A major purpose of the Technical Information Center is to provide the broadest dissemination possible of information contained in DOE's Research and Development Reports to business, industry, the academic community, and federal, state and local governments.

Although a small portion of this report is not reproducible, it is being made available to expedite the availability of information on the research discussed herein.

Health and Safety Research Division

**Nuclear and Chemical Waste Programs
(Activity No. AH 10 05 00 0; ONLWCO1)**

**RESULTS OF THE RADIOLOGICAL SURVEY AT
1047 CENTRAL AVENUE, ALBANY, NEW YORK (AL209)**

S. C. Hall and J. L. Marley

Date of Issue - November 1987

Investigation Team

**B. A. Berven - RASA Program Manager
W. D. Cottrell - FUSRAP Project Director
J. L. Marley - Field Survey Supervisor**

Survey Team Members

**A. C. Butler and S. C. Hall (ORNL)
F. G. Gardner and E. K. Roemer (ORAU)
E. Loy and R. Ray (D. Stone Assoc.)**

**Work performed as part of the
RADIOLOGICAL SURVEY ACTIVITIES PROGRAM**

**Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC05-84OR21400**

MASTER

CONTENTS

	<u>Page</u>
LIST OF FIGURES	v
LIST OF TABLES	vii
ACKNOWLEDGMENTS	ix
INTRODUCTION	1
SURVEY METHODS	1
SURVEY RESULTS	2
Gamma Measurements	2
Soil Sampling	2
Surface Measurements	3
SIGNIFICANCE OF FINDINGS	3
REFERENCES	5

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Diagram showing grid point and grid block locations outdoors on the property at 1047 Central Avenue, Albany, New York (AL209)	7
2	Front view of the property at 1047 Central Avenue, Albany, New York (AL209) looking northeast	8
3	Rear view of the property at 1047 Central Avenue, Albany, New York (AL209) looking west	9
4	Surface gamma exposure rates measured at grid points outdoors on the property at 1047 Central Avenue, Albany, New York (AL209)	10
5	Locations of soil samples on the property at 1047 Central Avenue, Albany, New York (AL209)	11

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Background radiation levels in the Albany area	12
2	Results of the gamma exposure rate measurements outdoors on the property at 1047 Central Avenue, Albany, New York (AL209)	13
3	Results of soil sample analysis on the property at 1047 Central Avenue, Albany, New York (AL209)	15
4	Results of surface analysis of structures at 1047 Central Avenue, Albany, New York (AL209)	16
5	Summary of outdoor measurements and sample results on the property at 1047 Central Avenue, Albany, New York (AL209)	17

ACKNOWLEDGMENTS

Research for this project was sponsored by the Division of Facility and Site Decommissioning Projects, U.S. Department of Energy, under Contract No. DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc. The authors wish to acknowledge the support of J. E. Baublitz, Deputy Director, Office of Remedial Action and Waste Technology; J. J. Fiore, Director, Division of Facility and Site Decommissioning Projects; Andrew Waller III, Division of Facility and Site Decommissioning Projects, Office of Nuclear Energy; and members of their staffs. In addition, the authors express appreciation to B. S. Ellis, D. A. Roberts, and T. R. Stewart (ORNL) for contributions in report preparation and review; F. G. Gardner [Oak Ridge Associated Universities (ORAU)] for participation in data processing; and to B. C. Littleton and L. J. Jeffers (Information Resources Organization) for manuscript preparation.

**RESULTS OF THE RADIOLOGICAL SURVEY AT
1047 CENTRAL AVENUE, ALBANY, NEW YORK (AL209)**

INTRODUCTION

Work with depleted uranium began in Colonie, New York, during 1958 at a plant owned by the National Lead Company.¹ Beginning in 1961, the Atomic Energy Commission (AEC), and other federal agencies engaged the National Lead Company (presently NL Industries, Inc.) in numerous contracts and subcontracts for the fabrication of enriched (3.6%) uranium fuel elements for the Hallam Reactor (Chicago Operations Office) and for the chemical processing of unirradiated, enriched uranium scrap (New York Operations Office).^{2,3} Since the termination of the AEC contracts, the work at the plant was devoted to the fabrication of shielding components, ballast weights, and projectiles from depleted uranium.¹ This plant has operated at a reduced level of activity after February 1980, and ownership of the plant and property was transferred to the Department of Energy (DOE) in February 1984.

A number of properties in the Albany/Colonie area have been identified as being potentially contaminated with uranium originating from the former National Lead Company's uranium forming plant in Colonie, New York.⁴ Radiological surveys were performed at 27 properties by members of the Radiological Survey Activities (RSA) group at Oak Ridge National Laboratory (ORNL) during the period August 18-August 29, 1986. The property at 1047 Central Avenue in Albany, New York (AL209) was the subject of a radiological investigation initiated August 26, 1986.

The commercial property consists of a two-story frame building located on an irregular lot. An asphalt drive connects the property to the street. A diagram of the property showing the approximate boundaries and the 6-m grid network established for measurements outside the building is shown in Fig. 1. The lot included in the radiological survey was ~18 m wide by 60 m deep. Front and rear views of the property are shown in Figs. 2 and 3, respectively.

SURVEY METHODS

The radiological survey methods employed in the survey of this property are described in Ref. 5.

The radiological survey of this property included: (1) gamma exposure rates at 1 m above the ground surface and at the ground surface at outdoor grid locations; (2) a gamma scan of the entire ground surface outdoors; (3) samples of outdoor soil; and (4) direct alpha and beta-gamma activity from surfaces of structures outdoors on the property, including asphalt paving. A comprehensive description of the survey methods and instrumentation has been presented in another report.⁶

SURVEY RESULTS

Typical background radiation levels for the Albany area are presented in Table 1. The data is provided for purposes of comparison with the survey results presented in this section.

All measurements presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations in soil samples.

Gamma Measurements

Results of grid point/grid block measurements are presented in Table 2. Surface gamma exposure rates measured at grid points over the entire outdoor property are shown on Fig. 4. Gamma exposure rates at 1 m above the ground surface ranged from 7 to 11 $\mu\text{R}/\text{h}$ (microroentgens* per hour) and averaged 9 $\mu\text{R}/\text{h}$. Gamma exposure rates at the ground surface at grid points ranged from 8 to 15 $\mu\text{R}/\text{h}$ and averaged 10 $\mu\text{R}/\text{h}$. The maximum gamma exposure rate measured on the property was 17 $\mu\text{R}/\text{h}$.

Soil Sampling

Eleven soil samples were taken at this property from six locations. The samples, taken without strict regard to gamma exposure rates at the sampling points, are denoted as systematic samples (AL209S). The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

*The roentgen (R) is a unit which was defined for radiation protection purposes for people exposed to penetrating x-rays or gamma radiation. A microroentgen (μR) is one millionth of a roentgen. A milliroentgen (mR) is one thousandth of a roentgen or one thousand microroentgens.

Samples were taken at 0 to 5 cm and at 5 to 15 cm depths from each location except AL209S1 where asphalt was hit at approximately 5 cm. Concentrations of ^{238}U in the soil samples ranged from 0.56 to 1.9 pCi/g (picocuries* per gram) and averaged 1.0 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 1.0 pCi/g and averaged 1.0 pCi/g in the 5 to 15 cm depth samples. The ratio of concentration at 0 to 5 cm to concentration at 5 to 15 cm depths was 1.0, indicating a uniformity of ^{238}U concentration, near area background, in the depth (0-15 cm) investigated.

Radium was measured in sample AL209S1A. The concentration of ^{226}Ra was 0.63 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the asphalt paving and on the roof of the building. The results of these measurements are listed in Table 4. The alpha activity ranged from <7 to 42 dpm/100 cm² and averaged 15 dpm/100 cm². Beta-gamma activity ranged from 0.01 to 0.04 mrad/h and averaged 0.02 mrad/h.

A summary of the outdoor measurement results is provided in Table 5.

SIGNIFICANCE OF FINDINGS

The background gamma radiation exposure rate for the State of New York averages 9.5 $\mu\text{R}/\text{h}$ ^{8,9} and averages 9 $\mu\text{R}/\text{h}$ for the Albany area (Table 1). The gamma exposure rates measured on this property at 1 m above the ground surface range from 7 to 11 $\mu\text{R}/\text{h}$ and average 9 $\mu\text{R}/\text{h}$ (the same as the background for the Albany area). The DOE guidelines¹⁰ state that gamma exposure rates inside occupied or habitable structures shall not exceed 20 $\mu\text{R}/\text{h}$ above background. Gamma exposure rates outside of structures shall be such that these exposure rates, due to residual radioactivity, will not result in potential doses (assuming a conservative but plausible use scenario) in excess of 100 mrem/y for long term exposure. These guidelines are not exceeded at this property.

*The curie is a unit used to define the radioactivity in a substance and equals that quantity of any radioactive isotope undergoing 2.2×10^{12} disintegrations per minute. The picocurie is one million-millionth of a curie or that amount yielding 2.2 disintegrations per minute.

The DOE guideline for ^{238}U concentration in soil at the Colonie, New York site is: (a) the ^{238}U concentration shall not exceed the limits of 35 pCi/g averaged over an area of 10 m x 10 m (33 ft x 33 ft), and over 5 cm (2 in.) depth; and (b) the concentration shall not exceed the additional restriction of 100 pCi/g maximum at a spot (1 m²) averaged over 5 cm (2 in.) depth.^{11,12} No 10 m x 10 m area was found that contains more than 35 pCi/g of ^{238}U in the soil. The average concentration was 1.0 pCi/g of ^{238}U in the systematic samples, a concentration within the range of background for the Albany, NY area (Table 1) and with no areas nor spots approaching the DOE guidelines of 35 or 100 pCi/g of uranium-238 in the soil. The 0.63 pCi/g of ^{226}Ra measured in the soil is less than the Albany area background of 0.85 pCi/g of radium-226.

Surface contamination of the structures on the property, as evaluated by alpha and beta-gamma activity, was well below the DOE guidelines and the State of New York Department of Labor (DOL) Industrial Code, Rule 38.¹³ The average alpha activity of 15 dpm/100 cm² obtained by measurements on the asphalt paving and on the roof of the building is well below the DOE limit of 5000 dpm/100 cm² and the DOL limit of 1000 dpm/100 cm² for fixed alpha activity from natural uranium, uranium-235, or uranium-238. The average and maximum beta-gamma activities of 0.02 and 0.04 mrad/h from these structures are less than the DOE limits of 0.20 and 1.0 mrad/h and the DOL limit of 0.25 mrem at 1 cm, respectively.

In summary, no radiation levels nor radionuclide concentrations exceeded the relevant state and federal guidelines used by the Department of Energy to determine if remedial action is warranted.

REFERENCES

1. J. Beck, "Report of Trip to NL Industries Plant, Colonie, N.Y." (August 10, 1983).
2. A Background Report for the Formerly Utilized Manhattan Engineer District, Atomic Energy Commission Sites Program, DOE/EV-0097A (September 1980).
3. J. L. Jacobs, Group Counsel, NL Industries, Inc., to S. R. Miller, DOE, letter "Albany" (December 21, 1983).
4. H. W. Jeter and D. M. Eagleson, A Survey of Uranium in Soils Surrounding the NL Bearings Plant, Teledyne Isotopes, IWL-9488-461 (October 31, 1980).
5. "Radiological Survey Plan for Vicinity Properties in Colonie and Albany, New York," letter from B. A. Berven, ORNL/RASA to A. J. Whitman, DOE/HQ (January 1984).
6. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, Procedures Manual for the Remedial Action Survey and Certification Activities (RASCA) Program, Oak Ridge National Laboratory, ORNL/TM-8600 (September 1982).
7. T. E. Myrick, B. A. Berven, and F. F. Haywood, State Background Radiation Levels: Results of Measurements Taken During 1975-1979, ORNL/TM-7343 (November 1981).
8. S. G. Levin, K. K. Stoms, E. Kuerze, and W. Huskisson, "Summary of Natural Environmental Gamma Radiation Using a Calibrated Portable Scintillation Counter," Radiological Health Data Report 9:679-695 (1968).
9. C. L. Lindekin, K. R. Peterson, D. E. Jones, and R. E. McMillen, "Geographical Variations in Environmental Radiation Background in the United States." Proceedings of the Second International Symposium on the Natural Radiation Environment, CONF-720805-P-1, pp. 317-331 (1972).
10. U.S. Department of Energy, Guidelines for Residual Radioactivity at Formerly Utilized Sites, Remedial Action Program and Remote Surplus Facilities Management Program Sites (Rev. 1, July 1985).
11. Environmental Research Division, Action Description Memorandum. "Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site." Argonne National Laboratory (August 5, 1984).
12. G. P. Turi, FUSRAP/Surplus Facilities Group, to James P. Alexander, Oak Ridge Operations Office (correspondence dated May 10, 1984).

13. State of New York, Department of Labor, "Ionizing Radiation Protection," Part 38 of Title 12 of The Official Compilation of Codes, Rules, and Regulations of the State of New York (cited as 12, NYCRR 38), July 10, 1978.

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1047 Central Avenue, Albany, New York (AL209).

Fig. 2. Front view of the property at 1047 Central Avenue, Albany, New York (AL209) looking northeast.

Fig. 3. Rear view of the property at 1047 Central Avenue, Albany, New York (AL209) looking west.

Fig. 5. Locations of soil samples on the property at 1047 Central Avenue, Albany, New York (AL209).

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.⁷

Table 2. Results of the gamma exposure rate measurements outdoors on the property at 1047 Central Avenue, Albany, New York (AL209)

Grid location ^a	Grid point measurements ^b ($\mu\text{R/h}$)		Range of gamma exposure rate during scan of grid block ^d ($\mu\text{R/h}$)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface ^c	
0+00, BL	11	15	-
0+06, BL	8	9	-
0+12, BL	9	10	-
0+18, BL	9	8	-
0+24, BL	9	9	-
0+30, BL	9	11	-
0+36, BL	9	10	-
0+42, BL	9	9	-
0+48, BL	9	10	-
0+54, BL	10	11	-
0+60, BL	10	10	-
0+12, 1L	8	8	-
0+18, 1L	9	10	-
0+24, 1L	8	10	-
0+30, 1L	10	10	-
0+36, 1L	8	9	-
0+00, 6L	10	15	7-17
0+06, 6L	8	9	8-10
0+12, 6L	e	e	8-10
0+18, 6L	e	e	8-11
0+24, 6L	e	e	8-11
0+30, 6L	e	e	8-10
0+36, 6L	e	e	9-11
0+42, 6L	7	8	8-11
0+48, 6L	e	e	7-9
0+54, 6L	9	10	-
0+12, 10.8L	9	9	-
0+24, 10.8L	8	9	-
0+00, 12L	11	10	8-17
0+06, 12L	8	9	8-10
0+12, 12L	9	8	7-10
0+18, 12L	8	8	7-10
0+24, 12L	8	9	7-10
0+25.2, 12L	9	8	-
0+30, 12L	e	e	-

Table 2 (continued)

Grid location ^a	Grid point measurements ^b ($\mu R/h$)		Range of gamma exposure rate during scan of grid block ^d ($\mu R/h$)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface ^c	
0+36, 12L	e	e	-
0+42, 12L	7	8	8-11
0+50, 12L	10	10	-
0+30, 15.2L	11	12	-
0+36, 15.2L	10	10	-
0+00, 18L	10	14	8-17
0+06, 18L	10	9	8-11
0+12, 18L	11	12	8-12
0+18, 18L	9	10	8-12
0+24, 18L	11	10	8-12
0+30, 18L	10	11	8-11
0+36, 18L	9	8	8-11
0+42, 18L	10	10	-
0+45.3, 18L	10	11	-

^aGrid location shown on Fig. 1.

^bGrid point measurements are discrete measurements at each grid point.

^cThese values are shown on Fig. 4.

^dGrid block measurements are obtained by a gamma scan of the entire block.

^eInaccessible.

Table 3. Results of soil sample analysis on the property at
1047 Central Avenue, Albany, New York (AL209)

Sample	Location ^a	Depth (cm)	Radionuclide concentration (pCi/g)	
			226 _{Ra} ^b	238 _U ^c
<u>Systematic samples^d</u>				
AL209S1	0+45, 12L	0-5	0.63 ± 0.11	0.82
AL209S2A	0+45, 6L	0-5	±	1.9
AL209S2B	0+45, 6L	5-15	±	1.6
AL209S3A	0+49, 12L	0-5	±	0.67
AL209S3B	0+49, 12L	5-15	±	0.61
AL209S4A	0+53, 6L	0-5	±	0.56
AL209S4B	0+53, 6L	5-15	±	0.77
AL209S5A	0+34, 15.5L	0-5	±	1.1
AL209S5B	0+34, 15.5L	5-15	±	1.0
AL209S6A	0+30, 15.5L	0-5	±	1.2
AL209S6B	0+30, 15.5L	5-15	±	0.90

^aLocations of soil samples are shown on Fig. 5.

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

^cAnalytical error of measurement results is $< \pm 5\%$ (95% confidence level).

^dSystematic samples are taken at grid locations irrespective of gamma exposure.

Table 4. Results of surface analysis of structures at
1047 Central Avenue, Albany, New York (AL209)

Structure	Number of measurements	Results		Average	
		(dpm/100 cm ²)	(mrad/h) ^a	(dpm/100 cm ²)	(mrad/h)
<u>Alpha Activity</u>					
Asphalt paving	7	14,14,7,21,7, 7,14	-	12	-
Roof of the building	9	<7,7,14,14,14, <u>14,42,21,35</u>	-	18	-
Total	16	<7-42	-	15	-
<u>Beta-Gamma</u>					
Asphalt paving	7	-	0.03,0.03,0.04,0.02, 0.02,0.03,0.02,	-	0.03
Roof of the building	9	-	0.01,0.01,0.02,0.02, 0.02,0.02,0.02, <u>0.02,0.03</u>	-	0.02
Total	16	-	0.01-0.04	-	0.02

^aThe rad is the unit of absorbed dose and is defined as the amount of radiation required to cause absorption of 100 ergs per gram of medium. (The erg is a unit of energy. One erg in the form of heat will raise the temperature of 1 gram of water about 2.4×10^{-8} °C.)

Table 5. Summary of outdoor measurements and sample results on the property at 1047 Central Avenue, Albany, New York (AL209)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m ($\mu\text{R/h}$) ^a	41	7-11	9
Gamma exposure rate at surface ($\mu\text{R/h}$) ^a	41	8-15	10
Scan, gamma exposure rate near surface ($\mu\text{R/h}$) ^b	-	7-17	-
Concentration of ²³⁸ U in surface soil (pCi/g), systematic locations ^c	11	0.56-1.9	1.0
Area estimated to contain ²³⁸ U concentrations exceeding guidelines (m ²)	-	-	None
Concentration of ²²⁶ Ra in surface soil (pCi/g), systematic locations ^c	1	-	0.63
<u>Surface measurements</u> ^d			
Alpha activity (dpm/100 cm ²)	16	7-42	15
Beta-gamma activity (mrad/h)	16	0.01-0.04	0.02

^aAt grid points.

^bScan of entire property.

^cSystematic samples, Table 3.

^dSurface measurements, Table 4.

INTERNAL DISTRIBUTION

1. B. A. Berven	10. P. T. Owen
2. R. O. Chester	11. T. H. Row
3. W. D. Cottrell	12. P. J. Walsh
4. S. C. Hall	13. IR&A Publications Office
5-9. J. L. Marley	14. Laboratory Records - RC

EXTERNAL DISTRIBUTION

- 15-19. S. W. Ahrends, U.S. Department of Energy, P.O. Box E,
Oak Ridge, TN 37831
20. J. D. Berger, Oak Ridge Associated Universities, P.O. Box 117,
Oak Ridge, TN 37831
- 21-23. J. J. Fiore, U.S. Department of Energy, 19901 Germantown
Road, Germantown, MD 20874
- 24-26. G. K. Hovey, Bechtel National, Inc., 800 Oak Ridge Turnpike,
Oak Ridge, TN 37831
27. G. P. Turi, U.S. Department of Energy, 19901 Germantown Road,
Germantown, MD 20874
28. J. W. Wagoner, U.S. Department of Energy, 19901 Germantown Road,
Germantown, MD 20874
29. Andrew Wallo III, U.S. Department of Energy, 19901 Germantown
Road, Germantown, MD 20874
30. Charles Young, The Aerospace Corporation, Suite 4000,
955 L'Enfant Plaza, SW, Washington, DC 20024
31. Office of Assistant Manager, Energy Research and Development,
Oak Ridge Operations Office, Oak Ridge, TN 37831
- 32-33. Office of Scientific and Technical Information, U.S. Department
of Energy, Oak Ridge, TN 37831