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FINAL RADIOLOGICAL SURVEY REPORT FOR THE HOT CELL 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 Hot Cell Site located on GA's Main Site. The Hot Cell Site includes the area where the former Hot Cell Facility (Building 23) was located, the outdoor service yard, and the immediately adjacent area beyond the yard[1]. The Building and surrounding structures were dismantled in accordance with an NRC and State-approved Decommissioning Plan. The contaminated equipment and most of the building were disposed of as radioactive waste. All asphalt and concrete was removed from the site and properly disposed of after radiological surveys were performed. The decommissioned site consists only of open land area (soil surfaces only).

GA is requesting both the Nuclear Regulatory Commission (NRC) and the State of California (RHB) to release the open land area comprising the Hot Cell Site to unrestricted use.

GA completed the radiological survey in accordance with a detailed Final Survey Plan submitted in May 1999 to the NRC and State of CA (provided in Appendix 1). This report documents the results of the Hot Cell Site survey and demonstrates that this land area meets the approved criteria for release to unrestricted use. The total land area to be released to unrestricted use is ~8,300 m^2.

Site Description

The GA Hot Cell Site is situated on Lots 31 and 34, of Torrey Pines Science Center Unit No. 2, in the City and County of San Diego, State of California, as shown on map number 12845 filed in the office of the County Recorder on July 23, 1991.

A plan view of GA's Main Site and GA's Sorrento Valley Site is shown in Figure 1. The Hot Cell Site land area is located on GA's Main Site. The location of the Hot Cell Site in relation to other surrounding GA facilities is shown in Figure 2. A drawing of the current Hot Cell Site showing the land area to be released to unrestricted use is shown in Figure 3, Hot Cell Site Area. The Hot Cell Site includes the area where the former Hot Cell Facility (Building 23) was located and the surrounding outside former radiation restricted area, and adjacent areas which had the potential of being impacted by Hot Cell operations.

These adjacent areas extend the total area to be released beyond the former radiation restricted

[1] GA Hot Cell Facility Decommissioning Plan, latest revision January 1998, PC000423/4

area. The resulting total area is referred to as the extended "footprint" or more simply as the "Hot Cell Site," (see Figure 3). A new fence was erected around most of the site footprint with the exception of the north corner and west corner which are located on a steep hillside. The fence also serves to control access to the area following decontamination and Final Survey efforts, and to delineate the majority of the Hot Cell Site boundary. See Figure 4 for the location of the existing fence and the boundary of the Hot Cell Site.

The Hot Cell Facility building (Building 23) along with support structures, tanks, vaults, piping and electrical conduits, both above and below ground, were dismantled and/or removed from the Hot Cell Site prior to GA conducting the Final Survey. Similarly, prior to the Final Survey, all asphalt and concrete ground coverings were surveyed, removed and appropriately disposed on the basis of the survey results. The site to be released consists only of open land area (soil surfaces only) comprising an area about 8,300 m^2.

Previous Activities (History of Use) and Decontamination Efforts

In support of activities involving predominantly government funded nuclear research and development (R&D), GA continuously maintained a fully operational Hot Cell Facility (HCF) for over 30 years. Built in 1958 as a heavily shielded remote-handling laboratory, the Hot Cell Facility supported a wide variety of radiological and investigative operations.

The HCF contained three shielded cells, the High Level Cell (HLC), the Low Level Cell (LLC), and the Metallography Cell. The HLC was used to perform destructive post-irradiation examinations on fuels and structural materials. The LLC served as the staging area for samples being transferred into and out of the HLC. The Metallography Cell was used to prepare irradiated fuel and metal samples (e.g. grinding) for use with the metallograph.

The hot cells were used to perform post-irradiation examinations on fuels, structural materials, and instrumentation for dosimetry. Most of the projects involved examination of irradiated fuel and graphite from High Temperature Gas-Cooled Reactors.

The HCF service gallery and the outside storage yard had been used for cask handling and cask maintenance activities, and for temporary radioactive waste storage, consolidation, packaging, and characterization (e.g., weighing, gamma scanning).

The HCF Building and surrounding structures were decommissioned in accordance with an NRC and State-approved Decommissioning Plan[1]. The contaminated equipment and most of the building structural material/debris were disposed of as radioactive waste. All asphalt and concrete was removed from the site and properly disposed of on the basis of radiological surveys. Accordingly, the site to be released consists only of an open land area (soil surfaces only).

During decommissioning activities, the HCF was completely dismantled. A substantial portion of the building was disposed of as radioactive waste, including the Cells, Manipulator Repair room and Machine shop. All support equipment associated with the HCF, such as underground tanks, wells, and piping systems were excavated, surveyed and disposed of as appropriate.

Portions of the building which were not directly involved in the handling of radioactive materials, such as the office rooms, change rooms, and rest rooms, were dismantled, surveyed, decontaminated if necessary, and disposed of as non-radioactive debris after being released to unrestricted use by the NRC and State.

During decommissioning efforts, numerous excavation pits and trenches were created during the removal of the following underground equipment: storage wells, ventilation system, drain system, building utility supplies, the exhaust stack sampling vault, and a diesel fuel tank. All but the stack sampling vault pit and diesel tank pit were left open for confirmatory sampling and survey purposes. Soil samples and direct radiation measurements were taken in the stack sampling pit, the pit was lined with burlap, then the pit was and filled in with the dirt previously excavated from this pit. The pit was filled in due to safety and logistics concerns with the continuation of the decommissioning efforts.

Soil samples were taken from the diesel fuel tank pit and then the pit was filled in with clean dirt imported from off site. Appendix 4 provides the results of radiological surveys completed in the Diesel Fuel Tank Pit, and Appendix 5 provides the results of radiological surveys completed in the Stack Sampling Pit.

Due to concerns that the open pits and trenches created during decommissioning activities would likely fill with water during the rainy season thereby making them unavailable for regulatory confirmatory surveying, GA requested that the (Nuclear Regulatory Commission (NRC) and the Oak Ridge Institute for Science and Education (ORISE) perform surveys of the pits and trenches in advance of the entire Hot Cell Site. GA had previously performed a survey and provided the NRC and ORISE with survey information including exposure rate measurements and the results of soil sample analyses. ORISE then requested additional information which GA provided in a report sent to ORISE in January 2000 summarizing GA's radiological surveys of the pits and trenches at the Hot Cell Site. This report is provided in Appendix 3.

Another trench formed during the decommissioning activities was a trench formed to expose the sewer line that traversed a portion of the Hot Cell Site Radiation Restricted Area. This sewer line serviced the neighboring Building 22 facility. This line was exposed and the trench was left open for survey purposes. The radiological survey performed by GA inside this trench was also included in the report sent to ORISE (Appendix 3).

A potable water line that serviced Building 22 also traverses the Hot Cell Facility "footprint" This water line was outside of the former Hot Cell Radiation Restricted Area. This line was not removed but was left exposed for the entire southern boundary of the footprint and approximately 25% of the eastern boundary for surveying purposes. The radiological survey performed by GA inside this trench was also included in the report sent to ORISE (Appendix 3).

There is a storm drain located within the Hot Cell footprint that drains to the east of the site. The results of GA's surveys and measurements associated with the storm drain pit and outflow are included in this Final Survey Report.

Following demolition of the building, support structures, shed, and underground wells, drain lines, ventilation ducting and other structures, extensive post decontamination surveys were taken to determine if, and where, additional remediation was needed. As a result of these surveys, extensive remediation of the soil was initiated and continued until surveys demonstrated that release criteria were met. A Final Survey was then conducted in accordance with the Final Survey Plan provided in Appendix 1.

During decommissioning activities, including soil remediation, a total of 154,000 ft^3 of material was disposed of as radioactive waste. Approximately 60,500 ft^3 of soil was sent to EnviroCare for disposal, the remaining 93,500 ft^3, which consisted of building materials, equipment, asphalt, and soil, was sent to the DOE Waste Disposal Site in Hanford, Washington.

In addition to the soil that was disposed of as radioactive waste, approximately 40,000 ft^3 of soil was removed from the Hot Cell Site. This soil is currently in a temporary storage area and will be the subject of a future request for release to unrestricted use.

Figure 5 provides an estimate of the depth and locations of soil removed from the surfaces of the Hot Cell Site and either placed in a temporary storage area or disposed of as radioactive waste.

Following the Final Survey, GA performed a Confirmatory Survey in accordance with a documented survey plan using qualified Health Physics technicians who were not involved with the Final Survey. The Confirmatory Survey Plan, survey locations, and results are provided in Appendix 9.

Classification

For radiological survey purposes, the entire Hot Cell Site was classified as an "affected area" due to the extensive use of radioactive materials within the Hot Cell Facility, the results of the Characterization Survey performed prior to decommissioning, and the proximity of the Hot Cell Facility to other nuclear facilities at GA, i.e., Building 27 (EA-1 radiochemistry building),

Building 27-1 (Bunker associated with radiochemistry activities), Building 21 (TRIGA research reactor building) and Building 22 (TRIGA Fuel Fabrication Facility).

Criteria for Release to Unrestricted Use

The Characterization Survey identified elevated activity primarily consisting of the fission product Cs-137, and the activation product Co-60, and, to a lessor degree, the fission product Cs-134 in some soil samples.

Based on the history of the Hot Cell Facility, it was prudent to address the question of whether plutonium and/or Am-241 was present in the soil. The following information is being supplied to address this issue:

1. Results for ~1,000 soil samples collected and analyzed by gamma spectroscopy (using a high purity germanium detector) during post decontamination surveys showed no measurable Am-241; the typical sensitivity for a 30 minute count is < 0.3 pCi/g.

2. The results of the analyses of these ~1,000 soil samples showed U-235 concentrations at or near natural background levels (i.e., typically < 0.2 pCi/g). During the characterization study, U-235 concentrations in ~30 soil samples analyzed were also found to be at or near background levels. On the basis of process knowledge, no plutonium is expected to be present. However, if it were present, it would be expected to be at levels significantly less than those of U-235.

3. General Atomics submitted ten (10) soil samples from the Hot Cell site and two (2) background soil samples to an outside laboratory for plutonium analysis. The results showed no detectable plutonium (see Appendix 6 for results).

Also, based on the history of the Hot Cell Facility, it was prudent to address the question of whether tritium (H-3) was present in the soil. The following information is being supplied to address this issue:

1. Tritium used in the Facility was contained inside an enclosed system within an enclosure which was confined to a single room (room 109) within the Hot Cell building. Tritium which was released (as effluent) was in a gaseous form. At the end of the project, DOE and GA personnel removed the tritium and the potentially contaminated equipment including the enclosure from the facility. Subsequently, during Hot Cell decommissioning and dismantlement, the walls and floors of this room (along with most of the building) were disposed of as radioactive waste.

2. Nevertheless, GA submitted ten (10) soil samples from the Hot Cell site and two (2) background soil samples to an outside laboratory for tritium analysis. No tritium was detected in any of the samples (see Appendix 6 for results).

The Hot Cell Site soil contaminants were found to be Cs-137 and Co-60 with occasional trace quantities of Cs-134. The uranium and thorium concentrations detected in the soil were at or near background levels. Sr-90 was estimated based on the Cs-137 concentration at a ratio of 2.1:1. This ratio was based on soil samples analyzed for Sr-90 at an outside lab (see Appendix 6 for results). This ratio is conservative because only soil samples with the highest Cs-137 concentrations were analyzed and only the samples wherein Sr-90 was detected were used to obtain the estimated ratio.

Release Criteria for Soils

The predominant radionuclides found at the Hot Cell Site and other GA facilities and the corresponding NRC-and State- approved release criteria (in pCi/g) are as follows:

Cs-137	15 pCi/g
Co-60	8 pCi/g
Cs-134	10 pCi/g
Sr-90	1,800 pCi/g
Enriched Uranium (U-234 + U-235)	30 pCi/g
Thorium (Th-228 + Th-232)	10 pCi/g
Depleted Uranium	35 pCi/g

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

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

Where: C_i = The average concentration of radionuclide i in the sample above background levels.

L_i = The release criteria for radionuclide i.

The sum of the fractions must be less than or equal to one for the sample to meet the approved release criteria.

Exposure Rate Guideline

The NRC- and State- approved release criterion for direct radiation measurements is as follows: Exposure rates measured at 1 m above the surface are not to exceed 10 μR/hr above natural background levels.

Instrumentation & Background Measurements

A list of instruments used during the radiological surveys is provided in Table 1. 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). All of the instruments used were calibrated semiannually and after repair, except for exposure rate meters which were calibrated quarterly.

Exposure Rate Background

Typical exposure rate background for this site using a Ludlum Model 3 ratemeter with a Model 44-10 (a 2" x 2" NaI detector) or a Model 19 microR meter is about 15 μR/hr measured at 1 m from the surface. This value can be measured south of Building 15 (an office building on the eastern portion of the GA site). Measurements taken offsite in 10 different locations (9 offsite and 1 onsite at a non-impacted area near Building 15) over a period of 15 months also averaged ~ 15 μR/hr (measured at 1 m from the surface). The range of 12-18 μR/hr is typical at the GA site for the external dose rates measured at 1 meter from the surface.

During the performance of post-decontamination surveys, it was discovered that direct radiation readings were elevated in the clay substrate that was encountered in pits and trenches. GA believed these elevated levels were due to the combined effect of geometry changes and a naturally higher uranium concentration/activity in the clay soil. In order to verify this, a 4' x 4' x 4' hole, called the "background pit", was dug in a non-impacted area on GA's site (within the Torrey Pines West Land Area). The underlying clay substrate was exposed in the pit. Exposure rate measurements taken in this pit ranged between 25 and 27 μR/hr on the soil surface within the pit. An exposure rate measurement taken 1 m from the pit soil surface (taken at the center of the pit) read 24 μR/hr. Appendix 2 provides the background pit location and all results.

Background Soil Concentrations of Concern

Typical background concentrations measured by gamma spectroscopy in soil near the GA site have been established (at the 95% confidence level) and are provided in Appendix 2. The locations where these samples were taken are also given in Appendix 2. These soil samples were taken from the top 6" of soil (surface samples).

Twenty-one (21) soil samples were also collected in the "Background Pit" in order to determine natural uranium and thorium concentrations in clay soil. The subsequent gamma spectroscopy results of soil samples collected in the pits did, in fact, show slightly higher uranium concentrations. Appendix 2 provides the results of these soil samples.

Final Surveys Performed

Objectives and Responsibilities

The objectives of the final survey plans were: (1) to demonstrate that the soil sample results, both at the surface and sub-surface, were well below GA's approved release criteria for unrestricted use, and, (2) that the exposure rate measurements taken throughout this open land area measured at 1 meter above the surface, were less than 10 μR/hr above background. Surveys were taken in accordance with an approved survey plan by qualified Health Physics Technicians having a minimum of three years health physics experience. Soil samples were counted in GA's Health Physics Laboratory which maintains an effective QA program.

Every survey taken was documented on a daily basis to a worksheet/drawing showing the approximate locations surveyed/sampled. The documentation included the results of the measurements (including units), the technician's signature, date, instrument(s) used (including the model and serial number of both the ratemeter and detector), calibration due date, % efficiency, background readings (if applicable) and any other pertinent information.

Each soil sample collected was controlled by a GA Chain of Custody procedure to verify the integrity of the sample was not compromised. Each sample was properly logged, sealed, labeled, packaged and tracked. The sampling locations were documented on a drawing.

Gridding

The entire open land area comprising the Hot Cell Site was "gridded" into 10m x 10m squares. The surface area was gridded in order to: (1) facilitate systematic selection of radiological measuring and soil sampling locations, (2) provide a means for referencing a measurement back to a specific location and (3) establish a uniform and distinct identification system. The horizontal (X) axis of the grid was delineated by numerical characters and the vertical (Y) axis by alphabetical characters. This established unique grids of easily identifiable entities as shown in Figure 4.

Survey Plan

The Final Survey Plan for the Hot Cell Site (Appendix 1) was developed based on the previous history of Hot Cell Site and adjacent buildings, the radionuclides of concern for this area, the potential for contamination, the various types of surfaces encountered and the classification of the area (suspect affected). These surveys included the following:

1. 100% of the accessible surfaces were scanned with a β/γ sensitive, 434 cm^2 gas flow proportional detector, scanned at approximately 1.5 to 2.0 inches from the surface.

2. 100% of the surface was scanned with a 2"X2" NaI detector held within 2" of the surface.

3. 100% of the surface was scanned with a 2"X2" NaI detector held at ~1 meter of the surface.

4. Core samples were taken at *each of* 36 locations at the following depths; 0-6", 6" to 12", 12"to 18", 18" to 24", 24" to 30", 30" to 36", 36" to 42", 42" to 48", 48" to 54", 54" to 60", 60" to 66", and 66" to 72".

5. Four (4) systematic surface (0-6") soil samples were taken in each grid for a total of 332 soil samples.

6. Each grid that had elevated readings using survey techniques 1 through 5 above, had an additional (up to 9) systematic soil samples taken following remediation in that grid (as described in the Final Survey Plan). A total of 66 additional samples were collected.

7 A direct radiation measurement was taken at contact and at 1 m from each soil sample location.

8. Gross α and β analysis was performed on the 35 soil samples which had the highest Cs-137 concentrations in order to (1) demonstrate that the Sr-90 concentrations in the highest potentially contaminated soil samples were well below the 1,800 pCi/g Sr-90 release criteria and (2) to provide additional assurance that other hard to detect isotopes are not present.

Soil Sampling

A total of 332 systematic surface (0-6") soil samples were taken from the exposed ground soil areas, in 10m x 10m gridded segments with hand tools. The locations selected were in accordance with the Final Survey Plan.

In addition, core samples were taken at 36 locations at the following depths: 0-6", 6" to 12", 12" to 18", 18" to 24", 24" to 30", 30" to 36", 36" to 42", 42" to 48", 48" to 54", 54" to 60", 60" to 66", and 66" to 72". The locations were selected based on areas having the highest potential for subsurface contamination, (i.e., drain line trenches, bottom of storage wells, liquid radioactive waste tank storage area, drainage areas, etc.).

Each of the soil samples taken was approximately 1 kilogram in mass. The samples were properly logged, labeled, tracked and packaged. All debris (i.e., grass, rocks, sticks, asphalt and foreign objects) was removed from each sample. Each soil sample was individually crushed to reduce large lumps, dried, placed into a tared marinelli beaker (filled to the top), weighed, sealed and transported to GA's Health Physics (HP) Laboratory.

Soil samples were analyzed in GA's Health Physics Laboratory with a Canberra Low Sensitivity Gamma Spectroscopy MCA System using a high purity Germanium Detector. The system was calibrated using NIST traceable standards and performance checked daily.

Soil samples were counted for a minimum of 30 minutes each. A 30 minute count was sufficient to detect the radionuclides of concern (Cs-137, Co-60 and Cs-134) at levels well below GA's approved soil release criteria.

Survey Summary

Comparisons of the Hot Cell Final Survey Plan requirements with the final surveys performed is shown below:

Comparisons of Final Survey Plan Commitments with Surveys Performed (Hot Cell Site)

Survey	Beta Scanning	Gamma Scanning (μR/hr)	Exposure Rate Measurements (μR/hr) at soil sample locations	# of Soil Samples	# of Core Samples
				Analyzed by Gamma Spectroscopy	
Hot Cell Final Survey Plan	100% of accessible surfaces	100% of accessible surfaces at contact	Contact and 1 meter readings at each soil sample location	4 samples in each 10m x 10m grid. Additional sampling if (1) radionuclide concentrations exceed the release criteria in any of the four samples collected *or* (2) elevated radiation levels are detected during the scan.	Depends on the potential for contamination
Final Surveys Performed	100% of accessible surfaces	100% of accessible surfaces at contact **and** 100% accessible surfaces at 1 meter	Contact and 1 meter readings at each soil sample location all 398 systematic soil sample locations	4 samples in each 10m x 10m grid (332 samples) 66 additional samples taken after remediation and/or elevated readings detected An additional 262 surface soil samples were collected inside pits and trenches (in addition to core samples)	36 locations sampled to a depth of 6' (432 samples)

[1] The total surface area to be released to unrestricted use is approximately 8300 m^2.

[2] The contaminants of concern are primarily Cs-137 and Co-60 (beta/gamma emitters).

QA Audits

In addition to the routine Quality Assurance (QA) activities, the following additional checks were made to verify the accuracy of the GA's HP laboratory results:

1. "Blind", blank samples were sent to the laboratory intermixed with the Final Survey soil samples.

2. Soil samples were sent to an independent laboratory for comparative analysis.

3. Soil samples were re-counted to evaluate the reproducibility of the results.

4. Audits, specifically focused on Hot Cell Final Survey Plan requirements, were also conducted.

Details on QA checks are provided in Appendix 8.

Results of the Final Surveys

The results of the Final Surveys are provided in figures and tables indicated below for each survey performed.

Scanning

Scans using floor monitors having 434 cm^2 gas-flow proportional detectors were conducted on accessible soil surfaces of the Hot Cell Site. The probes were held approximately 2" from the surface. An area was considered inaccessible when scanning would damage the probes and when the soil surface was too rough for a floor monitor to be used. Appropriate action was taken whenever elevated levels were discovered (e.g., investigation, remediation and/or removal of a hot particle). The area was then re-scanned to ensure that levels were no longer elevated. The results of this survey are presented in Figure 6.

Exposure Rate Measurements

Exposure rate measurements were taken at 1 m from the surface so that 100% coverage was obtained. The results are shown in Figure 7. Exposure rate measurements were all < 25 μR/hr at 1 m from the surface, below the exposure rate release criteria of 10 μR/hr above background at 1 m. Typical background is 15 μR/hr. Note: The background levels inside pits and trenches is higher, as shown in Appendix 2. The results of the surveys for the pits and trenches are summarized in Appendix 3.

In addition, the surface of the soil was scanned using 2"x2" Na(Tl) detectors, (held at ~ 1-2" from the surface) so that 100% coverage was obtained. The results are shown in Figure 8. Exposure rate measurements were all < 25 μR/hr.

Exposure Rate Measurements at Soil Sample Locations

Exposure rate measurements were taken at contact and at 1 m from each soil sample location using a 2"x2" NaI(Tl) detector. Exposure rate measurements were all < 25 μR/hr at 1 m from the surface, below the exposure rate release criteria of 10 μR/hr above background at 1 m. See Figure 9 for locations and results.

Soil Samples

Systematic surface (0-6") soil sampling was performed within each grid at locations approximately equidistant between the center and each of the four grid block corners (see Figure 10). The grid locations include sampling from underneath the previous Hot Cell Facility concrete pad and the outside storage yard within the radiation restricted area fence and in the area surrounding the restricted area. A total of 332 final soil samples were collected on the systematic grid system. Cs-137 and Co-60 were detected in many of the samples and trace quantities of Cs-134 were detected in some of the samples, but all results are all well below GA's soil release criteria.

Although none of the soil samples exceeded the release criteria, a few were close to the release criteria and/or radiation readings were somewhat elevated. In these areas, additional remediation (and subsequent sampling) was performed or additional sampling was conducted. In these areas, the 10 m grid was further subdivided as shown in Figure 2B of the Final Survey Plan (Appendix 1). A total of 66 additional soil samples (#'s 5332-5397) were collected. These soil sample locations are identified in Figure 10 and the results provided in Table 2B. Cs-137 and Co-60 were detected in many of the samples and trace quantities of Cs-134 were detected in some of the samples, but all results are all well below GA's soil release criteria.

Core Samples

Core samples were taken at 36 different locations on the Hot Cell site. The locations, shown in Figure 11, included those areas having the highest potential for subsurface contamination. These were the drain line trenches, depression areas, depression overflow area, and the bottoms of the hot cell pits. Other locations were also selected at random in areas where no subsurface contamination was expected.

Soil samples were collected every 6" down to a depth 6' in each location (12 soil samples per location), for a total of 432 soil samples. Gamma spectroscopy results indicated the presence of very low levels of Cs-137 and/or Co-60 in a few of the soil samples, but the levels were well

below the soil release criteria. Most of the results were at or near natural background levels. See Table 3 for soil sample results.

Storm Drain

Direct scans for beta activity and exposure rate measurements (μR/hr), were performed in the storm drain that is within the Hot Cell Site but outside the original radiation restricted area. The maximum beta reading was < 1,500 dpm/100 cm^2; well below the release limit for beta/gamma emitters of 5000 dpm/100 cm^2 (per Hot Cell Decommissioning Plan). The maximum exposure rate measurement was 27 μR/hr inside of the storm drain and 23 to 24 μR/hr inside the drain line itself, which is at or below natural background levels (as measured in the "background pit", Appendix 2).

In addition, one (1) soil sample was taken in the storm drain and three (3) were taken at the outflow. The soil sample analysis identified low levels of Cs-137 and Co-60, well below the soil release criteria. See Figures 12 and 13 for direct survey results and soil sample locations. See Table 4 for soil sample results.

Pits and Trenches

Final surveys in pits and trenches were performed prior to the Final Survey of the open land areas. The surveys for the pits and trenches are provided in Appendix 3. The results of about 221 soil samples collected in the pits and trenches are also in Appendix 3. The surveys for the diesel fuel tank pit are provided in Appendix 4 which also includes the gamma spectroscopy results for 31 soil samples taken in this pit. The surveys for the Stack Sampling Pit (including the results for 10 soil samples taken in this pit) are provided in Appendix 5.

Alpha/Beta Analysis

Thirty five (35) soil samples, selected from samples with the highest Cs-137 gamma spectroscopy results, were analyzed for gross alpha and gross beta activity in order to estimate the maximum Sr-90 concentration in the sample. The maximum gross beta result was 29 pCi/g, which is well below the 1,800 pCi/g Sr-90 limit. All gross alpha results were < 10 pCi/g. See Table 5 for details.

Estimate of Total Radioactivity Remaining

The Cs-137, Co-60, and Cs-134 radioactivity remaining on the Hot Cell Site was estimated. The estimate and basis for the estimate is provided in Appendix 7. The values were as follows:

Cs-137	1.69 mCi
Co-60	0.275 mCi
CS-134	0.01 mCi
Sr-90	3.50 mCi

GA also performed a confirmatory check on these values, i.e., another individual estimated the activity of each radionuclide remaining using independent estimates of the mass of affected soil, average concentration of each radionuclide and density of the soil. Appendix 10 provides the estimates which are in agreement (usually lower) than the values shown above.

Conclusion

The results of the final contamination and radiation surveys and the results of the analyses of soil samples, as documented in this report, demonstrate that the Hot Cell Site meets the NRC- and State- approved criteria for release to unrestricted use.

Table 1: List of Instruments

Meter S/N	Detector	Detector S/N	Calibration Due Date	Efficiency	Range (cpm)	Background Average (cpm)	Description
Ludlum Rate Meter Model 2221 S/N 97817	Ludlum Model 43-37 434 cm^2 Beta	S/N 094119 S/N 093599	Iinstruments are calibrated quarterly and post meter/detector repair. Only calibrated instruments were used for the final survey.	Efficiencies ranged between 20% and 24% with a Sr90 source	Four Linear Ranges 0-500,000 & One Log 50-500,000	1800 to 2100 on Soil	The instrument is a gas-flow proportional counter with an active probe area of 434 cm^2. The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from ground surface for optimum performance.
Ludlum Rate Meter Model 2221 S/N 97265	Ludlum Model 43-37 434 cm^2 Beta	S/N 086237 S/N 086238	Iinstruments are calibrated quarterly and post meter/detector repair. Only calibrated instruments were used for the final survey.	Efficiencies ranged between 20% and 24% with a Sr90 source	Four Linear Ranges 0-500,000 & One Log 50-500,000	1800 to 2100 on Soil	The instrument is a gas-flow proportional counter with an active probe area of 434 cm^2. The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick connects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model-3 Micro-R Meter S/N 153551	Ludlum Model 44-10 NaI 2"x 2" Scintillator	S/N 155109	Iinstruments are calibrated quarterly and post meter/detector repair. Only calibrated instruments were used for the final survey.	N/A	Four Ranges 0-500 μR/hr	10-18μR/hr @ or above soil surface. 25-27 μR/hr in pits and trenches.	Used for measuring external dose rates on the surface and at one (1) meter from the surface (i.e., initial ground surveys).

Table 1: List of Instruments

Meter S/N	Detector	Detector S/N	Calibration Due Date	Efficiency	Range (cpm)	Background Average (cpm)	Description
Ludlum Model-3 Micro-R Meter S/N 153590	Ludlum Model 44-10 NaI 2"x 2" Scintillator	S/N	Iinstruments are calibrated quarterly and post meter/detector repair. Only calibrated instruments were used for the final survey.		Four Ranges 0-500 μR/hr	10-18μR/hr @ or above soil surface. 25-27 μR/hr in pits and trenches.	Used for measuring external dose rates on the surface and at one (1) meter from the surface (i.e., initial ground surveys).
Ludlum Model-3 Micro-R Meter S/N 147819	Ludlum Model 44-10 NaI 2"x 2" Scintillator	S/N 153765	Iinstruments are calibrated quarterly and post meter/detector repair. Only calibrated instruments were used for the final survey.	N/A	Four Ranges 0-500 μR/hr	10-18μR/hr @ or above soil surface. 25-27 μR/hr in pits and trenches.	Used for measuring external dose rates on the surface and at one (1) meter from the surface (i.e., initial ground surveys).
Ludlum Model-3 Micro-R Meter S/N 151348	Ludlum Model 44-10 NaI 2"x 2" Scintillator	S/N 154618	Iinstruments are calibrated quarterly and post meter/detector repair. Only calibrated instruments were used for the final survey.	N/A	Four Ranges 0-500 μR/hr	10-18μR/hr @ or above soil surface. 25-27 μR/hr in pits and trenches.	Used for measuring external dose rates on the surface and at one (1) meter from the surface (i.e., initial ground surveys).

Table 1: List of Instruments

Meter S/N	Detector	Detector S/N	Calibration Due Date	Efficiency	Range (cpm)	Background Average (cpm)	Description
Ludlum Model-3 Micro-R Meter S/N 153311	Ludlum Model 44-10 NaI 2"x 2" Scintillator	S/N 155594	Iinstruments are calibrated quarterly and post meter/detector repair. Only calibrated instruments were used for the final survey.		Four Ranges 0-500 μR/hr	10-18μR/hr @ or above soil surface. 25-27 μR/hr in pits and trenches.	Used for measuring external dose rates on the surface and at one (1) meter from the surface (i.e., initial ground surveys).
Canberra Low Level α/β Counter	Gas Flow Proportional Detector	N/A	As needed	~ 26-30%	N/A	Varies with Sample	Canberra Model 2400 Low Level α/β gas proportional counting system was used to count soil samples for gross beta and alpha contamination. Results were reported as pCi/gm.
Canberra Gamma Spectroscopy System	High Purity Germanium Detector	N/A	As needed	Varies with Sample	N/A	Varies with Sample	Gamma Spectroscopy MCA system using a high purity Germanium detector.

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1)(2)(3)(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5000	0.01 ± 0.01	ND	ND	0.02 ± 0.02	<0.01
23S-99-5001	0.03 ± 0.02	0.04 ± 0.03	ND	0.06 ± 0.04	<0.01
23S-99-5002	0.09 ± 0.03	0.08 ± 0.06	ND	0.19 ±0.06	<0.01
23S-99-5003	0.36 ± 0.06	ND	ND	0.76 ± 0.13	0.02
23S-99-5004	0.57 ± 0.08	0.11 ± 0.06	ND	1.20 ± 0.17	0.05
23S-99-5005	ND	ND	ND	ND	0.00
23S-99-5006	ND	ND	ND	ND	0.00
23S-99-5007	0.04 ± 0.02	ND	ND	0.08 ± 0.04	<0.01
23S-99-5008	ND	ND	ND	ND	0.00
23S-99-5009	0.06 ± 0.03	0.04 ± 0.05	ND	0.13 ± 0.06	<0.01
23S-99-5010	0.05 ± 0.02	ND	ND	0.11 ± 0.04	<0.01
23S-99-5011	0.02 ± 0.01	0.04 ± 0.03	ND	0.04 ± 0.02	<0.01
23S-99-5012	0.01 ± 0.01	ND	ND	0.02 ± 0.02	<0.01
23S-99-5013	0.06 ± 0.02	ND	ND	0.13 ± 0.04	<0.01
23S-99-5014	0.36 ± 0.05	0.14 ± 0.09	ND	0.76 ± 0.11	0.04
23S-99-5015	ND	0.06 ± 0.05	ND	ND	<0.01
23S-99-5016	0.11 ± 0.05	ND	ND	0.23 ± 0.11	<0.01
23S-99-5017	0.03 ± 0.02	0.08 ± 0.07	ND	0.06 ± 0.04	0.01
23S-99-5018	ND	ND	ND	ND	0.00
23S-99-5019	0.01 ± 0.01	ND	ND	0.02 ± 0.02	<0.01
23S-99-5020	0.06 ± 0.02	ND	ND	0.13 ± 0.04	<0.01
23S-99-5021	0.01 ± 0.01	ND	ND	0.02 ± 0.02	<0.01
23S-99-5022	ND	ND	ND	ND	0.00
23S-99-5023	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1)(2)(3)(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5024	0.08 ± 0.02	ND	ND	0.17 ± 0.04	<0.01
23S-99-5025	0.33 ± 0.06	ND	ND	0.69 ± 0.13	0.02
23S-99-5026	0.18 ± 0.06	ND	ND	0.38 ±0.13	0.01
23S-99-5027	0.22 ± 0.05	0.09 ± 0.04	ND	0.46 ± 0.11	0.03
23S-99-5028	0.20 ± 0.07	ND	ND	0.42 ± 0.15	0.01
23S-99-5029	0.18 ± 0.04	0.09 ± 0.06	ND	0.38 ± 0.08	0.02
23S-99-5030	0.08 ± 0.03	ND	ND	0.17 ± 0.06	<0.01
23S-99-5031	0.04 ± 0.02	ND	ND	0.08 ± 0.04	<0.01
23S-99-5032	0.19 ± 0.05	0.13 ± 0.06	0.06 ± 0.05	0.40 ± 0.11	0.03
23S-99-5033	0.09 ± 0.03	0.10 ± 0.06	ND	0.19 ± 0.06	0.02
23S-99-5034	0.04 ± 0.02	ND	ND	0.08 ± 0.04	<0.01
23S-99-5035	0.05 ± 0.02	ND	ND	0.11 ± 0.04	<0.01
23S-99-5036	0.08 ± 0.04	ND	ND	0.17 ± 0.08	<0.01
23S-99-5037	0.29 ± 0.06	0.07 ± 0.06	ND	0.61 ± 0.13	0.03
23S-99-5038	0.43 ± 0.08	0.13 ± 0.07	ND	0.90 ± 0.17	0.04
23S-99-5039	1.22 ± 0.10	0.20 ± 0.06	ND	2.56 ± 0.21	0.11
23S-99-5040	0.29 ± 0.08	0.16 ± 0.10	ND	0.61 ± 0.17	0.04
23S-99-5041	0.23 ± 0.04	0.05± 0.05	ND	0.48 ± 0.08	0.02
23S-99-5042	0.23 ± 0.06	ND	ND	0.48 ± 0.13	0.02
23S-99-5043	0.19 ± 0.04	0.06 ± 0.07	ND	0.40 ± 0.08	0.02
23S-99-5044	0.68 ± 0.09	ND	ND	1.43 ± 0.19	0.05
23S-99-5045	0.85 ± 0.08	0.08 ±0.07	ND	1.79 ± 0.17	0.07
23S-99-5046	0.23 ± 0.06	0.12 ± 0.06	ND	0.48 ± 0.13	0.03
23S-99-5047	0.04 ± 0.02	ND	ND	0.08 ±0.04	<0.01
Nominal Background	0.07	ND	ND	ND	

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5048	0.02 ± 0.01	ND	ND	0.04 ± 0.02	<0.01
23S-99-5049	0.18 ± 0.04	0.22 ± 0.07	ND	0.38 ± 0.08	0.04
23S-99-5050	0.27 ± 0.07	ND	ND	0.57 ±0.15	0.02
23S-99-5051	0.08 ± 0.03	0.04 ± 0.04	ND	0.17 ± 0.06	<0.01
23S-99-5052	0.34 ± 0.07	ND	ND	0.71 ± 0.15	0.02
23S-99-5053	0.50 ± 0.07	0.16 ± 0.07	ND	1.05 ± 0.15	0.03
23S-99-5054	0.89 ± 0.08	0.06 ± 0.05	ND	1.87 ± 0.17	0.07
23S-99-5055	1.30 ± 0.10	0.45 ± 0.09	ND	2.73 ± 0.21	0.14
23S-99-5056	1.30 ± 0.09	0.29 ± 0.07	ND	2.73 ± 0.19	0.12
23S-99-5057	0.31 ± 0.07	0.12 ± 0.07	ND	0.65 ± 0.38	0.04
23S-99-5058	1.12 ± 0.10	ND	ND	2.35 ± 0.21	0.07
23S-99-5059	ND	ND	ND	ND	0.00
23S-99-5060	0.05 ± 0.02	ND	ND	0.11 ± 0.04	<0.01
23S-99-5061	0.07 ± 0.03	ND	ND	0.15 ± 0.06	<0.01
23S-99-5062	0.08 ± 0.03	0.03 ± 0.02	ND	0.17 ± 0.06	<0.01
23S-99-5063	0.49 ± 0.07	0.08 ± 0.06	ND	1.03 ± 0.15	0.04
23S-99-5064	1.30 ± 0.08	0.21 ± 0.07	ND	2.73 ± 0.17	0.11
23S-99-5065	1.40 ± 0.13	0.04± 0.04	ND	2.94 ± 0.27	0.10
23S-99-5066	0.20 ± 0.04	0.06 ± 0.05	ND	0.42 ± 0.08	0.02
23S-99-5067	0.20 ± 0.06	ND	ND	0.40 ± 0.12	0.01
23S-99-5068	0.58 ± 0.09	0.07 ± 0.04	ND	1.22 ± 0.19	0.05
23S-99-5069	0.17 ± 0.05	ND	ND	0.35 ± 0.11	0.01
23S-99-5070	0.01 ± 0.01	0.11 ± 0.06	ND	0.02 ± 0.02	<0.01
23S-99-5071	0.18 ± 0.06	0.07 ± 0.07	ND	0.38 ±0.04	0.01
Nominal Background	0.07	ND	ND	ND	

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5072	ND	ND	ND	ND	0.00
23S-99-5073	0.34 ± 0.08	0.21 ± 0.09	ND	0.71 ± 0.17	0.05
23S-99-5074	0.67 ± 0.08	0.09 ± 0.05	ND	1.41 ±0.17	0.06
23S-99-5075	0.71 ± 0.09	0.11 ± 0.11	ND	1.49 ± 0.19	0.06
23S-99-5076	1.04 ± 0.09	0.12 ± 0.07	ND	2.18 ± 0.19	0.09
23S-99-5077	0.18 ± 0.06	0.08 ± 0.07	ND	0.38 ± 0.13	0.02
23S-99-5078	0.12 ± 0.04	ND	ND	0.25 ± 0.08	<0.01
23S-99-5079	1.34 ± 0.11	0.32 ± 0.10	ND	2.68 ± 0.23	0.13
23S-99-5080	0.52 ± 0.02	0.09 ± 0.06	ND	1.09 ± 0.04	0.05
23S-99-5081	0.18 ± 0.06	ND	ND	0.38 ± 0.13	0.01
23S-99-5082	0.09 ± 0.03	ND	ND	0.19 ± 0.06	<0.01
23S-99-5083	0.08 ± 0.04	ND	ND	0.17 ± 0.08	<0.01
23S-99-5084	0.11 ± 0.04	ND	ND	0.23 ± 0.08	<0.01
23S-99-5085	0.09 ± 0.04	0.08 ± 0.07	ND	0.19 ± 0.08	0.02
23S-99-5086	0.44 ± 0.06	0.07 ± 0.05	ND	0.92 ± 0.13	0.04
23S-99-5087	0.52 ± 0.08	0.10 ± 0.07	ND	1.09 ± 0.17	0.05
23S-99-5088	0.33 ± 0.05	ND	ND	0.69 ± 0.17	0.02
23S-99-5089	0.35 ± 0.09	0.11± 0.06	ND	0.74 ± 0.19	0.04
23S-99-5090	1.30 ± 0.09	0.08 ± 0.05	0.08 ± 0.05	2.73 ± 0.19	0.10
23S-99-5091	1.00 ± 0.10	0.14 ± 0.08	ND	2.10 ± 0.21	0.08
23S-99-5092	0.41 ± 0.06	0.12 ± 0.08	ND	0.86 ± 0.13	0.04
23S-99-5093	0.17 ± 0.06	ND	ND	0.36 ± 0.13	0.01
23S-99-5094	0.07 ± 0.02	ND	ND	0.15 ± 0.04	<0.01
23S-99-5095	0.48 ± 0.07	0.16 ± 0.09	ND	1.00 ±0.15	0.05
Nominal Background	0.07	ND	ND	ND	

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5096	ND	ND	ND	ND	0.00
23S-99-5097	0.35 ± 0.12	0.10 ± 0.06	ND	0.74 ± 0.25	0.04
23S-99-5098	0.57 ± 0.09	ND	ND	1.20 ±0.19	0.04
23S-99-5099	1.00 ± 0.12	0.22 ± 0.09	ND	2.10 ± 0.25	0.09
23S-99-5100	0.48 ± 0.07	0.14 ± 0.06	ND	1.01 ± 0.15	0.05
23S-99-5101	0.75 ± 0.09	0.12 ± 0.09	ND	1.58 ± 0.19	0.07
23S-99-5102	0.05 ± 0.03	ND	ND	0.11 ± 0.06	<0.01
23S-99-5103	3.10 ± 0.13	0.30 ± 0.08	ND	6.51 ± 0.27	0.24
23S-99-5104	3.34 ± 0.14	0.31 ± 0.08	ND	7.01 ± 0.29	0.27
23S-99-5105	0.89 ± 0.10	0.12 ± 0.07	ND	1.87 ± 0.21	0.07
23S-99-5106	0.91 ± 0.07	0.13 ± 0.05	ND	1.91 ± 0.15	0.08
23S-99-5107	ND	ND	ND	ND	0.00
23S-99-5108	0.16 ± 0.04	0.07 ± 0.05	ND	0.34 ± 0.08	0.02
23S-99-5109	0.23 ± 0.06	ND	ND	0.48 ± 0.13	0.02
23S-99-5110	1.70 ± 0.10	0.24 ± 0.07	ND	3.57 ± 0.21	0.14
23S-99-5111	4.40 ± 0.18	0.78 ± 0.11	0.18 ± 0.09	9.24 ± 0.38	0.41
23S-99-5112	1.30 ± 0.11	0.16 ± 0.08	0.07 ± 0.05	2.73 ± 0.23	0.11
23S-99-5113	0.17 ± 0.05	0.08± 0.08	ND	0.36 ± 0.11	0.02
23S-99-5114	2.00 ± 0.13	0.51 ± 0.10	0.11 ± 0.06	4.20 ± 0.27	0.21
23S-99-5115	3.40 ± 0.19	0.07 ± 0.01	0.14 ± 0.11	7.14 ± 0.40	0.25
23S-99-5116	0.81 ± 0.08	0.15 ± 0.07	ND	1.70 ± 0.17	0.07
23S-99-5117	0.27 ± 0.05	ND	ND	0.57 ± 0.11	0.02
23S-99-5118	0.02 ± 0.01	ND	ND	0.04 ± 0.02	<0.01
23S-99-5119	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5120	ND	ND	ND	ND	0.00
23S-99-5121	0.15 ± 0.06	ND	ND	0.32 ± 0.13	0.01
23S-99-5122	0.03 ± 0.01	ND	ND	0.06 ± 0.02	<0.01
23S-99-5123	1.00 ± 0.15	0.19 ± 0.11	ND	2.10 ± 0.32	0.09
23S-99-5124	0.84 ± 0.10	0.20 ± 0.06	ND	1.76 ± 0.21	0.08
23S-99-5125	0.74 ± 0.13	ND	ND	1.55 ± 0.27	0.05
23S-99-5126	5.20 ± 0.18	0.38 ± 0.08	0.20 ± 0.06	10.92 ± 0.38	0.41
23S-99-5127	6.00 ± 0.20	0.22 ± 0.09	0.28 ± 0.08	12.60 ± 0.42	0.24
23S-99-5128	3.40 ± 0.15	0.84 ± 0.11	0.08 ± 0.07	7.14 ± 0.32	0.34
23S-99-5129	1.75 ± 0.11	ND	ND	3.67 ± 0.22	0.12
23S-99-5130	0.21 ± 0.04	0.08 ± 0.05	ND	0.44 ± 0.08	0.02
23S-99-5131	3.40 ± 0.15	0.38 ± 0.10	ND	7.14 ± 0.32	0.27
23S-99-5132	4.90 ± 0.16	0.37 ± 0.06	0.08 ± 0.04	10.29 ± 0.34	0.38
23S-99-5133	ND	ND	ND	ND	0.00
23S-99-5134	ND	ND	ND	ND	0.00
23S-99-5135	0.58 ± 0.10	0.08 ± 0.08	ND	1.22 ± 0.21	0.05
23S-99-5136	1.80 ± 0.12	0.29 ± 0.08	ND	3.78 ± 0.25	0.16
23S-99-5137	0.69 ± 0.09	0.10± 0.10	ND	1.45 ± 0.19	0.06
23S-99-5138	0.42 ± 0.08	0.14 ± 0.06	ND	0.88 ± 0.17	0.05
23S-99-5139	ND	ND	ND	ND	0.00
23S-99-5140	0.15 ± 0.05	0.05 ± 0.04	ND	0.32 ± 0.11	0.02
23S-99-5141	0.24 ± 0.06	ND	ND	0.50 ± 0.13	0.02
23S-99-5142[5]	3.40 ± 0.18	8.6 ± 0.30	0.08 ± 0.09	7.14 ± 0.38	1.31
23S-99-5143	0.11 ± 0.04	ND	ND	0.22 ± 0.08	<0.01
Nominal Background	0.07	ND	ND	ND	

Note: Shaded sample was remediated and resampled. See sample No. 23S-99-5342.

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5144	0.02 ± 0.01	ND	ND	0.04 ± 0.02	<0.01
23S-99-5145	ND	ND	ND	ND	0.00
23S-99-5146	1.90 ± 0.12	0.09 ± 0.07	ND	3.99 ± 0.25	0.14
23S-99-5147	1.20 ± 0.10	0.38 ± 0.08	ND	2.52 ± 0.21	0.13
23S-99-5148	0.61 ± 0.06	0.07 ± 0.06	ND	1.28 ± 0.13	0.05
23S-99-5149	0.08 ± 0.04	ND	ND	0.17 ± 0.08	<0.01
23S-99-5150	0.52 ± 0.06	0.07 ± 0.07	ND	1.09 ± 0.13	0.04
23S-99-5151	0.05 ± 0.03	ND	ND	0.11 ± 0.06	<0.01
23S-99-5152	2.50 ± 0.15	1.20 ± 0.14	ND	5.25 ± 0.32	0.32
23S-99-5153	0.65 ± 0.08	0.13 ± 0.07	ND	1.37 ± 0.17	0.06
23S-99-5154	0.12 ± 0.03	ND	ND	0.25 ± 0.06	0.01
23S-99-5155	0.76 ± 0.09	0.10 ± 0.06	ND	1.60 ± 0.19	0.06
23S-99-5156	0.37 ± 0.06	0.11 ± 0.06	ND	0.78 ± 0.13	0.04
23S-99-5157	5.30 ± 0.19	1.00 ± 0.11	0.09 ± 0.06	11.13 ±0.40	0.49
23S-99-5158	2.00 ± 0.12	0.93 ± 0.11	ND	4.20 ± 0.25	0.25
23S-99-5159	0.39 ± 0.09	0.14 ± 0.07	ND	0.82 ± 0.19	0.04
23S-99-5160	0.89 ± 0.09	0.16 ± 0.07	0.09 ± 0.06	1.87 ± 0.19	0.09
23S-99-5161	1.10 ± 0.11	0.25± 0.10	ND	2.31 ± 0.23	0.11
23S-99-5162	1.20 ± 0.08	0.14 ± 0.05	ND	2.52 ± 0.17	0.10
23S-99-5163	0.92 ± 0.10	0.24 ± 0.10	ND	1.93 ± 0.21	0.09
23S-99-5164	1.00 ± 0.09	0.11 ± 0.08	ND	2.10 ± 0.19	0.08
23S-99-5165	1.80 ± 0.10	0.12 ± 0.07	ND	3.78 ± 0.21	0.14
23S-99-5166	0.33 ± 0.06	0.10 ± 0.06	ND	0.69 ± 0.13	0.03
23S-99-5167	1.20 ± 0.13	0.15 ± 0.10	ND	2.52 ± 0.27	0.10
Nominal Background	0.07	ND	ND	ND	

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5168	0.92 ± 0.10	0.14 ± 0.08	ND	1.93 ± 0.21	0.08
23S-99-5169	0.74 ± 0.10	ND	ND	1.55 ± 0.21	0.05
23S-99-5170	0.45 ± 0.07	ND	ND	0.95 ± 0.15	0.03
23S-99-5171	0.37 ± 0.08	0.05 ± 0.05	ND	0.78 ± 0.17	0.03
23S-99-5172	2.30 ± 0.11	0.21 ± 0.05	ND	4.83 ± 0.23	0.18
23S-99-5173[5]	3.00 ± 0.17	6.10 ± 0.25	ND	6.30 ± 0.36	0.96
23S-99-5174	1.50 ± 0.12	0.07 ± 0.07	ND	3.15 ± 0.25	0.11
23S-99-5175	2.10 ± 0.12	0.14 ± 0.07	ND	4.41 ± 0.25	0.16
23S-99-5176	1.10 ± 0.08	0.09 ± 0.07	0.08 ± 0.06	2.31 ± 0.17	0.09
23S-99-5177	1.60 ± 0.12	0.26 ± 0.11	ND	3.36 ± 0.25	0.14
23S-99-5178	0.62 ± 0.06	ND	ND	1.30 ± 0.13	0.04
23S-99-5179	0.50 ± 0.08	0.24 ± 0.08	ND	1.05 ± 0.17	0.06
23S-99-5180	ND	ND	ND	ND	0.00
23S-99-5181	0.07 ± 0.04	ND	ND	0.15 ± 0.08	<0.01
23S-99-5182	0.34 ± 0.05	0.04 ± 0.04	ND	0.71 ± 0.11	0.03
23S-99-5183	2.33 ± 0.14	0.23 ± 0.09	ND	5.04 ± 0.29	0.19
23S-99-5184	2.80 ± 0.13	0.22 ± 0.07	0.08 ± 0.05	5.88 ± 0.27	0.22
23S-99-5185	1.40 ± 0.12	0.10± 0.07	ND	2.94 ± 0.25	0.11
23S-99-5186	0.42 ± 0.07	ND	ND	0.88 ± 0.15	0.03
23S-99-5187	0.46 ± 0.11	ND	ND	0.97 ± 0.23	0.03
23S-99-5188	2.10 ± 0.12	0.13 ± 0.07	ND	4.41 ± 0.25	0.16
23S-99-5189	2.50 ± 0.16	ND	ND	5.25 ± 0.34	0.17
23S-99-5190	1.07 ± 0.09	0.31 ± 0.07	ND	2.25 ± 0.19	0.11
23S-99-5191	1.46 ± 0.14	0.19 ± 0.10	ND	3.07 ± 0.29	0.12
Nominal Background	0.07	ND	ND	ND	

Note: Shaded sample was remediated and re-sampled as No. 23S-99-5354.

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1)(2)(3)(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5192	1.17 ± 0.09	ND	ND	2.46 ± 0.19	0.08
23S-99-5193	0.83 ± 0.09	0.12 ± 0.07	ND	1.74 ± 0.19	0.07
23S-99-5194	0.33 ± 0.05	0.11 ± 0.05	ND	0.69 ± 0.11	0.04
23S-99-5195	0.94 ± 0.11	0.07 ± 0.06	ND	1.97 ± 0.23	0.08
23S-99-5196	1.45 ± 0.12	0.11 ± 0.08	ND	3.05 ± 0.25	0.11
23S-99-5197	1.46 ± 0.13	0.14 ± 0.09	ND	3.07 ± 0.27	0.12
23S-99-5198	1.35 ± 0.10	0.71 ± 0.10	ND	2.84 ± 0.21	0.18
23S-99-5199	0.64 ± 0.10	0.47 ± 0.12	ND	1.34 ± 0.21	0.10
23S-99-5200	0.68 ± 0.08	ND	ND	1.43 ± 0.17	0.05
23S-99-5201	0.48 ± 0.10	ND	ND	1.01 ± 0.21	0.03
23S-99-5202	1.30 ± 0.10	0.09 ± 0.05	ND	2.73 ± 0.21	0.10
23S-99-5203	3.70 ± 0.18	0.36 ± 0.12	ND	7.77 ± 0.38	0.29
23S-99-5204	3.26 ± 0.16	0.37 ± 0.09	ND	6.85 ± 0.34	0.27
23S-99-5205	1.84 ± 0.13	0.13 ± 0.11	ND	3.86 ± 0.27	0.14
23S-99-5206	1.10 ± 0.53	ND	ND	2.31 ± 1.11	0.07
23S-99-5207	0.12 ± 0.05	ND	ND	0.25 ± 0.11	<0.01
23S-99-5208	0.48 ± 0.06	ND	ND	1.01 ± 0.13	<0.01
23S-99-5209	2.66 ± 0.14	0.29± 0.10	ND	5.59 ± 0.29	0.22
23S-99-5210	5.00 ± 0.17	0.54 ± 0.08	ND	10.50 ± 0.36	0.40
23S-99-5211	1.40 ± 0.12	0.21 ± 0.10	ND	3.08 ± 0.25	0.12
23S-99-5212	0.78 ± 0.11	0.54 ± 0.12	ND	1.64 ± 0.23	0.12
23S-99-5213	1.50 ± 0.16	0.13 ± 0.09	ND	3.15 ± 0.34	0.12
23S-99-5214	0.19 ± 0.05	ND	ND	0.40 ± 0.11	0.01
23S-99-5215	0.34 ± 0.07	ND	ND	0.71 ± 0.15	0.02
Nominal Background	0.07	ND	ND	ND	

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5216	0.85 ± 0.09	0.12 ± 0.07	ND	1.79 ± 0.19	0.07
23S-99-5217	0.53 ± 0.09	0.10 ± 0.09	ND	1.11 ± 0.19	0.05
23S-99-5218	0.04 ± 0.02	ND	ND	0.08 ± 0.04	<0.01
23S-99-5219	0.83 ± 0.10	ND	ND	1.73 ± 0.21	0.06
23S-99-5220	0.17 ± 0.05	ND	ND	0.36 ± 0.11	0.01
23S-99-5221	1.60 ± 0.12	0.18 ± 0.10	ND	3.36 ± 0.25	0.13
23S-99-5222	0.77 ± 0.09	0.08 ± 0.07	ND	1.62 ± 0.19	0.06
23S-99-5223	0.73 ± 0.10	0.09 ± 0.09	ND	1.53 ± 0.21	0.06
23S-99-5224	0.99 ± 0.09	0.10 ± 0.06	ND	2.08 ± 0.19	0.08
23S-99-5225	1.50 ± 0.13	0.13 ± 0.11	ND	3.15 ± 0.27	0.12
23S-99-5226	0.02 ± 0.01	ND	ND	0.04 ± 0.02	<0.01
23S-99-5227	0.41 ± 0.09	ND	ND	0.86 ± 0.19	0.03
23S-99-5228	0.68 ± 0.10	0.45 ± 0.11	ND	1.43 ± 0.21	0.10
23S-99-5229	1.00 ± 0.15	ND	ND	2.10 ± 0.32	0.07
23S-99-5230[5]	8.59 ± 0.22	0.86 ± 0.10	0.11 ± 0.06	18.04 ± 0.46	0.69
23S-99-5231	6.30 ± 0.24	0.86 ± 0.13	ND	13.23 ± 0.50	0.53
23S-99-5232	0.27 ± 0.05	0.05 ± 0.04	ND	0.57 ± 0.11	0.02
23S-99-5233	0.07 ± 0.03	ND	ND	0.15 ± 0.06	<0.01
23S-99-5234	0.06 ± 0.02	ND	ND	0.13 ± 0.04	<0.01
23S-99-5235	1.90 ± 0.13	0.83 ± 0.13	ND	3.99 ± 0.27	0.23
23S-99-5236	0.31 ± 0.05	ND	ND	0.65 ± 0.11	0.02
23S-99-5237	4.20 ± 0.18	0.46 ± 0.09	ND	10.08 ± 0.38	0.33
23S-99-5238	0.21 ± 0.04	ND	ND	0.44 ± 0.08	0.01
23S-99-5239	0.97 ± 0.14	0.21 ± 0.09	ND	2.04 ± 0.29	0.09
Nominal Background	0.07	ND	ND	ND	

Note: Additional samples taken in shaded sample area. See sample results 23S-99-5366 thru 5373.

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5240	ND	ND	ND	ND	0.00
23S-99-5241	4.00 ± 0.19	0.26 ± 0.09	ND	8.40 ± 0.40	0.30
23S-99-5242	0.38 ± 0.06	ND	ND	0.80 ± 0.13	0.03
23S-99-5243	0.57 ± 0.08	ND	ND	1.20 ± 0.17	0.04
23S-99-5244	0.21 ± 0.05	ND	ND	0.45 ± 0.11	0.01
23S-99-5245	0.10 ± 0.04	ND	ND	0.21 ± 0.08	<0.01
23S-99-5246	2.40 ± 0.15	0.36 ± 0.09	ND	5.04 ± 0.32	0.21
23S-99-5247	4.25 ± 0.24	0.74 ± 0.17	ND	8.93 ± 0.50	0.37
23S-99-5248	5.10 ± 0.20	0.94 ± 0.13	ND	10.71 ± 0.42	0.46
23S-99-5249	0.73 ± 0.11	0.84 ± 0.70	ND	1.53 ± 0.23	0.15
23S-99-5250	2.50 ± 0.18	0.32 ± 0.13	ND	5.25 ± 0.38	0.19
23S-99-5251[5]	11.56 ± 0.28	1.20 ± 0.13	ND	24.27 ± 0.59	0.95
23S-99-5252	0.76 ± 0.09	0.17 ± 0.08	ND	1.60 ± 0.40	0.08
23S-99-5253	1.90 ± 0.12	0.28 ± 0.08	ND	3.99 ± 0.25	0.16
23S-99-5254	1.20 ± 0.11	0.13 ± 0.09	ND	2.52 ± 0.23	0.10
23S-99-5255	0.37 ± 0.06	ND	ND	0.78 ± 0.13	0.02
23S-99-5256	0.62 ± 0.11	0.19 ± 0.10	ND	1.30 ± 0.23	0.07
23S-99-5257	5.70 ± 0.21	0.12 ± 0.06	0.07 ± 0.06	11.97 ± 0.44	0.40
23S-99-5258	1.30 ± 0.11	0.09 ± 0.08	ND	2.73 ± 0.23	0.10
23S-99-5259[5]	8.96 ± 0.23	1.20 ± 0.12	0.11 ± 0.07	18.82 ± 0.48	0.75
23S-99-5260	4.20 ± 0.15	0.40 ± 0.08	ND	8.82 ± 0.32	0.33
23S-99-5261	0.08 ± 0.04	ND	ND	0.17 ± 0.08	<0.01
23S-99-5262	0.13 ± 0.03	ND	ND	0.27 ± 0.06	<0.01
23S-99-5263	1.50 ± 0.11	0.19 ± 0.10	ND	3.15 ± 0.23	0.12
Nominal Background	0.07	ND	ND	ND	

Note: Shaded samples were remediated and re-sampled. For sample 23S-99-5251, see 23S-99-5396. For sample 23S-99-5259, see sample 23S-99-5374.

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5264	3.60 ± 0.14	0.23 ± 0.07	ND	7.56 ± 0.29	0.27
23S-99-5265	3.20 ± 0.15	0.15 ± 0.07	ND	6.72 ± 0.32	0.23
23S-99-5266	0.10 ± 0.05	ND	ND	0.21 ± 0.11	<0.01
23S-99-5267	0.05 ± 0.04	ND	ND	0.11 ± 0.08	<0.01
23S-99-5268	1.40 ± 0.09	0.13 ± 0.06	0.11 ± 0.06	2.94 ± 0.19	0.12
23S-99-5269	2.80 ± 0.15	0.21 ± 0.08	ND	5.88 ± 0.32	0.21
23S-99-5270	0.77 ± 0.09	0.14 ± 0.06	ND	1.62 ± 0.19	0.07
23S-99-5271	0.62 ± 0.08	ND	ND	1.30 ± 0.17	0.04
23S-99-5272	4.96 ± 0.19	0.35 ± 0.09	ND	10.42 ± 0.41	0.38
23S-99-5273	4.60 ± 0.20	0.27 ± 0.10	ND	9.66 ± 0.42	0.34
23S-99-5274	1.10 ± 0.09	0.17 ± 0.06	ND	2.31 ± 0.19	0.09
23S-99-5275	2.50 ± 0.17	0.11 ± 0.09	ND	5.25 ± 0.36	0.18
23S-99-5276	2.40 ± 0.14	0.18 ± 0.06	ND	5.04 ± 0.29	0.18
23S-99-5277	0.74 ± 0.09	ND	ND	1.55 ± 0.19	0.16
23S-99-5278	1.20 ± 0.09	0.16 ± 0.07	ND	2.52 ± 0.19	0.10
23S-99-5279	0.92 ± 0.10	0.18 ± 0.08	ND	1.93 ± 0.21	0.08
23S-99-5280	0.56 ± 0.07	0.15 ± 0.07	ND	1.18 ± 0.15	0.06
23S-99-5281	0.24 ± 0.08	0.14 ± 0.12	ND	0.50 ± 0.17	0.03
23S-99-5282	1.70 ± 0.11	0.31 ± 0.08	ND	3.57 ± 0.23	0.15
23S-99-5283	2.40 ± 0.16	0.21 ± 0.13	ND	5.04 ± 0.34	0.19
23S-99-5284	0.45 ± 0.06	0.06 ± 0.06	ND	0.95 ± 0.13	0.04
23S-99-5285	0.40 ± 0.07	ND	ND	0.84 ± 0.15	0.03
23S-99-5286	0.84 ± 0.08	0.07 ± 0.06	ND	1.76 ± 0.17	0.06
23S-99-5287	0.30 ± 0.06	0.06 ± 0.07	ND	0.63 ± 0.13	0.03
Nominal Background	0.07	ND	ND	ND	

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5288	0.68 ± 0.08	0.07 ± 0.05	ND	1.43 ± 0.17	0.05
23S-99-5289	0.12 ± 0.05	ND	ND	0.25 ± 0.11	<0.01
23S-99-5290	0.19 ± 0.05	ND	ND	0.40 ± 0.11	0.01
23S-99-5291	0.72 ± 0.11	ND	ND	1.51 ± 0.23	0.05
23S-99-5292	1.00 ± 0.12	0.26 ± 0.09	ND	2.10 ± 0.25	0.10
23S-99-5293	2.40 ± 0.23	0.43 ± 0.18	ND	5.04 ± 0.48	0.21
23S-99-5294	1.16 ± 0.11	0.11 ± 0.08	ND	2.43 ± 0.23	0.12
23S-99-5295	1.30 ± 0.18	0.21 ± 0.14	ND	2.73 ± 0.38	0.11
23S-99-5296	ND	ND	ND	ND	0.00
23S-99-5297	0.25 ± 0.06	ND	ND	0.53 ± 0.13	0.02
23S-99-5298	1.14 ± 0.14	0.24 ± 0.11	ND	2.40 ± 0.29	0.10
23S-99-5299	0.61 ± 0.14	0.16 ± 0.12	ND	1.28 ± 0.29	0.06
23S-99-5300	0.10 ± 0.05	ND	ND	0.21 ± 0.11	<0.01
23S-99-5301	0.57 ± 0.12	0.07 ± 0.04	ND	1.20 ± 0.25	0.05
23S-99-5302	0.17 ± 0.06	ND	ND	0.36 ± 0.13	0.01
23S-99-5303	0.48 ± 0.08	ND	ND	1.01 ± 0.17	0.03
23S-99-5304	0.28 ± 0.07	0.05 ± 0.04	ND	0.59 ± 0.15	0.03
23S-99-5305	0.40 ± 0.08	0.12 ± 0.09	ND	0.84 ± 0.17	0.04
23S-99-5306	0.72 ± 0.09	0.16 ± 0.11	ND	1.51 ± 0.19	0.07
23S-99-5307	1.14 ± 0.13	0.09 ± 0.09	ND	2.40 ± 0.27	0.08
23S-99-5308	0.34 ± 0.06	ND	ND	0.71 ± 0.13	0.02
23S-99-5309	0.04 ± 0.02	ND	ND	0.08 ± 0.04	<0.01
23S-99-5310	0.41 ± 0.06	ND	ND	0.86 ± 0.13	0.03
23S-99-5311	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 2A: Hot Cell Site Final Soil Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5312	0.46 ± 0.08	0.10 ± 0.09	ND	0.97 ± 0.17	0.04
23S-99-5313	0.63 ± 0.13	0.22 ± 0.12	ND	1.32 ± 0.27	0.07
23S-99-5314	0.64 ± 0.10	0.13 ± 0.08	ND	1.34 ± 0.21	0.06
23S-99-5315	0.43 ± 0.12	ND	ND	0.90 ± 0.23	0.03
23S-99-5316	0.34 ± 0.10	ND	ND	0.71 ± 0.21	0.02
23S-99-5317	0.57 ± 0.09	ND	ND	1.20 ± 0.19	0.04
23S-99-5318	0.40 ± 0.10	ND	ND	0.84 ± 0.21	0.03
23S-99-5319	0.18 ± 0.05	ND	ND	0.38 ± 0.11	0.01
23S-99-5320	0.48 ± 0.10	ND	ND	1.01 ± 0.21	0.03
23S-99-5321	0.97 ± 0.12	ND	ND	2.04 ± 0.25	0.06
23S-99-5322	0.26 ± 0.08	ND	ND	0.55 ± 0.17	0.02
23S-99-5323	0.45 ± 0.07	0.08 ± 0.06	ND	0.97 ± 0.15	0.04
23S-99-5324	0.03 ± 0.02	ND	ND	0.06 ± 0.04	<0.01
23S-99-5325	ND	ND	ND	ND	0.00
23S-99-5326	0.84 ± 0.13	0.23 ± 0.11	ND	1.76 ± 0.27	0.08
23S-99-5327	1.27 ± 0.12	0.17 ± 0.08	ND	2.67 ± 0.25	0.11
23S-99-5328	0.51 ± 0.10	0.14 ± 0.10	ND	1.07 ± 0.21	0.05
23S-99-5329	0.40 ± 0.06	0.10 ± 0.05	ND	0.84 ± 0.13	0.04
23S-99-5330	0.02 ± 0.02	ND	ND	0.04 ± 0.04	<0.01
23S-99-5331	0.08 ± 0.04	0.03 ± 0.03	ND	0.17 ± 0.08	<0.01
Nominal Background	0.07	ND	ND	ND	

Notes:
(1) Nominal Background subtracted for Cs-137
(2) Values calculated from Sr-90 to Cs-137 ratio of 2.1:1.0
(3) U-238, U-235, Th-282, and Th-232 were at, or near, natural background levels.
The maximum concentration detected was:
U-238 ≤ 3.20 pCi/g
U-235 ≤ 0.35 pCi/g
Th-228 ≤1.45 pCi/g
Th-232 ≤1.81 pCi/g
(4) ND means Not Detected, Background, or below the minimum detectable activity.

Table 2B: Hot Cell Site Final Soil Sample Results - Post Remediation

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5332	0.01 ± 0.01	0.05 ± 0.04	ND	0.02 ± 0.02	<0.01
23S-99-5333	1.30 ± 0.09	0.17 ± 0.07	ND	2.73 ± 0.19	0.11
23S-99-5334	2.64 ± 0.12	0.31 ± 0.07	ND	5.55 ±0.25	0.22
23S-99-5335	2.83 ± 0.13	0.08 ± 0.07	ND	5.94 ± 0.27	0.20
23S-99-5336	3.06 ± 0.13	0.37 ± 0.07	ND	6.42 ± 0.27	0.25
23S-99-5337	0.11 ± 0.05	ND	ND	0.23 ± 0.11	<0.01
23S-99-5338	0.14 ± 0.04	0.03 ± 0.04	ND	0.29 ± 0.08	0.01
23S-99-5339	1.20 ± 0.11	0.19 ± 0.08	ND	2.52 ± 0.23	0.10
23S-99-5340	3.35 ± 0.15	0.45 ± 0.09	ND	7.04 ± 0.32	0.28
23S-99-5341	0.04 ± 0.04	ND	ND	0.08 ± 0.08	<0.01
23S-99-5342	0.12 ± 0.04	0.16 ± 0.07	ND	0.25 ± 0.08	0.03
23S-99-5343	0.35 ± 0.06	0.06 ± 0.06	ND	0.74 ± 0.13	0.04
23S-99-5344	3.35 ± 0.19	0.27 ± 0.14	ND	7.03 ± 0.40	0.26
23S-99-5345	2.39 ± 0.14	0.26 ± 0.08	ND	5.03 ± 0.29	0.20
23S-99-5346	2.80 ± 0.14	0.16 ± 0.07	ND	5.88 ± 0.29	0.21
23S-99-5347	1.25 ± 0.11	0.17 ± 0.08	ND	2.62 ± 0.23	0.11
23S-99-5348	4.10 ± 0.15	0.37 ± 0.10	0.12 ± 0.06	8.61 ± 0.32	0.33
23S-99-5349	1.90 ± 0.14	0.21 ± 0.10	ND	3.99 ± 0.29	0.15
23S-99-5350	2.20 ± 0.14	0.15 ± 0.06	ND	4.62 ± 0.29	0.17
23S-99-5351	0.80 ± 0.11	ND	ND	1.68 ± 0.23	0.05
23S-99-5352	3.60 ± 0.14	0.11 ± 0.07	ND	7.56 ± 0.29	0.25
23S-99-5353	4.05 ± 0.21	0.18 ± 0.11	ND	8.51 ± 0.44	0.30
23S-99-5354	2.20 ± 0.14	0.46 ± 0.12	ND	4.62 ± 0.29	0.20
23S-99-5355	1.40 ± 0.14	0.12 ± 0.09	ND	2.94 ± 0.29	0.11
Nominal Background	0.07	ND	ND	ND	

Table 2B: Hot Cell Site Final Soil Sample Results Post Remediation

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5356	0.85 ± 0.08	ND	ND	1.79 ± 0.17	0.06
23S-99-5357	0.12 ± 0.04	ND	ND	0.25 ± 0.08	<0.01
23S-99-5358	2.36 ± 0.14	0.27 ± 0.08	0.14 ± 0.06	4.96 ±0.29	0.21
23S-99-5359	4.25 ± 0.21	0.38 ± 0.12	ND	8.93 ± 0.44	0.33
23S-99-5360	2.10 ± 0.11	0.23 ± 0.07	ND	4.41 ± 0.23	0.17
23S-99-5361	0.30 ± 0.06	0.07 ± 0.05	ND	0.63 ± 0.13	0.03
23S-99-5362	1.90 ± 0.11	0.25 ± 0.07	ND	3.99 ± 0.23	0.16
23S-99-5363	8.90 ± 0.22	1.10 ± 0.12	0.10 ± 0.09	18.69 ± 0.46	0.74
23S-99-5364	0.68 ± 0.07	0.06 ± 0.05	ND	1.43 ± 0.15	0.05
23S-99-5365	6.10 ± 0.20	0.10 ± 0.08	ND	12.81 ± 0.42	0.42
23S-99-5366	6.47 ± 0.20	0.71 ± 0.09	ND	13.58 ± 0.42	0.52
23S-99-5367	7.90 ± 0.23	0.78 ± 0.12	ND	16.59 ± 0.48	0.63
23S-99-5368	1.00 ± 0.08	0.12 ± 0.06	ND	2.10 ± 0.17	0.08
23S-99-5369	0.95 ± 0.11	0.16 ± 0.10	ND	1.98 ± 0.23	0.09
23S-99-5370	3.75 ± 0.16	0.26 ± 0.08	ND	7.87 ± 0.34	0.29
23S-99-5371	0.85 ± 0.08	0.07 ± 0.07	ND	1.79 ± 0.17	0.06
23S-99-5372	3.95 ± 0.15	0.38 ± 0.18	ND	8.29 ± 0.32	0.33
23S-99-5373	5.75 ± 0.21	0.49 ± 0.12	ND	12.06 ± 0.44	0.15
23S-99-5374	2.54 ± 0.14	0.25 ± 0.07	ND	5.34 ± 0.29	0.20
23S-99-5375	2.70 ± 0.14	0.26 ± 0.01	ND	5.67± 0.29	0.22
23S-99-5376	3.60 ± 0.15	0.27 ± 0.07	ND	7.56 ± 0.32	0.28
23S-99-5377	3.10 ± 0.16	0.60 ± 0.12	ND	6.51 ± 034	0.29
23S-99-5378	1.05 ± 0.09	0.08 ± 0.07	ND	2.20 ± 0.19	0.08
23S-99-5379	1.10 ± 0.11	0.14 ± 0.09	ND	2.31 ± 0.23	0.09
Nominal Background	0.07	ND	ND	ND	

Table 2B: Hot Cell Site Final Soil Sample Results - Post Remediation

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5380	0.81 ± 0.09	0.14 ± 0.05	ND	1.70 ± 0.19	0.07
23S-99-5381	2.20 ± 0.14	0.27 ± 0.09	ND	4.62 ± 0.29	0.18
23S-99-5382	2.26 ± 0.12	0.35 ± 0.25	ND	4.74 ±0.25	0.20
23S-99-5383	1.55 ± 0.12	0.09 ± 0.06	ND	3.26 ± 0.25	0.12
23S-99-5384	3.90 ± 0.17	0.28 ± 0.08	ND	8.19 ± 0.36	0.30
23S-99-5385	1.90 ± 0.13	0.50 ± 0.11	ND	3.99 ± 0.27	0.19
23S-99-5386	6.60 ± 0.23	0.70 ± 0.10	ND	13.86 ± 0.48	0.54
23S-99-5387	4.93 ± 0.21	0.26 ± 0.09	ND	10.36 ± 0.44	0.37
23S-99-5388	2.10 ± 0.13	0.10 ± 0.08	ND	4.41 ± 0.27	0.15
23S-99-5389	1.74 ± 0.14	0.62 ± 0.14	ND	3.65 ± 0.29	0.20
23S-99-5390	3.85 ± 0.66	ND	ND	8.08 ± 1.39	0.26
23S-99-5391	1.60 ± 0.86	ND	ND	3.36 ± 1.81	0.11
23S-99-5392	1.93 ± 0.13	0.33 ± 0.09	ND	4.06 ± 0.27	0.18
23S-99-5393	2.05 ± 0.16	0.24 ± 0.10	ND	4.30 ± 0.34	0.17
23S-99-5394	3.94 ± 0.18	0.27 ± 0.09	ND	8.27 ± 0.38	0.31
23S-99-5395	2.00 ± 0.18	0.27 ± 0.11	ND	4.20 ± 0.38	0.17
23S-99-5396	7.40 ± 0.23	0.30 ± 0.11	ND	15.54 ± 0.48	0.54
23S-99-5397	3.54 ± 0.08	0.48 ± 0.06	ND	7.43 ± 0.18	0.30
Nominal Background	0.07	ND	ND	ND	

Notes:
(1) Nominal Background subtracted for Cs-137
(2) Values calculated from Sr-90 to Cs-137 ratio of 2.1:1.0
(3) U-238, U-235, Th-282, and Th-232 were at, or near, natural background levels.
The maximum concentration detected was:
U-238 ≤ 3.20 pCi/g
U-235 ≤ 0.35 pCi/g
Th-228 ≤ 1.45 pCi/g
Th-232 ≤ 1.81 pCi/g
(4) ND means Not Detected, Background, or below the minimum detectable activity.

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1679 @ 0"	0.07 ± 0.05	0.17 ± 0.05	0.15 ± 0.11	ND	<0.01
23S-99-1679 @ 6"	0.58 ± 0.08	0.68 ± 0.12	1.22 ± 0.17	ND	0.12
23S-99-1679 @ 12"	ND	ND	ND	ND	0.00
23S-99-1679 @ 18"	ND	ND	ND	ND	0.00
23S-99-1679 @ 24"	ND	ND	ND	ND	0.00
23S-99-1679 @ 30"	ND	0.10 ± 0.06	ND	ND	0.01
23S-99-1679 @ 36"	ND	ND	ND	ND	0.00
23S-99-1679 @ 42"	ND	ND	ND	ND	0.00
23S-99-1679 @ 48"	ND	ND	ND	ND	0.00
23S-99-1679 @ 54"	ND	ND	ND	ND	0.00
23S-99-1679 @ 60"	ND	ND	ND	ND	0.00
23S-99-1679 @ 66"	ND	ND	ND	ND	0.00
23S-99-1680 @ 0"	ND	ND	ND	ND	0.00
23S-99-1680 @ 6"	ND	ND	ND	ND	0.00
23S-99-1680 @ 12"	ND	ND	ND	ND	0.00
23S-99-1680 @ 18"	ND	ND	ND	ND	0.00
23S-99-1680 @ 24"	ND	ND	ND	ND	0.00
23S-99-1680 @ 30"	ND	ND	ND	ND	0.00
23S-99-1680 @ 36"	ND	ND	ND	ND	0.00
23S-99-1680 @ 42"	ND	ND	ND	ND	0.00
23S-99-1680 @ 48"	ND	ND	ND	ND	0.00
23S-99-1680 @ 54"	ND	ND	ND	ND	0.00
23S-99-1680 @ 60"	ND	ND	ND	ND	0.00
23S-99-1680 @ 66"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1],[2],[3],[4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1681 @ 0"	ND	ND	ND	ND	0.00
23S-99-1681 @ 6"	ND	ND	ND	ND	0.00
23S-99-1681 @ 12"	ND	ND	ND	ND	0.00
23S-99-1681 @ 18"	ND	ND	ND	ND	0.00
23S-99-1681 @ 24"	ND	ND	ND	ND	0.00
23S-99-1681 @ 30"	0.09 ± 0.04	ND	0.19 ± 0.08	ND	<0.01
23S-99-1681 @ 36"	ND	ND	ND	ND	0.00
23S-99-1681 @ 42"	ND	ND	ND	ND	0.00
23S-99-1681 @ 48"	ND	ND	ND	ND	0.00
23S-99-1681 @ 54"	ND	ND	ND	ND	0.00
23S-99-1681 @ 60"	ND	ND	ND	ND	0.00
23S-99-1681 @ 66"	ND	ND	ND	ND	0.00
23S-99-1682 @ 0"	ND	ND	ND	ND	0.00
23S-99-1682 @ 6"	ND	ND	ND	ND	0.00
23S-99-1682 @ 12"	0.03 ± 0.02	ND	0.06 ± 0.04	ND	<0.01
23S-99-1682 @ 18"	ND	ND	ND	ND	0.00
23S-99-1682 @ 24"	ND	ND	ND	ND	0.00
23S-99-1682 @ 30"	ND	ND	ND	ND	0.00
23S-99-1682 @ 36"	ND	ND	ND	ND	0.00
23S-99-1682 @ 42"	ND	ND	ND	ND	0.00
23S-99-1682 @ 48"	ND	ND	ND	ND	0.00
23S-99-1682 @ 54"	ND	ND	ND	ND	0.00
23S-99-1682 @ 60"	ND	ND	ND	ND	0.00
23S-99-1682 @ 66"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1716 @ 6"	1.5 ± 0.13	0.57 ± 0.11	3.15 ± 0.27	0.11 ± 0.10	0.18
23S-99-1717 @ 12"	0.80 ± 0.12	0.26 ± 0.13	1.68 ± 0.26	ND	0.09
23S-99-1718 @ 18"	0.90 ± 0.13	2.31 ± 0.23	1.88 ± 0.28	ND	0.35
23S-99-1719 @ 24"	0.17 ± 0.06	0.10 ± 0.07	0.37 ± 0.13	ND	0.02
23S-99-1720 @ 30"	0.16 ± 0.08	0.20 ± 0.13	0.34 ± 0.17	ND	0.04
23S-99-1721 @ 36"	0.09 ± 0.06	0.10 ± 0.07	0.19 ± 0.13	ND	0.02
23S-99-1722 @ 42"	0.13 ± 0.06	0.14 ± 0.06	0.27 ± 0.13	ND	0.03
23S-99-1723 @ 48"	0.32 ± 0.10	0.22 ± 0.10	0.67 ± 0.21	ND	0.05
23S-99-1724 @ 54"	0.31 ± 0.08	0.24 ± 0.08	0.65 ± 0.17	ND	0.05
23S-99-1725 @ 60"	0.29 ± 0.07	ND	0.61 ± 0.15	ND	0.02
23S-99-1726 @ 66"	0.09 ± 0.04	ND	0.19 ± 0.08	ND	<0.01
23S-99-1727 @ 72"	0.20 ± 0.06	ND	0.42 ± 0.13	ND	0.01
23S-99-1728 @ 6"	0.07 ± 0.04	ND	0.15 ± 0.08	ND	<0.01
23S-99-1729 @ 12"	0.06 ±0.03	ND	0.13 ± 0.06	ND	<0.01
23S-99-1730 @ 18"	ND	ND	ND	ND	0.00
23S-99-1731 @ 24"	ND	ND	ND	ND	0.00
23S-99-1732 @ 30"	ND	ND	ND	ND	0.00
23S-99-1733 @ 36"	ND	ND	ND	ND	0.00
23S-99-1734 @ 42"	ND	ND	ND	ND	0.00
23S-99-1735 @ 48"	ND	ND	ND	ND	0.00
23S-99-1736 @ 54"	ND	ND	ND	ND	0.00
23S-99-1737 @ 60"	ND	ND	ND	ND	0.00
23S-99-1738 @ 66"	ND	ND	ND	ND	0.00
23S-99-1739 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1750 @ 6"	ND	ND	ND	ND	0.00
23S-99-1750 @ 12"	ND	ND	ND	ND	0.00
23S-99-1750 @ 18"	0.01 ± 0.01	ND	0.02 ± 0.02	ND	<0.01
23S-99-1750 @ 24"	ND	ND	ND	ND	0.00
23S-99-1750 @ 30"	ND	ND	ND	ND	0.00
23S-99-1750 @ 36"	ND	ND	ND	ND	0.00
23S-99-1750 @ 42"	ND	ND	ND	ND	0.00
23S-99-1750 @ 48"	ND	ND	ND	ND	0.00
23S-99-1750 @ 54"	ND	ND	ND	ND	0.00
23S-99-1750 @ 60"	ND	ND	ND	ND	0.00
23S-99-1750 @ 66"	ND	0.34 ± 0.20	ND	ND	0.04
23S-99-1750 @ 72"	ND	ND	ND	ND	0.00
23S-99-1751 @ 6"	0.17 ± 0.06	0.17 ± 0.09	0.36 ± 0.13	ND	0.03
23S-99-1751 @ 12"	0.05 ± 0.03	ND	0.11 ± 0.06	ND	<0.01
23S-99-1751 @ 18"	ND	ND	ND	ND	0.00
23S-99-1751 @ 24"	ND	ND	ND	ND	0.00
23S-99-1751 @ 30"	ND	ND	ND	ND	0.00
23S-99-1751 @ 36"	ND	0.29 ± 0.14	ND	ND	0.04
23S-99-1751 @ 42"	ND	ND	ND	ND	0.00
23S-99-1751 @ 48"	ND	ND	ND	ND	0.00
23S-99-1751 @ 54"	ND	ND	ND	ND	0.00
23S-99-1751 @ 60"	ND	ND	ND	ND	0.00
23S-99-1751 @ 66"	ND	ND	ND	ND	0.00
23S-99-1751 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1],[2],[3],[4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1752 @ 6"	ND	ND	ND	ND	0.00
23S-99-1752 @ 12"	ND	ND	ND	ND	0.00
23S-99-1752 @ 18"	ND	ND	ND	ND	0.00
23S-99-1752 @ 24"	ND	ND	ND	ND	0.00
23S-99-1752 @ 30"	ND	ND	ND	ND	0.00
23S-99-1752 @ 36"	ND	ND	ND	ND	0.00
23S-99-1752 @ 42"	ND	ND	ND	ND	0.00
23S-99-1752 @ 48"	ND	0.09 ± 0.04	ND	ND	0.01
23S-99-1752 @ 54"	ND	ND	ND	ND	0.00
23S-99-1752 @ 60"	ND	ND	ND	ND	0.00
23S-99-1752 @ 66"	ND	ND	ND	ND	0.00
23S-99-1752 @ 72"	ND	ND	ND	ND	0.00
23S-99-1753 @ 6"	ND	ND	ND	ND	0.00
23S-99-1753 @ 12"	ND	ND	ND	ND	0.00
23S-99-1753 @ 18"	ND	ND	ND	ND	0.00
23S-99-1753 @ 24"	ND	ND	ND	ND	0.00
23S-99-1753 @ 30"	ND	ND	ND	ND	0.00
23S-99-1753 @ 36"	ND	ND	ND	ND	0.00
23S-99-1753 @ 42"	ND	ND	ND	ND	0.00
23S-99-1753 @ 48"	ND	ND	ND	ND	0.00
23S-99-1753 @ 54"	ND	ND	ND	ND	0.00
23S-99-1753 @ 60"	ND	ND	ND	ND	0.00
23S-99-1753 @ 66"	ND	ND	ND	ND	0.00
23S-99-1753 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1754 @ 6"	ND	ND	ND	ND	0.00
23S-99-1754 @ 12"	ND	ND	ND	ND	0.00
23S-99-1754 @ 18"	ND	ND	ND	ND	0.00
23S-99-1754 @ 24"	ND	ND	ND	ND	0.00
23S-99-1754 @ 30"	ND	ND	ND	ND	0.00
23S-99-1754 @ 36"	ND	ND	ND	ND	0.00
23S-99-1754 @ 42"	ND	ND	ND	ND	0.00
23S-99-1754 @ 48"	ND	ND	ND	ND	0.00
23S-99-1754 @ 54"	ND	ND	ND	ND	0.00
23S-99-1754 @ 60"	ND	ND	ND	ND	0.00
23S-99-1754 @ 66"	ND	ND	ND	ND	0.00
23S-99-1754 @ 72"	ND	ND	ND	ND	0.00
23S-99-1755 @ 6"	0.11 ± 0.04	ND	0.23 ± 0.08	ND	<0.01
23S-99-1755 @ 12"	0.07 ± 0.03	ND	0.15 ± 0.06	ND	0.00
23S-99-1755 @ 18"	ND	ND	ND	ND	0.00
23S-99-1755 @ 24"	ND	ND	ND	ND	0.00
23S-99-1755 @ 30"	ND	ND	ND	ND	0.00
23S-99-1755 @ 36"	ND	ND	ND	ND	0.00
23S-99-1755 @ 42"	ND	ND	ND	ND	0.00
23S-99-1755 @ 48"	ND	ND	ND	ND	0.00
23S-99-1755 @ 54"	ND	ND	ND	ND	0.00
23S-99-1755 @ 60"	ND	ND	ND	ND	0.00
23S-99-1755 @ 66"	ND	ND	ND	ND	0.00
23S-99-1755 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1756 @ 6"	ND	ND	ND	ND	0.00
23S-99-1756 @ 12"	0.72 ± 0.09	ND	1.51 ± 0.19	0.09 ± 0.07	0.06
23S-99-1756 @ 18"	0.25 ± 0.08	ND	0.53 ± 0.17	ND	0.02
23S-99-1756 @ 24"	ND	ND	ND	ND	0.00
23S-99-1756 @ 30"	0.04 ± 0.04	ND	0.08 ± 0.08	ND	<0.01
23S-99-1756 @ 36"	0.12 ± 0.06	ND	0.25 ± 0.13	ND	<0.01
23S-99-1756 @ 42"	ND	ND	ND	ND	0.00
23S-99-1756 @ 48"	ND	ND	ND	ND	0.00
23S-99-1756 @ 54"	ND	ND	ND	ND	0.00
23S-99-1756 @ 60"	ND	ND	ND	ND	0.00
23S-99-1756 @ 66"	ND	ND	ND	ND	0.00
23S-99-1756 @ 72"	ND	ND	ND	ND	0.00
23S-99-1757 @ 6"	ND	ND	ND	ND	0.00
23S-99-1757 @ 12"	ND	ND	ND	ND	0.00
23S-99-1757 @ 18"	ND	ND	ND	ND	0.00
23S-99-1757 @ 24"	ND	ND	ND	ND	0.00
23S-99-1757 @ 30"	ND	ND	ND	ND	0.00
23S-99-1757 @ 36"	ND	ND	ND	ND	0.00
23S-99-1757 @ 42"	ND	ND	ND	ND	0.00
23S-99-1757 @ 48"	ND	ND	ND	ND	0.00
23S-99-1757 @ 54"	ND	ND	ND	ND	0.00
23S-99-1757 @ 60"	ND	ND	ND	ND	0.00
23S-99-1757 @ 66"	ND	ND	ND	ND	0.00
23S-99-1757 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1758 @ 6"	ND	ND	ND	ND	0.00
23S-99-1758 @ 12"	ND	ND	ND	ND	0.00
23S-99-1758 @ 18"	ND	0.23 ± 0.16	ND	ND	0.03
23S-99-1758 @ 24"	ND	0.06 ± 0.04	ND	ND	<0.01
23S-99-1758 @ 30"	ND	ND	ND	ND	0.00
23S-99-1758 @ 36"	ND	ND	ND	ND	0.00
23S-99-1758 @ 42"	ND	0.04 ± 0.02	ND	ND	<0.01
23S-99-1758 @ 48"	ND	ND	ND	ND	0.00
23S-99-1758 @ 54"	0.16 ± 0.04	ND	0.34 ± 0.09	ND	0.01
23S-99-1758 @ 60"	0.34 ± 0.09	ND	0.72 ± 0.19	ND	0.02
23S-99-1758 @ 66"	ND	ND	ND	ND	0.00
23S-99-1758 @ 72"	ND	ND	ND	ND	0.00
23S-99-1759 @ 6"	ND	ND	ND	ND	0.00
23S-99-1759 @ 12"	ND	ND	ND	ND	0.00
23S-99-1759 @ 18"	ND	ND	ND	ND	0.00
23S-99-1759 @ 24"	ND	0.08 ± 0.05	ND	ND	0.01
23S-99-1759 @ 30"	ND	ND	ND	ND	0.00
23S-99-1759 @ 36"	ND	ND	ND	ND	0.00
23S-99-1759 @ 42"	ND	ND	ND	ND	0.00
23S-99-1759 @ 48"	0.06 ± 0.02	0.03 ± 0.03	0.12 ± 0.04	ND	<0.01
23S-99-1759 @ 54"	ND	ND	ND	ND	0.00
23S-99-1759 @ 60"	ND	ND	ND	ND	0.00
23S-99-1759 @ 66"	ND	ND	ND	ND	0.00
23S-99-1759 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1760 @ 6"	ND	ND	ND	ND	0.00
23S-99-1760 @ 12"	ND	ND	ND	ND	0.00
23S-99-1760 @ 18"	ND	ND	ND	ND	0.00
23S-99-1760 @ 24"	0.39 ± 0.05	0.10 ± 0.05	0.82 ± 0.11	ND	0.04
23S-99-1760 @ 30"	0.28 ± 0.08	ND	0.59 ± 0.17	ND	0.02
23S-99-1760 @ 36"	ND	ND	ND	ND	0.00
23S-99-1760 @ 42"	ND	ND	ND	ND	0.00
23S-99-1760 @ 48"	ND	ND	ND	ND	0.00
23S-99-1760 @ 54"	0.91 ± 0.11	0.16 ± 0.09	1.91 ± 0.23	ND	0.08
23S-99-1760 @ 60"	0.41 ± 0.09	0.23 ± 0.10	0.86 ± 0.19	ND	0.06
23S-99-1760 @ 66"	0.09 ± 0.04	ND	0.19 ± 0.08	ND	<0.01
23S-99-1760 @ 72"	0.04 ± 0.03	ND	0.08 ± 0.06	ND	<0.01
23S-99-1761 @ 6"	0.25 ± 0.09	ND	0.53 ± 0.19	ND	0.02
23S-99-1761 @ 12"	0.05 ± 0.02	ND	0.11 ± 0.04	ND	<0.01
23S-99-1761 @ 18"	ND	ND	ND	ND	0.00
23S-99-1761 @ 24"	ND	ND	ND	ND	0.00
23S-99-1761 @ 30"	1.41 ± 0.10	ND	2.96 ± 0.21	ND	0.10
23S-99-1761 @ 36"	ND	ND	ND	ND	0.00
23S-99-1761 @ 42"	ND	ND	ND	ND	0.00
23S-99-1761 @ 48"	ND	ND	ND	ND	0.00
23S-99-1761 @ 54"	0.03 ± 0.01	ND	0.06 ± 0.02	ND	<0.01
23S-99-1761 @ 60"	ND	ND	ND	ND	0.00
23S-99-1761 @ 66"	0.06 ± 0.03	0.14 ± 0.08	0.13 ± 0.06	ND	<0.01
23S-99-1761 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1],[2],[3],[4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1762 @ 6"	ND	ND	ND	ND	0.00
23S-99-1762 @ 12"	ND	ND	ND	ND	0.00
23S-99-1762 @ 18"	0.03 ± 0.02	ND	0.06 ± 0.04	ND	<0.01
23S-99-1762 @ 24"	ND	ND	ND	ND	0.00
23S-99-1762 @ 30"	ND	ND	ND	ND	0.00
23S-99-1762 @ 36"	0.06 ± 0.04	ND	0.13 ± 0.08	ND	<0.01
23S-99-1762 @ 42"	ND	ND	ND	ND	0.00
23S-99-1762 @ 48"	ND	ND	ND	ND	0.00
23S-99-1762 @ 54"	0.02 ± 0.01	ND	0.04 ± 0.02	ND	<0.01
23S-99-1762 @ 60"	0.09 ± 0.05	ND	0.19 ± 0.11	ND	<0.01
23S-99-1762 @ 66"	ND	ND	ND	ND	0.00
23S-99-1762 @ 72"	0.04 ± 0.03	ND	0.08 ± 0.06	ND	<0.01
23S-99-1763 @ 6"	0.14 ± 0.07	ND	0.29 ± 0.15	ND	0.01
23S-99-1763 @ 12"	0.07 ± 0.03	ND	0.15 ± 0.06	ND	<0.01
23S-99-1763 @ 18"	0.02 ± 0.02	ND	0.04 ± 0.04	ND	<0.01
23S-99-1763 @ 24"	ND	ND	ND	ND	0.00
23S-99-1763 @ 30"	ND	ND	ND	ND	0.00
23S-99-1763 @ 36"	0.08 ± 0.04	ND	0.17 ± 0.08	ND	<0.01
23S-99-1763 @ 42"	ND	ND	ND	ND	0.00
23S-99-1763 @ 48"	ND	ND	ND	ND	0.00
23S-99-1763 @ 54"	ND	ND	ND	ND	0.00
23S-99-1763 @ 60"	ND	ND	ND	ND	0.00
23S-99-1763 @ 66"	ND	ND	ND	ND	0.00
23S-99-1763 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1764 @ 6"	1.70 ± 0.14	0.14 ± 0.08	3.57 ± 0.29	ND	0.13
23S-99-1764 @ 12"	0.95 ± 0.08	0.11 ± 0.06	2.00 ± 0.17	ND	0.08
23S-99-1764 @ 18"	0.66 ± 0.09	ND	1.39 ± 0.19	ND	0.06
23S-99-1764 @ 24"	0.44 ± 0.08	ND	0.92 ± 0.17	ND	0.03
23S-99-1764 @ 30"	0.29 ± 0.08	ND	0.61 ± 0.17	ND	0.02
23S-99-1764 @ 36"	0.32 ± 0.05	0.10 ± 0.06	0.67 ± 0.11	ND	0.03
23S-99-1764 @ 42"	0.18 ± 0.07	ND	0.38 ± 0.15	ND	0.01
23S-99-1764 @ 48"	0.36 ± 0.06	ND	0.76 ± 0.13	ND	0.02
23S-99-1764 @ 54"	0.26 ± 0.07	ND	0.55 ± 0.15	ND	0.02
23S-99-1764 @ 60"	0.16 ± 0.05	ND	0.34 ± 0.11	ND	0.01
23S-99-1764 @ 66"	0.04 ± 0.03	ND	0.08 ± 0.06	ND	<0.01
23S-99-1764 @ 72"	ND	ND	ND	ND	0.00
23S-99-1765 @ 6"	ND	ND	ND	ND	0.00
23S-99-1765 @ 12"	ND	ND	ND	ND	0.00
23S-99-1765 @ 18"	ND	ND	ND	ND	0.00
23S-99-1765 @ 24"	ND	ND	ND	ND	0.00
23S-99-1765 @ 30"	ND	ND	ND	ND	0.00
23S-99-1765 @ 36"	ND	ND	ND	ND	0.00
23S-99-1765 @ 42"	ND	ND	ND	ND	0.00
23S-99-1765 @ 48"	ND	ND	ND	ND	0.00
23S-99-1765 @ 54"	ND	ND	ND	ND	0.00
23S-99-1765 @ 60"	ND	ND	ND	ND	0.00
23S-99-1765 @ 66"	ND	ND	ND	ND	0.00
23S-99-1765 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1766 @ 6"	1.74 ± 0.14	0.20 ± 0.08	3.65 ± 0.30	ND	0.14
23S-99-1766 @ 12"	2.1 ± 0.13	0.33 ± 0.08	4.41 ± 0.27	ND	0.18
23S-99-1766 @ 18"	1.2 ± 0.15	0.17 ± 0.10	2.52 ± 0.32	ND	0.10
23S-99-1766 @ 24"	0.74 ± 0.03	0.16 ± 0.03	1.55 ± 0.06	ND	0.07
23S-99-1766 @ 30"	0.13 ± 0.04	ND	0.27 ± 0.08	ND	<0.01
23S-99-1766 @ 36"	0.29 ± 0.07	ND	0.61 ± 0.15	ND	0.02
23S-99-1766 @ 42"	0.14 ± 0.04	ND	0.29 ± 0.08	ND	0.01
23S-99-1766 @ 48"	0.14 ± 0.06	ND	0.29 ± 0.13	ND	0.01
23S-99-1766 @ 54"	0.28 ± 0.05	ND	0.59 ± 0.11	ND	0.02
23S-99-1766 @ 60"	0.02 ± 0.01	ND	0.04 ± 0.02	ND	<0.01
23S-99-1766 @ 66"	0.82 ± 0.10	0.15 ± 0.12	1.72 ± 0.21	ND	0.08
23S-99-1766 @ 72"	0.11 ± 0.01	ND	0.23	ND	<0.01
23S-99-1767 @ 6"	0.15 ± 0.08	ND	0.32 ± 0.17	ND	<0.01
23S-99-1767 @ 12"	0.09 ± 0.04	ND	0.19 ± 0.08	ND	<0.01
23S-99-1767 @ 18"	0.09 ± 0.04	ND	0.19 ± 0.08	ND	<0.01
23S-99-1767 @ 24"	ND	ND	ND	ND	0.00
23S-99-1767 @ 30"	ND	ND	ND	ND	0.00
23S-99-1767 @ 36"	ND	ND	ND	ND	0.00
23S-99-1767 @ 42"	ND	ND	ND	ND	0.00
23S-99-1767 @ 48"	ND	ND	ND	ND	0.00
23S-99-1767 @ 54"	ND	ND	ND	ND	0.00
23S-99-1767 @ 60"	ND	ND	ND	ND	0.00
23S-99-1767 @ 66"	ND	ND	ND	ND	0.00
23S-99-1767 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1768 @ 6"	0.17 ± 0.06	ND	0.36 ± 0.13	ND	0.01
23S-99-1768 @ 12"	0.08 ± 0.03	ND	0.17 ± 0.06	ND	<0.01
23S-99-1768 @ 18"	ND	ND	ND	ND	0.00
23S-99-1768 @ 24"	ND	ND	ND	ND	0.00
23S-99-1768 @ 30"	0.26 ± 0.09	ND	0.55 ± 0.19	ND	0.02
23S-99-1768 @ 36"	ND	ND	ND	ND	0.00
23S-99-1768 @ 42"	ND	ND	ND	ND	0.00
23S-99-1768 @ 48"	ND	ND	ND	ND	0.00
23S-99-1768 @ 54"	ND	ND	ND	ND	0.00
23S-99-1768 @ 60"	ND	ND	ND	ND	0.00
23S-99-1768 @ 66"	ND	ND	ND	ND	0.00
23S-99-1768 @ 72"	ND	ND	ND	ND	0.00
23S-99-1769 @ 6"	ND	ND	ND	ND	0.00
23S-99-1769 @ 12"	ND	ND	ND	ND	0.00
23S-99-1769 @ 18"	0.09 ± 0.04	ND	0.19 ± 0.09	ND	<0.01
23S-99-1769 @ 24"	ND	ND	ND	ND	0.00
23S-99-1769 @ 30"	ND	ND	ND	ND	0.00
23S-99-1769 @ 36"	ND	ND	ND	ND	0.00
23S-99-1769 @ 42"	ND	ND	ND	ND	0.00
23S-99-1769 @ 48"	ND	ND	ND	ND	0.00
23S-99-1769 @ 54"	ND	ND	ND	ND	0.00
23S-99-1769 @ 60"	ND	ND	ND	ND	0.00
23S-99-1769 @ 66"	ND	ND	ND	ND	0.00
23S-99-1769 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1],[2],[3],[4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1770 @ 6"	ND	ND	ND	ND	0.00
23S-99-1770 @ 12"	ND	ND	ND	ND	0.00
23S-99-1770 @ 18"	ND	ND	ND	ND	0.00
23S-99-1770 @ 24"	ND	ND	ND	ND	0.00
23S-99-1770 @ 30"	ND	ND	ND	ND	0.00
23S-99-1770 @ 36"	ND	ND	ND	ND	0.00
23S-99-1770 @ 42"	ND	ND	ND	ND	0.00
23S-99-1770 @ 48"	ND	ND	ND	ND	0.00
23S-99-1770 @ 54"	ND	ND	ND	ND	0.00
23S-99-1770 @ 60"	ND	ND	ND	ND	0.00
23S-99-1770 @ 66"	ND	ND	ND	ND	0.00
23S-99-1770 @ 72"	ND	ND	ND	ND	0.00
23S-99-1771 @ 6"	ND	ND	ND	ND	0.00
23S-99-1771 @ 12"	ND	ND	ND	ND	0.00
23S-99-1771 @ 18"	ND	ND	ND	ND	0.00
23S-99-1771 @ 24"	ND	ND	ND	ND	0.00
23S-99-1771 @ 30"	ND	ND	ND	ND	0.00
23S-99-1771 @ 36"	ND	ND	ND	ND	0.00
23S-99-1771 @ 42"	ND	ND	ND	ND	0.00
23S-99-1771 @ 48"	ND	ND	ND	ND	0.00
23S-99-1771 @ 54"	ND	ND	ND	ND	0.00
23S-99-1771 @ 60"	ND	ND	ND	ND	0.00
23S-99-1771 @ 66"	ND	ND	ND	ND	0.00
23S-99-1771 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1772 @ 6"	ND	ND	ND	ND	0.00
23S-99-1772 @ 12"	ND	ND	ND	ND	0.00
23S-99-1772 @ 18"	ND	ND	ND	ND	0.00
23S-99-1772 @ 24"	ND	ND	ND	ND	0.00
23S-99-1772 @ 30"	ND	ND	ND	ND	0.00
23S-99-1772 @ 36"	ND	ND	ND	ND	0.00
23S-99-1772 @ 42"	0.02 ± 0.02	ND	0.04 ± 0.04	ND	<0.01
23S-99-1772 @ 48"	ND	ND	ND	ND	0.00
23S-99-1772 @ 54"	ND	ND	ND	ND	0.00
23S-99-1772 @ 60"	ND	ND	ND	ND	0.00
23S-99-1772 @ 66"	ND	ND	ND	ND	0.00
23S-99-1772 @ 72"	ND	ND	ND	ND	0.00
23S-99-1773 @ 6"	0.98 ± 0.11	0.15 ± 0.10	2.06 ± 0.23	ND	0.09
23S-99-1773 @ 12"	0.26 ± 0.05	ND	0.55 ± 0.11	ND	0.02
23S-99-1773 @ 18"	0.37 ± 0.11	ND	0.78 ± 0.23	ND	0.03
23S-99-1773 @ 24"	0.35 ± 0.07	0.14 ± 0.10	0.74 ± 0.15	ND	0.03
23S-99-1773 @ 30"	0.16 ± 0.05	ND	0.34 ± 0.11	ND	0.01
23S-99-1773 @ 36"	ND	ND	ND	ND	0.00
23S-99-1773 @ 42"	0.13 ± 0.06	ND	0.27 ± 0.13	ND	0.01
23S-99-1773 @ 48"	ND	ND	ND	ND	0.00
23S-99-1773 @ 54"	ND	ND	ND	ND	0.00
23S-99-1773 @ 60"	ND	ND	ND	ND	0.00
23S-99-1773 @ 66"	ND	ND	ND	ND	0.00
23S-99-1773 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1],[2],[3],[4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1799 @ 6"	ND	0.12 ± 0.07	ND	ND	0.02
23S-99-1799 @ 12"	ND	ND	ND	ND	0.00
23S-99-1799 @ 18"	ND	ND	ND	ND	0.00
23S-99-1799 @ 24"	ND	ND	ND	ND	0.00
23S-99-1799 @ 30"	ND	ND	ND	ND	0.00
23S-99-1799 @ 36"	ND	ND	ND	ND	0.00
23S-99-1799 @ 42"	ND	ND	ND	ND	0.00
23S-99-1799 @ 48"	ND	ND	ND	ND	0.00
23S-99-1799 @ 54"	ND	ND	ND	ND	0.00
23S-99-1799 @ 60"	ND	ND	ND	ND	0.00
23S-99-1799 @ 66"	ND	ND	ND	ND	0.00
23S-99-1799 @ 72"	ND	ND	ND	ND	0.00
23S-99-1800 @ 6"	ND	ND	ND	ND	0.00
23S-99-1800 @ 12"	ND	ND	ND	ND	0.00
23S-99-1800 @ 18"	0.59 ± 0.09	0.15 ± 0.08	1.24 ± 0.19	ND	0.06
23S-99-1800 @ 24"	0.11 ± 0.04	ND	0.22 ± 0.08	ND	<0.01
23S-99-1800 @ 30"	ND	ND	ND	ND	0.00
23S-99-1800 @ 36"	ND	ND	ND	ND	0.00
23S-99-1800 @ 42"	0.02 ± 0.02	ND	0.04 ± 0.04	ND	<0.01
23S-99-1800 @ 48"	ND	ND	ND	ND	0.00
23S-99-1800 @ 54"	0.09 ± 0.05	ND	0.19 ± 0.11	ND	<0.01
23S-99-1800 @ 60"	0.05 ± 0.02	ND	0.11 ± 0.04	ND	<0.01
23S-99-1800 @ 66"	ND	ND	ND	ND	0.00
23S-99-1800 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1],[2],[3],[4]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1801 @ 6"	3.10 ± 0.20	0.30 ± 0.15	6.47 ± 0.42	ND	0.25
23S-99-1801 @ 12"	0.57 ± 0.09	0.13 ± 0.06	1.20 ± 0.19	ND	0.05
23S-99-1801 @ 18"	1.02 ± 0.05	ND	2.14 ± 0.09	ND	0.07
23S-99-1801 @ 24"	0.21 ± 0.06	ND	0.44 ± 0.13	ND	0.01
23S-99-1801 @ 30"	ND	ND	ND	ND	0.00
23S-99-1801 @ 36"	ND	ND	ND	ND	0.00
23S-99-1801 @ 42"	ND	ND	ND	ND	0.00
23S-99-1801 @ 48"	ND	ND	ND	ND	0.00
23S-99-1801 @ 54"	ND	ND	ND	ND	0.00
23S-99-1801 @ 60"	ND	ND	ND	ND	0.00
23S-99-1801 @ 66"	ND	ND	ND	ND	0.00
23S-99-1801 @ 72"	ND	ND	ND	ND	0.00
23S-99-1802 @ 6"	ND	ND	ND	ND	0.00
23S-99-1802 @ 12"	ND	ND	ND	ND	0.00
23S-99-1802 @ 18"	ND	ND	ND	ND	0.00
23S-99-1802 @ 24"	ND	ND	ND	ND	0.00
23S-99-1802 @ 30"	ND	ND	ND	ND	0.00
23S-99-1802 @ 36"	ND	ND	ND	ND	0.00
23S-99-1802 @ 42"	ND	ND	ND	ND	0.00
23S-99-1802 @ 48"	ND	ND	ND	ND	0.00
23S-99-1802 @ 54"	ND	ND	ND	ND	0.00
23S-99-1802 @ 60"	ND	ND	ND	ND	0.00
23S-99-1802 @ 66"	ND	ND	ND	ND	0.00
23S-99-1802 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Table 3: Hot Cell Site Soil Core Sample Results

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[(1),(2),(3),(4)]				
Sample ID	**^{137}Cs**	**^{60}Co**	**^{90}Sr**	**^{134}Cs**	**$\sum$ of Fractions**
23S-99-1803 @ 6"	ND	ND	ND	ND	0.00
23S-99-1803 @ 12"	0.14 ± 0.03	ND	0.29 ± 0.06	ND	0.01
23S-99-1803 @ 18"	0.06 ± 0.05	ND	0.13 ± 0.11	ND	<0.01
23S-99-1803 @ 24"	0.30 ± 0.07	0.08 ± 0.07	0.63 ± 0.15	ND	0.03
23S-99-1803 @ 30"	ND	ND	ND	ND	0.00
23S-99-1803 @ 36"	ND	ND	ND	ND	0.00
23S-99-1803 @ 42"	ND	ND	ND	ND	0.00
23S-99-1803 @ 48"	ND	ND	ND	ND	0.00
23S-99-1803 @ 54"	ND	ND	ND	ND	0.00
23S-99-1803 @ 60"	ND	ND	ND	ND	0.00
23S-99-1803 @ 66"	ND	ND	ND	ND	0.00
23S-99-1803 @ 72"	ND	ND	ND	ND	0.00
23S-99-1804 @ 6"	0.88 ± 0.03	0.16 ± 0.08	1.85 ± 0.06	ND	0.08
23S-99-1804 @ 12"	0.59 ± 0.07	0.20 ± 0.07	1.24 ± 0.15	ND	0.07
23S-99-1804 @ 18"	0.24 ± 0.06	0.09 ± 0.06	0.50 ± 0.13	ND	0.03
23S-99-1804 @ 24"	0.10 ±0.06	ND	0.21 ± 0.13	ND	<0.01
23S-99-1804 @ 30"	0.02 ± 0.01	0.06 ± 0.05	0.04 ± 0.02	ND	<0.01
23S-99-1804 @ 36"	ND	ND	ND	ND	0.00
23S-99-1804 @ 42"	ND	ND	ND	ND	0.00
23S-99-1804 @ 48"	ND	ND	ND	ND	0.00
23S-99-1804 @ 54"	ND	ND	ND	ND	0.00
23S-99-1804 @ 60"	ND	ND	ND	ND	0.00
23S-99-1804 @ 66"	ND	ND	ND	ND	0.00
23S-99-1804 @ 72"	ND	ND	ND	ND	0.00
Nominal Background	0.07	ND	ND	ND	

Notes:
(1) Nominal background (0.07 pCi/g) subtracted for ^{137}Cs.
(2) ^{90}Sr values are calculated values using the measured ^{90}Sr to ^{137}Cs ratio of 2.1:1.0.
(3) ND means Not Detectable, Background, or below Minimum Detectable Activity.
(4) ^{238}U, ^{235}U, ^{232}Th, and ^{228}Th were at, or below, natural background in clay.

Table 4: Hot Cell Site Storm Drain Soil Sample Gamma Spectroscopy Results

	Radionuclide Concentrations (pCi/g) *Background not subtracted*					
Sample ID	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{238}U**	**^{90}Sr$^{(1)}$**	**$\sum$ of Fractions**
23O-99-351	0.77 ± 0.14	0.53 ± 0.15	ND$^{(2)}$	ND	1.62 ±0.29	0.12
23O-99-352	1.16 ± 0.15	0.21 ± 0.08	0.06 ± 0.05	3.24 ± 1.41	2.44 ± 0.32	0.22
23O-99-353	1.09 ± 0.18	ND	ND	ND	2.29 ± 0.38	0.07
23O-99-354	1.00 ± 0.14	0.14 ± 0.11	0.07 ± 0.07	ND	2.10 ± 0.29	0.09
Nominal Background	0.07	ND	ND	2.10	ND	

Notes: 1. ^{90}Sr calculated by ^{90}Sr to ^{137}Cs ratio of 2.1:1

2. ND means Not Detectable, Background, or below Minimum Detectable Activity

Table 5: Gross Alpha/Gross Beta Results on Soil Samples from GA's Hot Cell Site

Sample #	Sample ID	Radionuclide Concentrations (pCi/g)	
		Gross alpha	Gross Beta
1	23S-99-5111	3.1 ± 0.8	17.2 ± 0.8
2	23S-99-5115	6.3 ± 1.1	20.1 ± 0.9
3	23S-99-5123	6.4 ± 1.0	19.7 ± 0.8
4	23S-99-5126	4.4 ± 0.8	15.6 ± 0.7
5	23S-99-5127	4.3 ± 0.8	14.8 ± 0.7
6	23S-99-5128	2.9 ± 0.9	19.1 ± 0.9
7	23S-99-5129	3.1 ± 0.6	13.0 ± 0.6
8	23S-99-5132	3.5 ± 0.8	15.7 0.7
9	23S-99-5152	1.8 ± 0.6	15.9 ± 0.8
10	23S-99-5157	2.4 ± 0.8	18.0 ± 0.9
11	23S-99-5161	7.5 ± 1.2	23.5 ± 1.0
12	23S-99-5182	4.4 ± 0.8	17.6 ± 0.7
13	23S-99-5189	7.5 ± 1.2	19.4 ± 0.9
14	23S-99-5210	4.6 ± 1.0	20.3 ± 0.9
15	23S-99-5212	4.5 ± 1.0	29.0 ± 1.1
16	23S-99-5213	6.7 ± 1.1	23.5 ± 0.9
17	23S-90-5225	5.7 ± 1.0	21.3 ± 0.9
18	23S-99-5227	9.0 ± 1.4	26.9±1.1
19	23S-99-5230	4.6 ± 0.9	19.7 ± 0.8
20	23S-99-5231	3.8 ± 0.9	19.8 ± 0.9
21	23S-99-5239	4.8 ± 1.0	26.4 ± 1.0

Table 5: Gross Alpha/Gross Beta Results on Soil Samples from GA's Hot Cell Site

Sample #	Sample ID	Radionuclide Concentrations (pCi/g)	
		Gross alpha	Gross Beta
22	23S-99-5241	5.5 ± 0.8	18.7 ± 0.7
23	23S-99-5247	5.8 ± 1.2	26.9 ± 1.2
24	23S-99-5248	4.2 ± 1.1	24.5 ± 1.2
25	23S-99-5250	3.2 ± 0.9	18.3 ± 0.9
26	23S-99-5257	3.4 ± 0.8	16.5 ± 0.8
27	23S-99-5259	5.1 ± 1.0	21.6 ± 0.9
28	23S-99-5260	2.5 ± 0.7	17.5 ± 0.8
29	23S-99-5265	3.6 ± 0.7	13.6 ± 0.6
30	23S-99-5269	7.2 ± 1.2	23.0 ± 1.0
31	23S-99-5272	3.7 ± 0.9	21.6 ± 1.0
32	23S-99-5273	4.0 ± 1.3	27.0 ± 1.4
33	23S-99-5283	4.2 ± 0.9	19.2 ± 0.9
34	23S-90-1759 @ -48" (core)	9.0 ± 1.5	27.0 ± 1.2
35	23S-99-1765 @ -30" (core)	11.0 ± 1.5	27.8 ± 1.1

Figure 1: Main Site and Sorrento Valley Site

PC-000495/0

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

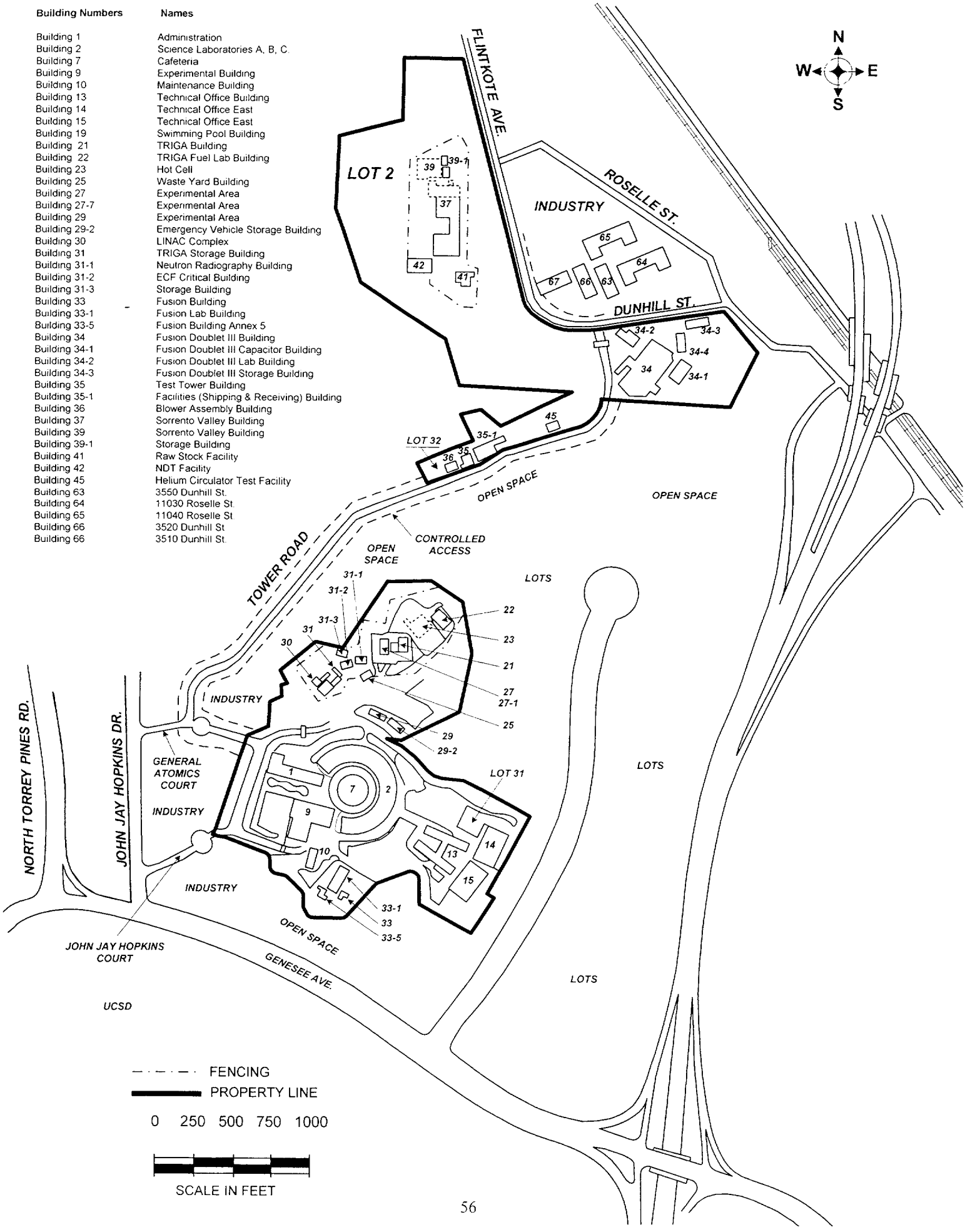


Figure 2: Relationship Between Building 27-1, 27, 21, 23 and 22

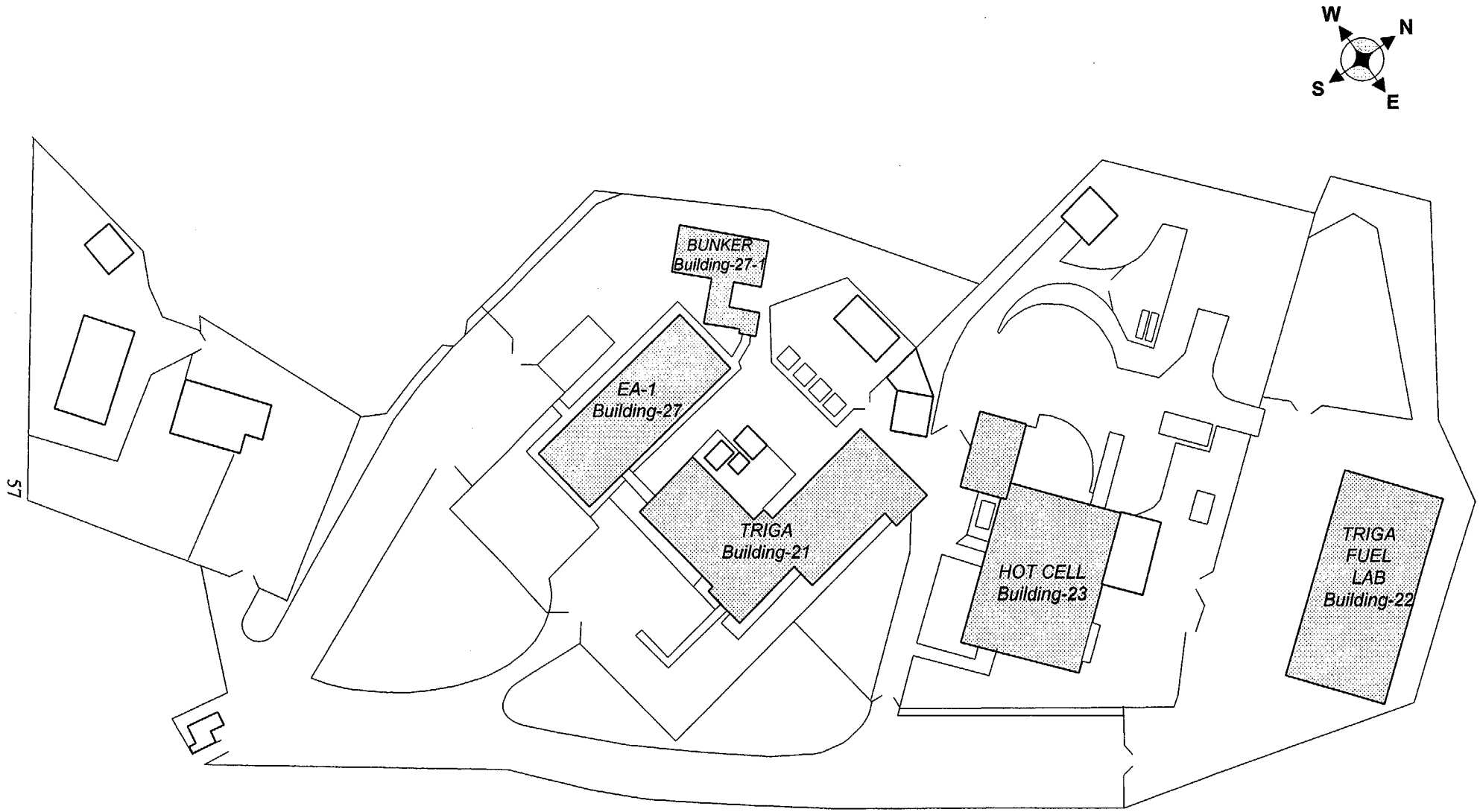


Figure 3: Hot Cell Site Area

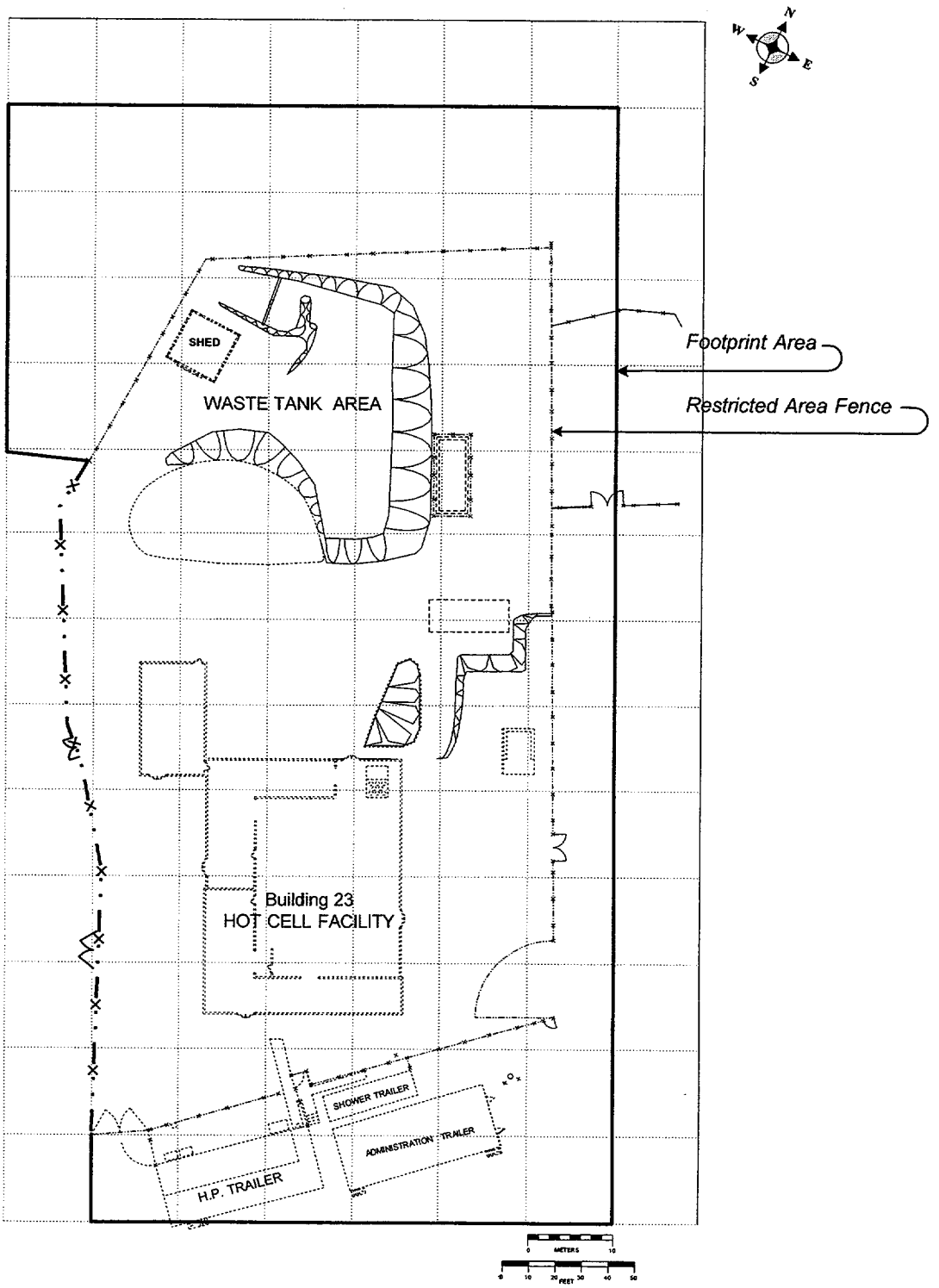
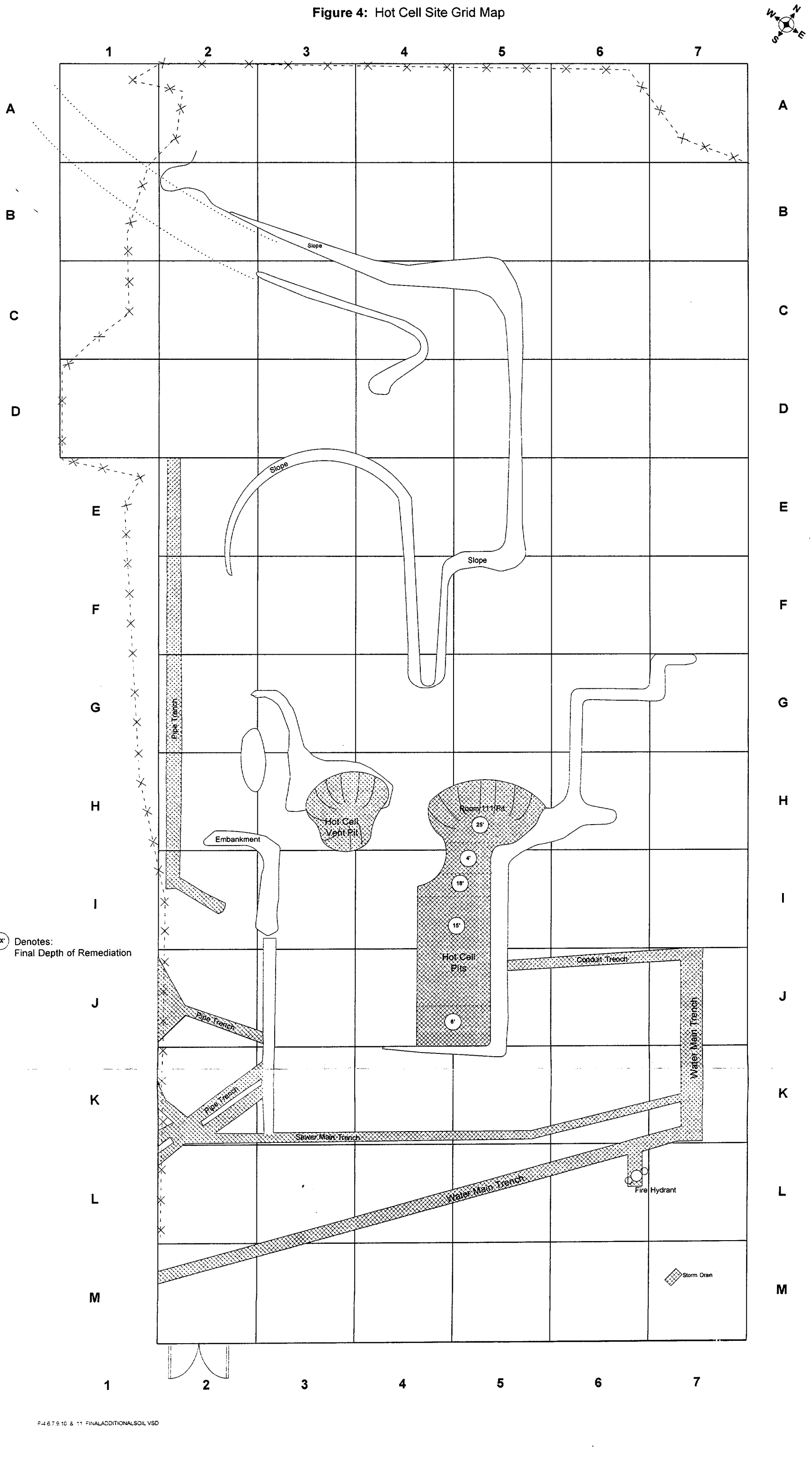


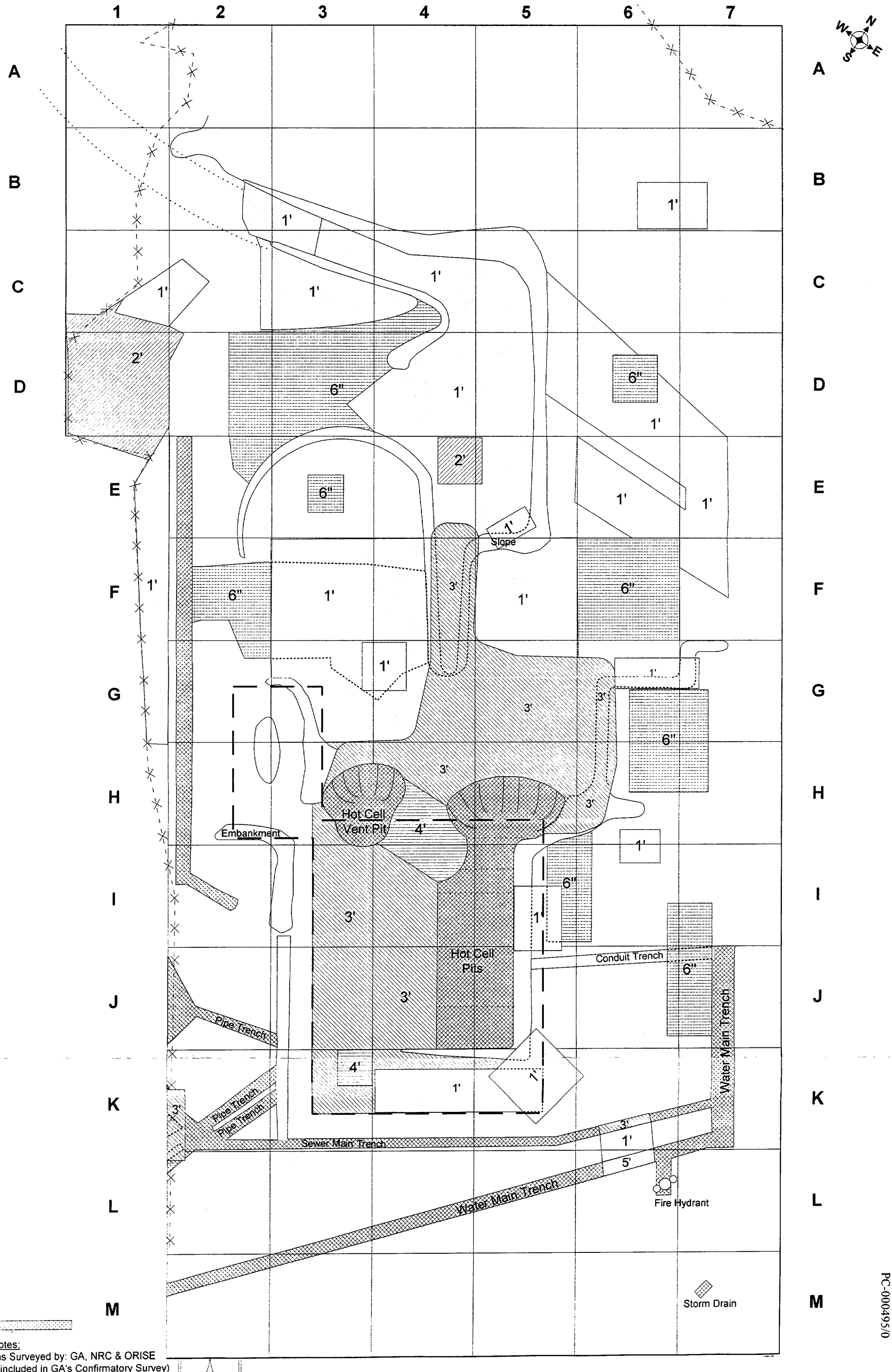
Figure 4: Hot Cell Site Grid Map



FILENAME

F-4 6,7 9,10 & 11 FINALADDITIONALSOIL VSD

Figure 5: Hot Cell Site Remediation



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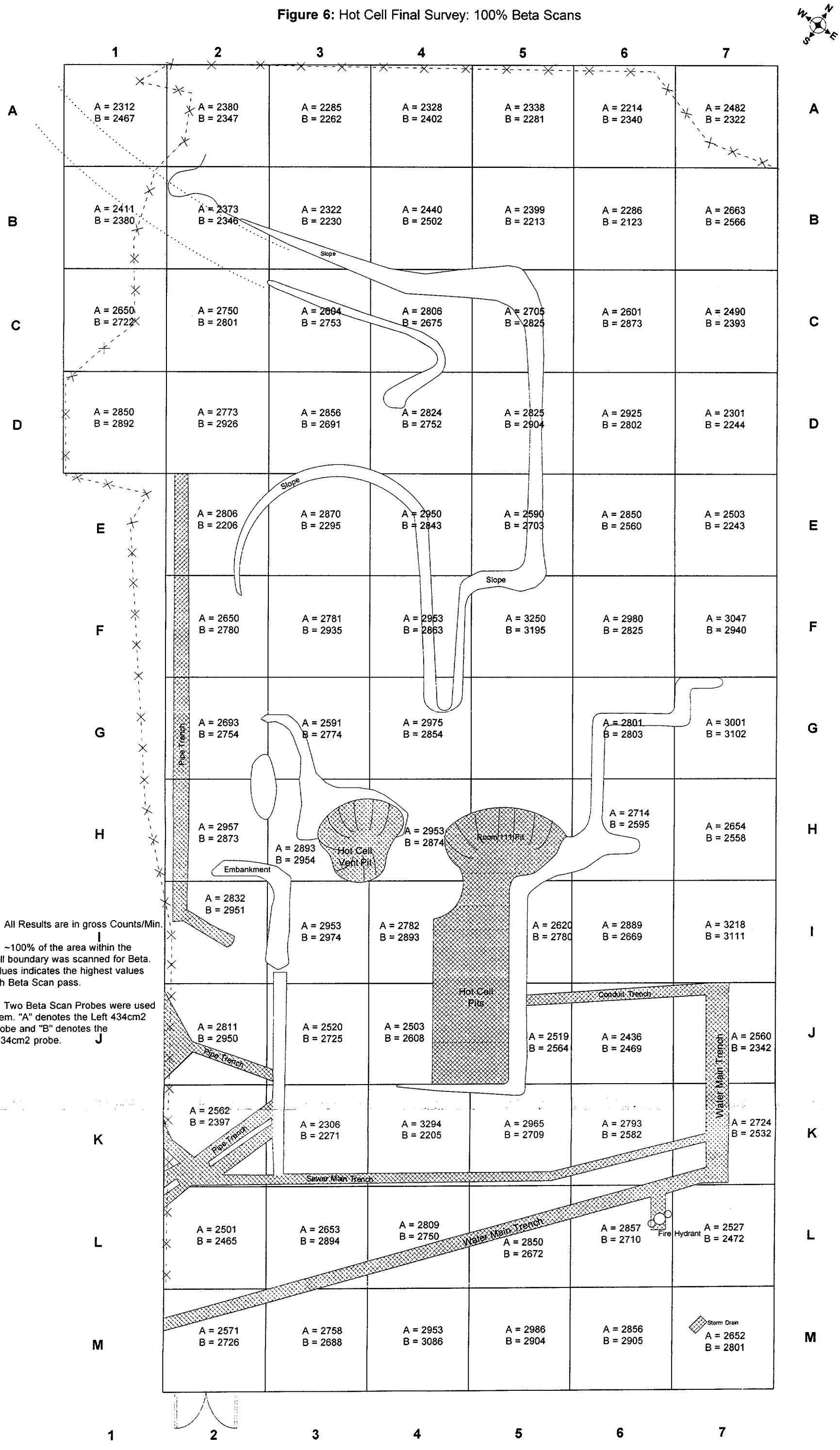
FULL FILENAME

E:\A GA BUILDINGS B-23 HOT CELL FACILITY\HC REMEDIATION FIG 1-4\BILLS\F-5 GA INTERNAL CONFIRMATORY SOIL.VSD

Figure 6: Hot Cell Final Survey: 100% Beta Scans



Notes:

1. All Results are in gross Counts/Min.

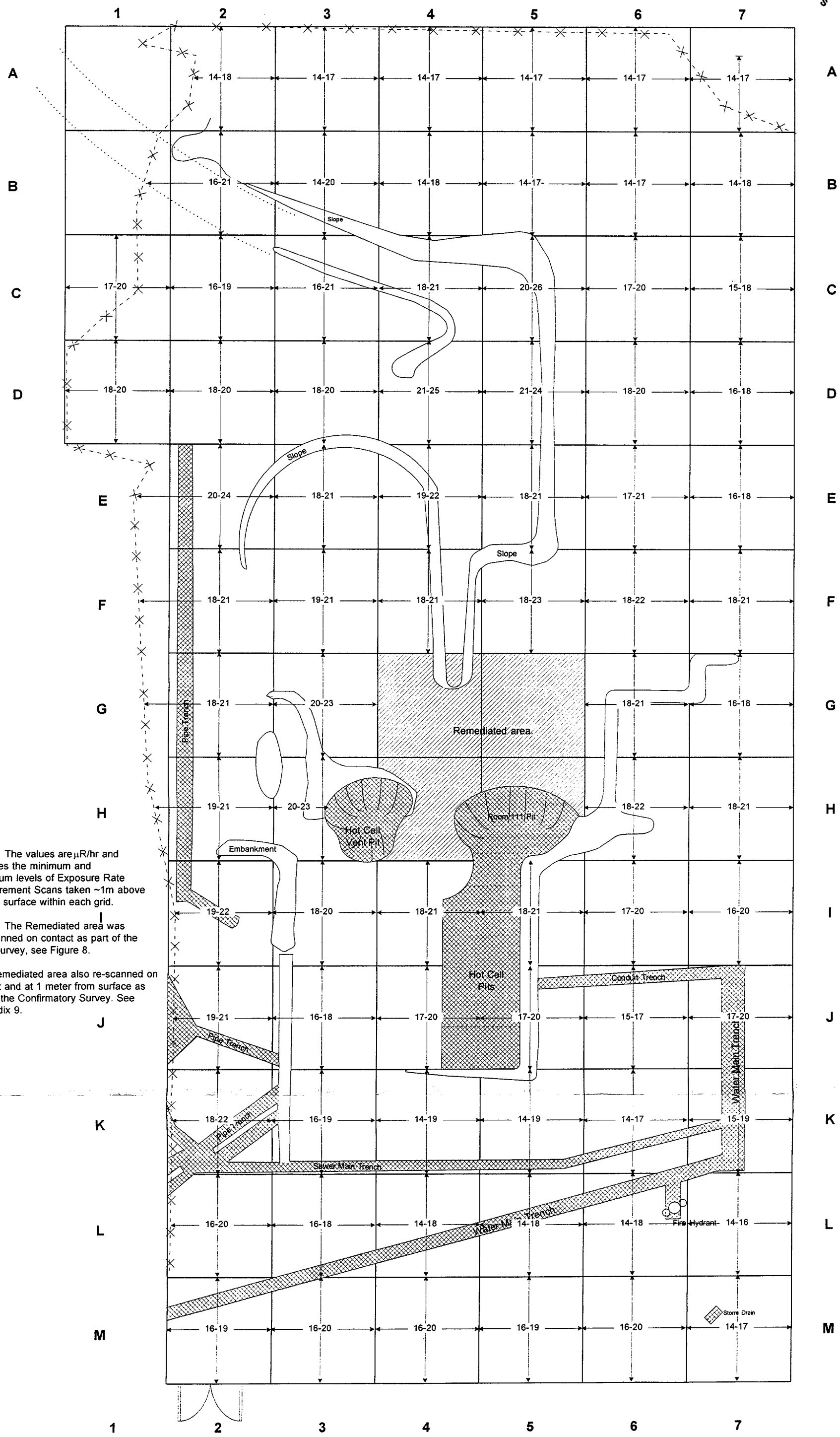
2. ~100% of the area within the Hot Cell boundary was scanned for Beta. The values indicates the highest values for each Beta Scan pass.

3. Two Beta Scan Probes were used in tandem. "A" denotes the Left 434cm2 beta probe and "B" denotes the Right 434cm2 probe.

FILENAME

F:\4 6 7 9 10 & 11 FINALADDITIONALSOIL VSD

Figure 7: Hot Cell Final Survey: Exposure Rate Measurement 100% Scans at 1 meter above surface



Notes:

1. The values are μR/hr and indicates the minimum and maximum levels of Exposure Rate Measurement Scans taken ~1m above ground surface within each grid.

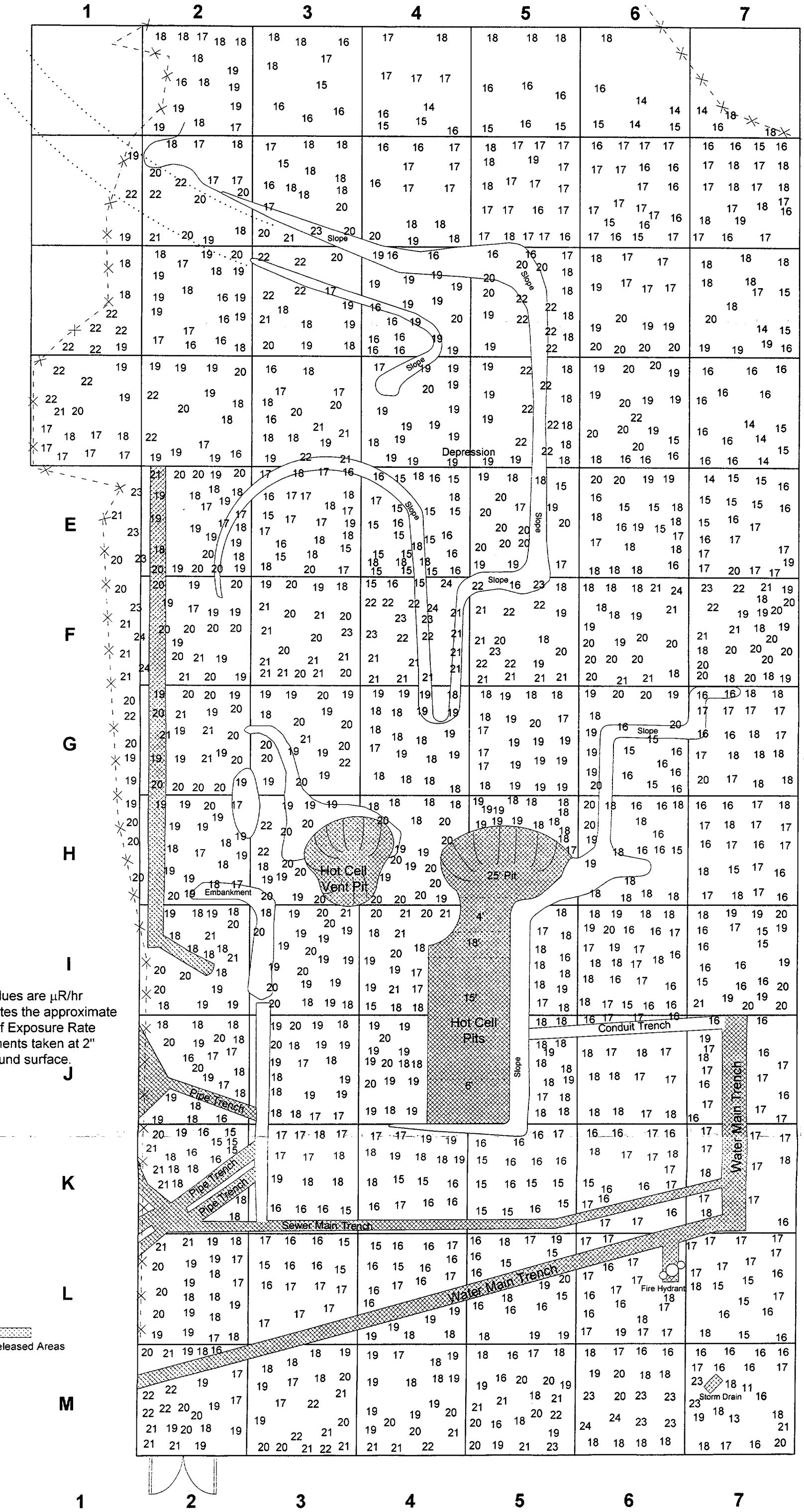
2. The Remediated area was Re-scanned on contact as part of the Final Survey, see Figure 8.

The Remediated area also re-scanned on contact and at 1 meter from surface as part of the Confirmatory Survey. See Appendix 9.

FILENAME

F-4,6,7,9,10 & 11 FINALADDITIONALSOIL.VSD

Figure 8: Hot Cell Final Survey: 100% Scan Results of Exposure Rate Measurements at ~2 inches above surface



Note:

1. The values are μR/hr and indicates the approximate location of Exposure Rate Measurements taken at 2" above ground surface.

Denotes: Released Areas

63

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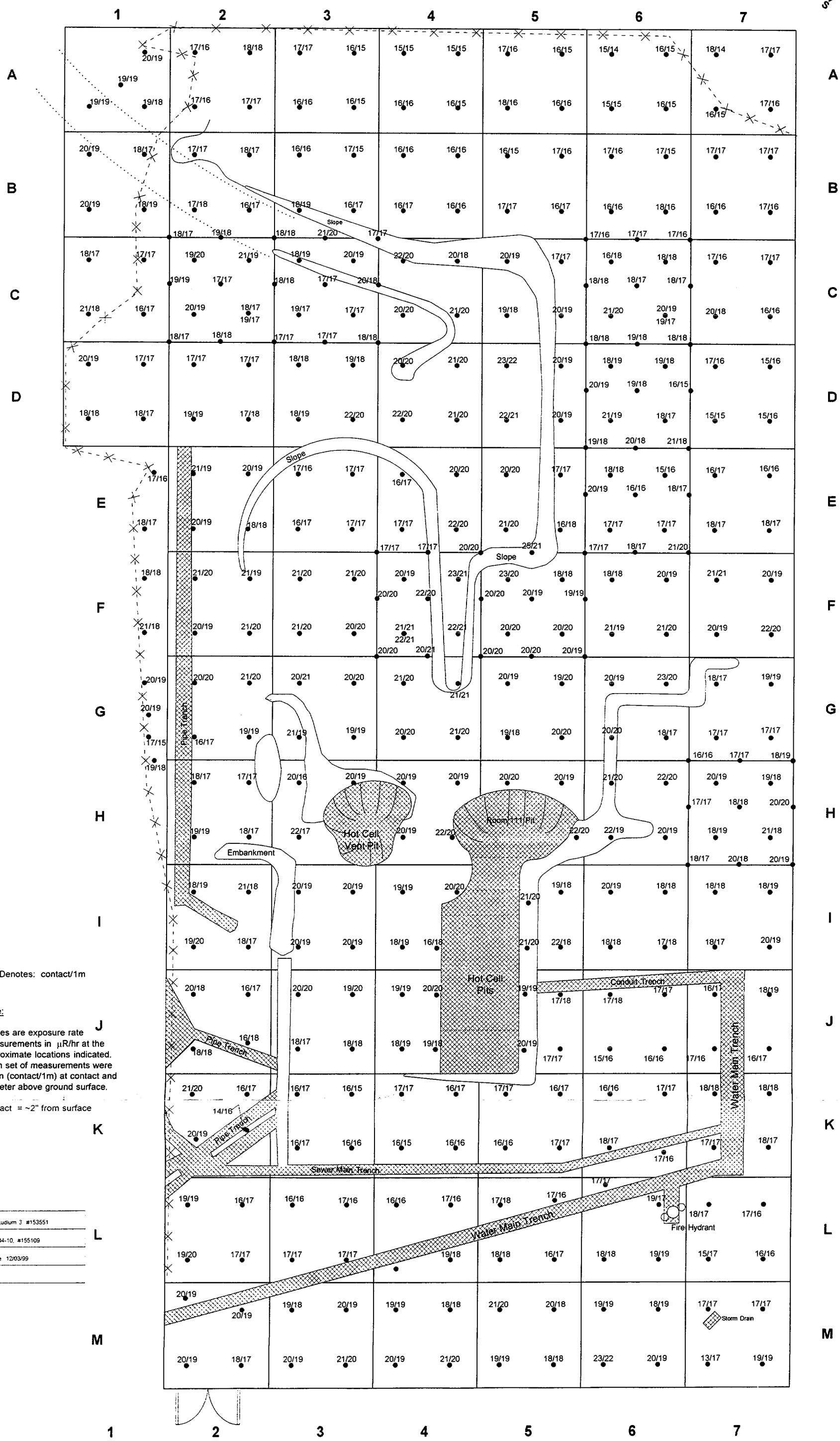
E:\AGA BUILDINGS\B-23 HOT CELL FACILITY\HC REMEDIATION FIG 1-4\BILLS-F-8 MICRORSURVEY AT CONTACT.VSD

Figure 9: Hot Cell: Final Survey. Results of Exposure Rate Measurements at Soil Sample Locations



XX/XX Denotes: contact/1m

Note:

Values are exposure rate measurements in μR/hr at the approximate locations indicated. Each set of measurements were taken (contact/1m) at contact and ~1meter above ground surface.

Contact = ~2" from surface

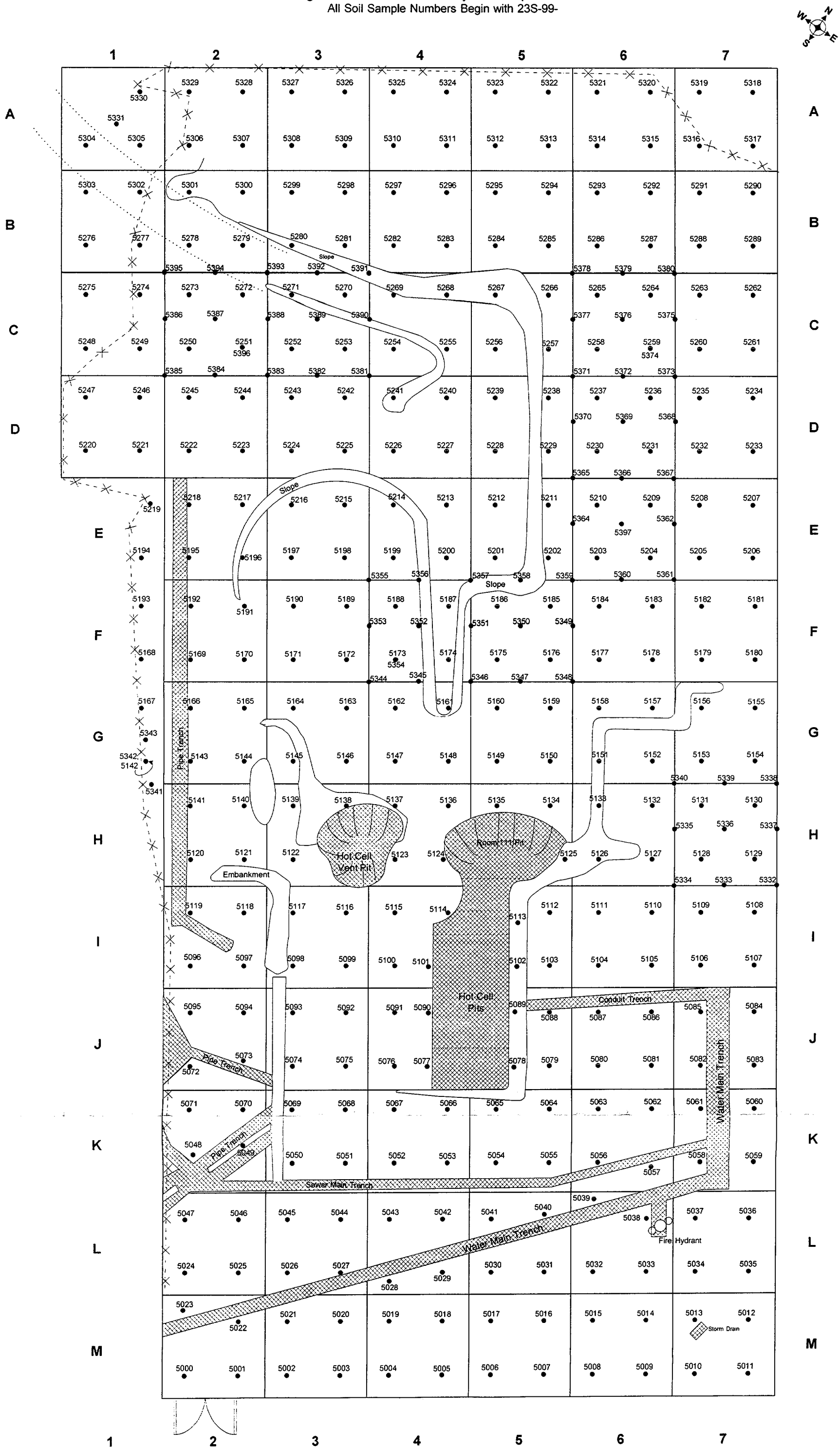
Meter Ludium 3 #153551
Probe 44-10, #155109
Cal Due 12/03/99

FILENAME

F-4 6,7,9,10 & 11 FINALADDITIONALSOIL.VSD

PC-0004950

Figure 10: Hot Cell: Final Survey: Soil Sample Locations
All Soil Sample Numbers Begin with 23S-99-

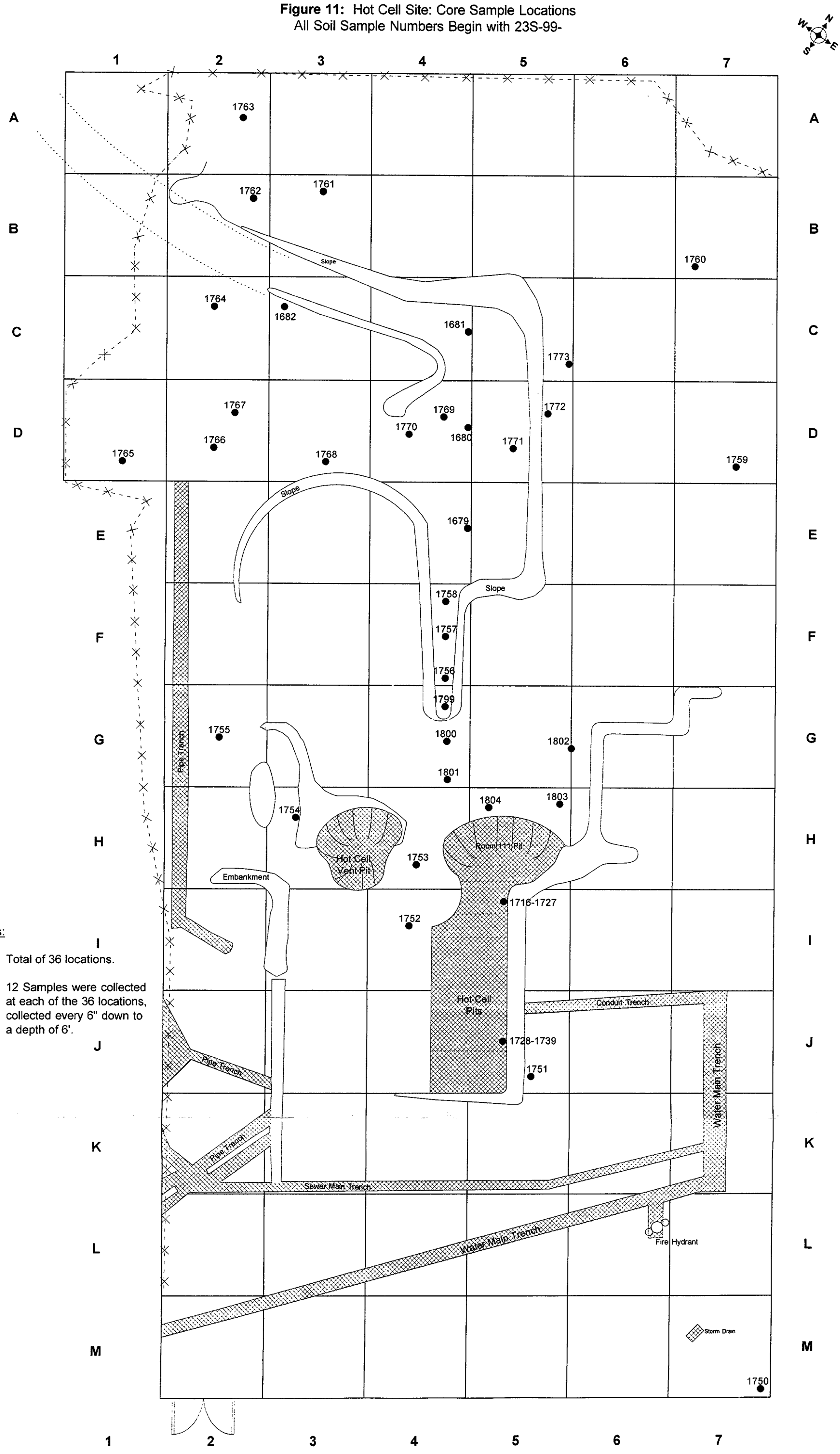


FILENAME

F-4 6 7 9 10 & 11 FINALADDITIONALSOIL VSD

PC-0004950

Figure 11: Hot Cell Site: Core Sample Locations
All Soil Sample Numbers Begin with 23S-99-



Notes:

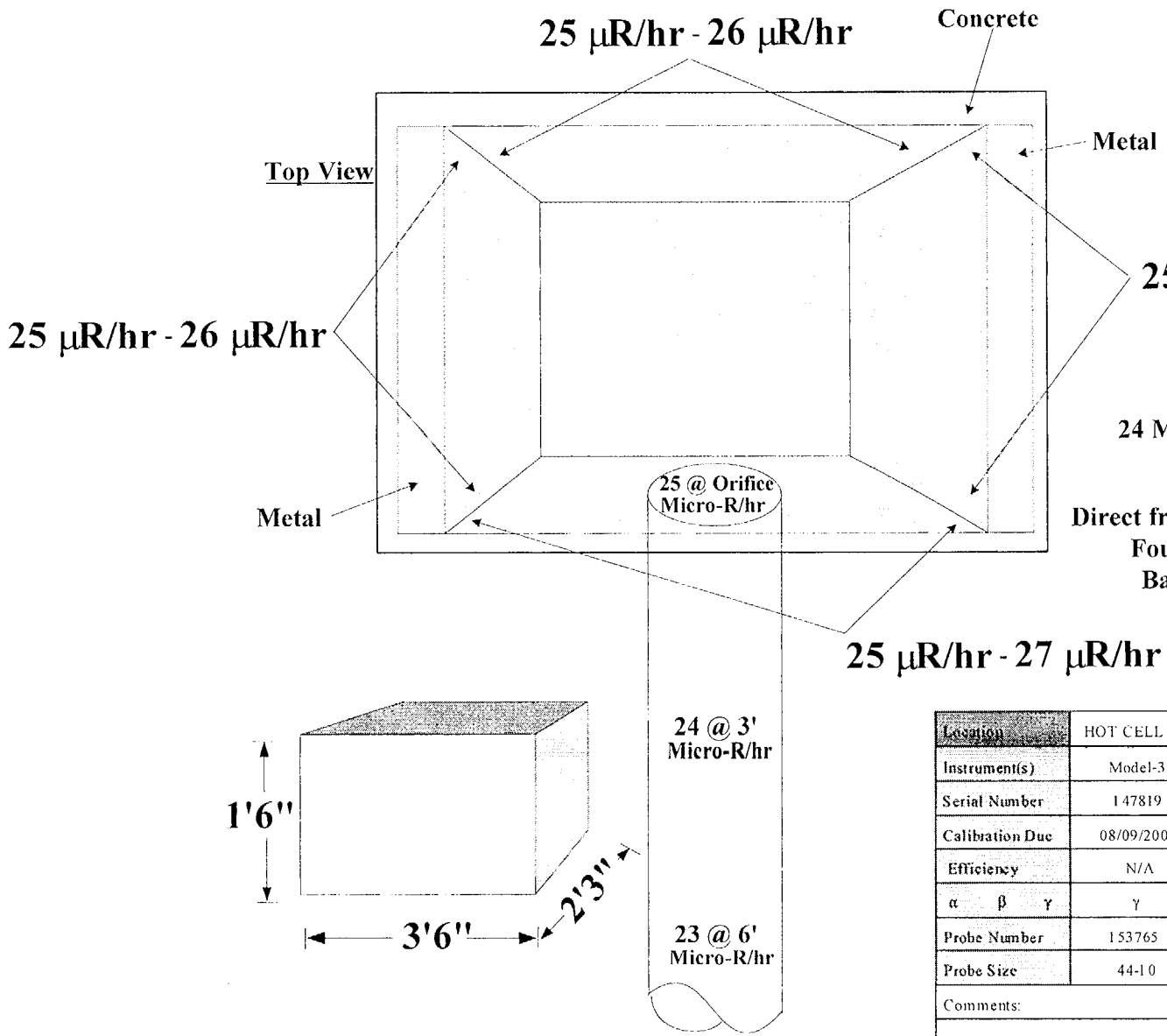
1. Total of 36 locations.

2. 12 Samples were collected at each of the 36 locations, collected every 6" down to a depth of 6'.

FILENAME

F-4.6.7.9.10 & 11 FINALADDITIONALSOIL.VSD

Figure 12: HOTCELL STORM DRAIN



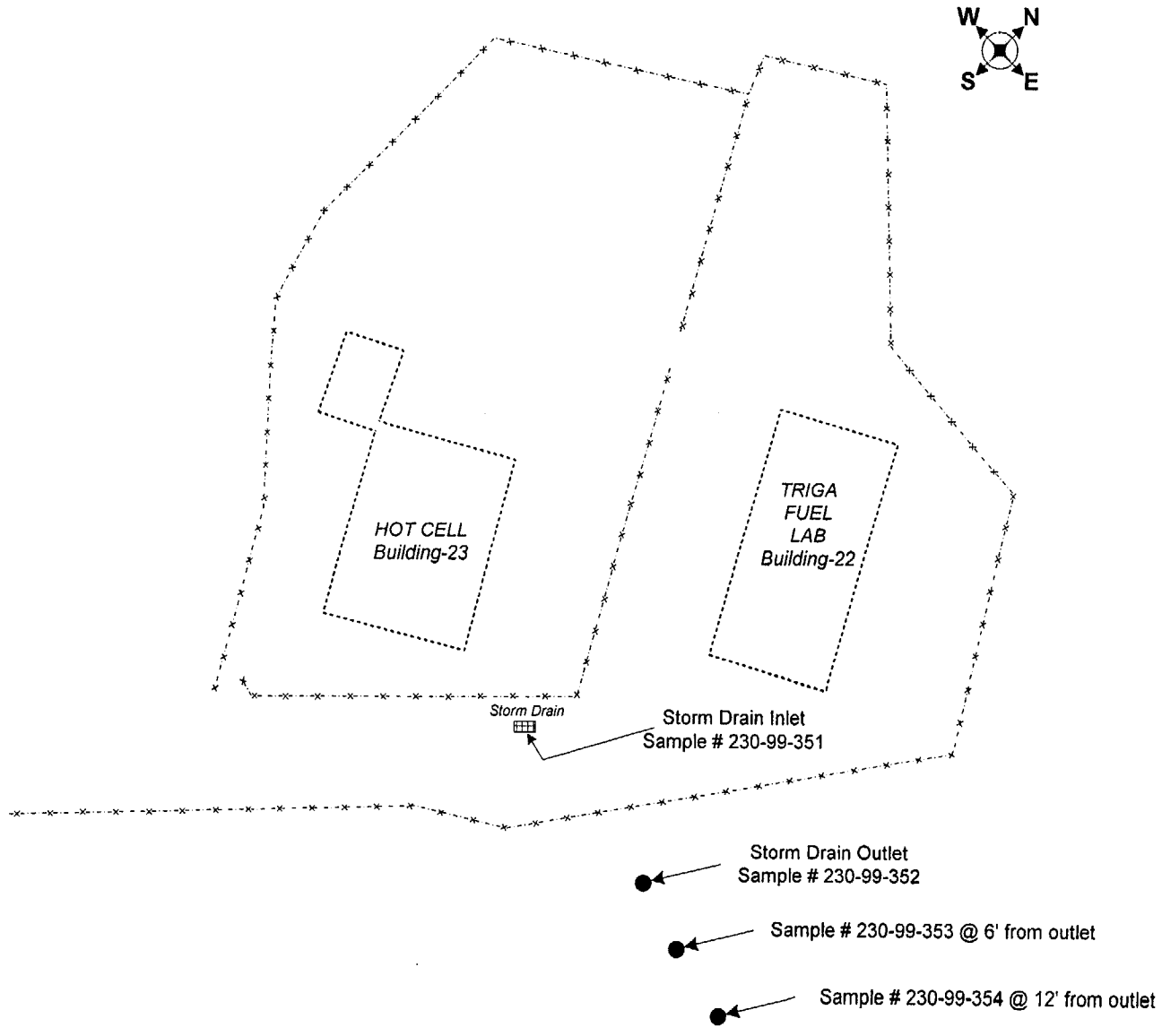
24 Micro-R per hour @ center of pit

Direct frisk of the Storm Drain with a 15cm² Model-3
Found no activity above Background level.
Background for the Model-3 was 80cpm.

All readings recorded in µR/hr (on surface of concrete)

Location	HOT CELL STORM DRAIN			
Instrument(s)	Model-3	Model-3	N/A	N/A
Serial Number	147819	99410	N/A	N/A
Calibration Due	08/09/2000	05/01/2000	N/A	N/A
Efficiency	N/A	21.25%	N/A	N/A
α β γ	γ	β	N/A	N/A
Probe Number	153765	117842	N/A	N/A
Probe Size	44-10	15cm²	N/A	N/A
Comments:				
Signature: C. Stanley			Date: 02/29/2000	

Figure 13: Hot Cell Storm Drain: Sample Locations



Appendix 1

of

General Atomics' Final Radiological Survey Report for the Hot Cell Site

"Revised Final Survey Plan (5/99) For General Atomics' Hot Cell Facility Area" dated May 25, 1999"

Revised Final Survey Plan (5/99)
For
General Atomics'
Hot Cell Facility Area

Prepared By: William T. LaBonte — Date: 5/25/99
William T. LaBonte, Health Physicist

Approved By: Laura Q. Gonzales — Date: 5/25/99
Laura Q. Gonzales, Health Physics Manager

Approved By: G C Bramblett — Date: 5/26/99
George C. Bramblett, Manager
Hot Cell Decommissioning Project

Approved By: Keith E. Asmussen — Date: 5/26/99
Keith E. Asmussen, Director
Licensing, Safety and Nuclear Compliance

1.0 **Objective**

The objective of the Final Radiological Survey Plan is to provide a plan, which after implementation, will demonstrate that the radiological conditions of General Atomics' (GA's) "Hot Cell Facility Area" meets the NRC and State of California approved criteria for release to unrestricted use. The "Hot Cell Facility Area" includes GA's Building 23 (the Hot Cell Facility), a fenced Hot Cell outside yard and a "footprint" around the fenced yard as shown in Figure 1.

This final radiological survey plan was prepared taking advantage of additional knowledge obtained during the actual decontamination and dismantlement phases of GA's Hot Cell Facility (HCF) decommissioning effort, and therefore represents a more focused and situation specific plan than that discussed in GA's Hot Cell Facility Decommissioning Plan (Document No. PC-000423, latest revision dated January 1998). This plan incorporates the necessary and appropriate criteria from Chapter 4, "Planned Final Radiation Survey", of the HCF Decommissioning Plan for a complete stand alone final survey document. Accordingly, this plan supersedes Chapter 4 in specifying how compliance with the release criteria will be demonstrated.

2.0 **Site Condition at Time of Final Radiological Survey**

Prior to the start of the Final Radiological Survey, (1) all building structures and support utilities will have been dismantled and removed, (2) all underground piping systems, drain lines, support utilities, storage wells and tanks associated with the Hot Cell Facility (HCF) will have been excavated and removed, and (3) all ground coverings, such as asphalt paving or concrete walkways and slabs will have been surveyed, removed and disposed of appropriately. One underground sewer line that traverses the HCF Restricted Area that was never connected to the HCF remains in place. In addition, there are underground sewer lines, fire hydrant piping, storm drains and electrical supply lines traversing a portion of the HCF survey "footprint" outside of, and South of, the HCF Restricted Area that were never associated with the HCF.

Any pits resulting from removal of structures will have been surveyed and the soil sampled prior to back-filling in accordance with a specific Survey Plan. In every instance, the survey will demonstrate that the residual soil and/or fill soil meet the criteria for unrestricted use. *The only surface remaining will be soil which will be surveyed and sampled in accordance with this Plan.*

3.0 **Background Information**

In support of GA's efforts involving predominantly government funded nuclear research and development (R&D), General Atomics (GA) continuously maintained a fully operational Hot Cell Facility (HCF) for over 30 years. Built in 1958 as a heavily

shielded remote-handling laboratory, the Facility supported a wide variety of radiological and investigative operations.

The HCF contained three shielded cells, the High Level Cell (HLC), the Low Level Cell (LLC), and the Metallography Cell. The HLC was used to perform destructive post-irradiation examinations on fuels and structural materials. The LLC served as the staging area for samples being transferred into and out of the HLC. The Metallography Cell was used to prepare irradiated fuel and metal samples (i.e., grinding) for use with the metallograph.

The hot cells were used to perform post-irradiation examinations on fuels, structural materials, and instrumentation for dosimetry. Most of the projects involved examination of irradiated fuel and graphite for High Temperature Gas-Cooled Reactors.

The HCF yard and the service gallery had been used for cask handling and cask maintenance activities, and for waste consolidation, packaging, and characterization (e.g., weighing, gamma scanning).

During Decommissioning activities, the HCF was completely dismantled. A substantial portion of the building was disposed of as radioactive waste, including the Cells Manipulator Repair room and Machine shop. All support equipment associated with the HCF, such as underground tanks, wells, and piping systems were excavated and disposed of as appropriate.

Portions of the building which were not directly involved in the handling of radioactive materials, such as the Office Rooms, Change Rooms, Rest Rooms, were dismantled, surveyed and released to unrestricted use. The NRC and State were notified of GA's intent to dispose of these portions for unrestricted use; and the NRC performed confirmatory surveys of portions of the structural materials.

Characterization surveys conducted on the accessible soil surfaces prior to the decommissioning efforts indicated wide spread, low levels of contamination within the Hot Cell Facility Area. The predominant radionuclides, as detected by gamma spectroscopy, were Cs-137, and Co-60 and Cs-134.

4.0 Classification

The entire "Hot Cell Facility Area" has been classified as an "Affected area" based on historical knowledge and characterization results and will be surveyed accordingly.

5.0 Release Criteria (per GA's NRC- and State- approved Hot Cell Decommissioning Plan)

5.1 Soil Release Criteria

The soil release criteria to be used are provided in Table 1. Based on historical

knowledge, characterization survey data, and soil samples taken to date, the predominant contaminants likely to be in the soil within the Hot Cell Facility Area are Cs-137 and Co-60. The release criteria provided in Table 1 for these radionuclides have been approved for the GA site since 1985 and applied to many GA Decommissioning Projects. Cs-134, Sr-90 and to a lesser extent other radionuclides noted on the table may also be detected in the soil.

Table 1: Soil and Concrete/Asphalt Rubble Release Criteria [1]

Radionuclide [4]	Release Criteria Based on External Exposure Limits, in pCi/g	Release Criteria Based on Internal Exposure Limits, in pCi/g
Co-60	8 [2]	
Cs-137	15 [2]	
Cs-134	10	
Eu-152	11	
Eu-154	10	
Eu-155	635	
Nb-94	7.5	
Sb-125	37	
Sr-90		1800 [2]
Natural Uranium		35 [3]
Enriched Uranium (U-235 & U-234)		30 [3]
Thorium (Th-232 & Th-228)		10 [3]

1 The release criteria shown in this table without annotation by footnotes 2 or 3 were calculated by the licensee using RESRAD version 5.18 adhering to the same assumptions that were provided in the correspondence listed in note 2 below. This corresponds to conservative calculation of the homogenous concentration of an isotope in the soil that by itself would give approximately 10 μR/hr external exposure rate above background for the maximum year of exposure.

2 These release criteria are based upon precedent through NRC and State of California approved release limits for the GA site. See correspondence K. E. Asmussen to W. T. Crow, dated October 1, 1985, correspondence identification 696-8023, Subject: "Docket 70-734: Plan for Obtaining Release of Certain Areas to Unrestricted Use."

3 These release criteria are based on past precedent established by NRC through NRC Policy Issue SECY-81-576, dated October 5, 1981, Subject "Disposal or on-site storage of residual thorium or uranium (either as natural ores or without daughters present) from past operations."

4 If additional nuclides are encountered during the Final Survey activities, values identified in the previously approved GA Hot Cell Facility Decommissioning Plan and the GA Site Decommissioning Plan will be used.

In situations where more than one isotope is detected in the soil, determination of conformance to release criteria will be made according to the following method for the mixture:

$$C_1 / G_1 + C_2 / G_2 + ... + C_n / G_n \leq 1$$

Where:

$C_1, C_{2,...n}$ is the concentration of nuclide 1, 2, ...n in the soil above background values
$G_1, G_{2,...n}$ is the release criteria of nuclide 1, 2, ...n

It is GA's intent to remediate areas containing elevated activity levels in the soil. However, in the event that reasonable efforts have been made and soil concentrations continue to remain elevated, GA may apply the criteria described in section 2.2 and section 8.0 of the manual referenced below[1] to determine compliance. Section 2.2 and section 8.0 of the manual specifies that areas of residual activity exceeding the guideline value, known as "elevated" areas, are acceptable, provided they do not exceed the guideline value by greater than a factor of $(100/A)^{½}$, where A is the area of residual activity in m^2, and provided the activity level at any location does not exceed *three times the guideline values*. In addition, radionuclide concentrations will be averaged to demonstrate the average is at or below guideline values, established as acceptable to NRC. Averaging will be based on a 100 m^2 (10 m x 10 m) grid.

GA may apply the release criteria in Table 1 to evaluations of representative samples of asphalt, concrete, or other similar construction media that have been reduced to rubble.

5.2 Exposure Rate Criteria

The release criteria for direct gamma scans is 10 μR/hr above background measured at 1m from the surface. Typically a background exposure rate of 15 μR/hr measured at 1 m above the ground surface is measured in unaffected areas using a microR meter.

For open land areas, exposure rates (measured at 1 m above the surface) can be averaged over 100 m^2 grid areas. The maximum exposure rates over any discrete area may not exceed two times the limit above background in accordance with section 2.2 and section 8.0 of the manual referenced below[1]. It is GA's intent to remediate all areas where microR readings exceed 10 microR/hr at 1 m above the surface. However, in the event that reasonable efforts have been made and measurements continue to remain elevated, GA may apply the criteria described above to determine compliance.

[1] Manual for Conducting Radiological Surveys in Support of License Termination (Draft for Comment), NUREG/CR-5849, ORAU-92/C57, Oak Ridge Associated Universities, June 1992.

6.0 Measurements for Demonstrating Compliance with Release Criteria

6.1 Background Concentrations

The soil release criteria are concentrations above natural background concentrations. Typical background concentrations for various types of media are provided below:

Typical soil concentrations are provided in the table below which represent the average results of seventeen (17) surface soil samples and ten (10) concrete samples collected in undisturbed areas from off site locations in the region surrounding the GA site.

Media Type	Cs-137 (pCi/g)	U-238 (pCi/g)	U-235 (pCi/g)	Th-232 (pCi/g)
Soil	0.21 ± 0.20	1.26 ± 0.78	0.08 ± 0.04	1.72 ± 0.92
Concrete	0.04 ±0.02	4.27 ±0.63	0.12 ± 0.03	3.62 ±0.24

6.2 Surface Soil Samples

Scanning (along the surface of the soil) will be performed to identify locations of elevated activity levels. Areas of suspected activity, identified by scanning or visual inspection, will be evaluated to determine their activity levels and the extent of contamination. Cleanup will be performed, as required, and the scanning repeated until remediation is accomplished as demonstrated by additional soil sampling, analysis and comparisons with the guidelines.

After scanning and remediation of known contaminated areas, grids will be established for the purpose of referencing the locations of samples and measurements taken during implementation of this final survey plan. The 10 m x 10 m grid system to be used is shown in Figure 2.

Systematic surface (0-6") soil sampling will be performed within each grid at locations approximately equidistant between the center and each of the four grid block corners (see Figure 2A). The grid locations include sampling from underneath the previous Hot Cell Facility concrete pad and the outside storage yard within the radiation restricted area fence and in the area surrounding the restricted area. Approximately 328 soil samples will be collected.

Additional remediation (and subsequent sampling) will be conducted if the release criteria are not met. In addition, if (1) radionuclide concentrations exceed the release criteria in any of the four samples collected *or* (2) elevated radiation levels are detected during the scan, then the 10 m grid will be further subdivided as shown in Figure 2B.

Biased samples will also be collected from underneath former concrete slabs where the

soil appears affected; i.e., discolored, odiferous or otherwise abnormal or suspected of contamination.

6.3 Subsurface Soil Samples

Remediation of soil, if necessary, will continue to a depth required to reduce the concentrations to levels below the release criteria. A final sample(s) after remediation will demonstrate that residual activity is below the release criteria.

Subsurface samples may be collected to a depth of one (1) to three (3) feet or more; depending on the potential for contamination. Subsurface samples will be collected in biased locations and will include: 1) each location (larger than 5 m^2) where soil contamination above the guidelines was discovered and remediated and 2) any location where exposure rate measurements exceed the radiation exposure limit. These measurements will be made using a microR meter or NaI (Tl) detector/ratemeter.

In addition, subsurface soil samples (to a minimum depth of 3 feet) will be collected in 25 locations shown in Figure 3 (if subsurface samples were not already collected due to the above criteria). Historical data indicates a potential for subsurface contamination in these locations.

Subsurface samples may also be collected in other suspect locations, if warranted by exposure rate measurements or remediation efforts.

6.4 Soil Samples Underneath Drain Lines and Underground Ventilation Ducts

When collecting samples from underneath the drain lines (in the trenches created during removal of the drain line), biased samples will be collected as follows:

1) Soil samples will be collected from underneath and around any drain lines which appear broken, corroded or otherwise deteriorated.

2) Soil samples will be collected whenever exposure rates are elevated (measured using microR meters and/or NaI (Tl) detectors/ratemeters).

3) Soil samples will be collected if the soil appears affected, i.e., discolored, odiferous or otherwise abnormal.

In addition, systematic samples will be collected approximately every 5 m (about every 15 feet) from underneath former drain lines.

In cases where drain line and ventilation duct removal resulted in pits rather than discrete trenches, the resultant pit(s) will be appropriately sampled (surface and subsurface) to demonstrate that the remaining soil meets the release criteria.

6.5 Sample Preparation and Control

Each soil sample will be properly logged, labeled, packaged and tracked. Approximately 1 kilogram of soil will be collected for each sample. All debris (grass, rocks, sticks, and foreign objects) will be removed from the sample. Samples will be dried, weighed and counted by gamma spectroscopy. The results of analyses will be reviewed by qualified GA Health Physics personnel to determine isotopic identification and concentrations. The GA gamma spectroscopy equipment will be maintained, calibrated and used in accordance with approved GA HP procedures. This analysis may also be performed by an approved contracted laboratory having equivalent or better capabilities. Final results will be reported in pCi/g for each applicable radionuclide.

Sr-90 concentrations will be inferred from Cs-137 concentrations based on information obtained during GA's extensive Characterization Survey. Selected samples will be analyzed by gross beta to demonstrate that the upper bound on the potential Sr-90 concentration is less than 1800 pCi/g (or well below the sum of the fractions if other radionuclides are present).

6.6 Exposure rate measurements

The entire Hot Cell Facility Area is identified with the "footprint area" border in Figure 1 The surface of the soil will be scanned using microR meters so that 100% coverage is obtained. Alert levels will be established at levels not to exceed 50% of the release criteria (< 5 μR/hr above background). Further investigation (which may include soil sampling) will be required when alert levels are exceeded.

To determine compliance with the external radiation limit of 10 microR/hr at 1 m above the surface, exposure rate measurements will be taken at 1 meter at all systematic soil sampling locations (after soil remediation has been completed). The results will be compared with the release criteria. A calibrated microR meter will be used to determine exposure rate measurements in microR/hr. Instruments will not be used in conditions that are not in conformance with manufacturer's recommendations.

7.0 **Documentation and Quality Assurance**

Surveys will be conducted by qualified Health Physics technicians having a minimum of 3 years Health Physics Technician experience following approved Health Physics procedures and this plan. The results of these surveys (including the review of gamma spectroscopy results for soil samples) will be reviewed and evaluated by a qualified Health Physicist.

Every exposure rate survey conducted will be documented, on a daily basis, on a drawing showing the approximate locations surveyed. The results will include the appropriate units, the signature of the technician(s) performing the survey, date(s) of survey, instrument(s) used, efficiency, background readings (if appropriate) and any other applicable information.

All soil sample locations will be documented, on a daily basis, on a drawing indicating the sample location, sample depth, a unique sample identification number, and the technician signature, date and time of documentation. In addition, each sample will be controlled by the approved Chain of Custody procedure.

Written procedures will be used for sample collection in order to ensure that samples are representative. Written procedures will also be utilized for sample preparation to ensure that media are prepared in accordance with laboratory specifications. A chain of custody will be maintained on all radiological samples to ensure integrity of the sample. Quality control records for laboratory counting systems will include the results of measurements of radioactive check sources, calibration sources, backgrounds and blanks.

Sample collection, analysis, and the associated documentation will adhere to written procedures and/or plans and meet the requirements in this plan and GA's NRC and State of California Radioactive Materials Licenses. The Health Physics Laboratory shall maintain a documented Quality Control program and documented calibration records for gamma spectroscopy instrumentation. Quality Assurance staff may audit the laboratory at any time to determine compliance with procedures and plans.

During the conduct of the Final Survey activities, Quality Assurance audits may be performed to verify that Project survey activities comply with established procedures and/or plans. Audit results will be reported to Project Management and corrective actions to resolve any identified deficiencies will be documented, tracked, and verified by the individual conducting the audit.

GA will cross-check gamma spectroscopy results by sending a minimum of five (5) soil samples to an offsite laboratory (Quanterra) for gamma spectroscopy analysis. In addition, periodic blank samples will be submitted to the Health Physics Laboratory for analysis. In addition, at least 10 soil samples containing measurable amounts of Cs-137 and/or Co-60 will be re-counted in the Health Physics Laboratory.

A Final Radiological Survey Report will be prepared by GA's Health Physics Group upon completion of the Final Survey. This report will include all survey data and results as well as instrumentation information, including calibration data, instrument efficiencies, minimum detectable activity and background information. This report will include the results of final surveys performed in excavation pits.

8.0 Internal GA Confirmatory Surveys

Following completion of a "Final Survey", GA normally will conduct an additional internal confirmatory survey of facilities and areas to be released to unrestricted use. Confirmatory measurements of the direct gamma scans of the HCF land areas will be performed by the GA Health Physics Staff who were not involved in the performance of the Final Survey. The results of this survey will also be documented in the Final

Radiological Survey Report. The internal confirmatory survey will include gamma scanning 10-25% of the soil surfaces using a NaI detector (i.e., microR meter). No beta scans are will be performed. At least 30 soil samples will be collected from biased locations and will include sampling locations where elevated radiation levels have been measured.

9.0 **External Confirmatory Survey**

Oak Ridge Institute for Science and Education, (ORISE), has been contracted by DOE to perform confirmatory measurements on soil sampling and direct gamma scans.

Figure 1: Hot Cell Facility Area

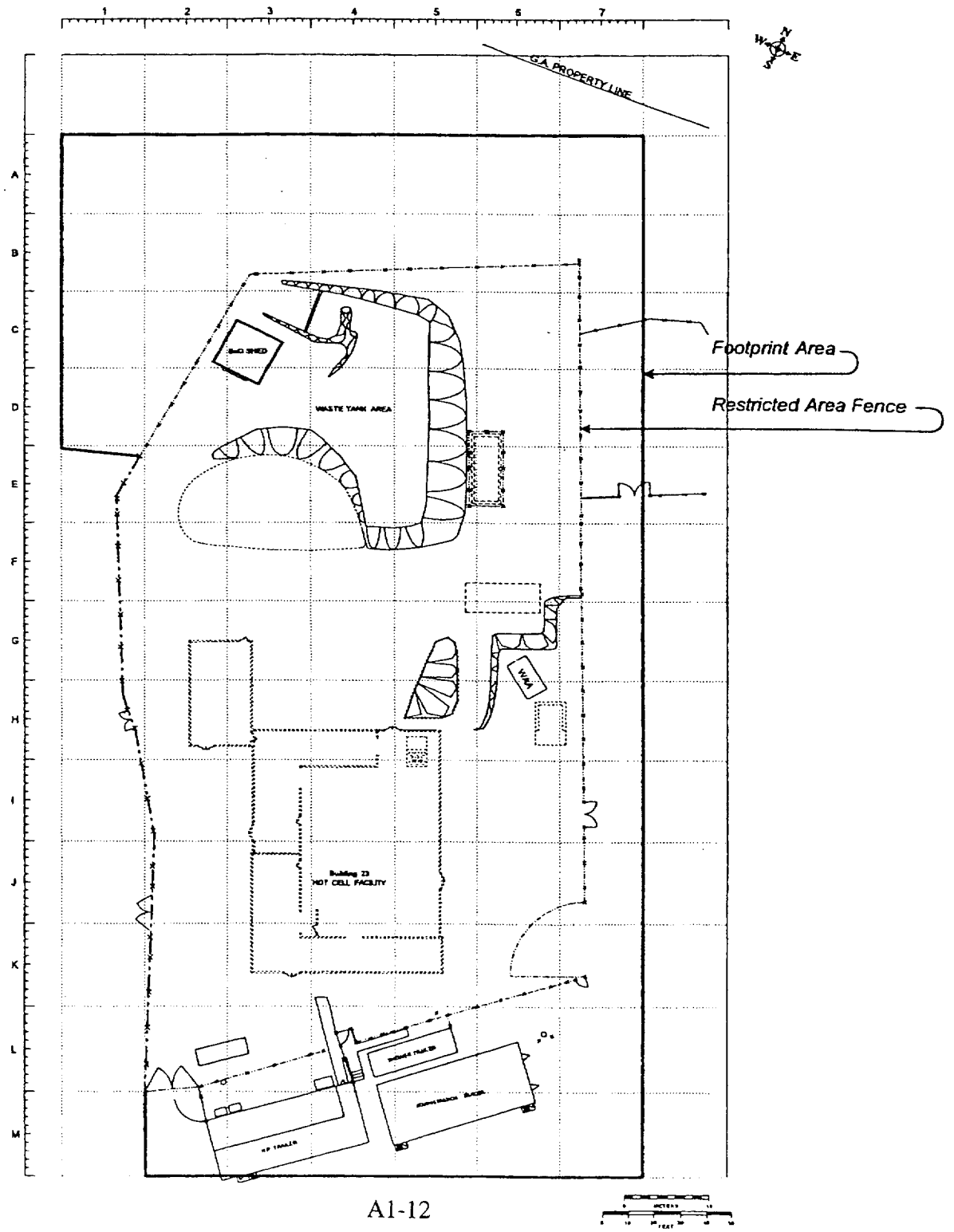


Figure 2: HCF Soil Survey Grid Map

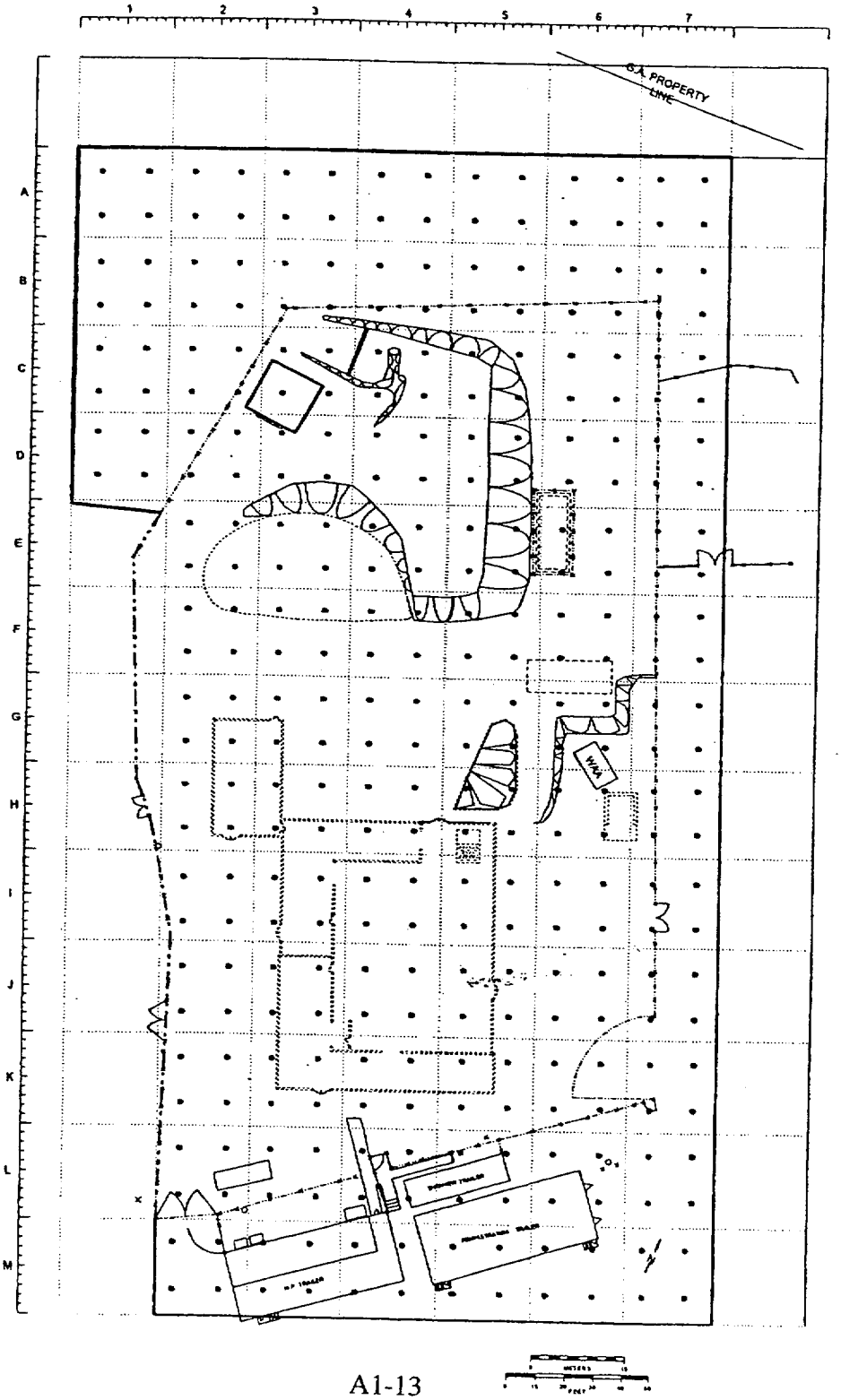


Figure 2A: Systematic Soil Sampling Method

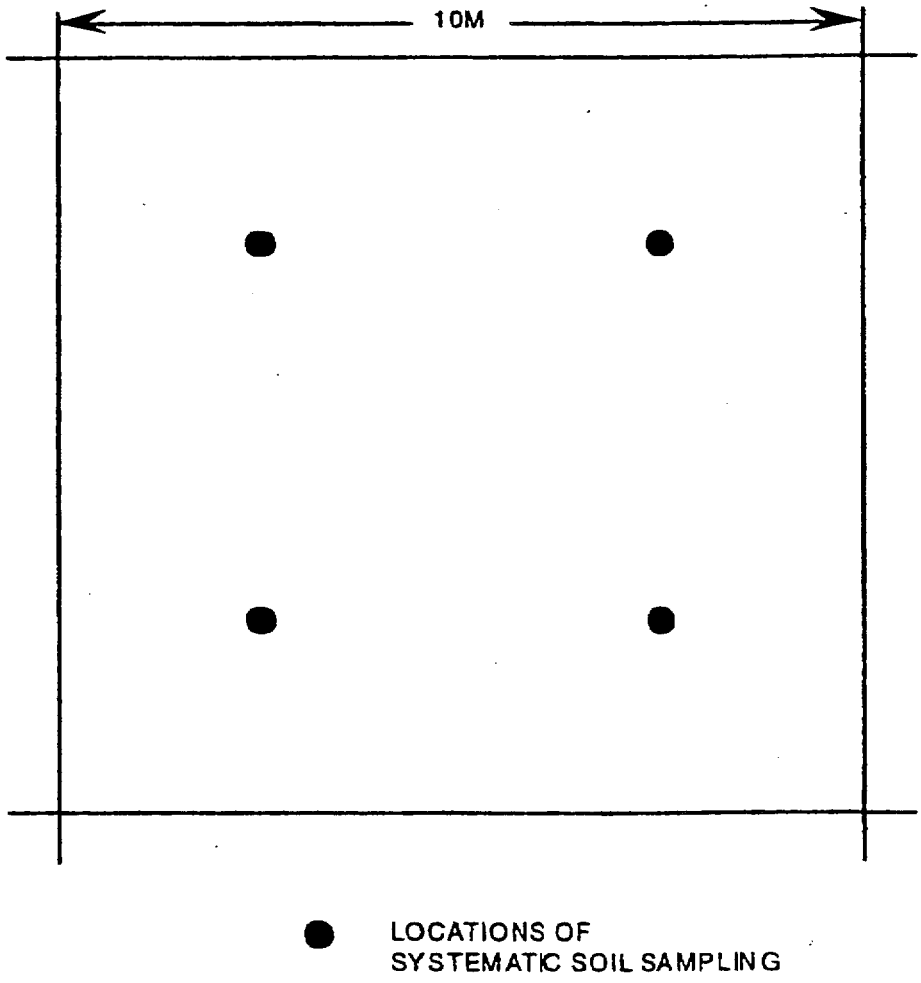


Figure 2B: Modified Systematic Sampling System

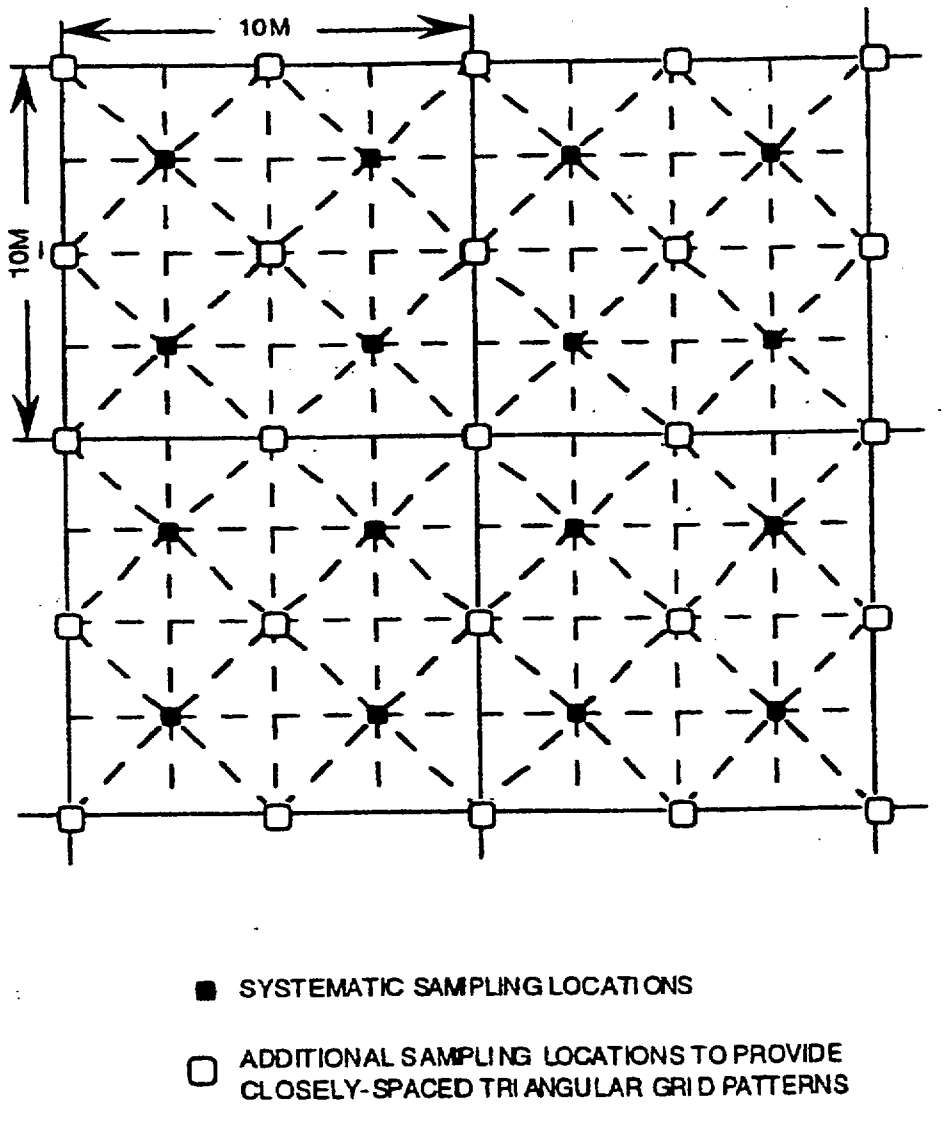
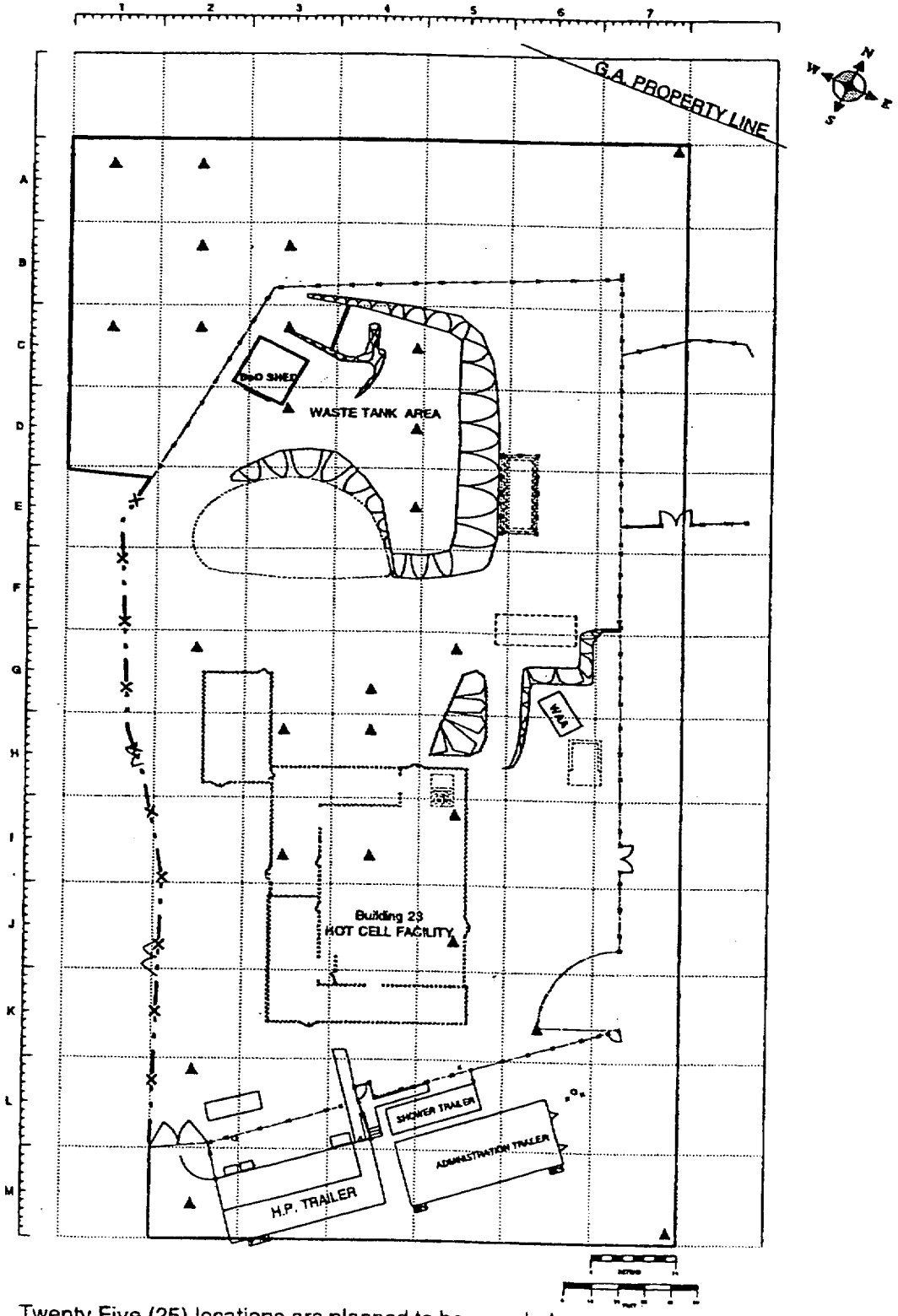


Figure 3: Subsurface Soil Sample Locations



Twenty Five (25) locations are planned to be sampled.

▲ = Sub-surface approximate locations

Appendix 2

of

General Atomics' Final Radiological Survey Report For the Hot Cell Site

"Background Pit, Pipe Surveys and Background Soil Sample Results"

Appendix 2: Background Pit and Pipe Surveys and Background Soil Sample Results

Background

During the performance of post-decontamination surveys, it was discovered that direct radiation readings were elevated in the clay substrate that was encountered in pits and trenches. GA believed these elevated levels were due to the combined effect of the geometry of the surrounding soil relative to the detectors and a naturally higher uranium content/activity in the clay soil. It order to verify this, a 4' x 4' x 4' hole, called the "background pit", was dug in a non-impacted area on GA's site called the Torrey Pines West Land Area on February 17-18, 2000. This land area had previously been released to unrestricted use. The underlying clay substrate was exposed in the pit. The approximate location of the background pit in the Torrey Pines West Land Area is shown in Figure A2-1.

The soil in this area is similar to the clay soil in the Hot Cell Site. This pit was used to gather background data to show that the current radiation exposure rate levels in the Hot Cell pits and trenches were due to naturally occurring radioactivity and not because of radioactive contamination as a result of GA Hot Cell activities.

This Appendix provides the results of the surveys (including gamma spectroscopy analysis of clay-type soil samples collected from inside the pit) as well as typical soil sample results for analysis of surface soil samples taken off the GA site.

Surveys Performed

Measurements were taken in the "background pit" with the two types of radiation survey instruments. The findings are as follows:

1) For the Ludlum Model 19 with a 1" X 1" NaI(Tl) detector, the radiation dose rate measurements ranged from 13 - 14 μR/hr outside the pit and 21 to 25 μR/hr inside the pit as shown in Figure A2-2.

2) For the Ludlum Model 3 with the 2" X 2" NaI(Tl) detector, the radiation dose rate measurements ranged from 14 to 15 μR/hr outside the pit and 25 to 27 μR/hr inside the pit (contact) as shown in Figure A2-3. An exposure rate measurement taken 1 m from the bottom of the pit soil surface and equidistant from the sides read 24 μR/hr (as shown in Figure A2-3).

A study was also conducted using three different types of pipe: pvc, steel and aluminum. The pipes were each 6" diameter and they were buried in a vertical position with the deep end being ~ 6' below the surface of the ground. This was done in the Torrey Pines West area. Radiation dose rate measurements were taken inside the pipes and the readings were as high as 31 μR/hr inside the pipes. This is significantly higher than the normal background of 15 μR/hr measured 1m above a soil surface. The dose rates vary depending upon the type of pipe being used with the steel pipe providing more shielding than pvc or aluminum. See Figure A2-2 for results.

Background Soil Concentrations of Concern

Typical Surface Background

Typical background concentrations, measured by gamma spectroscopy, in soil near the GA site have been established (at the 95% confidence level) and are provided in Table A2-1. This table also describes the locations where these samples were taken. These soil samples were taken from the top 6" of soil (surface samples).

The locations of where samples were taken are shown in Figure A2-4

Clay Soil Background

Twenty-one (21) soil samples were collected from inside the "Background Pit"in order to determine natural uranium and thorium concentrations in clay soil. Gamma spectroscopy results of these soil samples did, in fact, show slightly higher concentrations as shown in Table A2-2.

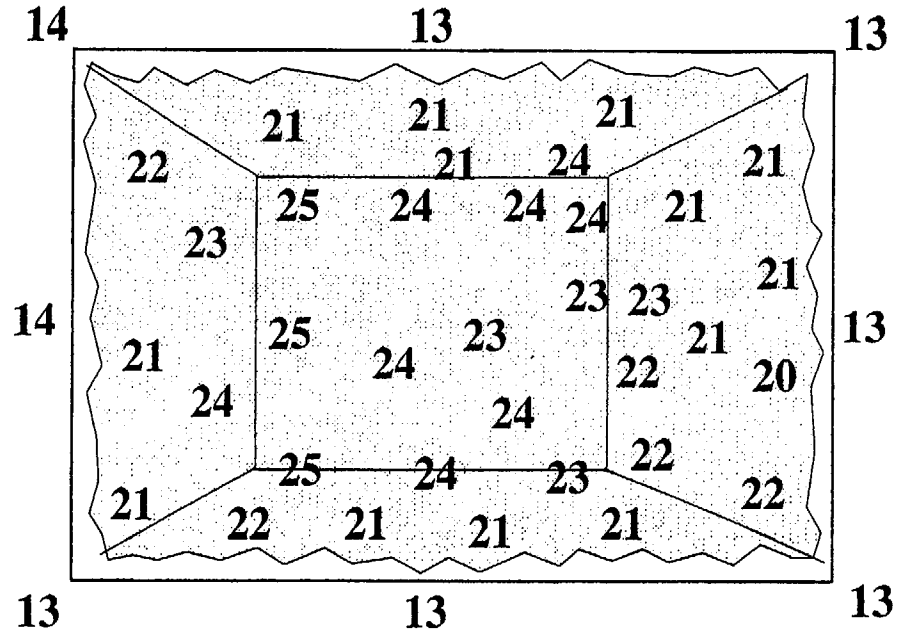
Figure: A2-2 Appendix 2

BACKGROUND PIT

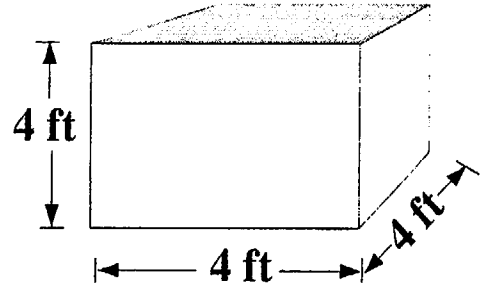
LUDLUM MODEL 19 µR/hr Meter

02/25/2000

Top View



20 Micro-R per hour @ one meter from bottom center of pit



Location	Background Pit Survey			
Instrument(s)	Model-19	N/A	N/A	N/A
Serial Number	144068	N/A	N/A	N/A
Calibration Due	04/06/2000	N/A	N/A	N/A
Efficiency	N/A	N/A	N/A	N/A
α β γ	γ	N/A	N/A	N/A
Probe Number	N/A	N/A	N/A	N/A
Probe Size	N/A	N/A	N/A	N/A
Comments: All readings recorded in Micro-R per hr				
Signature: C. Stanley			Date: 02/25/2000	

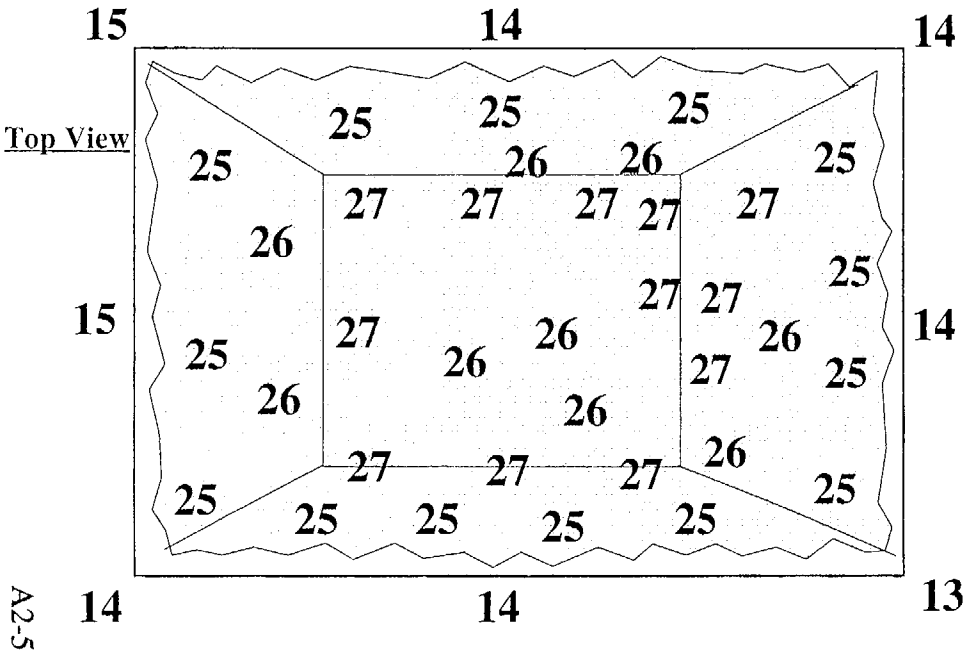
All readings recorded in µR/hr (on surface of soil)
***4ft deep pit dug in clay-type soil in Torrey Pines West land area.**

Figure: A2-3 Appendix 2

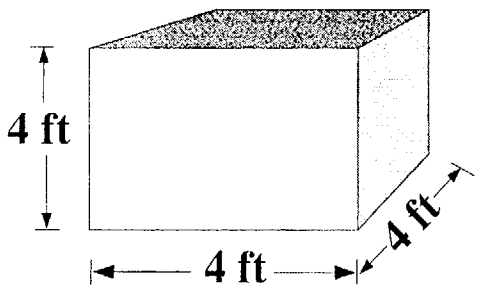
BACKGROUND PIT

02/18/2000 - 02/25/2000

LUDLUM MODEL 3 with 2"x 2" NaI (Tl) Detector (μR/hr)



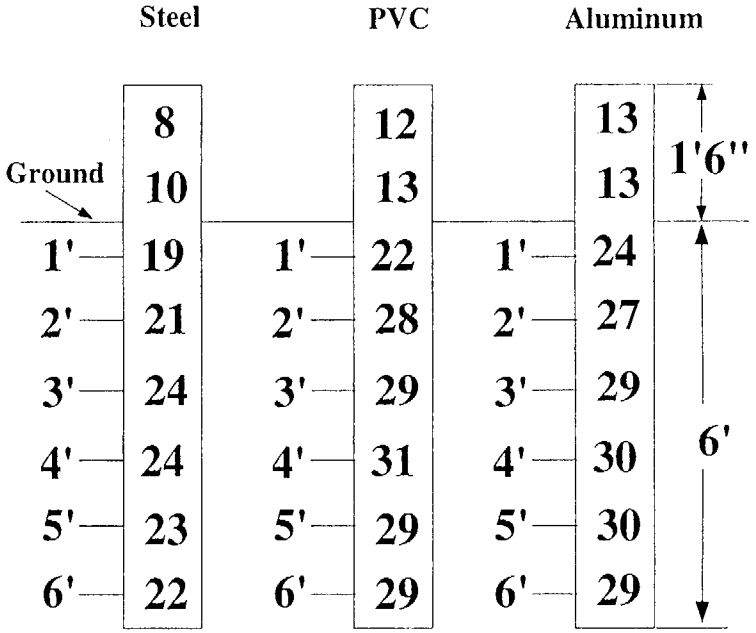
20 Micro-R per hour @ one meter from bottom center of pit



PIPE BACKGROUNDS

LUDLUM MODEL 3 with 2"x 2" NaI (Tl) Detector (μR/hr)

Pipe Diameter 6 inches



Location	Background Pit Survey			
Instrument(s)	Model-3	N/A	N/A	N/A
Serial Number	147819	N/A	N/A	N/A
Calibration Due	08/09/2000	N/A	N/A	N/A
Efficiency	N/A	N/A	N/A	N/A
α β γ	γ	N/A	N/A	N/A
Probe Number	153765	N/A	N/A	N/A
Probe Size	44-10	N/A	N/A	N/A
Comments: All readings recorded in Micro-R per hr				
Signature: C. Stanley B. Hunter			Date: 02/18/2000 - 02/25/2000	

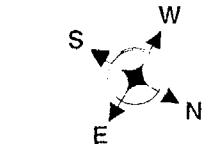
All readings recorded in μR/hr (on surface of soil)

***4ft deep pit dug in clay-type soil in Torrey Pines West land area.**

Figure: A2-4 Appendix 2

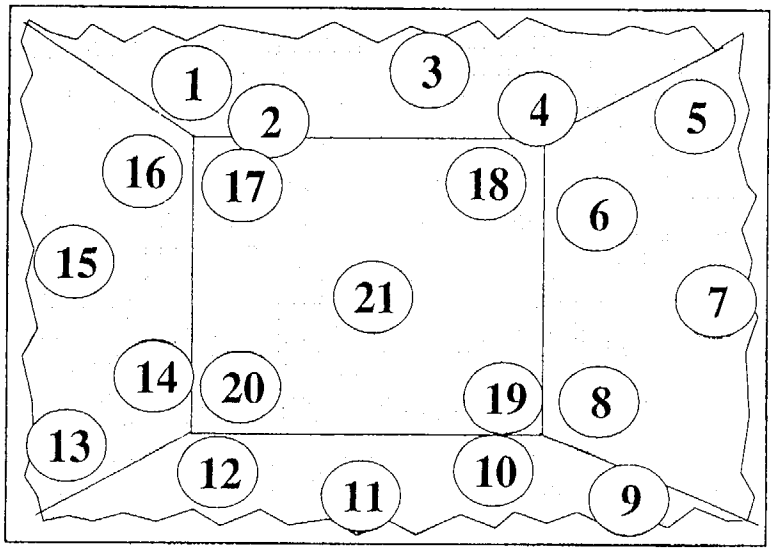
BACKGROUND PIT

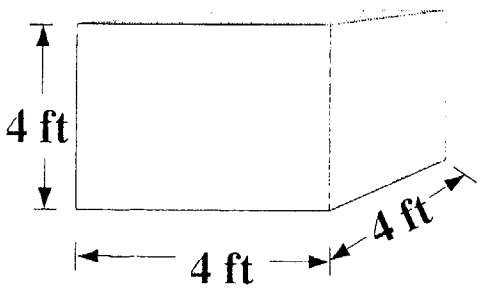
SOIL SAMPLE LOCATIONS



02/18/2000

Top View





(n) = Denotes Soil Sample Location

All soil samples begin with BP-s-n

B. Hunter

C. Stanley

Table A2-1: Surface Soil Sample Background Results [1]					
Sample ID [2]	U-235	U-238	Th-228	Th-232	**Total Thorium Th-228 + Th-232**
Radionuclide Concentrations (pCi/g)					
AJ	0.15 ± 0.03	1.98 ± 0.31	1.28 ± 0.07	1.47 ± 0.14	2.75
G2	0.12 ± 0.02	1.86 ± 0.29	0.92 ± 0.07	1.01 ± 0.12	1.93
AC	0.20 ± 0.03	2.27 ± 0.27	1.29 ± 0.07	1.34 ± 0.14	2.63
BKG-1	0.19 ± 0.06	2.06 ± 0.48	1.40 ± 0.16	1.44 ± 0.28	2.84
BKG-2	0.17 ± 0.05	2.30 ± 0.45	1.54 ± 0.15	1.57 ± 0.27	3.11
BKG-3	0.19 ± 0.05	ND	1.40 ± 0.14	1.62 ± 0.26	3.02
BKG-4	0.09 ± 0.04	1.15 ± 0.37	0.67 ± 0.09	0.84 ± 0.17	1.51
BKG-5	0.12 ± 0.06	2.77 ± 0.67	1.51 ± 0.16	1.79 ± 0.31	3.30
BKG-6	0.08 ± 0.03	ND	0.68 ± 0.09	0.76 ± 0.16	1.44
BKG-7	0.11 ± 0.04	1.83 ± 0.43	1.17 ± 0.12	1.28 ± 0.22	2.45
Mean ±2 σ	0.14 ±0.09	2.03 ± 0.93	1.19 ± 0.64	1.31 ± 0.68	2.5 ±1.32
Range	0.08 to 0.20	ND to 2.77	0.67 to 1.54	0.84 to 1.79	

[1] Samples gamma scanned for 1 hour.

ND = < 0.1 pCi/g for Cs-137, < 1.0 pCi/g for U-238

[2] Samples collected in June and August 1993, typically about 1-2 miles from the Building 37 site at the following locations:

AJ Collected on a hillside west of Building 39 & northwest of building 37, ~3' from GA's fence.

G2 Collected about 1200 feet west of Bldg 1 (near T.P. RD.) , and ~7/8 of a mile southwest of Building 37.

AC Collected about 1 mile southeast of the main site & about 2 miles southeast of Building 37.

BKG-1 Collected about 1 mile from Building 37 at the Scripps Hospital Entrance, east of Genesee Ave.

BKG-2 Collected about 1.2 miles from Building 37 at Sorrento Court Rd. by North entrance to Post Office.

BKG-3 Collected about 1.5 miles from Building 37 at Sorrento Vista Parkway near Lusk Blvd. South.

BKG-4 Collected about 1 mile west from Building 37, west off Genesee corner of North Torrey Pines Road and Torrey Pines

Table A2-2: Background Soil Sample Results in Clay Soil

	Results in pCi/g			
Sample Number	**^{235}U**	**^{238}U**	**^{228}Th**	**^{232}Th**
BKG PIT # 1	0.24 ± 0.11	2.45 ± 0.74	1.44 ± 0.16	2.23 ± 0.54
BKG PIT # 2	0.23 ± 0.07	2.80 ± 0.66	1.56 ± 0.14	2.10 ± 0.43
BKG PIT # 3	0.27 ± 0.11	2.73 ± 0.82	1.42 ± 0.16	2.72 ± 0.61
BKG PIT # 4	0.34 ± 0.11	2.62 ± 0.69	1.23 ± 0.13	1.77 ± 0.43
BKG PIT # 5	0.19 ± 0.11	2.56 ± 0.85	1.56 ± 0.24	2.29 ± 0.61
BKG PIT # 6	0.21 ± 0.08	2.67 ± 0.72	1.22 ± 0.10	1.85 ± 0.41
BKG PIT # 7	0.24 ± 0.10	2.56 ± 0.88	1.23 ± 0.16	2.40 ± 0.50
BKG PIT # 8	0.20 ± 0.09	2.35 ± 0.68	1.12 ± 0.11	1.73 ± 0.37
BKG PIT # 9	0.11 ± 0.09	2.02 ± 0.86	1.15 ± 0.14	1.93 ± 0.47
BKG PIT # 10	0.20 ± 0.07	2.99 ± 0.74	1.18 ± 0.13	1.78 ± 0.39
BKG PIT # 11	0.20 ± 0.11	1.77 ± 0.72	1.27 ± 0.15	1.95 ± 0.52
BKG PIT # 12	0.24 ± 0.08	2.45 ± 0.75	1.35 ± 0.12	2.07 ± 0.42
BKG PIT # 13	0.24 ± 0.11	3.32 ± 1.15	1.44 ± 0.17	2.34 ± 0.56
BKG PIT # 14	0.23 ±0.07	3.39 ± 0.80	1.36 ± 0.15	2.29 ± 0.42
BKG PIT # 15	0.23 ± 0.12	2.60 ±0.91	1.40 ± 0.18	2.34 ± 0.59
BKG PIT # 16	0.21 ± 0.09	3.17 ± 0.92	1.30 ± 0.12	2.29 ± 0.40
BKG PIT # 17	0.23 ± 0.10	2.46 ± 0.79	1.48 ± 0.14	2.57 ± 0.45
BKG PIT # 18	0.25 ± 0.08	2.86 ± 0.54	1.74 ± 0.19	1.91 ± 0.37
BKG PIT # 19	0.16 ± 0.10	2.39 ± 0.85	1.36 ± 0.13	1.95 ± 0.52
BKG PIT # 20	0.21 ± 0.08	3.06 ± 0.76	1.26 ± 0.13	2.15 ± 0.35
BKG PIT # 21	0.17 ± 0.09	2.14 ± 0.83	1.27 ± 0.15	2.21 ± 0.55
Average	0.21 ± 0.09	2.64 ± 0.80	1.36 ± 0.15	2.03 ± 0.47
Range	0.12 to 0.30	1.84 to 3.44	1.21 to 1.51	1.56 to 2.50

Appendix 3

of

General Atomics' Final Radiological Survey Report for the Hot Cell Site

"Letter dated January 24, 2000 from GA (W. LaBonte) to ORISE (R. Morton) providing GA's Results of Surveys Completed in the Hot Cell Pits and Trenches"

PC-000495/0

GENERAL ATOMICS

Internal Distribution:
K. Asmussen
G. Bramblett
L. Gonzales
B. Hunter
P. Maschka
V. Nicolayeff
K. Partain
Project Files

January 24, 2000

Mr. R. Morton

ORISE
Environmental Survey & Site Assessment Program
Energy/Environment System Division
P.O. Box 117
Oak Ridge, TN 37831-0117

Dear Mr. Morton:

I have enclosed the soil sample results you requested during your visit to GA on November 1, 1999 as attachments to this memo.

1. Attachment -1 contains the soil sample location maps and tabularized gamma spectroscopy results.

2. Attachment -2 contains the location of the split samples taken for the USNRC and the State of California. This attachment also includes the gamma spectroscopy results for the GA set of samples.

3. Attachment -3 is a map illustrating your sample locations along with the exposure rate measurements on contact with the sample locations.

If you have any questions pertaining to this package, please contact W. T. (Bill) LaBonte at 858-455-2346 or Laura Gonzales at 858-455-2758.

William T. LaBonte

William T. (Bill) LaBonte

CC: Mr. T. J. Vitkus

Enclosures

1. Hot Cell Site Pits and Trenches, Soil Sample Locations and Results

2. Hot Cell Site Pits and Trenches, Split Soil Sample Locations and GA Sample Set Results

3. Hot Cell Site Pits and Trenches, ORISE Soil Sample Locations and Contact Exposure Rate Measurements

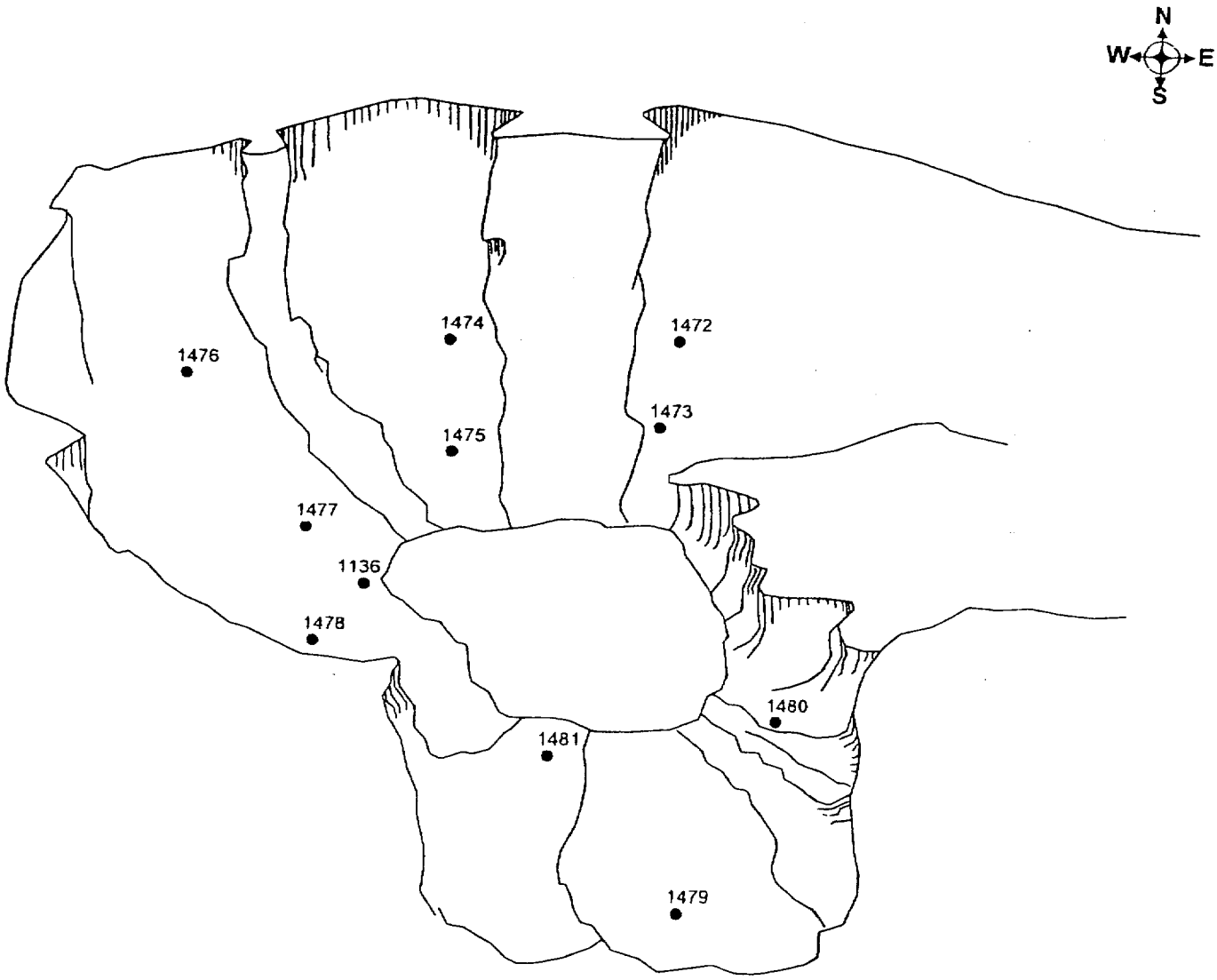
3550 GENERAL ATOMICS COURT, SAN DIEGO, CA 92121-1194 PO BOX 85608, SAN DIEGO, CA 92186-5608 (619) 455-3000

Attachment-1

Hot Cell Site Pits and Trenches

Soil Sample Locations and Results

Hot Cell Facilities: Vent Pit Soil Sample Locations



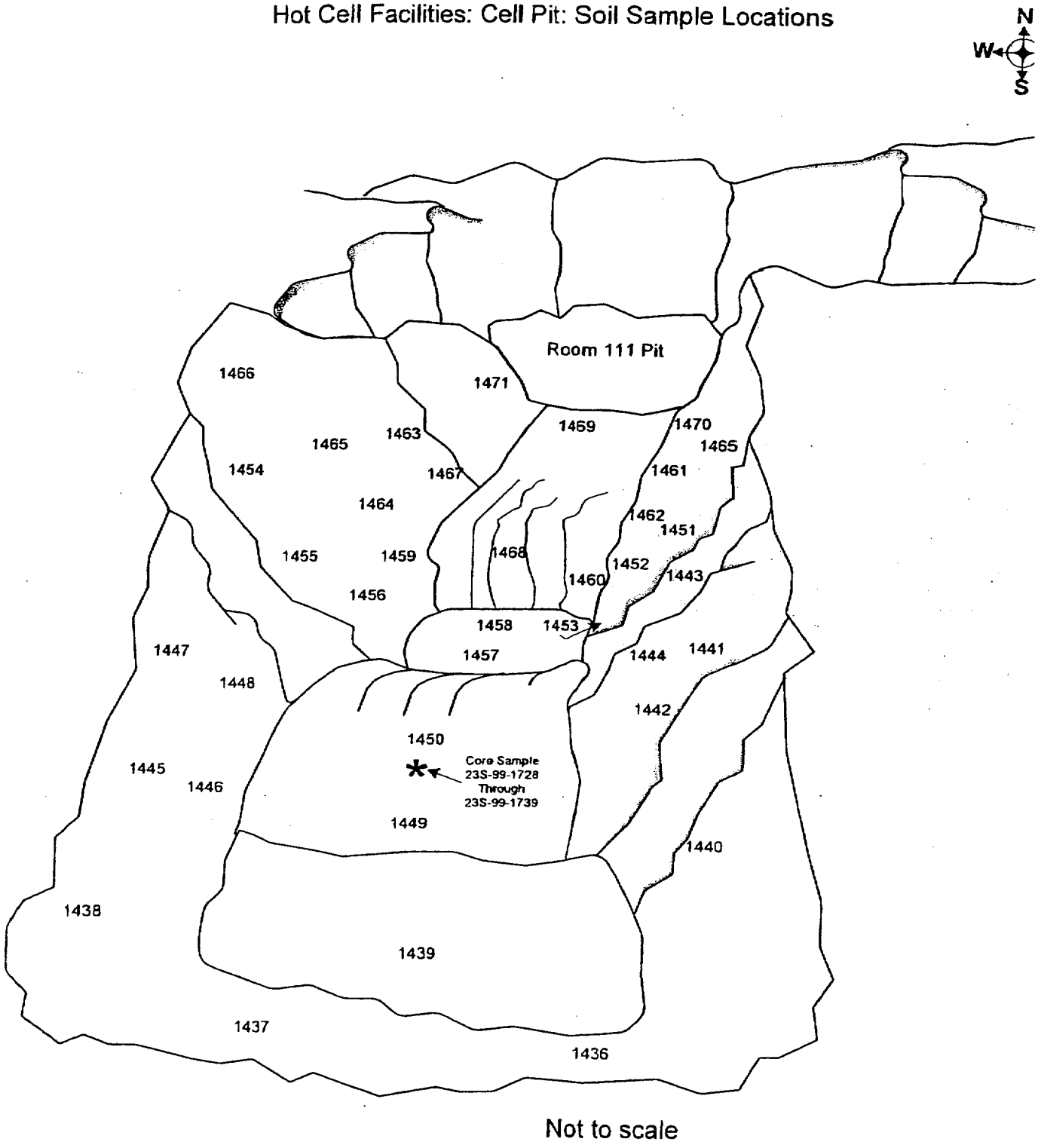
Not to scale

Notes:

1. The values are ID numbers and indicates the approximate locations where soil samples were taken for analysis.

2. All dirt/rubble surface.

Hot Cell Facilities: Cell Pit: Soil Sample Locations



Not to scale

Notes:

1. The values are ID numbers and indicates the approximate locations where soil samples were taken for analysis. All sample numbers begin with 23S-99-

2. All dirt/rubble surface.

FILENAME

MAP #

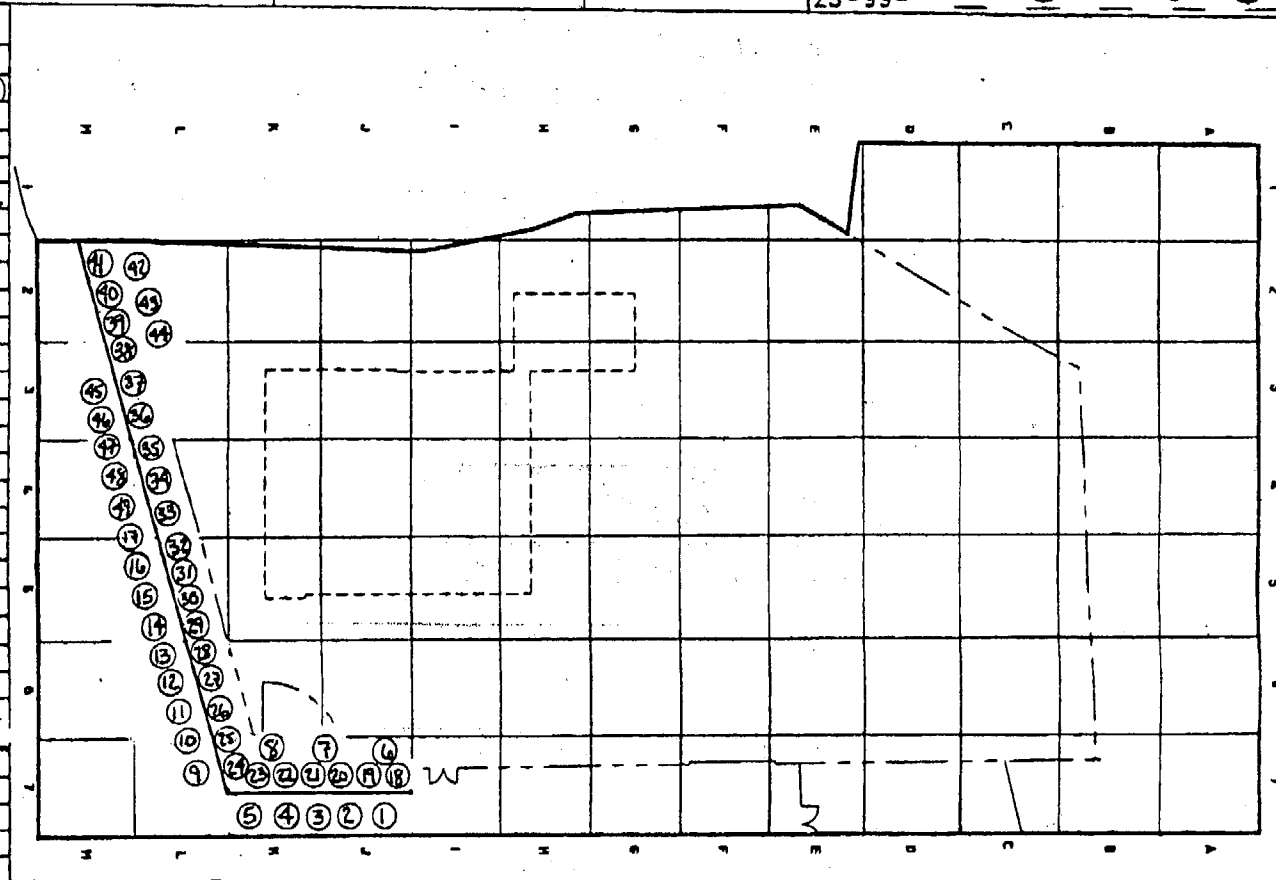
LOCATION: 23. YARD

DATE: 5-25-99, 5-27-99

TIME: 1300, 1100

SURVEY #: 23-99- 00286

Remarks: SOIL SAMPLES FOR WATER MAIN TRENCH. SAMPLES (18)-(41) TAKEN FROM BOTTOM OF TRENCH ~3'. ALL OTHER SAMPLES WERE TAKEN IN PILES OF EXCAVATED SOIL.



Legend

- CONTACT DOSE RATE
- 12" DOSE RATE
-) SMEAR
- LARGE AREA SMEAR
-) H^3 SMEAR
- BETA DOSE RATE ONLY
- X ALPHA ONLY
- ** BOUNDARY
-] AIR SAMPLE LOCATION
- 15 HOT SPOT

ALL SAMPLES BEGIN WITH: 235-99-

1	1561	16	1576	31	1591	41	1601
2	1562	17	1577	32	1592	42	1602
3	1563	18	1578	33	1593	43	1603
4	1564	19	1579	34	1594	44	1604
5	1565	20	1580	35	1595	45	1605
6	1566	21	1581	36	1596	46	1606
7	1567	22	1582	37	1597	47	1607
8	1568	23	1583	38	1598	48	1608
9	1569	24	1584	39	1599	49	16089
10	1570	25	1585	40	1600	50	16[illegible] 5-27
11	1571	26	1586				
12	1572	27	1587				
13	1573	28	1588				
14	1574	29	1589				
15	1575	30	1590				

COPY

INST. TYPE:	
SERIAL NUMBER:	
CAL DUE DATE:	
PROBE TYPE	
AREA (cm^2)	
EFF.	
INST. TYPE:	
SERIAL NUMBER:	
CAL DUE DATE:	
PROBE TYPE	
AREA (cm^2)	
EFF.	

SURVEYOR: BARBARA HUNTER

REVIEWED BY:

DATE: 6-8-99

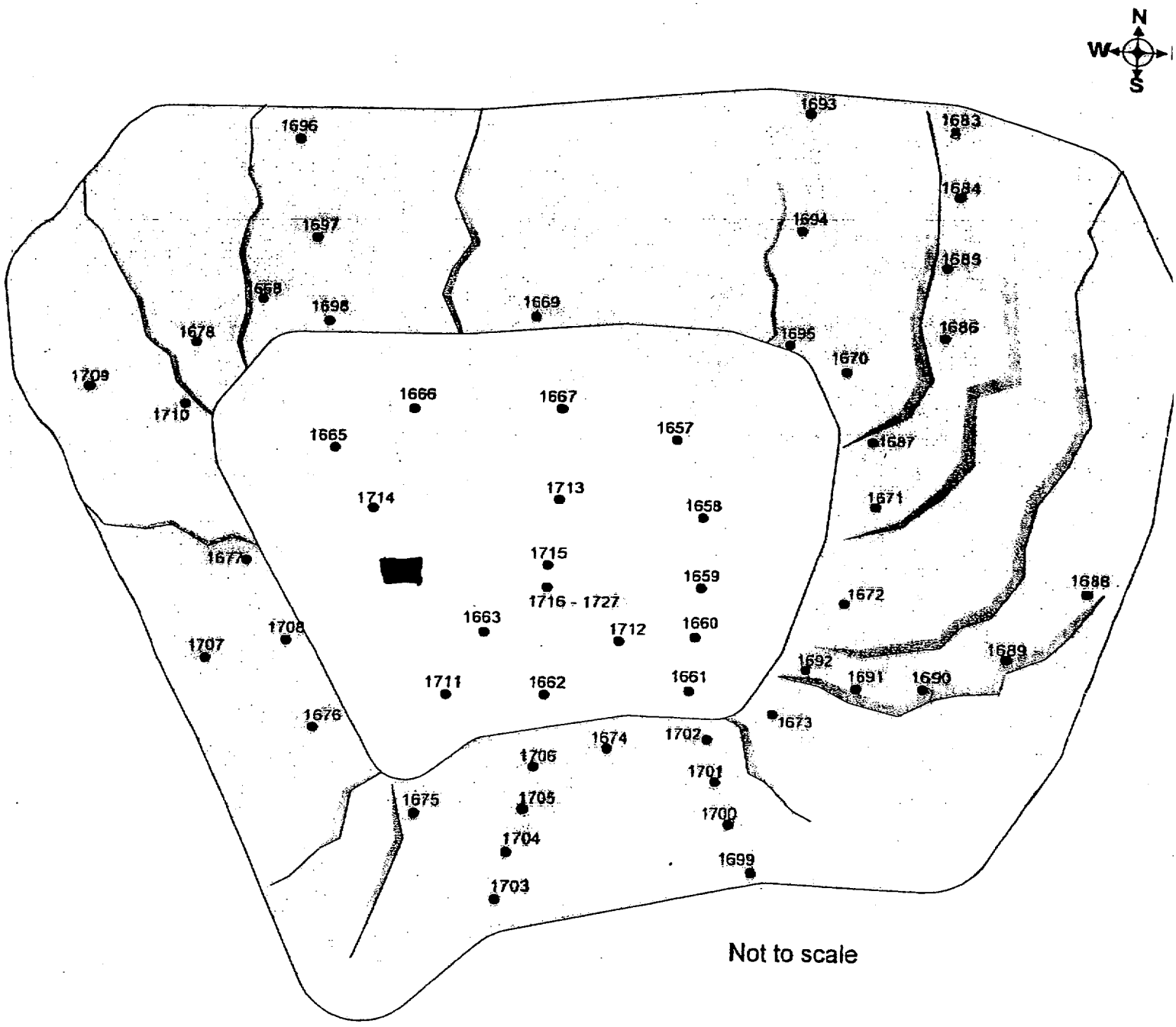
JOB RWP: 01

(1) All radiation readings are in mR/hr unless otherwise shown. (2) All smears not listed above or on a contaminated map are <1000 dpm/100cm²

A3-6

PC-000495/0

Hot Cell Facilities: Rm. 111 Pit. ~Soil Sample Locations



Notes:

1. The values are ID numbers and indicates the approximate locations where soil samples were taken for analysis.

2. All dirt/rubble surface.

MAP#	LOCATION: 23-YARD	DATE: 7-15-99	TIME: 1100	SURVEY #: 23-99- 00203

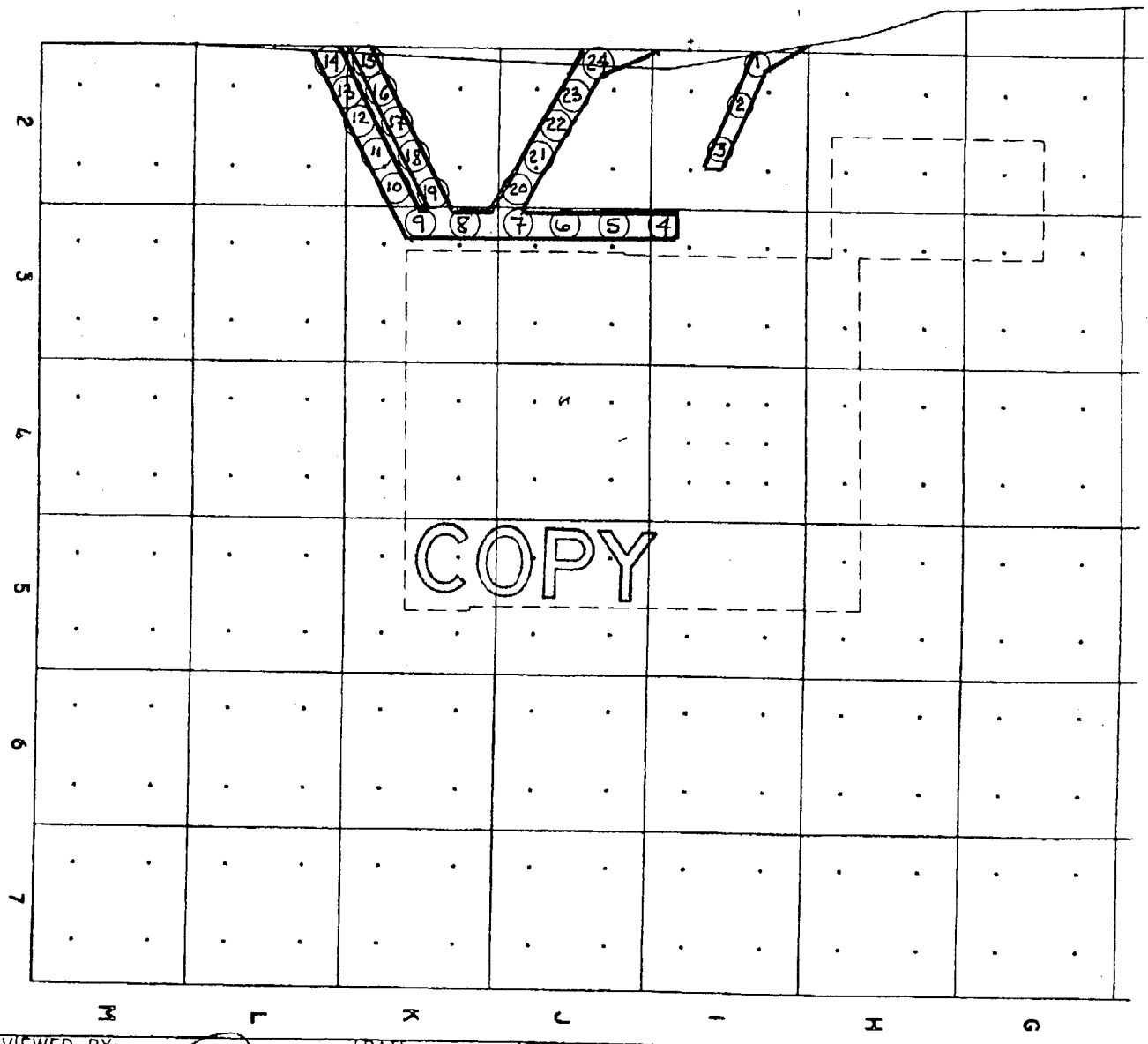
Remarks:
SOIL SAMPLES TAKEN IN TRENCHES FROM EXCAVATION OF CONDUIT AND WATER LINES.

Legend

*	CONTACT DOSE RATE
+	12" DOSE RATE
○	SMEAR
⫻	LARGE AREA SMEAR
◇	H^3 SMEAR
β	BETA DOSE RATE ONLY
α	ALPHA ONLY
XXX	BOUNDARY
[ ]	AIR SAMPLE LOCATION
HS	HOT SPOT

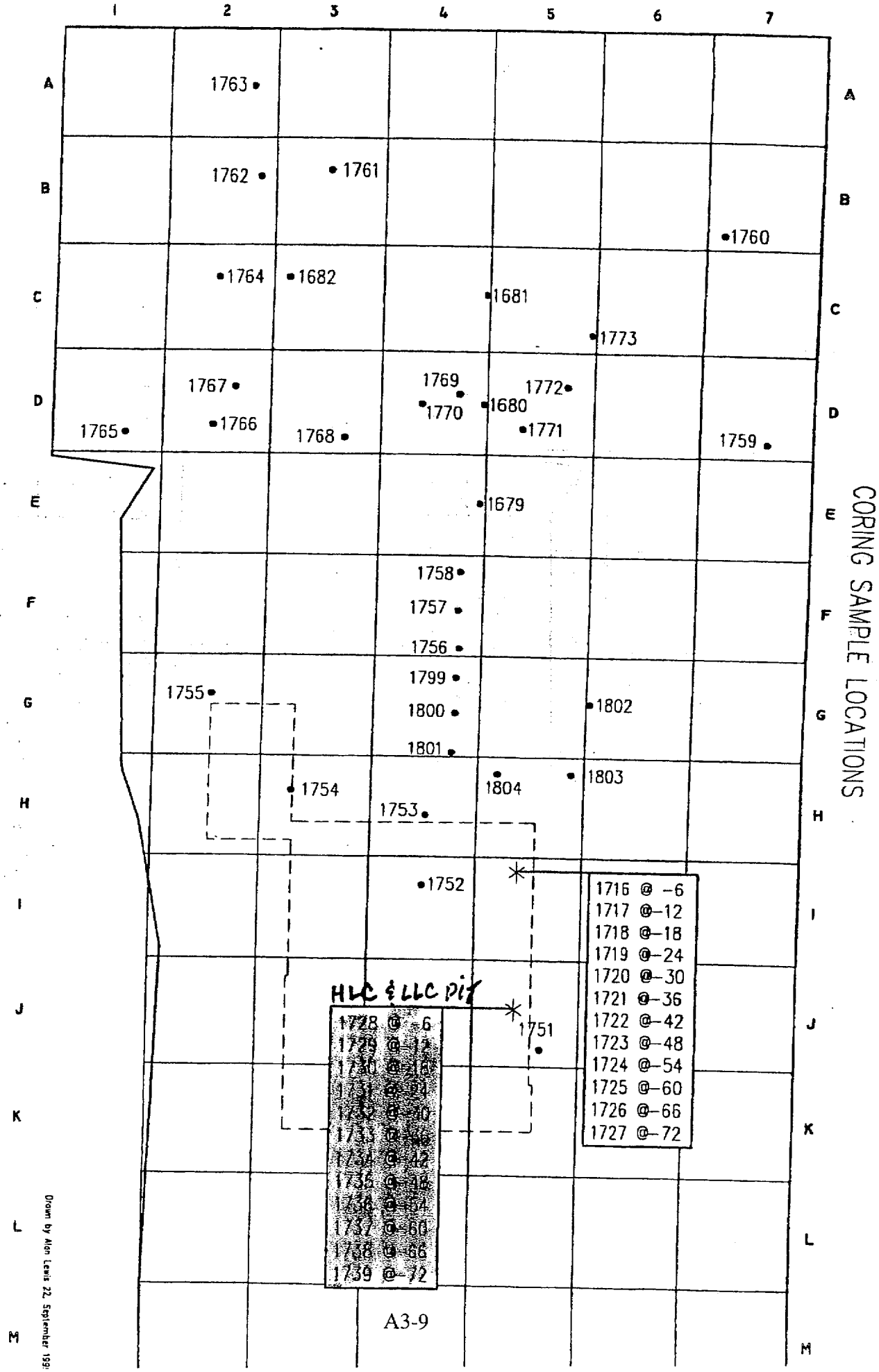
All samples begin with 235-99-

NO.	23-5-99-	NO.	23-5-99-
1	1774	16	1789
2	1775	17	1790
3	1776	18	1791
4	1777	19	1792
5	1778	20	1793
6	1779	21	1794
7	1780	22	1795
8	1781	23	1796
9	1782	24	1797
10	1783		
11	1784		
12	1785		
13	1786		
14	1787		
15	1788		



SURVEYOR: B.L. HUNTER	REVIEWED BY: Dupicate Murray	DATE: 7/15/99	JOB RWP: 01

(1) All radiation readings are in mR/hr unless otherwise shown. (2) All smears not listed above or on a supplemental map are <1000 dpm/100cm² B-γ or <1000 dpm/smear B-γ (LAS)(3) Indicate RWP for Job/Coverage surveys. (4) Please indicate any additional "Remarks" on survey map.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1758
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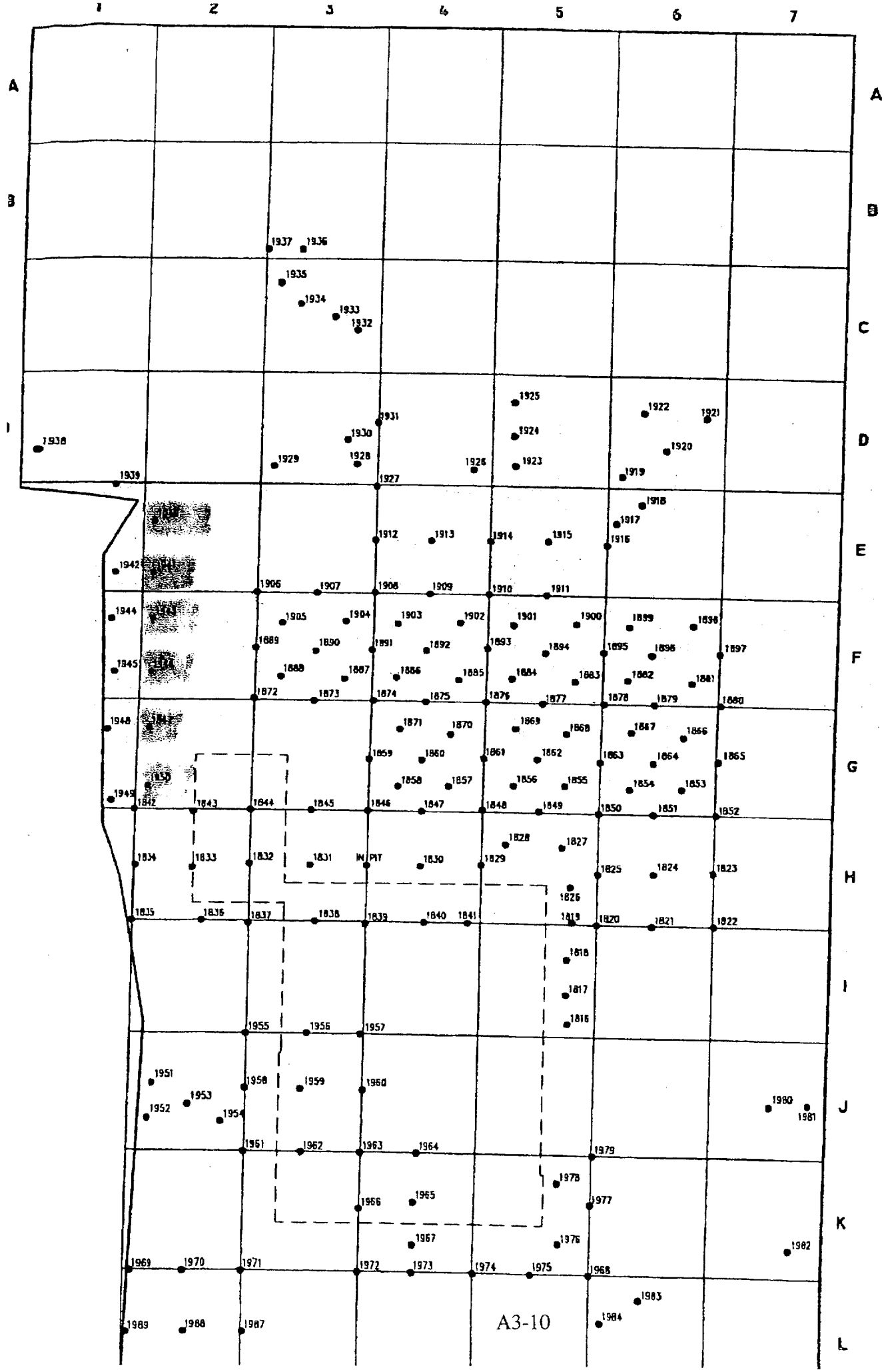
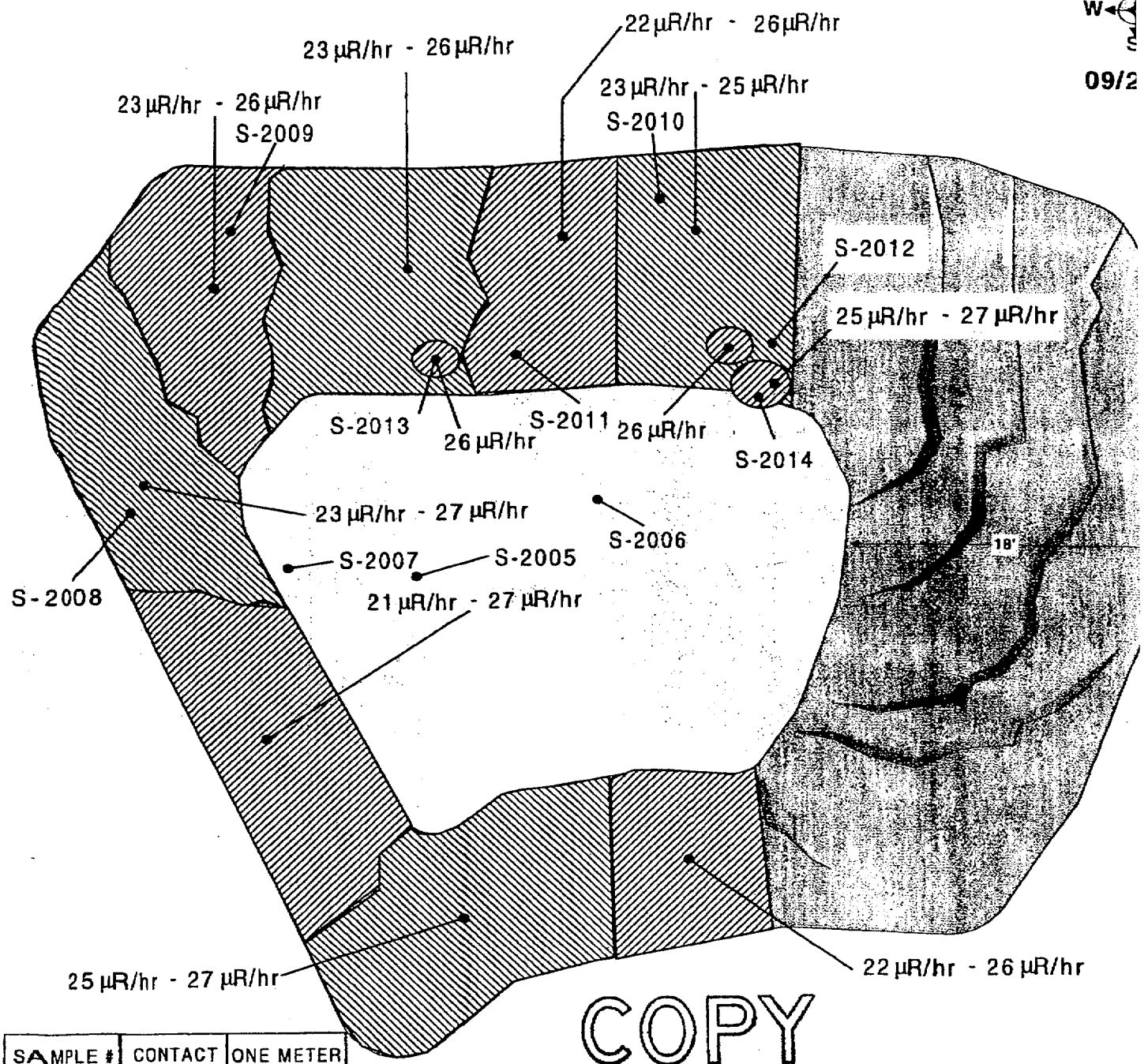
1799
1755
1800
1802
1801
1754
1804
1803
1753
1752
1751
HLC & LLC Pit
1716 @ -6
1717 @-12
1718 @-18
1719 @-24
1720 @-30
1721 @-36
1722 @-42
1723 @-48
1724 @-54
1725 @-60
1726 @-66
1727 @-72
1728 @ -6
1729 @-12
1730 @-18
1731 @-24
1732 @-30
1733 @-36
1734 @-42
1735 @-48
1736 @-54
1737 @-60
1738 @-66
1739 @-72
CORING SAMPLE LOCATIONS
Drawn by Alan Lewis 22 September 199

PC-000495/0



HOT CELL FACILITY POST REMEDIATION SOIL SAMPLES TAKEN 23 THRU 27 August 1999.

ALL SAMPLE NUMBERS BEGIN WITH 23S-99-____.



COPY

SAMPLE #	CONTACT	ONE METER
S-2005	26 µR/hr	26 µR/hr
S-2006	24 µR/hr	24 µR/hr
S-2007	26 µR/hr	25 µR/hr
S-2008	24 µR/hr	22 µR/hr
S-2009	22 µR/hr	20 µR/hr
S-2010	25 µR/hr	22 µR/hr
S-2011	25 µR/hr	23 µR/hr
S-2012	25 µR/hr	23 µR/hr
S-2013	26 µR/hr	25 µR/hr
S-2014	25 µR/hr	27 µR/hr

	Hot Cell Facilities: Rm 111 Pit			
	Model-3	N/A	N/A	N/A
	151348	N/A	N/A	N/A
	02/11/2000	N/A	N/A	N/A
	N/A	N/A	N/A	N/A
	Y	N/A	N/A	N/A
	145973	N/A	N/A	N/A
	44-10	N/A	N/A	N/A
Background	23 µR/hr	N/A	N/A	N/A

Comments:

Signature: C. Stanley Date 09/28/99

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
SampleNumber	^{238}U	^{235}U	^{137}Cs	^{134}Cs	^{60}Co	**Other**
23S-99-1136	<MDA	<MDA	0.02 ± 0.01	<MDA	<MDA	Not Identified
23S-99-1436	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1437	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1438	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1439	<MDA	0.16 ± 0.08	<MDA	<MDA	<MDA	^{228}Th=0.22±0.03, ^{232}Th=1.2±0.33
23S-99-1440	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1441	<MDA	0.20 ± 0.10	<MDA	<MDA	<MDA	^{228}Th=0.09±0.01, ^{232}Th=0.99±0.23
23 S-99-1442	<MDA	<MDA	5.0 ± 0.19	0.48 ± 0.08	<MDA	Not Identified
23S-99-1443	<MDA	0.07 ± 0.04	<MDA	<MDA	<MDA	^{232}Th=0.74±0.19
23S-99-1444	<MDA	<MDA	0.42 ± 0.07	<MDA	<MDA	Not Identified
23S-99-1445	<MDA	<MDA	0.09 ± 0.10	<MDA	0.10 ± 0.08	Not Identified
23S-99-1446	1.0 ± 0.25	0.03 ± 0.01	<MDA	<MDA	<MDA	^{232}Th=0.39±0.10
23S-99-1447	<MDA	<MDA	4.8 ± 0.25	0.22 ± 0.18	1.6 ± 0.20	Not Identified
23S-99-1448	1.3 ± 0.38	0.23 ± 0.03	2.4 ± 0.17	0.14 ± 0.09	0.60 ± 0.14	^{228}Th=0.23±0.03, ^{232}Th=0.89±0.20
23S-99-1449	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1450	1.0 ± 0.29	0.09 ± 0.03	0.57 ± 0.08	<MDA	<MDA	^{232}Th=0.69±0.14
23S-99-1451	<MDA	<MDA	0.72 ± 0.10	0.12 ± 0.09	0.13 ± 0.08	Not Identified
23S-99-1452	<MDA	0.05 ± 0.02	0.03 ± 0.02	<MDA	<MDA	^{232}Th=0.44±0.09
23S-99-1453	0.88 ± 0.22	0.08 ± 0.03	1.6 ± 0.12	0.10 ± 0.08	<MDA	Not Identified
23S-99-1454	<MDA	<MDA	0.37 ± 0.06	<MDA	0.22 ± 0.08	Not Identified
23S-99-1455	<MDA	0.10 ± 0.05	0.09 ± 0.05	<MDA	<MDA	Not Identified
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
Sample Number	**^{238}U**	**^{235}U**	**^{137}Cs**	**^{134}Cs**	**^{60}Co**	**Other**
23S-99-1456	0.83 ± 0.23	0.10 ± 0.04	0.02 ± 0.01	<MDA	<MDA	^{232}Th=0.49±0.10
23S-99-1457	<MDA	<MDA	0.07 ± 0.03	<MDA	<MDA	Not Identified
23S-99-1458	<MDA	0.11 ± 0.05	0.67 ± 0.11	<MDA	0.13 ± 0.08	^{232}Th=0.69±0.14
23S-99-1459	0.66 ± 0.14	0.11 ± 0.07	<MDA	<MDA	<MDA	^{232}Th=0.29±0.06
23S-99-1460	0.50 ± 0.16	0.03 ± 0.02	0.12 ± 0.04	<MDA	<MDA	^{232}Th=0.54±0.09
23S-99-1461	<MDA	<MDA	0.09 ± 0.05	<MDA	<MDA	Not Identified
23S-99-1462	1.9 ± 0.40	<MDA	0.10 ± 0.04	<MDA	<MDA	^{228}Th=0.14±0.02, ^{232}Th=1.0±0.18
23S-99-1463	0.40 ± 0.14	0.08 ± 0.04	<MDA	<MDA	<MDA	^{228}Th=0.02±0.01, ^{232}Th=0.49±0.13
23S-99-1464	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1465	<MDA	<MDA	2.6 ± 0.19	0.21 ± 0.11	0.14 ± 0.10	Not Identified
23S-99-1466	0.50 ± 0.15	0.10 ± 0.03	0.02 ± 0.01	<MDA	<MDA	^{232}Th=0.49±0.10
23 S-99-1467	1.3 ± 0.33	0.14 ± 0.05	0.36 ± 0.08	<MDA	0.12 ± 0.09	^{232}Th=0.75±0.14
23S-99-1468	1.2 ± 0.36	0.07 ± 0.03	0.33 ± 0.06	<MDA	0.12 ± 0.06	^{232}Th=0.49±0.18
23S-99-1469	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1470	0.60 ± 0.21	0.10 ± 0.04	<MDA	<MDA	<MDA	^{232}Th=0.39±0.08
23S-99-1471	0.62 ± 0.16	0.07 ± 0.02	0.06 ± 0.04	<MDA	<MDA	^{232}Th=0.39±0.09
23S-99-1472	<MDA	0.04 ± 0.01	0.10 ± 0.03	<MDA	<MDA	Not Identified
23S-99-1473	<MDA	<MDA	0.44 ± 0.10	<MDA	0.15 ± 0.08	Not Identified
23S-99-1474	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1475	<MDA	<MDA	0.13 ± 0.06	<MDA	<MDA	Not Identified
23S-99-1476	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1477	0.90 ± 0.28	<MDA	0.12 ± 0.05	<MDA	<MDA	Not Identified
23S-99-1478	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1479	<MDA	<MDA	0.05 ± 0.03	<MDA	0.15 ± 0.12	Not Identified
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
Sample Number	**^{238}U**	**^{235}U**	**^{137}Cs**	**^{134}Cs**	**^{60}Co**	**Other**
23S-99-1480	<MDA	<MDA	0.27 ± 0.06	<MDA	0.25 ± 0.07	Not Identified
23S-99-1481	<MDA	<MDA	0.14 ± 0.06	<MDA	<MDA	Not Identified
23S-99-1561	<MDA	<MDA	0.13 ± 0.05	<MDA	<MDA	Not Identified
23S-99-1562	<MDA	<MDA	0.35 ± 0.05	<MDA	0.10 ±-.05	Not Identified
23S-99-1563	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1564	<MDA	<MDA	0.22 ± 0.07	<MDA	<MDA	Not Identified
23S-99-1565	<MDA	<MDA	0.05 ± 0.03	<MDA	<MDA	Not Identifed
23S-99-1566	<MDA	<MDA	0.13 ± 0.05	<MDA	<MDA	Not Identified
23 S-99-1567	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1568	<MDA	<MDA	0.12 ± 0.04	<MDA	<MDA	Not Identified
23S-99-1569	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1570	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1571	<MDA	<MDA	0.31 ± 0.06	<MDA	<MDA	Not Identified
23S-99-1572	0.30 ±0.09	0.03 ± 0.01	0.25 ± 0.06	<MDA	0.06 ± 0.07	Not Identified
23S-99-1573	<MDA	<MDA	0.31 ± 0.07	<MDA	<MDA	Not Identified
23S-99-1574	<MDA	<MDA	0.06 ± 0.03	<MDA	<MDA	Not Identified
23S-99-1575	<MDA	<MDA	0.08 ± 0.05	<MDA	<MDA	Not Identified
23S-99-1576	<MDA	0.04 ± 0.03	0.15 ±0.03	<MDA	<MDA	Not Identified
23S-99-1577	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1578	<MDA	<MDA	0.02 ± 0.01	<MDA	<MDA	Not Identified
23S-99-1579	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1580	<MDA	<MDA	0.43 ± 0.07	<MDA	0.09 ± 0.06	Not Identified
23S-99-1581	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1582	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1583	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1584	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
Sample Number	**^{238}U**	**^{235}U**	**^{137}Cs**	**^{134}Cs**	**^{60}Co**	**Other**
23S-99-1585	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1586	<MDA	<MDA	0.15 ± 0.03	<MDA	<MDA	Not Identified
23S-99-1587	<MDA	<MDA	0.07 ± 0.03	<MDA	<MDA	Not Identified
23S-99-1588	<MDA	<MDA	0.13 ± 0.05	<MDA	<MDA	Not Identified
23S-99-1589	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1590	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identifed
23S-99-1591	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23 S-99-1592	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1593	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1594	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1595	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1596	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1597	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1598	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1599	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1600	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1601	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1602	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1603	<MDA	0.05 ± 0.03	<MDA	<MDA	<MDA	Not Identified
23S-99-1604	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1605	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1606	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1607	<MDA	<MDA	0.14 ± 0.04	<MDA	0.09 ± 0.08	Not Identified
23S-99-1608	<MDA	0.04 ± 0.03	<MDA	<MDA	<MDA	Not Identified
23S-99-1609	<MDA	<MDA	0.18 ± 0.05	<MDA	0.09 ± 0.06	Not Identified
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
Sample Number	**^{238}U**	**^{235}U**	**^{137}Cs**	**^{134}Cs**	**^{60}Co**	**Other**
23S-99-1657	<MDA	0.16 ± 0.06	1.2 ± 0.14	<MDA	0.23 ± 0.11	^{232}Th=0.44±0.15
23S-99-1658	0.53 ± 0.18	0.07 ± 0.03	1.4 ± 0.12	<MDA	0.40 ± 0.090	Not Identified
23S-99-1659	<MDA	<MDA	0.70 ± 0.13	<MDA	0.20 ± 0.12	Not Identified
23S-99-1660	<MDA	<MDA	1.4 ± 0.11	0.10 ± 0.05	0.46 ± 0.10	Not Identified
23S-99-1661	<MDA	0.10 ± 0.05	1.2 ± 0.13	0.11 ± 0.08	0.38 ± 0.13	^{232}Th=0.54±0.16
23S-99-1662	<MDA	0.03 ± 0.01	1.6 ± 0.12	<MDA	0.49 ± 0.10	Not Identified
23S-99-1663	<MDA	0.07 ± 0.04	3.7 ± 0.20	0.19 ± 0.12	0.90 ± 0.14	^{232}Th=0.49±0.14
23S-99-1665	0.15 ± 0.06	0.03 ± 0.02	2.8 ± 0.18	<MDA	0.65 ± 0.17	^{232}Th=0.48±0.14
23S-99-1666	0.21 ± 0.11	0.14 ± 0.06	2.2 ± 0.17	0.18 ± 0.10	0.54 ± 0.15	^{232}Th=0.34±0.16
23 S-99-1667	<MDA	<MDA	1.0 ± 0.10	<MDA	0.26 ± 0.08	Not Identified
23S-99-1668	<MDA	<MDA	0.17 ± 0.05	<MDA	<MDA	Not Identified
23S-99-1669	<MDA	<MDA	0.23 ± 0.06	<MDA	0.14 ± 0.11	Not Identified
23S-99-1670	0.42 ± 0.12	0.05 ± 0.02	0.24 ± 0.06	<MDA	<MDA	^{232}Th=0.64±0.13
23S-99-1671	0.83 ± 0.27	0.12 ± 0.07	0.27 ± 0.09	<MDA	<MDA	^{228}Th=0.57±0.07, ^{232}Th=1.5±0.41
23S-99-1672	<MDA	0.04 ± 0.01	<MDA	<MDA	<MDA	Not Identified
23S-99-1673	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1674	<MDA	0.04 ± 0.01	0.21 ± 0.07	<MDA	0.11 ± 0.08	Not Identified
23S-99-1675	0.57 ± 0.15	0.13 ± 0.05	<MDA	<MDA	<MDA	^{232}Th=0.89±0.17
23S-99-1676	1.0 ± 0.29	0.04 ± 0.02	0.29 ±0.08	<MDA	0.20 ± 0.09	^{228}Th=0.09±0.01, ^{232}Th=0.89±0.17
23S-99-1677	0.77 ± 0.22	0.11 ± 0.06	2.5 ± 0.18	0.18 ± 0.12	0.63 ± 0.15	^{228}Th=0.14±0.02
23S-99-1678	<MDA	0.06 ± 0.03	4.4 ± 0.18	0.14 ± 0.07	0.91 ± 0.12	^{232}Th=0.49±0.11
23S-99-1683	<MDA	0.07 ± 0.03	0.05 ± 0.03	<MDA	<MDA	Not Identified
23S-99-1684	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1685	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
Sample Number	**^{238}U**	**^{235}U**	**^{137}Cs**	**^{134}Cs**	**^{60}Co**	**Other**
23S-99-1686	<MDA	0.12 ± 0.07	0.13 ± 0.04	<MDA	0.18 ± 0.08	Not Identified
23S-99-1687	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1688	<MDA	<MDA	0.11 ± 0.04	<MDA	<MDA	Not Identified
23S-99-1689	<MDA	<MDA	0.12 ± 0.05	<MDA	0.10 ± 0.12	Not Identified
23S-99-1690	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1691	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1692	<MDA	<MDA	<MDA	0.07 ± 0.05	<MDA	Not Identified
23S-99-1693	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1694	<MDA	<MDA	0.01 ± 0.007	<MDA	<MDA	Not Identified
23S-99-1695	<MDA	0.06 ± 0.03	0.32 ± 0.09	<MDA	0.19 ± 0.10	Not Identified
23S-99-1696	<MDA	0.04 ± 0.02	0.17 ± 0.06	<MDA	0.10 ± 0.08	Not Identified
23S-99-1697	<MDA	0.06 ± 0.03	0.02 ± 0.02	<MDA	<MDA	^{228}Th=0.04±0.01, ^{232}Th=0.74±0.46
23S-99-1698	1.4 ± 0.36	0.14 ± 0.07	0.06 ± 0.03	<MDA	<MDA	^{232}Th=0.54±0.10
23S-99-1699	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1700	<MDA	0.06 ± 0.03	<MDA	<MDA	<MDA	Not Identified
23S-99-1701	<MDA	0.18 ± 0.07	<MDA	<MDA	<MDA	^{228}Th=0.28±0.03, ^{232}Th=0.94±0.18
23S-99-1702	<MDA	<MDA	0.07 ± 0.03	<MDA	0.04 ± 0.04	Not Identified
23S-99-1703	0.46 ± 0.17	0.11 ± 0.05	<MDA	<MDA	<MDA	^{228}Th=0.08±0.01, ^{232}Th=0.64±0.20
23S-99-1704	<MDA	0.13 ± 0.04	<MDA	<MDA	0.05 ± 0.04	^{232}Th=0.54±0.11
23S-99-1705	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
Sample Number	**^{238}U**	**^{235}U**	**^{137}Cs**	**^{134}Cs**	**^{60}Co**	**Other**
23 S-99-1706	1.4 ± 0.36	0.16 ± 0.05	0.44 ± 0.03	<MDA	0.23 ± 0.09	^{228}Th=0.25±0.03 ^{232}Th=0.84±0.19
23S-99-1707	0.53 ± 0.21	0.08 ± 0.04	<MDA	<MDA	<MDA	^{228}Th=0.15±0.02, ^{232}Th=1.1±0.27
23S-99-1708	0.60 ± 0.14	0.12 ± 0.09	2.6 ± 0.16	0.23 ± 0.13	0.52 ± 0.11	^{232}Th=0.74±0.18
23S-99-1709	<MDA	<MDA	5.1 ± 0.21	0.18 ± 0.08	0.54 ± 0.13	Not Identified
23S-99-1710	<MDA	<MDA	4.8 ± 0.19	0.15 ± 0.06	0.92 ± 0.12	^{232}Th=0.49±0.11
23S-99-1711	<MDA	0.06 ± 0.02	1.2 ± 0.11	0.08 ± 0.06	0.44 ± 0.13	Not Identified
23S-99-1712	<MDA	0.07 ± 0.03	0.87 ± 0.12	0.17 ± 0.11	0.22 ± 0.13	^{228}Th=0.06±0.01, ^{232}Th=0.69±0.17
23S-99-1713	<MDA	0.07 ± 0.04	2.1 ± 0.17	<MDA	0.90 ± 0.16	^{228}Th=0.15±0.02, ^{232}Th=0.94±0.24
23S-99-1714	0.47 ± 0.15	0.08 ± 0.04	0.80 ± 0.11	<MDA	0.22 ± 0.10	^{228}Th=0.12±0.01, ^{232}Th=0.89±0.16
23S-99-1715	<MDA	0.04 ± 0.03	1.3 ± 0.15	<MDA	0.60 ± 0.14	^{232}Th=0.74±0.22
23S-99-1716 @ 6"	1.4 ± 0.34	0.11 ± 0.04	1.5 ± 0.13	0.11 ± 0.10	0.57 ± 0.11	^{228}Th=0.13±0.01, ^{232}Th=0.29±0.07
23S-99-1717 @ 12"	0.82 ± 0.26	0.13 ± 0.06	0.80 ± 0.13	<MDA	0.26 ± 0.13	^{228}Th=0.16±0.02, ^{232}Th=1.1±0.22
23S-99-1718 @ 18"	0.90 ± 0.26	0.17 ± 0.06	0.90 ± 0.34	<MDA	<MDA	^{232}Th=0.69±0.21
23S-99-1719 @24"	<MDA	<MDA	0.17 ± 0.08	<MDA	0.10 ± 0.07	Not Identified
23S-99-1720 @30"	<MDA	0.07 ± 0.03	0.16 ± 0.08	<MDA	0.20 ± 0.13	^{232}Th=0.89±0.24
23S-99-1721 @ 36"	1.7 ± 0.49	0.09 ± 0.05	0.09 ± 0.06	<MDA	0.10 ± 0.07	^{232}Th=1.3±0.31
23S-99-1722 @ 42"	<MDA	0.11 ± 0.03	0.13 ± 0.06	<MDA	0.14 ± 0.06	Not Identified
23S-99-1723 @ 48"	<MDA	0.12 ± 0.06	0.32 ± 0.10	<MDA	0.22 ± 0.10	^{228}Th=0.21±0.02, ^{232}Th=0.94±0.23
23S-99-1724 @ 54"	0.77 ± 0.20	<MDA	0.31 ± 0.08	<MDA	0.24 ± 0.08	^{232}Th=0.69±0.28
23S-99-1725 @ 60"	1.1 ± 0.43	0.10 ± 0.06	0.29 ± 0.07	<MDA	<MDA	^{232}Th=0.74±0.25
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
Sample Number	**^{238}U**	**^{235}U**	**^{137}Cs**	**^{134}Cs**	**^{60}Co**	**Other**
23S-99-1726 @ 66"	0.74 ± 0.21	<MDA	0.09 ± 0.04	<MDA	<MDA	Not Identified
23S-99-1727 @ 72"	1.1 ± 0.26	0.04 ± 0.02	0.20 ± 0.06	<MDA	<MDA	^{228}Th=0.03±0.01, ^{232}Th=0.44±0.10
23S-99-1728@6"	0.24 ± 0.07	0.07 ± 0.03	0.07 ± 0.04	<MDA	<MDA	^{228}Th=0.16±0.02, ^{232}Th=0.39±0.08
23S-99-1729@12"	0.16 ± 0.06	0.10 ± 0.04	<MDA	<MDA	<MDA	^{232}Th=0.29±0.06
23S-99-1730@18"	0.61 ± 0.16	0.08 ± 0.03	0.06 ± 0.04	<MDA	<MDA	^{232}Th=0.69±0.13
23S-99-1731@24"	0.67 ± 0.18	0.12 ± 0.06	<MDA	<MDA	<MDA	^{232}Th=0.44±0.12
23S-99-1732@30"	0.29 ± 0.09	0.07 ± 0.03	<MDA	<MDA	<MDA	^{232}Th=0.49±0.10
23S-99-1733@36"	1.0 ± 0.35	0.18 ± 0.07	<MDA	<MDA	<MDA	^{232}Th=1.3±0.28
23S-99-1734@42"	0.57 ± 0.18	0.05 ± 0.03	<MDA	<MDA	<MDA	^{228}Th=0.21±0.03, ^{232}Th=1.0±0.27
23S-99-1735@48"	1.2 ± 0.37	0.05 ± 0.03	<MDA	<MDA	<MDA	^{232}Th=0.54±0.13
23S-99-1736@54"	0.93 ± 0.24	0.03 ± 0.01	<MDA	<MDA	<MDA	^{232}Th=0.49±0.10
23S-99-1737@60"	0.90 ± 0.34	0.16 ± 0.04	<MDA	<MDA	<MDA	^{232}Th=0.84±0.19
23S-99-1738@66"	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23 S-99-1739@72"	1.0 ± 0.31	0.13 ± 0.05	<MDA	<MDA	<MDA	^{232}Th=0.79±0.21
23S-99-1774	<MDA	<MDA	0.01 ± 0.007	<MDA	<MDA	Not Identified
23S-99-1775	0.32 ± 0.10	<MDA	<MDA	<MDA	<MDA	^{232}Th=0.74±0.18
23S-99-1776	0.87 ± 0.28	0.07 ± 0.03	0.05 ± 0.03	<MDA	0.06 ± 0.04	^{232}Th=0.80±0.18
23S-99-1777	0.32 ± 0.11	<MDA	0.42 ± 0.09	<MDA	1.2 ± 0.16	Not Identified
23S-99-1778	<MDA	<MDA	0.32 ± 0.08	<MDA	0.09 ± 0.06	Not Identified
23S-99-1779	<MDA	<MDA	0.33 ± 0.07	<MDA	0.09 ± 0.08	Not Identified
23S-99-1780	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1781	<MDA	<MDA	0.06 ± 0.03	<MDA	0.18 ± 0.09	Not Identified
23S-99-1782	<MDA	<MDA	0.10 ± 0.02	<MDA	0.07 ± 0.05	Not Identified
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
Sample Number	**^{238}U**	**^{235}U**	**^{137}Cs**	**^{134}Cs**	**^{60}Co**	**Other**
23S-99-1783	<MDA	0.05 ± 0.03	0.26 ± 0.07	<MDA	0.15 ± 0.08	$^{232}Th = 0.17 \pm 0.05$
23S-99-1784	<MDA	0.11 ± 0.08	1.08 ± 0.10	<MDA	0.25 ± 0.07	Not Identified
23S-99-1785	<MDA	0.02 ± 0.01	<MDA	<MDA	<MDA	$^{232}Th = 0.17 \pm 0.05$
23S-99-1786	<MDA	<MDA	0.08 ± 0.03	<MDA	<MDA	Not Identified
23S-99-1787	<MDA	<MDA	0.12 ± 0.06	<MDA	<MDA	Not Identified
23S-99-1788	0.21 ± 0.07	0.12 ± 0.05	0.09 ± 0.03	<MDA	0.08 ± 0.08	$^{232}Th = 0.23 \pm 0.05$
23S-99-1789	<MDA	<MDA	0.01 ± 0.01	<MDA	0.09 ± 0.06	$^{232}Th = 0.02 \pm 0.01$
23S-99-1790	<MDA	<MDA	<MDA	0.05 ± 0.04	<MDA	Not Identified
23S-99-1791	<MDA	<MDA	0.07 ± 0.05	<MDA	<MDA	$^{232}Th = 0.05 \pm 0.01$
23S-99-1792	<MDA	<MDA	0.04 ± 0.02	<MDA	<MDA	Not Identified
23S-99-1793	<MDA	<MDA	0.21 ± 0.06	<MDA	0.07 ± 0.06	$^{232}Th = 0.13 \pm 0.04$
23S-99-1794	<MDA	<MDA	<MDA	<MDA	<MDA	$^{232}Th = 0.33 \pm 0.08$
23S-99-1795	<MDA	0.13 ± 0.09	<MDA	<MDA	<MDA	$^{232}Th = 0.62 \pm 0.15$
23S-99-1796	<MDA	<MDA	0.03 ± 0.02	<MDA	<MDA	Not Identified
23S-99-1797	<MDA	0.01 ± 0.01	0.02 ± 0.02	<MDA	<MDA	$^{232}Th = 0.60 \pm 0.21$
23S-99-1940	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-1941	0.57 ± 0.27	<MDA	2.0 ± 0.15	<MDA	0.21 ± 0.12	Not Identified
23S-99-1943	<MDA	0.04 ± 0.02	2.7 ± 0.18	<MDA	0.22 ± 0.09	Not Identified
23S-99-1946	0.67 ± 0.22	0.10 ± 0.04	1.3 ± 0.12	<MDA	0.22 ± 0.10	$^{228}Th=0.06\pm0.01$, $^{232}Th=0.94\pm0.22$
23S-99-1947	<MDA	0.05 ± 0.02	0.20 ± 0.06	<MDA	<MDA	Not Identified
23S-99-1950	<MDA	<MDA	0.24 ± 0.06	<MDA	<MDA	Not Identified
23S-99-2005	0.51 ± 0.17	0.05 ± 0.02	2.4 ± 0.15	0.14 ± 0.07	0.63 ± 0.19	Not Identified
23S-99-2006	<MDA	<MDA	0.52 ±0.08	<MDA	0.12 ± 0.08	Not Identified
23S-99-2007	<MDA	<MDA	3.6 ± 0.30	<MDA	0.82 ± 0.25	Not Identified
23S-99-2008	<MDA	0.10 ± 0.04	<MDA	<MDA	<MDA	$^{232}Th=1.1 \pm 0.26$
23S-99-2009	<MDA	<MDA	0.79 ± 0.14	<MDA	0.49 ± 0.14	Not Identified
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

HCF Pits and Trenches Final Survey Soil Sample Results

	Sample Results in pCi/g Above Background					
Sample Number	**^{238}U**	**^{235}U**	**^{137}Cs**	**^{134}Cs**	**^{60}Co**	**Other**
23S-99-2010	<MDA	<MDA	<MDA	<MDA	<MDA	Not Identified
23S-99-2011	<MDA	0.17 ± 0.09	<MDA	<MDA	<MDA	Not Identified
23S-99-2012	1.0 ± 0.41	0.12 ± 0.06	1.3 ± 0.21	<MDA	0.52 ± 0.19	Not Identified
23S-99-2013	0.19 ± 0.06	0.03 ± 0.01	<MDA	<MDA	<MDA	Not Identified
23S-99-2014	<MDA	0.16 ± 0.05	<MDA	<MDA	<MDA	Not Identified
Nominal Background	2.1 pCi/g	0.14 pCi/g	0.07 pCi/g	N.D.	N.D.	
MDA	0.85 pCi/g	0.087 pCi/g	0.068 pCi/g	0.069 pCi/g	0.071 pCi/g	

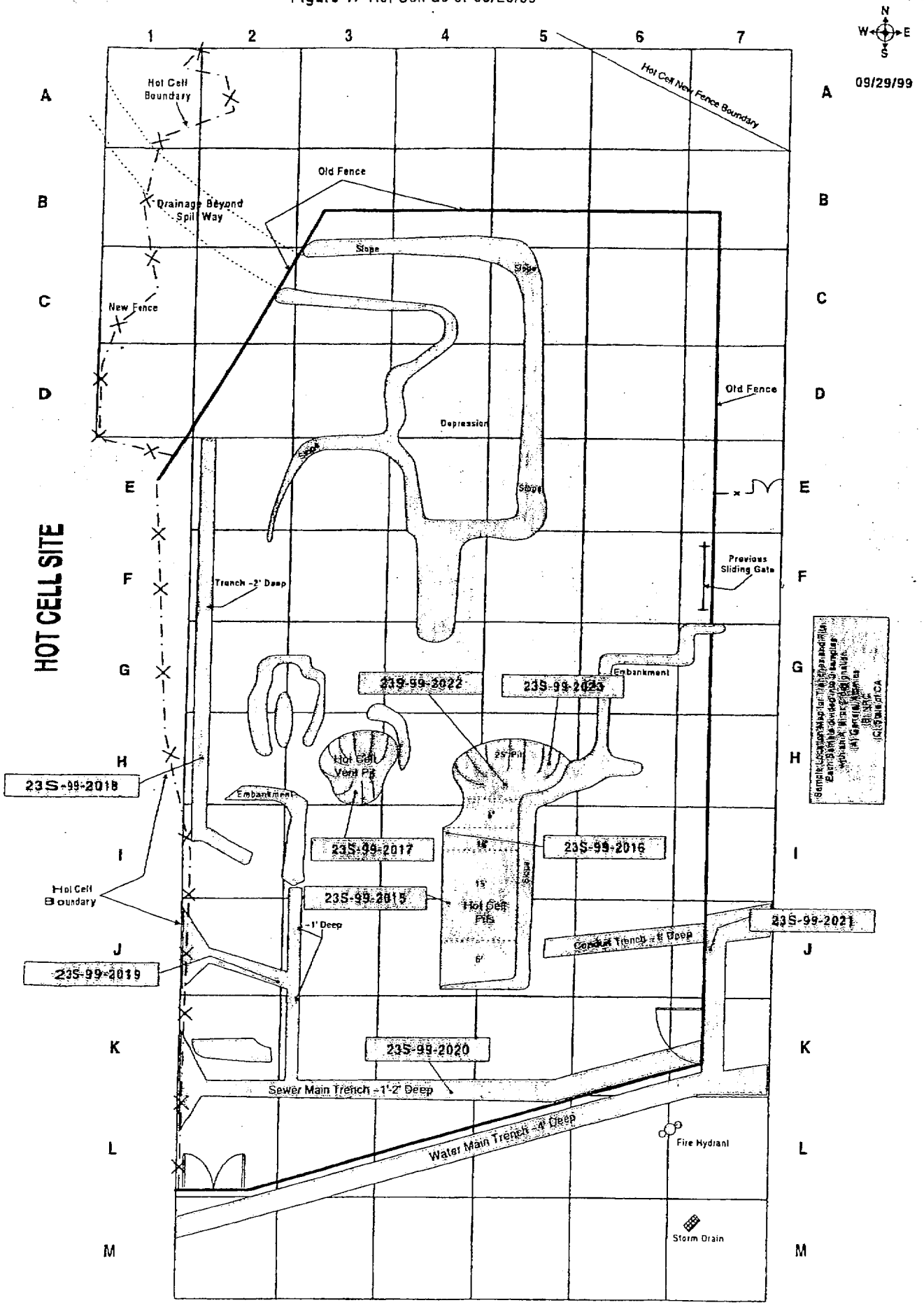
Note: <MDA means less than the Minimum Detectable Activity. Not Identified means not detected or Background.

Attachment-2

Hot Cell Site Pits and Trenches

Split Soil Sample Locations and GA Sample Set Results

Figure 1: Hot Cell as of 09/29/99



Hot Cell Site NRC Split Soil Sample Gamma Spectroscopy Results

GA Sample Set

Sample ID	Radionuclide Concentrations (pCi/g) *Gross Activity*[1]							
	^{137}Cs	^{60}Co	^{134}Cs	^{235}U	^{238}U	^{228}Th	^{232}Th	$\sum$ of Fractions
23S-99-2015A	0.30 ± 0.09	ND	ND	0.24 ± 0.07	3.4 ± 0.86	ND	2.25 ± 0.43	>0.30,<0.50
23S-99-2016A	ND	ND	ND	0.23 ± 0.07	3.3 ± 0.64	ND	1.8 ± 0.37	>0.30,<0.50
23S-99-2017A	ND	ND	ND	ND	ND	ND	ND	<0.30
23S-99-2018A	ND	ND	ND	0.18 ± 0.07	2.4 ± 0.70	ND	2.1 ± 0.39	<0.30
23S-99-2019A	ND	ND	ND	ND	ND	ND	ND	<0.30
23S-99-2020A	ND	ND	ND	ND	ND	ND	ND	<0.30
23S-99-2021A	0.23 ± 0.05	ND	ND	ND	ND	ND	ND	<0.30
23S-99-2022A	1.3 ± 0.12	0.46 ± 0.21	ND	0.19 ± 0.07	ND	ND	1.7 ± 0.21	<0.30
23S-99-2023A	0.25 ± 0.07	0.05 ± 0.05	ND	ND	ND	ND	ND	<0.30
Nominal Background	0.07	ND	ND	0.14	2.10	1.19	1.31	

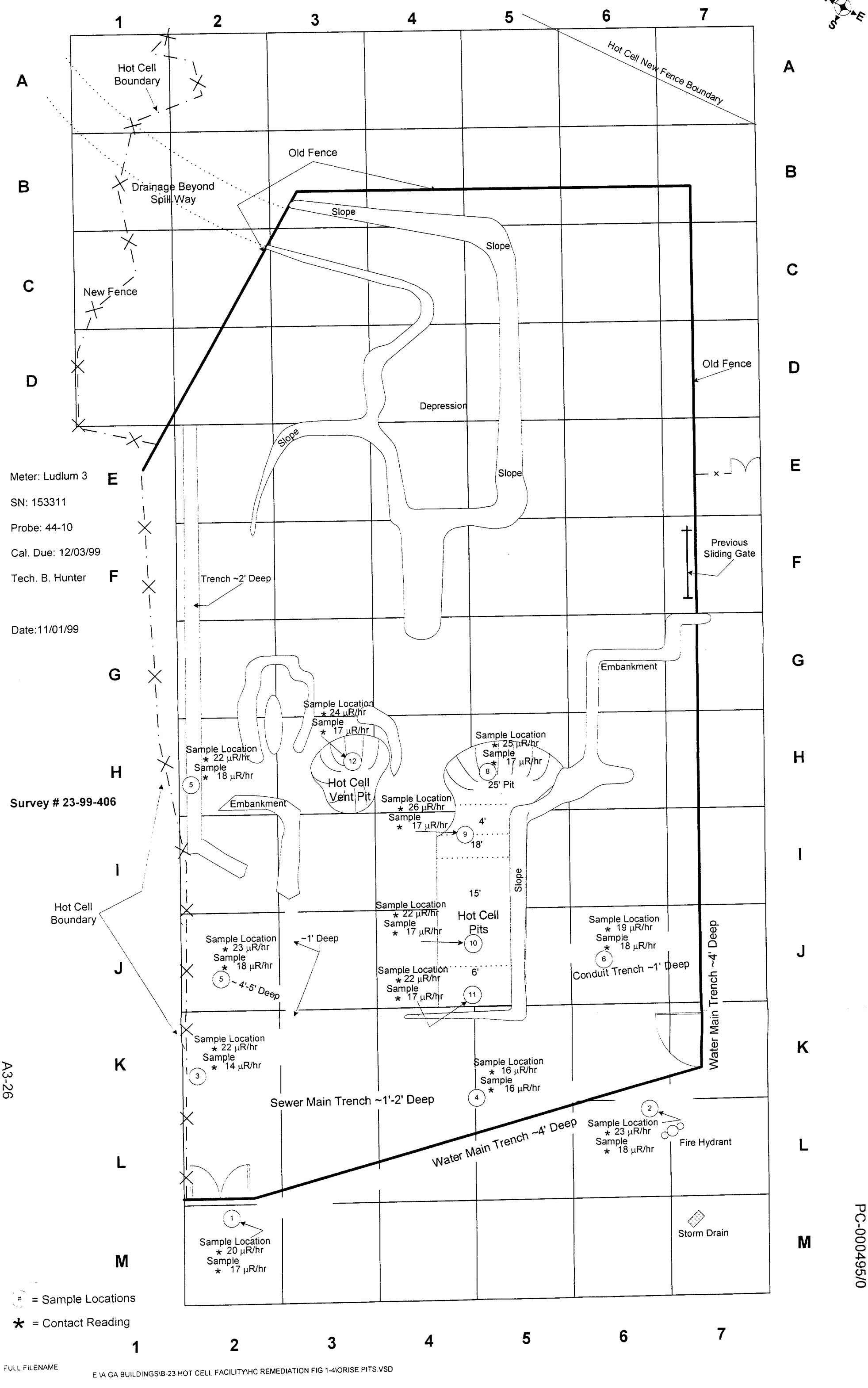
(1) ND means: Background, Not Detectable, or less than Minimum Detectable Activity.

Attachment-3

Hot Cell Site Pits and Trenches

ORISE Soil Sample Locations and Contact Exposure Rate Measurements

ORISE: Soil Sample Location Map 11/01/99



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Appendix 4

of

General Atomics' Final Radiological Survey Report for the Hot Cell Site

"Results of Radiological Surveys Completed in the Fuel Tank Pit"

Appendix 4
Results of the Radiological Surveys Completed in the Fuel Tank Pit Diesel Fuel Tank Pit

During construction of the Hot Cell Facility, a diesel fuel tank was installed to supply fuel for the boiler. The Diesel Fuel Tank was located adjacent to the Boiler Room. Figure A4-1 identifies the former location of this underground tank.

At a later time, circa mid-1980's, a natural gas supply system was added to provide fuel to the boiler and the Diesel Fuel Tank was removed from service and filled with sand.

In September 1997, the Diesel Fuel Tank was excavated and removed from the Hot Cell Site. During the removal of the tank, soil samples were taken of the soil around the tank and the sand inside of the tank. The description of the soil sample locations for samples taken on 9/19/97 and 9/22/97 are as follows:

Sample Number	Description
23S-97-048	East side of tank at approximately 2 ft. below the surface
23S-97-049	West side of tank at approximately 2 ft. below the surface
23S-97-050	West side of tank at approximately 8 ft. below the surface
23S-97-051	East side of tank at approximately 8 ft. below the surface
23S-97–52	Sand from inside of tank

The gamma spectroscopy analysis of these samples indicated there was no activity above natural background concentrations. See Table A4-1 for soil sample results.

The excavation pit created by the tank removal was filled in with clean soil from off site.

Figure A4-1: Hot Cell Site Diesel Fuel Tank Location

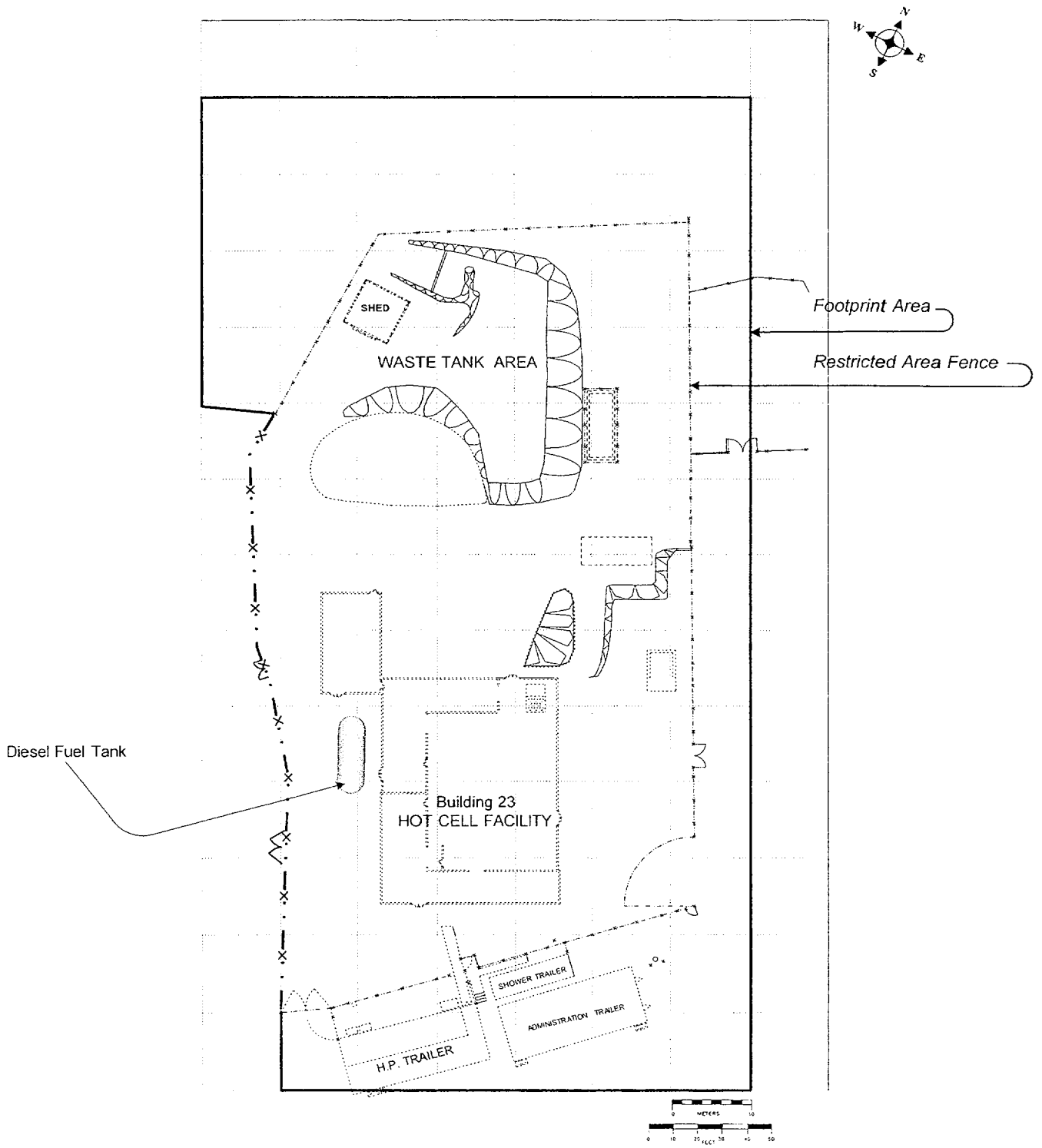


Table A4-1: Gamma Spectroscopy Soil Sample Results from Diesel Fuel Tank Area

#	Sample ID	Radionuclide Concentrations (pCi/g) [1] *Background Not Subtracted*							Sum of Fractions [2]
		Cs-137		Co-60		Sr-90	Cs-134		
		pCi/g	% error (2 SD)	pCi/g	% error (2 SD)	Estimated pCi/g [2]	pCi/g	% error (2 SD)	
1	23S-97-048	ND	--	ND	--	0	ND	--	0.00
2	23S-97-049	ND	--	ND	--	0	ND	--	0.00
3	23S-97-050	ND	--	ND	--	0	ND	--	0.00
4	23S-97-051	ND	--	ND	--	0	ND	--	0.00
5	23S-97-052	ND	--	ND	--	0	ND	--	0.00

(1) Gamma spectroscopy results of soil samples collected from the pit. Background was not subtracted from any of the results. The uranium and thorium values were at or near normal background levels. ND means < 0.1 pCi/g for Cs-137, Co-60 and Cs-134.

(2) Estimated pCi/g based on 2.1 times the Cs-137 concentration.

Appendix 5

of

General Atomics' Final Radiological Survey Report for the Hot Cell Site

"Results of Radiological Surveys Completed in the Stack Sampling Pit"

Appendix 5
Results of the Radiological Surveys Completed in the Stack Sampling Pit

Background:
During the removal of the Stack Sampling Pit at the Hot Cell Facility in June, 1998, a large excavation crater was created. Due to safety and logistics concerns with the continuation of demolition activities, the pit was surveyed,(including the collection of soil samples), lined with burlap material, and filled with soil removed during the excavation process. This excavated soil was also sampled and analyzed to demonstrate it was suitable for use as fill material. Figure A5-1 shows the location of the filled in pit.

Soil sampling
The soil sampling locations are identified in Figure A5-2. The results of soil sample analyses are provided in Table A5-1. Nothing was detected in twenty-four (24) of the thirty-one (31) samples analyzed. Only seven (7) out of the thirty-one (31) samples analyzed identified low levels of activity above natural background. The highest of these sample results was 32 % of the GA release limit.

Direct Radiation Dose Rate Measurements
Direct radiation measurements were made in the stack sampling pit with a Ludlum model 19 Micro-R meter which has an internal 1"x1" NaI(Tl) detector. The scans were performed 360^0 around the open pit at 3 ft., 2 ft., and 1 ft. above the ground, 360^0 at ground level, and 360^0 at contact with the pit walls every 1 ft. down to the bottom of the pit which was 12 ft. deep. At the time of this survey, the Hot Cell Facility was still standing and contributed to the high above ground radiation levels which were as high as 65 μR/hr. The radiation dose rates inside the pit at 1 ft. below the surface was as high as 40 μR/hr (maximum) which decreased to 35 μR/hr (maximum) at 2 ft. below the surface and stabilized between 20 to 30 μR/hr from 3 ft. below the surface to 12 ft. below the surface.

A summary of the radiation background surveys inside unaffected area pits range from 25 to 27 μR/hr, see Appendix 2,. Therefore, ignoring the "shine" from the Hot Cell Facilities, the radiation levels inside the stack sampling pit were at natural background levels. This conclusion is corroborated by the results of the soil sample analyses which demonstrate that the soil comprising the surface of the walls of the pit meets the approved release criteria. See table A5-2 for a summary of the results.

During soil remediation efforts, approximately three (3) feet of soil was removed from the top of the area the Stack Sampling Pit was located.

Figure A5-1: Hot Cell Stack Sampling Pit

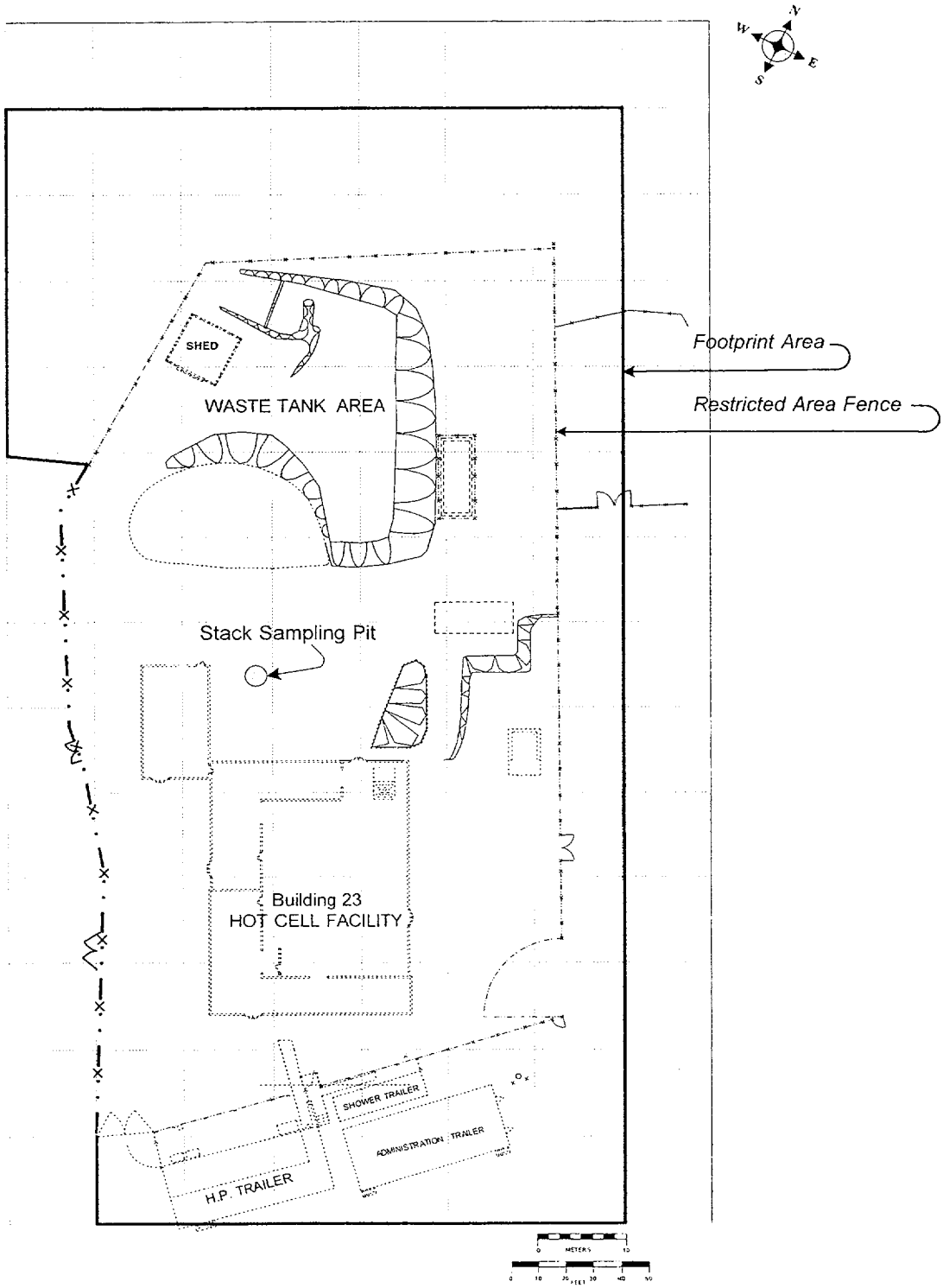
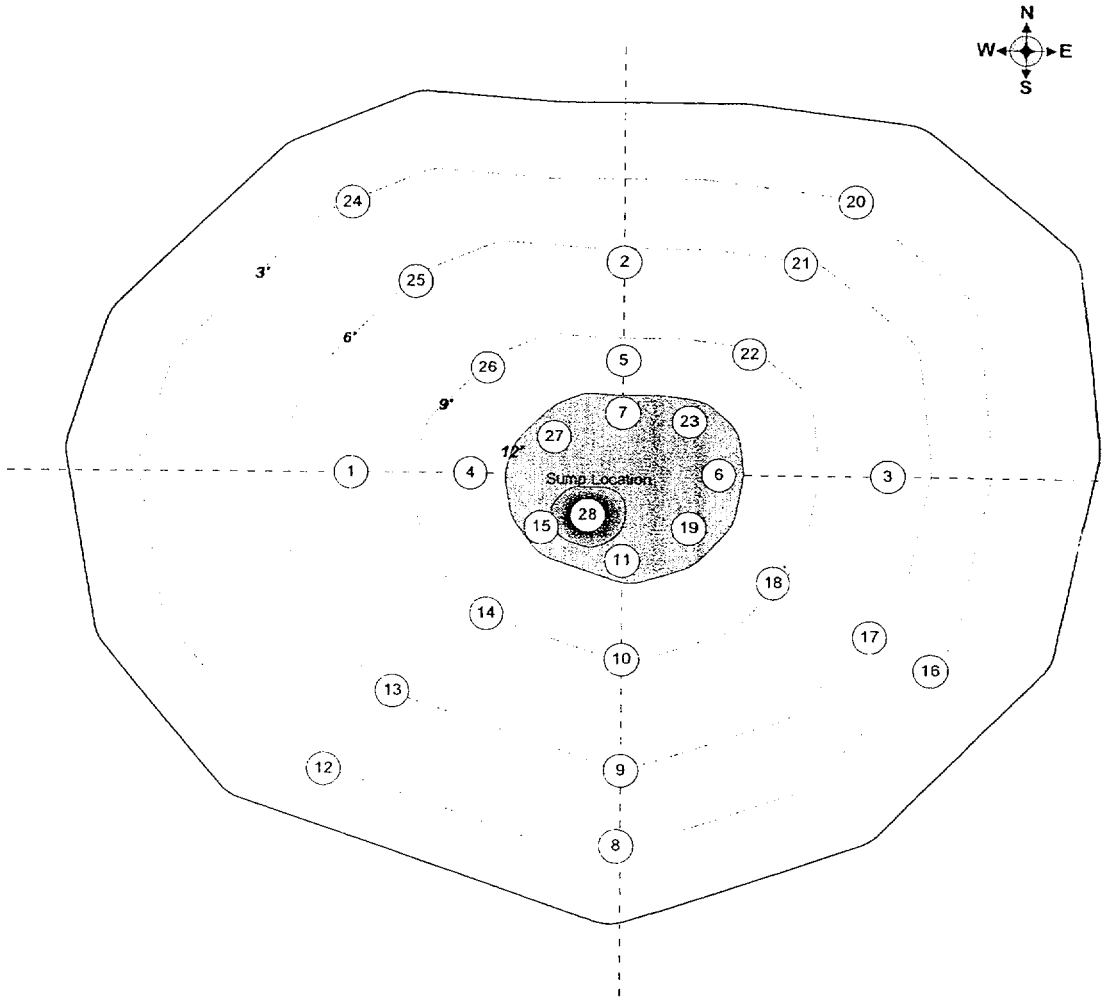


Figure 5A-2: Stack Sampling Pit Soil Sample Locations

#	Sample ID #
1	23S-98-086
2	23S-98-087
3	23S-98-088
4	23S-98-089
5	23S-98-090
6	23S-98-091
7	23S-98-092
8	23S-98-105
9	23S-98-106
10	23S-98-107
11	23S-98-108
12	23S-98-134
13	23S-98-135
14	23S-98-136
15	23S-98-137
16	23S-98-138
17	23S-98-139
18	23S-98-140
19	23S-98-141
20	23S-98-142
21	23S-98-143
22	23S-98-144
23	23S-98-145
24	23S-98-146
25	23S-98-147
26	23S-98-148
27	23S-98-149
28	23S-98-150



Samples 29, 30, and 31 listed in Table A5-1,
were taken in the excavated soil removed from Stack Sampling Pit.

Table A5-1: Gamma Spectroscopy Soil Sample Results from the Stack Sample Pit

#	Sample ID	Radionuclide Concentrations (pCi/g) [1] *Background Not Subtracted*							Sum of Fractions [2]
		Cs-137		Co-60		Sr-90	Cs-134		
		pCi/g	% error (2 SD)	pCi/g	% error (2 SD)	Estimated pCi/g [3]	pCi/g	% error (2 SD)	
1	23S-98-086	ND	--	ND	--	0	ND	--	0.00
2	23S-98-087	ND	--	ND	--	0	ND	--	0.00
3	23S-98-088	0.12	70.5	ND	--	0.252	ND	--	0.01
4	23S-98-089	ND	--	ND	--	0	ND	--	0.00
5	23S-98-090	ND	--	ND	--	0	ND	--	0.00
6	23S-98-091	ND	--	ND	--	0	ND	--	0.00
7	23S-98-092	ND	--	ND	--	0	ND	--	0.00
8	23S-98-105	ND	--	ND	--	0	ND	--	0.00
9	23S-98-106	ND	--	ND	--	0	ND	--	0.00
10	23S-98-107	ND	--	ND	--	0	ND	--	0.00
11	23S-98-108	ND	--	ND	--	0	ND	--	0.00
12	23S-98-134	ND	--	ND	--	0	ND	--	0.00
13	23S-98-135	ND	--	ND	--	0	ND	--	0.00
14	23S-98-136	ND	--	ND	--	0	ND	--	0.00
15	23S-98-137	ND	--	ND	--	0	ND	--	0.00
16	23S-98-138	0.10	72.8	0.19	4.9	0.21	ND	--	0.03
17	23S-98-139	ND	--	ND	--	0	ND	--	0.00
18	23S-98-140	0.11	55.1	ND	--	0.231	ND	--	0.01
19	23S-98-141	ND	--	ND	--	0	ND	--	0.00
20	23S-98-142	0.33	38.3	0.24	38.4	0.693	ND	--	0.05
21	23S-98-143	0.11	68.4	ND	--	0.231	ND	--	0.01
22	23S-98-144	ND	--	ND	--	0	ND	--	0.00
23	23S-98-145	ND	--	ND	--	0	ND	--	0.00
24	23S-98-146	ND	--	ND	--	0	ND	--	0.00

Table A5-1: Gamma Spectroscopy Soil Sample Results from the Stack Sample Pit

#	Sample ID	Radionuclide Concentrations (pCi/g) [1] *Background Not Subtracted*							Sum of Fractions [2]
		Cs-137		Co-60		Sr-90	Cs-134		
		pCi/g	% error (2 SD)	pCi/g	% error (2 SD)	Estimated pCi/g [3]	pCi/g	% error (2 SD)	
25	23S-98-147	ND	--	ND	--	0	ND	--	0.00
26	23S-98-148	ND	--	ND	--	0	ND	--	0.00
27	23S-98-149	ND	--	ND	--	0	ND	--	0.00
28	23S-98-150	ND	--	ND	--	0	ND	--	0.00
29	23S-98-151	ND	--	ND	--	0	ND	--	0.00
30	23S-98-152	2.56	8.6	1.07	18.2	5.376	ND	--	0.31
31	23S-98-153	2.48	7.0	1.25	12.9	5.208	ND	--	0.32

(1) Background was not subtracted from any of the results. The uranium and thorium values were at or near normal background levels. ND means < 0.1 pCi/g for Cs-137, Co-60 and Cs-134.

(2) Sum of Fractions Calculated as follows: $\sum_{i=1}^{n} C_i/L_i \leq 1$

Where: C_i = concentration of radionuclide i in soil (pCi/g)
L_i = Limit (concentration) for radionuclide i in soil (pCi/g)

(3) Estimated pCi/g based on 2.1 times the Cs-137 concentration.

Table A5-2 Stack Sampling Pit Radiation Dose Rate Measurements		
Distance From Ground Surface In Feet	**Radiation Dose Rates in μR/hr**	
	High	**Low**
+3	65	35
+2	60	35
+1	60	30
0	50	30
-1	40	30
-2	35	28
-3	30	20
-4 to -12	30	30

Notes:

1. All scans taken with a Ludlum model 19 Micro-R meter which has an internal 1'x1' NaI(Tl) detector.

2. All measurements taken 360^0 around the pit at the distances from the ground levels as indicated in the table.

3. All measurements in the pit were at 1 foot from the pit surface.

Appendix 6

of

General Atomics' Final Radiological Survey Report for the Hot Cell Site

"Hot Cell Facility Sr-90, Plutonium and Tritium Soil Sample Results"

Appendix 6: Hot Cell Facility Sr-90, Plutonium, and Tritium Soil Samples Results

Background

The Characterization Survey identified elevated activity in some soil samples. The elevated activity was primarily the fission product ^{137}Cs and the activation product ^{60}Co, and, to a lessor degree, the fission product ^{134}Cs.

Based on the history of the Hot Cell Facility, it was prudent to address the question of whether plutonium and/or Am-241 was present in the soil. The following information is being supplied to address this issue:

1. Results for ~1,000 soil samples collected and analyzed by gamma spectroscopy (using a high purity germanium detector) during post decontamination surveys showed no measurable Am-241; the typical sensitivity for a 30 minute count is < 0.3 pCi/g.

2. The results of the analyses of these ~1,000 soil samples showed U-235 concentrations at or near natural background levels (i.e., typically < 0.2 pCi/g). During the characterization study, U-235 concentrations in ~30 soil samples analyzed were also found to be at or near background levels. On the basis of process knowledge, no plutonium is expected to be present. However, if it were present, it would be expected to be at levels significantly less than those of U-235.

3. General Atomics submitted ten (10) soil samples from the Hot Cell site and two (2) background soil samples to an outside laboratory for plutonium analysis. The results showed no detectable plutonium (results attached).

Also based on the history of the Hot Cell Facility, it was prudent to address the question of whether tritium (^{3}H) was present in the soil. The following information is being supplied to address this issue.

1. Tritium used in the Facility was contained inside an enclosed system within an enclosure which was confined to a single room (room 109) within the Hot Cell building. Tritium which was released (as effluent) was in a gaseous form. At the end of the project, DOE personnel came onsite to remove the tritium and the potentially contaminated equipment including the enclosure from the facility. Subsequently, during Hot Cell decommissioning and dismantlement, the walls and floors of this room (along with most of the building) were disposed of as radioactive waste.

2. Nevertheless, GA submitted ten (10) soil samples from the Hot Cell site and two (2) background soil samples to an outside laboratory for tritium analysis. No tritium was detected in any of the samples (see Appendix 6 for results).

The Hot Cell Site soil contaminants were found to be Cs-137 and Co-60 with occasional trace quantities of Cs-134. The uranium and thorium concentrations detected in the soil were at or near background levels. Sr-90 was estimated based on the Cs-137 concentration at a ratio of 2.1:1. This ratio was based on soil samples analyzed for Sr-90 at an outside lab (results attached). This ratio is

conservative for the following reasons:

1. Only soil samples with the highest ^{137}Cs concentrations were analyzed.

2. When ^{90}Sr was not detected, the Minimum Detectable Activity for the analysis equipment was used as the ^{90}Sr concentration.

Attachments:

1. Memo dated January 12, 2000, from W. T. LaBonte to L. Q. Gonzales, on "Comparison of GA/Quanterra Hot Cell Soil Sample Analysis Results".

2. Memo dated January 12, 2000, from W. T. LaBonte to L. Q. Gonzales, on "Hot Cell Soil Sample Tritium Results"

3. Memo dated November 11, 1998, from W. T. LaBonte to L. Q. Gonzales, on "Hot Cell Facility Strontium-90 Results".

Internal Correspondence

From: W. T. LaBonte **In Reply Refer to:**

To: L. Q. Gonzales **Date:** January 12, 2000

Subject: Comparison of GA / Quanterra Hot Cell Soil Sample Analysis Results

Scope

On June 18, 1999, 10 soil samples from the Hot Cell Site and 2 background soil samples collected off site were sent to Quanterra Environmental Services for the following reasons:

1. To provide a cross check on the accuracy of the GA gamma spectroscopy analysis when compared to an independent laboratory.

2. To determine if Strontium-90 is present and, if present, the Strontium-90 to Cesium-137 ratio.

3. To determine if Plutonium, mainly mass numbers 238, 239 and 240, was present.

The samples were sent in 500 ml Marinelli containers to ensure a common geometry for gamma spectroscopy analysis, and the counting time was 30 minutes per sample at both laboratories. The background samples were sent to each laboratory as blind samples (identified the same as the site soil samples).

GA did not perform a Strontium or Plutonium analysis on these samples because the radiochemical capabilities required no longer exists at GA.

The criteria from the USNRC Inspection Procedure 84525, Quality Assurance and Confirmatory Measurements for In-Plant Radiochemical Analysis, was used to perform the comparison of the GA results with the Quanterra results.

Results

See the attached table, General Atomics and Quanterra Analysis Comparison, for a summary of the soil sample analysis results.

1. Strontium-90 Results: Strontium-90 was detected in 5 out of the 10 Hot Cell Site soil samples sent. It was not detected in the background samples. Cesium-137 was present In all but 1 sample Strontium-90 was detected in. In this sample, Strontium-90 was 1.07 pCi/g.

Results(cont.)

1.(cont.) The average concentration of Strontium, using the Minimum Detectable Activity (MDA) value for those cases where Strontium was not identified, was 0.88 pCi/g. The average concentration of Cesium-137, again using the MDA value when it was not identified, was 0.42 pCi/g. The resulting Strontium to Cesium ratio is 2.1:1. See attached table, ^{90}Sr to ^{137}Cs Ratio Determination Using Quanterra Analysis Results for details.

2. Plutonium Results: There was no Plutonium-238, 239, or 240 detected above the MDA value.

3. Gamma Spec Comparison: The GA results were , in all cases except 1, higher than the Quanterra results. The Agreement, as defined by the USNRC methodology, was good on all samples with detectable levels of Cesium-137. In 1 sample, the GA results indicated slight amounts of Cesium-137 but the Quanterra analysis did not detect it. Using the USNRC methodology, this amounts to a division by zero, which will produce a "bad" result. All of GA's Cobalt-60 results were in agreement with Quanterra's results.

Conclusions

1. Although GA does not have the capability of measuring Strontium-90 directly, the Strontium-90 to Cesium-137 ratio derived by the Quanterra analysis could be used to determine the Strontium-90 activity levels from the Cesium-137 levels, which are measurable by gamma spectroscopy. The ratio derived from the Quanterra analysis also indicates that Strontium-90 could never be above it's release criteria, (1800 pCi/g), if Cesium is below it's release criteria, (15 pCi/g).

2. The Quanterra results indicates Plutonium is not present in the Hot Cell Site soil.

3. The GA and Quanterra analysis results are comparable.

If you have any questions pertaining to this report, please contact me at extension 2346, or by my pager, No. 858-728-0953.

W. T. LaBonte

cc: K. Asmussen
G. Bramblett
I. Cruz
B. Hunter
P. Maschka
V. Nicolayeff
Project files

General Atomics and Quanterra Analysis Comparison

Sample Number	Isotope	GA Results in pCi/g	Quanterra Results in pCi/g	Resolution[1]	Ratio[2]	Δ[7]	%Δ[8]	Agreement Status[3]
23S-99-1070	^{137}Cs	0.48 ± 0.08	0.28 ± 0.05	5.6	1.7	0.20	41.7	OK
	^{60}Co	ND[4]	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA[5]	ND					
	Pu[6]	NA	ND					
23S-99-1119	^{137}Cs	1.0 ± 0.14	0.83 ± 0.12	6.9	1.2	0.17	17.0	OK
	^{60}Co	0.26 ± 0.13	0.17 ± 0.05	3.4	1.5	0.09	35.6	OK
	^{90}Sr	NA	0.84 ± 0.40					
	Pu[6]	NA	ND					
23S-99-1127	^{137}Cs	0.36 ± 0.08	0.41 ± 0.06	6.8	0.88	-0.05	-13.9	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	0.78 ± 0.39					
	Pu[6]	NA	ND					
23S-99-1135	^{137}Cs	0.12 ± 0.04	0.078 ± 0.031	2.5	1.5	0.032	26.7	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	1.32 ± 0.46					
	Pu[6]	NA	ND					
23S-99-1138	^{137}Cs	0.76 ± 0.12	0.53 ± 0.08	6.6	1.4	0.23	30.2	OK
	^{60}Co	0.16 ± 0.08	0.097 ± 0.041	2.4	1.6	0.063	39.3	OK
	^{90}Sr	NA	ND					
	Pu[6]	NA	ND					
23S-99-1140	^{137}Cs	2.0 ± 0.13	1.94 ± 0.22	8.8	1.0	0.06	3.0	OK
	^{60}Co	0.54 ± 0.15	0.44 ± 0.07	6.3	1.22	0.10	18.5	OK
	^{90}Sr	NA	0.92 ± 0.39					
	Pu[6]	NA	ND					
23S-99-1179	^{137}Cs	0.14 ± 0.04	0.068 ± 0.059	1.15	2.1	0.072	51.4	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	ND					
	Pu[6]	NA	ND					

General Atomics and Quanterra Analysis Comparison

Sample Number	Isotope	GA Results in pCi/g	Quanterra Results in pCi/g	Resolution[1]	Ratio[2]	Δ[7]	%Δ[8]	Agreement Status[3]
23S-99-1192	^{137}Cs	ND	ND	Not Defined	1.0	0	0	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	1.07 ± 0.49					
	Pu^{6}	NA	ND					
23S-99-1199	^{137}Cs	0.15 ± 0.07	ND	Not Defined	Not Defined	0.15	-	Not OK
	^{60}Co	ND[4]	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA[5]	ND					
	Pu^{6}	NA	ND					
23S-99-1219	^{137}Cs	ND	ND	Not Defined	1.0	0	0	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	ND					
	Pu^{6}	NA	ND					
23S-99-1557	^{137}Cs	ND	ND	Not Defined	1.0	0	0	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	ND					
	Pu^{6}	NA	ND					
23S-99-1620	^{137}Cs	ND	ND	Not Defined	1.0	0	0	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	ND					
	Pu^{6}	NA	ND					

Notes:

1. Resolution is the Quanterra result divided by it's associated 1σ uncertainty.
2. Ratio is the GA result divided by Quanterra result.
3. Agreement status is in accordance with acceptance criteria from NRC Inspection Procedure 84525, Quality Assurance and Confirmatory Measurements for In-Plant Radiochemical Analysis.
4. ND means not detectable, background, or below the Minimum Detectable Activity.
5. NA means not analyzed.
6. Includes mass numbers 238,239 and 240.
7. GA result minus Quanterra result.
8. Δ divided by GA result.

W:\hotcell\ga-qant.wpd

Internal Correspondence

From: W. T. LaBonte **In Reply Refer to:**

To: L. Q. Gonzales **Date:** January 12, 2000

Subject: Hot Cell Soil Sample Tritium Analysis Results

Scope

On September 27, 1999, 10 soil samples from the Hot Cell Site and 2 background soil samples collected off site were sent to Quanterra Environmental Services for Tritium analysis. The 2 background samples were sent to Quanterra as blind, blank samples.

Results

Quanterra performed their analysis on October 14, 1999. The results indicated that all 12 samples were far below the Minimum Detectable Activity level for the sample geometry and equipment used for analysis. See attached table for details.

Conclusion

Tritium is not present in the soil remaining at the Hot Cell Facility Site.

If you have any questions pertaining to this report, please contact me at extension 2346, or by my pager, No. 858-728-0953.

W. T. LaBonte

cc: K. Asmussen
G. Bramblett
I. Cruz
B. Hunter
P. Maschka
V. Nicolayeff
Project files

tritium.wpd 1-12-00

Hot Cell Site Soil Tritium Analysis Results

Sample ID	^{3}H results in pCi/g	^{3}H MDA in pCi/g
23S-99-1993	<1	875
23S-99-1994	<1	952
23S-99-1995	<1	875
23S-99-1996	<1	941
23S-99-1997	<1	906
23S-99-1998	<1	879
23S-99-1999	<1	797
23S-99-2000	<1	864
23S-99-2001	<1	783
23S-99-2002	<1	818
23S-99-2003	<1	955
23S-99-2004	<1	852

Notes:

1. Sample analysis performed by Quanterra Environmental Services on 10/14/99.

2. MDA means Minimum Detectable Activity.

Internal Correspondence

From: W. T. LaBonte

In Reply Refer To:

To: L. Q. Gonzales

Date: November 11, 1998

Subject: Hot Cell Facility Strontium-90 Results

Background

Five (5) soil samples, one (1) concrete sample, and one (1) drain line sludge sample were sent to Quanterra for Strontium-90 analysis. In addition, Quanterra was requested to perform gamma spectroscopy on the soil samples using the same count time, (30 minutes), and sample geometry as GA, (a 1 liter Marinelli container) in order to compare their analysis results with GA's. Five of the sample selected were taken in locations where Strontium was suspected and two samples were taken in areas where Strontium was not suspected.

The sample locations were as follows:

Sample Number	Location
23S-98-158	Vent Stack Area, East, Soil Sample
23S-98-159	Vent Stack Area, West, Soil Sample
23S-98-160	Depression Area, Soil Sample
23S-98-173	Southwest Gate, Soil Sample
23S-98-174	East Rolling Gate, Soil Sample
23C-98-42	MET Cell Floor, Concrete Sample
23O-98-018	HCF Hot Drain line, Sludge Sample

Results

Only one (1) sample had a high degree of probability that Strontium-90 existed. That was the Hot Drain line sludge sample which had 26,000 pCi/g. The Cesium-137 activity of this sample was 1.7E7 pCi/g and the Cobalt-60 Activity was 2.2E6 pCi/g. This one sample would indicate a Sr-Cs ration of 1.53E-3, (Cs-137 is 655 times higher than Sr-90). Of the remaining six (6) samples, the highest Sr-90 activity with the probability of being present was 1.4 pCi/g. It is not likely that Sr-90 was present in three (3) of the remaining six (6) samples. See the attached table, "Hot Cell Facility Strontium-90 Analysis Results" for detail. The soil release limit for Strontium-90, as stated in the GA Hot Cell Facility D&D Plan, is 1800 pCi/g.

The Quanterra gamma spectroscopy results on the five (5) soil samples were in agreement with GA's results for Cesium-137 and Cobalt-60. The naturally occurring daughters of Uranium-238 and Thorium-232 observed normally in GA's analyses were present, at the same level, in the Quanterra results. The Quanterra results did not identify Uranium-238 or Thorium-232 usually identified by GA, or Uranium-235 which occasionally is identified by GA. Protactinium-231, which is a daughter of Uranium-235, was identified by Quanterra, in some cases in high quantity, but neither the parent or daughters were identified. See the attached table and Quanterra Certificate of Analysis, dated November 9, 1998 for details.

Quanterra also provided gamma Spectroscopy results on the concrete and sludge samples which were intended for Strontium-90 analysis only. The sludge sample gamma spectroscopy results were equivalent to GA's analysis which, at GA, was counted for only 3 minutes due to the high activity levels, (samples are normally counted for 30 minutes or longer). The one anomaly that was observed is the concrete sample results. The GA analysis indicated 6.1 pCi/g of cesium-137 and 6.8 pCi/g of Cobalt-60. The Quanterra results indicated 269 pCi/g of Cesium-137 and Cobalt-60 was not identified. The high activity drain line sludge sample and the concrete sample were analyzed on the same day which was different than all of the other samples. It is possible that the high activity sample was counted first and the detector became contaminated or the high level sample was in close proximity to the analysis equipment when the concrete sample was counted, or a sample other than the one analyzed by GA was sent to Quanterra. Other than these possibilities, there is no reasonable explanation for the Quanterra results to indicate these high levels of Cesium-137 and no Cobalt-60. See the attached table and Quanterra Certificate of Analysis for detail.

Summary

If Strontium-90 is still present at the Hot Cell Facility, it is much less than the Cesium-137 concentrations. The surface contamination release criteria utilized at the Hot Cell, 3000 dpm/100 cm^2 fixed activity and 600 dpm/100 cm^2 removable activity, is based on a much higher concentration of Strontium-90 relative to Cesium-137 and therefore, is conservative.

The close agreement between GA's and Quanterra's soil sample analyses provides additional assurance that GA's analyses are accurate.

Recommendations

1. Continue to use the conservative contamination release criteria currently used at the Hot Cell Facility.

2. Use Cesium-137 for calibration and instrument response checks.

3. Considering the high cost and long lead time for Strontium-90 analysis, the results obtained in this study and the Characterization Survey indicates that additional Strontium-90 analysis is not necessary.

If there are questions pertaining to this report, please contact me at extension 2346.

William T. LaBonte

W. T. LaBonte

Attachments: (1) Hot Cell Facility Strontium-90 Analysis Results, and, (2) Quanterra, Certificate of Analysis

cc: K. Asmussen
V. Barbat
G. Bramblett
D. Czechowicz
B. Hunter
A. Lewis
P. Maschka
M. Monreal
V. Nicolayeff
K. Partain
J. Turner
A. Welch
EDF(7340)
Project Files

Hot Cell Facility Strontium-90 Analysis Results

Sample Number	GA Results in pCi/g	Quanterra Results in pCi/g
23S-98-158	^{137}Cs = 0.86(±0.09)	^{137}Cs = 1.08(±0.16), MDA= 0.63
	^{60}Co = 0.26(±0.10)	^{60}Co = 0.35(±0.06), MDA= 0.069
	Not Analyzed	^{90}Sr = 1.40(±0.35), MDA= 0.29
23S-98-159	^{137}Cs = 2.4(±0.14)	^{137}Cs = 2.19(±0.26), MDA=0.061
	^{60}Co = 0.70(±0.11)	^{60}Co = 0.80(±0.10), MDA=0.058
	Not Analyized	^{90}Sr = 0.25(±0.20), MDA= 0.32
23S-98-160	^{137}Cs = 59(±0.71)	^{137}Cs = 75.1(±8.1), MDA= 0.13
	^{134}Cs = 3.9(±0.20)	Not Identified
	^{60}Co = 2.7(±0.24)	^{60}Co = 3.28(±0.30), MDA=0.087
	Not Analyized	^{90}Sr = 1.09(±0.32), MDA= 0.35
23S-98-173	^{137}Cs = 0.87(±0.16)	^{137}Cs = 2.03(±0.58), MDA= 0.094
	^{60}Co = 0.30(±0.09)	^{60}Co = 0.88(±0.72), MDA=0.15
	Not Analyized	^{90}Sr = 0.69(±0.34), MDA= 0.50
23S-98-174	^{137}Cs = 1.3(±0.11)	^{137}Cs = 1.70(±0.22), MDA= 0.069
	^{134}Cs = 0.05(±0.04)	Not Identified
	^{60}Co = 0.27(±0.10)	^{60}Co = 0.35(±0.06), MDA= 0.055
	Not Analyzed	^{90}Sr = 0.90(±0.31), MDA= 0.39
23C-98-42	^{137}Cs = 6.1(±0.49)	^{137}Cs = 269(±37), MDA= 17.0
	^{60}Co = 6.8(±0.57)	Not Identified
	Not Analyzed	^{90}Sr = 11.9(±10.4), MDA= 16.7
23O-98-018	^{137}Cs = 6.9E7(±4.1E5)	^{137}Cs = 1.7E7(±1.7E6), MDA=1.4E4
	^{60}Co = 5.6E5(±1.1E5)	^{60}Co = 2.2E6(±1.6E5), MDA=7.0E3
	Not Analyzed	^{90}Sr = 2.6E4(±5.2E3), MDA= 136

Internal Correspondence

From: W. T. LaBonte

In Reply Refer To:

To: L. Q. Gonzales

Date: November 11, 1998

Subject: Hot Cell Facility Strontium-90 Results

Background

Five (5) soil samples, one (1) concrete sample, and one (1) drain line sludge sample were sent to Quanterra for Strontium-90 analysis. In addition, Quanterra was requested to perform gamma spectroscopy on the soil samples using the same count time, (30 minutes), and sample geometry as GA, (a 1 liter Marinelli container) in order to compare their analysis results with GA's. Five of the sample selected were taken in locations where Strontium was suspected and two samples were taken in areas where Strontium was not suspected.

The sample locations were as follows:

Sample Number	Location
23S-98-158	Vent Stack Area, East, Soil Sample
23S-98-159	Vent Stack Area, West, Soil Sample
23S-98-160	Depression Area, Soil Sample
23S-98-173	Southwest Gate, Soil Sample
23S-98-174	East Rolling Gate, Soil Sample
23C-98-42	MET Cell Floor, Concrete Sample
23O-98-018	HCF Hot Drain line, Sludge Sample

Results

Only one (1) sample had a high degree of probability that Strontium-90 existed. That was the Hot Drain line sludge sample which had 26,000 pCi/g. The Cesium-137 activity of this sample was 1.7E7 pCi/g and the Cobalt-60 Activity was 2.2E6 pCi/g. This one sample would indicate a Sr-Cs ration of 1.53E-3, (Cs-137 is 655 times higher than Sr-90). Of the remaining six (6) samples, the highest Sr-90 activity with the probability of being present was 1.4 pCi/g. It is not likely that Sr-90 was present in three (3) of the remaining six (6) samples. See the attached table, "Hot Cell Facility Strontium-90 Analysis Results" for detail. The soil release limit for Strontium-90, as stated in the GA Hot Cell Facility D&D Plan, is 1800 pCi/g.

The Quanterra gamma spectroscopy results on the five (5) soil samples were in agreement with GA's results for Cesium-137 and Cobalt-60. The naturally occurring daughters of Uranium-238 and Thorium-232 observed normally in GA's analyses were present, at the same level, in the Quanterra results. The Quanterra results did not identify Uranium-238 or Thorium-232 usually identified by GA, or Uranium-235 which occasionally is identified by GA. Protactinium-231, which is a daughter of Uranium-235, was identified by Quanterra, in some cases in high quantity, but neither the parent or daughters were identified. See the attached table and Quanterra Certificate of Analysis, dated November 9, 1998 for details.

Quanterra also provided gamma Spectroscopy results on the concrete and sludge samples which were intended for Strontium-90 analysis only. The sludge sample gamma spectroscopy results were equivalent to GA's analysis which, at GA, was counted for only 3 minutes due to the high activity levels, (samples are normally counted for 30 minutes or longer). The one anomaly that was observed is the concrete sample results. The GA analysis indicated 6.1 pCi/g of cesium-137 and 6.8 pCi/g of Cobalt-60. The Quanterra results indicated 269 pCi/g of Cesium-137 and Cobalt-60 was not identified. The high activity drain line sludge sample and the concrete sample were analyzed on the same day which was different than all of the other samples. It is possible that the high activity sample was counted first and the detector became contaminated or the high level sample was in close proximity to the analysis equipment when the concrete sample was counted, or a sample other than the one analyzed by GA was sent to Quanterra. Other than these possibilities, there is no reasonable explanation for the Quanterra results to indicate these high levels of Cesium-137 and no Cobalt-60. See the attached table and Quanterra Certificate of Analysis for detail.

Summary

If Strontium-90 is still present at the Hot Cell Facility, it is much less than the Cesium-137 concentrations. The surface contamination release criteria utilized at the Hot Cell, 3000 dpm/100 cm^2 fixed activity and 600 dpm/100 cm^2 removable activity, is based on a much higher concentration of Strontium-90 relative to Cesium-137 and therefore, is conservative.

The close agreement between GA's and Quanterra's soil sample analyses provides additional assurance that GA's analyses are accurate.

Recommendations

1. Continue to use the conservative contamination release criteria currently used at the Hot Cell Facility.

2. Use Cesium-137 for calibration and instrument response checks.

3. Considering the high cost and long lead time for Strontium-90 analysis, the results obtained in this study and the Characterization Survey indicates that additional Strontium-90 analysis is not necessary.

If there are questions pertaining to this report, please contact me at extension 2346.

William T. LaBonte

W. T. LaBonte

Attachments: (1) Hot Cell Facility Strontium-90 Analysis Results, and, (2) Quanterra, Certificate of Analysis

cc: K. Asmussen
V. Barbat
G. Bramblett
D. Czechowicz
B. Hunter
A. Lewis
P. Maschka
M. Monreal
V. Nicolayeff
K. Partain
J. Turner
A. Welch
EDF(7340)
Project Files

Hot Cell Facility Strontium-90 Analysis Results

Sample Number	GA Results in pCi/g	Quanterra Results in pCi/g
23S-98-158	^{137}Cs = 0.86(±0.09)	^{137}Cs = 1.08(±0.16), MDA= 0.63
	^{60}Co = 0.26(±0.10)	^{60}Co = 0.35(±0.06), MDA= 0.069
	Not Analyzed	^{90}Sr = 1.40(±0.35), MDA= 0.29
23S-98-159	^{137}Cs = 2.4(±0.14)	^{137}Cs = 2.19(±0.26), MDA=0.061
	^{60}Co = 0.70(±0.11)	^{60}Co = 0.80(±0.10), MDA=0.058
	Not Analyized	^{90}Sr = 0.25(±0.20), MDA= 0.32
23S-98-160	^{137}Cs = 59(±0.71)	^{137}Cs = 75.1(±8.1), MDA= 0.13
	^{134}Cs = 3.9(±0.20)	Not Identified
	^{60}Co = 2.7(±0.24)	^{60}Co = 3.28(±0.30), MDA=0.087
	Not Analyized	^{90}Sr = 1.09(±0.32), MDA= 0.35
23S-98-173	^{137}Cs = 0.87(±0.16)	^{137}Cs = 2.03(±0.58), MDA= 0.094
	^{60}Co = 0.30(±0.09)	^{60}Co = 0.88(±0.72), MDA=0.15
	Not Analyized	^{90}Sr = 0.69(±0.34), MDA= 0.50
23S-98-174	^{137}Cs = 1.3(±0.11)	^{137}Cs = 1.70(±0.22), MDA= 0.069
	^{134}Cs = 0.05(±0.04)	Not Identified
	^{60}Co = 0.27(±0.10)	^{60}Co = 0.35(±0.06), MDA= 0.055
	Not Analyzed	^{90}Sr = 0.90(±0.31), MDA= 0.39
23C-98-42	^{137}Cs = 6.1(±0.49)	^{137}Cs = 269(±37), MDA= 17.0
	^{60}Co = 6.8(±0.57)	Not Identified
	Not Analyzed	^{90}Sr = 11.9(±10.4), MDA= 16.7
23O-98-018	^{137}Cs = 6.9E7(±4.1E5)	^{137}Cs = 1.7E7(±1.7E6), MDA=1.4E4
	^{60}Co = 5.6E5(±1.1E5)	^{60}Co = 2.2E6(±1.6E5), MDA=7.0E3
	Not Analyzed	^{90}Sr = 2.6E4(±5.2E3), MDA= 136

Bill La Bonte

PC-000495/0

Quanterra

CERTIFICATE OF ANALYSIS

November 9, 1998

Project Name	: General Atomics
Quanterra Project Number	: 748.01
Date Received by Lab	: September 19, 1998
Number of Samples	: Seven
Sample Type(s)	: Solid

On September 19, 1998 seven samples were received at the Quanterra St. Louis laboratory from General Atomics. The following is a list of the samples and the Quanterra identification numbers:

CLIENT ID	Quanterra ID
23-S-98-158	18906-001
23-S-98-159	18906-002
23-S-98-160	18906-003
23-S-98-173	18906-004
23-S-98-174	18906-005
23C-98-42	18906-006
230-98-018	18906-007

II. Analytical Results/Methodology
The analytical results for this report are presented by analytical tests. Each set of data will include sample identification information, the analytical results, and the appropriate detection limits.

The analysis requested: gamma spectroscopy and strontium-90.

III. Quality Control
The QA/QC information can be found immediately following the analytical data. This QA/QC data are used to assess the laboratory's accuracy and precision during the analytical procedure.

V. Comments/Nonconformances
There were no nonconformances experienced with these samples.

Reviewed and approved:

John D. Powell
Project Manager

Category: Gamma Spec.

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Prep Date	Date Analyzed	Parameter	Result	Sigma Error (+/-)	MDA	Units
23-S-98-158	18906-001	Solid	08/18/98	09/19/98	10/14/98	10/15/98	Cesium-137	1.08	0.16	0.063	PCI/G
							Cobalt-60	0.35	0.06	0.069	PCI/G
							Potassium-40	18.7	2.4	0.46	PCI/G
							Radium-226	2.36	1.04	0.97	PCI/G
							Thorium-228	4.19	2.19	2.81	PCI/G
							Thorium-234	3.22	0.94	0.73	PCI/G
							Lead-212	1.67	0.23	0.083	PCI/G
							Protactinium-231	22.3	12.1	4.80	PCI/G
							Radium-223	0.33	0.21	0.30	PCI/G
							Thallium-208	0.44	0.08	0.062	PCI/G
							Bismuth-214	0.97	0.20	0.27	PCI/G
							Lead-214	1.02	0.13	0.11	PCI/G
							Thorium-231	0.77	0.40	0.51	PCI/G
							Actinium-228	1.37	0.40	0.48	PCI/G
23-S-98-159	18906-002	Solid	08/18/98	09/19/98	10/14/98	10/15/98	Cesium-137	2.19	0.26	0.061	PCI/G
							Cobalt-60	0.80	0.10	0.058	PCI/G
							Potassium-40	19.5	2.4	0.35	PCI/G
							Radium-226	1.36	0.90	1.16	PCI/G
							Thorium-234	1.62	0.56	0.66	PCI/G
							Lead-210	1.17	0.81	0.74	PCI/G
							Lead-212	1.83	0.21	0.079	PCI/G
							Bismuth-212	2.49	1.61	1.28	PCI/G
							Radium-224	20.0	11.6	1.42	PCI/G
							Thallium-208	0.47	0.08	0.054	PCI/G

Category: Gamma Spec.

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Prep Date	Date Analyzed	Parameter	Result	Sigma Error (+/-)	MDA	Units
23-S-98-159	18906-002	Solid	08/18/98	09/19/98	10/14/98	10/15/98	Bismuth-214	0.99	0.19	0.26	PCI/G
							Lead-214	1.10	0.14	0.10	PCI/G
							Actinium-228	1.39	0.17	0.24	PCI/G
23-S-98-160	18906-003	Solid	08/18/98	09/19/98	10/14/98	10/15/98	Cesium-137	75.1	8.1	0.13	PCI/G
							Cobalt-60	3.28	0.30	0.087	PCI/G
							Potassium-40	18.2	2.6	0.64	PCI/G
							Lead-210	2.18	1.45	1.70	PCI/G
							Lead-212	1.06	0.21	0.26	PCI/G
							Protactinium-231	8.95	7.25	8.03	PCI/G
							Radium-224	3.32	2.72	2.84	PCI/G
							Thallium-208	0.33	0.18	0.21	PCI/G
							Bismuth-214	0.59	0.26	0.35	PCI/G
							Lead-214	0.78	0.28	0.36	PCI/G
							Actinium-228	1.05	0.50	0.58	PCI/G
23-S-98-173	18906-004	Solid	08/26/98	09/19/98	10/14/98	10/15/98	Cesium-137	2.03	0.58	0.094	PCI/G
							Cobalt-60	0.88	0.72	0.15	PCI/G
							Potassium-40	48.0	4.1	0.89	PCI/G
							Radium-226	4.12	1.21	1.32	PCI/G
							Lead-210	1.84	0.94	1.10	PCI/G
							Lead-212	1.43	0.26	0.11	PCI/G
							Bismuth-212	2.01	1.27	1.78	PCI/G
							Protactinium-231	32.2	20.7	5.96	PCI/G
							Radium-224	14.6	8.9	2.26	PCI/G

Category: Gamma Spec.

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Prep Date	Date Analyzed	Parameter	Result	Sigma Error (+/-)	MDA	Units
23-S-98-173	18906-004	Solid	08/26/98	09/19/98	10/14/98	10/15/98	Thallium-208	0.51	0.12	0.089	PCI/G
							Bismuth-214	1.14	0.35	0.37	PCI/G
							Lead-214	0.98	0.20	0.13	PCI/G
							Actinium-228	1.65	0.76	0.81	PCI/G
23-S-98-174	18906-005	Solid	08/23/98	09/19/98	10/14/98	10/15/98	Cesium-137	1.70	0.22	0.069	PCI/G
							Cobalt-60	0.35	0.06	0.055	PCI/G
							Potassium-40	20.2	2.6	0.50	PCI/G
							Radium-226	2.07	0.86	0.98	PCI/G
							Thorium-228	2.80	2.13	2.68	PCI/G
							Thorium-234	1.56	0.79	0.56	PCI/G
							Lead-210	1.25	0.60	0.79	PCI/G
							Lead-212	1.48	0.21	0.078	PCI/G
							Bismuth-212	1.14	0.89	1.10	PCI/G
							Protactinium-231	12.9	9.7	4.73	PCI/G
							Thallium-208	0.39	0.07	0.057	PCI/G
							Bismuth-214	1.02	0.22	0.25	PCI/G
							Lead-214	0.88	0.14	0.10	PCI/G
							Thorium-231	0.51	0.39	0.49	PCI/G
							Actinium-228	1.03	0.32	0.43	PCI/G
23C-98-42	18906-006	Solid	08/17/98	09/19/98	10/14/98	10/14/98	Cesium-137	269	37	17.0	PCI/G
23O-98-018	18906-007	Solid	08/27/98	09/19/98	10/14/98	10/14/98	Cesium-137	16600000	1660000	13800	PCI/G
							Cobalt-60	2210000	162000	6990	PCI/G
NA	QCBLK185542-1	Solid	NA	NA	10/14/98	10/15/98	Americium-241	0.054	0.046	0.047	PCI/G

Category: Gamma Spec.

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Prep Date	Date Analyzed	Parameter	Result	Sigma Error (+/-)	MDA	Units
NA	QCBLK185542-1	Solid	NA	NA	10/14/98	10/15/98	Cesium-137	ND	---	0.052	PCI/G
NA	QCBLK187729-1	Solid	NA	NA	10/14/98	10/15/98	Cesium-137	ND	---	30.9	PCI/G
NA	QCLCS185542-1	Solid	NA	NA	10/14/98	10/15/98	Americium-241	110	---	---	%REC
							Cesium-137	120	---	---	%REC
							Cobalt-60	120	---	---	%REC
NA	QCLCS187729-1	Solid	NA	NA	10/14/98	10/15/98	Americium-241	100	---	---	%REC
							Cesium-137	101	---	---	%REC
							Cobalt-60	100	---	---	%REC

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PC-000495/0

Category: Strontium 90

Client ID	Laboratory ID	Matrix	Date Sampled	Date Received	Prep Date	Date Analyzed	Parameter	Result	Sigma Error (+/-)	MDA	Units
23-S-98-158	18906-001	Solid	08/18/98	09/19/98	10/26/98	10/26/98	Strontium 90	1.40	0.35	0.29	PCI/G
23-S-98-159	18906-002	Solid	08/18/98	09/19/98	10/26/98	10/26/98	Strontium 90	0.25	0.20	0.32	PCI/G
23-S-98-160	18906-003	Solid	08/18/98	09/19/98	10/26/98	10/26/98	Strontium 90	1.09	0.32	0.35	PCI/G
23-S-98-173	18906-004	Solid	08/26/98	09/19/98	10/26/98	10/26/98	Strontium 90	0.69	0.34	0.50	PCI/G
23-S-98-174	18906-005	Solid	08/23/98	09/19/98	10/26/98	10/26/98	Strontium 90	0.90	0.31	0.39	PCI/G
23C-98-42	18906-006	Solid	08/17/98	09/19/98	11/03/98	11/03/98	Strontium 90	11.9	10.4	16.7	PCI/G
23O-98-018	18906-007	Solid	08/27/98	09/19/98	11/03/98	11/03/98	Strontium 90	26200	5160	136	PCI/G
NA	QCBLK184984-1	Solid	NA	NA	10/26/98	10/26/98	Strontium 90	0.03	0.16	0.28	PCI/G
NA	QCBLK185543-1	Solid	NA	NA	11/03/98	11/03/98	Strontium 90	-0.13	0.27	0.47	PCI/G
NA	QCLCS184984-1	Solid	NA	NA	10/26/98	10/26/98	Strontium 90	147	---	---	%REC
NA	QCLCS185543-1	Solid	NA	NA	11/03/98	11/03/98	Strontium 90	96	---	---	%REC

Appendix 7

of

General Atomics' Final Radiological Survey Report for the Hot Cell Site

"Estimate of Activity Remaining at the Hot Cell Site"

GENERAL ATOMICS

Internal Correspondence

From:	W. T. LaBonte	**In Reply Refer To:**	wtl05.00
To:	L. Q. Gonzales	**Date:**	February 10, 2000

Subject: Estimate of Activity Remaining at the Hot Cell Site

The purpose of this correspondence is to provide an estimate of the activity remaining at the Hot Cell Site following the completion of D&D activities.

This estimate is based on the following:

1. The average activity concentrations contained in the Final Survey soil samples. It was assumed this average concentration applies to all of the Hot Cell Site soil.

2. The assumption that the activity is deposited in the top 6" of soil.

3. The area of the Hot Cell Site is 8300 m^2.

4. The density of the soil is 1.4 g/cc.

Applying factors 2, 3, produces a volume of 1.23E9 cc. This times the specific density, 1.4 g/cc, equals 1.72E9 g, the total mass for the 6" thick slab of soil covering the entire Hot Cell Site footprint. The average concentration of each isotope, excluding natural radioactivity, times this mass, equals the total activity as presented in the attached table.

The ^{90}Sr concentration, (which can not be measured directly at GA), was determined by applying the relative ratio of ^{90}Sr to ^{137}Cs, (which can be measured at GA), determined by an independent laboratory. This ratio is 2.1:1.

This estimate indicates that 1.69mCi of ^{137}Cs, 3.50 mCi of ^{90}Sr, 0.275 mCi of ^{60}Co and 0.01 mCi of ^{134}Cs remains in the Hot Cell Site Soil.

W. T. LaBonte

cc; K. Asmussen
G. Bramblett
P. Maschka
K. Partain
Project Files

Hot Cell Site Average Activity Remaining

	Average Radionuclide Concentrations (pCi/g) *Background Subtracted*[1]			
Page Number, Soil Sample Results.	**^{137}Cs**	**^{60}Co**	**^{134}Cs**	**^{90}Sr[1]**
1	0.093	0.022	0.000	0.195
2	0.124	0.037	0.004	0.260
3	0.242	0.066	0.004	0.508
4	0.414	0.085	0.000	0.869
5	0.481	0.036	0.000	1.010
6	0.399	0.086	0.000	0.838
7	0.401	0.063	0.000	0.842
8	1.260	0.174	0.013	2.646
9	0.766	0.097	0.023	1.609
10	2.029	0.206	0.046	4.261
11	0.574	0.618	0.000	1.205
12	1.241	0.254	0.013	2.606
13	0.876	0.081	0.006	1.840
14	1.313	0.109	0.006	2.757
15	1.471	0.192	0.000	3.089
16	0.994	0.142	0.000	2.087
17	1.960	0.584	0.008	4.116
18	2.569	0.348	0.000	5.395
19	2.394	0.225	0.013	5.027
20	1.723	0.136	0.008	3.618
21	0.857	0.126	0.000	1.800
22	0.591	0.131	0.000	1.241
23	0.421	0.032	0.000	0.884
24	0.396	0.075	0.000	0.832
Average	0.983	0.164	0.006	2.064
Total[2] (μCi)	1690.000	275.000	10.200	3540.000

Note: 1.The ^{90}Sr value is based on a measured ^{90}Sr to ^{137}Cs ratio of 2.1:1

2. The Total was determined by multipling the average value for each isotope by 1.72E9 g. The estimated volume of the top 6" of soil covering the HCF Site is 1.23E9 cc, the estimated specific weight of the soil is 1.4g/cc.

Appendix 8

of

General Atomics' Final Radiological Survey Report for the Hot Cell Site

"Hot Cell Facility Quality Assurance Checks"

Appendix 8: Hot Cell Facility Quality Assurance Checks

Background

During Hot Cell Final Survey activities, GA conducted a number of Quality Assurance checks. The applicable reports are provided in this appendix and summarized below.

1. HCF Blank Sample Analysis Results

2. HCF Soil Sample Recounts

3. Comparison of GA/Quanterra Hot Cell Soil Sample Analysis Results

4. Audit of the GA Hot Cell D&D Final Survey performed by QA.

5. Audit of the Hot Cell Final Survey Plan Requirements completed by Health Physics.

GENERAL ATOMICS

Internal Correspondence

		In Reply
From:	W. T. LaBonte	**Refer To:** wtl04.00
To:	L. Q. Gonzales	**Date:** February 10, 2000

Subject: HCF Blank Sample Analysis Results

To comply with the QA requirements committed to in the HCF Final Survey Plan, six (6) soil samples were collected at off-site locations, at employee backyards and open fields. These samples were processed exactly like final survey soil samples, including Chain of Custody tracking and tamper proof seals. The processed samples were included as "blind," (origin unknown to the laboratory), samples in batches of soil samples sent to the GA Health Physics Laboratory for analysis.

The GA analysis results are consistent with what would be expected for background samples; Only naturally occurring radioactivity was identified. See the attached table for details.

W. T. LaBonte

cc; K. Asmussen
G. Bramblett
I. Cruz
B. Hunter
P. Maschka
K. Partain
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Project Files

HCF Soil Sample
GA "Blind" Analysis Results

Sample Number	Gross Results in pCi/g		
	^{238}U	^{235}U	$Th(^{228+232})$
23S-99-1557	2.71 ± 0.88	0.18 ± 0.09	2.98 ± 0.55
23S-99-1558	3.78 ± 0.86	0.26 ± 0.09	3.29 ± 0.38
23S-99-1610	2.19 ± 0.66	0.17 ±0.10	2.51 ± 0.40
23S-99-1615	2.42 ± 0.83	0.18 ± 0.09	3.21 ± 0.54
23S-99-1620	3.09 ± 0.68	0.20 ± 0.07	3.00 ± 0.33
23S-99-1625	3.58 ± 1.18	0.12 ± 0.09	2.81 ± 0.61
Average	2.96 ± 0.85	0.19 ± 0.09	2.97 ± 0.47

Hot Cell Site
Final Survey Soil Sample Recount

Gamma Spectroscopy Results in pCi/g (*Background Subtracted*)

Sample Number	Initial Analysis				Recount			
	^{137}Cs	^{60}Co	^{235}U	^{238}U	^{137}Cs	^{60}Co	^{235}U	^{238}U
23S-99-5123	1.0 ± 0.15	0.19 ± 0.11	0.11 ± 0.04	0.98 ± 0.29	0.94 ±0.12	0.24 ± 0.11	0.08 ± 0.04	0.35 ± 0.13
23S-99-5126	5.2 ± 0.18	0.38 ± 0.08	ND	ND	5.45 ± 1.58	0.40 ± 0.08	ND	ND
23S-99-5127	6.0 ± 0.20	0.22 ± 0.09	ND	ND	6.06 ± 0.21	0.23 ± 0.07	ND	ND
23S-99-5129	1.8 ± 0.11	ND	0.40 ± 0.17	0.40 ± 0.11	1.68 ± 0.12	0.08 ± 0.07	0.39 ± 0.31	0.74 ±0.18
23S-99-5182	0.34 ± 0.05	0.04 ± 0.04	0.21 ± 0.04	0.47 ± 0.12	0.37 ± 0.05	0.07 ± 0.16	0.16± 0.14	0.77 ± 0.16
23S-99-5213	1.5 ± 0.16	0.13 ±0.09	0.18 ± 0.07	0.79 ± 0.25	1.47 ± 0.14	ND	0.14 ± 0.03	0.66 ± 0.22
23S-99-5225	1.5 ± 0.13	0.13 ± 0.11	0.15 ± 0.06	ND	1.43 ± 0.13	0.13 ± 0.09	ND	0.36 ± 0.13
23S-99-5230	8.5 ± 0.22	0.86 ± 0.10	0.04 ± 0.02	ND	8.75 ± 0.24	0.80 ± 0.14	ND	ND
23S-99-5231	6.3 ± 0.24	0.86 ± 0.13	0.02 ± 0.01	ND	6.39 ± 0.23	0.68 ± 0.13	ND	ND
23S-99-5239	0.97 ± 0.14	0.21 ± 0.09	0.25 ± 0.28	0.61 ± 0.24	0.95 ± 0.15	0.27 ± 0.12	0.14 ± 0.06	1.20 ± 0.38
23S-99-5259	8.9 ± 0.23	1.2 ± 0.12	ND	ND	8.93 ± 0.26	1.02 ± 0.13	ND	ND
23S-99-5269	2.8 ± 0.15	0.21 ± 0.08	0.12 ± 0.04	0.76 ± 0.21	2.73 ± 0.16	0.16 ± 0.14	0.09 ± 0.04	ND

Internal Correspondence

From: W. T. LaBonte **In Reply Refer to:**

To: L. Q. Gonzales **Date:** January 12, 2000

Subject: Comparison of GA / Quanterra Hot Cell Soil Sample Analysis Results

Scope

On June 18, 1999, 10 soil samples from the Hot Cell Site and 2 background soil samples collected off site were sent to Quanterra Environmental Services for the following reasons:

1. To provide a cross check on the accuracy of the GA gamma spectroscopy analysis when compared to an independent laboratory.

2. To determine if Strontium-90 is present and, if present, the Strontium-90 to Cesium-137 ratio.

3. To determine if Plutonium, mainly mass numbers 238, 239 and 240, was present.

The samples were sent in 500 ml Marinelli containers to ensure a common geometry for gamma spectroscopy analysis, and the counting time was 30 minutes per sample at both laboratories. The background samples were sent to each laboratory as blind samples (identified the same as the site soil samples).

GA did not perform a Strontium or Plutonium analysis on these samples because the radiochemical capabilities required no longer exists at GA.

The criteria from the USNRC Inspection Procedure 84525, Quality Assurance and Confirmatory Measurements for In-Plant Radiochemical Analysis, was used to perform the comparison of the GA results with the Quanterra results.

Results

See the attached table, General Atomics and Quanterra Analysis Comparison, for a summary of the soil sample analysis results.

1. Strontium-90 Results: Strontium-90 was detected in 5 out of the 10 Hot Cell Site soil samples sent. It was not detected in the background samples. Cesium-137 was present In all but 1 sample Strontium-90 was detected in. In this sample, Strontium-90 was 1.07 pCi/g.

Results(cont.)

1.(cont.) The average concentration of Strontium, using the Minimum Detectable Activity (MDA) value for those cases where Strontium was not identified, was 0.88 pCi/g. The average concentration of Cesium-137, again using the MDA value when it was not identified, was 0.42 pCi/g. The resulting Strontium to Cesium ratio is 2.1:1. See attached table, ^{90}Sr to ^{137}Cs Ratio Determination Using Quanterra Analysis Results for details.

2. Plutonium Results: There was no Plutonium-238, 239, or 240 detected above the MDA value.

3. Gamma Spec Comparison: The GA results were , in all cases except 1, higher than the Quanterra results. The Agreement, as defined by the USNRC methodology, was good on all samples with detectable levels of Cesium-137. In 1 sample, the GA results indicated slight amounts of Cesium-137 but the Quanterra analysis did not detect it. Using the USNRC methodology, this amounts to a division by zero, which will produce a "bad" result. All of GA's Cobalt-60 results were in agreement with Quanterra's results.

Conclusions

1. Although GA does not have the capability of measuring Strontium-90 directly, the Strontium-90 to Cesium-137 ratio derived by the Quanterra analysis could be used to determine the Strontium-90 activity levels from the Cesium-137 levels, which are measurable by gamma spectroscopy. The ratio derived from the Quanterra analysis also indicates that Strontium-90 could never be above it's release criteria, (1800 pCi/g), if Cesium is below it's release criteria, (15 pCi/g).

2. The Quanterra results indicates Plutonium is not present in the Hot Cell Site soil.

3. The GA and Quanterra analysis results are comparable.

If you have any questions pertaining to this report, please contact me at extension 2346, or by my pager, No. 858-728-0953.

W. T. LaBonte

cc: K. Asmussen
G. Bramblett
I. Cruz
B. Hunter
P. Maschka
V. Nicolayeff
Project files

General Atomics and Quanterra Analysis Comparison

Sample Number	Isotope	GA Results in pCi/g	Quanterra Results in pCi/g	Resolution[1]	Ratio[2]	Δ[7]	%Δ[8]	Agreement Status[3]
23S-99-1070	^{137}Cs	0.48 ± 0.08	0.28 ± 0.05	5.6	1.7	0.20	41.7	OK
	^{60}Co	ND[4]	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA[5]	ND					
	Pu^{6}	NA	ND					
23S-99-1119	^{137}Cs	1.0 ± 0.14	0.83 ± 0.12	6.9	1.2	0.17	17.0	OK
	^{60}Co	0.26 ± 0.13	0.17 ± 0.05	3.4	1.5	0.09	35.6	OK
	^{90}Sr	NA	0.84 ± 0.40					
	Pu^{6}	NA	ND					
23S-99-1127	^{137}Cs	0.36 ± 0.08	0.41 ± 0.06	6.8	0.88	-0.05	-13.9	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	0.78 ± 0.39					
	Pu^{6}	NA	ND					
23S-99-1135	^{137}Cs	0.12 ± 0.04	0.078 ± 0.031	2.5	1.5	0.032	26.7	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	1.32 ± 0.46					
	Pu^{6}	NA	ND					
23S-99-1138	^{137}Cs	0.76 ± 0.12	0.53 ± 0.08	6.6	1.4	0.23	30.2	OK
	^{60}Co	0.16 ± 0.08	0.097 ± 0.041	2.4	1.6	0.063	39.3	OK
	^{90}Sr	NA	ND					
	Pu^{6}	NA	ND					
23S-99-1140	^{137}Cs	2.0 ± 0.13	1.94 ± 0.22	8.8	1.0	0.06	3.0	OK
	^{60}Co	0.54 ± 0.15	0.44 ± 0.07	6.3	1.22	0.10	18.5	OK
	^{90}Sr	NA	0.92 ± 0.39					
	Pu^{6}	NA	ND					
23S-99-1179	^{137}Cs	0.14 ± 0.04	0.068 ± 0.059	1.15	2.1	0.072	51.4	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	ND					
	Pu^{6}	NA	ND					

General Atomics and Quanterra Analysis Comparison

Sample Number	Isotope	GA Results in pCi/g	Quanterra Results in pCi/g	Resolution[1]	Ratio[2]	Δ[7]	%Δ[8]	Agreement Status[3]
23S-99-1192	^{137}Cs	ND	ND	Not Defined	1.0	0	0	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	1.07 ± 0.49					
	Pu^{6}	NA	ND					
23S-99-1199	^{137}Cs	0.15 ± 0.07	ND	Not Defined	Not Defined	0.15	-	Not OK
	^{60}Co	ND[4]	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA[5]	ND					
	Pu^{6}	NA	ND					
23S-99-1219	^{137}Cs	ND	ND	Not Defined	1.0	0	0	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	ND					
	Pu^{6}	NA	ND					
23S-99-1557	^{137}Cs	ND	ND	Not Defined	1.0	0	0	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	ND					
	Pu^{6}	NA	ND					
23S-99-1620	^{137}Cs	ND	ND	Not Defined	1.0	0	0	OK
	^{60}Co	ND	ND	Not Defined	1.0	0	0	OK
	^{90}Sr	NA	ND					
	Pu^{6}	NA	ND					

Notes:

1. Resolution is the Quanterra result divided by it's associated 1σ uncertainty.
2. Ratio is the GA result divided by Quanterra result.
3. Agreement status is in accordance with acceptance criteria from NRC Inspection Procedure 84525, Quality Assurance and Confirmatory Measurements for In-Plant Radiochemical Analysis.
4. ND means not detectable, background, or below the Minimum Detectable Activity.
5. NA means not analyzed.
6. Includes mass numbers 238,239 and 240.
7. GA result minus Quanterra result.
8. Δ divided by GA result.

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GA AUDIT REPORT 98007
(FINAL REPORT)

FROM: Quality Systems

DATE: February 21, 2000
00:DP:12

TO: B. L. Coleman

SUBJECT: AUDIT OF THE GA HOT CELL D&D FINAL SURVEY

Purpose

The audit was performed to verify that approved documentation existed for the Hot Cell Final Survey, and that personnel are effectively implementing the quality assurance requirements contained in the Final Survey Plan and other controlling documents listed in Attachment 1.

Scope

The audit scope was limited to the activities associated with the Hot Cell D&D Final Survey which included: instructions and procedures; procurement control; identification and control of items; calibration of equipment; records collection, identification and retention. The audit included the witnessing of sample taking, chain of custody, sample preparation and analysis; and analyzing and documenting sample results.

Summary

Within the scope of the audit the records reviewed, personnel interviewed, and procedures and equipment examined, indicated that the Hot Cell D&D project and Health Physics personnel are effectively implementing the quality assurance requirements applicable to the areas audited. There were no adverse findings that required a documented corrective action response. The audit identified four observations which do not require formal corrective action response; however, recommendations accompany the observations for management consideration. The observations and recommendations are provided in Attachment 2.

The Hot Cell D&D project and Health Physics organizations have detailed procedures, logs, and checklists to provide assurance that the many and complex requirements of the federal and state regulations are met. A detailed checklist exists for documenting completion of all requirements contained in the Revised Final Survey Plan. Only a few items on the checklist remain open at the time of the audit.

All personnel contacted during the course of the audit appeared to be knowledgeable in their areas of responsibility and dedicated to successfully completing the Hot Cell Final Radiological Survey.

The details of the audit conduct are located in Attachment 1.

Follow-up

No audit follow-up action is required.

xc: K. A. Asmussen
G. C. Bramblett
R. H. Dalry
L. Gonzales
M. D. Kemp
V. Nicolayeff
D. I. Roberts
K. Partain
W. LaBonte

ATTACHMENT 1
QA AUDIT REPORT NO. 98007
AUDIT CONDUCT DETAILS

Auditor	Dates	Controlling Documents
D. Pettycord	2/1/2000 to 2/8/2000	PC-000423/4; QAPD 7340 Issue E; GA QA Manual Issue D; Revised Final Survey Plan (5/99); HP Procedures HP-522 Issue B; HP-1004 Issue B; HP-527 Issue A; SECY-81-576, Oct. 5, 1981

Personnel Contacted

K. Asmussen[2], G. Bramblett[1,2], B. Hunter, V. Nicolayeff[1,2], K. Partain, B. LaBonte[1], L. Gonzales[1,2], M. Dupray, I. Cruz, P. Maschka[2]

Audit Conduct

1. Reviewed requirements for sample logging, sample taking, identification of samples, preparation of samples for analysis, witnessed the taking of three yard samples, and verified that procedural requirements were met.

2. Examined several radiological detection instruments and verified they were in current calibration.

3. Selected two existing yard samples and observed re-analysis to confirm consistency with original analysis.

4. Witnessed sample analysis to verify the process was controlled and in accordance with procedures.

5. Observed calculations performed by Health Physics personnel to verify that sample results were within release criteria limits.

6. Selected several requirements contained in the Revised Final Survey Plan (5/99) and verified that they were on the Health Physics checklist and were completed.

7. Verified that chain of custody records are generated in accordance with procedures.

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[1]Attended Pre-Audit Conference
[2]Attended Post-Audit Conference

8. Examined the collection, identification, and retention of records generated during the Final Survey to verify that records are generated and maintained in accordance with requirements.

9. Examined the calculation code used to determine the release criteria to verify that it had been validated and retained in the GA-Controlled Program Library.

10. Examined working level procedures to verify that they were appropriately reviewed, approved and revised, and that current revisions were used.

ATTACHMENT 2
QA AUDIT REPORT NO. 98007
OBSERVATIONS

Observation No. 1

Decommissioning Plan PC-000423 Rev. 4, dated January 1998, Section 4 "Planned Final Radiation Survey," described the final survey requirements. This plan was approved by the NRC and Information-Issued by Configuration Management. Two revisions to the Final Radiation Survey Plan were issued; one dated 10/30/98 and one dated 5/99. These two documents which alter Section 4 of PC-000423 Rev. 4 do not have a PC number; they were not issued through Configuration Management, and they have not yet been formally approved by the NRC and the State.

Recommendation

It is recommended that 1) Section 4 of PC-000423 be revised to delete the section and refer to the new document, 2) assign the new document(s) a PC number and issue them through Configuration Management, 3) obtain formal NRC and State approval of the current version of the Final Radiological Survey Plan as soon as possible.

Observation No. 2

The revised Hot Cell Final Radiological Survey Plan dated May 25, 1999 identifies computer code RESRAD Version 5.18 to be used to calculate the release criteria listed in Table 1 of the plan. The RESRAD code has not been placed in the GA Controlled Program Library and no GA-generated documentation has been created to document the acceptability of the code for its use by GA for this application.

Recommendation

Generate the required documentation to support its acceptability for use and file the documentation in Configuration Management's Controlled Program Library.

Observation No. 3

Two weight balances in the HP Laboratory had current calibration stickers on them; however, there were no serial numbers. Therefore, they were not traceable from the balance to the certification.

Recommendation

Identify all balances in the HP Laboratory with serial numbers and retain a copy of the Calibration Certificates in the Laboratory.

Attachment 2
Audit Observations 98007
Page 2

Observation No. 4

Quality Assurance requirements for record retention requires procedures and practices which provide for protection of records and record retention periods to be defined. The subject of this audit was the Hot Cell D&D Project Final Survey; however, much of the work was conducted by the Health Physics organization involving Health Physics records. The practice is to keep the records indefinitely in retired storage; however, this practice is not defined in procedures, and microfilming and/or formal dual storage of records is not in place and not defined.

Recommendation

It is recommended that the Hot Cell D&D Project and/or Health Physics identify those records of the Hot Cell D&D work that require the protection of dual storage or dual storage microfilming, with particular attention to the need for protection of the Hot Cell Final Survey Records.

HP CHECKLIST FOR HOT CELL FINAL SURVEY PLAN REQUIREMENTS - As of February 16, 2000			
Commitments made in GA response (5/99 letter) to State of CA questions regarding the 10/98 Hot Cell Final Survey Plan			
Item #	*REQUIREMENT*	*COMMENTS*	*STATUS/DATE*
1	All HC pits which were filled have been lined with burlap.	23-98 - 517, 518, 520 (6/29/98, 7/20/98, 7/21/98) Stack Monitoring Vault Only; All other pits are open.	**Closed 9-10-99**
2	Twelve (12) soil samples will be sent to an outside lab for plutonium analysis; 10 soil samples from the Hot Cell site and 2 background soil samples. [Pu-238, Pu-239, Pu-240, Pu-241, Pu-242, and Pu-244.] The criteria for determining which samples to analyze will include (1) sampling areas with the highest potential for contamination, (2) analyzing samples containing Am-241 and (3) samples having elevated U-235 concentrations.	Sent soil samples to Quanterra for Pu analysis. No Pu detected in any of the samples. Results faxed to the State of CA.	**Closed 9-10-99**
3	Gamma scans will be conducted at 1-2 m intervals over approximately 100% of the site using NaI scintillation detectors and ratemeters with audible indicators. Locations of elevated radiation, suggesting the presence of surface or near surface contamination, will be marked and identified for further investigation.	The original final survey was redone after confirmatory surveys showed remediation was still needed. The Phase III confirmatory surface scan will serve as the Final Surface Scan. This was completed 11-15-99	**Closed 11-15-99**

Commitments made in GA response (5/99 letter) to State of CA questions regarding the 10/98 Hot Cell Final Survey Plan			
Item #	*REQUIREMENT*	*COMMENTS*	*STATUS/DATE*
4	Approximately 100% of all accessible soil surfaces will also scanned for beta emitters using a gas flow proportional detector having a 434 cm^2 beta detector.	Scans on accessible soil surfaces completed at various times. In some cases, additional soil was removed from scanned areas but a re-survey was not completed because an exposure rate survey was completed in each area remediated. Most of the surfaces (after remediation were rough and not conducive to this monitoring method).	**Closed 9/10/99**
5	GA will assume that the concentration of Sr-90 is 1.5 times the concentration of Cs-137.	Results based upon analysis performed by Quanterra. Memo 11/11/99 by W. LaBonte summarizes and evaluates the data.	**Closed 11/11/99**
6	At least 30 soil samples taken during the Final Survey will be analyzed by gross beta to demonstrate that the upper bound for Sr-90 is less than the soil release criteria of 1800 pCi/g. The samples are counted for 60 minutes.	a total of 36 soil samples were counted by gross alpha/beta. Results were obtained by 2/8/00 (or before) and were acceptable. All gross beta results were < 30 pCi/g. HP will include these results in the final radiological report for the Hot Cell Site.	**Closed 2/8/00**
7	The internal confirmatory survey will include gamma scanning 10-25% of the soil surfaces using a NaI detector (i.e., microR meter).	On December 21, 1999, Laura Gonzales issued the "New Confirmatory Survey Surface Scan". The survey began on December 22, 1999 and completed January 12, 2000. The plan included a surface scan of more than 25% of the surfaces (most surfaces received 100% scanning and a few areas received 10% scanning). The pits and trenches (done earlier) received 100% coverage. Results will be included in the Final Radiological Report for the Hot Cell Site.	**Closed 2/8/00**

Commitments made in GA response (5/99 letter) to State of CA questions regarding the 10/98 Hot Cell Final Survey Plan			
Item #	*REQUIREMENT*	*COMMENTS*	*STATUS/DATE*
8	During the internal confirmatory survey, at least 30 soil samples will be collected from biased locations and will include sampling locations where elevated radiation levels have been measured.	The Phase I soil sampling internal confirmatory survey plan was issued on January 7, 2000 and required 25 soil samples to be collected (18 surface and 7 subsurface samples in a total of 18 locations). On January 12, 2000, the Plan was amended (Phase II) to include 30 more soil samples in 19 different locations (19 surface and 11 subsurface soil samples). All 55 soil samples have been collected, processed and analyzed and found to be below the release criteria as of 2/8/00. Phase I and Phase II Soil Sampling Internal Confirmatory Survey Plans (done in 2 phases to allow for soil sampling to begin before surface scan was completed) were issued. See memo LQG:2000:4 and LQG:2000:6 dated 1/12/00 and 1/20/00, respectively; for more information.	**Closed 2/8/00**
9	An alert level has been established at which time an investigation is required; the alert level has been set at 50% of the limits. Any results > 20 micro/hr will be investigated	Established as per Final Survey Plan. The alert level was set at 25 μR/hr (28 μR/hr in pits) at the surface and 20 μR/hr at 1 m (background is ~15 μR/hr at 1 m and limit is 10 μR/hr above background at 1 m; therefore, 50% of the alert level is 20 μR/hr.	**Closed 12/10/99**
10	As part of the final survey report, an estimate of the total amount of residual activity remaining will be provided.	The estimate [See memo dated 2/10/00 from W. LaBonte to L. Gonzales (wt105.00)] was prepared by Bill LaBonte based on the results of New Final Survey soil samples.	**Closed 2/8/00**
11	Dose rate measurements (micro/hr) will be taken on the surface and at 1 m at each location where a soil sample was collected.	Dose rate measurements (micro/hr) were taken on the surface and at 1 m at each location where a final soil sample was collected (confirmed by Bill LaBonte) and where an internal confirmatory soil sample was collected (confirmed by Laura Gonzales)	**Closed 2/10/00**

Revised Hot Cell Final Survey Plan (5/99) Requirements			
Item #	REQUIREMENT	COMMENTS	STATUS/DATE
1	Scanning (along the surface of the soil) will be performed to identify locations of elevated activity levels. Areas of suspected activity, identified by scanning or visual inspection, will be evaluated to determine their activity levels and the extent of contamination. Cleanup will be performed, as required, and the scanning repeated until remediation is accomplished as demonstrated by additional soil sampling, analysis and comparisons with the guidelines.	Surface scanning was performed several times. The surface scan performed per "Phase III Confirmatory Survey" is being used as the Final Surface Scan Survey. Scanning was repeated whenever remediation was performed. About 65 additional soil samples were collected.	**Closed 2/10/00**
2	A 10 m x 10 m grid system will be used.	Complete as per the Final Survey Plan; 10mx10m grid system established.	**Closed 12/10/99**
3	Systematic surface (0-6") soil sampling will be performed within each grid at locations approximately equidistant between the center and each of the four grid block corners (see Figure 2A of Final Survey Plan). Approximately 328 systematic soil samples will be collected.	A total of 332 Final Soil Samples were taken during the second systematic sampling plan (New Final Survey). (There are a total of about 82 grids).	**Closed 12/10/99**
4	If (1) radionuclide concentrations exceed the release criteria in any of the four samples collected *or* (2) elevated radiation levels are detected during the scan, then the 10 m grid will be further subdivided as shown in Figure 2B of the Hot Cell Final Survey Plan.	Three samples were close to or above the limits (≥96%); therefore, additional sampling(after remediation) per the grid shown in Figure 2B of the Hot Cell Final Survey Plan was required in each of the 3 grids where the contaminated soil was found. Other areas where also remediated due to elevated radiation levels and/or elevated soil sample results. Additional soil samples per the grid shown in Figure 2B was done in 6 more of the grids (total of 9 grids).	**Closed 2/10/00**

Revised Hot Cell Final Survey Plan (5/99) Requirements			
Item #	REQUIREMENT	COMMENTS	STATUS/DATE
5	Biased samples will also be collected from underneath former concrete slabs where the soil appears affected; i.e., discolored, odiferous or otherwise abnormal or suspected of contamination.	Complete 10-08-99. Two (2) soil samples were taken beneath concrete. See "AD" and "CJ" of the "Elevated Areas" location map. Results were below the release criteria.	**Closed 12/10/99**
6	Subsurface samples may be collected to a depth of one (1) to three (3) feet or more; depending on the potential for contamination. Subsurface samples will be collected in biased locations and will include: 1) each location (larger than 5 m^2) where soil contamination above the guidelines was discovered and remediated and 2) any location where exposure rate measurements exceed the radiation exposure limit. These measurements will be made using a micro meter or NaI (Tl) detector/ratemeter	Complete 7-9-99 See the "Core Sample Location" drawing and the table of results prepared by Bill LaBonte.	**Closed 9/10/99**
7	In addition, subsurface soil samples (to a minimum depth of 3 feet) will be collected in 25 locations shown in Figure 3 (if subsurface samples were not already collected due to the above criteria).	Complete 7-9-99 See the "Core Sample Location" drawing and the table of results prepared by Bill LaBonte.	**Closed 9/10/99**
8	Biased samples underneath drain lines will be collected when (1) broken, corroded or otherwise deteriorated lines, (2) Soil samples will be collected whenever exposure rates are elevated (measured using micro meters and/or NaI (Tl) detectors/ratemeters) and/or (3) soil samples will be collected if the soil appears affected, i.e., discolored, odiferous or otherwise abnormal.	All drain lines were removed and soil remediated during the "Post D&D sampling and survey.	**Closed 12/10/99**
9	Systematic samples will be collected approximately every 5 m (about every 15 feet) from underneath former drain lines.	Complete 7-9-99. See the "Core Sample Location" map.	**Closed 12/10/99**

Revised Hot Cell Final Survey Plan (5/99) Requirements			
Item #	REQUIREMENT	COMMENTS	STATUS/DATE
10	In cases where drain line and ventilation duct removal resulted in pits rather than discrete trenches, the resultant pit(s) will be appropriately sampled (surface and subsurface) to demonstrate that the remaining soil meets the release criteria.	Complete. All trenches and drain lines have been sampled and/or remediated. A report was prepared by Bill LaBonte summarizing the data from all pits and trenches. A copy was provided to DOE, the State of CA and the NRC. ORISE (on behalf of DOE) conducted a confirmatory survey of the pits and trenches in September 1999; no elevated radiation areas were noted. The results of the soil samples collected by ORISE (12) have not yet been obtained. The NRC also performed a confirmatory survey of the pits and trenches. No elevated areas were found and soil samples they collected and analyzed were all well below the release criteria. Only the drain lines from the HHC and LLC's had sub-surface samples taken. See the "Core Sample Location" drawing for locations and Bill LaBonte's table of results.	**Closed 2/10/00**
11	Each soil sample will be properly logged, labeled, packaged and tracked.	In process according to the CoC procedures.	**Closed 12/10/99**
12	The surface of the soil will be scanned using micro meters so that 100% coverage is obtained. Alert levels will be established at levels not to exceed 50% of the release criteria (< 5 μR/hr above background). Further investigation (which may include soil sampling) will be required when alert levels are exceeded.	Some additional scanning was performed in all areas remediated. Levels at 1 m are at or below 20 μR/hr.	**Closed 9/3/99**

Revised Hot Cell Final Survey Plan (5/99) Requirements			
Item #	REQUIREMENT	COMMENTS	STATUS/DATE
13	To determine compliance with the external radiation limit of 10 micro/hr at 1 m above the surface, exposure rate measurements will be taken at 1 meter at all systematic soil sampling locations (after soil remediation has been completed). A calibrated micro meter will be used to determine exposure rate measurements in micro/hr.	Exposure rate measurements were taken at all locations where systematic soil samples were collected. This was completed as of 11/15/99. They were also taken in each location where additional soil samples were taken (the 9 grids discussed in item #4 above).	**Closed 2/11/00**
14	Surveys will be conducted by qualified Health Physics technicians having a minimum of 3 years Health Physics Technician experience following approved Health Physics procedures and this plan	All Health Physics technicians at GA have more than 3 years HP technician experience and follow HP procedures.	**Closed 12/10/99**
15	Every exposure rate survey conducted will be documented, on a daily basis, on a drawing showing the approximate locations surveyed. The results will include the appropriate units, the signature of the technician(s) performing the survey, date(s) of survey, instrument(s) used, efficiency, background readings (if appropriate) and any other applicable information.	Every exposure rate survey has been documented (original survey) on a drawing showing the approximate locations surveyed. The results include the appropriate units, the signature of the technician(s) performing the survey, date(s) of survey, instrument(s) used, efficiency, background readings (if appropriate) and any other applicable information.	**Closed 2/10/00**
16	Written procedures will be used for sample collection in order to ensure that samples are representative.	All samples are and have been collected in accordance with the Final Survey Plan.	**Closed 12/10/99**
17	Written procedures will also be utilized for sample preparation to ensure that media are prepared in accordance with laboratory specifications	HP-522 procedure covers sample preparation and lab counting.	**Closed 12/10/99**
18	A chain of custody will be maintained on all radiological samples to ensure integrity of the sample	Closed per HCD 3.5 and HP-522.	**Closed 12/10/99**

Revised Hot Cell Final Survey Plan (5/99) Requirements			
Item #	REQUIREMENT	COMMENTS	STATUS/DATE
19	Quality control records for laboratory counting systems will include the results of measurements of radioactive check sources, calibration sources, backgrounds and blanks.	HP procedures cover QA for HP Laboratory. Dave Pettycord recently conducted an audit of the HP Laboratory (2/00) and reviewed check sources, calibration sources, backgrounds and blanks. He had no findings; any concerns will be adequately addressed.	**Closed 2/11/00**
20	The Health Physics Laboratory shall maintain a documented Quality Control program and documented calibration records for gamma spectroscopy instrumentation	HP procedures cover QA for HP Laboratory A program is being maintained and was reviewed by Dave Pettycord during 2/00 audit of the HC activities. He had no findings; any concerns will be adequately addressed.	**Closed 2/11/00**
21	During the conduct of the Final Survey activities, Quality Assurance audits may be performed to verify that Project survey activities comply with established procedures and/or plans. Audit results will be reported to Project Management and corrective actions to resolve any identified deficiencies will be documented, tracked, and verified by the individual conducting the audit.	During D&D, an audit was performed by Bill Coleman. Dave Pettycord conducted a QA audit of the Hot Cell Final Survey Activities during the week of - 2/1/00 - 2/8/00. He will issue a report documenting his audit.	**Closed 2/9/00**
22	GA will cross-check gamma spectroscopy results by sending a minimum of five (5) soil samples to an offsite laboratory (Quanterra) for gamma spectroscopy analysis.	10 samples and 2 blanks were sent to Quanterra for analysis. Bill LaBonte compared the results from Quanterra to GA's HP lab and issued a report noting that the results for Cs-137 and Co-60 (predominant nuclides at the Hot Cell) were in agreement.	**Closed 2/10/00**

Revised Hot Cell Final Survey Plan (5/99) Requirements			
Item #	REQUIREMENT	COMMENTS	STATUS/DATE
23	Periodic blank samples will be submitted to the Health Physics Laboratory for analysis.	Samples 23S-99-1557, 1558, 1610, 1615, 1620, 1625 were blank soil samples collected off site. Bill LaBonte sent these six (6) blanks to the lab for analysis. The lab did not know where the samples came from. The results were consistent with values expected for natural background soil. [See memo dated 2/10/00 from B. LaBonte to L. Gonzales (wtl04.00) for results and evaluation].	**Closed 2/10/00**
24	In addition, at least 10 soil samples containing measurable amounts of Cs-137 and/or Co-60 will be re-counted in the Health Physics Laboratory.	Twelve (12) soil samples from the final survey were sent to the HP lab for re-analysis by gamma spec. A report on this test was written by Bill LaBonte and reported in memo dated February 4, 2000 (wtl01.00) "HCF Final Survey Soil Sample Analysis Reproducibility Test"	**Closed 2/9/00**
25	A Final Radiological Survey Report will be prepared by GA's Health Physics Group upon completion of the Final Survey.	Final Report being completed.	**Open**
26	This report will include all survey data and results as well as instrumentation information, including calibration data, instrument efficiencies, minimum detectable activity and background information.	Final Report being completed.	**Open**
27	This report will include the results of final surveys performed in excavation pits.	Final Report being completed.	**Open**

Revised Hot Cell Final Survey Plan (5/99) Requirements			
Item #	REQUIREMENT	COMMENTS	STATUS/DATE
28	Confirmatory measurements of the direct gamma scans of the HCF land areas will be performed by the GA Health Physics Staff who were not involved in the performance of the Final Survey.	See memo dated January 12, 2000 (LQG:2000:4)- provides a copy of each of the plans for the "New Internal GA Confirmatory Survey". The plans were implemented by Health Physics technicians who were not involved in the performance of the Final Survey.	**Closed 2/9/00**
29	The results of the internal confirmatory survey will also be documented in the Final Radiological Survey Report	The results of the Confirmatory Survey will be included in the Final Report.	**Open**
30	The internal confirmatory survey will include gamma scanning 10-25% of the soil surfaces using a NaI detector (i.e., micro meter).	The Confirmatory Survey Plan required scanning 10% of a few grids and 100% of most grids. (See LQG:2000:4 dated 1/12/2000 for details.	**Closed 2/9/00**
31	At least 30 soil samples will be collected from biased locations and will include sampling locations where elevated radiation levels have been measured.	The Confirmatory Survey Soil Sampling Plan (Phase I and II) included taking 55 soil samples in all. See memo LQG:2000:4 and LQG:2000:6 dated 1/12/00 and 1/20/00, respectively.	**Closed 2/9/00**
32	**(To eliminate Pu as a potential contaminant) Gamma spec** analysis will be requested by the offsite lab on the twelve (12) soil samples sent out for plutonium analysis; 10 soil samples from the Hot Cell site and 2 background soil samples.	Samples shipped to Quanterra on 6/17/99. Results returned 8/4/99. Results were reviewed by Bill LaBonte and were all < MDA. Plutonium is not a contaminant in the Hot Cell Soil Site.	**Closed 12/10/99**
33	**(To eliminate Tritium as a potential contaminant) Tritium analysis** will be requested by the offsite lab on the twelve (12) soil samples; 10 soil samples from the Hot Cell site and 2 background soil samples.	On 9/21/99, 12 samples were collected and sent to Quanterra for both Tritium and Gamma Spec analysis Results returned 10/25/99 from Quanterra. Results <MDA. See survey 23-99-366 for soil sample locations.	**Closed 12/10/99**

Revised Hot Cell Final Survey Plan (5/99) Requirements			
Item #	REQUIREMENT	COMMENTS	STATUS/DATE
34	Provide documentation for the removal of the Underground Diesel Storage Tank.	Provided most current microR/hr survey taken during tank removal along with soil samples results from tank excavation and slit samples with San Diego County Site Assessment and Mitigation Division. Included the Underground Storage Tank System Closure Report dated 10/22/97. To be filed with HC retired records (D&D).	**Closed 02/08/00**

Appendix 9

of

General Atomics' Final Radiological Survey Report for the Hot Cell Site

"Internal GA Confirmatory Survey for the Hot Cell Site"

Internal GA Confirmatory Survey Performed at the Hot Cell Site

Background

GA's Hot Cell Site is located on GA's Main Site (see Figure A9-1 and Figure A9-2). Figure A9-3 provides a drawing depicting the current surface configuration of the Hot Cell site. *All current surfaces are soil.* There are some pits and trenches as well as a large depression area and slopes.

Introduction

GA first completed a final radiological survey of the site as described in the Final Radiological Survey Plan (Appendix 1) prepared for the Hot Cell Site. Then, GA performed an internal radiological confirmatory survey.

The confirmatory survey included scanning the soil surfaces, investigation of elevated radiation measurements, collection of surface and subsurface soil samples and subsequent gamma spectroscopy analysis of the soil samples as well as gross alpha/beta counting of selected soil samples. In addition, exposure rate measurements (on the surface and at 1 m from the surface) were taken in each of the locations where soil samples were collected.

The data provided in this Appendix does not include the data for the pits and trenches within the Hot Cell Site. Following GA's surveys of the pits and trenches, they were surveyed by the NRC and ORISE. A report documenting the results of GA's radiological surveys and measurements was completed by GA and provided to ORISE. That report summarizes the data collected in the pits and trenches and is provided in Appendix 3.

Survey Plans

During December 1999, an internal GA Confirmatory Survey was initiated at GA's Hot Cell Site in accordance with the following Survey Plans. Copies of these Survey Plans are attached to this Appendix.

1. Internal Confirmatory Survey Plan for the Hot Cell Site (Building 23) - ***Scan Survey*** dated December 21, 1999.

2. Internal Confirmatory Survey Plan for the Hot Cell Site (Building 23) - ***Soil Survey*** dated January 7, 2000.

3. Internal Confirmatory Survey Plan for the Hot Cell Site (Building 23) - ***Soil Survey - Phase I and Phase II,*** written January 7, 2000 (revised January 12, 2000).

Documentation: Each radiological survey that GA conducted was documented on a daily basis to a worksheet/log book and on a drawing showing the appropriate locations surveyed. The documentation included the results of the measurements (including units), the technician's printed name and signature, date, instrument(s) used (including the model and serial number of both the

ratemeter and the detector), calibration due date, % efficiency, background readings (if applicable) and any other pertinent information.

Surface Scan and Results

For the surface scan, NaI detectors with audible indicators (i.e., micro meter) held about 3"-6" from the surface were used. Locations of elevated readings ($\geq$ 25 μR/hr on the surface), which may suggest the presence of surface or near surface contamination, were flagged for further investigation, and documented on a drawing.

The *surface scan* began December 21, 1999 and was completed on January 12, 2000. Most grids were scanned 100% and the other grids were scanned 10% (see Survey Plan for details). All of the grids in and adjacent to the area where principle hot cell activities were conducted were scanned 100%. The results of the surface scan are provided in Figures A9-4A and A9-4B. There were a total of 16 elevated areas ($\geq$ 25 μR/hr on the surface) found. All other areas that were scanned had measurements < 25 μR/hr on the surface.

The approximate locations of the 16 elevated areas are shown in Figure A9-4A. Further investigation was then conducted in each location. In 10 of the locations, a hot particle was found and removed and the surface exposure rate measured again and recorded. In the other 6 locations, no hot particle was found after further investigation. A total of 37 soil samples were collected as a result of the surface scan as follows:

- 16 surface (0-6") soil samples collected in each of the 16 elevated areas
- 8 subsurface (6"-12") soil samples
- 12 additional surface soil samples for further investigation and
- 1 surface soil sample taken after remediation.

Table A9-1 provides the grid location of each of the 16 areas (with elevated surface readings), the initial exposure rate reading, whether a hot particle was found in this location or not and the location, the action taken, the final exposure rate measurement (after removal of particle, remediation or further investigation). The table also gives the soil sample number(s) and types of soil sample (surface and/or subsurface) collected at each of the 16 locations, including the additional samples collected during the investigation of each location.

All soil samples were analyzed by gamma spectroscopy for 1 hour (after processing which includes drying the sample). The results are provided in Table A9-2. The predominant contaminants detected were Cs-137 and Co-60. Trace quantities of Cs-134 were also detected in a few of the soil samples. The Sr-90 concentrations were estimated based on the Cs-137 concentrations (the Sr-90 concentration was estimated as 2.1 times the Cs-137 concentration). This ratio was based on wet chemistry analysis of soil samples sent to an offsite lab for analysis (see Appendix 6). Uranium and thorium concentrations were at or near background levels.

Subsurface (6"-12") soil samples showed radionuclide concentrations much lower than the concentrations measured on the surface (0-6") in every location sampled.

None of the soil samples exceeded the soil release criteria in any of the 16 locations (after hot particles were removed from 10 locations).

Other Soil Sampling and Results

In addition to the 37 soil samples collected as a result of the surface scan, 32 more soil samples were collected based upon: (1) the results of the analyses of the Final Soil Samples, (2) suspect areas based on remediation efforts and (3) at random suspect locations. The soil sample locations are shown in Figure A9-5 and the results are provided in Table A9-2. The reason for collecting the soil sample in the particular location selected is provided in the legend of Figure A9-5. The gamma spectroscopy results showed Cs-137 and/or Co-60 in most of the samples. A few samples had trace quantities of Cs-134. The Sr-90 values were estimated based on 1.2 times the Cs-137 concentrations. All of the results were below the soil release criteria.

Comparison of Confirmatory Survey with Final Survey Plan Commitments

Scanning-In the May 1998 Final Survey Plan for the Hot Cell Site (Appendix 1), GA committed to conducting a gamma surface scan of ~10-25% of the soil surfaces. Scanning 25% of the surface would be equivalent to completing a 100% scan over about 21 of the 83 grids.

Surface scanning to provide 100% coverage was performed in about 52 of the grids, surface scanning to provide 10% coverage was performed in about 23 of the grids. In total, this is equivalent to completing a 100% scan over about 54 of the 83 grids; well in excess of what was required by the Final Survey Plan.

Soil Samples - The Final Survey Plan required GA to collect at least 30 soil samples from biased locations including locations where elevated radiation levels have been measured as part of the Internal GA Confirmatory Survey. A total of 69 soil samples were collected including 37 in locations where elevated radiation levels had been measured.

Alpha/Beta Analyses

In addition to gamma ray spectroscopy performed on each sample, 10 of the soil samples were also counted by using a low-level gas flow proportional counter for gross alpha and gross beta radioactivity (gross α/β).

The 10 soil samples were sample numbers 6018, 6020, 6021, 6022, 6024, 6028, 6029, 6031, 6032, and 6033. The results and grid locations are provided in Table A9-3 and the approximate locations are shown in Figure A9-5. The highest results noted were 9.4 pCi/g alpha activity and 30.9 pCi/g beta activity. The beta activity indicates that the maximum Sr-90 concentration in these soil samples was < 31 pCi/g; well below the Sr-90 soil release limit of 1,800 pCi/g.

Exposure Rate Measurements and Results

The release criteria is 10 μR/hr above background measured at 1 m from the soil surface. GA's typical background for direct radiation measurements (excluding pits and trenches where the background is much higher) is 15 μR/hr measured at 1 m from the soil surface; therefore, the release criteria is 25 μR/hr (including background). Note: This does not apply to pits and trenches where the background exposure rates are higher (see Appendix 2).

In addition to the exposure rates measured on the surface during the surface scan, exposure rate measurements were taken on the surface and at 1 m from the surface at fifty (50) locations where soil samples (surface and some subsurface) were collected. The results are provided in Table A9-2. The highest *surface* (contact) measurement detected was 26 μR/hr (without background subtracted). The highest exposure rate measurement *at 1 m above the soil surface* was 24 μR/hr (without background subtracted). All exposure rate measurements taken at 1 m above the soil surface during the confirmatory survey were below the release criteria (25 μR/hr, i.e., 10 μR/hr above background which is typically 15 μR/hr).

Additionally, exposure rate measurements at 1 m from the surface were taken on a systematic grid system. The approximate locations and results are shown in Figure A9-6. The highest results measured were 19 μR/hr excluding of pits and trenches and 24 μR/hr (inside a pit); all are below the exposure rate release criteria.

Conclusion

Based on GA's Final Survey and GA's Internal Confirmatory Survey performed at the Hot Cell Site, GA has decontaminated the site to levels below the approved release criteria for unrestricted use.

Table A9-1: GA Internal Confirmatory Survey - Elevated Surface Exposure Rate Locations

Location	Grid	Initial Surface Exposure Rate (μR/hr)	Was a Hot Particle Found?	If Yes, Exposure Rate Reading of Particle	Location of Particle and/or Action Taken	Final Exposure Rate Reading (μR/hr)	Soil Samples Collected 23S-00-# (See Table CS-2 for results)
1	K 6	28	Yes	35	Particle found ~1" below the surface	17	6035 surface only [1]
2	I 6	26	Yes	50	Particle found ~2" below the surface	20	6031 surface only
3	C 5	25	No	--	Measured at bottom of slope	25	6022 surface and subsurface samples [1]
4	D 5	25	No	--	Measured at bottom of slope	25	6023 surface and subsurface samples
5	F 5	26	No	--	Area has been previously excavated	26	6024 surface and subsurface samples
6	I 5	27	Yes	27	Particle found on surface	19	6030 surface only
7	J 4	30	Yes	40	Particle found ~ 3" below the surface	23	6028 surface only
8	I 5	25	No	--	Soil sample collected	25	6029 surface and subsurface samples
9	K 5	32	Yes	50	Particle found under rock between two previous remediation sites	19	6034 surface and subsurface samples
10	F 3	30	Yes	40	Particle found ~ 2" below the surface	20	6026 surface only
11	L 4	35	Yes	110	Particle found ~ 3" below the surface	17	6036 surface only
12	K 3	25	Yes	60	Particle found ~ 4 " below the surface	18	6033 surface only
13	G 2	25	Yes	32	Particle found ~ 1" below the surface	21	6025 surface only

Table A9-1: GA Internal Confirmatory Survey - Elevated Surface Exposure Rate Locations

Location	Grid	Initial Surface Exposure Rate (μR/hr)	Was a Hot Particle Found?	If Yes, Exposure Rate Reading of Particle	Location of Particle and/or Action Taken	Final Exposure Rate Reading (μR/hr)	Soil Samples Collected 23S-00-# (See Table CS-2 for results)
14	B/C 3	25	No	--	Soil sample 6018 was 0.62 times the soil release criteria. Six (6) additional soil samples were collected (6037 through 6042), results in Table CS-2 and soil sample locations in Figure CS-5. Results well <0.2 times the soil release criteria.	28	6018 surface and subsurface samples 6037 surface only 6038 surface only 6039 surface only 6040 surface only 6041 surface only 6042 surface only
15	K 1/2	30	No	--	Soil sample 6032 measured 0.68 times the soil release criteria. Soil removed and disposed of as radioactive waste. Re-sample 6049 was 0.14 times the release criteria (Table CS-2).	24 after removal of soil	6032 surface and subsurface samples 6049 surface sample Re-sampled after remediation
16	C 1	25	Yes	40	Particle found on the bottom of a 3" chunk of blacktop buried ~ 3" below the surface - the blacktop was removed and disposed of as radioactive waste. Soil sample 6021 taken at this location measured 0.71 times the release criteria. Six additional soil samples were collected in this area (6043 through 6048, results in Table CS-2). Locations in Figure CS-5. Results are < 0.4 times the release criteria.	23	6021 surface and subsurface samples 6043 surface only 6044 surface only 6045 surface only 6046 surface only 6047 surface only 6048 surface only

(1) Surface samples are ~0-6" and subsurface samples are ~6"-12".

Table A9-2: GA Internal Confirmatory Survey - Gamma Spectroscopy Soil Sample Results from GA's Hot Cell Site

#	Grid	Sample ID	Radionuclide Concentrations (pCi/g) [1] *Background Not Subtracted*							Sum of Fractions [2]	Exposure Rate Measurements [3]	
			Cs-137		Co-60		Sr-90	Cs-134			@ soil surface	@ 1 m from surface
			pCi/g	% error (2 SD)	pCi/g	% error (2 SD)	Estimated pCi/g [4]	pCi/g	% error (2 SD)			
1	C 6	23S-00-6000 (0-6")	5.08	3.6	0.41	21.2	10.7	ND	--	0.40	20	19
2	C 6	23S-00-6000 (6"-12")	3.11	4.9	0.29	30.8	6.53	ND	--	0.25	20	19
3	C/D 7	23S-00-6001 (0-6")	1.17	10.1	0.08	86.4	2.46	ND	--	0.09	20	19
4	D 6/7	23S-00-6002 (0-6")	0.07	63.6	ND	--	0.2	ND	--	0.00	17	16
5	D 6/7	23S-00-6002 (6"-12")	ND	--	ND	--	ND	ND	--	0.00	17	16
6	D/E 6	23S-00-6003 (0-6")	1.06	8.3	0.12	45.5	2.23	ND	--	0.09	19	18
7	D 6	23S-00-6004 (0-6")	0.20	34.6	ND	--	0.42	ND	--	0.01	16	15
8	D 6	23S-00-6005 (0-6")	2.08	5.7	0.16	35.1	4.37	ND	--	0.16	20	19
9	D 6	23S-00-6005 (6"-12")	1.30	8.7	0.12	57.1	2.73	ND	--	0.10	20	19
10	E 6	23S-00-6006 (0-6")	0.89	10.5	0.08	58.5	1.87	ND	--	0.11	17	16
11	E 6	23S-00-6007 (0-6")	1.07	7.8	0.11	49.5	2.25	ND	--	0.09	17	16
12	E 6	23S-00-6007 (6"-12")	1.06	10.3	0.08	97.2	2.23	ND	--	0.08	17	16
13	G 6	23S-00-6008 (0-6")	5.36	3.3	0.26	29.0	11.3	0.16	25.4	0.41	19	18
14	G 6	23S-00-6008 (6"-12")	1.42	7.3	0.14	57.9	2.98	ND	--	0.11	19	18

Table A9-2: GA Internal Confirmatory Survey - Gamma Spectroscopy Soil Sample Results from GA's Hot Cell Site

#	Grid	Sample ID	Radionuclide Concentrations (pCi/g) [1] *Background Not Subtracted*							Sum of Fractions [2]	Exposure Rate Measurements [3]	
			Cs-137		Co-60		Sr-90	Cs-134			@ soil surface	@ 1 m from surface
			pCi/g	% error (2 SD)	pCi/g	% error (2 SD)	Estimated pCi/g [4]	pCi/g	% error (2 SD)			
15	H 6	23S-00-6009 (0-6")	2.43	5.0	0.24	29.0	5.10	0.06	55.1	0.20	17	16
16	F 4	23S-00-6010 (0-6")	1.63	6.5	0.05	13.1	3.42	ND	--	0.12	24	23
17	F 4	23S-00-6010 (6"-12")	0.76	13.0	ND	--	1.60	ND	--	0.05	24	23
18	F 3	23S-00-6011 (0-6")	1.16	8.7	0.06	100.9	2.44	ND	--	0.09	21	20
19	E 3	23S-00-6012 (0-6")	0.65	10.6	0.08	55.7	1.37	ND	--	0.10	17	16
20	D 3	23S-00-6013 (0-6")	0.76	15.3	ND	--	1.60	ND	--	0.05	17	16
21	C 2	23S-00-6014 (0-6")	1.41	7.1	0.09	59.7	2.96	ND	--	0.11	19	18
22	C 2	23S-00-6015 (0-6")	1.64	7.9	0.13	62.4	3.28	ND	--	0.13	21	20
23	C 1	23S-00-6016 (0-6")	1.33	7.7	0.21	41.0	2.79	ND	--	0.12	19	18
24	C 1	23S-00-6016 (6"-12")	0.27	28.9	ND	--	0.57	ND	--	0.02	19	18
25	C 1	23S-00-6017 (0-6")	1.45	9.0	0.19	0.44	3.05	ND	--	0.12	20	19
26	B/C 3	23S-00-6018 (0-6")	7.15	3.1	1.10	12.55	15.02	ND	--	0.62	20	21
27	B/C 3	23S-00-6018 (6"-12")	0.48	18.6	0.12	63.1	1.01	ND	--	0.05	20	21
28	B 6/7	23S-00-6019 (0-6")	0.19	27.5	ND	--	0.40	ND	--	0.01	16	16

Table A9-2: GA Internal Confirmatory Survey - Gamma Spectroscopy Soil Sample Results from GA's Hot Cell Site

#	Grid	Sample ID	Radionuclide Concentrations (pCi/g) [1] *Background Not Subtracted*							Sum of Fractions [2]	Exposure Rate Measurements [3]	
			Cs-137		Co-60		Sr-90	Cs-134			@ soil surface	@ 1 m from surface
			pCi/g	% error (2 SD)	pCi/g	% error (2 SD)	Estimated pCi/g [4]	pCi/g	% error (2 SD)			
29	B 6/7	23S-00-6019 (6"-12")	0.27	35.8	ND	--	0.57	ND	--	0.02	16	16
30	B 7	23S-00-6020 (0-6")	0.07	78.9	ND	--	0.15	ND	--	0.00	19	16
31	B 7	23S-00-6020 (6"-12")	ND	--	ND	--	ND	ND	--	0.00	19	16
32	C 1	23S-00-6021 (0-6") [2 hour count]	8.03	1.8	1.36	6.8	16.86	ND	--	0.71	22	22
33	C 1	23S-00-6021 (6"-12")	1.52	9.4	0.21	46.7	3.19	ND	--	0.13	22	22
34	C 5	23S-00-6022 (0-6")	3.58	4.3	0.54	18.1	7.52	ND	--	0.31	22	21
35	C 5	23S-00-6022 (6"-12")	0.10	75.8	0.14	78.0	0.21	ND	--	0.02	22	21
36	D 5	23S-00-6023 (0-6")	0.85	13.2	0.33	30.7	1.79	ND	--	0.10	23	24
37	D 5	23S-00-6023 (6"12")	ND	--	0.14	52.4	ND	ND	--	0.02	23	24
38	F 5	23S-00-6024 (0-6")	0.27	38.3	0.05	122.4	0.57	ND	--	0.02	26	24
39	F 5	23S-00-6024 (6"-12")	ND	--	ND	--	ND	ND	--	0.00	26	24
40	F 2	23S-00-6025 (0-6")	0.30	19.3	ND	--	0.63	ND	--	0.02	20	20
41	F 3	23S-00-6026 (0-6")	0.38	13.0	0.04	106.3	0.80	ND	--	0.03	22	20
42	I 4	23S-00-6027 (0-6")	0.56	15.2	0.16	38.7	1.18	ND	--	0.06	19	19

Table A9-2: GA Internal Confirmatory Survey - Gamma Spectroscopy Soil Sample Results from GA's Hot Cell Site												
#	Grid	Sample ID	Radionuclide Concentrations (pCi/g) [1] *Background Not Subtracted*							Sum of Fractions [2]	Exposure Rate Measurements [3]	
			Cs-137		Co-60		Sr-90	Cs-134			@ soil surface	@ 1 m from surface
			pCi/g	% error (2 SD)	pCi/g	% error (2 SD)	Estimated pCi/g [4]	pCi/g	% error (2 SD)			
44	I 4	23S-00-6027 (6"-12")	0.28	21.3	0.07	72.1	0.59	ND	--	0.03	19	19
45	J 4	23S-00-6028 (0-6")	4.07	3.9	0.62	15.5	8.55	0.10	--	0.36	19	18
46	I 5	23S-00-6029 (0-6")	2.17	5.9	0.30	30.2	4.56	ND	--	0.18	25	18
47	I 5	23S-00-6029 (6"-12")	1.58	7.2	0.20	37.7	3.32	ND	--	0.13	25	18
48	I 5	23S-00-6030 (0-6")	2.35	4.9	0.29	24.2	4.94	ND	--	0.20	19	19
49	I 6	23S-00-6031 (0-6")	6.63	3.0	0.98	11.2	13.9	0.16	29.4	0.59	20	18
50	K 2	23S-00-6032 (0-6") Re-sampled after remediation (see 6049)	4.66	3.8	2.94	5.95	9.79	ND	--	0.68	30 Decreased to 24 after remediation (see 6049)	19
51	K 1/2	23S-00-6032 (6"-12") Re-sampled after remediation (see 6049)	2.29	5.2	1.70	7.7	4.81	ND	--	0.37	30 Decreased to 24 after soil removed (see 6049)	19
52	K 3	23S-00-6033 (0-6")	1.42	8.6	ND	--	2.98	ND	--	0.10	19	17
53	K 5	23S-00-6034 (0-6")	5.86	3.2	1.22	10.5	12.31	ND	0.93	0.55	18	17
54	K 5	23S-00-6034 (6"-12)	2.15	5.6	0.94	11.8	4.52	0.24	18.5	0.50	18	17

Table A9-2: GA Internal Confirmatory Survey - Gamma Spectroscopy Soil Sample Results from GA's Hot Cell Site												
#	Grid	Sample ID	Radionuclide Concentrations (pCi/g) [1] *Background Not Subtracted*							Sum of Fractions [2]	Exposure Rate Measurements [3]	
			Cs-137		Co-60		Sr-90	Cs-134			@ soil surface	@ 1 m from surface
			pCi/g	% error (2 SD)	pCi/g	% error (2 SD)	Estimated pCi/g [4]	pCi/g	% error (2 SD)			
55	K 6	23S-00-6035 (0-6")	1.49	7.6	0.27	33.1	3.13	ND	--	0.13	17	16
56	L 3/4	23S-00-6036 (0-6")	0.40	15.6	0.08	43.9	0.84	ND	--	0.04	16	16
57	A/B 2/3	23S-00-6037 (0-6")	0.53	17.6	0.18	46.4	1.11	ND	--	0.06	16	16
58	A/B 3	23S-00-6038 (0-6")	0.09	51.9	ND	--	0.19	ND	--	0.01	15	15
59	A/B 3/4	23S-00-6039 (0-6")	0.13	42.4	ND	--	0.27	ND	--	0.01	15	14
60	B 2/3	23S-00-6040 (0-6")	0.03	100.8	ND	--	0.06	ND	--	0.00	15	15
61	B 3	23S-00-6041 (0-6")	0.21	27.8	0.08	47.0	0.44	ND	--	0.02	17	17
62	B 3/4	23S-00-6042 (0-6")	0.84	11.2	0.55	61.1	1.76	ND	--	0.13	15	15
63	B/C 1	23S-00-6043 (0-6")	0.46	17.2	0.10	70.0	0.97	ND	--	0.04	20	18
64	B/C 1	23S-00-6044 (0-6")	3.36	4.4	0.19	39.6	7.01	ND	--	0.25	19	17
65	C 1	23S-00-6045 (0-6")	1.67	7.9	0.23	41.8	3.51	ND	--	0.14	19	18
66	C 1	23S-00-6046 (0-6")	3.25	5.0	1.21	11.3	6.83	ND-	--	0.37	20	18
67	C/D 1	23S-00-6047 (0-6")	3.10	6.3	0.31	36.6	6.51	ND	--	0.25	18	18
68	C/D 1	23S-00-6048 (0-6")	3.67	4.5	0.52	18.6	7.71	ND	--	0.31	19	18

Table A9-2: GA Internal Confirmatory Survey - Gamma Spectroscopy Soil Sample Results from GA's Hot Cell Site

#	Grid	Sample ID	Radionuclide Concentrations (pCi/g) [1] *Background Not Subtracted*							Sum of Fractions [2]	Exposure Rate Measurements [3]	
			Cs-137		Co-60		Sr-90	Cs-134			@ soil surface	@ 1 m from surface
			pCi/g	% error (2 SD)	pCi/g	% error (2 SD)	Estimated pCi/g [4]	pCi/g	% error (2 SD)			
69	K 2	23S-00-6049 (0-6") Sample after soil removed from 6032 location	0.20	26.7	0.07	99.0	0.42	ND	--	0.14	24	19

(1) Gamma spectroscopy results of soil samples collected at the Hot Cell Site as part of GA's Internal Confirmatory Survey. All soil samples counted for 1 hour unless otherwise indicated. Background was not subtracted from any of the results. The uranium and thorium values were at or near normal background levels. ND means < 0.1 pCi/g for Cs-137, Co-60 and Cs-134.

(2) Sum of Fractions Calculated as follows: Cs-137 concentration pCi/g/15 pCi/g + Co-60 concentration pCi/g/8 pCi/g + Sr-90 estimated concentration pCi/1800 pCi/g + Cs-134 concentration pCi/10 pCi/g. The sum of the fractions must be < 1 to meet the soil release criteria. Exposure Rate Measurements taken on the soil surface and at 1 m from the surface using a calibrated microR meter. See Figure CS-5 for the soil sample location.

(4) Estimated pCi/g based on 2.1 times the Cs-137 concentration (See Appendix 2).

Table A9-3: GA Internal Confirmatory Survey - Gross Alpha/Gross Beta Results on Soil Samples from GA's Hot Cell Site				
Sample #	Approximate Grid Location	Sample ID	Radionuclide Concentrations (pCi/g) ± 2 SD	
			Gross alpha	Gross Beta
1	B/C 3	23S-00-6018 (0-6")	4.8 ± 0.9	20.9 ± 0.8
2	B 7	23S-00-6020 (0-6")	4.5 ± 1.0	16.9 ± 0.9
3	C 1	23S-00-6021 (6"-12")	5.8 ± 1.5	23.2 ± 1.3
4	C 5	23S-00-6022 (0-6")	5.6 ± 1.0	27.5 ± 1.0
5	F 5	23S-00-6024 (0-6")	9.4 ± 1.9	2.8 ± 1.5
6	J 4	23S-00-6028 (0-6")	6.0 ± 1.0	18.3 ± 0.8
7	I 5	23S-00-6029 (0-6")	5.4 ± 1.4	18.7 ± 1.2
8	I 6	23S-00-6031 (0-6")	3.5 ± 1.6	10.1 ± 1.7
9	K 1/2	23S-00-6032 (0-6")	5.3 ± 1.2	30.9 ± 1.2
10	K 3	23S-00-6033 (0-6")	4.4 ± 1.2	14.7 ± 1.0

Figure A9-1: Main Site and Sorrento Valley Site

PC-000495/0

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

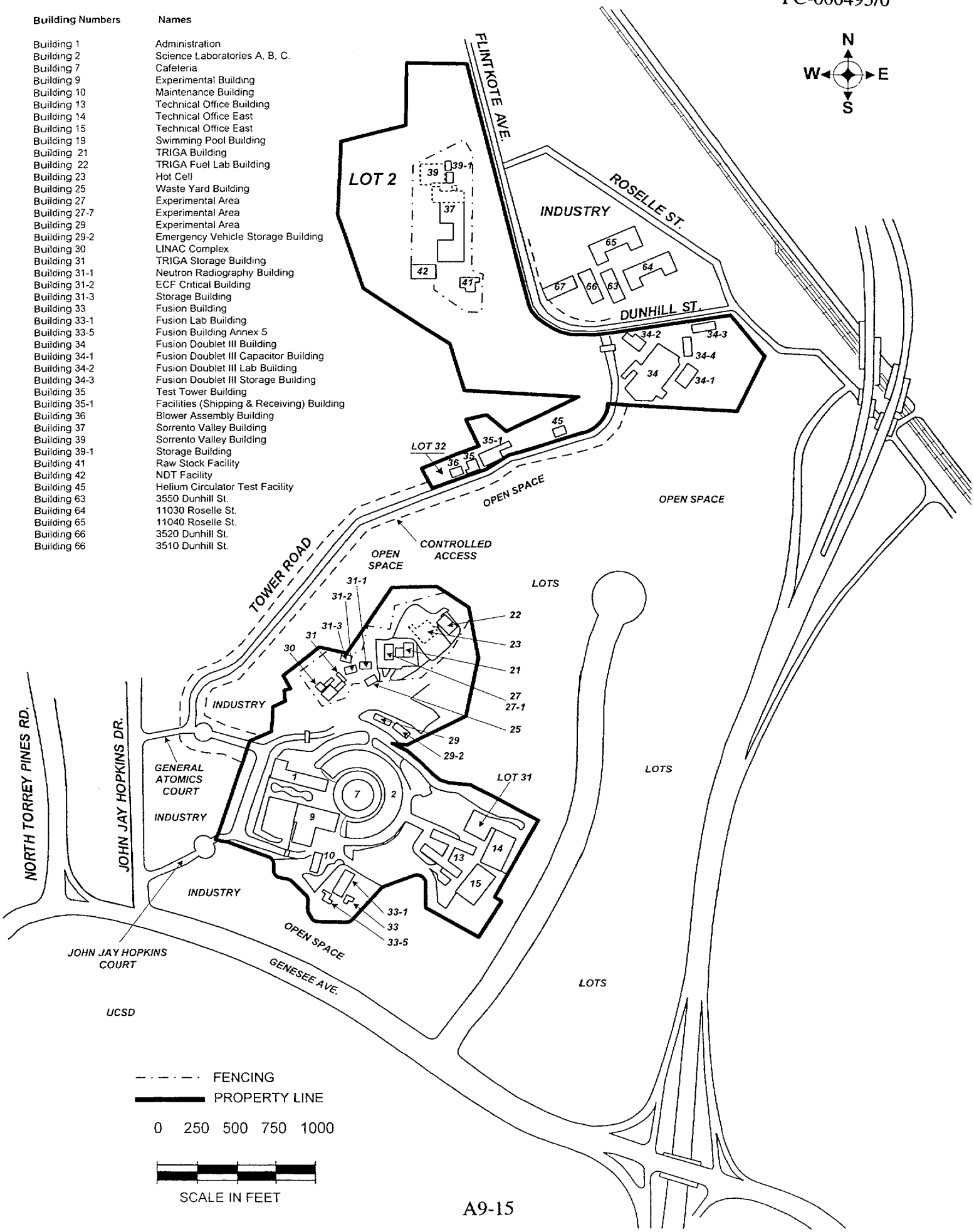


Figure A9-1: Main Site and Sorrento Valley Site

PC-000495/0

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

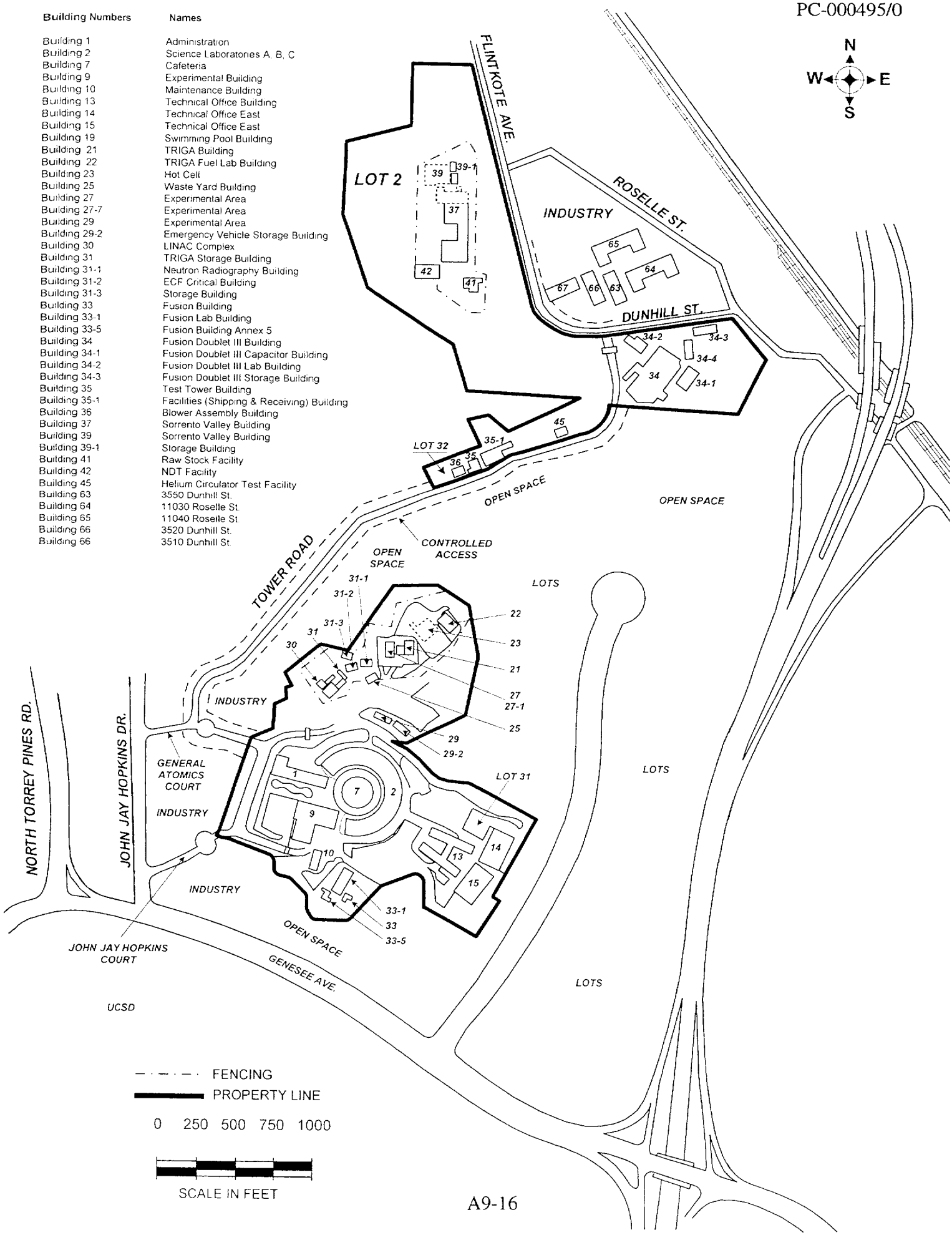


Figure A9-2: Relationship Between Building 27-1, 27, 21, 23 and 22

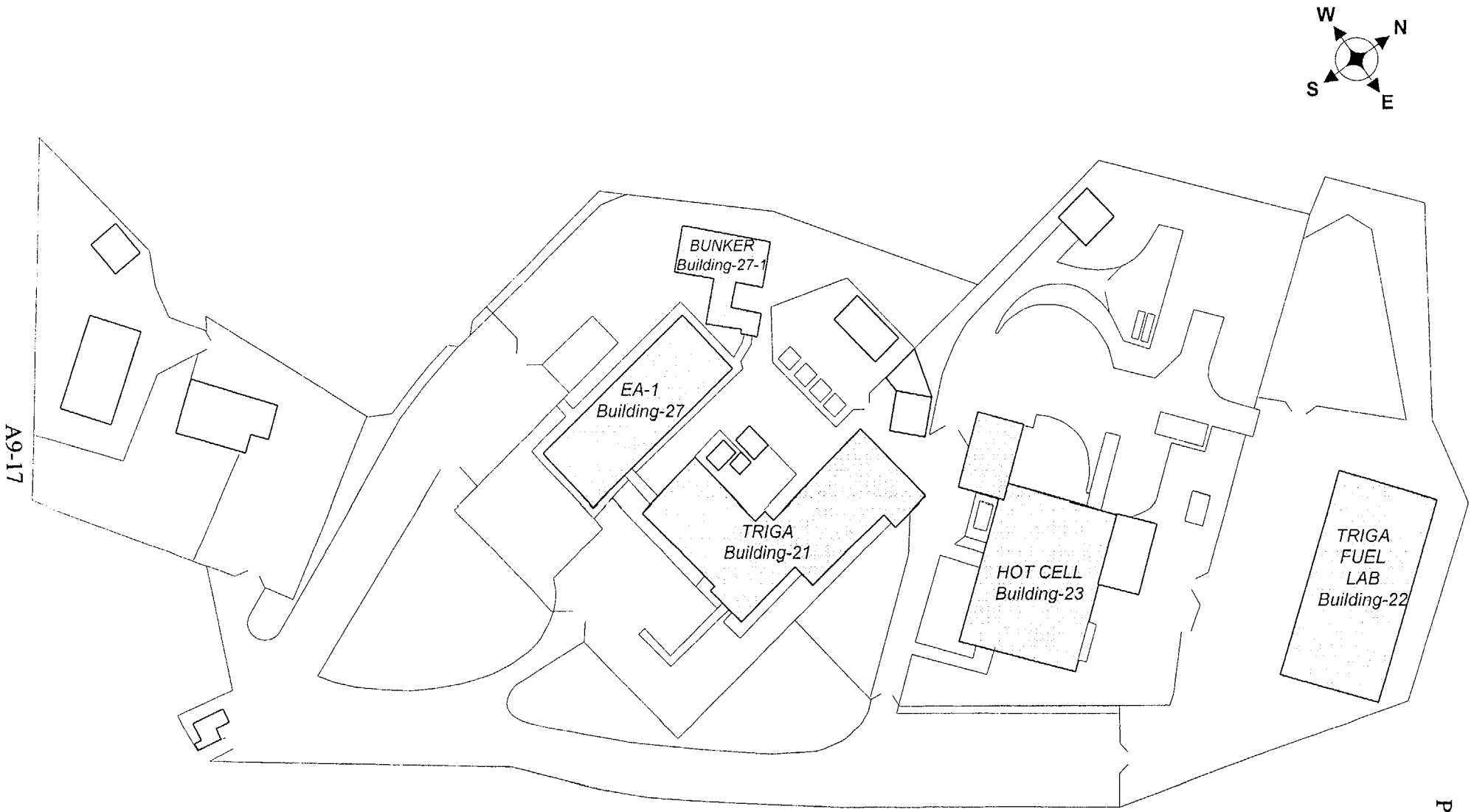
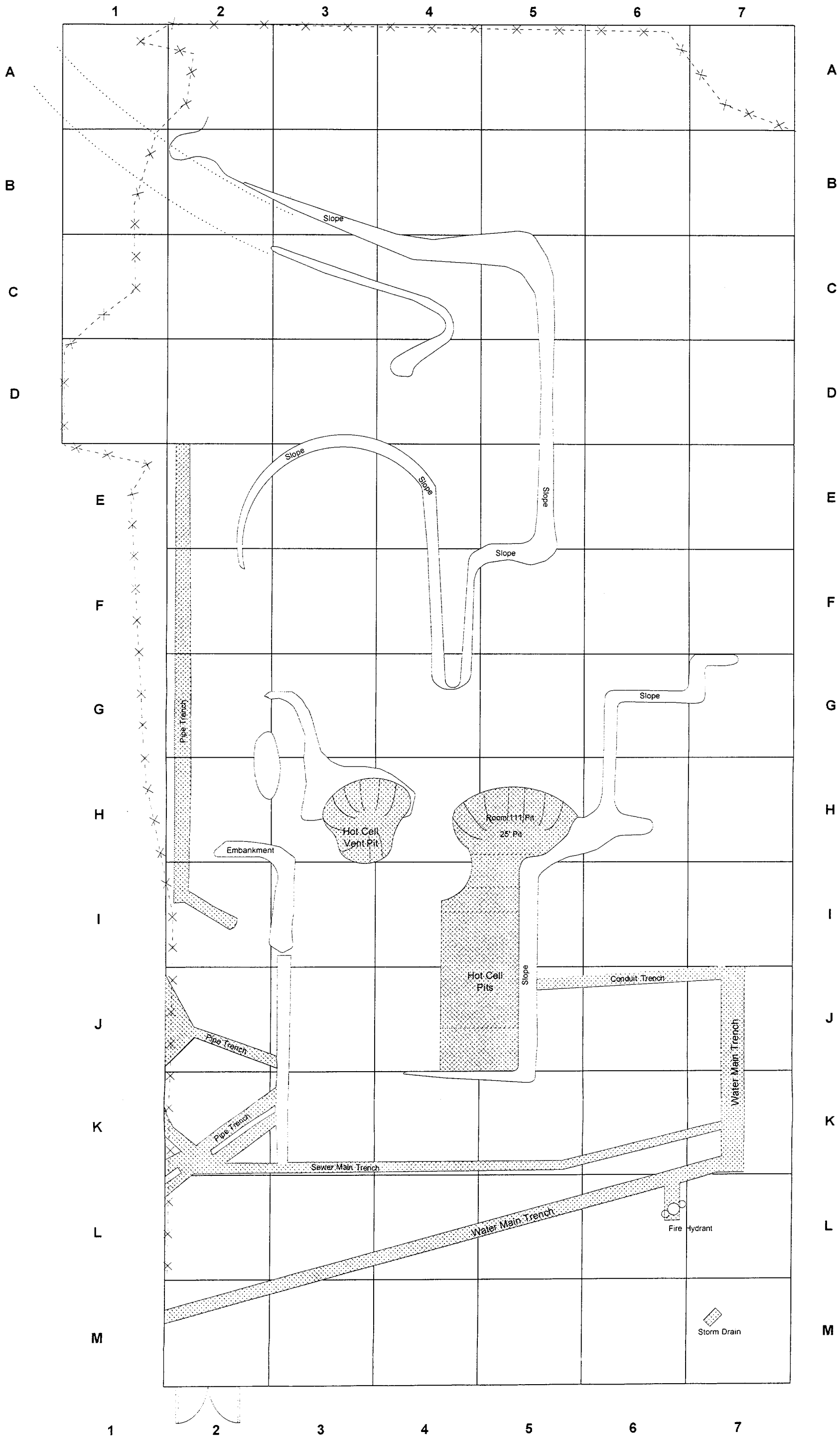


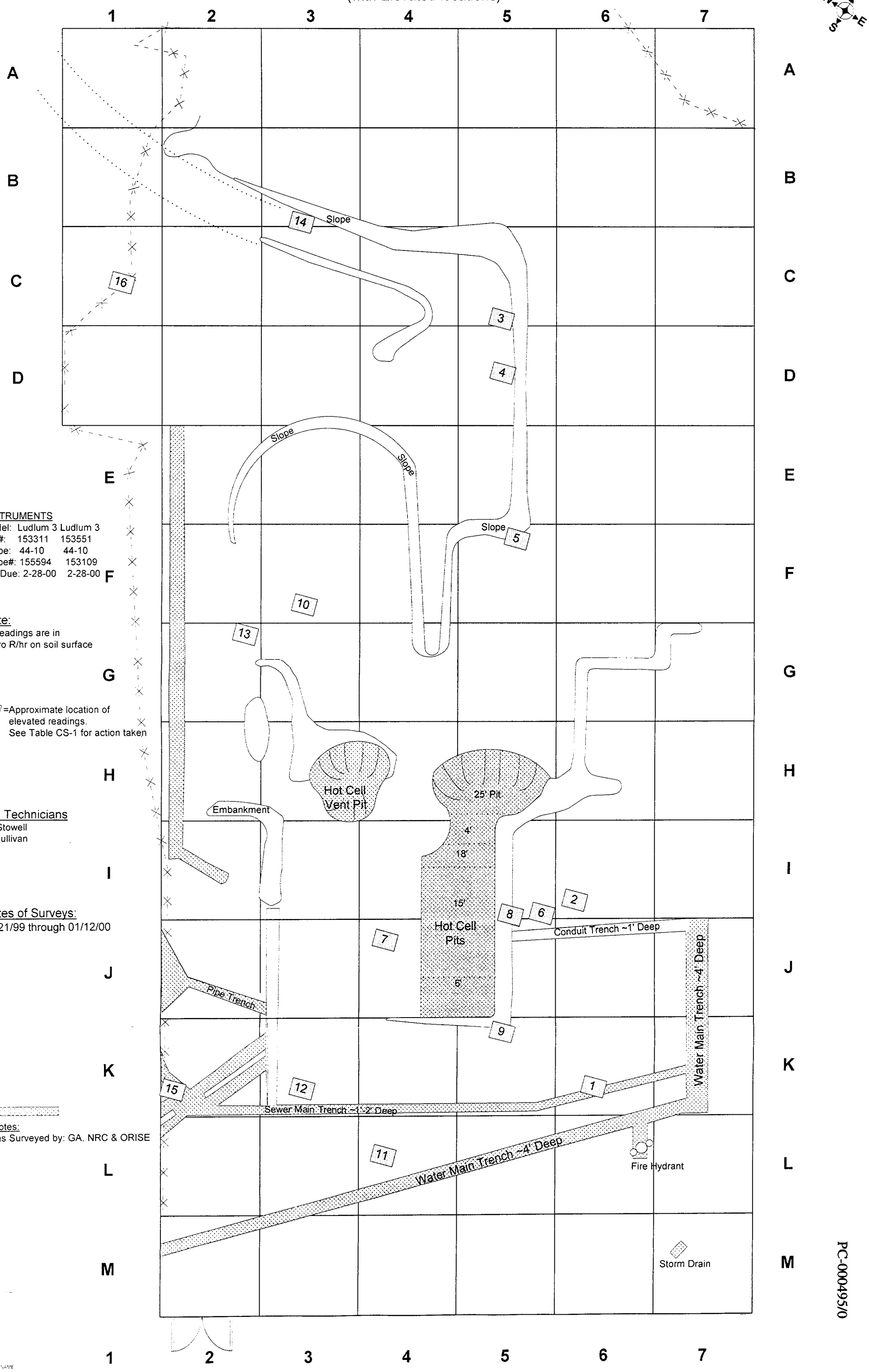
Figure A9-3: Current Hot Cell Site



FILENAME

FIG A9-3 FINALADDITIONALSOIL VSD

Figure A9-4A: GA Internal Confirmatory Survey - Surface Scan Results on the Hot Cell Site
(with Elevated locations)



INSTRUMENTS

Model:	Ludlum 3	Ludlum 3
Ser#:	153311	153551
Probe:	44-10	44-10
Probe#:	155594	153109
Cal Due:	2-28-00	2-28-00

Note:
All readings are in micro R/hr on soil surface

XX =Approximate location of elevated readings. See Table CS-1 for action taken

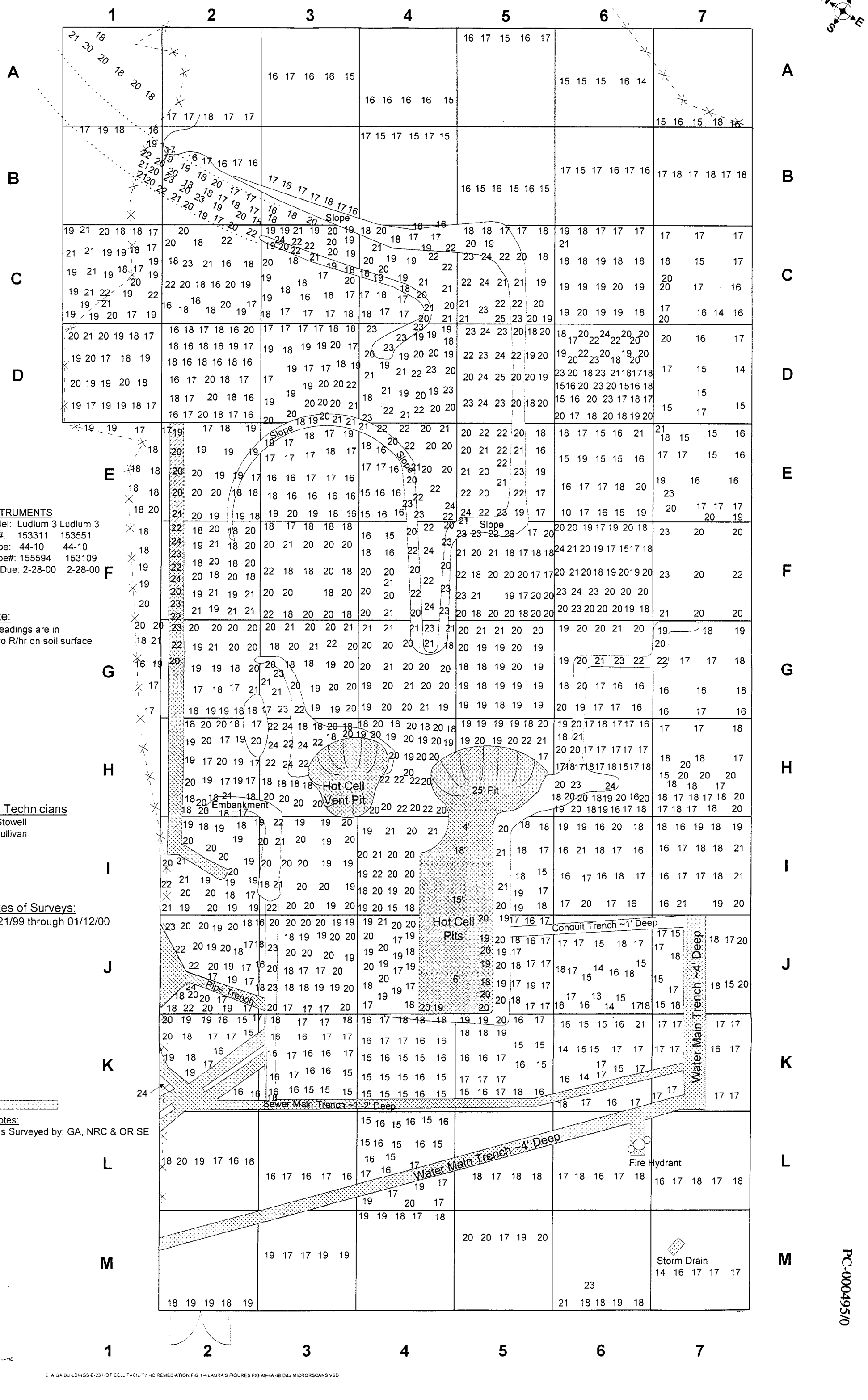
HP Technicians
R. Stowell
J. Sullivan

Dates of Surveys:
12/21/99 through 01/12/00

Denotes:
Areas Surveyed by: GA, NRC & ORISE

FILE NAME: C:\A GA BUILDINGS 8-23 HOT CELL FACILITY HC REMEDIATION FIG 1-4\LAURA'S FIGURES\FIG A9-4A 4B D&J MICRORSCANS.VSD

Figure A9-4B: GA Internal Confirmatory Survey - Surface Scan Results on the Hot Cell Site



INSTRUMENTS

Model:	Ludlum 3	Ludlum 3
Ser#:	153311	153551
Probe:	44-10	44-10
Probe#:	155594	153109
Cal Due:	2-28-00	2-28-00

Note:
All readings are in micro R/hr on soil surface

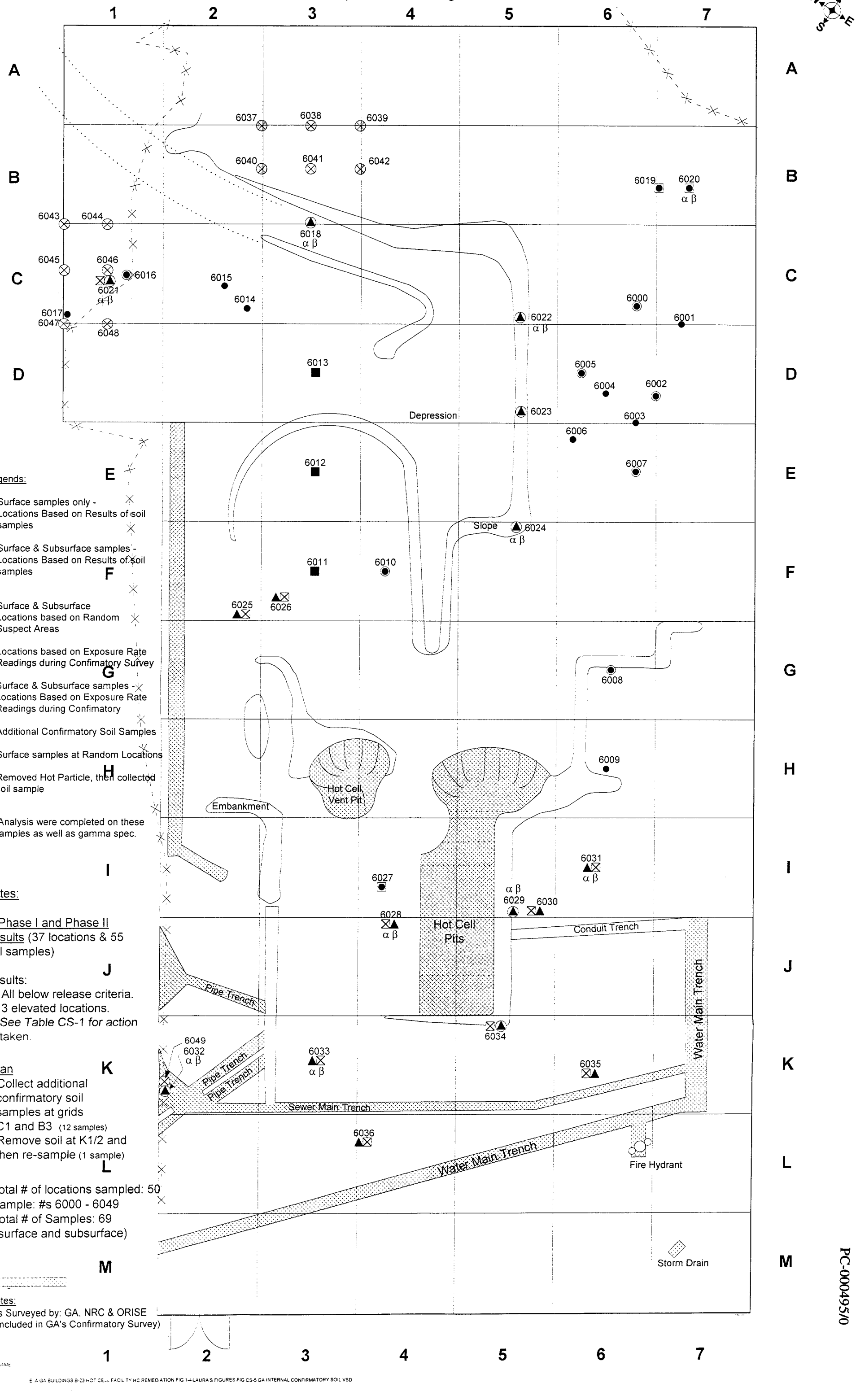
HP Technicians
R. Stowell
J. Sullivan

Dates of Surveys:
12/21/99 through 01/12/00

Denotes:
Areas Surveyed by: GA, NRC & ORISE

E:\A GA BUILDINGS B-23 HOT CELL FACILITY HC REMEDIATION FIG 1-4 LAURA'S FIGURES\FIG A9-4A 4B D&J MICRORSCANS V5D

Figure A9-5: GA Internal Confirmatory Survey: Soil sample Locations
All Sample Numbers Begin with 23S-00



Legends:

- ● = Surface samples only - Locations Based on Results of soil samples
- ◉ = Surface & Subsurface samples - Locations Based on Results of soil samples
- ◉ = Surface & Subsurface Locations based on Random Suspect Areas
- ▲ = Locations based on Exposure Rate Readings during Confimatory Survey
- ◭ = Surface & Subsurface samples - Locations Based on Exposure Rate Readings during Confimatory
- ⊗ = Additional Confirmatory Soil Samples
- ■ = Surface samples at Random Locations
- ⨯ = Removed Hot Particle, then collected soil sample

α/β Analysis were completed on these 10 samples as well as gamma spec.

Notes:

1. Phase I and Phase II Results (37 locations & 55 soil samples)

Results:
a) All below release criteria.
b) 3 elevated locations. *See Table CS-1 for action* taken.

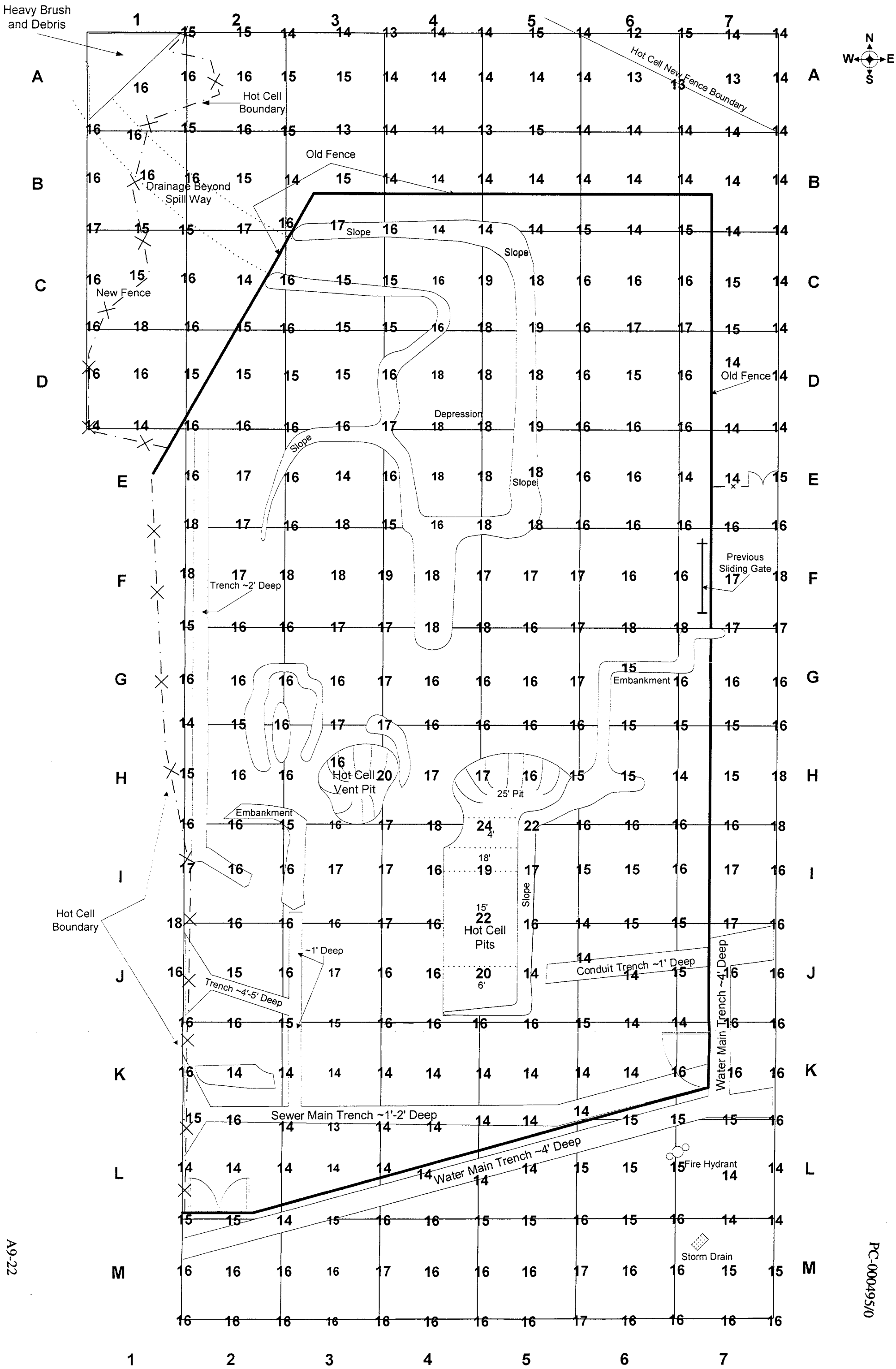
2. Plan
a) Collect additional confirmatory soil samples at grids C1 and B3 (12 samples)
b) Remove soil at K1/2 and then re-sample (1 sample)

3. Total # of locations sampled: 50
a) Sample: #s 6000 - 6049
b) Total # of Samples: 69 (surface and subsurface)

Denotes:
Areas Surveyed by: GA, NRC & ORISE
(not included in GA's Confirmatory Survey)

E:\A GA BUILDINGS B-23 HOT CELL FACILITY HC REMEDIATION FIG 1-4\LAURA'S FIGURES\FIG CS-5 GA INTERNAL CONFIRMATORY SOIL VSD

Figure A9-6: GA Internal Confirmatory Survey - Exposure Rate Survey at 1 meter from Surface



+22 LS

December 21, 1999
Prepared By: Laura Gonzales Laura Gonzales

INTERNAL CONFIRMATORY SURVEY PLAN FOR THE HOT CELL SITE (Building 23)- Scan Survey

1. **Background**

Soil contamination in excess of the release limits was found during the Final Survey and during the Confirmatory Survey. As a result, after remediation it was decided to re-do the Final Survey and the Confirmatory Survey. The "Phase III" surface scan was used as the Final Survey Surface Scan. The Final Survey included taking systematic grid samples. A few areas had to be remediated and additional samples were then taken in 9 of the grids. These samples are being counted and reviewed.

This "New Confirmatory Surface Scan Survey" covers only the surface exposure rate scanning of the site. Another Survey Plan will be written to cover the Soil Sampling Planned for the area after an evaluation of all of the data has been completed.

This plan requires 100% coverage over most grids within the Hot Cell Site (except the pits and trenches already surveyed by GA, NRC and ORISE) including the slopes and depression area as follows:

Grids C1 through C7 and Grids K1 through K7 **Inclusive (100%)**

This "New Confirmatory Surface Scan Survey" also requires 10% coverage over the following grids (the rest of the grids):

Grids A1 through A7 and B1 through B7 **Inclusive (10%)**
Grids L2 through L7 and M2 through M7

2. **Responsibility**

This surface scan will be performed by Joe Sullivan and Dick Stowell and the results reviewed by Laura Gonzales.

3. **Site Condition at Time of Confirmatory Radiological Survey**

The only surface remaining is soil.

4. **Exposure Rate *Surface* Scanning**

1. Surface gamma scans will be conducted at ~1 m intervals over approximately 100% of the grids noted above and 10% of all other grids (as described above); all pits and trenches are excluded.

   The surface scans will be performed using microR meters (with audible indicators). ***For this scan, use hand-held meters along the surface (~3-6").***

2. Locations of elevated readings ($\geq$ 25 μR/hr on the surface), which may suggest the presence of surface or near surface contamination, will be marked and identified for

further evaluation and investigation. Notify Laura Gonzales of any area exceeding this alert level as soon as possible.

3. Flag all areas with elevated readings with an approved color of flag *and* document readings on the survey map. Additional investigation, remediation and/or soil samples may be required in selected areas due to elevated measurements.

4. Collect a surface (0-6") soil sample and a subsurface soil sample 6"-12" anywhere surface readings exceed **30 μR/hr**. Notify HP management immediately.

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

January 7, 2000 Laura Gonzales Page 1 of 1
Prepared By: Laura Gonzales

INTERNAL CONFIRMATORY SURVEY PLAN FOR THE HOT CELL SITE (Building 23)- *Soil Survey*

1. **Background**
Soil contamination in excess of the release limits was found during the Final Survey and during the Confirmatory Survey. As a result, after remediation it was decided to re-do the Final Survey and the Confirmatory Survey. The "Phase III" surface scan was used as the Final Survey Surface Scan. The Final Survey included taking systematic grid samples. A few areas had to be remediated and additional samples were then taken in 9 of the grids. These samples are being counted and reviewed.

The "New Confirmatory Surface Scan Survey" issued on December 21, 1999 covered only the surface exposure rate scanning of the site. This Survey Plan covers the Confirmatory Soil Sampling Plan for the Hot Cell Site.

2. **Responsibility**
This soil samples will be collected by Joe Sullivan and Dick Stowell but may be processed by any Health Physics technician and counted by gamma spec. The results will be reviewed by Laura Gonzales.

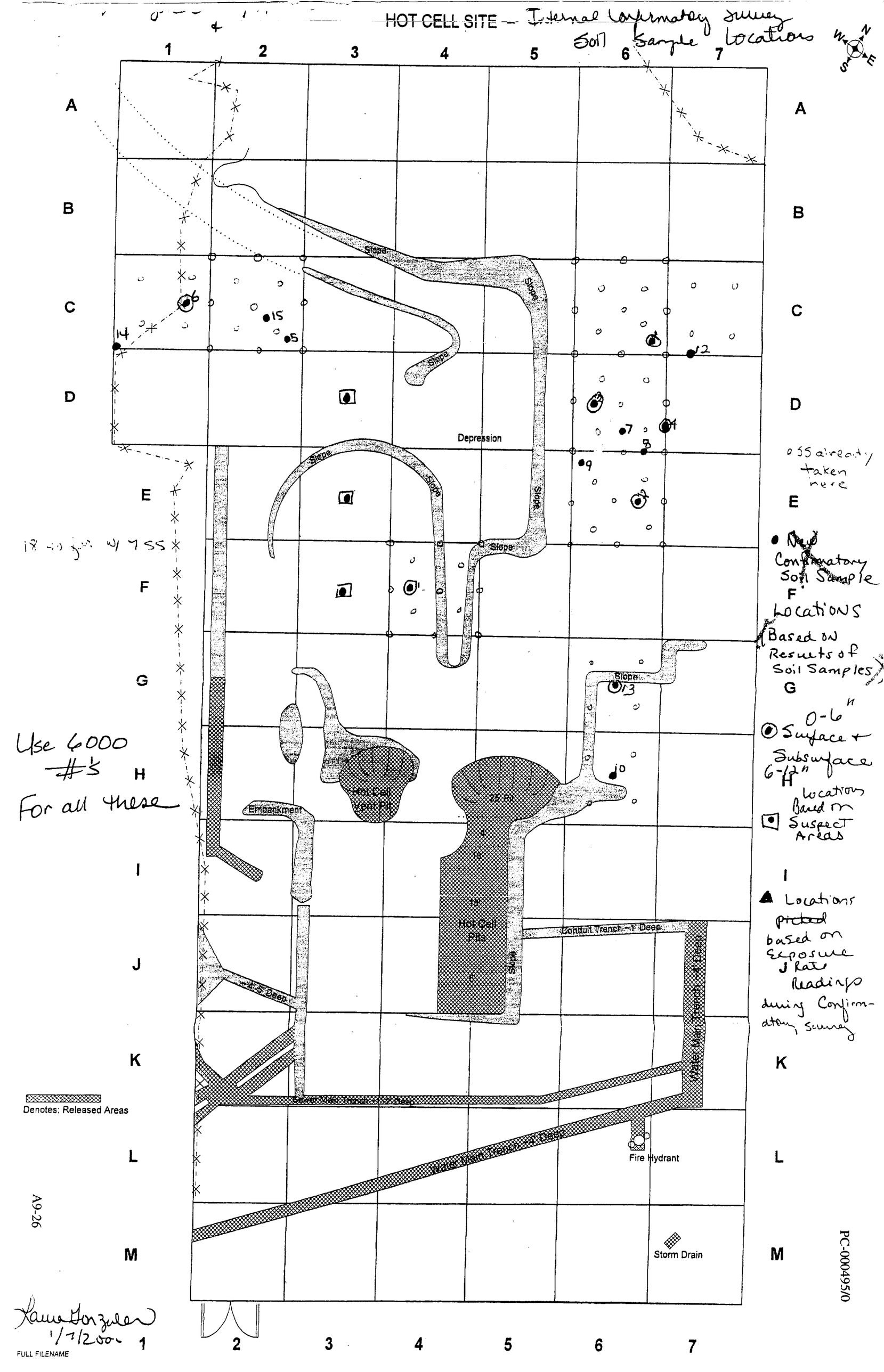
3. **Exposure Rate Measurements**
At each location where a soil sample is collected, take a surface exposure rate measurement (using a microR meter with audible indicator) and an exposure rate measurement at 1 m from the surface. Locations of elevated readings ($\geq$ 25 μR/hr on the surface), which may suggest the presence of surface or near surface contamination, must be reported immediately to Laura Gonzales.

4. **Soil Samples**
The locations selected to be sampled were based upon (1) the results of the Final Soil Samples, (2) suspect areas based on remediation efforts, (3) results of the final and confirmatory survey surface scan (exposure rate measurements) and (4) a random selection of locations.

Phase I
Soil samples will be collected in a total of 18 locations shown in the attached Figure. In every location, a surface (0-6") sample will be collected. In 7 selected areas, subsurface (6"-12") samples will be collected along with the surface samples as shown in the attached Figure. In all, 25 soil samples will be collected. All soil samples will be analyzed by gamma spectroscopy. Some samples will be counted by gross α/β also as indicated on the drawing.

Phase II
To be determined (this plan will be revised to include the other sample locations to be sampled).

5. **Documentation:** Every radiological survey conducted must be documented on a daily basis to a worksheet/log book and on a drawing showing the appropriate locations surveyed. The documentation must include the results of the measurements (including units), the technician's printed name and signature, date, instrument(s) used (including the model and serial number of


HOT CELL SITE – Internal Confirmatory Survey Soil Sample Locations
1 2 3 4 5 6 7
A B C D E F G H I J K L M
Slope
Depression
Embankment
Hot Cell vent Pit
Hot Cell Pits
Conduit Trench - 1' Deep
Water Main Trench - 1' Deep
Sewer Main Trench - 3' Deep
Fire Hydrant
Storm Drain
Denotes: Released Areas
055 already taken here
New Confirmatory Soil Sample Locations Based on Results of Soil Samples
0-6" Surface + Subsurface 6-12" location Based on Suspect Areas
Locations picked based on Exposure Rate Readings during Confirmatory Survey
Use 6000 #'s For all these
A9-26
PC-000495/0
Laura Gonzalez 1/7/2000
FULL FILENAME

January 7, 2000 Page 1 of 2
Revised January 12, 2000
Prepared By: Laura Gonzales

INTERNAL CONFIRMATORY SURVEY PLAN FOR THE HOT CELL SITE (Building 23)- *Soil Survey* - Phase I and Phase II

1. **Background**
Soil contamination in excess of the release limits was found during the Final Survey and during the Confirmatory Survey. As a result, after remediation it was decided to re-do the Final Survey and the Confirmatory Survey. The "Phase III" surface scan was used as the Final Survey Surface Scan. The Final Survey included taking systematic grid samples. A few areas had to be remediated and additional samples were then taken in 9 of the grids. These samples are being counted and reviewed.

The "New Confirmatory Surface Scan Survey" issued on December 21, 1999 covered only the surface exposure rate scanning of the site. This Survey Plan covers the Confirmatory Soil Sampling Plan for the Hot Cell Site.

2. **Responsibility**
This soil samples will be collected by Joe Sullivan and Dick Stowell but may be processed by any Health Physics technician and counted by gamma spec. The results will be reviewed by Laura Gonzales.

3. **Exposure Rate Measurements**
At each location where a soil sample is collected, take a surface exposure rate measurement (using a microR meter with audible indicator) and an exposure rate measurement at 1 m from the surface. Locations of elevated readings ($\geq$ 25 μR/hr on the surface), which may suggest the presence of surface or near surface contamination, must be reported immediately to Laura Gonzales.

4. **Soil Samples**
The locations selected to be sampled were based upon (1) the results of the Final Soil Samples, (2) suspect areas based on remediation efforts, (3) results of the final and confirmatory survey surface scan (exposure rate measurements) and (4) a random selection of locations.

Phase I
Soil samples will be collected in a total of 18 locations shown in the attached Figure. In every location, a surface (0-6") sample will be collected. In 7 selected areas, subsurface (6"-12") samples will be collected along with the surface samples as shown in the attached Figure. In all, 25 soil samples will be collected. Soil samples locations numbered 6000-6017 (location number remains the same in locations where surface and subsurface soil samples are collected, but this is indicated on the soil sample).

Phase II
Additional soil sample locations were determined after the surface exposure rate scan was completed on January 12, 2000. Soil samples will be collected in a total of 19 locations (for Phase II) shown in the attached Figure. In every location, a surface (0-6") sample will be collected. In 11 selected areas, subsurface (6"-12") samples will be collected along with the

surface samples as shown in the attached Figure. In all, 30 soil samples will be collected. Soil samples locations numbered 6018-6036 (location number remains the same in locations where surface and subsurface soil samples are collected, but this is indicated on the soil sample).

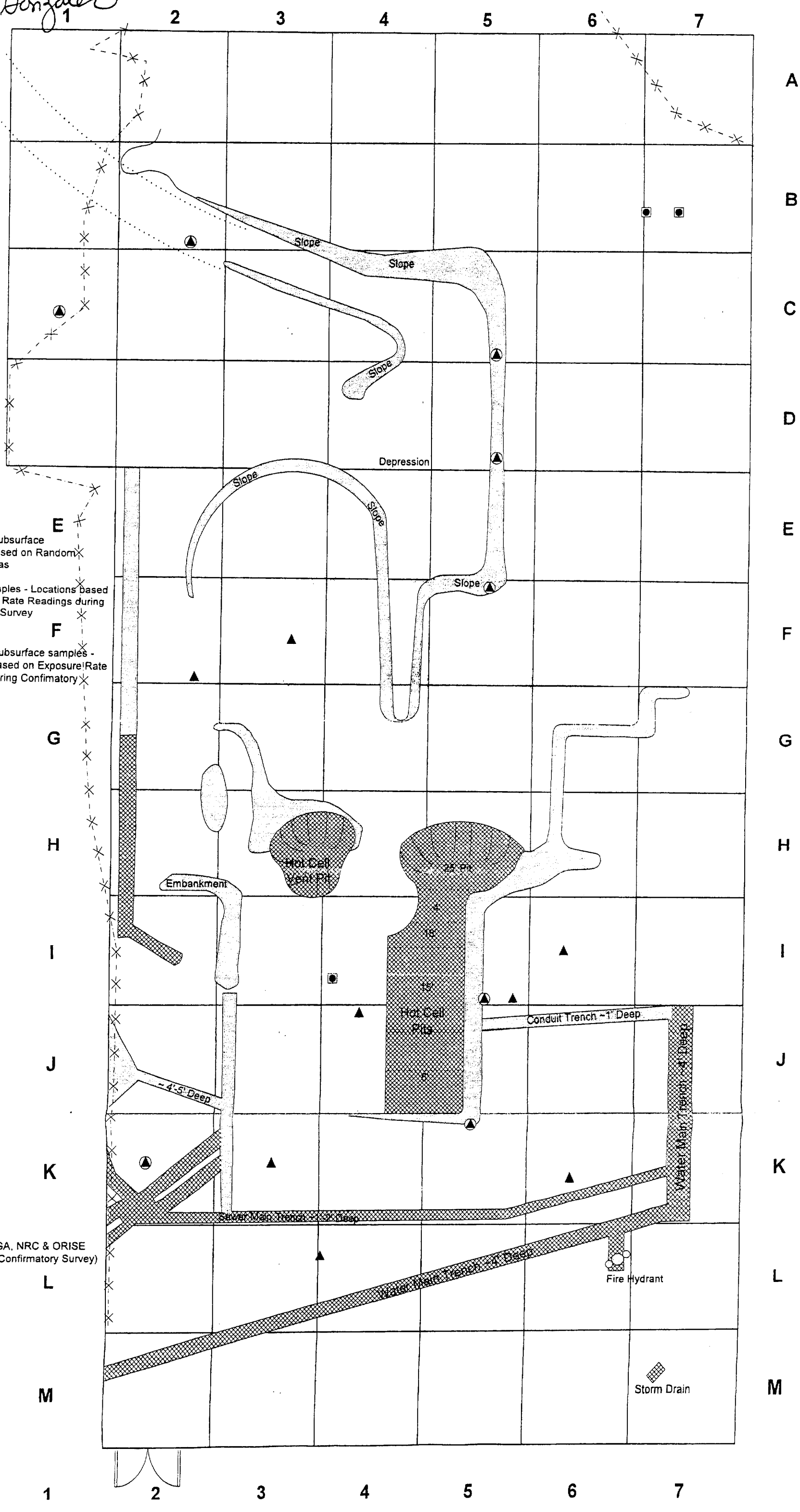
Total Phase I and Phase II Soil Sampling
Total number of locations: 37 Total number of Soil samples: 55

4. **Numbering and Analyses-** All soil samples will be analyzed by gamma spectroscopy for 30 minutes (after processing). In addition, 10 soil samples will be counted by gross α/β (to be determined after the gamma spec results have been obtained).

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

GA Internal Confimatory Survey Soil sample Locations at the Hot Cell Site - Phase II

Laura Gonzales
L. Gonzales
01/12/2000



Legends:

- ◉ = Surface & Subsurface Locations based on Random Suspect Areas
- ▲ = Surface Samples - Locations based on Exposure Rate Readings during Confimatory Survey
- ◭ = Surface & Subsurface samples - Locations Based on Exposure Rate Readings during Confimatory

Denotes:
Areas Surveyed by: GA, NRC & ORISE
(not included n GA's Confirmatory Survey)

Appendix 10

of

General Atomics' Final Radiological Survey Report for the Hot Cell Site

" Confirmatory Estimate of Radioactivity Remaining on the Hot Cell Site"

Appendix 10: Confirmatory Estimate of Radioactivity Remaining on the Hot Cell Site

Background

GA performed a confirmatory check on the estimates of radioactivity remaining on the Hot Cell Site provied in Appendix 7). This confirmatory check verified that the estimates provided in Appendix 7 were reasonable and that the assumptions used to obtain the estimates were acceptable. The values in Table A10-1 were used to obtain an average concentration for each radionuclide present in the Hot Cell Site.

Assumptions for Estimates

1. Estimated weight of soil ~ 85 lbs/ft (soil weighed) which is ~ 1.34 g/cm^3
2. Estimated depth of soil = 6" (0.15 m)
3. Estimated mass of affected soil: Maximum of 83 - 10m x 20m grids x 0.15 (6") of soil = 1,246 m^3 or 1.25e9 cm^3
6. Density of the soil: ~1.34 g/cm^3
7. Mass of affected soil: ~1.34 pCi/g x 1.25e9 cm^3 = 1.68e9 grams

Total Estimated Activity:

1. Total Cs-137 Estimated Activity:
   0.95 pCi/g Cs-137 x 1.68e9 g x 1e-6μCi/pCi = 1,596μCi or 1.60 mCi
2. Total Co-60 Estimated Activity:
   0.13 pCi/g Co-60 x 1.68e9 g x 1e-6μCi/pCi = 218.4 μCi or 0.22 mCi
3. Total Cs-134 Estimated Activity:
   0.0057 pCi/g Cs-134 x 1.68e9 g x 1e-6μCi/pCi = 9.576 μCi or 0.01 mCi
4. Total Sr-90 Estimated Activity: 2.1 times the Cs-137 activity: 2.1 x 1.60 mCi = 3.36 mCi

Table A10-1: Confirmatory Estimate of Radioactivity Remaining on the Hot Cell Site

	Radionuclide Concentrations (pCi/g) *Background Subtracted*[1][2][3][4]					
Sample ID	**^{137}Cs**	#	**^{60}Co**	**^{134}Cs**	**^{90}Sr**	**$\sum$ of Fractions**
23S-99-5000	0.01	1	ND	ND	0.02 ± 0.02	<0.01
23S-99-5001	0.03	2	0.04	ND	0.06 ± 0.04	<0.01
23S-99-5002	0.09	3	0.08	ND	0.19 ±0.06	<0.01
23S-99-5003	0.36	4	ND	ND	0.76 ± 0.13	0.02
23S-99-5004	0.57	5	0.11	ND	1.20 ± 0.17	0.05
23S-99-5005	ND	6	ND	ND	ND	0.00
23S-99-5006	ND	7	ND	ND	ND	0.00
23S-99-5007	0.04	8	ND	ND	0.08 ± 0.04	<0.01
23S-99-5008	ND	9	ND	ND	ND	0.00
23S-99-5009	0.06	10	0.04	ND	0.13 ± 0.06	<0.01
23S-99-5010	0.05	11	ND	ND	0.11 ± 0.04	<0.01
23S-99-5011	0.02	12	0.04	ND	0.04 ± 0.02	<0.01
23S-99-5012	0.01	13	ND	ND	0.02 ± 0.02	<0.01
23S-99-5013	0.06	14	ND	ND	0.13 ± 0.04	<0.01
23S-99-5014	0.36 ±	15	0.14	ND	0.76 ± 0.11	0.04
23S-99-5015	ND	16	0.06	ND	ND	<0.01
23S-99-5016	0.11	17	ND	ND	0.23 ± 0.11	<0.01
23S-99-5017	0.03	18	0.08	ND	0.06 ± 0.04	0.01
23S-99-5018	ND	19	ND	ND	ND	0.00
23S-99-5019	0.01	20	ND	ND	0.02 ± 0.02	<0.01
23S-99-5020	0.06	21	ND	ND	0.13 ± 0.04	<0.01
23S-99-5021	0.01	22	ND	ND	0.02 ± 0.02	<0.01
23S-99-5022	ND	23	ND	ND	ND	0.00
23S-99-5023	ND	24	ND	ND	ND	0.00

Table A10-1: Confirmatory Estimate of Radioactivity Remaining on the Hot Cell Site

23S-99-5024	0.08	25	ND	ND	0.17 ± 0.04	<0.01
23S-99-5025	0.33	26	ND	ND	0.69 ± 0.13	0.02
23S-99-5026	0.18	27	ND	ND	0.38 ±0.13	0.01
23S-99-5027	0.22	28	0.09	ND	0.46 ± 0.11	0.03
23S-99-5028	0.20	29	ND	ND	0.42 ± 0.15	0.01
23S-99-5029	0.18	30	0.09	ND	0.38 ± 0.08	0.02
23S-99-5030	0.08	31	ND	ND	0.17 ± 0.06	<0.01
23S-99-5031	0.04	32	ND	ND	0.08 ± 0.04	<0.01
23S-99-5032	0.19	33	0.13	0.06	0.40 ± 0.11	0.03
23S-99-5033	0.09	34	0.10	ND	0.19 ± 0.06	0.02
23S-99-5034	0.04	35	ND	ND	0.08 ± 0.04	<0.01
23S-99-5035	0.05	36	ND	ND	0.11 ± 0.04	<0.01
23S-99-5036	0.08	37	ND	ND	0.17 ± 0.08	<0.01
23S-99-5037	0.29	38	0.07	ND	0.61 ± 0.13	0.03
23S-99-5038	0.43	39	0.13	ND	0.90 ± 0.17	0.04
23S-99-5039	1.22	40	0.20	ND	2.56 ± 0.21	0.11
23S-99-5040	0.29	41	0.16	ND	0.61 ± 0.17	0.04
23S-99-5041	0.23	42	0.05	ND	0.48 ± 0.08	0.02
23S-99-5042	0.23	43	ND	ND	0.48 ± 0.13	0.02
23S-99-5043	0.19	44	0.06	ND	0.40 ± 0.08	0.02
23S-99-5044	0.68	45	ND	ND	1.43 ± 0.19	0.05
23S-99-5045	0.85	46	0.08	ND	1.79 ± 0.17	0.07
23S-99-5046	0.23	47	0.12	ND	0.48 ± 0.13	0.03
23S-99-5047	0.04	48	ND	ND	0.08 ±0.04	<0.01
23S-99-5048	0.02	49	ND	ND	0.04 ± 0.02	<0.01
23S-99-5049	0.18	50	0.22	ND	0.38 ± 0.08	0.04
23S-99-5050	0.27	51	ND	ND	0.57 ±0.15	0.02
23S-99-5051	0.08	52	0.04	ND	0.17 ± 0.06	<0.01

Table A10-1: Confirmatory Estimate of Radioactivity Remaining on the Hot Cell Site

23S-99-5052	0.34	53	ND	ND	0.71 ± 0.15	0.02
23S-99-5053	0.50	54	0.16	ND	1.05 ± 0.15	0.03
23S-99-5054	0.89	55	0.06	ND	1.87 ± 0.17	0.07
23S-99-5055	1.30	56	0.45	ND	2.73 ± 0.21	0.14
23S-99-5056	1.30	57	0.29	ND	2.73 ± 0.19	0.12
23S-99-5057	0.31	58	0.12	ND	0.65 ± 0.38	0.04
23S-99-5058	1.12	59	ND	ND	2.35 ± 0.21	0.07
23S-99-5059	ND	60	ND	ND	ND	0.00
23S-99-5060	0.05	61	ND	ND	0.11 ± 0.04	<0.01
23S-99-5061	0.07	62	ND	ND	0.15 ± 0.06	<0.01
23S-99-5062	0.08	63	0.03	ND	0.17 ± 0.06	<0.01
23S-99-5063	0.49	64	0.08	ND	1.03 ± 0.15	0.04
23S-99-5064	1.30	65	0.21	ND	2.73 ± 0.17	0.11
23S-99-5065	1.40	66	0.04	ND	2.94 ± 0.27	0.10
23S-99-5066	0.20	67	0.06	ND	0.42 ± 0.08	0.02
23S-99-5067	0.20	68	ND	ND	0.40 ± 0.12	0.01
23S-99-5068	0.58	69	0.07	ND	1.22 ± 0.19	0.05
23S-99-5069	0.17	70	ND	ND	0.35 ± 0.11	0.01
23S-99-5070	0.01	71	0.11	ND	0.02 ± 0.02	<0.01
23S-99-5071	0.18	72	0.07	ND	0.38 ±0.04	0.01
23S-99-5072	ND	73	ND	ND	ND	0.00
23S-99-5073	0.34	74	0.21	ND	0.71 ± 0.17	0.05
23S-99-5074	0.67	75	0.09	ND	1.41 ±0.17	0.06
23S-99-5075	0.71	76	0.11	ND	1.49 ± 0.19	0.06
23S-99-5076	1.04	77	0.12	ND	2.18 ± 0.19	0.09
23S-99-5077	0.18	78	0.08	ND	0.38 ± 0.13	0.02
23S-99-5078	0.12	79	ND	ND	0.25 ± 0.08	<0.01
23S-99-5079	1.34	80	0.32	ND	2.68 ± 0.23	0.13

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23S-99-5080	0.52	81	0.09	ND	1.09 ± 0.04	0.05
23S-99-5081	0.18	82	ND	ND	0.38 ± 0.13	0.01
23S-99-5082	0.09	83	ND	ND	0.19 ± 0.06	<0.01
23S-99-5083	0.08	84	ND	ND	0.17 ± 0.08	<0.01
23S-99-5084	0.11	85	ND	ND	0.23 ± 0.08	<0.01
23S-99-5085	0.09	86	0.08	ND	0.19 ± 0.08	0.02
23S-99-5086	0.44	87	0.07	ND	0.92 ± 0.13	0.04
23S-99-5087	0.52	88	0.10	ND	1.09 ± 0.17	0.05
23S-99-5088	0.33	89	ND	ND	0.69 ± 0.17	0.02
23S-99-5089	0.35	90	0.11	ND	0.74 ± 0.19	0.04
23S-99-5090	1.30	91	0.08	0.08	2.73 ± 0.19	0.10
23S-99-5091	1.00	92	0.14	ND	2.10 ± 0.21	0.08
23S-99-5092	0.41	93	0.12	ND	0.86 ± 0.13	0.04
23S-99-5093	0.17	94	ND	ND	0.36 ± 0.13	0.01
23S-99-5094	0.07	95	ND	ND	0.15 ± 0.04	<0.01
23S-99-5095	0.48	96	0.16	ND	1.00 ±0.15	0.05
23S-99-5096	ND	97	ND	ND	ND	0.00
23S-99-5097	0.35	98	0.10	ND	0.74 ± 0.25	0.04
23S-99-5098	0.57	99	ND	ND	1.20 ±0.19	0.04
23S-99-5099	1.00	100	0.22	ND	2.10 ± 0.25	0.09
23S-99-5100	0.48	101	0.14	ND	1.01 ± 0.15	0.05
23S-99-5101	0.75	102	0.12	ND	1.58 ± 0.19	0.07
23S-99-5102	0.05	103	ND	ND	0.11 ± 0.06	<0.01
23S-99-5103	3.10	104	0.30	ND	6.51 ± 0.27	0.24
23S-99-5104	3.34	105	0.31	ND	7.01 ± 0.29	0.27
23S-99-5105	0.89	106	0.12	ND	1.87 ± 0.21	0.07
23S-99-5106	0.91	107	0.13	ND	1.91 ± 0.15	0.08
23S-99-5107	ND	108	ND	ND	ND	0.00

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23S-99-5108	0.16	109	0.07	ND	0.34 ± 0.08	0.02
23S-99-5109	0.23	110	ND	ND	0.48 ± 0.13	0.02
23S-99-5110	1.70	111	0.24	ND	3.57 ± 0.21	0.14
23S-99-5111	4.40	112	0.78	0.18	9.24 ± 0.38	0.41
23S-99-5112	1.30	113	0.16	0.07	2.73 ± 0.23	0.11
23S-99-5113	0.17	114	0.08	ND	0.36 ± 0.11	0.02
23S-99-5114	2.00	115	0.51	0.11	4.20 ± 0.27	0.21
23S-99-5115	3.40	116	0.07	0.14	7.14 ± 0.40	0.25
23S-99-5116	0.81	117	0.15	ND	1.70 ± 0.17	0.07
23S-99-5117	0.27	118	ND	ND	0.57 ± 0.11	0.02
23S-99-5118	0.02	119	ND	ND	0.04 ± 0.02	<0.01
23S-99-5119	ND	120	ND	ND	ND	0.00
23S-99-5120	ND	121	ND	ND	ND	0.00
23S-99-5121	0.15	122	ND	ND	0.32 ± 0.13	0.01
23S-99-5122	0.03	123	ND	ND	0.06 ± 0.02	<0.01
23S-99-5123	1.00	124	0.19	ND	2.10 ± 0.32	0.09
23S-99-5124	0.84	125	0.20	ND	1.76 ± 0.21	0.08
23S-99-5125	0.74	126	ND	ND	1.55 ± 0.27	0.05
23S-99-5126	5.20	127	0.38	0.20	10.92 ± 0.38	0.41
23S-99-5127	6.00	128	0.22	0.28	12.60 ± 0.42	0.24
23S-99-5128	3.40	129	0.84	0.08	7.14 ± 0.32	0.34
23S-99-5129	1.75	130	ND	ND	3.67 ± 0.22	0.12
23S-99-5130	0.21	131	0.08	ND	0.44 ± 0.08	0.02
23S-99-5131	3.40	132	0.38	ND	7.14 ± 0.32	0.27
23S-99-5132	4.90	133	0.37	0.08	10.29 ± 0.34	0.38
23S-99-5133	ND	134	ND	ND	ND	0.00
23S-99-5134	ND	135	ND	ND	ND	0.00
23S-99-5135	0.58	136	0.08	ND	1.22 ± 0.21	0.05

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23S-99-5136	1.80	137	0.29	ND	3.78 ± 0.25	0.16
23S-99-5137	0.69	138	0.10	ND	1.45 ± 0.19	0.06
23S-99-5138	0.42	139	0.14	ND	0.88 ± 0.17	0.05
23S-99-5139	ND	140	ND	ND	ND	0.00
23S-99-5140	0.15	141	0.05	ND	0.32 ± 0.11	0.02
23S-99-5141	0.24	142	ND	ND	0.50 ± 0.13	0.02
23S-99-5142 Area was remediated and resampled; results of (23S-99-5342 used)	0.14	143	0.16	ND	0.25	0.03
23S-99-5143	0.11	144	ND	ND	0.22 ± 0.08	<0.01
23S-99-5144	0.02	145	ND	ND	0.04 ± 0.02	<0.01
23S-99-5145	ND	146	ND	ND	ND	0.00
23S-99-5146	1.90	147	0.09	ND	3.99 ± 0.25	0.14
23S-99-5147	1.20	148	0.38	ND	2.52 ± 0.21	0.13
23S-99-5148	0.61	149	0.07	ND	1.28 ± 0.13	0.05
23S-99-5149	0.08	150	ND	ND	0.17 ± 0.08	<0.01
23S-99-5150	0.52	151	0.07	ND	1.09 ± 0.13	0.04
23S-99-5151	0.05	152	ND	ND	0.11 ± 0.06	<0.01
23S-99-5152	2.50	153	1.20	ND	5.25 ± 0.32	0.32
23S-99-5153	0.65	154	0.13	ND	1.37 ± 0.17	0.06
23S-99-5154	0.12	155	ND	ND	0.25 ± 0.06	0.01
23S-99-5155	0.76	156	0.10	ND	1.60 ± 0.19	0.06
23S-99-5156	0.37	157	0.11	ND	0.78 ± 0.13	0.04
23S-99-5157	5.30	158	1.00	0.09	11.13 ±0.40	0.49
23S-99-5158	2.00	159	0.93	ND	4.20 ± 0.25	0.25
23S-99-5159	0.39	160	0.14	ND	0.82 ± 0.19	0.04
23S-99-5160	0.89	161	0.16	0.09	1.87 ± 0.19	0.09

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23S-99-5161	1.10	162	0.25	ND	2.31 ± 0.23	0.11
23S-99-5162	1.20	163	0.14	ND	2.52 ± 0.17	0.10
23S-99-5163	0.92	164	0.24	ND	1.93 ± 0.21	0.09
23S-99-5164	1.00	165	0.11	ND	2.10 ± 0.19	0.08
23S-99-5165	1.80	166	0.12	ND	3.78 ± 0.21	0.14
23S-99-5166	0.33	167	0.10	ND	0.69 ± 0.13	0.03
23S-99-5167	1.20	168	0.15	ND	2.52 ± 0.27	0.10
23S-99-5168	0.92	169	0.14	ND	1.93 ± 0.21	0.08
23S-99-5169	0.74	170	ND	ND	1.55 ± 0.21	0.05
23S-99-5170	0.45	171	ND	ND	0.95 ± 0.15	0.03
23S-99-5171	0.37	172	0.05	ND	0.78 ± 0.17	0.03
23S-99-5172	2.30	173	0.21	ND	4.83 ± 0.23	0.18
23S-99-5173 remediated and re-sampled; result for 23S-99-5354 used	2.20	174	0.46	ND	4.62	0.20
23S-99-5174	1.50	175	0.07	ND	3.15 ± 0.25	0.11
23S-99-5175	2.10	176	0.14	ND	4.41 ± 0.25	0.16
23S-99-5176	1.10	177	0.09	0.08	2.31 ± 0.17	0.09
23S-99-5177	1.60	178	0.26	ND	3.36 ± 0.25	0.14
23S-99-5178	0.62	179	ND	ND	1.30 ± 0.13	0.04
23S-99-5179	0.50	180	0.24	ND	1.05 ± 0.17	0.06
23S-99-5180	ND	181	ND	ND	ND	0.00
23S-99-5181	0.07	182	ND	ND	0.15 ± 0.08	<0.01
23S-99-5182	0.34	183	0.04	ND	0.71 ± 0.11	0.03
23S-99-5183	2.33	184	0.23	ND	5.04 ± 0.29	0.19
23S-99-5184	2.80	185	0.22	0.08	5.88 ± 0.27	0.22
23S-99-5185	1.40	186	0.10	ND	2.94 ± 0.25	0.11
23S-99-5186	0.42	187	ND	ND	0.88 ± 0.15	0.03
23S-99-5187	0.46	188	ND	ND	0.97 ± 0.23	0.03

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23S-99-5188	2.10	189	0.13	ND	4.41 ± 0.25	0.16
23S-99-5189	2.50	190	ND	ND	5.25 ± 0.34	0.17
23S-99-5190	1.07	191	0.31	ND	2.25 ± 0.19	0.11
23S-99-5191	1.46	192	0.19	ND	3.07 ± 0.29	0.12
23S-99-5192	1.17	193	ND	ND	2.46 ± 0.19	0.08
23S-99-5193	0.83	194	0.12	ND	1.74 ± 0.19	0.07
23S-99-5194	0.33	195	0.11	ND	0.69 ± 0.11	0.04
23S-99-5195	0.94	196	0.07	ND	1.97 ± 0.23	0.08
23S-99-5196	1.45	197	0.11	ND	3.05 ± 0.25	0.11
23S-99-5197	1.46	198	0.14	ND	3.07 ± 0.27	0.12
23S-99-5198	1.35	199	0.71	ND	2.84 ± 0.21	0.18
23S-99-5199	0.64	200	0.47	ND	1.34 ± 0.21	0.10
23S-99-5200	0.68	201	ND	ND	1.43 ± 0.17	0.05
23S-99-5201	0.48	202	ND	ND	1.01 ± 0.21	0.03
23S-99-5202	1.30	203	0.09	ND	2.73 ± 0.21	0.10
23S-99-5203	3.70	204	0.362	ND	7.77 ± 0.38	0.29
23S-99-5204	3.26	205	0.37	ND	6.85 ± 0.34	0.27
23S-99-5205	1.84	206	0.13	ND	3.86 ± 0.27	0.14
23S-99-5206	1.10	207	ND	ND	2.31 ± 1.11	0.07
23S-99-5207	0.12	208	ND	ND	0.25 ± 0.11	<0.01
23S-99-5208	0.48	209	ND	ND	1.01 ± 0.13	<0.01
23S-99-5209	2.66	210	0.29	ND	5.59 ± 0.29	0.22
23S-99-5210	5.00	211	0.54	ND	10.50 ± 0.36	0.40
23S-99-5211	1.40	212	0.21	ND	3.08 ± 0.25	0.12
23S-99-5212	0.78	213	0.54	ND	1.64 ± 0.23	0.12
23S-99-5213	1.50	214	0.13	ND	3.15 ± 0.34	0.12
23S-99-5214	0.19	215	ND	ND	0.40 ± 0.11	0.01
23S-99-5215	0.34	216	ND	ND	0.71 ± 0.15	0.02

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23S-99-5216	0.85	217	0.12	ND	1.79 ± 0.19	0.07
23S-99-5217	0.53	218	0.10	ND	1.11 ± 0.19	0.05
23S-99-5218	0.04	219	ND	ND	0.08 ± 0.04	<0.01
23S-99-5219	0.83	220	ND	ND	1.73 ± 0.21	0.06
23S-99-5220	0.17	221	ND	ND	0.36 ± 0.11	0.01
23S-99-5221	1.60	222	0.18	ND	3.36 ± 0.25	0.13
23S-99-5222	0.77	223	0.08	ND	1.62 ± 0.19	0.06
23S-99-5223	0.73	224	0.09	ND	1.53 ± 0.21	0.06
23S-99-5224	0.99	225	0.10	ND	2.08 ± 0.19	0.08
23S-99-5225	1.50	226	0.13	ND	3.15 ± 0.27	0.12
23S-99-5226	0.02	227	ND	ND	0.04 ± 0.02	<0.01
23S-99-5227	0.41	228	ND	ND	0.86 ± 0.19	0.03
23S-99-5228	0.68	229	0.45	ND	1.43 ± 0.21	0.10
23S-99-5229	1.00	230	ND	ND	2.10 ± 0.32	0.07
23S-99-5230	8.59	231	0.86	0.11	18.04 ± 0.46	0.69
23S-99-5231	6.30	232	0.86	ND	13.23 ± 0.50	0.53
23S-99-5232	0.27	233	0.05	ND	0.57 ± 0.11	0.02
23S-99-5233	0.07	234	ND	ND	0.15 ± 0.06	<0.01
23S-99-5234	0.06	235	ND	ND	0.13 ± 0.04	<0.01
23S-99-5235	1.90	236	0.83	ND	3.99 ± 0.27	0.23
23S-99-5236	0.31	237	ND	ND	0.65 ± 0.11	0.02
23S-99-5237	4.20	238	0.46	ND	10.08 ± 0.38	0.33
23S-99-5238	0.21	239	ND	ND	0.44 ± 0.08	0.01
23S-99-5239	0.97	240	0.21	ND	2.04 ± 0.29	0.09
23S-99-5240	ND	241	ND	ND	ND	0.00
23S-99-5241	4.00	242	0.26	ND	8.40 ± 0.40	0.30
23S-99-5242	0.38	243	ND	ND	0.80 ± 0.13	0.03
23S-99-5243	0.57	244	ND	ND	1.20 ± 0.17	0.04

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23S-99-5244	0.21	245	ND	ND	0.45 ± 0.11	0.01
23S-99-5245	0.10	246	ND	ND	0.21 ± 0.08	<0.01
23S-99-5246	2.40	247	0.36	ND	5.04 ± 0.32	0.21
23S-99-5247	4.25	248	0.74	ND	8.93 ± 0.50	0.37
23S-99-5248	5.10	249	0.94	ND	10.71 ± 0.42	0.46
23S-99-5249	0.73	250	0.84	ND	1.53 ± 0.23	0.15
23S-99-5250	2.50	251	0.32	ND	5.25 ± 0.38	0.19
23S-99-5251 Area remediated; used resample 23S-99-5396	7.40	1	0.30	ND		
23S-99-5252	0.76	2	0.17	ND	1.60 ± 0.40	0.08
23S-99-5253	1.90	3	0.28	ND	3.99 ± 0.25	0.16
23S-99-5254	1.20	4	0.13	ND	2.52 ± 0.23	0.10
23S-99-5255	0.37	5	ND	ND	0.78 ± 0.13	0.02
23S-99-5256	0.62	6	0.19	ND	1.30 ± 0.23	0.07
23S-99-5257	5.70	7	0.12	0.07	11.97 ± 0.44	0.40
23S-99-5258	1.30	8	0.09	ND	2.73 ± 0.23	0.10
23S-99-5259 Area remediated, used resample 23S-99-5374	2.54	9	0.25	ND		
23S-99-5260	4.20	10	0.40	ND	8.82 ± 0.32	0.33
23S-99-5261	0.08	11	ND	ND	0.17 ± 0.08	<0.01
23S-99-5262	0.13	12	ND	ND	0.27 ± 0.06	<0.01
23S-99-5263	1.50	13	0.19	ND	3.15 ± 0.23	0.12
23S-99-5264	3.60	14	0.23	ND	7.56 ± 0.29	0.27
23S-99-5265	3.20	15	0.15	ND	6.72 ± 0.32	0.23
23S-99-5266	0.10	16	ND	ND	0.21 ± 0.11	<0.01
23S-99-5267	0.05	17	ND	ND	0.11 ± 0.08	<0.01
23S-99-5268	1.40	18	0.13	0.11	2.94 ± 0.19	0.12

Table A10-1: Confirmatory Estimate of Radioactivity Remaining on the Hot Cell Site

23S-99-5269	2.80	19	0.21	ND	5.88 ± 0.32	0.21
23S-99-5270	0.77	20	0.14	ND	1.62 ± 0.19	0.07
23S-99-5271	0.62	21	ND	ND	1.30 ± 0.17	0.04
23S-99-5272	4.96	22	0.35	ND	10.42 ± 0.41	0.38
23S-99-5273	4.60	23	0.27	ND	9.66 ± 0.42	0.34
23S-99-5274	1.10	24	0.17	ND	2.31 ± 0.19	0.09
23S-99-5275	2.50	25	0.11	ND	5.25 ± 0.36	0.18
23S-99-5276	2.40	26	0.18	ND	5.04 ± 0.29	0.18
23S-99-5277	0.74	27	ND	ND	1.55 ± 0.19	0.16
23S-99-5278	1.20	28	0.16	ND	2.52 ± 0.19	0.10
23S-99-5279	0.92	29	0.18	ND	1.93 ± 0.21	0.08
23S-99-5280	0.56	30	0.15	ND	1.18 ± 0.15	0.06
23S-99-5281	0.24	31	0.14	ND	0.50 ± 0.17	0.03
23S-99-5282	1.70	32	0.31	ND	3.57 ± 0.23	0.15
23S-99-5283	2.40	33	0.21	ND	5.04 ± 0.34	0.19
23S-99-5284	0.45	34	0.06	ND	0.95 ± 0.13	0.04
23S-99-5285	0.40	35	ND	ND	0.84 ± 0.15	0.03
23S-99-5286	0.84	36	0.07	ND	1.76 ± 0.17	0.06
23S-99-5287	0.30	37	0.06	ND	0.63 ± 0.13	0.03
23S-99-5288	0.68	38	0.07	ND	1.43 ± 0.17	0.05
23S-99-5289	0.12	39	ND	ND	0.25 ± 0.11	<0.01
23S-99-5290	0.19	40	ND	ND	0.40 ± 0.11	0.01
23S-99-5291	0.72	41	ND	ND	1.51 ± 0.23	0.05
23S-99-5292	1.00	42	0.26	ND	2.10 ± 0.25	0.10
23S-99-5293	2.40	43	0.43	ND	5.04 ± 0.48	0.21
23S-99-5294	1.16	44	0.11	ND	2.43 ± 0.23	0.12
23S-99-5295	1.30	45	0.21	ND	2.73 ± 0.38	0.11
23S-99-5296	ND	46	ND	ND	ND	0.00

Table A10-1: Confirmatory Estimate of Radioactivity Remaining on the Hot Cell Site

23S-99-5297	0.25	47	ND	ND	0.53 ± 0.13	0.02
23S-99-5298	1.14	48	0.24	ND	2.40 ± 0.29	0.10
23S-99-5299	0.61	49	0.16	ND	1.28 ± 0.29	0.06
23S-99-5300	0.10	50	ND	ND	0.21 ± 0.11	<0.01
23S-99-5301	0.57	51	0.07	ND	1.20 ± 0.25	0.05
23S-99-5302	0.17	52	ND	ND	0.36 ± 0.13	0.01
23S-99-5303	0.48	53	ND	ND	1.01 ± 0.17	0.03
23S-99-5304	0.28	54	0.05	ND	0.59 ± 0.15	0.03
23S-99-5305	0.40	55	0.12	ND	0.84 ± 0.17	0.04
23S-99-5306	0.72	56	0.16	ND	1.51 ± 0.19	0.07
23S-99-5307	1.14	57	0.09	ND	2.40 ± 0.27	0.08
23S-99-5308	0.34	58	ND	ND	0.71 ± 0.13	0.02
23S-99-5309	0.04	59	ND	ND	0.08 ± 0.04	<0.01
23S-99-5310	0.41	60	ND	ND	0.86 ± 0.13	0.03
23S-99-5311	ND	61	ND	ND	ND	0.00
23S-99-5312	0.46	62	0.10	ND	0.97 ± 0.17	0.04
23S-99-5313	0.63	63	0.22	ND	1.32 ± 0.27	0.07
23S-99-5314	0.64	64	0.13	ND	1.34 ± 0.21	0.06
23S-99-5315	0.43	65	ND	ND	0.90 ± 0.23	0.03
23S-99-5316	0.34	66	ND	ND	0.71 ± 0.21	0.02
23S-99-5317	0.57	67	ND	ND	1.20 ± 0.19	0.04
23S-99-5318	0.40	68	ND	ND	0.84 ± 0.21	0.03
23S-99-5319	0.18	69	ND	ND	0.38 ± 0.11	0.01
23S-99-5320	0.48	70	ND	ND	1.01 ± 0.21	0.03
23S-99-5321	0.97	71	ND	ND	2.04 ± 0.25	0.06
23S-99-5322	0.26	72	ND	ND	0.55 ± 0.17	0.02
23S-99-5323	0.45	73	0.08	ND	0.97 ± 0.15	0.04
23S-99-5324	0.03	74	ND	ND	0.06 ± 0.04	<0.01

Table A10-1: Confirmatory Estimate of Radioactivity Remaining on the Hot Cell Site

23S-99-5325	ND	75	ND	ND	ND	0.00
23S-99-5326	0.84	76	0.23	ND	1.76 ± 0.27	0.08
23S-99-5327	1.27	77	0.17	ND	2.67 ± 0.25	0.11
23S-99-5328	0.51	78	0.14	ND	1.07 ± 0.21	0.05
23S-99-5329	0.40	79	0.10	ND	0.84 ± 0.13	0.04
23S-99-5330	0.02	80	ND	ND	0.04 ± 0.04	<0.01
23S-99-5331	0.08	81	0.03	ND	0.17 ± 0.08	<0.01
Sum of Average Concentrations (pCi/g)	317		42.052	1.91	666	--
Average Activity (pCi/g)	0.95		0.13	0.0057	2.0	--
Total Site Activity	1.60 mCi		0.22 mCi	0.01 mCi	3.36	--

Notes:
ND means Not Detected, Background, or below the minimum detectable activity. For Cs-137, Co-60 and Cs-134, ND means < 0.1 pCi/g.

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