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**RESULTS OF THE RADIOLOGICAL SURVEY
AT 4 MAPLEWOOD AVENUE,
COLONIE, NEW YORK (AL143)**

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RESULTS OF THE RADIOLOGICAL SURVEY AT
4 MAPLEWOOD AVENUE, COLONIE, NEW YORK (AL143)

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**RESULTS OF THE RADIOLOGICAL SURVEY AT
4 MAPLEWOOD AVENUE, COLONIE, NEW YORK (AL143)**

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 14 properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period May 4-May 16, 1986. The property at 4 Maplewood Avenue in Colonie, New York (AL143) was the subject of a radiological investigation initiated May 14, 1986.

The private property consists of a two-story frame house with attached garage located on a rectangular lot. An asphalt drive connects the garage to the street. A diagram of the property showing the approximate boundaries and the 4-m grid network established for measurements outside the house is shown in Fig. 1. The lot included in the radiological survey was ~13 m wide by 35.5 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 8 to 11 $\mu\text{R}/\text{h}$ (microroentgens* per hour) and averaged 10 $\mu\text{R}/\text{h}$. Gamma exposure rates at the ground surface at grid points ranged from 8 to 14 $\mu\text{R}/\text{h}$ and averaged 11 $\mu\text{R}/\text{h}$. The maximum gamma exposure rate measured on the property was 21 $\mu\text{R}/\text{h}$ and was found at the side entrance to the garage. Another slightly elevated measurement, 19 $\mu\text{R}/\text{h}$, was obtained at the brick wall near the front entrance to the house.

These maximum exposure rates are not related to residual radioactivity derived from the Colonie site. The difference in background gamma exposure rates measured at the two entrances and the surrounding soil are caused by the presence of trace amounts of naturally occurring radioactive elements in the construction materials. Bricks, concrete, and some naturally occurring stones used as construction materials typically exhibit an increase in gamma exposure rates when compared to surrounding soils.

Soil Sampling

Sixteen soil samples were taken at this property from eight locations. The samples, taken without strict regard to gamma exposure rates at the sampling points, are denoted as systematic samples (AL143S). 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. Concentrations of ^{238}U in the soil samples ranged from 2.6 to 92 pCi/g (picocuries* per gram) and averaged 22 pCi/g. The concentrations of ^{238}U in the 0 to 5 cm samples averaged 24 pCi/g and averaged 21 pCi/g in the 5 to 15 cm depth samples. The sample from grid location 0+06.5, 3.5R (AL143S1A) having the maximum concentration found on the property (92 pCi/g) was from depths of 0 to 5 cm. An area estimated at approximately 5 m² contained uranium-238 concentrations in the soil exceeding 35 pCi/g.

Radium was measured in sample AL143S1A. The concentration of ^{226}Ra was 0.69 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the asphalt paving and on the roofs of the house and garage. The results of these measurements are listed in Table 4. The alpha activity ranged from <7 to 49 dpm/100 cm² and averaged 28 dpm/100 cm². Beta-gamma activity ranged from 0.01 to 0.06 mrad/h and averaged 0.03 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 8 to 11 $\mu\text{R}/\text{h}$ and average 10 $\mu\text{R}/\text{h}$ (within the background range for the Albany area). The maximum external gamma levels measured on the property (19 to 21 $\mu\text{R}/\text{h}$) are due to natural background related to construction materials and are not the result of residual radioactivity from the Colonie site. 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),

*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.

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 averages more than 35 pCi/g of ²³⁸U in the soil. The average concentration was 22 pCi/g of ²³⁸U in the systematic samples, about two-thirds the limit of 35 pCi/g; therefore, the average concentration is well below the DOE guideline. The maximum concentration of ²³⁸U measured was 92 pCi/g, below the limit of 100 pCi/g averaged over a 1 m² area. The 0.69 pCi/g of ²²⁶Ra 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 28 dpm/100 cm² obtained by measurements on the asphalt paving and on the roofs of the house and garage 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 0.03 and 0.06 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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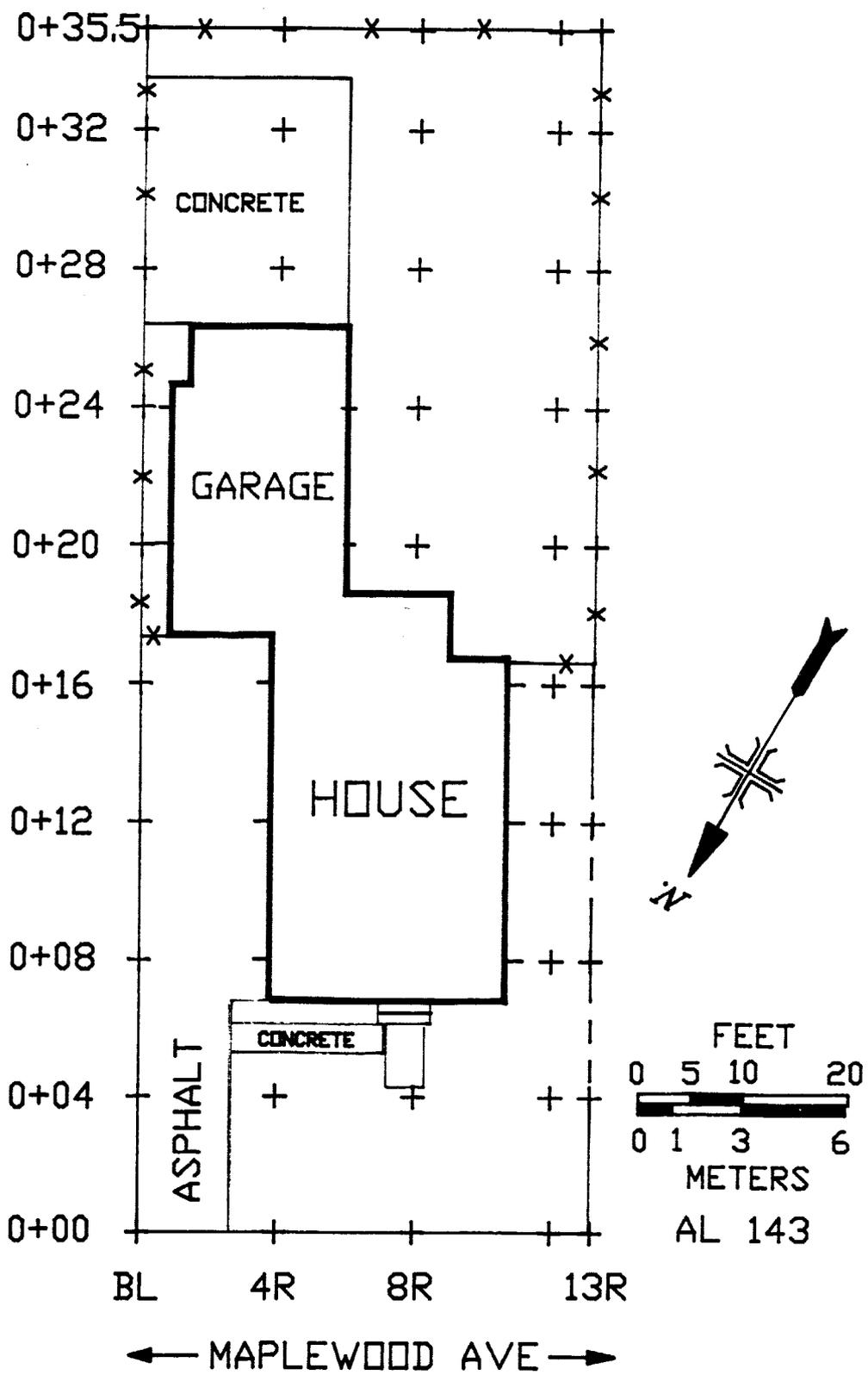


Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 4 Maplewood Avenue, Colonie, New York (AL143).

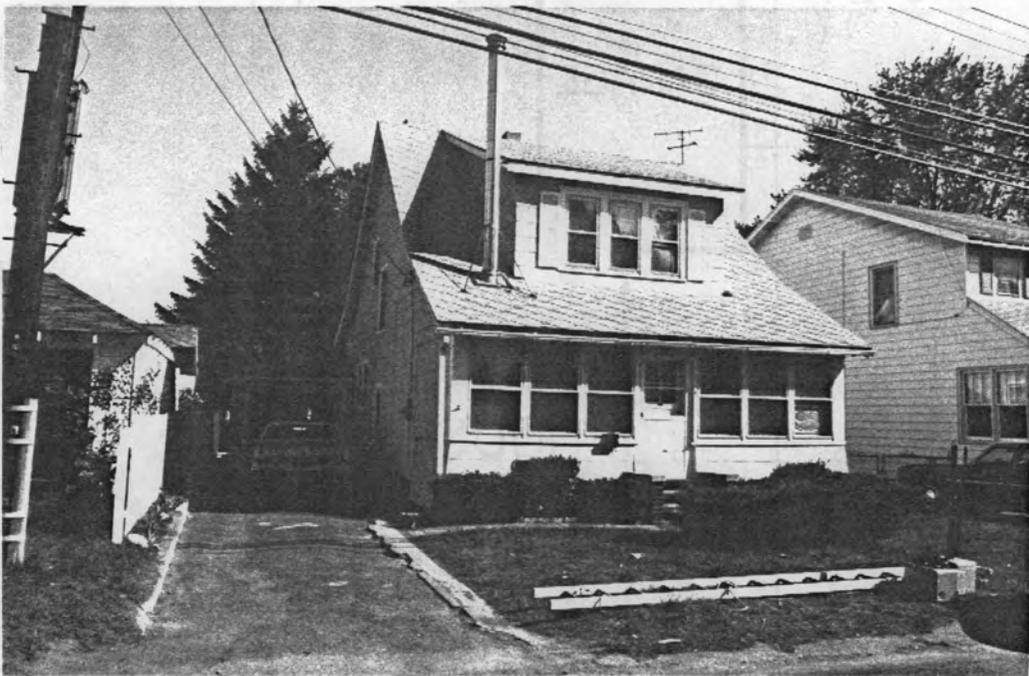


Fig. 2. Front view of the property at 4 Maplewood Avenue, Colonie, New York (AL143) looking southeast.



Fig. 3. Rear view of the property at 4 Maplewood Avenue, Colonie, New York (AL143) looking north.

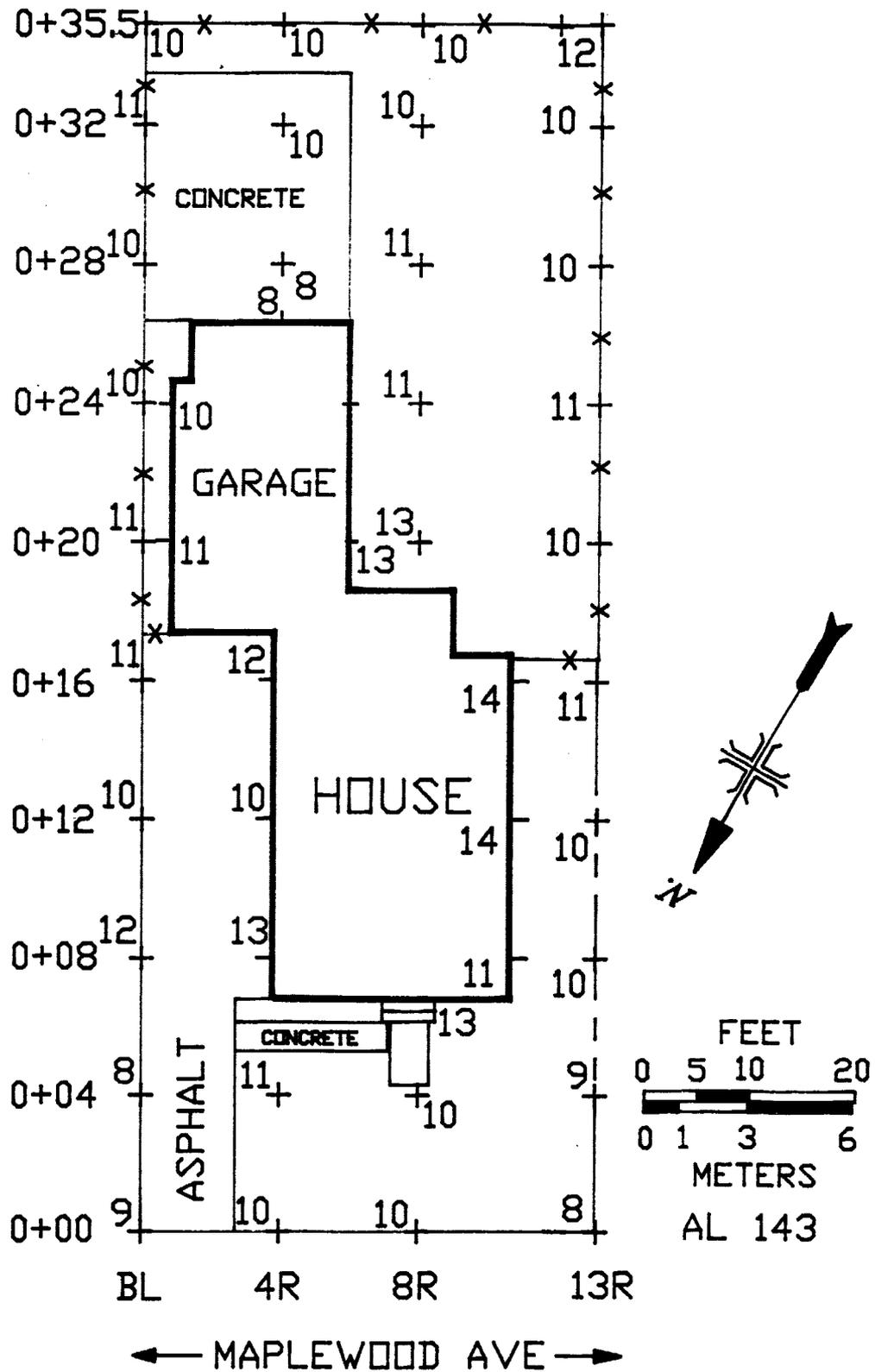


Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 4 Maplewood Avenue, Colonie, New York (AL143).

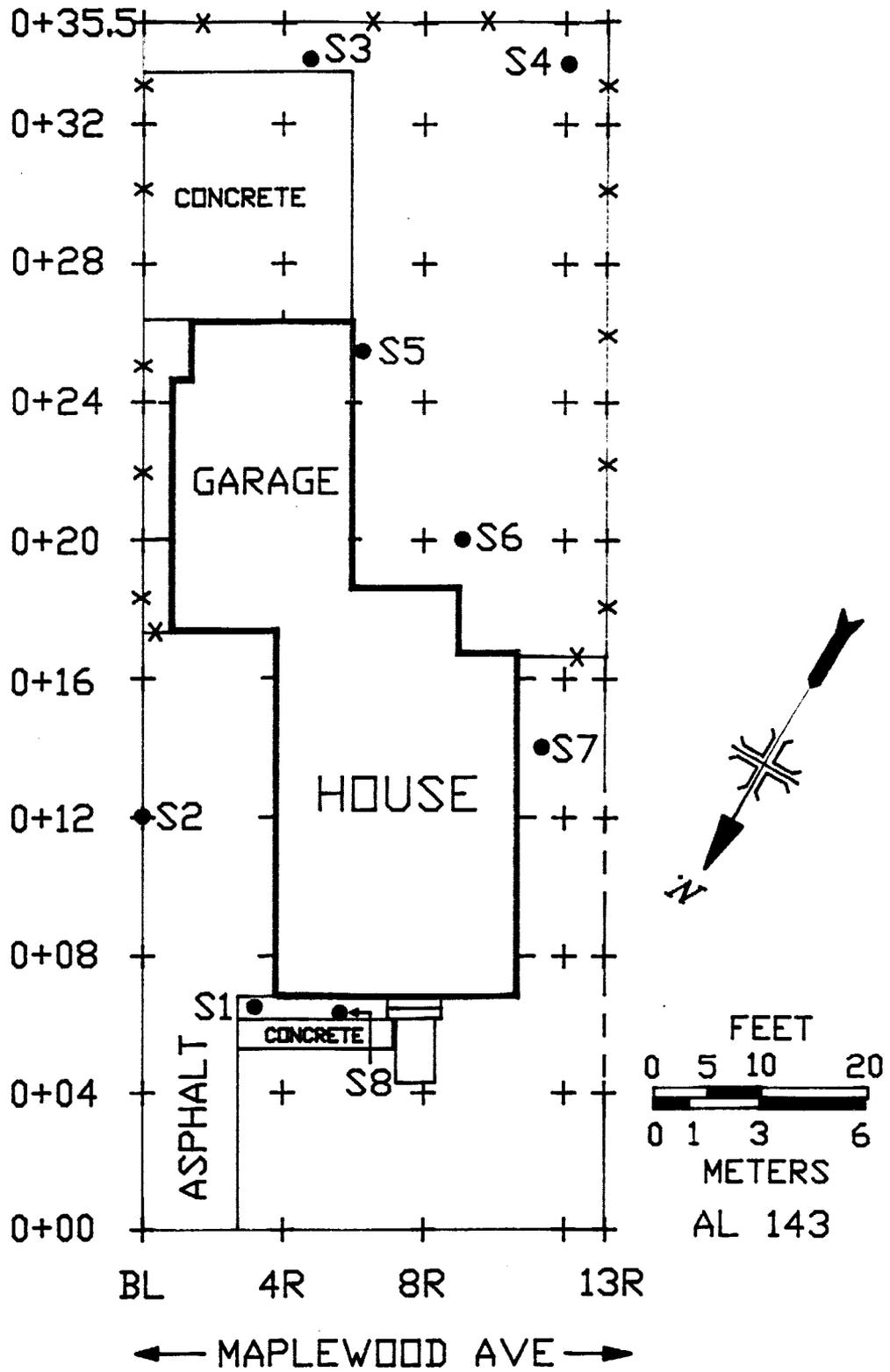


Fig. 5. Locations of soil samples on the property at 4 Maplewood Avenue, Colonie, New York (AL143).

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 4 Maplewood Avenue, Colonie, New York (AL143)

Grid location ^a	Grid point measurements ^b ($\mu\text{R}/\text{h}$)		Range of gamma exposure rates during scan of grid block ^d ($\mu\text{R}/\text{h}$)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface ^c	
0+00, BL	8	9	8-11
0+04, BL	8	8	8-15
0+08, BL	10	12	8-14
0+12, BL	10	10	8-14
0+16, BL	10	11	8-13
0+20, BL	10	11	8-13
0+24, BL	10	10	8-11
0+28, BL	8	10	8-12
0+32, BL	8	11	8-16
0+35.5, BL	9	10	-
0+20, 0.5R	10	11	-
0+24, 0.5R	10	10	-
0+00, 4R	10	10	8-11
0+04, 4R	10	11	8-19
0+08, 4R	11	13	-
0+12, 4R	8	10	-
0+16, 4R	10	12	-
0+20, 4R	e	e	8-13
0+24, 4R	e	e	8-21
0+26, 4R	8	8	-
0+28, 4R	8	8	8-11
0+32, 4R	10	10	8-13
0+35.5, 4R	10	10	-
0+00, 8R	9	10	9-11
0+04, 8R	9	10	8-11
0+06.5, 8R	10	13	-
0+08, 8R	e	e	10-13
0+12, 8R	e	e	10-13
0+16, 8R	e	e	10-13
0+20, 8R	11	13	10-13
0+21.3, 8R	11	13	-
0+24, 8R	10	11	8-11
0+28, 8R	11	11	8-12
0+32, 8R	10	10	8-11
0+35.5, 8R	10	10	-
0+08, 11R	10	11	-
0+12, 11R	10	14	-
0+16, 11R	10	14	-
0+00, 13R	10	8	-
0+04, 13R	10	9	-

Table 2 (continued)

Grid location ^a	Grid point measurements ^b ($\mu\text{R}/\text{h}$)		Range of gamma exposure rates during scan of grid block ^d ($\mu\text{R}/\text{h}$)
	Gamma exposure rate at 1 m	Gamma exposure rate at the surface ^c	
0+08, 13R	10	10	-
0+12, 13r	10	10	-
0+16, 13R	10	11	-
0+20, 13R	10	10	-
0+24, 13R	10	11	-
0+28, 13R	10	10	-
0+32, 13R	10	10	-
0+35.5, 13R	11	12	-

^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
4 Maplewood Avenue, Colonie, New York (AL143)

Sample	Location ^a	Depth (cm)	Radionuclide concentration (pCi/g)	
			²²⁶ Ra ^b	²³⁸ U ^c
Systematic samples^d				
AL143S1A	0+06.5, 3.5R	0-5	0.69 ± 0.09	92
AL143S1B	0+06.5, 3.5R	5-15	±	58
AL143S2A	0+12, BL	0-5	±	12
AL143S2B	0+12, BL	5-15	±	5.1
AL143S3A	0+34, 5R	0-5	±	14
AL143S3B	0+34, 5R	5-15	±	8.0
AL143S4A	0+33.5, 12R	0-5	±	15
AL143S4B	0+33.5, 12R	5-15	±	11
AL143S5A	0+25.5, 5.5R	0-5	±	26
AL143S5B	0+25.5, 5.5R	5-15	±	65
AL143S6A	0+20, 9R	0-5	±	3.6
AL143S6B	0+20, 9R	5-15	±	2.6
AL143S7A	0+14, 11.5R	0-5	±	9.8
AL143S7B	0+14, 11.5R	5-15	±	5.9
AL143S8A	0+06, 6R	0-5	±	18
AL143S8B	0+06, 6R	5-15	±	8.5

^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 the structures at
4 Maplewood Avenue, Colonie, New York (AL143)

Structure	Number of measurements	Results		Average	
		(dpm/100 cm ²)	(mrad/h) ^a	(dpm/100 cm ²)	(mrad/h)
Alpha Activity					
Paved driveway and walkway	6	14,14,49,<7, 14,28	-	21	-
Roofs of the house and garage	7	49,28,49,21, 35,21,35	-	34	-
Total	13	<7-49	-	28	-
Beta-Gamma					
Paved driveway	6	-	0.03,0.03,0.06, 0.04,0.03,0.02	-	0.04
Roofs of the house and garage	7	-	0.01,0.03,0.04, 0.03,0.02,0.02, 0.03	-	0.02
Total	13	-	0.01-0.06	-	0.03

^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 4 Maplewood Avenue, Colonie, New York (AL143)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m ($\mu\text{R/h}$) ^a	43	8-11	10
Gamma exposure rate at surface ($\mu\text{R/h}$) ^a	43	8-14	11
Scan, gamma exposure rate near surface ($\mu\text{R/h}$) ^b	-	8-21	-
Concentration of ²³⁸ U in surface soil (pCi/g), systematic locations ^c	16	2.6-92	22
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	-	0.69
<i>Surface measurements^d</i>			
Alpha activity (dpm/100 cm ²)	13	<7-49	28
Beta-gamma activity (mrad/h)	13	0.01-0.06	0.03

^aAt grid points, Table 2.

^bScan of entire property, Table 2.

^cSystematic samples, Table 3.

^dSurface measurements, Table 4.

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