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VIA EXPRESS DELIVERY SERVICE

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Subject: Docket No. 70-734; SNM-696: Request to Release the Non-Reactor Portion of GA's TRIGA® (Building 21) Reactor Site to Unrestricted Use and Delete From License.

Dear Mr. Baker:

General Atomics (GA) is continuing its efforts directed at decontaminating, as appropriate, and obtaining the release to unrestricted use of selected facilities and land areas at General Atomics. GA has recently completed the Final Radiological Survey of the Non-Reactor Portion of its TRIGA® (Building 21) Reactor Site which is associated with GA's Special Nuclear Materials License SNM-696.

Building 21 houses GA's TRIGA® Reactors Facility, various decommissioned rooms that had previously served as laboratories, a vault-like storage room, and other office and storage areas.

The rooms and laboratories not associated with the reactor portion of the building (i.e., non-reactor or non-NRR) have recently been decontaminated and are the subject of this request. These rooms and laboratories are referred to herein as the "Non-Reactor portion of Building 21" or the "Non-NRR portion of Building 21". (The roof over this portion of Building 21 was released May 18, 2006 (license amendment #85). Additionally, this request includes the outside areas around Building 21 which are not associated with the previous operation of two TRIGA® non-power reactors under the jurisdiction of GA's non-power reactor licenses R-38 and R-67.

The non-reactor portion of Building 21 is shown in Figure 3 of the enclosed report. The non-reactor portion of Building 21 has a floor space area of approximately 3,617 ft² (~336 m²). The open land area associated with the non-reactor portion of the site is approximately 18,280 ft² (~ 1700 m²) and is enclosed within a chain link fence. The total area to be released to unrestricted use is approximately 21,897 ft² (2,036 m²).

The portion of Building 21 (including the roof) and the outside areas associated with the previous use and possession of GA's two TRIGA® reactors (i.e., the Reactor or

NRR portion of the TRIGA[®] Reactors Site) will be decommissioned in accordance with GA's NRC-approved TRIGA[®] Decommissioning Plan at a later date.

This report documents the results of GA's comprehensive radiological measurements and surveys completed on the SNM-696 (aka Non-NRR) portion of the TRIGA[®] (Building 21) Site. In summary: (1) exposure rate measurements on the roof are at or near normal background levels, (2) radionuclide concentrations in the soil showed only trace concentrations of Cs-137 with lesser concentrations of Co-60 in some soil samples; levels which are all well below the NRC-approved soil release criteria, and (3) radiation levels on the facility surfaces were well below the NRC-approved release criteria.

The results of these surveys demonstrate that the Non-Reactor Portion of GA's TRIGA[®] (Building 21) Site meets the NRC-approved criteria for release to unrestricted use specified in GA's NRC-approved Site Decommissioning Plan. Accordingly, GA hereby requests NRC to release this site, as described in the enclosed report, to unrestricted use and delete it from GA's license number SNM-696.

If you should have any questions regarding this request, or the enclosure, please don't hesitate to contact Ms. Laura Q. Gonzales at (858) 455-2758 or laura.gonzales@gat.com, or me at (858) 455-2823.

Very truly yours,



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

Enclosure: "Final Radiological Survey Report for the Non-Reactor Portion of the TRIGA[®] (Building 21) Reactor Site"

cc: Dr. D. Blair Spitzberg, Chief, NMSS Branch 3, Region IV
Mr. Robert Evans, Fuel Cycle Inspector, NRC Region IV

GENERAL ATOMICS'
FINAL RADIOLOGICAL SURVEY REPORT
FOR THE NON-REACTOR PORTION OF THE TRIGA®
(BUILDING 21) REACTOR SITE

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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 facilities and land areas at General Atomics. GA has recently completed the Final Radiological Survey of the Non-Reactor Portion of the TRIGA® (Building 21) Reactor Site, located on GA's Main Site. This includes the outside land associated with the non-reactor portion of the site. These non-reactor areas are under the jurisdiction of GA's SNM-696 license issued by the Nuclear Regulatory Commission's (NRC's) Office of Nuclear Materials Safety and Safeguards (NMSS).

The remaining portion of Building 21 and outside land areas within the TRIGA® Reactor Site are licensed by the NRC's Office of Nuclear Reactor Regulation (NRR) and will be decommissioned in accordance with GA's approved TRIGA® Decommissioning Plan at a later date.

This report documents the results of GA's radiological measurements completed for the non-reactor (a.k.a non-NRR) portion of Building 21 and associated land areas. The results of these surveys demonstrate that the non-reactor portion of Building 21 and the associated open land areas meet the NRC- approved criteria for release to unrestricted use specified in GA's NRC-approved Site Decommissioning Plan.

GA is requesting the Nuclear Regulatory Commission (NRC) to release the non-reactor portions of the TRIGA® (Building 21) Reactor Site to unrestricted use.

Site Description

The TRIGA® Reactor Site, is located on GA's Main Site (see Figures 1A, 1B and 1C). The non-reactor portions (a.k.a. Non-NRR portion) of this Site is identified in Figure 2.

The non-reactor portion of Building 2 includes the rooms formerly identified as Rooms 109/110, 111, 112, 113, 114/115 (see Figure 3). During decommissioning activities, the room dividers between rooms 109 and 110, and between rooms 114 and 115 were removed, surveyed and appropriately disposed of. Open pipe trenches exist in rooms 109/110, 111, 113 and 114/115 created during the removal of drain piping. The non-reactor portion within Building 21 has a floor space area of approximately 3,617 ft² (~336 m²).

Room 111 contains the former Mark-III reactor pit. There are buried cooling system pipes which are connected to and accessible from the inside of this pit and a pipe used for activation experiments that is partially buried beneath the floor of room 111 and 113 that is accessible from both this pit and room 113.



The pipe trench located in the southern portion of room 109/110 is part of the reactor portion of the building and not included in this report. Additionally, the “mezzanine”, which is located in, and can be accessed from room 109/110, is also part of the reactor portion of the building and is not included in this report.

The open land area associated with the non-reactor portion of the site is approximately 18,280 ft² (~ 1700 m²) and is enclosed within a chain link fence. A large portion of the southern and eastern sides of this land area is paved with either concrete or asphalt. The paved portion is approximately 9,680 ft² (~ 900 m²).

There is a sewer line that traverses the land, roughly diagonally from the northwesterly to the southeasterly direction. Sewer vault S-20, which is associated with this sewer system, is located north of the building. This sewer line and vault were previously released to unrestricted use as part of GA’s “Sewer Project” (SNM-696 license amendment #82 dated August 26, 2004).

There is a storm drain system located at the southern end of this land area and numerous below grade level water, gas, and electrical controls/junction boxes/valves.

Following decommissioning of the former nuclear waste processing facility located in the Sorrento Valley Site, a counting trailer containing gamma spectroscopy equipment for analysis of packaged low level waste was re-located to the southeastern portion of this land area. Additionally, a truck scale was installed on the southern portion of this land area to weigh trucks loaded with low level waste shipping containers.

There is a large excavation pit adjacent to the west side of the building that is partially within the non-reactor portion of this land area. This excavation pit was formed during the removal of the make-up water tank for the TRIGA® Mark I reactor.

The total area to be released to unrestricted use is 21,897 ft² (2,036 m²); which includes 3,617 ft² inside the facility and 18,280 ft² of outside land area.

History of Use

The land area provided access to the TRIGA® reactor facility, was a staging area for equipment and materials used/removed from the TRIGA® reactor facility, and was a temporary storage area for packaged radioactive material awaiting shipment off site. At one time, a small machine shop was also located on this land area; it serviced TRIGA® reactor facility activities. This machine shop, which was constructed from corrugated metal on a concrete slab, was dismantled and disposed of in 2001. In 2003, a truck scale was added to the south-central portion of this land area and a trailer, containing gamma spectroscopy equipment for waste container analysis, was



placed in the southeast portion of this land area. This equipment was used to facilitate shipping activities associated with site D&D work between 2003 and 2005.

Room 109 was the former Fuel Development Research Lab 1 (FDRL-1) and room 110 was FDRL-2 where fission product release studies were performed.

Room 111 was the former TRIGA® Mark III reactor room. The TRIGA® Mark III was a 2000 kW(t) research reactor which achieved initial criticality in 1966. The reactor operated primarily in support of thermionics experiments. The Mark III reactor was shutdown, the fuel removed, decontamination activities performed, and the license terminated in 1975. Following license termination, the facility was converted to laboratory and test facilities for HTGR (High Temperature Gas-Cooled Reactor) fuel. Final decommissioning activities for what had been the Mark III reactor facility were initiated in 1998. The metal reactor tank liner was removed, surveyed and appropriately disposed of, sub-flooring piping was excavated and removed, and post D&D surveys were conducted. Areas with elevated activity levels detected during this survey were remediated/decontaminated.

Room 112 was the former TTSX (TRIGA® Thermal Stability X-Ray) Laboratory and Room 113 was the former TTSL (TRIGA® Thermal Stability Laboratory). High temperature post-irradiation annealing of coated fuel particles and various other activities including radiography and density measurements took place in these laboratories. More recently, Room 112 was used to store radioactive material.

Room 114 formerly housed a decontamination room used to support the fuel development laboratories and Room 115 was a restroom.

Decontamination Efforts

Several years ago and prior to the performance of this final survey, extensive decontamination of the floor and walls in the non-reactor portions of Building 21 was performed, especially in rooms 114/115, 112 and 113. As a result, very few locations of elevated radioactivity were detected during this final survey.

Elevated activity was detected in small localized areas in rooms 112 and 113. These "spots" were decontaminated to levels not discernable from normal background levels.

During the previous decommissioning efforts, all drain lines and buried piping (with the exception of the Mark-III cooling system and access piping) were excavated, surveyed, and disposed of appropriately based on survey results. Some remediation of the excavation trench soil was necessary due to elevated radioactivity levels of Cs-137.



Also during previous decontamination activities inside the Mark-III reactor pit, the stainless steel liner was removed and cut into manageable sections. All of the metal was surveyed and levels were not distinguishable from normal background levels with the exception of a small section of metal which had a tar coating on it. The tar was removed and disposed of as low level radioactive waste. The rest of the metal was staged and disposed of as non-radioactive after the NRC performed confirmatory surveys which yielded results in agreement with GA's.

Only one location, a small area outside and adjacent to the west side of Building 21, was remediated during the final survey documented by this report. The soil (contaminated with Cs-137) was removed and disposed of as radioactive waste.

Classification

Due to the extensive use and handling of radioactive material in this facility and associated land area, the entire non-reactor portion of the site was classified as a **Suspect Affected Area** for radiological survey purposes. The predominant contaminant, based on gamma spectroscopy analysis of concrete wall samples and soil samples, was determined to be Cs-137. Trace concentrations of Co-60 were also detected.

Criteria for Release to Unrestricted Use

As Low As Reasonably Achievable (ALARA)

During decommissioning efforts, GA always attempts to decontaminate to levels as close to "background" as possible and as far below the approved Release Criteria as reasonably achievable.

Facilities and Equipment (and Asphalt or Concrete Surfaces)

The U.S. NRC's and State DHS/RHB's criteria for release of facilities and equipment to unrestricted use is provided in Tables 1 and 2, respectively. The predominant contaminant, based on process knowledge and gamma isotopic analyses of concrete and soil samples, was identified as Cs-137. The applicable guidelines for beta/gamma emitters (including Cs-137) are summarized as follows:

5,000 dpm/100 cm², averaged over a 1 m² area
15,000 dpm/100 cm², maximum in a 100 cm² area if the average over 1 m² is met
1,000 dpm/100 cm², removable activity



Release Criteria for Soils

The predominant radionuclides at the GA Site and the NRC- approved release criteria in pCi/g (above natural background concentrations) for these radionuclides are provided as follows:

Enriched Uranium (U-234 + U-235)	30 pCi/g
Thorium (Th-228 + Th-232)	10 pCi/g
Depleted Uranium	35 pCi/g
Cs-137	15 pCi/g
Co-60	8 pCi/g

If more than one radionuclide exists, the sum of the fractions of the concentrations is calculated as follows:

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

Where: C_i = The average concentration levels of radionuclide I in the sample (above background).
 L_i = The release criteria for radionuclide I , and

The sum of the fractions must be less than or equal to one (1).

Exposure Rate Guideline

Exposure rates measured at 1 m above the surface are not to exceed 10 μ R/hr above natural background levels.

Instrumentation and Background Measurements

A list of instruments used during the radiological surveys is shown in Table 3. The table includes: (1) a description of the instrument, model number and its serial number, (2) a description of the detector (if applicable) and its serial number, (3) instrument ranges, (4) calibration due dates, (5) typical background readings and (6) calibration efficiencies (if applicable). The instruments are calibrated semiannually and after repair, except for exposure rate meters which were calibrated quarterly.

Background Measurements for Instruments/Detectors

Building 13 on GA's main site was used for conducting background measurements with instruments used for the final survey because: (1) There is no history involving the use or storage



of radioactive materials in Building 13, and (2) The various surfaces and construction materials found inside the Building 21 could also be found within and outside of Building 13. Background information, where appropriate, is included in Table 3.

Minimum Detectable Activity (MDA)

Minimum detectable activities (MDA's) for instruments used for fixed measurements, for each type of surface (see Table 3), were calculated using equation (5-2) from the 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)

The MDA for scans using the 434 cm^2 gas flow proportional detector (floor monitor) was calculated using equation 5-3 from the draft NUREG/CR-5849 (modified in accordance with the discussion on page 5.8 of the draft NUREG/CR-5849), as follows:

Equation (5-3):

$$MDA = \frac{X \times B_R}{E \times \frac{A}{100}} (dpm/100cm^2)$$

Where:

X = the multiple/portion of the background rate that can be discernable as an increase in instrument response by the surveyor (dependent on the type of instrument used).

B_R = background rate in (cpm)

E = efficiency

A = area of the detector (cm^2)

Exposure Rate Background

Typical exposure rate background for GA's site using a Ludlum Model 19 micro R meter is 12-18 $\mu R/hr$ measured at 1 m from the surface of soil. This range of exposure rates can be measured south of Building 15 (an office building on the eastern portion of the GA site). Measurements taken offsite in ten (10) different locations (nine (9) offsite and one (1) onsite at a non-impacted area near Building 15) over a period of 15 months also averaged $\sim 15 \mu R/hr$ (measured at 1 m from the surface). The range of 12-18 $\mu R/hr$ is typical at the GA site for the



external dose rates measured at 1 meter from the surface. Background exposure rates in non-impacted areas, measured with the specific instruments used for this final survey, are identified in Table 3.

Final Surveys Performed

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 approved release criteria for average surface contamination value in an area up to 100 cm², (3) To demonstrate soil sample results at the surface were well below GA's approved release criteria for unrestricted use, and, (4) That the exposure rate measurements taken in these areas, measured at 1 meter above the surface, were < 10 µR/hr above background.

Survey Plans

A Final Survey Plan (provided in Appendix A) was developed based on the previous history of use, results of periodic surveys performed in the non-reactor portion of the TRIGA® Site, the radionuclides of concern, the potential for contamination, the various types of surfaces encountered and the classification of the various areas.

The final surveys and soil sampling was conducted by qualified Health Physics Technicians having a minimum of three years health physics experience. Each survey taken was documented on a daily basis to a worksheet/drawing showing the approximate locations surveyed/sampled. Documentation includes the results of the measurements (including units), technician's signature, date, instrument(s) used (including model and serial number of both ratemeter and detector), calibration due date, % efficiency, and background readings.

Survey Summary

Comparisons of the Site Decommissioning Plan requirements with the Final Surveys performed in relation to the percentage of surface area scanned, number of measurements (i.e., number of fixed radiation measurements), and exposure rate measurements (µR/hr) are provided as follows:

**GENERAL ATOMICS**

Final Radiological Survey Report for the Non-Reactor Portion of the TRIGA® (Building 21) Reactor Site

Comparisons of Site Decommissioning Plan Requirements with Final Surveys Performed in the Non-Reactor Portion of the TRIGA® Facility

Survey Area ⁽¹⁾	Gridding Required ?	# of Direct Measurements Fixed α , β , or Wipes	Surface Scans α , β ,	# of Exposure Rate Fixed Measurements (μ R/hr)	Exposure Rate Scan Measurements (μ R/hr)	Soil Sampling
Interior of Building						
D-Plan ⁽²⁾ Suspect Affected Area (required) →	Yes, if feasible	Total = 171 Minimum of 1 per 4 m ² or 1 every 2m	100% accessible floors & walls below 2m	Total = 171 Minimum of 1 per 4 m ² or 1 every 2m	100% accessible floors and walls below 2m.	Not Applicable
Final Surveys Suspect Affected Area (performed) →	Yes, Where possible	Total = 566 168 α , 220 β 178 wipes	100% of accessible floor & walls < 2m; 10% of walls > 2m	392 measurements 339 plus 53 taken at each soil sample location	100% of accessible floor & walls < 2m; 10% of walls > 2m	29 soil samples ⁽³⁾
Open Land Area						
D-Plan ⁽²⁾ Suspect Affected Area (required) →	Yes, if feasible	Minimum of 225 based on 900 m ² paved surfaces.	100% of accessible paved surfaces	Total = 425 1 per 4 m ² or 1 every 2m. Minimum of 425 based on 1,700 m ²	100% of accessible surfaces	Sample on a 5 meter triangular grid.
Final Surveys Suspect Affected Area (performed) →	Yes, 10m x 10m grids	Total = 245 α = 75 β = 99 71 wipes	100% of paved surfaces survey for α and β radiation.	Total = 525 469 taken at 1 m from the surface, and 1 at each of 56 soil sample locations	100% of accessible surfaces scanned within 1" of the surface.	86 soil samples ⁽⁴⁾

⁽¹⁾ The total surface (Survey Required) area to be released. Inside the building, it is 7,148 ft² (~683 m²); floor space plus walls up 2 m.

⁽²⁾ D-Plan = GA's NRC- Approved Site Decommissioning Plan.

⁽³⁾ A total of 29 total soil samples were collected; 27 soil samples taken in trenches and 2 soil samples adjacent to trench outside room 111. Additionally, 18 concrete samples, 2 cement samples and 4 sand samples were also collected.

⁽⁴⁾ A total of 86 soil samples were collected; 42 surface (0-6") soil samples taken, 14 surface (0-6") soil samples were taken beneath the asphalt paving, and 30 core samples were taken at 6 different locations at depths of 6-12", 12-18", 18-24", 24-30" and 30-36".



Results of the Final Surveys

Interior of Building

Alpha Scans:

100% of the floor, 100% of the wall surfaces below 2 meters and 10% of the wall surfaces above 2 meters were scanned using a 434 cm² gas flow proportional detector held within ~½" of the surface. All scan results were not discernable from normal background levels except for one small spot inside the concrete service trench in room 109/110 (Figure 7). An alpha fixed measurement taken at this location was 40 cpm, which is only slightly distinguishable from normal background readings and < the MDA of 212 dpm/100 cm². Additionally, a concrete sample, Con-8, was collected at this location. See Figure 10 for location and Table 9 for results. The results for all radionuclides including Cs-137, Co-60, uranium and thorium were not distinguishable from normal background levels.

The locations and results of the alpha scans are provided in Figures 4, 7, 11, 14, 19, 24, 27, 33, 38, and 41.

Beta Scans:

100% of the floor, 100% of the wall surfaces below 2 meters and 10% of the wall surfaces above 2 meters were scanned for beta (β) activity using a 434 cm² gas flow proportional detector held within ~½" of the surface. Several isolated, elevated spots were found on the east and south walls of room 113. As a result, the entire east and south wall surfaces were scanned 100% for beta activity.

Scan readings ranged from 900 cpm to 3,500 cpm. The highest measurement (3,500 cpm) was located on an asphalt paved surface adjacent to concrete pads just outside of room 111. Elevated readings were also noted on the adjacent concrete pads (highest reading was 3400 cpm). See Figures 4, 7, 11, 14, 19, 24, 28, 33, 38, and 41 for locations and results.

Since the scan results on these two concrete pads and on the adjacent asphalt were higher than normal background readings, seventeen (17) 2 minute fixed measurements were taken on the asphalt and the two concrete pads (see Figure 40A). The highest reading was 2,012 counts per 2 minutes, which is equivalent to 1548 dpm/100 cm², which is well below the average release limit of 5,000 dpm/100 cm² for beta/gamma emitters (including Cs-137).

A concrete sample (Con-17) was also collected at the highest measurement location and analyzed by gamma spectroscopy. The results showed trace levels of Cs-137 present (0.13 ± 0.07 pCi/g). See Figure 44 for the location of the concrete sample collected and Table 9 for the gamma spectroscopy result.

Fixed Alpha Measurements:

A total of 168 alpha (α) measurements were taken with the detector probe held within $\sim 1/2$ " for ~ 1 minute. All measurements were at the natural background level for the surfaces measured and instruments used. See Figures 6, 9, 13, 16, 21, 26, 30, 35, 40, and 43 for survey locations and results.

Fixed Beta Measurements:

A total of 220 beta (β) measurements were taken with the detector probe held within $1/2$ " for 2 minutes. The highest measurement was 2,058 counts/2 minutes, which is 1,768 dpm/100 cm². This highest measurement was located on the east wall in room 113. Concrete samples taken from this wall were analyzed by gamma spectroscopy. Trace concentrations of Cs-137 were detected in some of the samples.

See Figures 6, 9, 13, 16, 21, 26, 30, 35, 40, 40A, and 43 for survey locations and results and Table 9 for gamma spectroscopy results.

Removable Contamination Surveys:

A total of 178 wipe samples (100 cm²) were taken and analyzed for alpha (α) and beta (β) activity. All results were at, or near natural background activity levels. See Figures 6, 9, 13, 21, 23, 26, 30, 32, 35, 37, 40, 43, and 45 for locations and Table 7 for results.

Exposure Rate Scans:

100% of the floor surfaces and 100% of the lower walls (below 2 meters) and 10% of the upper wall surfaces (above 2 meters) were scanned with a 2" x 2" NaI (TI) held within 1" of the surface. All results were not discernible from natural background activity levels. See Figures 5, 8, 12, 15, 20, 25, 29, 34, 39, and 42 for survey locations and results.

Fixed Exposure Rate Measurements:

A total of 334 fixed exposure rate measurements were taken (one measurement every 2 meters) inside the non-reactor portions of the building. In addition, 53 fixed measurements were taken (one at each soil sample location). All of the measurements were taken with a 2" x 2" NaI (TI) held at ~ 1 meter from the surface. All readings were not discernable from normal background levels. See Figures 5, 8, 10, 12, 15, 17, 20, 22, 25, 29, 31, 34, 36, 39, 42, and 44 for survey locations and results.

Buried Pipes

There is a beam tube and a cooling loop connected to the Mark III reactor pit. The beam tube provided access from room 113 to the active core region of the reactor for scientific experiments. This beam tube remained in place following the removal of the reactor vessel because it is encapsulated within the building structure. The cooling loop is a 12" diameter aluminum pipe buried approximately 12' below the floor surface of rooms 111, 113, 114 and 115 (see Figure 23



for an illustration of the approximate location). It re-circulated water from/to the reactor vessel to provide additional cooling. There is a vent line that is connected to this cooling loop and a small sample line that provided water sampling capabilities of the cavity surrounding the cooling loop to detect loop piping leakage that terminate in room 114/115. A video camera was inserted into both of the small lines that terminated in room 114/115 to verify their purpose and to verify they were free from obstructions. Both lines were free from obstructions from their origin to the termination in room 114/115. In addition, there is a storm drain that was installed under the access ramp to room 111. All of these buried lines were surveyed by feeding a large area wipe (masslinn wipes) through the lines and analyzing the wipes with portable instruments for alpha and beta activity. The results were not distinguishable from natural background activity. Additionally, a ½" NaI probe was fed through the entire length of each line. All results were at natural background levels. See Figures 23, 37, and 45 for locations and results.

Excavation Trench Soil Samples

A total of twenty-seven (27) surface (0-6") soil samples were taken in excavation trenches in rooms 113 and 114/115; eighteen (18) soil samples were taken in room 113 (see Figure 31) and 9 soil samples were taken in rooms 114/115 (see Figure 36). The samples were analyzed by gamma spectroscopy; the results are provided in Table 5. Trace concentrations of Cs-137 were detected in a few of the soil samples; the highest measurement being 0.94 ± 0.15 pCi/g (well below the approved soil release criteria, i.e., 15 pCi/g).

A surface soil/debris sample (sample B1-40) was collected from within the trench that extended from room 111 to outside the building (next to the west pad). The sample was analyzed by gamma spectroscopy and measured 11.01 ± 1.12 pCi/g Cs-137 (see Table 5). The trench was cleaned out and all soil/debris was removed and disposed of as radioactive waste.

Two other samples were taken next to the trench and directly outside room 111 (B21-41 and B-21-42). The approximate locations are shown in Figure 44. The gamma spectroscopy results were not discernable from normal background soil radionuclide concentrations. The results are provided in Table 5.

The twenty-nine (29) gamma spectroscopy results of the soil samples collected during the final survey within the non-reactor portion of Building 21 (and immediately outside of room 111 around the trench) are summarized below:

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Summary of Results for Soil Samples From the Non-Reactor Portion of Building 21						
	Radionuclide Concentrations (pCi/g)					
	¹³⁷ Cs	⁶⁰ Co	²²⁸ Th (²¹² Pb)	²³² Th (²²⁸ Ac)	²³⁸ U	²³⁵ U
High	0.94 ± 0.15	0.07 ± 0.06	1.33 ± 0.24	1.81 ± 0.44	ND	0.20 ± 0.12
Low	ND	ND	0.37 ± 0.09	0.70 ± 0.29	ND	0.05 ± 0.06
Average (N= 29)	0.18	<MDA (0.16)	0.88	1.25	<MDA (1.58)	<MDA (0.14)
Nominal Background	See Table 4 for typical background range and background locations.					

Concrete, Cement and Fill Sand Samples

Another 24 samples of concrete (18), cement (2) and fill sand (4) were taken during this final survey.

The approximate locations where these samples were collected are shown in Figures 10, 17, 22 and 31.

The concrete and cement samples were taken in areas that appeared to have higher than normal background readings in the Building 21 rooms and the Mark III reactor cavity-pit. The samples were analyzed by gamma spectroscopy. The results identified Cs-137 and Co-60 in trace concentrations as the contaminants; Cs-137 in slightly higher concentrations than Co-60 (see Table 9). The highest concentration of Cs-137 was 4.48 ± 0.5 pCi/g in a concrete sample and the highest concentration of Co-60 was 1.19 ± 0.18 pCi/g in the same concrete sample (see Table 9). Using the sum of fractions criteria, $(4.48/15 + 1.19/8)$, and not subtracting background concentrations, the result is 0.45 times the limit (45% of the limit).

The sand samples were taken of sand that was used to backfill some of the pipe trenches that were open to the outside of the building to determine if the sand had become contaminated since the installation. The approximate locations of the sand samples collected are shown in Figures 10 and 17. The highest concentration measured was 1.18 ± 0.16 Cs-137 and 0.28 ± 0.10 Co-60 (see Table 9). This indicates that sand was slightly contaminated, but well below the release criteria.

Open Land Area**Alpha Scans:**

100% of the paved surfaces were scanned with the detector held within ½" of the surface. All results were at natural background levels. See Figure 48 for locations and results.

Beta Scans:

100% of the paved surfaces were scanned for β activity. The results ranged for 1,100 to 1,400 cpm on metal surfaces, 2,000 to 2,600 cpm on concrete surfaces and 2,300 to 3,400 cpm on asphalt surfaces. See Figure 49 for locations and results.

Fixed Alpha Measurements:

A total of seventy-five (75) alpha (α) measurements were taken with the detector probe held within $\frac{1}{2}$ " for ~1 minute. All measurements were at the natural background level for the surfaces measured (0-20 cpm). See Figure 46 for survey locations and results.

Fixed Beta Measurements:

A total of ninety-nine (99) beta (β) measurements were taken with the detector probe held within $\frac{1}{2}$ " for ~2 minutes. The measurements ranged from a low of 580 counts per 2 minutes on metal, to a high of 1,912 counts per 2 minutes on asphalt, which corresponds to 787 dpm/100 cm². See Figure 46 for survey locations and results.

Removable Contamination Surveys:

A total of seventy-one (71), 100 cm² wipe samples were taken on paved surfaces and analyzed for α and β activity. All results were not discernible from natural background activity levels. See Figure 47 for locations and Table 8 for results.

Exposure Rate Scans:

100% of the surfaces were scanned with a 2" x 2" NaI (Tl) held within 1" of the surface. All results were not discernible from natural background activity levels. See Figure 50 for survey locations and results.

Fixed Exposure Rate Measurements:

A total of 469 measurements were taken, at 1 meter from the surface, using a 2" X 2" NaI(Tl) detector. All measurements were not discernible from natural background radiation levels. In addition, fixed exposure rate measurements were taken at 1 meter from the surface, using the same meter, at each soil sampling location. These measurements were also not discernible from natural background. See Figures 51 and 52 for survey locations and results.

Soil Samples:

A total of 86 soil samples were collected in the outside areas of the non-reactor area of the TRIGA® Site as follows:

- Forty-two (42) surface (0-6") soil samples were taken.
- Fourteen (14) soil (0-6") samples were collected from underneath the asphalt paving and
- Thirty (30) surface (0-6") and sub-surface (6"-12", 12"-18", 18"-24", 24"-30", and 30"-36") were taken at six locations.



The approximate locations of the soil samples are provided in Figure 52. The samples were analyzed by gamma spectroscopy and the results provided in Table 6. A summary of the results is provided below:

Summary of Soil Sample Results from the Non-Reactor Areas Outside Building 21						
	Radionuclide Concentrations (pCi/g)					
	¹³⁷ Cs	⁶⁰ Co	²²⁸ Th (²¹² Pb)	²³² Th (²²⁸ Ac)	²³⁸ U	²³⁵ U
High	0.94 ± 0.15	0.07 ± 0.06	2.07 ± 0.46	2.55 ± 0.55	1.78 ± 1.72	0.29 ± 0.13
Low	ND	ND	0.53 ± 0.13	0.90 ± 0.26	ND	ND
Average (N=86)	0.17	<MDA (0.16)	1.17	1.64	1.49	<MDA (0.14)
Nominal Background	See Table 4 for typical background range and background locations.					

All of the results were very low and well below the corresponding NRC- approved soil release criteria.

Confirmatory Survey

An internal confirmatory survey was performed by GA. This survey was conducted in accordance with a survey plan (provided in Appendix B). The results of this survey supports the results of the Final Survey; i.e., all residual activity is far below the NRC- approved release criteria as defined in GA's NRC- approved Site Decommissioning Plan.

See Appendix B for the confirmatory survey plan, a summary of the survey results , and the survey drawings showing the locations and results of all surveys performed.

Conclusion

Final contamination and radiation surveys, as well as the results of analyses of soil samples, as documented in this report, demonstrate that the Non-Reactor Portion of the TRIGA[®] (Building 21) Site, meets the NRC- approved criteria for release to unrestricted use.



GENERAL ATOMICS

Final Radiological Survey Report for the Non-Reactor Portion of the
TRIGA® (Building 21) Reactor Site

Conclusion

Final contamination and radiation surveys, as well as the results of analyses of soil samples, as documented in this report, demonstrate that the Non-Reactor Portion of the TRIGA® (Building 21) Site, meets the NRC- approved criteria for release to unrestricted use.

Table 1: USNRC'S ACCEPTABLE SURFACE CONTAMINATION LEVELS ¹

Nuclides	Average ^{b,c,f} (dpm/100cm ²)	Maximum ^{b,d,f} (dpm/100 cm 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, and geometric factors associated with the instrumentation.
- c Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.
- d The maximum contamination level applies to an area of not more than 100 cm².
- e The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, 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 cm² and 1.0 mRad/hr at 1 cm², respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Table 2: STATE OF CA ACCEPTABLE SURFACE CONTAMINATION LEVELS ¹

Nuclides ^a	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
<p>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.</p> <p>b As used in this table dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.</p> <p>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.</p> <p>d The maximum contamination level applies to an area of not more than 100 cm².</p> <p>e The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, then pertinent levels should be reduced proportionally and the entire surface should be wiped.</p> <p>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 cm² and 1.0 mrad/hr at 1 cm², respectively, measured through not more than 7 milligrams per square centimeter of total absorber.</p>			

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 used for the Non-NRR Portion of the TRIGA® Facility (Building 21) Final Survey

Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description
Instruments used inside Building 21						
Ludlum Model 2221 S/N 84459	Ludlum Model 43-37 434 cm ² gas flow proportional Alpha detector S/N 086215	Four Linear Ranges 0-500,000 & one Log 50-500,000	10-28-06 05-15-06	22.14%	<u>concrete</u> 10-60 cpm Scan MDA = 109 dpm/100 cm ² <u>cement block</u> -10-30 cpm Scan MDA = 62 dpm/100 cm ² <u>metal</u> - 0-40 cpm Scan MDA = 62 dpm/100 cm ² <u>glass</u> - 0-30 cpm Scan MDA = 47 dpm/100 cm ² <u>stucco</u> - 0-40 cpm Scan MDA = 62 dpm/100 cm ²	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 disconnects, 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 43-37 434 cm ² gas flow proportional Beta detector S/N 149017	Four Linear Ranges 0-500,000 & one Log 50-500,000	11-23-06 09-22-06 05-15-06	30.39%	<u>concrete</u> - 1300-2000 cpm Scan MDA= 375 dpm/100 cm ² <u>cement block</u> -1600-1900 cpm Scan MDA= 398 dpm/100 cm ² <u>metal</u> -700-1300 cpm Scan MDA= 227 dpm/100 cm ² <u>glass</u> - 1200-1500 cpm Scan MDA= 307 dpm/100 cm ² <u>stucco</u> - 1400-1800 cpm Scan MDA = 364 dpm/100 cm ²	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 disconnects, 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 43-68 100 cm ² gas flow proportional Beta detector S/N 142547	Four Linear Ranges 0-500,000 & one Log 50-500,000	10-28-06 05-15-06	34.36%	<u>concrete</u> - 948 ± 256 cp2m MDA = 212 dpm/100 cm ² <u>cement block</u> - 843 ± 120 cp2m MDA = 200 dpm/100 cm ² <u>metal</u> - 576 ± 105 cp2m MDA = 166 dpm/100 cm ² <u>glass</u> - 630 ± 123 cp2m MDA = 174 dpm/100 cm ² <u>stucco</u> - 777 ± 85 cp2m MDA = 193 dpm/100 cm ² <u>asphalt</u> - 1376 ± 74 cp2m MDA = 255 dpm /100 cm ²	Active Probe Area = 100 cm ² . The detector and rate meter are combined on a roll around cart. The instrument features a static-flow system, quick disconnects and a portable gas bottle.

Table 3: List of Instruments used for the Non-NRR Portion of the TRIGA® Facility (Building 21) Final Survey

Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description
Ludlum Model 3 S/N 153551	Ludlum Model 44-10 NaI (TI) Scintillator Gamma detector S/N 155109	Five Ranges 0-500 μ R/hr	09-05-06 07-14-06 05-03-06 02-27-06	N/A	μ R/hr <u>soil</u> 12-18 @ contact 12-17 @ 1 meter <u>concrete</u> 15-21 @ contact 15-21 @ 1 meter <u>cement block</u> 14-19 @ contact 14-18 @ 1 meter <u>metal</u> 9-13 @ contact 10-13 @ 1 meter <u>glass</u> 12-15 @ contact 13-15 @ 1 meter <u>stucco</u> 10-15 @ contact 11-15 @ 1 meter	2 inch x 2 inch NaI (TI) scintillator. Used for measuring external dose rates at the surface and at 1 meter.
Ludlum Model 3 S/N 151348	Ludlum Model 44-10 NaI (TI) Scintillator Gamma detector S/N 163169	Five Ranges 0-500 μ R/hr	10-04-06 06-30-06 04-14-06	N/A	<u>soil</u> 12-21 μ R/hr @ contact 12-19 μ R/hr @ 1 meter <u>concrete</u> 17-23 μ R/hr @ contact 17-22 μ R/hr @ 1 meter <u>asphalt</u> 20-23 μ R/hr contact 18-21 μ R/hr @ 1 meter	2 inch x 2 inch NaI (TI) scintillator. Used for measuring external dose rates at the surface and at 1 meter
Ludlum Model 3 S/N 131601	Ludlum Model 44-62 NaI (TI) Scintillator Gamma detector S/N 158626	Five Ranges 0-500 μ R/hr	09-06-06	N/A	Aluminum Pipe - 6-17 μ R/hr Steel Pipe - 5-13 μ R/hr PVC Pipe - 7-17 μ R/hr	1/2 inch x 1 inch NaI (TI) scintillator. Used for measuring internal dose rates of pipes.
Ludlum	Ludlum Model 44-9 15 cm ²	Four Ranges	10-28-06		Concrete-60-80 cpm	The instrument is used for beta/gamma surveying. The

Table 3: List of Instruments used for the Non-NRR Portion of the TRIGA® Facility (Building 21) Final Survey

Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description
Model 3 S/N 138880	Beta/Gamma detector S/N 117851	0-100,000 cpm	05-21-06	26.14%	Cement Block- 50-80 cpm Metal- 40-70 cpm	detector has an active probe area of 15 cm ² .
Ludlum Model 12 S/N 138738	Ludlum Model 43-65 Alpha Scintillator ZnS(Ag) Alpha detector S/N 145696	Four Ranges 0-500,000	08-16-06	22.14%	0-20 cpm (all) MDA = 212 dpm/100 cm ²	Active Probe Area = 50 cm ² . Used for Alpha surveying and fixed measurements.
Ludlum Model 12 S/N 91055	Ludlum Model 43-65 Alpha Scintillator ZnS(Ag) Alpha detector S/N 092190	Four Ranges 0-500,000	03-21-06	22.14%	0-20 cpm (all) MDA = 212 dpm/100 cm ²	Active Probe Area = 50 cm ² . Used for Alpha surveying and fixed measurements.
Canberra Low Level α/β Counter Model 2404	Gas Flow Proportional Detector	N/A	As needed	~26-30%	Varies with Sample	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
Instruments used on TRIGA Non-NRR Land Area						
Ludlum Model 2221 S/N 84459	Ludlum Model 43-37 434 cm ² gas flow proportional Alpha detector S/N 086215	Four Linear Ranges 0-500,000 & one Log 50-500,000	07-12-05	22.14%	<u>concrete</u> - 10-60 cpm Scan MDA = 109 dpm/100 cm ² <u>asphalt</u> - 0-80 cpm Scan MDA = 125 dpm/100 cm ² <u>metal</u> - 0-40 cpm Scan MDA = 62 dpm/100 cm ²	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 disconnects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model 2221	Ludlum Model 43-37 434 cm ² gas flow proportional	Four Linear Ranges 0-500,000 & one Log	12-27-05	30.39%	<u>concrete</u> -1300-2000 cpm Scan MDA = 375 dpm/100 cm ² <u>asphalt</u> -2000-2800 cpm	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 disconnects, a

Table 3: List of Instruments used for the Non-NRR Portion of the TRIGA® Facility (Building 21) Final Survey

Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description
S/N 154202	Beta detector S/N 149017	50-500,000			Scan MDA = 546 dpm/100 cm ² <u>metal</u> - 700-1300 cpm Scan MDA = 227 dpm/100 cm ²	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 43-68 100 cm ² gas flow proportional Beta detector S/N 142547	Four Linear Ranges 0-500,000 & one Log 50-500,000	07-12-05 12-27-05	34.36%	<u>concrete</u> - 1042 ± 90 cp2m MDA = 222 dpm/100 cm ² <u>asphalt</u> - 1371 ± 55cp2m MDA = 254 dpm/100 cm ²	Active Probe Area = 100 cm ² . The detector and rate meter are combined on a roll around cart. The instrument features a static-flow system, quick disconnects and a portable gas bottle.
Ludlum Model 12 S/N 138738	Ludlum Model 43-65 Alpha Scintillator ZnS(Ag) Alpha detector S/N 073360	Four Ranges 0-500,000	12-02-05	21.02%	0-20 cpm (all) MDA = 160 dpm/100 cm ² (all)	Active Probe Area = 50 cm ² . Used for Alpha surveying and fixed measurements.
Ludlum Model 3 S/N 151348	Ludlum Model 44-10 NaI (TI) Scintillator Gamma detector S/N 163169	Five Ranges 0-500 µR/hr	08-02-05 10-19-05 10-04-06	NA	<u>soil</u> - 13-19 µR/hr @ contact 13-17 µR/hr @ 1 meter <u>concrete</u> 17-22 µR/hr @ 1 meter <u>asphalt</u> - 19-20 µR/hr @ 1 meter	2 inch x 2 inch NaI (TI) scintillator. Used for measuring external dose rates at the surface and at 1 meter.
Canberra Low Level α/β Counter Model 2404	Gas Flow Proportional Detector	N/A	As needed	~26-30%	Varies with Sample	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

Table 4: General Atomics Gamma Spectroscopy Results of Background Surface Soil Samples

September 24, 2002

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U 144 (186) keV
Sample ID ↓	Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts						
Samples collected June, 2000 Re- analyzed November, 2001							
X-1	ND ¹	ND	0.49 ± 0.15	1.25 ± 0.34	1.74 ± 0.48	ND	ND
X-2	ND	ND	0.91 ± 0.23	0.91 ± 0.23	1.81 ± 0.46	1.17 ± 1.13	(0.09 ± 0.05)
X-3	ND	ND	1.40 ± 0.27	1.79 ± 0.37	3.19 ± 0.63	1.51 ± 1.20	(0.09 ± 0.09)
X-4	0.08 ± 0.07	ND	1.71 ± 0.31	2.08 ± 0.47	3.78 ± 0.78	ND	(0.18 ± 0.13)
X-5	ND	ND	1.52 ± 0.29	2.83 ± 0.70	4.35 ± 0.99	ND	(0.20 ± 0.15)
X-6	ND	ND	1.14 ± 0.32	1.12 ± 0.26	2.25 ± 0.58	ND	(0.09 ± 0.05)
X-7	0.11 ± 0.07	ND	1.68 ± 0.24	2.18 ± 0.47	3.86 ± 0.71	ND	(0.22 ± 0.10)
X-8	ND	ND	2.32 ± 0.38	2.14 ± 0.54	4.45 ± 0.92	ND	(0.26 ± 0.14)
X-9	ND	ND	0.61 ± 0.15	1.59 ± 0.42	2.20 ± 0.57	ND	ND
X-10	0.09 ± 0.06	ND	1.59 ± 0.26	1.39 ± 0.36	2.98 ± 0.61	0.75 ± 1.22	(0.13 ± 0.07)
Samples collected and analyzed September, 2002							
X-11	0.23 ± 0.07	ND	1.37 ± 0.29	1.71 ± 0.37	3.07 ± 0.66	1.13 ± 1.30	(0.25 ± 0.11)
X-12	0.31 ± 0.08	ND	0.50 ± 0.08	0.65 ± 0.18	1.14 ± 0.26	ND	(0.11 ± 0.07)
X-13	ND	ND	0.95 ± 0.20	1.13 ± 0.23	2.08 ± 0.43	1.29 ± 0.99	(0.14 ± 0.05)

¹ ND = Energy peak not identified

Table 4 (continued): General Atomics Gamma Spectroscopy Results of Background Surface Soil Samples
September 24, 2002

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U 144 (186) keV
Sample ID ↓	Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts						
X-14	ND	ND	1.42 ± 0.19	1.59 ± 0.29	3.01 ± 0.48	0.67 ± 0.71	(0.11 ± 0.05)
X-15	ND	ND	0.37 ± 0.09	0.56 ± 0.16	0.92 ± 0.25	0.50 ± 0.66	(0.04 ± 0.04)
X-16	0.06 ± 0.03	ND	0.97 ± 0.22	1.15 ± 0.23	2.12 ± 0.45	ND	(0.10 ± 0.05)
X-17	ND	ND	0.80 ± 0.12	0.96 ± 0.40	1.76 ± 0.52	ND	ND
X-18	0.25 ± 0.07	ND	0.77 ± 0.21	0.94 ± 0.24	1.71 ± 0.45	0.92 ± 0.94	(0.13 ± 0.08)
X-19	ND	ND	0.72 ± 0.12	0.68 ± 0.23	1.40 ± 0.35	ND	(0.11 ± 0.07)
X-20	ND	ND	1.42 ± 0.17	1.40 ± 0.27	2.82 ± 0.45	ND	(0.20 ± 0.09)
X-21	ND	ND	1.51 ± 0.32	1.48 ± 0.30	2.99 ± 0.62	2.47 ± 1.71	0.26 ± 0.23
X-22	0.07 ± 0.05	ND	0.85 ± 0.12	0.98 ± 0.29	1.83 ± 0.41	ND	(0.10 ± 0.08)
X-23	ND	ND	1.17 ± 0.15	1.33 ± 0.28	2.50 ± 0.42	ND	(0.10 ± 0.05)
X-24	ND	ND	2.03 ± 0.26	1.70 ± 0.33	3.73 ± 0.59	1.75 ± 1.37	(0.17 ± 0.06)
X-25	ND	ND	1.44 ± 0.29	1.36 ± 0.28	2.80 ± 0.57	1.52 ± 1.26	(0.19 ± 0.08)
X-26	ND	ND	1.81 ± 0.24	1.41 ± 0.31	3.22 ± 0.54	0.68 ± 0.96	(0.13 ± 0.06)
X-27	ND	ND	1.65 ± 0.20	2.00 ± 0.34	3.65 ± 0.54	ND	(0.15 ± 0.07)
X-28	ND	ND	1.40 ± 0.20	1.47 ± 0.33	2.87 ± 0.54	1.35 ± 1.03	(0.28 ± 0.07)
X-29	0.01 ± 0.07	ND	0.81 ± 0.17	1.61 ± 0.34	2.42 ± 0.51	ND	(0.09 ± 0.06)
X-30	ND	ND	1.90 ± 0.22	1.88 ± 0.33	3.79 ± 0.55	2.67 ± 1.79	(0.35 ± 0.11)

Table 4 (continued): General Atomics Gamma Spectroscopy Results of Background Surface Soil Samples
September 24, 2002

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 the end of the road in the field.
X5	Roselle Street, East of sample location ST64 ~ ½ mile from Building 37 (collected on the hillside)
X6	Roselle Street, East of sample location ST64 ~1 ½ mile from Building 37 (collected on hillside).
X7	Lusk Boulevard, from the hillside ~ 1 ½ miles from Building 37 (collected on the hillside).
X8	Vista Sorrento Parkway, ~ ½ mile from Building 37 (collected on the hillside).
X9	Callahan Road, ~ ½ mile from Building 37 (collected on the hillside).
X10	Eastgate Mall road, ~3 miles from Building 37 (collected in a field).
X11	Creek Road (North County).
X12	Canyon de Oro (North County).
X13	Palomar (North E County).
X14	Deer Springs Rd. (North County).
X15	Rice Canyon Rd. (North County).
X16	Las Pulgas Rd. (North County).
X17	Boderfield Park (South W County).
X18	Otay Mesa (South E County).
X19	Sunset Cliff (South W County).
X20	Marion Bear Park (South County).
X21	Mission Valley (South County).
X22	Santee (South E County)
X23	Ramona (East County).
X24	Via Abitura (San Diego).
X25	Black Mtn. Park (San Diego).
X26	Park Village (San Diego).
X27	Harris Plant Rd. (San Diego).
X28	Daley Center Dr. (San Diego).
X29	Harbison Canyon (East County).
X30	Apple St. (East San Diego).

Table 5: Gamma Spectroscopy Results of Soil Samples taken from Room 113, 114 and 115 Pipe Excavation Trench and Trench Outside Room 111 (External to Building 21)

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	<i>Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted</i>						
B21-1	ND	ND	0.77 ± 0.17	1.40 ± 0.34	2.17 ± 0.51	ND	0.07 ± 0.06
B21-2	ND	ND	0.93 ± 0.19	1.19 ± 0.28	2.12 ± 0.47	ND	ND
B21-3	0.18 ± 0.09	ND	1.32 ± 0.24	1.61 ± 0.42	2.93 ± 0.66	ND	ND
B21-4	ND	ND	0.85 ± 0.24	1.41 ± 0.31	2.26 ± 0.55	ND	ND
B21-5	ND	ND	0.88 ± 0.22	1.35 ± 0.45	2.23 ± 0.67	ND	0.07 ± 0.08
B21-6	ND	ND	0.76 ± 0.19	1.17 ± 0.39	1.93 ± 0.58	ND	0.06 ± 0.07
B21-7	0.04 ± 0.05	ND	0.79 ± 0.18	1.40 ± 0.33	2.19 ± 0.51	ND	0.11 ± 0.09
B21-8	ND	ND	1.33 ± 0.24	1.32 ± 0.35	2.65 ± 0.59	ND	ND
B21-9	0.04 ± 0.06	ND	1.26 ± 0.24	1.50 ± 0.37	2.76 ± 0.61	ND	ND
B21-10	ND	ND	1.08 ± 0.21	1.46 ± 0.35	2.54 ± 0.56	ND	ND
B21-11	ND	0.07 ± 0.06	0.68 ± 0.16	1.31 ± 0.37	1.99 ± 0.53	ND	0.08 ± 0.09
B21-12	ND	ND	0.84 ± 0.14	1.32 ± 0.31	2.16 ± 0.45	ND	0.07 ± 0.09
B21-13	0.04 ± 0.05	ND	0.60 ± 0.14	1.31 ± 0.36	1.91 ± 0.50	ND	0.15 ± 0.09
B21-14	ND	ND	0.60 ± 0.13	1.16 ± 0.33	1.76 ± 0.46	ND	0.05 ± 0.06
B21-15	ND	ND	0.51 ± 0.13	0.91 ± 0.26	1.42 ± 0.39	ND	0.13 ± 0.10
B21-16	ND	ND	1.03 ± 0.19	1.48 ± 0.35	2.51 ± 0.54	ND	0.15 ± 0.08

Table 5: Gamma Spectroscopy Results of Soil Samples taken from Room 113, 114 and 115 Pipe Excavation Trench and Trench Outside Room 111 (External to Building 21)

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	<i>Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds Not Subtracted</i>						
B21-17	ND	ND	0.52 ± 0.12	1.01 ± 0.29	1.53 ± 0.41	ND	0.09 ± 0.07
B21-18	ND	ND	0.37 ± 0.09	0.83 ± 0.29	1.20 ± 0.38	ND	ND
B21-19	ND	ND	0.68 ± 0.14	0.97 ± 0.31	1.65 ± 0.45	ND	0.09 ± 0.05
B21-20	0.07 ± 0.06	ND	1.05 ± 0.16	1.32 ± 0.38	2.37 ± 0.54	ND	0.20 ± 0.12
B21-21	ND	ND	0.64 ± 0.11	0.70 ± 0.29	1.34 ± 0.40	ND	ND
B21-22	0.33 ± 0.11	ND	1.24 ± 0.31	1.59 ± 0.36	2.83 ± 0.67	ND	0.15 ± 0.07
B21-23	0.03 ± 0.05	ND	0.73 ± 0.15	1.49 ± 0.42	2.22 ± 0.57	ND	0.06 ± 0.07
B21-24	0.08 ± 0.08	ND	1.19 ± 0.18	1.81 ± 0.44	3.00 ± 0.62	ND	0.13 ± 0.09
B21-25	0.26 ± 0.10	ND	1.06 ± 0.27	1.51 ± 0.37	2.57 ± 0.64	ND	0.15 ± 0.07
B21-26	0.25 ± 0.09	ND	0.95 ± 0.19	1.07 ± 0.35	2.02 ± 0.54	ND	ND
B21-27	0.94 ± 0.15	ND	0.78 ± 0.13	1.05 ± 0.31	1.83 ± 0.44	ND	ND
B-21-40	1.01 ± 1.12	0.83 ± 0.16	0.59 ± 0.15	0.77 ± 0.28	1.36 ± 0.43	ND	0.25 ± 0.07
B-21-41	0.77 ± 0.12	ND	1.03 ± 0.19	0.81 ± 0.24	1.84 ± 0.43	ND	0.08 ± 0.07
B-21-42	0.07 ± 0.06	ND	1.19 ± 0.19	0.90 ± 0.27	2.09 ± 0.46	ND	0.11 ± 0.06

- Notes:
1. ND means not detected.
 2. Average Minimum Detectable Activities (MDAs):

U-238 = 1.58 pCi/g (63 keV peak)	Co-60 = 0.16 pCi/g (1173 keV peak)
U-235 = 0.14 pCi/g (186 keV peak)	Th-228 = 0.21 pCi/g (238 keV peak)
Cs-137 = 0.13 pCi/g (662 keV peak)	Th-232 = 0.43 pCi/g (911 keV peak)
 3. Shaded data (soil sample B21-40) is for soil/debris removed and disposed of as low level radioactive waste.

Table 6: Gamma Spectroscopy Results of TRIGA® Non-NRR Soil Samples

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	<i>Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted</i>						
Non-NRR-1	ND	ND	0.95 ± 0.19	1.72 ± 0.42	2.67 ± 0.64	ND	0.10 ± 0.07
Non-NRR-2	0.18 ± 0.07	ND	1.11 ± 0.17	1.82 ± 0.41	2.93 ± 0.58	ND	ND
Non-NRR-3	0.54 ± 0.12	ND	1.00 ± 0.19	1.40 ± 0.40	2.40 ± 0.19	ND	ND
Non-NRR-4	0.19 ± 0.08	ND	1.26 ± 0.25	1.48 ± 0.41	2.74 ± 0.66	ND	ND
Non-NRR-5	0.06 ± 0.07	ND	0.76 ± 0.16	1.48 ± 0.39	2.24 ± 0.55	ND	ND
Non-NRR-6	0.49 ± 0.12	ND	1.05 ± 0.21	1.17 ± 0.39	2.22 ± 0.60	ND	0.08 ± 0.06
Non-NRR-7	0.04 ± 0.05	ND	0.79 ± 0.18	1.40 ± 0.33	2.19 ± 0.51	ND	0.11 ± 0.09
Non-NRR-8	ND	ND	1.33 ± 0.24	1.32 ± 0.35	2.65 ± 0.59	ND	ND
Non-NRR-9	0.04 ± 0.06	ND	1.26 ± 0.24	1.50 ± 0.37	2.76 ± 0.61	ND	ND
Non-NRR-10	ND	ND	1.08 ± 0.21	1.46 ± 0.35	2.54 ± 0.56	ND	ND
Non-NRR-11	ND	0.07 ± 0.06	0.68 ± 0.16	1.31 ± 0.37	1.99 ± 0.53	ND	0.08 ± 0.09
Non-NRR-12	ND	ND	0.84 ± 0.14	1.32 ± 0.31	2.16 ± 0.45	ND	0.07 ± 0.09
Non-NRR-13	0.10 ± 0.07	ND	1.34 ± 0.26	1.75 ± 0.44	3.09 ± 0.70	ND	0.12 ± 0.10
Non-NRR-14	ND	ND	1.50 ± 0.36	2.29 ± 0.52	3.79 ± 0.88	ND	ND
Non-NRR-15	ND	ND	1.61 ± 0.31	1.84 ± 0.46	3.45 ± 0.77	ND	ND
Non-NRR-16	ND	ND	1.66 ± 0.24	2.14 ± 0.48	3.80 ± 0.72	1.42 ± 1.32	0.22 ± 0.10
Non-NRR-17	ND	ND	1.61 ± 0.38	2.19 ± 0.49	3.80 ± 0.87	ND	0.07 ± 0.14

Table 6: Gamma Spectroscopy Results of TRIGA® Non-NRR Soil Samples

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	<i>Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted</i>						
Non-NRR-18	0.51 ± 0.13	ND	1.00 ± 0.18	1.66 ± 0.39	2.66 ± 0.57	1.00 ± 1.12	0.09 ± 0.09
Non-NRR-19	0.27 ± 0.12	ND	1.58 ± 0.24	1.87 ± 0.55	3.45 ± 0.79	ND	ND
Non-NRR-20	0.76 ± 0.15	ND	1.58 ± 0.28	1.87 ± 0.41	3.45 ± 0.69	ND	0.14 ± 0.09
Non-NRR-21	0.26 ± 0.09	ND	0.88 ± 0.18	1.73 ± 0.46	2.61 ± 0.64	ND	0.11 ± 0.08
Non-NRR-22	0.33 ± 0.11	ND	1.23 ± 0.31	1.59 ± 0.36	2.82 ± 0.67	ND	0.15 ± 0.07
Non-NRR-23	0.03 ± 0.05	ND	0.73 ± 0.15	1.49 ± 0.42	2.22 ± 0.57	ND	0.06 ± 0.07
Non-NRR-24	0.08 ± 0.08	ND	1.19 ± 0.18	1.81 ± 0.44	3.00 ± 0.62	ND	0.13 ± 0.09
Non-NRR-25	0.26 ± 0.10	ND	1.06 ± 0.27	1.51 ± 0.37	2.57 ± 0.64	ND	0.15 ± 0.07
Non-NRR-26	0.25 ± 0.09	ND	0.95 ± 0.19	1.07 ± 0.35	2.02 ± 0.54	ND	ND
Non-NRR-27	0.94 ± 0.15	ND	0.78 ± 0.13	1.05 ± 0.31	1.83 ± 0.44	ND	ND
Non-NRR-28	ND	ND	1.04 ± 0.22	1.38 ± 0.33	2.42 ± 0.55	ND	ND
Non-NRR-29	ND	ND	0.82 ± 0.13	1.07 ± 0.38	1.89 ± 0.51	ND	0.07 ± 0.06
Non-NRR-30	ND	ND	0.53 ± 0.13	1.25 ± 0.35	1.78 ± 0.48	ND	0.11 ± 0.08
Non-NRR-31	ND	ND	0.58 ± 0.13	0.99 ± 0.31	1.57 ± 0.44	ND	ND
Non-NRR-32	ND	ND	0.71 ± 0.22	0.92 ± 0.27	1.63 ± 0.49	ND	0.05 ± 0.06
Non-NRR-33	0.09 ± 0.07	ND	1.14 ± 0.18	1.28 ± 0.34	2.42 ± 0.52	ND	0.09 ± 0.08
Non-NRR-34	ND	ND	1.22 ± 0.26	1.63 ± 0.42	2.85 ± 0.68	0.45 ± 1.12	0.08 ± 0.07

Table 6: Gamma Spectroscopy Results of TRIGA® Non-NRR Soil Samples

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	<i>Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted</i>						
Non-NRR-35	ND	ND	1.02 ± 0.27	1.53 ± 0.40	2.55 ± 0.67	0.64 ± 0.83	0.08 ± 0.07
Non-NRR-36	ND	ND	0.88 ± 0.24	1.19 ± 0.33	2.07 ± 0.57	ND	0.08 ± 0.07
Non-NRR-37	0.03 ± 0.05	ND	0.90 ± 0.24	1.30 ± 0.35	2.20 ± 0.59	ND	ND
Non-NRR-38	ND	ND	1.18 ± 0.18	1.69 ± 0.36	2.87 ± 0.54	ND	0.09 ± 0.06
Non-NRR-39	ND	ND	0.42 ± 0.13	0.90 ± 0.26	1.32 ± 0.39	ND	ND
Non-NRR-40	ND	ND	1.02 ± 0.25	1.19 ± 0.36	2.21 ± 0.61	ND	0.08 ± 0.07
Non-NRR-41	ND	ND	0.92 ± 0.27	1.27 ± 0.36	2.19 ± 0.63	ND	0.09 ± 0.06
Non-NRR-42	ND	ND	1.42 ± 0.22	1.60 ± 0.44	3.02 ± 0.66	ND	ND
Non-NRR-43	ND	ND	1.74 ± 0.30	2.06 ± 0.47	3.80 ± 0.77	ND	0.21 ± 0.12
Non-NRR-44	0.13 ± 0.07	ND	0.84 ± 0.14	1.29 ± 0.37	2.13 ± 0.51	ND	0.08 ± 0.06
Non-NRR-45	ND	ND	0.62 ± 0.16	1.26 ± 0.30	1.88 ± 0.46	ND	ND
Non-NRR-46	ND	ND	0.80 ± 0.14	1.37 ± 0.35	2.17 ± 0.49	ND	ND
Non-NRR-47	ND	ND	0.97 ± 0.18	1.48 ± 0.41	2.45 ± 0.59	ND	0.16 ± 0.09
Non-NRR-48 0-6"	0.53 ± 0.12	ND	1.01 ± 0.22	2.00 ± 0.42	3.01 ± 0.64	ND	ND
Non-NRR-48 6"-12"	0.14 ± 0.08	ND	1.72 ± 0.25	2.34 ± 0.47	4.06 ± 0.72	ND	0.09 ± 0.09

Table 6: Gamma Spectroscopy Results of TRIGA® Non-NRR Soil Samples

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	<i>Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted</i>						
Non-NRR-48 12"-18"	0.08 ± 0.09	ND	1.26 ± 0.19	2.33 ± 0.52	3.59 ± 0.71	ND	0.10 ± 0.08
Non-NRR-48 18"-24"	0.19 ± 0.08	ND	1.12 ± 0.24	1.96 ± 0.48	3.08 ± 0.72	0.95 ± 1.25	0.11 ± 0.09
Non-NRR-48 24"-30"	ND	ND	1.36 ± 0.32	1.91 ± 0.45	3.27 ± 0.77	ND	0.17 ± 0.12
Non-NRR-48 30"-36"	0.21 ± 0.07	ND	0.98 ± 0.23	1.58 ± 0.51	2.56 ± 0.74	ND	ND
Non-NRR-49 0-6"	0.11 ± 0.07	ND	1.68 ± 0.30	1.83 ± 0.48	3.51 ± 0.78	ND	0.14 ± 0.11
Non-NRR-49 6"-12"	ND	ND	1.31 ± 0.24	2.12 ± 0.49	3.43 ± 0.73	ND	0.13 ± 0.10
Non-NRR-49 12"-18"	0.14 ± 0.09	ND	1.52 ± 0.27	2.05 ± 0.47	3.57 ± 0.74	ND	0.15 ± 0.10
Non-NRR-49 18"-24"	ND	ND	1.10 ± 0.30	1.51 ± 0.42	2.61 ± 0.72	ND	ND
Non-NRR-49 24"-30"	ND	ND	0.89 ± 0.27	1.16 ± 0.35	2.05 ± 0.62	ND	0.05 ± 0.09
Non-NRR-49 30"-36"	ND	ND	1.07 ± 0.31	1.51 ± 0.41	2.58 ± 0.72	ND	0.06 ± 0.07
Non-NRR-50 0-6"	ND	ND	0.84 ± 0.14	1.13 ± 0.34	1.97 ± 0.48	ND	0.13 ± 0.08

Table 6: Gamma Spectroscopy Results of TRIGA® Non-NRR Soil Samples

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	<i>Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted</i>						
Non-NRR-50 6"-12"	ND	ND	0.81 ± 0.26	1.22 ± 0.38	2.03 ± 0.64	ND	0.08 ± 0.06
Non-NRR-50 12"-18"	ND	ND	0.58 ± 0.13	1.14 ± 0.34	1.72 ± 0.47	ND	0.06 ± 0.10
Non-NRR-50 18"-24"	ND	ND	0.70 ± 0.15	1.01 ± 0.34	1.71 ± 0.49	0.59 ± 0.90	0.12 ± 0.07
Non-NRR-50 24"-30"	ND	ND	1.18 ± 0.24	1.01 ± 0.31	2.19 ± 0.55	ND	0.10 ± 0.10
Non-NRR-50 30"-36"	ND	ND	0.66 ± 0.14	1.05 ± 0.33	1.71 ± 0.47	ND	0.09 ± 0.09
Non-NRR-51 0-6"	0.11 ± 0.05	ND	0.99 ± 0.16	1.35 ± 0.36	2.34 ± 0.52	ND	0.11 ± 0.06
Non-NRR-51 6"-12"	0.11 ± 0.08	ND	1.19 ± 0.30	1.49 ± 0.40	2.68 ± 0.70	1.19 ± 1.34	0.10 ± 0.08
Non-NRR-51 12'-18"	ND	ND	1.23 ± 0.18	1.60 ± 0.38	2.83 ± 0.56	ND	0.11 ± 0.09
Non-NRR-51 18"-24"	ND	ND	1.67 ± 0.31	2.02 ± 0.47	3.69 ± 0.78	1.24 ± 1.32	0.10 ± 0.09
Non-NRR-51 24"-30"	0.08 ± 0.09	ND	1.11 ± 0.17	1.64 ± 0.38	2.75 ± 0.55	1.10 ± 1.04	0.10 ± 0.08
Non-NRR-51 30"-36"	0.10 ± 0.08	ND	1.18 ± 0.29	1.48 ± 0.38	2.66 ± 0.67	ND	0.13 ± 0.08

Table 6: Gamma Spectroscopy Results of TRIGA® Non-NRR Soil Samples

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	<i>Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted</i>						
Non-NRR-52 0-6"	0.25 ± 0.10	ND	1.38 ± 0.21	1.94 ± 0.47	3.32 ± 0.68	ND	0.13 ± 0.13
Non-NRR-52 6"-12"	0.13 ± 0.08	ND	1.47 ± 0.22	2.09 ± 0.44	3.56 ± 0.66	ND	0.17 ± 0.10
Non-NRR-52 12"-18"	0.15 ± 0.08	ND	1.17 ± 0.23	1.67 ± 0.42	2.84 ± 0.65	ND	0.20 ± 0.12
Non-NRR-52 18"-24"	0.07 ± 0.06	ND	0.98 ± 0.16	1.35 ± 0.37	2.33 ± 0.53	ND	0.06 ± 0.10
Non-NRR-52 24"-30"	0.18 ± 0.09	ND	1.52 ± 0.37	2.10 ± 0.50	3.62 ± 0.87	ND	0.11 ± 0.08
Non-NRR-52 30"-36"	0.22 ± 0.09	ND	1.46 ± 0.22	1.99 ± 0.43	3.45 ± 0.65	1.05 ± 1.34	0.13 ± 0.09
Non-NRR-53 0-6"	0.16 ± 0.09	ND	1.91 ± 0.43	2.47 ± 0.53	4.38 ± 0.96	1.18 ± 1.41	0.24 ± 0.13
Non-NRR-53 6"-12"	ND	ND	1.90 ± 0.28	2.55 ± 0.55	4.45 ± 0.83	ND	0.20 ± 0.09
Non-NRR-53 12"-18"	ND	ND	1.89 ± 0.37	2.42 ± 0.54	4.31 ± 0.91	1.78 ± 1.72	0.17 ± 0.08
Non-NRR-53 18"-24"	ND	ND	1.79 ± 0.26	2.54 ± 0.53	4.33 ± 0.79	1.18 ± 1.45	0.15 ± 0.10
Non-NRR-53 24"-30"	ND	ND	2.07 ± 0.46	2.40 ± 0.54	4.47 ± 1.00	0.99 ± 1.52	0.17 ± 0.08

Table 6: Gamma Spectroscopy Results of TRIGA® Non-NRR Soil Samples							
Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted						
Non-NRR-53 30"-36"	ND	ND	1.79 ± 0.30	2.28 ± 0.48	4.07 ± 0.78	1.44 ± 1.65	0.29 ± 0.13
Non-NRR-54	0.11 ± 0.08	ND	1.40 ± 0.31	2.24 ± 0.45	3.64 ± 0.76	ND	0.17 ± 0.11
Non-NRR-55	ND	ND	1.45 ± 0.29	2.36 ± 0.49	3.81 ± 0.78	ND	0.09 ± 0.11
Non-NRR-56	0.07 ± 0.07	ND	1.83 ± 0.46	2.52 ± 0.52	4.35 ± 0.98	1.66 ± 1.41	0.18 ± 0.12

Notes: 1. ND means not detected.

2. Average Minimum Detectable Activities (MDAs):

U-238 = 1.58 pCi/g (63 keV peak)

U-235 = 0.14 pCi/g (186 keV peak)

Cs-137 = 0.13 pCi/g (662 keV peak)

Co-60 = 0.16 pCi/g (1173 keV peak)

Th-228 = 0.21 pCi/g (238 keV peak)

Th-232 = 0.43 pCi/g (911 keV peak)

Table 7: Removable Contamination (Wipe) Results for the Non-NRR Portion of the TRIGA® Facility (Building 21)

Room 109/110				
Wipe #	Alpha	Beta	Location	Figure #
1	<20	<20	Overhead	6
2	<20	20	Overhead	6
3	<20	<20	Overhead	6
4	<20	<20	Overhead	6
5	<20	<20	Overhead	6
6	<20	<20	Overhead	6
7	<20	<20	Overhead	6
8	<20	<20	Overhead	6
9	<20	<20	Overhead	6
10	<20	26	Overhead	6
11	<20	<20	Overhead	6
12	<20	<20	Overhead	6
13	<20	<20	Overhead	6
14	<20	35	Overhead	6
15	<20	<20	Overhead	6
16	<20	<20	Overhead	6
17	<20	<20	Trench	9
18	<20	<20	Trench	9
19	<20	<20	Trench	9
20	<20	<20	Trench	9
21	<20	<20	Trench	9
22	<20	<20	South Wall	6
23	<20	<20	South Wall	6
24	<20	<20	Floor	6
25	<20	<20	Floor	6
26	<20	23	East Wall	6
27	<20	<20	Floor	6
28	<20	<20	Floor	6
29	<20	<20	Floor	6
30	<20	<20	Floor	6
31	<20	<20	Floor	6

Room 109/110 (continued)				
Wipe #	Alpha	Beta	Location	Figure #
32	<20	29	Floor	6
33	<20	<20	Floor	6
34	<20	<20	East Wall	6
35	<20	<20	North Wall	6
36	<20	<20	North Wall	6
37	<20	<20	North Wall	6
38	<20	<20	West Wall	6
39	<20	<20	West Wall	6

Room 111				
Wipe #	Alpha	Beta	Location	Figure #
1	<20	<20	North Wall	13
2	<20	<20	North Wall	13
3	<20	<20	North Wall	13
4	<20	<20	North Wall	13
5	<20	<20	Floor	13
6	<20	<20	Floor	13
7	<20	<20	Floor	13
8	<20	<20	Floor	13
9	<20	<20	Floor	13
10	<20	<20	Floor	13
11	<20	<20	Floor	13
12	<20	<20	Floor	13
13	<20	<20	Floor	13
14	<20	23	Floor	13
15	<20	<20	Floor	13
16	<20	<20	Floor	13
17	<20	<20	Floor	13
18	<20	<20	Floor	13
19	<20	<20	Floor	13

Table 7: Removable Contamination (Wipe) Results for the Non-NRR Portion of the TRIGA® Facility (Building 21)

Room 111 (continued)				
Wipe #	Alpha	Beta	Location	Figure #
20	<20	<20	West Wall	13
21	<20	<20	West Wall	13
22	<20	<20	West Wall	13
23	<20	<20	South Wall	13
24	<20	<20	South Wall	13
25	<20	20	South Wall	13
26	<20	<20	South Wall	13
27	<20	<20	East Wall	13
28	<20	<20	East Wall	13
29	<20	20	East Wall	13
30	<20	<20	Overhead	13
31	<20	20	Overhead	13
32	<20	65	Overhead	13
33	<20	46	Overhead	13
34	<20	26	Overhead	13
35	<20	<20	Overhead	13
36	<20	<20	Overhead	13
37	<20	<20	Overhead	13
38	<20	23	Overhead	13
39	<20	<20	Overhead	13
40	<20	20	Overhead	13
41	<20	<20	Overhead	13
42	<20	<20	Hoist	13
43	<20	<20	Hoist	13
44	<20	<20	Trench	16
45	<20	<20	Trench	16
46	<20	<20	Trench	16
47	<20	<20	Trench	16
48	<20	<20	Trench	16
49	<20	<20	Trench	16
50	<20	<20	Trench	16

Room 111 (continued)				
Wipe #	Alpha	Beta	Location	Figure #
51	<20	<20	Trench	16
52	<20	<20	Trench	16
53	<20	<20	Trench	16

Room 111 TRIGA® Mk III Pit				
Wipe #	Alpha	Beta	Location	Figure #
1	<20	<20	Wall	21
2	<20	<20	Wall	21
3	<20	<20	Wall	21
4	<20	<20	Wall	21
5	<20	<20	Wall	21
6	<20	<20	Wall	21
7	<20	<20	Floor	21
8	<20	<20	Wall	21
9	<20	<20	Wall	21
10	<20	<20	Wall	21
11	<20	20	Wall	21
12	<20	<20	Pipe	21
13	<20	<20	Pipe	21
14	<20	<20	Pipe	21
15	<20	<20	Pipe	21
16	<20	<20	Pipe	21

Room 112				
Wipe #	Alpha	Beta	Location	Figure #
1	<20	29	South Wall	26
2	<20	<20	Floor	26
3	<20	<20	West Wall	26
4	<20	<20	West Wall	26
5	<20	<20	Floor	26
6	<20	<20	Floor	26

Table 7: Removable Contamination (Wipe) Results for the Non-NRR Portion of the TRIGA® Facility (Building 21)

Room 112 (continued)				
Wipe #	Alpha	Beta	Location	Figure #
7	<20	<20	Floor	26
8	<20	<20	North Wall	26
9	<20	<20	East Wall	26
10	<20	38	West Wall	26
11	<20	38	Overhead	26
12	<20	136	Overhead	26
13	<20	<20	Overhead	26

Room 113				
Wipe #	Alpha	Beta	Location	Figure #
1	<20	<20	North Wall	30
2	<20	<20	North Wall	30
3	<20	<20	North Wall	30
4	<20	<20	East Wall	30
5	<20	<20	East Wall	30
6	<20	<20	East Wall	30
7	<20	<20	South Wall	30
8	<20	<20	South Wall	30
9	<20	<20	West Wall	30
10	<20	<20	Floor	30
11	<20	<20	Floor	30
12	<20	<20	Floor	30
13	<20	<20	Floor	30
14	<20	<20	Floor	30
15	<20	<20	Floor	30
16	<20	<20	Floor	30
17	<20	<20	Floor	30
18	<20	<20	Floor	30
19	<20	<20	Floor	30
20	<20	<20	Floor	30
21	<20	<20	Floor	30
22	<20	<20	Floor	30

Room 113 (continued)				
Wipe #	Alpha	Beta	Location	Figure #
23	<20	<20	East Wall	30
24	<20	47	Overhead	30
25	<20	<20	South Wall	30
26	<20	38	South Wall	30
27	<20	65	Overhead	30
28	<20	32	Overhead	30
29	<20	<20	South Wall	30
30	<20	<20	Overhead	30
31	<20	<20	Overhead	30
32	<20	68	Overhead	30
33	<20	<20	East Wall	30

Room 114/115				
Wipe #	Alpha	Beta	Location	Figure #
1	<20	<20	Floor	35
2	<20	<20	Floor	35
3	<20	<20	Floor	35
4	<20	<20	Floor	35
5	<20	<20	Floor	35
6	<20	<20	North Wall	35
7	<20	<20	East Wall	35
8	<20	<20	East Wall	35
9	<20	<20	South Wall	35
10	<20	<20	South Wall	35
11	<20	<20	West Wall	35
12	<20	<20	West Wall	35
13	<20	<20	North Wall	35
14	<20	<20	Overhead	35
15	<20	<20	Overhead	35
16	<20	<20	Overhead	35
17	<20	<20	Overhead	35

Table 7: Removable Contamination (Wipe) Results for the Non-NRR Portion of the TRIGA® Facility (Building 21)

Pad West of Roll-up Door Room 111				
Wipe #	Alpha	Beta	Location	Figure #
1	<20	<20	Pad	40
2	<20	<20	Pad	40
3	20	38	Trench	43
4	<20	<20	Pipe	43
5	<20	<20	Pipe	43
6	<20	<20	Pipe	43
7	<20	<20	Pipe	43

Table 8: Building 21, Non-Reactor Paved Land Area Wipe Sample Analysis Results

Sample Number	α in dpm/100 cm ²	β in dpm/100 cm ²	Sample Number	α in dpm/100 cm ²	β in dpm/100 cm ²
1	<20	<20	37	<20	<20
2	<20	<20	38	<20	<20
3	<20	<20	39	<20	<20
4	<20	<20	40	<20	<20
5	<20	<20	41	<20	<20
6	<20	<20	42	<20	<20
7	<20	<20	43	<20	<20
8	<20	<20	44	<20	<20
9	<20	<20	45	<20	<20
10	<20	35 \pm 21	46	<20	<20
11	<20	<20	47	<20	<20
12	<20	<20	48	<20	<20
13	<20	<20	49	<20	<20
14	<20	<20	50	<20	<20
15	<20	<20	51	<20	<20
16	<20	<20	52	<20	<20
17	<20	<20	53	<20	<20
18	<20	<20	54	<20	<20
19	<20	<20	55	<20	<20
20	<20	<20	56	<20	<20
21	<20	<20	57	<20	<20
22	<20	<20	58	<20	<20
23	<20	<20	59	<20	<20
24	<20	<20	60	<20	<20
25	<20	<20	61	<20	<20
26	<20	<20	62	<20	<20
27	<20	<20	63	<20	<20

Table 8: Building 21, Non-Reactor Paved Land Area Wipe Sample Analysis Results

Sample Number	α in dpm/100 cm ²	β in dpm/100 cm ²	Sample Number	α in dpm/100 cm ²	β in dpm/100 cm ²
28	<20	<20	64	<20	<20
29	<20	<20	65	<20	<20
30	<20	<20	66	<20	<20
31	<20	<20	67	<20	<20
32	<20	<20	68	<20	<20
33	<20	<20	69	<20	<20
34	<20	<20	70	<20	<20
35	<20	<20	71	<20	<20
36	<20	<20			

**TABLE 9: Gamma Spectroscopy Results of Concrete Samples, Cement Block Samples and
Pipe Trench Fill Sand Samples**

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted						
Concrete Samples							
B21 Non-NRR Con-1	0.15 ± 0.07	ND	1.17 ± 0.28	1.30 ± 0.29	2.47 ± 0.57	ND	0.14 ± 0.06
B21 Non-NRR Con-2	ND	ND	1.33 ± 0.35	1.62 ± 0.35	2.95 ± 0.70	0.22 ± 1.13	0.15 ± 0.08
B21 Non-NRR Con-3	0.55 ± 0.11	ND	1.20 ± 0.36	1.67 ± 0.36	2.87 ± 0.72	0.89 ± 1.05	0.14 ± 0.09
B21 Non-NRR Con-4	ND	ND	1.03 ± 0.29	1.28 ± 0.34	2.31 ± 0.63	1.00 ± 1.49	0.17 ± 0.11
B21 Non-NRR Con-5	0.37 ± 0.09	ND	1.43 ± 0.33	1.53 ± 0.34	2.96 ± 0.67	1.15 ± 1.12	0.10 ± 0.07
B21 Non-NRR Con-6	0.02 ± 0.05	ND	1.32 ± 0.21	1.53 ± 0.36	2.85 ± 0.57	3.19 ± 2.36	0.19 ± 0.10
B21 Non-NRR Con-7	ND	ND	1.28 ± 0.31	1.63 ± 0.39	2.91 ± 0.70	ND	0.14 ± 0.08
B21 Non-NRR Con-8	ND	ND	1.51 ± 0.35	1.61 ± 0.39	3.12 ± 0.74	ND	0.18 ± 0.08
B21 Non-NRR Con-9	4.48 ± 0.50	1.19 ± 0.18	1.23 ± 0.19	1.52 ± 0.39	2.75 ± 0.58	0.69 ± 1.24	0.19 ± 0.08
B21 Non-NRR Con-10	ND	ND	1.38 ± 0.21	1.92 ± 0.39	3.30 ± 0.60	ND	0.14 ± 0.10
**B21 Non-NRR Con-11	ND	0.23 ± 0.11	1.52 ± 0.22	1.83 ± 0.45	3.35 ± 0.67	ND	0.13 ± 0.07

TABLE 9: Gamma Spectroscopy Results of Concrete Samples, Cement Block Samples and Pipe Trench Fill Sand Samples

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	<i>Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted</i>						
B21 Non-NRR Con-12	ND	ND	1.44 ± 0.31	1.70 ± 0.39	3.14 ± 0.70	ND	0.10 ± 0.08
B21 Non-NRR Con-13	ND	ND	1.57 ± 0.36	1.86 ± 0.39	3.43 ± 0.75	1.23 ± 1.51	0.18 ± 0.11
B21 Non-NRR Con-14	ND	ND	1.49 ± 0.23	1.87 ± 0.40	3.36 ± 0.63	1.28 ± 1.16	0.16 ± 0.10
B21 Non-NRR Con-15	ND	ND	1.61 ± 0.25	1.93 ± 0.41	3.54 ± 0.66	1.46 ± 1.32	0.18 ± 0.12
B21 Non-NRR Con-16	ND	ND	1.60 ± 0.39	2.04 ± 0.46	3.64 ± 0.85	2.53 ± 1.92	0.30 ± 0.13
B21 Non-NRR Con-17	0.13 ± 0.07	ND	1.41 ± 0.21	1.78 ± 0.41	3.19 ± 0.62	1.34 ± 1.17	0.25 ± 0.09
B21 Non-NRR Con-18	ND	ND	1.42 ± 0.22	1.68 ± 0.36	3.10 ± 0.58	ND	0.15 ± 0.11
Cement Block Samples							
B21 Non-NRR CB-1	0.58 ± 0.13	ND	0.36 ± 0.13	0.76 ± 0.27	1.12 ± 0.40	ND	ND
B21 Non-NRR CB-2	0.46 ± 0.09	ND	0.94 ± 0.26	1.42 ± 0.39	2.36 ± 0.65	ND	ND
Fill Sand Samples							
B21 Non-NRR Sand-1	0.72 ± 0.12	ND	0.61 ± 0.14	0.90 ± 0.25	1.51 ± 0.39	ND	ND

**TABLE 9: Gamma Spectroscopy Results of Concrete Samples, Cement Block Samples and
Pipe Trench Fill Sand Samples**

Energy Peaks →	¹³⁷ Cs 661.6 keV	⁶⁰ Co 1173 keV	²²⁸ Th 238 keV (²¹² Pb)	²²⁸ Ra (²³² Th) 911 keV (²²⁸ Ac)	(Total) Th ²²⁸ Th + ²³² Th	²³⁸ U 63.3 (92.7) keV (²³⁴ Th)	²³⁵ U (144) 186 keV
Sample ID ↓	Radionuclide Concentrations (pCi/g) - Results ± 2σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted						
Fill Sand (Continued)							
B21 Non-NRR Sand-2	1.18 ± 0.16	0.28 ± 0.10	0.43 ± 0.11	0.81 ± 0.23	1.24 ± 0.34	ND	0.04 ± 0.04
B21 Non-NRR Sand-3	0.58 ± 0.10	ND	0.59 ± 0.11	0.85 ± 0.25	1.44 ± 0.36	ND	0.05 ± 0.07
B21 Non-NRR Sand-4	0.27 ± 0.09	ND	0.55 ± 0.15	0.99 ± 0.28	1.54 ± 0.43	ND	0.06 ± 0.06

- **Notes:**
1. ND means not detected.
 2. Average Minimum Detectable Activities (MDAs) for Soil:

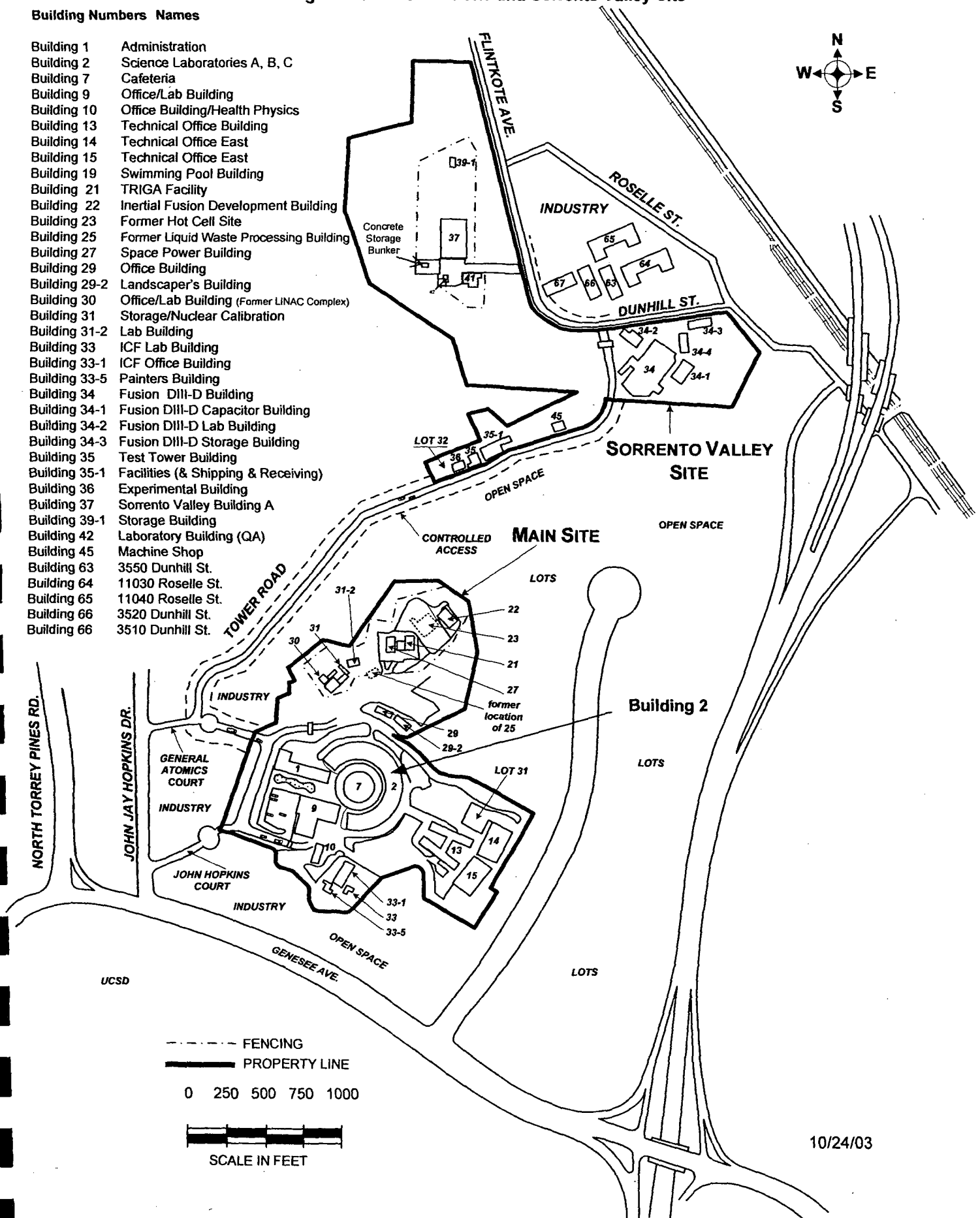
U-238 = 1.58 pCi/g (63 keV peak)
U-235 = 0.14 pCi/g (186 keV peak)
Cs-137 = 0.13 pCi/g (662 keV peak)

Co-60 = 0.16 pCi/g (1173 keV peak)
Th-228 = 0.21 pCi/g (238 keV peak)
Th-232 = 0.43 pCi/g (911 keV peak)
 3. Sample marked with a ** also contained Eu-152 at 0.42 ± 0.32 pCi/g.

Figure 1A: GA's Main Site and Sorrento Valley Site

Building Numbers Names

Building 1	Administration
Building 2	Science Laboratories A, B, C
Building 7	Cafeteria
Building 9	Office/Lab Building
Building 10	Office Building/Health Physics
Building 13	Technical Office Building
Building 14	Technical Office East
Building 15	Technical Office East
Building 19	Swimming Pool Building
Building 21	TRIGA Facility
Building 22	Inertial Fusion Development Building
Building 23	Former Hot Cell Site
Building 25	Former Liquid Waste Processing Building
Building 27	Space Power Building
Building 29	Office Building
Building 29-2	Landscaper's Building
Building 30	Office/Lab Building (Former LINAC Complex)
Building 31	Storage/Nuclear Calibration
Building 31-2	Lab Building
Building 33	ICF Lab Building
Building 33-1	ICF Office Building
Building 33-5	Painters Building
Building 34	Fusion DIII-D Building
Building 34-1	Fusion DIII-D Capacitor Building
Building 34-2	Fusion DIII-D Lab Building
Building 34-3	Fusion DIII-D Storage Building
Building 35	Test Tower Building
Building 35-1	Facilities (& Shipping & Receiving)
Building 36	Experimental Building
Building 37	Sorrento Valley Building A
Building 39-1	Storage Building
Building 42	Laboratory Building (QA)
Building 45	Machine Shop
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.



10/24/03

Figure 1B: Torrey Pines (Main) Site Land Areas

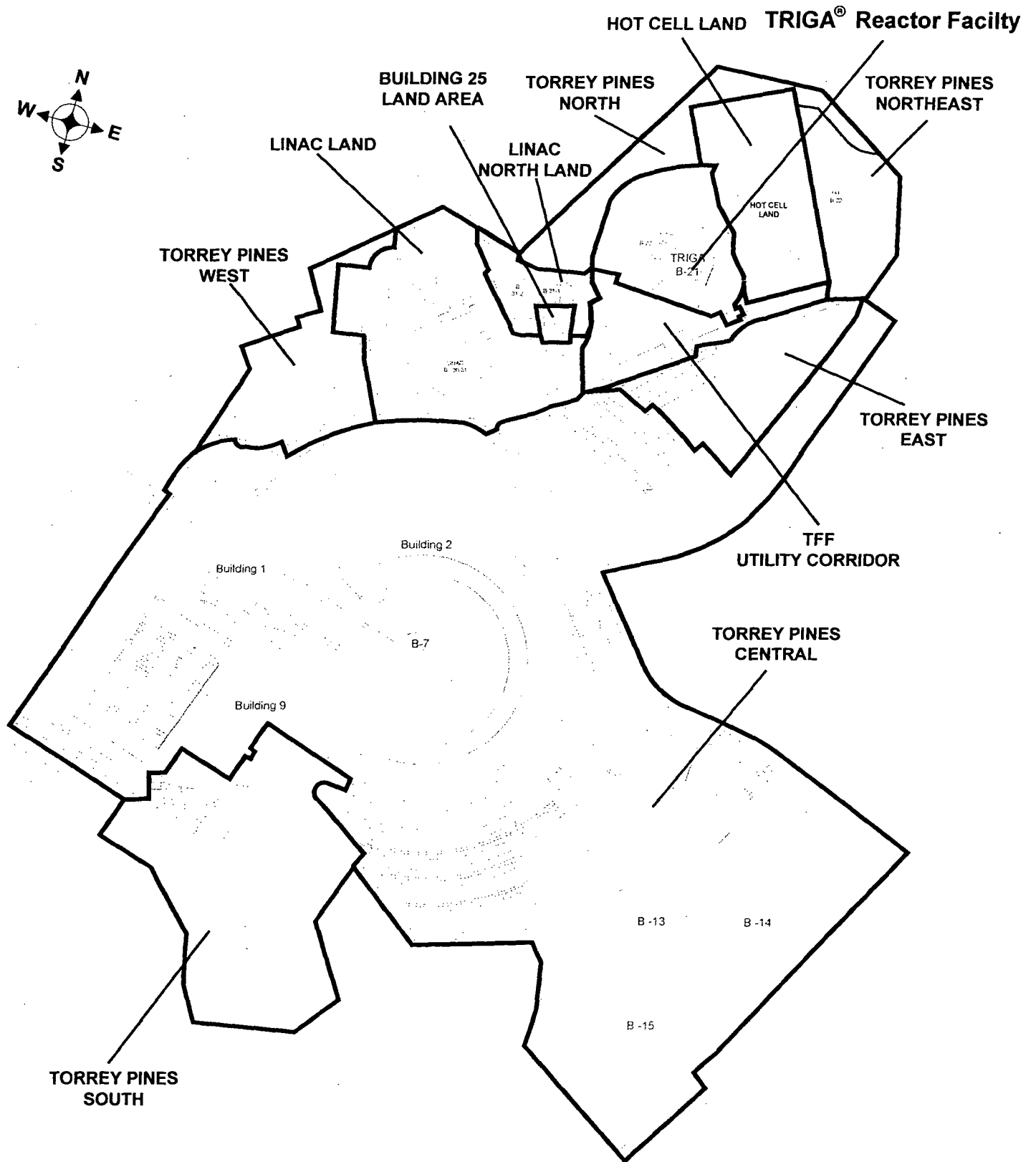


Figure 1C: GA's MainSite showing location of the TRIGA Site

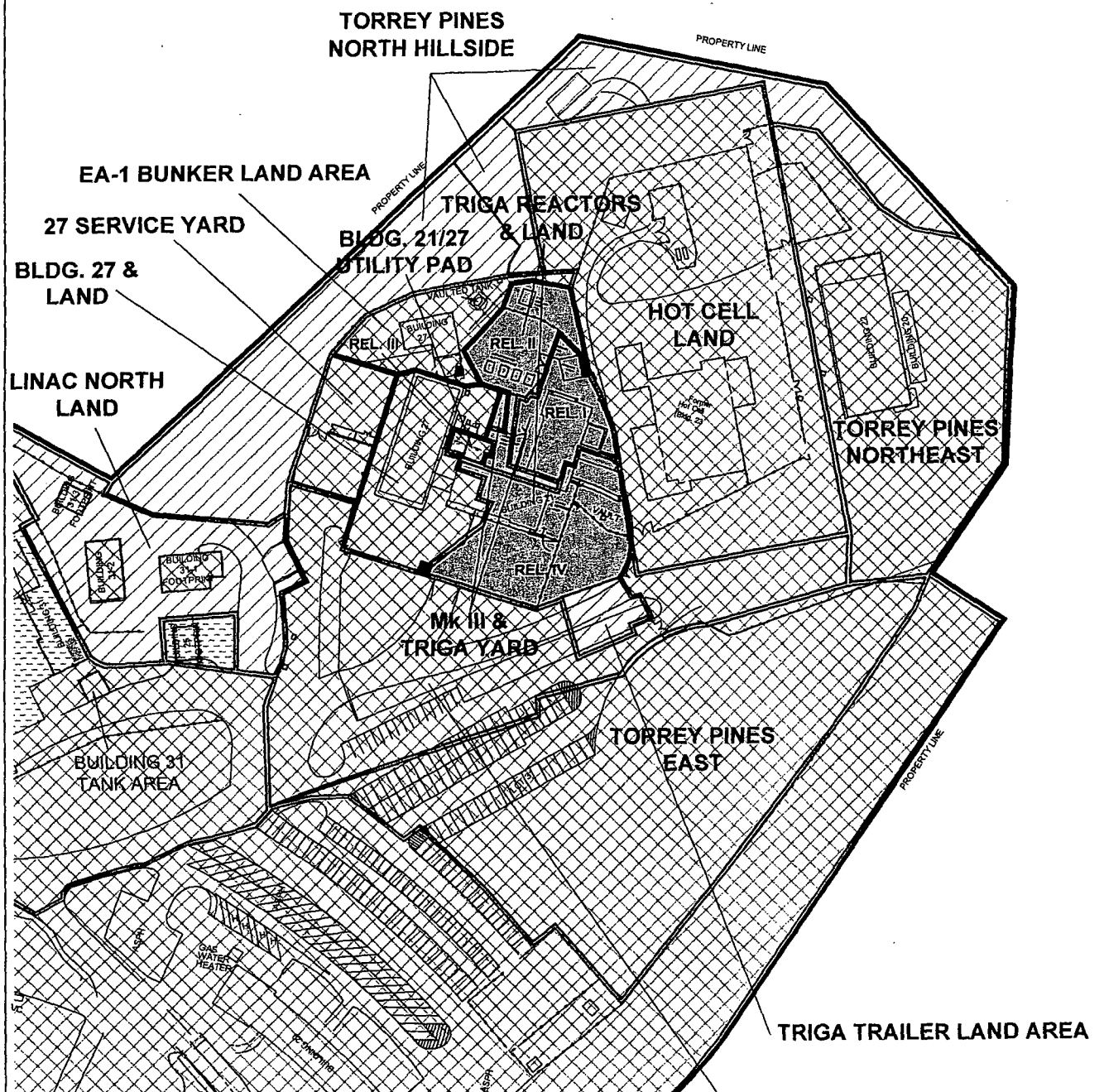
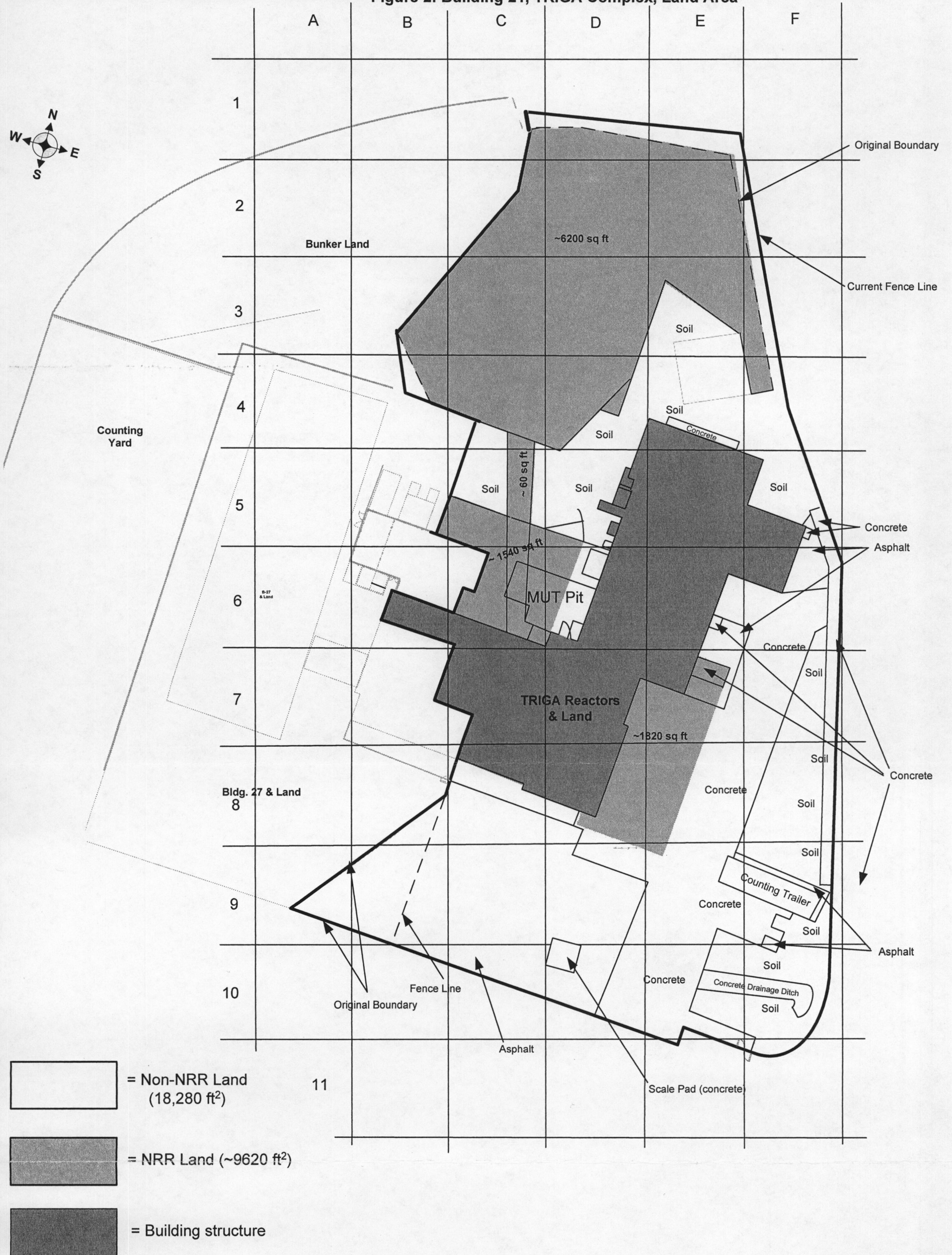


Figure 2: Building 21, TRIGA Complex, Land Area

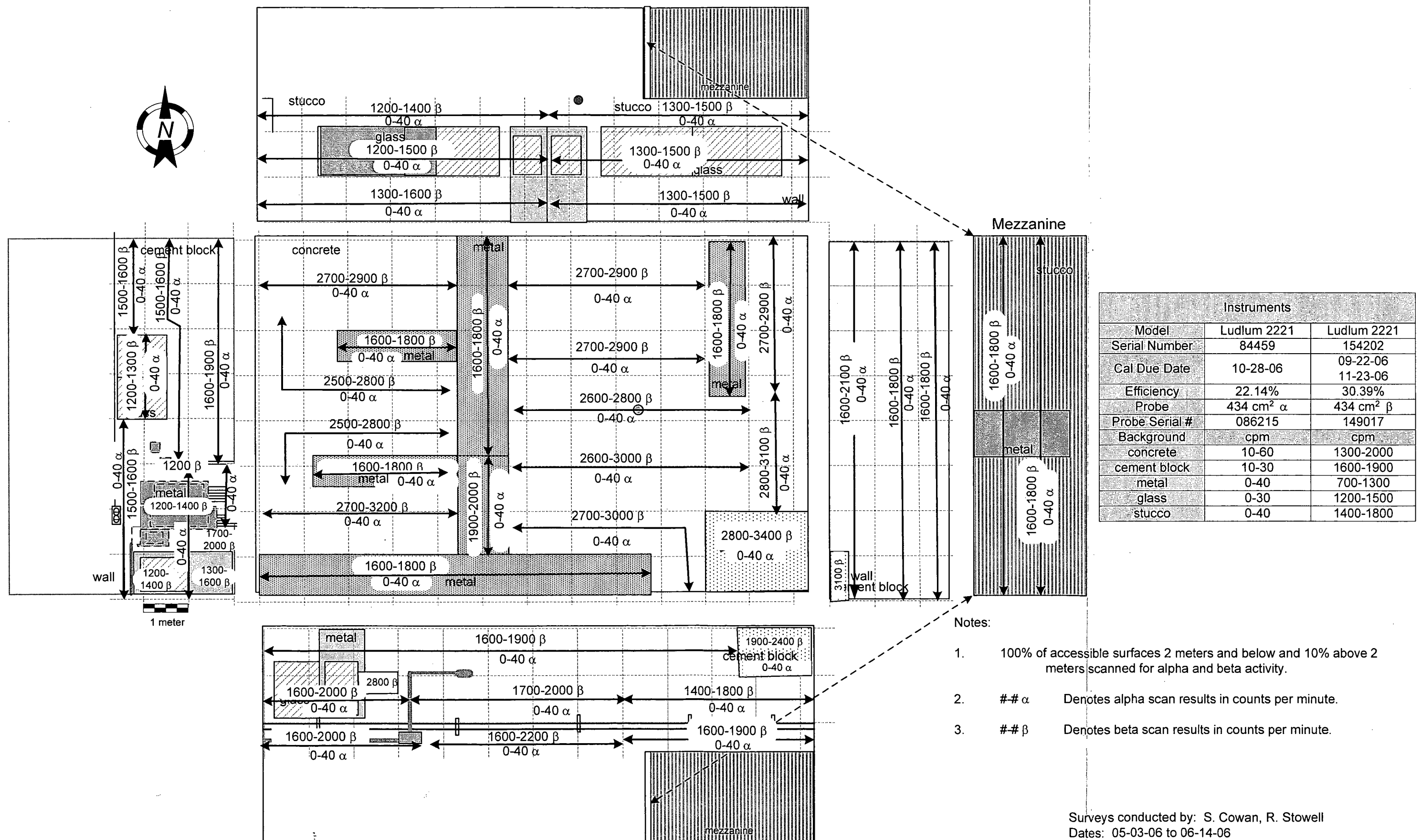


Floor plan of the NRR Licensed portion of the facility. The plan shows the following rooms and dimensions:

- Room 109/110:** 40' x 26'
- Room 111:** 40' x 36'8"
- Room 112:** 18' x 23'3"
- Room 113:** 24'8" x 23'4"
- Room 114/115:** 16'4" x 18'2"

The plan also includes a legend indicating the NRR Licensed portion (shaded area) and a central area labeled "MK III Pit".

Figure 4: Building 21 Room 109/110 Alpha and Beta Scan Measurement Locations and Results



1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐ 7. ☐ 8. ☐ 9. ☐ 10. ☐ 11. ☐ 12. ☐ 13. ☐ 14. ☐ 15. ☐ 16. ☐ 17. ☐ 18. ☐ 19. ☐ 20. ☐ 21. ☐ 22. ☐ 23. ☐ 24. ☐ 25. ☐ 26. ☐ 27. ☐ 28. ☐ 29. ☐ 30. ☐ 31. ☐ 32. ☐ 33. ☐ 34. ☐ 35. ☐ 36. ☐ 37. ☐ 38. ☐ 39. ☐ 40. ☐ 41. ☐ 42. ☐ 43. ☐ 44. ☐ 45. ☐ 46. ☐ 47. ☐ 48. ☐ 49. ☐ 50. ☐ 51. ☐ 52. ☐ 53. ☐ 54. ☐ 55. ☐ 56. ☐ 57. ☐ 58. ☐ 59. ☐ 60. ☐ 61. ☐ 62. ☐ 63. ☐ 64. ☐ 65. ☐ 66. ☐ 67. ☐ 68. ☐ 69. ☐ 70. ☐ 71. ☐ 72. ☐ 73. ☐ 74. ☐ 75. ☐ 76. ☐ 77. ☐ 78. ☐ 79. ☐ 80. ☐ 81. ☐ 82. ☐ 83. ☐ 84. ☐ 85. ☐ 86. ☐ 87. ☐ 88. ☐ 89. ☐ 90. ☐ 91. ☐ 92. ☐ 93. ☐ 94. ☐ 95. ☐ 96. ☐ 97. ☐ 98. ☐ 99. ☐ 100. ☐

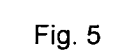


Figure 6: Building 21 Room 109/110 Fixed Alpha and Beta Measurement Locations and Results and Wipe Survey Locations

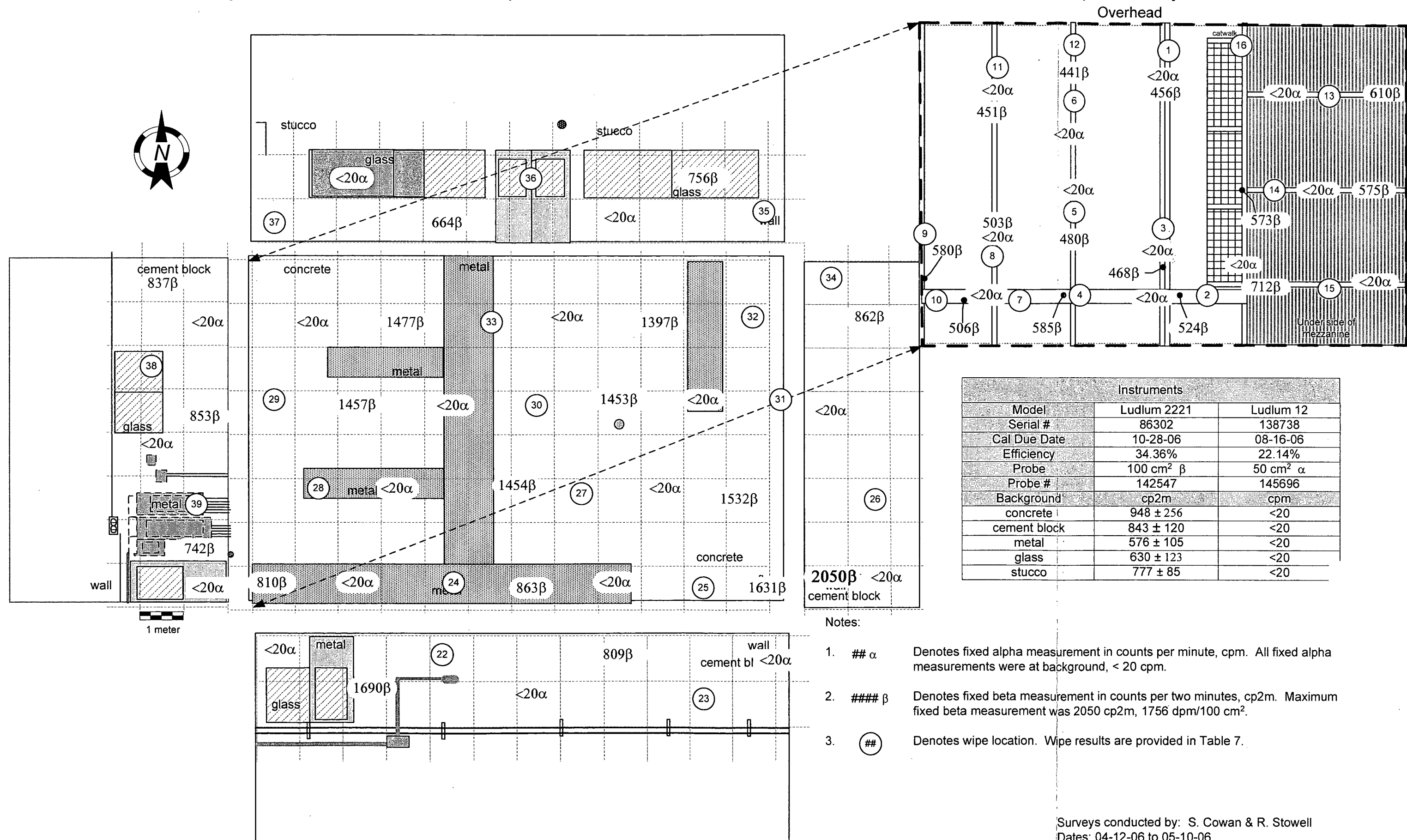


Figure 7: Building 21 Room 109/110 Service Trenches Alpha and Beta Scan Measurement Locations and Results

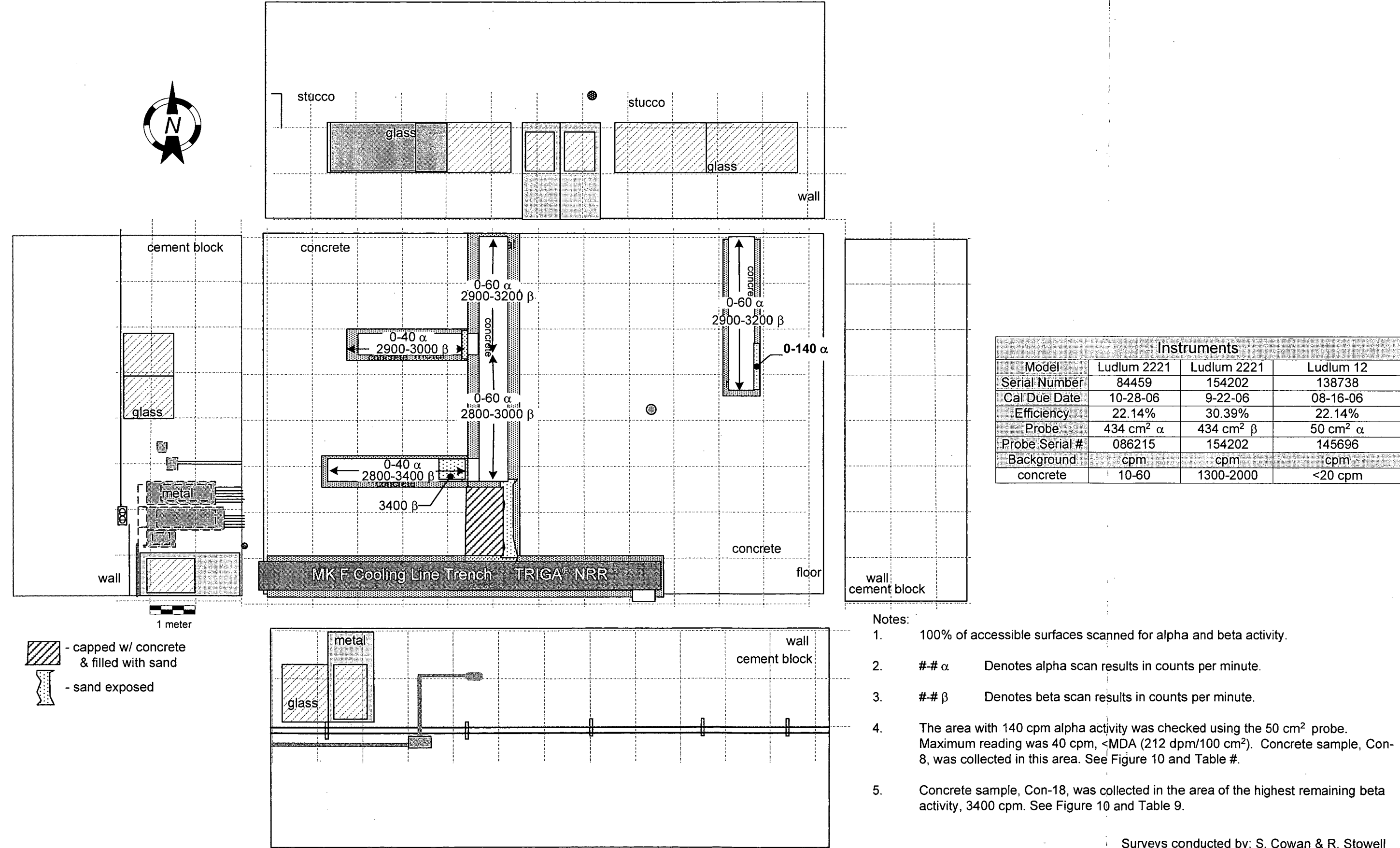


Figure 8: Building 21 Room 109/110 Service Trenches
Fixed Exposure Rate and Exposure Rate Scan Measurement Locations and Results

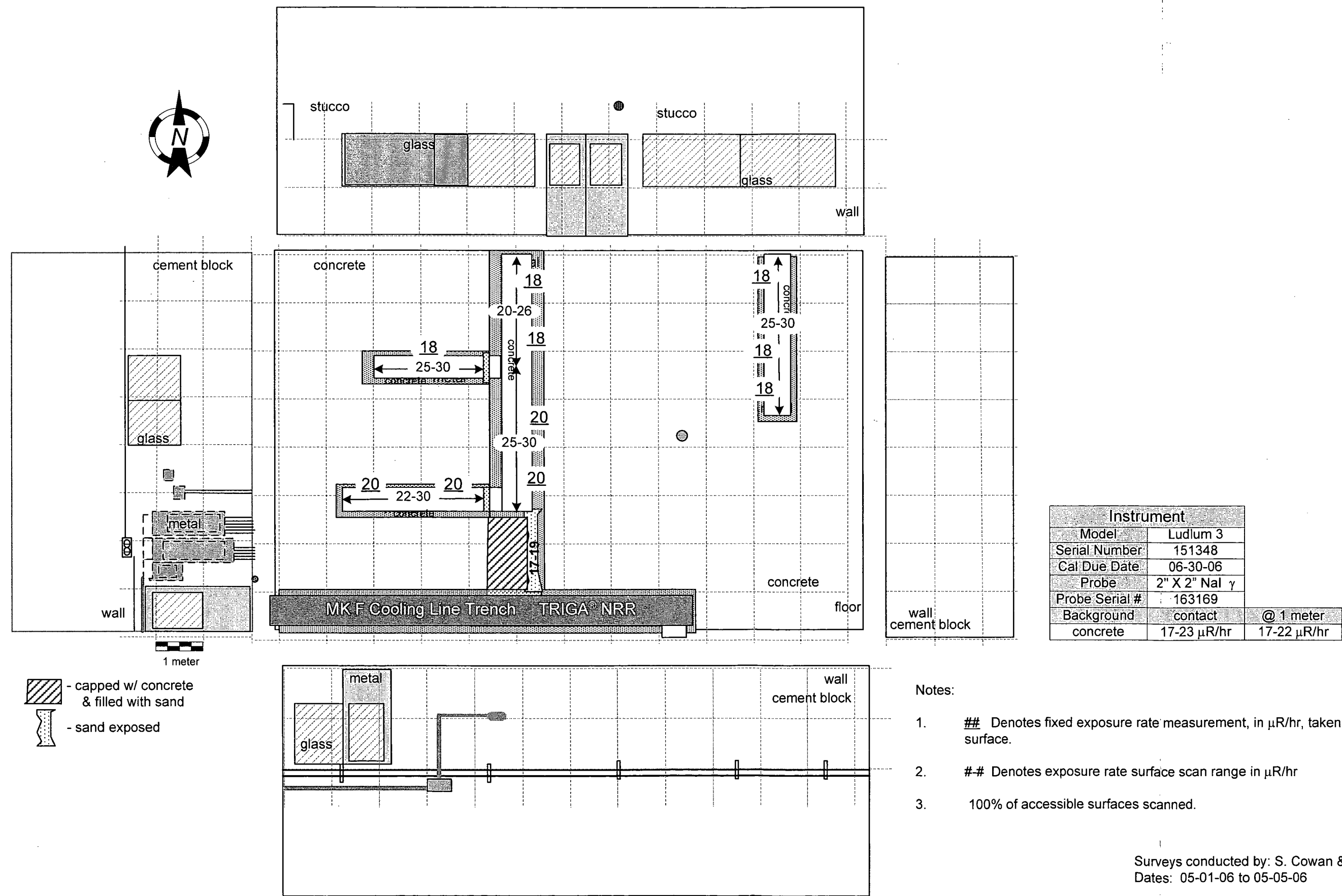
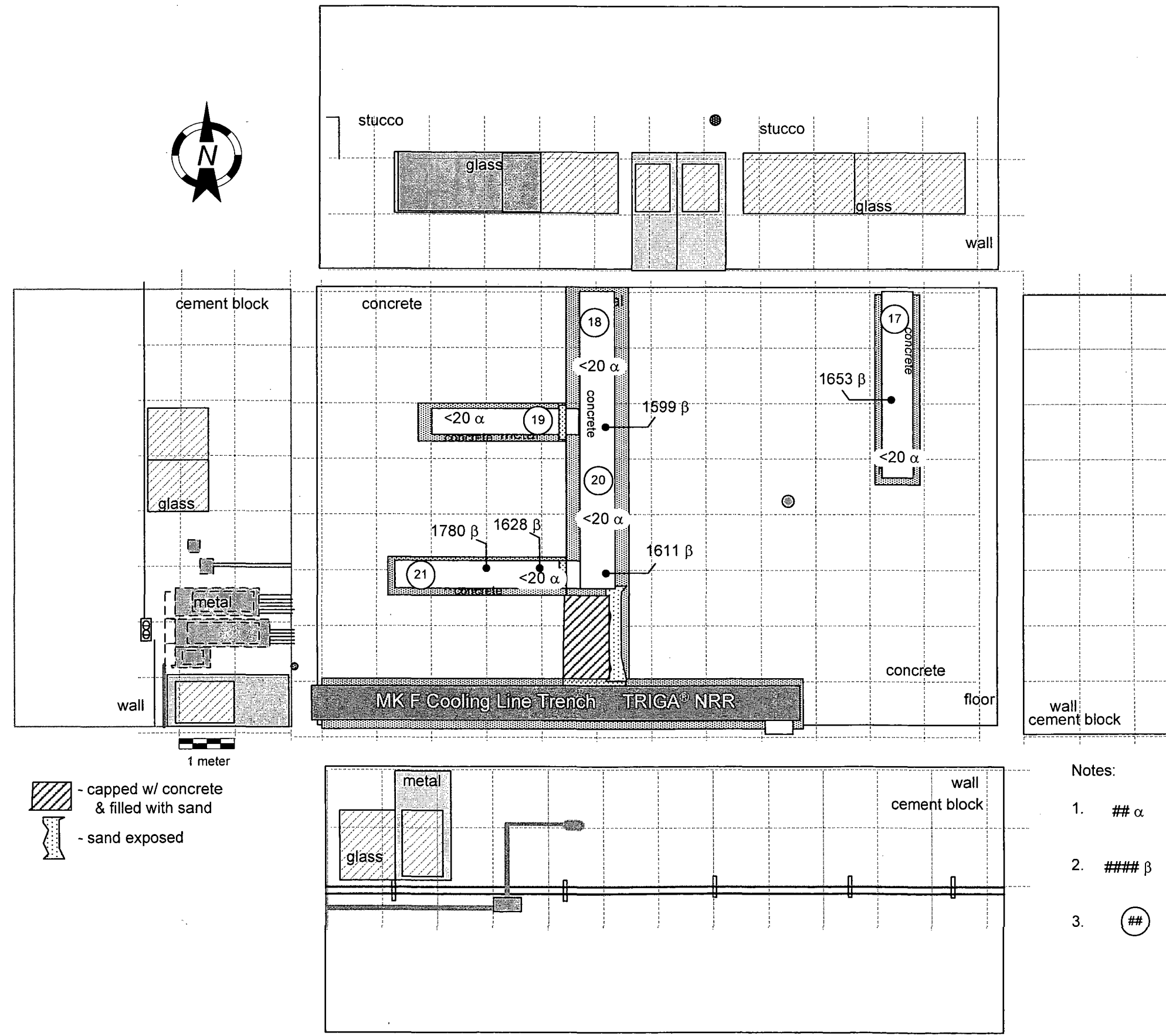


Figure 9: Building 21 Room 109/110 Service Trenches
Fixed Alpha and Beta Measurement Locations and Results and Wipe Survey Locations

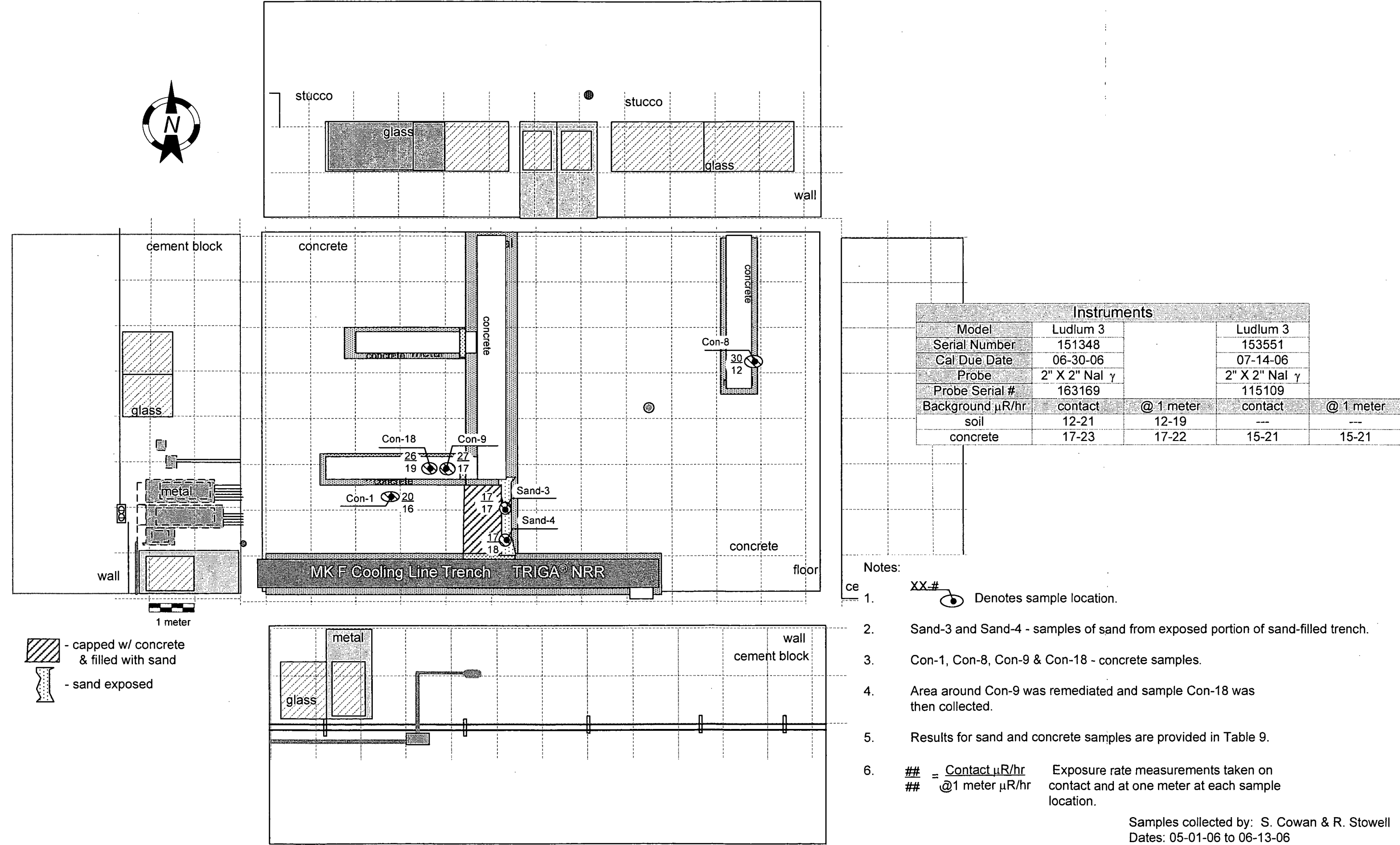


Instruments		
Model	Ludlum 12	Ludlum 2221
Serial Number	138738	86302
Cal Due Date	08-16-06	05-15-06 10-28-06
Efficiency	22.14 %	34.36%
Probe	50 cm ² α	100 cm ² β
Probe Serial #	145696	142547
Background	cpm	cp2m
concrete	<20	948 \pm 256

- Notes:
- 1. ## α Denotes fixed alpha measurement in counts per minute, cpm. All fixed alpha measurements were at background, < 20 cpm.
 - 2. #### β Denotes fixed beta measurement in counts per two minutes, cp2m. Maximum fixed beta measurement was 1780 cp2m, 1211 dpm/100 cm².
 - 3. ## Denotes wipe location. Wipe results are provided in Table 7.

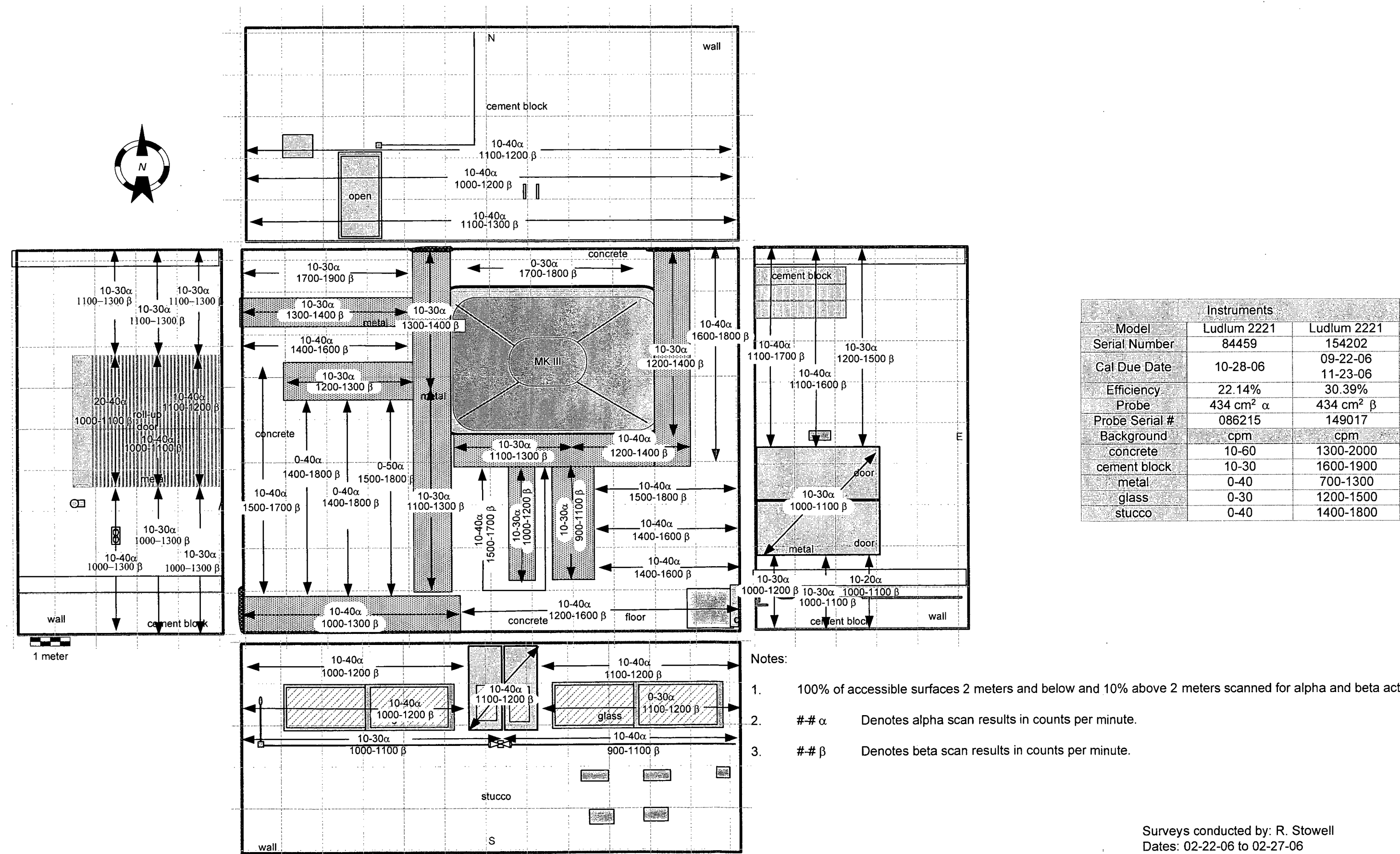
Surveys conducted by: S. Cowan & R. Stowell
Dates: 4-25-06, 05-01-06 & 06-13-03

Figure 10: Building 21 Room 109/110 Sample Locations



Samples collected by: S. Cowan & R. Stowell
Dates: 05-01-06 to 06-13-06

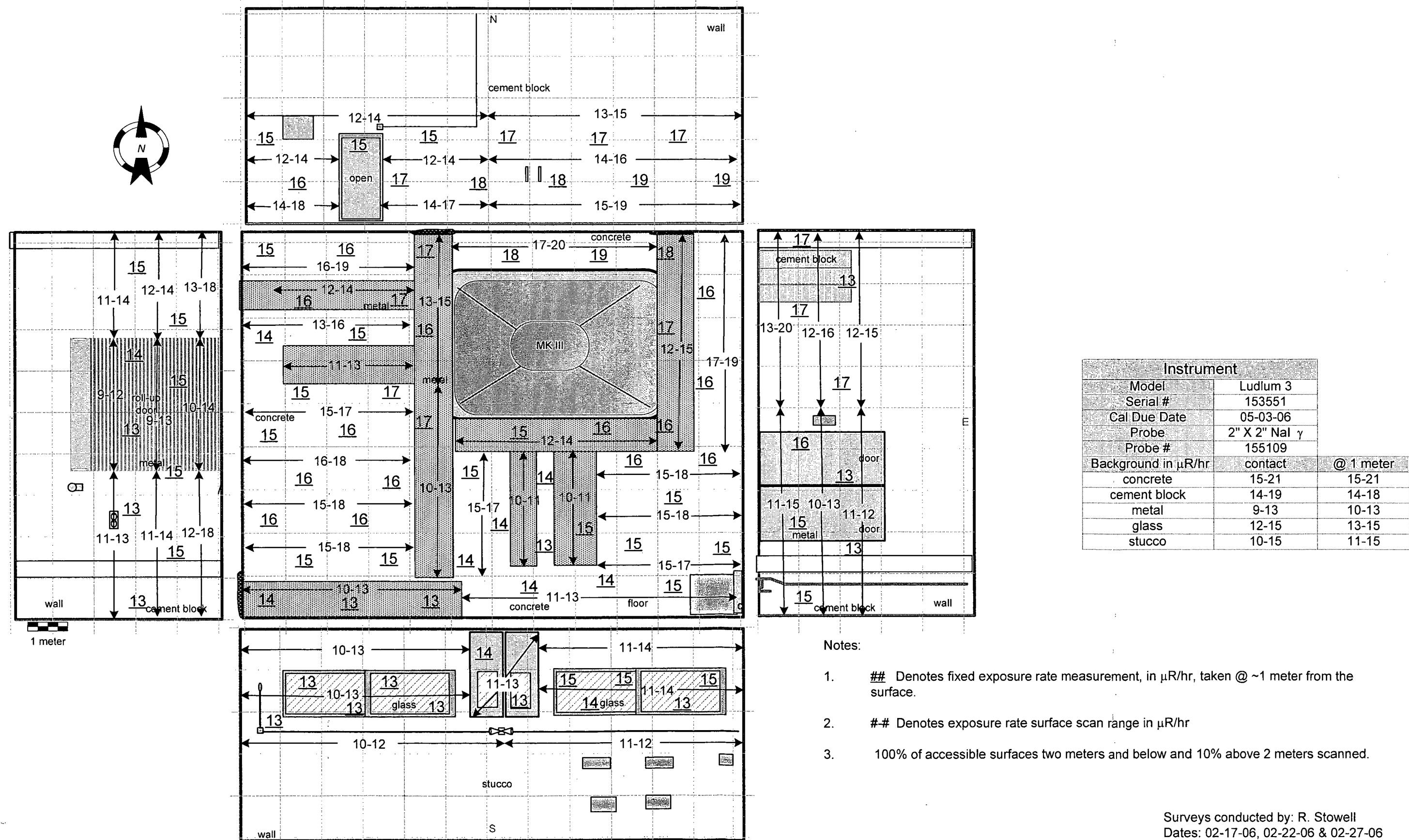
Figure 11: Building 21 Room 111 Alpha and Beta Scan Measurement Locations and Results



Surveys conducted by: R. Stowell
Dates: 02-22-06 to 02-27-06

Fig. 11

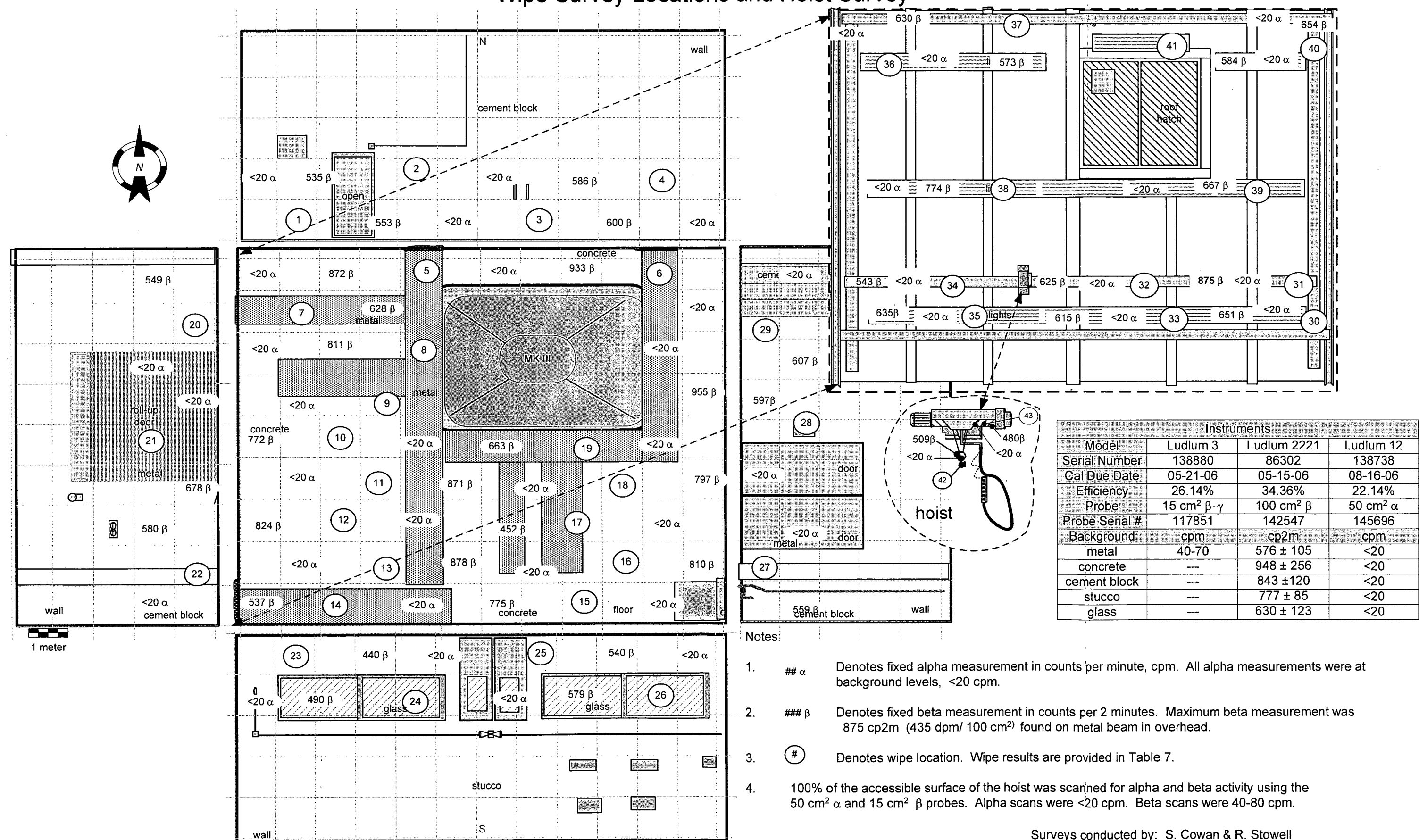
Figure 12: Building 21 Room 111 Fixed Exposure Rate and Exposure Rate Scan Measurement Locations and Results



Surveys conducted by: R. Stowell
Dates: 02-17-06, 02-22-06 & 02-27-06

Fig. 12

Figure 13: Building 21 Room 111 Fixed Alpha and Beta Measurements Locations and Results, Wipe Survey Locations and Hoist Survey Overhead



Surveys conducted by: S. Cowan & R. Stowell
Dates: 02-23-03, 02-24-06, 02-27-06 & 04-11-06

Figure 14: Building 21 Room 111 Service Trenches Alpha and Beta Scan Measurements Locations and Results

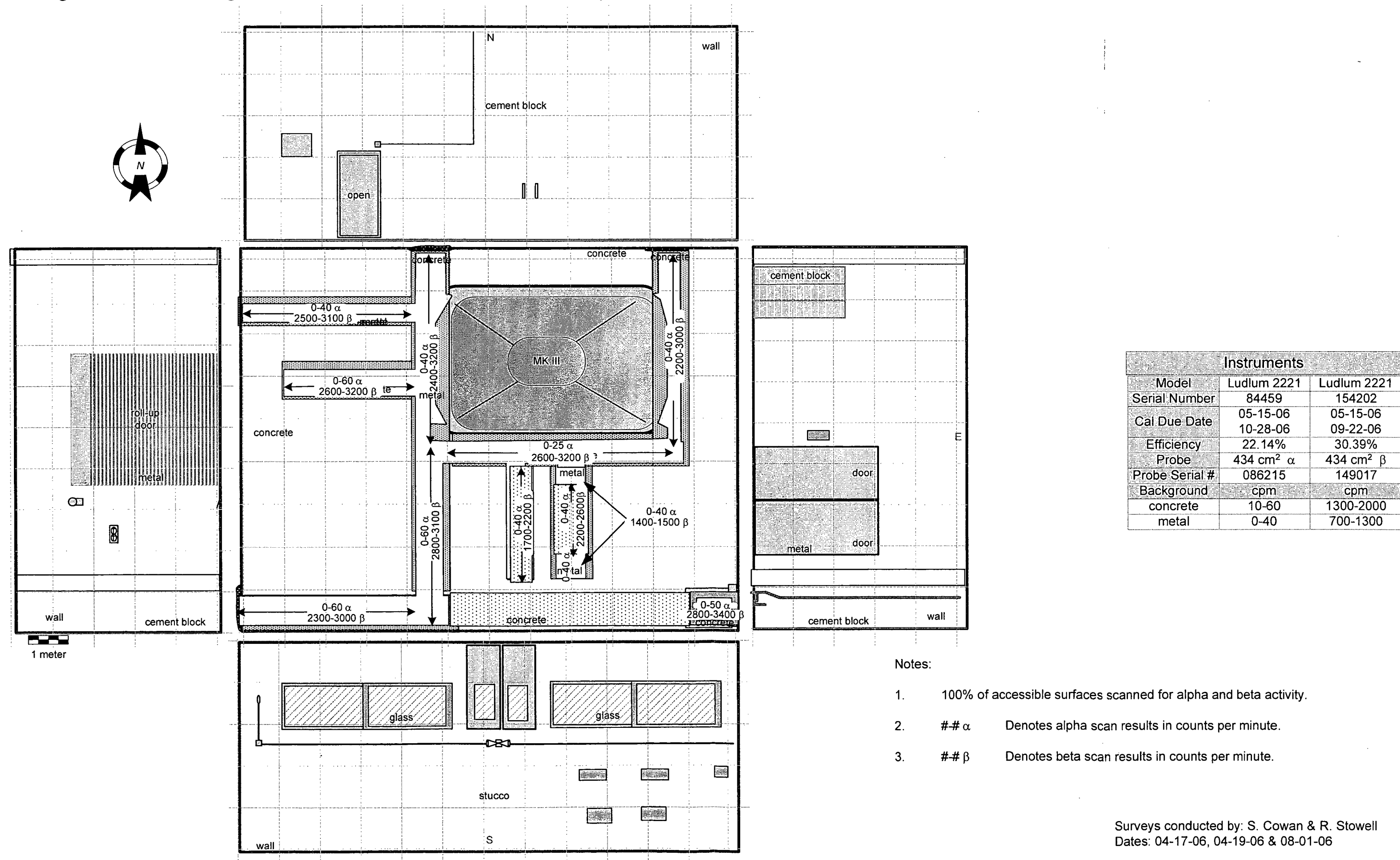


Figure 15: Building 21 Room 111 Service Trenches Fixed Exposure Rate And Exposure Rate Scan Measurement Locations and Results

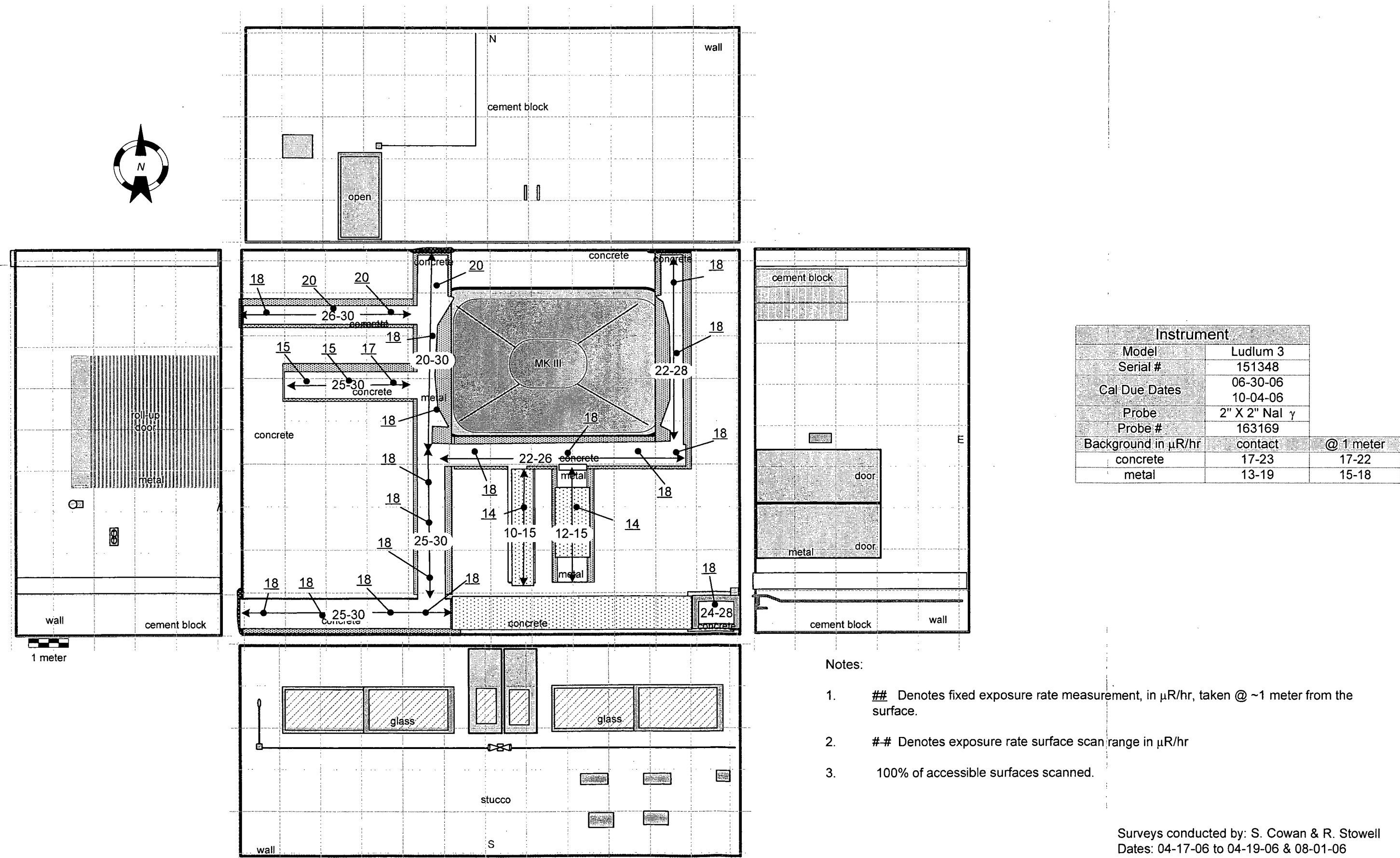


Fig. 15

Figure 16: Building 21 Room 111 Service Trenches
Fixed Alpha and Beta Measurements Locations and Results And Wipe Survey Locations

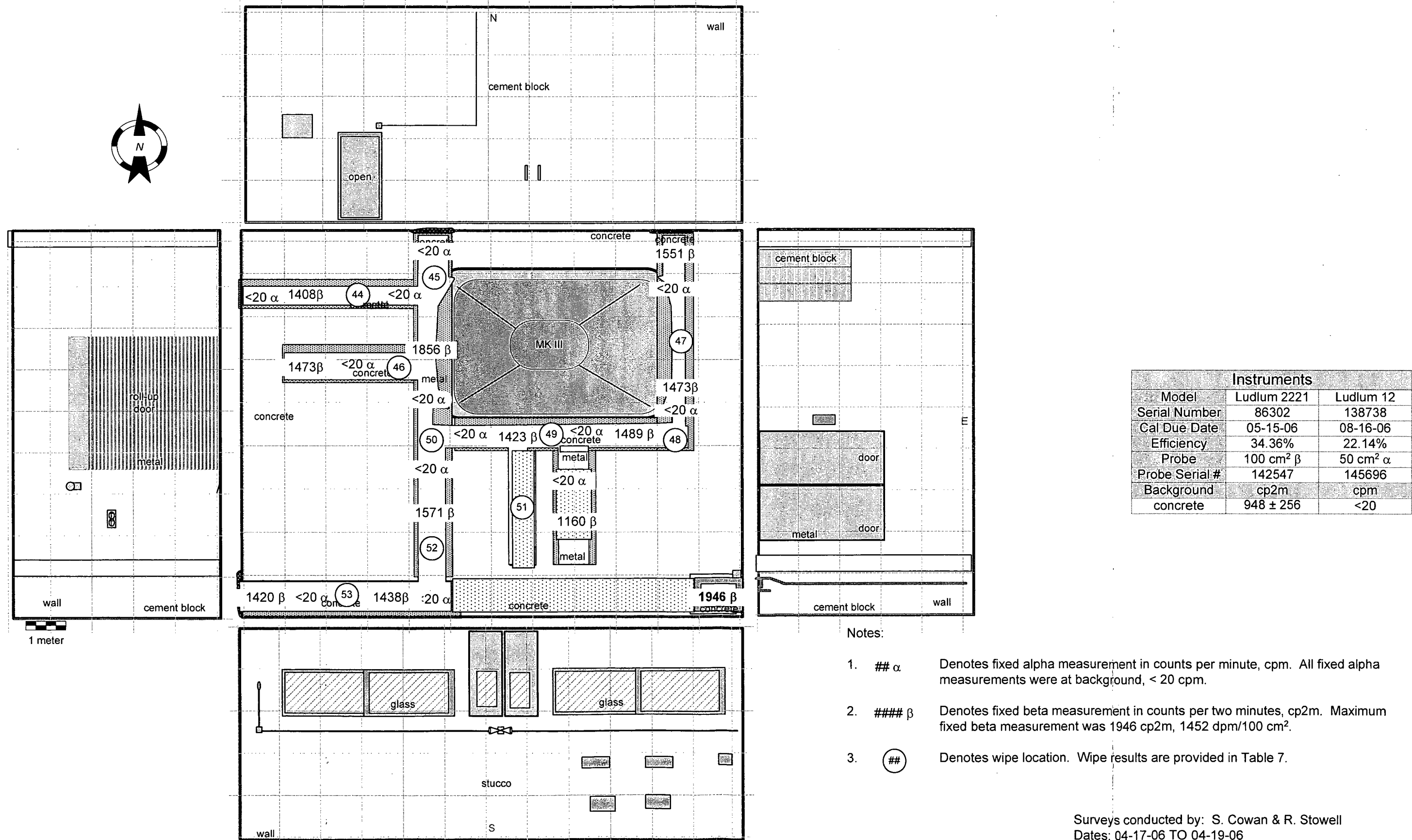


Figure 17: Building 21 Room 111 Sample Locations

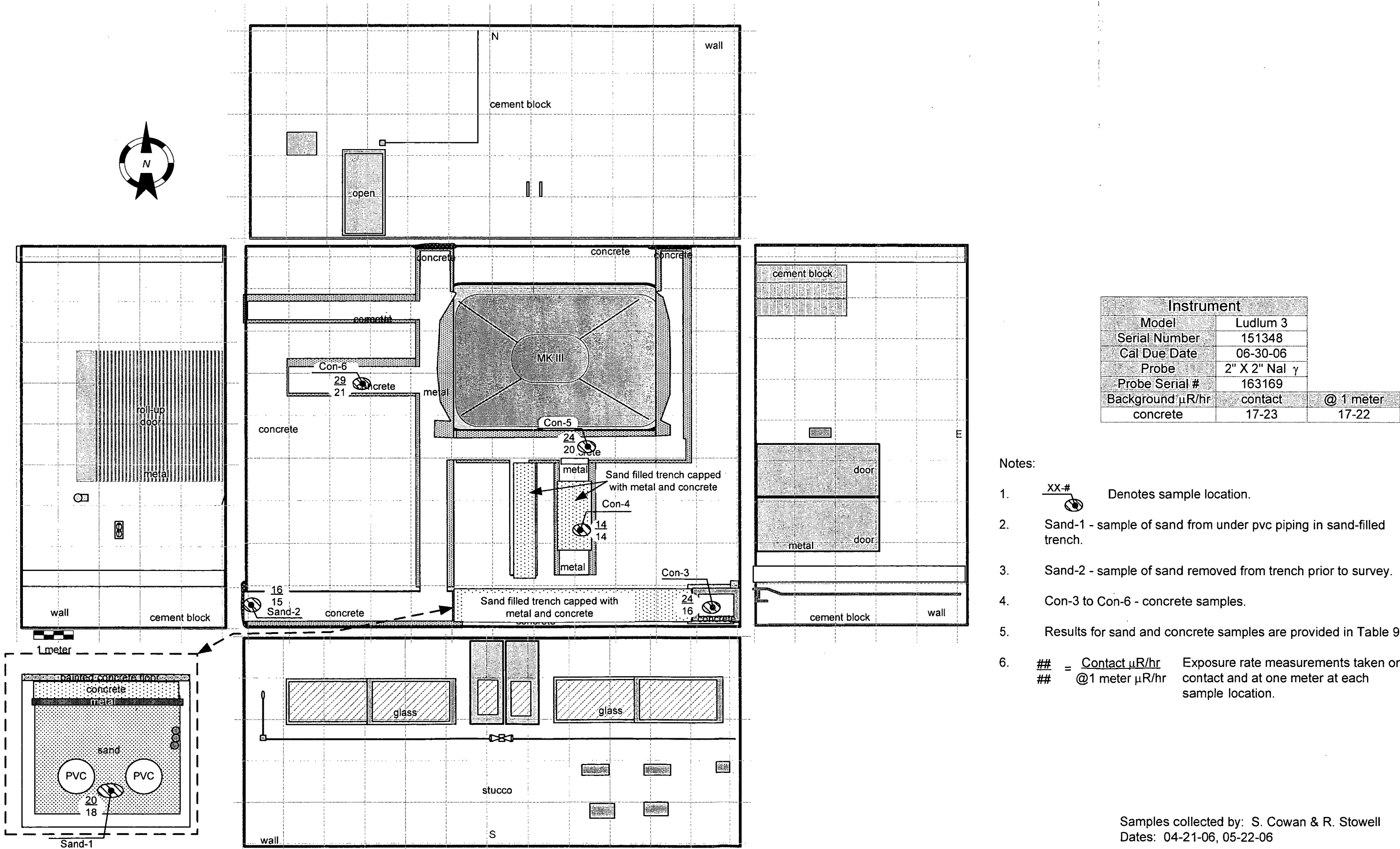


Fig. 17

Figure 18: Building 21 Room 111 Pipe Survey

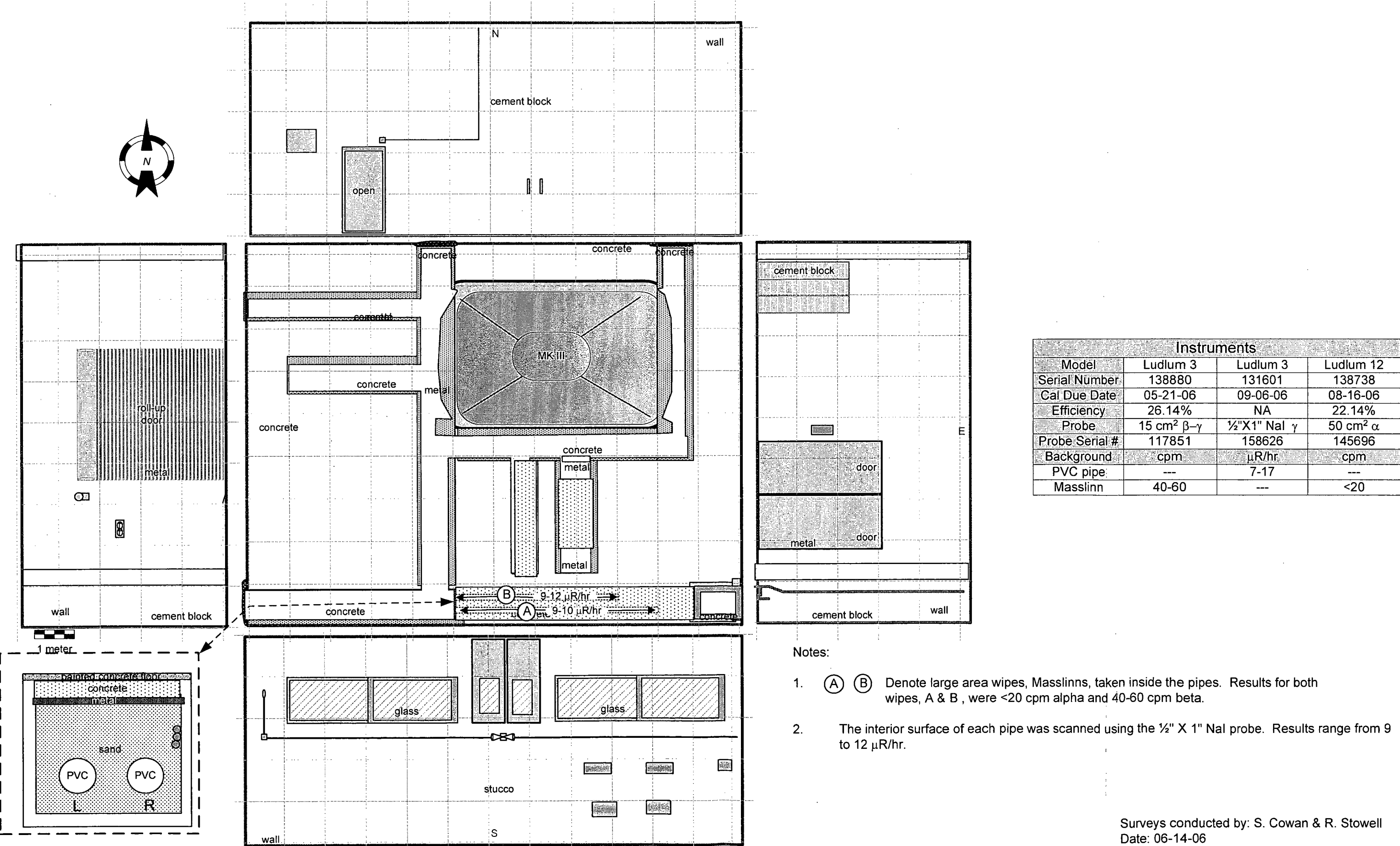
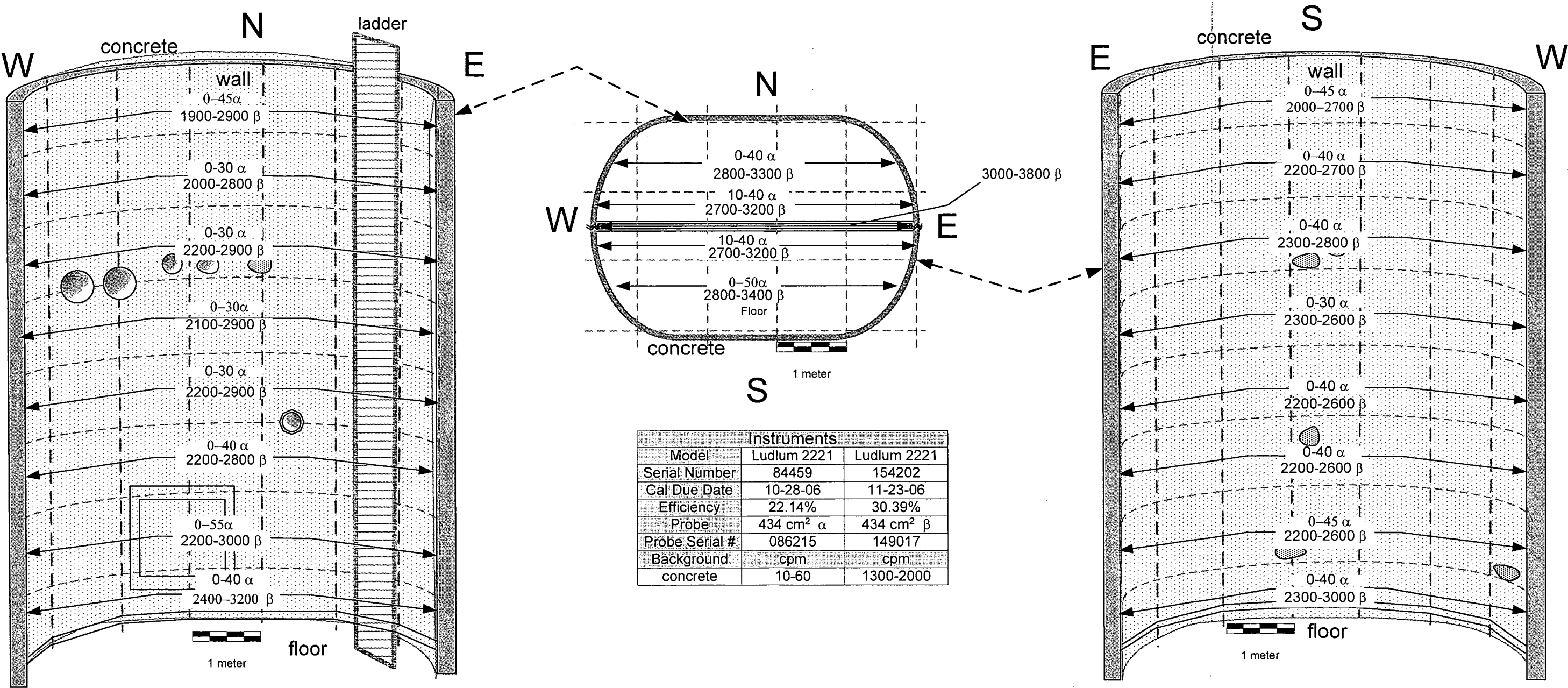


Fig. 18

Figure 19: Building 21 Room 111 TRIGA® MK III Pit Alpha and Beta Scan Measurement Locations and Results

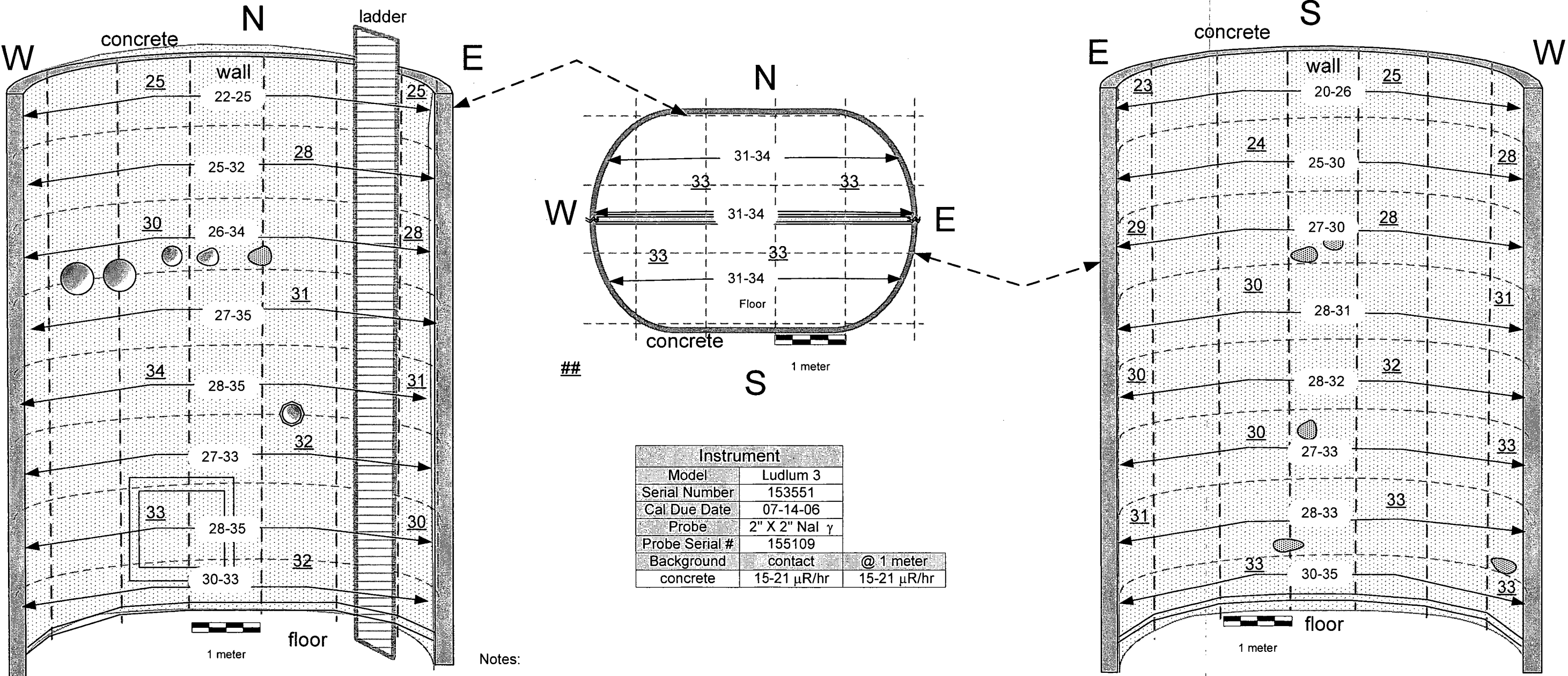


Notes:

1. 100% of accessible scanned for alpha and beta activity.
2. ## α Denotes alpha scan results in counts per minute.
3. ## β Denotes beta scan results in counts per minute.

Surveys conducted by: S. Cowan & R. Stowell
Dates: 05-30-06 to 06-02-06

Figure 20: Building 21 Room 111 TRIGA® MK III Pit
Fixed Exposure Rate and Exposure Rate Scan Measurement Locations and Results

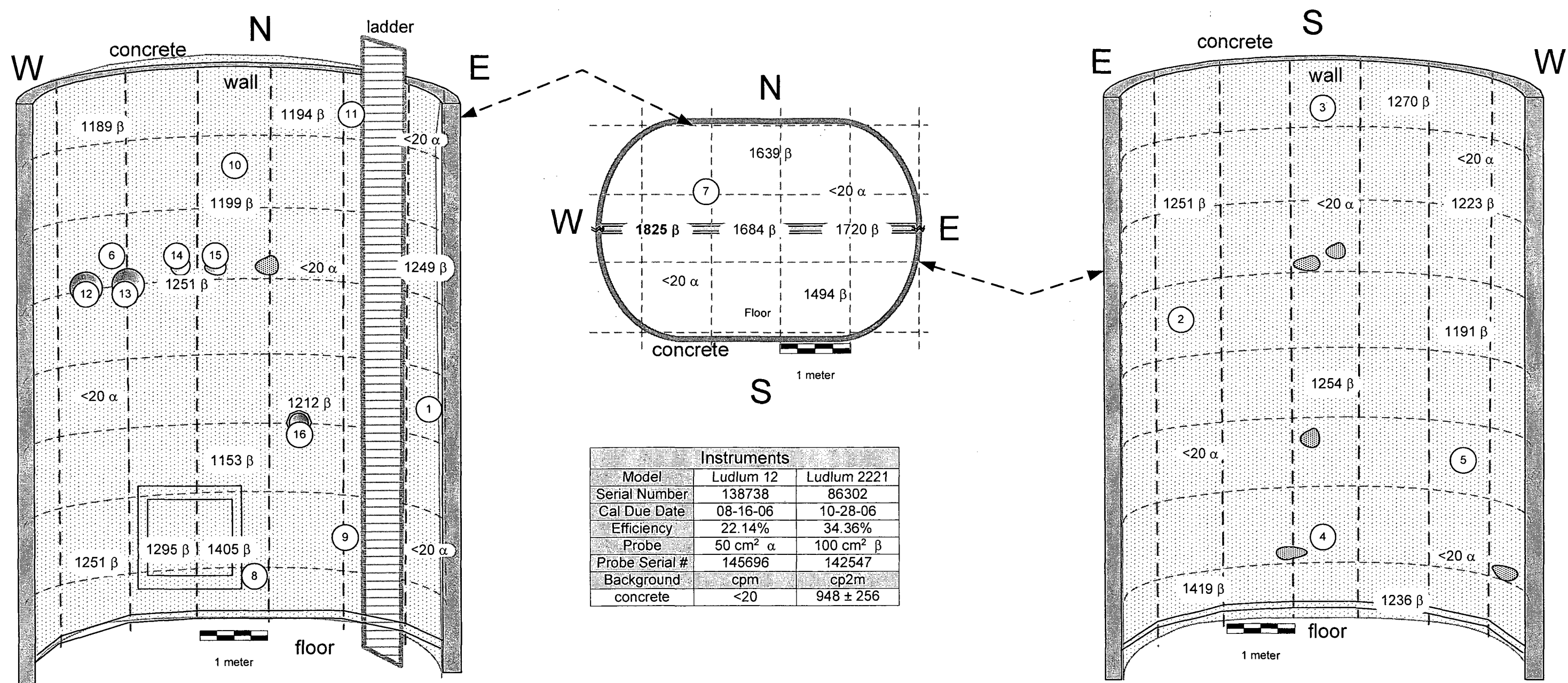


Notes:

1. ## Denotes fixed exposure rate measurement, in μ R/hr, taken @ ~1 meter from the surface.
2. #-# Denotes exposure rate surface scan range in μ R/hr
3. 100% of accessible surfaces scanned.

Surveys conducted by: R. Stowell & S. Cowan
Dates: 05-24-06 to 05-30-06

Figure 21: Building 21 Room 111 TRIGA® MK III Pit Fixed Alpha and Beta Measurement Locations and Results and Wipe Survey Locations

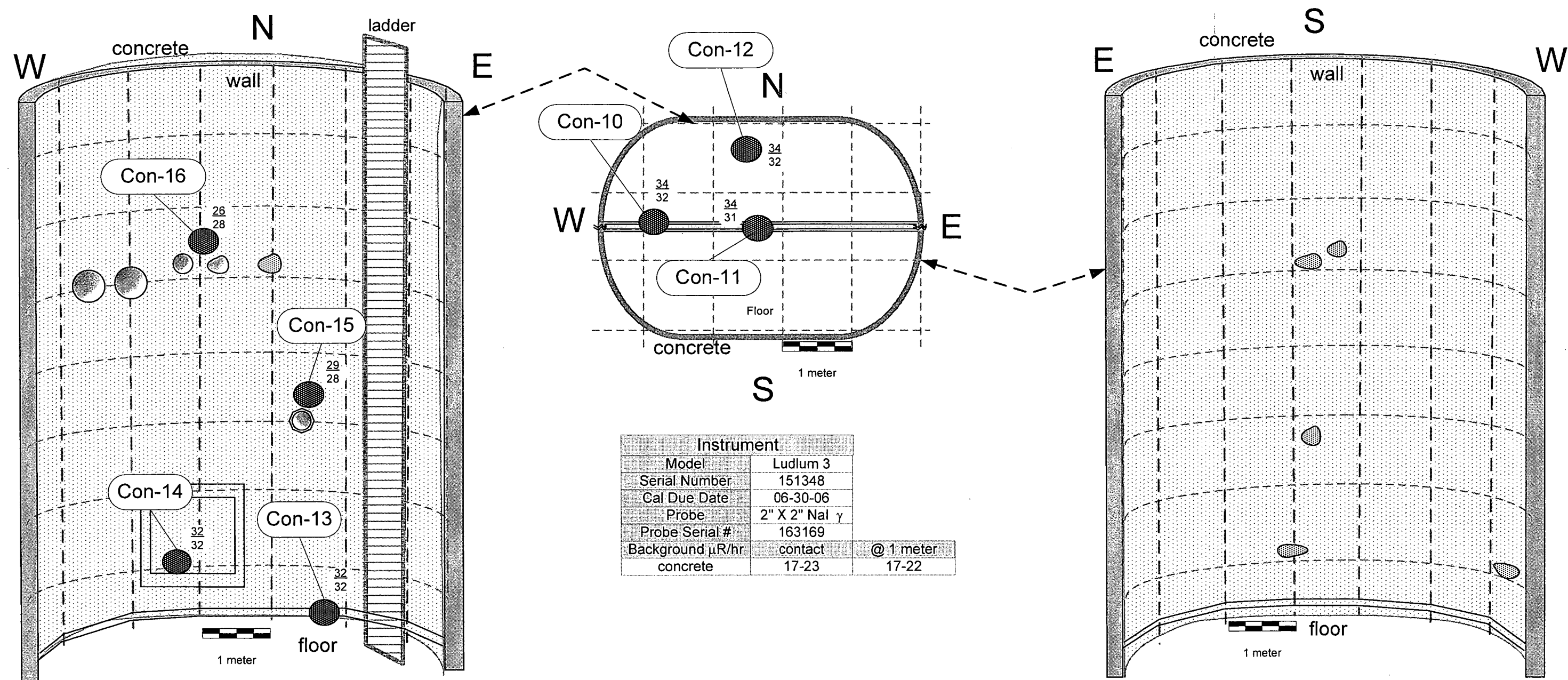



Notes:

1. ## α Denotes fixed alpha measurement in counts per minute, cpm. All fixed alpha measurements were at background, < 20 cpm.
2. #### β Denotes fixed beta measurement in counts per two minutes, cp2m. Maximum fixed beta measurement was 1825 cp2m, 1276 dpm/100 cm².
3. (##) Denotes wipe location. Wipe results are provided in Table 7.

Surveys conducted by: S. Cowan & R. Stowell
Dates: 06-01-06, 06-02-06 & 06-05-06

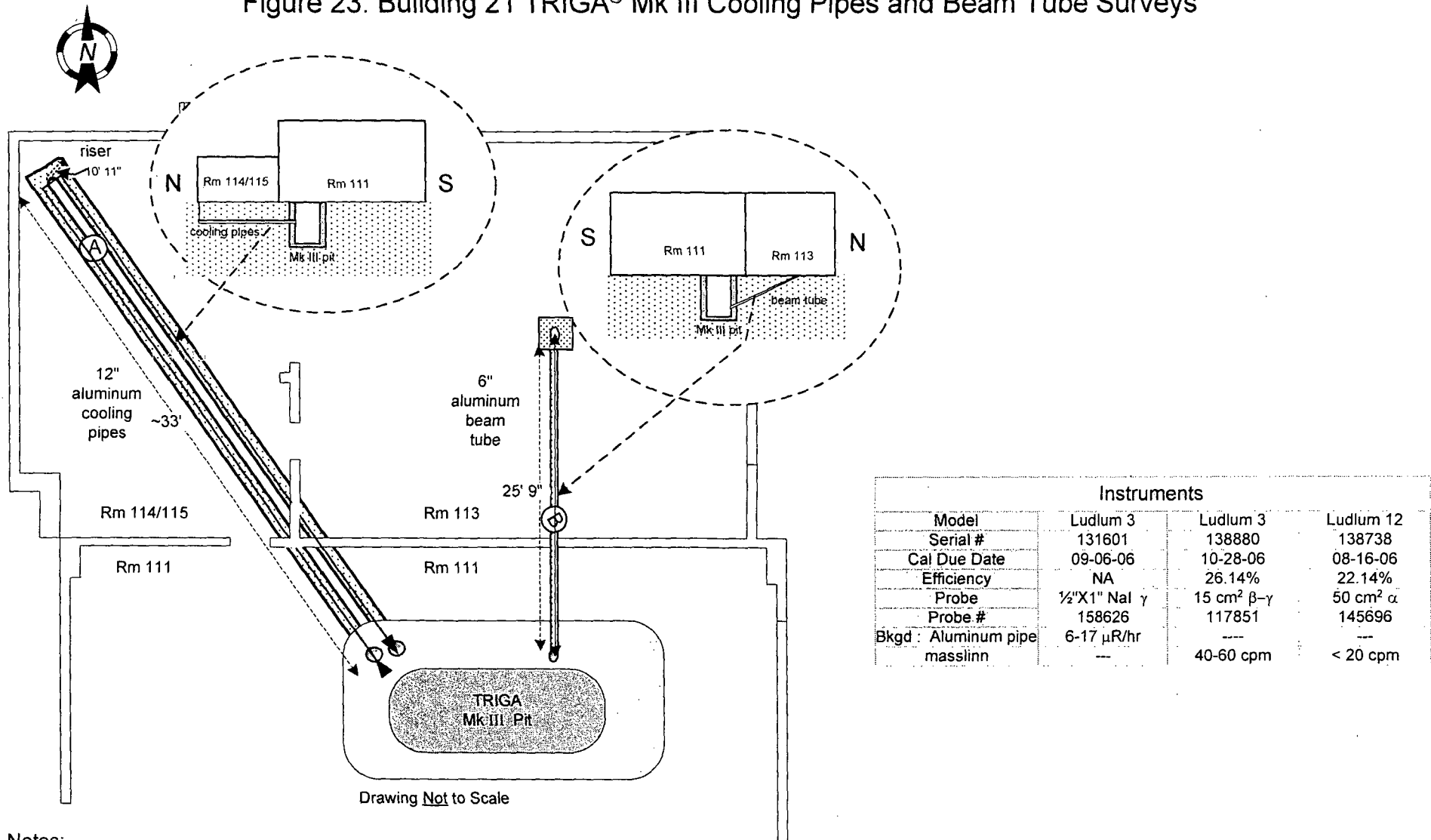
Figure 22: Building 21 Room 111 TRIGA® MK III Pit Sample Locations



- Notes:
1.  Con-# Denotes location of concrete sample.
2. Concrete sample results are provided in Table 9.
3. $\frac{\text{##}}{\text{##}}$ = $\frac{\text{Contact } \mu\text{R/hr}}{\text{@1 meter } \mu\text{R/hr}}$ Exposure rate measurements taken on contact and at one meter at each sample location.

Samples collected by: S. Cowan & R. Stowell
Dates: 06-07-06 & 06-08-06

Figure 23: Building 21 TRIGA® Mk III Cooling Pipes and Beam Tube Surveys



Notes:

1. (A) & (B) Denote large area wipes, Masslinns, taken inside the pipes. Results for both wipes, A & B, were <20 cpm alpha and 40-60 cpm beta.
2. The interiors of the cooling pipes and beam tube were scanned using the ½" NaI probe. Results range from 15 to 21 μR/hr inside the cooling pipes and 11-16 μR/hr inside the beam tube.

Surveys conducted by: S. Cowan & R Stowell
Date: 06-06-06

Figure 24: Building 21 Room 112 Alpha and Beta Scan Measurement Locations and Results

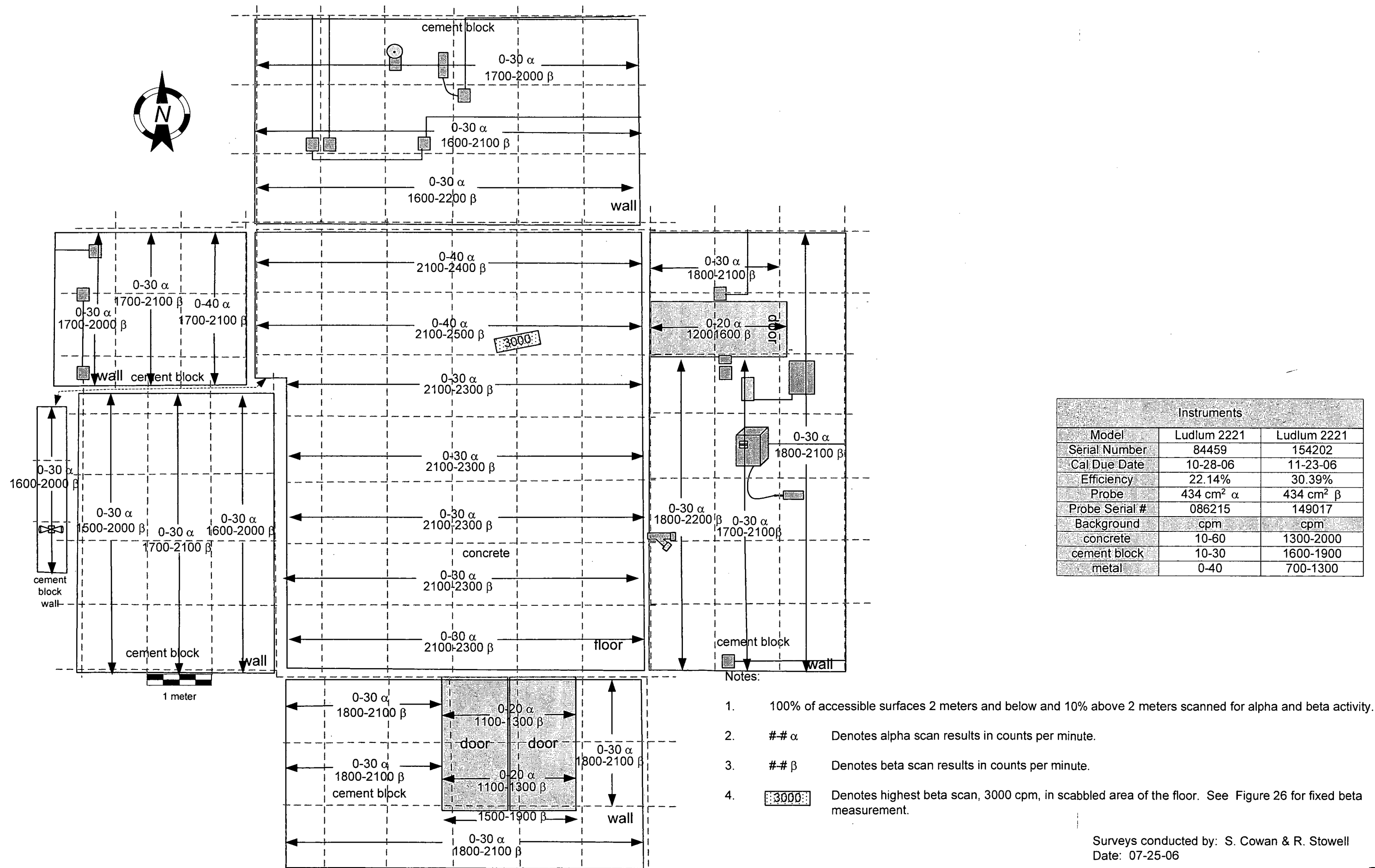


Fig: 24

Figure 25: Building 21 Room 112 Fixed Exposure Rate and Exposure Rate Scan Measurement Locations and Results

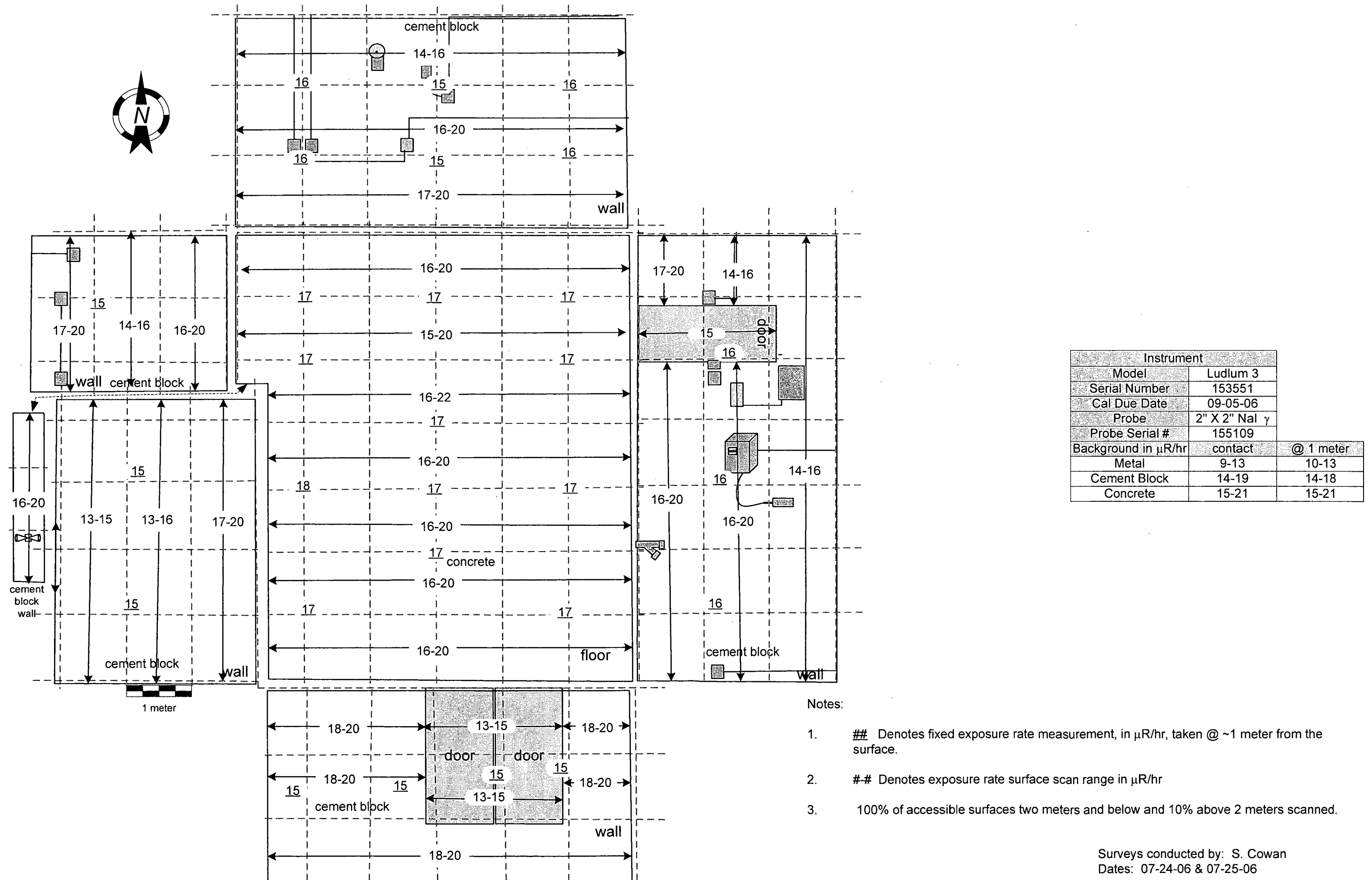


Figure 26: Building 21 Room 112 Fixed Alpha and Beta Measurement Locations and Results and Wipe Survey Locations

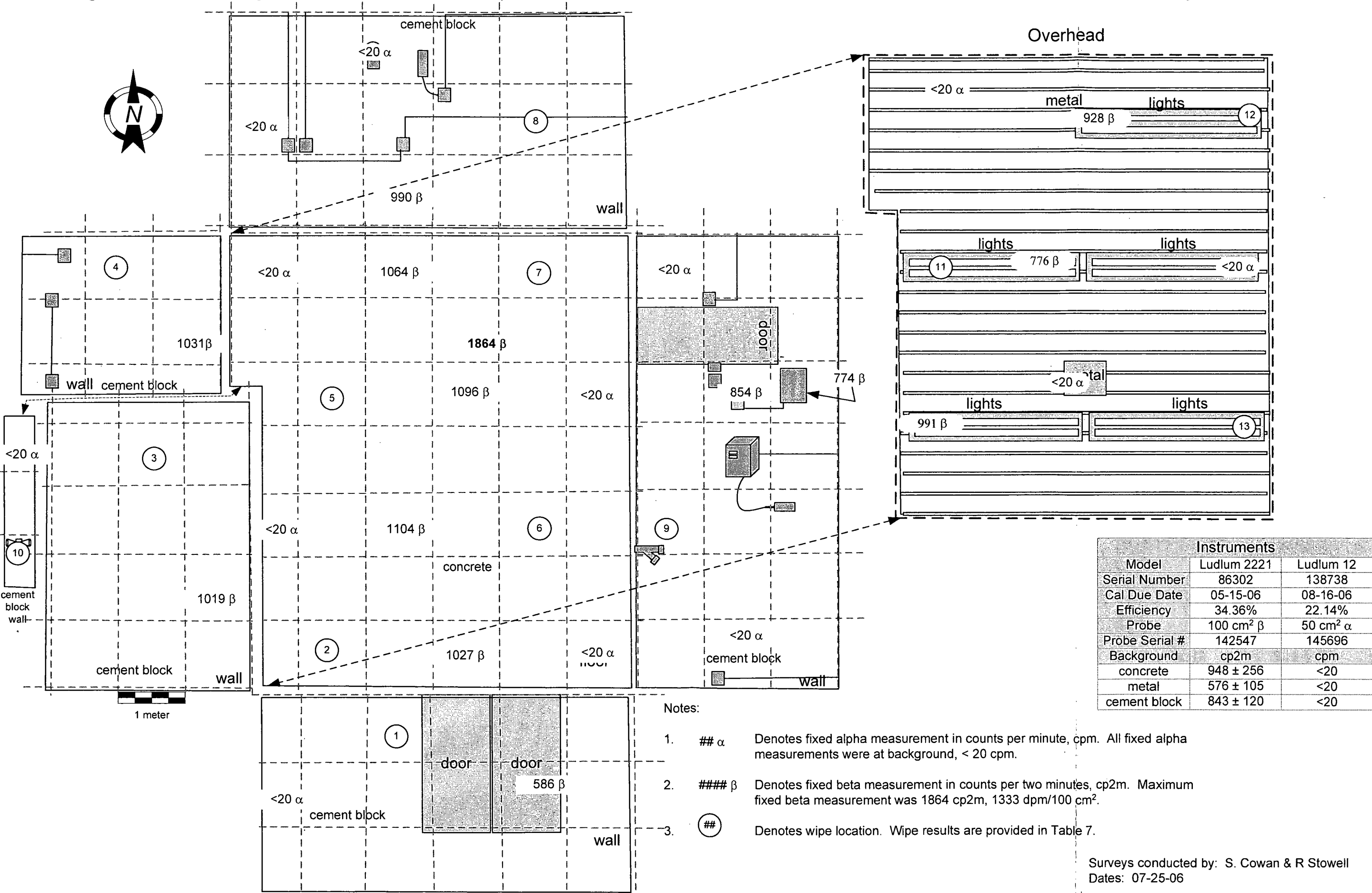
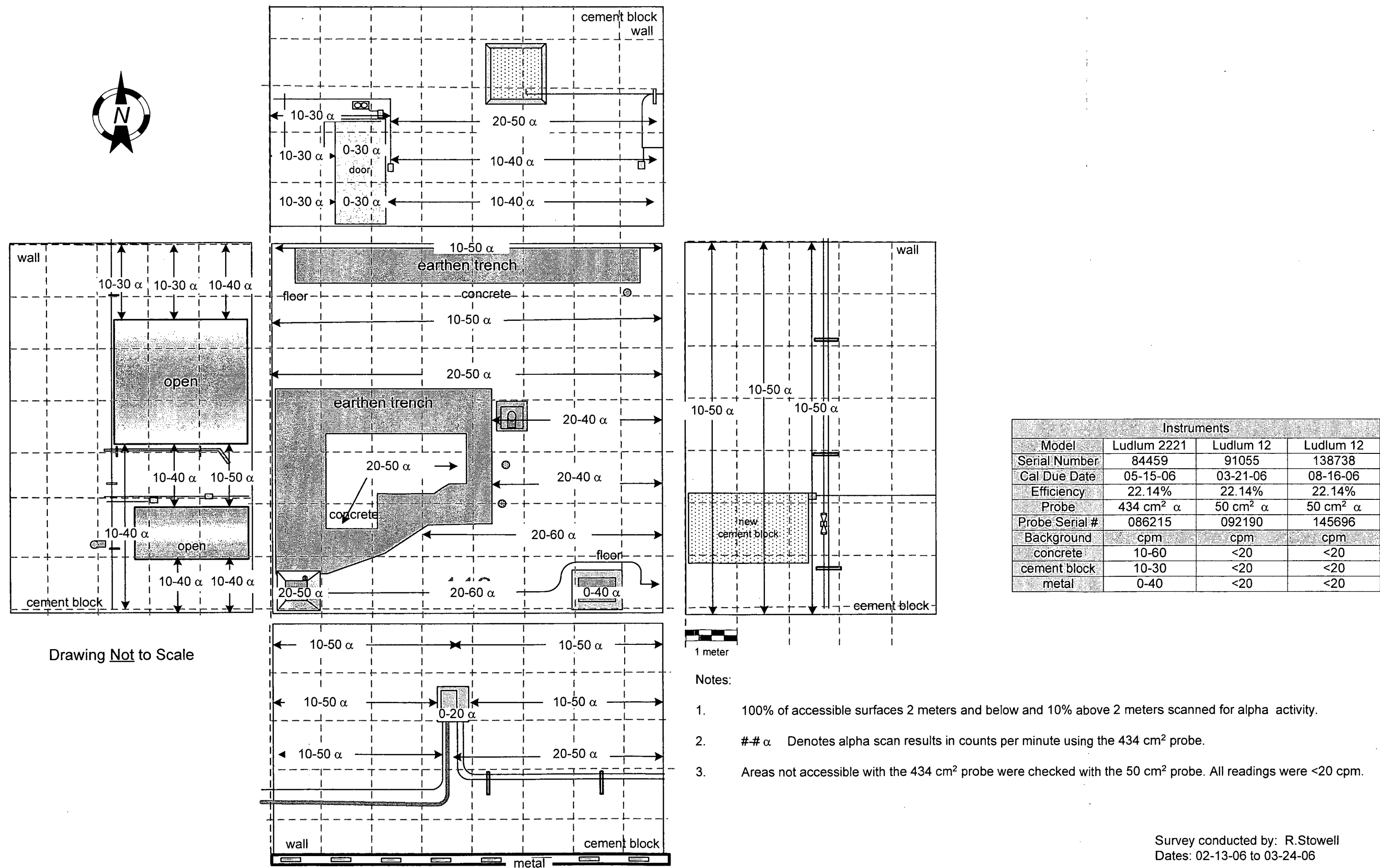


Fig. 26

Figure 27: Building 21 Room 113 Alpha Scan Measurement Locations and Results



Survey conducted by: R.Stowell
Dates: 02-13-06 to 03-24-06

Figure 28: Building 21 Room 113 Beta Scan Measurement Locations and Results

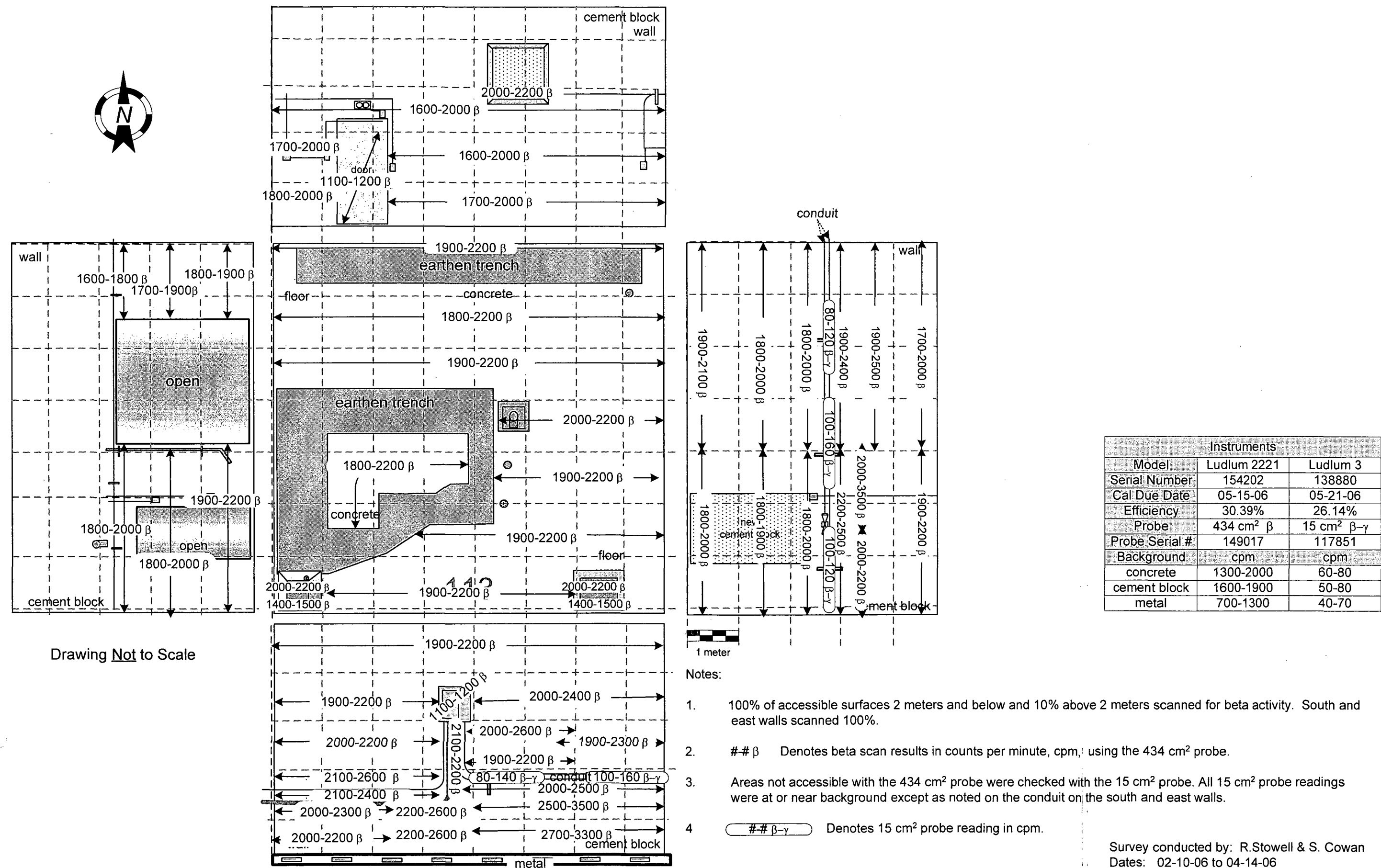
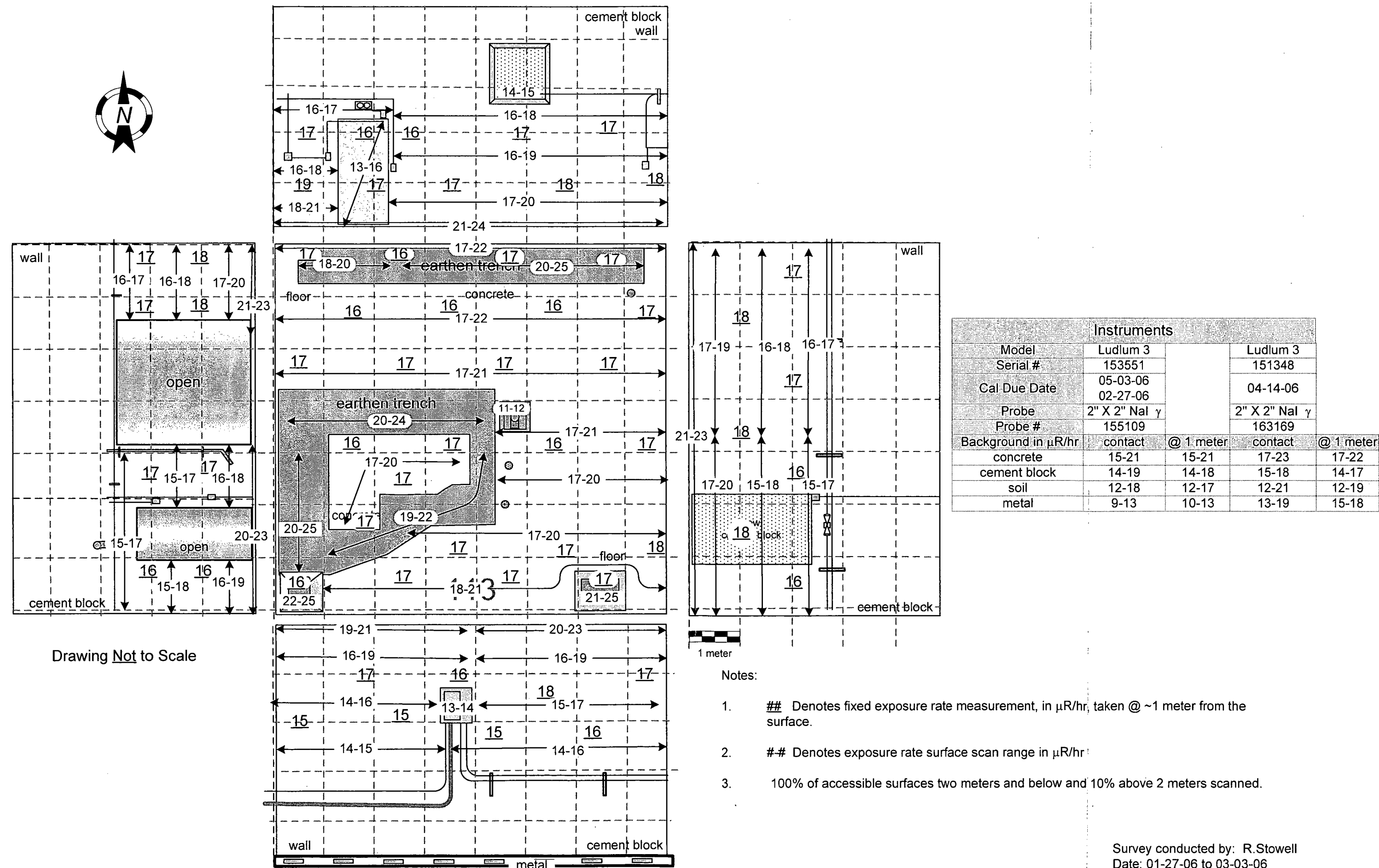


Figure 29: Building 21 Room 113 Fixed Exposure Rate and Exposure Rate Scan Measurement Locations and Results



Survey conducted by: R.Stowell
Date: 01-27-06 to 03-03-06

Figure 30: Building 21 Room 113 Fixed Alpha and Beta Measurement Locations and Results and Wipe Survey Locations

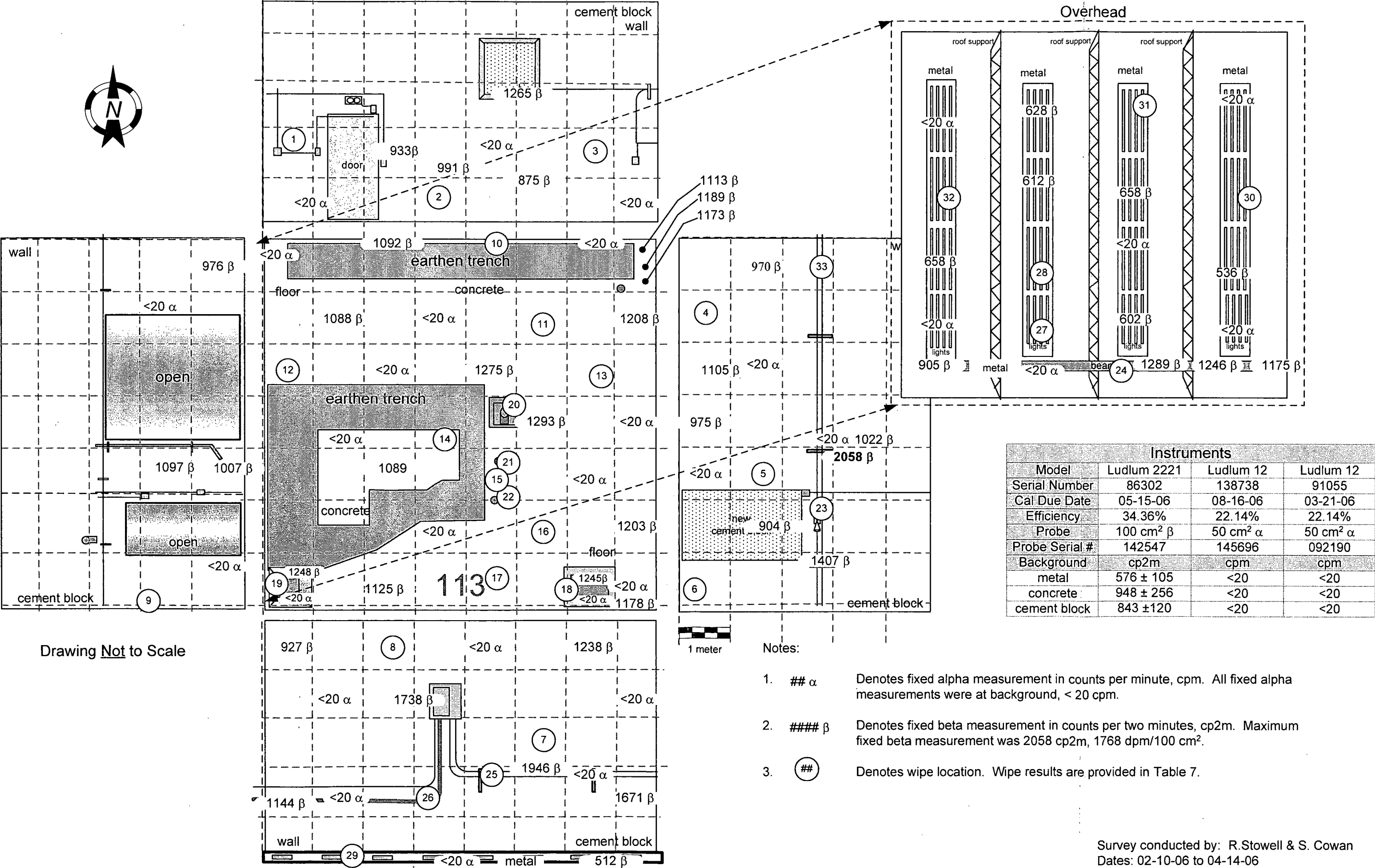


Fig. 30

Figure 31: Building 21 Room 113 Sample Locations

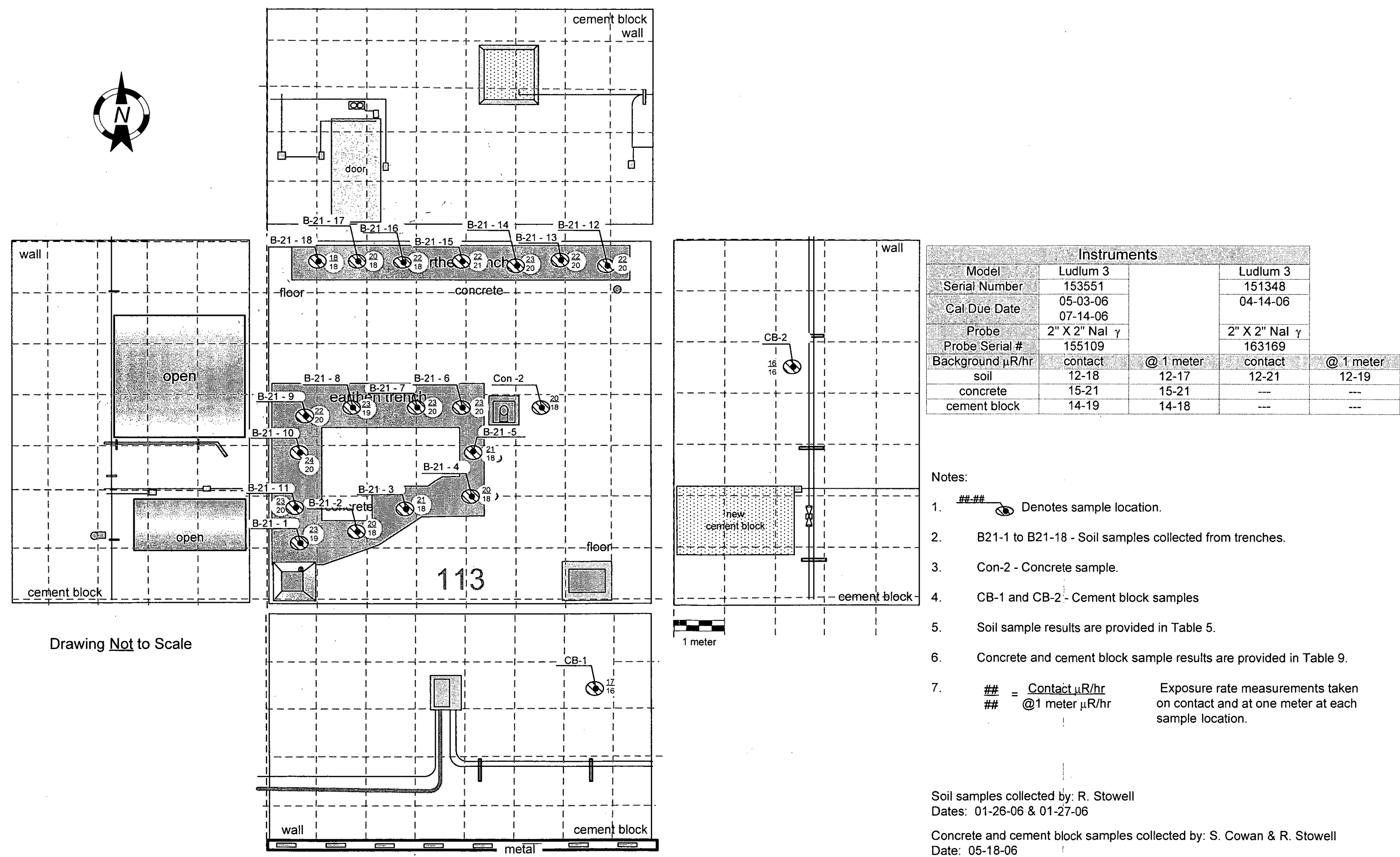


Fig. 31

Figure 32: Building 21 Room 113 Drain Pipe Survey

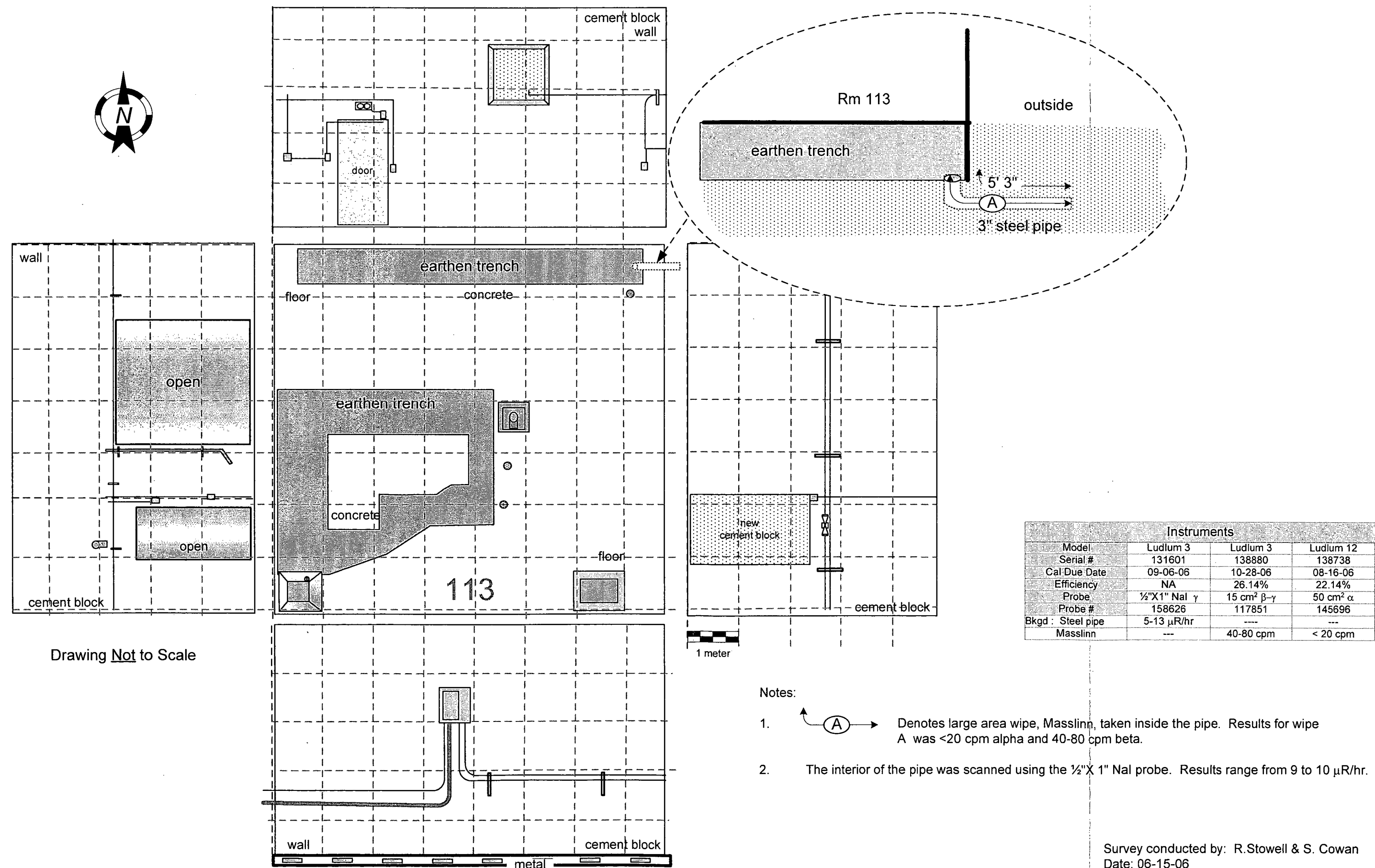
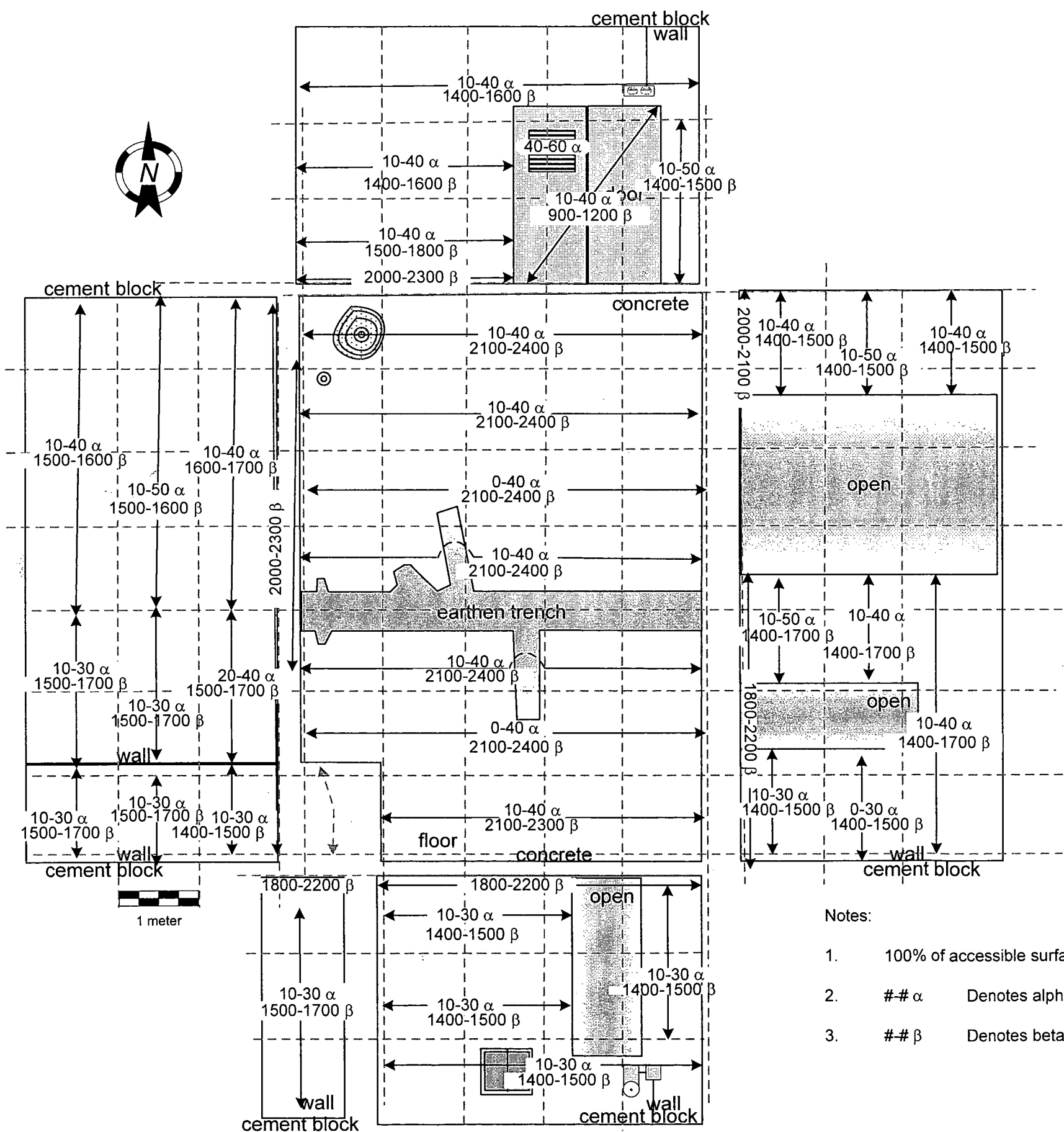


Figure 33: Building 21 Room 114/115 Alpha and Beta Scan Measurement Locations and Results



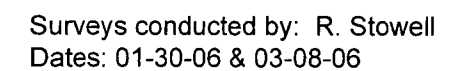
Instruments		
Model	Ludlum 2221	Ludlum 2221
Serial Number	84459	154202
Cal Due Date	05-15-06	09-22-06
Efficiency	22.14%	30.39%
Probe	434 cm ² α	434 cm ² β
Probe Serial #	086215	149017
Background	cpm	cpm
concrete	10-60	1300-2000
cement block	10-30	1600-1900
metal	0-40	700-1300

Notes:

- 100% of accessible surfaces 2 meters and below and 10% above 2 meters scanned for alpha and beta activity.
- ## α Denotes alpha scan results in counts per minute.
- ## β Denotes beta scan results in counts per minute.

Survey conducted by: R. Stowell
Dates: 03-10-06 to 03-23-06

Fig. 34



Notes:

1. ## Denotes fixed exposure rate measurement, in $\mu\text{R/hr}$, taken @ ~1 meter from the surface.
2. #-# Denotes exposure rate surface scan range in $\mu\text{R/hr}$
3. 100% of accessible surfaces two meters and below and 10% above 2 meters scanned.

Figure 35: Building 21 Room 114/115 Fixed Alpha and Beta Measurement Locations and Results and Wipe Survey Locations

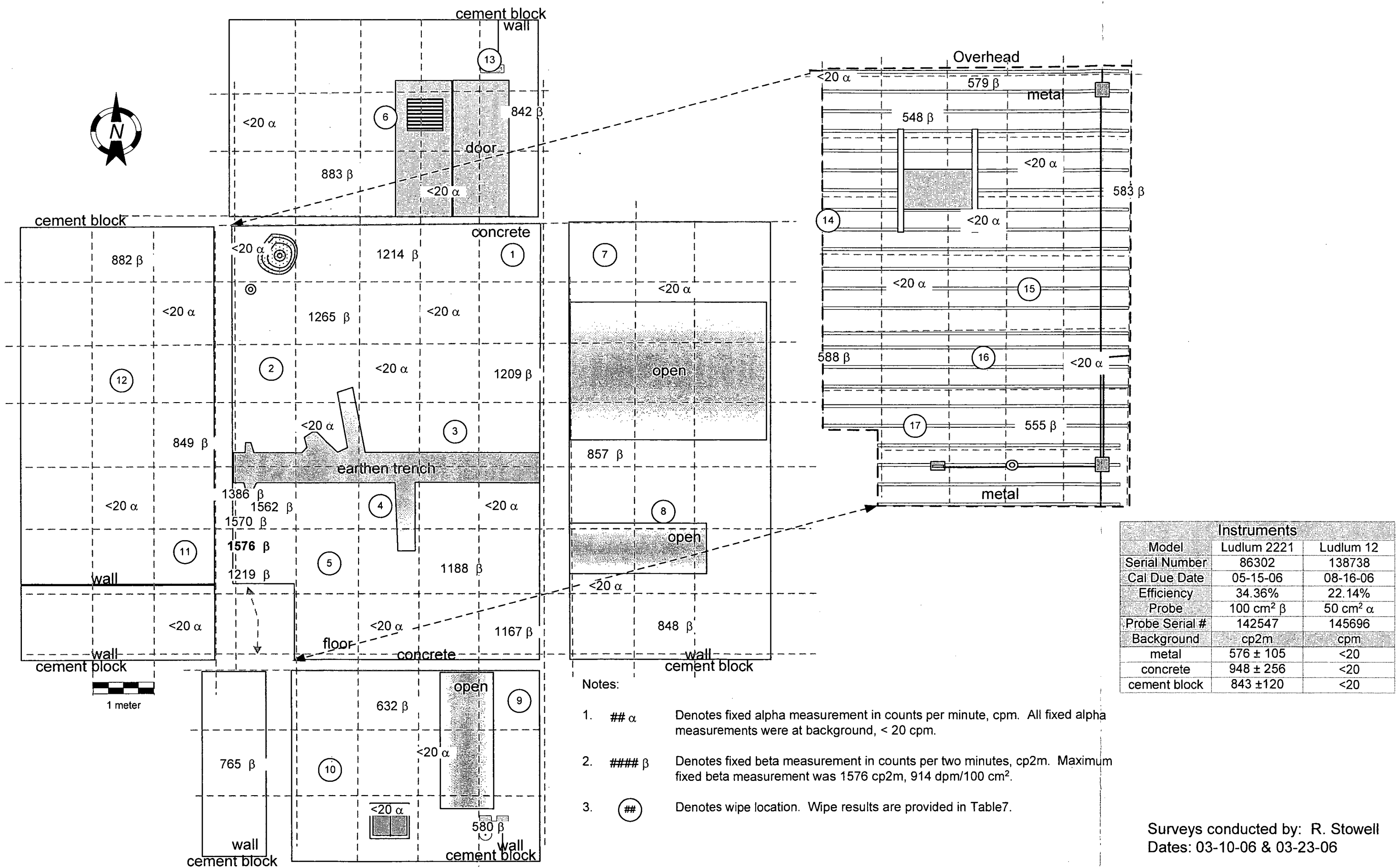
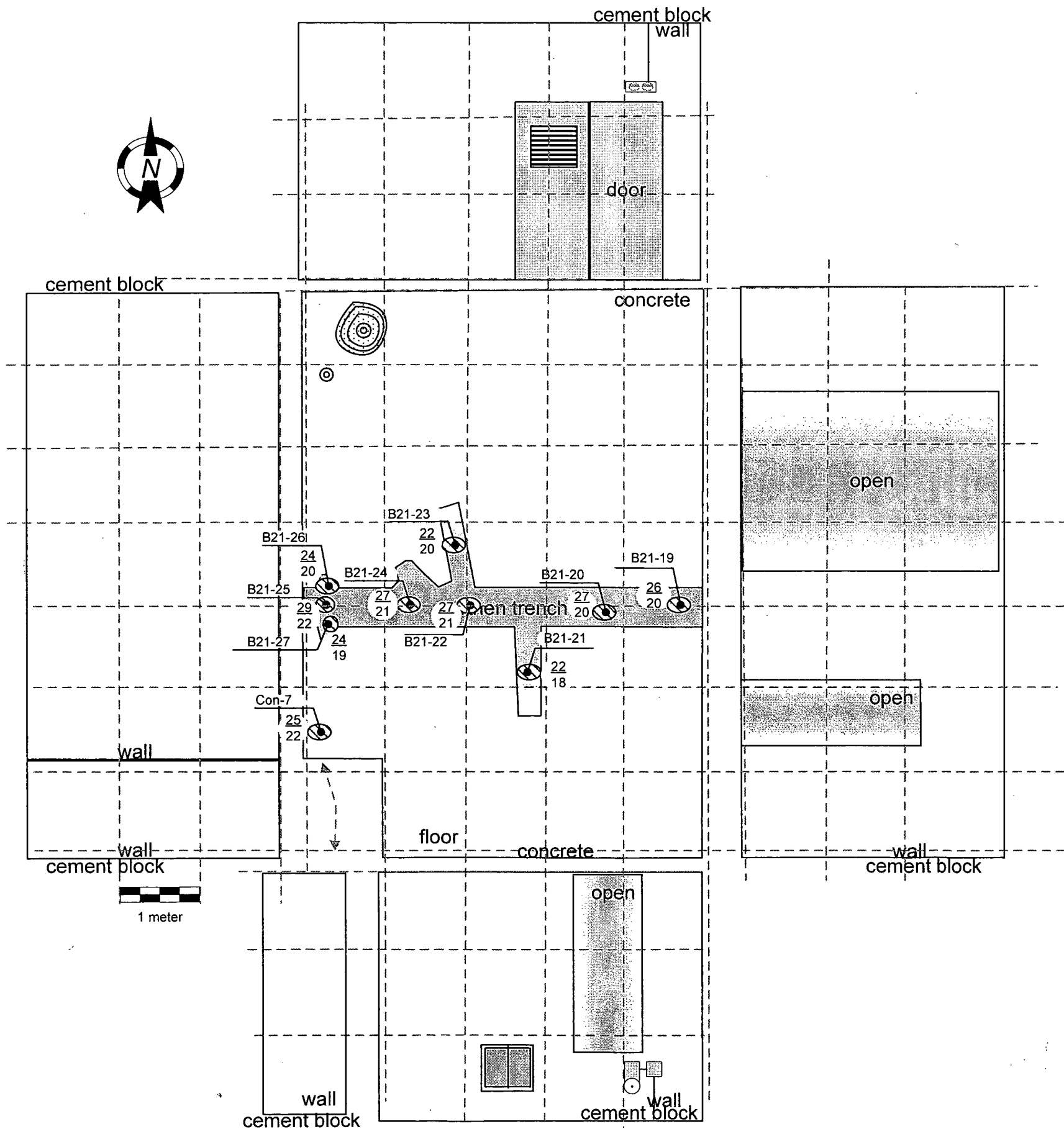


Fig. 35

Figure 36: Building 21 Room 114/115 Sample Locations

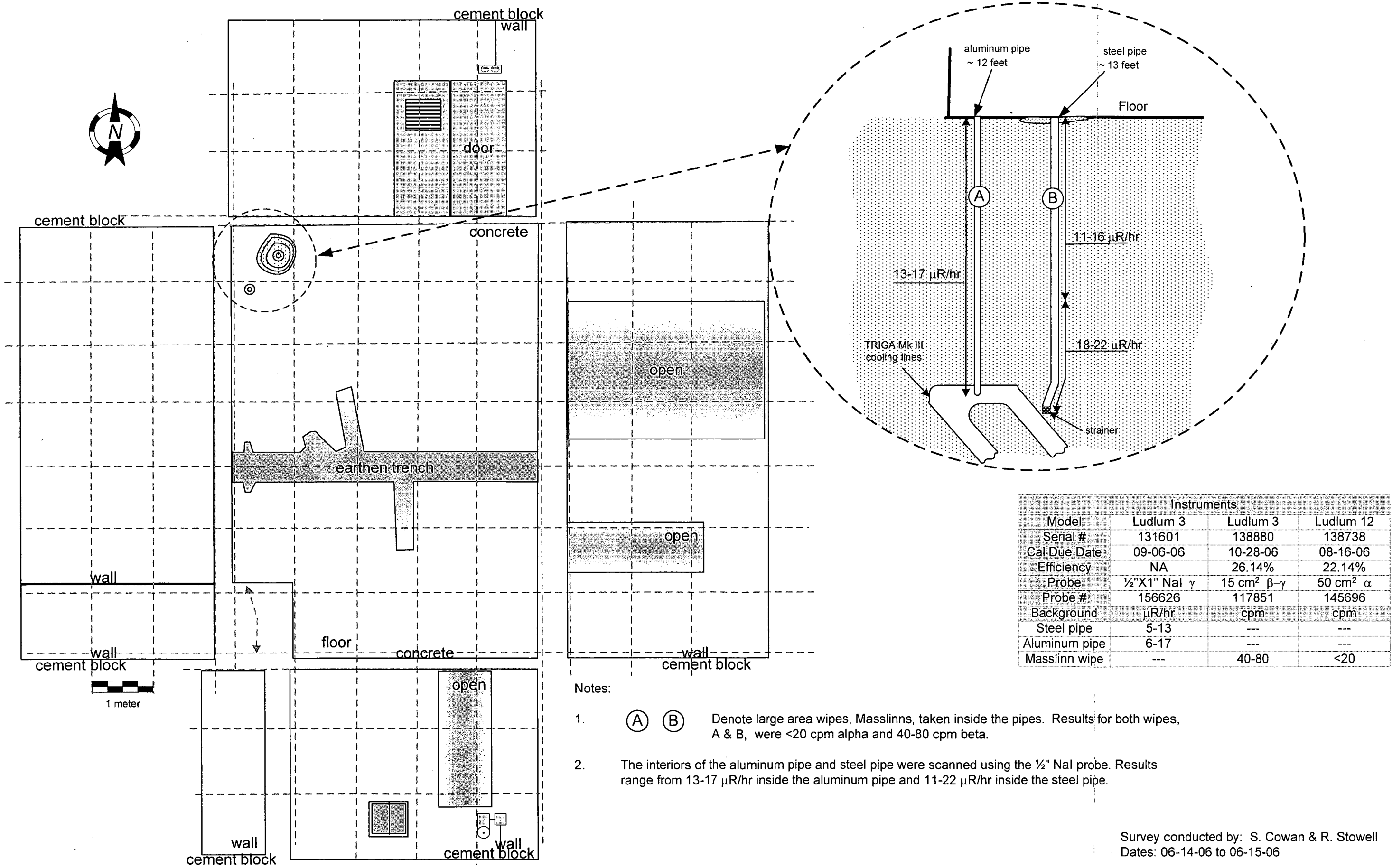


Instruments				
Model	Ludlum 3		Ludlum 3	
Serial Number	153551		151348	
Cal Due Date	07-14-06		04-14-06	
Probe	2" X 2" NaI γ		2" X 2" NaI γ	
Probe Serial #	155109		163169	
Background μ R/hr	contact	@ 1 meter	contact	@ 1 meter
soil	---	---	12-21	12-19
concrete	15-21	15-21	---	---

- Notes:
- ### Denotes sample location.
 - Con-7 - concrete sample. Results for this sample are provided in Table 9.
 - B21-19 to 27 - soil samples. Results for these samples are provided in Table 5.
 - ## = Contact μ R/hr Exposure rate measurements taken on contact and at one meter at each sample location.
@1 meter μ R/hr

Soil samples collected by: R. Stowell
Date: 01-30-06
Concrete sample collected by: S. Cowan & R. Stowell
Date: 05-19-06

Figure 37: Building 21 Room 114/115 Pipe Surveys

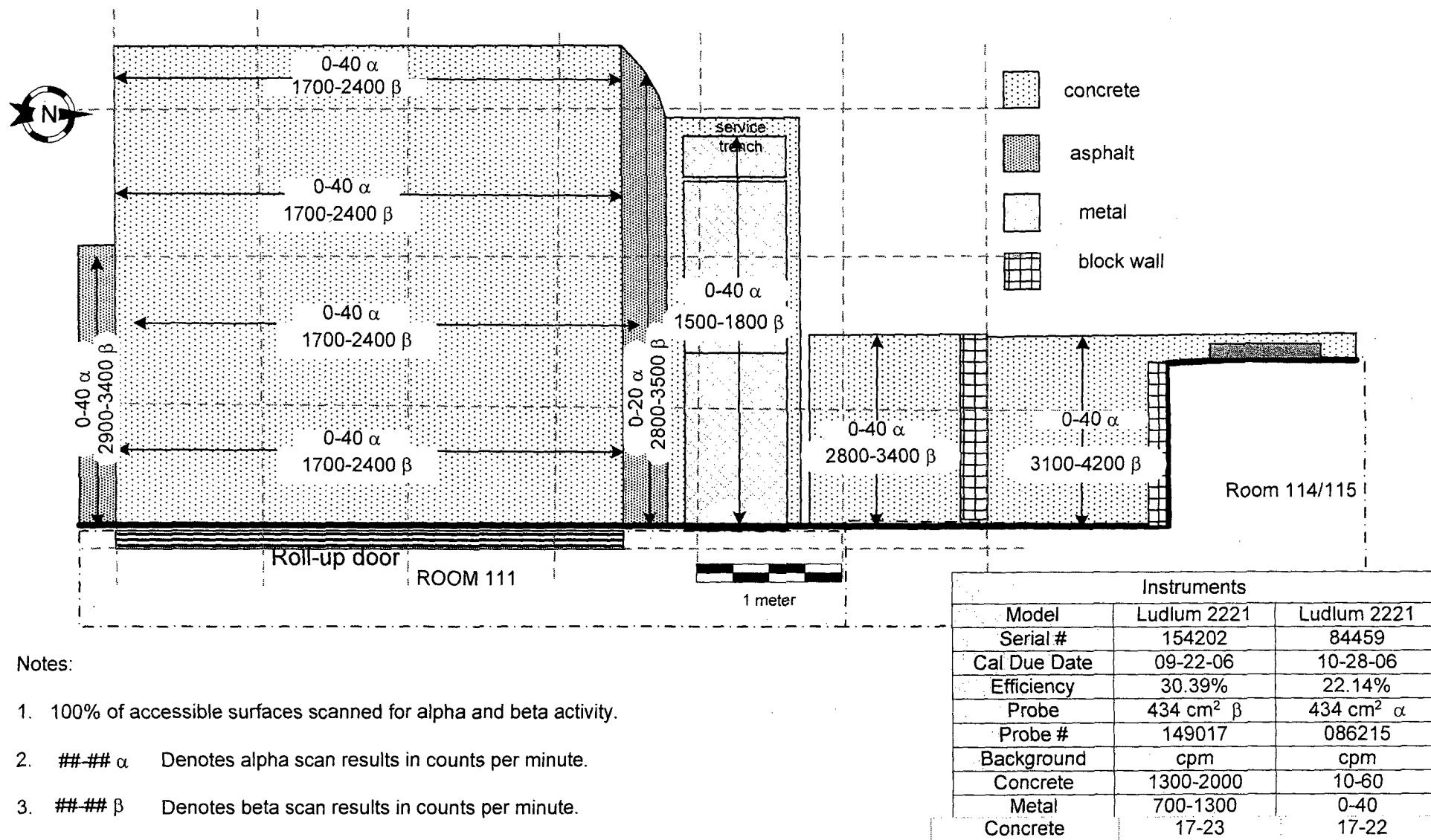


Notes:

1. (A) (B) Denote large area wipes, Masslinns, taken inside the pipes. Results for both wipes, A & B, were <20 cpm alpha and 40-80 cpm beta.
2. The interiors of the aluminum pipe and steel pipe were scanned using the $\frac{1}{2}$ " NaI probe. Results range from 13-17 $\mu\text{R/hr}$ inside the aluminum pipe and 11-22 $\mu\text{R/hr}$ inside the steel pipe.

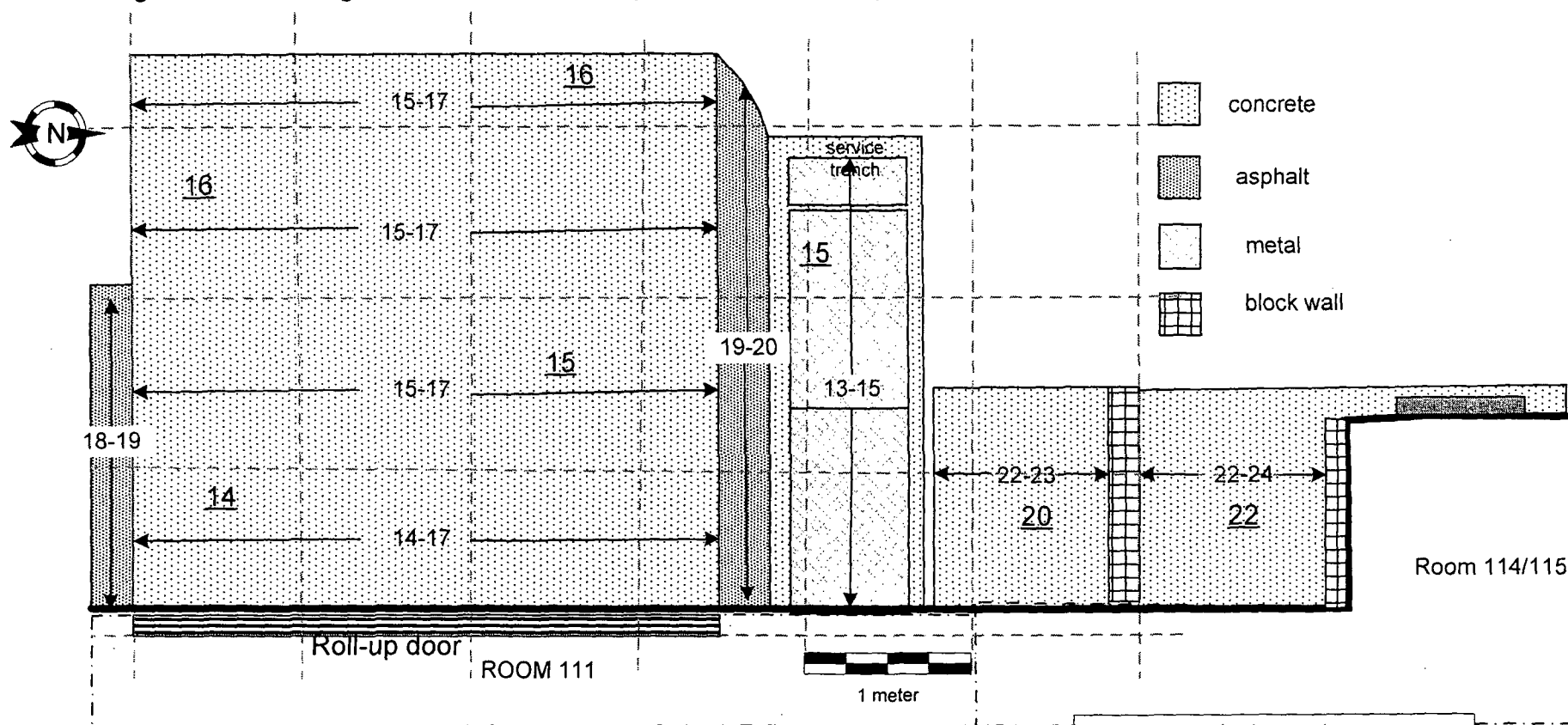
Survey conducted by: S. Cowan & R. Stowell
Dates: 06-14-06 to 06-15-06

Figure 38: Building 21 West Pad Alpha and Beta Scan Measurement Locations and Results



Surveys conducted by: S. Cowan
Dates: 06-13-06 & 06-15-06

Figure 39: Building 21 West Pad Fixed Exposure Rate and Exposure Rate Scan Measurement Locations and Results



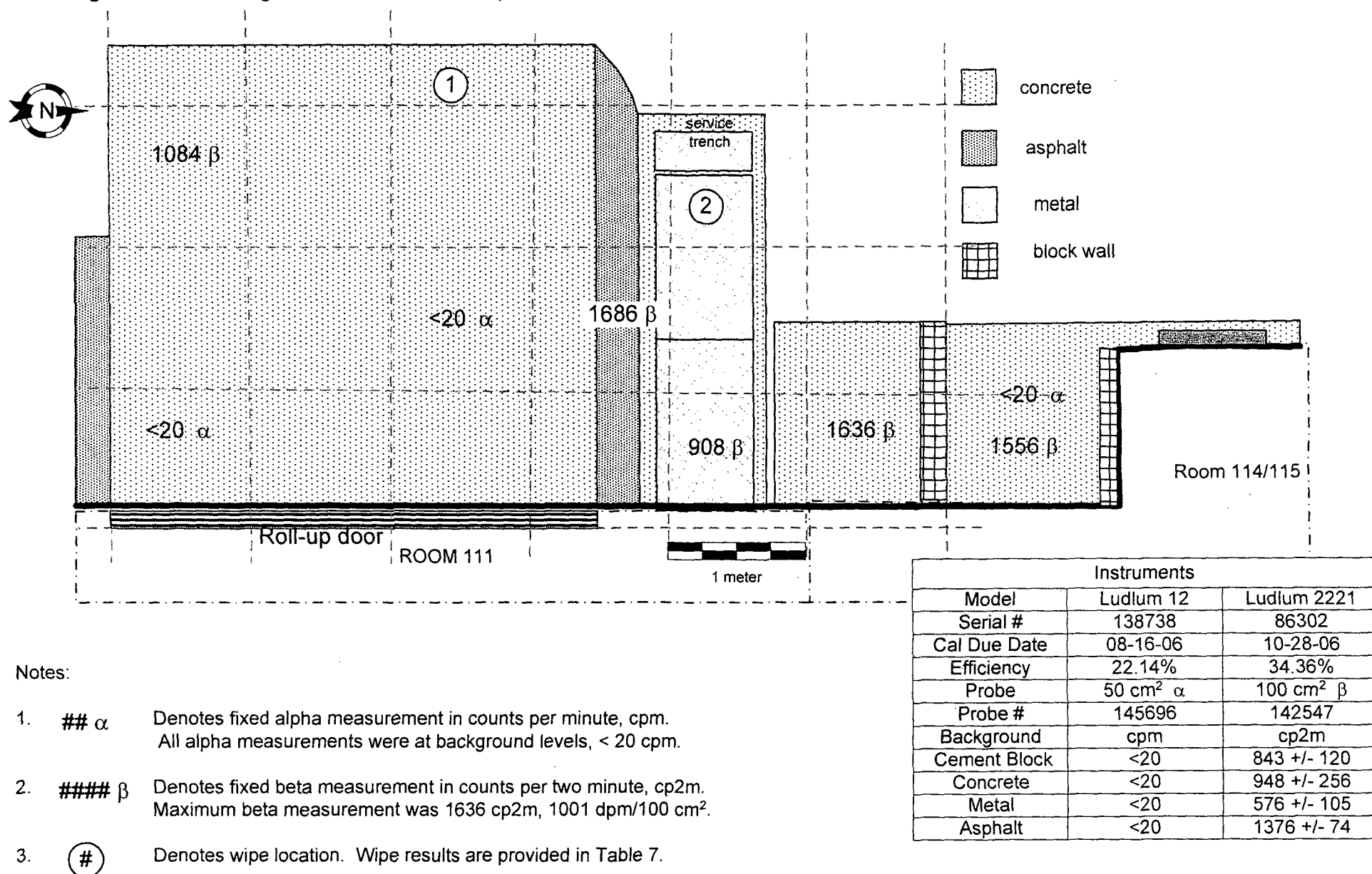
Notes:

1. ## Denotes fixed exposure rate measurement, in $\mu\text{R/hr}$, taken at ~ 1 meter from the surface.
2. ##-## Denotes exposure rate surface scan range in $\mu\text{R/hr}$.
3. 100% of accessible surfaces scanned.

Instrument		
Model	Ludlum 3	
Serial #	151348	
Cal Due Date	06-30-06	
Probe	2" X 2" NaI γ	
Probe #	163169	
Background $\mu\text{R/hr}$	contact	@ 1 meter
Concrete	17-23	17-22
Metal	13-19	15-18
Asphalt	20-21	19-20

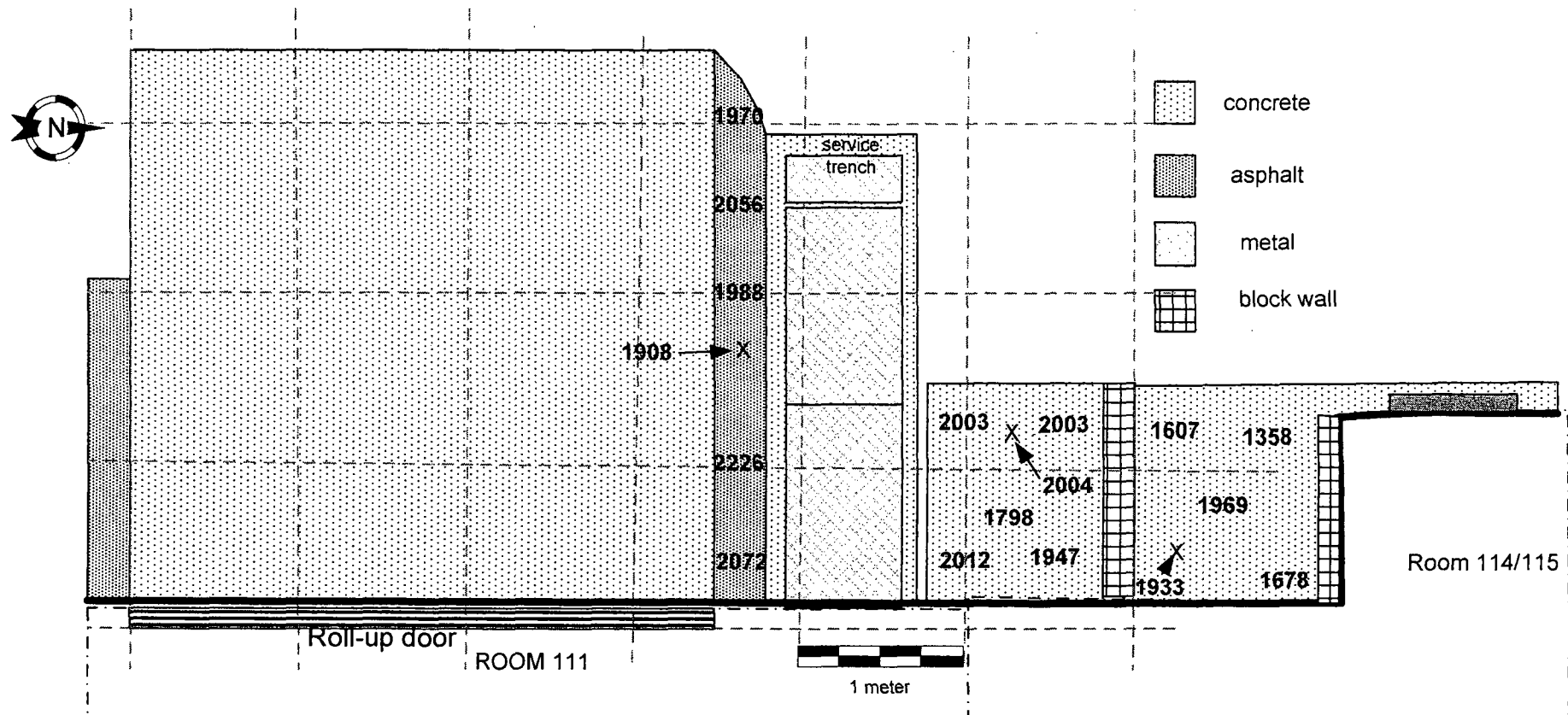
Survey conducted by: R. Stowell
Date: 06-13-06

Figure 40: Building 21 West Pad Fixed Alpha and Beta Measurement Locations and Results and Wipe Survey Locations.



Survey conducted by: S. Cowan & R. Stowell
 Dates: 06-13-06 to 06-14-06

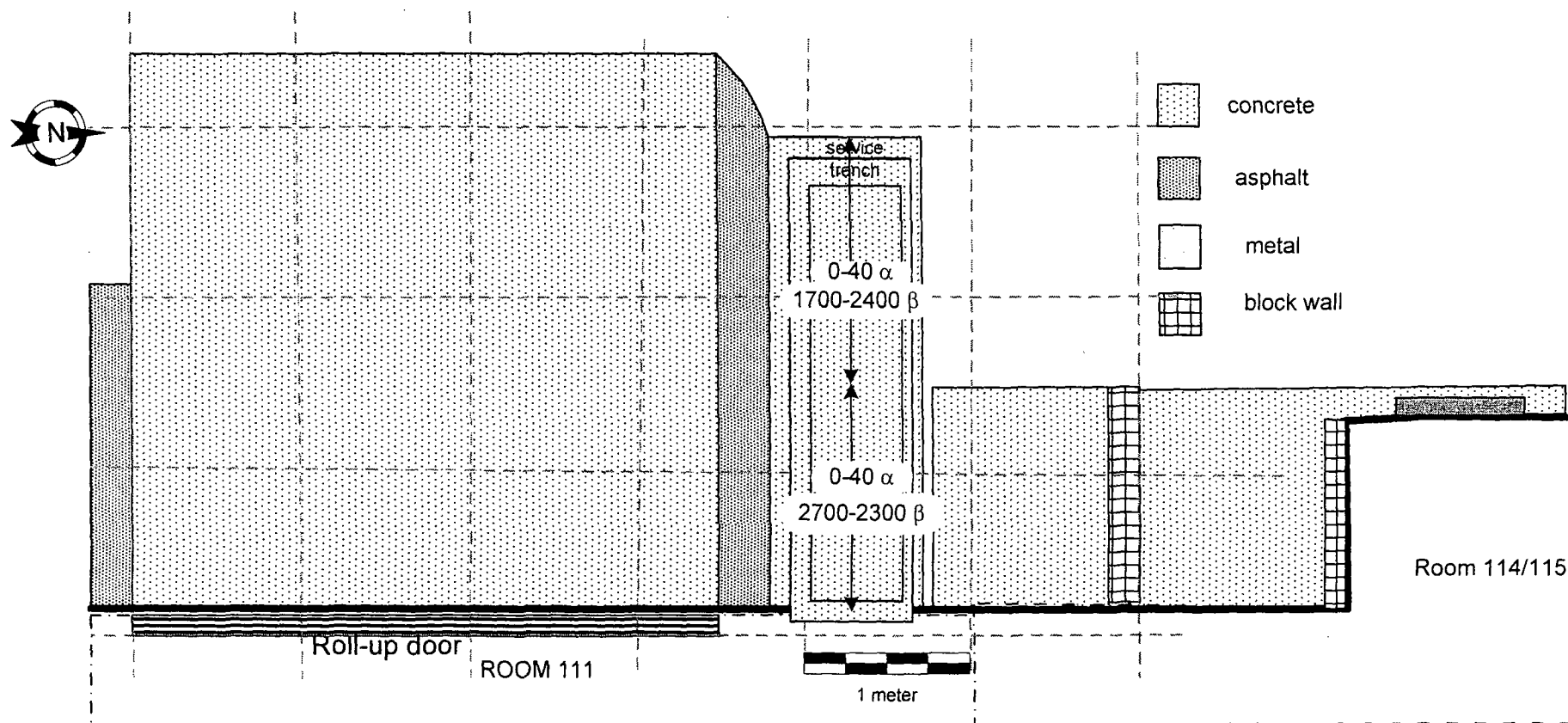
Figure 40A: Building 21 West Pad, Fixed Beta Measurement Locations and Results for Elevated Scan Measurement Areas



All measurements are 2 minute Fixed Beta measurement in counts/2m (cp2m).
 The Worst case, Highest measurement, 2012 cp2m on Concrete equals 1548 dpm/100cm².
 "X" marks the spot of the highest scan measurement.

Instruments	
Model	Ludlum 2221
Serial #	86302
Cal Due Date	05/07/07
Efficiency	34.36%
Probe	100 cm ² β
Probe #	142547
Background in CP2M	Cement Block= 843 +/- 120 Concrete= 948 +/- 256 Metal= 576 +/- 105 Asphalt= 1376 +/- 74
Survey conducted by: S. Cowan Date: 11/07/06	

Figure 41: Building 21 West Pad Service Trench Alpha and Beta Scan Measurement Locations and Results



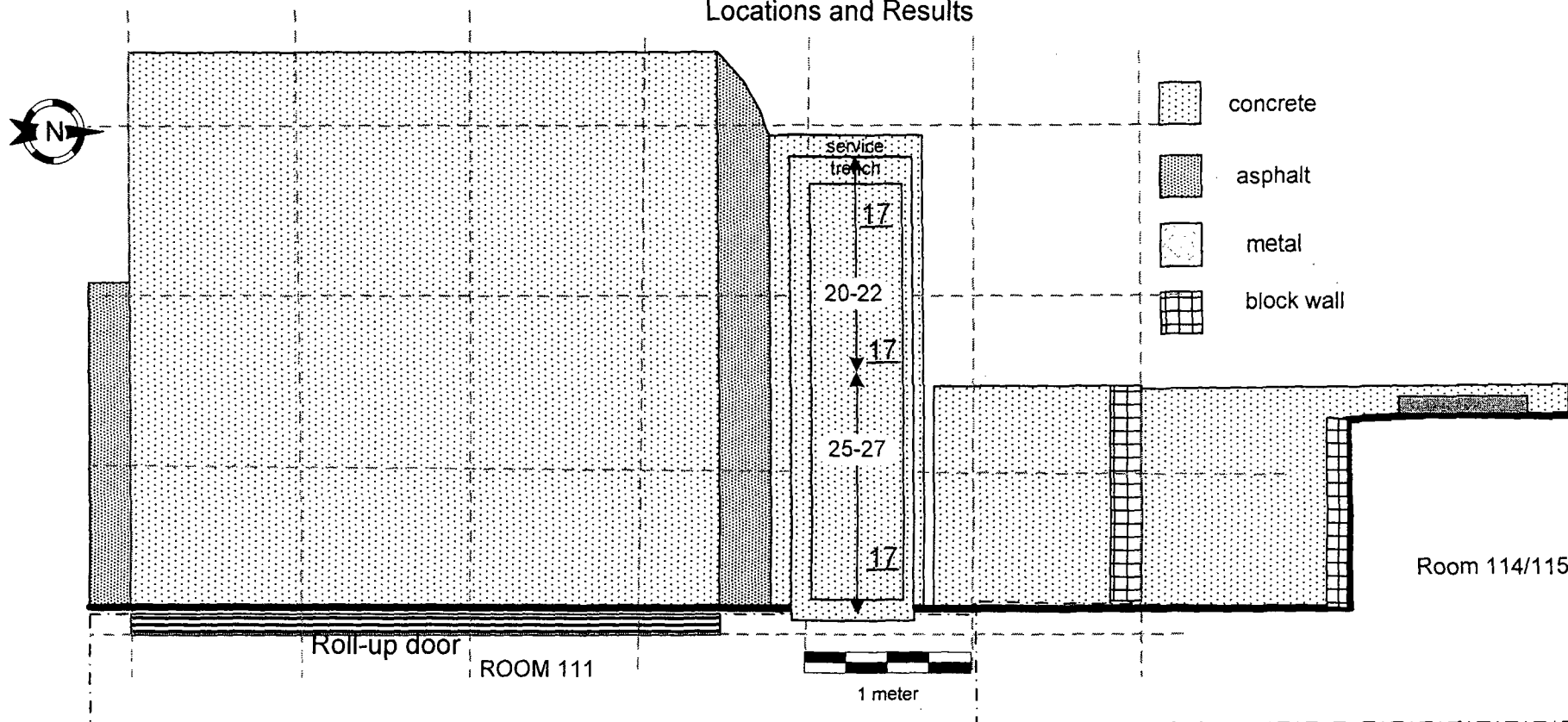
Notes:

1. 100% of accessible surfaces scanned for alpha and beta activity.
2. ##-## α Denotes alpha scan results in counts per minute.
3. ##-## β Denotes beta scan results in counts per minute.

Instruments		
Model	Ludlum 2221	Ludlum 2221
Serial #	154202	84459
Cal Due Date	09-23-06	05-15-06
Efficiency	30.39%	22.14%
Probe	434 cm ² β	434 cm ² α
Probe #	149017	086215
Background	cpm	cpm
Concrete	1300-2000	10-60

Surveys conducted by: S. Cowan
Date: 06-14-06

Figure 42: Building 21 West Pad Service Trench Fixed Exposure Rate and Exposure Rate Scan Measurement Locations and Results



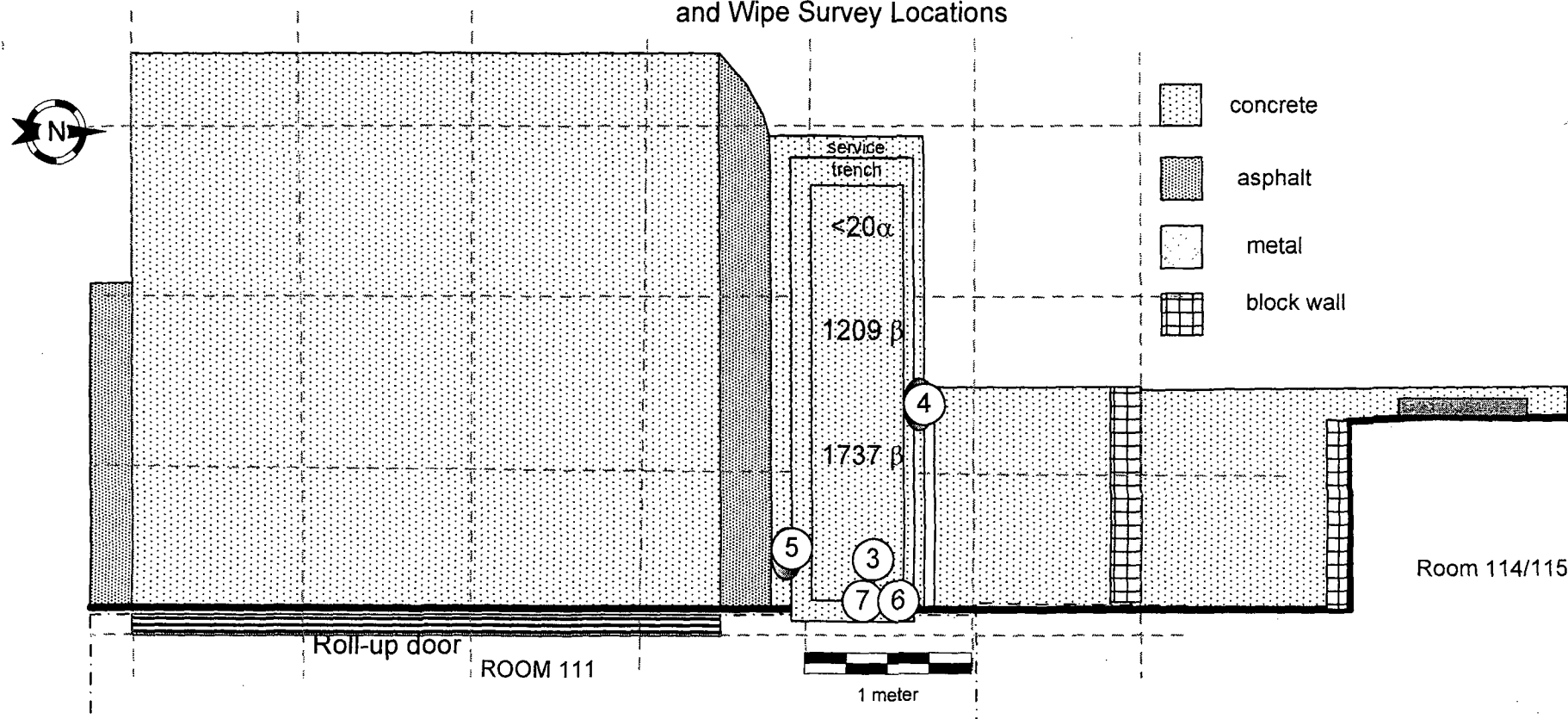
Notes:

1. **##** Denotes fixed exposure rate measurement, in $\mu\text{R/hr}$, taken at ~ 1 meter from the surface.
2. **##-##** Denotes exposure rate surface scan range in $\mu\text{R/hr}$.
3. 100% of accessible surfaces scanned.

Instrument		
Model	Ludlum 3	
Serial #	151348	
Cal Due Date	06-30-06	
Probe	2" X 2" NaI γ	
Probe #	163169	
Background $\mu\text{R/hr}$	contact	@ 1 meter
Concrete	17-23	17-22

Survey conducted by: S. Cowan
Date: 06-14-06

Figure 43: Building 21 West Pad Service Trench Fixed Alpha and Beta Measurement Locations and Results and Wipe Survey Locations



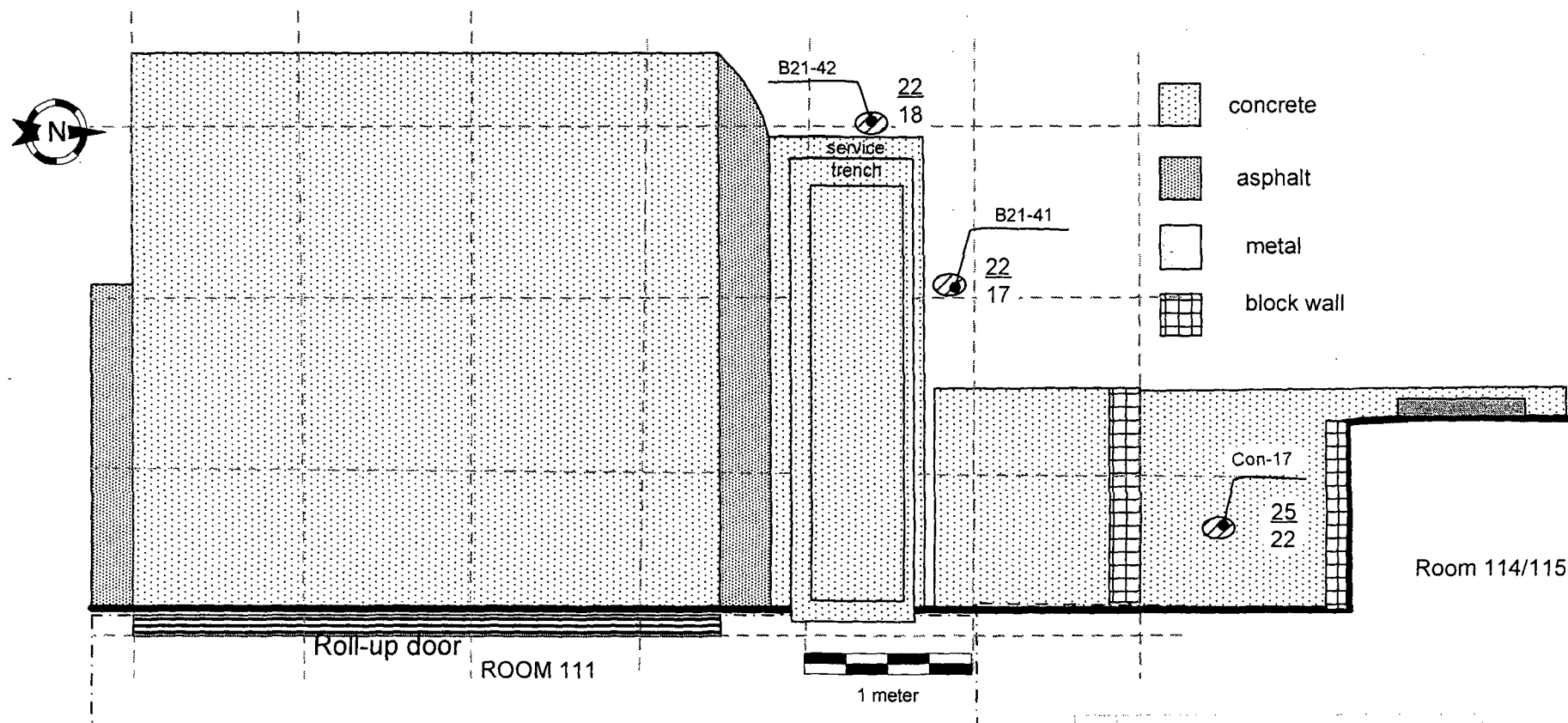
Notes:

1. **## α** Denotes fixed alpha measurement in counts per minute, cpm. All alpha measurements were at background levels, < 20 cpm.
2. **#### β** Denotes fixed beta measurement in counts per two minute, cp2m. Maximum beta measurement was 1737 cp2m, 1148 dpm/100 cm².
3. **(#)** Denotes wipe location. Wipe results are provided in Table 7.


Instruments		
Model	Ludlum 12	Ludlum 2221
Serial #	138738	86302
Cal Due Date	08-16-06	10-28-06
Efficiency	22.14%	34.36%
Probe	50 cm ² α	100 cm ² β
Probe #	145696	142547
Background	cpm	cp2m
Concrete	<20	948 +/- 256

Survey conducted by: S. Cowan & R. Stowell
Date: 06-14-06

Figure 44: Building 21 West Pad Sample Locations



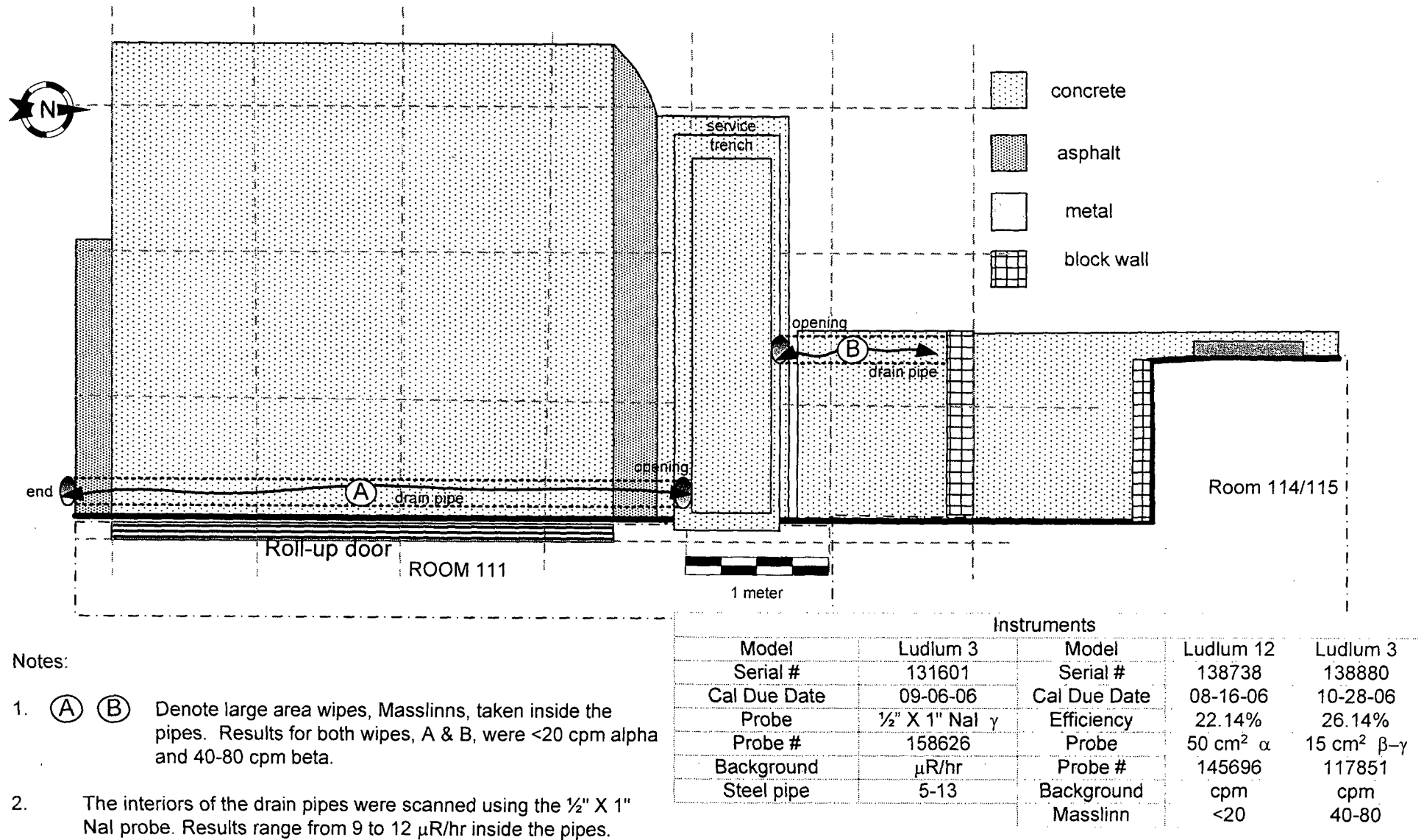
Notes:

1. $\text{B21-}\#$  Denotes sample location.
2. Soil sample results are provide in Table 5 and concrete samples results in Table 9..
3. Samples B21-41 and B21-42 are surface soil samples, 0-6" collected adjacent to the service trench.
4. Sample Con-17 was a concrete sample collected in the area of the highest beta scan measurement.
5. $\frac{\text{##}}{\text{##}} = \frac{\text{contact } \mu\text{R/hr}}{\text{@1 meter } \mu\text{R/hr}}$ Exposure rate measurements taken on contact and at one meter at each sample location

Instrument		
Model	Ludlum 3	
Serial #	151348	
Cal Due Date	06-30-06	
Probe	2" X 2" NaI γ	
Probe #	163169	
Background $\mu\text{R/hr}$	contact	@ 1 meter
Soil	12-21	12-19
Concrete	17-23	17-22

Samples collected by: R. Stowell
Date: 06-09-06 & 06-26-06

Figure 45: Building 21 West Pad Pipe Survey



Survey conducted by: S. Cowan & R. Stowell
Date: 06-14-06

Figure 46: TRIGA Non-NRR Land Area Fixed Alpha and Beta measurement Locations and Results



= Fixed Alpha Measurement in Counts/ min.

= Fixed Beta Measurement in Counts/2 min.

Location	Building 21 Non-Reactor	
Instruments	Ludlum 2221	Ludlum Model 12
Serial Number	86302	138738
Calibration Due	07/12/05, 12/27/05	12/02/05
Efficiency	34.36%	21.02%
α β γ	β	α
Probe Number	142547	073360
Probe	100 cm ² Beta	50 cm ² Alpha Scint.
Typical Background	1042± 90 c/2min (Con) 1371± 55 c/2min (Asph.)	0-20 cpm all surfaces
MDA in dpm/ 100 cm ²	222 (conc.) 254 (asphalt)	160
Surveyors : S. Cowan Date: 06/14/05 - 11/12/05		

Note: Drawing Not to scale

Figure 47 : TRIGA Non-NRR Land Area Wipe Sample Locations



⊙ = Wipe sample location, See Table ## for Alpha and Beta analysis results

Note: Drawing Not to scale

Figure 48: TRIGA Non-NRR Land Area Alpha Scan Locations and Results



= Non-NRR Land
(18,280 ft²)

= NRR Land (~9620 ft²)

= Building structure

= 100% Alpha Scans within 1" of paved Surfaces in Counts/min.

All Results are less than the MDA for the surface surveyed

Note: Drawing Not to scale

Location	Building 21 Non-Reactor
Instruments	Ludlum 2221
Serial Number	84459
Calibration Due	07/12/05
Efficiency	22.14%
α β γ	α
Probe Number	086215
Probe	434 cm ² Gas Flow Proportional
Typical Background in cpm	Concrete = 10-60 cpm Asphalt = 0-80 cpm Metal = 0-40 cpm
Scan MDA in dpm/100 cm ²	Concrete = 109, metal = 62 asphalt = 125
Surveyors : S. Cowan Date: 06/07/05 - 06/11/05	

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100



Note: Drawing Not to scale

Location	Building 21 Non-Reactor
Instruments	Ludlum 2221
Serial Number	154202
Calibration Due	12/27/05
Efficiency	30.39%
α β γ	β
Probe Number	149017
Probe	434 cm ² Gas Flow Proportional
Typical Background in cpm	Concrete = 1300-2000 cpm Asphalt = 2000-2800 cpm Metal = 700-1300 cpm
Scan MDA in dpm/100 cm ²	Concrete = 375, metal = 227 asphalt = 546
Surveyors : <u>S. Cowan</u> Date: <u>06/07/05 - 06/11/05</u>	

Downloaded from <http://ajphaphysoc.org/> on November 10, 2014

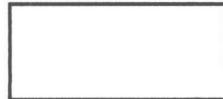




Location	Building 21 Non-Reactor
Instruments	Ludlum Model 3
Serial Number	151348
Calibration Due	08/02/05, 10/19/05, 10/04/06
Efficiency	NA
α β γ	γ
Probe Number	163169
Probe	2 x 2 NaI(Tl)
Typical Background in $\mu\text{R/hr}$	13-19, @ contact, Soil

Surveyors : S. Cowan Date: 06/01/05 -10/15/05. &09/01/06

Figure 51: TRIGA Non-NRR Fixed Exposure Rate Measurement Locations and Results



-  = Non-NRR Land (18,280 ft²)
-  = NRR Land (~9620 ft²)
-  = Building structure

All measurements taken approximately every 2 meters at 1 meter from the surface.
All Results in $\mu\text{R/hr}$.

Location	Building 21 Non-Reactor
Instruments	Ludlum Model 3
Serial Number	151348
Calibration Due	08/02/05, 10/19/05, 01/11/06, 10/04/06
Efficiency	NA
α β γ	γ
Probe Number	163169
Probe	2 x 2 NaI(Tl)
Typical Background in $\mu\text{R/hr}$	13-17, @ 1m, Soil 19-20 @ 1m, Asphalt 17-22 @ 1m, Concrete
Surveyors : S. Cowan Date: 07/28/05 - 11/12/05, & 9/01/06	

Note: Drawing Not to scale

Figure 52. TRIGA Non-NRR Soil Sample Locations and Micro-R Results at Sample Locations



Location	Building 21 Non-Reactor
Instruments	Ludlum Model 3
Serial Number	151348
Calibration Due	08/02/05, 10/19/05, 10/04/06
Efficiency	NA
α β γ	γ
Probe Number	163169
Probe	2 x 2 NaI(Tl)
Typical Background in μ R/hr	13-17, @ 1m, Soil
Surveyors : S. Cowan Date: 10/04/05 - 10/05/05 & 09/01/06	

Note: Drawing Not to scale