

March 23, 2005 696/CAL-3853

Mr. Merritt N. Baker (In Duplicate) Fuel Cycle Licensing Branch/Section 1 U.S. Nuclear Regulatory Commission Mail Stop T-8A33 Two White Flint North 11557 Rockville Pike Rockville, MD 20852-2738

Subject: Docket No. 70-734; SNM-696: Request to Release a Certain Portion of General Atomics' Facility to Unrestricted Use and Delete it from License SNM-696: Namely, GA's "DTSC Permitted Area (NWPF-1) of the Nuclear Waste Processing Facility"

and

Ms. Sudana Kwok State of California Department of Health Services Radiologic Health Branch Mail Stop 7610 1500 Capitol Sacramento, CA 95814-0208

Subject: Radioactive Materials License No. 0145-37: Request to Release a Certain Portion of General Atomics' Facility to Unrestricted Use and Delete it from License 0145-37: Namely, GA's "DTSC Permitted Area (NWPF-1) of the Nuclear Waste Processing Facility"

Dear Mr. Baker and Ms. Kwok:

As you are aware, 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 surveys of a large portion of its Nuclear Waste Processing Facility (NWPF) comprised of a portion of GA's Building 41 and adjacent land areas that are permitted as a mixed waste treatment and storage facility by the California Department of Toxic Substances Control (DTSC)(part of California EPA). This portion of the NWPF is referred to as the "DTSC Permitted Area" or simply as "NWPF-1." NWPF-1 is located on GA's Sorrento Valley Site.

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Prior to its being decommissioned, NWPF-1 was used to store, treat, package, re-package and ship radioactive and/or mixed (radioactive and hazardous) wastes generated by various GA projects and facilities. Those NWPF activities involving radioactive materials were conducted under the jurisdiction of the Nuclear Regulatory Commission (NRC) and the State of California Department of Health Services' Radiological Health Branch (RHB). Treatment and storage activities at NWPF-1 that involved waste materials that were both radioactive and hazardous, i.e., mixed waste, were conducted pursuant to a permit issued by, and under the jurisdiction of, DTSC. Thus, NWPF-1 is under the jurisdiction of three regulatory agencies: the NRC, the RHB, and DTSC.

This release request and the enclosed report address the radiological measurements and surveys conducted at NWPF-1. A separate investigation addressing hazardous constituents at NWPF-1 was completed under the oversight of DTSC. Those results were documented in a separate report submitted to DTSC in support of GA's request for "clean closure" of NWPF-1. That report demonstrated that the NWPF soils have no detectable anthropogenic hazardous constituents and no metals above regional background concentrations, and thus the NWPF meets DTSC's criteria for clean closure of a hazardous storage and treatment facility.

NWPF-1 includes the southern portion of Building 41, the adjacent land areas to the south and to the east of Building 41, the landscaped hillside to the east of the Building 41 (separating Building 41 from the Lower Storage Yard), the Lower Storage Yard and connecting roadway, and a heavily vegetated hillside to the south of the material treatment and storage areas of the NWPF (this hillside was included as part of NWPF-1 simply because it is within the NWPF security fence). NWPF-1 covers an area of approximately 32,730 ft2 (~3,044 m2).

It is to be noted that the northern portion of Building 41 has never been used for projects that involve the use of radioactive materials, and was effectively isolated from the NWPF portion of Building 41 by double corrugated metal walls.

Decontamination and decommissioning (D&D) of NWPF-1 began in May 2003. During decommissioning, all of the NWPF equipment and facilities (including walls, roof, and concrete floors of Building 41) were dismantled and disposed of as low level radioactive waste with the exception of the former NWPF office area where three walls, the concrete pad for the floor, and the roof remain. Asphalt was removed from the entire NWPF-1 during decommissioning activities and disposed of as low level radioactive waste, leaving only exposed soil.

Predominant radioactive contaminants identified in the soil were Cs-137, Co-60, uranium and thorium. Radioactively contaminated soil was removed from the site until radiation levels were well below the approved release criteria specified in GA's NRC- and State-approved Site Decommissioning Plan.

The enclosed report titled "Final Radiological Survey Report for the DTSC Permitted Area (NWPF-1 Site) of the Nuclear Waste Processing Facility" documents the results of GA's radiological measurements and soil sampling and analyses performed

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on NWPF-1. The results of these surveys and analyses demonstrate that NWPF-1 meets the NRC- and State- approved criteria for release to unrestricted use.

GA hereby requests the NRC and the RHB to release NWPF-1, as described in the enclosed report, to unrestricted use and delete it from GA's NRC and State of California special nuclear material and radioactive material licenses, respectively.

Consistent with decisions made during joint NRC, State of California and GA decommissioning coordination meetings, GA has requested that the NRC take the regulatory lead for the release of NWPF-1 to unrestricted use.

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

Very truly yours,

Keith E. a

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

- Enclosure: GA report titled: "Final Radiological Survey Report for the DTSC Permitted Area (NWPF-1 Site) of the Nuclear Waste Processing Facility," dated March 2005.
- cc: Dr. D. Blair Spitzberg, Chief, NMSS Branch 3, Region IV Mr. Rick Muñoz, Fuel Cycle Inspector, NRC Region IV Mr. Jeff Wong, State of CA, Berkeley, CA Ms. Barbara Hamrick, State of CA, Brea, CA



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# FINAL RADIOLOGICAL SURVEY REPORT FOR THE DTSC PERMITTED AREA (NWPF-1 SITE) OF THE NUCLEAR PROCESSING FACILITY

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Survey Technicians: Richard Stowell, Greg Sayers, Scott Cowan, and Joseph Sullivan

March 2005

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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 Surveys of a portion of the Nuclear Waste Processing Facility referred to as the "DTSC Permitted Area (NWPF-1 Site) of the Nuclear Waste Processing Facility", herein called the "NWPF-1 site", which is located on GA's Sorrento Valley Site (Figures 1, 2 and 3).

Since approximately 1984, the Nuclear Waste Processing Facility (NWPF) was used to store, treat, package, re-package and/or ship radioactive and/or mixed (radioactive and hazardous) wastes from various GA projects and facilities. The NWPF, in addition to being under the jurisdiction of the Nuclear Regulatory Commission (NRC) and the State of California Department of Health Services' Radiological Health Branch (DHS/RHB) (aka "State"), is also under the jurisdiction of the State of California Department of Toxic Substances Control (DTSC). In 2002, GA was issued a Hazardous Waste Facility Permit allowing treatment and storage units in three designated areas identified as NWPF-1, NWPF-2 and NWPF-3.<sup>1</sup> NWPF-1 and NWPF-2 are located on GA's Sorrento Valley Site. NWPF-1 includes the southern portion of Building 41 and the Lower Storage Yard. The northern side of Building 41 was isolated from the southern NWPF portion by double metal corrugated walls and was used for separate projects not involving the use of radioactive materials. NWPF-2 is the Upper Storage Yard of the NWPF-2 and NWPF-3 areas were addressed in previously submitted Radiological Survey Reports. This report covers only the NWPF-1 portion of the DTSC permit. The NWPF-1 site covers an area approximately 32,730 ft<sup>2</sup> (~3,044 m<sup>2</sup>).

The NWPF-1 area contained equipment and facilities used to process and package low level radioactive only wastes (low level waste), low level radioactive wastes having one or more hazardous constituents (mixed waste), and/or items having low levels of radioactive contamination, for transfer to and disposal at an authorized low level radioactive waste disposal facility.

<sup>&</sup>lt;sup>1</sup> GA submitted a Part A application to the U.S. EPA on March 22, 1989 and a Part B application was submitted to DTSC on March 27, 1996. By letter dated January 31, 2002 (signed by Mohinder S. Sandhu, Chief, Standarize Permits and Corrective Action Branch, DTSC to Dr. Keith Asmussen) Permit Number 02-NC-01 was issued to GA effective March 4, 2002 for GA's Nuclear Waste Processing Facility.

Decontamination and decommissioning (D&D) of the NWPF-1 began in May 2003. During decommissioning, all the NWPF equipment and facilities (including the walls, roofs and concrete floors) were dismantled and disposed of as low level radioactive waste with the exception of the concrete flooring and roof associated with the NWPF office areas, which were found to be radiologically clean.

Asphalt was removed from the entire NWPF-1 site during decommissioning activities and disposed of as low level radioactive waste leaving only exposed dirt.

Predominant radioactive contaminants identified in the soil were Cs-137, Co-60, uranium, and thorium. Radioactively contaminated soil was removed from the site until radioactive concentrations in the soil were well below the approved release criteria specified in GA's NRC- and State- approved Site Decommissioning Plan.

This report documents the results of GA's radiological measurements and soil sampling and analyses performed on the NWPF-1 Site. The results of these surveys and analyses demonstrate that this land area meets the NRC- and State- approved criteria for release to unrestricted use.

GA is requesting both the Nuclear Regulatory Commission (NRC) and the State of California Department of Health Services' Radiologic Health Branch (DHS/RHB) to release this land area to unrestricted use. By means of a separate request supported by a separate report, which documents the results of sampling and analyses for hazardous constituents, GA is requesting DTSC to grant "clean closure" status to GA's NWPF.

#### **Site Description**

A view of GA's Main Site and Sorrento Valley Site is shown in Figure 1. The Sorrento Valley Site has been divided into several land areas for the purpose of facilitating the efficient and organized release of the site to unrestricted use in a piecemeal fashion. The land areas are shown in Figure 2. The Sorrento Valley East Land Area is currently being used to support fusion research. The remainder of the land areas within the Sorrento Valley Site, with the exception of the Sorrento Valley South Land Area, have either been released to unrestricted use or are awaiting release (release requests and final radiological survey reports have been submitted to the NRC and the State).

The Sorrento Valley South (SVS) Land Area was further subdivided into three sections. They are referred to as: (1) The Remaining Portion of Building 41, (2) the DTSC Permitted Area (NWPF-1 Site), and (3) the rest of the SVS Land Area (see Figures 2 and 3). The NWPF-1 site covers an area approximately  $32,730 \text{ ft}^2$  (~ $3,044 \text{ m}^2$ ), the dimensions of which are shown in Figure 4.

The nuclear waste processing portion of Building 41 (Figure 5) consisted of a former radioactive material storage area (room 101), a compactor (in room 102), an enclosure for material handling which may have the potential to result in airborne radioactive contamination (in room 102), a storage area (room 103A), and a packaging area containing hoods, dryer ovens, and other equipment (room 103). The waste processing facility also included a solidification facility which had been added to the south end of Building 41 where low level liquid radioactive waste was stabilized by solidifying into concrete.

<u>Note</u>: While Room 101 of Building 41 was part of the nuclear waste processing facility, it was NOT part of the Part B permit, i.e., it was not part of the Part B permitted NWPF-1. However, because of its proximity to the portion of Building 41 that was part of NWPF-1, it was totally dismantled and disposed of as low level waste along with other adjacent parts of the Part B permitted portion of the the building. The results of final radiological surveys and measurements for Room 101 will be included in a separate report.

With the exception of the office area, the NWPF-1 portion of Building 41 and Room 101 were dismantled and disposed of as radioactive waste as shown in Figure 6. The northern portion of Building 41 (shown in Figure 7 along with the dismantled NWPF-1 area), was never used for work involving radioactive materials.

East of the building, at a grade level ~15 ft lower than Building 41, was a service and storage yard used mainly for storage of radioactive waste and mixed (radioactive and hazardous) waste, prior to processing. It was also used for packaging bulk shipments and staging packaged materials awaiting shipment to an authorized low level radioactive waste disposal facility.

There are no sewer systems traversing this land area, however, there were two (2) drain lines that diverted rainwater from the lower storage yard. These drain lines were removed during D&D and disposed of as low level radioactive waste.

#### **History and Classification**

#### **History**

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The NWPF facility had been the collection point for radioactive waste generated at GA since about 1984. The main functions of the NWPF were to stabilize liquid wastes (by solidification), and to compact, treat, sample, consolidate, package and re-package waste for shipment off site to an authorized disposal facility in accordance with approved standard operating procedures. The waste contained a variety of radionuclides but primarily consisted of mixed fission and mixed activation products, depleted uranium, enriched uranium, and/or thorium.

Packaged radioactive waste was staged in the bermed lower waste yard portion of this site awaiting shipment to an authorized low level radioactive waste disposal facility. To the south of the former processing/packaging facilities and waste storage yard lies a heavily vegetated hillside. The eastern portion of this hillside is included in this NWPF-1 site. It was included as part of the NWPF-1 simply because it was/is within the NWPF security fence. (The western portion of this hillside and the remainder of Sorrento Valley South land areas will be the subject of a future report).

#### Survey Classification

The only remaining portion of the building previously housing the NWPF Facility is a portion of concrete slab that was the sub-flooring for the NWPF office area and the roof above this area. No radioactive material was stored or handled in this office area. It was therefore classified as a *NON-Impacted Area* for radiological survey purposes (see Figure 8). The area of the concrete slab is approximately 780 ft<sup>2</sup> ( $\sim$ 73 m<sup>2</sup>).

The radiation restricted areas of Building 41 (shown in Figure 7), the solidification area, and all outside storage areas were classified as Suspect Affected Areas (Figure 8). In the Final Survey Plan, (provided in Appendix A), the heavily vegetated hillside to the south of the site was initially classified as a *Non-Impacted Area* for radiological survey purposes because there was no history of use involving radioactive material. However, during the performance of the final surveys, elevated radiation levels due to elevated radioactivity in the soil were discovered in a small area of the hillside. The Final Survey plan was amended to reflect the reclassification of the hillside area as a *Suspect Affected Area* (see Appendix A) which required more extensive surveys (see Figure 8). As a result, the entire open land area of the NWPF-1 site was classified as a Suspect Affected Area. This land area is ~31,950 ft<sup>2</sup> (~2,971 m<sup>2</sup>). The total NWPF-1 area is ~32,730 ft<sup>2</sup> (~3,044 m<sup>2</sup>).

#### Criteria for Release to Unrestricted Use

#### As Low As Reasonably Achievable (ALARA)

During decommissioning efforts, GA attempts to decontaminate to levels as close to "background" and as far below the approved Release Criteria (as identified in GA's NRC- and State- approved Site Decommissioning Plan) as reasonably achievable.

#### Facilities and Equipment (and Asphalt or Concrete Surfaces)

The predominant nuclides found in the NWPF-1 site were Cs-137, uranium and thorium. The applicable guidelines for Cs-137 (and most beta/gamma emitters), and uranium-235 and uranium-238 (and their decay products), are as follows:

5,000 dpm /100 cm<sup>2</sup>, averaged over a 1 m<sup>2</sup> area 15,000 dpm /100 cm<sup>2</sup>, total, maximum in a 100 cm<sup>2</sup> area 1,000 dpm/100 cm<sup>2</sup>, removable activity

The applicable guideline for Th-natural, and Th-232 is as follows:

1,000 dpm/100 cm<sup>2</sup>, averaged over 1 m<sup>2</sup> area 3,000 dpm/100 cm<sup>2</sup>, maximum in a 100 cm<sup>2</sup> area 200 dpm/100 cm<sup>2</sup>, removable activity

#### Release Criteria for Soils

The radionuclides found in the soil at the NWPF-1 site GA and the NRC- and State- approved release criteria in pCi/g (above natural background concentrations) for these radionuclides are provided as follows:

30 pCi/g
10 pCi/g
35 pCi/g
15 pCi/g
8 pCi/g
1800 pCi/g

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

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

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

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

#### Exposure Rate Guideline

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

#### **Instrumentation and Background Measurements**

A list of instruments used during the radiological surveys is shown in Table 3. The table includes: (1) a description of the instrument, model number and its serial number, (2) a description of the detector (if applicable) and its serial number, (3) instrument ranges, (4) calibration due dates, (5) typical background readings and minimum detectable activity (MDA's, if applicable) 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.

#### Background Measurements for Instruments/Detectors

Concrete near Building 13 on GA's main site was used for conducting background measurements with instruments used for the final survey because there is no history involving radioactive materials or storage of radioactive materials in Building 13. Background information, where appropriate, is included in Table 3.

Minimum detectable activities (MDA's) for instruments used for fixed measurements, for each type of surface (see Table 3), were calculated using equation (5-2) from the NUREG/CR-5849 as shown below:

Equation (5-2)

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

Where:  $B_R$ =background rate (cpm) E = efficiency t = count time (min)A = area of the detector (cm<sup>2</sup>)

The MDA for scan surveys using the 434 cm<sup>2</sup> gas flow proportional detector (floor monitor) was calculated using equation 5-3 from the draft NUREG/CR-5849 (modified in accordance with the discussion on page 5.8 of the draft NUREG/CR-5849).

Equation (5-3):  

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

Where:

- X = the multiple/portion of the background rate that can be discernable as an increase in instrument response by the surveyor (dependent on the type of instrument used).
- $B_R$  = background rate in (cpm)
- E = efficiency
- A = area of the detector (cm<sup>2</sup>)

#### 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 Table 4 along with the locations where these samples were taken.

#### Exposure Rate Background

Typical exposure rate background for GA's site using a Ludlum Model 19 micro R meter is 12-18  $\mu$ R/hr measured at 1 m from the surface of soil. This range of exposure rates can be measured south of Building 15 (an office building on the eastern portion of GA's Main 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  $\mu$ R/hr (measured at 1 m from the surface). The range of 12-18  $\mu$ R/hr is typical at the GA site for the external dose rates measured 1 meter from the surface.

#### Decontamination and Decommissioning (D&D) Efforts

There are no sewer systems traversing this land area, however, there were two (2) drain lines that diverted rainwater from the lower storage yard. These drain lines were removed during D&D and disposed of as low level radioactive waste.

#### Equipment Removal and Building Dismantlement

Decontamination and decommissioning (D&D) at the NWPF-1 site began in May 2003 with the removal of equipment and supplies used to support waste processing activities. Equipment and supplies found to clean, (i.e., radiation levels not distinguishable from normal background levels) were disposed of at a local landfill. Equipment found to be radioactively contaminated was packaged and disposed of as low level radioactive waste. Radioactively contaminated equipment included a mixing and filtering station, a cement mixer used to solidify liquid wastes, a rinsing station, a waste compactor, hoods, HEPA ventilation systems, enclosures, and other waste processing equipment located in the NWPF-1 portion of Building 41 (Figure 5).

The structural supports within the NWPF-1 portion of Building 41 (see Figure 7) were then dismantled and disposed of as radioactive waste. The roll-up door, other inner doors, sprinkler

<sup>7</sup> system, lights and electrical conduits were also removed and disposed of as radioactive waste. The interior of the Solidification Building was painted to fix potentially removable contamination before dismantlement and disposal as low level radioactive waste.

Asbestos containing materials were removed (by a certified asbestos abatement contractor) from the ceilings of Rooms 41-102, -103 and -103A (Figure 5). The asbestos containing materials were sent to a hazardous disposal facility after they were surveyed and found to be radiologically clean (i.e., not distinguishable from normal background levels). The remaining roofing materials and structural supports from the entire NWPF-1 area (other than over the office area) were dismantled and disposed of as radioactive waste.

The concrete floor of Rooms 41-101, -102, -103 and -103A was cut into approximately 6' by 8' sections, removed, temporarily stored in the lower yard, and later disposed of as radioactive waste. Only a portion of the concrete floor in what was the former office area, bathroom and hallway complex - rooms 104, 105 and 107 - remains (see Figure 7).

All of the walls associated with the processing areas of the NWPF-1 portion of Building 41 were disposed of as radioactive waste. The walls separating the NWPF portion of the building from the remainder of the building were double walls consisting of an outer and inner wall. The outer walls (i.e., walls on the NWPF side) were all disposed of as low level radioactive waste. After Health Physics completed a survey of the outer side of the former inner walls and found it to be free of radioactive contamination, a new outer wall was installed in order to fulfill security requirements for projects occupying the remaining portion of Building 41.

All of the asphalt paving within the Suspect Affected Areas of the NPWF-1 site was removed, temporarily stored, and eventually packaged and shipped to an authorized low level radioactive waste disposal site.

Due to the need to remove fencing and berms, during D&D efforts, "K" rails were positioned along the eastern boundary of the waste yard portion of this site to demarcate the NWPF-1 Site from the remaining portions of Sorrento Valley South Land Area. (Eventually the "K" rails were removed, surveyed and released to unrestricted use).

#### **Initial Surveys**

#### Drain Line Removal and Subsequent Survey

In November 2003, during demolition of the waste solidification building, a floor level grated-drain, was discovered. This drain had a collection box containing a drain pipe. The bottom of this collection box was gravel lined. Further investigation revealed that the drain line was connected to a

larger pipe buried outside of the solidification building that also collected rain water from the roof drains. This ~ 100' larger drain line traveled north from the former solidification building, underneath the sidewalk, along the entire east side of Building 41, to a concrete spillway adjacent to the access road for the Sorrento Valley Site. Most of the drain line was located beyond the NWPF-1 boundary (see Figure 8).

Elevated radiation levels were measured near the solidification area. A soil sample was collected immediately below the walkway in the storm drain runoff; gamma spectroscopy results showed Cs-137, U-235 and U-238 concentrations above each of their respective release limits (the result was  $\sim$ 36 times the release criteria). Co-60 was present about ½ of its limit. Another sample was collected at the discharge point of the drain line which was located on the soil on the east side of the yard (inside the controlled area fence). Contamination levels were  $\sim$ 0.7 times the release limits. A third sample was collected in a clean-out area before the storm drain culvert. The result showed only trace concentrations of Cs-137 contamination.

The drain line was excavated and packaged as radioactive waste along with the contaminated soil. Soil samples were taken at the solidification building, beneath the drain line at every pipe connection and/or every ten (10) feet of pipe run, and at the discharge end of the concrete spillway (most of which is outside of the NWPF-1 boundary). Soil remediation at the solidification area continued until soil sample results were well below the release criteria.

In February 2004, after all of the process equipment and facility dismantlement was completed, the area was gridded into 10m by 10m grids and an initial exposure rate scan (microR survey) of the entire surface of the SVS land area (including the NWPF-1 site) was completed in order to identify areas which may need remediation. Soil samples were collected in all areas where readings > 25  $\mu$ R/hr were measured. This survey resulted in eleven (11) locations having elevated (> 25 $\mu$ R/hr) radiation levels. Soil samples were taken in each of these locations and analyzed by gamma spectroscopy.

The soil sample results indicated that 6 of the 11 locations had radioactive soil concentrations above  $\sim$ 40% of the release criteria. The highest result was  $\sim$ 10 times the limits for Cs-137. One location in the lower yard had U-238 and U-235 contamination above the limits and one sample in the upper yard had thorium contamination at the release limit. Soil was removed from each of the 6 locations until radioactive concentrations in the remaining soil indicated remediation was successful (i.e., radioactive concentrations in soil were well below the approved release criteria for soil). Exposure rate levels, after remediation, returned to normal background levels. Subsequent soil samples collected at these locations showed radioactive concentrations in the release concentrations in the release concentrations in the release concentrations in the soil were < 0.3 times the release criteria for Cs-137.

Soil sample results from the other 5 locations indicated radioactive concentrations were well below the release criteria and no remediation was required.

Additionally, two elevated spots were found near the western edge of the excavation pit which resulted after removal of the drum washing sump which was part of the solidification facility. This area was remediated until radiation levels were at or near normal background levels.

Additional areas having elevated radiation readings (>  $25\mu$ R/hr on the surface) and/or soil contamination (identified by soil sampling and gamma spec analysis) were found including (1) several areas near the original locations which were disturbed during the remediation effort, (2) one area near (~1 ft away) from another remediated area in the lower yard, (3) an area near the former roll up door to room 41-103 which measured about 16.90 pCi/g of Cs-137 (the release criteria is 15 pCi/g). Another location which was known to be contaminated was the area near and along the south wall of Building 41. This area was dug out to allow for proper surveying and remediation. Each of the above mentioned locations was remediated by removing soil until radiation levels and soil radioactive concentrations were well below the release guidelines. Subsequent exposure rate scans showed only radiation levels at or near normal background levels.

#### Post Remediation D&D Survey

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A post remediation D&D survey plan was then prepared and executed. Four (4) areas having elevated radiation levels and/or elevated radioactive soil contamination were found during this survey. Each location was remediated and subsequent microR scans showed only normal background levels.

In May 2004, in order to determine if Sr-90 was a contaminant, GA sent five (5) radioactively contaminated soil samples to an outside laboratory for Sr-90 analysis (Severn Trent Laboratories). These soil samples had been analyzed by gamma spectroscopy at GA and were found to have elevated levels of Cs-137, Co-60, Cs-134, uranium and/or thorium contamination. The results showed positive Sr-90 contamination in 2 of the 5 soil samples. One of the positive samples, collected from the drum wash excavation pit area, had a result of  $0.89 \pm 0.3$ ; the minimum detectable concentration (MDA) was 0.4 pCi/g). The other positive sample was collected in the solidification area where the drain line was discovered. This result was  $13.4 \pm 1.6$  pCi/g (the MDA was 0.5 pCi/g). Although these two results were positive, they were well below the approved release criteria for Sr-90 of 1800 pCi/g (i.e., less than 1% of the limit). The other 3 sample results were below the MDA.

The two locations that had positive results for Sr-90 were remediated prior to the final survey. Also, since Sr-90 was detected above background in the soil, Sr-90 analysis was performed on 20 of the soil samples collected during the Final Surveys.

At least 200 post remediation D&D soil samples were taken prior to the start of the Final Survey. (Post D&D soil samples are not provided in this report; only the results from the Final Survey are provided).

#### Biased Sub-Surface Soil Sampling

GA's Site Decommissioning Plan requires that soil samples be collected in biased locations including each location (larger than  $5 \text{ m}^2$ ) where soil contamination above the guidelines was discovered and remediated. Typically, sub-surface soil samples will be collected to a depth of three (3) feet.

In the case of the NWPF-1 site, there were no areas larger than  $5 \text{ m}^2$  with soil contamination above the guidelines. However, GA removed soil from areas larger than  $5 \text{ m}^2$  in order to remove soil to levels far below the guidelines (i.e., ALARA) and/or to investigate areas of potential contamination.

In April 2004, sub-surface soil samples were collected in accordance with an approved plan (provided in Appendix A) in ten (10) different locations which had been remediated. The approximate locations are shown in Figure 9. Soil samples were collected every 6" (down to 36") in 6 of the 10 locations and every 6" (down to 12") at 4 of the 10 locations; for a total of 44 soil samples.

Gamma spectroscopy results for each of the 44 soil samples are provided in Table 5. The highest Cs-137 concentration was 1.8 pCi/g (~12% of the approved release criteria of 15 pCi/g). Co-60 was not detected in any of the soil samples. Thorium, U-238 and U-235 concentrations were at or near normal background levels and far below the approved release criteria.

#### **Final Surveys Performed**

#### **Objectives and Responsibilities**

The objectives of the final survey were: (1) to demonstrate that the average surface contamination levels for each survey unit were below the approved release criteria, (2) to show that the maximum residual activity did not exceed three times the approved release criteria for average surface contamination value in an area up to  $100 \text{ cm}^2$ , (3) to demonstrate soil sample results at the surface were well below GA's approved release criteria for unrestricted use, and, (4) that the exposure rate measurements taken in these areas, measured at 1 meter above the surface, were less than  $10 \mu \text{R/hr}$  above background.

#### Survey Plans

Final Survey Plans (provided in Appendix A) were developed based on the previous history of use for this site, the radionuclides of concern for this area, the potential for contamination, the various

types of surfaces encountered, and the classification of the various areas.

Surveys were taken in accordance with approved survey plans by qualified Health Physics Technicians having a minimum of three years health physics experience. Soil samples 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.

#### Final Surveys

In May 2004, GA initiated the Final Survey in accordance with a written plan (see Appendix A).

During the performance of the Final Survey, elevated soil activity levels were discovered in the heavily vegetated hillside south of the storage yard. This hillside was previously classified as a *Non-Impacted Area* for radiological survey purposes. The survey plan required the collection of eight soil samples. Gamma spectroscopy analysis of one sample showed U-235 concentrations above background (0.86 pCi/g U-235) but below the enriched uranium release criteria (assuming a conservative 30:1 ratio for U-234:U-235 for enriched uranium). It is unknown how this hillside area could have become radioactively contaminated. The hillside area was subsequently reclassified as a *Suspect Affected Area* which required more extensive surveys and soil sampling. The Final Survey plan (provided in Appendix A) was amended to reflect this change. Additional soil samples were collected to determine the extent of contamination. Soil was removed from the hillside area around the location where the enriched uranium contamination was found until U-235 concentrations were not distinguishable from normal background levels. The rest of the soil samples collected in the hillside area were at or near normal background levels.

A total of 264 soil samples were collected from the entire NWPF-1 site during the final survey.

#### Survey Summary

Comparisons of the Site Decommissioning Plan requirements with the Final Surveys performed in relation to the percentage of surface area scanned, number of measurements (e.g., number of fixed radiation measurements), exposure rate measurements ( $\mu$ R/hr) and soil samples taken are provided as follows:

Compari	Comparisons of Requirements with Final Surveys Performed on the NWPF-1 Area								
Survey Area**	Gridding Required?	# of Fixed Measurements	# of Fixed # of Exposure Rate Measurements Measurements (µR/hr)		# of Soil Samples Taken and Analyzed				
D-Plan Suspect Affected Area	Yes	Not Applicable	Total = 743 (1 per 4 m <sup>2</sup> )	Not Applicable	Total = 120 (4 per 100 m <sup>2</sup> )				
Final Surveys Suspect Affected Areas →	Yes 10m x 10m grids	Not Applicable	<ul> <li>Total = 1,069</li> <li>861 measurements @ 1 m from the surface</li> <li>208 measurements taken at each soil sample location</li> <li>plus 100% surface scan</li> </ul>	Not Applicable	<ul> <li>Total = 264</li> <li>135 surface (0-6") soil samples on 5 m grid</li> <li>56 sub-surface samples, and</li> <li>73 other</li> </ul>				
D-Plan Non-Impacted Areas →	No	Not Required	Not Required	Not Required	Not Required				
Final Surveys Non-Impacted Area →	No	<ul> <li>18</li> <li>measurements</li> <li>6 fixed α</li> <li>6 fixed β</li> <li>6 wipe</li> </ul>	8 fixed measurements taken at 1 meter from the surface <u>and</u> 10% surface scan.	10% of the surface scanned for $\alpha$ and $\beta$ activity.	Not Applicable				

\* D-Plan = GA Site Decommissioning Plan

\*\* The total surface area to be released is approximately 32,730 ft<sup>2</sup> (~ 3,044 m<sup>2</sup>). The Suspect Affected Area is approximately 31,950 ft<sup>2</sup> (~ 2,971 m<sup>2</sup>). The Non-Impacted Area is approximately 780 ft<sup>2</sup> (~73 m<sup>2</sup>).

#### **Results of the Final Surveys**

The final radiological survey results for the DTSC Permitted Area of the NWPF (NWPF-1 site) are provided in figures and tables as noted below:

#### Alpha ( $\alpha$ ) and Beta ( $\beta$ ) Scans

About 10% of the concrete pad (sub-floor of NWPF office area) (the Non-Impacted Area) was scanned for  $\alpha$  and  $\beta$  activity levels using a 434 cm<sup>2</sup> gas flow proportional detector. The results (0-40 cpm  $\alpha$  and 1200-1800 cpm  $\beta$ ) were not discernible from natural background levels. See Figure 10 for locations and results.

#### Fixed Measurements ( $\alpha$ and $\beta$ )

Six (6) one minute fixed  $\alpha$  measurements were taken on the concrete pad (sub-floor of NWPF office area) (the Non-Impacted Area) using a 50 cm<sup>2</sup> alpha detector. All measurements were less than the MDA of 209 dpm/100 cm<sup>2</sup>. Six (6) two minute fixed  $\beta$  measurements were also taken. All results were less than the minimum detectable activity level (MDA) of 205 dpm/100 cm<sup>2</sup>. The approximate locations of the measurements and the results are shown in Figure 11.

#### Removable Activity

Six (6) wipe measurements were taken in the Non-Impacted Area. All results were < 20 dpm/100 cm<sup>2</sup> and < 20 dpm/100 cm<sup>2</sup>. See Figure 11 for approximate locations and Table 7 for wipe survey results.

#### Exposure Rate Scans

About 10% of the concrete pad (sub-floor of NWPF office area) (the Non-Impacted Area) was scanned with a 2" by 2" NaI(Tl) detector held within 1" of the surface. The results ranged from 13-17  $\mu$ R/hr. See Figure 12 for approximate location and results.

About 100% of the Suspect Affected Area surface was scanned with a 2" by 2" NaI(Tl) detector held within 1" of the surface. The readings ranged from 12-23  $\mu$ R/hr on relatively flat surfaces and 19-27  $\mu$ R/hr in excavated trenches. See Figure 13 for locations and results.

Additional surface scans were completed in remediated areas and areas having the highest potential for contamination in accordance with a supplemental survey plan (see Appendix B). The results, which ranged from 16-23  $\mu$ R/hr, are provided in Figure 14.

#### Fixed Exposure Rate Measurements

Eight (8) fixed exposure rate measurements were taken in the Non-Impacted Area (concrete pad) using a 2" by 2" NaI(Tl) detector held one (1) meter from the surface. The highest measurement was 15  $\mu$ R/hr (range was 12-15  $\mu$ R/hr) which is not distinguishable from normal background levels. See Figure 12 for approximate locations and results.

Exposure rate measurements were taken at 861 locations in the Suspect Affected Area, one (1) meter from the surface, using a 2" by 2" NaI(Tl) detector. The highest measurement was 22  $\mu$ R/hr (ranged from 14-22  $\mu$ R/hr). The natural background as measured with this instrument was 12-17  $\mu$ R/hr. The measured exposure rate levels are well below the NRC- and State- approved criteria of less than 10  $\mu$ R/hr above background at one (1) meter above the surface. See Figure 15 for approximate locations and results.

In addition, a fixed exposure rate measurement was taken at 1 meter above the surface at each of 208 soil sample locations using a 2" by 2" NaI(Tl) detector. The highest measurement was 22  $\mu$ R/hr (range was 14-22  $\mu$ R/hr). See Figure 16 for approximate locations and Table 6 for results.

All of the exposure rate measurements were well below the NRC- and State- approved release criteria.

#### Soil Sample Collection

Each soil sample collected was approximately 1 kilogram in mass. The samples were properly logged, labeled, tracked and packaged into plastic bags. 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 tarred marinelli beakers (filled to the top), weighed, sealed and transported to GA's Health Physics Laboratory.

Soil samples were analyzed using a Canberra Low Sensitivity Gamma Spectroscopy MCA System having a high purity germanium detector. The system is 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 at levels well below GA's approved soil release criteria.

A total of 264 soil samples were collected during the final survey at 208 different locations (shown on Figure 16) as follows:

- 135 surface (0-6") soil samples taken on a 5 m triangular grid
- 56 sub-surface soil samples (below 6")
- 13 surface (0-6") soil samples collected inside the lower yard drain line trench
- 8 surface (0-6") soil samples taken in the hillside prior to re-classification
- 19 surface (0-6") soil samples taken in areas that were further remediated (not final samples)
- 33 surface (0-6") soil samples taken primarily around remediated areas

As mentioned above, the 135 surface samples were collected on a 5 m triangular grid. The 56 subsurface soil samples were collected at 14 locations as follows: (1) 50 subsurface (below 6") soil samples were collected every 6 inches in ten locations located on the triangular grid down to 36". These locations are DTSC-86, -90, -122, -133, -139, -142, -151, -156, -165, and -168, (2) 3 subsurface soil samples (from 6" down to 24") were collected every 6 inches at sample location DTSC-141, and (3) 3 subsurface soil samples (from 6" to 12") were collected every 6 inches in three locations; DTSC-14, -174 and -184.

Thirteen (13) surface soil samples were collected in an excavation trench resulting from removal of a buried drainage line discovered in the lower yard in May 2004 (approximate locations are shown in Figure 16). The drain line began at the base of some concrete stairs (which were removed and disposed of as radioactive waste) and ran in an easterly direction directly towards the street (Flintkote Avenue). The outfall was about 15 feet from the street. The drain line was a perforated thin plastic hose encased in loose stone fill material commonly used for ground drainage. The portion of drain line that traversed the NWPF-1 area was excavated. Surveys of the inside of the pipe and the outside the pipe showed radiation levels not distinguishable from normal background levels. All material removed from the trench during excavation was disposed of as low level radioactive waste. The thirteen soil samples (DTSC-1 through DTSC-13) were taken in the excavation trench every 10 feet from the edge of the NWPF-1 boundary to the point of origination within the yard (see Figure 16). Sample #1 was taken outside the fence which is also outside of the NWPF-1 site. All of the results (provided in Table 6) were at or near normal background levels.

The results for the initial eight (8) soil samples (DTSC-14 through DTSC-21) collected on the hillside (soil samples taken prior to reclassification of the hillside area as a suspect affected area) are also included in Table 6. The approximate locations are shown in Figure 16.

During the final survey, elevated radiation levels and/or soil radioactivity were also found in the former Solidification building foundation trench, the drum wash excavation pit next to the solidification building, the bottom of a slope east of the solidification building, and, the extreme northeastern boundary of the waste yard adjacent to the temporary "K" rails. There are nineteen (19) soil sample results on Table 6 which are shaded to represent locations where further remediation was performed after "final" soil samples indicated elevated radioactivity still present in the soil. Contaminated soil from each area (shown in Figure 14) was removed, packaged and shipped to an authorized low level radioactive waste disposal facility. The soil samples collected after further remediation (see Table 6 for results). All of the results of the analyses of "post-remediation" soil samples were all well below the release criteria.

#### Summary of Soil Sample Results

A summary of the gamma spectroscopy results for the final 245 soil samples is provided in the table below. The summary excludes the 19 soil samples taken in areas subsequently remediated.

Summary of Soil Sample Results											
	Radionuclide Concentrations (pCi/g)										
	<sup>137</sup> Cs <sup>60</sup> Co <sup>228</sup> Th ( <sup>212</sup> Pb) <sup>232</sup> Th <sup>238</sup> U <sup>232</sup> U <sup>232</sup> Th ( <sup>228</sup> Ac)										
High	1.77 ± 0.24	ND	3.13 ± 0.55	3.75 ± 0.78	4.88 ± 2.97	0.36 ± 0.09					
Low	ND	ND	0.42	ND	ND	ND					
Average (N=245)	0.16	<mda (0.16)</mda 	1.36	1.52	1.63	0.17					
Nominal Background		See Table 4 for typical background range and background locations.									

#### Notes:

- 1. ND means not detected.
- 2. Average Minimum Detectable Activity (MDA):

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

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

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

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

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

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

- 3. The high concentrations for each radionuclide did not occur in the same sample.
- 4. No sample had a sum of fractions greater than 1.0.
- 5. The Average Activity is based on the numerical average of all (245) samples. The MDA value was used in the calculation of the average when there was no detectable activity.
- 6. Only samples remaining after remediation were included in the calculation.
- 7. Background is <u>not</u> subtracted. See Table 4 for soil background information.
- 8. Soil sample locations are illustrated in Figure 16. Soil sample results are presented in Table 6.

The highest Cs-137 gamma spectroscopy analysis result was  $1.77 \pm 0.24$  pCi/g, which far below the NRC- and State- approved release limits of 15 pCi/g. Co-60 was not detected in any of the soil samples analyzed by gamma spectroscopy (i.e., all of the results were < 0.16 pCi/g).

Only trace amounts of U-238 and U-235 were detected by gamma spectroscopy. The highest U-238 result was  $4.88 \pm 2.97$  pCi/g and the highest U-235 result was  $0.36 \pm 0.09$  pCi/g.

#### Sr-90 Analyses

A total of 20 soil samples were sent to an offsite laboratory - Severn Trent Laboratories (STL) - for

Sr-90 analysis. Ten (10) of the samples were biased samples selected from locations having the highest potential for contamination (including the former solidification area and remediated areas). Most of these samples had Cs-137 contamination present at levels above background. The other ten (10) soil samples were taken on a grid system throughout the NWPF-1 site.

The 20 soil samples were DTSC-45, -58,- 69, -74, -81, -82, -91, -92, -96, -101, -125, -130, -133, - 163, -169, -172, -178, -188, -200, and -202. The approximate locations are shown in Figure 16. Sr-90 was not detected in any of the soil samples. All of the results (provided in Appendix B) were below the minimum detectable concentration for Sr-90 ( $\sim$ 0.5 pCi/g).

#### Uranium Isotopic Analyses

Four (4) of the soil samples with the highest U-235 and/or U-238 concentrations (based on GA's gamma spectroscopy results), were sent to Severn Trent Laboratories, Inc. (STL) for Uranium Isotopic Analysis. See Appendix B for a summary of those results.

The samples were:

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- DTSC-14, a surface (0-6") sample taken prior to final remediation and final survey,
- DTSC-14A, a sub-surface sample (6"-12") taken at location 14 prior to final remediation),
- DTSC-26 (a final surface sample), and
- DTSC-69 (a final surface sample)

The approximate locations are shown in Figure 16. The results (provided in Appendix B) showed that U-235 and U-238 were present in samples DTSC-14, -14A and -26. The ratio of U-234:U-235 ranged from 15:1 to 24:1. The highest result (DTSC-14A) was approximately 0.42 times the enriched uranium limit of 30 pCi/g [(12 pCi/g U-234 + 0.5 pCi/g U-235)/30 pCi/g] = 0.42]. This area was remediated.

Uranium results (U-234, U-235 and U-238) for soil sample DTSC-26 were: 11 pCi/g U-234, 0.56 pCi/g U-235 and 2.13 pCi/g U-238; ~38% of the release limit of 30 pCi/g for enriched uranium (U-234 + U-235). Uranium results (U-234, U-235 and U-238) for soil sample DTSC-69 were not discernable from normal background uranium concentrations.

#### Samples of Tree Roots and Leaves

In addition to the soil samples, a "tree root" sample from the drum wash excavation pit was collected and analyzed. The tree roots (from a nearby tree) had entered the drum wash metal sump and were present in the area. A sample of the "tree leaves" from the tree was also analyzed by gamma spectroscopy. In both samples, Cs-137 and Co-60 were not detected and the other radionuclides present were in concentrations that are not distinguishable from normal background levels.

#### **Confirmatory Survey**

#### Description

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In July and August 2004, GA conducted an internal confirmatory survey of the NWPF-1 site in accordance with a written plan (provided in Appendix C). The purpose of this survey was to determine if the final survey results effectively reflect the radiological conditions of the decommissioned NWPF-1 site.

This survey consisted of exposure rate scans and fixed measurements, alpha/beta activity measurements on concrete surfaces, and the analysis of soil samples collected in biased locations.

#### Exposure Rate Surface Scans and Results

Exposure rate surface scans (to provide ~100% coverage) using on a 2"x2" NaI(Tl) detector ( $\mu$ R meter) held ~1" from the surface were performed within a portion of the Suspect Affected Area of the NWPF-1 site (crossed hatched area shown on Figure 17). The readings ranged from 15 to 23  $\mu$ R/hr, which is at or near normal background levels.

About 10% of the rest of the surface of the NWPF-1 Suspect Affected Area was scanned using the microR meter. The exposure rate range was 15 to 23  $\mu$ R/hr. See Figure 17 for locations and results.

Exposure rate surface scans were also performed on 10% of the Non-Impacted Area. The readings ranged from 15-18  $\mu$ R/hr, which is indistinguishable from normal background levels (see Figure 18).

#### Exposure Rate Measurements

Exposure rate measurements were taken at the soil surface and at 1 meter from the surface at each of 53 soil sample locations. The readings ranged from 16-32  $\mu$ R/hr at the surface and 14-24  $\mu$ R/hr at 1 meter from the surface, which are at or near normal background levels. The results are provided in tabular form on Figure 19.

Four (4) fixed exposure rate measurements were taken 1 meter form the surface within the Non-Impacted Area (concrete pad) of the NWPF-1 site. These results are not discernible from natural

background. The readings were all 15  $\mu$ R/hr which is typical of normal background levels. The approximate locations and results are provided in Figure 18.

#### Alpha and Beta Scanning

Approximately 10% of concrete pad of the former NWPF office area, was scanned for beta activity using a 434 cm<sup>2</sup> proportional detector. The results ranged from 1200-1600 cpm beta and are

indistinguishable from normal background levels. Typical background on concrete for this detector is 1200-1500 cpm beta. See Figure 18 for approximate locations and results.

Approximately 10% of paved surfaces were scanned for alpha activity using a 434 cm<sup>2</sup> proportional detector. The results ranged from 3-48 cpm alpha. Typical background on concrete for this detector is 0-40 cpm. See Figure 18 for approximate locations and results.

#### Fixed Alpha and Fixed Beta Measurements and Results

Four (4) fixed alpha readings were taken on the concrete surface (the Non-Impacted Area) using a 50 cm<sup>2</sup> alpha detector. The measurements were not distinguishable from natural background alpha levels (< 20 cpm). See Figure 18 for locations and results.

Five (5) fixed beta readings were taken on the concrete surface (the Non-Impacted Area) using a 100 cm<sup>2</sup> beta proportional detector. All measurements were less than the minimum detectable activity (MDA) of 205 dpm/cm<sup>2</sup> for the instrument used. See Figure 18 for locations and results.

#### Removable Contamination Survey

Five (5) swipe samples for removable surface contamination were taken on the concrete surface (the Non-Impacted Area). All of the results were < 20 cpm/100 cm<sup>2</sup> alpha activity, and < 20 dpm/100 cm<sup>2</sup> beta activity. See Figure 18 locations and Table 9 for results.

#### Soil Sampling and Results

A total of 73 soil samples were collected, processed and analyzed by gamma spectroscopy during the confirmatory survey as follows:

- 53 surface (0-6") soil samples were collected at 53 locations (shown in Figure 19),
- 10 subsurface, (from 6" down to 36"), soil samples were collected at 2 of the locations (locations WYC-36 and WYC-37), and
- 10 soil samples were collected at 8 different locations (identified as BB-#) where slightly elevated radiation levels were measured. Subsurface soil samples (6"-12" and 12"-18") were collected at 1 of the 8 locations (location BB-1).

The gamma spectroscopy results are provided in Table 10. All of the soil sample results are well below the release criteria. The highest result was  $1.61 \pm 0.22$  pCi/g of Cs-137 (the release criteria for Cs-137 is 15 pCi/g). Co-60 was not detected in any of the soil samples (MDA ~0.16 pCi/g). Thorium and uranium concentrations were at or near normal background levels.

#### **Conclusion**

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#### **Conclusion**

Final contamination and radiation surveys, as well as the results of analyses of soil samples, as documented in this report, demonstrate that the DTSC Permitted Area (NWPF-1 Site) of the Nuclear Waste Processing Facility meets the NRC- and State- approved criteria for release to unrestricted use.

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

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

- b As used in this table dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, an geometric factors associated with the instrumentation.
- c Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.
- d The maximum contamination level applies to an area of not more than  $100 \text{ cm}^2$ .

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- e The amount of removable radioactive material per 100 cm<sup>2</sup> of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, then pertinent levels should be reduced proportionally and the entire surface should be wiped.
- f The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mRad/hr at 1 cm<sup>2</sup> and 1.0 mRad/hr at 1 cm<sup>2</sup>, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Table 2: STATE OF CA ACCEPT	ABLE SURFACE C	ONTAMINATI(	ON LEVELS 1
Nuclides	Average <sup>b,e,f</sup> (dpm/100cm <sup>2</sup> )	Maximum <sup>6,d.r</sup> (dpm/100cm <sup>2</sup> )	Removable <sup>b</sup> (dpm/100cm <sup>2</sup> )
U-nat, <sup>235</sup> U, <sup>238</sup> U, & associated decay products	5,000	15,000	1,000
Transuranics, <sup>226</sup> Ra, <sup>228</sup> Ra, <sup>230</sup> Th, <sup>228</sup> Th, <sup>231</sup> Pa, <sup>227</sup> Ac, <sup>125</sup> I, <sup>129</sup> I	100	300	20
Th-nat, <sup>232</sup> Th, <sup>90</sup> Sr, <sup>223</sup> Ra, <sup>224</sup> Ra, <sup>232</sup> U, <sup>126</sup> I, <sup>133</sup> I, <sup>131</sup> I	1,000	3,000	200
Beta/gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except <sup>90</sup> Sr and other noted above	5,000	15,000	1,000

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

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

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

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

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

f The average and maximum radiation levels associated with surface contamination resulting from betagamma emitters should not exceed 0.2 mrad/hr at 1 cm<sup>2</sup> and 1.0 mrad/hr at 1 cm<sup>2</sup>, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

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

	Table 3: DTSC Permitted Area (NWPF-1) Final Survey List Of Instruments									
Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description				
Ludlum Model 2221 S/N 84459	Ludlum Model 43-37 434 cm <sup>2</sup> gas flow proportional Alpha detector S/N 086215	Four Linear Ranges 0-500,000 & one Log 50-500,000	08-06-04	22.14%	10-60 cpm on concrete Scan MDA= 109 dpm/100 cm <sup>2</sup>	Active Probe Area = 434 cm <sup>2</sup> . The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick disconnects portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.				
Ludlum Model 2221 S/N 154202	Ludlum Model 43-37 434 cm <sup>2</sup> gas flow proportional Beta detector S/N 149017	Four Linear Ranges 0-500,000 & one Log 50-500,000	08-06-04	30.39%	1300-2000 cpm on concrete Scan MDA= 375 dpm/100 cm <sup>2</sup>	Active Probe Area = $434 \text{ cm}^2$ . The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick disconnects, portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.				
Ludlum Model 2221 S/N 86302	Ludium Model 43-68 100 cm <sup>2</sup> gas flow proportional Beta detector S/N 142547	Four Linear Ranges 0-500,000 & one Log 50-500,000	08-18-04	34.36%	880 ± 104 cp2m MDA = 205 dpm/100 cm²	Active Probe Area = $100 \text{ cm}^2$ . The detector and rate meter are combined on a roll around cart. The instrument features static-flow system, quick disconnects and a portable gas bottle.				
Ludlum Model 3 S/N 153551	Ludlum Model 44-10 Nal (Tl) Scintillator Gamma detector S/N 155109	Five Ranges 0-500 µR/hr	07-30-04 09-27-04	N/A	<u>soil</u> 12-18 μR/hr @ contact 12-17 μR/hr @ 1meter <u>concrete</u> 15-21 μR/hr @ contact 15-21 μR/hr @ 1meter	2 inch x 2 inch NaI (TI) scintillator. Used for measuring external dose rates at the surface and at 1 meter.				
Ludlum Model 3 S/N 151348	Ludlum Model 44-10 Nal (Tl) Scintillator Gamma detector S/N 163169	Five Ranges 0-500 µR/hr	07-30-04 10-06-04	N/A	<u>soil</u> 12-21 μR/hr @ contact 12-19 μR/hr @ Imeter	2 inch x 2 inch NaI (TI) scintillator. Used for measuring external dose rates at the surface and at 1 meter.				
Ludlum Model 12 S/N 138801	Ludlum Model 43-65 Alpha Scintillator ZnS(Ag) Alpha detector S/N 145696	Four Ranges 0-500,000	09-07-04	22.52%	0-20 cpm (all) MDA =209 dpm/100 cm <sup>2</sup>	Active Probe Area = 50 cm <sup>2</sup> . Used for Alpha surveying and fixed measurements.				
Canberra Low Level α/β Counter Model 2404	Gas Flow Proportional Detector	N/A	As needed	~26-30%	Varies with Sample	Canberra Model 2404 Low Level $\alpha/\beta$ gas proportional counting system used to count wipes for removable contamination. Results are usually reported as dpm/100 cm <sup>2</sup>				
Canberra Gamma Spectroscopy System	High Purity Germanium Detector	N/A	As needed	Varies with Sample	Varies with Sample	Gamma Spectroscopy MCA system using a high purity Germanium detector				

Table 4: General Atomics Gamma Spectroscopy Results of Background Surface Soil Samples         September 24, 2002										
Enërgy Peäks	<sup>137</sup> Cs , 661.6 keV	<sup>60</sup> C0 1173 keV	228 Th 238 keV ( <sup>212</sup> Pb)	<sup>228</sup> Ra ( <sup>232</sup> Th) 911 keV ( <sup>228</sup> Åe)	(Total) Th <sup>228</sup> Th + <sup>232</sup> Th	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	235U 44 (186) keV			
Sample ID			Radionuclide Conc	entrations (pCi/g) - Res	ults $\pm 2\sigma$ - 30 Minute C	ounts				
		Sample	es collected June, 2	2000 Re- analyzed No	ovember, 2001					
X-1	ND <sup>1</sup>	ND	$0.49 \pm 0.15$	$1.25 \pm 0.34$	$1.74 \pm 0.48$	ND	ND			
X-2	ND	ND	0.91 ± 0.23	0.91 ± 0.23	1.81 ± 0.46	1.17 ± 1.13	(0.09 ± 0.05)			
X-3	ND	ND	1.40 ± 0.27	1.79 ± 0.37	3.19 ± 0.63	1.51 ± 1.20	(0.09 ± 0.09)			
X-4	$0.08 \pm 0.07$	ND	$1.71 \pm 0.31$	$2.08 \pm 0.47$	3.78 ± 0.78	ND	(0.18 ± 0.13)			
X-5	ND	ND	$1.52 \pm 0.29$	$2.83 \pm 0.70$	4.35 ± 0.99	ND	$(0.20 \pm 0.15)$			
X-6	ND	ND	$1.14 \pm 0.32$	1.12 ± 0.26	$2.25 \pm 0.58$	ND	$(0.09 \pm 0.05)$			
X-7	0.11 ± 0.07	ND	1.68 ± 0.24	2.18 ± 0.47	3.86 ± 0.71	ND	(0.22 ± 0.10)			
X-8	ND	ND	$2.32 \pm 0.38$	2.14 ± 0.54	4.45 ± 0.92	ND	(0.26 ± 0.14)			
X-9	ND	ND	0.61 ± 0.15	$1.59 \pm 0.42$	$2.20 \pm 0.57$	ND	ND			
X-10	0.09 ± 0.06	ND	1.59 ± 0.26	$1.39 \pm 0.36$	$2.98 \pm 0.61$	0.75 ± 1.22	(0.13 ± 0.07)			
	Samples collected and analyzed September, 2002									
X-11	$0.23 \pm 0.07$	ND	1.37 ± 0.29	1.71 ± 0.37	3.07 ± 0.66	1.13 ± 1.30	$(0.25 \pm 0.11)$			
X-12	0.31 ± 0.08	ND	$0.50 \pm 0.08$	0.65 ± 0.18	1.14 ± 0.26	ND	(0.11 ± 0.07)			
X-13	ND	ND	0.95 ± 0.20	1.13 ± 0.23	$2.08 \pm 0.43$	1.29 ± 0.99	$(0.14 \pm 0.05)$			

<sup>&</sup>lt;sup>1</sup> ND = Energy peak not identified

Table 4 (cont	Fable 4 (continued): General Atomics Gamma Spectroscopy Results of Background Surface Soil Samples         September 24; 2002								
. Eñergy Peaks	<sup>137</sup> Cs 661:6 keV	<sup>60</sup> Co 1173 kēV	<sup>228</sup> Th 238 keV 238 keV	<sup>2238</sup> Ra ( <sup>232</sup> Th) 911 keV ( <sup>228</sup> Ac)	(Tota) Th 228 Th + 232 Th	<sup>238</sup> U 63.3 (92.7) keV ( <sup>239</sup> Th)	<sup>235</sup> U 7144 (186) keV		
Sample ID			Radionuclide Conc.	entrations (pCl/g) - Res	ults ± 20=30 Minute C	ounts			
X-14	ND	ND	1.42 ± 0.19	1.59 ± 0.29	3.01 ± 0.48	0.67 ± 0.71	(0.11 ± 0.05)		
X-15	ND	ND	0.37 ± 0.09	0.56 ± 0.16	$0.92 \pm 0.25$	0.50 ± 0.66	$(0.04 \pm 0.04)$		
X-16	0.06 ± 0.03	ND	$0.97 \pm 0.22$	1.15 ± 0.23	$2.12 \pm 0.45$	ND	(0.10 ± 0.05)		
X-17	ND	ND	$0.80 \pm 0.12$	$0.96 \pm 0.40$	1.76 ± 0.52	ND	ND		
X-18	$0.25 \pm 0.07$	ND	0.77 ± 0.21	$0.94 \pm 0.24$	1.71 ± 0.45	$0.92 \pm 0.94$	(0.13 ± 0.08)		
X-19	ND	ND	$0.72 \pm 0.12$	$0.68 \pm 0.23$	1.40 ± 0.35	ND	(0.11 ± 0.07)		
X-20	ND	ND	$1.42 \pm 0.17$	1.40 ± 0.27	$2.82 \pm 0.45$	ND	(0.20 ± 0.09)		
X-21	ND	ND	$1.51 \pm 0.32$	$1.48 \pm 0.30$	2.99 ± 0.62	2.47 ± 1.71	$0.26 \pm 0.23$		
X-22	0.07 ± 0.05	ND	$0.85 \pm 0.12$	$0.98 \pm 0.29$	$1.83 \pm 0.41$	ND	(0.10 ± 0.08)		
X-23	ND	ND	1.17 ± 0.15	1.33 ± 0.28	$2.50 \pm 0.42$	ND	(0.10 ± 0.05)		
X-24	ND	ND	2.03 ± 0.26	1.70 ± 0.33	3.73 ± 0.59	1.75 ± 1.37	(0.17 ± 0.06)		
X-25	ND	ND	1.44 ± 0.29	1.36 ± 0.28	$2.80 \pm 0.57$	1.52 ± 1.26	(0.19 ± 0.08)		
X-26	ND	ND	1.81 ± 0.24	$1.41 \pm 0.31$	$3.22 \pm 0.54$	0.68 ± 0.96	(0.13 ± 0.06)		
X-27	ND	ND	$1.65 \pm 0.20$	$2.00 \pm 0.34$	$3.65 \pm 0.54$	ND	(0.15 ± 0.07)		
X-28	ND	ND	$1.40 \pm 0.20$	$1.47 \pm 0.33$	2.87 ± 0.54	1.35 ± 1.03	(0.28 ± 0.07)		
X-29	0.01 ± 0.07	ND	$0.81 \pm 0.17$	1.61 ± 0.34	2.42 ± 0.51	ND	(0.09 ± 0.06)		
X-30	ND	ND	1.90 ± 0.22	1.88 ± 0.33	3.79 ± 0.55	2.67 ± 1.79	$(0.35 \pm 0.11)$		

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

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#### Sample Locations:

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- X1 Sorrento Valley Road near sample location ST65 on the hillside ~1 mile from Building 37.
- X2 Sorrento Valley Road near Carmel Mountain Road junction on steep cliff.
- X3 Sorrento Valley Road in Los Penasquitos Preserve ~2 miles from Building 37.

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

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

Table 5: Gamma Spectroscopy Results of Sub-Surface Soil Samples from Remediated Areas within the         DTSC Permitted Area (NWPF-1)											
Energy Peaks			<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV ( <sup>212</sup> Pb)	<sup>228</sup> Ra ( <sup>232</sup> Th) 911 keV ( <sup>228</sup> Ac)	<sup>(Total)</sup> Th <sup>228</sup> Th + <sup>232</sup> Th	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U 186 (144) keV		
Sample Location	Sample ID	Depth in inches	Radionuclide Concentrations ( $\rho Ci/g$ ) - Results $\pm 2\sigma$ - 30 Minute Counts - Backgrounds <u>Not</u> Subtracted								
1	96	0-6	0.06 ± 0.05	ND	$1.61 \pm 0.24$	1.74 ± 0.37	3.35 ± 0.61	1.03 ± 1.07	0.17 ± 0.07		
	96A	6-12	0.04 ± 0.05	ND	1.57 ± 0.24	1.78 ± 0.43	3.35 ± 0.67	0.74 ± 1.24	$0.18 \pm 0.10$		
	96B	12-18	ND	ND	1.64 ± 0.28	1.75 ± 0.39	3.39 ± 0.67	ND	ND		
	96C	18-24	0.09 ± 0.04	ND	1.25 ± 0.19	1.27 ± 0.31	2.52 ± 0.50	1.08 ± 1.06	0.11 ± 0.07		
	96D	24-30	ND	ND	$1.18 \pm 0.18$	1.09 ± 0.27	2.27 ± 0.45	ND	0.09 ± 0.04		
	96E	30-36	ND	ND	$1.22 \pm 0.24$	1.95 ± 0.47	3.17 ± 0.71	1.79 ± 1.21	0.21 ± 0.11		
2	97	0-6	ND	ND	1.74 ± 0.27	2.25 ± 0.48	3.99 ± 0.75	ND	0.25 ± 0.09		
	97A	6-12	$0.04 \pm 0.03$	ND	1.57 ± 0.24	1.83 ± 0.35	3.40 ± 0.59	1.29 ± 1.16	0.12 ± 0.07		
	• 97B	12-18	0.05 ± 0.06	ND	1.22 ± 0.24	2.12 ± 0.44	3.34 ± 0.68	ND	0.10 ± 0.08		
	97C	18-24	0.09 ± 0.04	ND	1.29 ± 0.29	$1.58 \pm 0.34$	2.87 ± 0.63	ND	0.11 ± 0.05		
	97D	24-30	ND	ND	1.19 ± 0.18	$1.61 \pm 0.31$	2.80 ± 0.49	ND	0.12 ± 0.06		
	97E	30-36	ND	ND	$1.39 \pm 0.23$	1.82 ± 0.36	3.21 ± 0.59	1.33 ± 1.18	$0.23 \pm 0.08$		
3	98	0-6	ND	ND	1.82 ± 0.33	2.04 ± 0.39	3.86 ± 0.72	0.74 ± 0.98	$0.18 \pm 0.08$		
	98٨	6-12	ND	ND	1.69 ± 0.26	1.99 ± 0.38	3.68 ± 0.64	0.40 ± 0.75	0.18 ± 0.08		

Table 5: Gamma Spectroscopy Results of Sub-Surface Soil Samples from Remediated Areas within the         DTSC Permitted Area (NWPF-1)													
	Energy Pea	ks	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV ( <sup>212</sup> Pb)	<sup>228</sup> Ra ( <sup>232</sup> Th) 911 keV ( <sup>228</sup> Ac)	(Total) Th 228Th + 232Th	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U 186 (144) keV				
Sample Location	Sample ID	Depth in inches	Radio	nuclide Conc	entrations (pCi/g	t) - Results $\pm 2\sigma$	30 Minute Counts - J	Backgrounds <u>Not</u> Si	ubtracted				
4	99	0-6	$0.72 \pm 0.14$	ND	$1.82 \pm 0.27$	1.59 ± 0.36	$3.41 \pm 0.63$	0.64 ± 1.08	$0.19 \pm 0.08$				
	99٨	6-12	$0.20 \pm 0.06$	ND	$1.64 \pm 0.27$	1.43 ± 0.31	3.07 ± 0.58	1.35 ± 1.32	0.15 ± 0.09				
5	100	0-6	ND	ND	2.18 ± 0.37	$2.48 \pm 0.51$	4.66 ± 0.88	ND	$0.15 \pm 0.09$				
	100A	6-12	ND	ND	$1.70 \pm 0.34$	1.73 ± 0.34	3.43 ± 0.68	1.38 ± 2.17	0.19 ± 0.07				
6	101	0-6	0.35 ± 0.09	ND	1.65 ± 0.28	1.79 ± 0.46	$3.44 \pm 0.74$	ND	ND				
	101A	6-12	$0.08 \pm 0.07$	ND	1.13 ± 0.21	1.93 ± 0.40	3.06 ± 0.61	ND	$0.22 \pm 0.11$				
7	102	0-6	ND	ND	0.87 ± 0.21	0.90 ± 0.26	1.77 ± 0.47	$0.32 \pm 0.59$	0.11 ± 0.05				
	102A	6-12	ND	ND	1.26 ± 0.32	$1.49 \pm 0.47$	2.75 ± 0.79	0.54 ± 1.03	0.16 ± 0.09				
	102B	12-18	ND	ND	0.95 ± 0.15	0.97 ± 0.26	$1.92 \pm 0.41$	ND	$0.14 \pm 0.06$				
	102C	18-24	ND	ND	$0.94 \pm 0.16$	1.31 ± 0.34	$2.25 \pm 0.50$	ND	$0.07 \pm 0.06$				
	102D	24-30	ND	ND	1.18 ± 0.18	1.15 ± 0.28	$2.33 \pm 0.46$	2.33 ± 1.52	0.16 ± 0.05				
	102E	30-36	0.10 ± 0.05	ND	1.10 ± 0.17	1.13 ± 0.29	$2.23 \pm 0.46$	ND	0.13 ± 0.06				
8	103	0-6	1.80 ± 0.23	ND	0.89 ± 0.14	0.96 ± 0.26	1.85 ± 0.40	ND	0.10 ± 0.08				
	103A	6-12	0.61 ± 0.13	ND	0.83 ± 0.16	1.56 ± 0.39	2.39 ± 0.55	ND	ND				
	Table 5: Gamma Spectroscopy Results of Sub-Surface Soil Samples from Remediated Areas within the   DTSC Permitted Area (NWPF-1)												
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	Energy Pez	ıks	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV ( <sup>212</sup> Pb)	<sup>228</sup> Ra ( <sup>232</sup> Th) 911 keV ( <sup>228</sup> Ac)	<sup>(Total)</sup> Th <sup>228</sup> Th + <sup>232</sup> Th	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U 186 (144) keV				
Sample Location	Sample ID	Depth in inches	Radio	onuclide Conc	entrations (pCi/g	$r$ ) - Results $\pm 2\sigma$	30 Minute Counts	Backgrounds <u>Not</u> S	ubtracted				
	103B	12-18	0.64 ± 0.12	ND	1.15 ± 0.30	1.53 ± 0.38	$2.68 \pm 0.68$	ND	$0.12 \pm 0.07$				
	103C	18-24	0.10 ± 0.06	ND	1.31 ± 0.31	2.15 ± 0.46	3.46 ± 0.77	2.01 ± 1.57	0.19 ± 0.08				
	103D	24-30	$1.42 \pm 0.21$	ND	1.21 ± 0.33	1.41 ± 0.44	2.62 ± 0.77	1.22 ± 1.09	0.12 ± 0.09				
	103E	30-36	$0.70 \pm 0.11$	ND	1.08 ± 0.17	$1.26 \pm 0.30$	$2.34 \pm 0.47$	0.92 ± 1.01	0.16 ± 0.06				
9	104	0-6	ND	ND	1.36 ± 0.21	1.76 ± 0.35	$3.12 \pm 0.56$	1.90 ± 1.39	0.18 ± 0.07				
	104A	6-12	ND	ND	1.09 ± 0.22	$1.88 \pm 0.41$	2.97 ± 0.63	0.52 ± 1.06	0.15 ± 0.07				
	104B	12-18	ND	ND	1.42 ± 0.29	$1.66 \pm 0.32$	3.08 ± 0.61	1.78 ± 1.47	0.12 ± 0.06				
	104C	18-24	ND	ND	$1.49 \pm 0.31$	1.75 ± 0.34	3.24 ± 0.65	1.87 ± 1.54	$0.12 \pm 0.07$				
	104D	24-30	ND	ND	1.47 ± 0.22	$1.66 \pm 0.32$	3.13 ± 0.54	0.70 ± 0.70	0.19 ± 0.08				
	104E	30-36	ND	ND	1.65 ± 0.35	1.78 ± 0.35	3.43 ± 0.70	1.99 ± 1.44	0.18 ± 0.06				
10	105	0-6	ND	ND	0.79 ± 0.15	$1.41 \pm 0.34$	2.20 ± 0.49	ND	ND				
	105A	6-12	ND	ND	$1.40 \pm 0.34$	$2.04 \pm 0.46$	$3.44 \pm 0.80$	ND	0.19 ± 0.11				
	105B	12-18	ND	ND	1.35 ± 0.32	1.79 ± 0.39	3.14 ± 0.71	ND	0.15 ± 0.10				
	105C	18-24	ND	ND	1.38 ± 0.30	1.56 ± 0.33	2.94 ± 0.63	ND	0.13 ± 0.05				

	Table 5: Gamma Spectroscopy Results of Sub-Surface Soil Samples from Remediated Areas within theDTSC Permitted Area (NWPF-1)											
Energy Peaks 137Cs 60Co 228Th 228Ra (232 (Total) Th 238U 238U 235U    661.6 keV 1173 238 keV Th) 128Th + 232Th 63.3 (92.7) 186 (144) ke    keV (212 Pb) 911 keV (228 Ac) (234 Th) 186 (144) ke												
Sample Location	Sample ID	Depth in inches	Radio	nuclide Conc	entrations (pCi/g	) - Results $\pm 2\sigma$	30 Minute Counts - E	Backgrounds <u>Not</u> S	ubtracted			
	105D	24-30	ND	ND	1.41 ± 0.22	1.91 ± 0.42	$3.32 \pm 0.64$	1.28 ± 1.17	$0.14 \pm 0.10$			
	105E	30-36	ND	ND	$1.33 \pm 0.20$	$1.49 \pm 0.34$	2.82 ± 0.54	1.74 ± 1.43	0.17 ± 0.08			

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Notes: 1. ND means not detected.

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2. Average Minimum Detectable Activities (MDAs):

Cs-137= 0.13 pCi/g (662 keV peak) Co-60 = 0.16 pCi/g (1173 keV peak)

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

Th-232 = 0.43 pCi/g (911 keV peak) U-235 = 0.14 pCi/g (186 keV peak) U-238 = 1.58 pCi/g (63 keV peak)

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### 3. Sample Numbers:

DTSC-# = Surface (0-6") soil samples DTSC-#A = Sub Surface (6-12") soil samples DTSC-#B = Sub Surface (12"-18") soil samples DTSC-#C = Sub Surface (18"-24") soil samples DTSC-#D = Sub Surface (24"-30") soil samples DTSC-#E = Sub Surface (30"-36") soil samples.

Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site											
С. С. Д. Д.	Energy Peaks -	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	228Th 238 keV 212Ph	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>228</sup> Ac	7 Th (228 <sup>Th</sup> + <sup>232</sup> Th)	<sup>238</sup> U - 63.3 (92.7) - keV ( <sup>234</sup> Th)	235U 	Comments	Exposure Rate @ 1m (µR/hr)	
	Sample ID			Radii 30 Minute C	onuclide Conce Sounts (except a	ntrations (pCi is noted) - Bac	/g) - Results ± 2c kgrounds <u>Not</u> Su	7 btracted		location	
1	DTSC-1	$0.50 \pm 0.15$	ND	$3.13 \pm 0.55$	$3.71 \pm 0.84$	$6.84 \pm 1.39$	ND	ND		16	
2	DTSC-2	ND	ND	$2.09 \pm 0.37$	$2.05 \pm 0.40$	$4.14 \pm 0.77$	$3.45 \pm 2.07$	$0.29 \pm 0.11$		21	
3	DTSC-3	ND	ND	$2.02 \pm 0.35$	$1.73 \pm 0.40$	$3.75 \pm 0.75$	$4.04 \pm 2.48$	$0.15 \pm 0.08$		22	
4	DTSC-4	ND	ND	$2.25 \pm 0.40$	$2.35 \pm 0.56$	$4.60 \pm 0.96$	ND	$0.22 \pm 0.10$		22	
5	DTSC-5	ND	ND	1.97 ± 0.34	$2.19 \pm 0.46$	$4.16 \pm 0.80$	$2.83 \pm 1.74$	$0.18 \pm 0.11$		22	
6	DTSC-6	ND	ND	1.70 ± 0.26	$2.13 \pm 0.44$	3.83 ± 0.70	ND	$0.19 \pm 0.10$		22	
7	DTSC-7	ND	ND	$1.87 \pm 0.33$	1.97 ± 0.58	3.84 ± 0.91	ND	$0.13 \pm 0.12$		22	
8	DTSC-8	ND	ND	1.89 ± 0.29	$2.50 \pm 0.45$	4.39 ± 0.74	ND	0.15 ± 0.07		22	
9	DTSC-9	ND	ND	$1.64 \pm 0.31$	1.71 ± 0.38	3.35 ± 0.69	1.85 ± 1.32	0.21 ± 0.09		22	
10	DTSC-10	ND	ND	$2.33 \pm 0.41$	$2.46 \pm 0.55$	4.79 ± 0.96	ND	ND		22	
11	DTSC-11	ND	ND	1.94 ± 0.41	$2.28 \pm 0.50$	4.22 ± 0.91	ND	$0.19 \pm 0.08$		20	
12	DTSC-12	ND	ND	2.28 ± 0.39	1.70 ± 0.42	3.98 ± 0.81	4.88 ± 2.97	$0.23 \pm 0.09$		21	
13	DTSC-13	ND	ND	2.28 ± 0.39	$2.32 \pm 0.56$	$4.60 \pm 0.95$	ND	0.29 ± 0.12		21	
14	DTSC-14	0.07±0.03	ND	-1.66±0.24	2.13±0.33	3.79 ± 0.57	1:65 ± 1.05	(0.86 ± 0.29)	Areas remediated. DTSC-68 and DTSC-	22.	
15	DTSC-14A	0.03±0.05	ND	1.73±0.30	1.73 ± 0.34	·3.46 ± 0.64.	-11.40 ± 6.26	$0.30 \pm 0.15$	69 are final soil.		

	Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site											
#	Energy Peaks →	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	228Th 238 keV 212Pb	228Ra(212Th) 911.keV -228Ac	Th (228 <sup>17</sup> + <sup>232</sup> Th)	<sup>238</sup> Ú 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)		
	Sample ID			Radi 30 Minute C	onuclide Conce Sounts (except a	ntrations (pCl is noted) - Bac	/g) - Results ± 2c kgrounds <u>Not</u> Su	t btracted		at soil sample.		
16	DTSC - 15	ND	ND	1.76 ± 0.31	1.57 ± 0.37	$3.33 \pm 0.68$	$0.75 \pm 0.52$	$0.15 \pm 0.09$		19		
17	DTSC - 16	ND	ND	1.39 ± 0.28	1.71 ± 0.44	3.10 ± 0.72	ND	ND		18		
18	DTSC - 17	ND	ND	$1.19 \pm 0.20$	1.29 ± 0.35	$2.48 \pm 0.55$	ND	ND		19		
19	DTSC - 18	ND	ND	$1.50 \pm 0.24$	$1.81 \pm 0.40$	$3.31 \pm 0.64$	ND	$0.08 \pm 0.11$		20		
20	DTSC - 19	ND	ND	$1.56 \pm 0.28$	$1.42 \pm 0.34$	$2.98 \pm 0.62$	3.49 ± 2.10	0.06 ± 0.10		19		
21	DTSC - 20	ND	ND	$2.08 \pm 0.37$	1.89 ± 0.43	3.97 ± 0.80	$3.32 \pm 1.84$	$0.20 \pm 0.11$		19		
22	DTSC - 21	ND	ND	$1.58 \pm 0.29$	1.39 ± 0.34	$2.97 \pm 0.63$	ND	$0.09 \pm 0.10$		19		
, 23	DTSC-22	0.17 ± 0.06	ND	-11:56±0.25	1:92 ± 0.44	3.48±0.69	ND	0:13 ± 0.08	Area remediated. Final soil samples are	19		
:24	DTSC - 23.	0.23 ± 0.08	ND :	1.69 ± 0.31	1.47,±0.35	3.16 ± 0.66	1.91 ± 1.06	0.14 ± 0.07	DTSC-68 and DTSC-69	-19		
25	DTSC - 24	$0.12 \pm 0.07$	ND	1.90 ± 0.33	1.75 ± 0.35	$3.65 \pm 0.68$	3.89 ± 2.15	(0.31 ± 0.07)		19		
26	DTSC - 25	ND	ND	$1.75 \pm 0.32$	1.84 ± 0.43	3.59 ± 0.75	$1.32 \pm 0.98$	0.26 ± 0.09		19		
27	DTSC-26	0.22 ± 0.10;	ND	1:50 ± 0.24	.2.011±0.47.	351±0.71	71.63±1.33	(0.46±0.39)	Area remediated. Final soil samples are	19		
28	<b>DTSC - 27</b>	$0.41 \pm 0.10$	ND	1:36 ± 0.34	1.77.±0.44	3.13±0.78	0.76±0.97	-0.17±0.11	DTSC-68 and DTSC-69	18		
29	DTSC - 28	ND	ND	0.96 ± 0.16	$1.19 \pm 0.38$	$2.15 \pm 0.54$	2.23 ± 1.56	$0.22 \pm 0.09$		18		

	Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site											
₩. 	Energy Peaks →	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 këV.	228Th 238 keV 212Pb	228Ra(232Th); 911 keV 228Ac	Th (228 <sup>m</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>233</sup> U (144) 186. keV	Comments	Exposure Rate @ 1m (µR/hr)		
	Sample ID			Radi 30 Minute C	onuclide Conce ounts (except a	ntrations (pCi s noted) - Baci	(g) - Řesülts ± 20 kgrounds <u>Not</u> Su	t btracted		location		
30	DTSC - 29	ND	ND	1.63 ± 0.29	1.69 ± 0.43	3.32 ± 0.72	3.73 ± 2.49	$0.28 \pm 0.11$		18		
31	DTSC - 30	$0.06 \pm 0.04$	ND	1.23 ± 0.26	$1.49 \pm 0.33$	2.72 ± 0.59	ND	(0.30 ± 0.33)		19		
32	DTSC - 31	ND	ND	1.18 ± 0.27	1.39 ± 0.34	2.57 ± 0.61	ND	0.10 ± 0.05		19		
33	DTSC - 32	ND	ND	1.28 ± 0.31	1.49 ± 0.38	2.77 ± 0.69	ND	0.12 ± 0.08		18		
34	DTSC - 33	ND	ND	0.78 ± 0.17	1.22 ± 0.32	$2.00 \pm 0.49$	ND	ND		17		
35	DTSC - 34	ND	ND	1.23 ± 0.30	1.72 ± 0.43	$2.95 \pm 0.73$	ND	$0.18 \pm 0.10$		19		
36	DTSC - 35	0.09 ± 0.06	ND	1.24 ± 0.20	1.57 ± 0.40	2.81 ± 0.60	ND	ND		18		
37	DTSC - 36	ND	ND	1.15 ± 0.20	1.07 ± 0.30	2.22 ± 0.59	ND	$0.11 \pm 0.07$		18		
38	DTSC - 37	ND	ND	1.64 ± 0.30	$2.11 \pm 0.48$	3.75 ± 0.78	ND	ND		18		
39	DTSC - 38	ND	ND	0.77 ± 0.16	$1.48 \pm 0.40$	$2.25 \pm 0.56$	ND	0.07 ± 0.08		17		
40	DTSC - 39	ND	ND	$1.09 \pm 0.17$	1.07 ± 0.30	2.16 ± 0.47	ND	ND		18		
41	DTSC - 40	ND	ND	1.00 ± 0.30	$1.40 \pm 0.36$	2.40 ± 0.66	ND	$0.08 \pm 0.08$		18		
42	DTSC - 41	ND	ND	0.98 ± 0.25	1.29 ± 0.31	2.27 ± 0.56	ND	0.06 ± 0.08		18		
43	DTSC - 42	$0.02 \pm 0.05$	ND	$1.86 \pm 0.34$	$2.27 \pm 0.60$	4.13 ± 0.94	ND	$0.17 \pm 0.12$		17		
44	DTSC - 43	ND	ND	$1.62 \pm 0.27$	$2.02 \pm 0.49$	$3.64 \pm 0.76$	ND	ND		18		

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	Table	6: Gamma	Spectrosc	opy Results	of Soil Sam	ples Collec	ted from the	DTSC Pern	nitted (NWPF-1) Si	te
та С. С. С	Energy Peaks →	<sup>137</sup> Cs 661.6 keV	160Co 1173 keV	228Th 238 keV 212Pb	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>228</sup> Ac	Th (228 <sup>m</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments .	Exposure Rate @ 1m (µR/hr)
	Sample ID i			Radi 30 Minute C	onuclide Conce Counts (except a	ntrations (pCL is noted) - Bac	/g) - Results ± 2c kgrounds <u>Not</u> Su	T btracted		at soil sample location
45	DTSC - 44	ND	ND	1.87 ± 0.30	1.78 ± 0.37	$3.65 \pm 0.67$	1.69 ± 1.48	$0.17 \pm 0.07$		18
46	DTSC - 45	ND	ND	$2.04 \pm 0.37$	$2.00 \pm 0.47$	$4.04 \pm 0.84$	ND	0.13 ± 0.09		18
47	DTSC - 46	ND	ND	$1.83 \pm 0.30$	$2.03 \pm 0.43$	3.86 ± 0.73	ND	$0.18 \pm 0.08$		18
48	DTSC - 47	ND	ND	$1.84 \pm 0.35$	$1.77 \pm 0.47$	3.61 ± 0.82	ND	ND		18
49	DTSC - 48	ND	ND	$1.43 \pm 0.31$	$1.70 \pm 0.37$	$3.13 \pm 0.68$	ND	$0.14 \pm 0.07$		18
50	DTSC - 49	ND	ND	$1.00 \pm 0.28$	$1.34 \pm 0.35$	2.34 ± 0.63	ND	ND		18
51	DTSC - 50	ND	ND	0.97 ± 0.20	$1.34 \pm 0.34$	$2.31 \pm 0.20$	ND	ND		17
52	DTSC - 51	ND	ND	$1.19 \pm 0.30$	$1.32 \pm 0.34$	$2.51 \pm 0.64$	ND	ND		18
53	DTSC - 52	ND	ND	$2.11 \pm 0.34$	1.81 ± 0.38	3.92 ± 0.72	ND	0.09 ± 0.05		18
54	DTSC - 53	ND	ND	1.47 ± 0.32	2.75 ± 0.66	4.22 ± 0.98	1.91 ± 1.87	$0.09 \pm 0.11$		18
55	DTSC - 54	ND	ND	1.77 ± 0.27	1.75 ± 0.36	$3.52 \pm 0.63$	ND	0.13 ± 0.06		18
56	DTSC - 55	ND	ND	$1.20 \pm 0.24$	$2.19 \pm 0.50$	3.39 ± 0.74	ND	$0.16 \pm 0.10$		18
57	DTSC - 56	ND	ND	1.67 ± 0.34	1.30 ± 0.33	2.97 ± 0.67	ND	0.16 ± 0.07		18
58	DTSC - 57	ND	ND	2.19 ± 0.39	1.82 ± 0.50	4.01 ± 0.89	ND	0.19 ± 0.09		18
59	DTSC - 58	ND	ND	$1.43 \pm 0.30$	$1.22 \pm 0.32$	2.65 ± 0.62	ND	ND		18

34. 1997 -	Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site											
	•Energy Peaks. →	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV <sup>212</sup> Pb	228Rå(232Th) 911 keV 228Ac	Th (228 <sup>75</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)		
	Sample ID			Radi 30 Minute C	onuclide Conce Counts (except d	ntrations (pCi s noted) - Baci	(g) - Rèsulis ± 2 c kgróunds <u>Not</u> Su	btracted		at soil sample- location		
60	DTSC - 59	ND	ND	0.99 ± 0.22	$1.72 \pm 0.37$	2.71 ± 0.59	ND	0.11 ± 0.06		18		
61	DTSC - 60	ND	ND	1.39 ± 0.33	$1.53 \pm 0.35$	$2.92 \pm 0.68$	ND	0.11 ± 0.05		18		
62	DTSC - 61	ND	ND	$1.51 \pm 0.24$	$1.52 \pm 0.34$	$3.03 \pm 0.58$	ND	0.16 ± 0.08		19		
63	DTSC - 62	ND	ND	$1.45 \pm 0.31$	1.62 ± 0.44	3.07 ± 0.75	ND	0.15 ± 0.07		19		
64	DTSC - 63	ND	ND	$0.94 \pm 0.33$	1.26 ± 0.32	2.20 ± 0.65	ND	ND		18		
65	DTSC - 64	ND	ND	0.92 ± 0.32	$1.23 \pm 0.31$	$2.15 \pm 0.32$	ND	ND		18		
66	DTSC - 65	ND	ND	1.27 ± 0.20	$1.54 \pm 0.33$	2.81 ± 0.53	0.13 ± 0.91	0.13 ± 0.07		18		
67	DTSC - 66	ND	ND	1.62 ± 0.29	1.91 ± 0.41	$3.53 \pm 0.70$	ND	0.10 ± 0.05		18		
68	DTSC - 67	ND	ND	1.21 ± 0.22	$2.00 \pm 0.49$	3.21 ± 0.71	1.05 ± 1.39	0.14 ± 0.09		18		
69	DTSC - 68	ND	ND	0.99 ± 0.22	1.72 ± 0.37	2.71 ± 0.59	ND	0.11 ± 0.06	Post remediation for area around DTSC-14	18		
70	DTSC - 69	ND	ND	1.34 ± 0.35	1.36 ± 0.36	2.70 ± 0.71	ND	0.18 ± 0.06	Post remediation for area around DTSC-14	19		
71	DTSC - 70	ND	ND	1.41 ± 0.27	1.55 ± 0.37	$2.96 \pm 0.64$	2.17 ± 1.58	0.27 ± 0.10		17		
72	DTSC - 71	ND_	ND	$1.28 \pm 0.21$	$1.32 \pm 0.31$	$2.60\pm0.52$	1.30 ± 1.19	$0.27 \pm 0.08$		17		
73	DTSC - 72	$0.10 \pm 0.04$	ND	0.83 ± 0.13	$0.83 \pm 0.22$	$1.66 \pm 0.35$	ND	$0.13 \pm 0.06$		14		

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Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site											
1.5.5.5. 1.5.5.5.5. 1.5.5.5.5.5.5.5.5.5.	Energy Peaks →	<sup>137</sup> Cs 661.6 keV	6°Co 1173 keV	<sup>228</sup> Th 238 keV <sup>212</sup> Pb	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>228</sup> Ac	Th (228 <sup>th</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th).	235U (144) 186 	Comments	Exposure Rate @ 1m (µR/hr)	
	Sample ID			Radi 30 Minute C	onuclide Conce ounts (except a	ntrations (pCl s noted) - Bac	(g) - Résults ± 2c kgróunds <u>Not</u> Su	t btracted		at soil sample location	
74	DTSC - 73	0.30 ± 0.08	ND	0.59 ± 0.23	1.14 ± 0.29	1.73 ± 0.52	ND	ND		17	
75	DTSC - 74	0.05 ± 0.03	ND	$1.52 \pm 0.30$	$1.44 \pm 0.33$	2.96 ± 0.63	1.19 ± 1.15	0.18 ± 0.07		17	
76	DTSC - 75	ND	ND	$0.55 \pm 0.20$	ND	$0.55 \pm 0.20$	ND	$0.08 \pm 0.06$		15	
77	DTSC - 76	ND	ND	0.91 ± 0.19	0.87 ± 0.21	1.78 ± 0.40	0.57 ± 0.57	0.11 ± 0.05		17	
78	DTSC - 77	ND	ND	$0.49 \pm 0.17$	1.22 ± 0.33	1.71 ± 0.50	ND	0.06 ± 0.05		14	
79	DTSC - 78	ND	ND	$1.16 \pm 0.25$	1.10 ± 0.27	$2.26 \pm 0.52$	0.72 ± 0.72	0.14 ± 0.06		18	
80	DTSC - 79	ND	ND	0.83 ± 0.32	$1.22 \pm 0.34$	2.05 ± 0.66	ND	0.08 ± 0.05		18	
81	DTSC - 80	$0.05 \pm 0.04$	ND	0.88 ± 0.15	1.05 ± 0.27	1.93 ± 0.42	1.19 ± 0.74	0.13 ± 0.07		16	
82	DTSC - 81	ND	ND	0.71 ± 0.25	1.22 ± 0.29	$1.93 \pm 0.54$	ND	$0.02 \pm 0.03$		19	
83	DTSC-82	1.39 ± 0.19	ND	1.68 ± 0.26	1.87 ± 0.35	3.55 ± 0.61	ND	0.28 ± 0.09		19	
84	DTSC-83	0.07 ± 0.06	ND	$0.43 \pm 0.17$	$1.10 \pm 0.31$	$1.53 \pm 0.48$	ND	ND		17	
85	DTSC-84	ND	ND	$1.26 \pm 0.24$	1.23 ± 0.28	2.49 ± 0.52	1.46 ± 1.18	0.19 ± 0.06		19	
86	DTSC-85	ND	ND	$1.26 \pm 0.28$	$1.75 \pm 0.38$	3.01 ± 0.66	1.42 ± 1.24	0.25 ± 0.09		18	
87	DTSC-86	ND	ND	1.32 ± 0.21	$1.92 \pm 0.39$	$3.24 \pm 0.60$	ND	$0.29 \pm 0.10$		12	
88	DTSC-86A	ND	ND	$1.34 \pm 0.21$	$1.59 \pm 0.33$	$2.93\pm0.54$	2.12 ± 1.47	0.28 ± 0.08		12	

	Tablê	6: Gamma	Spectrosc	opy Results (	of Soil Sam	ples Collect	ted from the	DTSC Pern	iitted (NWPF-1) Si	tē
	Energy Peaks -	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV <sup>212</sup> Pb	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>218</sup> Ac	-Th (228 <sup>15</sup> + <sup>232</sup> Th)	<sup>238</sup> Ú 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV.	Comments	Exposure Rate @ 1m (µR/hr)
	Sample ID			Radio 30 Minute C	onuclide Conce ounts (except a	ntrations (pCi s noted) - Bac	(g) - Results ± 2 c kgrounds <u>Not</u> Su	t btracted		location
89	DTSC-86B	ND	ND	$1.84 \pm 0.34$	1.65 ± 0.39	3.49 ± 0.73	1.00 ± 1.23	$0.18 \pm 0.11$		12
90	DTSC-8C	ND	ND	$1.43 \pm 0.31$	$1.52 \pm 0.34$	$2.95 \pm 0.65$	ND	$0.12 \pm 0.06$		12
91	DTSC-86D	ND	ND	1.61 ± 0.29	1.76 ± 0.39	3.37 ± 0.68	ND	0.16 ± 0.09		12
92	DTSC-86E	ND	ND	1.50 ± 0.32	1.70 ± 0.34	$3.20 \pm 0.66$	ND	$0.13 \pm 0.07$		12
93	DTSC-87	ND	ND	1.28 ± 0.32	1.53 ± 0.34	2.81 ± 0.66	ND	$0.20 \pm 0.08$		19
94	DTSC-88	ND	ND	1.50 ± 0.27	1.84 ± 0.45	3.34 ± 0.72	ND	0.11 ± 0.07		18
95	DTSC-89	$0.32 \pm 0.08$	ND	1.24 ± 0.20	$1.39 \pm 0.31$	2.63 ± 0.51	1.43 ± 1.04	$0.14 \pm 0.06$		18
96	DTSC-90	$0.20 \pm 0.11$	ND	1.27 ± 0.27	1.93 ± 0.59	3.20 ± 0.86	ND	$0.10 \pm 0.11$		18
97	DTSC-90A	ND	ND	1.28 ± 0.26	$1.08 \pm 0.30$	2.36 ± 0.56	ND	$0.13 \pm 0.06$		18
98	DTSC-90B	ND	ND	$1.53 \pm 0.34$	$2.03 \pm 0.47$	3.56 ± 0.81	1.52 ± 1.39	$0.14 \pm 0.10$		18
99	DTSC-90C	ND	ND	1.50 ± 0.32	1.73 ± 0.39	$3.23 \pm 0.71$	1.59 ± 1.27	$0.14 \pm 0.08$		18
100	DTSC-90D	ND	ND	1.70 ± 0.27	$2.18 \pm 0.43$	3.88 ± 0.70	ND	0.19 ± 0.08		18
101	DTSC-90E	ND	ND	$1.61 \pm 0.34$	1.82 ± 0.47	3.43 ± 0.81	1.00 ± 0.90	0.17 ± 0.09		18
102	DTSC-91	$0.61 \pm 0.11$	ND	$1.40 \pm 2.82$	$1.44 \pm 0.33$	$2.84 \pm 3.16$	1.32 ± 1.10	0.20 ± 0.09		18
103	DTSC-92	ND	ND	1.12±0.18	$1.40 \pm 0.36$	$2.52 \pm 0.54$	1.42 ± 1.24	0.14 ± 0.05		20

Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site											
300 30 40 40 40 40 40 40 40 40 40 40 40 40 40	Energy Peaks →	<sup>ij7</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV <sup>212</sup> Pb	228Ra(232Th) 911 keV 228Ac	Th (228 <sup>m</sup> + <sup>232</sup> Th)	<sup>239</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)	
	Sâmple ID			Radii 30 Minute C	onuclide Conce ounts (except a	ntrations (pCi s noted) - Bac	/g) <sup>1</sup> - Results ± 20 kgrounds <u>Not</u> Su	T biracted		at soil sample location	
104	DTSC-93	ND	ND	1.36 ± 0.32	1.82 ± 0.42	$3.18 \pm 0.74$	ND	$0.13 \pm 0.09$		20	
105	DTSC-94	0.07 ± 0.03	ND	$1.52 \pm 0.24$	1.58 ± 0.33	3.10 ± 0.57	ND	$0.23 \pm 0.06$		19	
106	DTSC-95	$0.23 \pm 0.08$	ND	$1.51 \pm 0.24$	$1.89 \pm 0.42$	$3.40 \pm 0.66$	ND	$0.27 \pm 0.10$		19	
107	DTSC-96	1.36 ± 0.20	ND	1.51 ± 0.30	1.37 ± 0.31	$2.88 \pm 0.61$	0.94 ± 1.10	$0.25 \pm 0.09$		19	
108	DTSC-97	ND	ND	0.64 ± 0.16	$1.23 \pm 0.35$	1.87 ± 0.51	ND	$0.05 \pm 0.08$		19	
109	DTSC-98	0.10 ± 0.05	ND	$1.29 \pm 0.24$	$1.56 \pm 0.34$	$2.85 \pm 0.58$	$0.60 \pm 0.91$	0.17 ± 0.06		19	
110	DTSC 99	ND	ND	1.54 ± 0.27	1.51 ± 0.39	3.05 ± 0.66	ND	0.11 ± 0.06		18	
111	DTSC 100	0.10 ± 0.06	ND	1.51 ± 0.36	$1.70 \pm 0.35$	3.21 ± 0.71	2.18 ± 1.62	0.14 ± 0.07		19	
112	DTSC-101	$1.77 \pm 0.24$	ND	3.18 ± 0.49	$2.70 \pm 0.50$	5.88 ± 0.99	ND	0.23 ± 0.09		20	
113	DTSC-102	ND	ND	1.66 ± 0.27	$1.48 \pm 0.34$	3.14 ± 0.61	ND	$0.18 \pm 0.08$		18	
114	DTSC103	ND	ND	$1.34 \pm 0.30$	$1.50 \pm 0.35$	2.84 ± 0.65	1.94 ± 1.45	ND		18	
115	DTSC-104	ND	ND	1.71 ± 0.28	$1.49 \pm 0.34$	$3.20 \pm 0.62$	ND	ND		18	
116	DTSC-105	ND	ND	1.53 ± 0.29	$1.78 \pm 0.42$	3.31 ± 0.29	ND	ND		19	
117	DTSC-106	ND	ND	1.28 ± 0.23	1.19 ± 0.31	$2.47 \pm 0.54$	ND	ND		19	
118	DTSC-107	ND	ND	1.67 ± 0.31	1.60 ± 0.40	$3.27 \pm 0.71$	ND	0.14 ± 0.10		20	

	Table	6: Gamma	Spectrosco	opy Results	of Soil Sâmj	ples Collec	ted from the	DTSC Pern	nitted (NWPF-1) Si	te
1000 A	Energy Peaks	<sup>137</sup> Čs , 661.6 keV	<sup>60</sup> Cō 1173 keV	228Th 238 keV 212Pb	228Ra(232Th) 911 keV 228Ac	Th (228 <sup>m</sup> + <sup>232</sup> Th)	63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)
	Sample ID			Radio 30 Minute C	onuclide Conce ounts (except a	ntrations (pCL s noted) - Bac	(g) - Results ± 2 c kgrounds <u>Not</u> Su	T biracted		location
119	DTSC-108	$0.03 \pm 0.02$	ND	1.37 ± 0.20	$1.65 \pm 0.22$	$3.02 \pm 0.42$	$0.92 \pm 0.52$	$0.17 \pm 0.03$		20
120	DTSC-109	ND	ND	$1.42 \pm 0.32$	2.00 ± 0.46	$3.42 \pm 0.78$	ND	ND		20
121	DTSC-110	ND	ND	1.82 ± 0.32	$2.20 \pm 0.47$	$4.02 \pm 0.79$	ND	0.07 ± 0.08		19
122	DTSC-111	ND	ND	$1.24 \pm 0.24$	1.31 ± 0.37	2.55 ± 0.61	ND	$0.16 \pm 0.12$		19
123	DTSC-112	ND	ND	1.51 ± 0.27	$1.40 \pm 0.36$	2.91 ± 0.63	ND	0.19 ± 0.09		20
124	DTSC-113	ND	ND	1.39 ± 0.22	1.65 ± 0.39	$3.04 \pm 0.61$	ND	ND		19
125	DTSC-114	ND	ND	$1.74 \pm 0.31$	1.98 ± 0.49	3.72 ± 0.80	ND	ND		19
126	DTSC-115	ND	ND	0.61 ± 0.22	$1.00 \pm 0.24$	1.61 ± 0.46	ND	ND		19
127	DTSC-116	$0.01 \pm 0.04$	ND	0.81 ± 0.27	1.11 ± 0.27	$1.92 \pm 0.54$	ND	ND		19
128	DTSC-117	ND	ND	$0.42 \pm 0.14$	$0.61 \pm 0.15$	1.03 ± 0.29	ND	0.06 ± 0.03		19
129	DTSC-118	ND	ND	1.15 ± 0.32	1.29 ± 0.31	$2.44 \pm 0.63$	1.11 ± 1.09	$0.13 \pm 0.07$		18
130	DTSC-119	ND	ND	$0.93 \pm 0.15$	1.08 ± 0.27	2.01 ± 0.42	ND	0.16 ± 0.08		18
131	DTSC-120	ND	ND	$0.64 \pm 0.23$	1.07 ± 0.22	1.71 ± 0.45	ND	0.06 ± 0.03		19
132	DTSC-121	ND	ND	1.42 ± 0.22	$1.41 \pm 0.31$	$2.83 \pm 0.53$	$1.66 \pm 1.31$	0.17 ± 0.06		20
133	DTSC-122	$0.05 \pm 0.04$	ND	$1.48 \pm 0.24$	1.56 ± 0.33	3.04 ± 0.57	1.14 ± 1.10	0.23 ± 0.10		18

Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site											
1000 1000 1000 1000 1000 1000 1000 100	Energy Peaks →	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	228 238 keV 212 pb	- <sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>228</sup> Ac	Th. (228 <sup>th</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>24</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)	
	Sample ID			Radia 30 Minute C	onuclide Conce ounts (except a	ntrations (pCl s noted) - Baci	(g) - Results ± 20 kgrounds <u>Not</u> Su	btracted		location	
134	DTSC-122A	ND	ND	0.83 ± 0.28	0.96 ± 0.28	1.79 ± 0.56	ND	$0.07 \pm 0.04$		18	
135	DTSC-122B	ND	ND	1.16 ± 0.21	1.62 ± 0.38	2.78 ± 0.59	0.79 ± 1.07	0.16 ± 0.07		18	
136	DTSC-122C	0.01 ± 0.04	ND	1.38 ± 0.29	1.62 ± 0.35	$3.00 \pm 0.64$	1.94 ± 1.61	$0.15 \pm 0.08$		18	
137	DTSC-122D	ND	ND	$1.84 \pm 0.31$	$1.62 \pm 0.38$	3.46 ± 0.69	ND	$0.22 \pm 0.07$		18	
138	DTSC-122E	ND	ND	$1.78 \pm 0.30$	$1.48 \pm 0.36$	$3.26 \pm 0.66$	ND	$0.25 \pm 0.09$		18	
139	DTSC-123	ND	ND	1.03 ± 0.16	$1.14 \pm 0.28$	$2.17 \pm 0.44$	ND	$0.05 \pm 0.05$		19	
140	DTSC-124	0.06 ± 0.05	ND	0.71 ± 0.15	1.05 ± 0.29	$1.76 \pm 0.44$	ND	$0.08 \pm 0.07$		17	
141	DTSC-125	$0.82 \pm 0.13$	ND	1.13 ± 0.21	0.98 ± 0.23	2.11 ± 0.44	ND	0.09 ± 0.06		18	
142	DTSC-126	$0.33 \pm 0.07$	ND	1.30 ± 0.26	$1.42 \pm 0.30$	$2.72 \pm 0.56$	2.38 ± 1.55	0.27 ± 0.09		21	
143	DTSC-127	ND	ND	1.49 ± 0.29	$1.64 \pm 0.35$	$3.13 \pm 0.64$	2.08 ± 1.61	0.25 ± 0.09		21	
144	DTSC-128	ND	ND	1.37 ± 0.27	1.48 ± 0.33	2.85 ± 0.60	ND	0.22 ± 0.09		18	
145	DTSC-129	$0.49 \pm 0.09$	ND	1.45 ± 0.60	$1.43 \pm 0.32$	$2.88 \pm 0.92$	1.18 ± 1.45	0.18 ± 0.08		19	
146	DTSC-130	0.05 ± 0.05	ND	$1.02 \pm 0.24$	1.10 ± 0.26	$2.12 \pm 0.50$	ND	(0.06 ± 0.27)		18	
147	DTSC-131	0.11 ± 0.05	ND	1.34 ± 0.21	1.30 ± 0.27	$2.64 \pm 0.48$	1.37 ± 1.22	0.16 ± 0.07		19	
148	DTSC-132	0.58 ± 0.11	ND	1.30 ± 0.27	$1.40 \pm 0.32$	2.70 ± 0.59	ND	0.16 ± 0.08		18	

Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site									te	
· · · · · · · · · · · · · · · · · · ·	Energy Peaks →	<sup>137</sup> Cś 661.6 keV	<sup>60</sup> Co 1173 keV-	238 keV 212Pb	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>228</sup> Ac	Th (228 <sup>m</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)
	Sample ID			Radi 30 Minute C	onuclide Conce ounts (except a	ntratiòns (pCi s noted) - Baci	(g) - Results ± 20 kgrounds <u>Not</u> Su	t biracted		at soil sample location
149	DTSC-133	0.07 ± 0.04	ND	0.83 ± 0.18	$0.83 \pm 0.24$	1.66 ± 0.42	ND	ND		16
150	DTSC-133A	0.11 ± 0.05	ND	0.83 ± 0.21	1.12 ± 0.29	1.95 ± 0.21	ND	ND		16
151	DTSC-133B	ND	ND	0.77 ± 0.13	0.77 ± 0.24	1.54 ± 0.37	ND	0.15 ± 0.07		16
152	DTSC-133C	$0.03 \pm 0.04$	ND	1.13 ± 0.20	0.99 ± 0.27	2.12 ± 0.47	ND	0.15 ± 0.07		16
153	DTSC-133D	0.07 ± 0.05	ND	0.92 ± 0.24	1.10 ± 0.29	2.02 ± 0.53	ND	ND		16
154	DTSC-133E	ND	ND	1.28 ± 0.21	$1.52 \pm 0.34$	$2.80 \pm 0.55$	ND	0.26 ± 0.10		16
155	DTSC-134	$0.56 \pm 0.10$	ND	1.24 ± 0.20	$1.30 \pm 0.33$	2.54 ± 0.53	ND	0.23 ± 0.07		18
156	DTSC-135	0.01 ± 0.04	ND	1.17 ± 0.25	1.30 ± 0.29	2.47 ± 0.54	1.38 ± 1.28	$0.24 \pm 0.08$		19
157	DTSC-136	ND	ND	1.10 ± 0.17	1.12 ± 0.27	$2.22 \pm 0.44$	1.98 ± 1.53	$0.18 \pm 0.08$		19
158	DTSC-137	ND	ND	$1.21 \pm 0.27$	1.06 ± 0.27	$2.27 \pm 0.54$	1.12 ± 1.05	0.19 ± 0.08		20
159	DTSC-138	0.11 ± 0.05	ND	1.27 ± 0.20	1.28 ± 0.29	2.55 ± 0.49	1.34 ± 1.16	$0.17 \pm 0.07$		20
160	DTSC-139	0.11 ± 0.06	ND	$1.38 \pm 0.30$	1.66 ± 0.36	$3.04 \pm 0.66$	1.45 ± 1.37	$0.25 \pm 0.06$		20
161	DTSC-139A	$0.10 \pm 0.05$	ND	1.35 ± 0.29	$1.41 \pm 0.30$	2.76 ± 0.59	$2.44 \pm 1.80$	0.25 ± 0.07		20
162	DTSC-139B	ND	ND	1.33 ± 0.21	1.42 ± 0.29	$2.75 \pm 0.50$	2.32 ± 1.58	$0.23 \pm 0.07$		20
163	DTSC-139C	ND	ND	$1.52 \pm 0.23$	1.60 ± 0.32	$3.12 \pm 0.55$	1.45 ± 1.23	0.17 ± 0.06		20

Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site										
	Energy Pcaks →	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Со 1173 keV	<sup>228</sup> Th 238 keV. <sup>212</sup> Pb	<sup>• 228</sup> Rå( <sup>232</sup> Th) 911 keV <sup>228</sup> Ac	Th (228 <sup>m</sup> + <sup>233</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>24</sup> Th)	2 <sup>235</sup> U (144) 186 keV	Comments	Exposure Rate @ Im (µR/hr)_
	Sample ID			Ràdio 30 Minute C	onuclide Concel ounts (except à	ntrations (pCi s noted) - Bac	(g) - Results ± 20 kgrounds <u>Not</u> Su	btracted		at soil sample. _location
164	DTSC-139D	ND	ND	$1.56 \pm 0.24$	1.73 ± 0.38	3.29 ± 0.62	1.11 ± 0.94	0.19 ± 0.06		20
165	DTSC-139E	ND	ND	1.31 ± 0.29	1.48 ± 0.32	2.79 ± 0.61	ND	0.11 ± 0.06		20
166	DTSC-140	$0.05 \pm 0.04$	ND	1.66 ± 0.33	1.71 ± 0.38	$3.37 \pm 0.71$	2.64 ± 2.03	$0.29 \pm 0.10$		18
.167	• DTSC-141 4,	4.71 ± 0.56	ND	1.12±0.30	1.34 ± 0.29	2.46 ± 0.59	ND	70.09 ± 0.08		19
-168	DTSC-141A	3:58 ± 0:43	ND		1.40 ± 0.32 ;	2.52 ±.0.53	1.67±1.20	0:12 ± 0.06 .	Final soil sample is	现在17月2日
169	DTSC-141B	0.43 ± 0.09	ND	1.59 ± 0.24 >	1:75±0.34	3:34 ± 0.58	ND	0.20±0.08	DTSC-185	3月17月13月13月13月13月13月13月13月13月13月13月13月13月13月
170	DTSC-141C	0.13 ± 0.05	ND	1.60 ± 0.27	1.44±0.30	3:04±0.57	2.1.03 ± 1.04	0.14 ± 0.07		· 17 14 - 24 - 24 - 24 - 24 - 24 - 24 - 24 -
171	DTSC-142	ND	ND	1.34 ± 0.27	$1.54 \pm 0.32$	2.88 ± 0.59	2.59 ± 1.77	$0.24 \pm 0.07$		19
172	DTSC-142A	ND	ND	1.15 ± 0.25	$1.16 \pm 0.33$	2.31 ± 0.58	ND	0.16 ± 0.06		19
173	DTSC-142B	ND	ND	1.39 ± 0.24	1.59 ± 0.38	2.98 ± 0.62	$1.40 \pm 1.35$	0.07 ± 0.07		19
174	DTSC-142C	ND	ND	1.51 ± 0.26	$1.77 \pm 0.34$	3.28 ± 0.60	ND	0.19 ± 0.08		19
175	DTSC-142D	ND	ND	0.62 ± 0.20	$1.02 \pm 0.22$	$1.64 \pm 0.42$	ND	$0.06 \pm 0.03$		19
176	DTSC-142E	ND	ND	$1.43 \pm 0.52$	$1.64 \pm 0.38$	3.07 ± 0.90	1.12 ± 1.19	$0.17 \pm 0.07$		19
177	DTSC-143	ND	ND	$1.34 \pm 0.33$	1.73 ± 0.44	3.07 ± 0.77	ND	$0.24 \pm 0.14$		19
178	DTSC-144	ND	ND	$1.25 \pm 0.25$	$1.45 \pm 0.32$	2.70 ± 0.57	1.97 ± 1.41	0.23 ± 0.08		19

	Table	6: Gaṁma	Spectrosco	opy Results	of Soil Samj	oles Collect	ed from the	DTSC Pern	iitted (NWPF-1) Si	te
#	Energy Peaks	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV <sup>212</sup> Pb	228 Ra(232 Th) 911 keV 228 Ac	Th, (228 <sup>n</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	235U (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)
	Sample ID			Radii 30 Minute C	onuclide Conce ounts (except a	ntrations (pCi s noted) - Bacl	(g) - Résults ± 2 c kgrounds <u>Not</u> Su	t . biracted		at soil sample
179	DTSC- 145	ND	ND	1.35 ± 0.31	1.43 ± 0.36	2.78 ± ± 0.67	1.53 ± 1.27	0.21 ± 0.10		19
180	DTSC-146	ND	ND	0.98 ± 0.22	1.22 ± 0.28	2.20 ± 0.50	ND	0.05 ± 0.05		17
181	DTSC-147	ND	ND	1.09 ± 0.24	1.37 ± 0.32	2.46 ± 0.56	0.60 ± 0.71	0.18 ± 0.07		18
182	DTSC-148	$0.02 \pm 0.03$	ND	$1.15 \pm 0.18$	1.28 ± 0.30	2.43 ± 0.48	0.83 ± 1.12	0.19 ± 0.06		20
183	DTSC-149	ND	ND	1.42 ± 0.29	1.26 ± 0.29	$2.68 \pm 0.58$	2.56 ± 1.74	$0.26 \pm 0.07$		20
184	DTSC-150	ND	ND	1.37 ± 0.29	1.60 ± 0.36	2.97 ± 0.65	ND	0.20 ± 0.08		19
185	DTSC-151	ND	ND	1.06 ± 0.27	1.17 ± 0.28	2.23 ± 0.55	ND	0.13 ± 0.07		17
186	DTSC-151A	ND	ND	1.13 ± 0.28	$1.28 \pm 0.35$	2.41 ± 0.63	ND	$0.12 \pm 0.06$		17
187	DTSC-151B	ND	ND	$1.26 \pm 0.27$	$1.36 \pm 0.30$	2.62 ± 0.57	$0.56 \pm 1.11$	$0.12 \pm 0.06$		17
188	DTSC-151C	ND	ND	$1.52 \pm 0.24$	$1.71 \pm 0.42$	$3.23 \pm 0.66$	$2.22 \pm 1.57$	0.18 ± 0.10		17
189	DTSC-151D	ND	ND	1.47 ± 0.31	$1.61 \pm 0.36$	3.08 ± 0.67	1.85 ± 1.58	0.21 ± 0.08		17
190	DTSC-151E	ND	ND	$1.54 \pm 0.36$	1.60 ± 0.33	3.14 ± 0.69	0.99 ± 1.21	0.15 ± 0.09		17
191	DTSC-152	ND	ND	$1.54 \pm 0.26$	1.81 ± 0.39	3.35 ± 0.65	$1.05 \pm 0.97$	0.17 ± 0.10		20
192	DTSC-153	ND	ND	1.41 ± 0.22	1.51 ± 0.38	$2.92 \pm 0.60$	$1.83 \pm 1.46$	$0.23 \pm 0.08$		20
193	DTSC-154	ND	ND	1.31 ± 0.21	1.59 ± 0.34	2.90 ± 0.55	0.98 ± 1.12	$0.14 \pm 0.08$		19

Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site									te	
#:	Energy Peaks	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>218</sup> Th 238 keV - 212Pb	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV. <sup>228</sup> Ac	Th (228 <sup>m</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)
	Sample ID			Radia 30 Minute C	oniiclide Conce Sounts (except a	ntrations (pCl s noted) - Bacl	(g) - Results ± 20 kgrounds <u>Not</u> Su	btracted		location
194	DTSC-155	ND	ND	0.92 ± 0.21	0.97 ± 0.22	1.89 ± 0.43	1.33 ± 1.06	0.12 ± 0.05		17
195	DTSC-156	ND	ND	0.85 ± 0.19	0.87 ± 0.28	1.72 ± 0.47	ND	0.15 ± 0.06		18
196	DTSC-156A	ND	ND	$1.62 \pm 0.32$	1.83 ± 0.35	$3.45 \pm 0.67$	ND	0.20 ± 0.06		18
197	DTSC-156B	ND	ND	1.41 ± 0.22	1.49 ± 0.35	2.90 ± 0.57	1.70 ± 1.36	0.16 ± 0.07		18
198	DTSC-156C	ND	`ND	$1.57 \pm 0.33$	1.80 ± 0.36	3.37 ± 0.69	1.98 ± 1.47	0.17 ± 0.07		18
199	DTSC-156D	ND	ND	$1.57 \pm 0.24$	1.63 ± 0.35	3.20 ± 0.59	$2.34 \pm 1.61$	0.16 ± 0.08		18
200	DTSC-156E	ND	ND	$1.53 \pm 0.31$	1.67 ± 0.34	3.20 ± 0.65	1.11 ± 1.01	$0.18 \pm 0.07$		18
201	DTSC-157	ND	ND	$1.43 \pm 0.28$	1.72 ± 0.36	$3.15 \pm 0.64$	1.26 ± 1.12	$0.20 \pm 0.07$		17
202	DTSC-158	$0.05 \pm 0.04$	ND	$0.85 \pm 0.22$	$0.98 \pm 0.27$	1.83 ± 0.49	ND	0.09 ± 0.07		20
203	DTSC-159	ND	ND	1.44 ± 0.28	$1.68 \pm 0.40$	$3.12 \pm 0.68$	1.40 ± 1.01	$0.30 \pm 0.10$		20
204	DTSC-160	0.02 ± 0.05	ND	1.20 ± 3.07	1.16 ± 0.28	2.36 ± 3.35	1.40 ± 1.21	0.14 ± 0.06		18
205	DTSC-161	ND	ND	1.29 ± 0.27	$1.36 \pm 0.30$	$2.65 \pm 0.57$	1.20 ± 1.11	0.21 ± 0.08		19
206	DTSC-162	ND	ND	1.38 ± 0.30	$1.46 \pm 0.35$	2.84 ± 0.65	ND	$0.14 \pm 0.08$		20
207	DTSC-163	ND	ND	$1.42 \pm 0.27$	1.41 ± 0.29	2.83 ± 0.56	1.03 ± 1.03	$0.22 \pm 0.08$		19
208	DTSC-164	ND	ND	1.43 ± 0.28	$1.42 \pm 0.30$	$2.85 \pm 0.58$	1.83 ± 1.41	0.27 ± 0.09		20

	Table	6: Gamma	Spectrosco	opy Results	of Soil Samj	ples Collect	ted from the	DTSC Pern	iitted (NWPF-1) Si	e
······································	Energy, Peaks →	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV <sup>212</sup> Pb	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>228</sup> Ac	Th (228 <sup>m</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> Ü (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)
	Sample ID			Radii 30 Minute C	onuclide Conce Counts (except a	ntrations (pCi s noted) - Baci	(g) - Results ± 2 c kgrounds <u>Not</u> Su	t btracted		at soil sample location
209	DTSC-165	$0.02 \pm 0.04$	ND	$1.35\pm0.21$	$1.38 \pm 0.31$	$2.02 \pm 1.53$	2.02 ± 1.53	$0.24 \pm 0.08$		20
210	DTSC-165A	ND	ND	$1.03 \pm 0.17$	1.09 ± 0.29	$2.12 \pm 0.46$	2.38 ± 1.61	$0.16 \pm 0.08$		20
211	DTSC-165B	ND	ND	$1.49 \pm 0.32$	1.49 ± 0.32	$2.98\pm0.64$	1.43 ± 1.07	$0.22 \pm 0.09$		20
212	DTSC-165C	ND	ND	$1.45 \pm 0.30$	$1.44 \pm 0.32$	2.89 ± 0.62	1.04 ± 1.10	$0.25 \pm 0.09$		20
213	DTSC-165D	ND	ND	$1.53 \pm 0.32$	1.80 ± 0.38	3.33 ± 0.70	1.51 ± 1.42	$0.14\pm0.08$		20
214	DTSC-165E	ND	ND	$1.67 \pm 0.32$	1.56 ± 0.35	3.23 ± 0.67	1.62 ± 1.25	0.20 ± 0.06		20
215	DTSC-166	0.02 ± 0.03	ND	1.24 ± 0.25	1.30 ± 0.32	$2.54 \pm 0.57$	1.81 ± 1.57	0.10 ± 0.07		20
216	DTSC-167	ND	ND	1.02 ± 0.16	1.02 ± 0.26	$2.04 \pm 0.42$	1.54 ± 1.30	0.16 ± 0.09		18
217	DTSC-168	0.03 ± 0.04	ND	1.38 ± 0.86	1.40 ± 0.30	2.78 ± 1.16	1.41 ± 1.24	0.16 ± 0.05		16
218	DTSC-168A	ND	. ND	1.70 ± 0.34	1.87 ± 0.38	3.57 ± 0.72	2.55 ± 1.68	$0.17 \pm 0.07$		16
219	DTSC-168B	ND	ND	$1.64 \pm 0.32$	1.84 ± 0.35	3.48 ± 0.67	2.06 ± 1.58	$0.14 \pm 0.07$		16
220	DTSC-168C	ND	ND	1.80 ± 0.34	1.90 ± 0.37	3.70 ± 0.71	2.26 ± 1.64	$0.22 \pm 0.09$		16
221	DTSC-168D	ND	ND	1.68 ± 0.35	1.78 ± 0.36	3.46 ± 0.71	1.97 ± 1.42	0.21 ± 0.08		16
222	DTSC-168E	ND	ND	1.61 ± 0.25	$1.52 \pm 0.37$	3.13 ± 0.62	1.02 ± 1.10	$0.17 \pm 0.07$		16
223	DTSC-169	$0.07 \pm 0.05$	ND	$0.81 \pm 0.14$	0.98 ± 0.29	1.79 ± 0.43	0.95 ± 1.12	0.22 ± 0.10		16

	Table 6: Gamma Spectroscopy Results of Soil Samples Collected from the DTSC Permitted (NWPF-1) Site								<b>e</b> .	
	Energy Peaks →	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 kéV	228 Th 238 keV 212 Pb	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>228</sup> Ac	Th (228 <sup>n</sup> + <sup>232</sup> Th)	<sup>238</sup> Ü 63.3 (92.7) keV.( <sup>234</sup> Th)	<sup>235</sup> Ü (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)
	Sample ID			Radio 30 Minute C	onuclide Cóncel ounts (except a	ntrátions (pCi s noted) - Bacl	(g) - Results ± 20 kgrounds <u>Not</u> Su	biracted		location
224	DTSC-170	ND	ND	$1.32 \pm 0.28$	$1.45 \pm 0.29$	2.77 ± 0.57	ND	0.19 ± 0.08		18
225	DTSC-171	ND	ND	$1.31 \pm 0.20$	1.57 ± 0.34	$2.88 \pm 0.54$	2.74 ± 1.86	$0.25 \pm 0.07$		20
226	DTSC-172	$0.02 \pm 0.05$	ND	1.29 ± 0.25	$1.41 \pm 0.32$	2.70 ± 0.57	1.58 ± 1.33	$0.20 \pm 0.07$		20
227	DTSC-173	ND	ND	1.31 ± 0.27	1.26 ± 0.28	2.57 ± 0.55	$1.84 \pm 1.46$	$0.20 \pm 0.06$		20
228.	DTSC-174 .	8,93 ± 1.02	ND	1.54±0.35	1.47.±0.32	3.01 ± 0.67.	1.42 ± 1.35	0.21 ± 0.09	Area remediated. Final	19
- 229,-	DTSC-174A	0.68 ± 0.11	-0.06±0.06	1.47 ± 0.31	11.57,±0.33	3.04 ± 0.64.	1.08 ± 1.09	-0.18±0.10	DTSC-205 through DTSC-208	19
230	DTSC-175	ND	ND	1.08 ± 0.19	$1.62 \pm 0.34$	2.70 ± 0.53	1.46 ± 1.23	$0.13 \pm 0.07$		17
231	DTSC-176	ND	ND	1.04 ± 0.18	1.12 ± 0.28	$2.16 \pm 0.46$	ND	$0.12 \pm 0.07$		17
232	DTSC-177	ND	ND	1.03 ± 0.19	1.35 ± 0.28	$2.38 \pm 0.47$	ND	$0.12 \pm 0.07$		17
233	DTSC-178	0.60 ± 0.10	ND	1.27 ± 0.26	1.30 ± 0.32	2.57 ± 0.58	ND	0.13 ± 0.08		17
234	DTSC-179	ND	ND	1.40 ± 0.22	1.61 ± 0.32	$3.01 \pm 0.54$	1.20 ± 1.10	$0.16 \pm 0.06$		17
235	DTSC-180	0.05 ± 0.03	ND	$0.55 \pm 0.12$	0.68 ± 0.21	1.23 ± 0.33	ND	0.11 ± 0.06		16
236	DTSC-181	0.19 ± 0.06	ND	1.56 ± 0.33	1.73 ± 0.37	3.29 ± 0.70	1.08 ± 1.10	$0.22 \pm 0.07$		18

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	Table	6: Gamma	Spectrosc	opy Results	of Soil Samj	ples Collec	ted from the	DTSC Pern	nitted (NWPF-1) Si	te
	Energy Peaks -	<sup>137</sup> Cs 561.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV <sup>212</sup> Pb	<sup>228</sup> Ra( <sup>232</sup> Th). 911 keV <sup>228</sup> Ac	Th (228 <sup>Th</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments	Exposure; Raté @ 1m (µR/hr)
	Sample ID:			Radio 30 Minute C	oniuclide Conce Sounts (except a	ntrations (pCl s noted) - Bac	/g) - Results ± 20 kgrounds <u>Not</u> Su	T biracted		location
237	DTSC-182	$0.72 \pm 0.12$ .	ND	1.40 ± 0.35	1.44 ± 0.31	2.84 ± 0.66.	ND	2.0.20 ± 0.08	Area remediated.	19
,238	DTSC-183	4.07 ± 0.49	ND	1.71±0.26	±1:78±0.37	3.49 ± 0.63	ND	± 0.20 ± 0.08	Final soil samples for this area are samples	17
239	DTSC-184	4:15 ± 0:50	ND	-1.57±0.33	1.81 ± 0.38	3.38 ± 0.71	1.92 ± 1:60	0.20 ± 0.09	DTSC-205 through DTSC-208	18
240	5 TSC-184A	1716±0.18	ND	1.71 ± 0.27	1,58 ± 0.37;	3.29 ± 0.64	1.69 ± 1.33	0.24 ± 0.09		18
241	DTSC-185	ND	ND	2.04 ± 0.31	2.45 ± 0.46	4.49 ± 0.77	2.23 ± 1.92	0.36 ± 0.09	Final sample for area DTSC-141	18
242	, DTSC-186	22:14 ± 3:14.	$0.04 \pm 0.04$	1:36 ± 0.44	1.75 ± 0.35	3:11 ± 0.79	88.71 ± 318.3	0:15 ± 0.08.	Area remediated. Final:	21
									DTSC-208	
243	DTSC-187	ND	ND	1.21 ± 0.26	1.25 ± 0.30	2.46 ± 0.56	1.13 ± 1.09	$0.16 \pm 0.08$		18
244	DTSC-188	ND	ND	$1.52 \pm 0.32$	$1.63 \pm 0.33$	3.15 ± 0.65	ND	0.16 ± 0.08		18
245	DTSC-189	ND	ND	0.60 ± 0.21	1.15 ± 0.23	1.75 ± 0.44	ND	0.07 ± 0.04		20
246	DTSC-190	ND	ND	0.88 ± 0.19	1.06 ± 0.25	1.94 ± 0.44	ND	0.08 ± 0.05		20
247	DTSC-191	ND	ND	1.27 ± 0.27	1.49 ± 0.31	2.76 ± 0.58	1.98 ± 1.48	0.25 ± 0.08		22
248	DTSC-192	ND	ND	1.33 ± 0.28	1.27 ± 0.29	2.60 ± 0.57	ND	$0.21 \pm 0.08$		20
249	DTSC-193	ND	ND	$1.48 \pm 0.30$	$1.54 \pm 0.33$	$3.02 \pm 0.63$	0.81 ± 1.01	0.18 ± 0.08		20

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	Table	6: Gamma	Spectrosc	opy Results	of Soil Samj	oles Collec	ted from the	DTSC Perm	iitted (NWPF-1) Si	te
	Energy Péaks →	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV 2 <sup>212</sup> Pb	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>228</sup> Ac	Th (228 <sup>m</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments	Exposure Rate @ 1m (µR/hr)
	Sample ID			Radi 30 Minute C	onuclide Conce ounts (except a	ntrations (pCl s noted) - Bac	/g) - Résúlts ± 20 kgrounds <u>Not</u> Su	btracted		location
250	DTSC-194	ND	ND	$1.40 \pm 0.27$	$1.52 \pm 0.32$	$2.92 \pm 0.59$	1.95 ± 1.65	0.26 ± 0.09		19
251	DTSC-195	$0.51 \pm 0.12$	ND	$1.44 \pm 0.23$	$1.62 \pm 0.34$	3.06 ± 0.57	2.12 ± 1.62	0.21 ± 0.06		20
252	DTSC-196	$0.28 \pm 0.08$	ND	$1.32 \pm 0.27$	1.39 ± 0.31	2.71 ± 0.58	1.74 ± 1.39	0.28 ± 0.09		20
253	DTSC-197	$1.15 \pm 0.16$	ND	$1.00 \pm 0.16$	$1.24 \pm 0.27$	$2.24 \pm 0.43$	1.00 ± 0.89	0.19 ± 0.08		20
254	DTSC-198	0.41 ± 0.09	ND	$1.57 \pm 0.24$	1.53 ± 0.33	3.10 ± 0.57	ND	0.18 ± 0.06		20
255	DTSC-199	ND	ND	0.92 ± 0.21	1.09 ± 0.28	2.01 ± 0.49	ND	0.16 ± 0.08		19
256	DTSC- 200	ND	ND	$1.42 \pm 0.21$	1.49 ± 0.33	2.91 ± 0.54	ND	0.16 ± 0.06		· 19
257	DTSC-201	ND	ND	$1.06 \pm 0.17$	1.21 ± 0.28	2.27 ± 0.45	ND	0.14 ± 0.06		19
258	DTSC-202	ND	ND	$1.20 \pm 0.24$	1.39 ± 0.30	$2.59 \pm 0.54$	ND	0.15 ± 0.06		20
259	DTSC-203	÷2:35 ± 0.28	ND	1:59 ± 0.22	1.99 ± 0.37	3.58 ± 0.59.	1.58±1:39	0.16±0.08	Area remediated. Final	18
260	DTSC-204	.5.32 ± 0.57	ND	; 1.56±0.25	1.67 ± 0.32	3.23 ± 0.57,	2.70 ± 1.90	0.28±0.10	DTSC- 205 through DTSC 208	
261	DTSC-205	ND	ND	$1.62 \pm 0.23$	1.39 ± 0.34	3.01 ± 0.57	2.19 ± 1.66	0.19 ± 0.07		19
262	DTSC-206	ND	ND	1.56 ± 0.29	1.63 ± 0.37	3.19 ± 0.66	1.61 ± 1.29	$0.22 \pm 0.07$	Final soil samples for several remediated	19
263	DTSC-207	ND	ND	1.78 ± 0.25	1.78 ± 0.37	3.56 ± 0.62	2.39 ± 1.81	0.18 ± 0.07	areas	19
264	DTSC-208	0.17 ± 0.06	ND	1.67 ± 0.24	1.70 ± 0.38	$3.37 \pm 0.62$	2.24 ± 1.80	0.23 ± 0.09		19

	Table	6: Gamma	Spectrosc	opy Results	of Soil Sam	ples Collect	ted from the	DTSC Pern	iitted (NWPF-1) Site		
	Energy Peaks →	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	228Th 238 keV 212Pb	<sup>228</sup> Ra( <sup>232</sup> Th) 911 keV <sup>228</sup> Âc	Th (228 <sup>n</sup> + <sup>232</sup> Th)	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	Comments Rate @ 1m (µR/hr)		
	Samplé ID	Radionuclide Concentrations (ρCl/g) - Results ± 2σ .30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted									
265	NWPF Tree Leaves	ND	ND	1.01 ± 0.27	ND	1.01 ± 0.27	ND	0.01 ± 0.11	Sample of tree leaves from tree whose roots entered the sump area of the Solidification Area		
266	NWPF Tree Roots	ND	ND	0.98 ± 0.36	ND	0.98 ± 0.36	ND	0.22 ± 0.21	Sample of tree roots from a nearby tree. Roots were present in the sump area of the Solidification Area		

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1. Soil was removed (remediated) at shaded data locations.

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

U-238 = 1.58 pCi/g (63 keV peak)Co-60 = 0.16 pCi/g (1173 keV peak)U-235 = 0.14 pCi/g (186 keV peak)Th-228 = 0.21 pCi/g (238 keV peak)Cs-137= 0.13 pCi/g (662 keV peak)Th-232 = 0.43 pCi/g (911 keV peak)

## 4. Sample Numbers:

DTSC-# = Surface (0-6") soil samples

DTSC-#A = Sub Surface (6-12") soil samples

DTSC-#B = Sub Surface (12"-18") soil samples

DTSC-#C = Sub Surface (18"-24") soil samples

DTSC-#D = Sub Surface (24"-30") soil samples

DTSC-#E = Sub Surface (30"-36") soil samples.

Table 7: Wipe Survey Results for DTSC Permitted Area (NWPF-1)								
Sample Number	α Activity in dpm/100cm <sup>2</sup>	$\beta$ Activity in dpm/100cm <sup>2</sup>						
and the second sec	<20	<20						
2	<20	<20						
3	<20	<20						
<b>4</b>	<20	<20						
5	<20	<20						

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	Table 8: List C	Of Instrument	s for the NW	<u>PF-1 (DT</u>	SC Permitted Area)	Confirmatory Survey
Instrument	Detector	Range (cpm)	Calibration Due Date	Efficiency	Background	Description
Ludlum Model 2221 S/N 84459	Ludlum Model 43-37 434 cm <sup>2</sup> gas flow proportional Alpha detector S/N 086215	Four Linear Ranges 0-500,000 & one Log 50-500,000	01-13-05	22.14%	40 cpm on concrete Scan MDA= 125 dpm/100 cm <sup>2</sup>	Active Probe Area = $434 \text{ cm}^2$ . The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick disconnects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model 2221 S/N 154202	Ludlum Model 43-37 434 cm <sup>2</sup> gas flow proportional Beta detector S/N 149017	Four Linear Ranges 0-500,000 & one Log 50-500,000	01-28-05	30.39%	1200-1500 cpm on concrete Scan MDA= 338 dpm/100 cm <sup>2</sup>	Active Probe Area = $434 \text{ cm}^2$ . The detector and rate meter are combined and mounted on a roll around cart. The instrument features a static-flow system, quick disconnects, a portable gas bottle and a means to adjust the height of the detector from the floor for optimum performance.
Ludlum Model 2221 S/N 86302	Ludium Model 43-68 100 cm <sup>2</sup> gas flow proportional Beta detector S/N 142547	Four Linear Ranges 0-500,000 & one Log 50-500,000	01-13-05	34.36%	880 ± 104 cp2m MDA = 205 dpm/100 cm <sup>2</sup>	Active Probe Area = 100 cm <sup>2</sup> . The detector and rate meter are combined on a roll around cart. The instrument features a static-flow system, quick disconnects and a portable gas bottle.
Ludlum Model 3 S/N 153551	Ludlum Model 44-10 Nal (TI) Scintillator Gamma detector S/N 155109	Five Ranges 0-500 µR/hr	12-27-04 4-8-05	N/A	<u>soil</u> 12-18 μR/hr @ contact 12-17 μR/hr @ Imeter <u>concrete</u> 15-21 μR/hr @ contact 15-21 μR/hr @ Imeter	2 inch x 2 inch Nal (TI) scintillator. Used for measuring external dose rates at the surface and at 1 meter.
Ludlum Model 3 S/N 151348	Ludlum Model 44-10 Nal (TI) Scintillator Gamma detector S/N 163169	Five Ranges 0-500 μR/hr	07-30-04 10-06-04	N/A	<u>soil</u> 12-21 μR/hr @ contact 12-19 μR/hr @ Imeter	2 inch x 2 inch NaI (TI) scintillator. Used for measuring external dose rates at the surface and at 1 meter.
Ludlum Model 12 S/N 73914	Ludlum Model 43-65 Alpha Scintillator ZnS(Ag) Alpha detector S/N 076803	Four Ranges 0-500,000	02-25-05	22.52%	0-20 cpm (all) MDA =209 dpm/100 cm²	Active Probe Area = 50 cm <sup>2</sup> . Used for Alpha surveying and fixed measurements.
Canberra Low Level α/β Counter Model 2404	Gas Flow Proportional Detector	N/A	As needed	~26-30%	Varies with Sample	Canberra Model 2404 Low Level $\alpha/\beta$ gas proportional counting system used to count wipes for removable contamination. Results are usually reported as dpm/100 cm <sup>2</sup> .
Canberra Gamma Spectroscopy System	High Purity Germanium Detector	N/A	As needed	Varies with Sample	Varies with Sample	Gamma Spectroscopy MCA system using a high purity Germanium detector

Table 9: NWPF-1 (DTSC Permitted Area) Confirmatory Survey   Wipe Survey Results									
Sample Number	α Activity in dpm/100cm <sup>2</sup>	$\beta$ Activity in dpm/100cm <sup>2</sup>							
1	<20	<20							
2	<20	<20							
3	<20	<20							
	<20	<20							
5	<20	<20							

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Table 10: Gamma Spectroscopy Results of NWPF-1 Site Land Area Confirmatory Soil Samples									
Energy Peaks	<sup>137</sup> Čs 661.6 keV	<sup>60</sup> Có 1173 keV	238 keV ( <sup>212</sup> Pb)	<sup>228</sup> Ra ( <sup>222</sup> Th) 911 keV ( <sup>228</sup> Ac)	(Toia) Th 228Th + 232Th	<sup>138</sup> Ü 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV		
Sample ID 🕴	Radionuclide Concentrations (pCVg) - Results ± 2 σ - 30 Minute Counts (except as noted) - Backgrounds <u>Not</u> Subtracted								
WYC-1	ND	ND	1.43 ± 0.29	1.69 ± 0.36	$3.12 \pm 0.65$	2.74 ± 2.08	0.14 ± 0.07		
WYC-2	ND	ND	1.39 ± 0.20	$1.55 \pm 0.40$	2.94 ± 0.60	ND	0.17 ± 0.10		
WYC-3	ND	ND	1.60 ± 0.23	1.83 ± 0.38	$3.43 \pm 0.61$	2.06 ± 1.90	$0.20 \pm 0.07$		
WYC-4	ND	ND	$0.95 \pm 0.18$	1.34 ± 0.28	2.29 ± 0.46	ND	$0.18 \pm 0.06$		
WYC-5	ND	ND	1.35 ± 0.19	$1.55 \pm 0.32$	2.90 ± 0.51	1.74 ± 1.60	0.17 ± 0.06		
WYC-6	$0.26 \pm 0.08$	ND	1.36 ± 0.21	$1.33 \pm 0.31$	2.69 ± 0.52	ND	$0.15 \pm 0.06$		
WYC-7	$0.55 \pm 0.10$	ND	1.58 ± 0.29	$1.63 \pm 0.32$	3.21 ± 0.61	ND	0.19 ± 0.06		
WYC-8	$0.15 \pm 0.07$	ND	1.62 ± 0.36	1.89 ± 0.42	3.51 ± 0.78	1.70 ± 1.71	$0.20 \pm 0.09$		
WYC-9	$0.13 \pm 0.07$	ND	$1.47 \pm 0.32$	1.91 ± 0.38	3.38 ± 0.70	1.88 ± 1.76	$0.26 \pm 0.10$		
WYC-10	ND	ND	1.16 ± 0.17	$1.30 \pm 0.33$	$2.46 \pm 0.50$	1.14 ± 1.11	0.17 ± 0.05		
WYC-11	ND	ND	1.24 ± 0.25	1.28 ± 0.28	$2.52 \pm 0.53$	ND	$0.12 \pm 0.05$		
WYC-12	ND	ND	$1.06 \pm 0.15$	1.19 ± 0.28	$2.25 \pm 0.43$	0.85 ± 0.96	$0.12 \pm 0.07$		
WYC-13	ND	ND	1.63 ± 0.23	1.73 ± 0.33	3.36 ± 0.56	1.61 ± 1.38	0.17 ± 0.09		
WYC-14	ND	ND	1.52 ± 0.29	1.61 ± 0.36	3.13 ± 0.65	0.80 ± 1.30	0.18 ± 0.07		
WYC-15	$0.05 \pm 0.04$	ND	1.18 ± 0.23	1.16 ± 0.29	$2.34 \pm 0.52$	1.93 ± 1.43	0.19 ± 0.08		

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Table 10: Gamma Spectroscopy Results of NWPF-1 Site Land Area Confirmatory Soil Samples								
Energy Peaks	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	228Th 238 keV ( <sup>212</sup> Pb)	228Rá (231 Th) 911 keV (228 Ac)	(Tota) Th 228 Th + 232 Th	<sup>238</sup> U - ; (63.3 (92.7) keV - ; ( <sup>234</sup> Th) - ;	(144) 186 keV	
Sample ID	Radionuclide	Concentration	s (pCi/g) - Results	$\pm 2\sigma$ - 30 Minute C	ounts (except as i	ioted) - Background	ls <u>Not</u> Subtracted	
WYC-16	$0.28\pm0.07$	ND	1.37 ± 0.27	1.57 ± 0.30	2.94 ± 0.57	1.72 ± 1.37	0.13 ± 0.06	
WYC-17	ND	ND	1.19 ± 0.28	1.26 ± 0.29	$2.45 \pm 0.57$	0.50 ± 0.90	$0.24 \pm 0.07$	
WYC-18	$0.05 \pm 0.04$	ND	1.40 ± 0.29	$1.58 \pm 0.37$	2.98 ± 0.66	2.22 ± 1.76	0.26 ± 0.09	
WYC-19	ND	ND	1.72 ± 0.29	$1.54 \pm 0.31$	$3.26 \pm 0.60$	ND	0.13 ± 0.07	
WYC-20	ND	ND	1.65 ± 0.31	1.71 ± 0.40	3.36 ± 0.71	2.05 ± 1.64	0.19 ± 0.08	
WYC-21	ND	ND	1.21 ± 0.23	1.39 ± 0.31	$2.60 \pm 0.54$	1.28 ± 1.28	$0.25 \pm 0.08$	
WYC-22	ND	ND	1.81 ± 0.25	1.54 ± 0.33	3.35 ± 0.58	ND	0.18 ± 0.09	
WYC-23	ND	ND	1.62 ± 0.23	1.72 ± 0.36	3.34 ± 0.59	1.80 ± 1.49	0.21 ± 0.09 ·	
WYC-24	ND	ND	1.47 ± 0.23	1.79 ± 0.33	3.26 ± 0.56	2.32 ± 1.73	0.17 ± 0.06	
WYC-25	0.06 ± 0.07	ND	1.55 ± 0.40	2.10 ± 0.47	3.65 ± 0.87	0.97 ± 1.10	0.17 ± 0.07	
WYC-26	, ND	ND	1.29 ± 0.19	1.28 ± 0.32	2.57 ± 0.51	ND	0.22 ± 0.09	
WYC-27	ND	ND	$2.05 \pm 0.30$	$1.62 \pm 0.36$	3.67 ± 0.66	2.82 ± 2.09	0.17 ± 0.06	
WYC-28	ND	ND	1.58 ± 0.29	1.59 ± 0.33	3.17 ± 0.62	1.90 ± 1.63	0.12 ± 0.06	
WYC-29	ND	ND	1.20 ± 0.21	$1.64 \pm 0.38$	2.84 ± 0.59	0.90 ± 1.12	0.24 ± 0.09	
WYC-30	$0.64 \pm 0.10$	ND	$1.45 \pm 0.27$	$1.32 \pm 0.30$	2.77 ± 0.57	2.43 ± 1.72	$0.20 \pm 0.07$	

Table 10: Gamma Spectroscopy Results of NWPF-1 Site Land Area Confirmatory Soil Samples								
Energy Péaks	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV ( <sup>211</sup> Pb)	<sup>228</sup> Ra ( <sup>232</sup> Th) 911 këV ( <sup>228</sup> Ac)	(Total) Th 228Th + 232Th	<sup>238</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	<sup>235</sup> U (144) 186 keV	
Sample ID	Radionüclide.C	Concentrations	(pCi/g) - Results	±2σ-30 Minute C	ounts (except as i	noted) - Background	ls <u>Not</u> Subtracted	
WYC-31	ND	ND	1.41 ± 0.22	$1.60 \pm 0.33$	3.01 ± 0.55	$0.62 \pm 0.90$	0.13 ± 0.05	
WYC-32	ND	ND	1.31 ± 0.22	1.03 ± 0.26	$2.34 \pm 0.48$	ND	$0.07 \pm 0.07$	
WYC-33	0.07 ± 0.05	ND	1.44 ± 0.23	1.30 ± 0.33	2.74 ± 0.56	ND	$0.20\pm0.09$	
WYC-34	$0.03 \pm 0.04$	ND	1.75 ± 0.26	$1.57 \pm 0.35$	$3.32 \pm 0.61$	1.09 ± 1.18	$0.15 \pm 0.08$	
WYC-35	$0.04 \pm 0.03$	ND	1.71 ± 0.36	1.58 ± 0.33	3.29 ± 0.69	ND	0.13 ± 0.07	
WYC-36	ND	ND	1.39 ± 0.23	2.09 ± 0.41	$3.48 \pm 0.64$	1.74 ± 1.63	0.25 ± 0.09	
WYC-36A	ND	ND	1.66 ± 0.23	$1.62 \pm 0.34$	3.28 ± 0.57	1.10 ± 1.12	$0.24 \pm 0.08$	
WYC-36B	ND	ND	1.66 ± 0.23	1.90 ± 0.39	$3.56\pm0.62$	1.68 ± 1.36	$0.20\pm0.07$	
WYC-36C	ND	ND	1.76 ± 0.38	$2.33 \pm 0.48$	4.09 ± 0.86	1.38 ± 1.59	$0.16 \pm 0.11$	
WYC-36D	ND	ND	2.25 ± 0.33	$2.23 \pm 0.44$	$4.48 \pm 0.77$	1.47 ± 1.45	$0.23 \pm 0.11$	
WYC-36E	0.09 ± 0.05	ND	1.85 ± 0.26	1.87 ± 0.40	3.72 ± 0.66	1.61 ± 1.39	$0.22 \pm 0.09$	
WYC-37	0.40 ± 0.09	ND	1.39 ± 0.20	$1.69 \pm 0.45$	3.08 ± 0.65	ND	$0.19 \pm 0.11$	
WYC-37A	$0.18 \pm 0.05$	ND	1.55 ± 0.25	1.34 ± 0.29	2.89 ± 0.54	ND	0.14 ± 0.06	
WYC-37B	$0.06 \pm 0.04$	ND	1.25 ± 0.21	1.83 ± 0.35	3.08 ± 0.56	1.37 ± 1.39	0.17 ± 0.12	
WYC-37C	0.08 ± 0.07	ND	1.31 ± 0.21	2.17 ± 0.48	3.48 ± 0.69	ND	0.17 ± 0.11	

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Table 10: Gamma Spectroscopy Results of NWPF-1 Site Land Area Confirmatory Soil Samples								
Energy Peaks	<sup>117</sup> Cs 661.6 keV	<sup>60</sup> Co -1173 keV	<sup>228</sup> Th 238 keV (. <sup>212</sup> Pb)	<sup>228</sup> Ra ( <sup>232</sup> Th) 911 keV ( <sup>228</sup> Ac)	(Total) Th 228 Th + 232 Th	<sup>238</sup> U 63:3 (92:7) keV ≃ ( <sup>234</sup> Th)	<sup>235</sup> U 7 (144) 186 keV	
Sample ID.	Radionúclide (	Concentrations	(pCi/g) - Results	±2σ-30 Minute C	ounts (except as i	iotéd) - Background	ls <u>Not</u> Subtracted	
WYC-37D	ND	ND	1.71 ± 0.24	1.71 ± 0.35	$3.42 \pm 0.59$	$0.95 \pm 1.08$	$0.19 \pm 0.08$	
WYC-37E	ND	ND	1.61 ± 0.23	$1.94 \pm 0.39$	$3.55 \pm 0.62$	1.71 ± 1.41	$0.14 \pm 0.06$	
WYC-38	ND	ND	1.71 ± 0.28	1.50 ± 0.42	3.21 ± 0.70	1.08 ± 1.08	0.13 ± 0.09	
WYC-39	ND	ND	$1.66 \pm 0.32$	1.95 ± 0.39	3.61 ± 0.71	1.19 ± 1.08	$0.12 \pm 0.06$	
WYC-40	ND	ND	1.55 ± 0.38	1.77 ± 0.38	3.32 ± 0.76	2.26 ± 1.34	$0.06 \pm 0.08$	
WYC-41	ND	ND	2.27 ± 0.37	1.80 ± 0.37	4.07 ± 0.74	1.15 ± 1.39	$0.19 \pm 0.08$	
WYC-42	0.07 ± 0.05	ND	1.57 ± 0.33	1.59 ± 0.36	3.16 ± 0.69	2.45 ± 1.90	$0.18 \pm 0.08$	
WYC-43	ND	ND	1.64 ± 0.35	1.63 ± 0.37	3.27 ± 0.72	0.74 ± 1.20	$0.18 \pm 0.10$	
WYC-44	$0.10 \pm 0.08$	ND	1.67 ± 0.40	1.85 ± 0.43	3.52 ± 0.83	0.77 ± 1.19	$0.16 \pm 0.08$	
WYC-45	ND	ND	1.63 ± 0.24	2.24 ± 0.53	3.87 ± 0.77	1.30 ± 1.40	$0.21 \pm 0.12$	
WYC-46	ND	ND	$1.40 \pm 0.20$	$1.43 \pm 0.30$	$2.83 \pm 0.50$	ND	$0.16 \pm 0.08$	
WYC-47	ND	ND	1.43 ± 0.35	1.91 ± 0.39	3.34 ± 0.74	1.47 ± 1.43	0.27 ± 0.12	
WYC-48	1.19 ± 0.17	ND	1.41 ± 0.20	1.73 ± 0.35	3.14 ± 0.55	1.07 ± 1.00	$0.20 \pm 0.08$	
WYC-49	$0.15 \pm 0.05$	ND	1.27 ± 0.22	$1.18 \pm 0.27$	2.45 ± 0.49	ND	$0.10 \pm 0.06$	
WYC-50	ND	ND	1.62 ± 0.38	$2.28 \pm 0.47$	3.90 ± 0.85	ND	0.29 ± 0.12	

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Table 10: Gamma Spectroscopy Results of NWPF-1 Site Land Area Confirmatory Soil Samples										
Energy Peaks	<sup>137</sup> Cs 661.6 keV	<sup>60</sup> Co 1173 keV	<sup>228</sup> Th 238 keV ( <sup>212</sup> Pb)	<sup>228</sup> Ra ( <sup>222</sup> Th) 911 keV ( <sup>228</sup> Ac)	(Total) Th 228Th + 232Th	<sup>236</sup> U 63.3 (92.7) keV ( <sup>234</sup> Th)	235 <sub>U</sub> 2(144) 186 keV			
Sample ID V	Sample ID Radionuclide Concentrations (pCl/g) - Results ± 2 \sigma - 30 Minute Counts (except as noted) - Backgrounds Not Subtracted									
WYC-51	ND	ND	$1.12 \pm 0.30$	$1.67 \pm 0.43$	2.79 ± 0.73	ND	$0.08 \pm 0.07$			
WYC-52	ND	ND	$1.43 \pm 0.30$	1.83 ± 0.45	3.26 ± 0.75	0.73 ± 0.57	0.12 ± 0.09			
WYC-53	ND	ND	$0.89 \pm 0.26$	$1.40 \pm 0.34$	$2.29\pm0.60$	ND	ND			
BB-1	0.12 ± 0.07	ND	$1.62 \pm 0.24$	$2.20 \pm 0.45$	3.82 ± 0.69	ND	0.25 ± 0.11			
BB-2	$0.06 \pm 0.04$	ND	$1.72 \pm 0.24$	1.91 ± 0.38	3.63 ± 0.62	1.20 ± 1.42	$0.21 \pm 0.11$			
BB-3	ND	ND	1.42 ± 0.21	1.81 ± 0.40	3.23 ± 0.61	ND	$0.17 \pm 0.11$			
BB-4	ND	ND	$0.82 \pm 0.15$	1.06 ± 0.25	$1.88 \pm 0.40$	ND	$0.05 \pm 0.05$			
BB-5A	ND	ND	1.39 ± 0.19	$1.31 \pm 0.31$	$2.70 \pm 0.50$	2.20 ± 1.67	$0.24 \pm 0.10$			
BB-5B	ND	ND	$1.42 \pm 0.21$	1.76 ± 0.45	3.18 ± 0.66	1.48 ± 1.52	$0.20\pm0.10$			
BB-5C	ND	ND	$1.42 \pm 0.27$	$1.52 \pm 0.35$	$2.94 \pm 0.62$	1.11 ± 1.23	$0.26 \pm 0.07$			
BB-6	1.61 ± 0.22	ND	$1.24 \pm 0.24$	$2.02 \pm 0.45$	3.26 ± 0.69	ND	0.27 ± 0.14			
BB-7	ND	ND	1.23 ± 0.20	1.17 ± 0.34	2.40 ± 0.54	1.40 ± 1.19	0.14 ± 0.07			
BB-8	$0.84 \pm 0.14$	ND	$1.54 \pm 0.23$	1.77 ± 0.52	3.31 ± 0.75	2.72 ± 2.21	$0.19 \pm 0.10$			

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### Notes:

- 1. ND means not detected.
- 2. Average Minimum Detectable Activities (MDAs): U-238 = 1.58 pCi/g (63 keV peak) U-235 = 0.14 pCi/g (186 keV peak) Cs-137= 0.13 pCi/g (662 keV peak)

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3. Sample Numbers:

DTSC-# = Surface (0-6") soil samples DTSC-#A = Sub Surface (6-12") soil samples DTSC-#B = Sub Surface (12"-18") soil samples DTSC-#C = Sub Surface (18"-24") soil samples DTSC-#D = Sub Surface (24"-30") soil samples. Co-60 = 0.16 pCi/g (1173 keV peak) Th-228 = 0.21 pCi/g (238 keV peak) Th-232 = 0.43 pCi/g (911 keV peak)

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#### **Building Numbers Names**



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# Figure 6: Building 41 showing Demolished Portions

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Note: all Depths and locations are approximate



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Date: 05-19-04





Surveys Conducted by: G. Sayer & R. Stowell Dates: 05-05-04 to 07-21-04



4. On 05-20-04 this area was remediated and the subsequent reading was 23  $\mu R/hr$  on contact.

Surveys conducted by: R. Stowell & G. Sayer Dates: 05-18-04, 05-20-04 & 05-24-04



2. Results range from 14 to 22  $\mu$ R/hr.

Surveys Conducted by: G. Sayer & R. Stowell Dates: 05-21-04 to 06-30-04





(A 6"-12") and 141 ( A 6"-12", B 12"-16", C 16"-24").

- 4. Soil samples results are provided in Table 5 and Table 6.
- 5. Fixed Exposure Rate Measurement were taken at each soil sample location (see Table 6 for results).

Samples Collected by: S. Cowan, G. Sayer & R. Stowell Dates: 05-24-04 to 07-21-04





## $\alpha$ and $\beta$ Scans performed with 434 cm<sup>2</sup> gas flow proportional detectors

Instruments						
Model	Lud 2221	Lud 2221	Lud 2221	Lud Mod 12	Lud Mod 3	
Serial #	86302	154202	84459	73914	151348	
Cal Due Date	01/13/05	01/28/05	01/13/05	02/25/05	12/31/04	
Probe	100 cm² β	<b>434 cm<sup>2</sup> β</b>	434 cm <sup>2</sup> α	50 cm² α	2"x 2"	
Probe #	142547	149017	086215	076803	163169	
Efficiency	34.26%	30.39%	22.14%	22.52 %	n/a	
Bkg Concrete	880cp2m	1200-1500 cpm	0-40 cpm	0-20 cpm	10-18 μR/hr	
MDA Concrete	205dpm/100 <sup>2</sup>	n/a	n/a	209dpm/100cm <sup>2</sup>	n/a	

Technicians : J. Sullivan / S. Cowan Date : 09/27/04 - 10/04/04 Surface Scan measurement=



Wipe Location= (#)

Fixed measurement=

µ R/hr@ 1 meter (gamma), cpm (alpha) at surface, cp2m at surface (beta)



Figure 19: DTSC Permitted Area (NWPF-1) Confirmatory Survey, Soil Samples

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-WYC 2-		-WYC-12-	20/20	-WYC 23-		-WYC 33 -		-WYC 43 -	- 15/14	WYC 53-	13/13
WYC 3	20/20	WYC 13	24/20	WYC 24	27/22	WYC 34	18/16	WYC 44	19/17		
WYC 4	18/18	WYC 15	22/20	WYC 25	16/15	WYC 35	22/16	WYC 45	24/22	WYC 14	20/18
WYC 5	20/18	WYC 16	20/17	WYC 26	22/22	WYC 36	19/19	WYC 46	28/16		
WYC 6	20/18	WYC 17	20/20	WYC 27	24/24	WYC 37	16/16	WYC 47	27/18		
WYC 7	20/20	WYC 18	25/20	WYC 28	22/22	WYC 38	25/21	WYC 48	28/16	· · · -	
WYC 8	20/18	WYC 19	32/24	WYC 29	23/18	WYC 39	· ·	WYC 49	17/16		
WYC 9	16/14	WYC 20	25/18	WYC 30	23/20	WYC 40	25/20	WYC50	17/17		
WYC 10	18/20	WYC 21	25/22	WYC 31	23/17	WYC 41	24/22	WYC 51	15/15		
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# **General Atomics'**

Final Radiological Survey Report for the DTSC Permitted Area (NWPF-1 Site) of the Nuclear Waste Processing Facility

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Appendix A

Final Survey Plans for the NWPF-1 (DTSC Site) Land Area

Page 1 of 2

April 21, 2004

Approved By:

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Prepared By: W. T. LaBonte

tonzales 4/21/04

## Post D&D Sub-Surface Soil Sampling Plan for the DTSC Waste Yard

The NRC and State of California approved GA Site Decommissioning Plan requires sub-surface soil sampling in any area in which remediation was necessary. The purpose of this plan is to identify the sub-surface soil sampling, and ultimate analysis, to comply with this requirement.

This Survey Plan only covers sub-surface soil sampling in areas that remediation was required due to the discovery of elevated activity levels in surface (0-6") soil samples obtained during the performance of post D&D surveys.

See Figure 1 for the location of the Sorrento Valley South Land Area, and Figure 2 for the locations and depths of sub-surface soil sampling.

## Sub-Surface Soil Sampling Planned

A total of 44 soil samples in 10 locations will be taken in the DTSC Waste Yard as depicted in Figure 2.

Each of the soil samples taken should be approximately 1 kilogram in mass. The samples should be properly logged, labeled, tracked and packaged into plastic bags. All debris (i.e., grass, rocks, sticks, asphalt and foreign objects) must be removed from each sample. Each soil sample should be individually crushed to reduce large lumps, dried, placed into tarred marinelli beakers (filled to the top), weighed, sealed and transported to GA's Health Physics Laboratory for analysis.

Soil samples should be analyzed in GA's Health Physics Laboratory with a Canberra Low Sensitivity Gamma Spectroscopy MCA System using a high purity germanium detector. The system is calibrated using NIST traceable standards and performance checked daily. Soil samples should be counted for a minimum of 30 minutes each. A 30 minute count is sufficient to detect the radionuclides of concern at levels below GA's approved soil release criteria.

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#### **Release Criteria for Soils**

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

Enriched Uranium (U-234 + U-235)	30 pCi/g
Thorium (Th-228 + Th-232)	10 pCi/g
Depleted Uranium	35 pCi/g
Cs-137	15 pCi/g
Cs-134	10 pCi/g
Co-60	8 pCi/g
Eu-152	11 pCi/g

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

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

Where:  $C_i =$  The average

concentration levels of radionuclide *i* in the sample (above background).

 $L_i$  = The release criteria for radionuclide *i*.

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

#### **Documentation**

*Every* sample collected must be documented *on a daily basis* on a drawing showing the approximate locations surveyed.

Figure 1: Sorrento Valley South, Including the DTSC NWPF Site and Building 41



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Figu	re 2: DTSC Waste Yard Sub-Surface Soil Sample Locations
	riegon (1) (1) (1) (1) (1) (1) (1) (1)
1	0-6", 6"-12", 12"-18", 18"-24", 24"-30", and 30"-36"
2	0-6", 6"-12", 12"-18", 18"-24", 24"-30", and 30"-36"
3	0-6" and 6" 12"
<u> </u>	0-6" and 6"-12"
6	0-6" and 6"-12"
7	0-6" 6"-12" 12"-18" 18"-24" 24"-30" and 30"-36"
/1 8	0-6", 6"-12", 12"-18", 18"-24", 24"-30", and 30"-36"
i <u>9</u>	0-6", 6"-12", 12"-18", 18"-24", 24"-30", and 30"-36"
10	0-6", 6"-12", 12"-18". 18"-24". 24"-30", and 30"-36"
/	Note: all Depths and locations are approximate
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Page 1 of 5

May 4, 2004 Prepared By: W. T. LaBonte Approved By: <u>Haura Honzales</u> 5/4/04

#### Final Survey Plan for the NWPF DTSC Site

This Final Survey Plan is for the NWPF DTSC Site land areas. Portions of this land area formerly contained facilities to process and package low level radioactive waste for burial at approved disposal sites. These facilities have been demolished and packaged and/or disposed of as low level radioactive waste. A small piece of concrete that was part of the waste processing facility office floor was not removed and disposed of because there are plans to incorporate this into the remainder of building 41 facilities following unconditional release of this former Waste Yard site.

This Survey Plan covers Mainly open land areas. There are no sewer or storm drain systems traversing this land area.

This land area is approximately 31,950 ft<sup>2</sup> (~2971 m<sup>2</sup>). See Figure 1 and 2 for the location of the Sorrento Valley South Land Area and the NWPF DTSC site.

## History and Classification

## History

The NWPF DTSC Site (a.k.a. NWPF Waste Yard) has been the collection point for all radioactive waste generated at GA. The radioactive waste was processed and packaged for disposal at licensed/approved low level waste facilities. Following packaging, the radioactive material was staged in the waste yard awaiting shipment to the disposal facility.

During the D&D activities, the processing facilities, (compactor room, solidification room, etc.), which occupied a portion of Building 41, were dismantled, with the exception of a small piece of concrete slab that was part of the office area floor, and disposed of as low level radioactive waste. The remaining portion of Building 41 was surveyed in accordance with the approved GA Site D&D Plan. No activity above background was detected.

Asphalt paving was removed from the portions of the Waste Yard that are considered to be Suspect Affected Areas and is currently awaiting packaging for shipment to an approved low level radioactive waste disposal site.

A Post D&D survey was performed. During the performance of this survey, 4 areas requiring remediation were identified and remediated. Following remediation, sub-surface soil samples, (as far down as 3 feet below the post remediation surface) were taken in all remediated areas.

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## **Classification**

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There is a hillside to the east of the portion of the fenced off, bermed, DTSC Waste Yard previously used for low level radioactive waste storage. This hillside is heavily vegetated and was never used for the storage or handling of radioactive materials. This area is classified as a NON-Impacted Area for radiological survey purposes. This area is approximately 8570 ft<sup>2</sup> (~797 m<sup>2</sup>).

The <u>only</u> remaining portion of the Nuclear Waste Processing Facility is a portion of concrete slab that was the sub-flooring for the office area. No radioactive material was stored or handled in this office area. It is therefore classified as a **NON-Impacted Area** for radiological survey purposes. The concrete slab is approximately 780 ft<sup>2</sup> ( $\sim$ 73 m<sup>2</sup>).

The remaining portion of the land area is classified as a Suspect Affected Area. This land area is approximately 23,380 ft<sup>2</sup> (~ 2453 m<sup>2</sup>).

## Survey Objectives and Responsibility

The purpose of performing a final survey is to demonstrate that the radiological conditions within the NWPF DTSC Site Land Area satisfy the NRC and State of CA guidelines for release to unrestricted use. The objectives include (1) to show that the average surface contamination levels for each survey unit are within the authorized value, (2) to show that the maximum residual activity ("hot spot" area) do not exceed three times the average value in an area up to  $100 \text{ cm}^2$ , (3) that a reasonable effort has been made to clean removable contamination and fixed contamination and (4) that the exposure rates in occupiable locations are less than  $10 \mu$ R/hr above background measured at 1 meter above the surface.

Samples will be counted in the Health Physics laboratory (onsite). Surveys will be taken only by qualified Health Physics Technicians having a minimum of 3 years Health Physics Technician experience. The survey and final report documenting the survey will be performed by GA's Health Physics group.

## **Final Radiological Surveys Planned**

The radiological surveys, identified in the table below are the minimum survey requirements. If elevated levels are found, the area may have to be re-classified to a higher survey classification and additional surveys will be required. Notify Health Physics management immediately if levels above the alert levels are detected during the performance of this survey.

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## Final Radiological Surveys Planned for the NWPF DTSC Site Land Area

SurveyType/Action	Non-Impacted Area	Suspect Affected Area	
Grid Area	No	Yes, 10m x 10m grids.	
Concrete Surfaces <sup>(1)</sup> (Scan w/ 434 cm <sup>2</sup> alpha probe).	10% Scan of surface.	Not Applicable.	
Concrete Surfaces <sup>(1)</sup> (Scan w/ 434 cm <sup>2</sup> beta probe).	10% Scan of surface.	Not Applicable	
Minimum number of Fixed Measurements <sup>(3)</sup> <sup>(4)</sup>	Measurement every ~2 m Alternate between (1) a wipe <sup>(2)</sup> , (2) an alpha fixed measurement and (3) a beta fixed measurement on all concrete surfaces. Total measurements = 18 based on ~73 m <sup>2</sup> .	Not Applicable.	
µR/hr Readings (scans) @ surface	10% of accessible surfaces	100% of accessible surfaces	
µR/hr Readings (Fixed)	One (1) every ~ 7 m <u>plus</u> One (1) at each soil sample location	One (1) every ~ 2 m <u>plus</u> One (1) at each soil sample location.	
Surface (0-6") Soil Samples @ 1m from surface	8 surface (0-6") soil samples, see figure 3 for locations.	100 surface (0-6") samples based on a 5 m triangular grid sampling, see Figure-3 for locations.	
Sub-Surface Soil Samples.	None	In Areas that required remediation: See Sub- Surface Soil Sampling plan issued on 4/21/04. <u>Random Sub-Surface Sampling</u> : in the ten (10) areas identified in Figure-3, sample at 0-6", 6"-12", 12"-18", 18"-24", 24"-30", and 30"-36". A total of 60 samples.	
Miscellaneous	None	Sample tree roots from former Solidification Building Drum Wash Pit area and leaves from closest tree(s). Analyze by gamma spec.	

Clean surfaces to remove debris or dirt.

For removable measurements, take a 100 cm<sup>2</sup> wipe at each location and count using a low level alpha/beta counter. For the fixed measurements:

- For  $\alpha$  measurements; use either the hand held alpha counter (minimum of ~6 second count). Document all ٠ readings in cpm.
- For  $\beta$  measurements; take a 2 minute count using the 100 cm<sup>2</sup> gas flow proportional detector (beta) with the Model 2221 ratemeter. Document all readings and mark on a drawing the locations the readings were taken.

A "measurement" is either (1) a "fixed" radiation measurement representing total activity or (2) a wipe (removable activity).

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## Release Criteria (per GA Site Decommissioning Plan)

## **Direct Surface Scans**

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Characterization and pre/post remediation surveys performed on this land area and in the former processing facility included gamma spectroscopy analysis. The predominate isotope detected was Cs-137.

The release criteria for most beta/gamma emitters (which includes Cs-137) is:

## $5,000 \text{ dpm}/100 \text{ cm}^2$ , averaged over 1 m<sup>2</sup> area 15,000 dpm/100 cm<sup>2</sup>, maximum in a 100 cm<sup>2</sup> area 1,000 dpm/100 cm<sup>2</sup>, removable contamination.

## **Exposure Rate Measurements**

The release criteria for exposure rates measured at 1 m above the surface is 10  $\mu$ R/hr above background.

## Soil Criteria (soil limits apply to roof gravel, concrete rubble and asphalt rubble)

The release criteria for soil are specified in the Site Decommissioning Plan and summarized below. The values presented below are above background levels.

Cs-137	15 pCi/g
Co-60	8 pCi/g
Enriched Uranium (U-234 plus U-235)	30 pCi/g
Thorium (Th-232 plus Th-228)	10 pCi/g
Sr-90	1800 pCi/g

If multiple nuclides are present, the sum of the ratios of the concentration of each Radionuclide to its respective guideline must not exceed 1. If other nuclides are encountered, notify HP Management for release criteria.

## Alert Levels

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

## **On Concrete or Asphalt Surfaces**

Note: The Alert levels provided below are based on the background cpm plus the meter cpm value taking into account the instrument efficiency and probe surface area. The alert level for each instrument used must be determined prior to performing surveys. The background determination must be performed in building 13 or other HP management approved area.

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## Alpha Monitoring

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>100 cpm alpha using the large area (434 cm<sup>2</sup>) probe. If >100 cpm, check with a hand held alpha meter. >60 cpm using a hand held alpha probe, notify Health Physics Management.

## Beta Scanning using 434 cm<sup>2</sup> probe

 $> \sim 300$  cpm above background using any other 434 cm<sup>2</sup> probe.

## Beta Scanning using a 15 cm<sup>2</sup> pancake GM detector

> ~ 80 cpm above background.

## **Exposure Rate Measurement**

Exposure rate measurements at contact (1-2" above the surface) and at 1m above the surface: 20  $\mu$ R/hr.

## Soil Samples

Any Radionuclide above natural background levels (see HP-40 for background levels). All soil sample results must be reviewed by Laura Gonzales or Bill LaBonte.

## **Documentation**

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

Figure 1: Main Site and Sorrento Valley Site

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Page 1 of 6

May 4, 2004

Revised June 3, 2004 Prepared By: W. T. LaBonte What the Approved By: <u>Aquita Horana torian</u> L. Q. Gonzales Q

## **Revision**<sub>1</sub>

#### Final Survey Plan for the NWPF DTSC Site

This Final Survey Plan is for the NWPF DTSC Site land areas. Portions of this land area formerly contained facilities to process and package low level radioactive waste for burial at approved disposal sites. These facilities have been demolished and packaged and/or disposed of as low level radioactive waste. A small piece of concrete that was part of the waste processing facility office floor was not removed and disposed of because there are plans to incorporate this into the remainder of building 41 facilities following unconditional release of this former\_Waste Yard site.

This Survey Plan covers Mainly open land areas. There are no sewer or storm drain systems traversing this land area.

This land area is approximately 31,950 ft<sup>2</sup> (~2971 m<sup>2</sup>). See Figure 1 and 2 for the location of the Sorrento Valley South Land Area and the NWPF DTSC site.

#### **Reason for Revision**

During the performance of the final survey in accordance with the original Final Survey Plan, elevated activity levels were discovered on the heavily vegetated hillside originally classified as a Non-Impacted area. In addition, a drainage pipe, apparently installed in the past to provide storm water drainage for the paved areas in the lower elevations of this land area, was discovered. This revision re-classifies the hillside as a suspect affected area and increases the survey requirements to satisfy the up graded classification survey requirements and incorporates additional survey requirements following the removal of the discovered drainage pipe.

#### **History and Classification**

#### History

Y

The NWPF DTSC Site (a.k.a. NWPF Waste Yard) has been the collection point for all radioactive waste generated at GA. The radioactive waste was processed and packaged for disposal at licensed/approved low level waste facilities. Following packaging, the radioactive material was staged in the waste yard awaiting shipment to the disposal facility.

During the D&D activities, the processing facilities, (compactor room, solidification room, etc.), which occupied a portion of Building 41, were dismantled, with the exception of a small piece of concrete

R:waste yard/DTSC final survey plan rev 1.wpd

slab that was part of the office area floor, and disposed of as low level radioactive waste. The remaining portion of Building 41 was surveyed in accordance with the approved GA Site D&D Plan. No activity above background was detected.

Asphalt paving was removed from the portions of the Waste Yard that are considered to be Suspect Affected Areas and is currently awaiting packaging for shipment to an approved low level radioactive waste disposal site.

A Post D&D survey was performed. During the performance of this survey, 4 areas requiring remediation were identified and remediated. Following remediation, sub-surface soil samples, (as far down as 3 feet below the post remediation surface) were taken in all remediated areas.

There is a hillside to the east of the portion of the fenced off, bermed, DTSC Waste Yard previously used for low level radioactive waste storage. This hillside is heavily vegetated and was never used for the storage or handling of radioactive materials. However, during the performance of the final survey ion accordance with the original Final Survey Plan, issued on May 4, 2004, elevated soil activity levels were discovered in this area.

A Health Physics technician noticed an open end for a buried pipe while performing a surveillance tour of the former waste yard and Sorrento Valley South land areas. Further investigation indicated that this pipe open end was a buried drainage pipe used to divert storm water from the DTSC land areas to protect the asphalt paving. The pipe was a continuous run of drainage tubing encased in loose stone fill material. The pipe was excavated and surveyed No activity above natural background was detected on, or in, the pipe... All material removed from the trench during excavation was disposed of as low level radioactive waste because of the State of California moratorium on sending decommissioning materials to local land fill sites.. The excavation trench resulting from the removal of this pipe was scanned with a 2" x 2" NaI(TI) detector. No activity above natural background was detected. soil samples taken at the pipe discharge end were not distinguishable from natural background.

## **Classification**

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The <u>only</u> remaining portion of the Nuclear Waste Processing Facility is a portion of concrete slab that was the sub-flooring for the office area. No radioactive material was stored or handled in this office area. It is therefore classified as a **NON-Impacted Area** for radiological survey purposes. The concrete slab is approximately 780 ft<sup>2</sup> ( $\sim$ 73 m<sup>2</sup>).

All of the open land area is classified as a Suspect Affected Area. This land area is approximately  $31,950 \text{ ft}^2$  (~ 2971 m<sup>2</sup>).

## Survey Objectives and Responsibility

The purpose of performing a final survey is to demonstrate that the radiological conditions within the NWPF DTSC Site Land Area satisfy the NRC and State of CA guidelines for release to unrestricted use. The objectives include (1) to show that the average surface contamination levels for each survey

R:waste yard/DTSC final survey plan rev 1.wpd

unit are within the authorized value, (2) to show that the maximum residual activity ("hot spot" area) do not exceed three times the average value in an area up to  $100 \text{ cm}^2$ , (3) that a reasonable effort has been made to clean removable contamination and fixed contamination and (4) that the exposure rates in occupiable locations are less than 10  $\mu$ R/hr above background measured at 1 meter above the surface.

Samples will be counted in the Health Physics laboratory (onsite). Surveys will be taken only by qualified Health Physics Technicians having a minimum of 3 years Health Physics Technician experience. The survey and final report documenting the survey will be performed by GA's Health Physics group.

#### **Final Radiological Surveys Planned**

The radiological surveys, identified in the table below are the minimum survey requirements. If elevated levels are found, the area may have to be re-classified to a higher survey classification and additional surveys will be required. Notify Health Physics management immediately if levels above the alert levels are detected during the performance of this survey.

Page 4 of 6

## Final Radiological Surveys Planned for the NWPF DTSC Site Land Area

SurveyType/Action	Non-Impacted Area	Suspect Affected Area
Grid Area	No	Yes, 10m x 10m grids.
Concrete Surfaces <sup>(1)</sup> (Scan w/ 434 cm <sup>2</sup> alpha probe).	10% Scan of surface.	Not Applicable.
Concrete Surfaces <sup>(1)</sup> (Scan w/ 434 cm <sup>2</sup> beta probe).	10% Scan of surface.	Not Applicable
Minimum number of Fixed Measurements <sup>(3)</sup> <sup>(4)</sup>	Measurement every ~2 m Alternate between (1) a wipe <sup>(2)</sup> , (2) an alpha fixed measurement and (3) a beta fixed measurement on all concrete surfaces. Total measurements = 18 based on ~73 m <sup>2</sup> .	Not Applicable.
µR/hr Readings (scans) @ surface	10% of accessible surfaces	100% of accessible surfaces
µR/hr Readings (Fixed)	One (1) every ~ 7 m <u>.</u>	One (1) every ~ 2 m <u>plus</u> One (1) at each soil sample location.
Surface (0-6") Soil Samples @ 1m from surface	Not Applicable	<ul> <li>135 surface (0-6") samples based on a 5 m triangular grid sampling, see Figure-3 for locations. Note: there are seven (7) additional samples from the un-remediated hillside original FSP requirements.</li> </ul>
Sub-Surface Soil Samples.	Not Applicable	In Areas that required remediation: See Sub- Surface Soil Sampling plan issued on 4/21/04. Random Sub-Surface Sampling: in the ten (10) areas identified in Figure-3, sample at 0-6", 6"-12", 12"-18", 18"-24", 24"-30", and 30"-36". A total of 60 samples. Drainage Pipe Trench take soil samples 0-6" beneath the removed drainage pipe every 10 feet(~ 3m) in the excavation trench.
Miscellaneous	None	Sample tree roots from former Solidification Building Drum Wash Pit area and leaves from closest tree(s). Analyze by gamma spec.

R:waste yard/DTSC final survey plan rev 1.wpd

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#### Table Notes

- 1. Clean surfaces to remove debris or dirt.
- 2. For removable measurements, take a 100 cm2 wipe at each location and count using a low level alpha/beta counter.
- 3. For the fixed measurements:
  - For  $\alpha$  measurements; use either the hand held alpha counter (*minimum* of ~6 second count). Document all readings in cpm.
  - For  $\beta$  measurements; take a 2 minute count using the 100 cm2 gas flow proportional detector (beta) with the Model 2221 ratemeter. Document all readings and mark on a drawing the locations the readings were taken.
- 4. A "measurement" is either (1) a "fixed" radiation measurement representing total activity or (2) a wipe (removable activity).

#### Release Criteria (per GA Site Decommissioning Plan)

#### **Direct Surface Scans**

Characterization and pre/post remediation surveys performed on this land area and in the former processing facility included gamma spectroscopy analysis. The predominate isotope detected was Cs-137.

The release criteria for most beta/gamma emitters (which includes Cs-137) is:

# $5,000 \text{ dpm}/100 \text{ cm}^2$ , averaged over 1 m<sup>2</sup> area 15,000 dpm/100 cm<sup>2</sup>, maximum in a 100 cm<sup>2</sup> area 1,000 dpm/100 cm<sup>2</sup>, removable contamination.

#### **Exposure Rate Measurements**

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

#### Soil Criteria (soil limits apply to roof gravel, concrete rubble and asphalt rubble)

The release criteria for soil are specified in the Site Decommissioning Plan and summarized below. The values presented below are above background levels.

Cs-137	15 pCi/g
Co-60	8 pCi/g
Enriched Uranium (U-234 plus U-235)	30 pCi/g
Thorium (Th-232 plus Th-228)	10 pCi/g
Sr-90	1800 pCi/g

If multiple nuclides are present, the sum of the ratios of the concentration of each Radionuclide to its respective guideline must not exceed 1. If other nuclides are encountered, notify HP Management for release criteria.

#### Alert Levels

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

R:waste yard/DTSC final survey plan rev 1.wpd

## **On Concrete or Asphalt Surfaces**

Note: The Alert levels provided below are based on the background cpm plus the meter cpm value taking into account the instrument efficiency and probe surface area. The alert level for each instrument used must be determined prior to performing surveys. The background determination must be performed in building 13 or other HP management approved area.

## Alpha Monitoring

>100 cpm alpha using the large area (434 cm<sup>2</sup>) probe. If >100 cpm, check with a hand held alpha meter. >60 cpm using a hand held alpha probe, notify Health Physics Management.

## Beta Scanning using 434 cm<sup>2</sup> probe

 $> \sim 300$  cpm above background using any other 434 cm<sup>2</sup> probe.

## Beta Scanning using a 15 cm<sup>2</sup> pancake GM detector

> ~ 80 cpm above background.

## **Exposure Rate Measurement**

Exposure rate measurements at contact (1-2" above the surface) and at 1m above the surface: 20  $\mu$ R/hr.

## Soil Samples

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Any Radionuclide above natural background levels (see HP-40 for background levels). All soil sample results must be reviewed by Laura Gonzales or Bill LaBonte.

## **Documentation**

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

Figure 1: Main Site and Sorrento Valley Site

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Page 1. of 2

May 20, 2004 Prepared By: W. T. LaBonte

Janua Q Jonzales Approved By:

#### Final Survey Plan for the NWPF DTSC Site

#### Supplement -1

This supplement to the NWPF DTSC Site Final Survey Plan covers <u>Only</u> the additional surveying required in the areas where additional remediation was performed due to elevated radiation dose rate measurements discovered during the exposure rate surface scans.

These requirements are in addition to the survey requirements identified in the NWPF DTSC Site Final Survey Plan.

#### Purpose

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During the performance of radiation dose rate surface scan surveys, elevated radiation levels were detected in four areas as identified in figure-1. The numbers identified in the four (4) major areas depicted in figure-1, were soil samples collected at the location of each elevated reading. This figure also identifies the radiation levels (contact with the surface) found initially and after remediation.

The purpose of this survey is to determine if the remediation actions performed were effective and to satisfy the 100% surface scan survey requirements identified in the Final Survey Plan issued on May 4, 2004.

#### **Classification**

This entire survey area, as identified on Figure-1, is within the Suspect Affected Survey Area identified in the Final Survey Plan.

#### Survey Objectives and Responsibility

The purpose of performing a final survey is to demonstrate that the radiological conditions within the NWPF DTSC Site Land Area satisfy the NRC and State of CA guidelines for release to unrestricted use. The objectives include (1) to show that the average surface contamination levels for each survey unit are within the authorized value, (2) to show that the maximum residual activity ("hot spot" area) do not exceed three times the average value in an area up to  $100 \text{ cm}^2$ , (3) that a reasonable effort has been made to clean removable contamination and fixed contamination and (4) that the exposure rates in occupiable locations are less than  $10 \mu \text{R/hr}$  above background measured at 1 meter above the surface.

R:SVS Post D&D.wpd
Samples will be counted in the Health Physics laboratory (onsite). Surveys will be taken only by qualified Health Physics Technicians having a minimum of 3 years Health Physics Technician experience. The survey and final report documenting the survey will be performed by GA's Health Physics group.

# **Supplemental Surveys Planned**

Perform a 100% surface scan of the four (4) areas identified on Figure-1 with a 2" x 2" NaI(Tl) detector held within 1" of the surface.

# Release Criteria (per GA Site Decommissioning Plan)

# Exposure Rate Measurements

The release criteria for exposure rates measured at 1 m above the surface is 10  $\mu$ R/hr above background.

# Alert Levels

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

# **Exposure Rate Measurement**

Exposure rate measurements at contact (1-2" above the surface) and at 1m above the surface: 20  $\mu$ R/hr.

# **Documentation**

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



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Sample No. Post D&D	Initial μR/hr Contact	Post µR/hr Contact	Notes
106	28	23	Removed several shovelfuls of dirt, no Hot Particles detected.
107	27	21	Several backhoe scoops removed.
109	27	21	Removed a few shovelfuls of dirt, no Hot Particles detected.
110	40	NA	Sample 110 is a sample of the soil removed from this location, $\mu$ R/hr readings on sample bag.
112	60	22	130 μR/hr Hot Particle found near the surface.
113	33	21	40 μR/hr Hot Particle found near the surface.
114	40	22	45 μR/hr Hot Particle found at the surface.
116	27	24	Two backhoe scoops removed.

A-24

# **General Atomics'**

# Final Radiological Survey Report for the

DTSC Permitted Area (NWPF-1 Site)

of the Nuclear Waste Processing Facility

**Appendix B** 

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. | \_\_\_ Uranium Isotopic and Strontium-90 Analysis Results

TSC-WASTE YARD



STL St. Louis 13715 Rider Trail North Earth City, MO 63045

Tel: 314 298 8566 Fax: 314 298 8757 www.stl-inc.com

# ANALYTICAL REPORT

General Atomics

Lot #: F4H050281

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Bradley Hoag

General Atomics 39 Trailer 11222 Flintkote San Diego, CA 92121

SEVERN TRENT LABORATORIES, INC.

Scheibel

Project Manager

August 18, 2004



LOT# F4H050281

B-1

Severn Trent Laboratories, Inc.

#### Case Narrative LOT NUMBER: F4H050281

This report contains the analytical results for the 23 samples received under chain of custody by STL St. Louis on August 5, 2004. These samples are associated with your General Atomics project.

The analytical results included in this report meet all applicable quality control procedure requirements.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by STL St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Observations/Nonconformances

1. Sample Receipt and Log In

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

II. Sample Analysis

There were no observations or nonconformances associated with the analysis of these samples.

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# **METHODS SUMMARY**

#### F4H050281

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Isotopic Uranium by Alpha Spectroscopy Percent Moisture Strontium 90 by GFPC	EML A-01-R MOD MCAWW 160.3 MOD EML SR-03-RC MO	MCAWW 160.3 MOD
References:		

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

#### MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

LOT# F4H050281

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# SAMPLE SUMMARY

#### F4H050281

			SAMPLED	SAMP
<u>WO #</u>	SAMPLE#	CLIENT SAMPLE ID	DATE	TIME
GMJXW	001	DTSC-14	05/26/04	09:00
GMJ03	002	DTSC-14A	06/01/04	09:00
GMJ06	003	DTSC-26	06/01/04	09:30
GMJ09	004	DTSC-69	06/08/04	09:00
GMJ1M	005	DTSC-45	06/08/04	09:30
GMJ1V	006	DTSC-58	06/08/04	10:00
GMJ11	007	DTSC-74	06/10/04	09:00
GMJ13	800	DTSC-81	06/10/04	09:30
GMJ2V	009	DTSC-82	06/10/04	10:00
GMJ20	010	DTSC-91	06/11/04	09:00
GMJ25	011	DTSC-92	06/11/04	09:30
GMJ3E	012	DTSC-96	06/11/04	10:00
GMJ6P	013	DTSC-101	06/11/04	10:30
GMJ6R	014	DTSC-125	06/15/04	09:00
GMJ6V	015	DTSC-130	06/15/04	09:30
GMJ66	016	DTSC-133	06/15/04	10:00
GMJ67	017	DTSC-163	06/18/04	09:00
GMJ69	018	DTSC-169	06/21/04	09:00
GMJ7D	019	DTSC-172	06/21/04	09:30
GMJ7G	020	DTSC-178	06/24/04	09:00
GMJ7J	021	DTSC-188	07/06/04	09:00
GMJ7L	022	DTSC-200	07/07/04	09:00
GMJ70	023	DT5C-202	07/07/04	09:30

#### NOTE (S) :

- The analytical results of the samples listed above are presented on the following pages.

- All calculations are performed before rounding to avoid round-off errors in calculated results.

- Results noted as "ND" were not detected at or above the stated limit.

- This report must not be reproduced, except in full, without the written approval of the laboratory.

- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor,

paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

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# GENERAL ATOMICS

### Client Sample ID: DTSC-14

#### Severn Trent Laboratories - Radiochemistry

Lab Sample ID: Work Order: Matrix:	F4H050281-001 GMJXW Solid			Date Collected: Date Received:	05/2 08/0	6/04 09 5/04 09	900 915	
Parameter	Result	Qual	Total Uncert. (2 g+/-)	xpc	Prop Date	Analysis Date	Batch #	YId N
ISO URANIUM (SHO	RT CT) DOE A-01-R	MOD		pCi/g	J-01-R	MOD		
Uranium 234	11.2		1.2	0.1	08/07/04	08/11/04	4220064	76
Uranium 235	0.73	J	0.23	0.1	08/07/04	08/11/04	4220064	76
Uranium 238	1.52		0.31	0.08	08/07/04	08/11/04	4220064	76

NOTE (S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only. Bold results are greater than the MDC

J Result is greater than sample detection limit but less than stated reporting limit.

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### GENERAL ATOMICS

### Client Sample ID: DTSC-14 DUP

#### Severn Trent Laboratories - Radiochemistry

Lab Sample ID: Work Order: Matrix:	F4H050281-0 GMJXW SOLID	01X		Date Collected: Date Received:	05/2 08/0	6/04 09 5/04 09	900 915	
Parameter	Result	Qual	Total Uncert. (2 c+/-)	жос	<b>Frep</b> Date	Analysis Date	Batch #	¥ld %
ISO URANIUM (SHO	RT CT) DOE A-O	1-R MOD		pCi/g	<b>A-01-R</b>	MOD		
Uranium 234	12.0		1.2	0.1	08/07/04	08/11/04	4220064	108
<b>Vranium 235</b>	0.50	J	0.18	0.09	08/07/04	08/11/04	4220064	108
Uranium 238	1.81		0.32	0.08	08/07/04	08/11/04	4220064	108

NOTE (S)

Data are incomplete without the case marrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

J Result is greater than sample detection limit but less than stated reporting limit.

Uranium 238

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### **GENERAL ATOMICS**

### Client Sample ID: DTSC-14A

#### Severn Trent Laboratories - Radiochemistry

Lab Sample ID: Work Order: Matrix:	F4H050281-00 GMJ03 SOLID	2		Date Collecte Date Received	d: 06/ l: 08/	/01/04 0: /05/04 0:	900 915	
Parameter	Result	Qual	Total Uncert. (2 c+/-)	IDC	<b>Prep</b> Date	Analysis Date	Jatch #	YId 1
ISO URANIUN (SHO	RT CT) DOE A-01	-R NOD	<b>P</b>	Ci/g	<b>λ-01</b> -	R MOD		
Uranium 234	5.66		0.72	0.14	08/07/	04 08/11/04	4220064	75
Uranium 235	0.37	J	0.17	0.11	08/07/	04 08/11/04	4220064	75

0.1

08/07/04 08/11/04 4220064

75

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NOTE (S)

Data are incomplete without the case narrative.

NDC is determined by instrument performance only.

Bold results are greater than the NDC

J Result is greater than sample detection limit but less than stated reporting limit.

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### GENERAL ATOMICS

# Client Sample ID: DTSC-26

#### Severn Trent Laboratories - Radiochemistry

	Lab Sample ID: Work Order: Matrix:	F4H050281-00 GMJ06 SOLID	3		Date Collected: Date Received:	06/0 08/0	1/04 09 5/04 09	930 915	
	Parameter	Regult	Qual	Total Uncert. (2 g+/-)	MC	Prep Date	Analysis Date	Batch #	TId N
. •	ISO URANIUM (SHO)	RT CT) DOE A-01	-R MOD	p(	Ci/g	A-01-R	XOD		
	Uranium 234	11.0		1.3	0.1	08/07/04	08/11/04	4220064	69
-	Uranium 235	0.56	3	0.22	0.15	08/07/04	08/11/04	4220054	69
	Uranium 238	2.13		0.41	0.13	08/07/04	08/11/04	4220064	69

NOTE (S)

Data are incomplete without the case narrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

Result is greater than sample detection limit but less than stated reporting limit. J

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### GENERAL ATOMICS

### Client Sample ID: DTSC-69

#### Severn Trent Laboratories - Radiochemistry

Lab Sample ID Work Order: Matrix:	: F4H050281-004 GMJ09 SOLID	4		Date Collected: Date Received:	06/0 08/0	8/04 09 5/04 09	900 915	
Perameter	Result	Qual	Total Uncert. (2 g+/-)	юc	Prep Date	Analysis Date	Batch #	71d %
ISO URANIUM (SH	ORT CT) DOE A-01	-R NOD	P	Ci/g	A-01-R	MOD		
Uranium 234	3.20		0.56	0.13	08/07/04	08/11/04	4220064	56
Uranium 235	0.20	J	0.14	0.12	08/07/04	08/11/04	4220064	56
Uranium 238	0.78	J	0.25	0.12	08/07/04	08/11/04	4220064	56
SR-90 BY GFPC D	OE SR-03-RC MOD		F	oCi/g	SR-03-1	RC NOD		
Strontium 90	-0.42	υ	0.34	0.64	08/10/04	08/17/04	4223086	60

NOTE (S)

Data are incomplete without the case marrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

Result is greater than sample detection limit but less than stated reporting limit. 3

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# GENERAL ATOMICS

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### Client Sample ID: DTSC-69 DUP

#### Severn Trent Laboratories - Radiochemistry

Lab Sample ID: Work Order: Matrix:	F4H050281-004 GMJ09 SOLID	X		Date Collected Date Received:	: 06/ 08/	06/08/04 0 08/05/04 0		
Parameter	Result	Qual	Total Uncert. (2 g+/-)	NDC	Prep Date	Analysi: Date	S Batch #	YId N
SR-90 BY GFPC DO	SR-03-RC MOD		3	ci/g	SR-03	-RC NOD		
Strontium 90	0.17	U	0.28	0.46	08/10/0	4 08/17/	04 4223086	70

NOTE (S)

Data are incomplete without the case narrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

U Result is less than the sample detection limit.

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### GENERAL ATOMICS

### Client Sample ID: DTSC-45

#### Severn Trent Laboratories - Radiochemistry

	Lab Sample ID: Work Order: Matrix:	F4H050281-005 GMJ1M SOLID			Date Collected: Date Received:	06/ 08/	08/04 05/04	0930 0915	
	Parameter	Result	Qual	Total Uncert. (2 <sub>C+</sub> /-)	XDC	<b>Prep</b> Date	Analysi: Date	Batch #	rld %
,	SR-90 BY GFPC DOE Strontium 90	8R-03-RC MOD 0.32	U	0.31	0.51	SR-03 08/10/0	-RC MOD	04 4223086	65
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NOTE(S)

\_\_\_\_ Data are incomplete without the case narrative.

NDC is determined by instrument performance only. Bold results are greater than the MDC

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# GENERAL ATOMICS

### Client Sample ID: DTSC-58

#### Severn Trent Laboratories - Radiochemistry

	Lab Sample ID: Work Order: Matrix:	F4H050281-006 GMJ1V SOLID	;		Date Collected: Date Received:	06/0 08/0	8/04 10 5/04 09	000 915	
	Parameter	Regult	Qual	Total Uncert. (2 c+/-)	NDC	Prep Date	Analysis Date	Batch #	¥ld ¥
· -	SR-90 BY GPPC DO	SR-03-RC MOD		]	pCi/g	SR-03-1	RC MOD	_	
	Strontium 90	0.19	U	0.28	0.47	08/10/04	08/17/04	4223086	79

NOTE (S)

Data are incomplete without the case marrative.

MDC is determined by instrument performance only. Bold results are greater than the NDC

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# GENERAL ATOMICS

### Client Sample ID: DTSC-74

#### Severn Trent Laboratories - Radiochemistry

•	Lab Sample ID: Work Order: Matrix:	F4H050281-007 GMJ11 SOLID			Date Collected Date Received:	: 06/ 08/	06/10/04 0 08/05/04 0		
	Perapeter	Result	Qual	Total Uncert. (2 c+/-)	<b>XDC</b>	Prep Date	Analys: Date	is Batch ♥	Yld %
	SR-90 BY GFPC DOE Strontium 90	SR-03-RC MOD 0.33	U	0.41	0.68	SR-03 08/10/0	-RC MOD	/04 4223086	54

NOTE (S)

- Data are incomplete without the case marrative.

MDC is determined by instrument performance only. Bold results are greater than the MDC

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# GENERAL ATOMICS

#### Client Sample ID: DTSC-81

#### Severn Trent Laboratories - Radiochemistry

Lab Sample ID: Work Order: Matrix:	F4H050281-008 GMJ13 SOLID	F4H050281-008 GMJ13 SOLID		Date Collected: Date Received:	06/10/04 093 08/05/04 093		0930 0915	
Parameter	Result	Qual	Total Uncert. (2 0+/-)	) MDC	Prep Date	Analysi Date	≡ Batch ∉	<b>71d %</b>
SR-90 BY GFPC DO Strontium 90	E SR-03-RC MOD 0.13	υ	0.30	p <b>Ci/g</b> 0.51	SR-03- 08/10/0	-RC NOD 4 08/17/	04 4223086	70

NOTE (S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only. Bold results are greater than the MDC

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### GENERAL ATOMICS

### Client Sample ID: DTSC-82

#### Severn Trent Laboratories - Radiochemistry

	Lab Sample ID: Work Order: Matrix:	F4H050281-009 GMJ2V SOLID			Date Collected: Date Received:	06/1 08/0	0/04 10 5/04 0	000 915	
_	Parameter	Result	Qual	Total Dncert. (2 c+/-)	KOC	Frep Date	Analysis Date	Batch #	YId N
-	SR-90 BY GFPC DOP Strontium 90	8R-03-RC MOD 0.27	υ	0.29	pCi/g 0.47	<b>SR-03-</b> 08/10/04	RC MOD 08/17/04	4223086	74

NOTE (S)

Data are incomplete without the case parrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

U Result is less than the sample detection limit.

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# GENERAL ATOMICS

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# Client Sample ID: DTSC-91

### Severn Trent Laboratories - Radiochemistry

Lab Sample ID: Work Order: Matrix:	F4H050281-010 GMJ20 Solid			Date Collected: Date Received:	06/11/04 09 08/05/04 09		900 915	
Parabeter	Result	Qual	Total Uncert. (2 g+/-)	<b>X</b> DC	<b>Fre</b> p Date	Analysis Date	Batch #	YId %
SR-90 BY GPPC DOB Strontium 90	SR-03-RC NOD 0.45	υ	0.37	Ci/g 0.58	8R-03- 08/10/04	RC NOD	4223085	60

NOTE (S)

Data are incomplete without the case marrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

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# GENERAL ATOMICS

#### Client Sample ID: DTSC-92

#### Severn Trent Laboratories - Radiochemistry

-	Lab Sample ID: Work Order: Matrix:	F4H050281-011 GMJ25 SOLID			Date Collected: Date Received:	06/: 08/0	L1/04 0: 05/04 0:	930 915	
-	Parameter	Result	Qual	Total Uncert. (2 c+/-)	MDC	Prep Date	Analysis Date	Jatch #	Yld %
•	SR-90 BY GFPC DOR	SR-03-RC NOD		5	oCi/g	8R-03-	RC MOD		
•	Strontium 90	-0.12	U	0.32	0.57	08/10/04	08/17/04	4223086	63

NOTE (S)

Data are incomplete without the case marrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

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# GENERAL ATOMICS

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### Client Sample ID: DTSC-96

#### Severn Trent Laboratories - Radiochemistry

	Lab Sample ID: Work Order: Matrix:	F4H050281-012 GMJ3E Solid			Date Collected Date Received:	06/11/04 08/05/04		1000 0915	
•	Parameter	Result	Qual (	Total Uncert. (2 c+/-)	300C	Frep Date	Analysi Date	S Jatch Ø	YId S
	SR-90 BY GFPC DOE Strontium 90	8R-03-RC NOD -0.12	υ	0.27	0.49	SR-03- 08/10/0	-RC MOD 4 08/17/	04 4223086	66

NOTE (S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only. Bold results are greater than the MDC

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### GENERAL ATOMICS

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### Client Sample ID: DTSC-101

#### Severn Trent Laboratories - Radiochemistry

Lab Sample ID: Work Order: Matrix:	F4H050281-013 GMJ6P SOLID			Date Collected Date Received:	l: 06/ 08/	06/11/04 1 08/05/04 0		
Parameter	Result	Qual	Total Uncert. (2 c+/-)	XDC	Prep Date	Analys: Date	ls Batch #	YIG &
SR-90 BY GFPC DOE Strontium 90	SR-03-RC NOD 0.23	υ	J 0.26	Ci/g 0.43	SR-03 08/10/0	-RC MOD	/04 4223086	76

NOTE (S)

Data are incomplete without the case narrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

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# GENERAL ATOMICS

#### Client Sample ID: DTSC-125

#### Severn Trent Laboratories - Radiochemistry

Lab Sample ID: Work Order: Matrix:	F4H050281-014 GMJ6R SOLID	14		Date Collected: Date Received:	06/ 08/	06/15/04 09 08/05/04 09		
Parameter	Result	Qual	Total Ducert. (2 c+/-)	жос	7rep Date	Analysis Date	Batch #	¥1d %
SR-90 BY GFPC DO	E SR-03-RC MOD		1	pCi/g	BR-03-	RC NOD		
Strontium 90	-0.01	υ	0.31	0.55	08/10/0	4 08/17/0	04 4223086	64

NOTE (S)

\_ Data are incomplete without the case marrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

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# GENERAL ATOMICS

#### Client Sample ID: DTSC-133

#### Severn Trent Laboratories - Radiochemistry

:	Lab Sample ID: Work Order: Matrix:	F4H050281-016 GMJ66 SOLID			Date Collected: Date Received:	06/1 08/0	15/04 1 05/04 0	000 915	
; [	Parameter	Result	Qual	Total Uncert. (2 c+/-)	юс	Prep Date	Analysis Date	Batch #	TId %
; ; ·	SR-90 BY GYPC DOB Strontium 90	8R-03-RC MOD 0.05	υ	1 0.31	0.53	SR-03- 08/10/04	RC MOD 08/17/04	4223086	76

NOTE (S)

Data are incomplete without the case marrative.

NDC is determined by instrument performance only. Bold results are greater than the MDC

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### GENERAL ATOMICS

### Client Sample ID: DTSC-163

#### Severn Trent Laboratories - Radiochemistry

_	Lab Sample ID: Work Order: Matrix:	F4H050281-017 GMJ67 SOLID			Date Collected: Date Received:	06/1 08/0	.8/04 0 5/04 0	900 915	
2	Parameter	Result	Qual	Total Uncert. (2 g+/-)	xoc	Prep Date	Analysis Date	Batch #	71d %
	SR-90 BY GFPC DO	SR-03-RC NOD		1	pCi/g	SR-03-	RC NOD		
÷	Strontium 90	0.07	U	0.36	0.61	08/10/04	08/17/0	4223086	78

NOTE (S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only. Bold results are greater than the NDC

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# GENERAL ATOMICS

### Client Sample ID: DTSC-169

#### Severn Trent Laboratories - Radiochemistry

•	Lab Sample ID: Work Order: Matrix:	P4H050281-018 GMJ69 SOLID			Date Collected: Date Received:	06/2 08/0	21/04 05/04	0900 0915	
	Parameter	Result	Qual	Total Uncert. (2 g+/-)	жос	Prep Date	Analysis Date	Batch #	YIG &
	SR-90 BY GFPC DOB Strontium 90	SR-03-RC NOD 0.07	υ	1	0.50	SR-03- 08/10/04	RC MOD 08/17/0	4 4223086	80

NOTE (S)

Data are incomplete without the case narrative.

KDC is determined by instrument performance only. . Bold results are greater than the MDC

U Result is less than the sample detection limit.

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# GENERAL ATOMICS

### Client Sample ID: DTSC-172

#### Severn Trent Laboratories - Radiochemistry

_	Lab Sample ID: Work Order: Matrix:	F4H050281-019 GMJ7D SOLID			Date Collected: Date Received:	06/2 08/0	1/04 09 5/04 09	930 915	
L	Parameter	Result	Qual	Total Uncert. (2 g+/-)	XOC	Prep Date	Analysis Date	Batch #	YId N
-	SR-90 BY GYPC DOE Strontium 90	SR-03-RC MOD 0.20	υ	p 0.32	0.54	SR-03-1 08/10/04	RC MOD 08/17/04	4223086	73

NOTE (S)

Data are incomplete without the case narrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

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### GENERAL ATOMICS

### Client Sample ID: DTSC-178

#### Severn Trent Laboratories - Radiochemistry

· ·	Lab Sample ID: Work Order: Matrix:	F4H050281-020 GMJ7G SOLID			Date Collected: Date Received:	06/24/04 0 08/05/04 0	900 915	
	Parameter	Result	Qual	Total Uncert. (2 c+/-)	жас	Prep Analysis Date Date	Batch #	rid N
	SR-90 BY GFPC DOE Strontium 90	SR-03-RC HOD -0.37	υ	1 0.44	0.79	SR-03-RC NOD 08/10/04 08/17/0	4 4223086	63

NOTE (S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only. Bold results are greater than the NDC

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	C:	lient	Sample	ID:	DTSC-18	8			
	Severn	Trent	Laborato	ries ·	- Radioche	mistry			
Lab Sample ID: Work Order: Matrix:	F4H050281-021 GMJ7J SOLID			Dat Dat	e Collected: e Received:	07/0 08/0	6/04 09 5/04 09	000 915	
Parameter	Result	Qual	Total Uncert. (2 c+/-)		XDC	Prop Date	Analysis Date	Batch #	Yld
SR-90 BY GPPC DO	SR-03-RC MOD			pCi/g		SR-03-1	RC MOD		
SR-90 BY GFPC DOM Strontium 90	8 SR-03-RC MOD 0.26	υ 	0.45	pCi/g	0.75	SR-03-1 08/10/04	RC MOD 08/17/04	42230	86

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NOTE (S)

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HDC is determined by instrument performance only. Bold results are greater than the NDC

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### GENERAL ATOMICS

# Client Sample ID: DTSC-200

#### Severn Trent Laboratories - Radiochemistry

Lab Sample ID: Work Order: Matrix:	F4H050281-022 GMJ7L Solid			Date Collected: Date Received:	07/07/04 08/05/04		0900 0915	
Parameter	Result	Qual	Total Uncert. (2 g+/-)	NDC	Prep Date	Analysi Data	B Batch #	YId %
SR-90 BY GFPC DON	BR-03-RC MOD		1	pCi/g	SR-03	-RC MOD		
Strontium 90	0.23	U	0.37	0.62	08/10/0	4 08/17/	04 4223086	67

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Data are Data are incomplete without the case narrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

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		(	GENERAL	ATOMICS				
	c	Lient	Sample	ID: DTSC-20	2			
	Severn	Trent	Laborato	cies - Radioche	mistry			
Lab Sample ID: Work Order: Matrix:	F4H050281-023 GMJ70 SOLID			Date Collected: Date Received:	07/0 08/0	7/04 5/04	0930 0915	
Parameter	Result	Qual	Total Uncert. (2 c+/-)	жос	Prop Date	Analysi Date		YId s
SR-90 BY GFPC DOI	SR-03-RC MOD			pCi/g	SR-03-1	RC MOD		
Strontium 90	0.24	U	0.38	0.62	08/10/04	08/17/	04 4223086	69

NOTE (S)

Data are incomplete without the case marrative.

NDC is determined by instrument performance only. Bold results are greater than the NDC

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#### METHOD BLANK REPORT

Severn Trent Laboratories - Radiochemistry

Client Lot ID: Matrix:	F4H050281 Solid							
			Total			Lab	Sample ID	
Parameter	Regult	Qual	Uncert. (2 σ+/-)	MDC	7rep Date	Analysis Date	Batch #	Tld 1
ISO URANIUM (SH	IORT CT) DOE A-	01-R MOD	pCi/g	A-01-R MOD		<b>74</b> H0	70000-064	1B
Uranium 234	0.017	U	0.050	0.085	08/07/04	08/11/04	4220064	90
Uranium 235	0.015	U	0.041	0.039	08/07/04	08/11/04	4220064	90
Uranium 238	0.024	U	0.046	0.072	08/07/04	08/11/04	4220064	90
SR-90 BY GPPC I	OR SR-03-RC M	מנ	pCi/g	SR-03-RC NO	פי	74H1	.00000-08	6B
Charles 00	-0.08	17	0.30	0.53	08/10/04	08/17/04	4223086	79

NOTE (S)

Data are incomplete without the case marrative.

NDC is determined using instrument performance only

Bold results are greater than the MDC

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#### DUPLICATE EVALUATION REPORT

#### Severn Trent Laboratories - Radiochemistry

Client Lot ID:	F4H050281	Date Sampled:	06/08/04
Matrix:	SOLID	Date Received:	08/05/04

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	SAICP LE		Total Uncert.		DUPLICATE		Total Uncert.		QC Sample ID	
Jarameter	Result		(20+/-)	4 Yld	Yld Result		(2 a+/-)	\$ ¥ld	Precision	
SR-90 BY GFPC DOR	SR-03-RC	NOD		pCi/g	SR-03	-R	C NOD		F4H050281-004	
Strontium 90	-0.42	υ	0.34	60	0.17	U	0.28	70	-471	*RPD
	Ba	tch Ø:	4223086	(Sample)	422308	6	(Duplicate)			
ISO URANIUM (SHORT	CT) DOR	A-01-R	NOD	pCi/g	A-01-1	R	COM		F4H050281-001	
Uranium 234	11.2		1.2	76	12.0		1.2	108	7	<b>\$</b> RPD
Uranium 235	0.73	J	0.23	76	0.50	J	0.18	108	37	\$RPD
Uranium 238	1.52		0.31	76	1.81		0.32	108	17	*RPD
	34	tch #1	4220064	(Sample)	422005	4	(Duplicate)			

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NOTE (S)

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Data are incomplete without the case narrative. Calculations are performed before rounding to avoid round-off error in calculated results

Result is greater than sample detection limit but less than stated reporting limit. J

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### Laboratory Control Sample Report

### Severn Trent Laboratories - Radiochemistry

Client Lot ID:	F4H050281
Matrix:	SOLID

		Total			Lab i	Sample ID
Spike Amount	Result	Uncert. (2 g+/-)	MDC	% Yld	t lec	QC Control Limits
T CT) DOE A-01-R	MOD	pCi/g	A-01-R MOD		<b>74</b> H0	70000-064C
19.6	18.1	2.7	0.8	107	92	(70 - 130)
19.6	15.4	2.4	0.4	107	79	(70 - 130)
Batch #:	4220064		Analysis Date:	08/1	1/04	
SR-03-RC MOD		pCi/g	SR-03-RC MOD		F4H1	00000-086C
9.70	11.2	1.4	0.4	78	116	(53 - 138)
Batch #:	4223086		Analysis Date:	08/1	7/04	
	Spike Amount T CT) DOE A-01-R 19.6 19.6 Batch #: : SR-03-RC MOD 9.70 Batch #:	Spike Amount Result   T CT) DOE A-01-R MOD 19.6   19.6 18.1   19.6 15.4   Batch #: 4220064   : SR-03-RC MOD 9.70   9.70 11.2   Batch #: 4223086	Total Ducert. Spike Amount Result (2 g+/-) T CT) DOE A-01-R MOD pCi/g 19.6 18.1 2.7 19.6 15.4 2.4 Batch #: 4220064 : SR-03-RC MOD pCi/g 9.70 11.2 1.4 Batch #: 4223086	Total Dicert.   Spike Amount Result (2 g+/-) MDC   T CT) DOE A-01-R MOD pCi/g A-01-R MOD   19.6 18.1 2.7 0.8   19.6 15.4 2.4 0.4   Batch #: 4220064 Analysis Dates   : SR-03-RC MOD pCi/g SR-03-RC MOD   9.70 11.2 1.4 0.4   Batch #: 4223086 Analysis Dates	Total Dicert.   Spike Amount Result (2 g+/-) MDC % Yid   T CT) DOE A-01-R MOD pCi/g A-01-R MOD % Yid   19.6 18.1 2.7 0.8 107   19.6 15.4 2.4 0.4 107   Batch #: 4220064 Analysis Date: 08/11   : SR-03-RC MOD pCi/g SR-03-RC MOD 78   9.70 11.2 1.4 0.4 78   Batch #: 4223086 Analysis Date: 08/1	Total Lab :   Spike Amount Result (2 g+/-) MDC % Yid % Mac   T CT) DOE A-01-R MOD pCi/g A-01-R MOD 74H0   19.6 18.1 2.7 0.8 107 92   19.6 15.4 2.4 0.4 107 79   Batch #: 4220064 Analysis Date: 08/11/04   : SR-03-RC MOD F4H1   9.70 11.2 1.4 0.4 78 116   Batch #: 4223086 Analysis Date: 08/17/04

General Atomics' Final Radiological Survey Report for the DTSC Permitted Area (NWPF-1 Site) of the Nuclear Waste Processing Facility

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**Appendix C** 

**Confirmatory Survey Plan**
Page 1 of 5

July 15, 2004	libubate
Prepared By: W.	T. LaBonte and Laura Gonzales
	$\geq 0$ $\forall z = 1$
Approved By:	Jama Honzales
	L. Q. Gonzales <sup>1</sup>

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### GA's Internal Confirmatory Survey Plan for the NWPF DTSC Area

This Confirmatory Survey Plan is for the Nuclear Waste Processing Facility (NWPF) DTSC Area which is within the Sorrento Valley South Land Area. Portions of this land area formerly contained facilities to process and package low level radioactive waste for burial at approved low level radioactive waste disposal sites. The equipment and facilities have been demolished and packaged as low level radioactive waste.

<u>Note:</u> A small piece of concrete that was part of the waste processing facility office floor was not removed and disposed of because there are plans to incorporate this into the remainder of Building 41 following release of the former NWPF site.

This Internal GA Confirmatory Survey Plan covers *Mainly* open land areas. There are no sewer or storm drain systems traversing this land area. A drain pipe which collected rain gutter water and was connected to a "French Drain" inside of the Solidification Building was removed prior to the demolition of the Solidification Building. Elevated soil activity levels were detected at the "French Drain" and at the discharge end of this drain line. This line was excavated, surveyed, and disposed of as low level radioactive waste along with the excavated soil with elevated levels. Additionally, a drain pipe, previously installed to drain water from under the asphalt paved portions of the lower waste yard, was discovered during the performance of the Final survey. This line was removed. All surveys taken on this pipe (internal and external) were at natural background levels.

This land area is approximately 31,950 ft<sup>2</sup> ( $\sim$ 2971 m<sup>2</sup>). See Figures 1 and 2 for the location of the Sorrento Valley South Land Area and the NWPF DTSC site.

### **History and Classification**

#### <u>History</u>

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The NWPF DTSC Site has been the collection point for all radioactive waste generated at GA. The radioactive waste was processed and packaged for disposal at licensed/approved low level waste facilities. Following packaging, the radioactive material was staged in the waste yard awaiting shipment to the disposal facility. The outline of the NWPF DTSC area is the former radiation restricted area.

R:\b-41 & waste yard\waste yard\dtsc confirmatory survey.wpd

During D&D activities, the processing facilities, (compactor room, solidification room, etc.), which occupied a portion of Building 41, were dismantled (with the exception of a small piece of concrete slab that was part of the office area floor) and disposed of as low level radioactive waste. The remaining portion of Building 41 was surveyed in accordance with GA's NRC- and State- approved Site Decommissioning Plan. No activity above background was detected.

Asphalt paving was removed from NWPF DTSC area considered to be Suspect Affected Areas and disposed of low level radioactive waste at an approved facility. A Post D&D survey was performed.

During the performance of this survey, four (4) areas requiring remediation were identified and remediated. Following remediation, sub-surface soil samples, (as far down as 3 feet below the post remediation surface) were taken in all remediated areas.

There is a heavily vegetated hillside on the east end of the NWPF DTSC area which was never used for the storage or handling of radioactive materials. However, during the performance of the final survey (performed in accordance with the original Final Survey Plan issued on May 4, 2004), elevated soil activity levels were discovered in this area.

A Health Physics technician noticed an open end for a buried pipe while performing a surveillance tour of the former waste yard and Sorrento Valley South land areas. Further investigation indicated that this pipe open end was a buried drainage pipe used to divert storm water from the DTSC land areas to protect the asphalt paving. The pipe was a continuous run of drainage tubing encased in loose stone fill material. The pipe was excavated and surveyed. No activity above natural background was detected on, or in, the pipe. The excavation trench resulting from the removal of this pipe was scanned with a 2" x 2" Nal(Tl) detector. No activity above natural background was detected. Soil samples taken at the pipe discharge end were not distinguishable from natural background.

### **Classification**

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The <u>only</u> remaining portion of the Nuclear Waste Processing Facility is a small concrete slab that was the sub-flooring for the office area. No radioactive material was stored or handled in this office area. It was classified as a **NON-Impacted Area** for radiological survey purposes. The concrete slab is approximately 780 ft<sup>2</sup> ( $\sim$ 73 m<sup>2</sup>).

The rest of the NWPF DTSC area is open land area and was classified as a Suspect Affected Area. This land area is approximately 31,950 ft<sup>2</sup> (~ 2971 m<sup>2</sup>) due to the history of use and soil contamination found in the area.

## Survey Objectives and Responsibility

The purpose of this Internal Confirmatory Survey is to verify the site meets the release criteria specified in GA's NRC- and State- approved Decommissioning Plan by performing biased and random radiological surveys and soil sampling in areas with the highest potential for elevated activity levels, based on a review of the Final Radiological Survey results.

Samples will be counted in the Health Physics laboratory (onsite). Surveys will be taken only by qualified Health Physics Technicians having a minimum of 3 years Health Physics Technician experience. The survey and final report documenting the survey will be performed by GA's Health Physics group.

#### **Confirmatory Radiological Surveys Planned**

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The radiological surveys, identified in the table below are the minimum survey requirements. If elevated levels are found, the area may have to be re-classified to a higher survey classification and additional surveys will be required. Notify Health Physics management immediately if levels above the alert levels are detected during the performance of this survey.

Survey Type/Action	Non-Impacted Area	Suspect Affected Area
Grid Area	No	Yes, Previously gridded 10m x 10m grids.
Concrete Surfaces <sup>(1)</sup> (Scan w/ 434 cm <sup>2</sup> alpha probe).	10% Scan of surface.	Not Applicable.
Concrete Surfaces <sup>(1)</sup> (Scan w/ 434 cm <sup>2</sup> beta probe).	10% Scan of surface.	Not Applicable
Minimum number of Fixed Measurements <sup>(3)</sup> <sup>(4)</sup>	Take five (5) equally spaced measurements. Alternate between (1) a wipe <sup>(2)</sup> , (2) an alpha fixed measurement and (3) a beta fixed measurement on all concrete surfaces.	Not Applicable.
µR/hr Readings (scans) @ surface	10% of accessible surfaces	100% of accessible surfaces in shaded areas indicated on Figure 3, 10% in the remaining area.
µR/hr Readings (Fixed) surface and at 1 m from surface	4 locations evenly spaced	One (1) every ~ 2 m in shaded areas indicated on Figure 3, <u>plus</u> One (1) at each soil sample location.
Surface (0-6") Soil Samples @ 1m from surface	Not Applicable	50 surface (0-6") samples (see Figure-3 for locations)
Sub-Surface Soil Samples	Not Applicable	Collect samples in 2 locations at 0-6", 6"-12", 12"-18", 18"-24", 24"-30", and 30"-36". (See Figure-3 for locations).

### Final Radiological Surveys Planned for the NWPF DTSC Site Land Area

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#### Table Notes

Clean surfaces to remove debris or dirt.

- 1. For removable measurements, take a 100 cm<sup>2</sup> wipe at each location and count using a low level alpha/beta counter.
- 2. For the fixed measurements:
  - For  $\alpha$  measurements; use either the hand held alpha counter (*minimum* of ~6 second count). Document all readings in cpm.
  - For  $\beta$  measurements; take a 2 minute count using the 100 cm2 gas flow proportional detector (beta) with the Model 2221 ratemeter. Document all readings and mark on a drawing the locations the readings were taken.
- 3. A "measurement" is either (1) a "fixed" radiation measurement representing total activity or (2) a wipe (removable activity).

### Release Criteria (per GA Site Decommissioning Plan)

#### **Direct Surface Scans**

Characterization and pre/post remediation surveys performed on this land area and in the former processing facility included gamma spectroscopy analysis. The predominate isotope detected was Cs-137 with some locations having Uranium and Thorium contamination.

The release criteria for most beta/gamma emitters (which includes Cs-137 and uranium-235 and uranium-238) is:

5,000 dpm/100 cm<sup>2</sup>, averaged over 1 m<sup>2</sup> area 15,000 dpm/100 cm<sup>2</sup>, maximum in a 100 cm<sup>2</sup> area 1,000 dpm/100 cm<sup>2</sup>, removable contamination

The release criteria for thorium is as follows:

1,000 dpm/100 cm<sup>2</sup>, averaged over 1 m<sup>2</sup> area 3,000 dpm/100 cm<sup>2</sup>, maximum in a 100 cm<sup>2</sup> area

200 dpm/100 cm<sup>2</sup>, removable contamination

#### **Exposure Rate Measurements**

The release criteria for exposure rates measured at 1 m above the surface is  $10 \mu$ R/hr above background.

#### Soil Criteria (soil limits apply to roof gravel, concrete rubble and asphalt rubble)

The release criteria for soil are specified in the Site Decommissioning Plan and summarized below. The values presented below are above background levels.

Cs-137	15 pCi/g
Co-60	8 pCi/g
Enriched Uranium (U-234 plus U-235)	30 pCi/g
Thorium (Th-232 plus Th-228)	10 pCi/g
Sr-90	1800 pCi/g

If multiple nuclides are present, the sum of the ratios of the concentration of each Radionuclide to its respective guideline must not exceed 1. If other nuclides are encountered, notify HP Management for release criteria.

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### Alert Levels

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

### **On Concrete or Asphalt Surfaces**

Note: The Alert levels provided below are based on the background cpm plus the meter cpm value taking into account the instrument efficiency and probe surface area. The alert level for each instrument used is determined prior to performing surveys. The background determination must be performed in building 13 or other HP management approved area.

## Alpha Monitoring

>100 cpm alpha using the large area (434 cm<sup>2</sup>) probe. If >100 cpm, check with a hand held alpha meter. >60 cpm using a hand held alpha probe, notify Health Physics Management.

### Beta Scanning using 434 cm<sup>2</sup> probe

> ~300 cpm above background using any other 434 cm<sup>2</sup> probe.

## Beta Scanning using a 15 cm<sup>2</sup> pancake GM detector

> ~ 80 cpm above background.

### **Exposure Rate Measurement**

Exposure rate measurements at contact (1-2" above the surface) and at 1m above the surface and 25  $\mu$ R/hr.

### Soil Samples

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Any Radionuclide above natural background levels (see HP-40 for background levels). All soil sample results must be reviewed by Laura Gonzales or Bill LaBonte.

# **Documentation**

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



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