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(AL174)

RESULTS OF THE RADIOLOGICAL SURVEY AT 23 LILY STREET, ALBANY, NEW YORK (AL174)

OPERATED BY
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RESULTS OF THE RADIOLOGICAL SURVEY AT 23 LILY STREET, ALBANY, NEW YORK (AL174)

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RADIOLOGICAL SURVEY ACTIVITIES PROGRAM

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RESULTS OF THE RADIOLOGICAL SURVEY AT 23 LILY STREET, ALBANY, NEW YORK (AL174)

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 (RASA) group at Oak Ridge National Laboratory (ORNL) during the period July 13-July 26, 1986. The property at 23 Lily Street in Albany, New York (AL174) was the subject of a radiological investigation initiated July 21, 1986.

The residential property consists of a two-story frame house located on a rectangular lot. An asphalt driveway connects the house to the street. A diagram of the property showing the approximate boundaries and the 5-m grid network established for measurements outside the house is shown in Fig. 1. The lot included in the radiological survey was ~20 m wide by 30 m deep. Front and side 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 8 to 12 μR/h (microroentgens* per hour) and averaged 9 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 8 to 14 μR/h and averaged 10 μR/h. The maximum gamma exposure rate measured on the property was 15 μR/h.

Soil Sampling

Twelve soil samples were taken at this property from 6 locations. The samples, taken without strict regard to gamma exposure rates at the sampling points, are denoted as systematic samples (AL174S). The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

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*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. Concentrations of ^{238}U in the soil samples ranged from 0.64 to 3.0 pCi/g (picocuries* per gram) and averaged 1.4 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 1.7 pCi/g and averaged 1.2 pCi/g in the 5 to 15 cm depth samples. Two samples from grid locations 0+05, 7R and 0+23, 10R (AL174S1A and AL174S5A) having the maximum concentration found on the property (3.0 pCi/g) were from depths of 0 to 5 cm.

Radium was measured in sample AL174S1A. The concentration of ^{226}Ra was 0.59 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the asphalt paving and on the roof of the house. The results of these measurements are listed in Table 4. The alpha activity ranged from <7 to 28 dpm/100 cm^2 and averaged 13 dpm/100 cm^2. 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 μR/h[8,9] and averages 9 μR/h for the Albany area (Table 1). The gamma exposure rates measured on this property at 1 m above the ground surface range from 8 to 12 μR/h and average 9 μR/h (the same as background for the Albany area). The DOE guidelines[10] state that gamma exposure rates inside occupied or habitable structures shall not exceed 20 μR/h. 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.

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*The curie is a unit used to define the radioactivity in a substance and equals that quantity of any radioactive isotope undergoing 2.2 x 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 m^2) 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 1.4 pCi/g of ^{238}U in the systematic samples, less than one-tenth the limit of 35 pCi/g; therefore, the average concentration is well below the DOE guideline. The maximum concentration of ^{238}U measured was 3.0 pCi/g, well below the limit of 100 pCi/g averaged over 1 m^2 area. The 0.59 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 concentrations of some radionuclides in the soil at this property are above background levels, but are below applicable DOE guidelines.

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 13 dpm/100 cm^2 obtained by measurements on the asphalt paving and on the roof of the building is well below the DOE limit of 5000 dpm/100 cm^2 and the DOL limit of 1000 dpm/100 cm^2 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, while some radiological measurements were greater than background levels normally encountered in the State of New York and the Albany area, 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.

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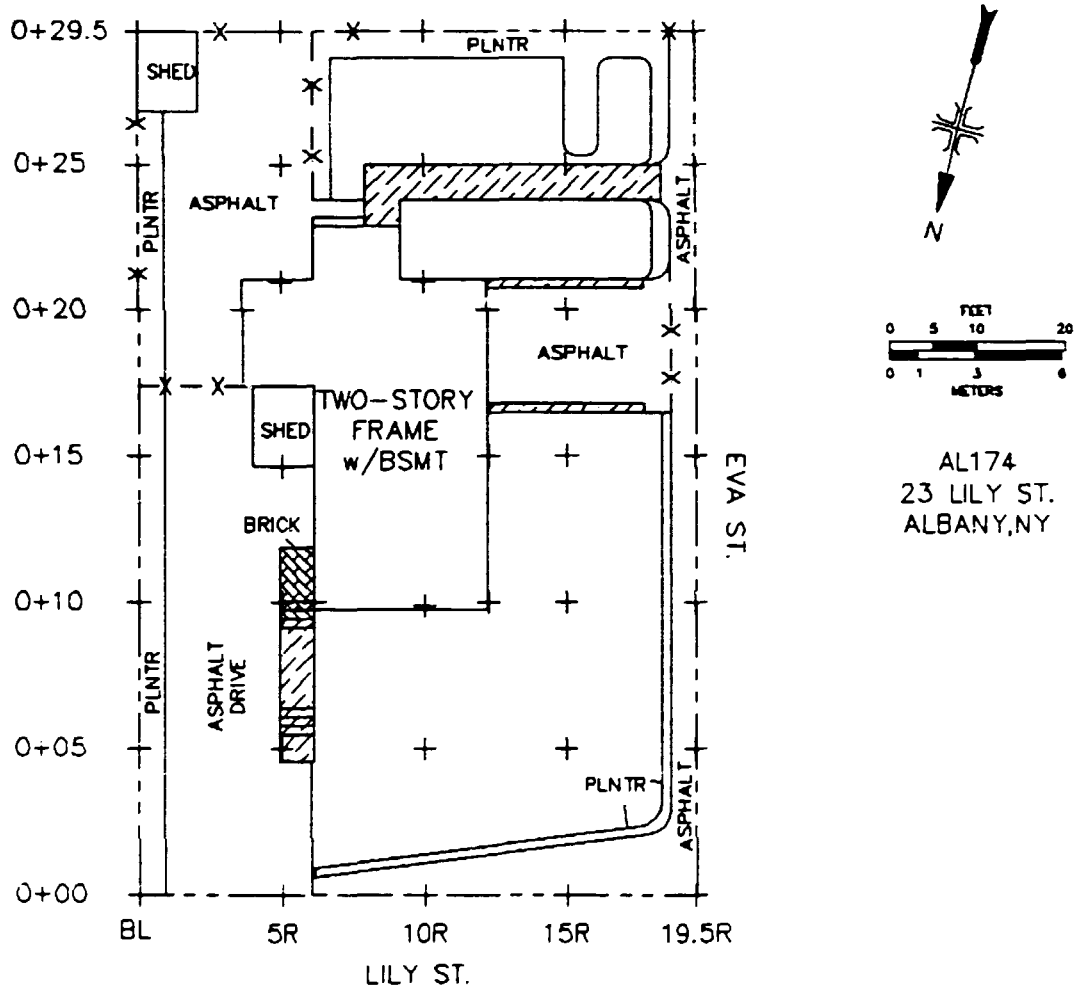

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 23 Lily Street, Albany, New York (AL174).

Fig. 2. Front view of the property at 23 Lily Street, Albany, New York (AL174) looking south.

Fig. 3. Side view of the property at 23 Lily Street, Albany, New York (AL174) looking northeast.

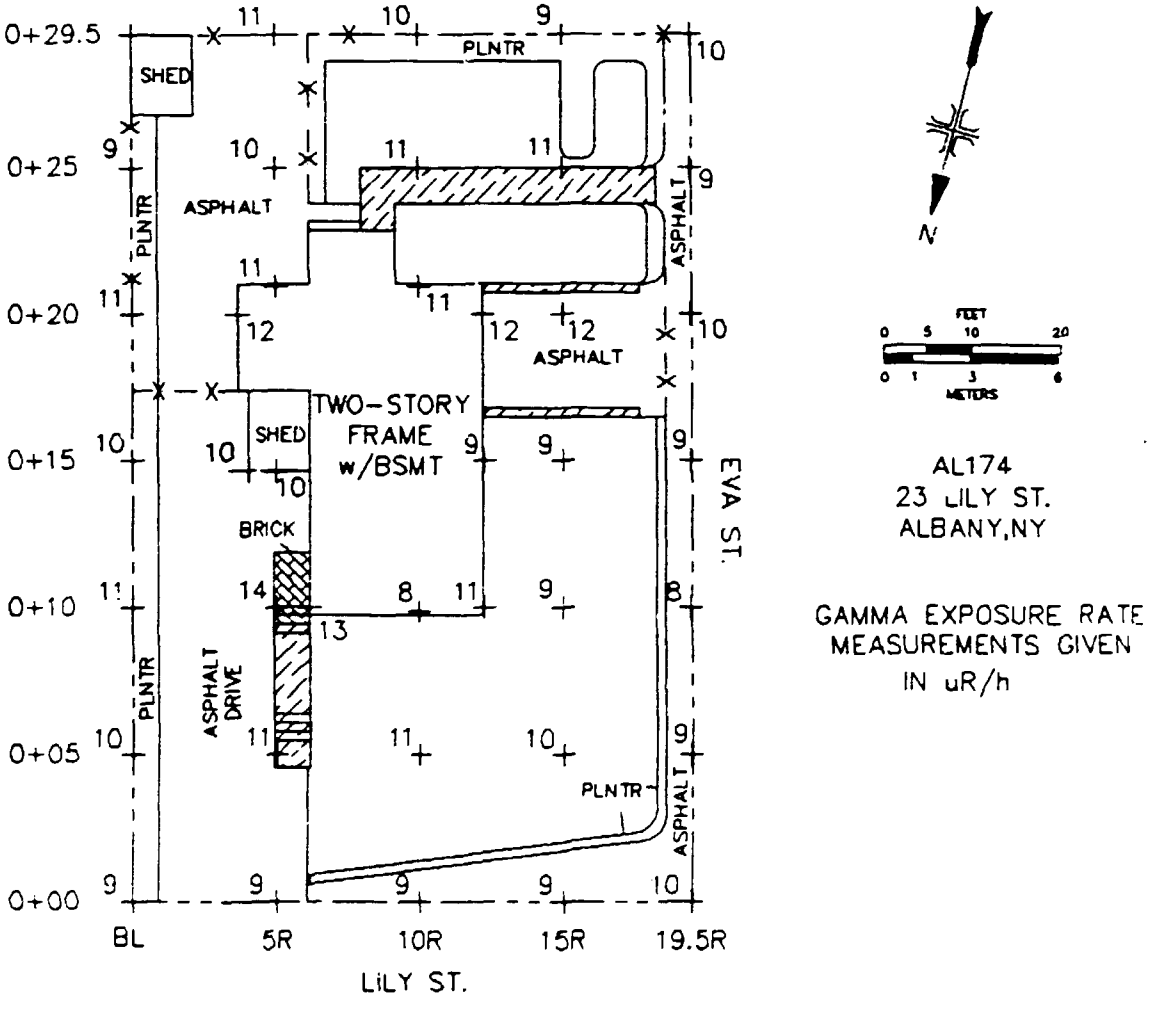

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 23 Lily Street, Albany, New York (AL174).

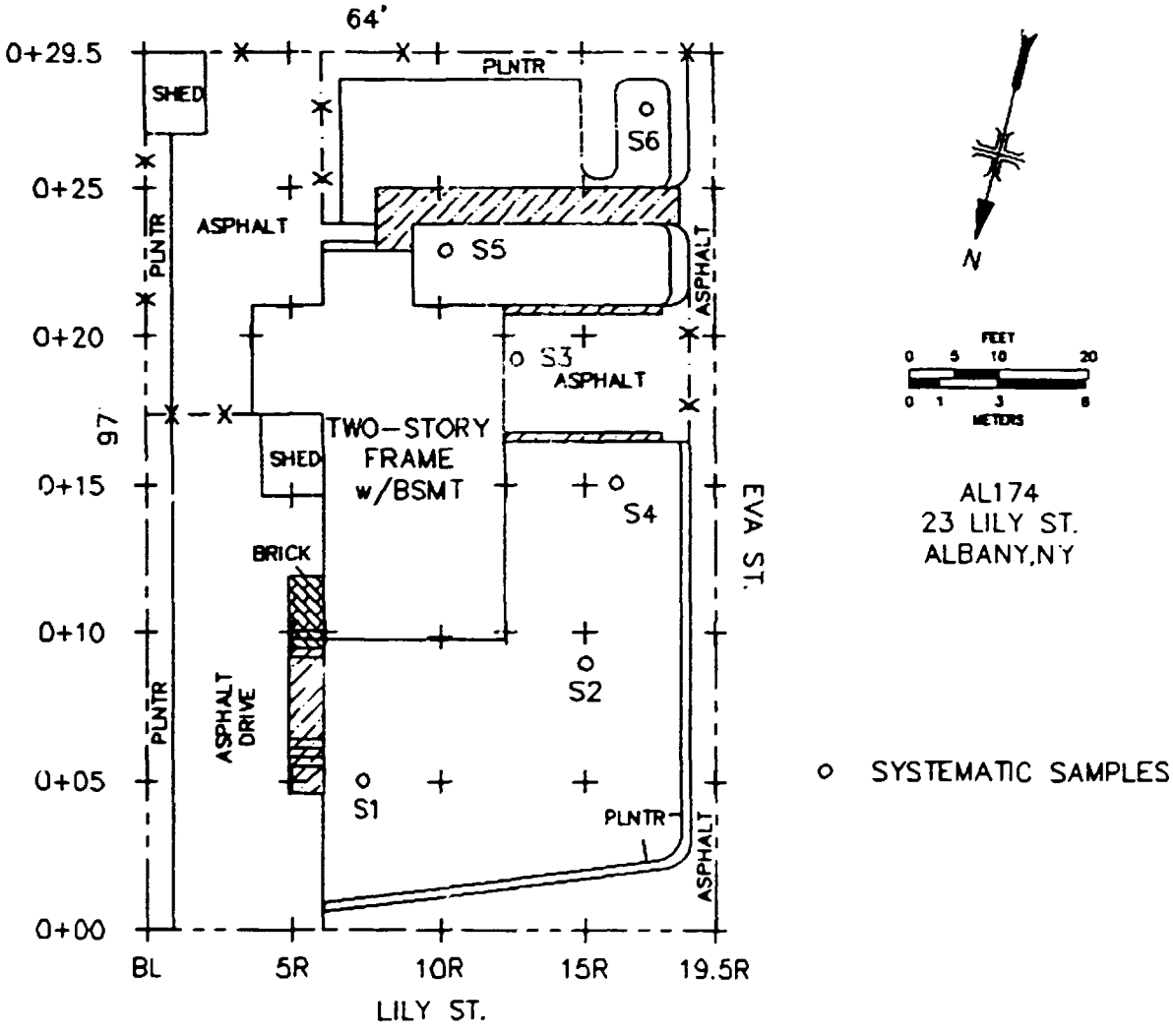

Fig. 5. Locations of soil samples on the property at 23 Lily Street, Albany, New York (AL174).

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 (μR/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

[a]Values obtained from four locations in the Albany area.
[b]Soil 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 23 Lily Street, Albany, New York (AL174)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+00, BL	9	9	7-10
0+05, BL	9	10	7-12
0+10, BL	10	11	7-12
0+15, BL	10	10	7-11
0+20, BL	10	11	7-11
0+25, BL	10	9	7-10
0+29.5, BL	e	e	-
0+20, 3.5R	11	12	-
0+15, 3.6R	10	10	-
0+00, 5R	9	9	7-10
0+05, 5R	10	11	7-11
0+10, 5R	10	14	8-14
0+14, 5R	9	10	-
0+15, 5R	e	e	-
0+20, 5R	e	e	7-10
0+21.2, 5R	10	11	-
0+25, 5R	9	10	7-10
0+29.5, 5R	11	11	-
0+10, 5.7R	9	13	-
0+00, 10R	9	9	8-11
0+05, 10R	9	11	7-11
0+09.5, 10R	8	8	-
0+10, 10R	e	e	8-12
0+15, 10R	e	e	9-15
0+20, 10R	e	e	8-12
0+21.2, 10R	10	11	-
0+25, 10R	10	11	7-11
0+29.5, 10R	8	10	-
0+10, 11.5R	9	11	-
0+15, 11.5R	9	9	-
0+20, 11.5R	12	12	-
0+00, 15R	8	9	7-9
0+05, 15R	9	10	7-10
0+10, 15R	9	9	7-10
0+15, 15R	10	9	7-10

Table 2 (continued)

Grid location[a]	Grid point measurements[b] (μR/h)		Range of gamma exposure rate during scan of grid block[d] (μR/h)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface[c]	
0+20, 15R	10	12	7-12
0+25, 15R	9	11	7-12
0+29.5, 15R	9	9	-
0+00, 19.5R	9	10	-
0+05, 19.5R	9	9	-
0+10, 19.5R	8	8	-
0+15, 19.5R	9	9	-
0+20, 19.5R	9	10	-
0+25, 19.5R	10	9	-
0+29.5, 19.5R	10	10	-

[a]Grid location shown on Fig. 1.

[b]Grid point measurements are discrete measurements at each grid point.

[c]These values are shown on Fig. 4.

[d]Grid block measurements are obtained by a gamma scan of the entire block.

[e]Inaccessible.

Table 3. Results of soil sample analysis on the property at 23 Lily Street, Albany, New York (AL174)

Sample	Locations[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
		Systematic samples[d]		
AL174S1A	0+05, 7R	0-5	0.59 ± 0.07	3.0
AL174S1B	0+05, 7R	5-15	±	0.97
AL174S2A	0+08, 15R	0-5	±	0.64
AL174S2B	0+08, 15R	5-15	±	0.85
AL174S3A	0+18, 12R	0-5	±	1.7
AL174S3B	0+18, 12R	5-15	±	0.86
AL174S4A	0+15, 17R	0-5	±	0.70
AL174S4B	0+15, 17R	5-15	±	1.5
AL174S5A	0+23, 10R	0-5	±	3.0
AL174S5B	0+23, 10R	5-15	±	1.7
AL174S6A	0+27, 17R	0-5	±	1.1
AL174S6B	0+27, 17R	5-15	±	1.3

[a]Locations of soil samples are shown on Fig. 5.

[b]Indicated counting error is at the 95% confidence level (± 2σ).

[c]Analytical error of measurement results is < ± 5% (95% confidence level).

[d]Systematic samples are taken at grid locations irrespective of gamma exposure.

Table 4. Results of surface analysis of structures at 23 Lily Street, Colonie, New York (AL174)

Structure	Number of measurements	Results (dpm/100 cm^2)	Results (mrad/h)[a]	Average (dpm/100 cm^2)	Average (mrad/h)
Alpha Activity					
Asphalt paving	10	<7,14,<7,<7,28, 14,14,14,14,28	-	15	-
Roof of the house	4	<7,<7,14,<7	-	9	-
Total	14	<7-28	-	13	-
Beta-Gamma					
Asphalt paving	10	-	0.02,0.02,0.02,0.02, 0.03,0.03,0.02,0.02, 0.04,0.03	-	0.02
Roof of the house	4	-	0.02,0.01,0.03,0.02	-	0.02
Total	14	-	0.01-0.04	-	0.02

[a]The 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 23 Lily Street, Albany, New York (AL174)

Measurement of sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	39	8-12	9
Gamma exposure rate at surface (μR/h)[a]	39	8-14	10
Scan, gamma exposure rate near surface (μR/h)[b]	-	7-15	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	12	0.64-3.0	1.4
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	-	0.59
Surface measurements[d]			
Alpha activity (dpm/100 cm^2)	14	<7-28	13
Beta-gamma activity (mrad/h)	14	0.01-0.04	0.02

[a]At grid points.
[b]Scan of entire property.
[c]Systematic samples, Table 3.
[d]Surface measurements, Table 4.

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