70-734

GA Technologies

REPORT ON DECONTAMINATION AND DECOMMISSIONING OF GA TECHNOLOGIES' OLD WASTE PROCESSING FACILITY AND SURROUNDING AREAS PHASE I

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1. INTRODUCTION

1.1. AREAS TO BE RELEASED TO UNRESTRICTED USE

The GA Technologies Inc. (GA) old Waste Processing Facility (WPF) and the surrounding canyon and ridge areas have been selected for decontamination and decommissioning (D&D) under the requirements specified in NRC Docket 70-734: Plan For Obtaining Release of Certain Areas to Unrestricted Use*, herein referred to as the Plan.

The decontamination project was started by GA in July 1984 and a contract was issued to AWC, Inc. to provide additional support beginning November 1984.

The principal area to be released to unrestricted use is shown in Figure 1A. The area includes the Waste Processing Facility, the associated canyon area and other land (mainly hillsides and canyons) surrounding the facility. Due to the complexity of the project, it was determined that the work efforts for release of this area would be handled in two phases.

The work performed under Phase I of the project was to prepare the area within the boundary shown in Figure 1B, except the areas indicated as Phase II, for release to unrestricted use.

This report provides information on the decontamination/decommissioning conducted for Phase I of this project. The target criteria for unrestricted release, the method used, and the data showing compliance with the target criteria, are provided.

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*NRC Docket 70-734: Plan for Obtaining Release of Certain Areas to Unrestricted Use, GA submittal letter 696-8023.

1.2. SITE DESCRIPTION

Figure 1A shows the specific area enclosed within the boundary to be prepared for release to unrestricted use. This portion of GA's site represents about 80 acres. Due to the complex operations required to handle and dispose of the large volume of contaminated soil, the work efforts preparing this area for release to unrestricted use will be conducted in two phases.

The work conducted under Phase I includes the area within the boundary shown in Figure 1B except the three areas designated Phase II. The Phase I area contains approximately 78 acres.

1. The contaminated (affected) areas in Phase I represent about two acres of land. These affected areas are designated Area A (canyon area below the Waste Processing Facility), Area B (canyon area below the evaporation ponds), Area C (area north of ponds) and Area D (evaporation ponds). Figure 4 shows these areas in greater detail. The Phase II areas shown in Figure 1B are the incinerator site, the old Waste Processing Facility and a small area where asphalt contaminated with low levels of uranium and thorium was buried in 1974 under GA's Radioactive Material License issued by the State of California. The Waste Processing Facility site and the incinerator site are covered with concrete or asphalt and are being used as staging areas for the contaminated soil removed from the affected areas. A brief description of the contaminated areas is provided below.

2. The canyon areas (Area A) is the ~3/4 acre area adjacent to and below the old Waste Processing Facility. Water runoff from the facility enters the canyon area.

3. The canyon area is a one acre area adjacent to the solar evaporation ponds, Waste Processing Facility and incinerator pad.

A spill in 1972 from the evaporation ponds contaminated part of this canyon area directly below the ponds with approximately 100 gms of enriched uranium along with thorium, Cs-134, Cs-137, Co-60 and Sr-90.

4. The hillside above the ponds, (Area C) is on a ~1/2 acre area which contained discrete localized plots of contaminated soil.

5. The Solar Evaporation Ponds consisted of four sets of three 20 ft x 20 ft concrete ponds 1 ft deep designed to contain contaminated liquid which in turn is evaporated by solar energy. Three sets of ponds were used for liquid waste containing enriched uranium and thorium. The fourth pond contained liquid waste contaminated with mixed fission and activation products. Through the years there was some cross contamination of the ponds necessitated by one or the other set of ponds being full when there was a need to place additional liquid waste in the ponds. Sludge was periodically removed, packaged and disposed of to an approved radioactive waste land burial site.

1.3. OBJECTIVES

The objective of this project was to remove all sources of radiation and contamination so that the area meets the requirements for release to unrestricted use, as specified in the Plan.

2. SUMMARY

The decontamination/decommissioning of GA's old Waste Processing Facility and surrounding area is being conducted in two phases. This report documents the activities conducted under Phase I.

Phase I areas are the Solar Evaporation Ponds, the canyon areas below the Waste Processing Facility and the solar evaporation ponds, and the areas of raw land (mainly canyons and hillsides) surrounding these areas. Phase I consists of ~78 acres, approximately two of which contained soil contamination exceeding the target criteria for release to unrestricted use as described in the GA Plan. These affected areas (i.e., contaminated) were decontaminated as part of the Phase I effort.

Every location was decontaminated to:

1. Meet the license criteria for release of a facility or equipment to unrestricted use.

2. Remove any contaminated soil until the residuals meet the NRC policy (SECY 81-576) Option 1 criteria.

Approximately 82,000 cu ft of soil containing about 480 millicuries of activity was removed for disposal at an approved radioactive waste land burial site.

All the areas within the Phase I boundary were decontaminated below the target criteria for release to unrestricted use.

3. TARGET CRITERIA FOR UNRESTRICTED RELEASE

The following target criteria are taken from the U.S. Nuclear Regulatory Commission (USNRC) approved decontamination plan for release of certain areas to unrestricted use.

3.1. FACILITY AND EQUIPMENT

Table 1 is taken from USNRC's criteria for releasing facilities and equipment to unrestricted use. This table was used for releasing process equipment or buildings to unrestricted use. It has been incorporated into our SNM-696 license. Ponds, tanks, etc., were treated as process equipment. The above criteria will not be utilized for soils.

3.2. DIRECT RADIATION

External radiation (gamma dose rate in air one meter above ground level) shall not exceed 10 μR/hr above background for a diffuse source area (a contaminated area greater than 30 ft x 30 ft) and shall not exceed 20 μR/hr above background for a discrete area (a contaminated area smaller than 30 ft x 30 ft).

3.3. INHALATION PATHWAY

Table 2 contains values of soil contamination (pCi/gm) which if residing on the surface and inhaled would not lead to an exposure exceeding the Option I acceptability limit. Soil contamination above these Table 2 values may be acceptable under certain circumstances but only if a specifically analyzed intrusion scenario shows that any individual will not be exposed to radiation levels greater than those appropriate for NRC/EPA Option I.

TABLE 9

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b c f]	MAXIMUM[b d f]	REMOVABLE[b e f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1000 dpm $\beta\gamma$/100 cm^2

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

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

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

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

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

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

TABLE 2

INDIVIDUAL CONCENTRATION IN SOIL RESULTING IN AN ANNUAL INHALATION DOSE OF 20 mrem TO THE LUNG[a] AND 60 mrem TO THE BONE[b]

Radionculide	Solubility Classification	Derived Concentration (pCi/g)	
		Lung (20 mrem)	Bone (60 mrem)
U-238	Y	35	1.2×10^{4}
U-238	W	3.2×10^{2}	3.9×10^{3}
U-238	D	1.9×10^{4}	1.2×10^{3}
U-235	Y	35	1.2×10^{4}
U-235	W	3.2×10^{2}	3.9×10^{3}
U-235	D	1.9×10^{4}	1.2×10^{3}
U-234	Y	30	1.0×10^{4}
U-234	W	2.8×10^{2}	3.6×10^{3}
U-234	D	1.7×10^{4}	1.1×10^{3}
Th-232	Y	35	2.6×10^{2}
Th-232	W	3.3×10^{2}	1.0×10^{2}
Ra-228	W	3.3×10^{3}	2.9×10^{3}
Th-228[c]	Y	20	1.8×10^{3}
Th-228	W	1.3×10^{2}	3.3×10^{2}
Co-60[d]	Y	1.2×10^{4}	1.6×10^{6}
Co-60	W	1.2×10^{5}	5.8×10^{6}
Cs-137[d]	D	9.6×10^{5}	1.8×10^{6}
Sr-90[d]	Y	1.8×10^{3}	2.6×10^{5}
Sr-90	D	1.6×10^{6}	2.8×10^{4}

[a] Pulmonary lung (570 gm); consistent with EPA's Transuranics Guidance.

[b] Bone means osseous tissue, (5,000 gm); consistent with EPA's Transuranic Guidance.

[c] The daughters of Th-228 and Ac-228 do not contribute significantly to the inhalation dose because of their comparatively short half-lives.

[d] Solubility classifications are based on ICRP-30.

3.4. INGESTION PATHWAY

The GA site is located within a semi arid region zoned for light industry and Research and Development. The area is not, nor will likely be, allowed any residential or agricultural land usage. There is no potable water on the site or its environs. A brackish water table is approximately 275 to 300 ft deep at about the same level as the nearby salt water backwater and marshes. Therefore, the pathway for ingestion of any residual contamination via any food or water is highly improbable.

However, vegetation (brush, weeds, etc.) removed from the GA site for unrestricted disposal could possibly enter the ingestion pathway. Therefore, the contamination levels of such vegetation must satisfy the target criteria for ingestion exposure (as well as the target criteria for direct radiation and inhalation exposure).

The target criteria for food ingestion exposure is 30 mrem/yr to the bone (NRC Policy Issue SECY-81-576). The dose commitment resulting from ingestion (vegetation, beef, milk) of radionuclides from contaminated vegetation are shown in Table 3. These values are based upon a unit concentration of 1 pCi/gram of each radionuclide in the vegetation.

3.5. SUMMARY OF LIMITING CONCENTRATIONS FOR DIRECT RADIATION AND INHALATION DOSE LIMITS

Table 4 summarizes the derived limiting concentrations of various groups of radionuclides for the compliance of the direct radiation and inhalation dose limits. Meeting the target criteria in Table 4 will indicate that the residuals satisfy the Option I acceptability criteria.

TABLE 3[a]

DOSE COMMITMENT RESULTING FROM INGESTION (VEGETATION, BEEF, MILK) OF RADIONUCLIDES FROM CONTAMINATED VEGETATION (BRUSH, WEEDS, ETC.). FIGURES BASED ON A UNIT CONCENTRATION OF 1 pCi/g OF EACH NUCLIDE IN THE VEGETATION.

Radionuclides	Bone Dose (mrem/yr)
U-238	1.9E-0
U-235	1.9E-0
U-234	2.2E-0
Th-232	2.1E-0
Th-230	2.0E-0
Th-228	4.0E-1
Ra-228	4.5E-0
Ra-226	8.9E-0
Sr-90	6.1E-0
Cs-137	2.3E-1
Pu-239	5.6E-2

[a]Reference: NRC's Docket No. 70-820 -- United Nuclear Corporation Resources Company "Soil Decontamination Criteria for the Decommissioning of the UNC's Facility." Scrap Recovery Junction, Rhode Island.

TABLE 4
DERIVED ANNUAL LIMITING CONCENTRATIONS FOR
VARIOUS GROUPS OF RADIONUCLIDES

Radionuclide	Derived Limiting Concentration (pCi/g)		
	Inhalation		Direct Radiation[a]
	Lung (20 mrem)	Bone (60 mrem)	(10 μR/hr)
Depleted uranium			
U-238, U-234 (Y)	35	--	--
U-238, U-234 (W)	3.2×10^{2}	--	--
U-238, U-234 (D)	--	--	8.0×10^{2}
High-enriched uranium			
U-234, U-235 (Y)	30	--	--
U-234, U-235 (W)	2.8×10^{2}	--	--
U-234, U-235 (D)	--	--	8.0×10^{2}
Natural Thorium			
Th-232, Th-228 (Y)	--	--	10
Th-232, Th-228 (W)	--	--	10
Cobalt			
Co-60 (Y)	--	--	8
Co-60 (W)	--	--	8
Cesium			
Cs-137 (D)	--	--	15
Strontium			
Sr-90 (Y)	1.8×10^{3}	--	--
Sr-90 (D)	--	2.8×10^{4}	--

[a] GA prefers to use an instrument (microR meter) to demonstrate compliance of 10 μR/hr above background at one meter for diffuse areas.

4. RADIATION DETECTION INSTRUMENTATION

The following radiation detection instruments were used for radiation surveys:

4.1. LUDLUM MODEL 19 MicroR METER

The microR meter used for radiation surveys was manufactured by Ludlum Measurements (Model 19) and was used for direct measurements of external gamma radiation. The instrument has five linear ranges: 0 to 25 μR/hr, 0 to 50 μR/hr, 0 to 250 μR/hr, 0 to 5000 μR/hr.

4.2. LUDLUM MODEL 3 GM SURVEY METER

The geiger counter used was manufactured by Ludlum Measurements and has a Model 3 count rate meter with a Model 44-9 pancake probe used for field monitoring of low level beta/gamma radiation. The "pancake" GM detector has a window thickness of less than 7 mg/cm^2. The instrument has four ranges: 0 to 500 cpm, 0 to 5000 cpm, 0 to 50,000 cpm, and 0 to 500,000 cpm.

4.3. EBERLINE MODEL RO-2 ION CHAMBER

An ionization chamber manufactured by Eberline (Model RO-2) was used in one small area of the pond where the gamma readings exceeded 5 mR/hr. The instrument has four scales: 0 to 5 mR/hr, 0 to 50 mR/hr, 0 to 500 mR/hr and 0 to 5000 mR/hr.

4.4. EBERLINE E-520 GM SURVEY METER

Another geiger counter, the Eberline E-520 count rate meter with HP-260 "Pancake" GM detector having a window density thickness of less

than 7 mg/cm^2 was used for field monitoring of low level beta/gamma radiation. The instrument has five ranges: 0 to 250 cpm, 0 to 2500 cpm, 0 to 25,000 cpm, 0 to 250,000 cpm, and 0 to 2.5 x 10^6 cpm.

4.5. EBERLINE PAC 4S ALPHA SURVEY METER

Alpha Survey meters manufactured by Eberline (Model PAC 4S) were used for field monitoring of low level alpha radiation. The instrument has two logarithmic ranges of 0 to 20,000 cpm and 0 to 2 x 10^6 cpm.

4.6. DAVIDSON MULTI-CHANNEL ANALYZER

The Davidson Model 4106 Multi-Channel Analyzer (MCA) and 3 in. x 3 in. NaI detector were used for well logging gamma emitting radionuclides. The analyzer and detector were calibrated using naturally occurring radioactive isotopes present in the soil and comparisons with soil sample analysis.

4.7. CANBERRA MODEL 2404 ALPHA, BETA, GAMMA SYSTEM

A Low Level Alpha, Beta, Gamma Counting System manufactured by Canberra Industries, Inc. (Model 2404) was used to count air samples, wipes, and soil samples taken during the decontamination project.

4.8. GERMANIUM-LITHIUM-Ge(Li) DETECTOR SYSTEM

Two Ge(Li) detector systems were used to perform the gamma spectrum analysis on the soil samples. Results have been stored permanently on magnetic tape at GA.

4.9. INSTRUMENT CALIBRATION

All instruments were maintained and properly calibrated. Three microR meters were calibrated by the manufacturer (Ludlum Measurements, Inc.) prior to starting the decontamination efforts. Three GA and two

AWC microR meters were checked for consistent readings every two days. The five instruments all read within ±1.5 μR/hr.

All instruments (except microR meters) are calibrated on a six month schedule and were checked daily using a check source to verify proper instrument response.

5. PERSONNEL PROTECTION

5.1. PROTECTIVE CLOTHING

During the removal and stockpiling of contaminated soil, asphalt and concrete, all personnel were kept out of the dust generated to every extent possible. The requirement for protective clothing was relaxed after the first week since no contamination had been found on air samples, hands, shoes, or clothing.

5.2. PERSONNEL MONITORING

All personnel permanently assigned to the Waste Processing Facility decontamination effort were assigned appropriate personnel monitoring devices by GA.

5.3. AIR SAMPLING

Air samples were collected during the removal and stockpiling of contaminated concrete, asphalt, and soil. One air sampler was stationed downwind from each primary work area. Air samples were allowed to decay for at least a 24 hr period prior to counting to allow the naturally occurring daughters of radon to decay. Results of these air samples are shown in Appendix 4. Results show airborne radioactivity concentrations were relatively low.

5.4. PERSONNEL SURVEYS

All personnel involved in the decontamination effort were surveyed prior to coffee breaks, lunch break, and before leaving the area at the end of each work day. These personnel surveys verified that proper

contamination control procedures were in place and effective in all work areas.

5.5. IN VIVO TOTAL BODY COUNTS

Personnel that were scheduled for steady work on the project were given an in vivo total body count before starting the work project. At the completion of the project after the contaminated soil is disposed of and the Phase II cleanup completed, they will again be given an in vivo total body count to compare with the initial one.

6. INITIAL SURVEY AND SOIL SAMPLING

6.1. NATURAL BACKGROUND ASSESSMENT

For the purposes of the decontamination and final radiation survey of the WPF and surrounding areas, the background to be subtracted from the gross radiation measurements was determined based on numerous measurements taken adjacent to and within 1/2 mile of the WPF. The background varied from 13 to 18 μR/hr, therefore it was decided to use 15 μR/hr as background.

6.2. EXTERNAL RADIATION SURVEY PROCEDURES

The external radiation surveys were conducted using a microR meter to measure direct radiation exposure.

The initial survey was a "walkover" survey, consisting of random readings taken in order to locate affected areas. Readings were recorded for any location whenever they exceeded 10 μR/hr above background at one meter above the surface.

The affected areas were identified and surveyed on a 10 ft x 10 ft grid. These areas were later identified as Area A (below the Waste Processing Area), Area B (canyon below the evaporation ponds), Area C (north of evaporation ponds) and Area D (ponds). These areas are shown in Figure 4.

Measurements at each grid intersection were recorded. If the level did not exceed 10 μR/hr above background measured at one meter above the surface, the surveyor moved to the next grid intersection. If the level exceeded 20 μR/hr above background (at one meter), a surface reading was also taken. The readings are shown in Figure 2.

6.3. SOIL SAMPLING

After the affected areas were identified, soil samples were collected to identify the radionuclides present and their quantities to assist in characterizing the site. Core samples were obtained in the solar evaporation ponds (Area D), the spill area below the ponds (Area B), the canyon floor, and north of the solar evaporation ponds (Area C), to evaluate the extent of subsurface contamination.

Samples were collected in Area A at various depths at 6 to 12 in. increments to a maximum depth of 4 ft. Beyond this depth soil sample radionuclide concentrations were below the target criteria.

The samples were collected, prepared, and analyzed as described below.

- Collection.

  a. The surface vegetation (brush and weeds) were removed by cutting off at ground level, not uprotted.

  b. Surface samples (0 to 1 in.) were collected; approximately 2 kilograms of soil sample.

  c. A composite soil sample 0 to 6 in., 1 in. to 6 in. or 1 in. to 12 in. were collected based on the area and estimated depth of contamination.

  d. If subsurface soil contamination was found, then additional samples (e.g., core samples) were taken at sufficient depths to provide an estimate of the extent of contamination.

- Preparation.

  a. The soil samples were free of vegetation and rocks.

  b. The samples were dried to remove moisture.

  c. The sample was ground to a fine powder with no "clumping" (clumping would be due to excess moisture), or were crushed and mixed to eliminate clumping and to homogenize.

- Analysis.

  a. The soil samples were analyzed by gamma ray spectroscopy using Ge(Li) detector systems. The analyses were performed to written procedures. All gamma emitting radionuclides were identified and their concentrations were determined. The Th-232 value was obtained based on the concentrations of the daughter radionuclides. Th-232 was assumed to be in equilibrium with its daughters.

  b. Wet chemistry was performed on selected soil samples to measure concentrations of Sr-90. Soil samples from every affected area were analyzed for Sr-90.

Figure 3 shows the soil sample collection locations.

The analytical results are provided in Appendix 1. The gamma ray spectroscopy results showed that the predominant radionuclides present were Cs-137, Co-60, U-235 and Th-232. The Sr-90 concentrations are provided in Appendix 6. The highest levels were found in Area D, the solar evaporation ponds. Sr-90 was found in areas where Co-60 and Cs-137 was also present, therefore, the cleanup of areas with Cs-137 and Co-60 contamination would also clean up Sr-90 contamination.

7. DECONTAMINATION METHODS

7.1. FACILITIES AND EQUIPMENT

Concrete from the twelve solar evaporation ponds was released for unrestricted disposal on August 23, 29, 30 and 31, 1984 based on the following:

1. Surveys of the concrete remaining after surface scabbling showed calculated disintegrations per minute per 100 cm^2 areas of the ponds were within the limits provided in Table 1.

2. Instruments used in the survey were calibrated against standards and efficiencies and correction factors were determined.

3. Corrections for background radiation were conservative.

The method used, instruments and data associated with the grid surveys of the concrete surfaces was summarized in a report prepared and submitted to the NRC in October 1984. This report is provided in Appendix 8.

In addition to the concrete from the twelve (12) solar evaporation ponds, an additional 3200 cu ft of asphalt and concrete were surveyed by AWC, Inc. and released to unrestricted use. Surfaces had been scabbled or jackhammered if contamination was detected. Any material found with detectable contamination was transferred to the soil staging area (Phase II) for later disposal at an approved radioactive waste land burial site. The "clean" material was segregated and a request made to the NRC for release of the material as non-radioactive.

Radiation surveys consisted of the following:

1. A GM survey with pancake probe to detect surfaces contaminated with beta emitting radionuclides. The pancake probe was placed within 1/2 in. of the surface and moved sufficiently slow to detect any radiation above background.

2. Where surfaces required an alpha survey, an alpha scintillation probe was used. The scintillation probe was placed on the surface to be surveyed for 10 to 15 seconds and the reading observed.

3. For gamma radiation surveys, a microR meter was used to measure radiation levels at a given point. The meter was held at the desired position above the measured surface for 5 to 10 seconds or until the meter reading stabilized. Measurements were taken at one meter above the surface or at contact, as indicated in the survey results.

4. Wipe samples were taken inside and outside all the buildings on the floors, walls, and ceilings and counted for beta and alpha radiation. All equipment used was also wipe surveyed before leaving the area. The results of these surveys are shown in Appendix 5.

The minimum detection limits for the instruments used to survey the asphalt and concrete are:

alpha:	10 dpm/100 cm^2 area
beta/gamma:	1500 dpm/100 cm^2 area
gamma:	3 μR/hr.

7.2. DECONTAMINATION OF SOIL IN AREAS B, C, AND D

The soil in affected Areas B, C, and D identified in Figure 4 was contaminated primarily with Cs-137 and Co-60, with lesser concentrations of Sr-90, U-235 and Th-232. Because of this, direct radiation measurements were used to demonstrate compliance for both the external radiation dose and inhalation criteria.

The highest levels of contamination were located with the microR meter. All the soil with contamination levels exceeding 10 μR/hr above background at approximate ground contact was removed with a large backhoe (Grade All) and transferred by truck to the soil staging areas.

When the cleanup was completed and verified based upon detecting less than 10 μR/hr above background at one meter above the surface, soil samples were collected and analyzed to confirm compliance. The first foot of soil was collected, prepared, and analyzed to:

1. Verify the correlation between the μR/hr readings and the soil contamination concentrations.

2. Check compliance with the inhalation criteria for these areas.

The locations of these soil samples are shown in Figure 6. The results of the analyses are provided in Tables 2-B, 2-C, and 2-D of Appendix 2. The samples were analyzed by gamma ray spectroscopy using a Ge(Li) detector system, and for gross beta concentrations by counting a sample on a low-level alpha-beta counting system. These results provide maximum values for Sr-90 if it is assumed that all the beta activity is Sr-90. Since the inhalation dose limit for Sr-90 is 1800 pCi/g (Table 4) and the gross beta values are well below this level, compliance with the inhalation dose limit is demonstrated, even when the doses from the other radionuclides are added to the total dose. For example, a level of 100 pCi/g would only add ~6% to the total lung dose limit of

20 mrem/yr. All gross beta results in the soil samples from these areas were <100 pCi/g.

7.3. DECONTAMINATION OF SOIL IN AREA A

The same decontamination method described above for Areas B, C, and D was used to remove soil in Area A to levels which met the release criteria.

Soil was removed until the μR reading was less than 10 μR/hr above background at one meter. Then eight (8) soil samples were collected, prepared, and analyzed. Two (2) of the eight (8) samples (A-2 and A-8) showed U-235 levels above the inhalation dose limits. Additional soil was removed in these two locations until the rationuclide concentrations met the inhalation dose limit. The results are provided in Table 2-A of Appendix 2 and the soil sample locations are shown in Figure 6.

Since the μR meter readings were not the controlling criterion in this area, i.e., a correlation did not exist between μR meter readings and the results of soil sample analyses to meet both the inhalation and direct radiation pathway limits, additional soil sampling was conducted. A correlation did not exist due to the relatively high levels of U-235 in comparison to Cs-137 and Co-60.

Representative soil samples were then collected at each 30 ft x 30 ft grid from the first inch (1 in.) of soil and analyzed. The subsurface soil (1 in. to 12 in.) was also collected to determine the extent of subsurface contamination. Although, only 5% of the subsurface samples needed to be analyzed according to GA's Plan, at least 98% of them were analyzed to determine subsurface contamination levels.

When results indicated contamination levels exceeding the inhalation dose limit concentrations, additional soil was removed until further soil sampling showed the limit was met.

Initial analysis of Sr-90 concentrations in soil samples collected in Area A prior to decontamination indicated no Sr-90, therefore it was conservatively assumed that Sr-90 was present at the level of detection, i.e., <5.5 pCi/g.

Section 8.3 provides further information on the results of the soil samples.

8. COMPLIANCE WITH THE TARGET CRITERIA

8.1. FACILITIES AND EQUIPMENT

Asphalt and concrete from the evaporation ponds, retaining walls and other areas around the Waste Processing Facility were surveyed for contamination. The results were compared to the release limits in Table 1. Material found with detectable contamination was placed in the contamination soil staging areas for later shipment to an approved radioactive waste land burial site. The "clean" material was segregated and the NRC was requested to release the material for unrestricted disposal, e.g., ship to landfill.

8.2. DIRECT RADIATION

The direct radiation level of 10 μR/hr above background was intended as a target criterion for open land cleanup. The radiation level was measured using calibrated microR meters capable of distinguishing from background levels.

Upon completion of soil decontamination, a final survey was made of the waste processing and canyon areas. The purpose of this survey was to verify all significant contamination had been removed and the area meets the target criteria.

To demonstrate compliance with the direct radiation limit, the affected areas were divided into grids about 30 ft x 30 ft for surveying purposes and the following conditions had to be met:

> External radiation (gamma dose rate in air one meter above ground level) could not exceed 10 μR/hr above background for a diffuse source area (a contaminated

area greater than 30 ft x 30 ft) and could not exceed 20 μR/hr above background for a discrete area (a contaminated area smaller than 30 ft x 30 ft).

The affected areas (Areas A, B, C, and D) were surveyed on a 10 ft x 10 ft grid. The results of the survey are shown in Figure 5A. All radiation levels were <10 μR/hr above background, measured at one meter above ground level.

Land surrounding the affected areas but within the Phase I boundary was surveyed for external radiation by a "walkover" survey at 30 ft intervals. The results of this survey are shown in Figure 5B. All radiation levels were less than 10 μR/hr above a 15 μR/hr background. In general, the levels in Figure 5B are a few microR/hr above the background selected for this area. However, soil samples collected from several locations remote from the affected areas and analyzed for the various radionuclides did not confirm the presence of contamination in the soil. Thus it appears that a higher background may have been more appropriate with regard to the direct radiation measurements.

8.3. INHALATION OF PARTICULATES

Table 2 summarizes the derived soil contamination limits for each inhaled radionuclide, which result in a committed dose of 20 mrem/yr to the lung and 60 mrem/yr to the bone. It is noted that Table 2 soil limits are for individual radionuclides. When a mixture of these radionuclides existed in soil, the following formula was applied to show compliance:

$$\text{the sum of } Ci/Li \leq 1$$

where Ci = the average soil concentration of radionuclide i,

Li = the derived maximum soil limit for radionuclide i (from Table 2).

In Areas B, C, and D, a correlation existed between the microR meter readings and the results of soil sample analyses due to the relatively high concentrations of Cs-137 and Co-60 as compared to U-235. The results are provided in Tables 2-B, 2-C, and 2-D of Appendix 2. These results established that both the inhalation and direct radiation pathway limits were met when using the direct microR meter readings.

In Area A, final soil samples were collected after decontamination was completed, on a 30 ft x 30 ft grid. The top one inch (1 in.) of soil was collected and analyzed for the various radionuclides to demonstrate compliance with the target criteria given in Table 3. The locations of the soil samples collected are shown in Figure 7 and the results of the analyses are provided in Table 3-A of Appendix 3. Since the derived concentrations in Table 2 also apply to subsurface soil contamination, samples were collected at each location from one inch to one foot (1 in. to 1 ft) and analyzed to determine the extent of subsurface contamination. The results of these analyzes are also provided in Table 3-A of Appendix 3. Although GA's Plan specified that only 5% of the subsurface samples needed to be analyzed, about 98% of the samples were analyzed. Both the surface and subsurface soil radionuclide concentrations are within the inhalation dose pathway limits.

Eighteen random surface soil samples were also collected from Areas A, B, C, and D, representing about 8% of the grid locations. These results are provided in Table 3-B of Appendix 3 and also meet the criteria.

8.4. INGESTION OF VEGETATION (Brush, weeds, etc.)

Table 3 summarizes the derived vegetation contamination limits for each ingested radionuclide which would result in a committed dose of 30 mrem/yr to the bone. The vegetation contamination limits given in Table 3 are for individual radionuclides. For a mixture of these

radionuclides present in vegetation, the following formula was applied to demonstrate compliance:

$$\text{the sum of } Ci/Li \leq 1.0$$

where Ci = average concentration of radionuclide i in vegetation,

Li = derived limit for radionuclide i in vegetation (from Table 3).

The vegetation (brush, weeds, iceplant, etc.) was removed from Areas A, B, C, and D prior to removal of contaminated soil. The vegetation was cut at the surface level avoiding the removal of any roots and associated soil, and was placed in a staging area.

Several samples of the vegetation were collected from each of the five piles. The samples were dried and analyzed for radioactivity by gamma spectroscopy using a Ge(Li) detector system. The five samples were then composited and analyzed for Sr-90 by wet chemistry techniques.

The results are provided in Appendix 7. The levels show compliance with the radionuclide concentrations shown in Table 3.

Samples of the vegetation were collected by the NRC for their independent analysis. Their analysis also showed compliance with the criteria, and approval was given to GA to dispose of the vegetation as non-radioactive in a local sanitary landfill facility.

9. RADIOACTIVE WASTE SUMMARY

9.1. RADIONUCLIDE CONCENTRATIONS AND VOLUMES

Table 5 lists the area, soil volume, and average concentration of the predominant radionuclides present in the soil.

TABLE 5
SOIL VOLUMES AND RADIONUCLIDE CONCENTRATIONS

Area	Soil Volume Cu Ft	Radionuclide Concentrations (pCi/g)				
		Cs-137	Co-60	U-235	Th-232	Sr-90
A	10,020	2	0.1	2	24	<5.5[(a)]
B	14,580	46	6	1.4	5	35
C	1,350	100	3	2	3	8
D	55,755	82	39	0.4	2	69
Total Soil	81,705					

(a) Minimum detectable level is <5.5 pCi/g.

Table 6 lists total microcuries of the radionuclides for each area. The total microcuries for each radionuclide is also provided.

TABLE 6
TOTAL ACTIVITIES OF MAJOR RADIONUCLIDES IN THE SOIL REMOVED

	Radionuclide Activity (microcuries)				
Area	Cs-137	Co-60	U-235	Th-232	Sr-90
A	774	40	774	9,300	<2,130
B	25,900	3,380	788	2,800	19,705
C	5,200	156	104	156	416
D	176,000	83,000	860	4,300	148,350
Totals	207,874	86,576	2,526[a]	16,556[b]	170,601

[a] Equivalent to 1263 grams U-235.

[b] Equivalent to 151 kilograms Th-232.

10. CONCLUSION

The land designated as Phase I of this project has been decontaminated to meet the target criteria for release to unrestricted use.

APPENDIX 1
SOIL SAMPLES TAKEN PRIOR TO DECONTAMINATION

Sample No.	Location ID	Depth	Radionuclide Concentration (pCi/g) Cs-137	Co-60	U-235	Th-232[a]
1	U	0-6 in.	M[b]	M	0.2	0.9
		6-12 in.	0.4	M	0.2	0.8
2	W	0-6 in.	0.2	0.02	0.1	1.1
		6-12 in.	0.1	M	0.1	1.3
		1-2 ft	0.03	M	0.1	1.1
		2-3 ft	0.03	M	0.1	1.1
3	W-1	0-6 in.	1.2	0.02	0.3	2.2
		6-12 in.	0.7	0.01	0.3	1.7
4	X	0-6 in.	0.2	0.1	0.2	2.1
		6-12 in.	0.1	0.04	0.1	1.8
5	DS-134	0-1 in.	1.65	M	1.4	13.0
	DS-135	6 in.	2.2	M	2.4	43.0
	DS-136	12 in.	M	M	1.0	16.0
6	B-23	0-1 ft	5.11	2.39	M	M
		1-2 ft	M	1.3	0.3	M
		2-3 ft	M	M	0.3	M
		3-4 ft	0.91	M	M	M
7	B-22	0-1 ft	37.1	9.8	M	M
		1-2 ft	0.7	M	M	M
		2-3 ft	M	M	M	M
		3-4.5 ft	M	M	M	M
8	B-10	1-2 ft	M	M	M	M
		2-3 ft	M	M	M	M
		3-4 ft	M	M	M	M
9	B-9	1-2 ft	M	M	M	M
		2-3 ft	M	M	0.3	M
		3-4 ft	M	M	M	M
10	B-8	1-2 ft	M	M	M	M
		2-3 ft	M	M	M	M
		3-4 ft	M	M	M	M
11	B-5	1-2 ft	M	M	M	M
		2-3 ft	M	M	M	M
		3-5 ft	M	M	M	M
12	B-24	0-1 ft	2.33	M	M	M
		1-2 ft	M	M	M	M
		2-3 ft	M	M	0.3	M
		3-4 ft	M	M	0.2	M

SOIL SAMPLES TAKEN PRIOR TO DECONTAMINATION (Continued)

Sample No.	Location ID	Depth	Radionuclide Concentration (pCi/g) Cs-137	Co-60	U-235	Th-232(a)
13	B-25	0-1 ft	1.26	M	0.2	M
		1-2 ft	M	M	M	M
		2-3 ft	M	M	M	M
		3-4 ft	M	M	M	M
14	B-26	0-1 ft	1.09	2.83	M	M
		1-2 ft	M	1.79	M	M
		2-3 ft	M	M	M	M
		3-4 ft	M	M	0.3	M
15	B-27	0-1 ft	3.3	4.41	M	M
		1-2 ft	M	24.2	0.5	M
		2-3 ft	M	13.5	M	M
		3-4 ft	M	3.0	M	M
		4-5 ft	M	M	0.3	M
		5-6 ft	M	M	M	M
		6-7 ft	M	M	M	M
		7-9 ft	M	M	M	M
16	B-28	0-1 ft	148.46	36.1	M	M
		1-2 ft	240.0	138.0	M	4.5
		2-3 ft	25.8	187.0	M	2.4
		3-4 ft	1.57	34.5	M	M
		4-5 ft	M	7.9	M	M
		5-6 ft	M	2.3	0.3	--
		6-7 ft	M	4.11	M	M
		7-8 ft	M	2.6	M	M
		8-9 ft	M	6.81	M	M
		9-10 ft	0.63	M	M	M
		10-11 ft	M	M	--	--
17	B-38	0-1 in.	404.0	68.2	M	M
		1-2 ft	3.45	1.85	M	--
		2-3 ft	M	7.59	0.3	--
18	B-37	0-1 ft	105.0	14.7	0.6	M
		1-2 ft	M	M	--	--
		2-3 ft	M	M	--	--
		3-4 ft	0.66	M	M	M
19	B-36	0-1 ft	407.4	142.0	M	2.6
		1-2 ft	1.57	10.0	M	M
		2-3 ft	M	1.51	M	M
		3-4 ft	M	M	M	M
		4-5 ft	M	1.43	--	--

SOIL SAMPLES TAKEN PRIOR TO DECONTAMINATION (Continued)

Sample No.	Location ID	Depth	Radionuclide Concentration (pCi/g) Cs-137	Co-60	U-235	Th-232(a)
20	B-35	0-1 ft	58.9	163.3	M	M
		1-2 ft	2.83	93.9	0.3	M
		2-3 ft	M	6.98	M	M
		3-4 ft	M	1.63	M	M
		4-5 ft	M	3.7	--	--
		5-6 ft	M	M	M	--
		6-7 ft	M	M	0.3	--
		7-8 ft	M	M	--	--
		8-9 ft	M	M	0.2	--
21	B-34	0-1 ft	M	M	M	M
		1-2 ft	M	M	M	M
		2-3 ft	24.7	13.9	0.4	M
		4-5 ft	M	M	--	--
		5-6 ft	M	M	--	--
		6-7 ft	M	M	--	--
		7-8 ft	M	M	0.3	--
22	B-7	1-2 ft	35.2	1.8	M	M
		3-4 ft	0.7	M	M	M
		4-5 ft	M	M	0.1	M
		5-6 ft	M	M	M	M
23	B-6	1-2 ft	28.9	1.6	M	2.2
		2-3 ft	4.6	1.53	M	M
		3.5-5 ft	35.4	1.8	M	M
24	B-39	0-1 ft	20.4	4.19	M	M
		1-2 ft	14.2	2.49	M	M
		2-3 ft	4.74	5.58	M	M
		3-4 ft	M	5.15	--	--
25	DS-131	0-1 in.	648.9	455.9	4.5	--
	DS-132	6 in.	421.7	166.9	5.0	7.3
26	B-40	0-1 ft	M	M	M	M
		1-2 ft	M	M	0.3	--
		2-3 ft	M	M	M	M
		3-4 ft	M	M	--	--
27	B-29	0-1 ft	3.9	M	0.2	M
		1-2 ft	M	M	M	M
		2-3 ft	M	M	M	M
		3-4 ft	M	M	M	M
28	B-30	0-1 ft	4.2	M	M	M
		1-2 ft	M	M	M	M
		2-3 ft	M	M	M	M
		3-4 ft	M	M	M	M

SOIL SAMPLES TAKEN PRIOR TO DECONTAMINATION (Continued)

Sample No.	Location ID	Depth	Radionuclide Concentration (pCi/g) Cs-137	Co-60	U-235	Th-232[a]
29	DS-123	0-1 in.	27.9	3.1	0.6	--
	DS-124	1-6 in.	2.0	M	M	--
	DS-125	6-12 in.	M	M	M	M
	DS-126	1-2 ft	0.65	M	M	M
30	DS-119	0-1 in.	163.7	9.8	0.9	2.5
	DS-120	1-6 in.	87.3	5.2	0.9	M
	DS-121	6-12 in.	19.5	1.3	0.4	--
	DS-122	1-2 ft	14.2	M	M	--
31	DS-127	0-1 in.	16.5	2.2	M	--
	DS-128	0-6 in.	2.5	2.1	0.3	--
	DS-129	6-12 in.	746.7	11.3	M	--
	DS-130	1-2 ft	70.1	7.5	M	--
32	B-32	0-1 ft	1.3	--	M	M
		1-2 ft	M	M	M	M
		2-3 ft	M	M	M	M
		3-4 ft	M	M	M	M
33	B-33	0-1 ft	4.21	M	M	M
		1-2 ft	M	M	0.6	M
		2-3 ft	M	M	M	2.0
		3-4 ft	M	M	M	M
34	B-31	0-1 ft	28.5	4.7	0.5	M
		1-2 ft	M	--	M	M
		2-3 ft	M	--	M	M
		3-4 ft	M	--	M	M
35	A	0-6 in.	33.0	19.4	0.6	3.2
		6-12 in.	8.8	4.7	0.4	5.6
36	DS-76	0-1 in.	80.4	20.6	2.7	4.96
		1-6 in.	23.8	2.07	6.1	3.24
37	DS-92	0-1 in.	5.7	M	0.2	M
38	DS-79	0-1 in.	13.3	M	0.4	2.6
		1-6 in.	2.6	0.3	0.3	1.8
39	DS-86	0-1 in.	82.8	3.4	3.3	3.6
40	DS-87	0-1 in.	6.9	M	M	M
	DS-91	0-1 in.	31.5	0.8	1.0	2.5
41	DS-78	0-1 in.	71.1	3.7	4.0	22.1
		1-6 in.	83.2	2.3	3.3	6.8
42	DS-77	0-1 in.	162.3	7.6	6.4	3.25
		1-6 in.	35.9	3.5	1.2	2.04
43	DWYS-1		115.9	12.7	6.8	11.9

SOIL SAMPLES TAKEN PRIOR TO DECONTAMINATION (Continued)

Sample No.	Location ID	Depth	Radionuclide Concentration (pCi/g) Cs-137	Co-60	U-235	Th-232[a]
44	DWYS-2		103.5	15.0	4.2	6.7
45	DWYS-3		119.4	9.7	5.6	17.1
46	A-1	0-6 in.	42.0	17.0	4.2	5.4
		6-12 in.	26.0	6.8	2.5	3.6
		1-2 ft	3.9	1.0	0.5	M
		3-4 ft	0.1	0.1	0.2	1.8
47	DWYS-4		17.6	1.8	0.4	2.2
48	DWYS-5		21.8	2.8	0.8	2.9
49	DWYS-6		16.8	2.5	0.3	M
50	DWYS-7		16.3	5.7	0.5	M
51	DWYS-8		26.1	3.3	0.9	2.6
52	DWYS-9		25.0	7.7	0.8	2.5
53	DWYS-10		8.9	3.7	0.3	M
54	DS-80	0-1 in.	13.4	2.6	0.4	M
	DS-81	1-6 in.	1.5	M	M	M
	DS-82	6-12 in.	M	M	M	M
	DS-83	1-2 ft	M	M	M	M
55	DS-84	0-1 in.	81.7	8.8	3.7	3.6
	DS-85	1-6 in.	15.5	2.9	0.8	2.0
56	C	0-6 in.	7.8	0.3	0.5	1.0
		6-12 in.	9.6	0.5	0.6	1.0
57	F	0-6 in.	0.5	0.1	0.2	1.3
		6-12 in.	0.2	0.1	0.1	1.3
		1-2 ft	0.1	0.01	0.1	1.2
		2-3 ft	0.1	0.01	0.1	1.2
58	E	0-6 in.	16.8	1.6	0.4	2.5
		6-12 in.	3.9	0.3	0.2	1.7
59	D	0-1 in.	8.2	1.5	0.2	1.8
		0-6 in.	7.3	1.7	0.2	1.7
		6-12 in.	3.3	0.8	0.2	1.7
60	DS-113	0-1 in.	M	M	0.3	--
	DS-114	6 in.	M	M	0.4	--
	DS-115	12 in.	M	M	0.5	--
	DS-116	1-2 ft	M	M	0.4	--
	DS-117	2-3 ft	M	M	0.3	M
	DS-118	3-4 ft	M	M	M	--

SOIL SAMPLES TAKEN PRIOR TO DECONTAMINATION (Continued)

Sample No.	Location ID	Depth	Radionuclide Concentration (pCi/g) Cs-137	Co-60	U-235	Th-232[a]
61	DS-107	0-1 in.	0.52	M	M	--
	DS-108	6 in.	M	M	0.3	--
	DS-109	12 in.	M	M	0.2	M
	DS-110	1-2 ft	M	M	M	M
	DS-111	2-3 ft	M	M	M	M
	DS-112	3-4 ft	M	M	M	M
62	DS-133	0-1 in.	M	M	0.7	2.5
63	DS-255 B-11	0-1 ft	1.0	M	0.6	2.3
		1-2 ft	M	M	0.2	2.0
		2-3 ft	M	M	M	1.7
		3-4 ft	M	M	M	1.3
64	DS-256 B-12	0-1 ft	M	M	0.2	1.9
		1-2 ft	M	M	0.3	1.8
		2-3 ft	M	M	M	1.9
		3-4 ft	M	M	M	1.9
65	DS-257 B-13	0-1 ft	M	M	0.3	2.6
		1-2 ft	M	M	M	2.0
		2-3 ft	M	M	M	2.1
66	DS-258 B-14	0-1 ft	M	M	M	2.0
		1-2 ft	M	M	M	2.0
		2-3 ft	M	M	0.2	2.0
		3-4 ft	M	M	M	2.0
67	DS-137	0-1 in.	56.9	2.0	26.9	25.8
68	DS-260 B-16	0-1 ft	M	M	0.6	3.4
		1-2 ft	M	M	0.3	2.1
		2-2.5 ft	M	M	0.2	2.2
69	DS-259 B-15	0-1 ft	M	M	0.5	2.5
		1-2 ft	M	M	0.3	1.9
		2-3.5 ft	M	M	0.3	2.3
70	DS-261 B-17	0-1 ft	M	M	7.9	5.7
		1-2 ft	M	M	0.2	1.8
		2-3 ft	M	M	M	1.8
		3-4 ft	M	M	0.2	1.7
71	DS-138	0-1 in.	M	M	10.1	301.9
72	B-10	0-2 ft	M	M	0.2	2.1
73	B-6	0-4 ft	M	M	M	1.8
74	B-9	0-2 ft	M	M	M	1.8
75	B-7	0-3.5 ft	M	M	M	1.8

SOIL SAMPLES TAKEN PRIOR TO DECONTAMINATION (Continued)

Sample No.	Location ID	Depth	Radionuclide Concentration (pCi/g) Cs-137	Co-60	U-235	Th-232[a]
76	B-8	0-4 ft	M	M	M	2.3
77	I	0-6 in.	0.6	0.03	0.1	1.8
		6-12 in.	0.1	0.03	0.2	1.6
78	J	0-6 in.	0.1	0.1	0.2	1.5
		6-12 in.	0.8	0.04	0.2	1.5
		1-2 ft	0.8	0.04	0.2	1.3
		2-3 ft	2.5	0.1	0.4	1.6
		3-4 ft	3.8	0.2	0.7	1.9
		4-4.5 ft	0.2	0.02	0.1	1.3
		4.5-5 ft	M	M	0.1	1.2
79	P	0-6 in.	0.9	0.05	0.1	1.4
80	Q	0-6 in.	0.56	0.04	0.1	1.4
		6-12 in.	0.58	0.04	0.1	1.4
		1-2 ft	0.83	0.02	0.2	1.3
		2-3 ft	0.15	0.01	0.1	1.5
		3-4 ft	0.05	0.01	0.1	1.3
		4-5 ft	0.01	0.01	0.1	1.5
81	O	0-6 in.	1.1	M	0.3	1.1
		6-12 in.	0.4	M	0.2	0.8
		1-2 ft	0.2	M	0.3	1.0
		2-3 ft	M	M	0.2	0.1
82	B-41	0-1 ft	13.4	1.90	0.4	M
		1-2 ft	M	M	0.3	M
		2-3 ft	M	M	0.2	M
		3-4 ft	M	M	0.3	M
		4-5 ft	M	M	M	--
83	B	0-6 in.	2.1	0.1	0.2	1.0
		6-12 in.	1.5	M	0.2	1.0

[a] Th-232 value obtained by assuming equilibrium with the daughters AC-228 and Ra-228.

[b] M - minimal means:

<0.1 pCi/g Cs-137
<0.1 pCi/g Co-60
<0.4 pCi/g U-235
<2.0 pCi/g Th-232

APPENDIX 2
RESULTS OF SOIL SAMPLES COLLECTED AFTER CLEAN-UP

TABLE 2-A
AREA "A" SOIL SAMPLE RESULTS

Sample ID		Radionuclide Concentration (pCi/g)								
		Co-60	Cs-137	Th-228	Th-232[a]	Ra-226	U-238	U-235	% Lung Dose (20 mRem/yr)	Gross Beta
A1	DS 279	ND	0.2 ± 0.1	2.1 ± 0.3	2.6 ± 0.5	1.0 ± 0.2	1 ± 2	0.24 ± 0.12	46.6	80.54 ± 2.95
A2	DS 280	ND	0.52 ± 0.06	4.4 ± 0.4	5.1 ± 0.4	1.3 ± 0.2	3 ± 2	0.32 ± 0.12	139	88.43 ± 3.47
A2-1	DS 305	1.78 ± [illegible]25	8.73 ± 0.69	1.71 ± 0.43	1.82 ± 0.66	0.88 ± 0.36	1.67 ± 1.09	0.40 ± 0.16	63.5	94.44 ± 3.18
A2-2	DS 501	0.00 ± [illegible].00	0.11 ± 0.07	1.15 ± 0.47	1.79 ± 0.72	1.29 ± 0.47	2.66 ± 1.55	0.24 ± 0.18	45.8	78.35 ± 3.00
A3	DS 281	ND	3.2 ± 0.4	2.1 ± 0.3	2.2 ± 0.4	1.1 ± 0.2	3 ± 2	0.22 ± 0.14	49.1	102.70 ± 3.32
A4	DS 282	1.0 ± 0.2	2.6 ± 0.3	1.8 ± 0.3	2.1 ± 0.4	1.0 ± 0.2	1 ± 1	0.12 ± 0.09	30.7	92.81 ± 3.16
A5	DS 283	ND	2.0 ± 0.3	1.9 ± 0.4	1.8 ± 0.4	1.0 ± 0.2	2 ± 2	0.14 ± 0.10	33.3	82.86 ± 2.99
A6	DS 284	ND	0.4 ± 0.1	1.7 ± 0.3	2.1 ± 0.4	1.1 ± 0.3	2 ± 2	0.18 ± 0.12	39.6	77.02 ± 2.89
A7	DS 285	ND	0.3 ± 0.1	1.6 ± 0.3	1.7 ± 0.5	1.2 ± 0.2	2 ± 2	0.5 ± 0.2	72.4	75.52 ± 2.85
A8	DS 286	ND	1.0 ± 0.1	1.4 ± 0.3	1.6 ± 0.2	1.1 ± 0.1	6 ± 3	5.4 ± 0.4	611	79.15 ± 2.92
A8-1	DS 304	3.29 ± 0.39	100.00 ± 5.87	3.06 ± 0.69	3.32 ± 1.16	0.78 ± 0.47	1.16 ± 1.42	2.28 ± 0.44	281	232.40 ± 4.95
A8-2	DS 500	0.00 ± 0.00	0.48 ± 0.12	1.48 ± 0.44	1.42 ± 0.80	1.98 ± 0.39	0.96 ± 0.79	0.19 ± 0.12	35.2	71.91 ± 2.79
A9	DS 306	0.00 ± 0.00	0.00 ± 0.00	1.41 ± 0.27	2.75 ± 0.53	1.37 ± 0.27	2.85 ± 1.09	0.08 ± 0.07	30.7	84.71 ± 3.02
A10	DS 307	0.00 ± 0.00	1.09 ± 0.19	1.47 ± 0.28	1.85 ± 0.53	1.41 ± 0.27	4.72 ± 1.41	0.27 ± 0.14	56.7	84.41 ± 3.01
A11	DS 378	0.00 ± 0.00	0.18 ± 0.08	1.62 ± 0.30	1.94 ± 0.50	1.10 ± 0.24	1.24 ± 1.08	0.15 ± 0.11	33.9	75.54 ± 2.86
A12	DS 377	0.00 ± 0.00	0.62 ± 0.16	1.77 ± 0.33	1.38 ± 0.48	1.37 ± 0.28	0.88 ± 0.94	0.14 ± 0.11	31.2	82.66 ± 2.98
A13	DS 497	0.00 ± 0.00	0.00 ± 0.00	1.47 ± 0.46	1.64 ± 0.71	1.17 ± 0.44	2.94 ± 1.41	0.04 ± 0.09	16.3	79.82 ± 2.79
A14	DS 498	0.00 ± 0.00	0.00 ± 0.00	1.53 ± 0.46	1.50 ± 0.54	1.21 ± 0.40	2.53 ± 1.29	0.10 ± 0.09	29.9	72.62 ± 2.80
A15	DS 499	0.00 ± 0.00	0.00 ± 0.00	1.60 ± 0.46	1.80 ± 0.78	1.19 ± 0.41	2.09 ± 1.23	0.17 ± 0.13	37.7	71.28 ± 2.92
A16	DS 503	0.00 ± 0.00	0.00 ± 0.00	1.00 ± 0.45	1.56 ± 0.78	0.78 ± 0.42	1.94 ± 1.20	0.10 ± 0.10	26.5	72.40 ± 3.02
A17	DS 504	0.00 ± 0.00	0.71 ± 0.16	1.28 ± 0.38	1.48 ± 0.57	1.19 ± 0.38	0.94 ± 0.77	0.21 ± 0.13	36.4	78.89 ± 2.92

[a] Th-232 value obtained by assuming equilibrium with the daughters Ac-228 and Ra-228.

TABLE 2-B
AREA "B" SOIL SAMPLE RESULTS

Sample ID			Radionuclide Concentration (pCi/g)								
			Co-60	Cs-137	Th-228	Th-232[a]	Ra-226	U-238	U-235	% Lung Dose (20 mRem/yr)	Gross Beta
B1	DS 287		0.2 ± 0.1	ND	1.4 ± 0.2	1.4 ± 0.4	1.1 ± 0.2	ND	0.2 ± 0.1	32.6	72.70 ± 2.80
B2	DS 288		ND	ND	2.0 ± 0.3	2.2 ± 0.4	1.3 ± 0.2	2 ± 2	0.13 ± 0.09	36.1	79.82 ± 2.93
B3	DS 289		ND	1.8 ± 0.2	1.7 ± 0.2	1.8 ± 0.3	0.9 ± 0.2	2 ± 2	0.11 ± 0.09	31.1	76.52 ± 2.86
B4	DS 290		ND	1.1 ± 0.1	1.3 ± 0.2	1.6 ± 0.4	0.9 ± 0.3	3 ± 2	0.12 ± 0.8	32.6	67.58 ± 2.70
B5	DS 291		0.4 ± 0.2	3.6 ± 0.4	1.7 ± 0.4	2.1 ± 0.5	1.1 ± 0.3	3 ± 2	0.34 ± 0.15	59.8	81.73 ± 2.97
B6	DS 292		ND	0.5 ± 0.1	1.5 ± 0.4	1.8 ± 0.4	1.1 ± 0.3	2 ± 2	0.07 ± 0.07	25.8	81.40 ± 2.96
B7	DS 293		ND	1.6 ± 0.2	1.6 ± 0.3	1.6 ± 0.5	1.1 ± 0.2	2 ± 2	0.15 ± 0.10	34.5	78.10 ± 2.89
B8	DS 294		0.3 ± 0.2	2.2 ± 0.3	1.7 ± 0.3	1.6 ± 0.4	1.1 ± 0.2	2 ± 2	0.33 ± 0.13	54.4	81.89 ± 2.97
B9	DS 295		ND	0.2 ± 0.1	1.6 ± 0.3	1.7 ± 0.4	1.0 ± 0.2	2 ± 2	0.11 ± 0.9	30.4	69.03 ± 2.73
B10	DS 296		ND	ND	1.7 ± 0.3	1.9 ± 0.4	0.9 ± 0.2	1 ± 2	0.09 ± 0.08	26.4	72.67 ± 2.80
B11	DS 297		0.2 ± 0.1	7.9 ± 0.6	1.5 ± 0.3	1.6 ± 0.5	0.8 ± 0.2	ND	0.10 ± 0.09	22.9	86.75 ± 3.05
B12	DS 298		0.2 ± 0.1	1.9 ± 0.2	1.2 ± 0.4	1.4 ± 0.5	0.9 ± 0.3	2 ± 2	0.02 ± 0.08	17.9	78.40 ± 2.90
B13	DS 299		0.5 ± 0.2	1.3 ± 0.2	1.2 ± 0.3	1.4 ± 0.5	0.9 ± 0.3	1 ± 1	0.05 ± 0.05	18.2	79.30 ± 2.93
B14	DS 406	1 in.[b]	0.00 ± 0.00	1.09 ± 0.20	1.42 ± 0.45	1.61 ± 0.69	1.10 ± 09.41	0.00 ± 0.00	0.14 ± 0.09	27.8	75.56 ± 2.85
B14	DS 403	1 ft	0.00 ± 0.00	2.95 ± 0.32	1.50 ± 0.40	1.72 ± 0.62	0.97 ± 0.35	0.99 ± 0.75	0.37 ± 0.16	56.1	
B15	DS 401	1 in.	0.00 ± 0.00	0.42 ± 0.11	0.94 ± 0.34	1.19 ± 0.50	0.71 ± 0.29	0.55 ± 0.51	0.05 ± 0.05	15.4	76.60 ± 2.79
B15	DS 409	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.06 ± 0.36	1.32 ± 0.55	0.69 ± 0.32	1.39 ± 0.60	0.04 ± 0.04	17.3	
B16	DS 405	1 in.	0.00 ± 0.00	1.93 ± 0.24	1.25 ± 0.36	1.56 ± 0.58	0.94 ± 0.33	1.82 ± 1.05	0.09 ± 0.08	25.9	80.12 ± 2.94
B16	DS 402	1 ft	0.00 ± 0.00	0.40 ± 0.13	1.21 ± 0.42	1.23 ± 0.61	0.70 ± 0.35	0.57 ± 0.59	0.05 ± 0.06	16.8	
B17	DS 404	1 in.	1.30 ± 0.24	6.11 ± 0.54	1.76 ± 0.48	2.13 ± 0.79	0.90 ± 0.38	1.45 ± 1.23	0.49 ± 0.17	73.3	90.41 ± 3.12
B17	DS 410	1 ft	0.00 ± 0.00	0.15 ± 0.08	1.17 ± 0.39	1.42 ± 0.61	0.93 ± 0.36	2.03 ± 1.24	0.08 ± 0.07	24.8	
B18	DS 466	1 in.	0.71 ± 0.18	0.90 ± 0.19	1.45 ± 0.50	1.58 ± 0.73	0.98 ± 0.45	0.77 ± 0.85	0.13 ± 0.09	28.2	73.22 ± 2.80
B18	DS 465	1 ft	0.25 ± 0.08	2.43 ± 0.30	1.45 ± 0.45	2.13 ± 0.87	0.93 ± 0.40	1.53 ± 1.04	0.16 ± 0.12	35.2	75.71 ± 2.86

[a] Th-232 value obtained by assuming equilibrium with the daughters Ac-228 and Ra-226.

[b] 1 in. = 0-1 in.
1 ft = 1-12 in.

TABLE 2-C
AREA "C" SOIL SAMPLE RESULTS

Sample ID			Radionuclide Concentration (pCi/g)								
			Co-60	Cs-137	Th-228	Th-232[a]	Ra-226	U-238	U-235	% Lung Dose (20 mRem/yr)	Gross Beta
C-1	DS 398		0.00 ± 0.00	0.05 ± 0.04	1.64 ± 0.41	1.72 ± 0.63	0.96 ± 0.15	0.92 ± 0.71	0.10 ± 0.08	26.9	72.43 ± 2.80
C-2	DS 399		0.00 ± 0.00	0.00 ± 0.00	1.64 ± 0.44	1.95 ± 0.64	1.21 ± 0.39	0.98 ± 0.96	0.24 ± 0.15	43.7	
C-3	DS 400		0.00 ± 0.00	0.00 ± 0.00	1.75 ± 0.41	2.04 ± 0.63	1.22 ± 0.38	1.93 ± 1.05	0.03 ± 0.04	23.4	71-83 ± 2.79
C-4	DS 451	1 in.[b]	0.00 ± 0.00	0.46 ± 0.13	1.77 ± 0.42	1.34 ± 0.55	1.06 ± 0.28	0.69 ± 0.62	0.04 ± 0.04	16.9	74.84 ± 2.84
C-4	DS 464	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.42 ± 0.38	1.91 ± 0.60	0.87 ± 0.31	1.66 ± 0.82	0.11 ± 0.09	29.2	69.33 ± 2.74
C-5	DS 454	1 in.	0.00 ± 0.00	0.00 ± 0.00	1.26 ± 0.38	1.17 ± 0.62	0.86 ± 0.33	1.09 ± 0.96	0.08 ± 0.08	22.1	72.74 ± 3.41
C-5	DS 416	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.17 ± 0.34	1.43 ± 0.52	0.79 ± 0.29	0.95 ± 0.93	0.07 ± 0.07	21.0	
C-6	DS 463	1 in.	0.00 ± 0.00	0.83 ± 0.17	2.22 ± 0.50	2.18 ± 0.75	0.92 ± 0.39	2.51 ± 1.26	0.51 ± 0.17	80.9	79.15 ± 2.92
C-6	DS 421	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.17 ± 0.35	1.13 ± 0.43	0.89 ± 0.30	1.57 ± 1.01	0.08 ± 0.07	22.0	72.22 ± 2.79
C-7	DS 459	1 in.	0.00 ± 0.00	0.16 ± 0.07	1.40 ± 0.36	1.38 ± 0.57	0.92 ± 0.33	0.00 ± 0.00	0.11 ± 0.09	23.6	80.59 ± 2.95
C-7	DS 418	1 ft	0.00 ± 0.00	0.00 ± 0.00	0.92 ± 0.32	1.18 ± 0.51	0.67 ± 0.30	0.74 ± 0.53	0.03 ± 0.03	13.1	71.67 ± 2.78
C-8	DS 457	1 in.	0.00 ± 0.00	0.00 ± 0.00	1.26 ± 0.37	1.69 ± 0.60	1.04 ± 0.32	1.63 ± 0.85	0.14 ± 0.10	31.0	76.94 ± 2.89
C-8	DS 450	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.45 ± 0.40	1.66 ± 0.67	0.77 ± 0.35	0.00 ± 0.00	0.25 ± 0.13	39.9	75.06 ± 2.85
C-9	DS 453	1 in.	0.00 ± 0.00	0.32 ± 0.09	1.16 ± 0.35	1.31 ± 0.57	0.82 ± 0.33	0.00 ± 0.00	0.15 ± 0.10	26.1	75.63 ± 2.86
C-9	DS 460	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.40 ± 0.37	1.68 ± 0.58	0.81 ± 0.32	1.68 ± 0.82	0.07 ± 0.07	24.1	75.03 ± 2.85

[a] Th-232 value obtained by assuming equilibrium with the daughters Ac-228 and Ra-228.

[b] 1 in. = 0-1 in.
1 ft = 1-12 in.

TABLE 2-D
AREA "D" SOIL SAMPLE RESULTS

Sample ID			Radionuclide Concentration (pCi/g)								
			Co-60	Cs-137	Th-228	Th-232[a]	Ra-226	U-238	U-235	% Lung Dose (20 mRem/yr)	Gross Beta
D-1	DS 417	1 in.[b]	0.00 ± 0.00	0.48 ± 0.12	1.51 ± 0.42	1.25 ± 1.66	0.92 ± 0.36	2.67 ± 1.23	0.15 ± 0.10	35.3	70.03 ± 2.74
D-1	DS 425	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.29 ± 0.39	1.72 ± 0.67	0.80 ± 0.34	1.93 ± 1.26	0.09 ± 0.07	26.7	72.87 ± 2.80
D-2	DS 419	1 in.	1.71 ± 0.28	0.00 ± 0.00	1.38 ± 0.46	1.76 ± 0.78	1.11 ± 0.45	1.97 ± 1.08	0.06 ± 0.07	24.4	82.28 ± 2.97
D-2	DS 414	1 ft	0.00 ± 0.00	0.25 ± 0.09	1.26 ± 0.48	1.19 ± 0.66	0.91 ± 0.42	1.51 ± 1.01	0.06 ± 0.06	21.3	
D-3	DS 415	1 in.	14.09 ± 1.13	2.32 ± 0.32	1.27 ± 0.48	1.91 ± 0.90	0.84 ± 0.42	3.09 ± 1.43	0.50 ± 0.19	76.5	95.24 ± 3.19
D-3	DS 452	1 ft	0.00 ± 0.00	0.22 ± 0.09	1.18 ± 0.39	1.28 ± 0.56	0.73 ± 0.34	0.00 ± 0.00	0.17 ± 0.12	28.3	74.54 ± 2.84
D-4	DS 407	1 in.	0.28 ± 0.04	5.52 ± 0.47	1.28 ± 0.37	1.64 ± 0.66	0.94 ± 0.35	1.63 ± 0.96	0.06 ± 0.05	22.5	81.95 ± 2.97
D-4	DS 411	1 ft	0.00 ± 0.00	0.46 ± 0.12	1.35 ± 0.38	1.43 ± 0.58	0.86 ± 0.32	1.38 ± 0.63	0.13 ± 0.08	28.9	
D-5	DS 413	1 in.	0.16 ± 0.12	1.26 ± 0.19	1.40 ± 0.40	1.46 ± 0.53	0.98 ± 0.36	0.98 ± 0.74	0.17 ± 0.12	33.1	79.96 ± 2.93
D-5	DS 412	1 ft	0.00 ± 0.00	0.58 ± 0.14	1.36 ± 0.41	1.37 ± 0.64	0.94 ± 0.37	1.45 ± 0.97	0.07 ± 0.07	22.8	
D-6	DS 408	1 in.	0.52 ± 0.13	0.16 ± 0.07	1.43 ± 0.46	1.34 ± 0.69	0.94 ± 0.40	0.00 ± 0.00	0.07 ± 0.08	19.4	85.93 ± 3.04
D-6	DS 424	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.18 ± 0.39	0.70 ± 1.35	1.18 ± 0.36	1.01 ± 0.81	0.04 ± 0.05	15.4	75.84 ± 2.87
D-7	DS 427	1 in.	3.53 ± 0.40	0.00 ± 0.00	1.24 ± 0.41	0.82 ± 0.57	1.07 ± 0.41	1.73 ± 0.74	0.08 ± 0.08	23.0	76.75 ± 2.88
D-7	DS 422	1 ft	0.54 ± 0.15	0.00 ± 0.00	1.30 ± 0.42	1.31 ± 0.61	1.27 ± 0.42	0.88 ± 0.94	0.09 ± 0.07	22.7	79.45 ± 2.93
D-8	DS 458	1 in.	0.85 ± 0.16	1.54 ± 0.23	1.31 ± 0.38	1.49 ± 0.63	0.85 ± 0.36	1.76 ± 1.11	0.09 ± 0.08	26.3	87.39 ± 3.07
D-8	DS 420	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.50 ± 0.38	1.48 ± 0.55	0.83 ± 0.32	2.48 ± 1.03	0.04 ± 0.05	23.6	71.56 ± 2.78
D-9	DS 449	1 ft	0.00 ± 0.00	0.74 ± 0.15	1.26 ± 0.43	1.20 ± 0.65	0.85 ± 0.39	0.00 ± 0.00	0.14 ± 0.10	25.2	80.62 ± 2.95
D-9	DS 462	1 in.	0.00 ± 0.00	0.00 ± 0.00	1.25 ± 0.41	1.43 ± 0.60	0.89 ± 0.36	2.05 ± 1.26	0.06 ± 0.06	23.5	80.92 ± 2.95
D-10	DS 461	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.21 ± 0.44	1.62 ± 0.72	0.72 ± 0.37	2.74 ± 1.32	0.13 ± 0.10	33.2	77.15 ± 3.46
D-10	DS 456	1 in.	1.16 ± 0.20	3.66 ± 0.37	1.49 ± 0.41	1.74 ± 0.68	0.89 ± 0.34	0.93 ± 0.79	0.06 ± 0.06	23.3	92.46 ± 3.15

[a] Th-232 value obtained by assuming equilibrium with the daughters Ac-228 and Ra-228.

[b] 1 in. = 0-1 in.
1 ft = 1-12 in.

APPENDIX 3
FINAL SOIL SAMPLE RESULTS

TABLE 3-A
AREA "FA" SOIL SAMPLE RESULTS

Sample ID					Radionuclide Concentration (pCi/g)								
					Co-60	Cs-137	Th-228	Th-232[a]	Ra-226	U-238	U-235	% Lung Dose (20 mRem/yr)	Gross Beta
FA-1	DS 440	N 7155	E 9655	1 in.[b]	0.00 ± 0.00	0.00 ± 0.00	1.15 ± 0.41	1.08 ± 0.62	1.09 ± 0.39	0.00 ± 0.00	0.10 ± 0.09	20.1	71.15 ± 2.77
FA	DS 443	N 7155	E 9655	1 ft	0.00 ± 0.00	0.02 ± 0.04	1.20 ± 0.40	1.29 ± 0.59	1.11 ± 0.40	0.57 ± 0.77	0.05 ± 0.06	17.3	72.44 ± 2.80
FA-2	DS 355	N 7160	E 9700	1 in.	0.00 ± 0.00	0.97 ± 0.16	1.71 ± 0.39	1.75 ± 0.59	0.92 ± 0.33	2.23 ± 0.69	0.75 ± 0.20	104	83.17 ± 2.99
FA	DS 364	N 7160	E 9700	1 ft	0.00 ± 0.00	0.79 ± 0.16	1.68 ± 0.44	1.99 ± 0.71	1.12 ± 0.37	1.76 ± 1.06	0.56 ± 0.19	81.4	72.49 ± 2.79
FA-3	DS 509	N 7170	E 9580	1 in.	0.00 ± 0.00	0.00 ± 0.00	1.28 ± 0.43	1.35 ± 0.64	1.51 ± 0.43	3.49 ± 1.23	0.23 ± 0.14	45.7	79.66 ± 2.93
FA	DS 439	N 7170	E 9580	1 ft	0.00 ± 0.00	0.60 ± 0.14	1.88 ± 0.46	1.77 ± 0.67	1.23 ± 0.39	2.25 ± 1.63	0.48 ± 0.17	74.3	83.51 ± 3.00
FA-4	DS 438	N 7170	E 9610	1 in.	0.00 ± 0.00	0.31 ± 0.10	1.77 ± 0.48	1.69 ± 0.76	1.48 ± 0.46	1.86 ± 1.17	0.38 ± 0.19	61.7	83.02 ± 2.99
FA	DS 447	N 7170	E 9610	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.25 ± 0.49	1.32 ± 0.34	1.18 ± 0.48	1.77 ± 1.33	0.20 ± 0.15	37.6	74.10 ± 2.83
FA-5	DS 507	N 7170	E 9640	1 in.	0.00 ± 0.00	0.00 ± 0.00	1.15 ± 0.43	1.32 ± 0.67	0.70 ± 0.36	1.48 ± 0.99	0.06 ± 0.05	20.3	70.82 ± 2.77
FA	DS 426	N 7170	E 9640	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.23 ± 0.35	1.38 ± 0.51	0.87 ± 0.34	0.78 ± 0.66	0.11 ± 0.09	24.9	75.36 ± 2.86
FA-6	DS 361	N 7170	E 9670	1 in.	0.00 ± 0.00	0.52 ± 0.12	1.28 ± 0.24	1.42 ± 0.40	1.17 ± 0.23	2.21 ± 1.06	0.11 ± 0.08	28.8	71.64 ± 2.78
FA	DS 381	N 7170	E 9670	1 ft	0.00 ± 0.00	0.25 ± 0.09	1.27 ± 0.35	1.37 ± 0.52	1.11 ± 0.34	1.24 ± 0.80	0.11 ± 0.09	26.1	
FA-7	DS 371	N 7170	E 9700	1 in.	0.00 ± 0.00	1.14 ± 0.19	1.27 ± 0.24	1.67 ± 0.44	1.06 ± 0.23	0.86 ± 0.85	0.14 ± 0.10	29.0	74.76 ± 2.84
FA	DS 390	N 7170	E 9700	1 ft	0.00 ± 0.00	0.19 ± 0.08	1.11 ± 0.41	1.68 ± 0.70	1.15 ± 0.41	2.24 ± 1.25	0.13 ± 0.10	31.0	
FA-8	DS 430	N 7200	E 9580	1 in.	0.00 ± 0.00	0.00 ± 0.00	1.31 ± 0.35	1.65 ± 0.59	0.90 ± 0.32	1.51 ± 0.91	0.10 ± 0.08	27.2	70.96 ± 2.77
FA	DS 445	N 7200	E 9580	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.49 ± 0.42	1.78 ± 0.65	1.17 ± 0.39	0.00 ± 0.00	0.06 ± 0.07	19.6	77.27 ± 2.89
FA-9	DS 346	N 7200	E 9610	1 in.	0.00 ± 0.00	0.24 ± 0.10	1.74 ± 0.28	1.73 ± 0.45	1.43 ± 0.27	1.85 ± 1.25	0.27 ± 0.14	54.6	75.16 ± 2.84
FA	DS 393	N 7200	E 9610	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.56 ± 0.42	2.01 ± 0.65	0.92 ± 0.36	1.10 ± 0.84	0.10 ± 0.09	27.9	
FA-10	DS 315	N 7200	E 9640	1 in.	0.00 ± 0.00	0.28 ± 0.11	1.70 ± 0.29	1.81 ± 0.51	1.17 ± 0.26	2.35 ± 1.03	0.24 ± 0.14	48.5	74.62 ± 2.84
FA	DS 362	N 7200	E 9640	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.53 ± 0.25	1.75 ± 0.41	1.04 ± 0.20	3.08 ± 1.06	0.18 ± 0.11	42.0	70.81 ± 2.93
FA-11	DS 357	N 7200	E 9670	1 in.	0.00 ± 0.00	1.00 ± 0.16	1.15 ± 0.35	1.43 ± 0.76	1.11 ± 0.35	1.04 ± 0.94	0.10 ± 0.09	23.9	72.63 ± 2.80
FA	DS 311	N 7200	E 9670	1 ft	ND	0.2 ± 0.1	1.6 ± 0.3	1.7 ± 0.4	1.2 ± 0.3	1 ± 2	0.10 ± 0.09	33.2	73.80 ± 2.83
FA-12	DS 319	N 7200	E 9700	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.40 ± 0.46	1.37 ± 0.64	1.06 ± 0.41	2.46 ± 1.18	0.14 ± 0.11	33.6	74.84 ± 2.84
FA-13	DS 314	N 7230	E 9610	1 in.	0.00 ± 0.00	2.78 ± 0.35	1.99 ± 0.35	2.32 ± 0.63	1.37 ± 0.29	1.96 ± 1.56	0.30 ± 0.16	60.7	92.81 ± 3.16
FA	DS 335	N 7230	E 9610	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.41 ± 0.42	1.89 ± 0.65	0.92 ± 0.35	2.48 ± 1.18	0.12 ± 0.10	33.5	82.86 ± 2.99
FA-14	DS 367	N 7230	E 9640	1 in.	0.00 ± 0.00	3.05 ± 0.34	1.91 ± 0.32	1.85 ± 0.46	1.19 ± 0.25	1.46 ± 1.28	0.15 ± 0.11	35.5	83.94 ± 3.01
FA	DS 312	N 7230	E 9640	1 ft	ND	2.4 ± 0.3	1.9 ± 0.3	2.2 ± 0.6	1.2 ± 0.2	1 ± 2	0.22 ± 0.13	50.6	80.87 ± 2.95
FA-15	DS 374	N 7230	E 9670	1 in.	0.00 ± 0.00	0.40 ± 0.10	1.58 ± 0.26	1.65 ± 0.45	1.00 ± 0.22	1.46 ± 1.11	0.15 ± 0.10	33.4	84.00 ± 3.01
FA	DS 396	N 7230	E 9670	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.16 ± 0.36	1.57 ± 0.57	0.87 ± 0.32	2.02 ± 1.12	0.04 ± 0.04	30.4	
FA-16	DS 373	N 7230	E 9700	1 in.	0.00 ± 0.00	1.65 ± 0.26	1.53 ± 0.29	1.51 ± 0.44	1.07 ± 0.25	2.82 ± 1.17	0.22 ± 0.12	44.4	76.06 ± 2.87
FA	DS 391	N 7230	E 9700	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.15 ± 0.37	1.67 ± 0.64	0.95 ± 0.34	1.53 ± 0.91	0.07 ± 0.07	22.4	
FA-17	DS 434	N 7245	E 9610	1 in.	0.00 ± 0.00	0.95 ± 0.17	1.10 ± 0.40	0.72 ± 0.82	0.88 ± 0.36	2.37 ± 1.13	0.07 ± 0.07	21.8	58.63 ± 2.64

TABLE 3-A (Continued)

Sample ID				Radionuclide Concentration (pCi/g)								
				Co-60	Cs-137	Th-228	Th-232[a]	Ra-226	U-238	U-235	% Lung Dose (20 mRem/yr)	Gross Beta
FA	DS 429	N 7245	E 9610	1 ft	0.00 ± 0.00	0.22 ± 0.09	1.25 ± 0.35	1.34 ± 0.54	0.96 ± 0.35	0.31 ± 0.53	0.10 ± 0.08	21.9	68.56 ± 2.72
FA-18	DS 441	N 7260	E 9580	1 in.	0.00 ± 0.00	0.49 ± 0.13	1.88 ± 0.45	2.11 ± 0.66	1.05 ± 0.38	1.05 ± 0.90	0.30 ± 0.15	51.6	79.88 ± 2.94
FA	DS 444	N 7260	E 9580	1 ft	0.00 ± 0.00	0.36 ± 0.12	1.70 ± 0.44	2.06 ± 0.67	0.96 ± 0.38	0.00 ± 0.00	0.31 ± 0.15	48.5	79.37 ± 2.93
FA-19	DS 349	N 7260	E 9610	1 in.	0.00 ± 0.00	7.56 ± 0.67	2.32 ± 0.35	2.28 ± 0.61	1.17 ± 0.29	1.47 ± 1.38	0.52 ± 0.20	80.3	90.25 ± 3.10
FA	DS 365	N 7260	E 9610	1 ft	0.00 ± 0.00	4.12 ± 0.43	2.10 ± 0.34	2.30 ± 0.53	0.99 ± 0.24	1.61 ± 1.34	0.28 ± 0.15	53.3	74.48 ± 2.83
FA-20	DS 351	N 7260	E 9640	1 in.	0.00 ± 0.00	7.18 ± 0.62	2.12 ± 0.52	2.20 ± 0.76	0.98 ± 0.40	2.71 ± 1.35	0.28 ± 0.15	55.8	90.90 ± 3.12
FA	DS 348	N 7260	E 9640	1 ft	0.00 ± 0.00	1.17 ± 0.21	1.59 ± 0.29	1.78 ± 0.47	1.06 ± 0.24	2.75 ± 1.23	0.14 ± 0.11	37.1	77.29 ± 2.88
FA-21	DS 435	N 7260	E 9670	1 in.	0.00 ± 0.00	2.19 ± 0.27	1.58 ± 0.44	1.72 ± 0.67	1.06 ± 0.38	0.92 ± 0.81	0.18 ± 0.12	35.3	78.30 ± 2.90
FA	DS 431	N 7260	E 9670	1 ft	0.00 ± 0.00	0.18 ± 0.08	1.49 ± 0.37	1.69 ± 0.62	0.98 ± 0.33	2.39 ± 1.14	0.07 ± 0.07	26.8	73.47 ± 2.98
FA-22	DS 433	N 7260	E 9685	1 in.	0.00 ± 0.00	1.13 ± 0.20	1.36 ± 0.44	1.48 ± 0.75	1.00 ± 0.40	1.41 ± 1.03	0.15 ± 0.12	32.0	69.49 ± 2.75
FA	DS 448	N 7260	E 9685	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.55 ± 0.31	1.37 ± 0.67	1.00 ± 0.39	0.00 ± 0.00	0.08 ± 0.08	20.6	74.21 ± 2.83
FA-23	DS 369	N 7260	E 9700	1 in.	0.00 ± 0.00	0.81 ± 0.17	1.53 ± 0.29	1.57 ± 0.45	1.02 ± 0.24	2.76 ± 1.28	0.16 ± 0.11	37.6	71.04 ± 2.76
FA	DS 389	N 7260	E 9700	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.28 ± 0.46	1.63 ± 0.70	0.99 ± 0.39	1.37 ± 1.02	0.12 ± 0.11	28.6	
FA-24	DS 358	N 7290	E 9580	1 in.	0.00 ± 0.00	2.14 ± 0.27	1.85 ± 0.29	2.22 ± 0.48	1.07 ± 0.24	0.00 ± 0.00	0.31 ± 0.14	50.2	74.50 ± 2.84
FA	DS 366	N 7290	E 9580	1 ft	0.00 ± 0.00	0.22 ± 0.09	1.55 ± 0.26	1.66 ± 0.42	1.03 ± 0.22	0.00 ± 0.00	0.12 ± 0.08	26.2	
FA-25	DS 340	N 7290	E 9610	1 in.	0.00 ± 0.00	0.90 ± 0.17	3.75 ± 0.47	3.73 ± 0.68	1.21 ± 0.29	1.48 ± 1.40	0.40 ± 0.18	78.9	93.60 ± 3.17
FA	DS 394	N 7290	E 9610	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.43 ± 0.42	1.79 ± 0.67	1.02 ± 0.38	2.07 ± 1.30	0.07 ± 0.07	25.8	
FA-26	DS 333	N 7290	E 9640	1 in.	0.58 ± 0.14	2.44 ± 0.32	2.77 ± 0.60	2.96 ± 0.85	1.15 ± 0.46	4.98 ± 1.99	0.21 ± 0.14	59.9	90.38 ± 3.12
FA	DS 342	N 7290	E 9640	1 ft	0.00 ± 0.00	0.44 ± 0.14	1.59 ± 0.43	1.83 ± 0.66	1.37 ± 0.40	3.05 ± 1.30	0.10 ± 0.09	33.1	81.65 ± 3.18
FA-27	DS 310	N 7290	E 9670	1 in.	ND	1.7 ± 0.3	1.8 ± 0.3	1.9 ± 0.5	1.1 ± 0.2	1 ± 2	0.10 ± 0.09	28.0	80.84 ± 2.95
FA	DS 309	N 7290	E 9670	1 ft	ND	ND	1.7 ± 0.3	2.0 ± 0.5	1.1 ± 0.2	2 ± 2	0.08 ± 0.07	30.6	82.04 ± 2.97
FA-28	DS 387	N 7290	E 9700	1 in.	0.00 ± 0.00	0.39 ± 0.12	1.48 ± 0.41	1.35 ± 0.60	1.14 ± 0.37	2.21 ± 1.13	0.13 ± 0.11	32.5	78.16 ± 2.91
FA	DS 383	N 7290	E 9700	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.29 ± 0.38	1.45 ± 0.56	1.05 ± 0.35	1.54 ± 1.22	0.14 ± 0.12	30.8	
FA-29	DS 352	N 7290	E 9730	1 in.	0.00 ± 0.00	0.98 ± 0.19	1.25 ± 0.45	1.51 ± 0.68	1.04 ± 0.41	1.90 ± 1.13	0.06 ± 0.07	22.9	71.04 ± 2.76
FA	DS 339	N 7290	E 9730	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.68 ± 0.31	1.96 ± 0.54	1.19 ± 0.27	0.43 ± 0.54	0.15 ± 0.11	32.1	77.62 ± 2.90
FA-30	DS 508	N 7300	E 9570	1 in.	0.00 ± 0.00	1.93 ± 0.25	2.08 ± 0.45	2.54 ± 0.73	1.05 ± 0.36	1.06 ± 1.00	0.26 ± 0.13	49.4	79.85 ± 2.94
FA	DS 446	N 7300	E 9570	1 ft	0.00 ± 0.00	0.83 ± 0.17	1.44 ± 0.42	1.76 ± 0.65	0.89 ± 0.35	1.63 ± 0.85	0.23 ± 0.13	42.1	79.15 ± 2.92
FA-31	DS 360	N 7300	E 9600	1 in.	0.00 ± 0.00	2.99 ± 0.35	1.83 ± 0.30	2.04 ± 0.53	1.09 ± 0.24	1.29 ± 1.13	0.21 ± 0.13	23.4	76.79 ± 2.88
FA	DS 379	N 7300	E 9600	1 ft	0.00 ± 0.00	0.46 ± 0.14	1.87 ± 0.32	1.95 ± 0.53	1.13 ± 0.26	1.68 ± 1.27	0.21 ± 0.13	43.5	
FA-32	DS 432	N 7320	E 9570	1 in.	0.00 ± 0.00	1.31 ± 0.20	2.12 ± 0.48	2.66 ± 0.73	0.78 ± 0.35	3.28 ± 1.24	0.39 ± 0.16	70.7	75.15 ± 3.07
FA	DS 423	N 7320	E 9570	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.30 ± 0.51	1.71 ± 0.75	0.92 ± 0.45	1.12 ± 0.89	0.18 ± 0.12	24.7	71.78 ± 2.79
FA-33	DS 436	N 7320	E 9580	1 in.	0.00 ± 0.00	0.00 ± 0.00	1.38 ± 0.43	1.42 ± 0.67	0.97 ± 0.39	0.00 ± 0.00	0.14 ± 0.11	26.9	75.18 ± 2.84

TABLE 3-A (Continued)

Sample ID					Radionuclide Concentration (pCi/g)								
					Co-60	Cs-137	Th-228	Th-232[a]	Ra-226	U-238	U-235	% Lung Dose (20 mRem/yr)	Gross Beta
FA	DS 428	N 7320	E 9580	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.54 ± 0.47	1.55 ± 0.76	1.17 ± 0.44	0.28 ± 0.68	0.08 ± 0.07	20.7	80.50 ± 2.93
FA-34	DS 354	N 7320	E 9590	1 in.	0.00 ± 0.00	1.18 ± 0.18	1.57 ± 0.40	1.98 ± 0.61	1.01 ± 0.35	1.93 ± 0.90	0.54 ± 0.17	78.9	78.07 ± 2.90
FA	DS 385	N 7320	E 9580	1 ft	0.00 ± 0.00	0.63 ± 0.15	1.39 ± 0.39	1.71 ± 0.60	0.95 ± 0.34	1.29 ± 0.85	0.44 ± 0.16	64.5	
FA-35	DS 350	N 7320	E 9610	1 in.	0.00 ± 0.00	0.45 ± 0.13	1.30 ± 0.26	1.38 ± 0.44	0.96 ± 0.23	0.70 ± 0.73	0.18 ± 0.10	32.7	63.27 ± 2.61
FA	DS 382	N 7320	E 9610	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.12 ± 0.34	1.31 ± 0.52	1.03 ± 0.34	1.56 ± 1.19	0.04 ± 0.04	18.4	
FA-36	DS 345	N 7230	E 9640	1 in.	0.00 ± 0.00	1.05 ± 0.22	1.80 ± 0.36	2.65 ± 0.53	1.36 ± 0.31	0.98 ± 1.04	0.20 ± 0.14	40.2	74.89 ± 2.84
FA	DS 380	N 7320	E 9640	1 ft	0.00 ± 0.00	0.46 ± 0.13	1.39 ± 0.41	1.84 ± 0.67	1.05 ± 0.37	2.98 ± 1.25	0.20 ± 0.13	43.4	
FA-37	DS 338	N 7320	E 9670	1 in.	0.00 ± 0.00	0.60 ± 0.16	1.67 ± 0.33	1.71 ± 0.51	1.16 ± 0.27	2.29 ± 1.18	0.11 ± 0.11	32.4	76.64 ± 2.88
FA	DS 330	N 7320	E 9670	1 ft	0.00 ± 0.00	0.56 ± 0.15	1.10 ± 0.37	1.26 ± 0.59	0.87 ± 0.36	1.88 ± 1.03	0.23 ± 0.13	39.8	71.13 ± 2.77
FA-38	DS 343	N 7320	E 9700	1 in.	0.00 ± 0.00	1.82 ± 0.29	1.57 ± 0.32	1.50 ± 0.51	1.11 ± 0.28	3.08 ± 1.30	0.14 ± 0.12	36.7	76.66 ± 2.87
FA	DS 370	N 7320	E 9700	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.58 ± 0.30	1.79 ± 0.52	1.22 ± 0.27	1.64 ± 1.31	0.10 ± 0.09	29.0	
FA-39	DS 308	N 7350	E 9610	1 in.	ND	0.7 ± 0.2	1.4 ± 0.2	1.5 ± 0.4	0.9 ± 0.2	2 ± 2	0.31 ± 0.13	50.5	64.42 ± 2.65
FA	DS 344	N 7350	E 9610	1 ft	0.00 ± 0.00	0.44 ± 0.14	1.37 ± 0.27	1.30 ± 0.46	0.96 ± 0.25	1.31 ± 1.15	0.19 ± 0.12	35.7	65.37 ± 2.65
FA-40	DS 347	N 7350	E 9640	1 in.	0.00 ± 0.00	0.32 ± 0.13	2.75 ± 0.43	2.51 ± 0.58	1.23 ± 0.29	1.08 ± 1.10	0.20 ± 0.14	46.3	77.38 ± 3.09
FA	DS 395	N 7350	E 9640	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.27 ± 0.40	1.73 ± 0.63	1.25 ± 0.40	1.54 ± 1.00	0.15 ± 0.11	32.5	
FA-41	DS 331	N 7350	E 9670	1 in.	0.06 ± 0.04	0.96 ± 0.11	1.29 ± 0.32	1.49 ± 0.43	0.99 ± 0.29	1.61 ± 0.79	0.12 ± 0.07	28.6	77.29 ± 2.89
FA	DS 316	N 7350	E 9670	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.51 ± 0.46	1.92 ± 0.74	1.06 ± 0.41	2.67 ± 1.19	0.19 ± 0.13	41.7	82.53 ± 2.99
FA-42	DS 320	N 7350	E 9700	1 in.	0.00 ± 0.00	1.36 ± 0.24	1.51 ± 0.48	1.89 ± 0.81	1.09 ± 0.43	0.00 ± 0.00	0.15 ± 0.13	30.1	82.42 ± 2.98
FA	DS 321	N 7350	E 9700	1 ft	0.00 ± 0.00	0.38 ± 0.12	1.53 ± 0.43	1.75 ± 0.68	1.01 ± 0.39	1.77 ± 1.11	0.14 ± 0.11	33.2	76.64 ± 2.88
FA-43	DS 328	N 7380	E 9610	1 in.	0.00 ± 0.00	0.79 ± 0.19	1.87 ± 0.33	2.14 ± 0.61	1.30 ± 0.30	1.72 ± 1.42	0.17 ± 0.12	39.7	84.22 ± 3.02
FA	DS 334	N 7380	E 9610	1 ft	0.00 ± 0.00	0.41 ± 0.13	1.48 ± 0.49	1.32 ± 0.68	1.42 ± 0.48	0.85 ± 0.90	0.14 ± 0.10	29.5	77.29 ± 2.89
FA-44	DS 329	N 7380	E 9640	1 in.	0.00 ± 0.00	0.37 ± 0.13	1.45 ± 0.30	1.88 ± 0.57	1.10 ± 0.27	1.35 ± 0.96	0.18 ± 0.12	36.4	69.65 ± 2.75
FA	DS 384	N 7380	E 9640	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.08 ± 0.33	1.26 ± 0.52	0.77 ± 0.31	1.78 ± 0.96	0.06 ± 0.06	21.3	
FA-45	DS 341	N 7380	E 9670	1 in.	0.00 ± 0.00	0.89 ± 0.19	1.48 ± 0.30	1.84 ± 0.56	1.18 ± 0.27	1.01 ± 1.03	0.12 ± 0.10	29.6	73.15 ± 2.81
FA	DS 323	N 7380	E 9670	1 ft	0.00 ± 0.00	0.00 ± 0.00	1.59 ± 0.31	1.97 ± 0.51	1.18 ± 0.27	1.80 ± 1.13	0.11 ± 0.10	30.6	78.66 ± 2.91
FA-46	DS 375	N 7380	E 9700	1 in.	0.00 ± 0.00	1.10 ± 0.20	1.54 ± 0.30	1.77 ± 0.51	1.01 ± 0.24	2.15 ± 1.11	0.21 ± 0.13	42.1	72.85 ± 2.80
FA	DS 317	N 7380	E 9700	1 ft	0.00 ± 0.00	1.10 ± 0.21	1.76 ± 0.51	2.00 ± 0.76	1.27 ± 0.44	3.08 ± 1.48	0.14 ± 0.12	39.6	81.44 ± 2.96

[a] Th-232 value obtained by assuming equilibrium with the daughters AC-228 and Ra-228.

[b] 1 in. = 0-1 in.
1 ft = 1-12 in.

TABLE 3-B
FINAL RANDOM "FR" SOIL SAMPLE RESULTS

Sample ID		Radionuclide Concentration (pCi/g)							% Lung Dose (20 mRem/yr)	Gross Beta
		Co-60	Cs-137	Th-228	Th-232[a]	Ra-226	U-238	U-235		
FR-1	DS 164	0.00 ± 0.00	0.42 ± 0.12	1.42 ± 0.42	1.45 ± 0.61	1.40 ± 0.43	1.90 ± 1.16	0.16 ± 0.13	34.8	74.87 ± 2.83
FR-2	DS 165	0.00 ± 0.00	0.36 ± 0.11	1.48 ± 0.38	1.53 ± 0.55	1.25 ± 0.35	1.37 ± 0.99	0.14 ± 0.10	31.5	77.15 ± 2.89
FR-3	DS 166	0.00 ± 0.00	0.40 ± 0.07	1.16 ± 0.30	1.26 ± 0.40	1.06 ± 0.30	0.89 ± 0.57	0.11 ± 0.07	24.7	71.03 ± 2.80
FR-4	DS 167	0.00 ± 0.00	0.19 ± 0.07	0.95 ± 0.39	1.23 ± 0.60	0.81 ± 0.37	0.75 ± 0.66	0.18 ± 0.12	30.8	64.15 ± 2.64
FR-5	DS 171	0.00 ± 0.00	0.00 ± 0.00	1.89 ± 0.44	2.26 ± 0.67	1.26 ± 0.37	2.94 ± 1.34	0.10 ± 0.08	35.1	84.22 ± 3.01
FR-6	DS 172	0.00 ± 0.00	0.37 ± 0.12	1.62 ± 0.48	1.68 ± 0.75	1.05 ± 0.43	0.00 ± 0.00	0.11 ± 0.10	25.2	73.02 ± 2.45
FR-7	DS 173	0.00 ± 0.00	0.16 ± 0.07	1.16 ± 0.39	1.66 ± 0.66	1.03 ± 0.35	1.49 ± 0.91	0.07 ± 0.06	22.3	75.79 ± 2.86
FR-8	DS 174	0.00 ± 0.00	0.00 ± 0.00	1.57 ± 0.44	1.48 ± 0.65	1.36 ± 0.43	1.93 ± 1.23	0.04 ± 0.05	22.4	76.32 ± 2.88
FR-9	DS 175	0.35 ± 0.10	5.02 ± 0.47	1.61 ± 0.46	1.88 ± 0.78	1.09 ± 0.42	2.38 ± 1.25	0.18 ± 0.13	40.2	86.58 ± 3.02
FR-10	DS 176	0.31 ± 0.10	3.46 ± 0.40	1.42 ± 0.48	1.64 ± 0.66	1.08 ± 0.46	2.99 ± 1.37	0.36 ± 0.17	60.7	86.98 ± 3.06
FR-11	DS 177	0.49 ± 0.13	4.23 ± 0.46	1.77 ± 0.57	1.85 ± 0.86	1.06 ± 0.51	2.05 ± 1.31	0.22 ± 0.15	44.5	86.68 ± 3.03
FR-12	DS 178	0.00 ± 0.00	0.37 ± 0.13	1.27 ± 0.42	1.57 ± 0.70	1.19 ± 0.43	1.67 ± 1.38	0.07 ± 0.07	23.3	75.26 ± 2.88
FR-13	DS 179	0.00 ± 0.00	0.00 ± 0.00	1.54 ± 0.42	1.77 ± 0.65	1.08 ± 0.39	1.18 ± 0.88	0.00 ± 0.01	16.8	75.66 ± 2.86
FR-14	DS 488	0.00 ± 0.00	1.32 ± 0.20	1.53 ± 0.39	1.91 ± 0.66	0.86 ± 0.34	1.05 ± 1.03	0.05 ± 0.06	22.1	77.23 ± 2.89
FR-15	DS 496	1.37 ± 0.22	1.42 ± 0.19	1.25 ± 0.38	1.55 ± 0.63	1.81 ± 0.32	1.62 ± 1.14	0.05 ± 0.05	20.5	75.85 ± 3.23
FR-16	DS 492	0.00 ± 0.00	0.14 ± 0.07	1.43 ± 0.40	1.45 ± 0.58	0.74 ± 0.32	0.83 ± 0.70	0.07 ± 0.07	22.1	69.22 ± 2.73
FR-17	DS 490	0.00 ± 0.00	3.19 ± 0.32	1.27 ± 0.38	1.58 ± 0.56	0.90 ± 0.34	1.90 ± 0.99	0.14 ± 0.11	31.4	72.58 ± 2.97
FR-18	DS 494	0.00 ± 0.00	0.84 ± 0.16	1.52 ± 0.41	1.85 ± 0.64	1.91 ± 0.31	2.01 ± 1.04	0.12 ± 0.09	31.6	70.38 ± 3.28

[a] Th-232 value obtained by assuming equilibrium with the daughters Ac-228 and Ra-228.

APPENDIX 4
AIR SAMPLE DATA

Date	Sample	Alpha (pCi/m^3)	Beta (pCi/m^3)
8-30-85	WY-1	1.4	<3.7
	WY-2	<0.3	1.0
9-3-85	WY-3	<0.3	<0.2
	WY-4	<0.1	<0.1
9-4-85	WYB-1	<0.1	<0.1
	WYB-2	<0.1	<0.2
9-5-85	WYB-2	<0.7	<1.9
	WYC-3	<0.1	<0.7
9-6-85	WYB-2	<0.1	<0.4
	WYC-3	0.2	<0.1
9-7-85	WYB-2	<0.1	0.5
	WYC-3	<0.1	<0.1
9-9-85	WYB-2	<0.1	<0.3
	WYC-3	<0.1	<0.1
9-10-85	WYB-2	<0.1	<0.3
	WYD-4	<0.1	<0.3
9-11-85	WYB-2	<0.1	<0.4
	WYD-4	<0.1	<0.2
9-12-85	WYB-2	<0.1	<0.2
	WYB-4	<0.4	<0.1
9-13-85	WYA-1	<0.1	<0.3
	WYB-2	<0.1	<0.2
9-14-85	WYB-2	<0.1	<0.2
9-16-85	WYD-4	<0.1	0.2
	WYB-2	<0.1	0.3
9-17-85	WYB-2	<0.2	0.3
	WYD-4	<0.1	0.1
9-19-85	WYD-4	<0.1	<0.5
	WYE-5	<0.1	0.5
9-20-85	WYD-4	<0.1	<0.1
	WYE-5	<0.2	0.9
9-21-85	WYD-4	0.2	0.5
	WYE-5	0.2	0.3
9-23-85	WYD-4	<0.1	<0.1
	WYE-5	<0.2	1.3

AIR SAMPLE DATA (Continued)

Date	Sample	Alpha (pCi/m^3)	Beta (pCi/m^3)
9-24-85	WYD-4	<0.1	0.3
	WYB-2	<0.1	0.3
9-25-85	WYB-2	0.2	0.7
	WYD-4	<0.1	<0.1
9-26-85	WYB-2	<0.1	0.9
	WYD-4	<0.1	<0.1
10-11-85	WY	<0.1	<0.4
10-14-85	WY	<0.1	<0.2
10-15-85	WY	<0.1	<0.2
10-16-85	WY	0.1	<0.2
10-21-85	WY	0.1	0.2

APPENDIX 5
WIPE SURVEYS

Sample ID	Alpha (DPM/100 cm^2)	Beta (DPM/100 cm^2)
Grade - All No. 7		
CR 7-1	<0.3	<0.7
CR 7-2	<0.3	<0.7
CR 7-3	<0.3	<0.7
CR 7-4	<0.3	<0.7
CR 7-5	<0.3	<0.7
CR 7-6	<0.3	<0.7
CR 7-7	<0.3	<0.7
CR 7-8	<0.3	<0.7
CR 7-9	<0.3	<0.7
CR 7-10	<0.3	0.9
Average	0.3	0.7
Truck No. 15		
TR 15-1	<0.3	0.9
TR 15-2	<0.3	<0.7
TR 15-3	<0.3	<0.7
TR 15-4	<0.3	<0.7
TR 15-5	<0.3	<0.7
TR 15-6	<0.3	<0.7
TR 15-7	<0.3	<0.7
TR 15-8	<0.3	2.5
TR 15-9	<0.3	<0.7
TR 15-10	<0.3	<0.7
Average	0.3	0.8
Propane Tank		
TK-1	<0.3	<0.7
TK-2	<0.3	<0.7
Average	0.3	0.7
Fence	0.9	<0.8
Fence 2	<0.3	<0.8
Average	0.6	0.8

WIPE SURVEYS (Continued)

Sample ID	Alpha (DPM/100 cm^2)	Beta (DPM/100 cm^2)
Skip Loader		
CF 34-1	<0.3	<0.7
CF 34-2	<0.3	<0.7
CF 34-3	<0.3	<0.7
CF 34-4	<0.3	<0.7
CF 34-5	<0.3	<0.7
CF 34-6	<0.3	<0.7
CF 34-7	<0.3	<0.7
CF 34-8	<0.3	<0.7
CF 34-9	<0.3	<0.7
CF 34-10	<0.3	<0.7
Average	0.3	0.7
Front End Loaders		
MF 15-1	<0.3	<0.7
MF 15-2	<0.3	<0.7
MF 15-3	<0.3	<0.7
MF 15-4	<0.3	<0.7
FM 15-5	<0.3	<0.7
Average	0.3	0.7
1 Ton Dump Truck		
TR 144-1	<0.3	1.2
TR 144-2	<0.3	<0.7
TR 144-3	<0.3	<0.7
TR 144-4	<0.3	<0.7
TR 144-5	<0.3	<0.7
Average	0.3	0.8
Comp roof	<0.3	<0.7
2 x 6	<0.3	<0.7
2 x 6	<0.3	<0.7
Plywood	<0.3	<0.7
Junction box	<0.3	<0.7
Conduit	<0.3	<0.7
Dry wall	<0.3	<0.7
Shower door	<0.3	<0.7
Tar paper	<0.3	<0.7
Dry wall No. 2	<0.3	<0.7
Shower	<0.3	<0.7
Electrical wire	0.6	<0.7
Conducit 4	<0.3	<0.7
Hot water heat	<0.3	<0.7

WIPE SURVEYS (Continued)

Sample ID	Alpha (DPM/100 cm^2)	Beta (DPM/100 cm^2)
Truck No. 8		
TR 8-1	<0.3	<0.7
TR 8-2	<0.3	<0.7
TR 8-3	<0.3	<0.7
TR 8-4	<0.3	<0.7
TR 8-5	<0.3	<0.7
TR 8-6	<0.3	<0.7
TR 8-7	<0.3	<0.7
TR 8-8	<0.3	<0.7
TR 8-9	<0.3	0.9
TR 8-10	<0.3	<0.7
Average	0.3	0.7
Backhoe No. 50		
1	<0.9	<0.7
2	<0.9	<0.7
3	<0.9	<0.7
4	<0.9	<0.7
5	<0.9	<0.7
6	<0.9	<0.7
7	<0.9	<0.7
8	<0.9	<0.7
9	<0.9	<0.7
10	<0.9	<0.7
Average	0.9	0.7
Don's Backhoe No. 8		
AWC-1	<0.3	<0.7
AWC-2	<0.3	1.2
AWC-3	<0.3	<0.7
AWC-4	<0.3	<0.7
AWC-5	<0.3	<0.7
AWC-6	<0.3	<0.7
AWC-7	<0.3	<0.7
AWC-8	<0.3	<0.7
AWC-9	1.6	<0.7
Average	0.4	0.8

WIPE SURVEYS (Continued)

Sample ID	Alpha (DPM/100 cm^2)	Beta (DPM/100 cm^2)
Empty Drums		
1	<0.3	<0.7
2	<0.3	<0.7
3	<0.3	<0.7
4	<0.3	<0.7
5	<0.3	3.0
6	<0.3	<0.7
7	0.6	<0.7
8	<0.3	<0.7
9	<0.3	1.0
10	<0.3	<0.7
11	<0.3	<0.7
12	<0.3	<0.7
13	<0.3	<0.7
14	<0.3	1.0
15	<0.3	<0.7
16	<0.3	1.2
17	<0.3	<0.7
18	<0.3	<0.7
19	<0.3	<0.7
20	<0.3	1.2
21	<0.3	<0.7
22	<0.3	8.7
23	<0.3	<0.7
24	<0.3	<0.7
25	<0.3	<0.7
Average	0.3	1.2

APPENDIX 6
Sr-90 RESULTS FOR SOIL SAMPLES TAKEN PRIOR TO DECONTAMINATION

Sample ID	Location	Sr-90 Concentration (pCi/g)
	Area A	
5	DS-134, surface 0-1 in.	<5.5
	DS-135, 0-6 in.	<5.5
	DS-136, 6-12 in.	<5.5
	Area B	
25	DS-131, surface 0-1 in.	110.0
	DS-132 0-6 in.	62.0
30	DS-119, surface 0-1 in.	20.0
27	B-29, 0-1 ft	<5.5
34	B-31, 0-1 ft	8.7
	B-31, 2-3 ft	<5.5
43	DWYS-1	16.0
53	DWYS-10	<5.5
36	DS-76, 0-1 in.	5.5
	DS-76, 1-6 in.	13.0
	Area C	
67	DS-137	10.0
71	DS-138	6.0
	Area D (Ponds)	
73	B-6, 3.5-5 ft	<5.5
76	B-8, 1-2 ft	<5.5
7	B-22, 0-1 in.	15.0
16	B-28, 0-1 ft	43.0
	B-28, 1-2 ft	400.0
	B-28, 2-3 ft	290.0
	B-28, 3-4 ft	140.0
	B-28, 4-5 ft	59.0
	B-28, 5-6 ft	19.0
	B-28, 6-7 ft	31.0
	B-28, 7-8 ft	31.0
	B-28, 9-10 ft	3.0
	B-28, 10-11 ft	<5.5
19	B-36, 0-1 ft	41.0
	B-36, 1-2 ft	<5.5

APPENDIX 7
ANALYSIS OF VEGETATION (BRUSH) FROM WASTE YARD PONDS AND CANYONS

	Isotope	pCi/gm	+/- 2 Standard Deviations
Pile 1	Cs-137	0.32	40%
	Th-228	0.044	41%
	Ra-226	0.069	41%
	Ra-228	0.31	21%
Pile 2	Cs-137	0.46	29%
	Th-228	0.14	36%
	Ra-226	0.0045	73%
Pile 3	Cs-137	0.43	40%
	Th-228	0.064	37%
	Ra-226	0.045	55%
	Ra-228	0.079	61%
Pile 4	Co-60	1.4	11%
	Cs-137	4.9	73%
	Th-228	0.13	30%
	Ra-226	0.055	49%
	Ra-228	0.22	29%
	U-235	0.015	87%
	Cs-134	0.063	45%
Pile 5	Co-60	0.39	19%
	Cs-137	3.8	10%
	Th-228	0.40	27%
	Ra-226	0.33	37%
	Ra-228	0.49	39%
	Th-234	0.22	69%

Sr-90 Analysis

Samples from the five piles of vegation were combined and analyzed for Sr-90 using wet chemistry methods. The results were 1.3 pCi/g for both duplicate samples.

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	Ra-228	0.31	21%
Pile 2	Cs-137	0.46	29%
	Th-228	0.14	36%
	Ra-226	0.0045	73%
Pile 3	Cs-137	0.43	40%
	Th-228	0.064	37%
	Ra-226	0.045	55%
	Ra-228	0.079	61%
Pile 4	Co-60	1.4	11%
	Cs-137	4.9	73%
	Th-228	0.13	30%
	Ra-226	0.055	49%
	Ra-228	0.22	29%
	U-235	0.015	87%
	Cs-134	0.063	45%
Pile 5	Co-60	0.39	19%
	Cs-137	3.8	10%
	Th-228	0.40	27%
	Ra-226	0.33	37%
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	Th-234	0.22	69%

Sr-90 Analysis

Samples from the five piles of vegation were combined and analyzed for Sr-90 using wet chemistry methods. The results were 1.3 pCi/g for both duplicate samples.

APPENDIX 8
RELEASE OF CONCRETE FROM EVAPORATION PONDS AS NON-RADIOACTIVE

APPENDIX 8
RELEASE OF CONCRETE FROM EVAPORATION PONDS
AS NON-RADIOACTIVE

Concrete from the solar evaporation ponds located at the Waste Processing Facility was released for unrestricted disposal on August 23, 29, 30, and 31, 1984 based on the following:

1. Surveys of the concrete remaining after surface scrabbling showed that calculated disintegrations per minute in 100 cm^2 areas of the ponds were within the guidelines established by Federal (Attachment 1) and State (Attachment 2) regulatory agencies.

2. Instruments used in the survey were calibrated against standards and efficiencies and correction factors were determined.

3. Corrections for background radiation were conservative due to the area and the use of unshielded detectors.

Attached are the grid surveys of the solar evaporation pond concrete surfaces after scrabbling ponds 1 through 4 (Attachments 3 through 6).

The values given in dpm (disintegrations per minute) were determined by correcting the counts per minute of the detector used to survey the ponds for background efficiency and geometric factors. The instruments used were a Ludlum Geiger Counter Model 3, S/N 30309 with a pancake GM detector probe, calibrated 7/5/84, which has a 15.2 cm^2 area detector, and an Eberline Model PAC-1SA alpha counter, S/N 30353 which has a 72.5 cm^2 area detector, calibrated 9-11-84.

Discussion:

Ge(Li) scans of representative samples of the concrete from each pond showed that Cs-137 was by far the major activity contributor, therefore efficiency values for Cs-137 were used to evaluate the beta-gamma levels.

A. Beta-Gamma Levels

The counts per minute measured and recorded in the surveys were corrected as follows:

(1) Background - A "standard" natural background of 100 cpm was subtracted from the readings while they were being taken although a higher background could be justified because of the relatively high background in the immediate area of the survey and because the detector used was unshielded. A background of 200 cpm was subtracted from the Pond 3C readings due to a 10mR/hr area caused by a large pile of concrete rubble from the Hot Cell pond (Pond 4) which was temporarily stored nearby. The 200 cpm reading was subtracted from the readings 0 - 3 feet away from the rubble. The background subtracted from the readings during the survey was conservative. No additional background has been subtracted from the readings.

(2) Efficiency - The detector efficiency was determined by making measurements with a standard source.

In order to simulate the conditions on the scrabbled pond surfaces, a one-foot square area of a cement block was spiked with a known amount of Cs-137: (2.28×10^4 dpm/100 cm^2 $\pm$ 15%). This corresponds to 3466 dpm/15.2 cm^2 area. This block then simulates the pond measurements.

Surface measurements of the block were taken with the instrument simulating the pond surfaces and the results were as follows:

Gross readings (average of 5 readings)
= 1210 cpm ± 50 cpm

Background in area (where measurements were taken)
= 70 cpm ± 10 cpm

Net reading = 1140 cpm ± 51 cpm

Efficiency = $\frac{\text{Net cpm}/15.2\ \text{cm}^2}{\text{dpm}/15.2\ \text{cm}^2}$ = 1140/3466 = 32.9%

(3) Geometry Correction - Since the values listed in Table 1 of Attachments 1 and 2 are in dpm/100 cm^2, a correction factor was applied to the values to correct for the smaller area of the detector. The detector probe used has a 15.2 cm^2 area, therefore a correction factor of 6.58 was applied to all the values.

(4) The efficiency and geometry correction result in multiplying the count per minute reading by 20 to obtain disintegrations per minute.

(5) The highest reading was an 800 cpm reading (Pond 2C) over a less than 10 cm^2, which was observed where a bolt had been taken out of the concrete. The guidelines specify maximum readings of 15,000 dpm/100 cm^2 area which translates (with our calibration) to a reading of 750 cpm throughout a 100 cm^2 area. In reality, the 800 cpm measurement was made over an area much smaller (15.2 cm^2) and the contamination was over an area less than 10 cm^2. The local 3 ft)2 region was otherwise at a much lower count; i.e. 175 cpm/100 cm^2 average. The result is that the count rate was much lower averaged over the entire 100 cm^2 area assuming that there were other "hot spots" in the 100 cm^2 area which a count rate the same as the maximum count rate in a nearby (3 ft)^2 area. This gives us a maximum of 550 cpm or 11000 dpm in this 100 cm^2 area.

B. Alpha Levels

The alpha counts per minute measured and recorded in the surveys were corrected as follows:

(1) Background - None subtracted

(2) Efficiency - During the calibration of the PAC-1SA alpha counters, the instruments are checked against a standard source and are adjusted to read in counts per minute 50% of the total dpm value. Therefore, efficiency is 50%.

(3) Geometry - The area of the detector is 72.5 cm^2, therefore a correction factor of 1.38 was applied to all the values.

(4) The efficiency and geometry correction results in multiplying the counts per minute reading by 2.76 to obtain disintegrations per minute.

The maximum reading was <100 cpm which is 276 dpm in any area, well below the levels specified in Table 1 of the guidelines (Attachments 1 and 2) for U-235 or natural thorium.

The results show compliance with the guidelines for release to unrestricted use.

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

To Harry / Duffy / Bob / Quintana
These are the Guidelines which will be imposed on us by our new SNM 696 license. The Table I Values are no different than required under our current license.

Bill

U. S. Nuclear Regulatory Commission
Division of Fuel Cycle and Material Safety
Washington, D.C. 20555

July 1982

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Fuel Cycle and Material Safety, USNRC, Washington, D.C. 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b c f]	MAXIMUM[b d f]	REMOVABLE[b e f]
-nat, U-235, U-238, and ssociated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
ransuranics, Ra-226, Ra-228, h-230, Th-228, Pa-231, c-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
h-nat, Th-232, Sr-90, a-223, Ra-224, U-232, I-126, -131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
eta-gamma emitters (nuclides ith decay modes other than lpha emission or spontaneous ission) except Sr-90 and thers noted above.	5000 dpm βγ/100 cm^2	15,000 dpm βγ/100 cm^2	1000 dpm βγ/100 cm^2

[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 detecter for background, efficiency, and geometric factors associated with the instrumentation.

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

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

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

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

NUCLIDES[a]	AVERAGE[b c f]	MAXIMUM[b d f]	REMOVABLE[b e f]
-nat, U 235, U-238, and ssociated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
ransuranics, Ra-226, Ra-228, -230, Th-228, Pa-231, -227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
h-nat, Th-232, Sr-90, a-223, Ra-224, U-232, I-126, -131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
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Attachment 2

6/11/84 40 3 old. 6/14/84 L. Quinton Decom File State of CA

GUIDELINES FOR DECONTAMINATION

OF FACILITIES AND EQUIPMENT

PRIOR TO RELEASE FOR UNRESTRICTED USE

Unconditional release of radioactively contaminated facilities and equipment requires decontamination to prevent risk to the public health and safety with subsequent unrestricted use.

Section 30298 of the California Radiation Control Regulations specifies that the user is responsible for this decontamination. The Department will impose no conditions with respect to future use of equipment and facilities following decontamination consistent with the following guidelines:

(a) The user shall make every reasonable effort to eliminate residual contamination.

(b) No covering shall be applied to contaminated surfaces of equipment or structures by paint, plating or other means prior to release for unrestricted use. Equipment may be released and coated per paragraph (e) below if it is established by documented survey that concentrations are below the limits specified in Table I.

(c) The radioactivity on the interior surfaces of pipes, drainlines or duct work can be determined by making measurements of all traps and other appropriate access points, provided contamination at these locations is likely to be representative of contamination on the interior of the pipes, drainlines or duct work. Surfaces of premises, equipment or scrap which are likely to be contaminated but are of such size, construction or location as to make the surface inaccessible for purposes of measurement should be assumed to be contaminated in excess of the permissable radiation limits.

(d) In the case of facilities to be released, Section 30298 requires 30 days prior notice of intent to vacate. This notice must be followed by a report summarizing the results of surveys following decontamination establishing that levels of radioactivity are within the limits specified in Table I.

The summary should be supported by sufficiently detailed survey records maintained available for inspection. The Department must have an opportunity to confirm by spot survey the summary report submitted prior to granting approval for release.

(e) In the case of equipment to be released, no request or report is required if guide limits are met. The licensee must, however, maintain detailed survey records sufficient to justify the release.

(f) If California guidelines are not satisfied in a particular instance, the Department must be consulted with respect to future use of the item in question, except where there will be a transfer to a specific license. The Department's determination as to whether the item may be released will involve such factors as the practicality of further decontamination, and the likely hazard considering possible future use of the item. Requests for review and variance should provide: (1) Detailed and specific information describing the item, radioactive contaminants and the nature, extent and degree of residual contamination. (2) A detailed health and safety analysis establishing that residual contamination is not of concern with respect to the health and safety of the public given the nature of the residue and the prospective use of the facilities or equipment.

TABLE I
ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDE	AVERAGE[b c] (dpm/100 cm^2)	MAXIMUM[b d] (dpm/100 cm^2)	REMOVABLE[b e] (dpm/100 cm^2)
ıat, U-235, U-238, and sociated decay products	5,000	15,000	1,000
ınsuranics, Ra-226, Ra-228, -230, Th-228, Pa-231 -227, I-125, I-129	100	300	20
-nat, Th-232, Sr-90 -223, Ra-224, U-232, 126, I-131, I-133	1,000	3,000	200
ta-gamma emitters (nuclides th decay modes other than pha emission or spontaneous sion) except Sr-90 and ıers noted above.	5,000	15,000	1,000
3, C-14 except as DNA ecursors f/	20,000	60,000	4,000

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

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

aximum contamination level applies to an area of not more than 100 cm^2.

mount of removable radioactive material per 100 cm^2 of surface area should be determined ping that area with dry filter or soft absorbent paper, applying moderate pressure, and sing the amount of radioactive material on the wipe with an appropriate instrument of known iency. When removable contamination on objects of less surface area is determined, the ment levels should be reduced proportionally and the entire surface should be wiped.

recursors mean molecules or compounds that are directly incorporated into the DNA molecule y DNA biosythesis, e.g. purine and pyrimidine bases and their analogs, nucleotides and osides. The acceptable surface contamination levels for H-3 and C-14 in DNA precursors s tabulated in paragraph (d) for beta-gamma-emitters.

Regulatory Guide 1.86 Termination of Operating Licenses for Nuclear Reactors, Washington (June 1974)

I, Control of Radioactive Surface Contamination on Materials, Equipment and Facilities Be Released for Uncontrolled Use, final draft, proposed American National Standard N-313, nic Industrial Forum, Inc., N.Y. (June 1974)

POND 1C

7000	6000	8000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	166	138
5000	6000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
5000	5000	5000	5000	5000	5000	6000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	166
8000	5000	5000	6000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	207
6000	5000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
6000	5000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
9000	5000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138

POND 1B

6000	5000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
8000	5000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
6000	5000	5000	5000	6000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
7000	5000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
6000	6000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
5000	5000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
6000	5000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138

ATTACHMENT 3

SURFACE CONTAMINATION LEVELS
PONDS 1A, 1B, AND 1C

Note:

(1) Levels were taken on Pond concrete after scrabbling and cleaning.

(2) Each square represents a 3 foot square area.

(3) Upper values are in dpm and represent the maximum beta-gamma contamination level in a 100 cm^2 area.

(4) Middle values are the average contamination levels in a $(3ft)^2$ area.

(5) Lower values are the maximum alpha contamination levels in dpm/100 cm^2.

POND 1A

6000	5000	5000	6000	7000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
5000	6000	5000	5000	5000	5000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	138
7000	6000	5000	5000	6000	5000	5000
2000	2000	2000	2000	2000	2000	2000
166	138	138	138	138	138	138
8000	6000	5000	5000	5000	6000	7000
2000	2000	2000	2000	2000	2000	2000
193	138	138	138	138	138	138
6000	5000	5000	5000	5000	5000	6000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	166
5000	5000	5000	5000	5000	5000	6000
2000	2000	2000	2000	2000	2000	2000
138	138	138	138	138	138	207
6000	5000	5000	5000	5000	6000	5000
2000	2000	2000	2000	2000	2000	2000
138	138	138	207	138	166	138

ATTACHMENT 4

SURFACE CONTAMINATION LEVELS PONDS 2A, 2B, AND 2C

POND 2A

6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	7000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
7000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138

POND 2B

6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	9000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	7000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
7000	6000	6000	8000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138

Note:

(1) Levels were taken on Pond concrete after scrabbling and cleaning.

(2) Each square represents a 3 foot square area.

(3) Upper values are in dpm and represent the maximum beta-gamma contamination level in a 100 cm^2 area.

(4) Middle values are the average contamination levels in a $(3ft)^2$ area.

(5) Lower values are the maximum alpha contamination levels in dpm/100 cm^2.

6000	6000	6000	12000	6000	6000	7000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
7000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
8000	6000	6000	6000	6000	6000	8000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
7000	6000	6000	6000	6000	6000	11000*
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	6000	6000	6000	6000	10000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138
6000	6000	7000	14000	6000	9000	6000
3500	3500	3500	3500	3500	3500	3500
138	138	138	138	138	138	138

* An 800 cpm spot was observed in a 10 cm^2 area. The count rate averaged over the entire 100 cm^2 area was calculated to be 550 cpm or 11,000 dpm.

ATTACHMENT 5

SURFACE CONTAMINATION LEVELS
PONDS 3A, 3B, AND 3C

Note:

(1) Levels were taken on Pond concrete after scrabbling and cleaning.

(2) Each square represents a 3 foot square area.

(3) Upper values are in dpm and represent the maximum beta-gamma contamination level in a 100 cm^2 area.

(4) Middle values are the average contamination levels in a $(3ft)^2$ area.

(5) Lower values are the maximum alpha contamination levels in dpm/100 cm^2.

POND 3

6000	6000	6000	6000	6000	6000	7000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	6000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
7000	6000	6000	6000	6000	6000	7000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	6000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	6000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	6000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276

POND 3B

6000	6000	8000	6000	6000	6000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
8000	6000	6000	6000	6000	7000	6000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	7000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
7000	6000	6000	9000	6000	6000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	7000	10000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	9000	6000	6000	6000	6000	7000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	7000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276

6000	6000	6000	6000	6000	6000	6000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	7000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	7000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
7000	6000	6000	6000	6000	6000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	6000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	7000	9000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
6000	6000	6000	6000	6000	7000	9000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276

POND 4A

10000	9000	8000	8000	10000	9000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
10000	8000	7000	6000	7000	8000	9000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
10000	8000	7000	7000	8000	9000	10000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
12000	9000	7000	7000	6000	8000	11000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
11000	9000	8000	6000	7000	9000	11000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
14000	10000	9000	8000	7000	7000	10000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
12000	10000	9000	8000	7000	8000	9000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276

POND 4B

8000	7000	8000	9000	8000	8000	9000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
9000	8000	5000	5000	6000	7000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
7000	6000	5000	6000	5000	7000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
8000	7000	5000	6000	5000	6000	7000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
9000	6000	6000	6000	6000	6000	7000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
10000	8000	7000	8000	7000	6000	6000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276
9000	7000	8000	10000	8000	7000	8000
4000	4000	4000	4000	4000	4000	4000
276	276	276	276	276	276	276

ATTACHMENT 6

SURFACE CONTAMINATION LEVELS
PONDS 4A AND 4B

Note:

(1) Levels were taken on Pond concrete after scrabbling and cleaning.

(2) Each square represents a 3 foot square area.

(3) Upper values are in dpm and represent the maximum beta-gamma contamination level in a 100 cm^2 area.

(4) Middle values are the average contamination levels in a $(3ft)^2$ area.

(5) Lower values are the maximum alpha contamination levels in dpm/100 cm^2.

COUNTY OF SAN DIEGO

-LEGEND-

BOUNDARIES IN ORDER OF PRECEDENCE

PREPARED UNDER THE DIRECTION
of
DEPARTMENT OF TRANSPORTATION
County of San Diego

CONTROL DATA FURNISHED
by
SURVEY SECTION
Department of Transportation

HORIZONTAL CONTROL BASED
on
NORTH AMERICAN DATUM

VERTICAL CONTROL BASED
on
U.S.C. & G.S. 1929 SEA LEVEL DATUM

ORTHOPHOTO IMAGE PREPARED
from
PHOTOGRAPHY DATED 4-21-77
by
INLAND AERIAL SURVEYS

TOPOGRAPHY COMPILED
by
PHOTOGRAMMETRIC METHODS
from
PHOTOGRAPHY DATED 4-21-77
by
INLAND AERIAL SURVEYS

FINAL MAP PREPARED
by
MAPPING SECTION
Department of Transportation

This Map Complies with
NATIONAL MAP ACCURACY STANDARDS

SCALE 1 : 2400 (1" = 200')
INDEX CONTOUR INTERVAL 25 FEET
CONTOUR INTERVAL 5 FEET
TWO THOUSAND FOOT CALIFORNIA RECTANGULAR GRID (ZONE VI)
THE RECTANGULAR COORDINATE VALUES ARE SHOWN ON THE SOUTH AND WEST MARGINS
THE GEOGRAPHIC VALUES ARE SHOWN ON THE NORTH AND EAST MARGINS

TOPOGRAPHIC SURVEY

FIGURE 1A – PRINCIPAL AREA TO BE RELEASED

FIGURE 1A PRINCIPAL AREA TO BE RELEASED

DENOTES BOUNDARY OF AREA TO BE RELEASED TO UNRESTRICTED USE

BOUNDARY SEGMENT

BOUNDARY

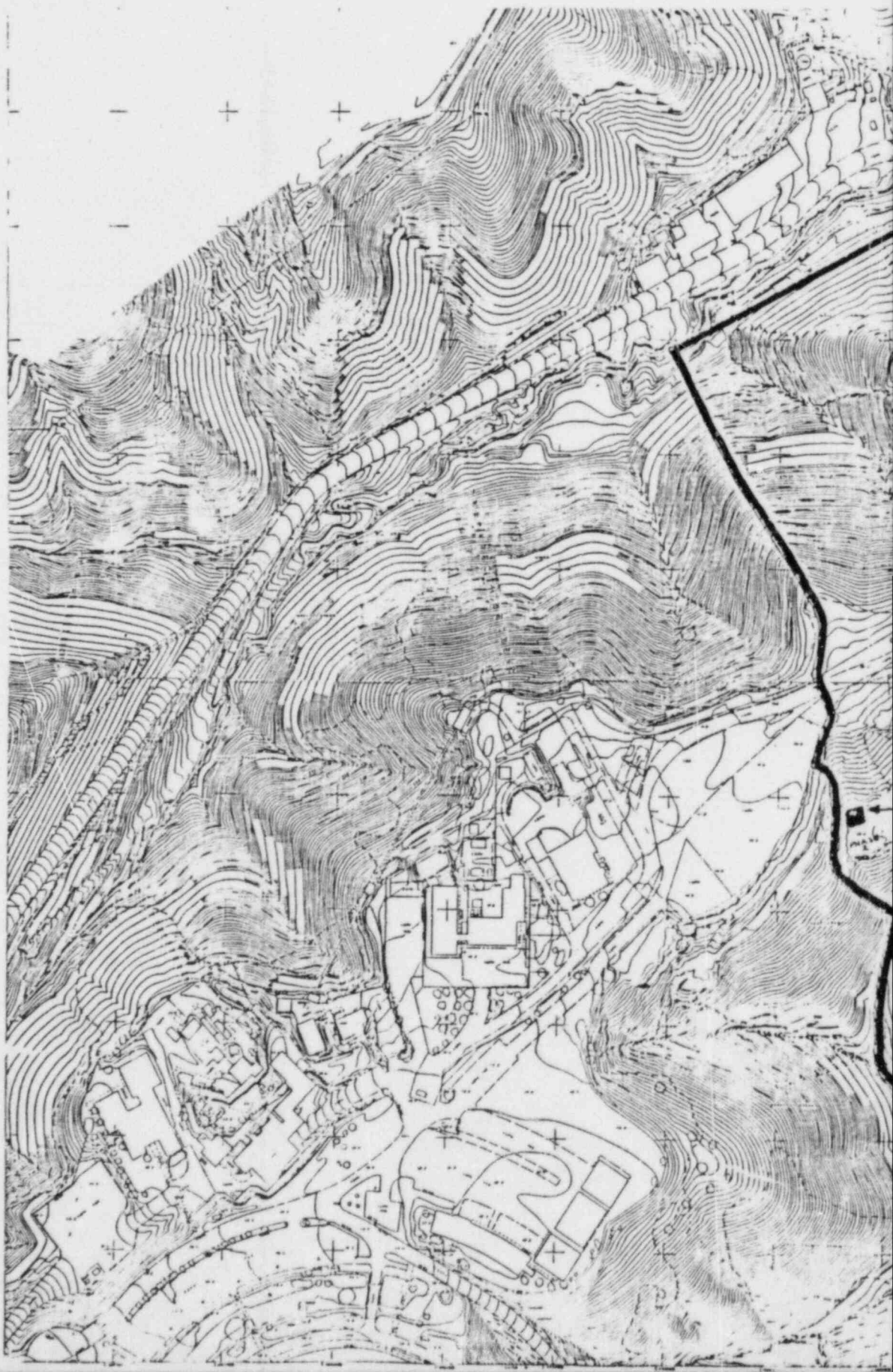
EXISTING BOUNDARY (fence, gate, etc.)
SDG&E Gas Transmission Line Easements
PROPERTY LINE
PROPERTY LINE with FENCE
PROPERTY LINE
NATURAL BOUNDARY/SHORE (only between slopes)

INDEX TO ADJOINING SHEETS

270-1689	270-1695	270-1701
266-1689	266-1695	266-1701
262-1689	262-1695	262-1701

SAN DIEGO COUNTY
CALIFORNIA
SHEET NO. 266-1695

8601090379 - 01



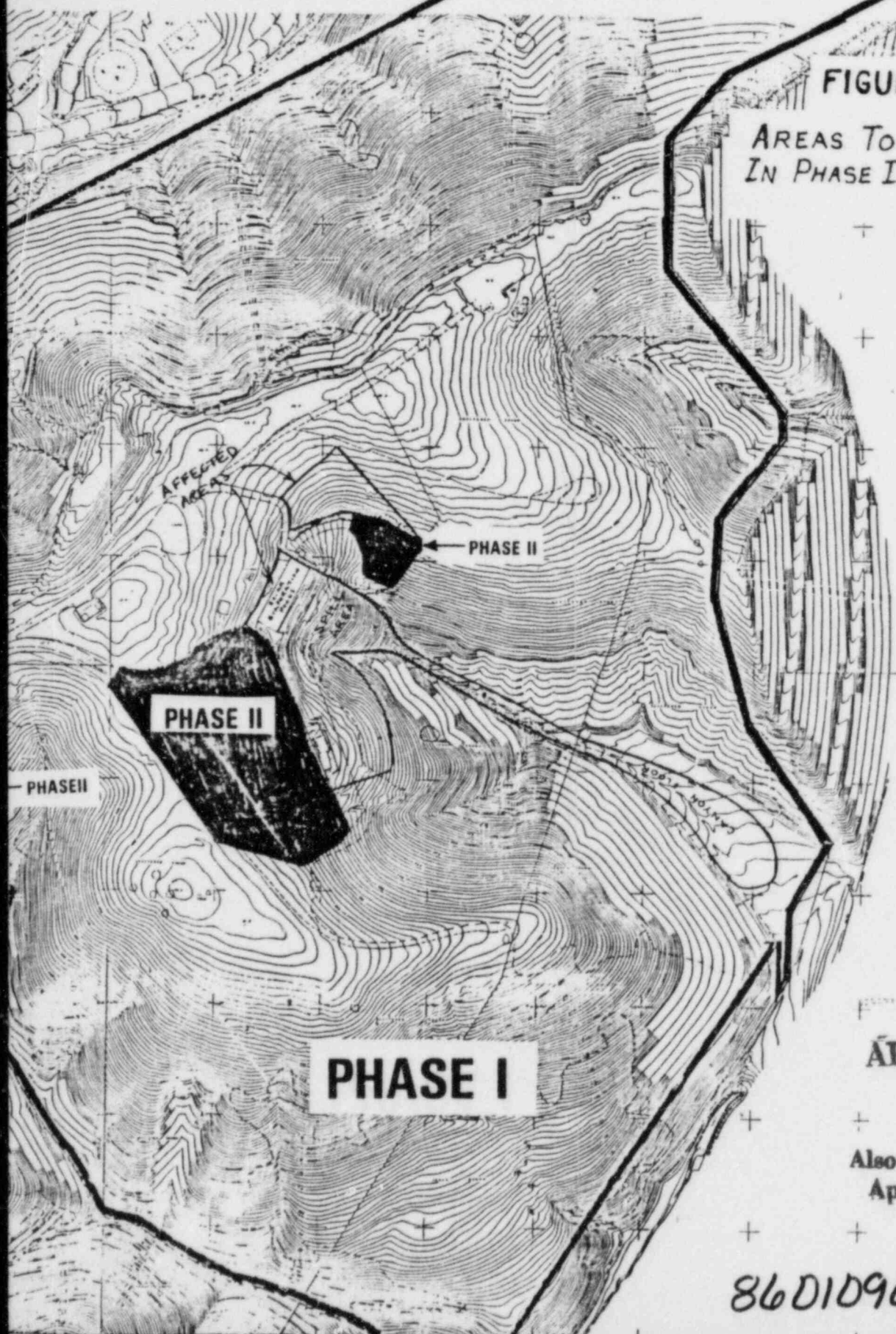


FIGURE 1B

AREAS TO BE RELEASED IN PHASE I AND PHASE II

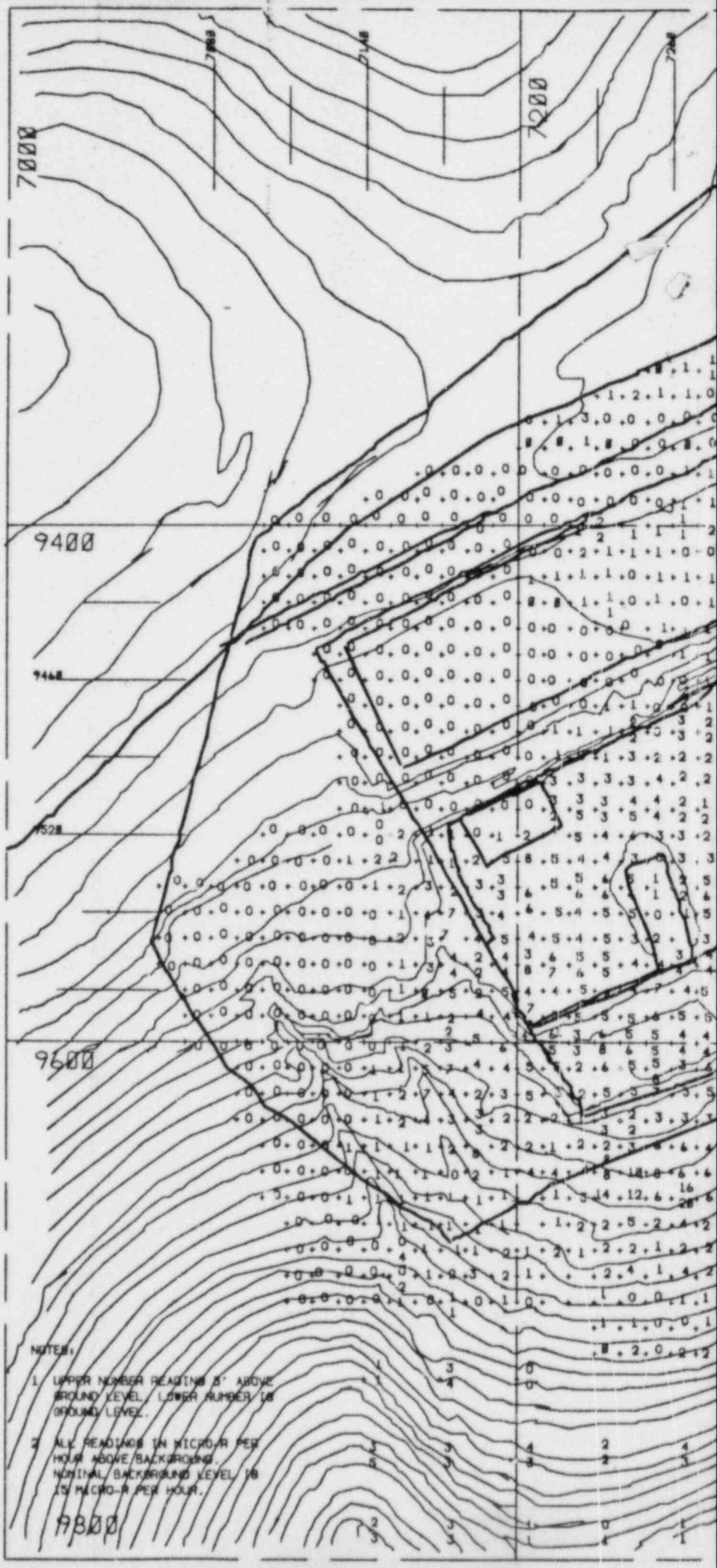


FIGURE 2 – INITIAL SURVEY READINGS