lists the instruments used during the radiological surveys. The table includes: (1) a description of the instrument, the model and serial numbers, (2) a description of the detector (If applicable) and its serial number, (3) instrument ranges, (4) calibration due dates and efficiencies and (5) typical background count rates. All instruments used were calibrated semiannually and after repair except for exposure rate meters which were calibrated quarterly.

BACKGROUND MEASUREMENTS

Instrument Background Measurements

Building 13 on GA's main site was used for conducting background measurements on most instruments used for the final survey because: (1) there is no history of use or storage of radioactive materials in Building 13, (2) the various surfaces found the Building 30 Phase V rooms labs could also be found in Building 13, and (3) the age of the building approximates the age of Building 30.

Background measurements are provided in Tables 3 and 4. The mean and standard deviation of measurements made for each surface surveyed with the 100 cm^2 beta detector, 50 cm^2 alpha detector and/or 15 cm^2 Geiger counter were calculated using equations 8-11 and 8-12 from NUREG/CR-5849 as shown below:

Equation (8-11):

$$\bar{x} = \frac{1}{n_s} \sum_{i=1}^{n_s} x_i$$

Equation (8-12):

$$s_x = \sqrt{\frac{\sum_{i=1}^{n} (\bar{x} - x_i)^2}{n-1}}$$

Background measurements and minimum detectable activities (MDA's) for each type of surface and for various counting times are also provided in Table 4. Minimum detectable activities (MDA's) for each type of surface, were calculated using equation (5-2) from NUREG/CR-5849 as shown below:

Equation (5-2):

$$MDA = \frac{2.71 + 4.65\sqrt{B_R \times t}}{t \times E \times \frac{A}{100}} (dpm/100cm^2)$$

Where:
B_R=*background rate (cpm)*
t = *count time (min)*
E = *efficiency*
A = *area of the detector* (cm^2)

Background Soil Concentrations

Typical background concentrations in soil near the GA site have been measured by gamma spectroscopy (at the 95% confidence level) and are provided in Table 7 along with a description of the locations where these samples were taken.

Exposure Rate Background

Building 30 is comprised of two distinct types of areas which correspond to two different types of construction features and/or materials of construction. Therefore, the normal background levels are different for each type of area.

The first type of area consists of outside concrete pads, sidewalks, and exposed soil in and around former Rooms 113A and 120. The normal background level used as the basis for evaluating this area is the background typical for GA's site, i.e., nominally 15 μR/hr with a range of about 12 to 18 μR/hr measured at 1 m from the surface. This value can be measured south of Building 15 (an office building on the eastern portion of the GA site). Measurements taken offsite in 10 different locations over a period of a year also gave an average value of about 15 μR/hr.

The second type of area is represented by Rooms 108B, 113, 113A, 114, 114A, 123. These areas are characterized by having concrete floors, walls and ceilings. The normal background level used as the basis for evaluating these areas is the background measured in a room of all-concrete construction, i.e., concrete floors, walls and ceiling. Normal background for this type of area ranges from about 20 to 23 μR/hr, as measured in a concrete room in GA's Building 1 (GA's Administration Office Building).

SURVEY PLANS

Survey plans which documented the types of surveys to be performed and the locations were developed based upon the physical characteristics of the various rooms, the radioactive material used, the potential for contamination, and the results of the characterization surveys. The physical characteristics of the rooms include the consideration of vents, ducts, floor drains, whether surfaces are painted or unpainted, overhead structures, floor coverings, etc. Types of surveys performed include scanning, exposure rate measurements and survey measurements (wipes and fixed measurements). In areas where elevated readings were detected, additional surveys were taken. See Appendix A for examples of the Survey Plans.

RESULTS OF THE CHARACTERIZATION SURVEYS

Elevated beta and gamma radiation levels were measured in several rooms. Elevated alpha radiation levels were measured in Room 123, no other room had alpha radiation measurements above background levels. A description of the radiation survey results for each room follows.

Room 114A - The floor and walls were scanned for beta/gamma radiation using a 434 cm^2 floor monitor detector. All measurements were at or near normal background measurements. **No decontamination required.**

Room 114 - The floor and walls were scanned for beta/gamma radiation using a 434 cm^2 floor monitor detector. All measurements were at or near normal background measurements, except the East wall. This wall was a shield wall separating rooms 114 and 113. Radiation levels above the release criteria were detected on this wall.

Room 113 - The floor and walls were scanned for beta/gamma radiation using a 434 cm^2 floor

monitor detector. All measurements were at or near normal background levels, except the East and West walls. The east and west walls were shield walls separating rooms 114 and 113 and rooms 113 and 113A. Radiation levels above the release criteria were detected on these walls. The east and west walls were also surveyed with a microR meter and radiation levels greater than 10 μR/hr above background were detected on these two walls.

Room 113A: The floor, walls, and ceiling were scanned for beta/gamma radiation using a 434 cm^2 floor monitor detector. Readings above the alert levels were detected. These areas were surveyed with a GM pancake counter and measurements above the release criteria were found on all surfaces. The walls, floor, and ceiling were scanned with a microR meter and radiation levels greater than 10 μR/hr above background were detected on all surfaces. A total of 25 concrete core samples were taken from the floor, walls, and ceiling. In addition two cores were cut all the way through one of the concrete ceiling beams. The cores were cut into 2" pieces and they were counted by gamma spectroscopy. Co-60 was detected in a number of the samples, with the highest being:

5.49 pCi/g in one wall sample,
1.73 pCi/g in one ceiling sample,
21.7 pCi/g in one floor sample, and
4.72 pCi/g in the ceiling beam sample.

It was decided to dismantle the entire Room.

Room 108B: This area is the location for the main entrance "shield door". The "shield door" was made of solid concrete and measured 6' wide , 7' long, and 8'6" high. The entire space for this doorway is approximately 204 ft^2. The floor, walls, and ceiling of the space were scanned for beta/gamma radiation using a 434 cm^2 floor monitor detector and hand-held pancake GM detectors. All surfaces of the "shield door" was scanned with a 434 cm^2 detector and a pancake GM detector. All measurements were at or near normal background levels. **No decontamination required.**

Room 119: The floor, walls, and ceiling were scanned for beta/gamma radiation using a 434 cm^2 floor monitor detector and hand-held GM detectors as needed. All measurements were at or near normal background levels. **No decontamination required.**

Room 120: The four foot high concrete wall and the floor were surveyed for beta/gamma radiation using a 434 cm^2 floor monitor detector and hand-held GM detectors as needed, and all measurements were at or near background levels. The concrete was removed and stored for release by the State of California. Soil samples were taken and all samples results were below the approved release criteria. **No decontamination required.** Burlap fabric was laid in the resultant "pit" and the pit was filled with soil to make a ramp for heavy equipment to get close to the LINAC for removal of the roof, walls, floor, and soil from Room 113A.

Room 122: This building was made of sheet metal walls and ceiling with a concrete floor. The floor,

walls, and ceiling were scanned for beta/gamma radiation using a 434 cm^2 floor monitor detector and hand-held GM detectors as needed. All measurements were at or near normal background levels. **No decontamination required.**

North Tunnel (NT): This area was the rear entrance into room 113A. The shield door is still in place but part of the outer surface was jack-hammered and removed a number of years ago. The floor, walls, and ceiling were scanned for beta/gamma radiation using a 434 cm^2 floor monitor detector and hand-held GM detectors as needed. All measurements were at or near normal background levels. **No decontamination was required.**

Room 123: The floor, walls, and ceiling were scanned for beta/gamma radiation using a 434 cm^2 floor monitor detector and hand-held GM detectors as needed; the area was also surveyed with alpha floor monitors and hand-held meters. Several spots on the floor and one spot on the wall were found to be contaminated above the release criteria for both alpha and beta radiations. The shield door had been removed a number of years ago.

There was a six foot deep by four foot diameter hole in the floor where the Accelerator Pulsed Fast Assembly (APFA) was stored when it was not being used. Part of the APFA support assembly was still in the pit. This metal support assembly was surveyed and found to be below the release criteria. The assembly was removed and disposed of as clean waste.

The West wall in this room was found to be contaminated around the beam port hole.

DECONTAMINATION

Room 114A: No decontamination was required, no dismantlement was performed in this area.

Room 114: Portions of the east wall, which was a stacked concrete block shield wall, separating rooms 113 and 114 were activated (the wall contained activated material due to high energy gamma and neutron irradiation). This wall was dismantled and surveyed. Those concrete blocks that were contaminated or activated above the release criteria were disposed of as radioactive waste. The concrete blocks that were at or below the normal background levels were released to unrestricted use.

Room 113: The west wall, which is the east wall of room 114 was dismantled as stated above. The east wall, which was also a stacked concrete block shield wall, separating Rooms 113 and 113A was contaminated (activated). This wall was dismantled and surveyed. Those concrete blocks that were contaminated or activated above the release criteria were disposed of as radioactive waste. The concrete blocks that were at or below the normal background levels were released to unrestricted use.

Room 113A: Contamination above the release levels was detected in this room (direct beta and μR surveys). Gamma ray analysis of core samples collected from the walls, floor, and ceiling showed

low levels of Co-60. The entire room was dismantled.

Prior to removing the walls and ceiling, the 9 feet of earthen cap shielding had to be removed from the top of the roof and from the area outside of the walls. Before removing the earthen cap, soil samples were collected and analyzed by gamma ray spectroscopy to determine if any radioactive materials were present. Soil samples were collected from 17 locations above the roof. See Figure 5. Three (3) samples were collected from each location: from (1) the top surface of the soil bank, from (2) either a depth of 2 - 2.5 feet above the roof or from a depth of 1 - 2 feet above the roof, and from (3) immediately above the roof. See Figure 6. A total of 51 samples were collected. (See ***NOTE*** below). In five (5) of the 51 soil samples, trace quantities of activation products were detected: Co-60 concentrations in these five (5) soil samples measured from 0.15 pCi/g to 0.25 pCi/g and Eu-154 concentrations measured from 0.25 pCi/g to 1.01 pCi/g. All five of these samples were collected from immediately above the top of the roof. These samples were all below the approved criteria for release to unrestricted use. The results of all other soil samples showed levels not discernable from normal background levels.

NOTE: *A letter from GA, CAL-3271, signed by Keith E. Asmussen dated September 12, 2000 was sent to the State of California requesting release of soil from the Building 30 earthen cap temporarily stored in two Bins, T-10 and T-12, to unrestricted use. That letter included some of the figures in this report and all of the gamma scan and survey data tables; therefore, the gamma scan and survey data tables are not included in this report.*

Soil samples were taken at ten locations along the outside of the north wall and at five locations along the outside of the south wall. See Figure 7. The north side was sampled more intensely than the south side because most accelerator operations were conducted on the north side or in the middle of the room. Only a few experiments were conducted in the southeast corner of the room. In addition, the direct radiation surveys conducted inside the room showed higher readings on the north wall than on the south wall. On the north side, three samples were collected from each sample location at 2 feet, 7 feet, and 10 feet below the roof surface. On the south side, only one sample was collected from each location at 7 feet below the roof surface. A total of 35 samples were collected. (Refer to the ***NOTE*** above). None of the samples collected showed any radioactivity above the normal background levels. Therefore, these samples are all below the approved criteria for release to unrestricted use.

The soil on top of the roof and from the sides of the roof was removed and placed in two bins in the Soil Storage Area. One pile contained background soil from the top surface down to 1.5 feet above the roof and the soil from the sides of the room. The second pile contained the slightly contaminated soil from 1.5 feet above the roof down to the roof level. These two piles of soil, identified as bins T-10 and T-12, respectively, were held for sampling and inspection by the State of California.

NOTE: *A letter from GA, CAL-3271, signed by Keith E. Asmussen dated September 12, 2000 was sent to the State of California requesting release of the two bins, T-10 and T-12, to unrestricted use.*

That letter included the figures in this report and all of the gamma scan and survey data tables; therefore, the gamma scan and survey data tables are not included in this report. The State of California Radiological Health Branch personnel surveyed and sampled these two bins and subsequently released them to unrestricted use (License Amendment #144 dated November 6, 2000).

The concrete roof, walls, and floors of Room 113A were cut into ~6' X 8' slabs with water cooled saws. The slabs were removed and laid out in the back yard of the LINAC complex where they were individually surveyed over 100% of the inside surface and the cut sides with 434 cm^2 beta/gamma detectors and/or hand held pancake GM detectors. In areas where elevated readings were measured, the area was scanned with hand held GM pancake detectors. Fixed beta measurements were taken on each slab along with microR exposure rate measurements. Removable contamination surveys (smears) were taken on each slab and these smears were all below the release levels. Those slabs that measured above the release criteria were packaged and sent to radioactive waste disposal. The slabs that were below the approved criteria for release to unrestricted use were stored in the Soil Storage Area bin T-27 and were held for sampling and inspection by the State of California. (See the ***NOTE*** below).

NOTE: *A letter from GA, CAL-3277, signed by Keith E. Asmussen dated September 22, 2000 was sent to the State of California requesting release of Bin T-27 to unrestricted use. That letter included the gamma scan and survey data tables; therefore, the gamma scan and survey data tables are not included in this report. The State of California Radiological Health Branch personnel surveyed and sampled this material. GA is awaiting the license amendment releasing this material to unrestricted use.*

The water, concrete sludge, and broken concrete from cutting the walls and ceiling were stored in drums. The drums were sampled and counted on the gamma ray analyzer. Those samples that were above the release criteria were disposed of as radioactive waste, and those samples that were below the approved criteria for release to unrestricted use were moved to the soil storage area bin T-25 and T-34 and were held for sampling and inspection by the State of California. (Refer to the ***NOTE*** above).

A second concrete slab (a subfloor) was found underneath the main floor. The subfloor was scanned with the 434 cm^2 floor monitors, all areas that measured above 2300 cpm were surveyed with 15 cm^2 GM detectors. All surveys were at or near background levels. (See Figures 8, 9 ,10, and 11). The sub-floor was cut up and much of it broken into small pieces. The slabs and drums of broken concrete were removed and placed in Soil Staging Area bins T-22 and T-25, and held for sampling and inspection by the State of California. Since the floor was removed and these surveys are not Final Surveys, the data is not included in Table 5, but is recorded on the figures. (See the ***NOTE*** below).

NOTE: *A letter from GA, CAL-3277, signed by Keith E. Asmussen dated September 22, 2000 was sent to the State of California requesting release of bins T-22 and T-25 to unrestricted use. That letter included the gamma scan and survey data tables; therefore, the gamma scan and survey data*

tables are not included in this report. The State of California Radiological Health Branch personnel surveyed and sampled these bins. GA is awaiting a license amendment releasing this material to unrestricted use.

After the sub-floor was removed from room 113A, an exposure rate scan and exposure rate measurements were taken on the soil surface (See Figure 39). Soil samples were taken at 21 locations in and around the perimeter of the room on the North and South sides. See Figure 40 and Table 6 for the locations and the results of the soil sampling. The gamma scans results of these soil samples were all below the approved criteria for release to unrestricted use

There is an large opening in the east wall separating Rooms 113A and 123. A survey inside this opening showed elevated readings on the lower portion of the opening. Surveys of this wall with a MicroR meter conducted from Room 123, confirmed the elevated readings. This area was decontaminated; refer to Room 123 below for details.

Room 108B: Main entrance and shield door area. All surveys were at or near background levels. See Figures 26, 27, 28, and 29. The ceiling and the shield door were removed. Confirmatory surveys were completed by the NRC and they found that these two items met the guidelines for release to unrestricted use. They were disposed of at the local landfill. **No decontamination was required.**

Room 119: All surveys were at or near background levels and they meet the guidelines for release to unrestricted use. The ceiling was cut into sections and removed to the Soil Storage Area bin T-19 which have been sampled and surveyed by the State of California. The wall was a concrete block wall and it was broken into sections and removed to the Soil Storage Area bin T-25 and T-34 and was held for sampling and inspection by the State of California.

NOTE: A letter from GA, CAL-3277, signed by Keith E. Asmussen dated September 22, 2000 was sent to the State of California requesting release of bins T-19, T-25 and T-34 to unrestricted use. That letter included the gamma scan and survey data tables; therefore, the gamma scan and survey data tables are not included in this report. The State of California Radiological Health Branch personnel surveyed and sampled this material. GA is awaiting the license amendment releasing this material to unrestricted use.

Room 120: All surveys were at or near background levels and meet the guidelines for release to unrestricted use. The walls and floor were cut into sections and removed to the Soil Storage Area where they were sampled and inspected by the State of California. The resulting depression in the soil was lined with burlap cloth to mark the location of the original soil. The depression was filled with soil to provide access for heavy equipment to get close to the LINAC wall in order to remove the cut sections from Rooms 113A and 119.

Room 122: The sheet metal walls and ceiling were surveyed and all surveys were at or near background levels and below the guidelines for release to unrestricted use. The walls and ceiling

were removed and disposed of at the local land fill. The concrete floor was surveyed and all surveys were at or near background levels and are below the guidelines for release to unrestricted use. The floor is in place and is available for sampling and inspection by the State of California and/or the NRC. **No decontamination was required.**

North Tunnel (NT): All surveys were at or near background levels and are below the guidelines for release to unrestricted use. **No decontamination was required.**

Room 123: The contamination found on the floor and wall was removed with jack hammers and scabblers. The contamination inside the large penetration on the west wall (separating rooms 113A and 123) was found to be activated materials from operation of neutron targets in Room 113A. Concrete samples were analyzed on a gamma ray spectrometer and the radioactive materials were identified as Eu-152 and Eu-154. Radiation measurements taken in the general area ranged from 40 to 65 μR/hr. Approximately three inches of concrete was removed with jack hammers and the measured dose rate increased to ~120 μR/hr. Jack hammering continued until the microR exposure rate measurements were <10 microR/hr above background at 2" above the surface.

Some of the wall penetrations in this room were lined with metal and the 434 cm^2 surveys indicated elevated radiation levels. The areas with elevated readings were checked with 15 cm^2 GM pancake detectors and all of these measurements were at or near background levels.

The concrete walls and floor of the pit were surveyed and they were found to be below the release criteria. The concrete was broken up and removed to the Soil Storage Area Bin T-45. Samples were collected from the broken concrete and counted on the gamma spectrometer to search for and identify any radioactive materials. The hydraulic ram in the pit that was used to raise the APFA reactor assemble was removed and surveyed and released as clean material. Soil samples were taken in the pit underneath the concrete bottom and a final soil sample was scraped off the hydraulic ram when it was pulled out of the pit. The results of the gamma ray analysis were all below the release criteria. See Figure 65 and Table 6 for the locations and the results of the soil and concrete samples gamma ray analysis. The soil and concrete was packed into drums and moved to the Soil Storage Area Bin T-45 where they were preserved for final release by the State of California.

NOTE: A letter from GA, CAL-3277, signed by Keith E. Asmussen dated September 22, 2000 was sent to the State of California requesting release of bin T-45 to unrestricted use. That letter included the gamma scan and survey data tables. The State of California Radiological Health Branch personnel surveyed and sampled this material. GA is awaiting a license amendment releasing this material to unrestricted use.

FINAL SURVEYS

Objectives and Responsibilities

The objectives of the final survey plans were: (1) to demonstrate that the average surface

contamination levels for each survey unit were below the approved release criteria, (2) to show that the maximum residual activity did not exceed three times the approval release criteria for average surface contamination value in an area up to 100 cm^2, (3) to demonstrate that the soil sample results were well below GA's approved release criteria for unrestricted use, and (4) to show that the exposure rate measurements taken in these labs measured at 1 meter above the surface are less than 10 μR/hr above background.

Final Survey Plans

Final Survey Plans which specified the types and locations of surveys to be performed were developed based upon the physical characteristics of the area, the radioactive materials used, and the potential for contamination. The plans followed the requirements stated in GA's approved Site Decommissioning Plan. The surveys completed include β and α scanning, collection and analyses (by gross alpha/beta counting) of smears, the taking of fixed β measurements on the floor and wall surfaces, exposure rate measurements (μR/hr), and the sampling and isotopic analyses (by gamma spectroscopy) of soil exposed after dismantlement of Room 113A and removal of the concrete pit in room 123. In addition, alpha surveys were conducted in Room 123.

Copies of the Final Survey Plans are provided in Appendix A.

Gridding

The floor in room 123 was gridded into 1m x 1m grid and the exposed soil under room 113A was gridded into 4m x 4m grid in order to: (1) facilitate systematic selection of radiological measurement and soil sampling locations, (2) provide a means for referencing a measurement back to a specific location and (3) establish a uniform and distinct identification system. The X axis of the grid was delineated by numerical characters and the Y axis by alphabetical characters. This established a unique grid of easily identifiable entities. The other rooms were not gridded because they were unaffected areas except for the shield walls which had been completely dismantled and removed.

Documentation

Surveys were taken in accordance with approved survey plans by qualified Health Physics Technicians having a minimum of three years health physics experience. Soil samples and wipes (100 cm^2) were counted in GA's Health Physics Laboratory which maintains an effective QA program.

Every survey taken was documented on a daily basis to a worksheet/drawing showing the approximate locations surveyed/sampled. The figures provided in this report include the measurement locations (and, in some cases, the results of these measurements (including units), the technician's name, date(s) of the surveys, instrument(s) used (including the model and serial number of both the ratemeter and detector), calibration due date, % efficiency, background readings (if applicable) and any other pertinent information.

Comparisons with Site Decommissioning Plan

Comparisons of the site Decommissioning Plan requirements with the Final Surveys performed in relation to the percentage of surface area scanned, number of fixed and removable measurements performed, exposure rate measurements (μR/hr) and soil samples taken are provided as follows:

Comparisons of Site Decommissioning Plan (Site D-Plan) Requirements with the Final Surveys Performed in the Building 30 Phase V Rooms

Unaffected Areas	**Scanning β on concrete**	**# of Measurements (fixed & wipes)**	**# of Exposure Rate Measurements (μR/hr) @ 1m above the surface**	**Soil Samples**
Site D-Plan	10% coverage floor and lower walls	30 minimum 1 every ~7m	1 per 10 m^2 or 1 every 3m	None
Final surveys performed in Unaffected Areas	100% floor and walls below 2m. 10% of walls above 2m.	Varied from 1 every ~0.5m to 1 every 2m	Scan 20% of floor 2" above surface. 1 every 3m	Room 113A 1 every ~1 m
Suspect Affected Areas	**Scanning β on concrete**	**# of Measurements (fixed & wipes)**	**# of Exposure Rate Measurements (μR/hr) @ 1m above the surface**	**Soil Samples**
Site D Plan	100% coverage floor and lower walls	30 minimum 1 per 4 m^2 or 1 every ~2m	1 per 4 m^2 or 1 every ~2m or 1 every ~3m	Suspect Affected Areas. One every 5m
Final Surveys Performed in Rm 123	100% α on floor 100% β on floor 100% β on walls floor to ceiling	44 total 1 every ~ 0.5m	100% scan ~2" above floor and 1 every ~2m	4 from bottom of the pit.

[1] If no gamma emitters are present.

RESULTS OF THE FINAL SURVEY

Scans: Suspect Affected Areas

Room 123: 100% of the floor was scanned with floor monitors for alpha and beta radiations and 100% of the walls from floor to ceiling were scanned for beta radiation. All survey and soil sample results were below the approved release criteria.

Room 113A: 100% of the lower east wall (< 2m) was scanned for beta radiation and 10% of the wall

above 2m was scanned. In areas where the floor monitors indicated elevated readings, the area was scanned with 100 cm² beta detectors or hand held GM detectors and/or a hand held 50 cm² alpha detectors. The results of the scans are provided in Table 5 and the locations are shown in the respective figures as noted on the table. The exposed soil area was surveyed with a microR meter (See Figure 39 for location of the measurements and Table 5 for results) and soil samples were collected as shown on Figure 40 (See Table 6 for sample results). All survey and soil sample results were below the approved release criteria

Scans: Unaffected Areas

For the final survey in Unaffected Areas, 100% of the floors were scanned with floor monitors for beta radiation and 10% of the floors were scanned for alpha radiation. In addition, 100% of the lower walls (<2m) were scanned for beta radiation. In areas where the floor monitors indicated elevated readings, the area was scanned with 100 cm² beta detectors or hand held GM detectors and/or a hand held 50 cm² alpha detectors. The results of the scans are provided in Table 5 and the locations are shown in the respective figures as noted on the tables.

Fixed Measurements

Fixed measurements were performed for beta radiation using a gas-flow proportional counter having a 100 cm^2 detector. The counting time for the beta fixed measurements was one (1) minute. Alpha fixed measurements were obtained using the 50 cm^2 alpha detector. The counting time for each alpha fixed measurements was ~30 seconds. For all fixed measurements, an appropriate background was determined for each type of surface and subtracted from the survey readings. The readings were converted to dpm/100 cm^2 using the efficiency of the detector and the detector size. GA's intent was to demonstrate (with fixed measurements) that levels were below the release criteria for the isotopes identified in each lab.

The results of the fixed measurements in Building 30 Phase V rooms are summarized in Table 5, and the locations are shown in the respective figures as noted on the Table. A total of 194 fixed measurements were taken, at ~ 1 every 2m. The results show that all radiation levels were well below the release criteria for the isotopes identified; Co-60, Eu-152, and Eu-154, all beta/gamma emitters. The release criteria for these isotopes is 5000 dpm/100 cm² (average). Most measurements were equal to or less than the MDA for the material surveyed.

Removable Contamination Surveys

Removable contamination measurements (smears) were performed on all surfaces including the floors, walls, ducts, and lights. Smear surveys consisted of using a Whatman Filter Paper (4.7 cm diameter) and wiping an area of ~100 cm^2. The smears were counted in GA's Health Physics Laboratory using a Canberra 2404 low level alpha/beta gas flow proportional counter. A total of 241 smears were taken. The results of all removable contamination surveys are provided in Table 5 and the approximate locations where the smears were taken are shown in the respective figures as noted on Table 5. Removable contamination levels were all below the release criteria. Alpha results were all <10 dpm/100 cm^2 and beta results were all $\leq$ 25 dpm/100 cm^2.

Paint Samples

Paint samples were obtained from each of the walls in Rooms 114A, 114, and 113. Fixed beta measurements were taken at the sample locations before and after the sample were removed. The fixed beta measurements on the walls were all <MDA. All 18 paint samples were counted in the HP Lab for alpha and beta radiation. All readings were below the release criteria for the isotopes identified. The results of the paint sampling are Table 5 and the approximate locations where the samples were taken are shown in the respective figures as noted on Table 5.

Exposure Rate Measurements

Direct Radiation exposure rate measurements using a microR meter were taken 1m from the surface in every room ~3m apart in unaffected areas and ~2m apart in Suspect Affected Areas. A total of 150 measurements were taken. The radiation levels varied according to the type of surface being surveyed (soil or concrete) and whether the location was inside or outside the building. The measured radiation levels were <10 μR/hr above the appropriate background.

Soil Sample Results and Evaluation

Soil sample results were collected from each room where the concrete floor was removed during decontamination efforts. All of the soil samples were processed and analyzed by gamma spectroscopy; the results were below the criteria for release to unconditional use. See Table 6 for the results.

Activation Product Concentrations - Evaluation

In one soil sample Co-60 at a concentration of 0.11 pCi/g was detected. It was also detected in another sample at 0.02 pCi/g. No other activation products were detected in the final soil samples (see Table 6).

In the worst case, there may be $\leq$ 0.1 pCi/g Co-60, $\leq$ 0.1 pCi/g Eu-152 and $\leq$ 0.1 pCi/g of Eu-154 present, but not detected (based on a 30 minute count, concentrations $\geq$ 0.1 pCi/g are normally detected). The sum of the fractions assuming these concentrations were present, but not measured, is as follows: 0.1 pCi/g Co-60/8 pCi/g (limit) + 0.1 pCi/g Eu-152/11 pCi/g (limit) + 0.1 pCi/g Eu-154/10 pCi/g (limit) = 0.02 (~2% of the limits).

Thorium Concentrations - Evaluation

No thorium contamination was present (determined both by process knowledge and analysis). All thorium results were at or near normal background levels and well below the 10 pCi/g limit.

Enriched Uranium Evaluation

Other than Room 123, no enriched uranium contamination was identified (by process knowledge and sample results). All soil sample results were not discernable from background radiation levels for a 30 minute count; the maximum U-235 concentration in a soil sample was 0.32 pCi/g and the maximum U-235 concentration in a background soil sample was 0.32 pCi/g, see Tables 6 and 7, respectively.

For Room 123, where enriched uranium contamination was found to be a contaminant, an evaluation of the soil samples results was performed (beyond reporting that the results are below the release criteria). The highest U-235 concentration was 0.25 pCi/g. For a 30 minute count, this value is not discernable from background. However, without subtracting background (assuming that this concentration is all due to contamination rather than background radiation), the maximum enriched uranium possible is as follows:

The enriched uranium limit (30 pCi/g) applies to the sum of the U-234+U-235 concentrations after background concentrations are subtracted. For enriched uranium, the ratio of U-234:U-235 can be as high as 30:1. Assuming a ratio of 30:1 (conservative), the maximum enriched uranium present when 0.25 pCi/g of U-235 is measured (without background subtraction) is 7.75 pCi/g (0.25 pCi/g of U-235 plus 7.5 pCi/g U-234) or 25% of the limits.

If background is subtracted, then the value becomes much less than 25% of the limits. For example, if 0.1 pCi/g U-235 is subtracted from 0.25 pCi/g which leaves a net of 0.15 pCi/g , then the total enriched uranium is 4.65 pCi/g or 16% of the limit.

Depleted Uranium Evaluation

Other than Room 123, no depleted uranium contamination was identified (by process knowledge and sample results) above natural background levels after a 30 minute count. The maximum U-238 concentration (which is either natural uranium or depleted uranium), was 3.47 pCi/g (see Table 6). The maximum U-238 concentration in a background soil sample was 4.49 pCi/g, see Tables 6 and 7, respectively.

For Room 123, where depleted uranium was a potential, an evaluation of the soil samples results was performed (beyond reporting that the results are below the release criteria). The highest U-238 concentration was 3.42 pCi/g. For a 30 minute count, this value is not discernable from background. However, without subtracting background (assuming that this concentration is all due to contamination rather than background radiation), the maximum depleted uranium possible is 3.42 pCi/g; the limit for depleted uranium is 35 pCi/g. Therefore, this result, without background subtraction, is 10% of the allowable limits. Therefore, the worst case is that all results are less than 10% of the depleted uranium limits.

Highest Sum of Fractions (% of the Limits)

The sample with the highest fraction of the limits (0.33) is B30S-123-2 with 0.25 due to enriched uranium, 0.06 due to depleted uranium and 0.02 due to activation products. This fraction (0.33 or 33% of the limits) is a worst case scenario since no background was subtracted and detection limits were used as positive values. Note: Thorium was detected, but at natural background levels only. Thorium was also not a contaminant or potential contaminant in the building. Therefore, it was not included in the sum of the fractions.

INTERNAL CONFIRMATORY SURVEY

After completing its' final surveys, GA conducted an internal confirmatory survey of the Building 30 Phase V rooms. All survey results were at or near background levels. See Appendix B for the results of GA' Confirmatory Survey.

CONCLUSION

The results of the final and confirmatory surveys provided in this report, demonstrate that the rooms designated as "Building 30 Phase V", and as defined in this report, meet the NRC- and State-approved guidelines for release to unrestricted use.

TABLES

Table 1: USNRC'S ACCEPTABLE SURFACE CONTAMINATION LEVELS [1]

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

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

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

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

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

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

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

[1] **Guidelines For Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses For byproduct, Source, or Special Nuclear Material**, USNRC, July 1982, incorporated into GA's SNM 696 license.

Table 2: STATE OF CA ACCEPTABLE SURFACE CONTAMINATION LEVELS [1]

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

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

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

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

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

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

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

1 Guidelines For Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses For byproduct, Source, or Special Nuclear Material, also known as "Decon-1" incorporated into GA's State of CA Radioactive Materials License.

TABLE 3: LIST OF INSTRUMENTS

Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description
Ludlum Model 2221 S/N **97287**	Ludlum Model 43-37 gas proportional (434 cm^2) **Alpha detector** S/N 148926	Four Linear Ranges 0-500,000 & one Log 50-500,000	9-13-00	21.25%	Varies according to surface being scanned See Table 4	Active Probe Area = 434 cm^2. The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model 2221 S/N **86302**	Ludlum Model 43-37 gas proportional (434 cm^2) **Beta detector** S/N 086215	Four Linear Ranges 0-500,000 & one Log 50-500,000	1-24-00	21.70%	Varies according to surface being scanned See Table 4	Active Probe Area = 434 cm^2. The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model 2221 S/N **84459**	Ludlum Model 43-37 gas proportional (434 cm^2) **Beta detector** S/N 086213	Four Linear Ranges 0-500,000 & one Log 50-500,000	1-05-00	21.27%	Varies according to surface being scanned See Table 4	Active Probe Area = 434 cm^2. The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model 2221 S/N **154202**	Ludlum Model 43-37 gas proportional (434 cm^2) **Beta detector** S/N 149017	Four Linear Ranges 0-500,000 & one Log 50-500,000	10-17-00	22.79%	Varies according to surface being scanned See Table 4	Active Probe Area = 434 cm^2. The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model 2221 S/N **148436**	Ludlum Model 43-68 100 cm^2 proportional **Beta detector** S/N 120477	Four Linear Ranges 0-500,000 & one Log 50-500,000	7-10-00	26.27%	Varies according to surface being scanned See Table 4	100 cm^2 gas flow proportional counter.
Ludlum Model 2221 S/N **84423**	Ludlum Model 43-68 100 cm^2 proportional **Beta detector** S/N 119444	Four Linear Ranges 0-500,000 & one Log 50-500,000	2-2-00 1-5-00	19.81% (Co60) 26.20% (Sr90) 26.22% (Sr90) 19.81% (Co60)	Varies according to surface being scanned	100 cm^2 gas flow proportional counter

TABLE 3: LIST OF INSTRUMENTS

Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description
Ludlum Model 19 Micro-R Meter S/N **144068**	RCA 6199 coupled to a NaI (Tl) Scintillator	Five Ranges 0-5 mR/hr	1-3-00 10-6-99	N/A	10-18 µR/hr	1 inch x 1 inch NaI (Tl) scintillator is mounted internally. Used for initial survey on ground floor and for measuring external dose rates on the surface and at one meter.
Ludlum Model 19 Micro-R Meter S/N **87120**	RCA 6199 coupled to a NaI (Tl) Scintillator	Five Ranges 0-5 mR/hr	7-10-00 4-9-01	NA	10-18 µR/hr	1 inch x 1 inch NaI (Tl) scintillator is mounted internally. Used for initial survey on ground floor and for measuring external dose rates on the surface and at one meter.
Ludlum Model 12 S/N **138801**	Ludlum Model 43-65 **Alpha Scintillator** ZnS(Ag) S/N 145696	Four Ranges 0 - 500,000	07-11-00	21.58%	0 - 20	Active Probe Area = 50 cm^2
Ludlum Model 3 S/N **15055**	Ludlum Model 44-9 **15 cm^2 Beta/Gamma** S/N 76109	Four Ranges 0-100,000	11-22-00 5-29-00 11-23-99	24.23% 24.23% 24.23%	80-120 (concrete) 60-80 (metal)	The instrument is used for beta/gamma surveying. The detector has an active probe area of 15 cm^2.
Ludlum Model 3 S/N **139168**	Ludlum Model 44-9 **15 cm^2 Beta/Gamma** S/N 145981	Four Ranges 0-100,000	11-11-99	21.05%	80-120 (concrete)	The instrument is used for beta/gamma surveying. The detector has an active probe area of 15 cm^2.
Ludlum Model 3 S/N **153590**	Ludlum Model 44-10 NaI (Tl) Scintillator **Gamma Detector** S/N 155190	Five Ranges 0-500 µR/hr	03-01-00	NA	10-18 µR/hr	2 inch x 2 inch NaI (Tl) scintillator. Used for initial survey on ground floor and for measuring external dose rates on the surface and at one meter.
Ludlum Model 3 S/N **151348**	Ludlum Model 44-10 NaI(Tl) Scintillator **Gamma Detector** S/N 154618	Five Ranges 0-500 µR/hr	12-11-00	NA	10-18 µR/hr	2 inch x 2 inch NaI (Tl) scintillator. Used for initial survey on ground floor and for measuring external dose rates on the surface and at one meter.
Canberra Low Level α/β Counter Model 2404	Gas Flow Proportional Detector	N/A	As needed	~26-30%	Varies	Canberra Model 2404 Low Level α/β gas proportional counting system used to count wipes for removable contamination. Results are usually reported as dpm/100 cm^2.

TABLE 3: LIST OF INSTRUMENTS

Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description
Canberra Gamma Spectroscopy System	High Purity Germanium Detector	N/A	As needed	Varies with Sample	Varies with Sample	Gamma Spectroscopy MCA system using a high purity Germanium detector.

Table 4: Background Measurements

Ludlum Model 2221 Rate Meter S/N 97287 with Model 43-37 Probe S/N 148926 Alpha Floor Monitor Background Scan Results: 434cm² Detector (Efficiency = 21.25%)	
Background Surface Materia	**Alpha Scan Range (cpm)**
Concrete	0 - 20
Concrete Block	0 - 20

Ludlum Model 2221 Rate Meter S/N 86302 with Model 43-37 Probe S/N 086215 Beta Floor Monitor Background Scan Results: 434cm² Detector (Efficiency = 21.70%)	
Background Surface Material	**Beta/Gamma Scan Range (cpm)**
Concrete	1478 - 1765
Concrete Block	1253 - 1538
Metal	853 - 1185

Ludlum Model 2221 Rate Meter S/N 84459 with Model 43-37 Probe S/N 086213 Beta Floor Monitor Background Scan Results: 434cm² Detector (Efficiency = 21.27%)	
Background Surface Material	**Beta/Gamma Scan Range (cpm)**
Concrete	1858 - 2036

Ludlum Model 2221 Rate Meter S/N 154202 with Model 43-37 Probe S/N 149017 Beta Floor Monitor Background Scan Results: 434cm² Detector (Efficiency = 22.79%)	
Background Surface Material	**Beta/Gamma Scan Range (cpm)**
Concrete	1600 - 1995
Concrete Block	1697 - 1806
Stucco	1136 - 1303
Wood	945 - 1086
Metal	697 - 806

Table 4: Background Measurements

Ludlum Model 3 Rate Meter S/N 15055 with Model 44-9 Probe S/N 076109 15cm² Beta/Gamma Detector: Background Measurement Results (Efficiency = 24.23%)	
Background Material	**Beta/Gamma Measurement Range (cpm)**
Concrete	80 - 120
Concrete Block	70 - 110
Metal	60 - 80

Ludlum Model 3 Rate Meter S/N 139168 with Model 44-9 Probe S/N 145981 15cm² Beta/Gamma Detector: Background Measurement Results (Efficiency = 21.05%)	
Background Material	**Beta/Gamma Measurement Range (cpm)**
Concrete	80 - 100

Ludlum Model 2221 Rate Meter S/N 148436 with Model 43-68 Probe S/N 120477 100 cm² Beta Detector (Efficiency = 26.27%)		
Background Material	**Average of 10 Measurements 1 minute each (cpm ± 2σ)**	**MDA (dpm/100cm²)**
Concrete	554 ± 56	443
Concrete Block	437 ± 36	399
Stucco	304 ± 36	319

Ludlum Model 2221 Rate Meter S/N 84423 with Model 43-68 Probe S/N 119444 100 cm² Beta Detector (Efficiency = 26.27% - Sr90) (Efficiency = 18.91% - Co60) as of 07-07-99 (Efficiency = 19.80% - Co60) as of 08-10-99		
Background Material	**Average of 10 Measurements 2 minute each (cp2m ± 2σ)**	**MDA (dpm/100cm²)**
Concrete	1011 ± 48	398 (Co 60) as of 07-07-99 380 (Co 60) as of 08-10-99
Concrete Block	803 ± 64	355 (Co 60) as of 07-07-99 339 (Co 60) as of 08-10-99

Table 5: Results of Final Surveys in Building 30 -Phase V

Figure #	Location All surfaces are concrete	Scan Results 434 cm² β (cpm range)	Fixed β Measurements 100cm² detector		# of Smears	Maximum Result/smear dpm/100cm²		# of Paint Samples	Maximum Result / paint dpm/100cm²		Exposure Rate Scans Range µR/hr floor only	Exposure Rate Measurement Range (µR/hr) 1m above the surface	
			# of measurements	Maximum Result dpm/100cm²		α	β		α	β		# of Measurements	Range µR/hr
12, 17, 18, 19	Rm 114A Floor	1400-1800 linoleum 2100-2300 concrete	7 linoleum 1 concrete	742 862	8	<10	<10	0	NA	NA	23-33	7	20-26
13, 14, 15, 16, 18	Rm 114A Walls (up 2m) Concrete	900-2200[1]	9	469	8	<10	<10	4	<10	<40	NA	NA	NA
13, 14, 15, 16	Rm 114A Walls (Above 2m) concrete	1400-2300	0	NA	0	NA	NA	0	NA	NA	NA	NA	NA
20, 21, 22, 24	Rm. 114 Floor	950-1700	9	≤380	13	<10	<10	0	NA	NA	22-30 @ 2" 22-28 @ 1m	8	25-28
20, 21, 22	Rm. 114 Walls (up 2m)	800-1600	11	≤380	17	<10	<10	0	NA	NA	NA	NA	NA
23	Rm 114 Paint Sample Location	NA	14	(before) (after) ≤267 / ≤267	0	NA	NA	7	<15	<25	NA	NA	NA
20	Rm. 114 Walls (above 2m)	900-1750	0	NA	0	NA	NA	0	NA	NA	NA	NA	NA
25	Rm. 114 Along centerline of overhead	1200-1700	0	NA	12	<10	<10	0	NA	NA	NA	NA	NA

Table 5: Results of Final Surveys in Building 30 -Phase V

Figure #	Location All surfaces are concrete	Scan Results 434 cm² β (cpm range)	Fixed β Measurements 100cm² detector		# of Smears	Maximum Result/smear dpm/100cm²		# of Paint Samples	Maximum Result / paint dpm/100cm²		Exposure Rate Scans Range µR/hr floor only	Exposure Rate Measurement Range (µR/hr) 1m above the surface	
			# of measurements	Maximum Result dpm/100cm²		α	β		α	β		# of Measurements	Range µR/hr
20, 21, 22, 24	Rm. 113 Floor	1200-1700	8	≤380	16	<10	<10	0	NA	NA	22-28 @ 2" 22-28 @ 1m	6	22-27
20, 22	Rm. 113 Walls (up 2m)	1000-1600	12	≤380	9	<10	<10	NA	NA	NA	NA	NA	NA
23	Rm 113 Paint Sample Location	NA	12	(before) (after) ≤380 / ≤380	0	NA	NA	6	<10	10	NA	NA	NA
20, 22	Rm. 113 Walls (above 2m)	1300-1600	0	NA	0	NA	NA	0	NA	NA	NA	NA	NA
25	Rm. 113 Along centerline of overhead	1400-1800	0	NA	9	<10	<10	0	NA	NA	NA	NA	
26, 27, 28, 29	Rm. 108B Floor	1200-1500	3	≤380	4	<10	<10	NA	0	0	20 - 24	6	22-24
26, 27, 28	Rm. 108B Walls (up 2m)	1200-1750	8	≤380 paint(before)(after) ≤297/≤297	8	<10	<10	1	<10	10	NA	NA	NA
26	Rm. 108B Walls(above 2m)	1200-1650	0	NA	0	NA	NA	NA	0	0	NA	NA	NA
31, 32, 33, 34	Rm 113A Footings	480-760	8	1068	20	<10	<15	NA	NA	NA	17-21	NA	NA

Table 5: Results of Final Surveys in Building 30 -Phase V

Figure #	Location All surfaces are concrete	Scan Results 434 cm² β (cpm range)	Fixed β Measurements 100cm² detector		# of Smears	Maximum Result/smear dpm/100cm²		# of Paint Samples	Maximum Result / paint dpm/100cm²		Exposure Rate Scans Range µR/hr floor only	Exposure Rate Measurement Range (µR/hr) 1m above the surface	
			# of measurements	Maximum Result dpm/100cm²		α	β		α	β		# of Measurements	Range µR/hr
35, 36, 37	Rm 113A East Wall	800-1300 concrete 500-800 metal	15	<380	20	<10	<25	NA			NA	NA	
37, 38	Rm. 113A East Wall (neutron target hole)	900-4500	NA		9	<10	<25	NA			NA		
39	Rm 113a Exposed Soil	NA	NA		NA			NA			16-23	77	16-22
41,42, 43, 44	Rm 113A North Tunnel, Floor	1800-2200	8	875	6	<10	<15	NA			19-22	NA	NA
41, 42, 43, 44	Rm 113A North Tunnel, Walls	1200-2300	15	<398	10	<10	<15	NA			17-23	NA	NA
41, 42, 43,44	Rm 113A North Tunnel, Ceiling	1800-2200	6	<398	6	<10	<15	NA			19-21	NA	NA
41, 42, 43, 44	Rm 113A North Tunnel , Shield Door	<50 cpm (15 cm² GM Pancake GM)	2	<398	2	<10	<15	NA			14-15	NA	NA
45, 46, 47, 48	Rm. 119 Floor	1200-1600	12	≤380	9	<10	<20	NA	NA	NA	16-19	6	16-19
45, 46, 47	Rm. 119 South Wall	700-1500	6	≤380	8	<10	<20	NA	NA	NA	NA	NA	NA

Table 5: Results of Final Surveys in Building 30 -Phase V

Figure #	Location All surfaces are concrete	Scan Results 434 cm² β (cpm range)	Fixed β Measurements 100cm² detector		# of Smears	Maximum Result/smear dpm/100cm²		# of Paint Samples	Maximum Result / paint dpm/100cm²		Exposure Rate Scans Range µR/hr floor only	Exposure Rate Measurement Range (µR/hr) 1m above the surface	
			# of measurements	Maximum Result dpm/100cm²		α	β		α	β		# of Measurements	Range µR/hr
45, 46, 47	Rm. 119 West Wall	1100-1400	4	≤339	6	<10	<20	NA	NA	NA	NA	NA	NA
49, 50, 51, 52	Rm. 122 Floor Only	1650-2000	8	≤380	9	<10	<10	NA	NA	NA	14-17	9	12-15
54, 57, 59, 60, 62	Rm 123 Floor General Area	1590-2200 β 20-80 α	10	<443	10	<10	<10	NA	NA	NA	NA	28	18-24
54, 58	Rm 123 Floor Elevated Area	2400-3200 β 100-400 α	NA		NA			NA			NA		
59, 60, 62	Rm 123 Floor Elevated Area Post-Decon	20-80 α	1	<443	1	<10	<10	NA	NA	NA	NA	2	22
55, 57,	Rm 123 Walls Floor to Ceiling	998-1940	12	761	11	<10	<10	NA	NA	NA	NA	NA	NA
56, 60, 62	Rm 123 Wall Penetrations and Entrance Pit	600-1428 β 434 cm² 20-60 βγ 15 cm²	1	<443	7	<10	<10	NA	NA	NA	NA	1	19
61	Rm 123 Overhead Fixtures	80-120 15 cm²	NA		NA			NA			NA		

Table 5: Results of Final Surveys in Building 30 -Phase V

Figure #	Location All surfaces are concrete	Scan Results 434 cm² β (cpm range)	Fixed β Measurements 100cm² detector		# of Smears	Maximum Result/smear dpm/100cm²		# of Paint Samples	Maximum Result / paint dpm/100cm²		Exposure Rate Scans Range µR/hr floor only	Exposure Rate Measurement Range (µR/hr) 1m above the surface	
			# of measurements	Maximum Result dpm/100cm²		α	β		α	β		# of Measurements	Range µR/hr
63	Rm 123 Pre-decon West Wall Penetration	NA	NA		NA			NA			26-65		
64	Rm 123 Post-decon West Wall Penetration	NA	NA		NA			NA			14-23		

(1) Measurements taken on metal, wood, and glass were all below the approved release levels

(2) MDA (concrete) = 380 dpm/100cm² For Co-60

TABLE 6: GAMMA SPECTROSCOPY RESULTS OF SOIL SAMPLES FROM BUILDING 30 PHASE V

Sample ID	Figure No.	Location	Radionuclide Concentration (pCi/gm) - Results ± 2σ - Background not Subtracted 30 minute counts					
			^{137}Cs 662 keV peak	^{60}Co Average of 1173/1332 keV peaks	^{154}Eu Average of 123/102/1280 keVpeaks	Total Thorium ^{228}Th+^{232}Th	^{238}U 63.2 (92.8) keV peak	^{235}U 186(144) keV peak
SOIL SAMPLES FROM UNDERNEATH THE SUBFLOOR IN ROOM 113A SAMPLES # B30-SS-99-01 TO 21								
1	40	North Side	ND	ND	ND	3.26	2.78	0.32
2	40	North Side	ND	ND	ND	2.83	2.96	0.18
3	40	North Side	ND	ND	ND	3.22	2.42	0.21
4	40	North Side	ND	ND	ND	2.65	2.00	0.16
5	40	North Side	ND	ND	ND	2.39	1.75	0.17
6	40	Center	ND	ND	ND	2.63	2.66	0.18
7	40	Center	ND	0.11	ND	3.06	2.84	0.15
8	40	Center	ND	ND	ND	2.99	2.84	0.22
9	40	Center	ND	ND	ND	3.04	2.28	0.21
10	40	Center	ND	0.02	ND	2.87	2.84	0.23
11	40	Center	ND	ND	ND	3.42	2.55	0.27
12	40	South Side	ND	ND	ND	3.69	2.32	0.20
13	40	South Side	ND	ND	ND	2.38	1.90	0.09
14	40	South Side	ND	ND	ND	3.58	3.47	0.23
15	40	South Side	ND	ND	ND	2.59	1.53	0.17

TABLE 6: GAMMA SPECTROSCOPY RESULTS OF SOIL SAMPLES FROM BUILDING 30 PHASE V

Sample ID	Figure No.	Location	Radionuclide Concentration (pCi/gm) - Results ± 2σ - Background not Subtracted 30 minute counts					
			^{137}Cs 662 keV peak	^{60}Co Average of 1173/1332 keV peaks	^{154}Eu Average of 123/102/1280 keVpeaks	Total Thorium ^{228}Th+^{232}Th	^{238}U 63.2 (92.8) keV peak	^{235}U 186(144) keV peak
16	40	South Side	ND	ND	ND	3.41	2.67	0.23
17	40	South Side	ND	ND	ND	3.72	2.36	0.18
18	40	South Side	ND	ND	ND	3.25	2.46	0.23
19	40	South Side	ND	ND	ND	3.24	3.27	0.22
20	40	South Side	ND	ND	ND	3.17	2.48	0.19
21	40	South Side	ND	ND	ND	2.32	1.76	0.13
CONCRETE AND SOIL SAMPLES FROM HOIST PIT IN ROOM 123								
B30C-123-1	65	Concrete from Pit bottom	ND	ND	ND	1.89	1.77	0.09
B30C-123-2	65	Concrete from Pit bottom	ND	ND	ND	1.58	2.20	0.15
B30S-123-1	65	Immediately below the concrete	ND	ND	ND	2.62	3.42	0.23
B30S-123-2	65	~1.5 ft below the concrete	ND	ND	ND	3.16	2.22	0.25
B30S-123-3	65	~3 ft below the concrete	ND	ND	ND	2.79	2.48	0.24
B30S-123-4	65	From the bottom 6 ft of the ram	ND	ND	ND	3.12	2.87	0.24

* Without background subtraction

ND = < 0.1 pCi/g Cs-137, < 0.1 pCi/g Co-60, < 0.1 pCi/g Eu-154.

TABLE 7: Background Soil (*Surface*) Samples

Samples Collected 06/05/00 & 06/06/00 By Ed Rudgers. Samples Counted for this report 7/20/00 - 7/24/00

Sample ID	Radionuclide Concentration = pCi/g				30 Minute Count Time		
	^{137}Cs 662 keV	^{60}Co Average of 1173/ 1332 keV peaks	^{228}Th Average of 238/583 keV peaks	^{228}Ra (^{232}Th) Average of 338/911 keV peaks	Total Thorium ^{228}Th + ^{232}Th	^{238}U 92.77 keV	^{235}U 186(144) keV
X1	ND	ND	0.48 ± 0.09	0.89 ± 0.27	1.37	1.89 ± 0.57	0.13 ± 0.06
X2	ND	ND	0.67 ± 0.12	1.50 ± 0.40	2.17	1.07 ± 0.58	0.13 ± 0.08
X3	0.06 ± 0.04	ND	1.01 ± 0.10	1.51 ± 0.29	2.52	1.86 ± 0.29	0.23 ± 0.09
X4	ND	ND	1.19 ± 0.23	3.04 ± 0.84	4.24	2.48 ± 1.48	0.28 ± 0.17
X5	ND	ND	1.40 ± 0.19	2.43 ± 0.68	3.83	4.49 ± 1.64	0.32 ± 016
X6	ND	ND	0.66 ± 0.10	1.00 ± 0.30	1.66	1.91 ± 0.65	0.14 ± 0.08
X7	0.13 ± 0.07	ND	1.19 ± 0.14	2.27 ± 0.56	3.46	3.38 ± 1.08	0.18 ± 0.10
X8	ND	ND	0.98 ± 0.12	1.48 ± 0.35	2.46	2.34 ± 0.95	0.14 ± 0.09
X9	0.09 ± 0.08	ND	0.65 ± 0.11	1.09 ± 0.43	1.74	1.16 ± 0.68	0.10 ± 0.08
X10	ND	ND	0.87 ± 0.12	1.36 ± 0.39	2.22	1.97 ± 0.66	0.16 ± 0.08
AVE.	0.09 ± 0.06	ND	0.91 ± 0.13	1.66 ± 0.45	2.57	2.26 ± 0.83	0.18 ± 0.10

ND = Not Detected. = < 0.1 pCi/g Cs-137 and < 0.1 pCi/g Co-60

Sample Locations

X1 Sorrento Valley Road near sample location ST65 on the hillside ~1 mile from Building 37.

X2 Sorrento Valley Road near Carmel Mountain Road junction on steep cliff.

X3 Sorrento Valley Road in Los Penasquitos Preserve ~2 miles from Building 37.

X4 Sorrento Valley Court at end of the road in the field.

X5 Roselle Street, East of sample location ST64 from the hillside ~ ½ mile from Building 37.

X6 Roselle Street, East of sample location ST64 from the hillside ~1 ½ mile from Building 37.

Lusk Boulevard, from the hillside ~ 1 ½ miles from Building 37.

X9 Callahan Road, from the hillside ~ ½ mile from Building 37.

X10 Eastgate Mall road, from field ~3 miles from Building 37.

FIGURES

Figure 1: Main Site and Sorrento Valley Site

Building Numbers	Names
Building 1	Administration
Building 2	Science Laboratories A, B, C.
Building 7	Cafeteria
Building 9	Experimental Building
Building 10	Maintenance Building
Building 13	Technical Office Building
Building 14	Technical Office East
Building 15	Technical Office East
Building 19	Swimming Pool Building
Building 21	TRIGA Building
Building 22	TRIGA Fuel Lab Building
Building 23	Hot Cell
Building 25	Waste Yard Building
Building 27	Experimental Area
Building 27-7	Experimental Area
Building 29	Experimental Area
Building 29-2	Emergency Vehicle Storage Building
Building 30	LINAC Complex
Building 31	TRIGA Storage Building
Building 31-1	Neutron Radiography Building
Building 31-2	ECF Critical Building
Building 31-3	Storage Building
Building 33	Fusion Building
Building 33-1	Fusion Lab Building
Building 33-5	Fusion Building Annex 5
Building 34	Fusion Doublet III Building
Building 34-1	Fusion Doublet III Capacitor Building
Building 34-2	Fusion Doublet III Lab Building
Building 34-3	Fusion Doublet III Storage Building
Building 35	Test Tower Building
Building 35-1	Facilities (Shipping & Receiving) Building
Building 36	Blower Assembly Building
Building 37	Sorrento Valley Building
Building 39	Sorrento Valley Building
Building 39-1	Storage Building
Building 41	Raw Stock Facility
Building 42	NDT Facility
Building 45	Helium Circulator Test Facility
Building 63	3550 Dunhill St.
Building 64	11030 Roselle St.
Building 65	11040 Roselle St.
Building 66	3520 Dunhill St.
Building 66	3510 Dunhill St.

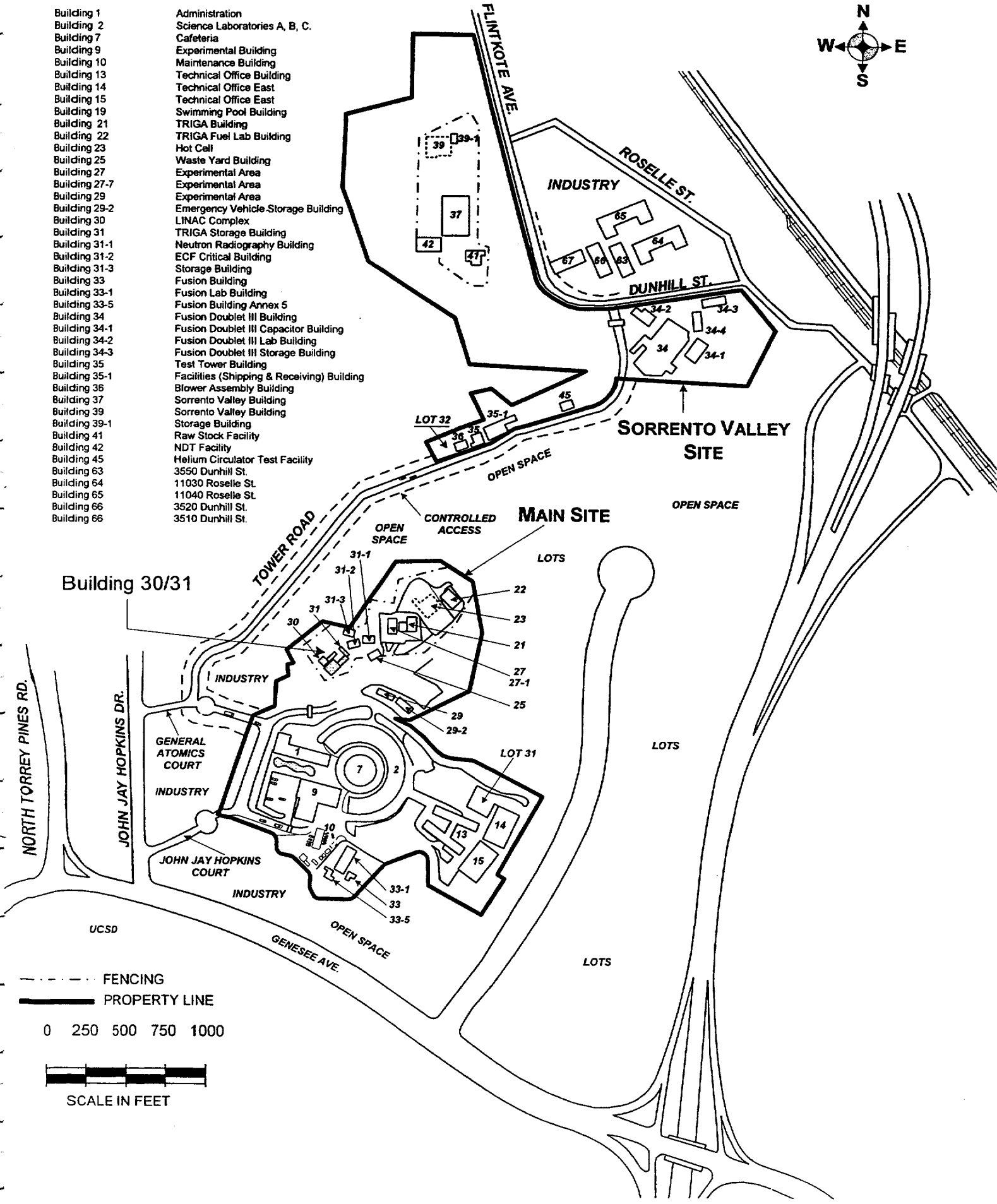
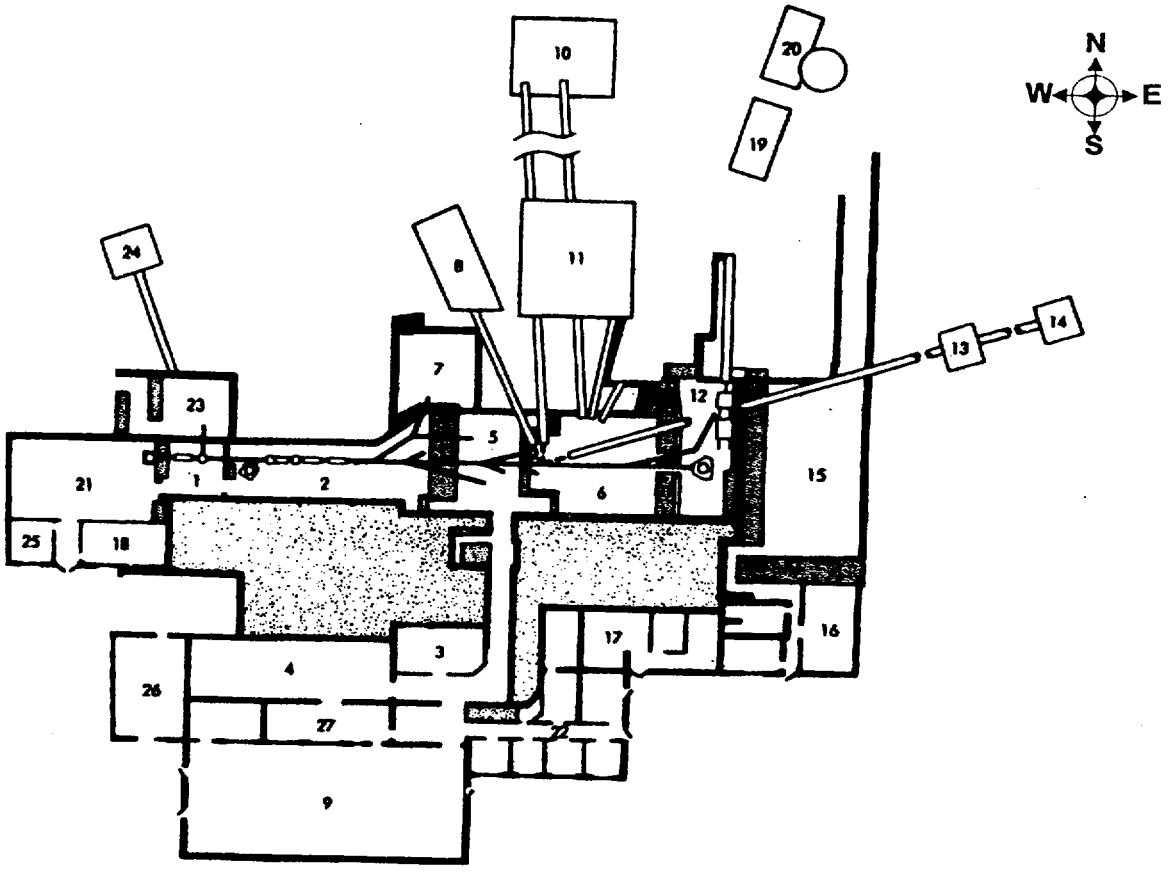
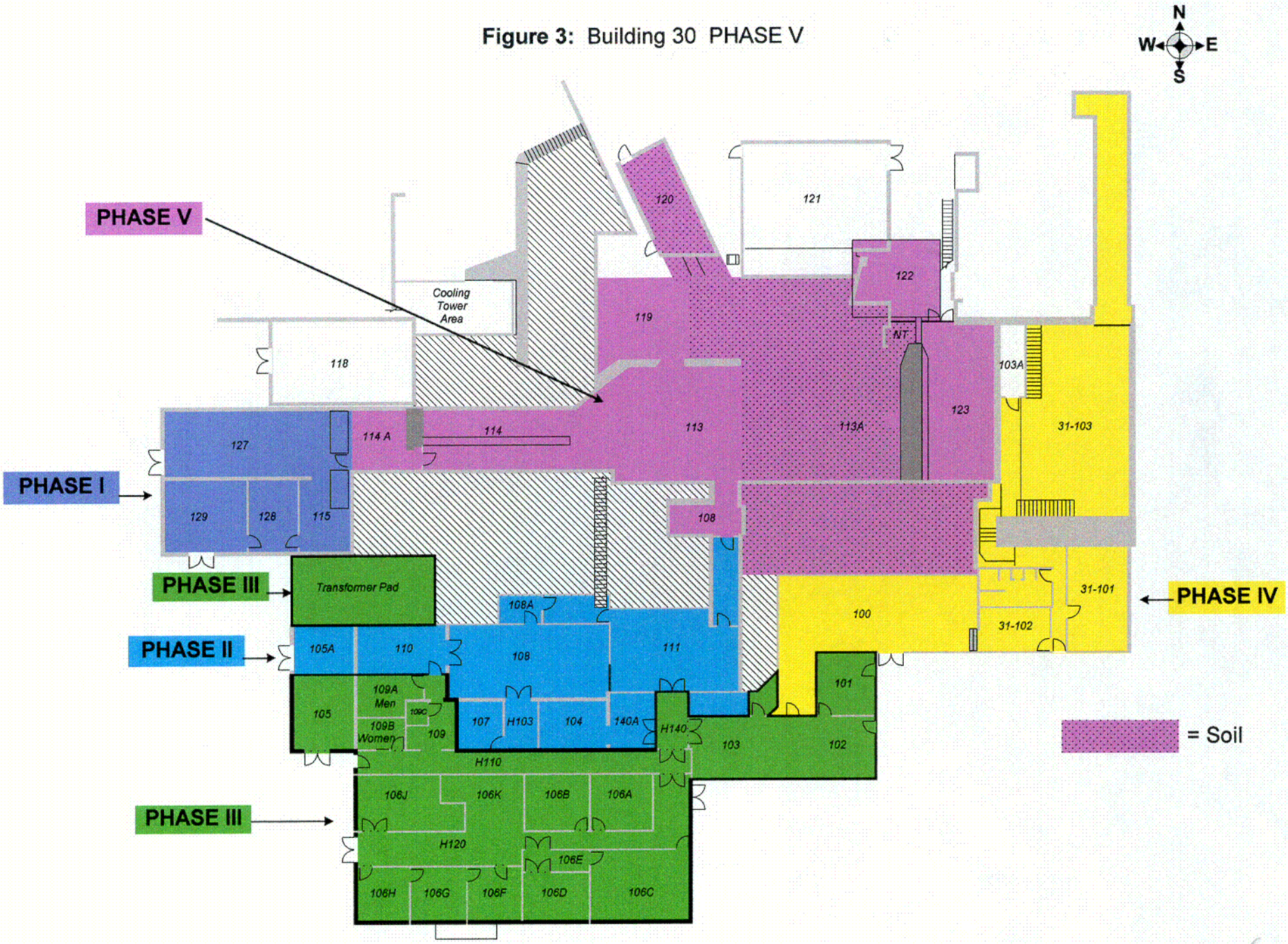


Figure 2: Building 30/31 Original Linear Accelerator Facility (LINAC)



1. 25 MeV Accelerator
   Pulse Radiolysis Facility
   Dosimetry, Detector Calibration, and Radiation Effects Cell
2. 75 MeV Accelerator
   Accelerator Tuning and Isotope Production Cell
3. 75/100 MeV Accelerator Control Room
4. Data Acquisition and On-Line Computer Facility
5. Radiation Effects Cell
6. Neutron Targets Cell
7. Electron Penetration Facility
   Gamma Ray Penetration Facility
   Positron Scattering Facility
   Neutron Yield Measurement Cell
   Single Electron-per-Pulse Cell
   Detector Calibration Cell
8. Scintillator Building
   Neutron Capture Cross-Section Facility
9. Vac Lab, Setup Room, Equipment Storage
10. 50-Metre Building
    Thermal, Intermediate and Fast Neutron Spectrum Station
    Fast Neutron Cross-Section Cell
    Neutron Inelastic Scattering Cross-Section Cell
11. 16-Metre Building
    Thermal and Intermediate Neutron Spectrum
    Thermal Neutron Total Cross-Section Cell
    Thermal Neutron Scattering Cross-Section Cell
12. Fast Reactor Spectral Test Facility
    Split Bed Subscritical Assembly
    Lattice Thermal Spectrum Cell
13. 100-Metre Building
    Fast Neutron Spectrum Station
    Neutron Capture Cross-Section Cell
14. 200-Metre Building
    Fast Neutron Spectrum Station
    Neutron Capture Cross-Section Cell
15. CF Radiography Cell
16. CF Applications Lab
17. Chem Lab
18. 25-MeV Control and Data Acquisition Room
19. CF Control Station
20. CF Storage Tower
21. Accelerator Modulator Room
22. Offices
23. Radiation Processing Cell
24. Neutron Detector Building
25. Data Acquisition Room
26. Machine Shop
27. Technician Shop

Figure 3: Building 30 PHASE V



C-1

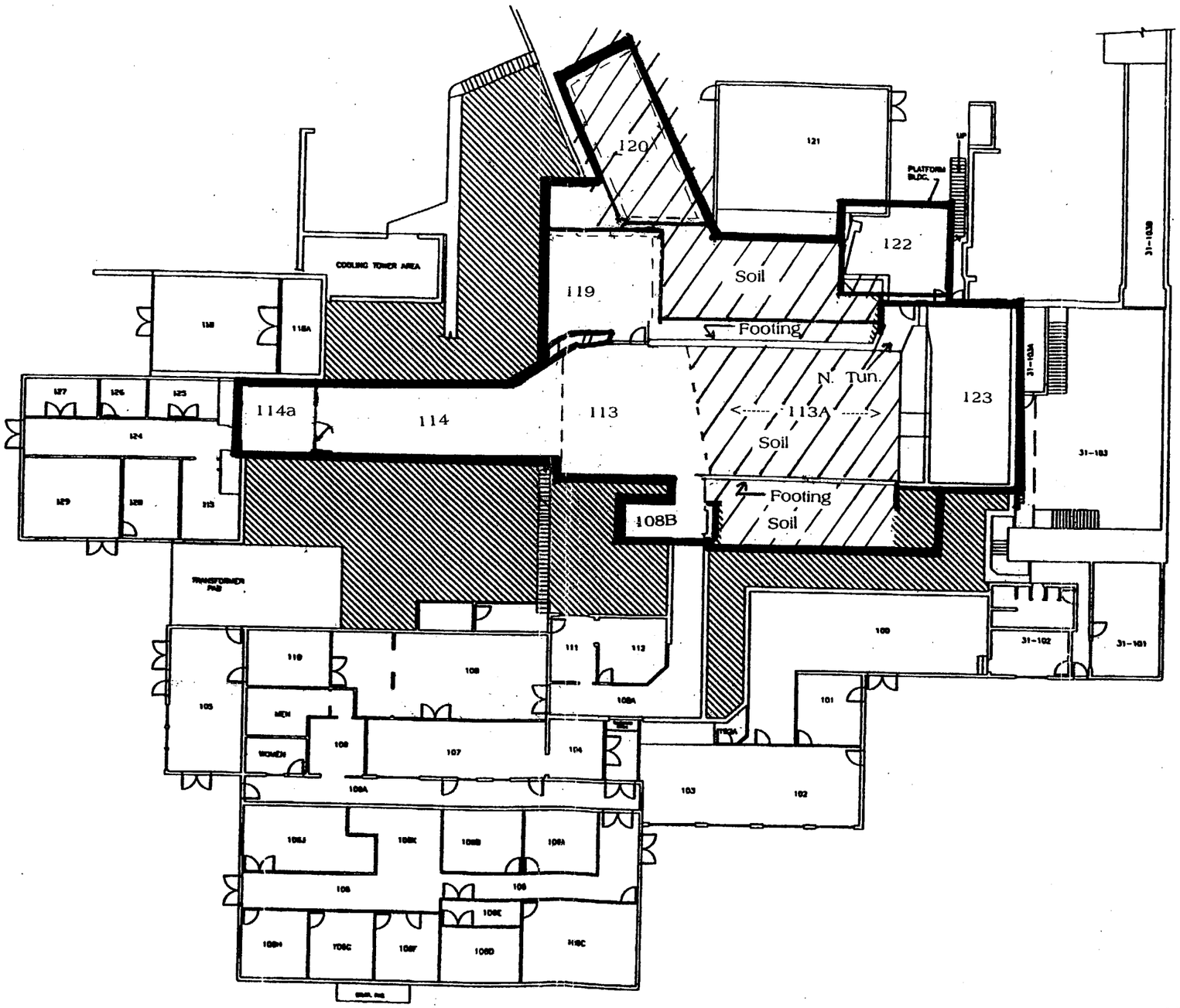


Figure 4:

Building 30

Phase V Rooms

DATE ISSUED: 07/27/94

REV.	DESCRIPTION	APPROVED	DATE
A	RELOCATION OF BUILDING 2 TO BUILDING 30	H. LOMAX	12/27/95

DESIGN BY:

PROPRIETARY INFORMATION

GENERAL ATOMICS

PROJECT BUILDING 30 AND 31

DESCRIPTION OCCUPANCY

SHEET NUMBER

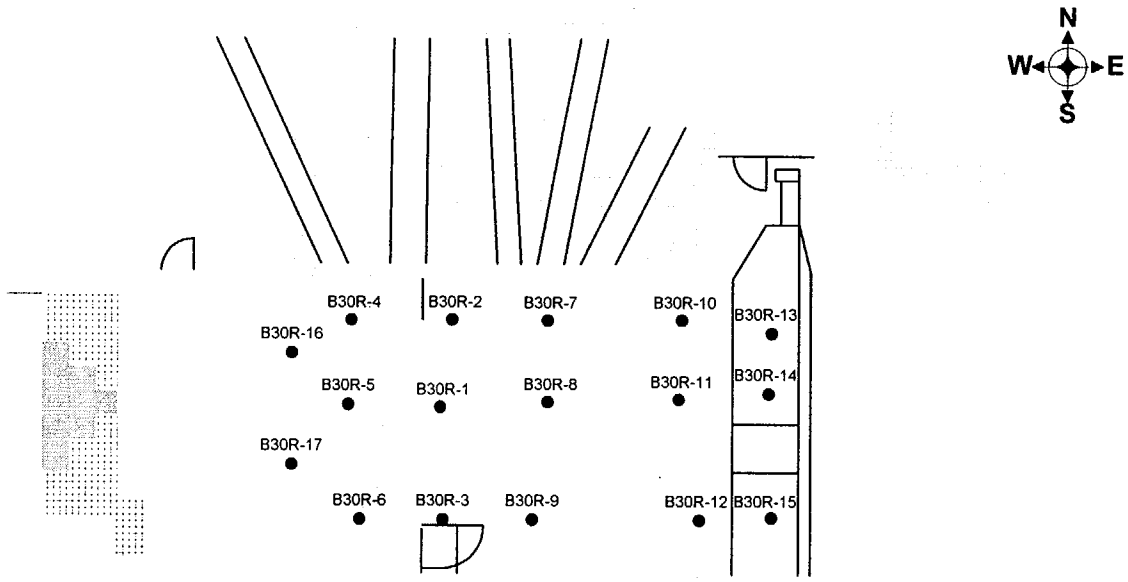
OCC

FAC. ENG. NO.

OCCB30

SCALE 3/32" = 1'-0"

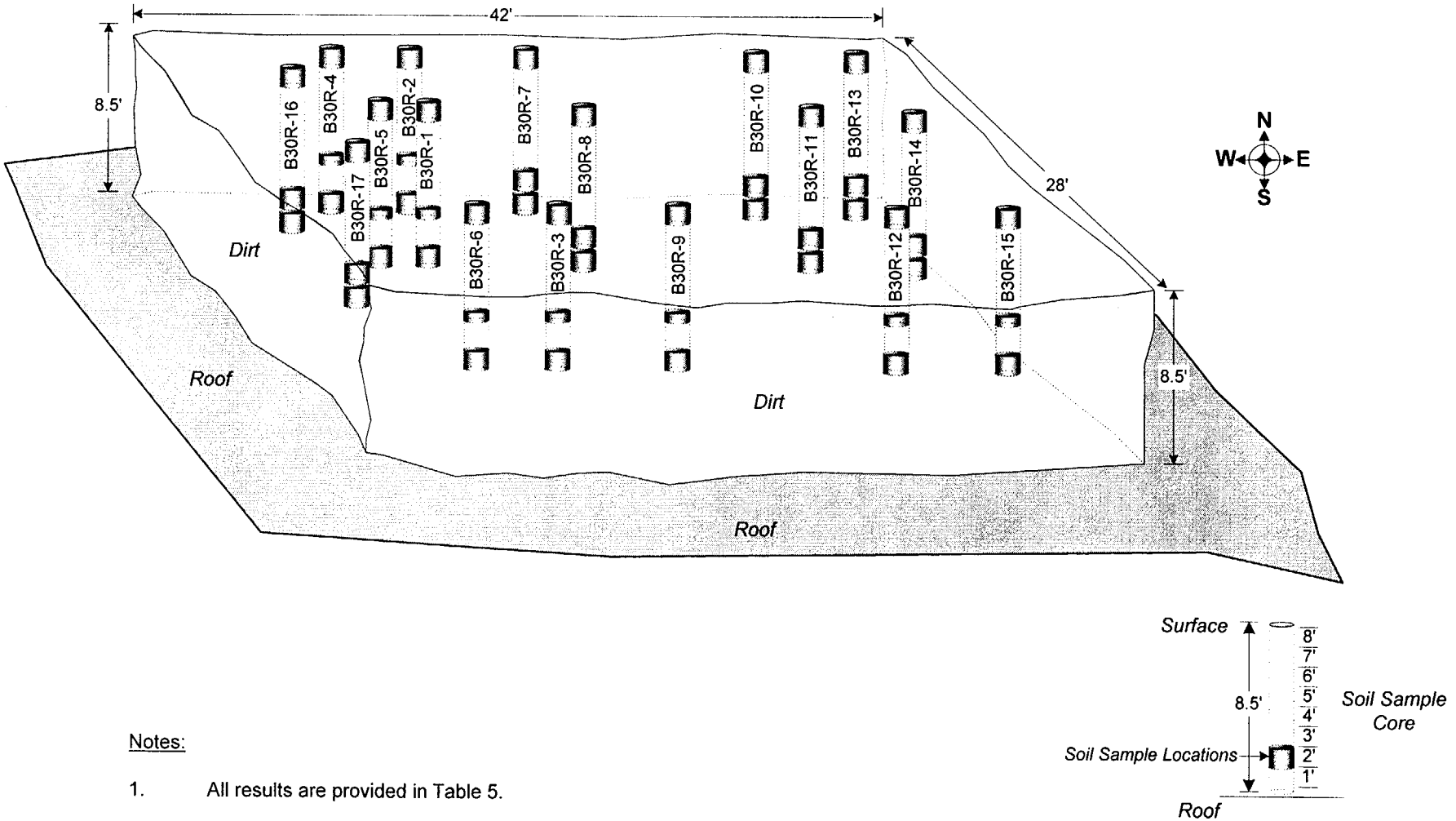
Figure 5: Soil Sample Locations from Earthen Cap Shielding Above Rooms 113 and 113A



Notes:

1. The darkened circles are the approximate locations of Core Samples taken through the earth cap to the roof.
2. Each Core Sample is approximately 8.5' (from surface to roof).

Figure 6: Sample Locations and Depth of Samples from Earthen Shield Cap Shielding above Rooms 113 and 113A

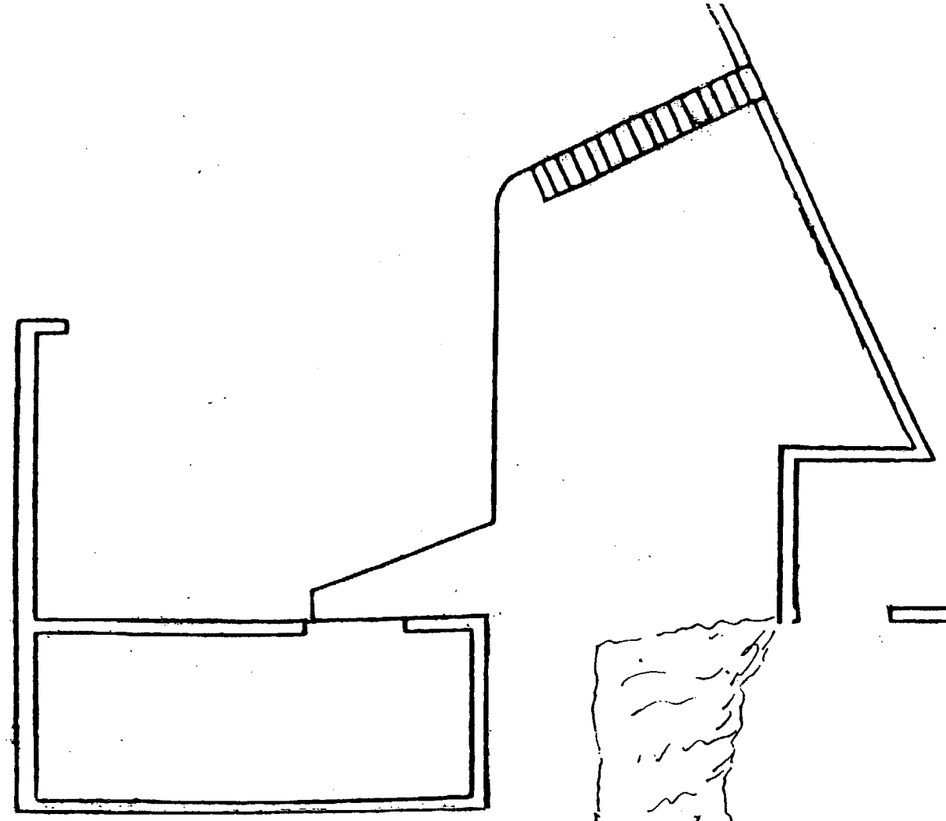


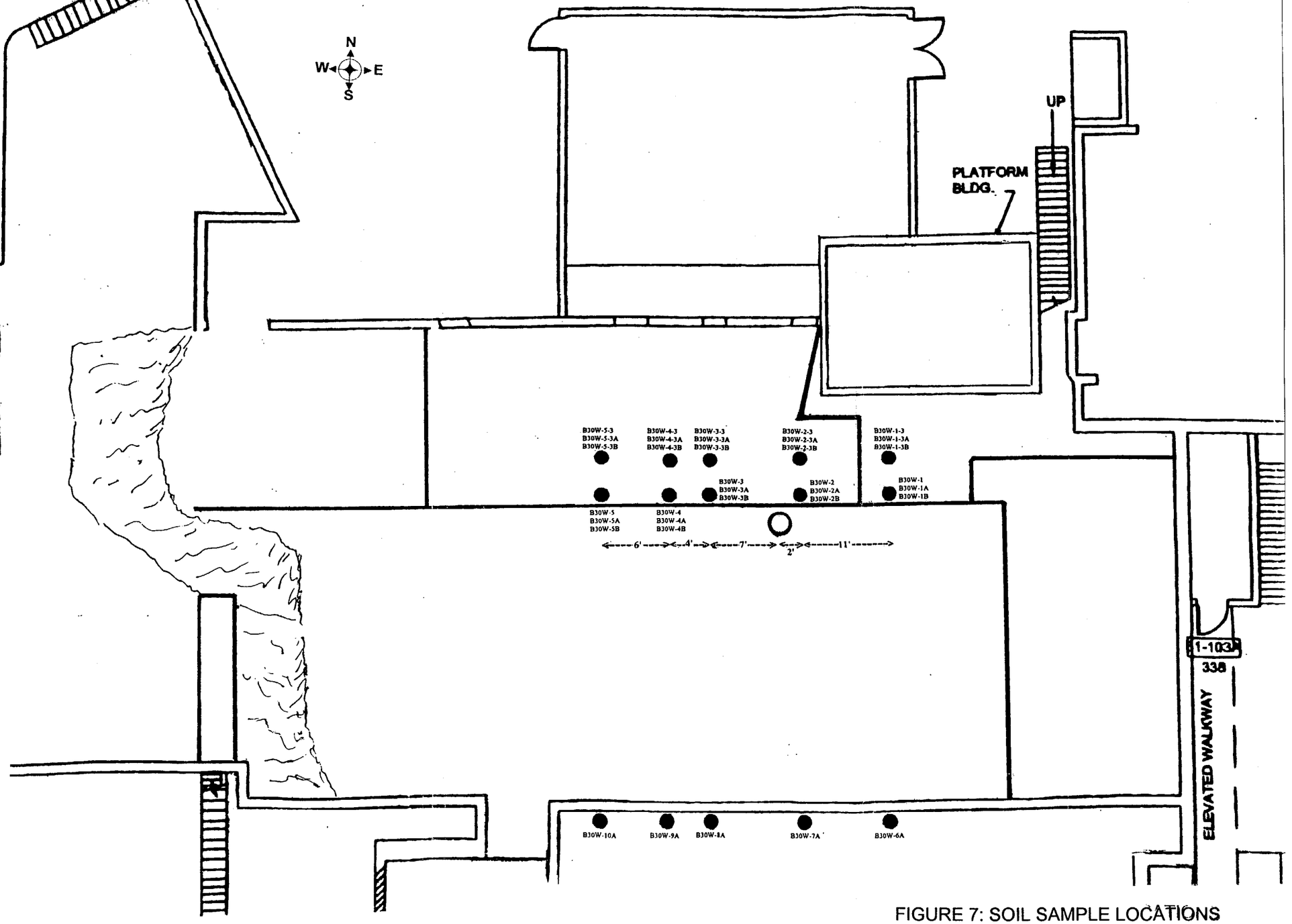
Notes:

1. All results are provided in Table 5.
2. The dark shaded cylinder (inside the core) shapes are the approximate locations of samples taken.
3. Each core from soil surface to roof is approximately 8.5' deep. Three (3) soil samples were taken from each core.

B/30 LINAC EXTERIOR SOIL SAMPLE LOCATIONS

PHIL POOLE
4-9-99





DEPTH BELOW ROOF LINE AT WHICH SOIL SAMPLES WERE TAKEN							
	2ft.	7ft.	10ft.		2ft.	7ft.	10ft
Location				Location			
B30W-1	X			B30W-1-3	X		
B30W-1A		X		B30W-1-3A		X	
B30W-1B			X	B30W-1-3B			X
B30W-2	X			B30W-2-3	X		
B30W-2A		X		B30W-2-3A		X	
B30W-2B			X	B30W-2-3B			X
B30W-3	X			B30W-3-3	X		
B30W-3A		X		B30W-3-3A		X	
B30W-3B			X	B30W-3-3B			X
B30W-4	X			B30W-4-3	X		
B30W-4A		X		B30W-4-3A		X	
B30W-4B			X	B30W-4-3B			X
B30W-5	X			B30W-5-3	X		
B30W-5A		X		B30W-5-3A		X	
B30W-5B			X	B30W-5-3B			X
B30W-6A		X					
B30W-7A		X					
B30W-8A		X					
B30W-9A		X					
B30W-10A		X					

B30/LINAC EXTERIOR SOIL SAMPLE LOCATIONS

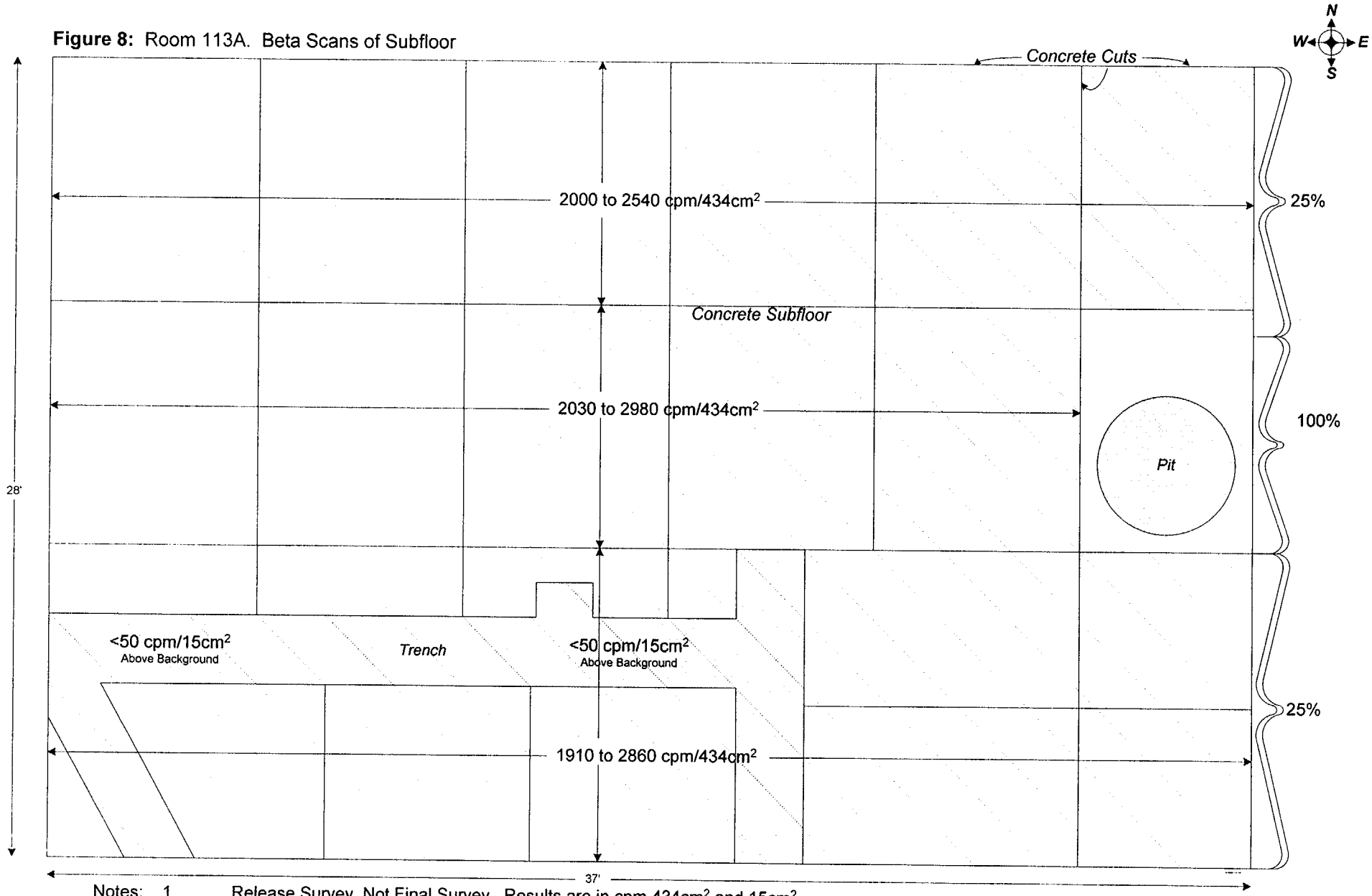
Soil samples drawn along the north and south walls of Rm. 113/113A

- Location nos. B30W-1 through B30W-5 and B30W-1-3 through B30W-5-3 were each sampled at 3 separate depths, below the roof line, of 2ft., 7ft. & 10ft.
- Location nos. B30W-6A through B30W-10A were singularly sampled only at 7ft. below the roof line.

09 Apr. 99
Phil Poole

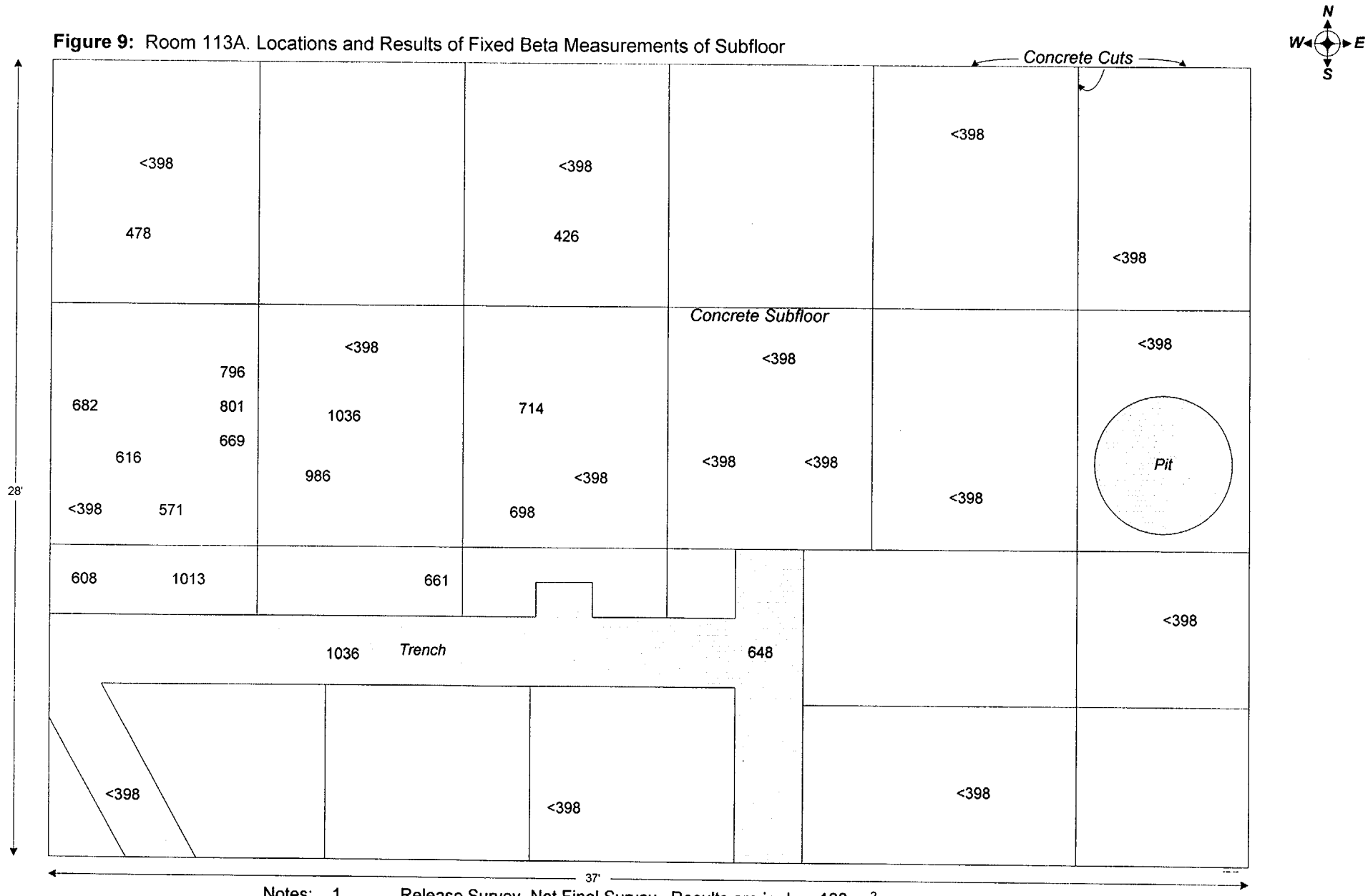
FIGURE 7: SOIL SAMPLE LOCATIONS FROM OUTSIDE THE SOUTH AND NORTH WALLS OF ROOM 113A

Figure 8: Room 113A. Beta Scans of Subfloor



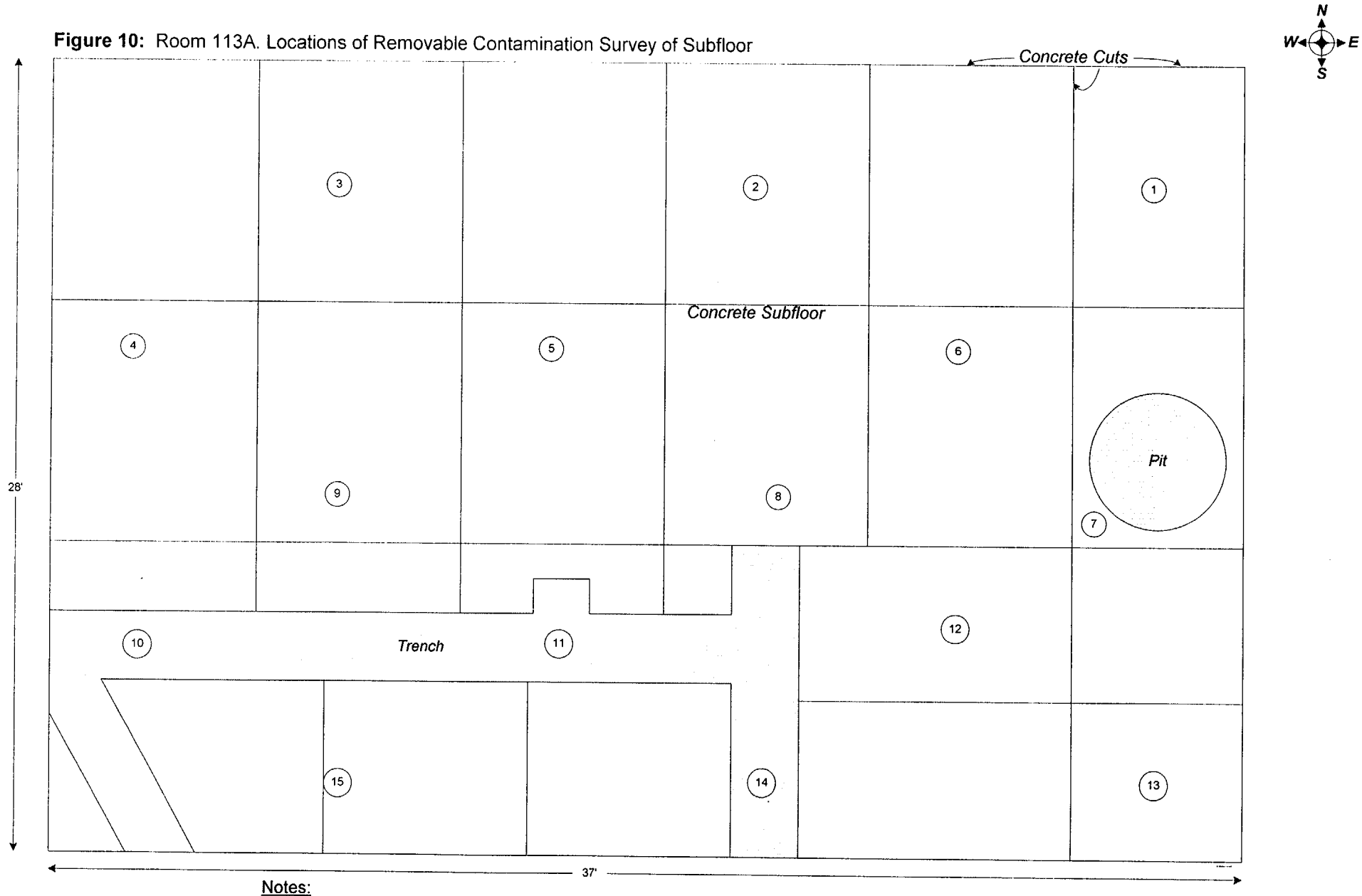
Notes:
1. Release Survey, Not Final Survey. Results are in cpm 434cm² and 15cm².
2. ~ 25% of North and South end of the subfloor was scanned for Beta and the center of subfloor was scanned
   ~ 100% Beta using a 434cm² detector. All scan results in cross hatched area.
   ~100% of the Trench was scanned for Beta with a 15cm² GM. All areas above 2300 cpm were surveyed with a 15cm² GM.
3. Background: 434cm² = 1858 -2036 cpm, 15cm² = 100 cpm.
4. All concrete surface.

Figure 9: Room 113A. Locations and Results of Fixed Beta Measurements of Subfloor



Notes:
1. Release Survey, Not Final Survey. Results are in dpm 100cm^2.
2. The values are dpm/100cm^2 and indicate the approximate locations of measurements taken. Two minute (cp2m) fixed Beta readings were taken.
3. MDA: 398 dpm/100cm^2.
4. All concrete surface.

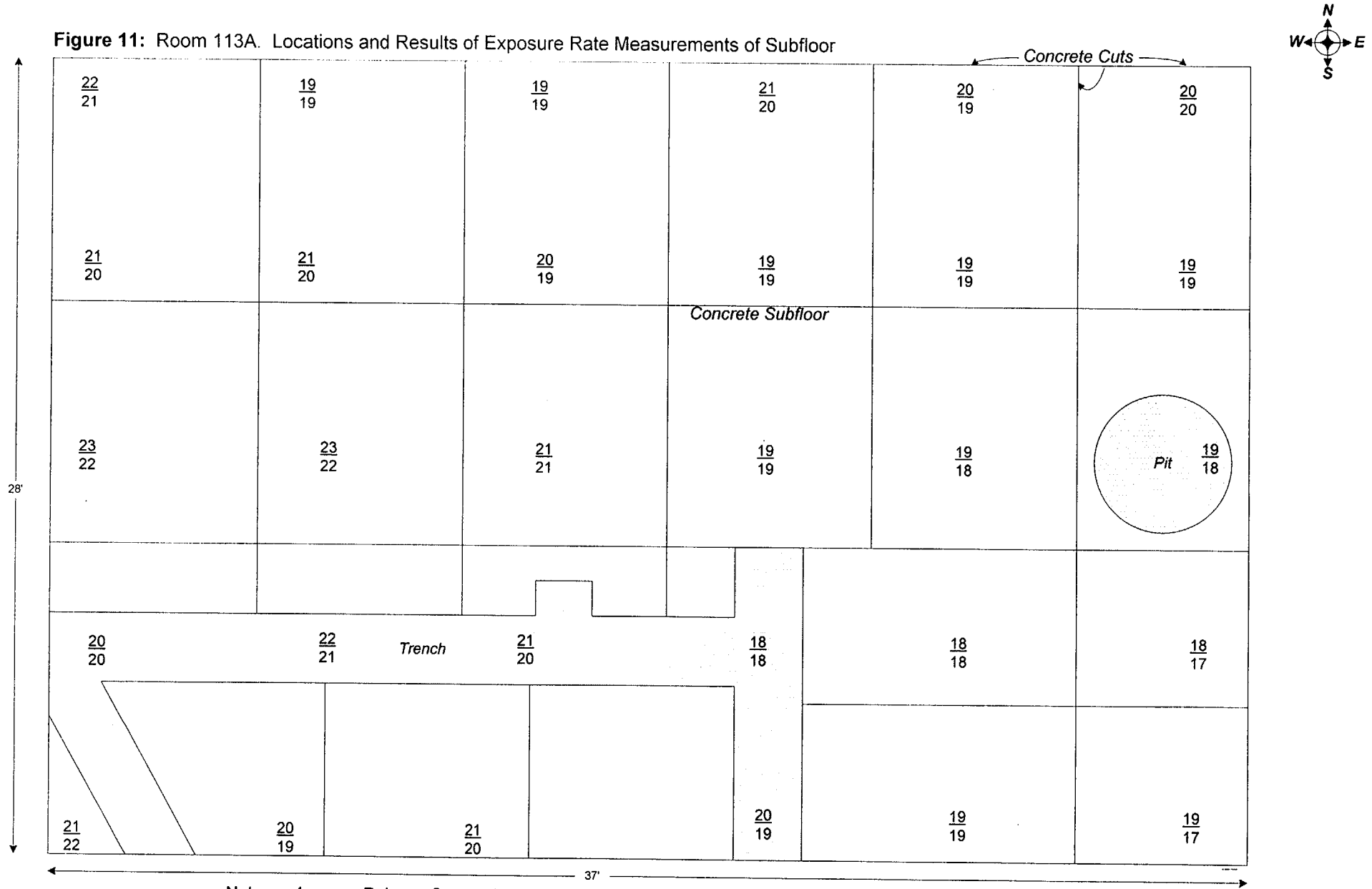
Figure 10: Room 113A. Locations of Removable Contamination Survey of Subfloor



Notes:

1. Release Survey, Not Final Survey.
2. The Numbers circled are the approximate locations of wipes taken.
3. All concrete surface.

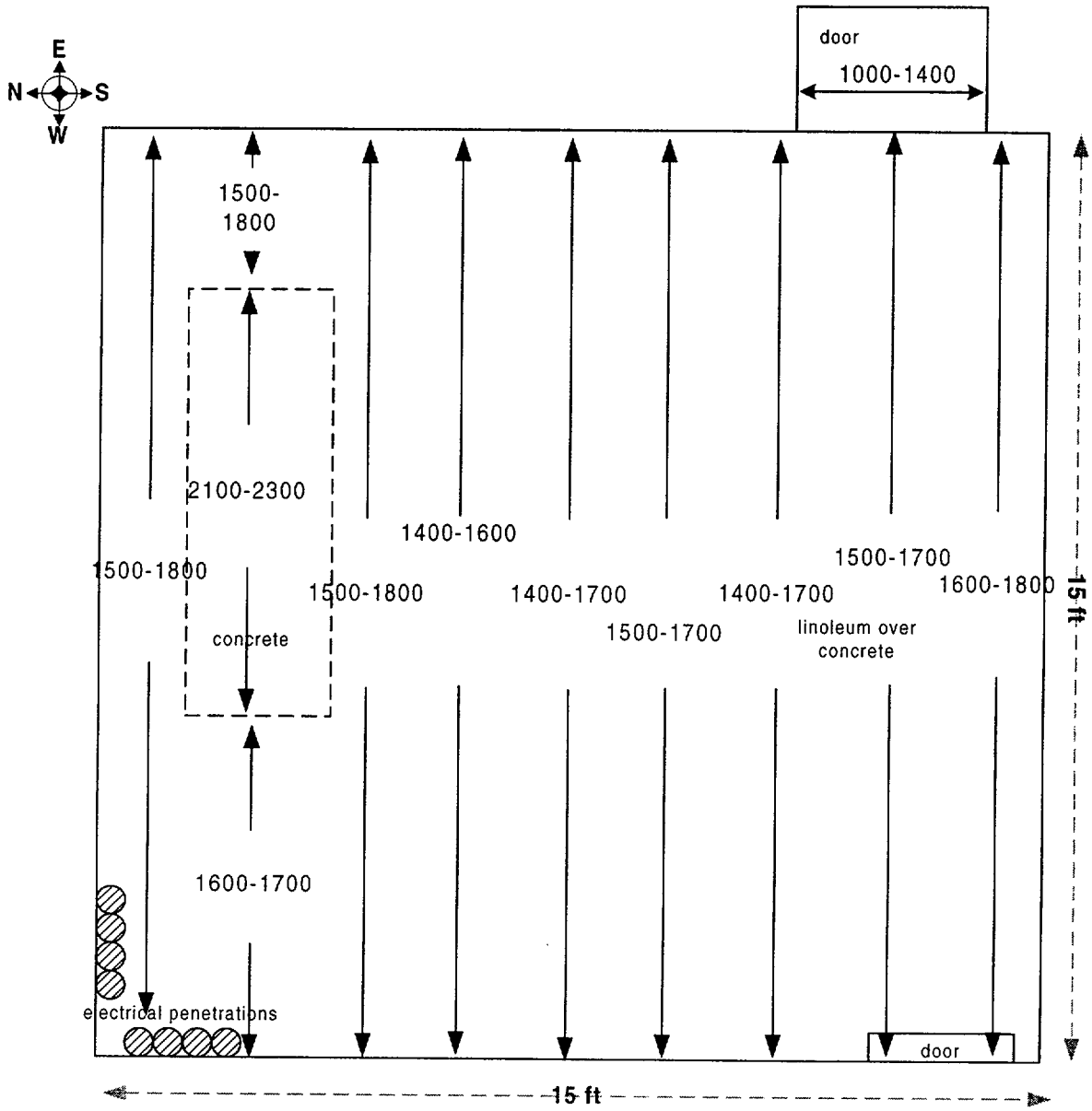
Figure 11: Room 113A. Locations and Results of Exposure Rate Measurements of Subfloor



Notes:
1. Release Survey, Not Final Survey.
2. The values are μR/hr and indicates the approximate location of Exposure Rate Measurements taken at ~1ft. above ground surface and ~1m above ground surface. Background: 10 - 18 μR/hr.
3. All concrete surface.

$\frac{nn}{nn}$ Denotes = $\frac{1'}{1m}$

Figure 12: Room 114A 100% Beta Scan of Floor



Survey Conducted by: R Stowell
Date: 12-06-99

Notes:

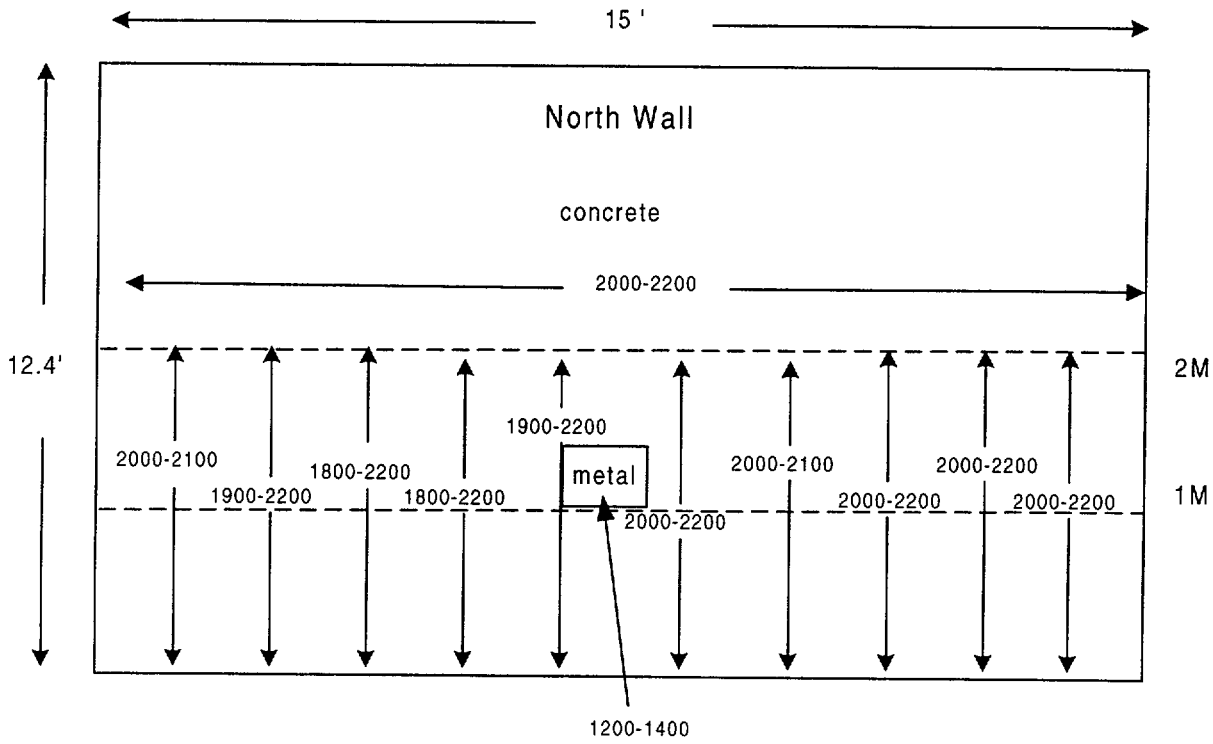
1. Survey results are provided in Table 5.

2. ~100% of acccessible surface area scanned.

3. Scan results ranged from 1000 to 2300 cpm.

Instruments	
Model	2221
Serial #	84459
Cal Due Date	01-31-00
Efficency %	21.67
Probe	434 cm^2 β
Probe #	086213
Background concrete	1848-2036 cpm
Background linoleum over concrete	1188-1462 cpm

Figure 13: Room 114A North Wall Beta Scans



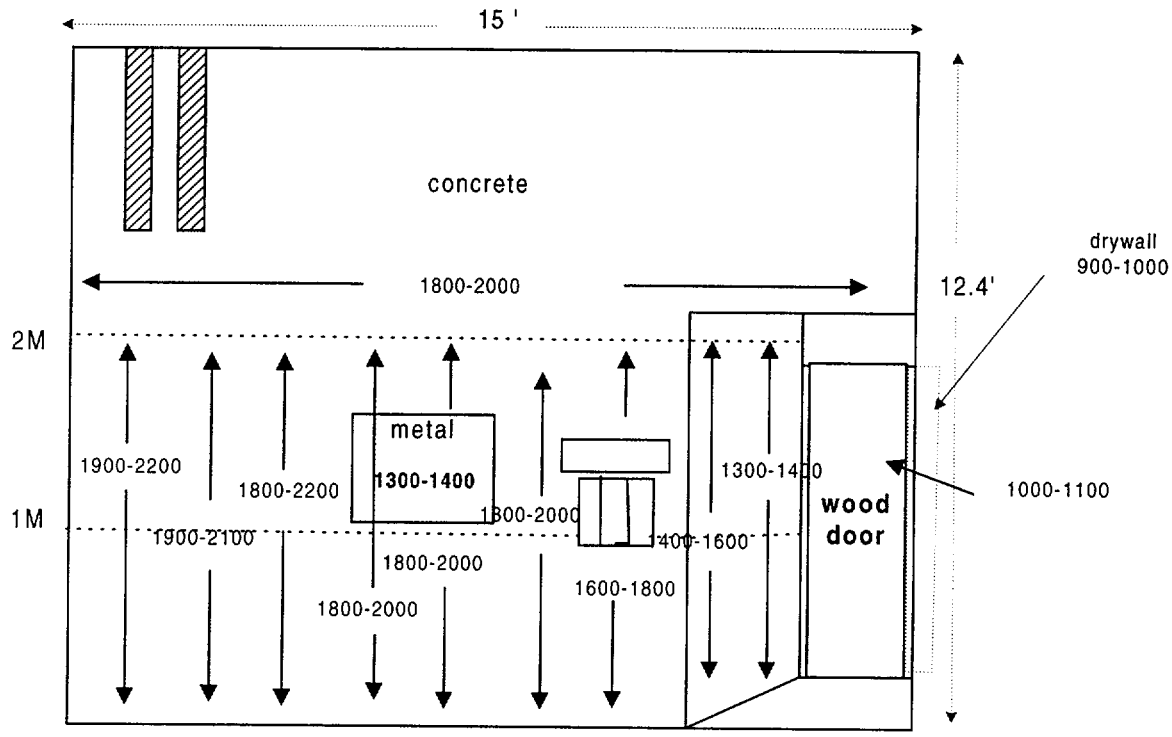
Survey Conducted by: R. Stowell
Date: 12-07-99

Instrument	
Model	Ludlum 2221
Serial #	84459
Cal Due Date	01-31-00
Efficiency %	21.67
Probe	434 cm^2 β
Probe #	086213
Background (metal)	816 - 1047 cpm
Background (concrete)	1848 - 2036 cpm

Notes:

1. Survey results are provided in Table 5.
2. ~100% 2 meters and below and ~10% above 2 meters were scanned.
3. Scan results ranged from 1200 to 2200 cpm beta.

Figure 14: Room 114A East Wall Beta Scans



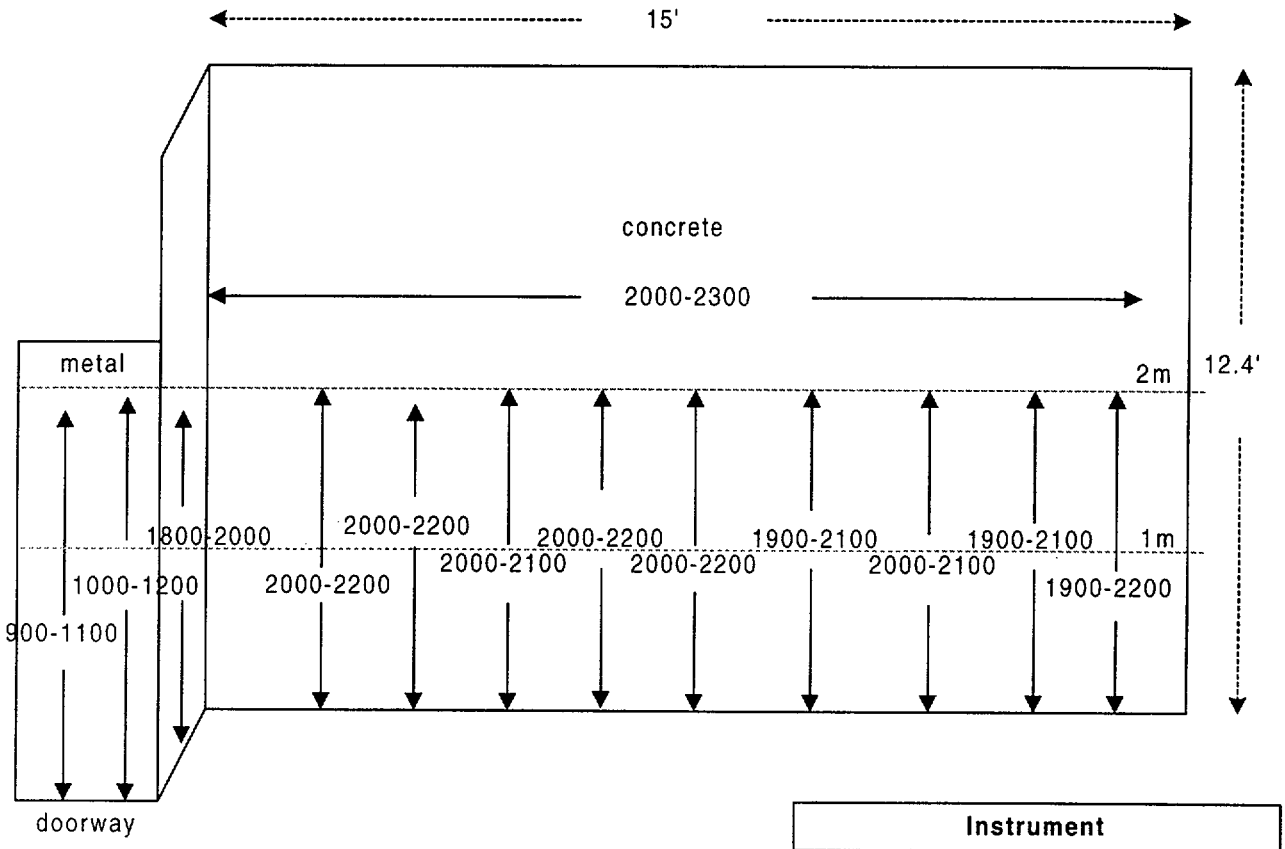
Survey Conducted by: R. Stowell
Date: 12-07-99

Instrument	
Model	Ludlum 2221
Serial #	84459
Cal Due Date	01-31-00
Efficiency %	21.67
Probe	434 cm^2 β
Probe #	086213
Background (metal)	816 - 1047 cpm
Background (concrete)	1848 - 2036 cpm
Background (wood)	1061-1262 cpm
Background (drywall)	770 - 937 cpm

Notes:

1. Survey results are provided in Table 5.
2. ~100% 2 meters and below and ~10% above 2 meters were scanned.
3. Scan results ranged from 900 to 2200 cpm beta.

Figure 15: Room 114A South Wall Beta Scans



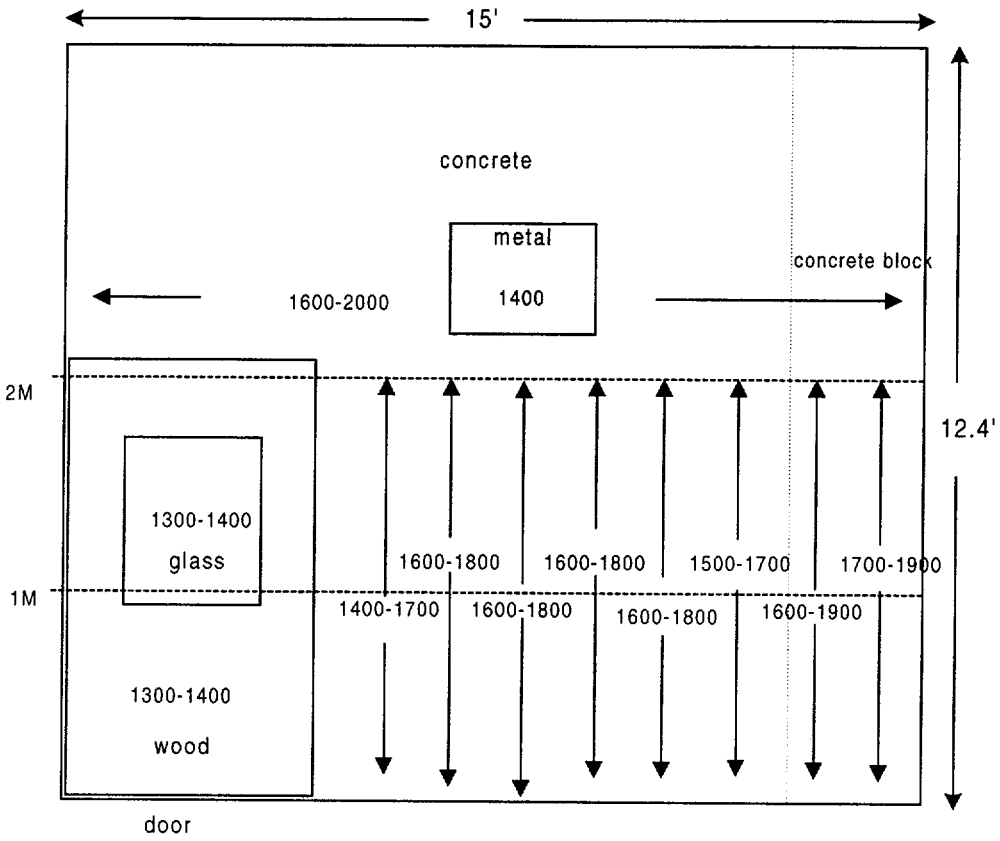
Instrument	
Model	Ludlum 2221
Serial #	84459
Cal Due Date	01-31-00
Efficiency %	21.67
Probe	434 cm^2 β
Probe #	086213
Background (metal)	816 - 1047 cpm
Background (concrete)	1848 - 2036 cpm

Survey Conducted by: R. Stowell
Date: 12-06-99

Notes:

1. Survey results are provided in Table 5.
2. ~100% 2 meters and below and ~10% above 2 meters were scanned.
3. Scan results ranged from 900 to 2300 cpm beta.

Figure 16: Room 114A West Wall Beta Scans



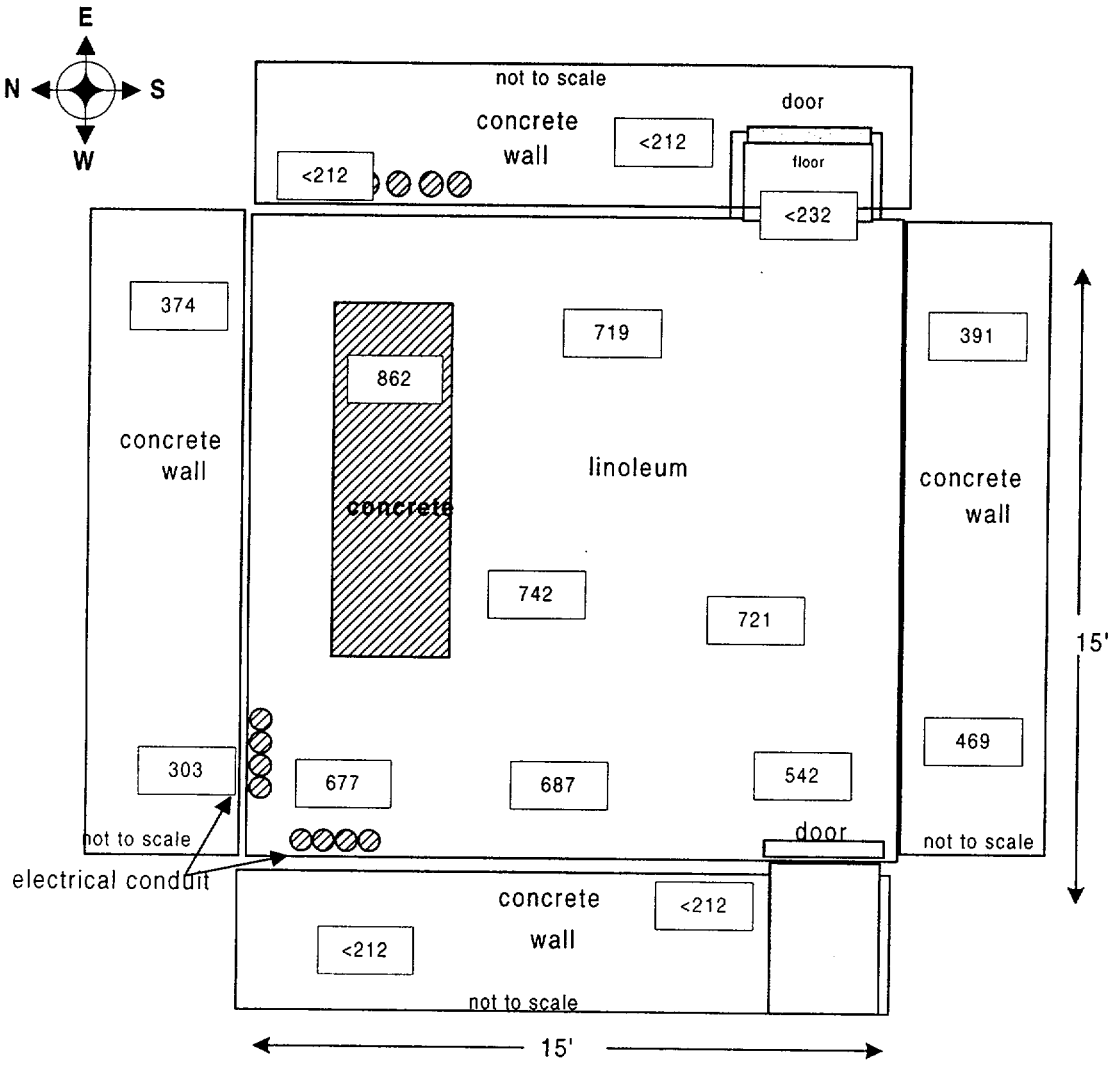
Instrument	
Model	Ludlum 2221
Serial #	84459
Cal Due Date	01-31-00
Efficiency %	21.67
Probe	434 cm^2 β
Probe #	086213
Background (metal)	816 - 1047 cpm
Background (concrete)	1848 - 2036 cpm
Background (wood)	1061-1262 cpm
Background (glass)	787-917 cpm
Background (concrete block)	1174-1409

Survey Conducted by: R. Stowell
Date: 12-06-99

Notes:

1. Survey results are provided in Table 5.
2. ~100% 2 meters and below and ~10% above 2 meters were scanned.
3. Scan results ranged from 1300 to 2000 cpm beta.

Figure 17: Room 114A Fixed Beta Survey



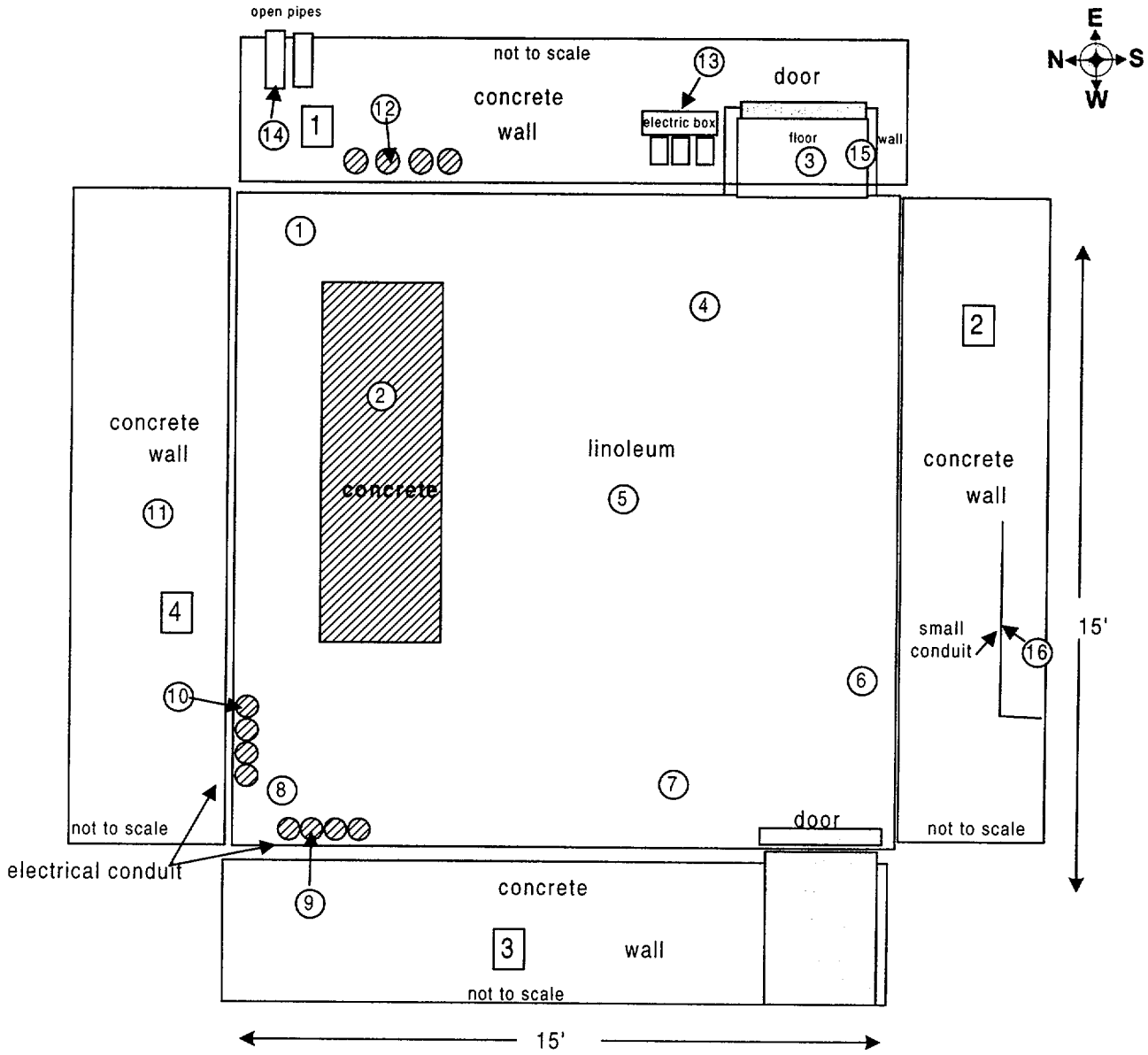
Instrument	
Model	Ludlum 2221
Serial #	84423
Cal Due Date	02-02-00
Efficiency %	26.20
Probe	100 cm^2 β
Probe #	119444
Background (linoleum over con)	655 ± 21cp2m
MDA (linoleum over concrete)	232 dpm/100 cm^2
Background (concrete)	1011 ± 24 cp2m
MDA (concrete)	212 dpm/100 cm^2

Survey Conducted by: R. Stowell
Date: 12-07-99

Notes:

1. Survey results are provided in table 5.
2. [XXX] Denotes 2 minute fixed beta reading location with results shown in dpm/100 cm^2.

Figure 18: Room 114A Smear and Paint Sample Locations



Survey Conducted by: R. Stowell
Date: 12-08-99

Notes:

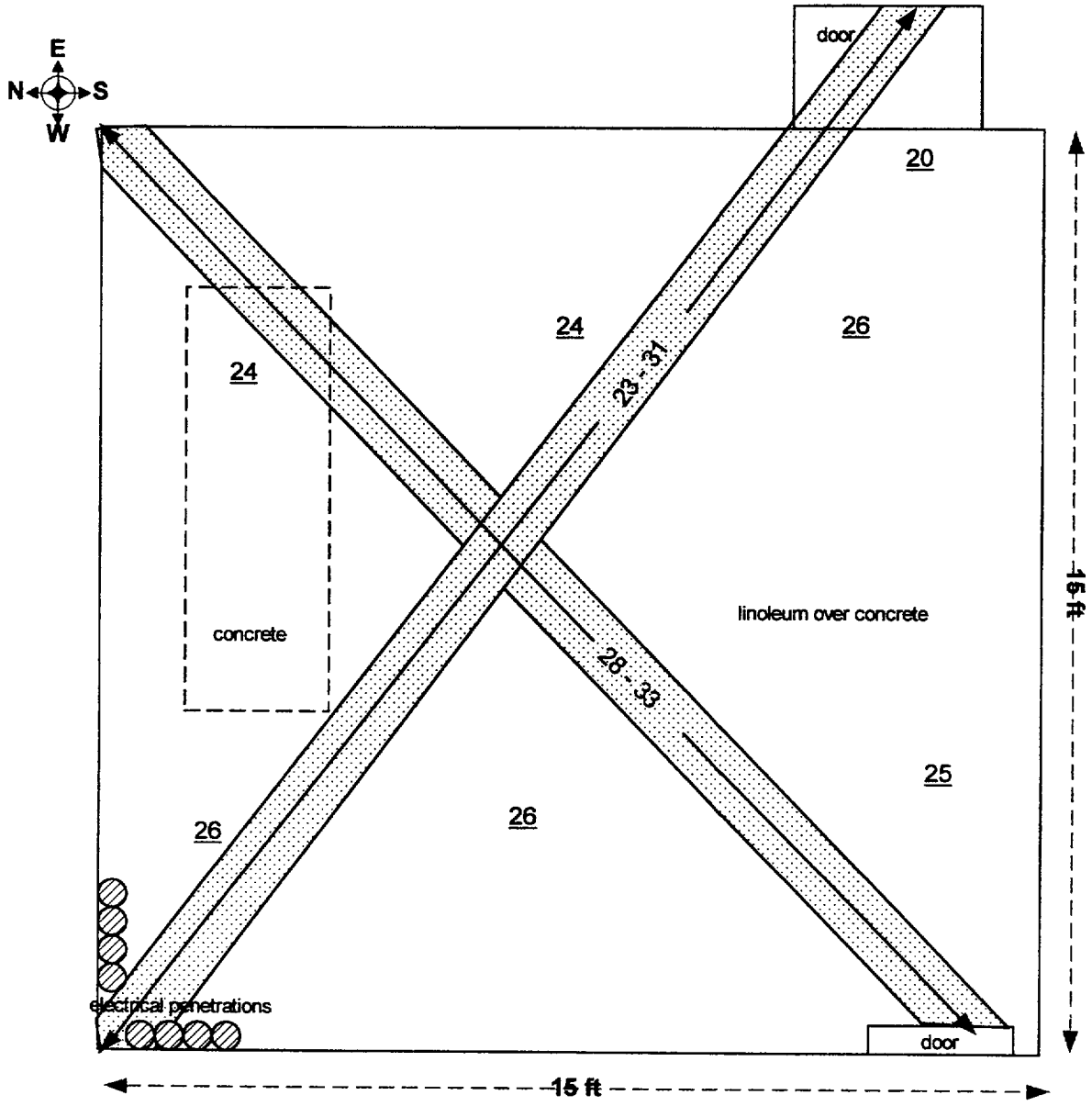
1. Smear results are provided in Table 5.

2. Paint sample results are provided in Table 5.

3. (x) Denotes approximate smear location.

4. [X] Denotes approximate paint sample location.

Figure 19 : Room 114A MicroR Scans of Floor and Exposure Rate Measurements



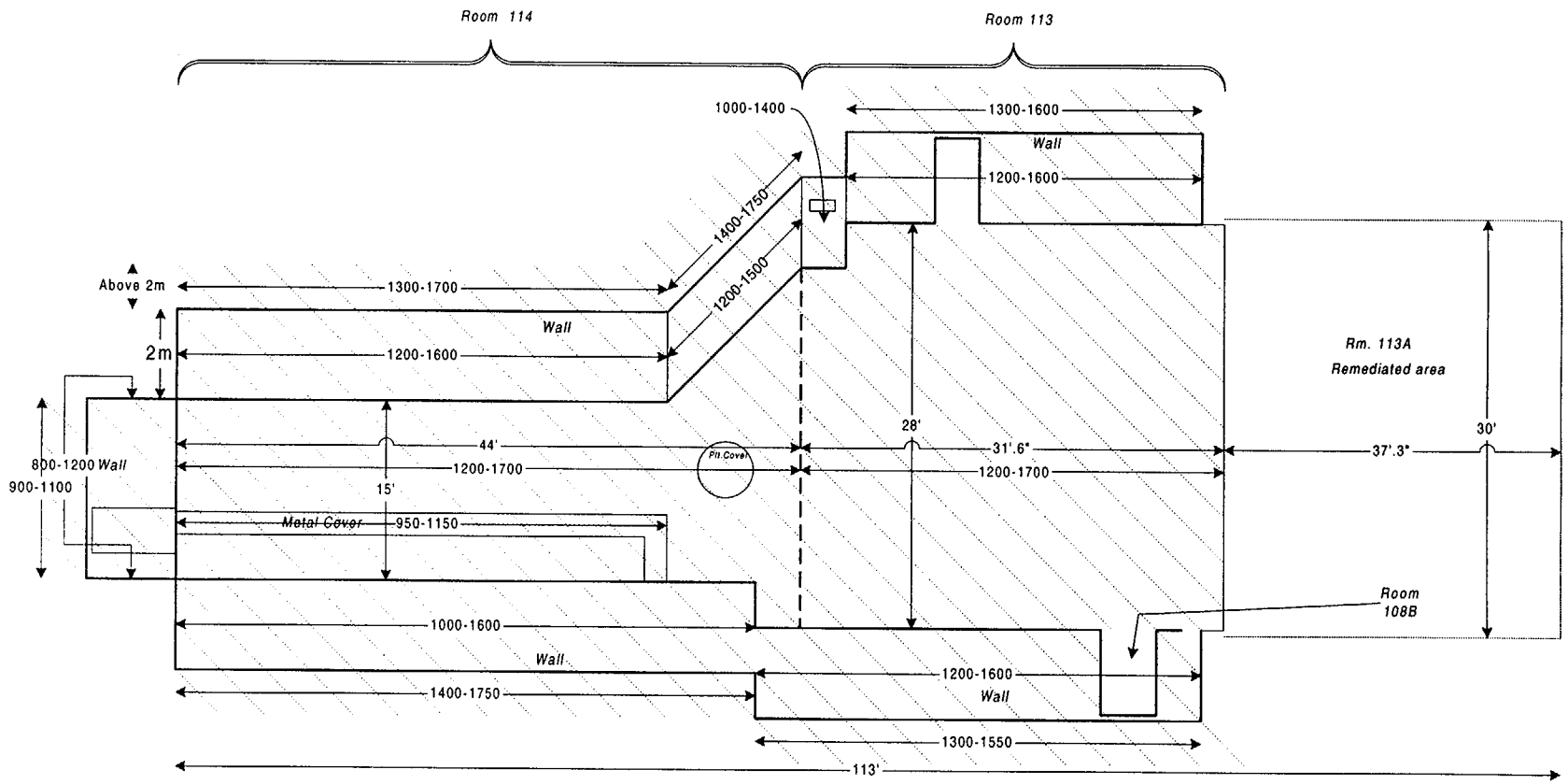
Surveys Conducted by: R Stowell and P. Poole
Dates: 12-06-99 and 01-19-01

Notes:

1. Survey results are provided in Table 5.
2. [ ] Denotes surface scanned, results range from 23 to 33 μR/hr.
3. XX Denotes exposure rate measurements, in μR/h, taken at 1 meter above the surface. Results range from 20 to 26 μR/hr.

Instruments		
Model	Ludlum 3	Ludlum 19
Serial #	151348	87120
Cal Due Date	02-11-00	01-09-01
Probe	44-10 (2"X2")	NA
Probe #	154618	NA

Figure 20: Rooms 114 and 113. Final Beta Scans on Floor and Walls



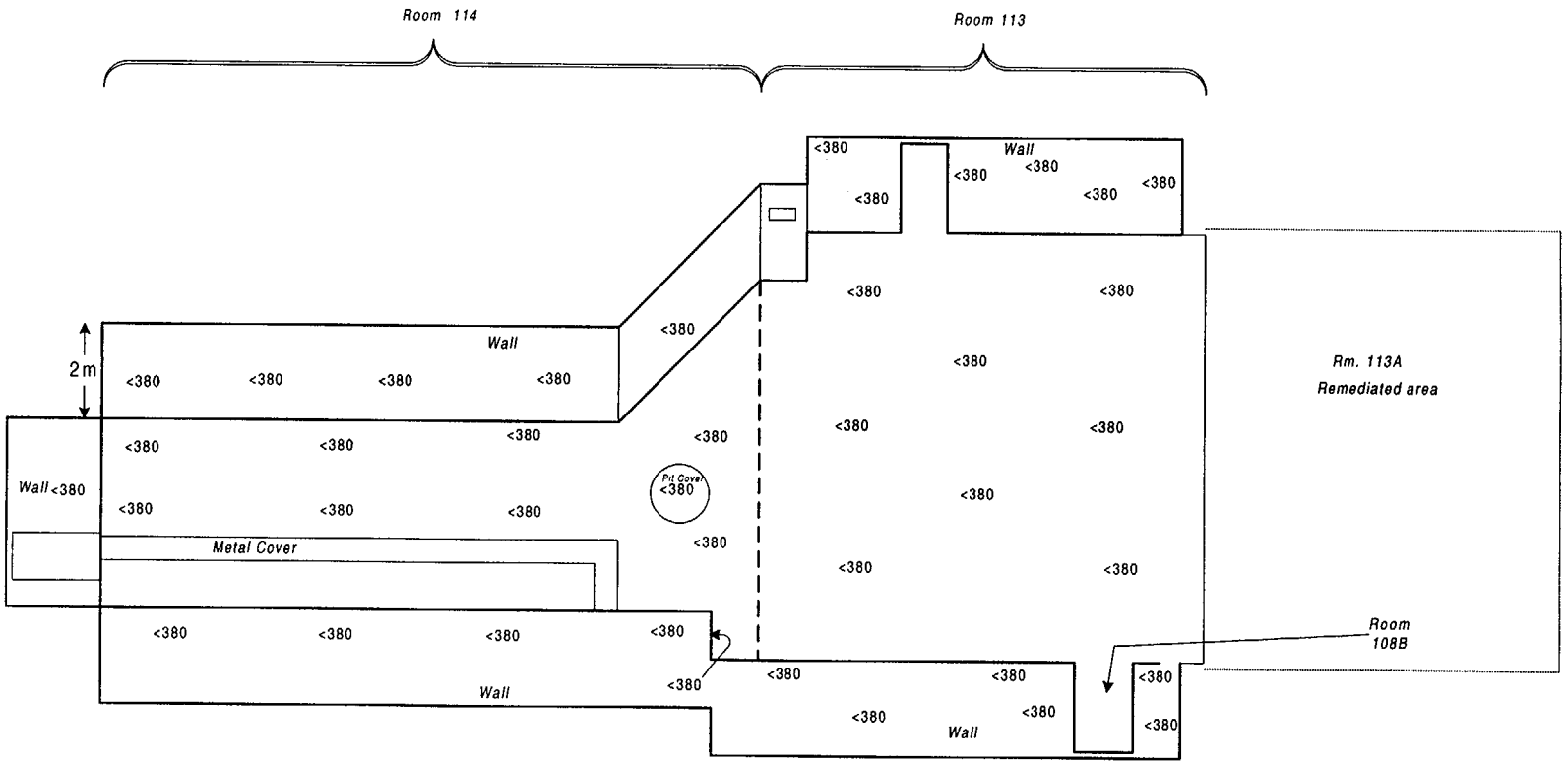
Notes:

1. Survey results are provided in Table 5. Results are in cpm 434cm^2.

2. ~100% of the floor was scanned for Beta. Scan results in cross hatched area.
   ~100% of the walls (2m up) were scanned for Beta. Scan results in cross hatched area.
   ~10% of the walls (above 2m) were scanned for Beta.

3. Backgrounds: 434cm^2 over Concrete = 1478 -1765 cpm. and over Metal = 853 -1185 cpm.

Figure 21: Rooms 114 and 113 Locations of Final Fixed Beta Measurements Survey



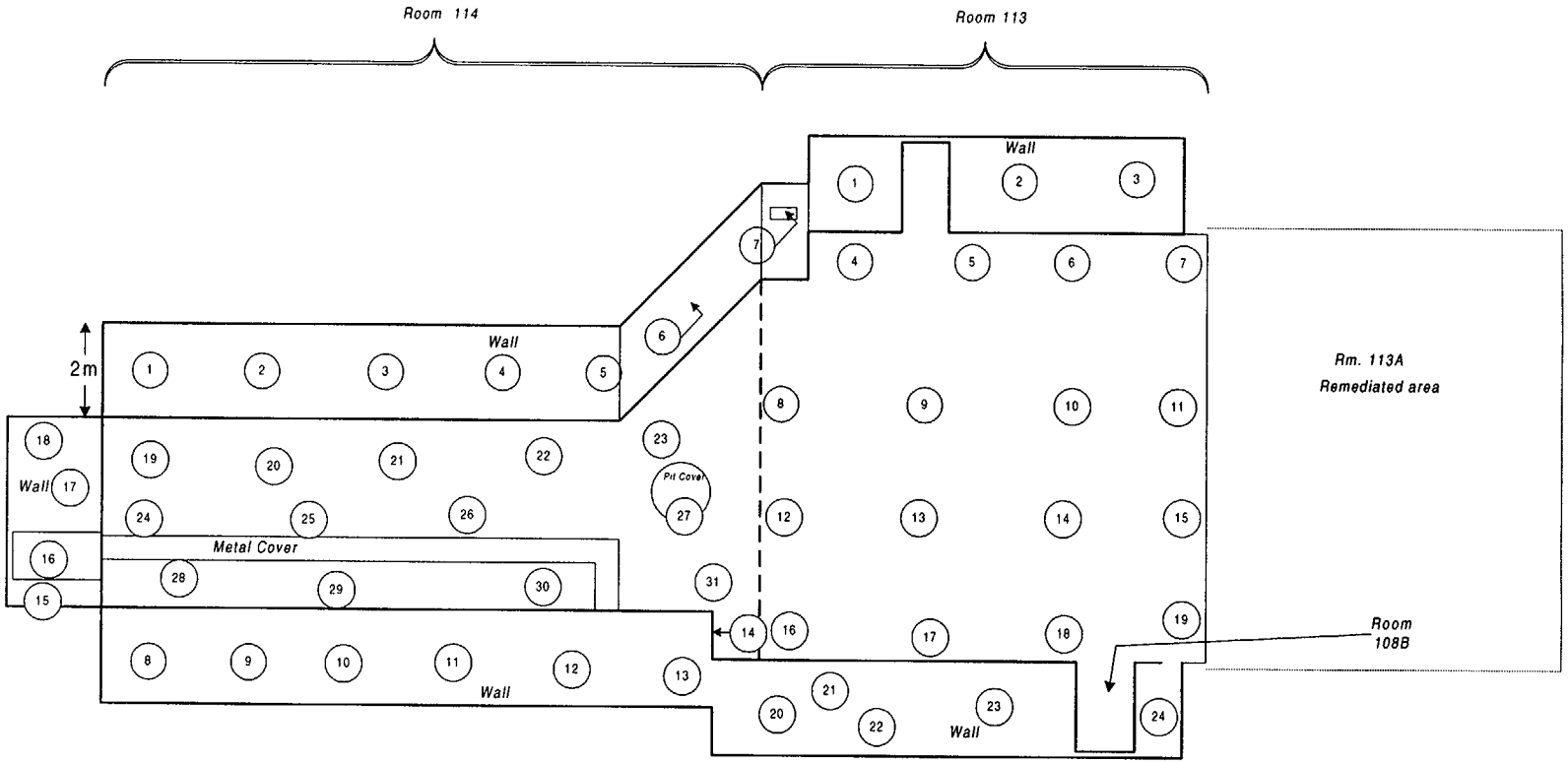
Notes:

1. Survey results are provided in Tables 5. Results are in dpm 100cm^2.

2. The values are dpm/100cm^2 and indicate the approximate locations of measurements taken. Two minute (cp2m) fixed Beta readings were taken.

3. MDA: Concrete = 380 dpm/100cm^2.

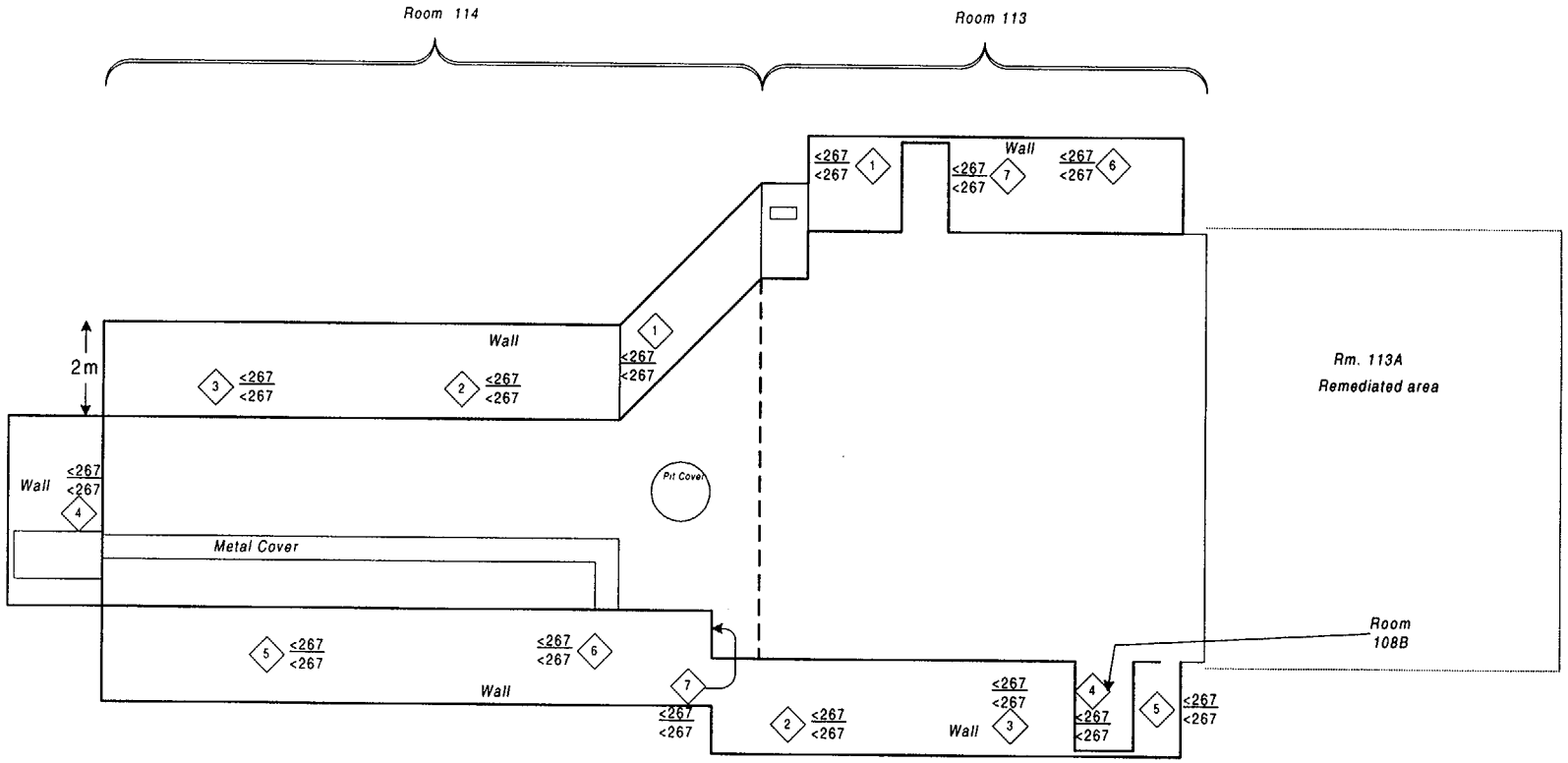
Figure 22: Rooms 114 and 113 Location of Final Removable Contamination Survey



Notes:

1. Survey results are provided in Tables 5.
2. The Numbers circled are the approximate locations of wipes taken.
3. Concrete and metal surfaces.

Figure 23: Room 114 and 113 Locations of Final Paint Samples



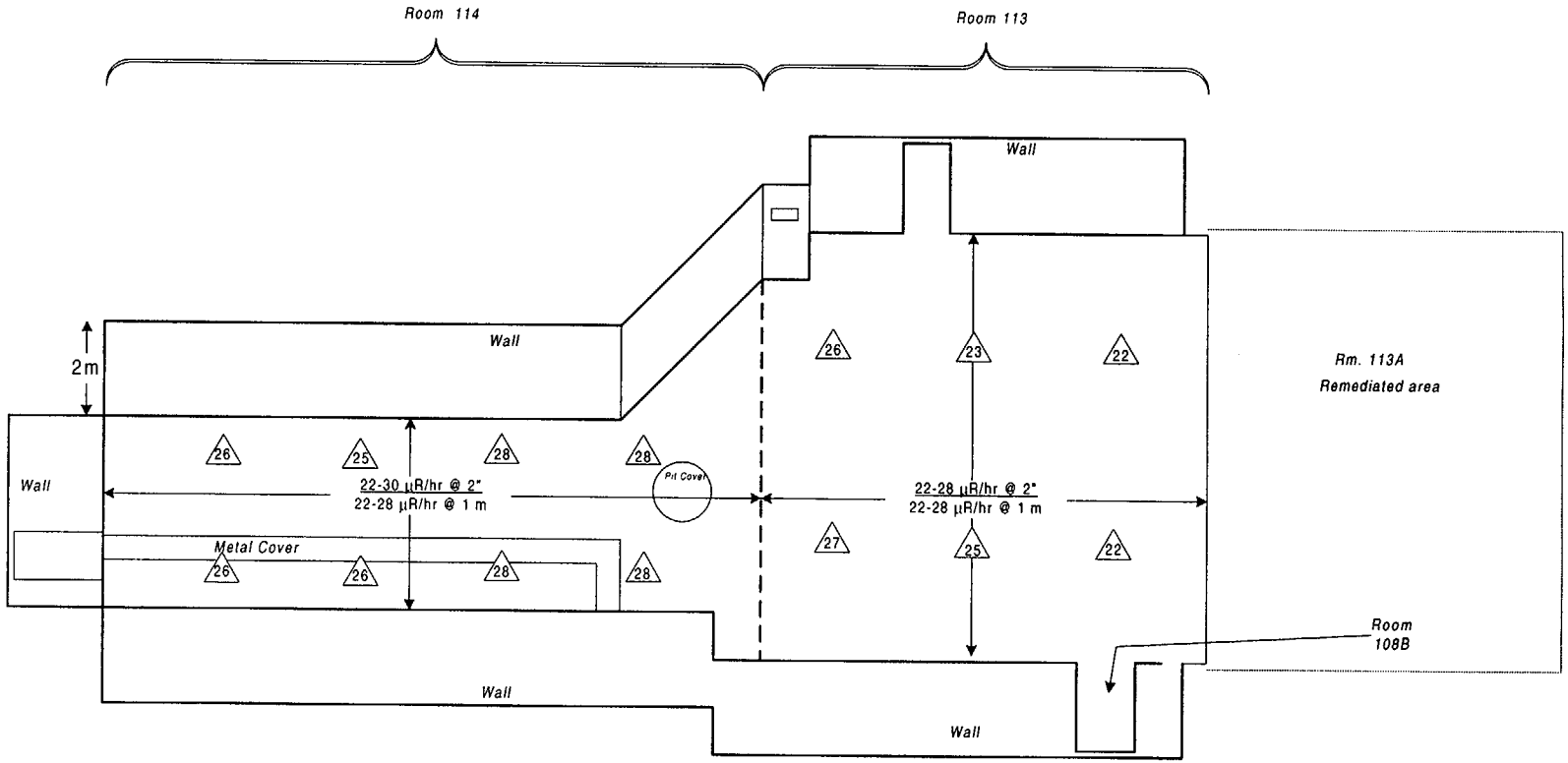
Notes:

1. Survey results are provided in Tables 5. Results are in dpm 100cm^2.

2. The triangles indicate the approximate locations of paint samples taken.
   The values are dpm/100cm^2 and indicate the approximate locations of measurements taken before and after.
   Two minute (cp2m) fixed Beta readings were taken.

3. MDA: Paint over Concrete = 267 dpm/100cm^2. Removed Paint/over Concrete = 267 dpm/100cm^2.

Figure 24: Rooms 114 and 113 Locations and Results of Final Exposure Rate Surface Scans and Exposure Rate Measurements



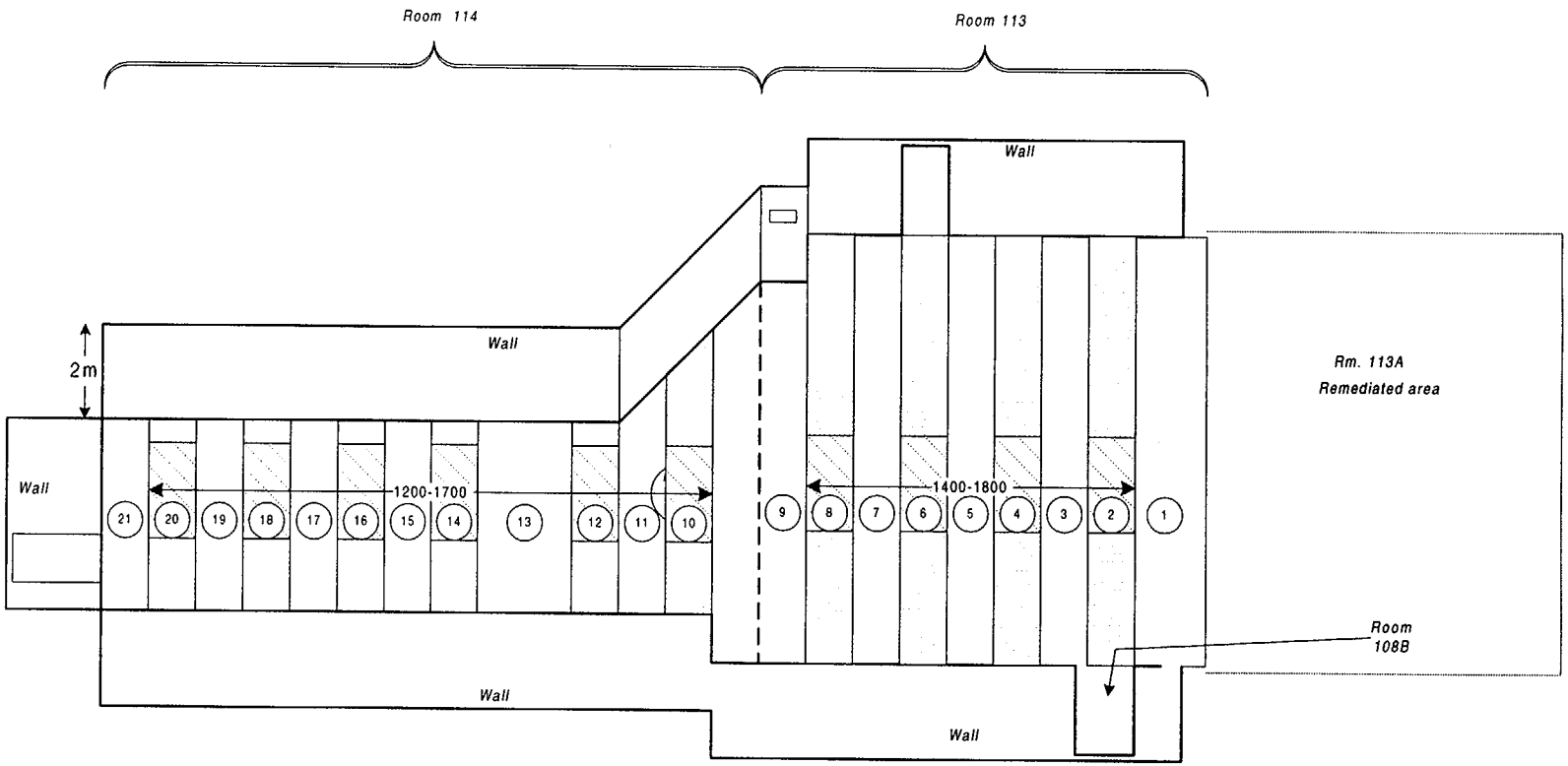
Notes:

1. The values are µR/hr and indicates the approximate directions (arrows) of Exposure Rate Scans taken at ~ 2" and at ~1m above ground surface.
   And the values in triangles (stationary measurements) are µR/hr and indicates the approximate locations of Exposure Rate Measurement taken ~ 1m above ground surface.

2. Background: 10 - 18 µR/hr.

3. All concrete surface.

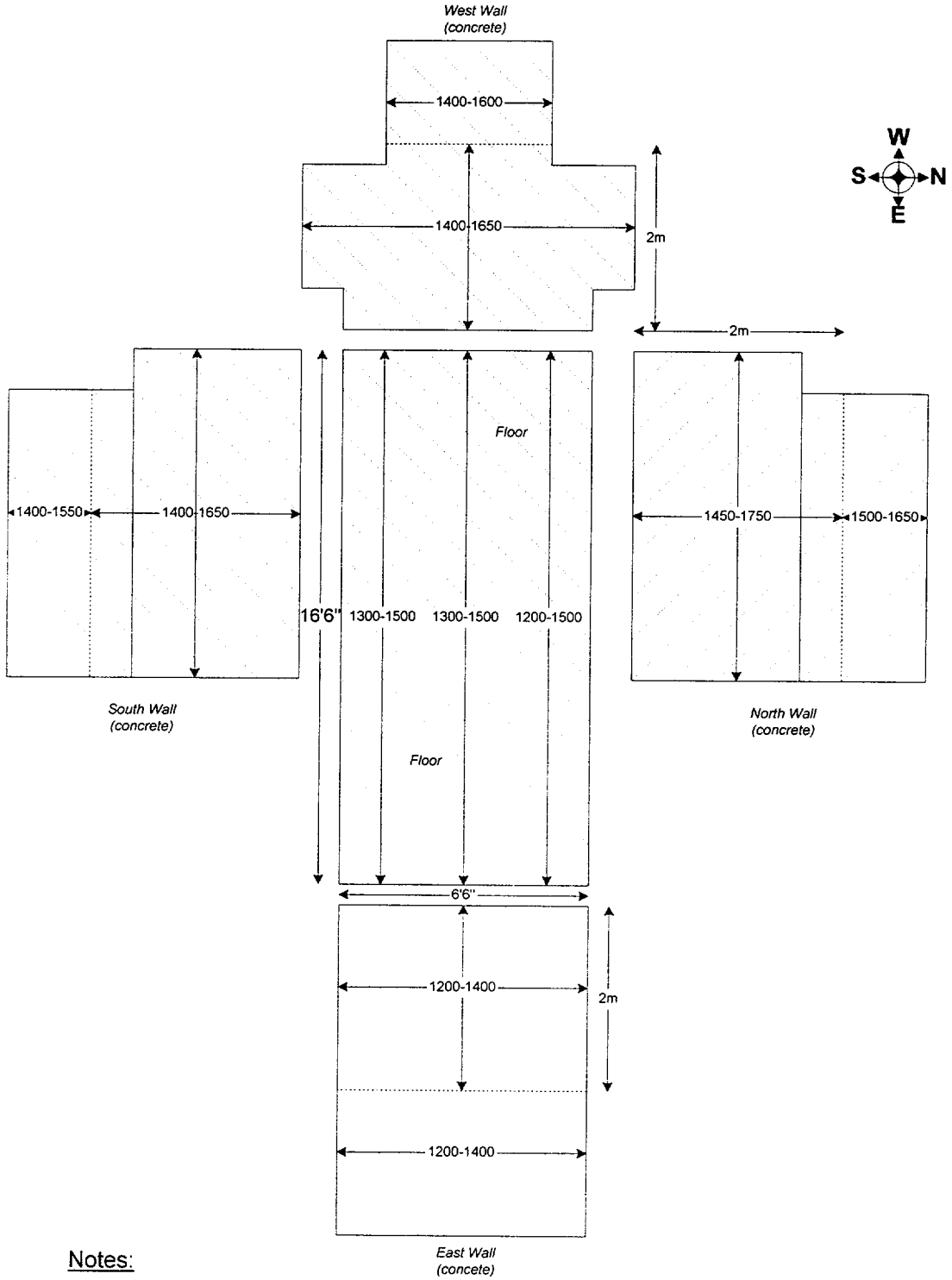
Figure 25: Rooms 114 and 113 Overhead Support Beams. Scans and Locations of Removable Contamination Surveys



Notes:

1. Survey results are provided in Table 5. Results are in cpm 434cm^2.
2. ~10% of the Overhead Structures were scanned for Beta. 434cm^2 Beta Scan results in cross hatched area.
3. The Numbers circled are the approximate locations of wipes taken.
4. Background: 1478 -1765 cpm.
5. All concrete surface.

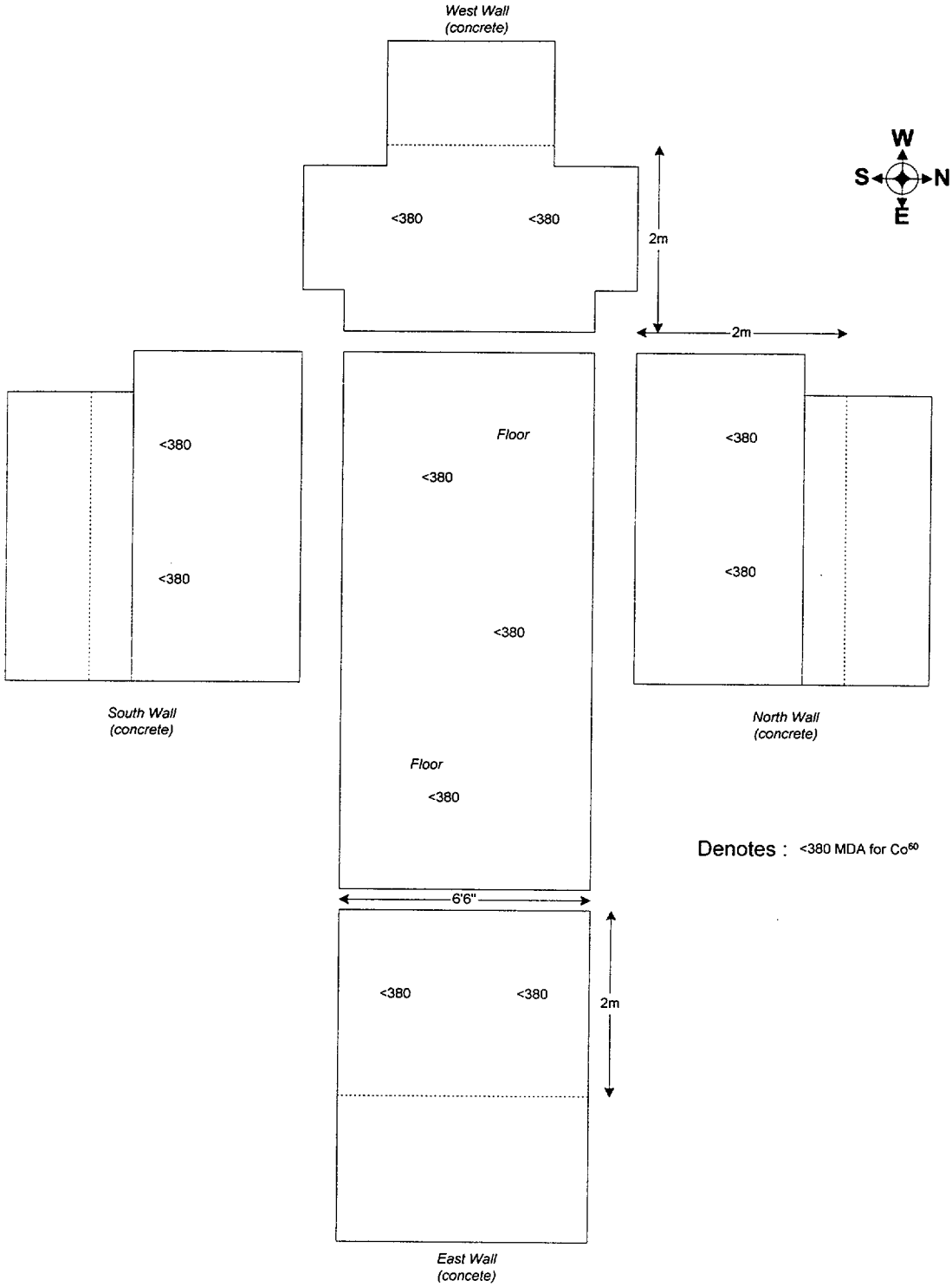
Figure 26: Room 108B. Final Beta Scans on Floor and Walls



Notes:

1. Survey results are provided in Table 5. Results are in cpm 434cm^2.
2. ~100% of the floor was scanned for Beta. Scan results in cross hatched area.
   ~100% of the walls were scanned for Beta. Scan results in cross hatched area.
   ~10% of the walls (above 2m) were scanned for Beta.
3. Background: 434cm^2 = 1478 - 1765.
4. All concrete surface.

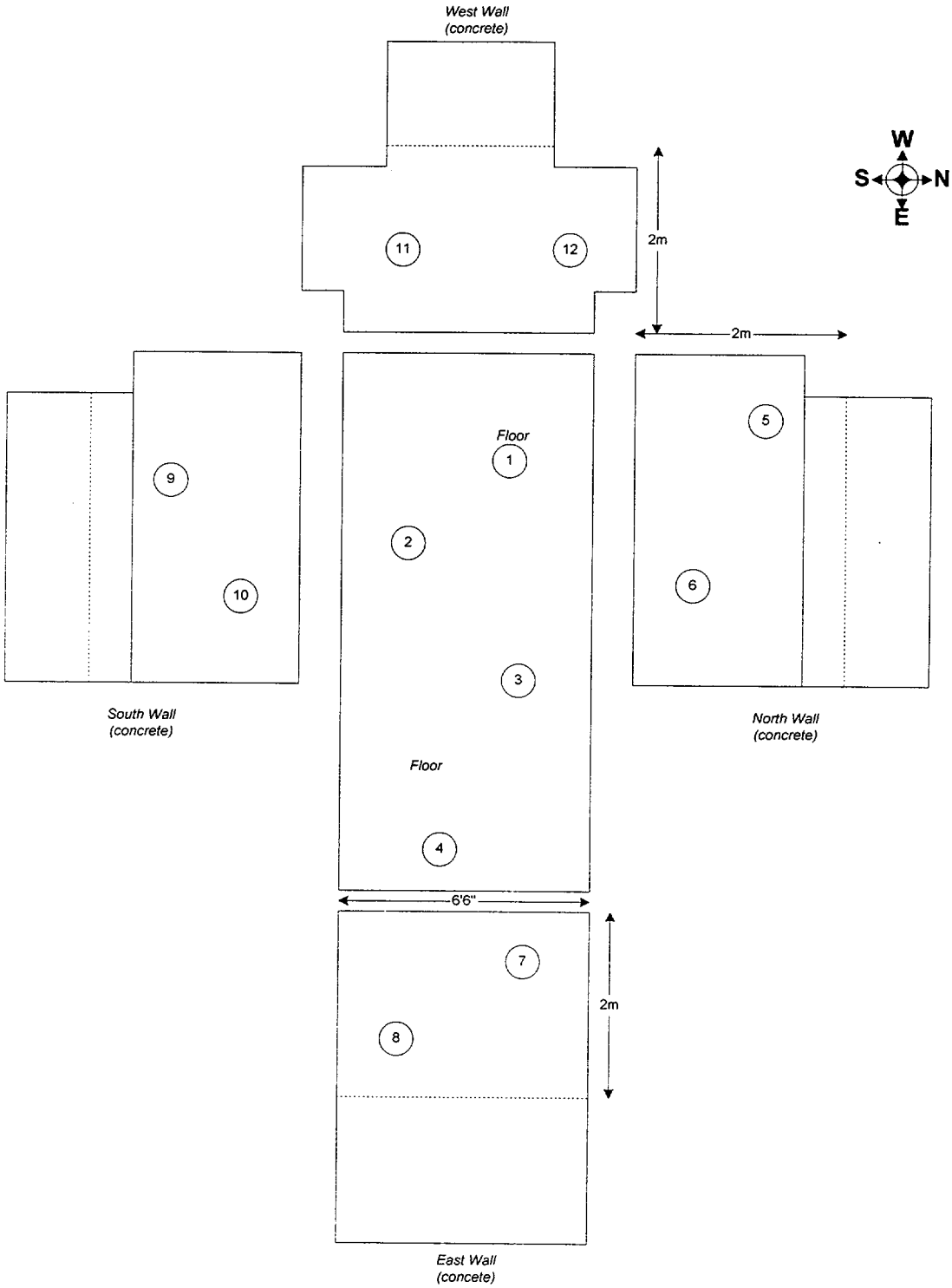
Figure 27: Room 108B. Locations of Final Fixed Measurements Survey



Notes:

1. Survey results are provided in Tables 5.
2. The values are dpm/100cm^2 and indicate the approximate locations of measurements taken. Two minute (cp2m) fixed Beta readings were taken.
3. MDA: 380 dpm/100cm^2.
4. All concrete surface.

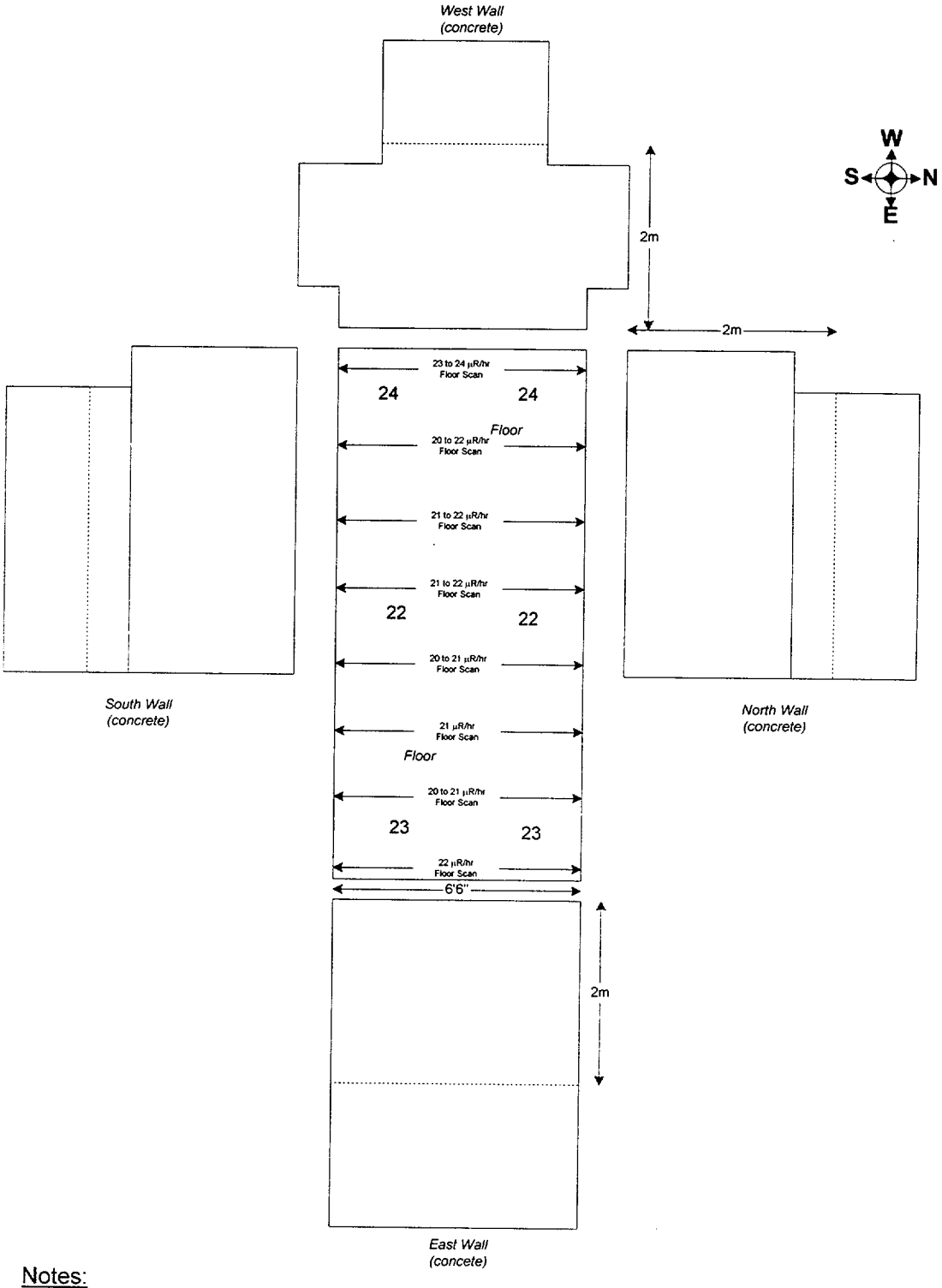
Figure 28: Room 108B Locations of Final Removable Contamination Survey



Notes:

1. Wipe results are provided in Table 5.
2. The Numbers circled are the approximate locations of wipes taken.
3. All concrete surface.

Figure 29: Room 108B Locations and Results of Final Exposure Rate Measurements



Notes:

1. The values are µR/hr and indicates the approximate location of Exposure Rate Measurements taken ~1m above ground surface. µR/hr floor scans were taken ~2" above floor surface.

2. Background: 10 - 18 µR/hr.

3. All concrete surface.

Figure 30: Room 113A North and South Footings after Removal of the Subflooring

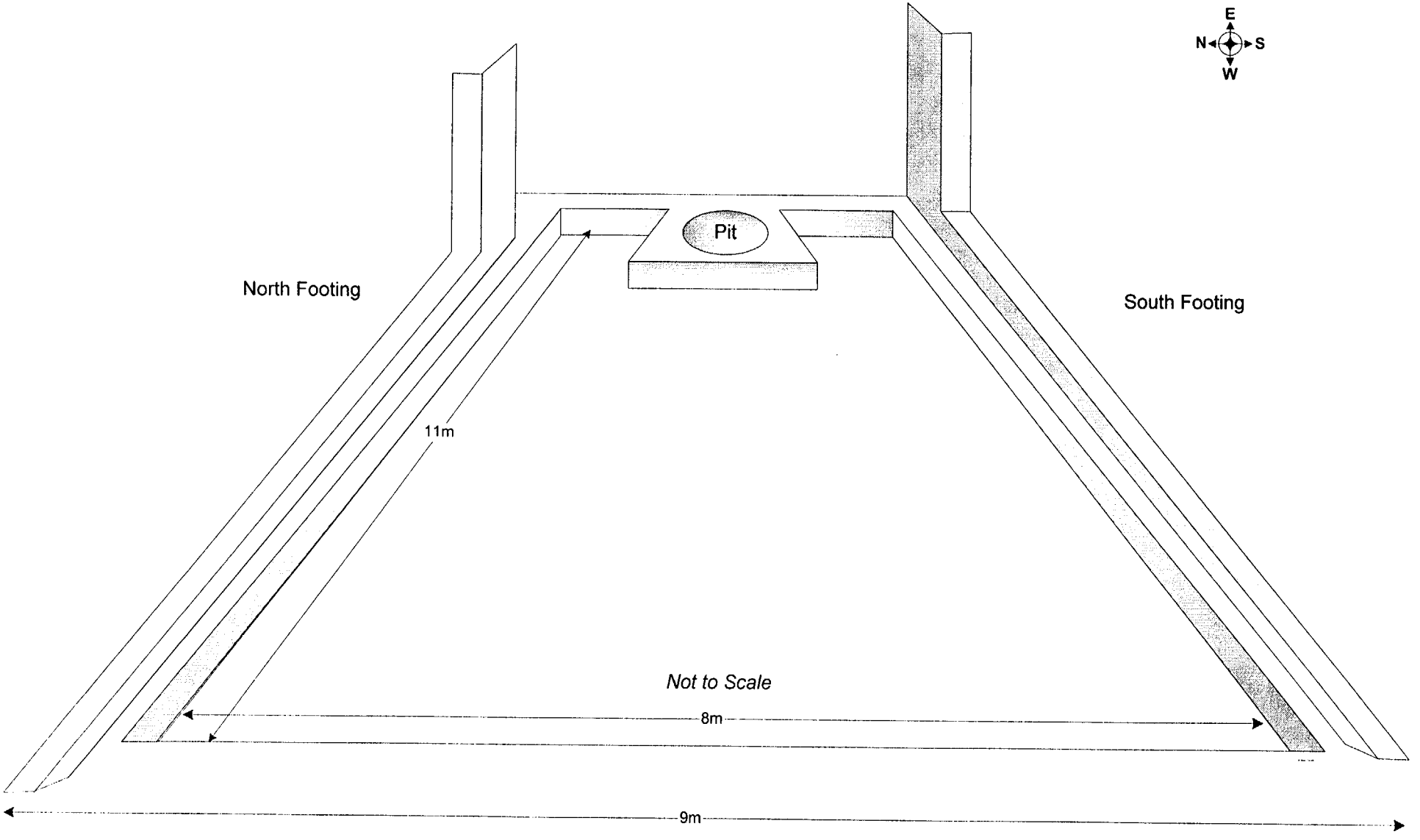
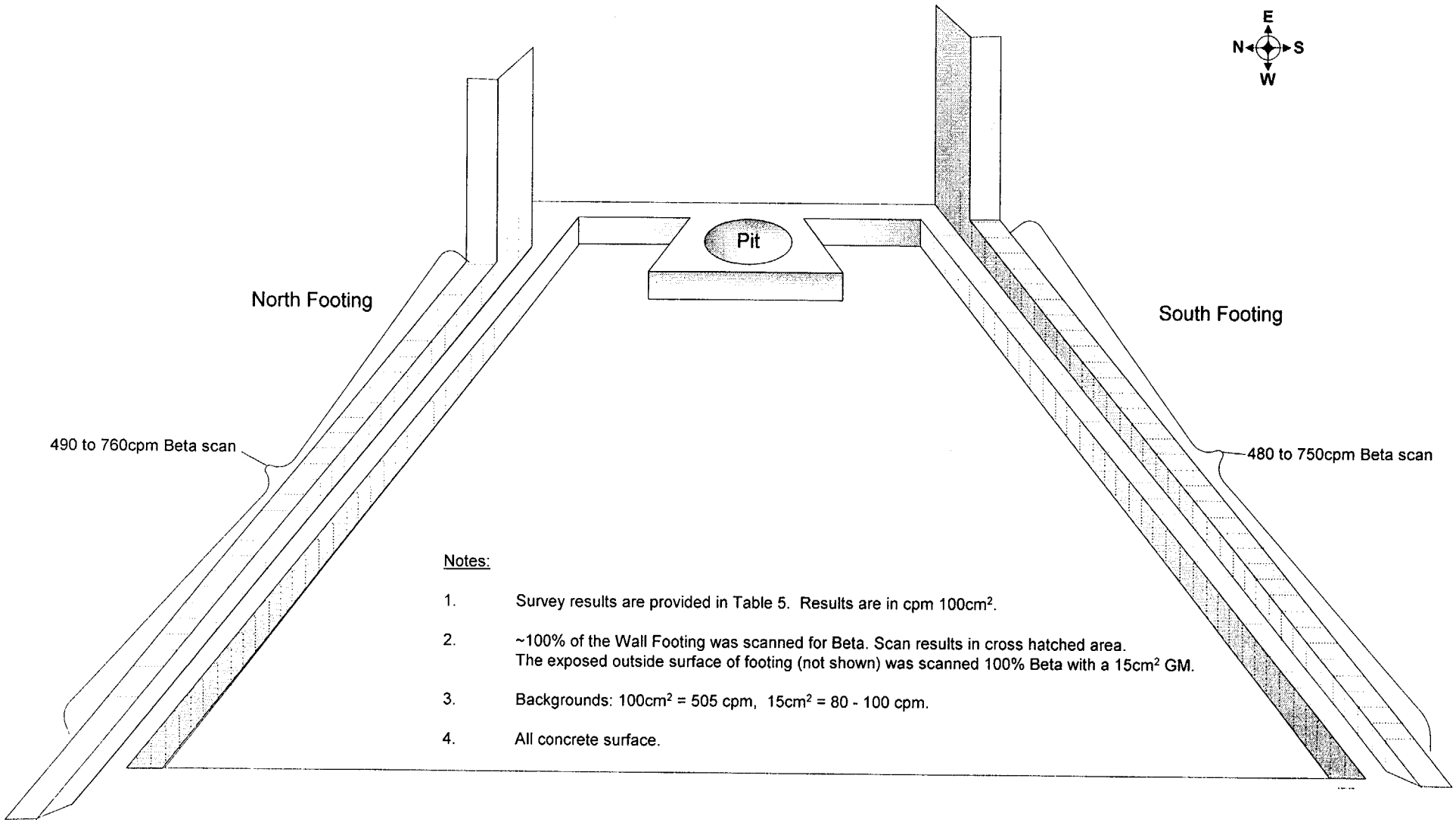


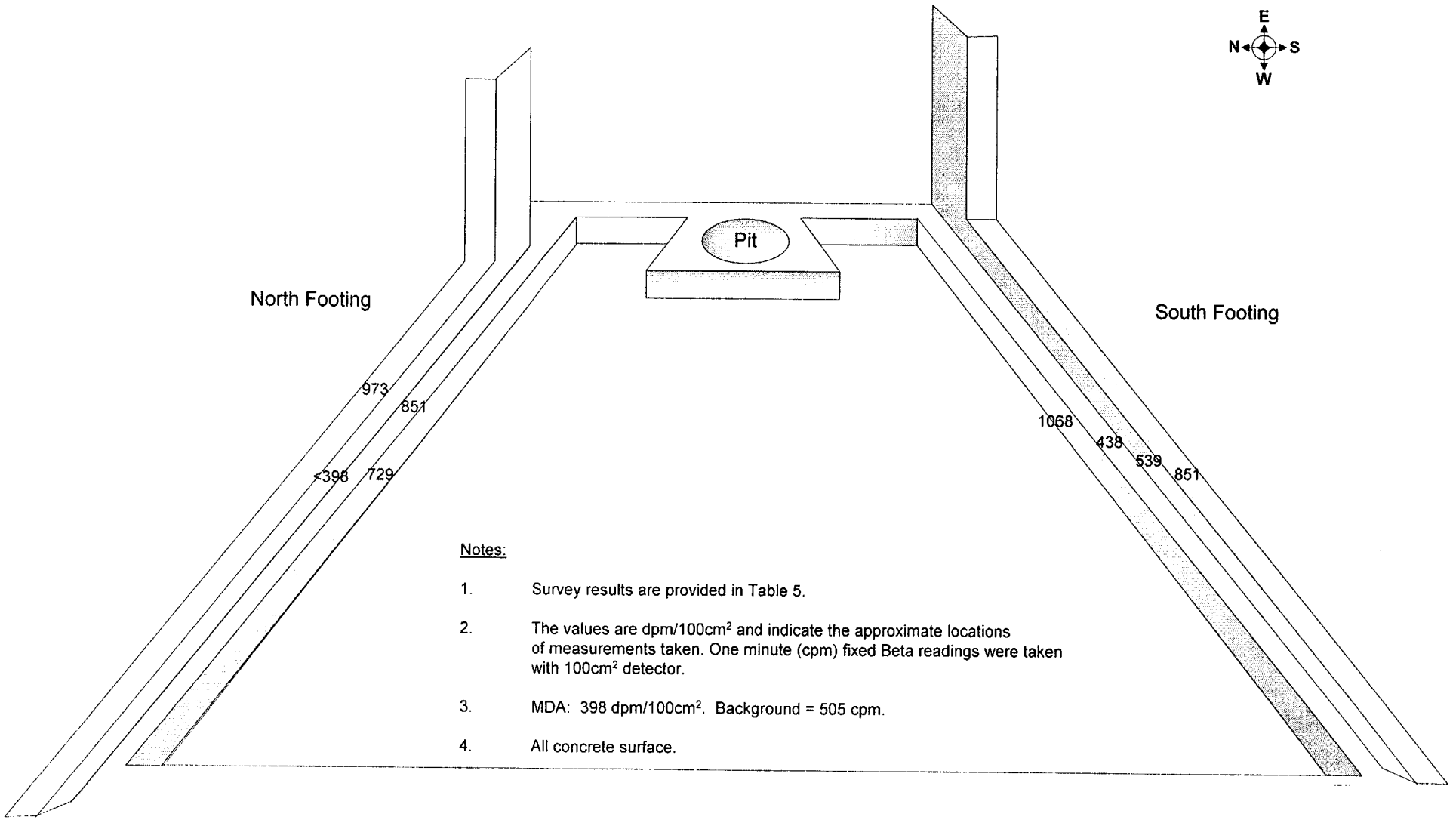
Figure 31: Room 113A. Beta Scans on the North and South Footings



Notes:

1. Survey results are provided in Table 5. Results are in cpm 100cm^2.
2. ~100% of the Wall Footing was scanned for Beta. Scan results in cross hatched area. The exposed outside surface of footing (not shown) was scanned 100% Beta with a 15cm^2 GM.
3. Backgrounds: 100cm^2 = 505 cpm, 15cm^2 = 80 - 100 cpm.
4. All concrete surface.

Figure 32: Room 113A. Locations and Results of Fixed Measurements on the North and South Footings



Notes:

1. Survey results are provided in Table 5.
2. The values are dpm/100cm^2 and indicate the approximate locations of measurements taken. One minute (cpm) fixed Beta readings were taken with 100cm^2 detector.
3. MDA: 398 dpm/100cm^2. Background = 505 cpm.
4. All concrete surface.

Figure 33: Room 113A. Locations of Removable Contamination Survey on the North and South Footings

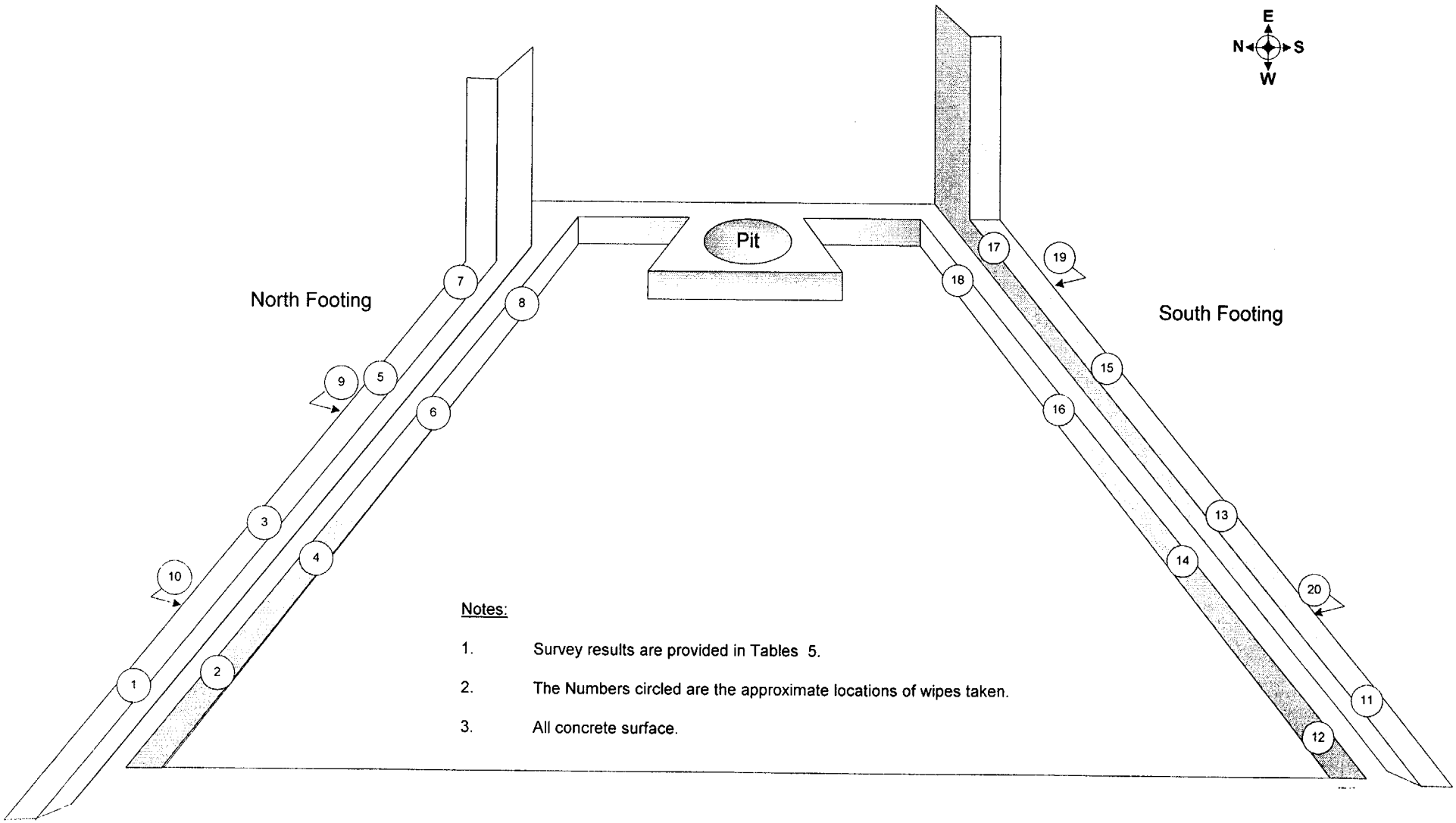


Figure 34: Room 113A. Results of Exposure Rate Measurements on the North and South Footings

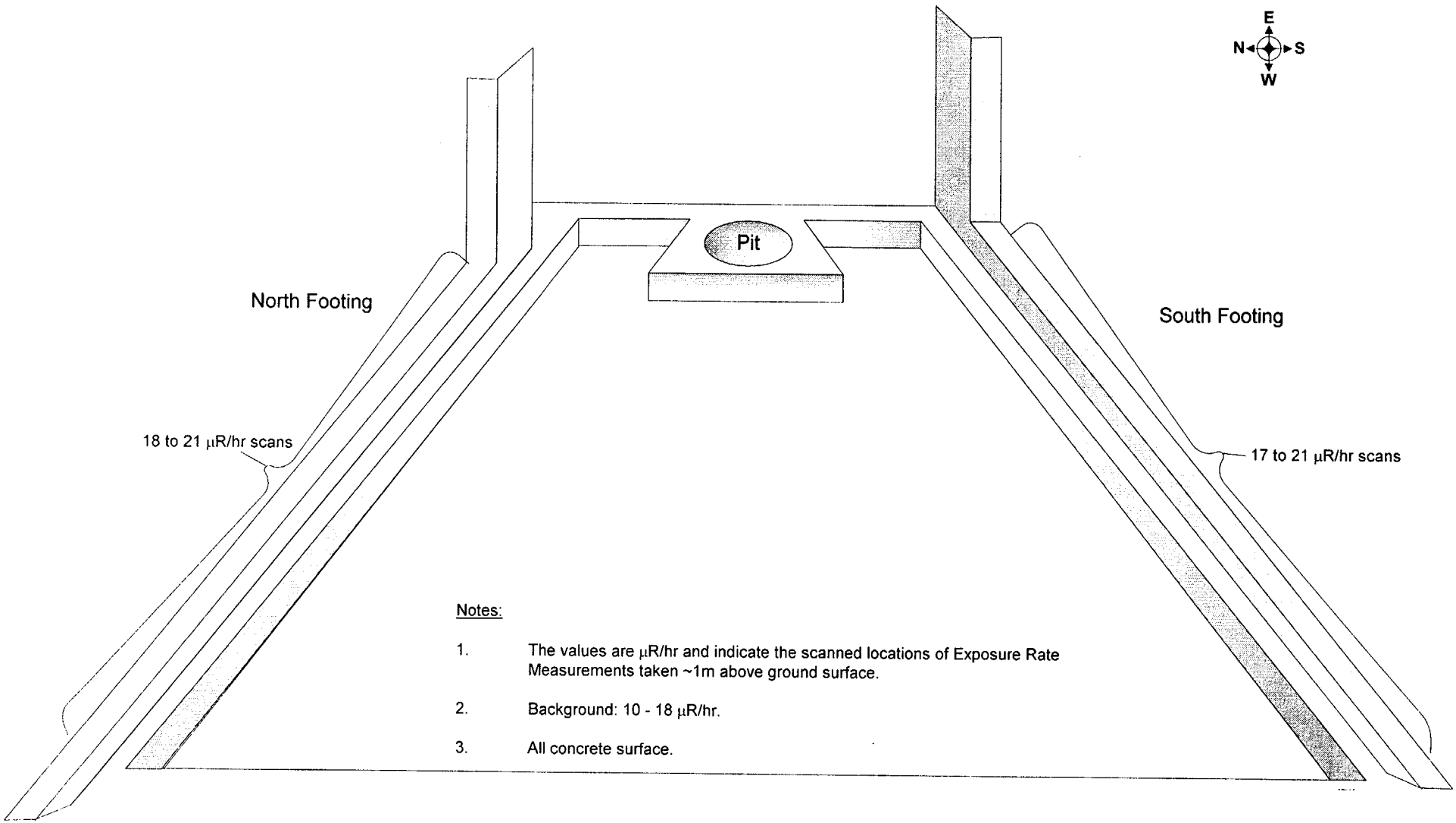
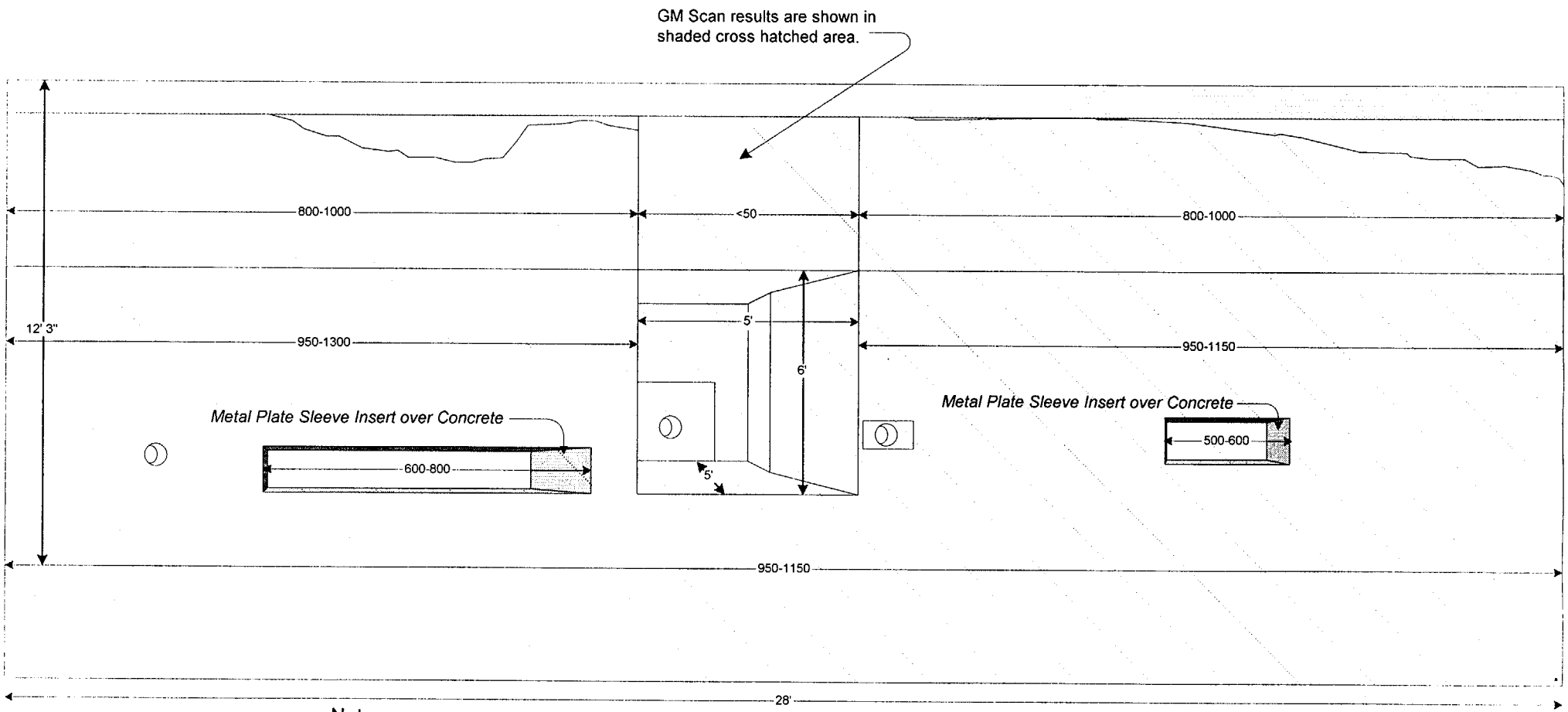


Figure 35: Room 113A East Wall. Final Beta Scans on the Wall



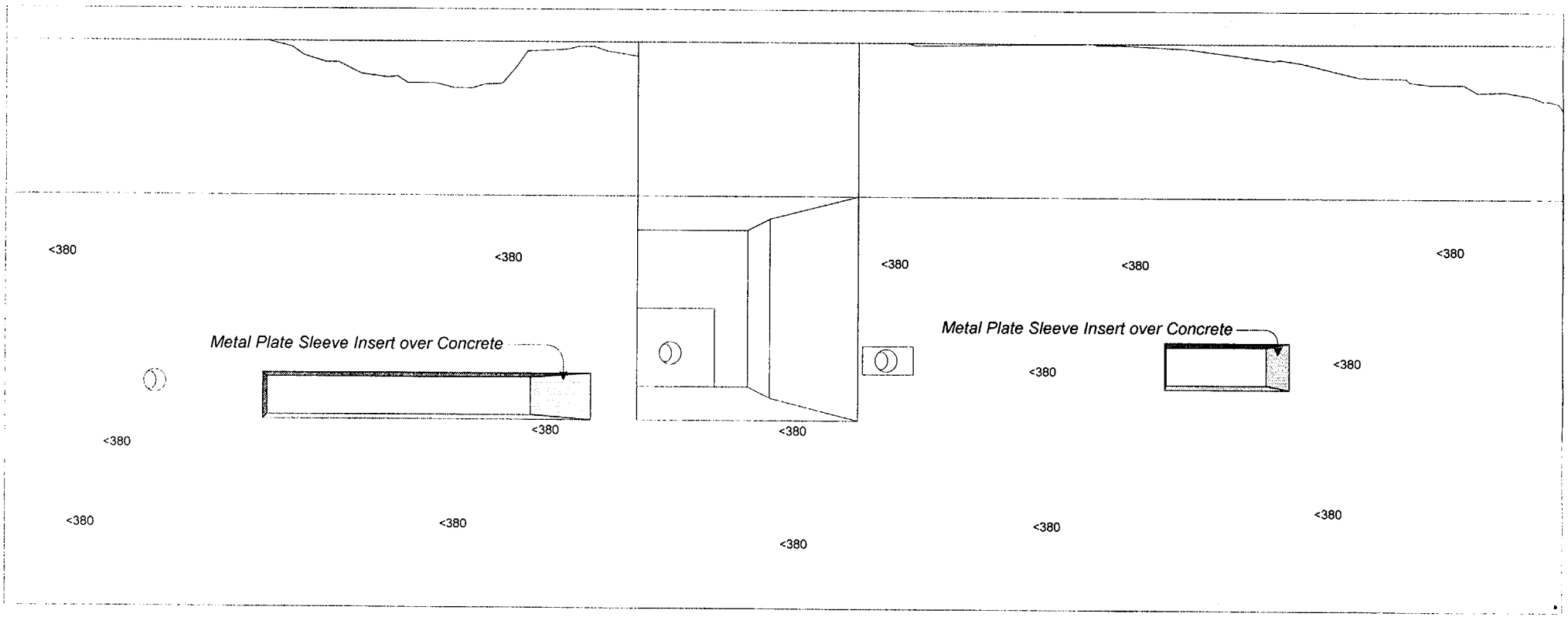
Notes:

1. Survey results are provided in Table 5. Results are in cpm/434cm^2.

2. ~100% of the wall was scanned for Beta. Scan results in cross hatched area.
   ~20% of the upper wall was scanned for Beta with a 15cm^2 GM Detector Probe
   Scan results is shown in shaded cross hatched area.

3. Backgrounds: 434cm^2 over Concrete = 1478 -1765 cpm. Over Metal = 853 -1185 cpm and
   15cm^2 over Concrete = 80 - 100

Figure 36: Room 113A East Wall. Locations and Results of Final Fixed Measurements Survey



Notes:

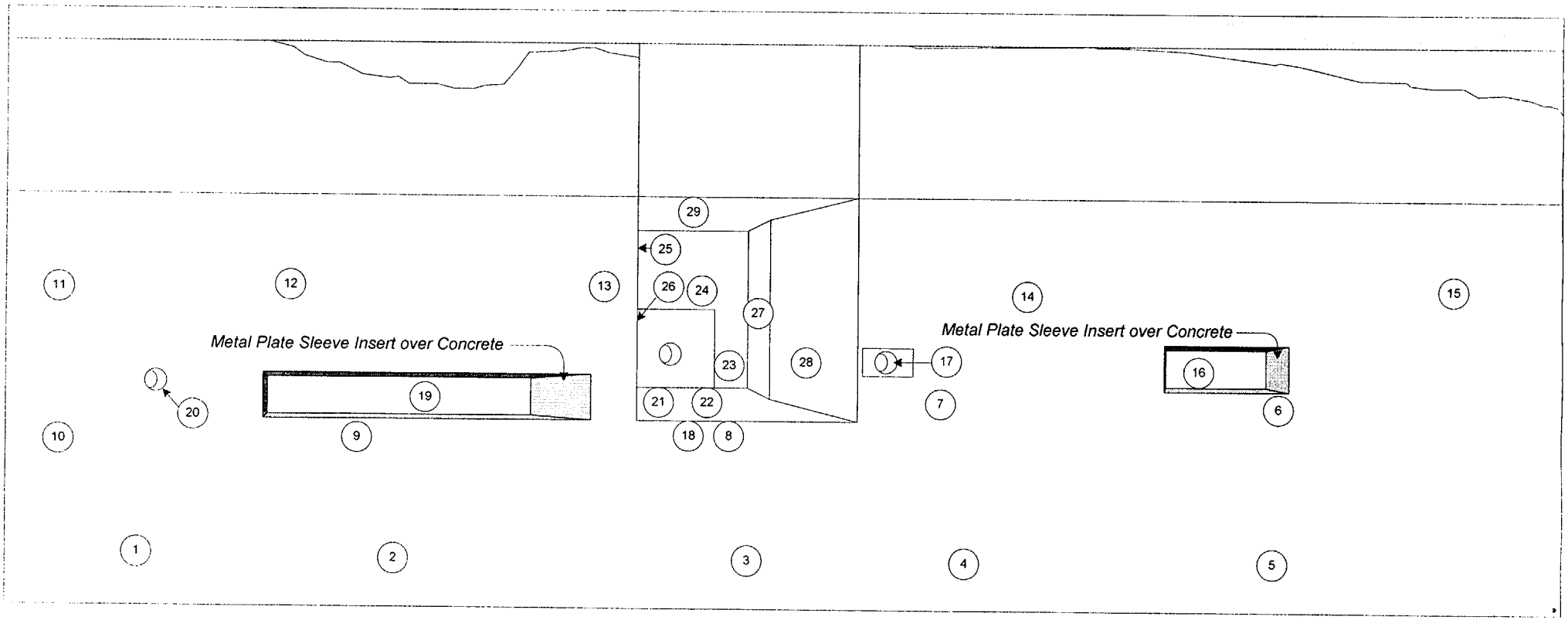
1. Survey results are provided in Tables 5.

2. The values are dpm/100cm^2 and indicate the approximate locations of measurements taken. Two minute (cp2m) fixed Beta readings were taken.

3. MDA: 380 dpm/100cm^2.

4. Concrete surface.

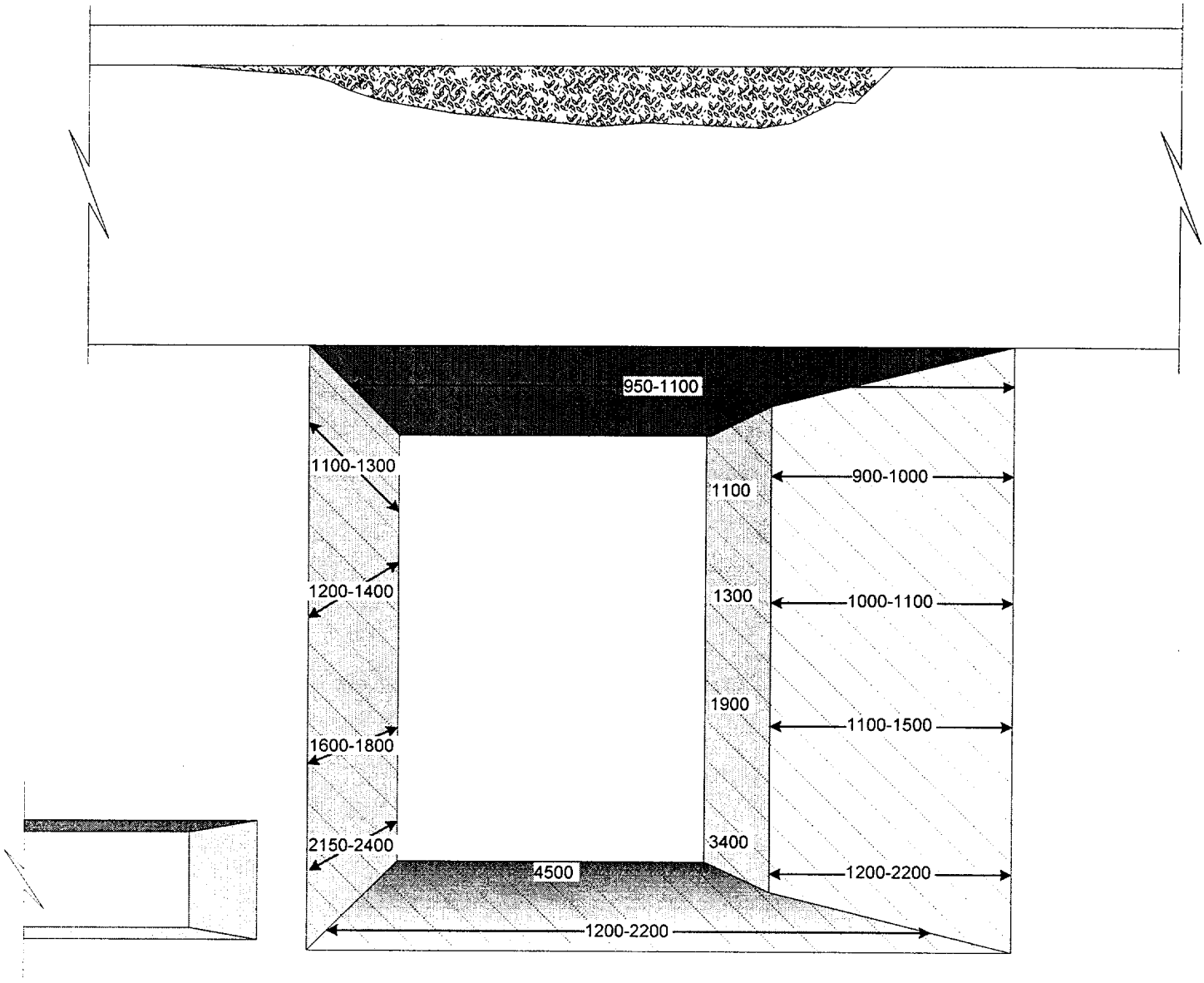
Figure 37: Room 113A East Wall. Location of Final Removable Contamination Survey



Notes:

1. Wipe results are provided in Table 5.
2. The Numbers circled are the approximate locations of wipes taken.
3. Concrete and metal surfaces.

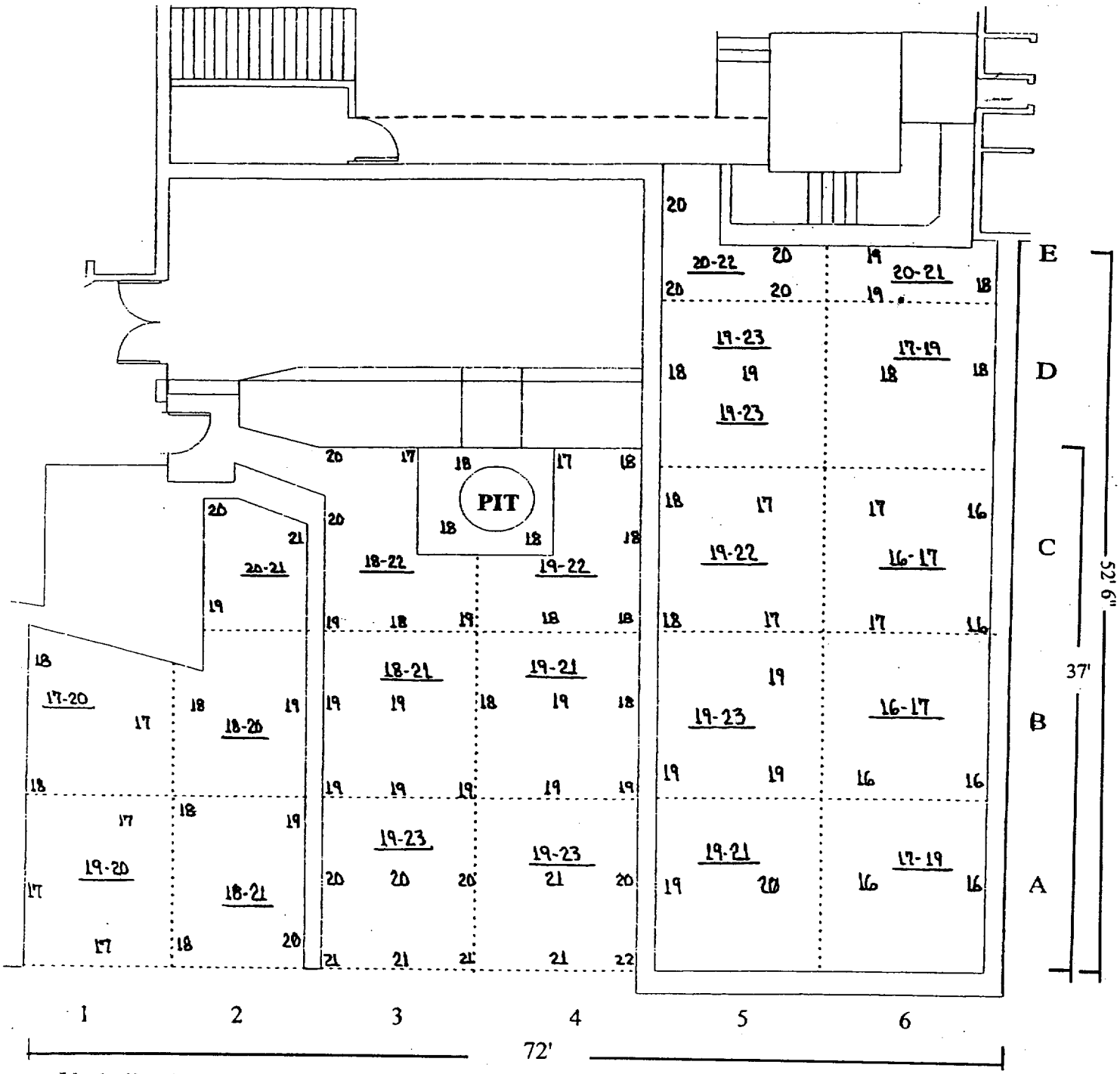
Figure 38: 113A East Wall (Neutron Target Hole). Final Beta Scan Survey



Notes:

1. Survey results are provided in Table 5. Results are in cpm 434cm^2.
2. ~100% of all sides of Neutron Target Hole was scanned for Beta. Scan results in cross hatched area.
3. Backgrounds: 434cm^2 = 1478 -1765 cpm.
4. All concrete surface.

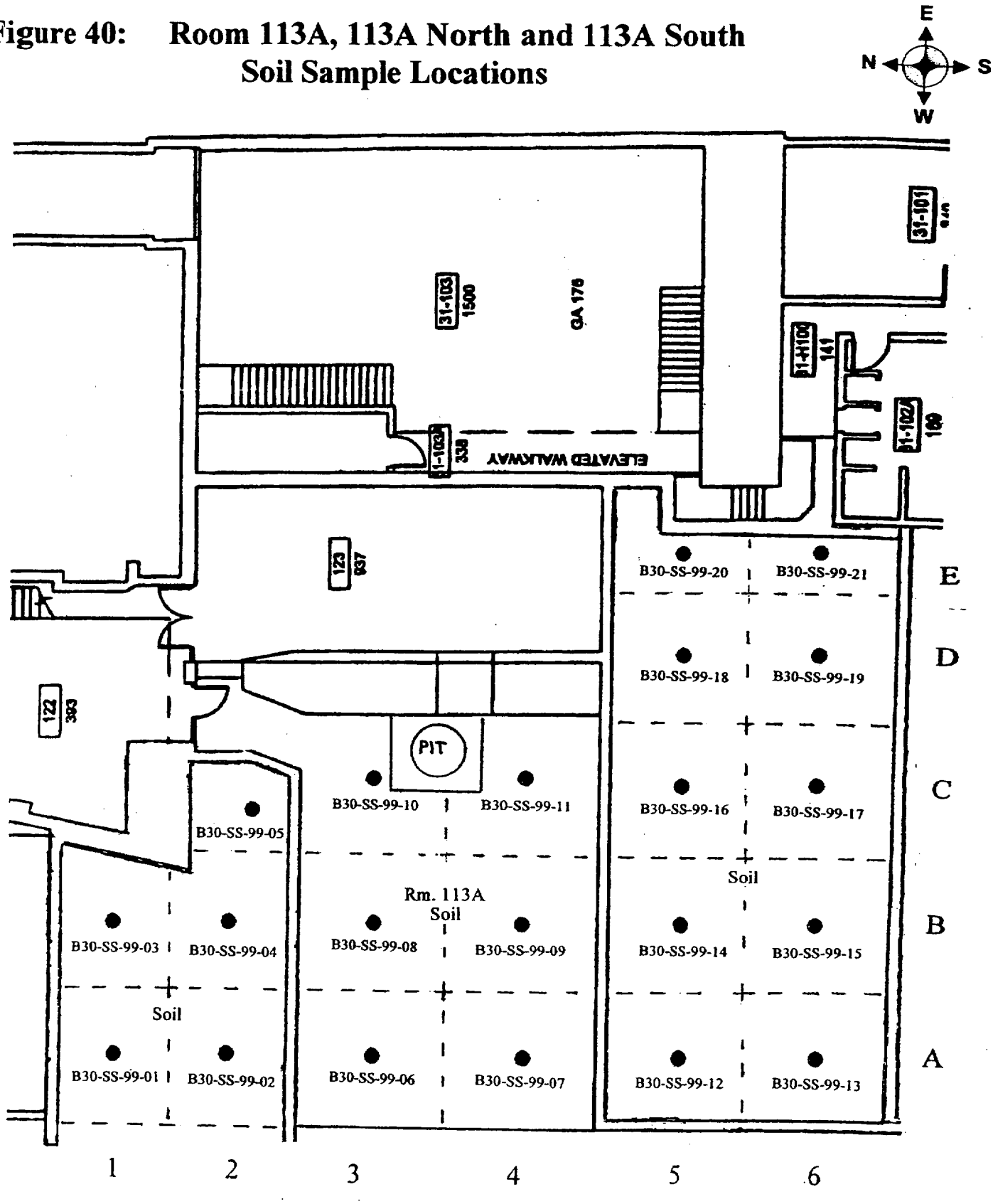
Figure 39: Room 113A, 113A North, 113A South Exposed Soil MicroR Scans and Exposure Rate Measurements



- Underlined measurements indicate surface scans per grid.
- Other numbers indicate "stationary" surface readings taken at a height of 1 meter

B30 113A, 113A North & 113A South - Exposure Rate Measurements / Scans				
Instrument	Serial #	Calibration Due	Background(μR/hr)	α β γ
Ludlum 19	144068	01-03-99	10 - 18	γ
Surveyor: Phil Poole			Date: 11-04-99	

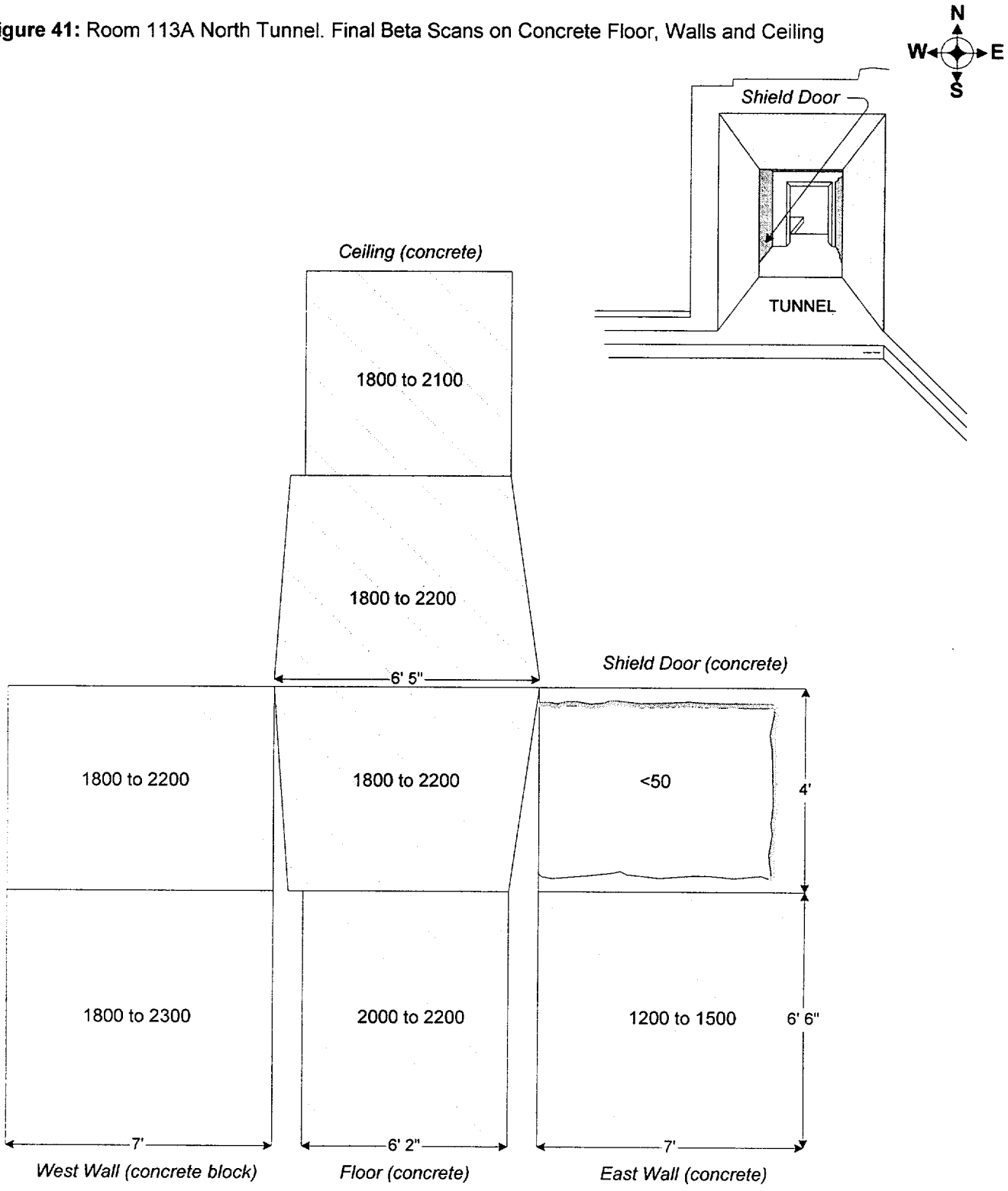
Figure 40: Room 113A, 113A North and 113A South Soil Sample Locations



Surveyor: Phil Poole

Date: 10-27-99

Figure 41: Room 113A North Tunnel. Final Beta Scans on Concrete Floor, Walls and Ceiling



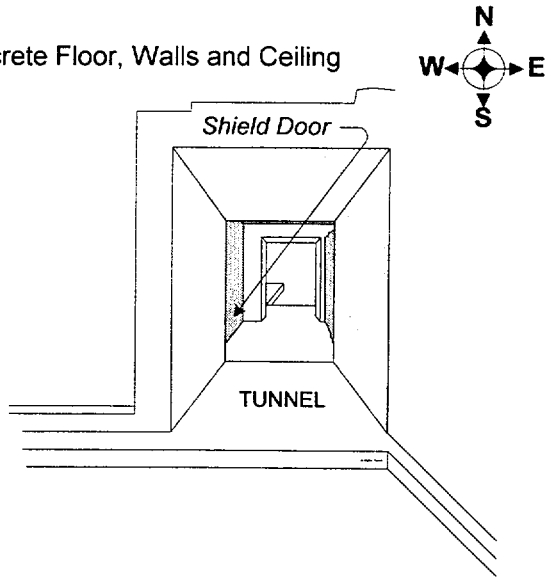
Notes:

1. Survey results are provided in Table 5. Results are in cpm 434cm^2.

2. ~100% of the floor was scanned for Beta. Scan results in cross hatched area.
   ~100% of the walls were scanned for Beta. Scan results in cross hatched area.

3. Background: 434cm^2 = 1858 - 2036 cpm.
4. Shield door was scanned with a 15cm^2 pancake GM probe.
5. All concrete surface.

Figure 42: Room 113A North Tunnel
Locations and Results of Final Fixed Beta Measurements on Concrete Floor, Walls and Ceiling



All Measurements are in dpm/100cm^2

Ceiling (concrete)

<398	<398
<398	<398
<398	
<398	

Shield Door (concrete)

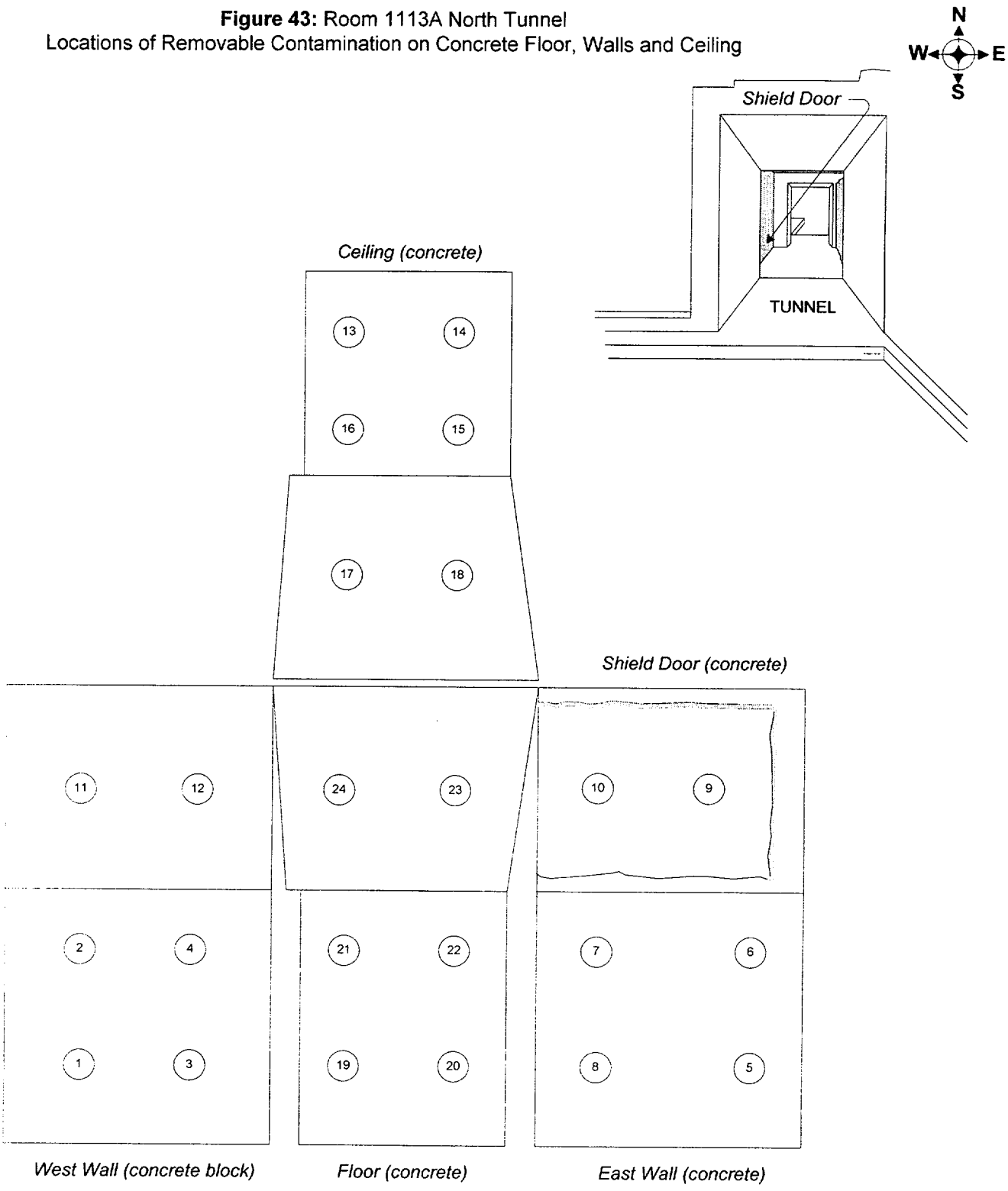
<398	<398	<398	875	746	<398	<398		
<398	<398	<398	<398	<398	<398	<398	<398	
			616	<398				
<398	<398	<398			<398	<398	<398	
			653	<398				

West Wall (concrete block) *Floor (concrete)* *East Wall (concrete)*

Notes:

1. Survey results are provided in Tables 5.
2. The values are dpm/100cm^2 and indicate the approximate locations of measurements taken. Two minute (cp2m) fixed Beta readings were taken.
3. MDA: 398 dpm/100cm^2
4. All concrete surface.

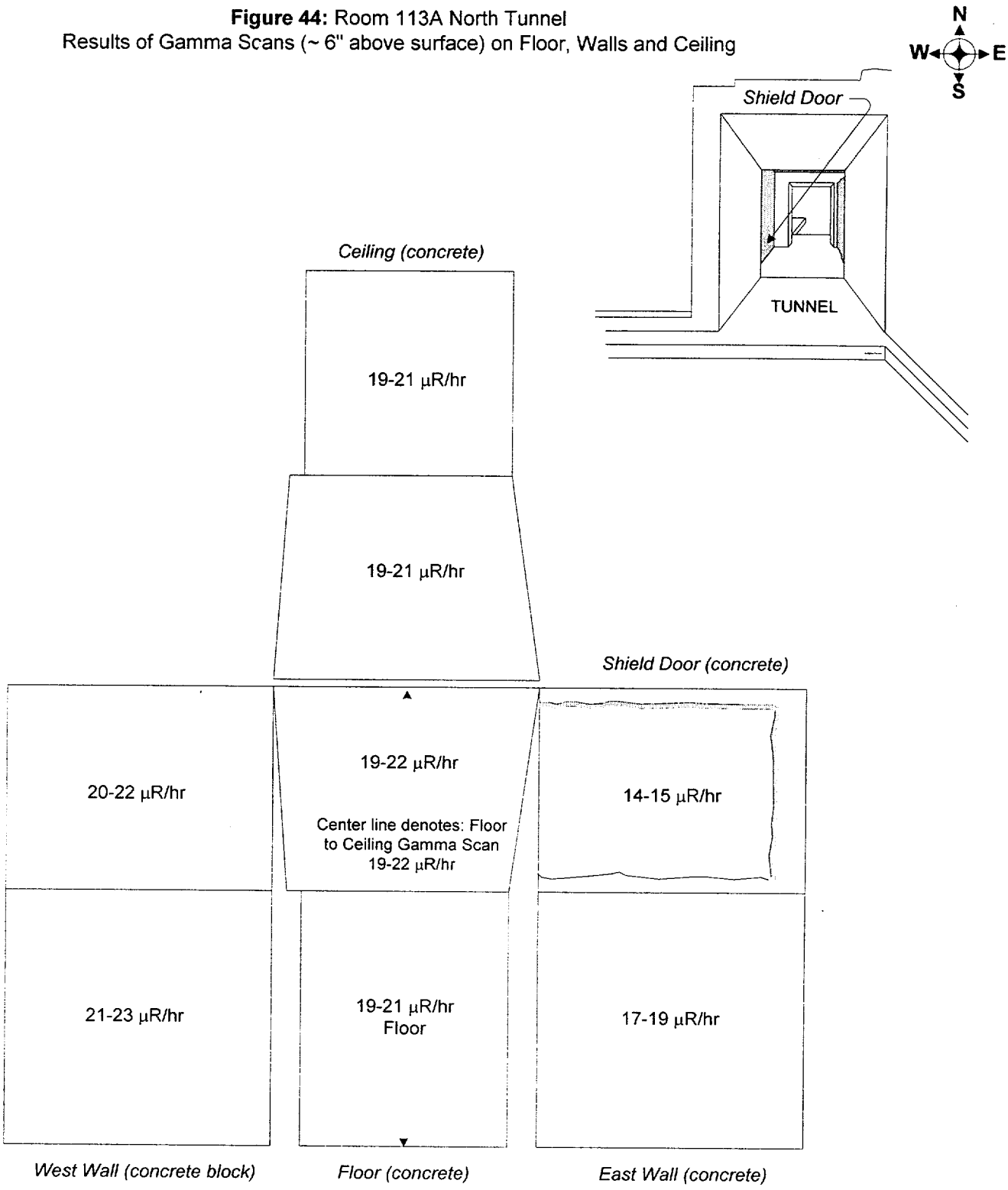
Figure 43: Room 1113A North Tunnel
Locations of Removable Contamination on Concrete Floor, Walls and Ceiling



Notes:

1. Survey results are provided in Tables 5.
2. The Numbers circled are the approximate locations of wipes taken.
3. All concrete surface.

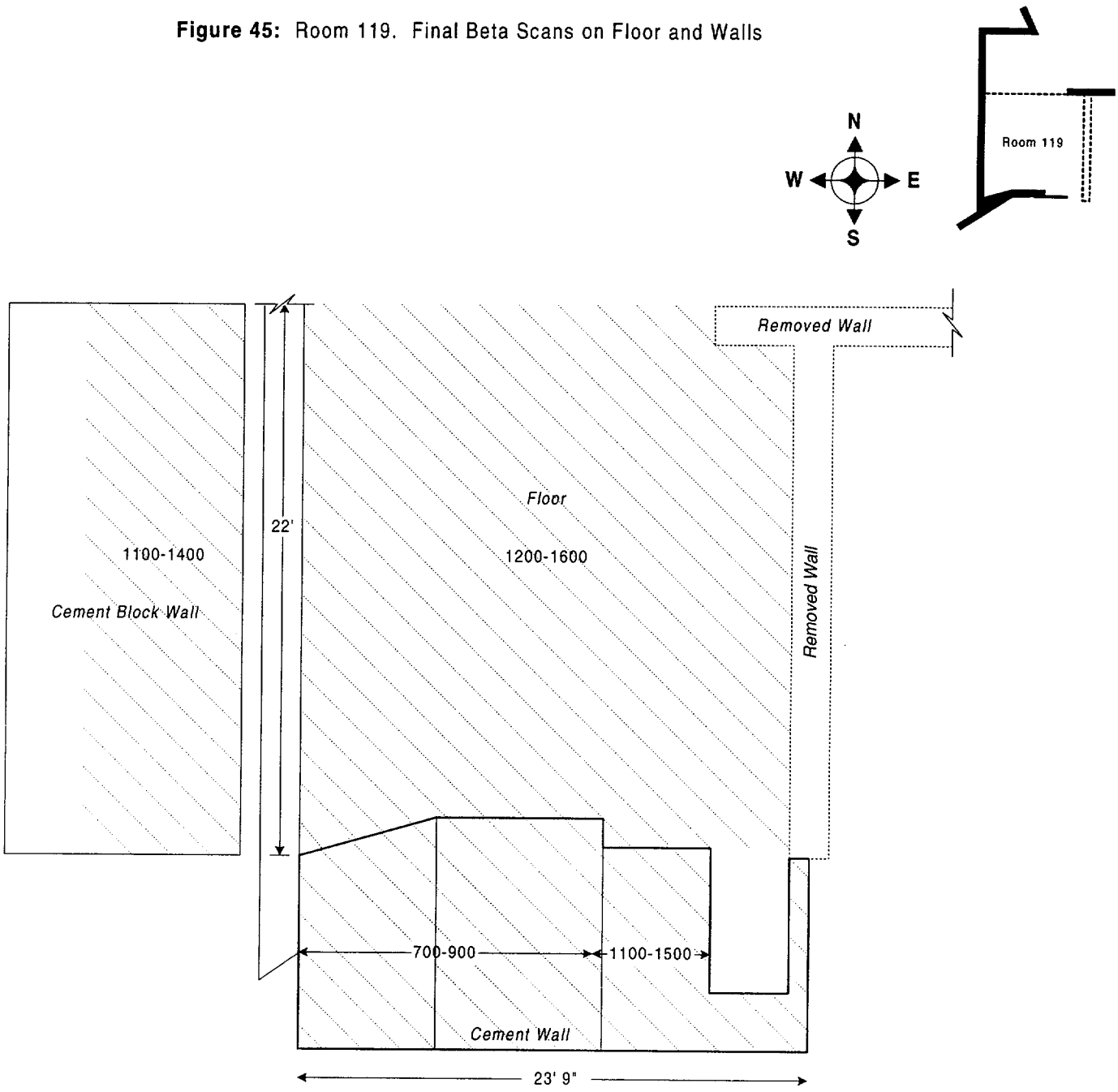
Figure 44: Room 113A North Tunnel
Results of Gamma Scans (~ 6" above surface) on Floor, Walls and Ceiling



Notes:

1. The values are µR/hr and indicate scans at ~6" from all surface. 100% of all surface were scanned.
2. Background: 10 - 18 µR/hr.
3. All concrete surface.

Figure 45: Room 119. Final Beta Scans on Floor and Walls



Notes:

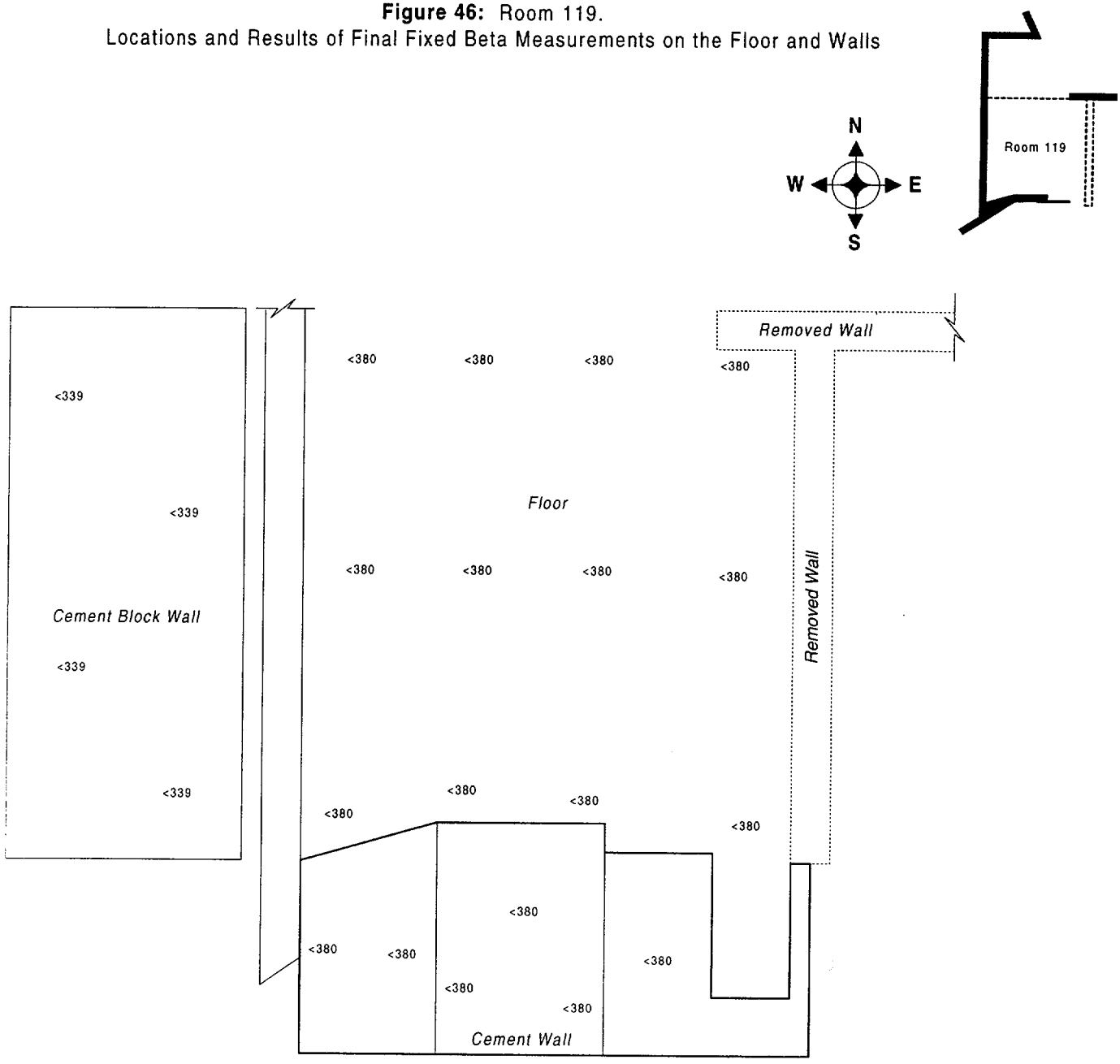
1. Survey results are provided in Table 5. Results are in cpm 434cm^2.

2. ~100% of the floor was scanned for Beta. Scan results in cross hatched area.
   ~100% of the walls (2m up) were scanned for Beta. Scan results in cross hatched area.

3. The North and East Walls and the Roof have been removed.

4. Backgrounds: 434cm^2 over Concrete = 1478 - 1765 cpm.
   434cm^2 over Cement Block = 1253 - 1538 cpm.

Figure 46: Room 119.
Locations and Results of Final Fixed Beta Measurements on the Floor and Walls



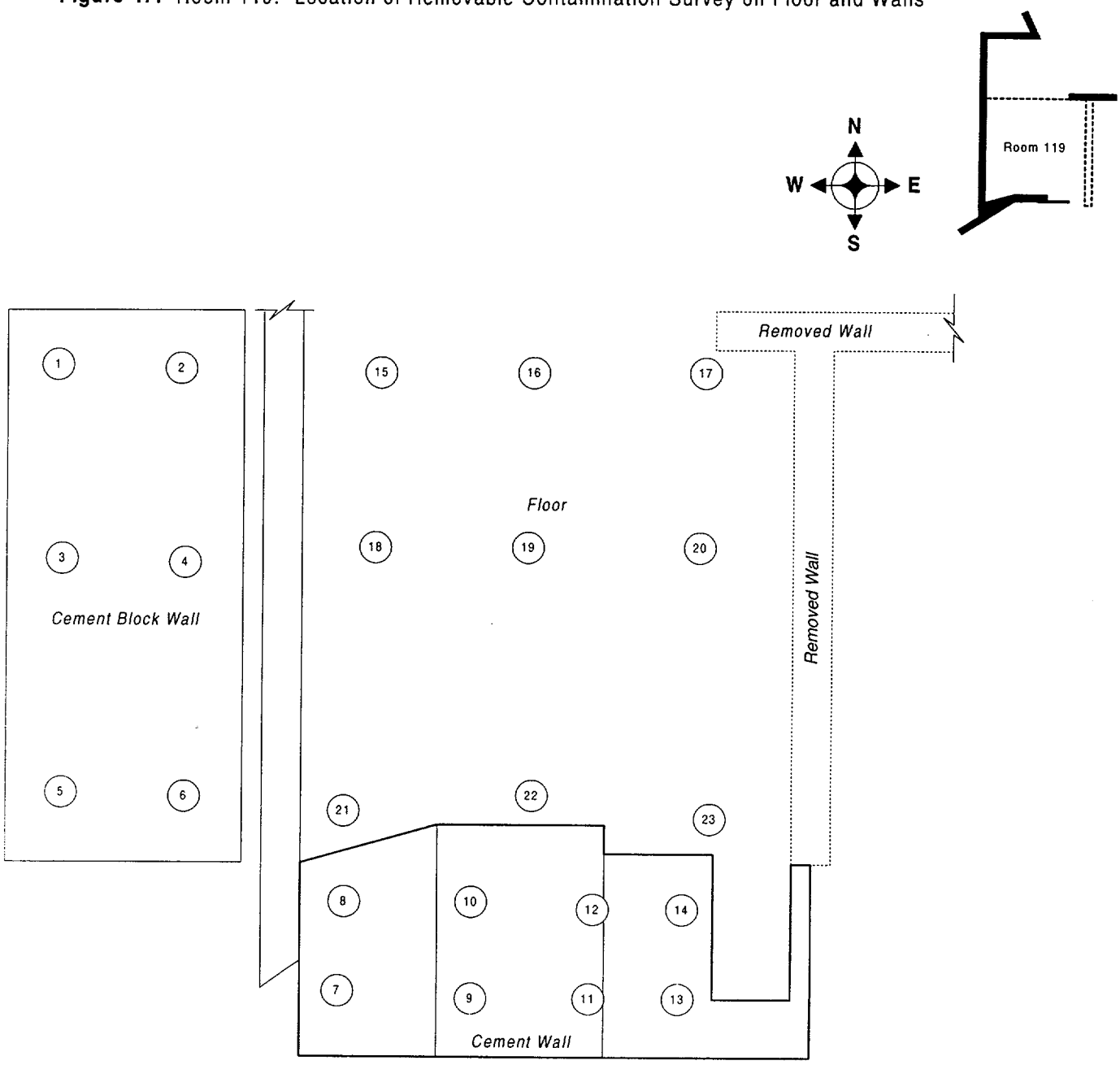
Notes:

1. Survey results are provided in Tables 5.

2. Two minute (cp2m) fixed Beta readings were taken.
The values are dpm/100cm^2 and indicate the approximate locations of measurements taken.

3. MDA: Concrete = 380 dpm/100cm^2. Cement Block = 339 dpm/100cm^2.

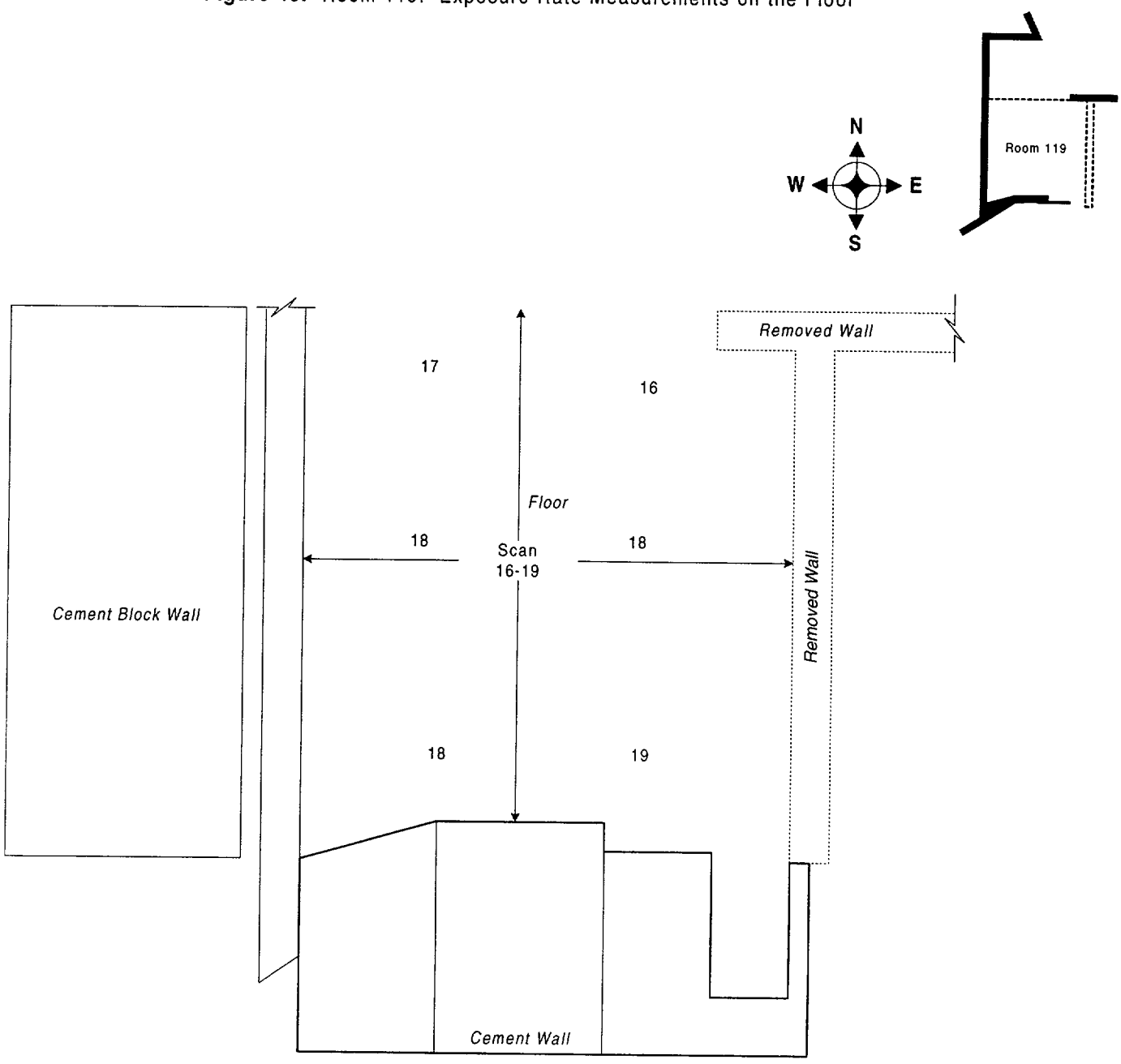
Figure 47: Room 119. Location of Removable Contamination Survey on Floor and Walls



Notes:

1. Wipe results are provided in Table 5.
2. The Numbers circled are the approximate locations of wipes taken.
3. All concrete surface.

Figure 48: Room 119. Exposure Rate Measurements on the Floor



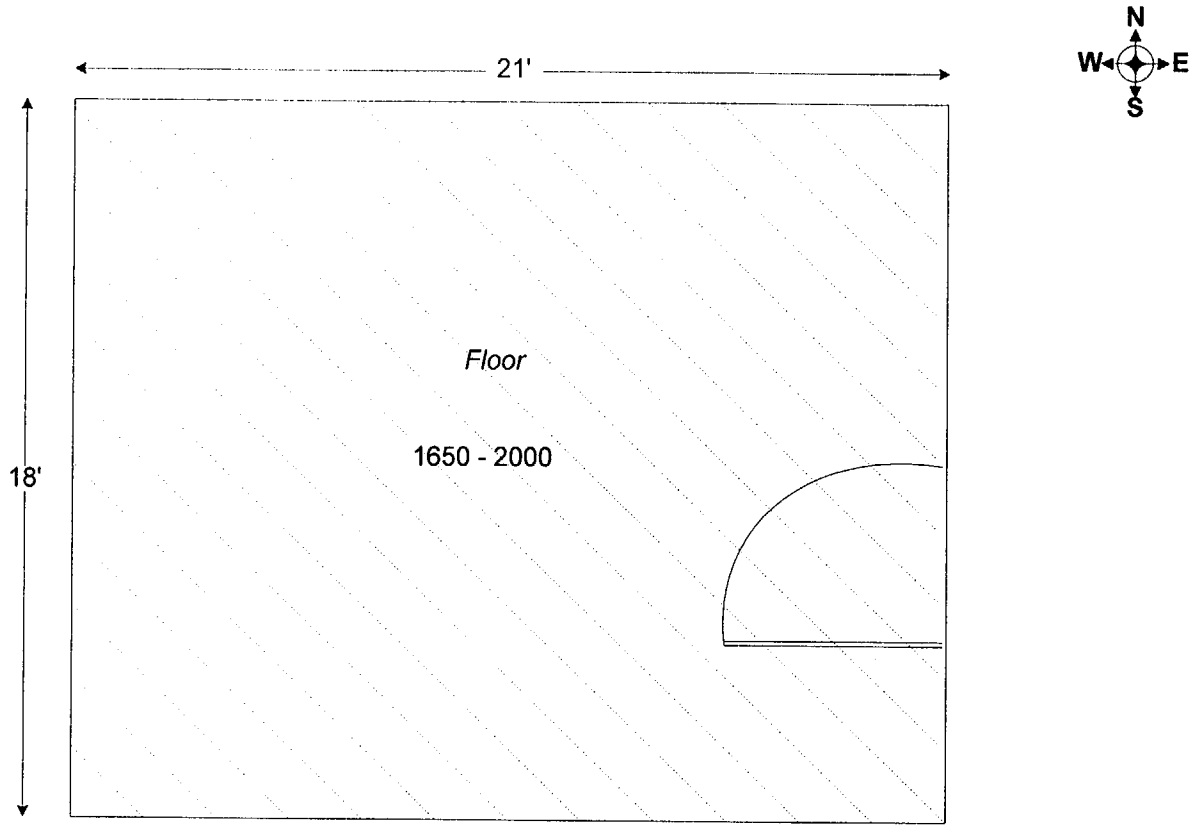
Notes:

1. The values are µR/hr and indicates the approximate location of Exposure Rate Measurements taken ~1m above floor surface. Scan ~ 75% of surface at 2".

2. Background: 10 - 18 µR/hr.

3. Cement block and concrete surface.

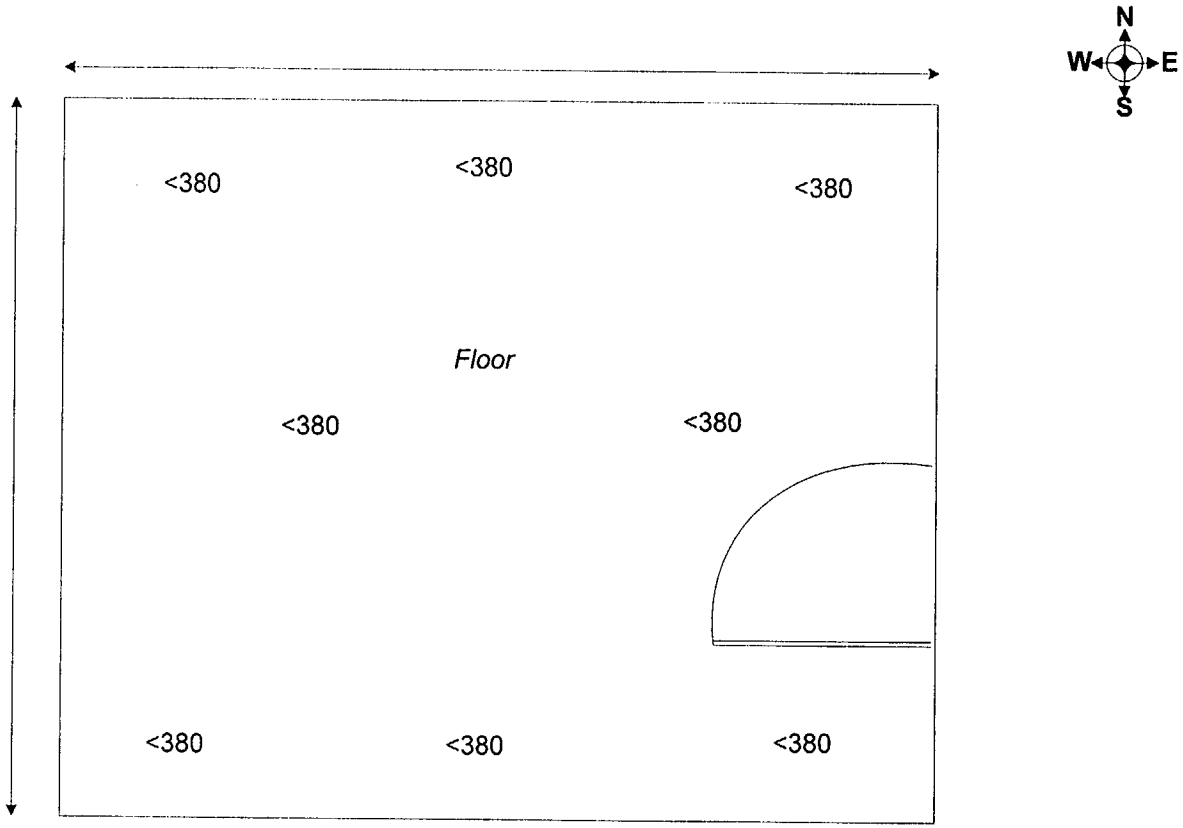
Figure 49: Room 122. Final Beta Scans on Floor



Notes:

1. Survey results are provided in Table 5. Results are in cpm 434cm^2.
2. ~100% of the floor was scanned for Beta. Scan results in cross hatched area.
3. Metal Ceiling and Walls have been removed.
4. Background: 434cm^2 = 1478 - 1765 cpm.
5. All concrete surface.

Figure 50: Room 122. Locations and Results of Final Fixed Beta Measurements



Notes:

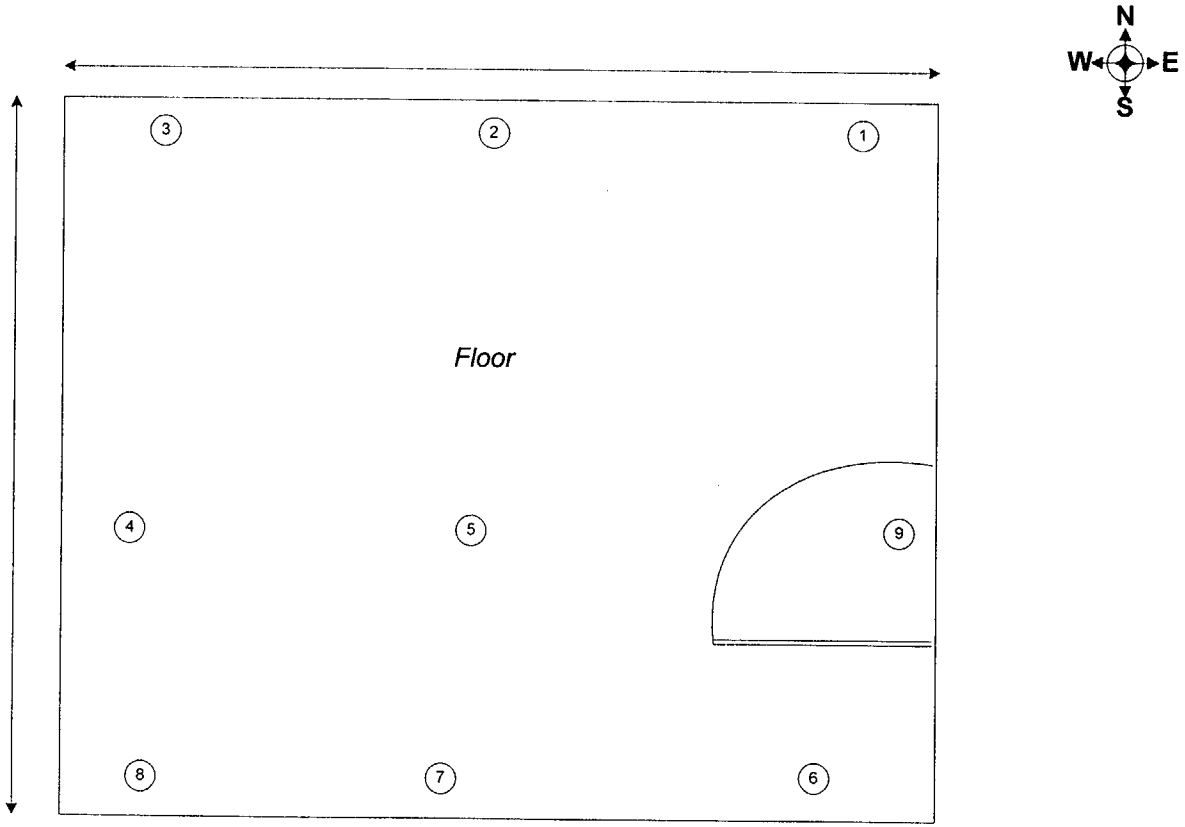
1. Survey results are provided in Tables 5.

2. The values are dpm/100cm^2 and indicate the approximate locations of fixed measurements taken. Two minute (cp2m) fixed Beta readings were taken.

3. MDA: 380 dpm/100cm^2.

4. All concrete surface.

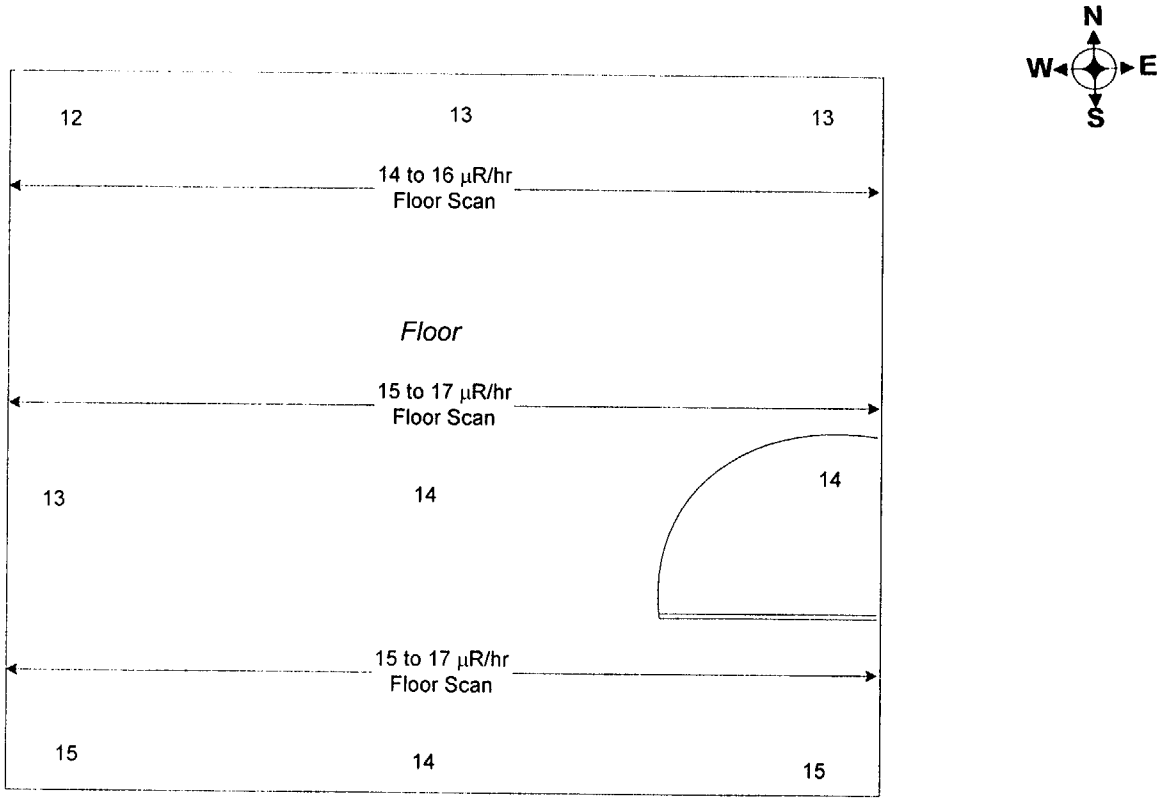
Figure 51: Room 122. Locations of Final Removable Contamination Survey



Notes:

1. Wipe results are provided in Table 5.
2. The Numbers circled are the approximate locations of wipes taken.
3. All concrete surface.

Figure 52: Room 122. Locations and Results of micro-R Scans and Final Exposure Rate Measurements



Notes:

1. The values are µR/hr and indicates the approximate location of Exposure Rate Measurements taken ~1m above ground surface. µR/hr floor scans were taken ~2" above floor surface.

2. Background: 10 - 18 µR/hr.

3. All concrete surface.

Figure 53: Room 123. Phase V

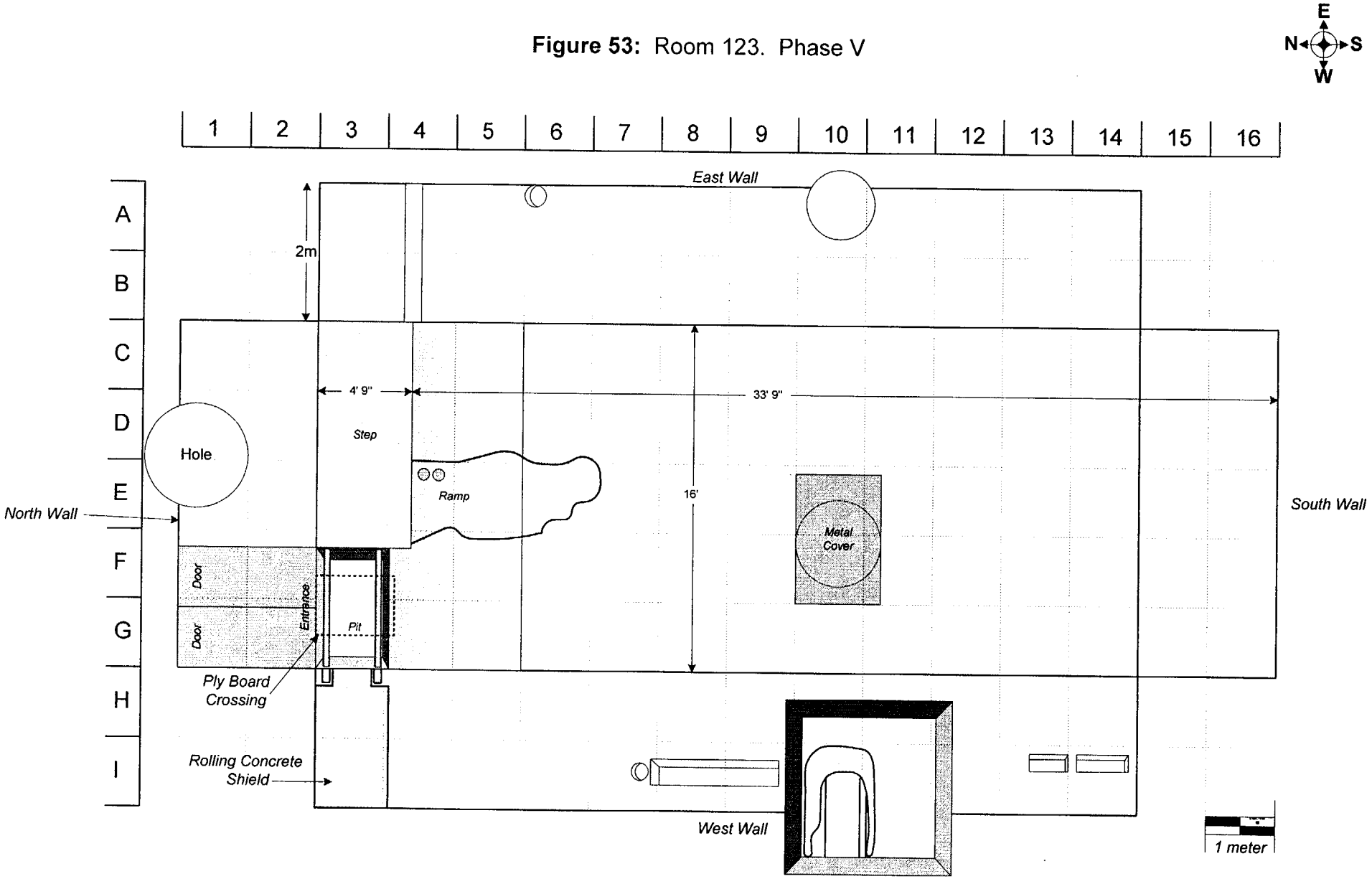
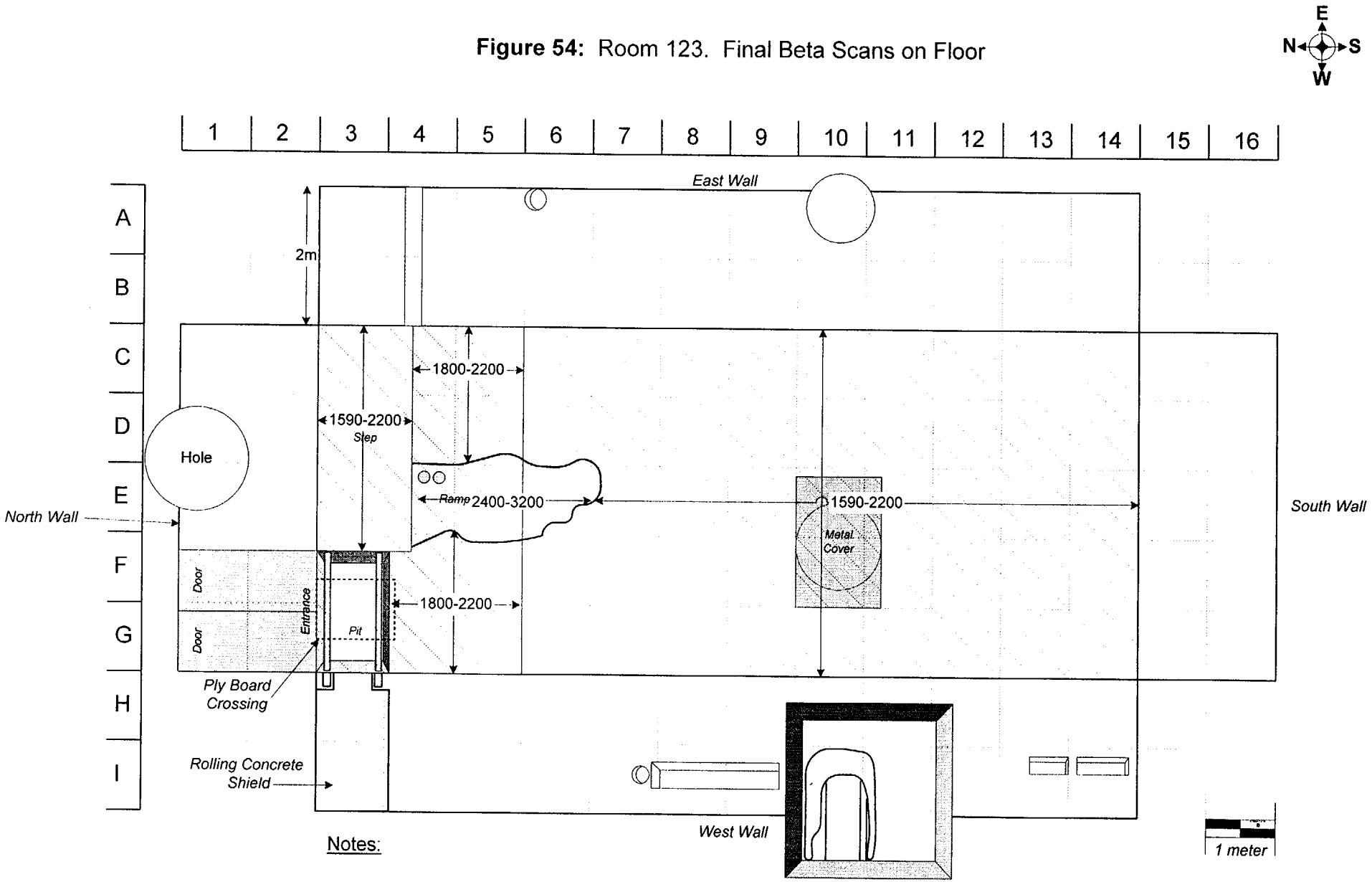


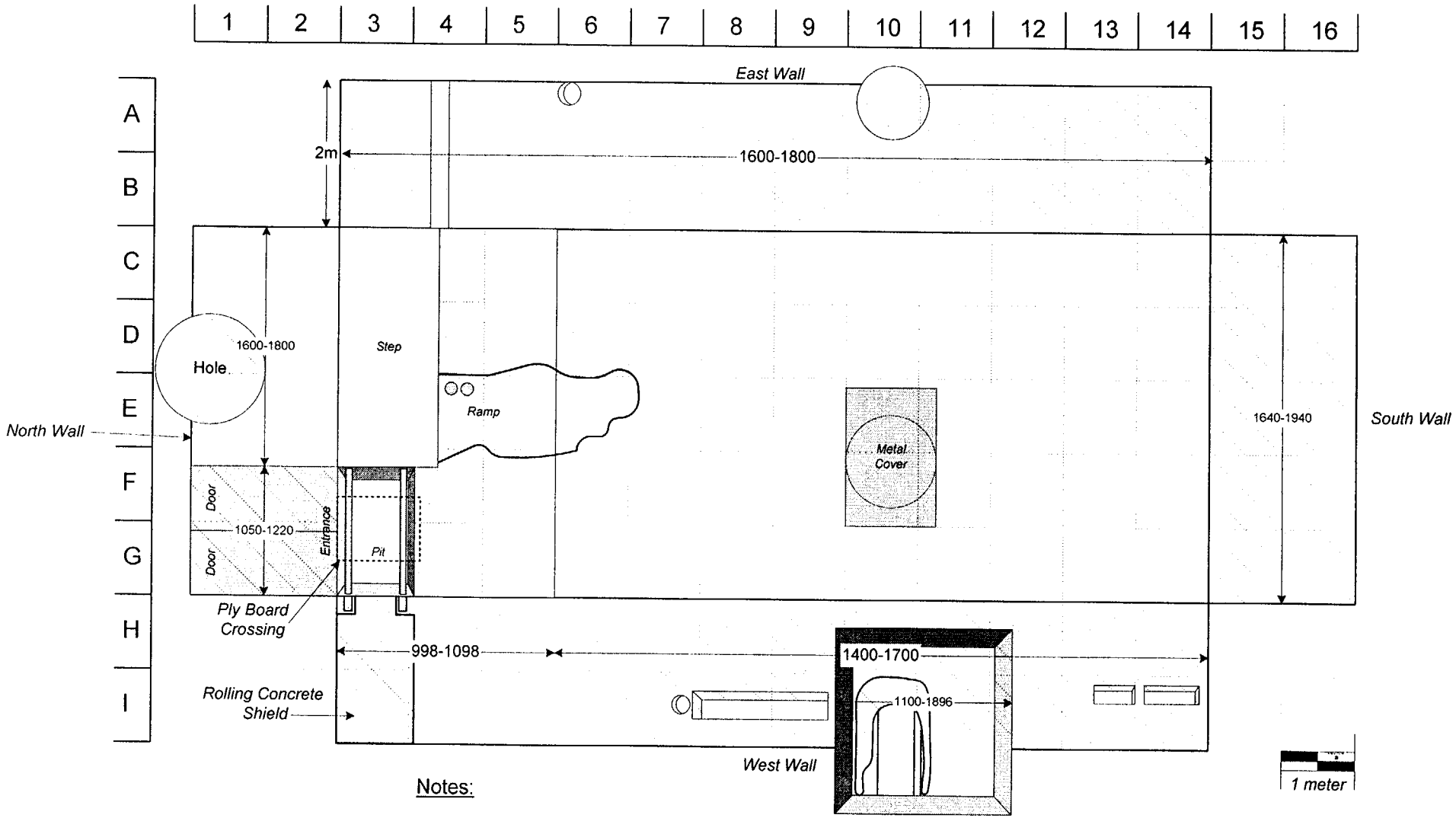
Figure 54: Room 123. Final Beta Scans on Floor



Notes:

1. Survey results are provided in Table 5. Results are cpm 434cm^2.
2. ~100% of the floor was scanned for Beta. Scan results in cross hatched area.
3. Background: 434cm^2 = 1600 - 1995 cpm.
4. All concrete surface.

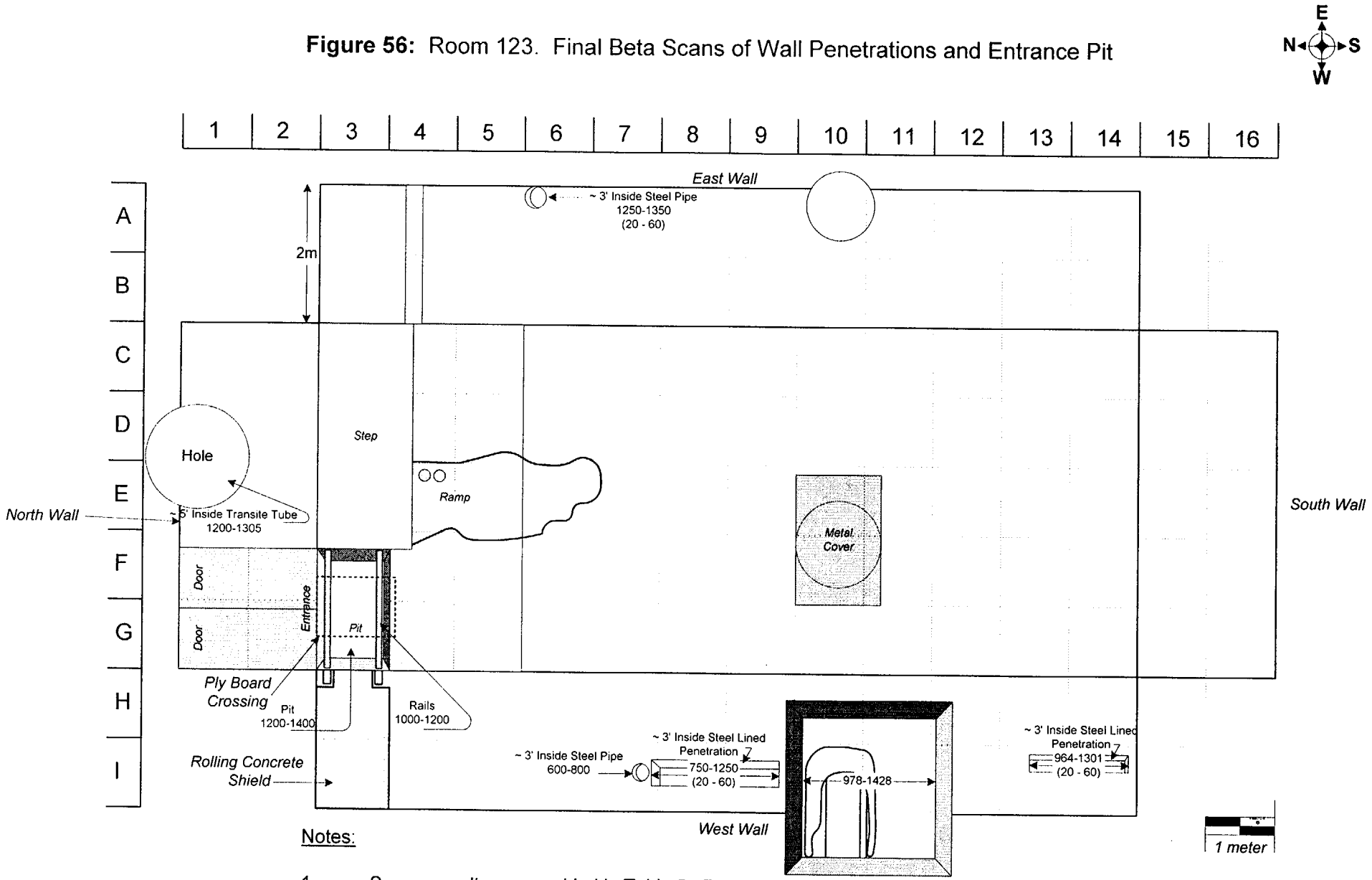
Figure 55: Room 123. Final Beta Scans on the Walls (Floor to Ceiling)



Notes:

1. Survey results are provided in Table 5. Results are in 434cm^2.
2. ~100% of the Walls were scanned for Beta. Scan results in cross hatched area.
3. Background: 434cm^2 over Concrete = 1600 - 1995 cpm.
   Over Cement block = 1567 - 1719 cpm and over Wood = 945 - 1086 cpm.

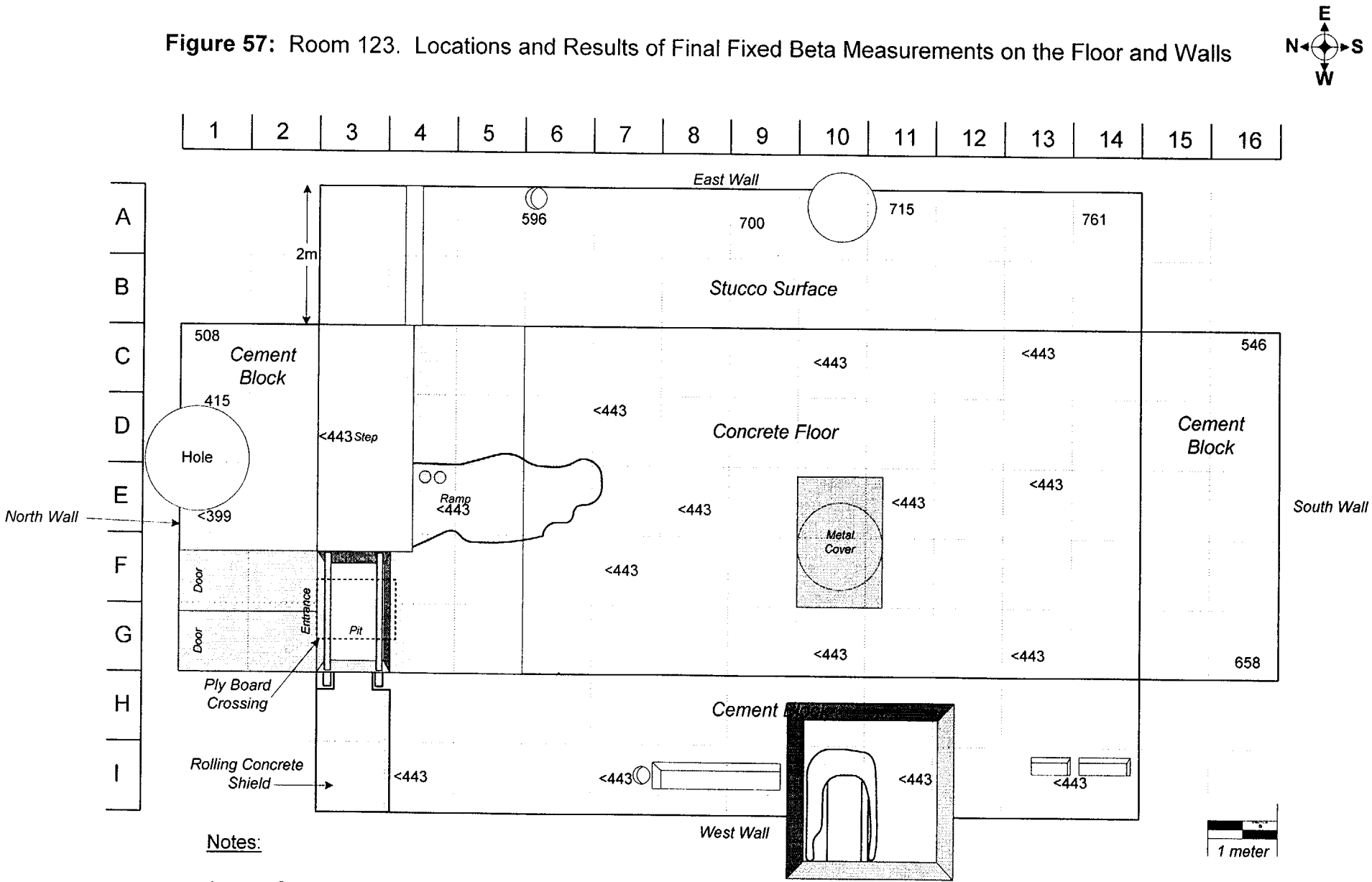
Figure 56: Room 123. Final Beta Scans of Wall Penetrations and Entrance Pit



Notes:

1. Survey results are provided in Table 5. Results are in cpm 434cm^2.
2. Wall Penetrations and Entrance Pit was scanned for Beta.
3. Background: 434cm^2 over Concrete = 1600 - 1995 cpm and 434cm^2 over Metal = 697- 806 cpm.
4. (# - #) denotes survey with a 15cm^2 GM Pancake probe. (backgrounds = 60 - 80 cpm in air).

Figure 57: Room 123. Locations and Results of Final Fixed Beta Measurements on the Floor and Walls



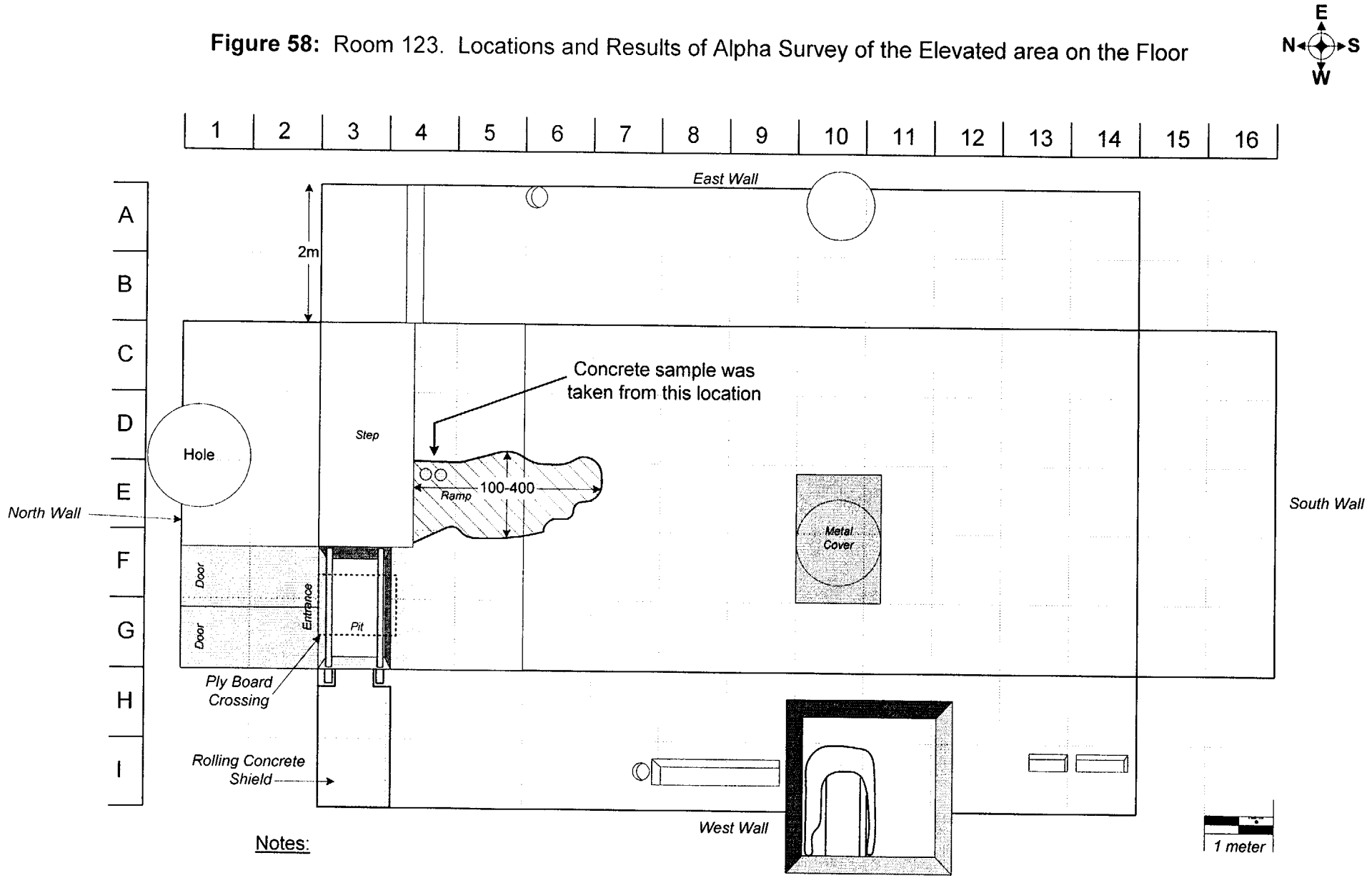
Notes:

1. Survey results are provided in Tables 5.

2. The values are dpm/100cm^2 and indicate the approximate locations of measurements taken. One minute (cpm) fixed Beta readings were taken.

3. MDA: Concrete MDA = 443 dpm/100cm^2, Cement Block MDA = 399 dpm/100cm^2 & Stucco MDA = 319 dpm/100cm^2.

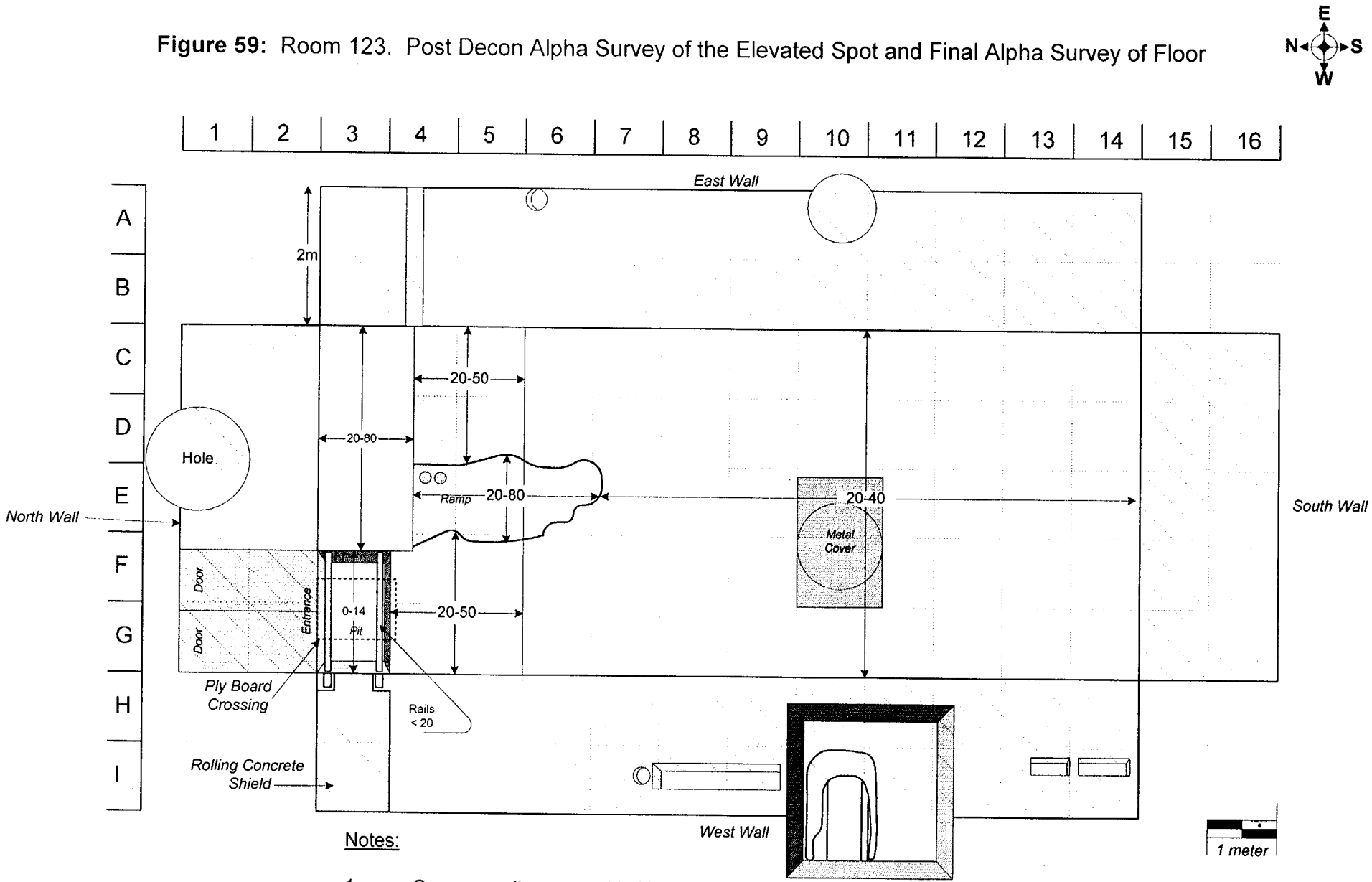
Figure 58: Room 123. Locations and Results of Alpha Survey of the Elevated area on the Floor



Notes:

1. Survey results are provided in Table 5. Results in cpm 50cm^2.
2. ~100% of the cross hatch area on floor was scanned for Alpha.
3. Background: 50cm^2 = 0 - 20 cpm.
4. All concrete surface.

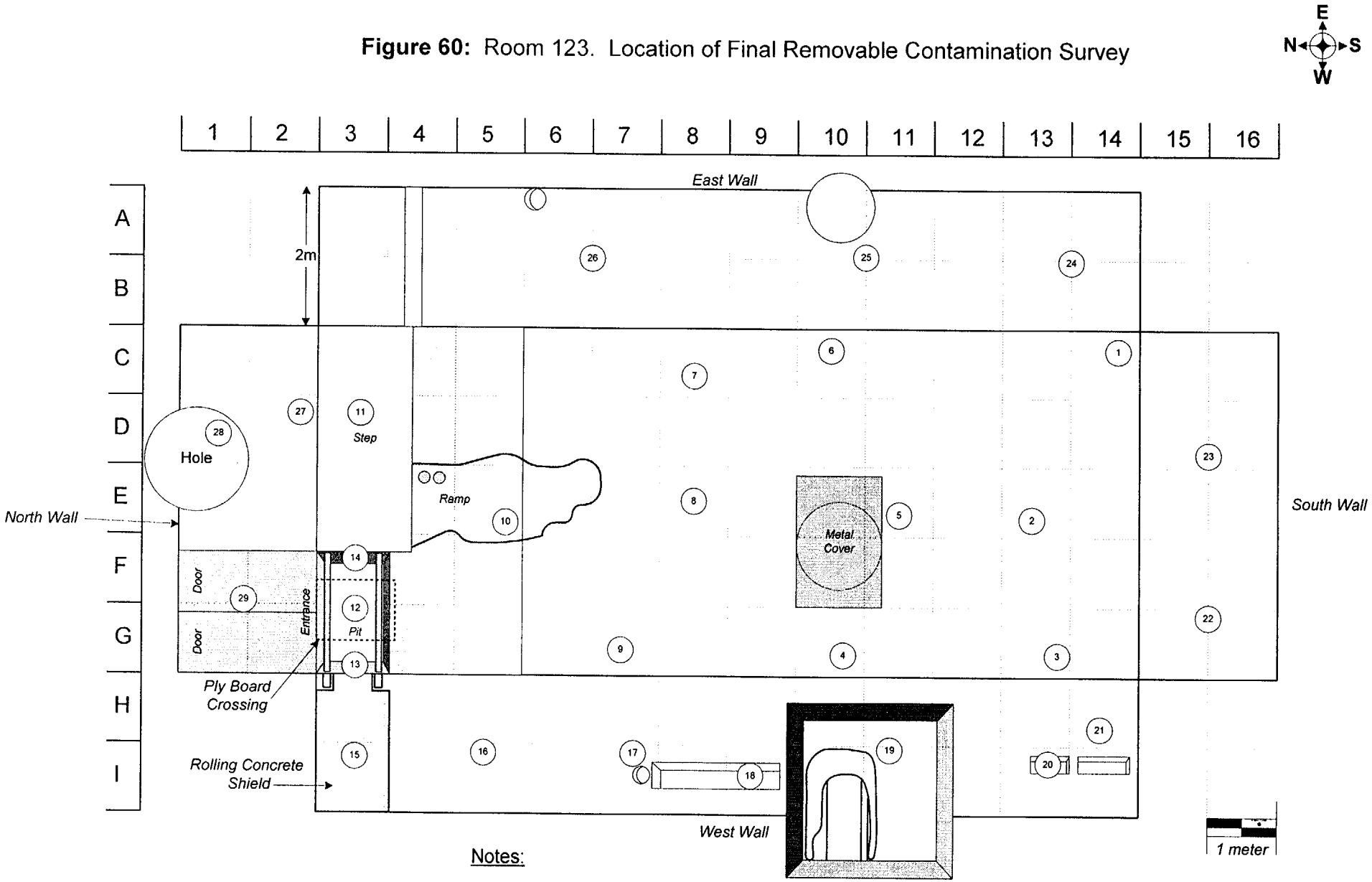
Figure 59: Room 123. Post Decon Alpha Survey of the Elevated Spot and Final Alpha Survey of Floor



Notes:

1. Survey results are provided in Table 5. Results are in cpm 434cm^2.
2. ~100% of the floor was scanned for Alpha. Scan results in cross hatched area.
3. Backgrounds: 434cm^2 = 0 - 20 cpm and 50cm^2 detector = 0 - 20cpm
4. All concrete surface.

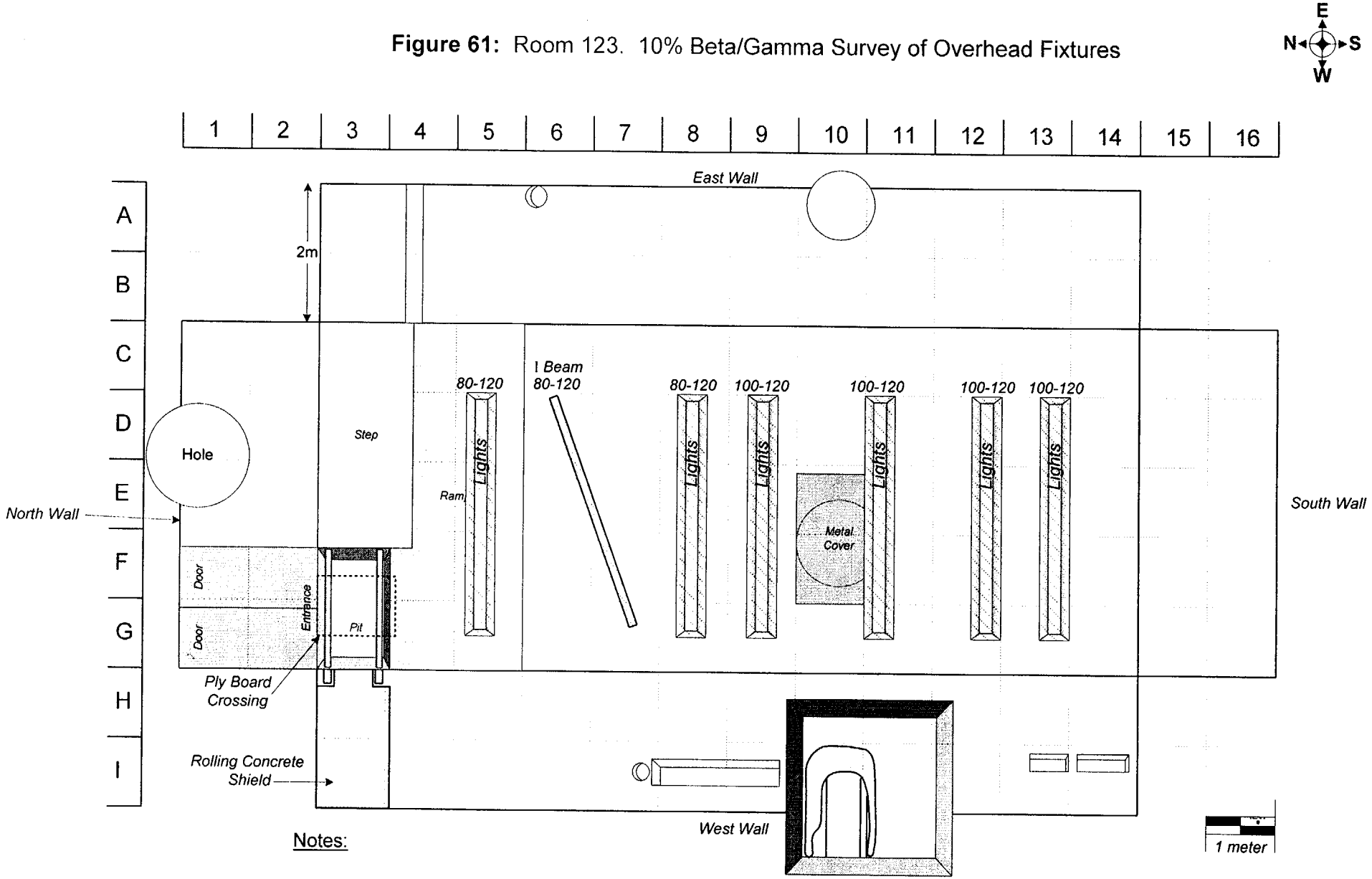
Figure 60: Room 123. Location of Final Removable Contamination Survey



Notes:

1. Wipe results are provided in Table 5.
2. The Numbers circled are the approximate locations of wipes taken.
3. Concrete, cement block, stucco and metal surface.

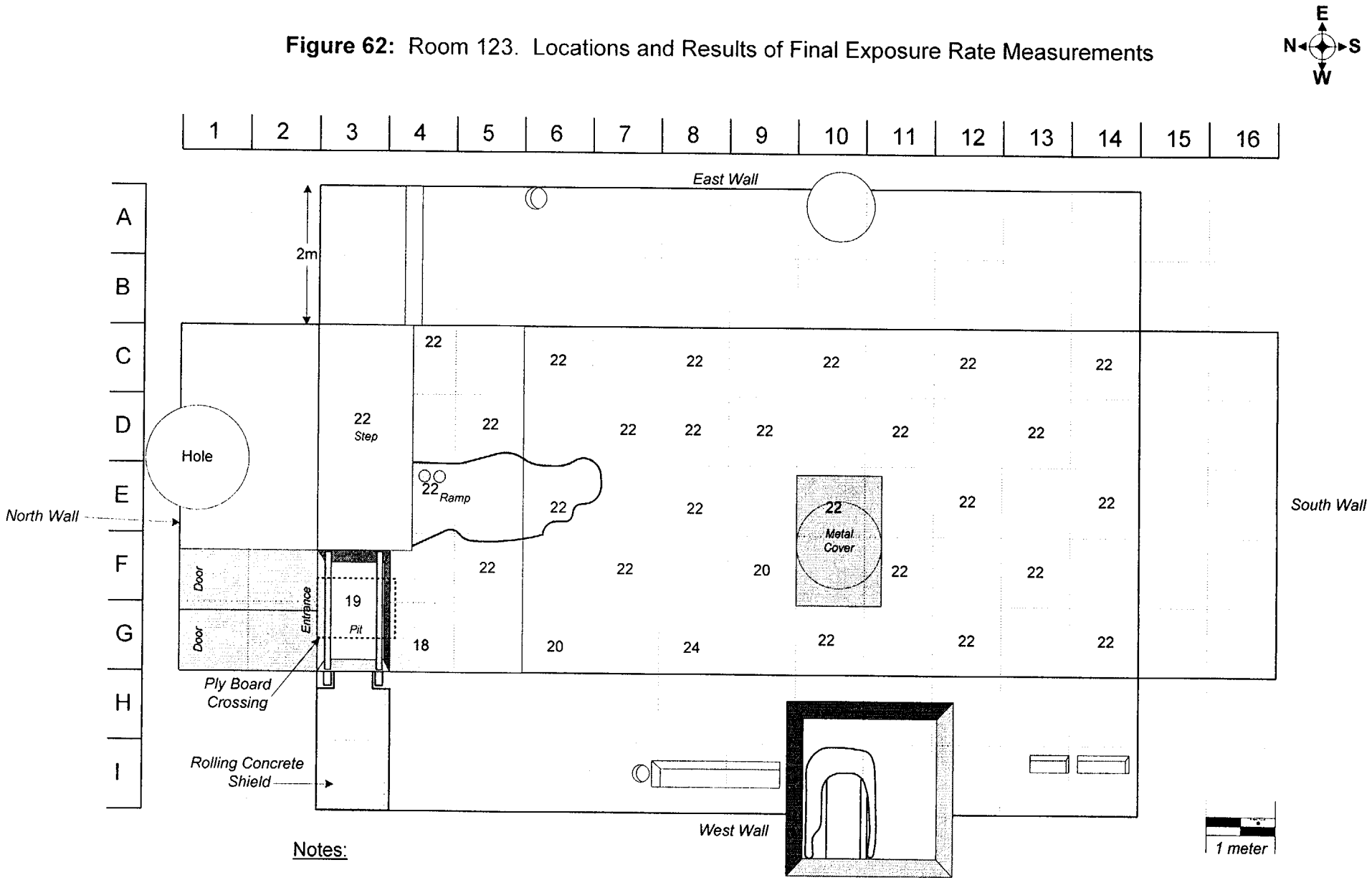
Figure 61: Room 123. 10% Beta/Gamma Survey of Overhead Fixtures



Notes:

1. Survey results are provided in Table 5. Results in cpm 15cm².
2. ~10% of the Overhead Fixtures was scanned for Beta/Gamma. Scan results in cross hatched area.
3. Background: 15cm² = 60 - 80
4. All metal surface.

Figure 62: Room 123. Locations and Results of Final Exposure Rate Measurements



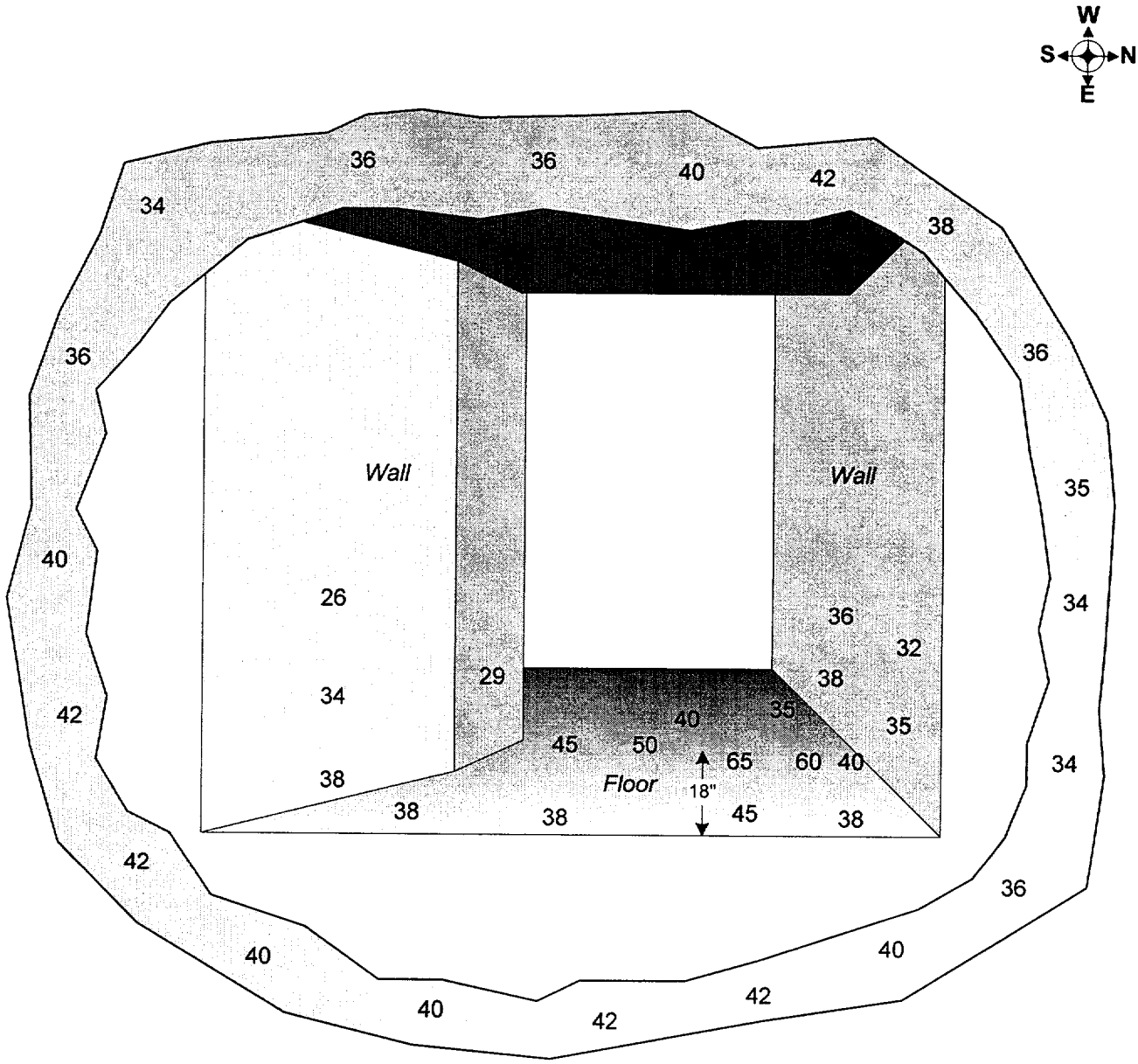
Notes:

1. The values are μR/hr and indicates the approximate location of Exposure Rate Measurements taken ~1m above ground surface.

2. Background: 10 - 18 μR/hr.

3. All concrete, metal surfaces.

Figure 63: Room 123.Exposure Rate Measurements of Large Wall Penetration in West Wall
Initial Survey Prior to Decontamination



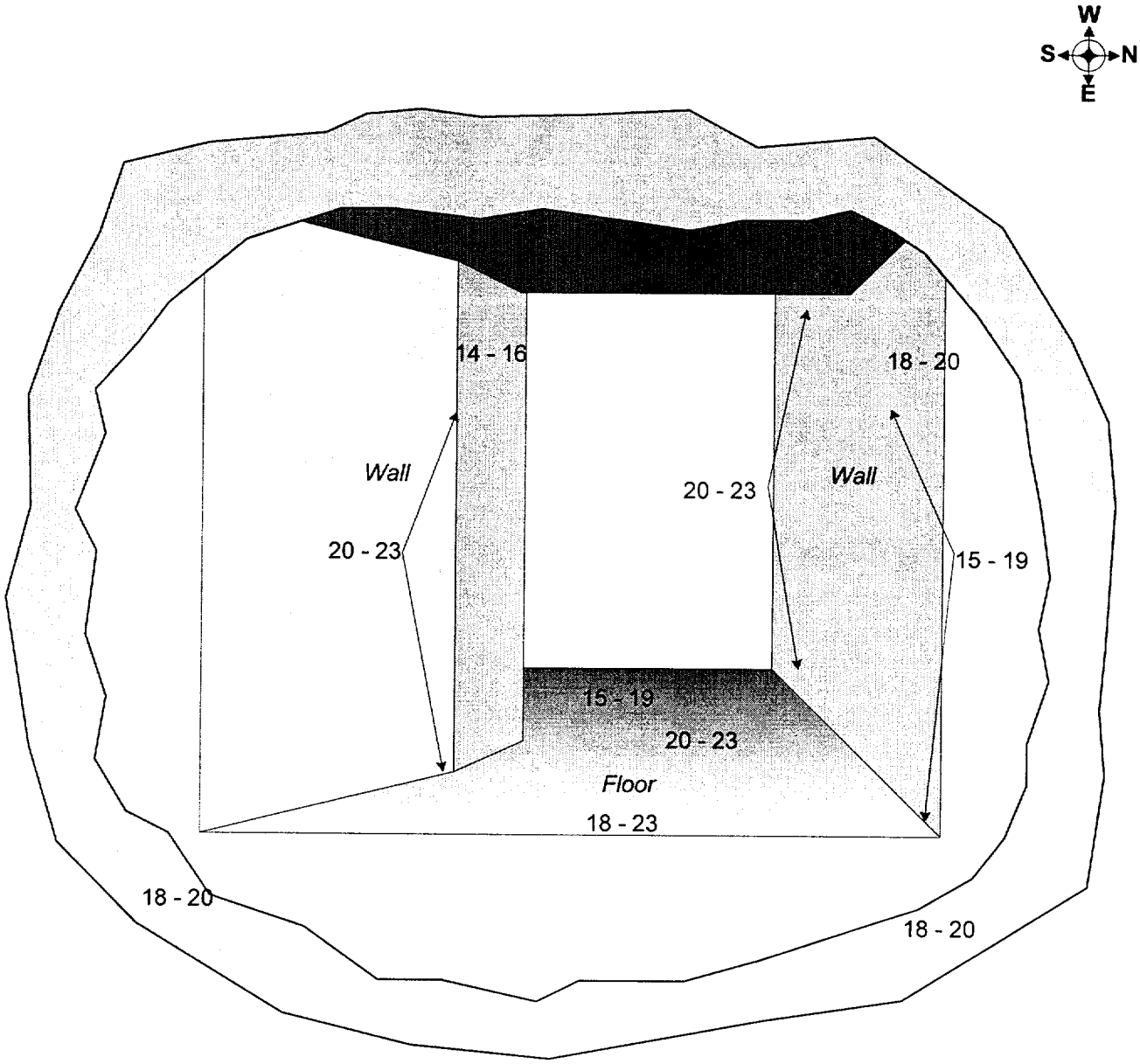
Notes:

1. The values are μR/hr and indicates the approximate location of Exposure Rate Measurements taken ~1" above surface.

2. Background: 10 - 18 μR/hr.

3. All concrete surface.

Figure 64: Room 123. Post Decon Exposure Rate Measurements of Large Wall Penetration in West Wall



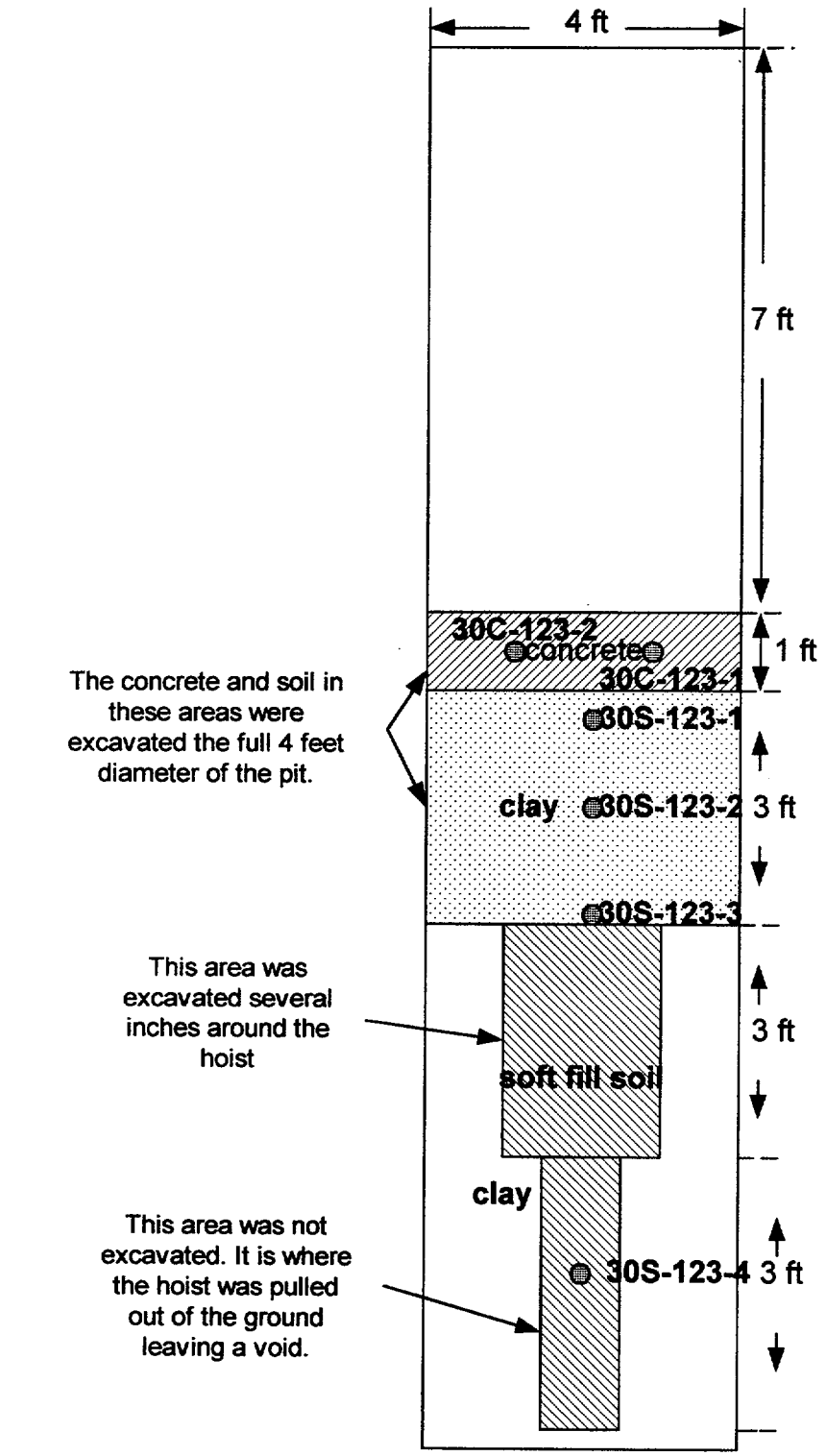
Notes:

1. The values are μR/hr and indicates the approximate location of Exposure Rate Measurements taken ~1" above surface.

2. Background: 10 - 18 μR/hr.

3. All concrete surface.

Figure 65: Building 30 Room 123 Pit Soil and Concrete Samples



Notes:

1. All of the samples were taken from the material after it was removed from the pit.
2. Locations shown are of the general area the material was removed from.
3. Sample 30S-123-4 was collected from the bottom 6 feet of the hoist after it was pulled from the pit.

Samples Collected By: R. Stowell
Date: 03-01-00

APPENDIX A

BUILDING 30 PHASE V

FINAL SURVEY PLANS

March 13, 1998 PRM

Paul R. Maschka and Laura Gonzales

CHARACTERIZATION SURVEY PLAN FOR BUILDING 30, PHASE 3 5 PRM

Building-30 Phase 3 includes rooms 113, 113A, 114, 119, 122, and 123 as shown in Figure 1.

CHARACTERIZATION SURVEY

The purpose of this survey is to determine if the rooms are contaminated, what the contaminants are and if decontamination is required.

BACKGROUND

A 100 MeV linear electron accelerator (LINAC) was operated in this building. The LINAC consisted of two in-line accelerators which were operated independently at 25 and 75 MeV, respectively. The two accelerators could be connected in tandem and could operate up to 100 MeV. The layout of the accelerator facility is shown in Figure 1.The accelerators were located in Room 114. There is a shield wall in the west end of the room that separates the two accelerator rooms. The single section accelerator located in the west end of the room could direct the electron beam into that section of the room and into Room 118. The three-section accelerator located in the east end of room 114 could direct the electron beam to operating positions called "ports" into rooms 114, 119, 113, 113A, and 123. The primary use of the accelerator was nuclear physics research, production of high energy neutrons, radiation processing of semiconductors and gem stones, sterilization of medical products, testing of electronic circuits and components, and production of radioisotopes. The final room included in Phase 3 is room 122. Room 122 contained the control consoles for the subcritical reactor assemble, the Accelerator Pulsed Fast Assembly, and the neutron generator all of which had been located in room 123.

Room 114 (west end) The single section accelerator was located in this room and it was used for radiation processing of semiconductors and gem stones. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples.

Room 118 (At the time that the accelerator was operating this was one large open room without the partition that now separates the area into two rooms.) This room was used for radiation processing of semiconductors and gem stones, sterilization of medical products, and production of radioisotopes. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples.

Room 114 (east end) This room contained the three-section accelerator and was used for isotope production, gamma irradiation of various materials, and for nuclear physics experiments. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples.

Room 113 **This room was used for testing of electronic circuits and components. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples.**

Room 113A **This room was used for nuclear physics research and production of high energy neutrons. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples. Depleted uranium targets, in sealed canisters, were used for creation of high energy neutrons.**

Room 119 **This room was used for nuclear physics research. Radioactive materials in the form of beta/gamma emitters and positron emitters were created as a result of the irradiation of samples.**

Room 122 **This room was the control room for the split-bed subcritical reactor assembly, the Accelerator Pulsed Fast Reactor Assembly, and the neutron generator located in room 123. Radioactive materials in the form of beta/gamma emitters and positron emitters were examined and stored in this room for short periods of time.**

Room 123 **This room was used for nuclear physics research. This room had contained two experimental reactor assemblies, a subcritical split-bed assemble and an Accelerator Pulsed Fast Assembly which was a critical assembly. Both of these units were removed in 1972. After the reactor assemblies were removed a neutron generator producing 14 MeV neutrons was operated in this cell. The neutron generator was aimed at the south wall.**

DOCUMENTATION

Every survey conducted must be documented *on a daily basis* on a drawing showing the approximate locations surveyed. Include the results (including units), the technician's signature, date, instrument(s) used (including model and serial number of both the ratemeter and the detector), calibration due date, % efficiency, background readings (if applicable) and any other applicable information.

ALERT LEVELS

1. **Beta scan with 433 cm^2 detector = >2500 cpm***
2. **Beta reading with 100 cm^2 detector for a 2 minute count = > 2000 cpm****
3. **µR/hr = >25 µR/hr*****

* **approximately 1500 dpm/100cm^2 if evenly distributed**

** **approximately 2500 dpm/100cm^2**

*** **Radiation measurements were taken in Building 13 Service Corridor with had concrete floor, walls, and ceiling containing pipes and service conduits. The dose rates in this area were 18 to 20 µR/hr. The LINAC Facility, Building 30, has concrete floors, walls, and ceiling similar to Building 13 and most likely will have dose readings in a similar range; therefore, the alert level was selected at ½ the allowable dose above background which is 10 µr/hr.**

CHARACTERIZATION SURVEY BUILDING-30 PHASE 3

Survey	Room 114 West	Room 114 East	Room 113	Room 113A
Preliminary Survey	None	Masslin plywood on east wall, remove wood.	Masslin steel plate on W. Wall Remove steel.	Spot check & masslin bricks from E Wall. Remove. Scan neutron shield (N Wall)100% Beta & take smears. Remove
Masslin Survey Floor	Yes Beta only	Yes Beta only	Yes Beta only	Yes Beta and Alpha
Floor scan 434 cm^2 probe	100% Beta	100% Beta 100% Beta in trough	100% Beta 100% Beta in troughs	100% Beta, 100% Beta in troughs. 25% Alpha N to S
North Wall Scan 434 cm^2 probe	50% Beta	25% Beta	25% Beta	50% Beta
East Wall Scan 434 cm^2 probe	50% Beta	100% Beta[1] 3m center, 50% remainder	100% Beta	50% Beta
South Wall Scan 434 cm^2 probe	50% Beta	50% Beta	25% Beta include shield door. 100% Hall to 113A	50% Beta
West Wall Scan 434 cm^2 probe	50% Beta	50% Beta	100% Beta[1] 2m center, 25% remainder	100% Beta including storage bins
Fixed Measurements 100 cm^2 β probe 2 minute count	N, E, & S walls 5' up every 2m	E&S walls 5' up every 2m	E&S walls 5' up every 2m	All walls 5' up every 2m
MicroR Survey	Scan, take reading every 3m	Scan, take reading every 3 m	Scan, take reading every 3 m	Scan, take readings every 3m
Smears	4 Floor 2 each wall	10 Floor 6 each wall	6 Floor 4 S,W,N walls. 8 East wall	10 Floor 10 each wall

NOTES:

a. Wall scans are to be taken from the floor to ceiling.

b. Take 10 spot check readings with the 434 cm^2 beta probe on the ceiling in room 113A and room 123.

c. The radioactive materials used at Building -30 included mixed activation products, depleted uranium and U-235;
therefore, the release levels are: 5000 dpm/100cm^2 average,
15,000 dpm/100cm^2 maximum, and
1000 dpm/100cm^2 removable for both alpha and beta.

[1] Center the 100% beta scans on the wall opening.

CHARACTERIZATION SURVEY BUILDING-30 PHASE 3

Survey	Room 119	Room 123	Room 122
Preliminary Survey	None	Masslin bricks and square steel tubes in NE corner for Beta & Alpha. Scan bricks for Beta. Scan steel tubes for Beta and alpha. Remove	None
Masslin Survey Floor	Yes Beta only	Yes Beta and Alpha	Yes Beta only
Floor scan 434 cm^2 probe	100% Beta	100% Beta 50% alpha	100% Beta
North Wall Scan 434 cm^2 probe	25% Beta	50% Beta [2]	25% Beta
East Wall Scan 434 cm^2 probe	25% Beta	50% Beta [2]	25% Beta
South Wall Scan 434 cm^2 probe	25% Beta	50% Beta [2]	25% Beta
West Wall Scan 434 cm^2 probe	25% Beta	50% Beta [2]	25% Beta
Fixed Measurements 100 cm^2 β probe 2 minute count	N&E walls 5' up every 2m	All walls 5' up every 2m	None
MicroR Survey	Scan, take readings every 3m	Scan, take readings every 3m	Scan, take readings every 3m
Smears	4 Floor, 2 each wall	8 Floor, 4 E&W walls, 2 N&S walls	4 Floor only

NOTES:

a. Wall scans are to be taken from the floor to ceiling.

b. Take 10 spot check readings with the 434 cm^2 beta probe on the ceiling in room 113A and room 123.

c. The radioactive materials used at Building-30 included mixed activation products, depleted uranium and U-235;
Therefore, the release levels are: 5000 dpm/100cm^2 average,
15,000 dpm/100cm^2 maximum, and
1000 dpm/100cm^2 removable for both alpha and beta.

[2] If the beta reading is >75% of the release level, survey 25% of the wall for alpha.

Addendum 1: to Characterization Survey Plan for Building 30, Phase 3.

For Room 122 add the following surveys:

Survey 25% of the fixtures on the walls and ceiling using hand-held GM detector. Take one 100 cm^2 smear on each fixture.

Observe the documentation and alert level requirements in the original survey plan.

Paul R. Maschka Date: March 22, 1999

Paul R. Maschka

July 15, 1998

Paul R. Maschka and Laura Q. Gonzales
Paul R Maschka Laura Q. Gonzales

BUILDING 30 PHASE 3, SUPPLEMENTAL CHARACTERIZATION SURVEY PLAN # 5 prm

BACKGROUND

During the Characterization Survey elevated µR dose rates were measured on the concrete ceiling beams as shown on Figure 1. The dose rates measured were from 30 to 55 µR/hr. The higher dose rates were measured on the west side of each beam, which is reasonable because the west side of the beam faced the source of radiation. Normal background radiation dose rates are 12 to 15 µR/hr outside. However, these LINAC rooms are all concrete, floors, walls, and ceiling. A concrete room background radiation was obtained by measuring the dose rate in a similar concrete room (Building 1 basement) and those measurements were 20 to 23 µR/hr.

Since the shield wall has been removed, another µR survey will be completed to find out if the dose rates at the beams have changed. In addition surface measurements will be made using the 100 cm^2 beta probe. The two beams with the highest dose rates will be core sampled to determine the amount of activity in the beams and the location of the radioactive materials inside the beams.

The beams measure 29 inches from the bottom of the beam to the ceiling and 24 inches thick.

ADDITIONAL CHARACTERIZATION SURVEYS

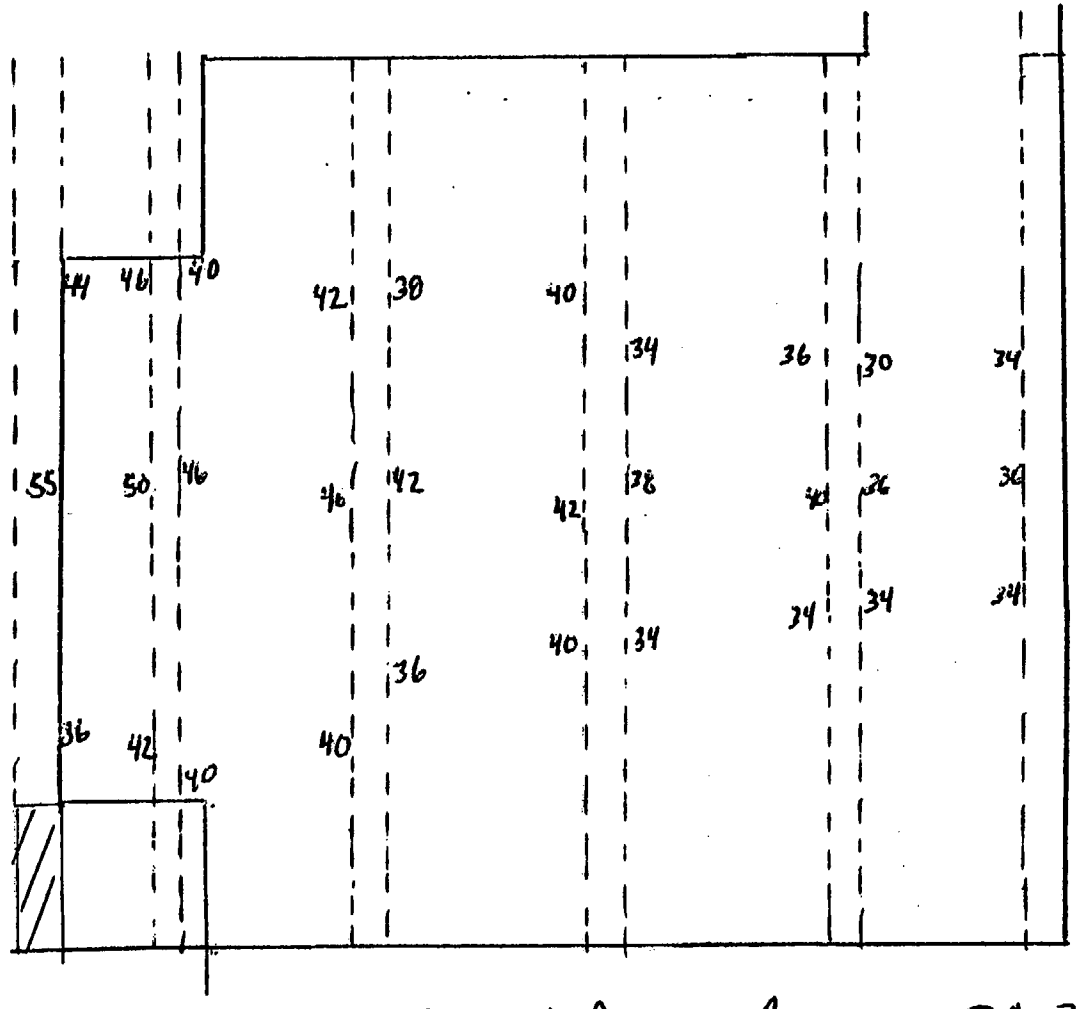
1. **Take a µR survey on the ceiling support beams on the west side and the east side of each beam.**

2. **Take direct radiation readings with the 100 cm^2 beta detector, 2 minute count, on the both sides of the beams with the highest dose rates. These beams will be the ones that are core sampled.**

3. **Take either 2" or 2.5" core samples completely through the two beams that have the highest dose rates. Cut or break the cores into ~2" lengths. Mark each segment as to its location in the beam measuring from west to east. The first piece would be #1 0-2", the second piece would be #2 2-4", and so on. Place each piece in a plastic bag and mark the bag with the sample information and deliver to the HP lab for gamma analysis.**

B-70 Lit-C
113A
5-13-98

Concrete ceiling support beams



N
W - I - E
S

Model 19
uR meter
Serial # 144022
Cal due 7-14-98

General Area uR scan 30-34 at 1 meter ~~ground level~~ air
30-44 at ground level

Micro R survey
E. Ramirez / E. Ramirez

FIGURE 1: Concrete Ceiling Support Beams

GENERAL ATOMICS

SAMPLING PLAN FOR BUILDING 30, ROOMS 113A AND 123

October 21, 1998 Refer: PRM-98-46

Prepared by: Paul Maschka Paul R. Maschka Date 10/21/98

Approved by: Laura Gonzales Laura Gonzales Date 10/21/98

Purpose

The purpose of this sampling plan is to characterize the activation of the walls, floors, and ceiling of Rooms 113A and 123 in Building 30 and to determine activity in the concrete and rebar.

Summary

A total of 19 locations will be sampled. The cores samples should be at least 4" long and possibly longer to include the rebar. The core will be split into 2" pieces for counting.

Background

The radiation dose rates measured at the ceiling beams in room 113A ranged from 30 to 55 μR/hr and the general area at 1 meter above the floor measured 28 to 36 μR/hr The dose rates in room 113 were 20 to 28 μR/hr. The normal background dose rates range from 10-15 μR/hr and can be as high as 22 μR/hr for a concrete room.

Two core samples were taken from two different ceiling beams in room 113A. Moffatt, Nichol, & Ferver Engineers were consulted and they recommended that the integrity of the main (longitudinal) reinforcing bars be maintained; therefore, the samples were taken on the vertical face above the lower longitudinal rebar. The cores were drilled completely through the beam. The cores were broken into two inch pieces and each piece was counted on the gamma ray analyzer. The activity (Co-60) on both ends of each core sample showed higher activity than in the center of the core. The samples with the steel rebar were almost three times higher than the concrete samples without rebar. The rebar counted separately had very high Co-60 concentrations.

Core Sampling Plan for Walls, Floors and Ceilings

The potentially activated area was identified based on history of use (Paul Maschka worked at the facility during accelerator operations) and based on radiation exposure rate readings. The genera location where the samples will be taken have been marked on the walls, floors, and ceiling using chalk. See Figure 1. Core Sample Locations, Building 30, Room 113a and Room 123

Room 113A

Floor	- 3 cores 2 to 6 inches long separated into two inch segments.
N. Wall	- 3 cores 2 to 6 inches long separated into two inch segments.
S. Wall	- 3 cores 2 to 6 inches long separated into two inch segments.
E. Wall	- 2 cores 2 to 6 inches long separated into two inch segments.

Room 123

Ceiling	- 2 cores 2 to 6 inches long separated into two inch segments.
Floor	- 2 cores 2 to 6 inches long separated into two inch segments.
W. Wall	- 1 core 2 to 6 inches long separated into two inch segments.
E. Wall	- 2 cores 2 to 6 inches long separated into two inch segments.
S. Wall	- 1 core 2 to 6 inches long separated into two inch segments.

1. The general locations where the samples are to be taken have been marked on the surface.

2. Have a contractor locate the rebar within the marked location. (G.Bramblett)

3. Using a 2" core drill, remove a 4" to 6" deep core sample from each position where the rebar has been located.

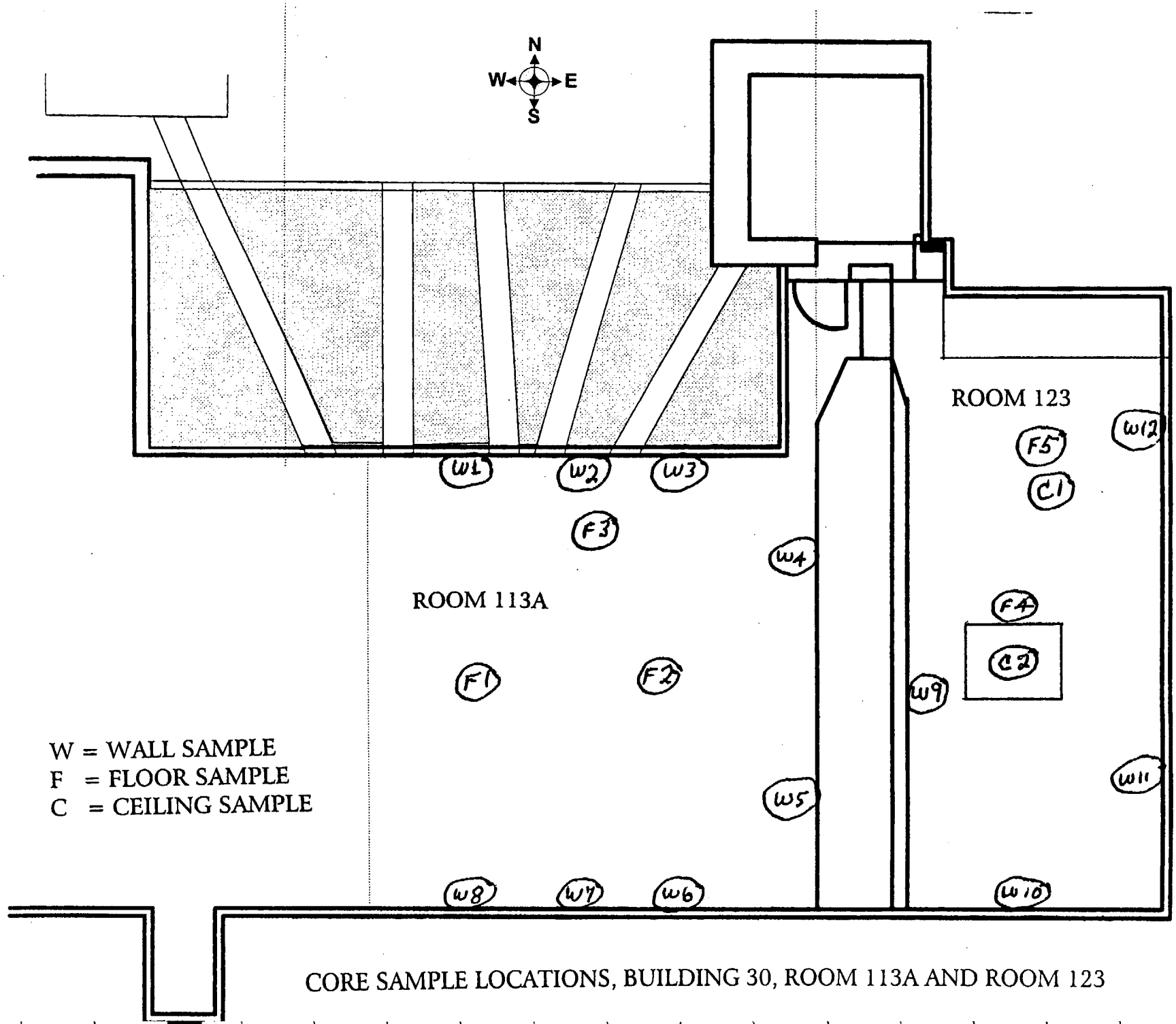
4. Cut or break the sample into 2" pieces and place each piece in a sample container (100 ml container).

5. Count the samples by gamma ray spec. for 30 minutes (enough time for Co-60 determination).

6. Separate out the rebar and count it by itself.

7. Give the results to Paul Maschka or Laura Gonzales to evaluate.

cc: G. Bramblett



CORE SAMPLE LOCATIONS, BUILDING 30, ROOM 113A AND ROOM 123

March 8, 1999
Paul R. Maschka
Paul R. Mas as of Ba
BUILDING 30
CHARACTERIZATION SURVEY PLANS FOR SOIL, GUNITE, AND CONCRETE ON TOP OF THE LINAC CENTRAL CORE AREA.

BACKGOUND

The concrete samples taken of the walls, floor, and ceiling in room 113A showed Co-60 contamination of the rebar about 50%of the release level. The concrete samples were <10% of the release level. Soil samples of the soil above the ceiling and outside the walls are needed. The soil forms the shielding on the outside of the building. Part of the soil is covered with concrete and with gunite (sprayed on concrete with little or no aggregate) and this will be need to be surveyed before removal. The soil will be sampled to determine if there are radioactive isotopes in the soil and how far above the roof and out from the sides of the building the contamination extends.

Classification of the Areas

The areas are composed of the concrete and the gunite covering over the soil, the soil, and room 113A.

Unaffected Areas
The concrete and gunite on top of the soil.
The upper soil surface.

Non-Suspect Affected Areas
The soil just above the roof and just outside the side walls.

Suspect Affected Areas
Room 113A floor, walls, and ceiling, all of this structure will be cut into pieces and disposed of as radioactive waste.

Surveys of the Concrete, Gunite, and Soil

Survey 25% of the concrete and gunite with a 434 cm^2 Beta detector. Mark any area above the alert level and survey this area with a GM pancake detector.

Survey the soil at each roof sample location with a μR survey instrument one meter above the surface.

Report any areas above alert level to HP Management.

Soil Samples

Roof Soil Samples
Collect soil samples from the top of the roof at seventeen (17) locations indicated on the attached drawing. Collect three soil samples from each location at the depths indicated in Table 1.

TABLE 1: Depth at which Soil Samples are to be Collected From Top of Roof				
Sample Number	Surface or top of soil under gunite	Between 2' & 2.5' above the roof	Between 1' & 2' above roof	Immediately above the roof
B30R-1	Yes	Yes		Yes
B30R-2	Yes	Yes		Yes
B30R-3	Yes	Yes		Yes
B30R-4	Yes	Yes		Yes
B30R-5	Yes	Yes		Yes
B30R-6	Yes	Yes		Yes
B30R-7	Yes		Yes	Yes
B30R-8	Yes		Yes	Yes
B30R-9	Yes	Yes		Yes
B30R-10	Yes		Yes	Yes
B30R-11	Yes		Yes	Yes
B30R-12	Yes	Yes		Yes
B30R-13	Yes		Yes	Yes
B30R-14	Yes		Yes	Yes
B30R-15	Yes	Yes		Yes
B30R-16	Yes		Yes	Yes
B30R-17	Yes		Yes	Yes

Outside Wall Soil Samples

Collect soil samples from outside the walls at the ten (10) locations shown on the attached drawing. Collect three samples from each location as described below:

Sample #1. Two feet down from the top of the roof.
Sample #2. Seven feet down from the top of the roof.
Sample #3. Ten feet down from the top of the roof.

ALERT LEVELS

1. Beta scan with 433 cm^2 detector = ≥2400 cpm*
2. Beta/gamma reading with pancake GM detector = ≥100 cpm above background**
3. µR/hr = ≥25 µR/hr***

* approximately 1500 dpm/100cm² if evenly distributed

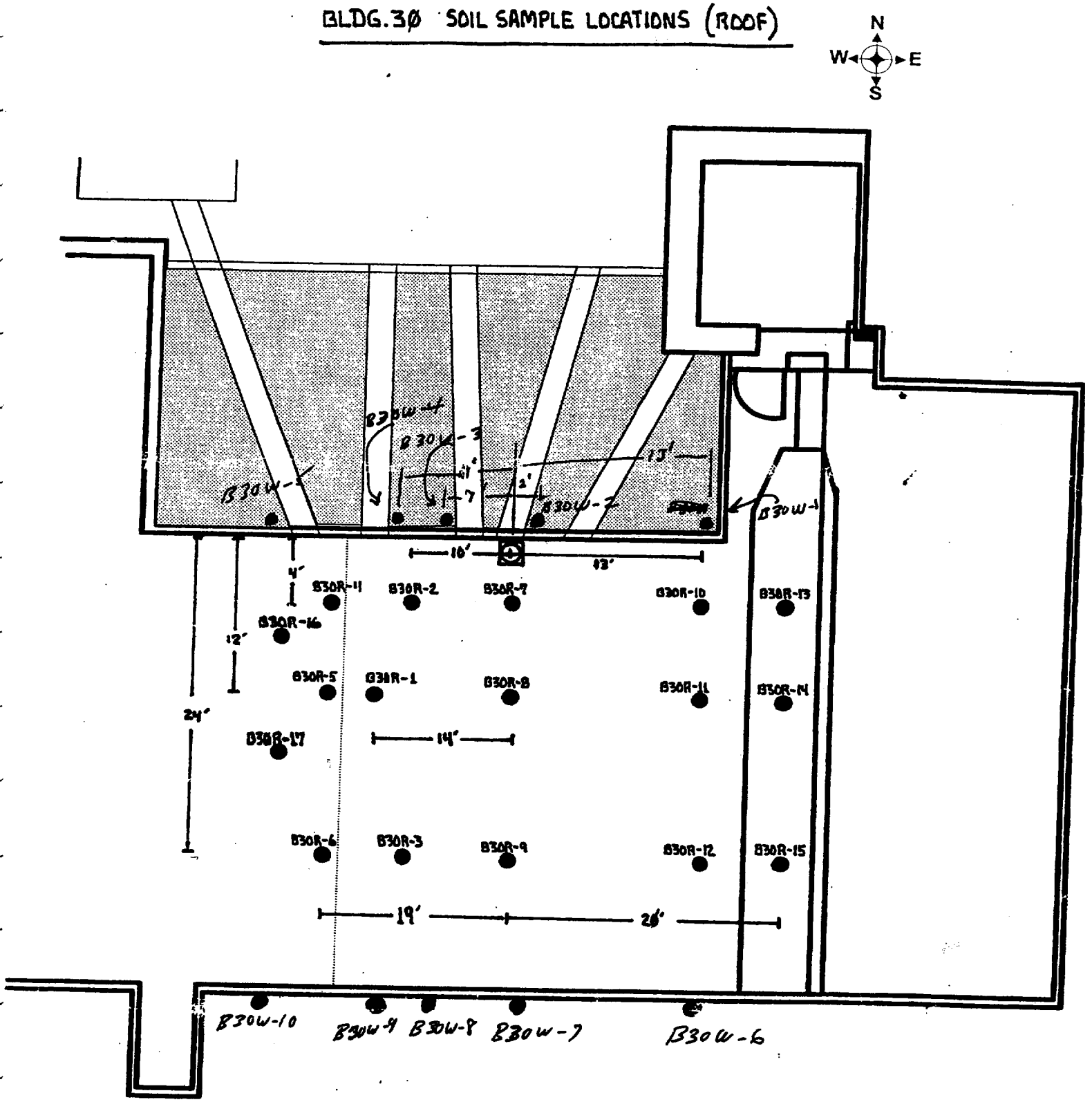
** approximately 2500 dpm/100cm²

*** Radiation measurements were taken in Building 13 Service Corridor with had concrete floor, walls, and ceiling containing pipes and service conduits. The dose rates in this area were 18 to 20 μR/hr. The LINAC Facility, Building 30, has concrete floors, walls, and ceiling similar to Building 13 and most likely will have dose readings in a similar range; therefore, the alert level was selected at ½ the allowable dose above background which is 10 μr/hr.

DOCUMENTATION

Every survey conducted must be documented *on a daily basis* on a drawing showing the approximate locations surveyed. Include the results (including units), the technician's signature, date, instrument(s) used (including model and serial number of both the ratemeter and the detector), calibration due date, % efficiency, background readings (if applicable) and any other applicable information.

BLDG. 30 SOIL SAMPLE LOCATIONS (ROOF)



June 10, 1999

Prepared by Paul R. Maschka

Approved Paul R. Maschka Date 6/10/99
Paul R. Maschka

SURVEY PLAN FOR THE SUBFLOOR IN ROOM 113a OF BUILDING 30

Background and Purpose

The floor above the subfloor was activated and has been removed and will be diposed of as radioactive waste. The upper floor was ~8" thick which should have been sufficient thickness to shield the subfloor from the radiation that produced the activation products. Therefore, it is not anticipated that the subfloor will be activated.

The tar paper on top of the subfloor will be frisked and smeared and disposed of clean waste or radioactive waste as is determined from the survey data.

Classification

The newly exposed tar paper and sublfloor is not expected to be contaminated or activated and is classified as a unaffected area at this time. If the surveys show fixed or removable contamination the classification will be changed and the survey requirements will be increased.

SURVEYS

Griddling - Not required

Frisking - The tar paper, only, will be frisked and smeared for free release. If it is contaminated, it will be disposed of as radioactive waste.

Scanning - Scan 100% of the subfloor surface down the center of the room 4 detectors wide for **beta** radiation using the 434 cm^2 probes. Scan ~25% of the rest of the floor. Mark all areas above the alert levels and survey those areas with hand-held GM pancake detectors.

Direct Measurements - Take 30 direct measurement evenly spaced across the surface of the subfloor. Alternate the direct measurements between a 100 cm^2 **beta** 2 minute count and a 100 cm^2 smear for removable contamination.

Exposure Rate Measurements - Scan the subfloor at ~1' and 1m above the surface with a microR meter and take a reading at 1' and 1m every 2 meters across the surface.

Documentation

The radiological survey conducted must be documented to a worksheet or logbook and on a drawing showing the appropriate locations surveyed. The documentation must include the results of the measurements (including units), the technicians printed name and signature, date, instrument(s) used (including the model and serial number of both the ratemeter and the detector), calibration due date, % efficiency, background readings (if applicable) and any other pertinent information.

Alert Levels

Notify Health Physics Management if any of the following alert levels are exceeded:

Beta Monitoring

>300 cpm above the appropriate background using the 434 cm^2 probe.
>200 cpm above the appropriate background using the 100 cm^2 probe.
>150 cpm above background using a portable GM detector.

Exposure Rate Measurements

10 μR/hr above background.

SURVEY PLAN FOR B30/RM.113A WALL FOOTINGS

Gridding - N/A

Scanning - Scan 100% of the surface area with a 100cm^2 Beta probe.
Survey all areas above the alert levels with a hand-held GM
15 cm^2 detector

Direct Measurments - On each of the 4 exposed surface areas of each footing take a 1 minute fixed Beta measurement on the area with the highest Beta scan reading or the highest microR reading.

- Take (20)100cm^2 smears for removable contamination.

Exposure Rate Measurements- Scan 100% of the surface areas with a MicroR meter at contact and 1 meter.

Alert Levels

Beta monitoring: > 200 cpm above the appropriate background using the 100cm^2 probe.
> 100 cpm above background using a portable GM detector.

Exposure Rate Measurements

10 µR/hr above background.

This plan prepared by Phil Poole as per Paul Maschka.

Phil Poole
7-7-99

OK Paul R. Maschka

Date: July 23, 1999
Prepared by: John Turner

Approved: Laura Gonzales Laura D Gonzales Date: 7/23/99
Paul Maschka Paul R McDonald Date: 7/23/99

Survey Plan for Concrete Slabs Removed from Building 30/Room 113A

Purpose

The purpose of this survey is to determine if the concrete slabs (i.e., floor and walls) removed from Building 30, Room 113A satisfies the NRC and/or State of CA (RHB) guidelines for release to unrestricted use and ensure that the radiological conditions are below the approved release criteria specified in GA's Site Decommissioning Plan. If these materials meet the requirements for unrestricted use then these concrete slabs will be properly stored until approval from the State (RHB) and/or NRC for disposal to a local landfill.

Site Description

Building 30/31 complex is located on General Atomics' Torry Pines Mesa Site. A plan view of the GA Site is shown in Figure 1. A diagram of the 30/31 complex is shown in Figure 2. A diagram of Building 30, Room 113A is shown in Figure 3.

Background and Classification

The Linac Facility (building 30/31 complex) previously housed a 100 MeV linear accelerator and most recently housed a 14 MeV linear accelerator. Room 113A was at the "core" of all operations involving the linear accelerator. Room 113A was classified as a "suspect affected area." The total floor space was ~ 88 m^2. The floor and walls of Room 113A were sectioned into ~ 2m x 2m slabs with a concrete cutter. The slabs were removed and placed on a pallet outside the building in a temporary storage area until they could be surveyed to determine disposition. Room 113A no longer exists.

Release Limits (per GA site Decommissioning Plan)

Facilities and Equipment

The primary contaminant of concern for this site is Co^{60} based on characterization studies. The applicable guidelines for residual contamination on building surfaces are:

5,000 dpm/100cm^2 (averaged over a 1 m^2 area)
15,000 dpm/100cm^2 (maximum in a 100 cm^2 area if the average over 1 m^2 is met)
1,000 dpm/100cm^2 (removable activity)

Exposure Rate Level

The guideline value for exposure rates measured at 1 m above the surface is 10 μR/hr above background.

Alert Levels

Beta Alert Levels

If the following "alert levels" are exceeded, notify HP Management so an evaluation can be performed to determine if increased survey coverage is required.

> 400 cpm above the appropriate background using the large area (434 cm^2) probe.
> 600 cpm above the appropriate background (using the 100 cm^2 probe) for 2 minute counts.
> 50 cpm above the appropriate background using the GM 15 cm^2 pancake probe.

Note: If the alert level during scanning with the 434 cm^2 probe is exceeded, survey this area with the GM 15 cm^2 pancake probe to determine activity. If the alert level with the GM probe is exceeded, measure the exposure rate (on contact) with a micro R meter to determine if the μR/hr limit is exceeded. Notify HP management with the survey results and locations to determine the course of action.

Exposure Rate Alert

Background is typically ~15 μR/hr (i.e., an average of 12-18 μR/hr range) at 1 meter above the surface. The alert level is 20 μR/hr at 1 meter from the surface. The alert level is 25 μR/hr at the surface (~ 6").

Notes:

(1) Conduct most of the surveys on the concrete surfaces that faced the interior of the building (i.e., inside surfaces of the walls and top surface of the floor). These are the surfaces that would have been susceptible to activation from the linear accelerator operations.

(2) Conduct surveys on the sides of the concrete slab where they were sectioned with the concrete cutter (4 sides, each ~ 1 foot thick).

(3) Spot check (GM survey) on the exterior portions of the walls that were in contact with ground (earth/dirt) material and spot check (GM survey) the bottom side of the floor slabs.

(4) Only β/γ type surveys will be conducted due to the nature of the radiation present or possibly present.

Documentation

Every radiological survey conducted must be documented on a daily basis to a worksheet/log book and on a drawing showing the appropriate locations surveyed. The documentation must include the results of the measurements (including units), the technician's printed name and signature, date, instrument(s) used (including the model and serial number of both the ratemeter and the detector), calibration due date, % efficiency, background readings (if applicable) and any other pertinent information.

Surveys for Building 30/Room 113A Concrete Slabs

Type of Survey	Surveys to be Performed on the "Suspect Affected Area" Concrete Slabs
Masslin Surveys	No
Grid (1 x 1 meter)	Not feasible (the slabs are only ~ 2m x 2m in size)
Conduct surveys using instruments/probes with known background levels or determine background levels at Building 13 before usage. Structural materials that will be encountered are concrete and maybe metal rebar.	
Concrete Slabs (1) (2) (Scan top surface w/434 cm^2 β probe)	100% β (interior facing surfaces only)
Concrete Sides (1) (2) (Scan each surface w/434 cm^2 β probe)	100% β (sectioned sides only @ ~ 1 foot thick)
Number of Planned Measurements on the Concrete Slabs (3) (4)	Total of 4 on each concrete slab removed from the floor and walls of Room 113A, as follows: (a) take 2 (2 min.) fixed β measurements, and (b) take 2 wipes
Number of Planned Measurements on the Sectioned Concrete Sides (3)	Take 1 (2 minute) fixed β measurement per side (a total of 4/slab), and take each measurement on rebar, if exposed
μR/hr Readings on all surfaces (~ 6")	Scan ~ 50% of all surfaces (record range/concrete slab)

(1) Clean all surfaces to remove debris or dirt (sweep and/or vacuum, as needed).

(2) If contamination above the alert level is detected on any of the surfaces, Health Physics will evaluate the need for additional survey coverage. Survey coverage will be increased if contamination levels above 75% of background levels are detected (the Site Plan requires reclassification if levels >75% are detected).

(3) For the fixed measurements:

- For β measurements; take a 2 minute count using the 100 cm^2 gas flow proportional detector (beta) with the Model 2221 ratemeter. Document all readings and mark on a drawing where the readings were taken.

(4) For removable measurements:

- Take a 100 cm^2 wipe at select locations; count using a low level α/β counter in the HP Lab. Document all readings and mark on a drawing where the readings were taken.

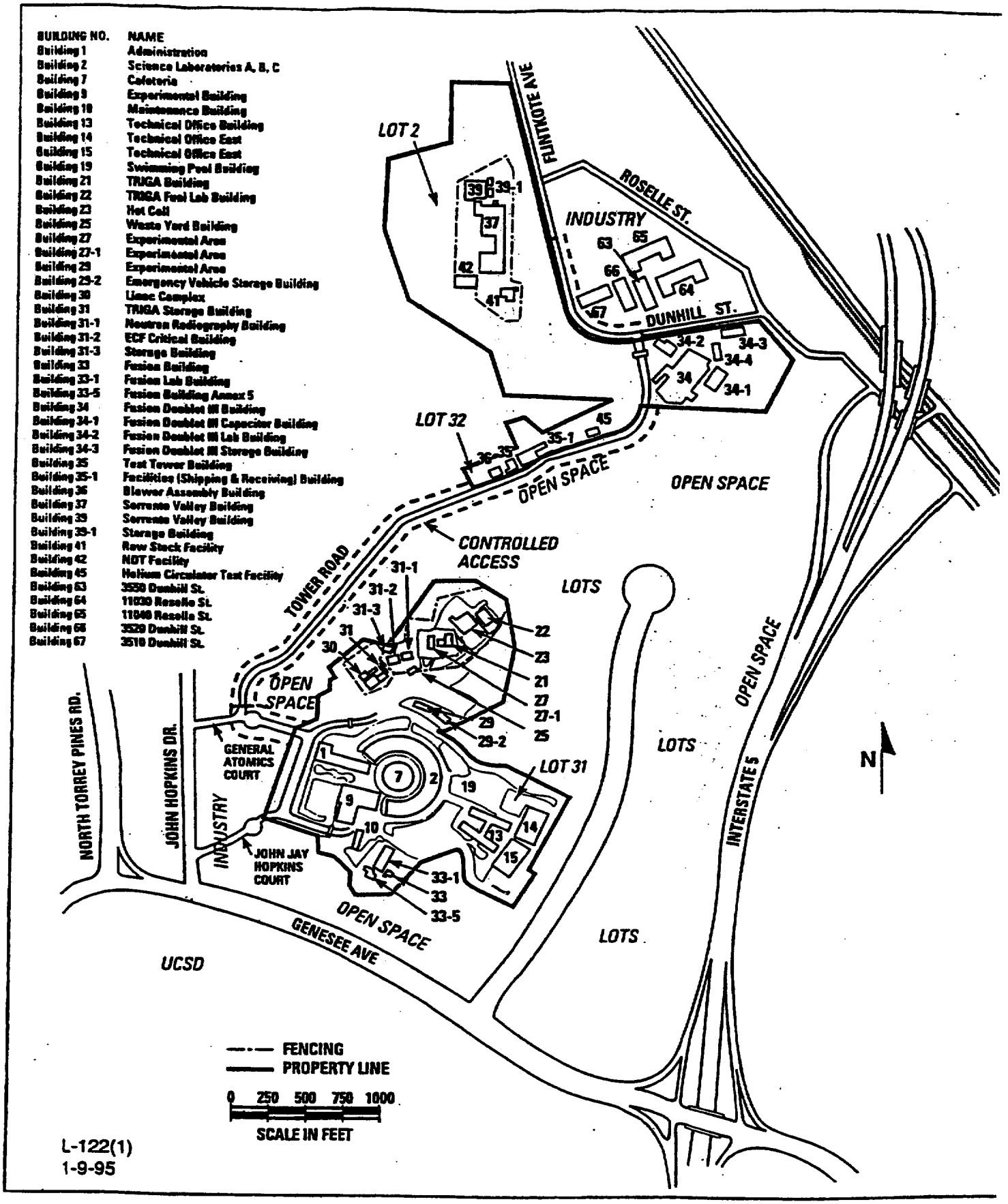
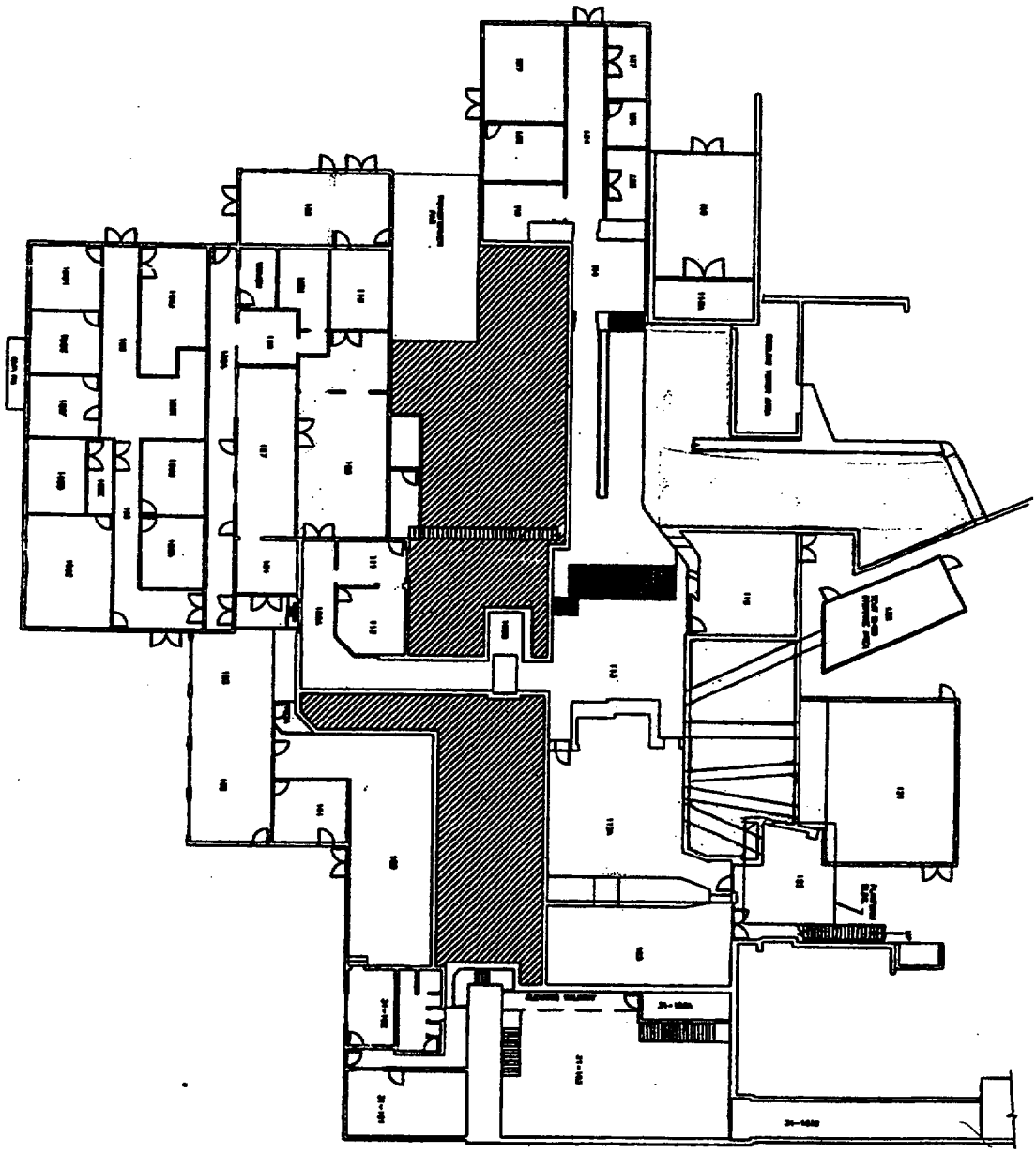
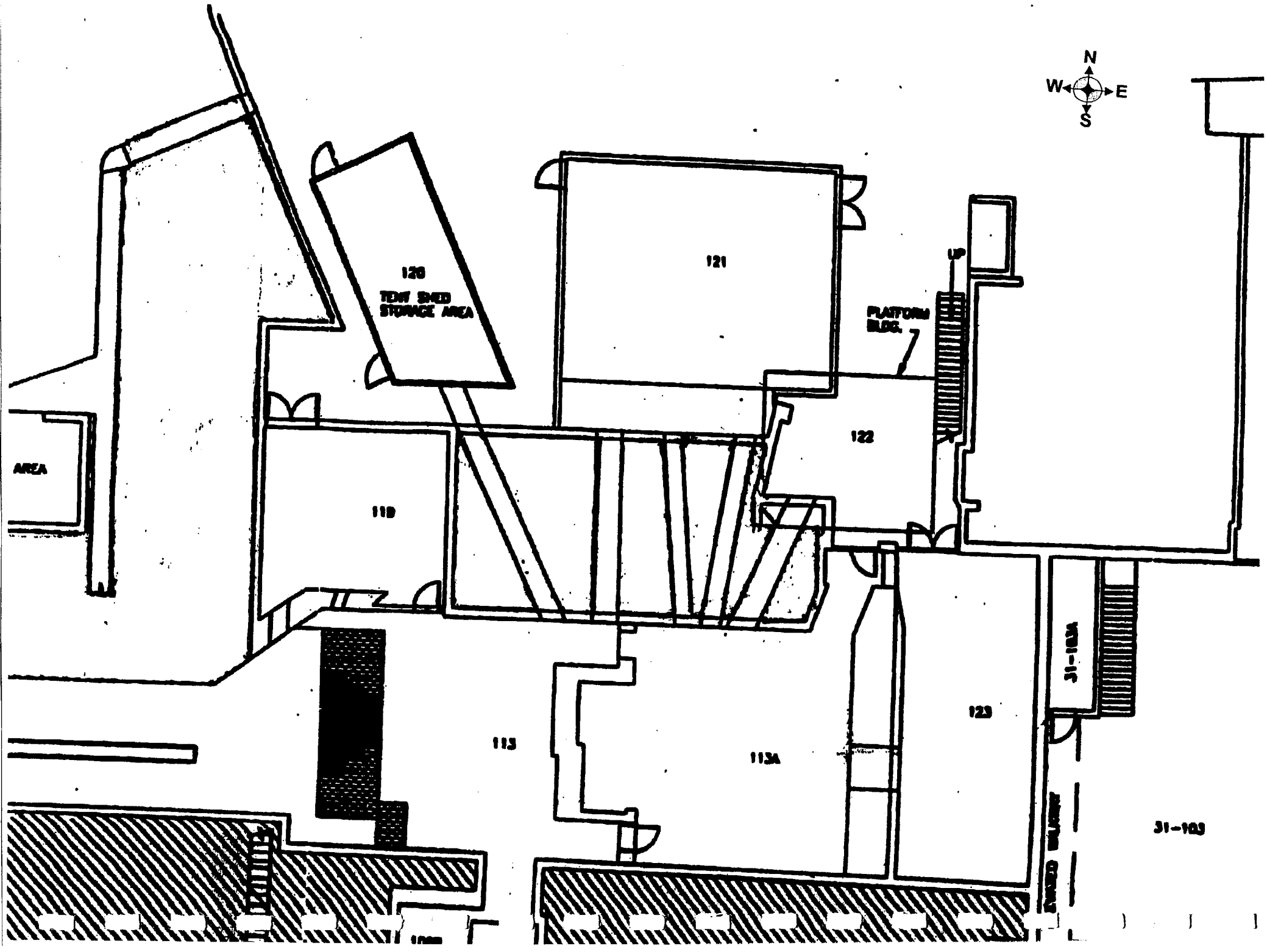


Figure 1: Plan View of General Atomics Site



PROJECT BUILDING 30 AND 31	GENERAL ATOMICS	PROPRIETARY INFORMATION	DESIGN BY		DATE ISSUED 07/27/94
DESCRIPTION OCCUPANCY			REV.	DESCRIPTION	APPROVED DATE
			A	RELOCATION OF BUILDING 2 TO BUILDING 30	H. LOMAX 2/27/95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121
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PLATFORM
BLDG.
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119
123
113
113A
31-109

August 19, 1999

Prepared by Paul R. Maschka

Approved Paul R Maschka Date 8-19-99
Paul R. Maschka

SURVEY PLAN FOR THE NORTHEAST ENTRANCE TUNNEL TO ROOM 113a BUILDING 30

Classification
The tunnel entrance is not expected to be contaminated or activated and is classified as a unaffected area at this time. If the surveys show fixed or removable contamination the classification will be changed and the survey requirements will be increased.

SURVEYS

Gridding - Not required

Scanning - Scan 100% of the floor, walls, and ceiling for **beta** radiation using the 434 cm^2 probes. Mark all areas above the alert levels and survey those areas with hand-held GM pancake detectors.

Direct Measurements - Take 6 direct measurements with 100 cm^2 beta probe (2 minute count) evenly spaced across the surface of the floor, 6 on the ceiling and 6 on each wall, take a minimum of 24 measurements. Take 4 smears each on the floor, walls, and ceiling.

Exposure Rate Measurements - Scan 100% of the floor and wall surfaces at contact with a microR meter.

Documentation
The radiological survey conducted must be documented to a worksheet or logbook and on a drawing showing the appropriate locations surveyed. The documentation must include the results of the measurements (including units), the technicians printed name and signature, date, instrument(s) used (including the model and serial number of both the ratemeter and the detector), calibration due date, % efficiency, background readings (if applicable) and any other pertinent information.

Alert Levels

Notify Health Physics Management if any of the following alert levels are exceeded:

Beta Monitoring

>300 cpm above the appropriate background using the 434 cm^2 probe.
>200 cpm above the appropriate background using the 100 cm^2 probe.
>150 cpm above background using a portable GM detector.

Exposure Rate Measurements

10 μR/hr above background.

October 20, 1999
Prepared by Paul R. Maschka PM by LL

Approved Laura Gonzales Date 10/22/99
Laura Gonzales

FINAL SURVEY PLAN FOR BUILDING 30, PHASE 5, LINAC CORE

Building-30 Phase 5 includes the areas that had been rooms 108, 113, 113a, 114, 114a, 119, 120, 122, and 123 as shown in Figure 1.

PURPOSE

The purpose of this survey is to confirm that these rooms meet the criteria for release to unconditional use.

BACKGROUND

Characterization surveys were completed for Rooms 108, 114a, 114, 113, 113a, 119, 120, and 122. The surveys taken in Rooms 108, 114a, 114, 113, 119, and 120 were below the release criteria for unconditional use. The floor, walls, and ceiling in Room 113a were activated. Core samples were taken and they revealed that the rebar and the concrete contained concentrations of Co-60 that were above the release level.

The top, north and south exterior sides of the building (Room 113a) were covered with soil for personnel shielding. The soil was sampled and was free of contamination except for one foot of soil that was immediately on top of the roof. This top soil and two samples from the sides were contaminated with Co-60 that measured above background but below the release level. The soil was removed and sent to the temporary soil storage area where it waits for release surveys by the NRC and/or the State of California.

After the soil was removed, the floors, walls and ceiling (Room 113a) were cut into ~ 6' X 8' slabs and were removed. The concrete slabs were laid out in the LINAC back yard area and surveyed over 100% of their surface. Those slabs that were above the release level were packaged and sent to the NTS as radioactive waste. The slabs that were below the release level were sent to the temporary storage area where it waits for release surveys by the NRC and/or the State of California.

Room 122 was a platform building constructed of sheet metal that was located to the north of the LINAC building. This building was surveyed inside and out and it measured below the release

criteria. The building was disassembled and sent to the temporary storage area where it waits for release surveys by the NRC and/or the State of California.

Room 120, located to the north of the LINAC building, had a concrete floor and concrete walls up ~ 4 feet. Above the four feet the walls and ceiling were sheet metal. This building was surveyed and it met the criteria for free release. The concrete was sent to the temporary storage area where it waits for release surveys by the NRC and/or the State of California. The soil under the floor was sampled and all the samples were below the release criteria.

Room 119 was a concrete and sheet metal room. It was surveyed and it met the criteria for free release. It was dismantled and sent to the temporary storage area where it waits for release surveys by the NRC and/or the State of California.

Room 123 has not been characterized. Therefore, the final survey for this room will be thorough. Alpha activity, as well as beta activity, will be investigated due to some of the experiments conducted, exclusively, within this area. If elevated levels of activity are discovered within this area the final survey will be halted and the area(s) decontaminated. Room 123 is isolated from the rest of the rooms being investigated during the Final Survey Plan and decontamination activities will not be detrimental to any of the final surveys being conducted in these areas.

All that remains of the facility are Rooms 114a, 114, 113, 123, floor & walls of 119, floor of 122 and the soil beneath & to the sides of Room 113a and its one remaining wall.

Classification

Rooms 114, 114a, 113, 119, the soil north and south of room 113a, and the floor for room 122 are classified as Unaffected Areas.

Room 123 is classified as Non-Suspect Affected Area.

Room 113a, all that remains is the soil and one wall that are classified as Suspect Affected Areas.

Release Levels (per GA's Site Decommissioning Plan)

Facilities and Equipment

The primary contaminant of concern for this site is Co-60. The applicable guidelines for residual contamination on building surfaces are:

5,000 dpm/100 cm^2 (averaged over 1 m^2 area)
15,000 dpm/100 cm^2 (maximum in a 100 cm^2 area if the average over 1 m^2 is met).
1,000 dpm/100 cm^2 (removable activity)

Exposure Rate Level

The guideline value for esposure rates measured at 1 m above the surface is 10 μr/hr above background.

Soil Release Criteria

The predominant radionuclide found at Building 30 is Co-60 and the soil release criteria for Co-60 is 8 pCi/gm.

ALERT LEVELS

Notify Health Physics management if any of the following alert levels are exceeded.

Smears

If any smear is >75% of the release level (> 750 dpm/100cm²).

Beta Monitoring

> 300 cpm above Building 13 background using the 434 cm² probe.
> 200 cpm or 400 counts in 2 minutes above Building 13 background using the 100 cm² probe.
> 100 cpm above background using a portable GM detector.

Exposure rate Measurements

> 25 μR at contact
> 20 μR at 1m above the surface

SOIL SAMPLES

Soil samples will be collected with a sample size of approximately 1 kilogram. The sampling locations will be identified on drawings. The samples will be properly logged, labeled, tracked and packaged into plastic bags. All debris (grass, rocks, sticks and foreign objects) will be removed from the sample. Soil samples will be crushed to reduce large lumps. All samples will be dried, placed into tared marinelli beakers (filled to the top), secured, weighed, transferred to and counted in the GA Health Physics Laboratory by gamma spectroscopy. Results will be reported in pCi/g for each radionuclide of concern.

DOCUMENTATION

Every survey conducted must be documented *on a daily basis* on a drawing showing the approximate locations surveyed. Include the results (including units), the technician's signature, date, instrument(s) used (including model and serial number of both the ratemeter and the detector), calibration due date, % efficiency, background readings (if applicable) and any other applicable information.

FINAL SURVEY FOR BUILDING-30 PHASE 5 , (LINAC CORE) FOLLOWING THE REQUIREMENTS OF THE SITE DECOMMISSIONING PLAN [1]						
Room or Location	SCANS			MEASUREMENTS	PAINT SAMPLES	EXPOSURE RATE MEASUREMENTS
	Floor and Walls Below 2 m	Walls above 2 m	Overhead Fixtures			
	Survey	Survey	Survey	Direct and Smears [2]	No. of Samples	µR Survey
Unaffected Areas						
Room 114a NEEDS DOING	100% beta only	10% beta only	None	16 direct beta 16 smears	4	Scan 20% of the surface ~ 2" above floor. Take 1 measurement every 3 m or a minimum of 6 readings, evenly spaced.
Room 114	100% beta only	10% beta only	None	16 direct beta 16 smears	4	Scan 20% of the surface ~ 2" above floor. Take 1 measurement every 3 m or a minimum of 6 readings, evenly spaced.
Room 113	100% beta only	10% beta only	None	16 direct beta 16 smears	4	Scan 20% of the surface ~ 2" above floor. Take 1 measurement every 3 m or a minimum of 6 readings, evenly spaced.
Former Room 119. Remaining floor and walls.	100% beta only	None	None	16 direct beta 16 smears	None	Scan 20% of the surface ~ 2" above floor. Take 1 measurement every 3 m or a minimum of 6 readings, evenly spaced.
Former Room 122 Floor only	100% beta only	None	None	8 direct beta 8 smears	None	Scan 20% of the surface ~ 2" above floor. Take 1 measurement every 3 m or a minimum of 6 readings, evenly spaced.
Soil North and South of room 113a	N/A	N/A	None	Lay out a 4m x 4m grid. Take one surface sample (0-6") every 4m [3] ← (4)	N/A	Scan 20% of the soil surface ~ 2" above. Take 1 measurement every 3 m or a minimum of 12 readings, evenly spaced.
Room 108 (former shield wall area)	100% beta only	10% beta only	None	8 direct beta 8 smears	N/A	Scan 20% of the surface ~ 2" above floor. Take one measurement every 3 m or a minimum of 4 readings, evenly spaced.

FINAL SURVEY FOR BUILDING-30 PHASE 5 , (LINAC CORE)
FOLLOWING THE REQUIREMENTS OF THE SITE DECOMMISSIONING PLAN [1]

Room or Location	SCANS			MEASUREMENTS	PAINT SAMPLES	EXPOSURE RATE MEASUREMENTS
	Floor and Walls Below 2 m	Walls above 2 m	Overhead Fixtures			
	Survey	Survey	Survey	Direct and Smears [2]	No. of Samples	μR Survey
Non-Suspect Affected Area						
Room 123	100 % alpha & beta	10 % alpha & beta	25% alpha & beta	20 direct beta & 20 direct alpha 20 smears	None	Scan 50% of the surface ~ 2" above floor. Take 1 measurement every 3 m or a minimum of 10 readings, evenly spaced.
Suspect Affected Areas						
Room 113a. one remaining wall	100% of the wall (lower wall, below 2 meters)	10% or 25% of walls above 2m [3]	None	15 direct beta 15 smears	None	N/A
Room 113a soil	N/A	N/A	N/A	Lay out a 4m x 4m grid. Take one surface sample (0-6") every 4m. [4]	N/A	Scan 100% of the surface ~ 2" above soil. Take 1 measurement every 2 m or a minimum of 36 readings, evenly spaced.

(1) Survey coverage will be increased if contamination levels above 75% of release levels are detected (the Site Plan requires reclassification if levels > 75% of release levels are detected).

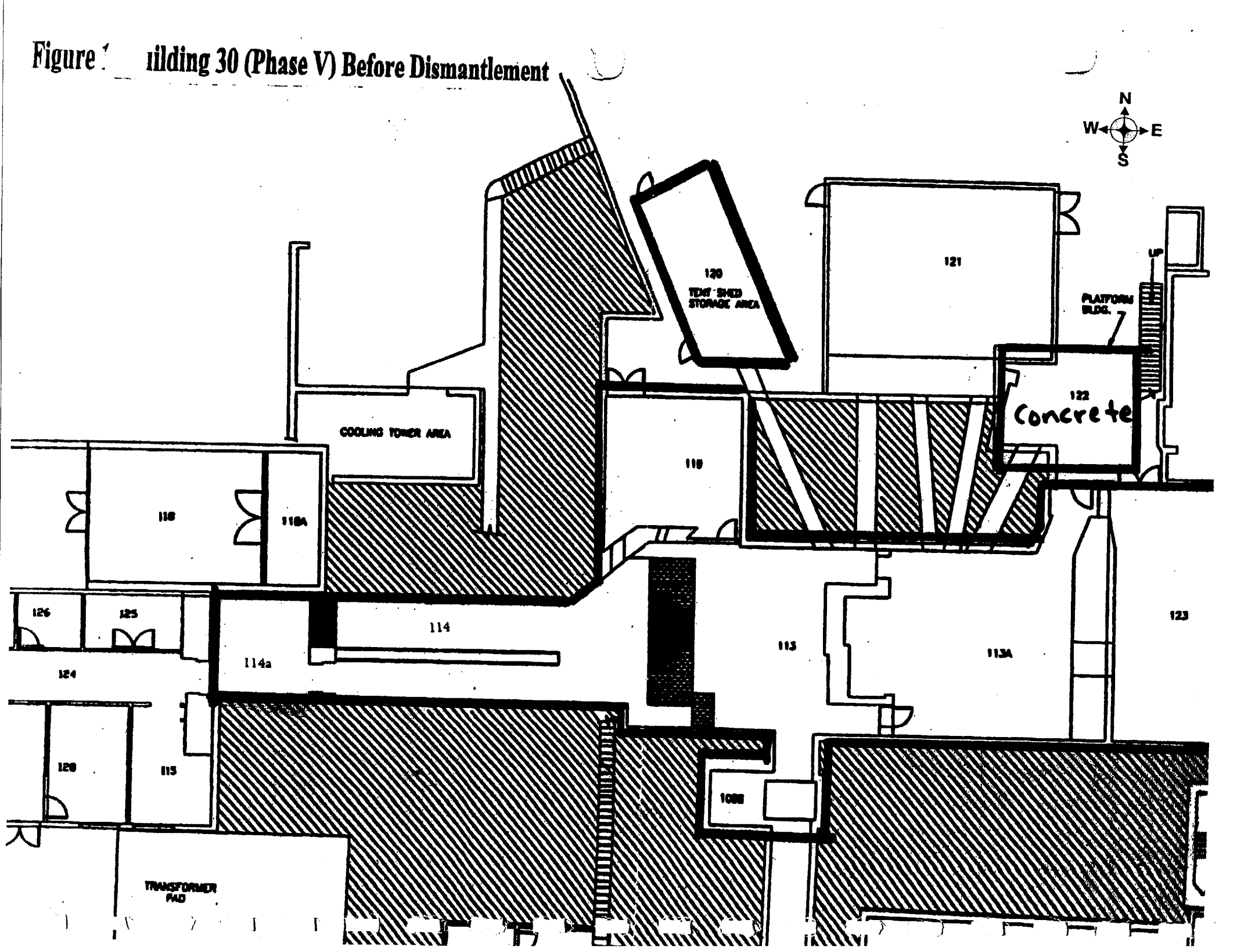
(2) For the fixed (direct) measurements:

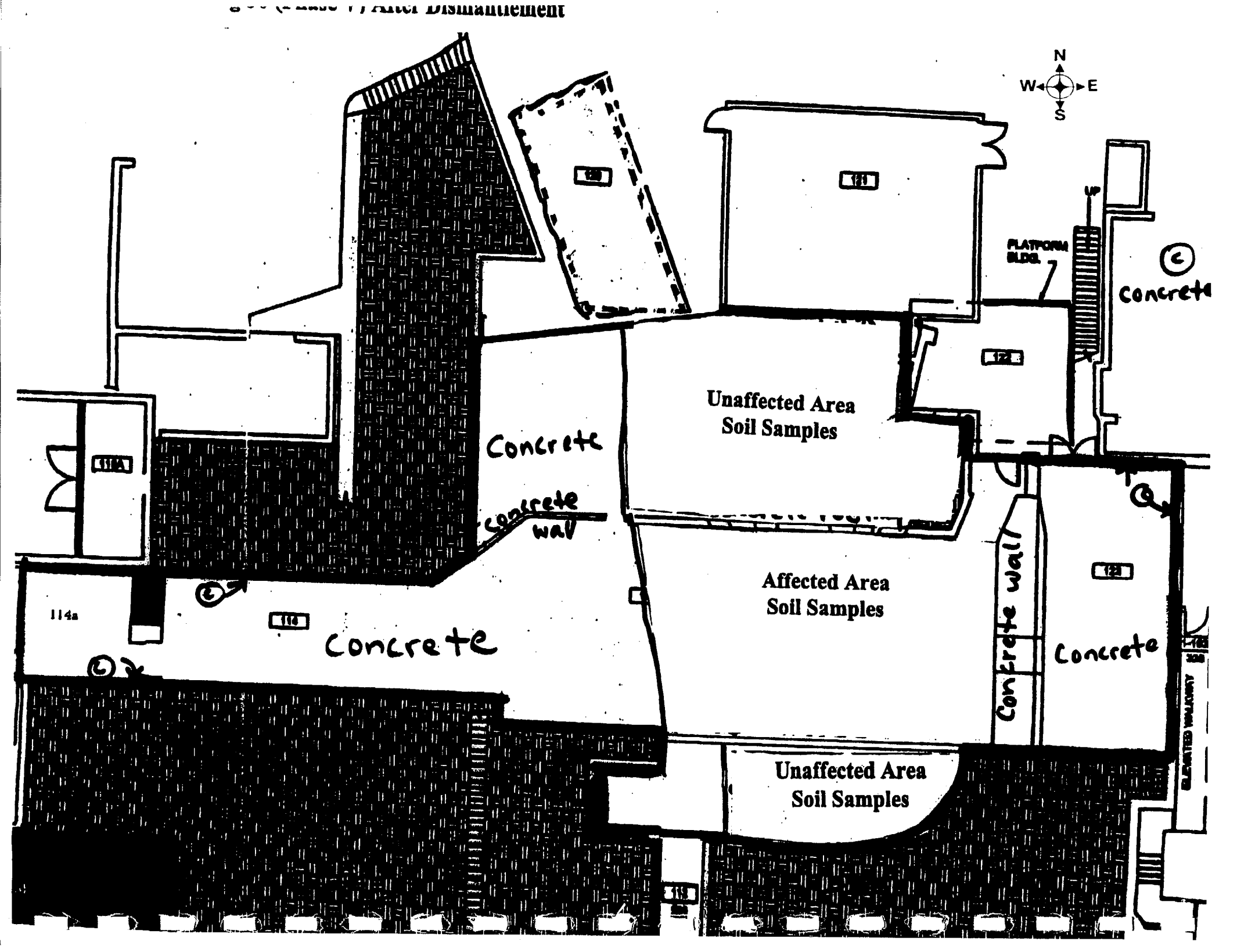
- For β measurements: take a 2 minute count using the 100 cm^2 gas flow proportional detector (beta) with the Model 2221 ratemeter. Document all readings and mark on a drawing where the readings were taken.
- For α measurements: take a ~ 10 second reading with the 50 cm^2 hand-held alpha detector. Document all readings and mark on a drawing where the readings were taken.
- For removable measurements (smears): take a 100 cm^2 smear at select locations; count using a low level α/β counter in the HP Laboratory. Mark on a drawing where the smears were taken.

(3) If contamination is detected on the lower portion (< 2 m) of the wall, then scan 25% for α & β.
If no contamination is detected on the lower portion (< 2 m) of the wall, then scan 10% for α & β.

(4) The Site Decommissioning Plan requires sampling in suspect affected areas on a 5 m triangular grid. Sampling on a 4 m x 4 m grid is more conservative and consistent with the established grid needed for fixed and removable measurements.

Figure 1 Building 30 (Phase V) Before Dismantlement




N
W
E
S
Unaffected Area
Soil Samples
Affected Area
Soil Samples
Unaffected Area
Soil Samples
Concrete
concrete wall
Concrete
Concrete
Concrete
Concrete wall
PLATFORM BLDG.
114a

FINAL SURVEY PLAN FOR BUILDING 30, ROOMS 123 AND 118

Prepared by: Paul R. Maschka Date: 4/3/00
Paul R. Maschka

Approved by: Laura Gonzales Date: 4/3/00
Laura Gonzales

Background

Building 30 previously housed a 100 MeV linear electron accelerator (LINAC). The LINAC consisted of two in-line accelerators which were operated independently at 25 and 75 MeV, respectively. The two accelerators could be connected in tandem and could operate up to 100 MeV. The single section accelerator located in the west end of room 114 could direct the electron beam into Room 118. The three-section accelerator located in the east end of Room 114 could direct the electron beam into other rooms including Room 123.

Survey Objectives and Responsibilities

The purpose of performing a final survey is to demonstrate that the radiological conditions in each room satisfy the NRC and State of CA guidelines for release to unrestricted use. The objective include (1) to show that the average surface contamination levels for each survey unit are within the authorized value, (2) to show that the maximum residual activity ('hot spot" area do not exceed three times the average value in an area up to 100 cm^2 and (3) that a reasonable effort has been made to clean removable contamination and fixed contamination and (4) that the exposure rates in occupiable locations are less than 10 μR/hr above background measured at 1 meter above the surface. Samples will be counted in GA's Health Physics laboratory. Surveys will be taken only by qualified Health Physics Technicians having a minimum of 3 years Health Physics Technician experience following approved Health Physics procedures and this Plan. The survey and final report documenting eh survey will be performed by GA's Health Physics group.

History of Use of Radioactive Materials

Room 118 was used for sterilization of medical products and radiation processing of gem stones and semiconductors. Most recently a new concrete block divider wall was erected to form a storage room for two casks containing irradiated fuel from the Hot Cell. After the fuel casks were moved to Building 31, the divider wall was surveyed and found to be below the approved guidelines for release to unconditional use. That wall has been dismantled and disposed of as clean waste. A small section of the north wall in this room still contains activated radioactive materials due to past accelerator operations, and will require careful examination to determine the extent and quantity of activation. It is anticipated that some of this wall may need to be removed.

Three core samples were removed from the north wall and divided into a concrete sample and a rebar sample (one core did not have any rebar). From each location two samples were collected from the soil that is behind the wall. The gamma scan of the rebar showed Co-60 activity levels of 0.11 pCi/g and 0.23 pCi/g. Only one concrete sample showed any Co-60 and that was 0.02 pCi/g. All of the soil samples were at or near background levels and no Co-60 was detected. Additional core samples may be taken during this final survey if the direct measurements show elevated readings above the alert levels.

Room 123 had been used for critical and subcritical reactor experiments. The west wall was activated and a large part of the wall has been removed to eliminate the radioactive materials. The hydraulic ram that had been in pit in the floor was dug out and removed. The concrete, soil, and the ram itself were all below the approved guidelines for release to unconditional use, no Co-60 nor Eu-152 or Eu-154 were detected in the gamma scans of the soil and concrete samples. The ram was disposed of as clean waste. The concrete and soil removed from the pit is stored in drums and will go to the temporary soil storage area until released by the State and/or the NRC.

Classification

Both of these rooms are classified as Suspect Affected Areas.

Release Limits

The primary contaminants are Co-60, Eu-152, and Eu-154 (beta/gamma emitters).

Beta/Gamma Emitters

5000 dpm/100 cm^2, averaged over a 1m^2 area

15,000 dpm/100 cm^2, maximum in a 100 cm^2 area if the average over 1 m^2 is met.

1000 dpm/100 cm^2, Removable activity

Alert Levels

Notify Health Physics management if any of the following alert levels are exceeded.

Smears

If any smear is >75% of the release level (750 dpm/100 cm^2), increase the number of smears to define the area of contamination and mark the area.

Alpha Alert Levels

If the following "alert levels" are exceeded, notify HP Management so an evaluation can be performed to determine if increased survey coverage is required or to evaluate decontamination requirements.

>100 cpm alpha using the large area (434 cm^2)probe.

>60 cpm using a hand-held alpha probe (50 cm^2) - (~1500 dpm/100 cm^2)

Beta Alert Levels

If the following "alert levels" are exceeded, notify HP Management so an evaluation can be performed to determine if increased survey coverage is required or to evaluate decontamination requirements.

>~300 cpm beta above background using the large area (434 cm^2) probe
>~200 cpm above background using the 100 cm^2 probe
>~100 cpm above background using a portable GM detector.

Exposure Dose Rate Measurements
If the following "alert levels" are exceeded, notify HP Management so an evaluation can be performed to determine if increased survey coverage is required or to evaluate decontamination requirements.
>30 μR/hr on the surface.

Documentation
Every survey conducted must be documented *on a daily basis* on a drawing showing the approximate locations surveyed. Include the results (including units), the technician's name and signature, date, instrument(s) used (including model and serial number of both the ratemeter and the detector), calibration due date, % efficiency, background readings (if applicable) and any other applicable information.

Note: The marked "Spot" on the north wall in Room 118 should be surveyed first. Survey 100% of the surface of the "spot" with the 100 cm^2 beta probe and with a MicroR meter. Document the data on a drawing for HP Management to review. Further core samples may need to be taken to determine if parts of this wall need to be removed.

Final Surveys For Building 30, Rooms 118 and 123

Type of Survey	30 - 118	30 - 123
	Suspect Affected Area	Suspect Affected Area
Gridding	Yes 1m x 1m floor and wall up 2m	Yes 1m x 1m floor and wall up 2m
Floor α Scan with 434 cm ^{2} probe	10% (no uncontained U or Th was used or stored in this room)	100%
Floor β Scan with 434 cm ^{2} probe	100%	100%
Walls β Scan with 434 cm ^{2} probe	North wall 100% to Ceiling All other walls 100% up 2m and 10% above 2m	All Walls 100% to the Ceiling
Walls β Scan with 100 cm^2 beta probe	**100% of the Marked "spot' on north wall**	**NA**
Overhead Fixtures β Scan hand held GM detectors	10%	10%
Number of Fixed Measurements with 100 cm^2 beta probe	16 on floor, 4 on each wall at 5' above the floor	12 on floor 4 on each wall at 5' above the floor
Number of smears	16 8 - floor 8 - wall	16 8 - floor 8 - wall
Number of MicroR measurements	Scan 100% of the surface of the floor and suspect area on the wall. Take a measurement Every 2m - 1m above floor.	Scan 100% of the surface of the floor. Take a measurement Every 2m - 1m above floor.

Note: The marked "Spot" on the north wall in Room 118 should be surveyed first. Survey 100% of the surface of the "spot" with the 100 cm^2 beta probe and with a MicroR meter. Document the data on a drawing for HP Management to review. Further core samples may need to be taken to determine if parts of this wall need to be removed.

APPENDIX B

BUILDING 30 PHASE V

RESULTS OF GA'S INTERNAL CONFIRMATORY SURVEY

Appendix B
Building 30 Phase V
GA Confirmatory Survey

Description

Following the completion of the Final Survey of Building 30 Phase V, a confirmatory survey was performed by a Health Physics Technician who had not worked on the Final Survey. The Confirmatory Survey was performed in accordance with an approved Survey Plan (attached). The purpose of this survey was to confirm that the Final Survey performed was effective in identifying the radiological conditions of the area.

The survey consisted of beta scans with a 434 cm^2 gas flow proportional counter in all rooms and alpha scans in Room 123 with a 434 cm^2 gas flow proportional counter; fixed beta and alpha measurements in each room with a 100 cm^2 beta proportional counter and a 50 cm^2 alpha scintillation detector; removable contamination smears ; exposure rate scans at ~6" above the floor and exposure rate measurements at 1 meter above the surface; and soil samples from areas where the concrete was removed.

A description of instruments used for this survey, along with their calibration, efficiency, and background information is provided in Table 3.

Survey Results

The highest beta scan was 2000 - 2200cpm (Background = 1600 - 1995cpm). The highest alpha scan was 0 - 20cpm (Background = 0-20 cpm). See the figures for the locations and results of the surveys.

Fixed beta measurements above the MDA (232 dpm/100 cm^2) measured from 252 to 768 dpm/100 cm^2. Fixed alpha measurements were all <20 cpm/100 cm^2 (~ background). See the figures for the results and location of the surveys.

The exposure rate measurements at 1 meter above the floor measured 16-30 μR/hr. See the figures for the results and location of the surveys.

The highest removable contamination results was sample # 6 , in Room 123, 49 alpha dpm/100 cm^2, all other alpha smears were <15 dpm/100 cm^2. The highest beta sample was # 6 which measured 117 dpm/100 cm^2 (beta) in Room 123, all other beta smears were <25 dpm/100 cm^2. See the figures for the location of the smears and Table 2 for the results of the smears.

Soil samples were collected from exposed areas. All samples were below the approved criteria for release to unconditional use. See the figures for the locations of the soil samples and see Table 1 for the results of the analysis of the soil samples.

Conclusion

All of the Confirmatory Surveys results indicated that activity levels in the Phase V area are below the approved release criteria, which agrees with the Final Survey results.

TABLE 1: GAMMA SPECTROSCOPY RESULTS OF SOIL SAMPLES FROM BUILDING 30 PHASE V CONFIRMATORY

Radionuclide Concentration (pCi/gm) - Results ± 2σ - Background not Subtracted - 30 minute counts

Sample ID	Figure No.	Location	^{137}Cs 662 kev peak	^{60}Co Ave.of 1173/1332 peaks	^{154}Eu Average of 123/102/1280 Kev peaks	Total Thorium $^{228}Th+^{232}Th$	^{238}U 63.2 (92.8) keV peak	^{235}U 186(144) keV peak
SOIL SAMPLES FROM ROOM 113A LOCATION								
B30-113A -1	CS 7	N-W Corner	ND	ND	ND	3.40	2.95 ± 1.57	0.20 ± 0.20
B30-113A - 2	CS 7	N Center	ND	ND	ND	3.57	2.21 ± 1.65	0.22 ± 0.22
B30-113A - 3	CS 7	N-E Corner	ND	ND	ND	3.94	2.04 ± 1.66	0.21 ± 0.21
B30-113A - 4	CS 7	S-E Corner	ND	ND	ND	3.61	2.08 ± 1.31	0.16 ± 0.08
B30-113A - 5	CS 7	S Center	ND	0.11 ± 0.06	ND	3.38	2.18 ± 1.39	0.23 ± 0.10
B30-113A - 6	CS 7	S-W Corner	ND	ND	ND	3.65	2.45 ± 1.29	0.14 ± 0.08
B30-113A - 7	CS 7	N Footing	ND	ND	ND	2.94	1.87 ± 1.33	0.12 ± 0.07
B30-113A - 8	CS 7	S Footing	ND	ND	ND	3.49	0.85 ± 0.99	0.18 ± 0.08
SOIL SAMPLES FROM ROOM 123 PIT								
B30 - 123 PIT -1	CS 1	PIT	ND	ND	ND	3.55	1.77 ± 1.08	0.2 1 ± 0.08
B30 -123 PIT -2	CS 1	PIT	ND	ND	ND	3.05	0.88 ± 0.85	0.16 ± 0.09
B30 - 123 PIT-3	CS 1	PIT	ND	ND	ND	3.31	1.65 ± 1.04	0.19 ± 0.09

NOTES ND Means: ^{137}Cs = <0.1 pCi/g ^{60}Co = <0.1 pCi/g ^{154}Eu = <0.1 pCi/g

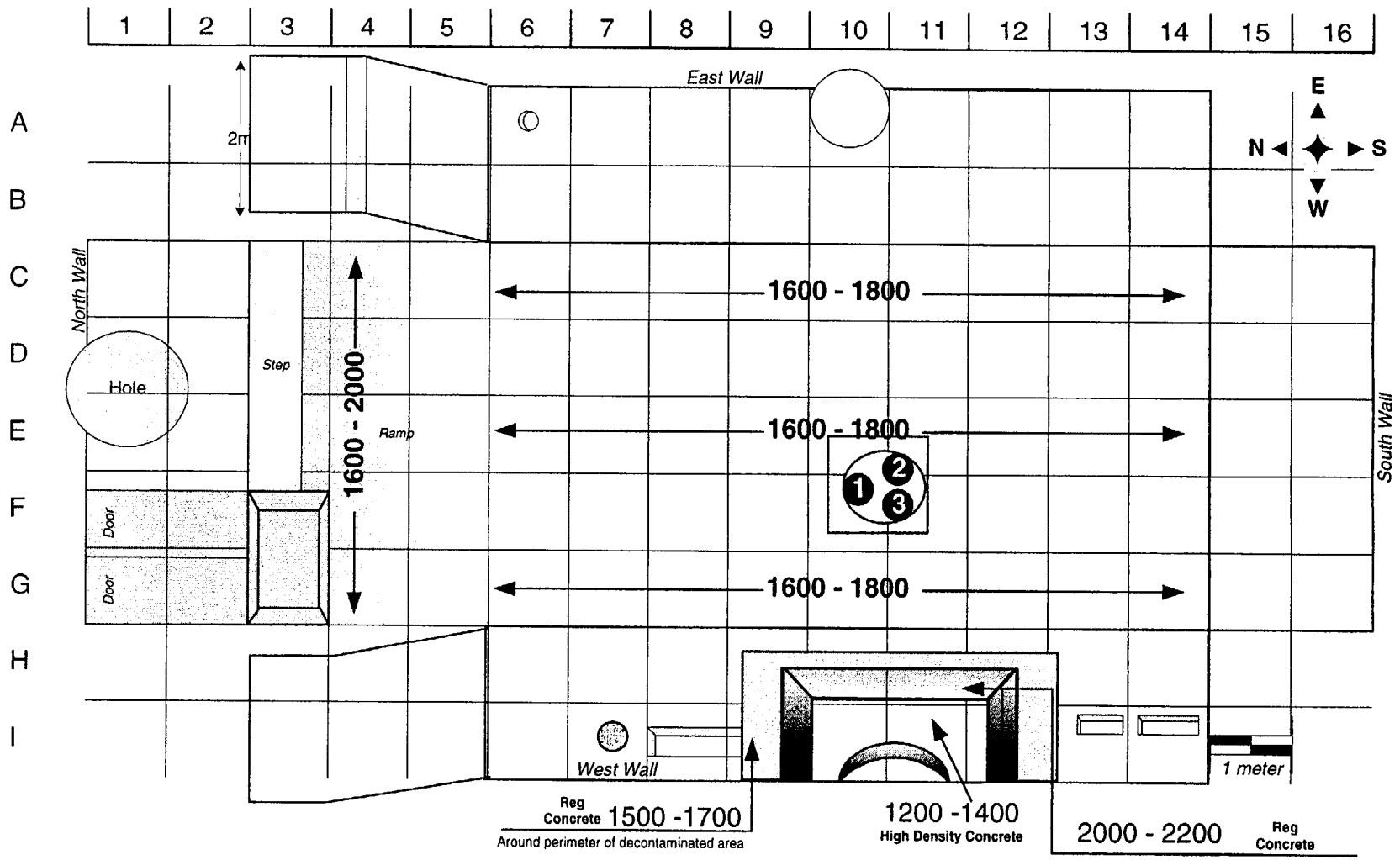
Table 2: Building 30 Phase V Removable Contamination Survey Results			
Room No.	Sample No.	Alpha dpm/100 cm²	Beta dpm/100 cm²
123	1	<10	<10
123	2	<10	<10
123	3	<10	<10
123	4	<10	<10
123	5	<10	<10
123	6	49	117
114A	1	<15	<15
114A	2	<15	<15
114A	3	<15	<15
114A	4	<15	<15
114A	5	<15	<15
114A	6	<15	<15
114 & 113	1	<10	<20
114 & 113	2	<10	<20
114 & 113	3	<10	<20
114 & 113	4	<10	<20
114 & 113	5	<10	<20
114 & 113	6	<10	<20
119	1	<10	<15
119	2	<10	<15
119	3	<10	<15
119	4	<10	<15
119	5	<10	<15
119	6	<10	<15
122	1	<10	<15
122	2	<10	<15

Table 2: Building 30 Phase V Removable Contamination Survey Results			
Room No.	Sample No.	Alpha dpm/100 cm²	Beta dpm/100 cm²
122	3	<10	<15
122	4	<10	<15
122	5	<10	<15
122	6	<10	<15

TABLE 3: LIST OF INSTRUMENTS

Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description
Ludlum Model 2221 S/N **97287**	Ludlum Model 43-37 gas proportional (434 cm^2) **Alpha detector** S/N 148926	Four Linear Ranges 0-500,000 & one Log 50-500,000	9-13-00 02-26-01	21.25% 24.25%	Varies according to surface being scanned See Table 4	Active Probe Area = 434 cm^2. The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model 2221 S/N **154202**	Ludlum Model 43-37 gas proportional (434 cm^2) **Beta detector** S/N 149017	Four Linear Ranges 0-500,000 & one Log 50-500,000	10-17-00	22.79%	Varies according to surface being scanned See Table 4	Active Probe Area = 434 cm^2. The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model 2221 S/N **84423**	Ludlum Model 43-68 100 cm^2 proportional **Beta detector** S/N 119444	Four Linear Ranges 0-500,000 & one Log 50-500,000	03-20-01 2-2-00	24.14% 19.81% (Co60) 26.20% (Sr90)	Varies according to surface being scanned	100 cm^2 gas flow proportional counter
Ludlum Model 12 S/N **91051**	Ludlum Model 43-65 **Alpha Scintillator** ZnS(Ag) S/N 94053	Four Ranges 0 - 500,000	9-14-00	21.58%	0 - 20	Active Probe Area = 50 cm^2
Ludlum Model 3 S/N **139180**	Ludlum Model 44-9 **15 cm^2 Beta/Gamma** S/N 145973	Four Ranges 0-100,000	12-27-00	21.25%	80-120 (concrete) 60-80 (metal)	The instrument is used for beta/gamma surveying. The detector has an active probe area of 15 cm^2.
Ludlum Model 19 Micro-R Meter S/N **123930**	RCA 6199 coupled to a NaI (Tl) Scintillator	Five Ranges 0-5 mR/hr	8-30-00	N/A	10-18 µR/hr	1 inch x 1 inch NaI (Tl) scintillator is mounted internally. Used for initial survey on ground floor and for measuring external dose rates on the surface and at one meter.
Canberra Low Level α/β Counter Model 2404	Gas Flow Proportional Detector	N/A	As needed	~26-30%	Varies	Canberra Model 2404 Low Level α/β gas proportional counting system used to count wipes for removable contamination. Results are usually reported as dpm/100 cm^2.
Canberra Gamma Spectroscopy System	High Purity Germanium Detector	N/A	As needed	Varies with Sample	Varies with Sample	Gamma Spectroscopy MCA system using a high purity Germanium detector.

CS 1 : BUILDING 30 Room 123 Beta Scan and Soil Sample Locations



Instrument	2221
Serial #	154202
Probe #	149017
Size / Type	434cm²
Cal Due	10/17/00
Eff %	22.97
Background	1600 - 1995

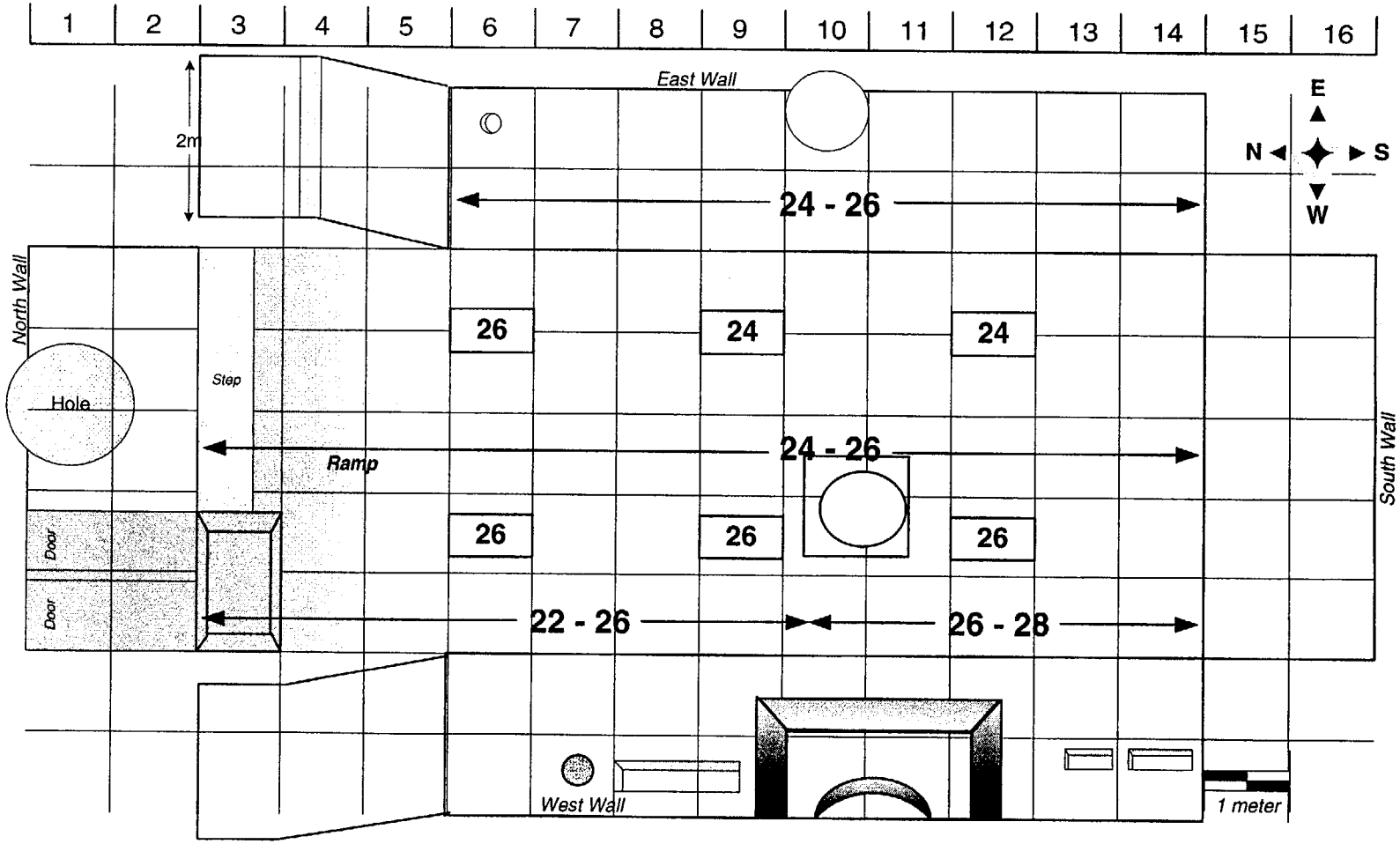
0000 - 0000 = Beta scan reading in cpm

❶ = Soil sample Location

Technician : J.T. Sullivan
Date : 08/30/00

HDC = High density Concrete & RC = Regular concrete

CS 2 : BUILDING 30 Room 123 Exposure Rate Survey



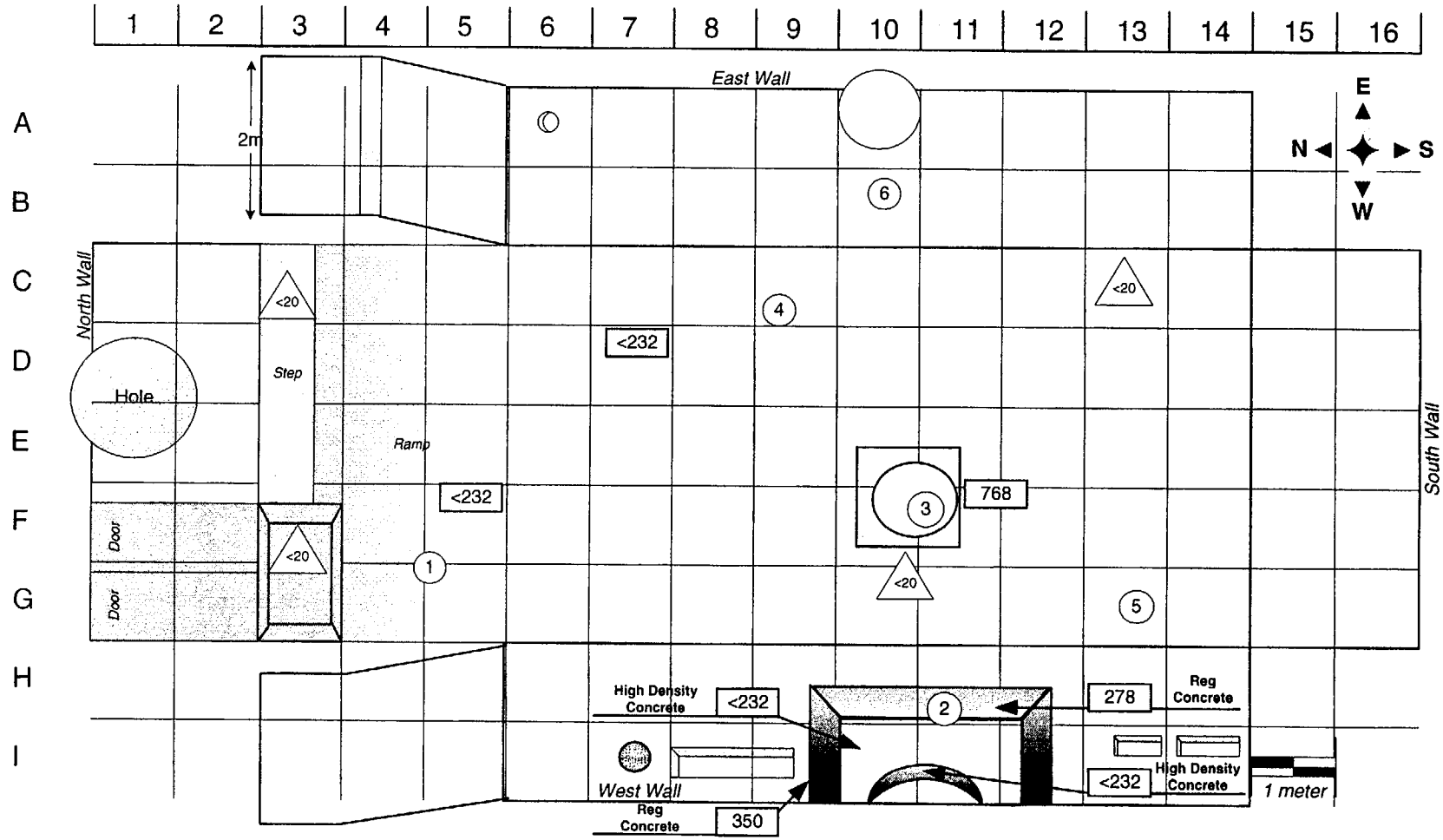
Instrument	M19
Serial #	123930
Probe #	N/A
Size / Type	Gamma
Cal Due	10/12/00
Eff %	N/A
Background	28µR

Technican : J.T. Sullivan
Date : 08/30/00

26 - 28 = Exposure rate in µR/hr @ 6" scan.

28 = Exposure rate in µR/hr @ 1 Meter fixed.

CS 3 : Building 30, Room 123 Fixed Reading And Smear Smear Survey



Instrument	2221	M-12
Serial #	84423	91051
Probe #	119444	94053
Size / Type	100cm² β	50cm² α
Cal Due	02/20/00	10/12/00
Eff %	24.14	21.58
Background HDC	1011 cp2m	<20cpm
Background RC	1011 cp2m	<20cpm

HDC = High density Concrete & RC = Regular concrete

<20 = Fixed Alpha reading in cpm

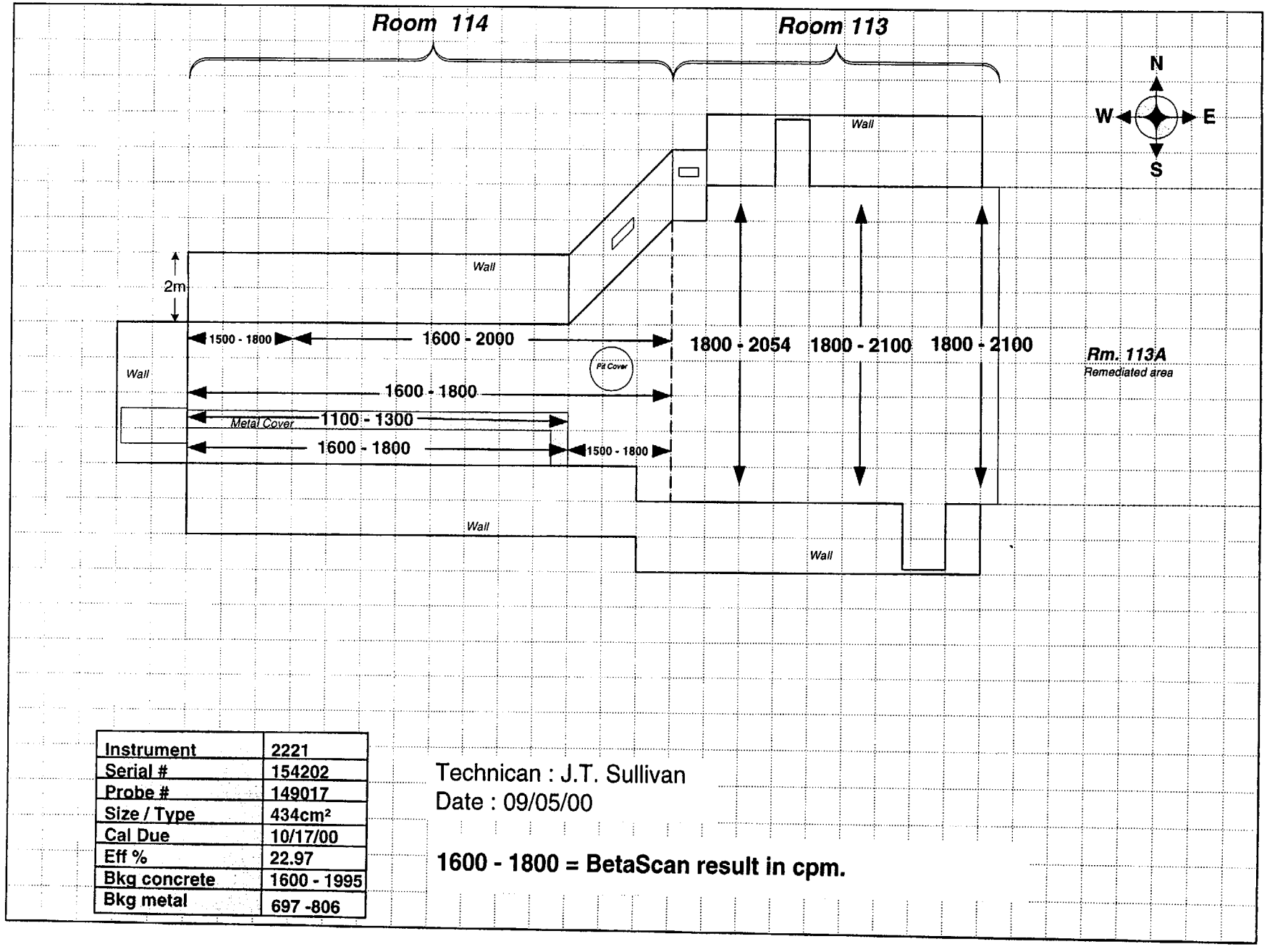
963 = Fixed Beta reading in dpm / 100cm²

(1) = Smear location

MDA = 232dpm/100cm2 Beta fixed

Technician : J.T. Sullivan
Date : 08/30/00

CS 4 : Building 30/31, Room 114 and 113: Beta Scan Survey

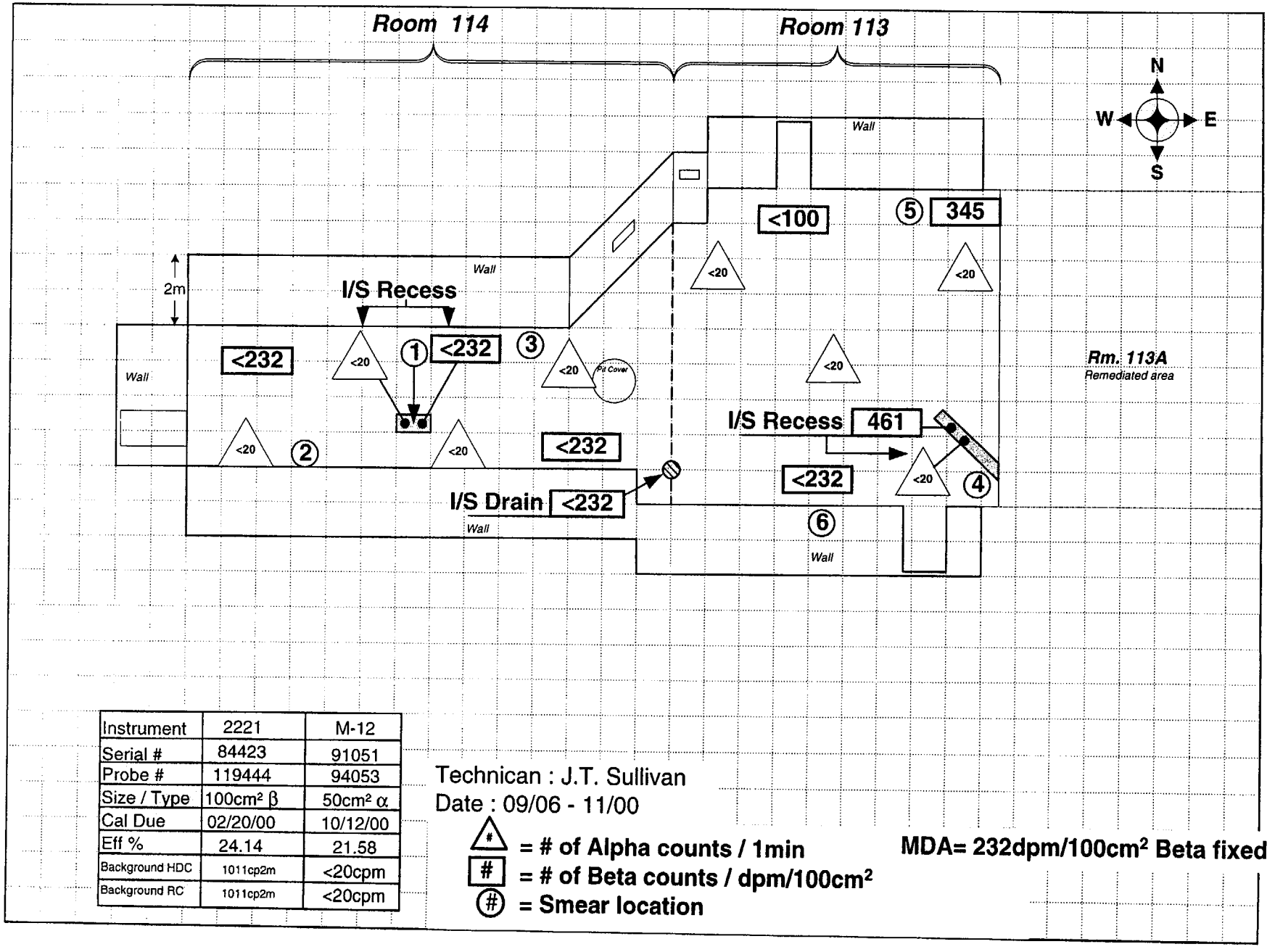


Instrument	2221
Serial #	154202
Probe #	149017
Size / Type	434cm²
Cal Due	10/17/00
Eff %	22.97
Bkg concrete	1600 - 1995
Bkg metal	697 -806

Technican : J.T. Sullivan
Date : 09/05/00

1600 - 1800 = BetaScan result in cpm.

CS 5 : Building 30/31, Room 114 and 113: Fixed α , β and Smear Survey



Instrument	2221	M-12
Serial #	84423	91051
Probe #	119444	94053
Size / Type	100cm² β	50cm² α
Cal Due	02/20/00	10/12/00
Eff %	24.14	21.58
Background HDC	1011cp2m	<20cpm
Background RC	1011cp2m	<20cpm

Technican : J.T. Sullivan
Date : 09/06 - 11/00

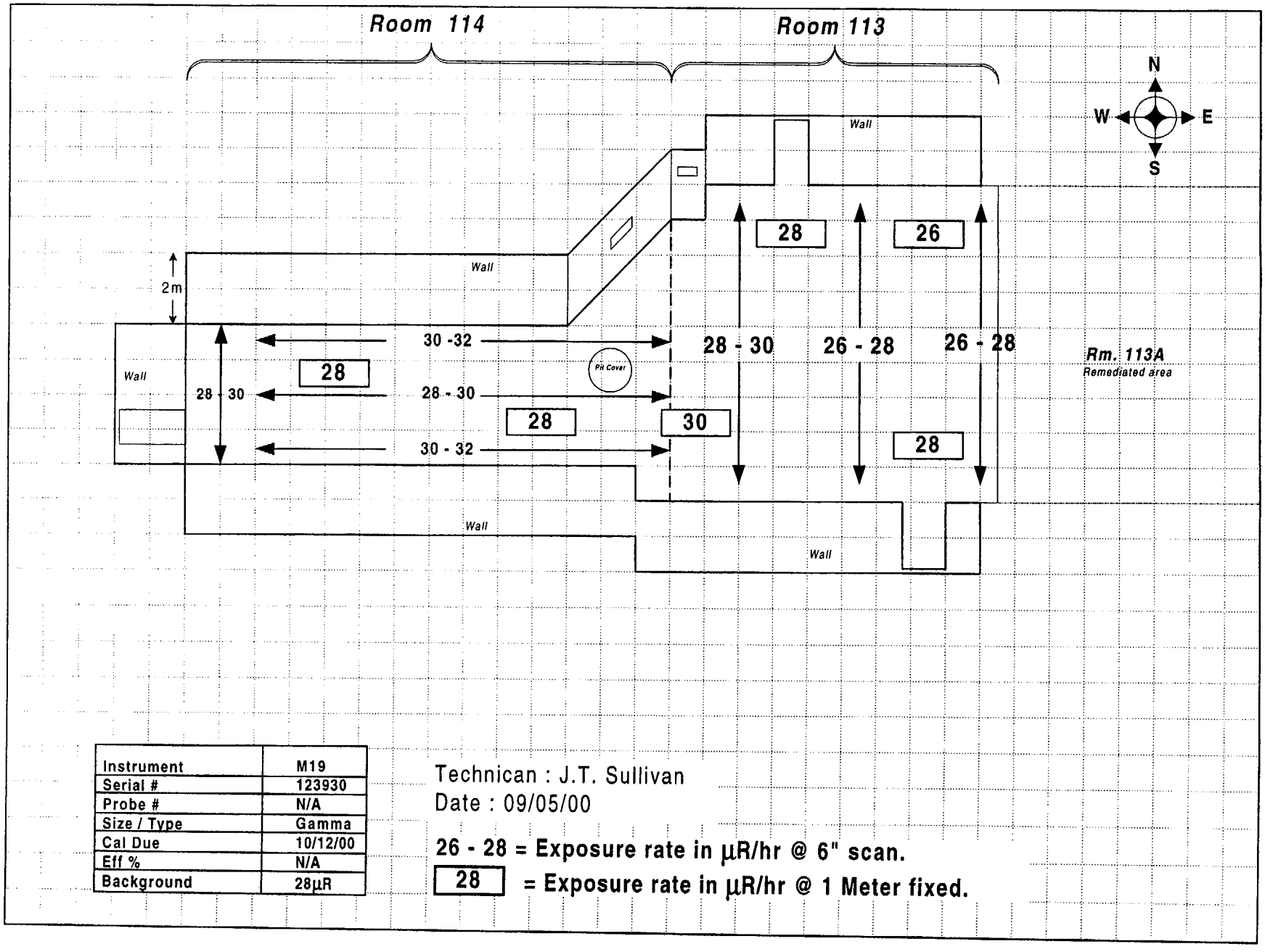
<# = # of Alpha counts / 1min

[#] = # of Beta counts / dpm/100cm²

(#) = Smear location

MDA= 232dpm/100cm² Beta fixed

CS 6 : Building 30/31, Room 114 and 113: Exposure Rate Survey



Instrument	M19
Serial #	123930
Probe #	N/A
Size / Type	Gamma
Cal Due	10/12/00
Eff %	N/A
Background	28µR

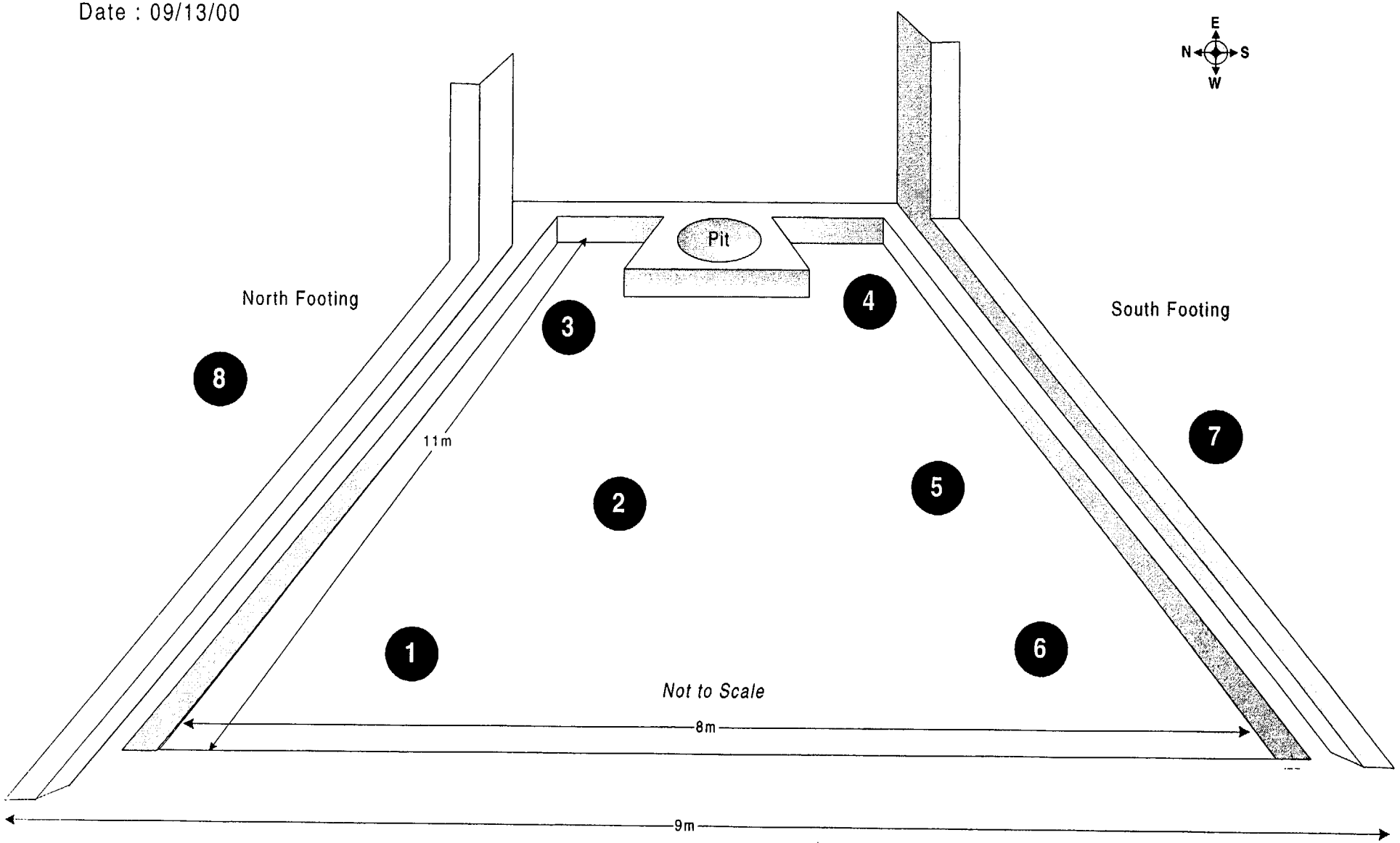
Technican : J.T. Sullivan
Date : 09/05/00

26 - 28 = Exposure rate in µR/hr @ 6" scan.

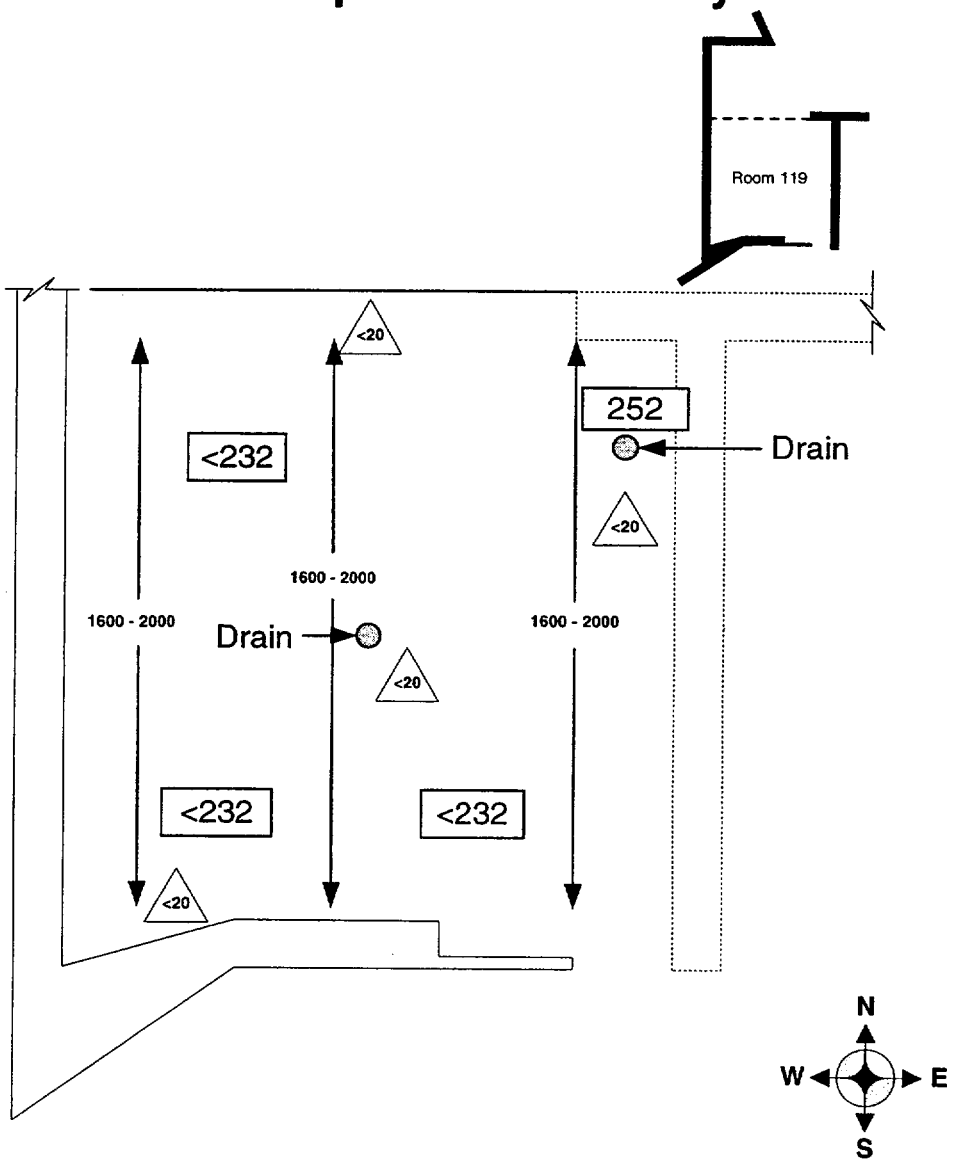
28 = Exposure rate in µR/hr @ 1 Meter fixed.

CS 7 : Building 30 (LINAC) Room 113A. North and South Footings, Soil Sample Locations.

Technician : J. T. Sullivan
Date : 09/13/00



CS 8 : Building 30 Room 119: Beta Scan, Beta Fixed And Alpha Fixed Survey



Instrument	2221	M-12	Instrument	2221
Serial #	84423	91051	Serial #	154202
Probe #	119444	94053	Probe #	149017
Size / Type	100cm² β	50cm² α	Size / Type	434cm² β
Cal Due	02/20/00	10/12/00	Cal Due	10/17/00
Eff %	24.14	21.58	Eff %	22.97
Background Con	1011 cp2m	0-20cpm	Background con	1600 - 1995

Technician : J.T. Sullivan
Date : 09/14/00

[#] = # of dpm / 100cm² Fixed Beta

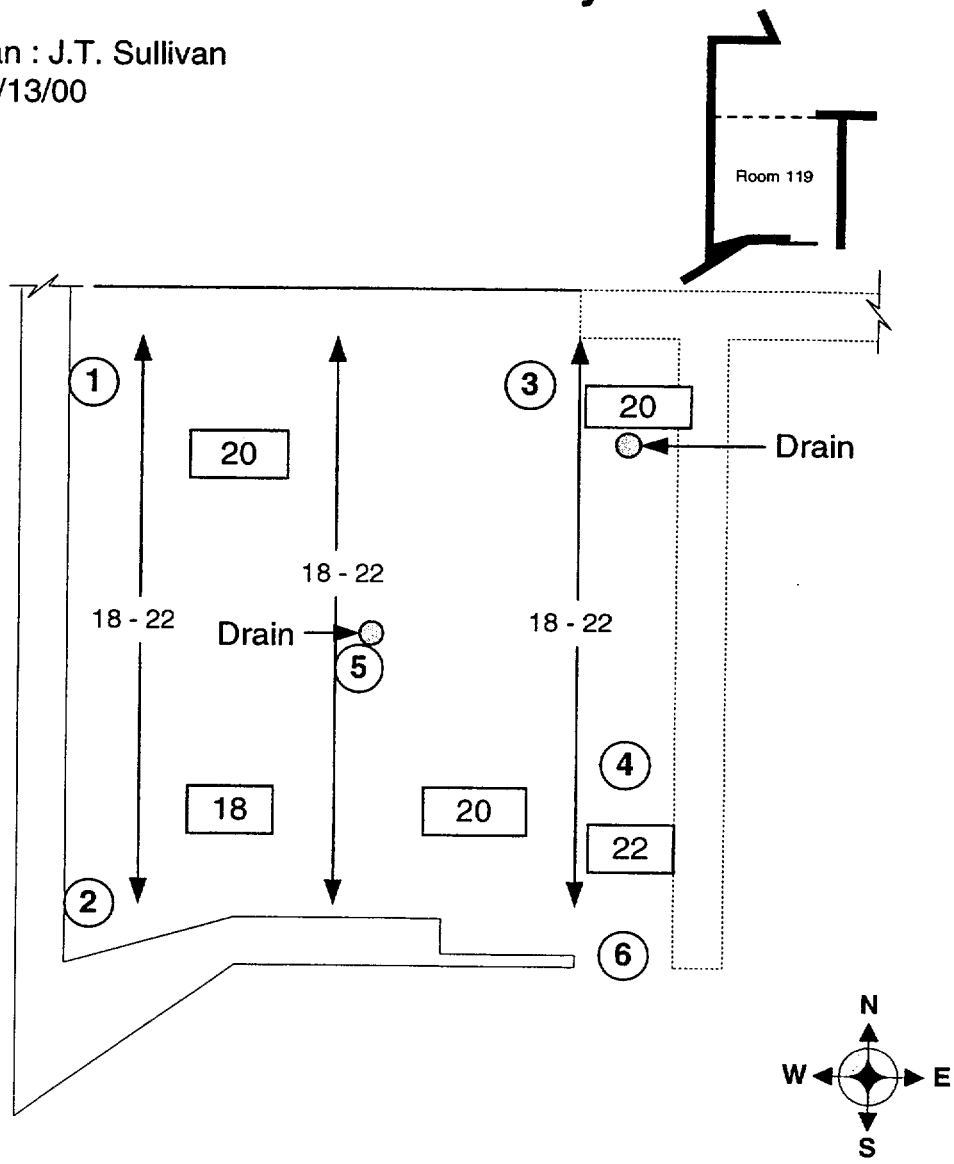
<#> = # of cpm Fixed Alpha

0000 - 0000 = # of cpm Beta Scan

MDA =232dpm/100cm² for Beta fixed.

CS 9 : Building 30 Room 119: Exposure Rate And Smear Survey

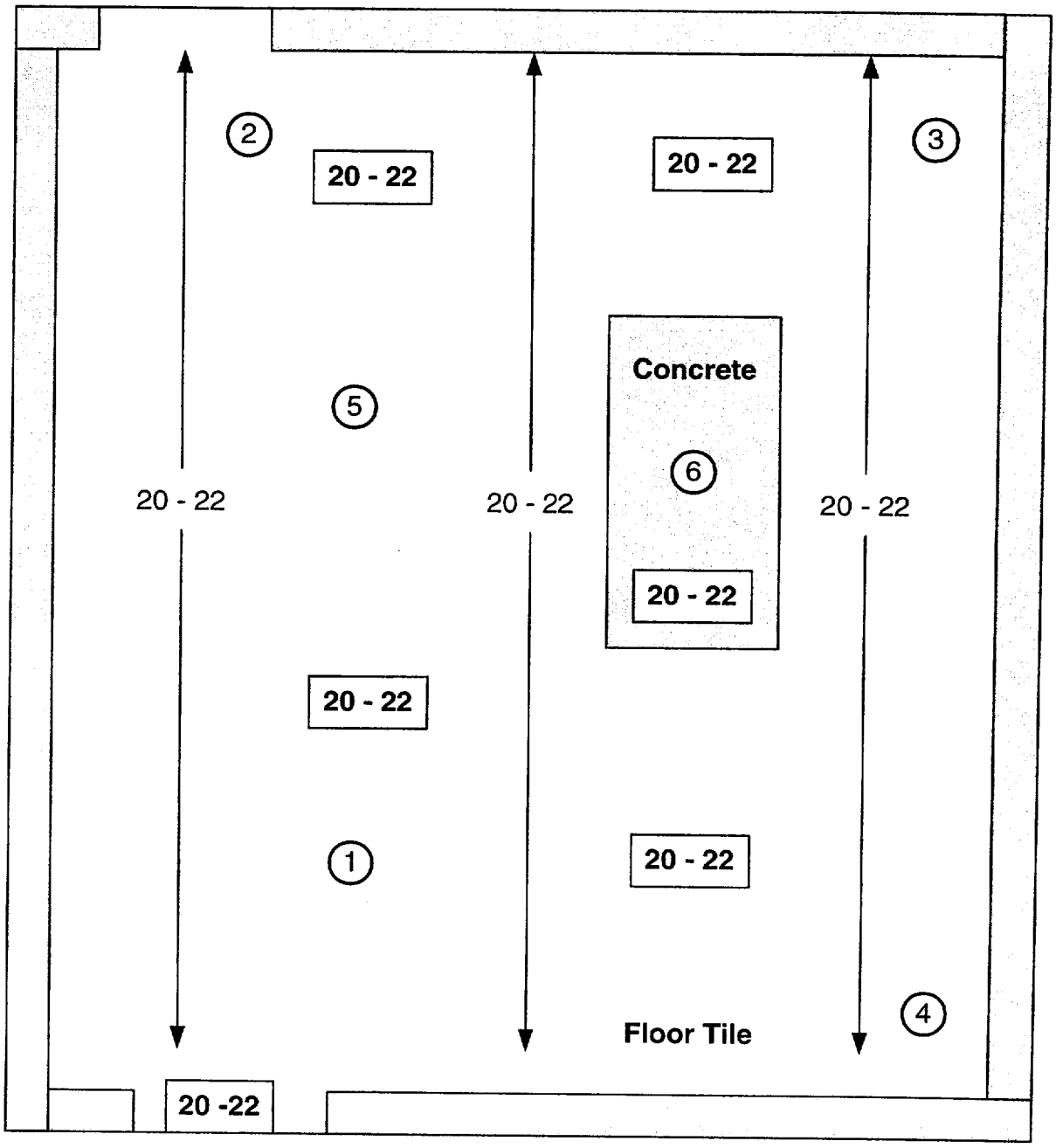
Technician : J.T. Sullivan
Date : 09/13/00



Instrument	M19
Serial #	123930
Probe #	N/A
Size / Type	Gamma
Cal Due	10/12/00
Eff %	N/A
Background	18- 20 µR

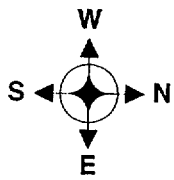
18 - 20 = Exposure rate in µR/hr @ 6" scan.
28 = Exposure rate in µR/hr @ 1 Meter fixed.
(#) = Smear Location

CS 10 : Room 114A Exposure Rate And Smear Survey



Instrument	M19
Serial #	123930
Probe #	N/A
Size / Type	Gamma
Cal Due	10/12/00
Eff %	N/A
Background	18-20µR

Technician : J.T. Sullivan
Date : 09/14/00

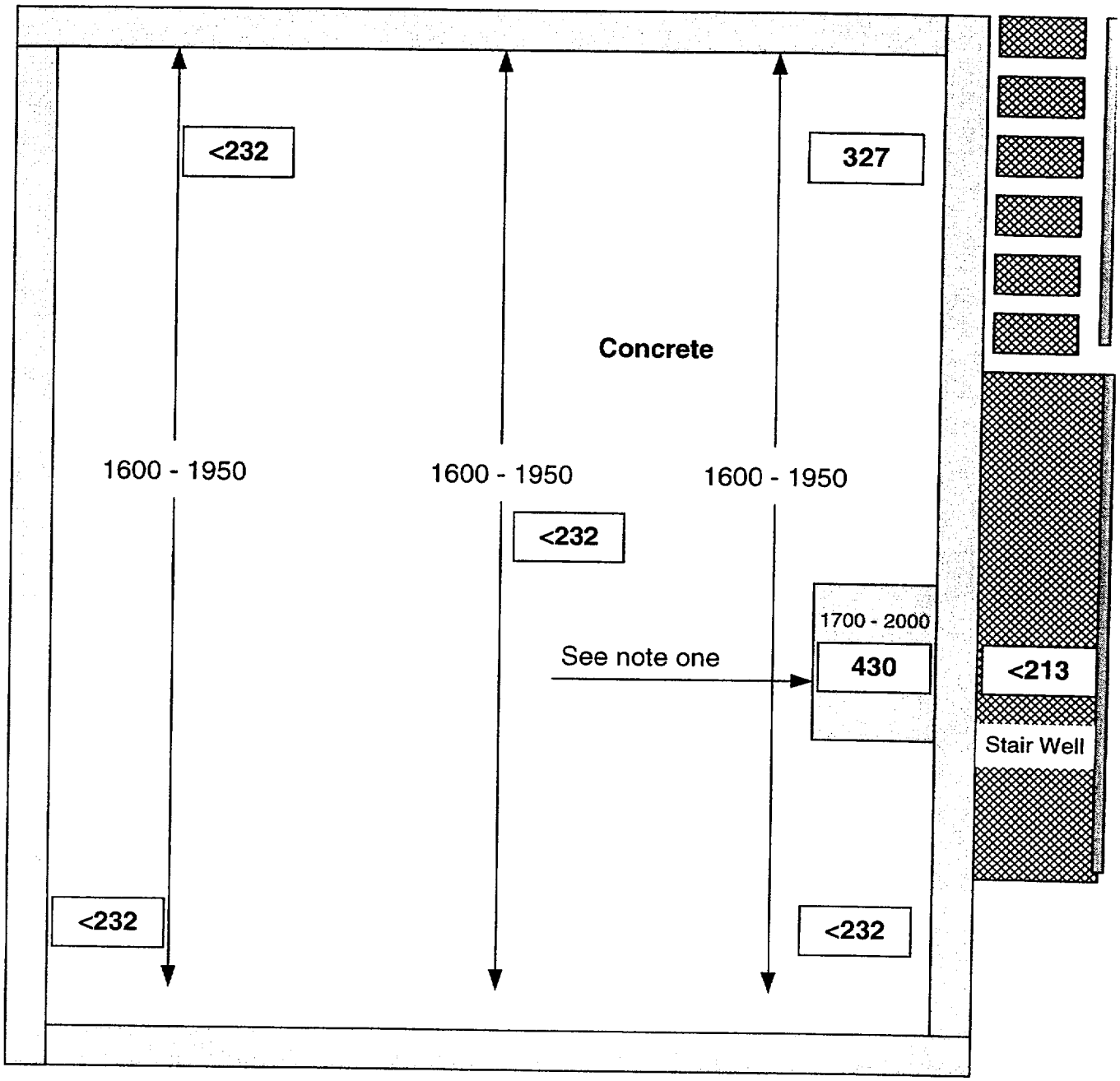


20 - 22 = Exposure rate in µR/hr @ 6" scan.

20-22 = Exposure rate in µR/hr @ 1 Meter fixed.

(#) = Smear Location

CS 12 : Room 122 Beta Fixed And Beta Scan Survey



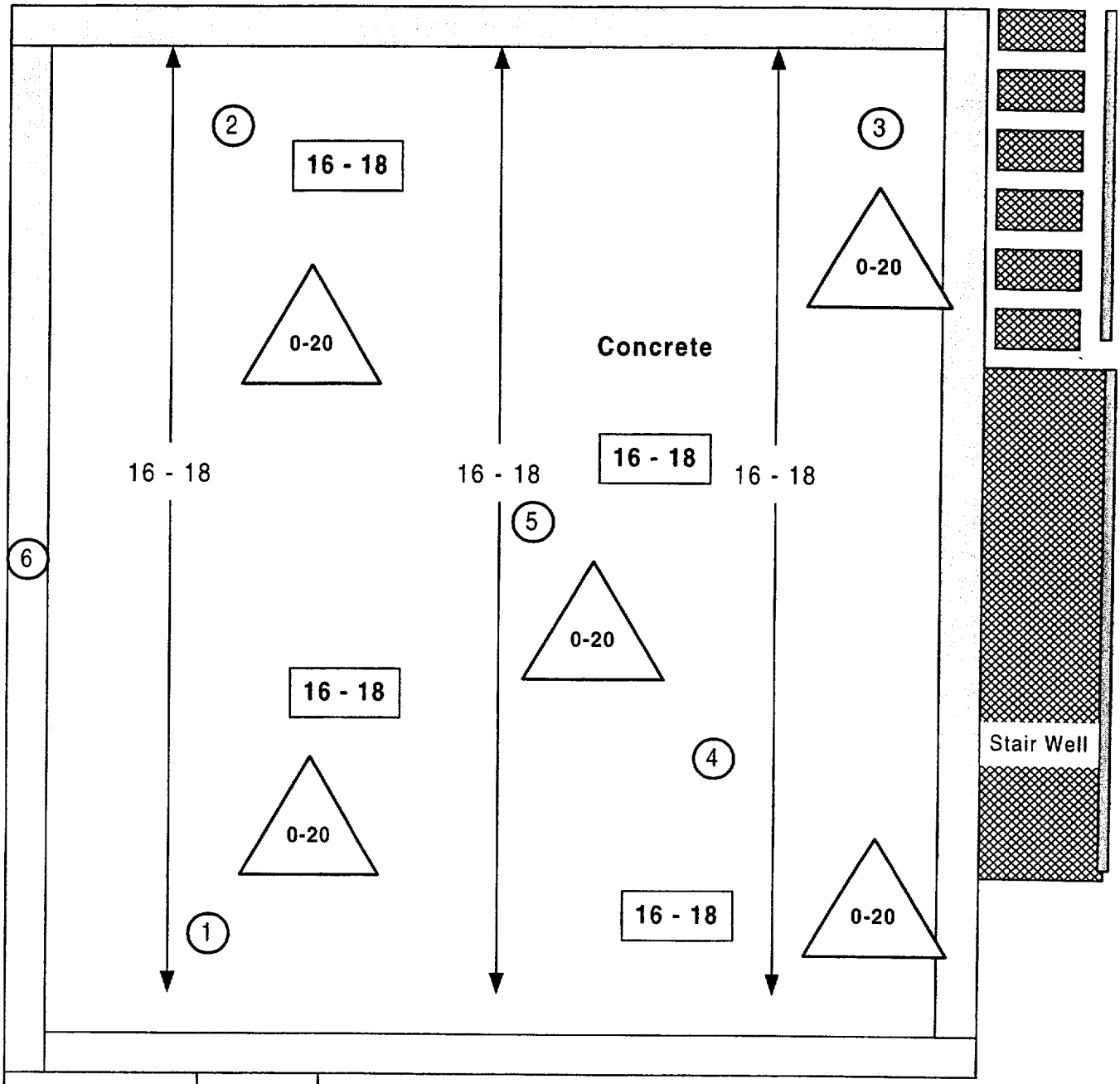
Instrument	2221	Instrument	2221	Instrument	M3
Serial #	84423	Serial #	154202	Serial #	139180
Probe #	119444	Probe #	149017	Probe #	145973
Size / Type	100cm² β	Size / Type	434cm² β	Size / Type	15 β
Cal Due	02/20/00	Cal Due	10/17/00	Cal Due	12/27/00
Eff %	24.14	Eff %	22.97	Eff %	21.25
Background con	1011 cp2m	Background con	1600 - 1995	Background con	80 - 120 cpm
Background metal	575 cp2m				

Note 1:
The shaded area above the fixed limit, was checked with a GM pancake probe and no readings above background were observed. MDA= 232dpm/100cm² for Beta fixed (concrete).MDA= 213 Beta fixed (metal).

Technician : J.T. Sullivan
Date : 09/18/00

1600 - 1850 = cpm Beta scan.
= dpm / 100cm² Beta fixed.

CS 13 : Room 122 Exposure Rate, Alpha Fixed And Smear Survey



Instrument	M19
Serial #	123930
Probe #	N/A
Size / Type	Gamma
Cal Due	10/12/00
Eff %	N/A
Background	18-20µR
Instrument	M-12
Serial #	91051
Probe #	94053
Size / Type	50cm² α
Cal Due	10/12/00
Eff %	21.58
Background	<20cpm

Technician : J.T. Sullivan
Date : 09/14/00

N
W E
S

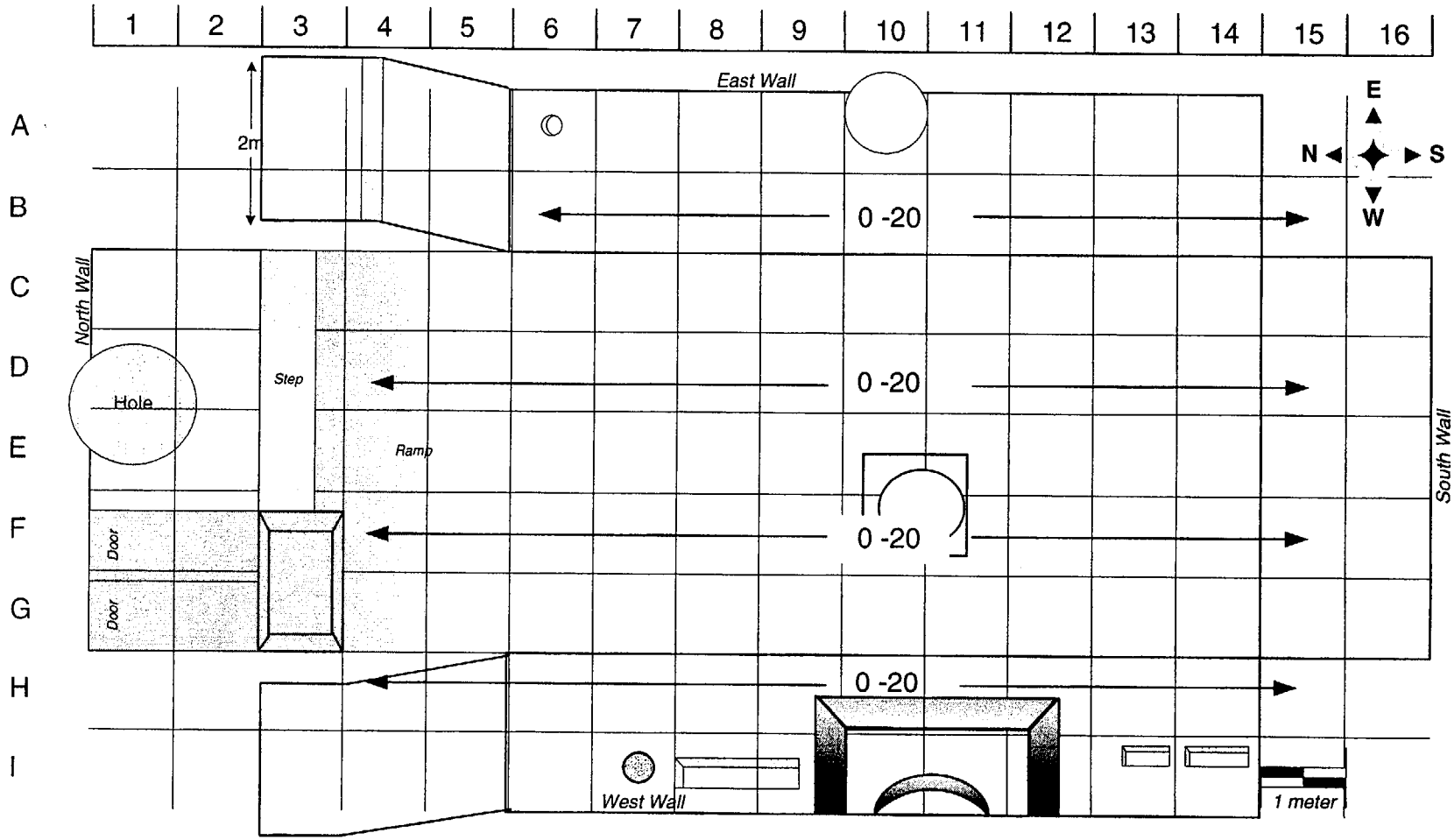
0-20 = # cpm / 1min Alpha Fixed

20 - 22 = Exposure rate in µR/hr @ 6" scan.

20 - 22 = Exposure rate in µR/hr @ 1 Meter fixed.

(#) = Smear Location

CS 14 : BUILDING 30 ROOM 123 Alpha Scan Survey



Instrument	2221
Serial #	97287
Probe #	148926
Size / Type	434cm² α
Cal Due	02/26/01
Eff %	24.25
Background	0-20cpm

0 - 20 = Alpha scan reading in cpm

Technician : J.T. Sullivan
Date : 08/30/00

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