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**RESULTS OF THE RADIOLOGICAL SURVEY
OF STATE OF NEW YORK LAND
BETWEEN 80-110 YARDBORO AVENUE,
ALBANY, NEW YORK, (AL151)**

MASTER

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Health and Safety Research Division

**Nuclear and Chemical Waste Programs
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ALBANY, NEW YORK (AL151)**

S. C. Hall and J. L. Marley

Date of Issue - December 1987

Investigation Team

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

Survey Team Members

**B. S. Ellis, S. C. Hall, and W. Winton (ORNL)
T. D. Herrera and J. F. Lisco (ORAU)**

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

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**RESULTS OF THE RADIOLOGICAL SURVEY OF STATE OF
NEW YORK LAND BETWEEN 80-110 YARDBORO AVENUE,
ALBANY, NEW YORK (AL151)**

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 12 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period June 2-June 11, 1986. The property between 80-110 Yardboro Avenue, Albany, New York, (AL151) was the subject of a radiological investigation initiated June 8, 1986.

The property consists of a vacant parcel with no structures on a rectangular lot. A concrete slab extends onto the lot from the property to the east. A diagram of the property showing the approximate boundaries and the 20-m grid network established for measurements are shown in Fig. 1. The rectangular area included in the radiological survey was ~120 m wide by 34 m deep. Two views of the property are shown in Figs. 2 and 3. The red brick building partially showing in the background in Figs. 2 and 3 is the former NL Industries Plant.

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) a gamma scan of the entire ground surface outdoors; and (2) samples of outdoor soil. 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 block measurements are presented in Table 2. Gamma exposure rates at the ground surface ranged from 8 to 27 $\mu\text{R/h}$ (shown on Fig. 4). The maximum gamma exposure rate measured on the property was 27 $\mu\text{R/h}$ and was found just off the concrete slab on the northeast end of the property.

Soil Sampling

Twenty-one soil samples were taken at this property. The samples, taken without strict regard to gamma exposure rates at the sampling points, are denoted as systematic samples (AL151S). 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 depths from each location. Concentrations of ^{238}U in the soil samples ranged from 0.81 to 490 pCi/g (picocuries* per gram) and averaged 60 pCi/g. The sample from grid location 0+20, 35L (AL151S18) was found to have the maximum concentration on the property (490 pCi/g). An area on the northeast corner of the property estimated at approximately 700 m² contained uranium-238 concentrations in the soil exceeding 35 pCi/g (see Fig. 6).

Radium was measured in sample AL151S1. The concentration of ^{226}Ra was 0.56 pCi/g.

A summary of the outdoor measurement results is provided in Table 4.

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 the ground surface ranged from 8 to 27 $\mu\text{R}/\text{h}$ (exceeding the background range 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 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} Approximately a 700 m² area was found that averages more than 35 pCi/g of ^{238}U in the soil. The average concentration was 133 pCi/g of ^{238}U in the contaminated area exceeding the DOE guideline of 35 pCi/g. In addition the maximum concentration of ^{238}U measured, 490 pCi/g, exceeds the DOE guideline of 100 pCi/g for any spot (1 m²). The 0.56 pCi/g of ^{226}Ra measured in the soil is less than the Albany area background of 0.85 pCi/g of radium-226.

*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.

In summary, while some radiological measurements were greater than background levels normally encountered in the State of New York and the Albany area, no radiation levels exceeded guidelines; however ^{238}U concentrations exceeded the relevant state and federal guidelines used by the Department of Energy to determine if remedial action is warranted.

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Fig. 1. Diagram showing grid point and grid block locations outdoors on the State of New York (NY) property between 80-110 Yardboro Avenue, Albany, New York (AL151)

Fig. 2. View of the NY property between creek and 80 Yardboro Avenue, Albany, New York (AL151) looking east.

Fig. 3. View of the NY property between 110 Yardboro Avenue, Albany, New York (AL151) and the creek, looking north.

Fig. 4. Surface gamma exposure rates measured outdoors on the NY property between 80-110 Yardboro, Albany, New York (AL151).

Fig. 5. Locations of soil samples on the NY property between 80-110 Yardboro Avenue, Albany, New York (AL151).

Fig. 6. Area estimated to contain uranium-238 concentrations exceeding guidelines at the NY property between 80-110 Yardboro Avenue, Albany, New York (AL151)

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 NY property between 80-110 Yardsboro Avenue, Albany, New York (AL151)

Grid location ^a	Range of gamma exposure rates during scan of grid block ^{a,b} ($\mu\text{R/h}$)
0+00, BL	10-27
0+20, BL	
0+00, 20L	9-18
0+20, 20L	
0+00, 40L	9-14
0+20, 40L	
0+00, 60L	8-12
0+20, 60L	
0+00, 80L	8-12
0+20, 80L	
0+00, 100L	8-11
0+20, 100L	

^aGrid locations and measurements are shown on Figs. 1 and 4.

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

Table 3. Results of soil sample analysis on the NY property between 80-110 Yardboro Avenue, Albany, New York (AL151)

Sample	Location ^a	Depth (cm)	Radionuclide concentration (pCi/g)	
			²²⁶ Ra ^b	²³⁸ U ^c
<u>Systematic samples^d</u>				
AL151S1	0+10, BL	0-5	0.56 ± 0.09	31
AL151S2	0+22, 2.5L	0-5	±	52
AL151S3	0+20, 20L	0-5	±	30
AL151S4	0+22, 5L	0-5	±	71
AL151S5	0+14, 7L	0-5	±	100
AL151S6	0+10, 20L	0-5	±	6.2
AL151S7	0+32, 14L	0-5	±	170
AL151S8	0+10, 60L	0-5	±	4.0
AL151S9	0+20, 60L	0-5	±	3.0
AL151S10	0+10, 80L	0-5	±	0.81
AL151S11	0+20, 80L	0-5	±	2.0
AL151S12	0+10, 100L	0-5	±	5.0
AL151S13	0+20, 100L	0-5	±	2.4
AL151S14	0+10, 110L	0-5	±	3.0
AL151S15	0+20, 110L	0-5	±	2.8
AL151S16	0+10, 40L	0-5	±	8.4
AL151S17	0+20, 40L	0-5	±	18
AL151S18	0+20, 35L	0-5	±	490
AL151S19	0+25, 25L	0-5	±	93
AL151S20	0+33, 30L	0-5	±	160
AL151S21	0-12, 48L	0-5	±	15

^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. Summary of outdoor measurements and sample results on the NY property at 80-110 Yardboro Avenue, Albany, New York (AL151)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Scan, gamma exposure rate near surface ($\mu\text{R/h}$) ^a	-	8-27	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations ^b	21	0.81-490	60
Area estimated to contain ^{238}U concentrations exceeding guidelines (m^2)	-	-	700
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations ^b	1	-	0.56

^aScan of entire property.

^bSystematic samples, Table 3.

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