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**PRELIMINARY
SITE SURVEY REPORT
FOR THE SACANDAGA SITE,
GLENVILLE, NEW YORK**

W. D. Cottrell
R. D. Foley
R. F. Carrier

MASTER

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HEALTH AND SAFETY RESEARCH DIVISION

Nuclear and Chemical Waste Programs
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PRELIMINARY SITE SURVEY REPORT FOR THE SACANDAGA SITE, GLENVILLE, NEW YORK*

INTRODUCTION

The Sacandaga Atomic Power Laboratory (SAPL), located on Sacandaga Road in the Town of Glenville, Schenectady County, New York, was operated by the General Electric Company Knolls Atomic Power Laboratory (KAPL) for the Atomic Energy commission (AEC) from 1947-1951 (Fig. 1). Originally used for the study and development of radar during World War II, the facilities housed later operations involving Physics studies and sodium technology development in support of breeder reactor design and other AEC programs. Of the numerous original buildings shown on Fig. 2, only Building P, the Critical Assembly Building, remains standing. Front and rear views of the small, concrete block building are shown in Figs. 3 and 4. The remaining structure is situated on ~51 acres of land most of which is covered by a heavy growth of trees and brush. An abundance of rubbish and dismantled structural materials is strewn throughout the site (Fig. 5). The present owner uses the building as a storage area. It is estimated that the total inventory of radioactive materials on the site included ~300 kg of uranium in the form of solid metal discs, ~8 mg of plutonium on platinum discs covered with plastic, and ~3 mg of radium sealed in a radium/beryllium source. Both ^{238}U and ^{235}U in solid metal form were used in experiments for breeder reactor studies. With the termination of Thermal Test Reactor and Preliminary Pile Assembly operations in March, 1951, the Sacandaga equipment was dismantled and moved to the Knolls site in nearby Schenectady.¹

The Office of Naval Reactors requested, through the office of Remedial Action and Waste Technology, that the radiological survey group from the Formerly Utilized Sites Remedial Action Program (FUSRAP) conduct an independent assessment of the radiological condition of the Sacandaga Site. This type of assessment typically involves a two-stage process. The first part consists of a site visit and preliminary scoping survey to verify that no radiological hazard exists at a specific site, and to collect sufficient data to plan the second part of the process – the more comprehensive radiological survey. The preliminary radiological scoping survey discussed in this report was conducted, at the request of DOE, by Oak Ridge National Laboratory on July 22, 1988. Compared to the large size of the property, the survey was limited in scope, including only the 5–6 acres enclosed within the fence and concentrating on those areas having the greatest possibility of containing residual

*The survey was performed by members of the Measurement Applications and Development Group of the Health and Safety Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400.

radioactive material. The survey team identified these areas through review of historical information provided by Naval Reactors and KAPL.¹

SURVEY METHODS

Because the site is very large, the scoping survey was limited to a gamma scan at the surface in areas selected from review of the site history and discussions with KAPL personnel; collection of soil samples; and measurements of transferable alpha and beta-gamma activity levels inside the building. A comprehensive description of the survey methods and instrumentation has been presented in another report.²

Using a portable gamma scintillation meter, ranges of measurements were recorded by scanning the ground surface outdoors and within Building P. Systematic soil samples were then collected irrespective of gamma exposure rates. These sampling locations are selected as part of a sampling grid or to obtain a general representation of the radioactive content of the soil around the site without regard to gamma radiation levels. In addition, soil samples were collected from the ground surface (0–20 cm) in outdoor areas of elevated gamma levels. Samples taken in these locations are referred to as biased samples and are more likely to contain elevated radioactivity than systematic samples. All samples were analyzed for radionuclide content. Beryllium concentrations were determined in selected samples. Smears were also obtained from designated surfaces inside the building to establish transferable alpha and beta-gamma activity levels.

SURVEY RESULTS

Typical background radiation levels for the eastern New York area are listed in Table 1. These data are provided for comparison with survey results presented in this section. DOE guidelines for the release of property for unrestricted use are listed in Table 2. All direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations measured in environmental samples.

Indoor Survey Results

Gamma Radiation Levels

Gamma exposure rates on surfaces inside Building P ranged from 5 to 6 $\mu\text{R/h}$ (Fig. 6). The observed levels are lower than the typical average background gamma exposure rate of 9 $\mu\text{R/h}$ found in the Schenectady/Albany area (Table 1). Background will vary from

building to building depending upon particular construction materials and the type of soil on which the building rests. All values are below the DOE reference guideline of $20 \mu\text{R/h}$ above background for indoor areas (Table 2).

Indoor Alpha and Beta-gamma Measurements

Smear samples were obtained from various locations inside the building. Analysis of the smears showed that all measurements of transferable alpha activity levels were at background. Transferable beta-gamma measurements yielded levels ranging from background to $260 \text{ dpm}/100 \text{ cm}^2$. The maximum measurement, $260 \text{ dpm}/100 \text{ cm}^2$, was obtained in the open area of Building P (covered port, Fig. 6) and is well below the reference guideline of $1000 \text{ dpm}/100 \text{ cm}^2$ for removable beta-gamma surface contamination (Table 2).

Outdoor Survey Results

Gamma Radiation Levels

A scan of the surface outdoors on the property disclosed exposure rates generally ranging from 5 to $10 \mu\text{R/h}$ (Fig. 7). These values are within the range of typical background gamma levels (Table 1).

Systematic and Biased Soil Samples

Two systematic soil samples (S) were collected at two locations as shown on Fig. 8. The results of laboratory analyses are provided in Table 3. Uranium-238 was found at concentrations of 1.3 and 1.9 pCi/g in these samples, slightly above typical background (Table 1). Concentrations of ^{226}Ra and ^{232}Th in systematic samples were 1.5 and 0.98 pCi/g , and 2.5 and 1.1 pCi/g , respectively, values also slightly in excess of background values. Cesium-137 concentrations in two systematic surface soil samples were 0.34 and 0.76 pCi/g , which are in the range of typical background concentrations due to fallout from nuclear weapons testing.

In seven biased (B) soil samples taken from six different locations of elevated gamma levels on the property, concentrations of ^{238}U ranged from <1.5 to 2.7 pCi/g . These samples averaged 1.9 pCi/g . The maximum uranium concentration was found in sample B10 (Fig. 8). Concentrations of ^{226}Ra and ^{232}Th in biased samples were 1.1 to 2.3 pCi/g , averaging 1.5 pCi/g , and 1.1 to 2.6 pCi/g , averaging 1.6 pCi/g , respectively. Cesium-137 concentrations ranged from <0.02 to 0.69 pCi/g , averaging 0.23 pCi/g . These values are typical of concentrations found in soil from fallout from nuclear weapons testing.

The results of soil sample analyses show that concentrations of ^{238}U , ^{226}Ra , and ^{232}Th are slightly higher than levels typical for the general Albany area (Table 1); however, they are no higher than levels measured in other areas having similar types of soil (i.e., soils containing shale and cinders). Concentrations of ^{232}Th , ^{226}Ra and ^{238}U at levels of 2-4 pCi/g are not inconsistent with concentrations of these radionuclides found in cinders from coal burning at other locations and, based on radionuclide ratios and concentrations, it appears that the primary source of most of the radioactivity in the samples is probably due to radionuclides naturally present in soil and ashes.

Representatives from the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) collected soil samples at this site coincident with the ORNL survey. However, in neither case were the samples actually split for independent analysis. NYSDEC/NYSDOH results are summarized in the appendix and were similar to ORNL results.

CONCLUSIONS

The results of the limited scoping survey of a portion of the Sacandaga Site reveal no data to indicate that residual radioactivity from former operations exists either indoors or outdoors on that portion of the site surveyed. However, since this property contains approximately 51 acres and the limited survey covered only that portion of the site that contained the process and associated service buildings (5-6 acres), the data from this survey, while indicative, is not a comprehensive assessment of the radiological condition of the entire site. If a higher degree of confidence is desired, a more detailed survey of at least a portion of the site would be required. This detailed survey should include subsurface investigation of those areas known to contain buried rubble from demolished structures formerly part of the site. Soil samples should also be collected and analyzed for ^{226}Ra , ^{232}Th , ^{238}U , ^{137}Cs , ^{239}Pu , and non-radioactive beryllium.

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Fig. 1. Diagram showing general location of the Sacandaga Site.

Fig. 2. Diagram showing property boundaries and all buildings and structures as located during 1947-1951 operations at the Sacandaga Site. (Blowup, Fig. 7, p. 12.)

ORNL-PHOTO 1074-89

Fig. 3. View of the front of Building P at the Sacandaga Site, looking north.

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Fig. 4. View of the rear of Building P at the Sacandaga Site, looking south.

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Fig. 5. View of typical outdoor area at the Sacandaga Site.

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Fig. 6. Diagram of Building P at the Sacandaga site showing indoor gamma exposure rates and location of soil sample S1.

Fig. 7. Blowup of Sacandaga Site showing surveyed area and outdoor gamma exposure rates.

Fig. 8. Blowup of Sacandaga Site showing surveyed area and locations of systematic (S) and biased (B) soil samples.

Table 1. Background radiation levels in the Albany area

Type of radiation measurement or sample	Radiation level or radionuclide concentration	
	Range	Average
Gamma exposure rate at 1 m above floor or ground surface ($\mu\text{R/h}$) ^a	8-10	9
Concentration of radionuclides in soil (pCi/g) ^b		
²³⁸ U	0.76-1.2	0.96
²²⁶ Ra	0.48-1.2	0.85

^aValues obtained from four locations in the Albany area.

^bSoil samples (NY1-NY6) obtained from six locations around the Albany area. ³

Table 2. Applicable guidelines for protection against radiation^a
(Limits for uncontrolled areas)

Mode of exposure	Exposure conditions	Guideline value
Gamma radiation	Indoor gamma radiation level (above background)	20 μ R/h
Surface contamination ^b	²³⁸ U, U-natural	
	Fixed on surfaces	5000 dpm/100 cm ²
	Removable	1000 dpm/100 cm ²
	Beta-gamma emitters ^c	
	Fixed on surfaces	5000 dpm/100 cm ²
	Removable	1000 dpm/100 cm ²
	²³² Th, Th-natural	
	Fixed on surfaces	1000 dpm/100 cm ²
	Removable	200 dpm/100 cm ²
	²²⁶ Ra, transuranics	
	Fixed on surfaces	100 dpm/100 cm ²
	Removable	20 dpm/100 cm ²
Beta-gamma dose rates	Surface dose rate averaged over not more than 1 m ²	0.20 mrad/h
	Maximum dose rate in any 100 cm ² area	1.0 mrad/h
Radionuclide concentrations in soil	Maximum permissible concentration of the following radionuclides in soil above background levels averaged over 100 m ² area	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface
	²³² Th	
	²³⁰ Th	
	²²⁸ Ra	
	²²⁶ Ra	
	²³⁸ U	
		Derived (site specific)

^aU.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites (Revision 2, March 1987).

^bDOE surface contamination guidelines are consistent with *NRC Guidelines for Decontamination at Facilities and Equipment Prior to Release for Unrestricted use or Termination of Licenses for By-Product, Source, or Special Nuclear Material* (May 1987).

^cBeta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except ⁹⁰Sr, ²²⁸Ra, ²²³Ra, ²²⁷Ac, ¹³³I, ¹³¹I, ¹²⁹I, ¹²⁶I, and ¹²⁵I.

Table 3. Concentrations of radionuclides and beryllium in surface soil samples from the Sacandaga Site

Sample number ^a	Depth (cm)	Radionuclide concentration (pCi/g)				Be (μg/g)
		²²⁶ Ra ^b	²³² Th ^b	²³⁸ U ^b	¹³⁷ Cs ^b	
<i>Systematic Samples^c</i>						
S1	0—5	1.5 ±0.01	2.5 ±0.02	1.3 ±0.04	0.76 ±0.01	d
S2	0—15	0.98 ±0.008	1.1 ±0.02	1.9 ±0.3	0.34 ±0.01	1.1
<i>Biased Samples^c</i>						
B1	0—8	1.1 ±0.02	1.1 ±0.03	1.1 ±0.02	0.69 ±0.01	1.3
B2	0—15	1.3 ±0.06	1.4 ±0.2	1.8 ±0.08	0.059 ±0.02	d
B10	0—15	2.3 ±1	2.6 ±0.4	<1.5	<0.04	d
B11A	0—10	2.2 ±0.06	2.4 ±0.1	2.7 ±2	0.12 ±0.04	d
B11B	10—20	1.2 ±0.03	1.2 ±0.05	<2.6	<0.022	d
B12	0—10	1.2 ±0.06	1.3 ±0.06	1.7 ±0.2	<0.02	<1
B13	0—8	1.2 ±0.02	1.2 ±0.03	1.7 ±0.2	0.065 ±0.01	d

^aLocations of soil samples are shown on Figs. 6 and 8.

^bIndicated counting error is at the 95% confidence level ($\pm 2 \sigma$).

^cSystematic samples are taken at selected locations irrespective of gamma exposure.

^dNo analysis performed.

^eBiased soil samples are taken from areas shown to have elevated gamma exposure rates.

APPENDIX

Comparison of NYSDEC/NYSDOH and ORNL Soil Sample Results

APPENDIX

The New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) collected soil samples independent from, but concurrent with the ORNL survey of the Sacandaga Site. The locations of NYSDEC/NYSDOH soil samples and the results of their analyses are shown in the following diagram and table. ORNL sample locations and results are indicated in Fig. 8 and Table 3 of this report.

A comparison of the separate radionuclide analyses of the soil samples shows a range of concentrations for ^{238}U of 0.8 to 2.4 pCi/g (NYSDEC/NYSDOH) and 1.1 to 2.7 pCi/g (ORNL). Considering the analytical variables, including the stipulated counting errors and the fact that the state data refer to wet weight, the results are similar. Only ORNL sample B13 and NYSDEC/NYSDOH sample 885272 were taken from the same general location on the property. The content of ^{238}U in those two samples was 1.7 and 2.4 pCi/g, respectively, and the corresponding ^{226}Ra concentrations were 1.2 and 1.0 pCi/g. Although the results for some samples show concentrations of ^{238}U slightly elevated above average background levels for the general Albany area, they are in the range of background levels measured in other areas containing similar material (i. e., shale and cinders).

Fig. A.1 Building P (Critical Assembly Building) on the Sacandaga Site showing locations of NYSDEC/NYSDOH soil samples.

**Concentrations of principal radionuclides in soil samples from
the former KAPL Sacandaga Street Site, Glenville, New York**

Data provided by NYSDEC/NYSDOH^a

NYSDEC Sample number ^b	Radionuclide concentration (pCi/g)			
	²²⁶ Ra	²³² Th	²³⁸ U	²³⁵ U
885267	1.6 ± 0.3	1.7 ± 0.2	2.2 ± 1.3	<0.4
885268	0.49 ± 0.08	0.71 ± 0.06	1.3 ± 0.4	<0.12
885269	0.49 ± 0.19	0.61 ± 0.1	1.4	<0.3
885271	0.81 ± 0.13	0.77 ± 0.11	0.8 ± 0.5	0.2
885272	1.0 ± 0.2	1.2 ± 0.18	2.4 ± 1.2	<0.3

^aNew York State Department of Environmental Conservation (NYSDEC); New York State Department of Health (NYSDOH).

^bSee attached map for sampling locations.

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