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RESULTS OF THE RADIOLOGICAL SURVEY AT 1110 CENTRAL AVENUE, ALBANY, NEW YORK (AL215)

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

ORNL/RASA--87/112

DE89 009183

Health and Safety Research Division

Nuclear and Chemical Waste Programs
(Activity No. AH 10 05 00 0; ONLWC01)

RESULTS OF THE RADIOLOGICAL SURVEY AT 1110 CENTRAL AVENUE, ALBANY, NEW YORK (AL215)

J. L. Marley and R. F. Carrier

Date of Issue - February 1988

Investigation Team

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

Survey Team Members

W. Winton (ORNL)
W. H. Burke, A. K. Klitz (ORAU)
E. T. Loy, W. H. Shinpaugh (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

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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-AC05-840R21400 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 Wallo 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 and T. R. Stewart (ORNL) for participation in report preparation and review; and B. C. Littleton and L. J. Jeffers (Information Resources Organization) for manuscript preparation.

RESULTS OF THE RADIOLOGICAL SURVEY AT 1110 CENTRAL AVENUE, ALBANY, NEW YORK (AL215)

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 nine properties by members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) during the period April 27-May 7, 1987. The property at 1110 Central Avenue in Albany, New York (AL215) was the subject of a radiological investigation initiated May 4, 1987.

This commercial property consists of a one-story concrete block office building (Building 1), a one-story concrete block warehouse (Building 2), and four connected storage buildings constructed variously of wood, metal, or concrete block. The structures are situated on an irregularly shaped lot. A diagram of the property showing the approximate boundaries and the 10-m grid network established for measurements outside the buildings is shown in Fig. 1. The lot included in the radiological survey was ~45 m wide by 98 m deep. Two 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 27 μR/h (microroentgens* per hour) and averaged 12 μR/h. Gamma exposure rates at the ground surface at grid points ranged from 9 to 27 μR/h and averaged 13 μR/h. The maximum gamma exposure rate measured on the property was 32 μR/h and was from the soil at the northeast corner of Building 2, the location of soil sample AL215B11, and from the soil at 0+90, BL, where soil sample AL215B7 was collected (Table 3). Other elevated gamma exposure rates ranging from 18 to 27 μR/h were associated with the concrete block of which the buildings were constructed, and from stacks of firebricks and clay flue tiles that may be sold as construction materials. These gamma exposure rates emanating from the commercial products (Fig. 3) are not related to residual radioactivity derived from the Colonie site. Naturally-occurring radiation from bricks, concrete, and other similar materials such as clay typically exhibit higher gamma exposure rates when compared to surrounding soils.

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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.

Soil Sampling

Thirty-four soil samples were taken at this property from 24 locations. All samples were collected at a depth of 0 to 5 cm with the exception of one sample which consisted of roof dirt. Twenty-two of these samples, taken without strict regard to gamma exposure rates at the sampling points, are denoted as systematic samples (AL215S). Twelve samples, designated as biased samples (AL215B), were collected from areas having elevated gamma exposure rates. Sample AL215B12 was taken from the southwest corner of the roof of Building 2 at the location of the maximum alpha activity found on the property (63 dpm/100 cm^2, Table 4). The locations of the samples are shown in Fig. 5, and the results of analysis are presented in Table 3.

Concentrations of ^{238}U in the systematic soil samples ranged from 2.7 to 140 pCi/g (picocuries* per gram) and averaged 30 pCi/g. The concentrations of ^{238}U in the biased samples ranged from 4.4 to 770 pCi/g and averaged 330 pCi/g. The sample of roof dirt from Building 2 (AL215B12) contained 46 pCi/g ^{238}U. An area estimated at approximately 35 m^2 contained uranium-238 concentrations in the soil exceeding guidelines (Fig. 6).

Radium was measured in each sample. The concentrations of ^{226}Ra in systematic samples ranged from 0.47 to 1.1 pCi/g, and averaged 0.63 pCi/g. The concentrations of ^{226}Ra in biased samples ranged from 0.47 to 0.77 pCi/g, averaging 0.64 pCi/g.

Surface Measurements

Alpha and beta-gamma activity was measured at selected locations on the asphalt paving and on the roofs of the buildings. The results of these measurements are listed in Table 4. The alpha activity ranged from <7 to 63 dpm/100 cm^2 and averaged 26 dpm/100 cm^2. Beta-gamma activity ranged from 0.02 to 0.12 mrad/h and averaged 0.04 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 $\mu R/h$[8,9] and averages 9 $\mu R/h$ 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 27 $\mu R/h$ and average 12 $\mu R/h$

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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.

(slightly above the range of 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 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 limit 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] An area of ~35 m^2 was found that averages more than 35 pCi/g of ^{238}U in the soil. The average area-weighted concentration in the contaminated area was 360 pCi/g. Furthermore, the maximum concentration of ^{238}U measured was 770 pCi/g, considerably above the limit of 100 pCi/g averaged over a 1 m^2 area. One small spot, ~1 m^2, at the northeastern corner of Building 2 also exceeded the 100 pCi/g guideline. The 0.64 pCi/g of ^{226}Ra measured in the soil is less than the Albany area background of 0.85 pCi/g of radium-226.

In summary, while some radiological measurements at this property are in excess of background levels normally encountered in this area of New York, under current conditions there is no possibility that individuals using the property will receive radiation exposure in excess of limits established for protection of the general public. However, some areas of soil contain concentrations of uranium-238 in excess of guidelines used by the Department of Energy to determine if remedial action is warranted.

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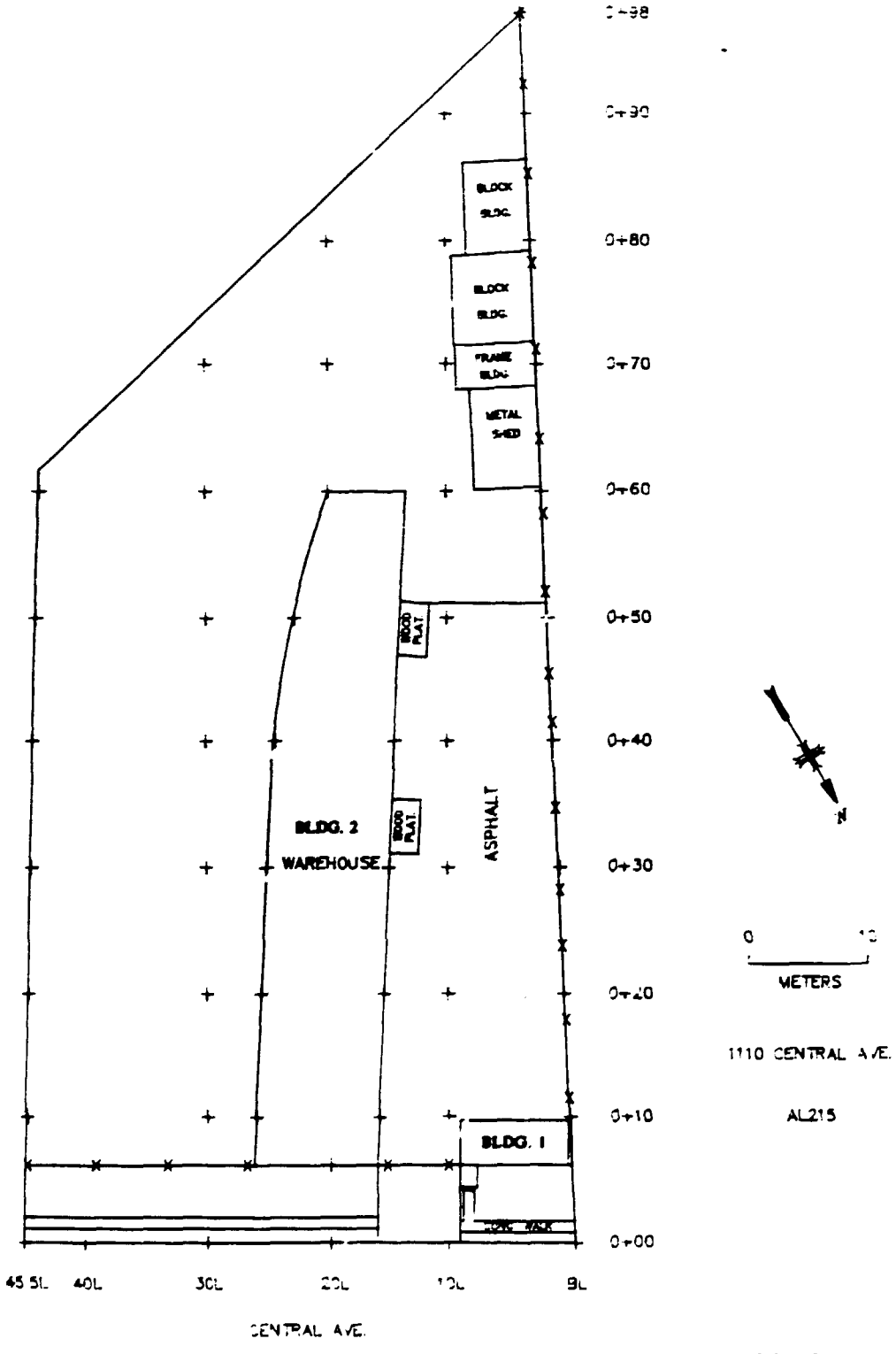

Fig. 1. Diagram showing grid point and grid block locations outdoors on the property at 1110 Central Avenue, Albany, New York (AL215).

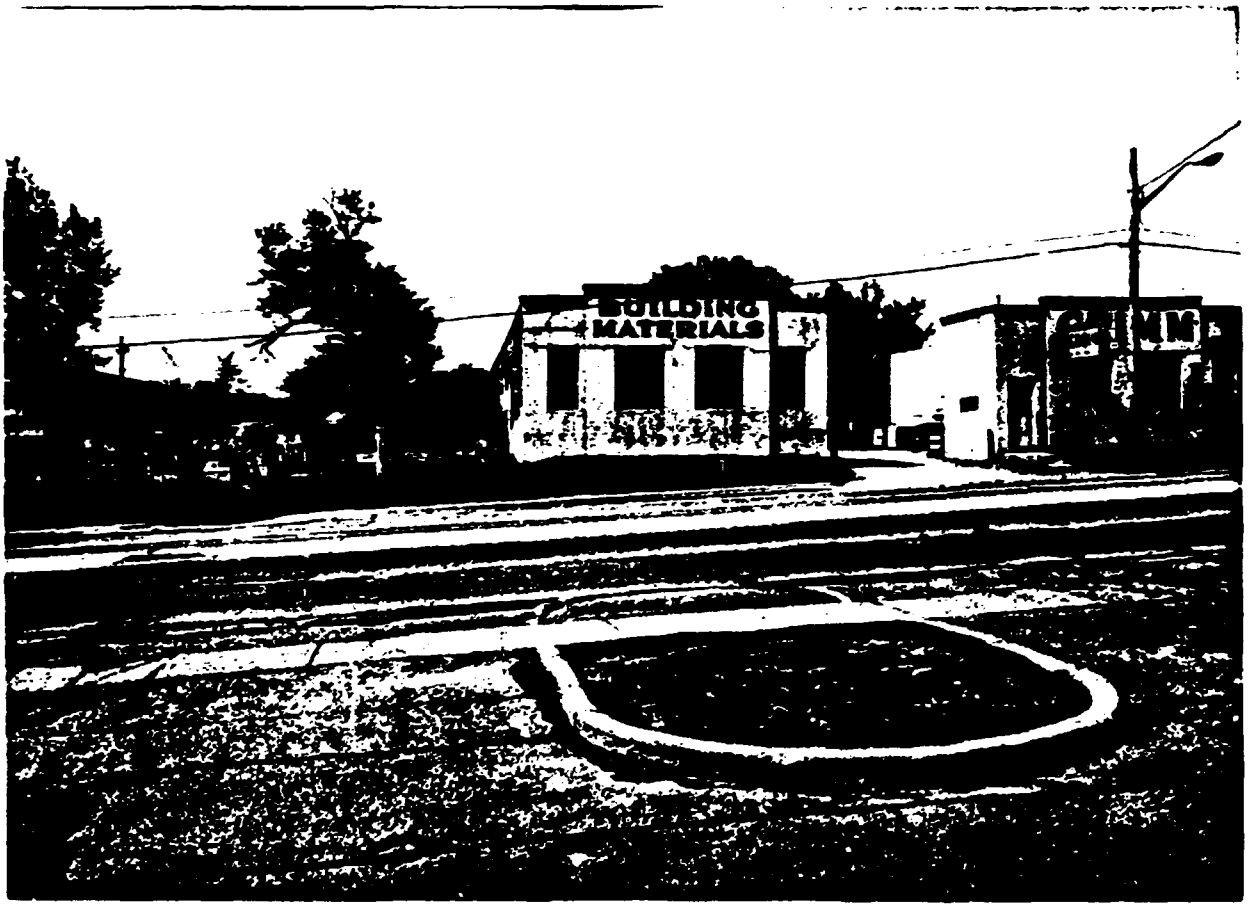

Fig. 2. Front view of the property at 1110 Central Avenue, Albany, New York (AL215) looking southwest.

Fig. 3. Rear view of the property at 1110 Central Avenue, Albany, New York (AL215) looking north.

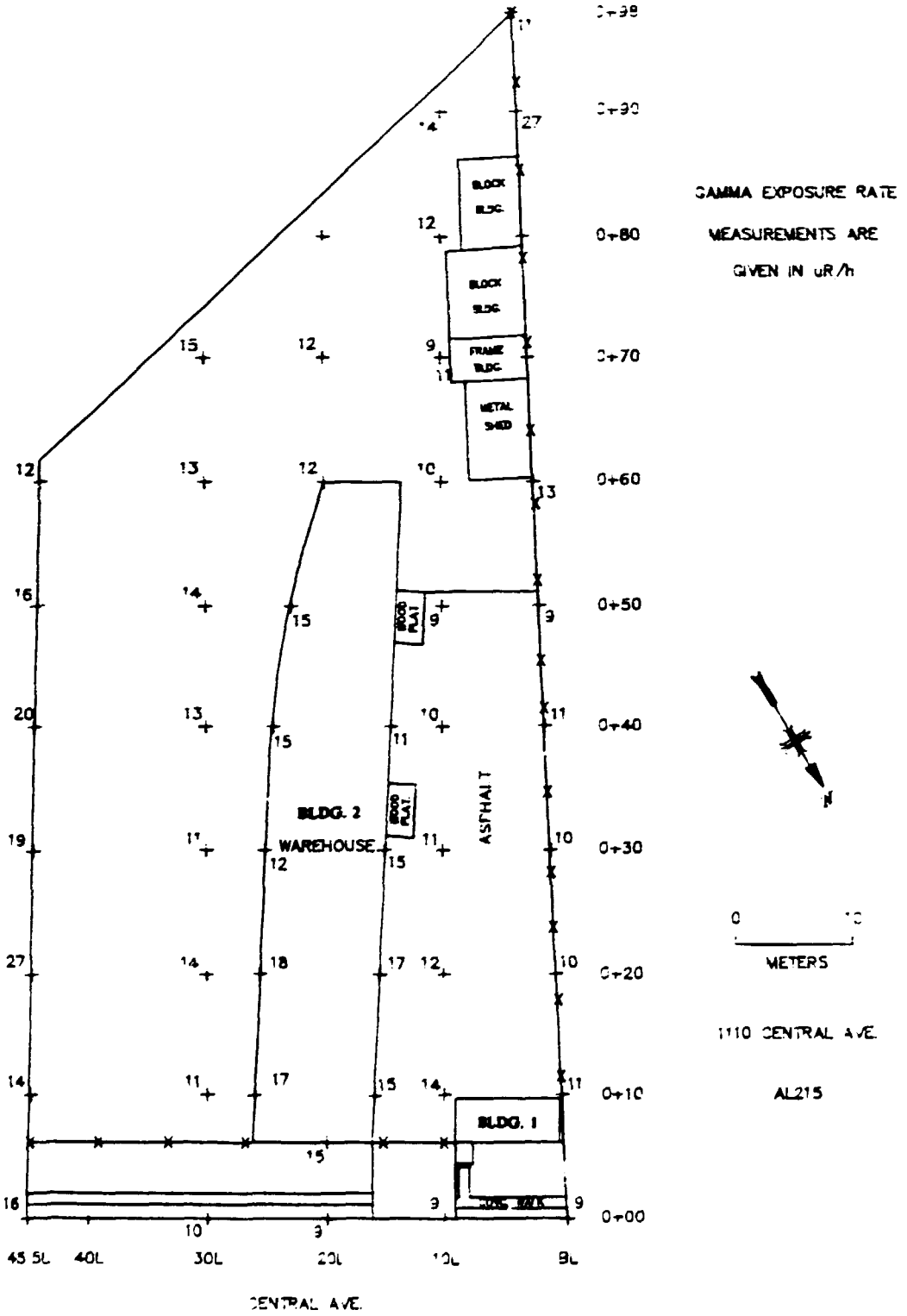

Fig. 4. Surface gamma exposure rates measured at grid points outdoors on the property at 1110 Central Avenue, Albany, New York (AL215).

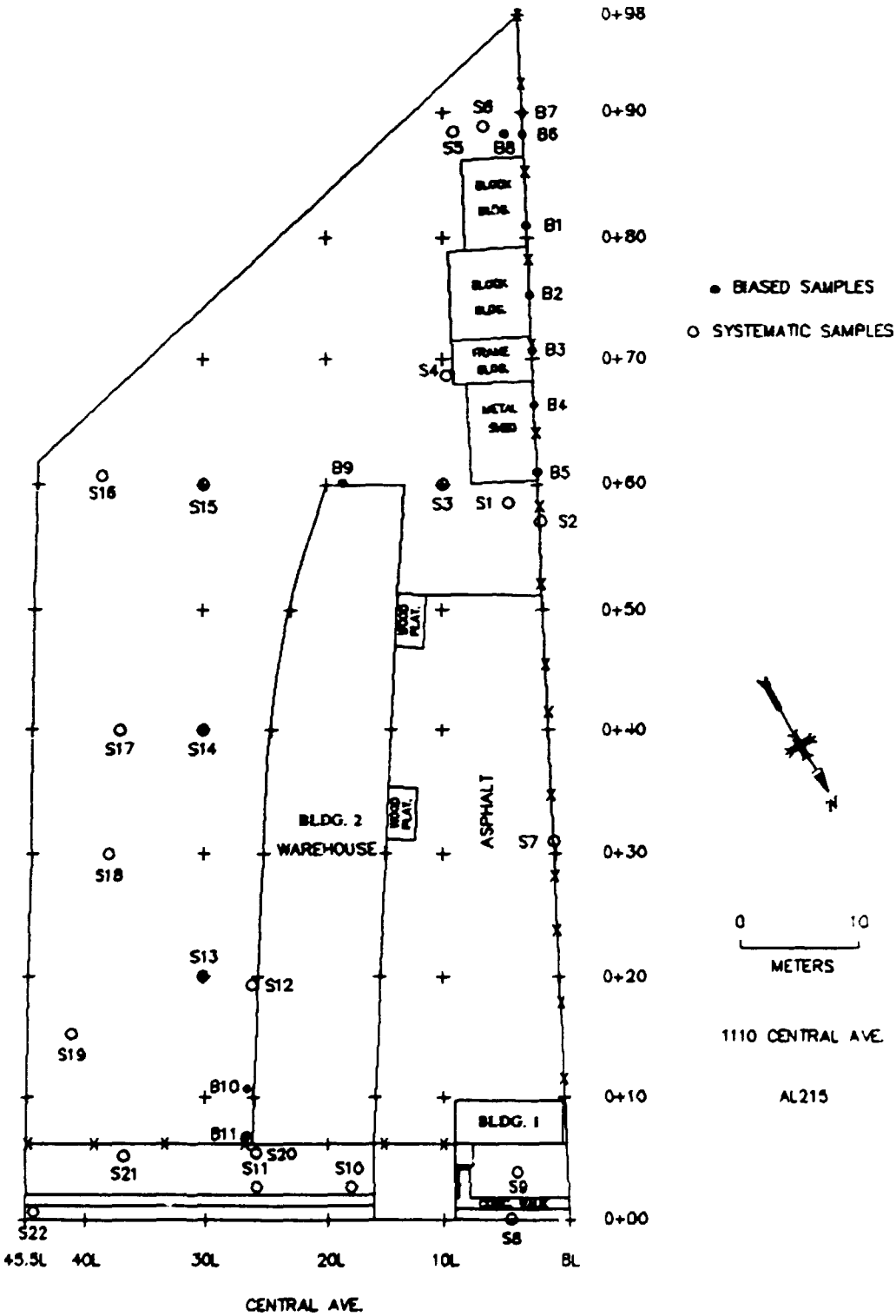

Fig. 5. Locations of soil samples on the property at 1110 Central Avenue, Albany, New York (AL215).

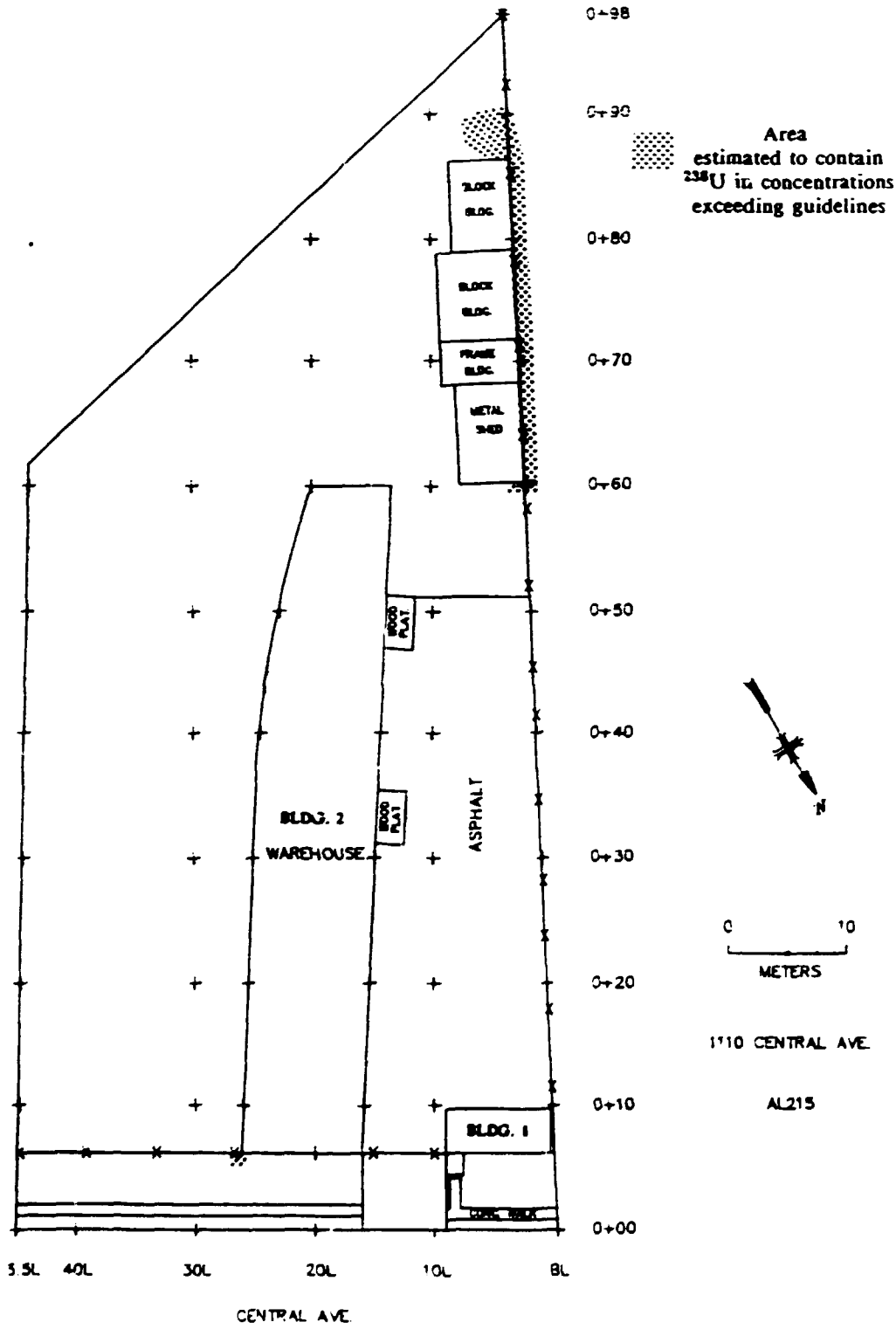

Fig. 6. Area estimated to contain uranium-238 concentrations exceeding guidelines on the property at 1110 Central Avenue, Albany, New York (AL215)

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 1110 Central Avenue, Albany, New York (AL215)

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	9-18
0+10, BL	11	11	9-19
0+20, BL	8	10	8-12
0+30, BL	9	10	8-19
0+40, BL	9	11	9-19
0+50, BL	7	9	8-19
0+60, BL	9	13	7-13
0+70, BL	e	e	11-15
0+80 BL	e	e	11-15
0+90, BL	15	27	11-32
0+98, BL	13	11	-
0+80, 4L	14	e	-
0+70, 9L	11	11	-
0+00, 10L	9	9	9-18
0+10, 10L	12	14	11-18
0+20, 10L	12	12	9-19
0+30, 10L	11	11	8-14
0+40, 10L	9	10	8-11
0+50, 10L	9	9	8-14
0+60, 10L	9	10	8-11
0+70, 10L	9	9	8-11
0+80, 10L	11	12	11-12
0+90, 10L	13	14	-
0+40, 13L	9	11	-
0+30, 13.75L	13	15	-
0+20, 14.4L	17	17	-
0+10, 15.3L	15	15	-
0+00, 20L	9	9	9-32
0+06, 20L	15	15	-
0+10, 20L	e	e	12-19
0+20, 20L	e	e	11-22
0+30, 20L	e	e	-
0+40, 20L	e	e	10-14
0+50, 20L	e	e	-
0+60, 20L	11	12	9-12
0+70, 20L	12	12	10-12
0+80, 20L	e	e	-
0+50, 20.8L	14	15	9-15
0+40, 22.8L	14	15	-

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+30, 23L	12	12	-
0+20, 24L	18	18	-
0+10, 24.7L	17	17	-
0+00, 30L	9	10	9-14
0+10, 30L	12	11	8-18
0+20, 30L	12	14	9-19
0+30, 30L	11	11	8-19
0+40, 30L	11	13	9-19
0+50, 30L	11	14	9-14
0+60, 30L	9	13	8-16
0+70, 30L	14	15	-
0+80, 30L	e	e	-
0+00, 45.5L	11	16	-
0+10, 45 5L	12	14	-
0+20, 45.5L	27	27	-
0+30, 45.5L	18	19	-
0+40, 45.5L	19	20	-
0+50, 45.5L	15	16	-
0+61, 45.5L	11	12	-

[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 1110 Central Avenue, Albany, New York (AL215)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
Systematic samples[d]				
AL215S1	0+59, 2L	0-5	0.47	6.5
AL215S2	0+58, BL	0-5	0.50	16
AL215S3	0+60, 10L	0-5	0.58	14
AL215S4	0+68, 9L	0-5	0.51	28
AL215S5	0+89, 5L	0-5	0.79	3.8
AL215S6	0+89, 3L	0-5	0.74	83
AL215S7	0+31, BL	0-5	0.48	10
AL215S8	0+00, 5L	0-5	0.53	9.0
AL215S9	0+03.5, 5L	0-5	0.62	22
AL215S10	0+02, 19L	0-5	0.59	12
AL215S11	0+04, 26.7L	0-5	0.60	18
AL215S12	0+19, 24L	0-5	0.66	21
AL215S13	0+20, 30L	0-5	0.74	2.7
AL215S14	0+40, 30L	0-5	0.52	11
AL215S15	0+60, 30L	0-5	1.1	73
AL215S16	0+61, 41.5L	0-5	1.0	66
AL215S17	0+40, 40L	0-5	0.70	9.0
AL215S18	0+30, 40.5L	0-5	0.70	48
AL215S19	0+15, 42L	0-5	0.81	36
AL215S20	0+06, 26L	0-5	0.70	140
AL215S21	0+05, 37L	0-5	0.70	19
AL215S22	0+01, 44L	0-5	0.57	6.5
Biased samples[e]				
AL215B1	0+81, BL	0-5	0.70	210
AL215B2	0+75, BL	0-5	0.73	160
AL215B3	0+71, BL	0-5	0.76	380
AL215B4	0+67, BL	0-5	0.48	590
AL215B5	0+61, BL	0-5	0.52	720
AL215B6	0+89, BL	0-5	0.72	120
AL215B7	0+90, BL	0-5	0.47	730
AL215B8	0+89.5, 1L	0-5	0.64	260

Table 3 (continued)

Sample	Location[a]	Depth (cm)	Radionuclide concentration (pCi/g)	
			^{226}Ra[b]	^{238}U[c]
Biased samples[e] (continued)				
AL215B9	0+60, 18L	0-5	0.69	4.4
AL215B10	0+12, 25.7L	0-5	0.65	16
AL215B11	0+06, 24.7L	0-5	0.77	770
AL215B12	Roof, Bldg. 2	-	0.62	46

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

[b]Counting error is ± 8% (2 σ).

[c]Error of measurement results is ± 15% (2 σ) at the 35 pCi/g level.

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

[e]Biased samples are taken from areas having elevated gamma exposure rates.

Table 4. Results of surface analysis of structures at 1110 Central Avenue, Albany, New York (AL215)

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	15	7,28,21,28, 35,7,14,<7, 35,14,49,7, 21,14,7	-	31	-
Roofs of the buildings	17	35,28,14,42, 63,35,14,14, 14,56,21,21, 28,42,42,35, 28	-	20	-
Total	32	<7-63	-	26	-
Beta-Gamma					
Asphalt paving	15	-	0.02,0.03,0.03, 0.03,0.04,0.04, 0.06,0.03,0.05, 0.08,0.05,0.02, 0.03,0.02,0.03	-	0.04
Roofs of the buildings	17	-	0.03,0.07,0.03, 0.12,0.06,0.04, 0.03,0.03,0.03, 0.03,0.02,0.04, 0.02,0.02,0.05, 0.09,0.03	-	0.04
Total	32	-	0.02-0.12	-	0.04

[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 1110 Central Avenue, Albany, New York (AL215)

Measurement or sample type	Number of measurements/ samples	Range	Mean
Gamma exposure rate at 1 m (μR/h)[a]	49	7-27	12
Gamma exposure rate at surface (μR/h)[a]	49	9-27	13
Scan, gamma exposure rate near surface (μR/h)[b]	-	7-32	-
Concentration of ^{238}U in surface soil (pCi/g), systematic locations[c]	22	2.7-140	30
Concentration of ^{238}U in surface soil (pCi/g), biased locations[c]	12	4.4-770	330
Area estimated to contain ^{238}U concentrations exceeding guidelines (m^2)	-	-	35
Concentration of ^{226}Ra in surface soil (pCi/g), systematic locations[c]	22	0.47-1.1	0.63
Concentration of ^{226}Ra in surface soil (pCi/g), biased locations[c]	12	0.47-0.77	0.64
Surface measurements[d]			
Alpha activity (dpm/100 cm^2)	32	<7-63	26
Beta-gamma activity (mrad/h)	32	0.02-0.12	0.04

[a]At grid points, Table 2.
[b]Scan of entire property, Table 2.
[c]Soil and roof samples, Table 3.
[d]Surface measurements, Table 4.

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