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FOLLOW--UP CONFIRMATORY SURVEY OF PHASE I DECOMMISSIONING FORMER WASTE PROCESSING FACILITY GA TECHNOLOGIES SAN DIEGO, CALIFORNIA

P. R. COTTEN

Radiological Site Assessment Program
Manpower Education, Research, and Training Division

FINAL REPORT
MARCH 1988

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OF PHASE I DECOMMISSIONING
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GA TECHNOLOGIES
SAN DIEGO, CALIFORNIA

INTRODUCTION

In mid 1984, GA Technologies, Inc. (GA) of San Diego, California, initiated Phase I decommissioning activities of the Former Waste Processing Facility (Figures 1-3). Phase I includes the Solar Evaporation Pond Area, the areas immediately surrounding the Former Waste Processing Facility and Incinerator Pad, a previous burial site for contaminated asphalt, the hillside and canyon below the waste handling facilities, and undeveloped land surrounding the Waste Processing Facilities. During December 10-17, 1985 a confirmatory survey of Phase I remediation was performed by the Radiological Site Assessment Program of Oak Ridge Associated Universities (ORAU). The survey identified 49 small isolated areas (Figure 4) of residual contamination; these areas were primarily east and north of the Waste Processing Facility, and in the vicinity of the former Solar Evaporation Ponds.[1]

During 1987, GA Technologies performed additional remedial actions to remove contamination identified by the December 1985 ORAU survey. A report, prepared by GA indicates that this remedial action was effective in reducing residual contamination to within the guidelines established for the site.[2] At the request of the Nuclear Regulatory Commission's Region V Office, a followup survey of these recleaned areas was performed by ORAU during September 1987. This report describes the procedures and results of that survey.

PROCEDURES

1. The licensee's grid system was reestablished at 30 ft (9.1 m) intervals to provide reference points for measurements and sampling.

2. A walkover surface gamma scan was conducted at 1-2 m intervals throughout the remediated area, using portable countrate instruments with NaI(Tl) gamma scintillation detectors and audible indicators. A scan of the canyon drainage area, southeast of the Waste Processing Facilities, was also performed.

3. Exposure rates were measured at the surface and 1 m above the surface at seven locations (Figure 5), where additional remedial action had been performed. These locations represented those areas which were noted by the 1985 survey to have higher levels of contamination. Measurements were also performed at four locations in the Canyon (Figure 6).

4. Surface soil samples were collected at locations of exposure rate measurements.

5. Samples and data were returned to Oak Ridge, Tennessee for analyses and evaluation. Appendices A and B contain additional information regarding equipment and procedures. Results were compared to guidelines established for decommissioning of this facility (Appendix C).

RESULTS

Walkover gamma scans did not identify any locations of significantly elevated direct radiation levels in the remediated area or along the canyon floor. Gamma exposure rates measured in these areas are presented in Table 2. In the remediated area these rates ranged from 16 to 23 μR/h at surface contact and from 15 to 18 μR/h at 1 m above the surface. Measurements along the canyon floor ranged from 15 to 18 μR/h at the surface and from 14 to 16 μR/h at 1 m above the surface. For comparison, the background exposure rates in the vicinity of the GA Technologies facility averages about 9.7 μR/h at 1 m above the surface (Table 1A). The guideline for decommissioning requires that the average exposure rate be less than 10 μR/h above background, which would be a total of 19.7 μR/h. All exposure levels measured at 1 m above the surface during this survey were less than 19.7 μR/h and therefore this guideline is satisfied.

Tables 3 and 4 present the concentrations of gamma emitting radionuclides, measured in surface soil collected from the remediated and canyon floor areas. Ranges of concentrations in these samples were Co-60, <0.05 to 1.78 pCi/g; Cs-137, 0.28 to 11.9 pCi/g; Ra-226, 0.83 to 1.57 pCi/g; U-235, <0.23 to 1.69 pCi/g; U-238, <0.78 to 3.45 pCi/g; Th-228, 1.03 to 9.57 pCi/g; Th-232, 0.98 to 7.46 pCi/g. Concentrations of Sr-90 and isotopic uranium in two composite samples, representing the remediated area and canyon area, are listed in Table 5. The Sr-90 concentrations are 0.32 and 2.20 pCi/g; the highest uranium levels are U-238, which are 3.29 and 4.42 pCi/g. On the basis of the U-234/U-238 ratios, it appears that the uranium is depleted in the U-235 and U-234 isotopes.

With exception of the total thorium (Th-228 and Th-232) concentration, in the sample from location 105B, all radionuclide levels were below the guideline values in Appendix C and most were in the range of baseline concentrations (see Table 1b). The thorium concentration in sample 105B was 17.55 pCi/g, or 15.26 pCi/g above the average background level. This is slightly higher than the guideline value of 10 pCi/g above background. Surface scans in this area did not identify significantly elevated direct radiation levels, and sampling during the 1985 survey indicated that soils at grid intersections in the vicinity of this location were well within the guideline levels. Contamination at grid coordinate 7695N, 9550E is therefore an isolated small area, and averaging over adjacent soil will result in a concentration which satisfies the 10 pCi/g guideline.

SUMMARY

During September 1987, Oak Ridge Associated Universities performed a radiological survey of areas within the Phase I Decommissioning activities of GA Technologies in San Diego, California. The survey included locations, which had been remediated, following their identification by a December 1985 ORAU survey, and a section of canyon area in the drainage pathway from the Waste Processing Facility. Survey activities consisted of walkover gamma scans, exposure rate measurements, and soil sampling and analyses. Findings identified no areas exceeding the decommissioning guidelines, authorized by the Nuclear Regulatory Commission for this site. Based on these results it is ORAU's opinion that the radiological data, as presented by the licensee, is adequate and accurate and that the radiological conditions satisfy the established guidelines for release for unrestricted use.

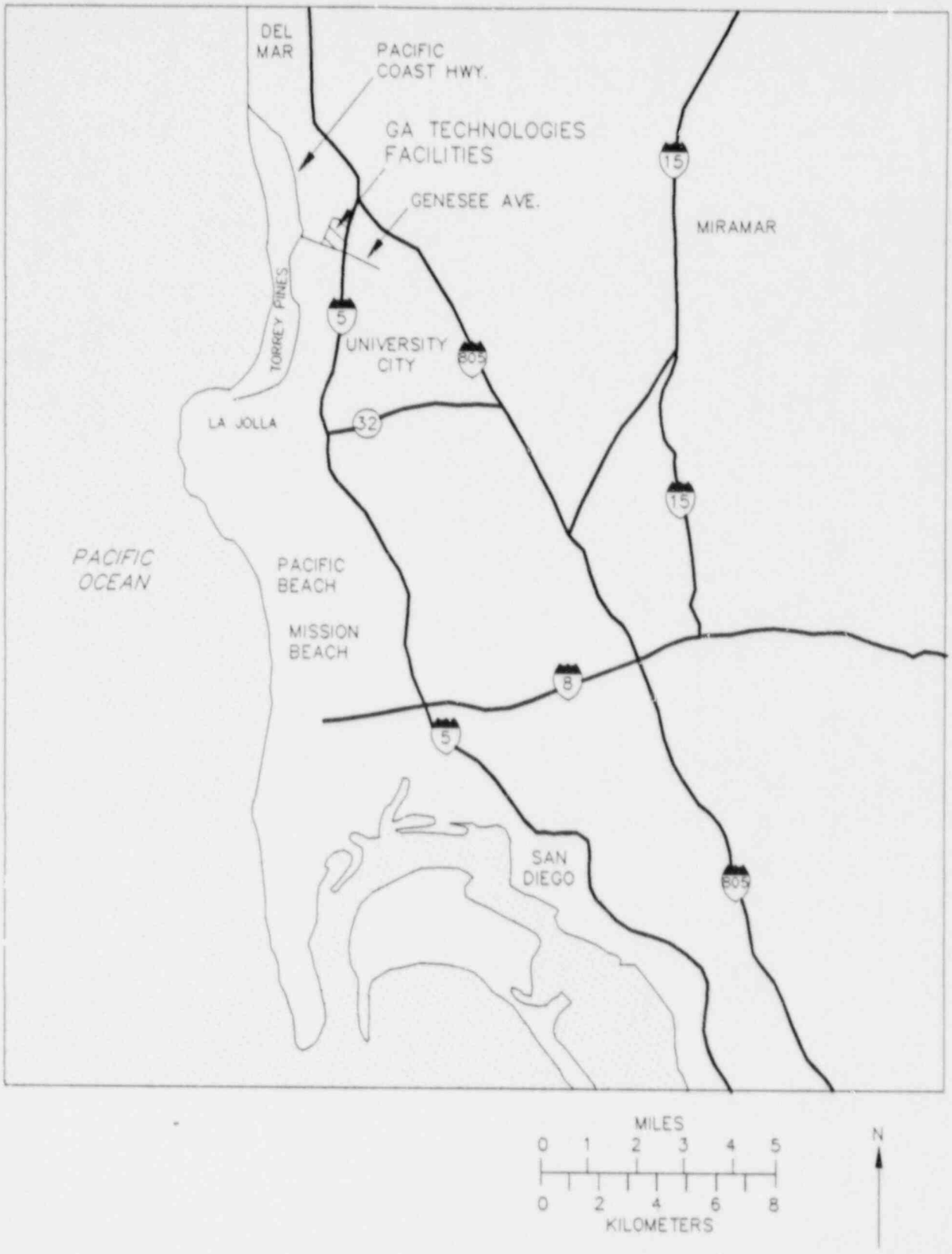

FIGURE 1: Map of San Diego Area, Indicating the Location of the GA Technologies Facilities

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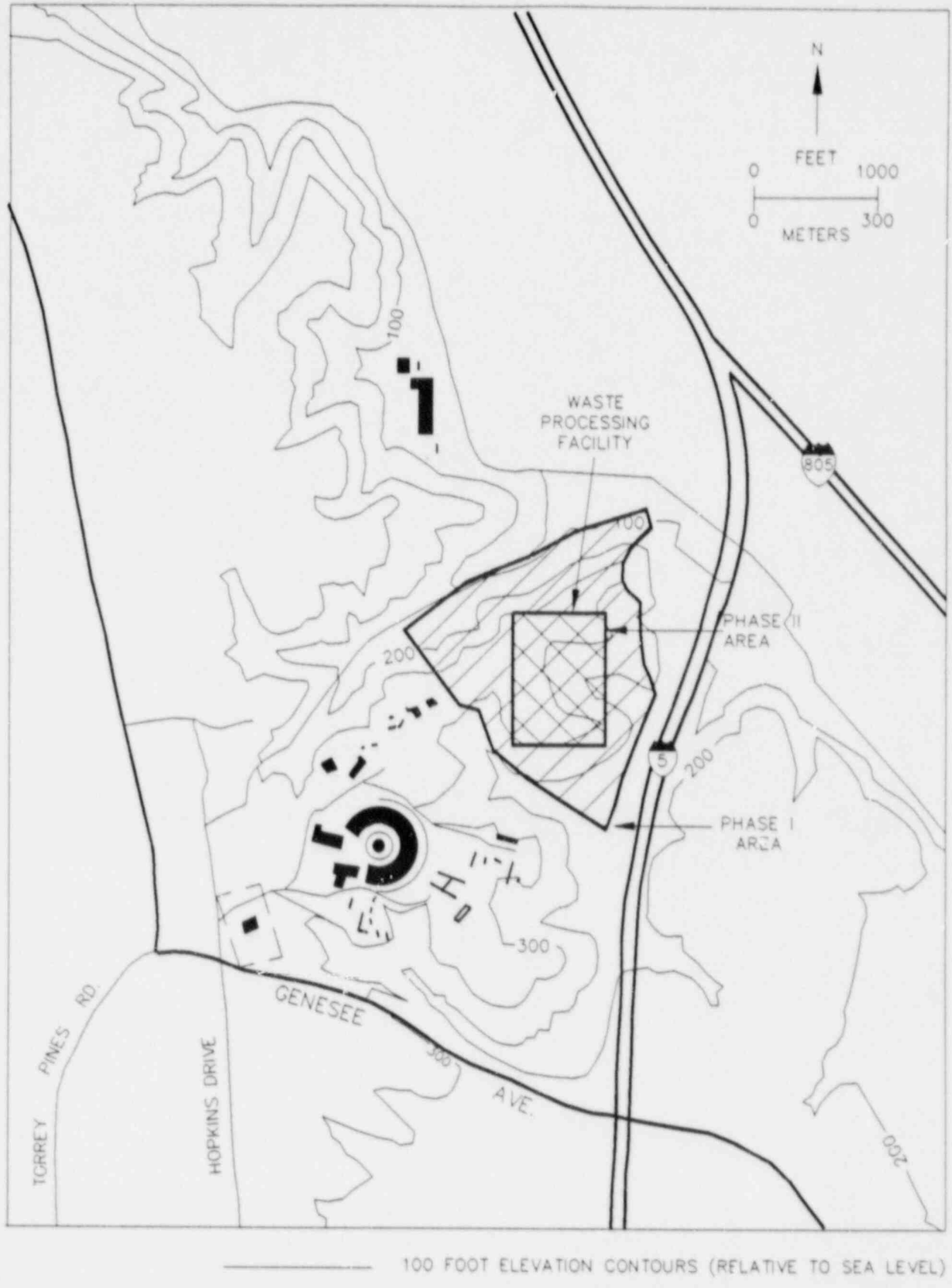

FIGURE 2: Area of GA Technologies Plant, Illustrating the Phase I Decommissioning Area

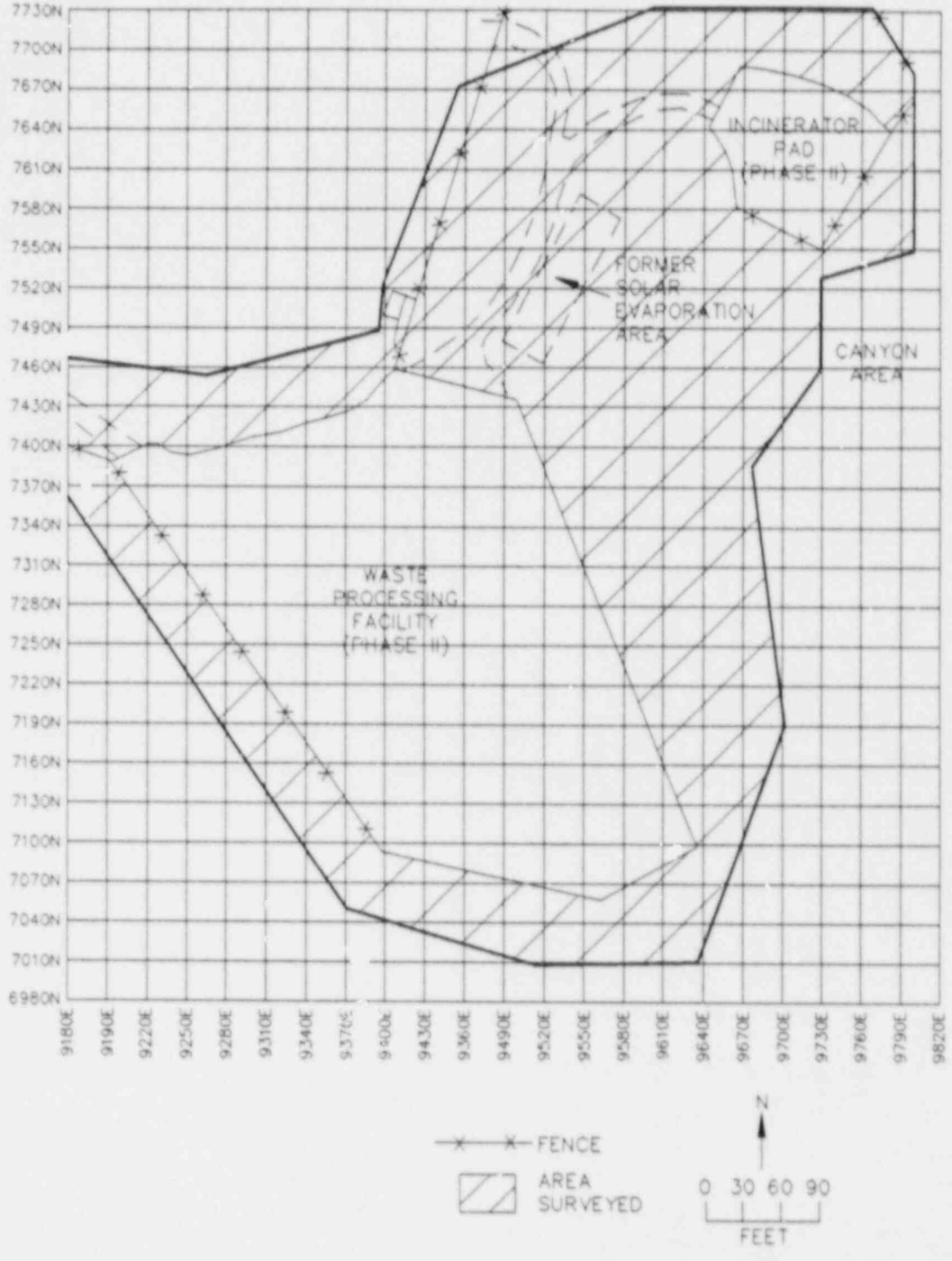

FIGURE 3: Waste Processing Facility Area, Indicating the Grid System used for Survey Reference

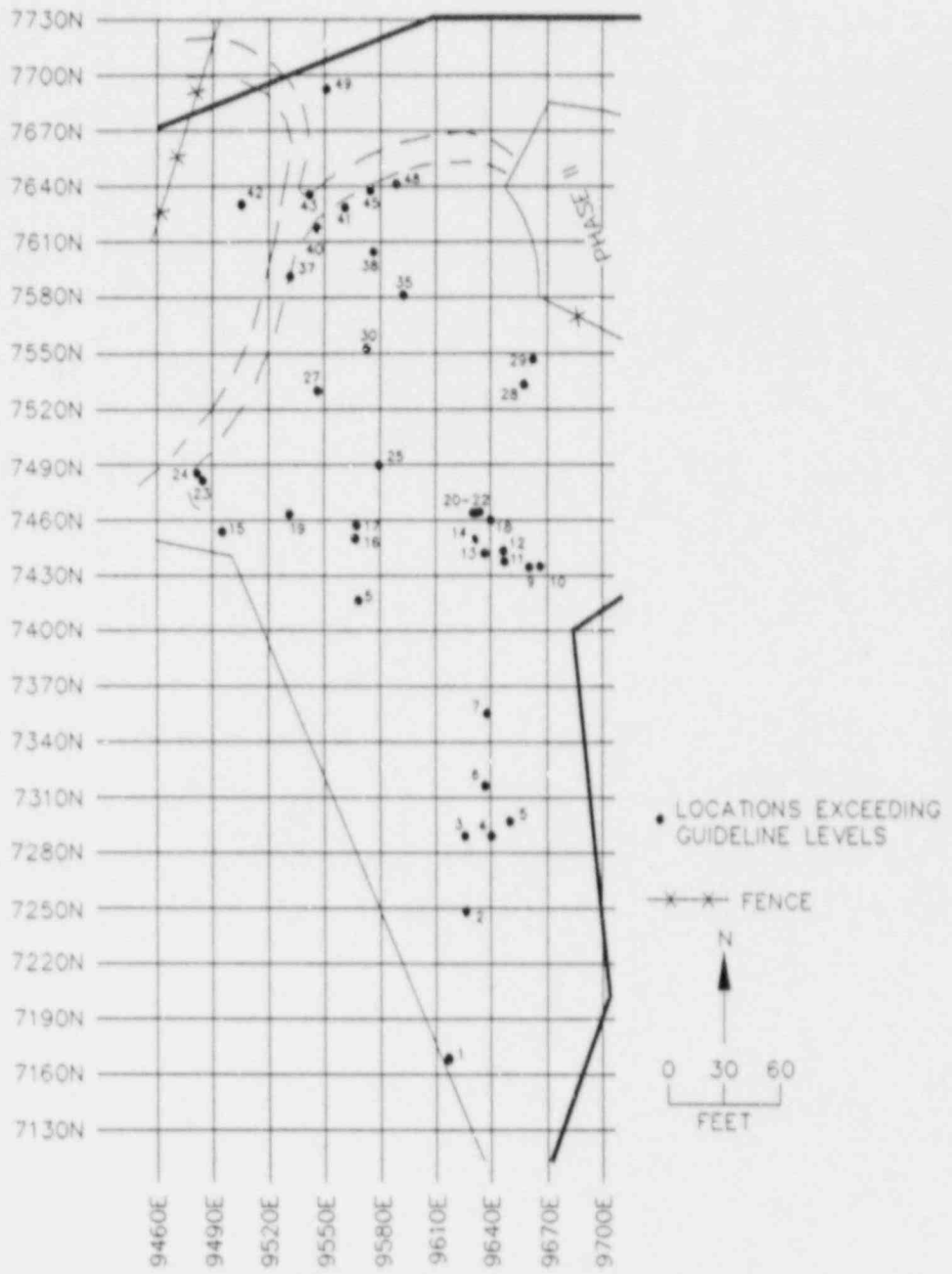

FIGURE 4: Locations Where December 1985 Survey Indicated Soil Concentrations Exceeding Guideline Levels

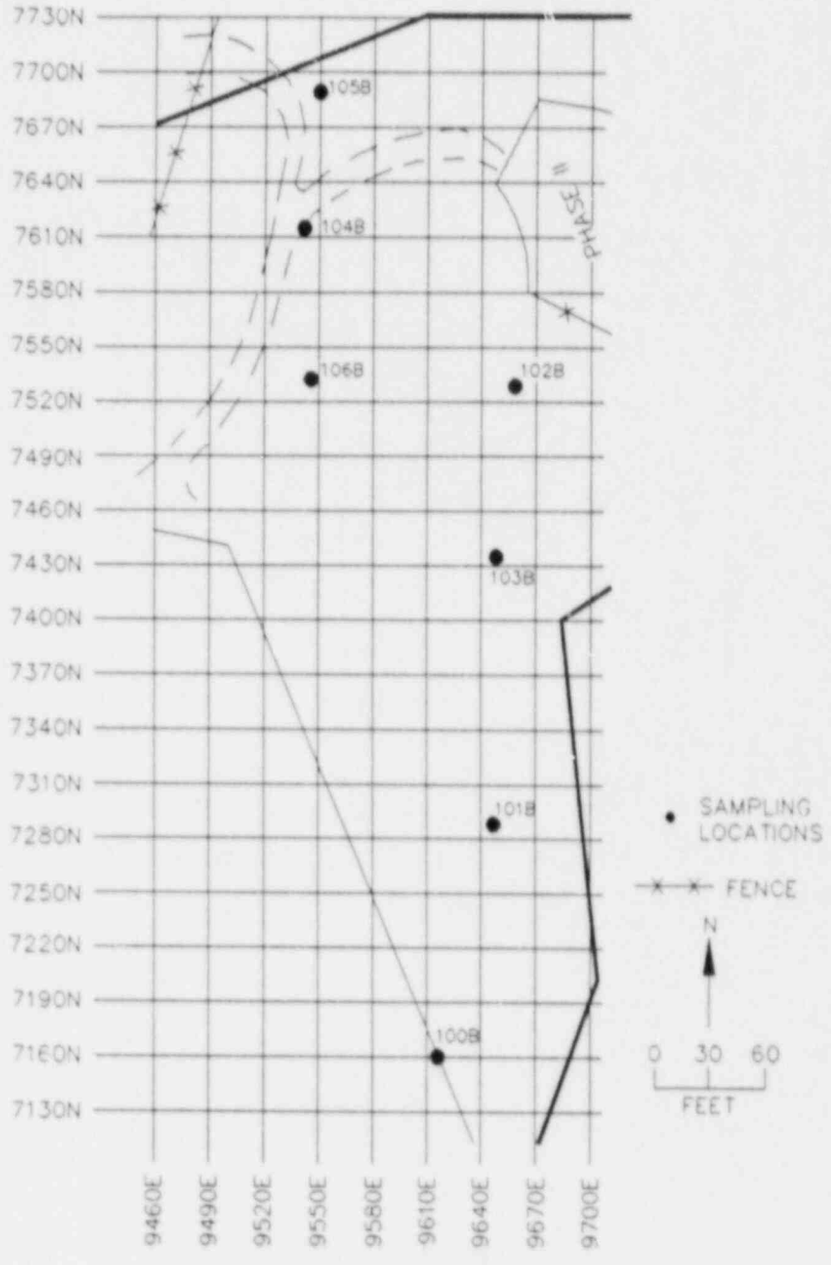

FIGURE 5: Sampling Locations, Phase I Follow-up

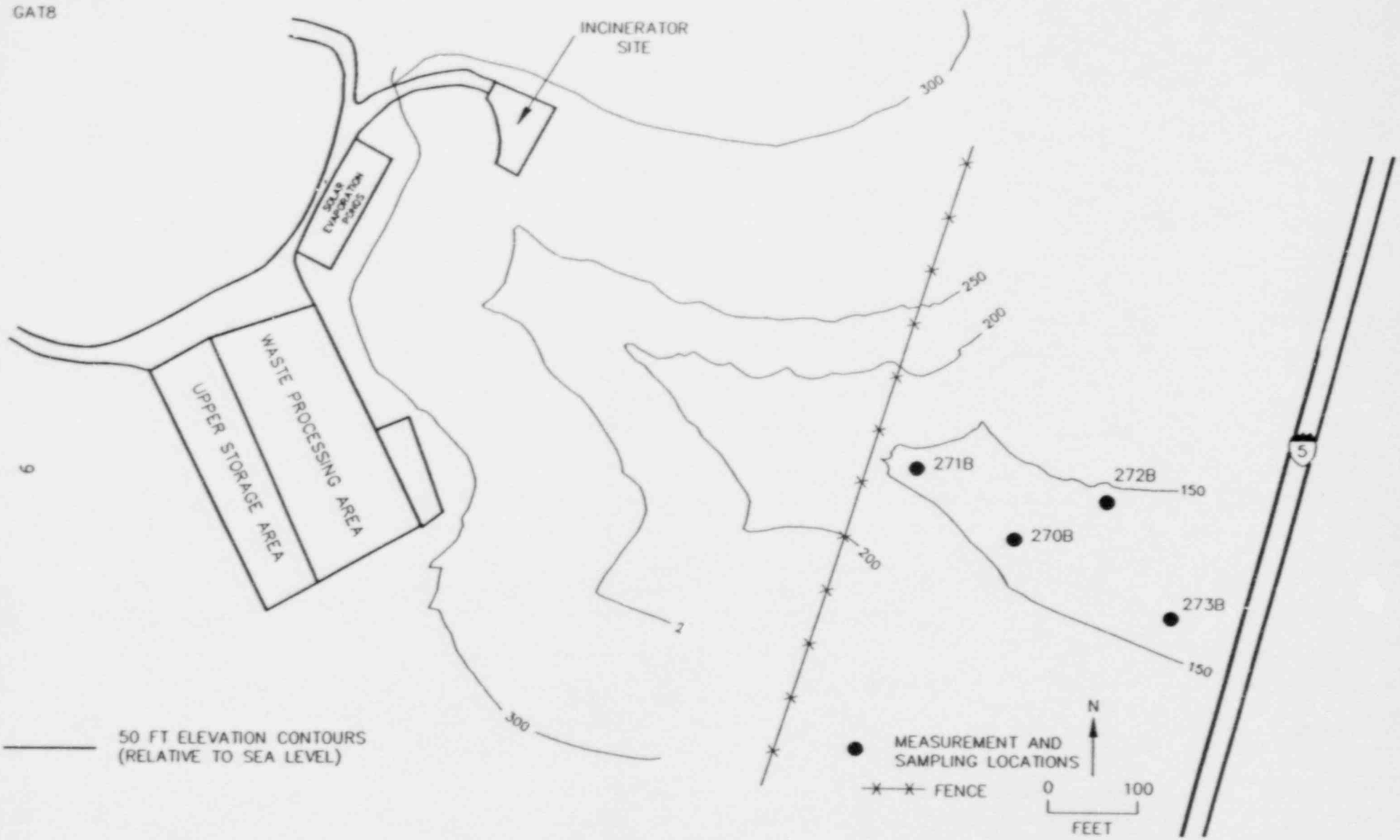

FIGURE 6: Locations of Measurement and Sampling Locations Along the Canyon Floor

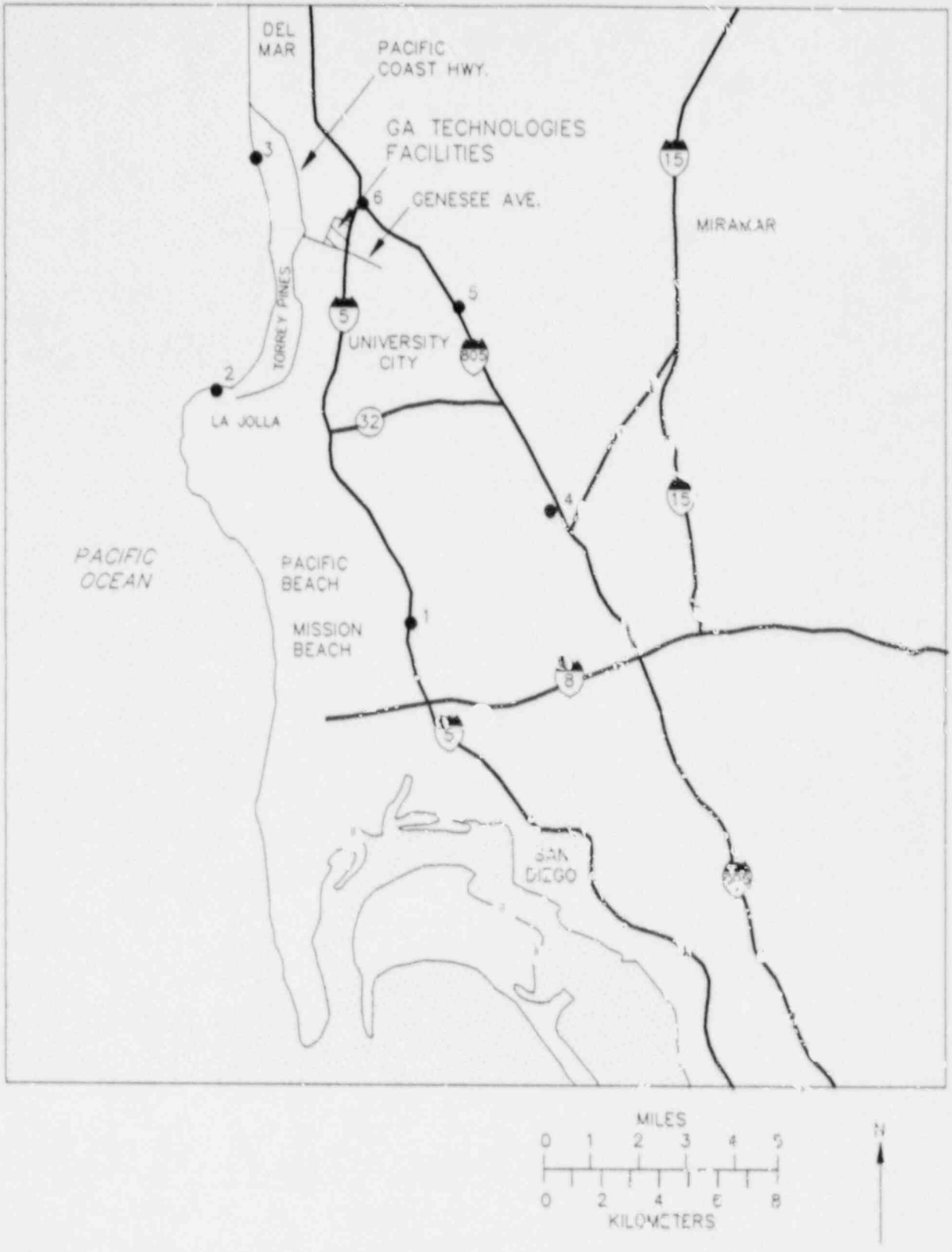

FIGURE 7: Locations (●) of Background Measurements and Baseline Soil Samples from the Vicinity of GA Technologies

TABLE 1A

BACKGROUND RADIATION LEVELS
GA TECHNOLOGIES
SAN DIEGO, CALIFORNIA

Location[a]	Gamma Exposure Rates at 1 m Above the Surface (μR/h)	Gamma Exposure Rates at the Surface (μR/h)
1	7	8
2	8	8
3	7	7
4	10	10
5	13	15
6	13	15
RANGE	7 TO 13	7 TO 15
AVERAGE	9.7	10.5

[a]Refer to Figure 7.

TABLE 18

BASELINE RADIONUCLIDE CONCENTRATIONS IN SOIL
GA TECHNOLOGIES
SAN DIEGO, CALIFORNIA

Location[a]	Radionuclide Concentrations (pCi/g)						
	Co-60	Cs-137	Ra-226	U-235	U-238	Th(228 & 232)	K-40
1	<0.03	<0.02	0.59 ± 0.14[b]	<0.17	1.6 ± 1.2	1.34 ± 0.46	14.0 ± 1.7
2	<0.05	0.16 ± 0.11	0.53 ± 0.22	<0.20	1.6 ± 1.5	1.98 ± 0.86	25.0 ± 3.3
3	<0.04	<0.04	0.79 ± 0.20	0.39 ± 0.24	1.1 ± 0.5	2.24 ± 0.62	10.4 ± 1.7
4	<0.08	<0.05	1.20 ± 0.29	<0.32	<1.1	3.08 ± 0.79	29.0 ± 3.4
5	<0.05	<0.05	1.23 ± 0.22	0.69 ± 0.55	1.3 ± 0.6	3.20 ± 0.80	24.3 ± 2.7
6	<0.05	<0.05	0.65 ± 0.16	<0.22	1.0 ± 0.9	1.92 ± 0.78	30.2 ± 2.9
RANGE	<0.03 to <0.08	<0.02 to <0.16	0.53 to 1.23	<0.17 to 0.69	1.0 to 1.6	1.34 to 3.20	10.4 to 30.2
AVERAGE	<0.05	<0.06	0.83	<0.33	1.3	2.29	22.2

[a]Refer to Figure 7.

[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of 6 to 10% have not been propagated in these data.

TABLE 2

EXPOSURE RATES AT SAMPLING LOCATIONS
PHASE I FOLLOW-UP
GA TECHNOLOGIES
SAN DIEGO, CALIFORNIA

Location[a] ID	Grid Coordinate N	Grid Coordinate E	Exposure Rate (μR/h) Contact	Exposure Rate (μR/h) 1 m Above Surface
100B	7160	9620	16	15
101B	7240	9646	16	15
102B	7532	9660	16	16
103B	7432	9645	20	18
104B	7611	9541	23	16
105B	7688	9550	20	15
106B	7528	9544	20	16
270B	Canyon Floor		18	16
271B	Canyon Floor		16	15
272B	Canyon Floor		15	14
273B	Canyon Floor		16	14

[a]Refer to Figures 5 and 6.

TABLE 3

RADIONCULIDE CONCENTRATIONS IN SOIL FROM REMEDIATED AREAS
PHASE I FOLLOW-UP
GA TECHNOLOGIES
SAN DIEGO, CALIFORNIA

Sample No.	Location[a]	Radionuclide Concentrations (pCi/g)						
		Co-60	Cs-137	Ra-226	U-235	U-238	Th-228	Th-232
100B	7160N,9620E	<0.05	0.28 ± 0.12	1.17 ± 0.25	<0.23	<0.8	1.59 ± 0.42	1.61 ± 0.47
101B	7290N,9646E	1.78 ± 0.27[b]	9.97 ± 0.44	1.17 ± 0.40	<0.38	3.5 ± 0.9	2.10 ± 0.42	1.96 ± 0.55
102B	7532N,9660E	<0.08	1.78 ± 0.19	1.50 ± 0.33	<0.32	<0.9	1.95 ± 0.48	2.03 ± 0.70
103B	7432N,9645E	0.52 ± 0.15	2.92 ± 2.51	1.30 ± 0.2	<0.28	<0.8	2.76 ± 0.45	1.96 ± 0.55
104B	7611N,9541E	<0.06	1.52 ± 0.17	1.57 ± 0.23	<0.26	3.0 ± 0.7	1.62 ± 0.48	2.06 ± 0.50
105B	7688N,9550E	<0.06	0.32 ± 0.14	1.07 ± 0.32	1.69 ± 0.86	<1.5	9.57 ± 0.81	7.40 ± 0.87
106B	7528N,9544E	1.50 ± 0.28	11.85 ± 0.50	0.83 ± 0.33	<0.31	<0.9	1.26 ± 0.48	1.40 ± 0.57

[a]Refer to Figure 5.
[b]Uncertainties represent the 95% confidence levels based only on counting statistics; additional laboratory uncertainties of 6 to 10% have not been propagated into these data.

TABLE 4

RADIONCULIDE CONCENTRATIONS IN SOIL FROM THE CANYON FLOOR
PHASE I FOLLOW-UP
GA TECHNOLOGIES
SAN DIEGO, CALIFORNIA

Sample[a] No.	Radionuclide Concentrations (pCi/g)						
	Co-60	Cs-137	Ra-226	U-235	U-238	Th-228	Th-232
270B	0.15 ± 0.10[b]	0.97 ± 0.16	1.0 ± 0.2	0.57 ± 0.12	1.7 ± 0.6	1.62 ± 0.44	2.00 ± 0.57
271B	0.18 ± 0.20	0.68 ± 0.15	1.4 ± 0.3	0.27 ± 0.14	<1.0	1.03 ± 0.50	0.98 ± 0.37
272B	<0.05	0.15 ± 0.09	1.4 ± 0.3	0.20 ± 0.06	2.4 ± 0.67	1.50 ± 0.28	1.50 ± 0.53
273B	0.17 ± 0.12	1.3 ± 0.2	1.3 ± 0.2	0.41 ± 0.13	0.94 ± 1.7	1.64 ± 0.39	1.60 ± 0.47

[a]Refer to Figure 6.
[b]Uncertainties represent the 95% confidence levels based only on counting statistics; additional laboratory uncertainties of 6 to 10% have not been propagated into these data.

TABLE 5

RADIONUCLIDE CONCENTRATIONS IN COMPOSITE SOIL SAMPLES
PHASE I FOLLOW-UP
GA TECHNOLOGIES
SAN DIEGO, CALIFORNIA

Sample ID	Radionuclide Concentrations (pCi/g)			
	Sr-90	U-234	U-235	U-238
Composite A[a]	0.32 ± 0.12[b]	1.85 ± 0.26	0.13 ± 0.08	4.42 ± 0.40
Composite B	2.20 ± 0.30	1.74 ± 0.24	0.07 ± 0.06	3.29 ± 0.34

[a]Sample identification numbers:
Composite A: (270B; 271B; 272B; 273B)
Composite B: (7290N, 9646E; 7432N, 9645E; 7611N, 9541E; 7528N, 9544E)

[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.

REFERENCES

1. "Confirmatory Survey of Phase I Decommissioning Former Waste Processing Facility," GA Technologies, San Diego, California, Oak Ridge Associated Universities, July 1986.

2. Letter from K.E. Asmussen (GA Technologies Inc.) to R. R. Thomas (U.S. Nuclear Regulatory Commission, Region V), Reference "License SNM-696, Docket 70-1734" August 12, 1987.

APPENDIX A

MAJOR SAMPLING AND ANALYTICAL EQUIPMENT

APPENDIX A

MAJOR SAMPLING AND ANALYTICAL EQUIPMENT

The display or description of a specific product is not to be construed as an endorsement of that product or its manufacturer by the authors or their employer.

A. Direct Radiation Measurements

Eberline "RASCAL"
Portable Ratemeter-Scaler
Model PRS-1
(Eberline, Sante Fe, NM)

Eberline PRM-6
Portable Ratemeter
(Eberline, Sante Fe, NM)

Victoreen NaI Scintillation Detector
Model 489-55
(Victoreen, Cleveland, OH)

Reuter-Stokes Pressurized Ionization Chamber
Model RSS-111
(Reuter-Stokes, Cleveland, OH)

B. Laboratory Analyses

Automatic low-background Alpha-Beta Counter
Model LB5110-2080
(Tennelec, Inc., Oak Ridge, TN)

High-Purity Germanium Detector
Model GMX-23195-S, 23% efficiency
(EG&G ORTEC, Oak Ridge, TN)

Used in conjunction with:
Lead Shield, G-16
(Gamma Products Inc., Palos Hills, IL)

High Purity Germanium Coaxial Well Detector
Model GWL-110210-PWS-S, 23% Efficiency
(EG&G ORTEC, Oak Ridge, TN)

Used in conjunction with:
Lead Shield Model G-16
(Applied Physical Technology, Atlanta, GA)

High Purity Germanium Detector
Model IGC25, 25% Efficiency
(Princeton Gamma-Tech, Princeton, NJ)

Used in conjunction with:
Lead Shield
(Nuclear Data, Schaumburg, IL)

Multichannel Analyzer
ND-66/ND-680 System
(Nuclear Data Inc., Schaumburg, IL)

Alpha Spectrometry System
Tennelec Electronics
(Tennelec, Oak Ridge, TN)

Surface Barrier Detectors
(EG&G ORTEC, Oak Ridge, TN)

Multichannel Analyzer
Model ND-66
(Nuclear Data, Schaumburg, IL)

APPENDIX B

MEASUREMENT AND ANALYTICAL PROCEDURES

APPENDIX B

Measurement and Analytical Procedures

Gamma Surface Scans

Walkover surface scans were performed at approximately 1-2 m intervals using Eberline Model PRM-6 portable ratemeters with Victoreen Model 489-55 gamma scintillation probes containing 3.2 cm X 3.8 cm NaI(Tl) scintillation crystals. Relative count rates were monitored using earphones and increased rates above the ambient background levels were noted.

Exposure Rate Measurements

Measurements of gamma exposure rates were performed using an Eberline PRM-6 portable ratemeter with a Victoreen Model 489-55 gamma scintillation probe containing a 3.2 cm x 3.8 cm NaI(Tl) scintillation crystal. Count rates were converted to exposure rates (μR/h) by cross-calibrating with a Reuter Stokes model RSS-111 pressurized ionization chamber.

Soil Sample Analysis

Gamma Spectroscopy

Soil samples were dried, mixed, and a portion sealed in 0.5-liter Marinelli beaker. The quantity placed in the beaker was chosen to reproduce the calibrated counting geometry and typically ranged from 600 to 800 g of soil. Net soil weights were determined and the samples counted using intrinsic germanium and Ge(Li) detectors coupled to a Nuclear Data Model ND-680 pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. Energy peaks used for determination of radionuclides of concern were:

Co-60 - 1.173 MeV
Cs-137 - 0.662 MeV
Ra-226 - 0.609 MeV from Bi-214 (secular equilibrium assumed)
U-235 - 0.144 MeV
U-238 - 0.094 MeV from Th-234 (secular equilibrium assumed)
Th-228 - 0.583 MeV from Tl-209 (secular equilibrium assumed)
Th-232 - 0.911 MeV from Ac-228 (secular equilibrium assumed)

The spectra were also reviewed for the presence of other radionuclides.

Strontium-90 Analysis

Aliquots of soil were dissolved by pyrosulfate fusion and the strontium precipitated as a sulfate. Successive treatments with EDTA preferentially removed lead and excess calcium and returned the strontium to solution. Ferric and other insoluble hydroxides was precipitated at a pH of 12 to 14. Strontium was reprecipitated as a sulfate. Barium was removed as a chromate using DTPA. The final precipate of strontium carbonate was counted using a low-background Tennelec alpha-beta proportional counter.

Alpha Spectrometry for Isotopic Uranium

Aliquots of soil were dissolved by pyrosulfate fusion and precipitated by barium sulfate. The barium sulfate precipitate was redissolved and uranium was separated by liquid-liquid extraction. The uranium was then precipitated with a cerium fluoride carrier and counted using surface barrier detectors (ORTEC), alpha spectrometers (Tennelec), and an ND-66 Multichannel Analyzer (Nuclear Data).

Uncertainties and Detection Limits

The uncertainties associated with the analytical data presented in the tables of this report, represent the 95% confidence levels for that data. These uncertainties were calculated based on both the gross sample count levels and the associated background count levels. When the net sample count was less than the 95% statistical deviation of the background count, the sample concentration was reported as less than the detection capability of the measurement procedure.

Because of variations in background levels, sample volumes or weights, measurement efficiencies, and Compton contributions from other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument. Additional uncertainties of ± 6 to 10%, associated with sampling and laboratory procedures, have not been propagated into the data presented in this report.

Calibration and Quality Assurance

Laboratory and field survey procedures are documented in the following manuals, developed specifically for the Oak Ridge Associated Universities' Radiological Site Assessment Program: "Survey Procedures Manual," Revision 3, May 1987; "Laboratory Procedures Manual", Revision 3, May 1987 and "Quality Assurance Manual", Revision 1, June 1987.

With the exception of the measurements conducted with portable gamma scintillation survey meters, instruments were calibrated with NBS-traceable standards. The calibration procedures for the portable gamma instruments are performed by comparison with an NBS calibrated pressurized ionization chamber.

Quality control procedures on all instruments included daily background and check-source measurements to confirm equipment operation within acceptable statistical fluctuations. The ORAU laboratory participates in the EPA and EML Quality Assurance Programs.

APPENDIX C

DECOMMISSIONING GUIDELINES FOR THE GA TECHNOLOGIES WASTE PROCESSING FACILITY

APPENDIX C

Decommissioning Guidelines for the
GA Technologies Waste Processing Facility

Target criteria for unrestricted release of the GA Technologies' Waste Processing Facility and surrounding areas are presented in the licensee's final report and are as follows:

External Radiation

The gamma exposure rate at 1 m above the ground surface shall not exceed 10 μR/h above background for an area of greater than 30 ft (9.1 m) x 30 ft (9.1 m) and shall not exceed 20 μR/h above background for any discrete area [i.e. less than 30 ft (9.1 m) x 30 ft 9.1 m)].

Inhalation and Ingestion

Concentrations of radionuclides in soil shall be such that inhalation and ingestion are not expected to result in annual dose equivalents exceeding 20 mrem to the lung or 60 mrem to the bone.

Limiting soil concentrations were derived to satisfy these external and internal target criteria. The concentration limits are presented in the following Table.

Radionuclide	Concentration Limit Above Background (pCi/g)
Depleted Uranium	35
Enriched Uranium	30
Thorium (Natural)	10
Co-60	8
Cs-137	15
Sr-90	1.8×10^3

Where more than one radionuclide is present, the sum of the ratios of the individual radionuclide concentrations to their respective concentration limits shall not exceed 1.