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SUBJECT PRELIM RADU SURVEY OF PLETCHER RD LEWISTON, NY

FROM BERGER TO DIST COMM DATE 09/13/83

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COMMENTS \_\_\_\_\_

PRELIMINARY RADIOLOGICAL SURVEY OF  
PLETCHER ROAD  
LEWISTON, NEW YORK

J.D. Berger

INTRODUCTION

During the 1940's and 1950's, low-level radioactive wastes and contaminated materials from operations of the Manhattan Engineer District and Atomic Energy Commission were stored and processed at the Lake Ontario Ordnance Works (now known as the Niagara Falls Storage Site (NFSS) and associated off-site properties) in Lewiston, New York. Many of the wastes were transported to the site by truck. The final portion of the route was east along Pletcher Road from Creek Road (Route 18) to Campbell Street - the entrance to the site. Previous surveys of off-site properties L and M at the NFSS, and of a private residence have identified elevated direct radiation levels and Ra-226 soil concentrations along the north shoulder of Pletcher Road.<sup>1-3</sup> These findings indicated a need to determine the radiological conditions along other portions of this road. In July and August 1983 ORAU conducted measurements of direct radiation and radionuclide levels in soil along Pletcher Road, between Harold Road and the intersection with Creek Road.

DESCRIPTION OF SURVEYED AREA

Pletcher Road is a two-lane, asphalt county road, running in an east/west direction between River Road (along the Niagara River) and Harold Road. Between Creek Road and Harold Road - a distance of about 2945 m - the road is straight and level, varying in width from approximately 10 m at the Creek Road intersection to about 6 m near the Campbell Street entrance to the NFSS. The road divides 1800 m east of Creek Road; the southern portion of the divided road is not used by regular traffic.

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Prepared by the Radiological Site Assessment Program, Manpower Education, Research, and Training Division of Oak Ridge Associated Universities, Oak Ridge, Tennessee, under Contract DE AC05-76OR00033 with the Department of Energy.

September 13, 1983

In addition to the entrance to the NFSS, there are 15 residential driveways, an entrance to a commercial campground, and several unpaved private access roads along this section of Pletcher Road. The land bordering the road is generally level; much of this land is farmland or is undeveloped and overgrown with brush and weeds. Figure 1 is a drawing of the section of Pletcher Road included in this survey.

## SURVEY PROCEDURE

### Objective

The objective of the survey was to measure direct radiation levels and concentrations of radionuclides in soil along Pletcher Road. Comparison of the results with the criteria established for properties at the NFSS would determine the need for corrective action and/or additional survey information.

### Procedure

1. Pletcher Road was divided into 200 m intervals between Harold Road and Creek Road. Campbell Street and the north edge of Pletcher Road were used as reference points for all survey measurements and sampling. Figures 2-6 indicate the grid established along Pletcher Road.
2. As a result of elevated radiation levels noted near the intersection with Creek Road, the survey was extended 200 m further west along Pletcher Road and 200 m north and south of Pletcher Road, along Creek Road.
3. Walkover surface scans were conducted at about 1 m intervals on the road surface and on the shoulders, to 3 m from the road edge. Gamma scintillation probes and portable ratemeters were used for these scans. Locations of elevated contact radiation levels were noted.
4. At 200 m intervals along the road, gamma exposure rates at the surface and at 1 m above the surface and beta-gamma dose rates at the surface were measured on the road shoulders, at the edge of the paving.

Portable gamma scintillation survey meters were used for exposure rate measurements. Conversion of these measurements to exposure rates in microrentgens per hour ( $\mu R/h$ ) was in accordance with cross calibration with a pressurized ionization chamber. Measurements of beta-gamma dose rates were conducted using thin-window ( $7 \text{ mg/cm}^2$ ) G-M detectors and portable scaler/ratemeters. Meter readings were converted to dose-rate in microrads per hour ( $\mu rad/h$ ) based on cross calibration with a thin-window ionization chamber using soil samples containing elevated concentrations of Ra-226.

5. Surface (0-15 cm) soil samples of approximately 1 kg each were collected from the shoulders of the road at 200 m intervals.
6. At locations of elevated surface gamma radiation levels, beta-gamma dose rates and exposure rates at 1 m above the surface were also measured. Surface soil samples were obtained from these locations, and, following sampling, the surface exposure levels were remeasured to evaluate the effectiveness of shallow sampling on the removal of the radiation source. The locations where these additional measurements and samples were obtained are indicated on Figures 2-6.
7. Soil samples were analyzed by gamma spectrometry; Ra-226, U-238, U-235, and Cs-137 were the major radionuclides of interest, although spectra were reviewed for evidence of other gamma emitters.

RESULTS

Direct Radiation Levels

Direct radiation levels, systematically measured at 200 m intervals along Pletcher Road, are presented in Table 1. Gamma exposure rates at 1 m above the surface ranged from 6 to 14  $\mu R/h$ ; background exposure rates in this area of New York typically average approximately 8  $\mu R/h$ . Contact gamma exposure rates and beta-gamma dose rates at these locations ranged from 6 to 20  $\mu R/h$  and 6 to 83  $\mu rad/h$ , respectively. The highest levels for all categories of measurements were obtained on the north shoulder of the road, 600 m west of Campbell Street.

The walkover survey identified areas with generally elevated surface radiation levels and several small isolated areas with contact radiation levels significantly higher than the adjacent surfaces. These areas are shown on Figures 2-6 and the associated radiation levels are presented in Table 2. Gamma exposure rates at contact with these locations ranged from 20 to 95  $\mu\text{R}/\text{h}$ . At 1 m above the surface the exposure rates ranged from 9 to 27  $\mu\text{R}/\text{h}$ . Dose rates ranged from 20 to 250  $\mu\text{rad}/\text{h}$ .

The highest levels were at locations 4E,12S (in the median strip near the entrance to the NFSS) and 2734W,0W (on the north edge of the paved surface at the intersection with Creek Road). It was observed that the elevated radiation levels were generally within 1-2 m of the edge of the paved surface. Radiation levels were not reduced by sampling and at some locations the sampling resulted in an increase in the contact radiation level.

#### Radionuclide Concentrations in Surface Soil

Table 3 lists the concentrations of radionuclides measured in surface soil from 200 m intervals along Pletcher Road. The major radionuclide noted in these soil samples was Ra-226; concentrations ranged from 0.34 to 15.1 pCi/g. For comparison, the levels of Ra-226 measured in 20 baseline soil samples from the Lewiston area ranged from <0.09 to 1.22 pCi/g (average approximately 0.7 pCi/g). Most of the samples taken between Creek Road and Campbell Street exceeded the baseline levels. Systematic samples from locations 600W,6S; 1000W,12S; 1980W,12S; and 800W,1N contained the highest levels of Ra-226. These levels were 15.1, 7.84, 7.74, and 6.06 pCi/g, respectively.

Concentrations of radionuclides in samples from locations of elevated direct radiation levels are presented in Table 4. All samples contained Ra-226 concentrations exceeding the baseline levels. Highest concentrations of Ra-226 were measured in samples B3 (206 pCi/g) and B18 (171 pCi/g) from locations 4E,12S and 2678W,10S. Sample B3 from location 4E,12S also contained 40.7 pCi/g of U-238. Other samples did not contain additional radionuclides in significant concentrations.

COMPARISON OF SURVEY RESULTS WITH GUIDELINES

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Guidelines applicable to cleanup of the Niagara Falls Storage Site properties are presented in Table 5. All exposure rates at 1 m above the ground surface along Pletcher Road are well below the 60  $\mu$ R/h criteria established by the NRC for open land areas. Surface beta-gamma dose rates also satisfy the criteria of 1.0 mrad/h maximum and 0.2 mrad/h average. There are several general areas (shaded regions on Figures 2-6) where the results of soil sampling and surface scans indicate that the Ra-226 soil concentrations averaged over 100 m<sup>2</sup> may exceed 5 pCi/g above background. Further surface and subsurface sampling will be required to delineate the full extent of contamination at these locations. Other locations of Ra-226 surface soil contamination are small and isolated. At these locations the concentrations averaged over 100 m<sup>2</sup> would be below the criteria level.

SUMMARY

A survey of direct radiation levels and concentrations in surface soil was performed along Pletcher Road in the vicinity of the Niagara Falls Storage Site (former Lake Ontario Ordnance Works), by Oak Ridge Associated Universities. The results of the survey indicate general and isolated areas of surface soil Ra-226 contamination along the shoulders of the road. The distribution pattern and the history of transportation of wastes along this road suggest that the source of the contamination was leakage from transport vehicles. This contamination was probably carried to the shoulders of the road by precipitation run-off. Due to their low solubility, these contaminants remain in the gravel and soil along the road, where they were initially deposited.

It is recommended that additional measurements - both surface and subsurface - be conducted to better delineate the extent of contamination in some of the areas and thereby determine requirements; if any, for removal of contaminated soils. The findings of this survey also suggest a need for gamma scans of other roads previously used for the transportation of contaminated wastes to the site. Although there were small areas of contaminated residues along Pletcher Road, under present conditions of property use, these contaminants do not pose health risks.

REFERENCES

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1. B.P. Rocco, Comprehensive Radiological Survey, Off-Site Property L, Niagara Falls Storage Site, Lewiston, New York, ORAU, Oak Ridge, TN, May 1983.
2. B.P. Rocco, Comprehensive Radiological Survey, Off-Site Property M, Niagara Falls Storage Site, Lewiston, New York, ORAU, Oak Ridge, TN, May 1983.
3. M.W. Stafford, Radiological Survey of a Private Residence, 1161 Fletcher Road, Youngstown, New York, June 1983.

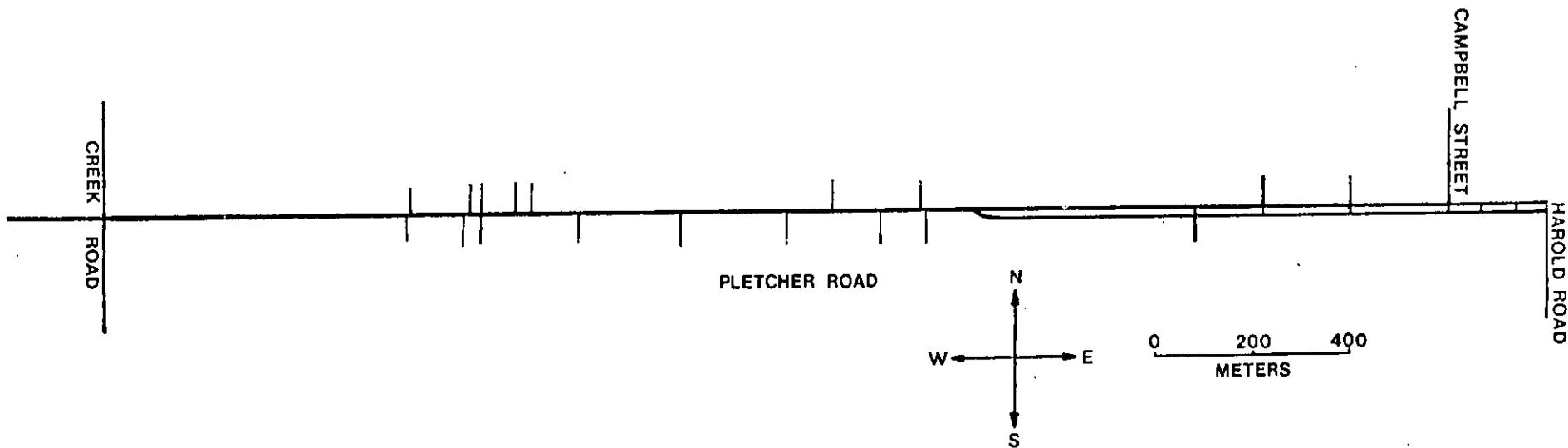


FIGURE 1. Drawing of Portion of Pletcher Road, Showing Locations of Connecting Roads and Driveways.

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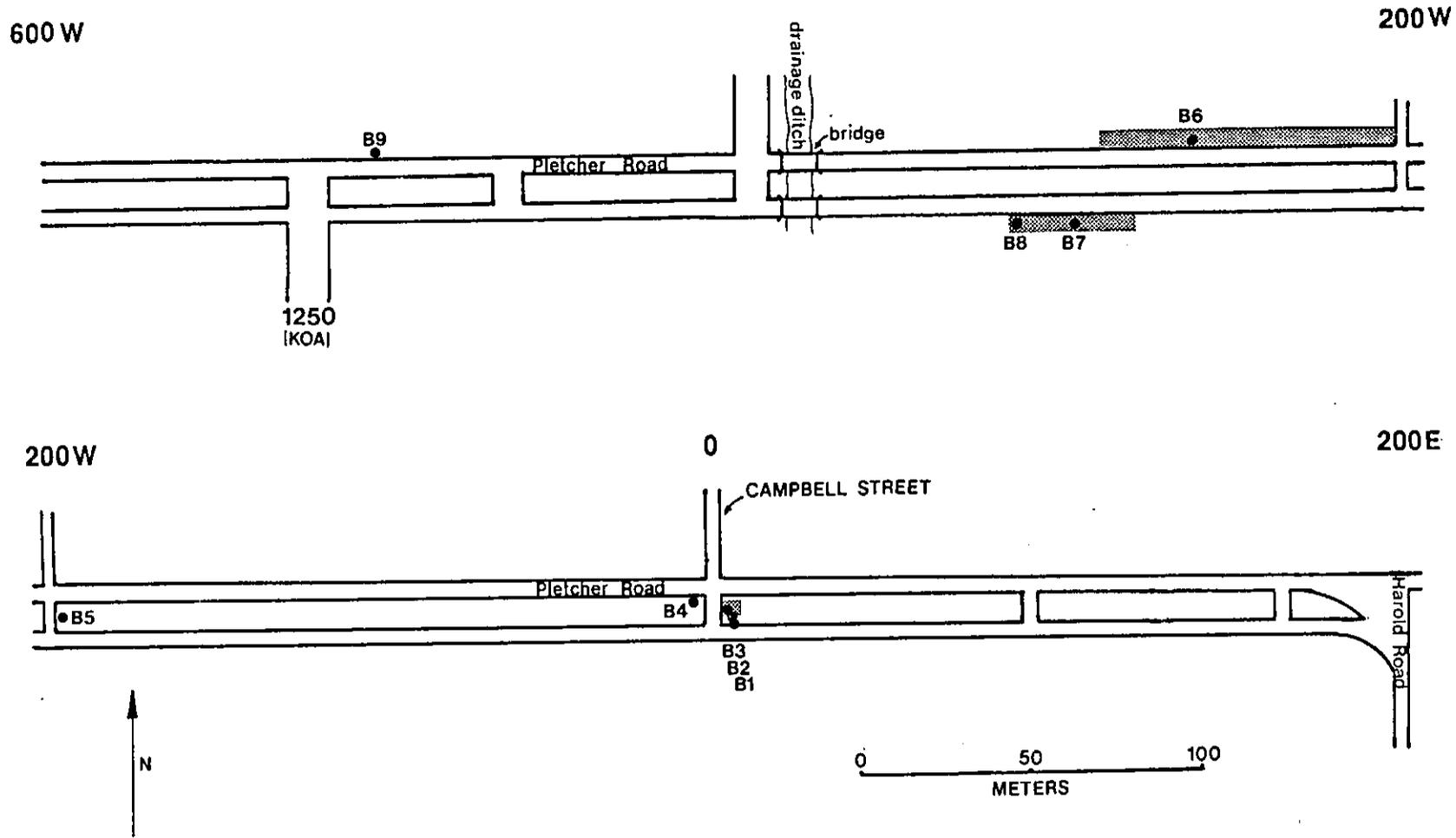


FIGURE 2. Sections of Pletcher Road, Indicating Locations of Elevated Radiation Levels. (Shading indicates generally elevated areas; dots are small, isolated hot-spots.)

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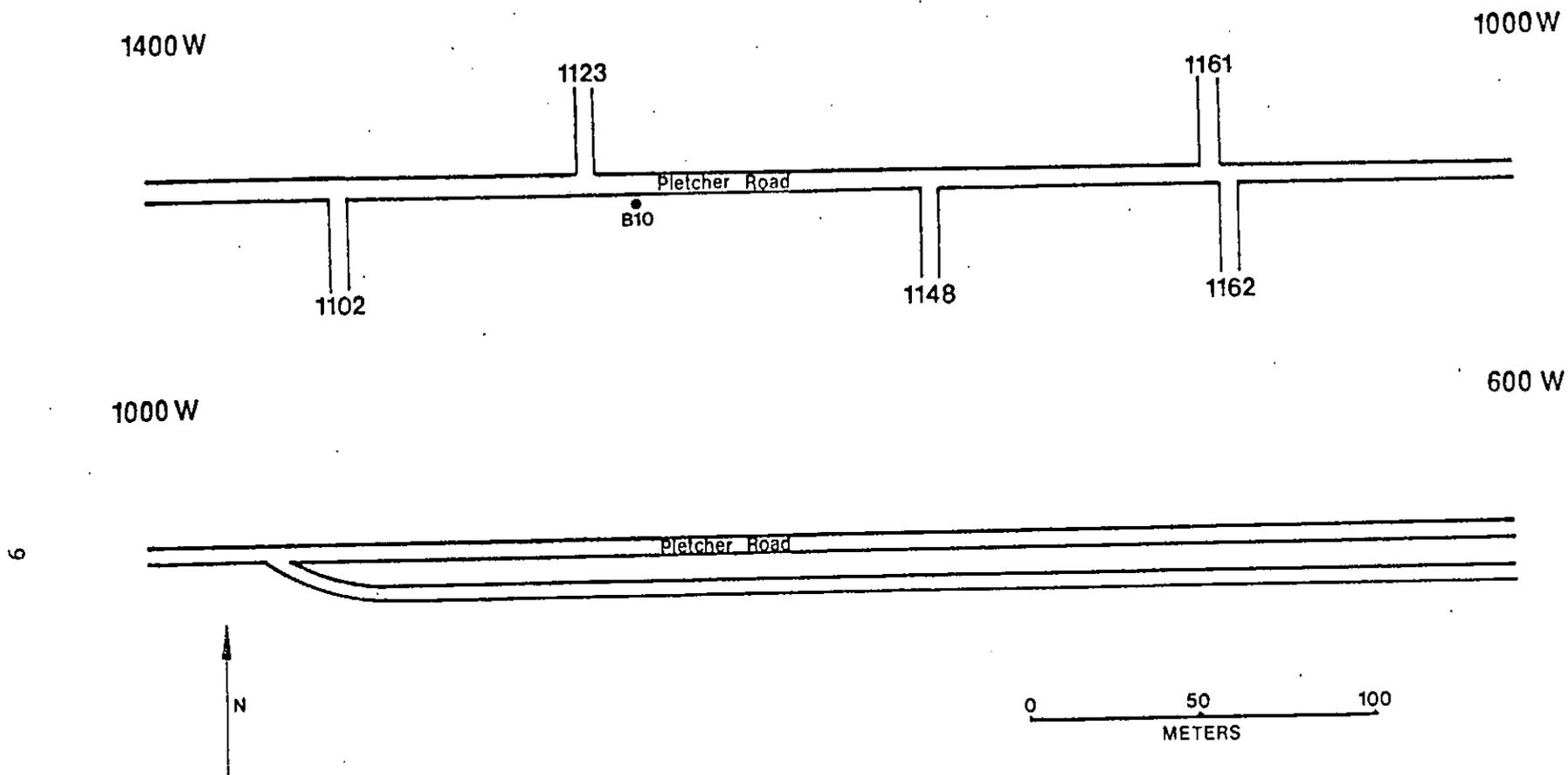


FIGURE 3. Sections of Pletcher Road, Indicating Locations of Elevated Radiation Levels. (Shading indicates generally elevated areas; dots are small, isolated hot-spots.)

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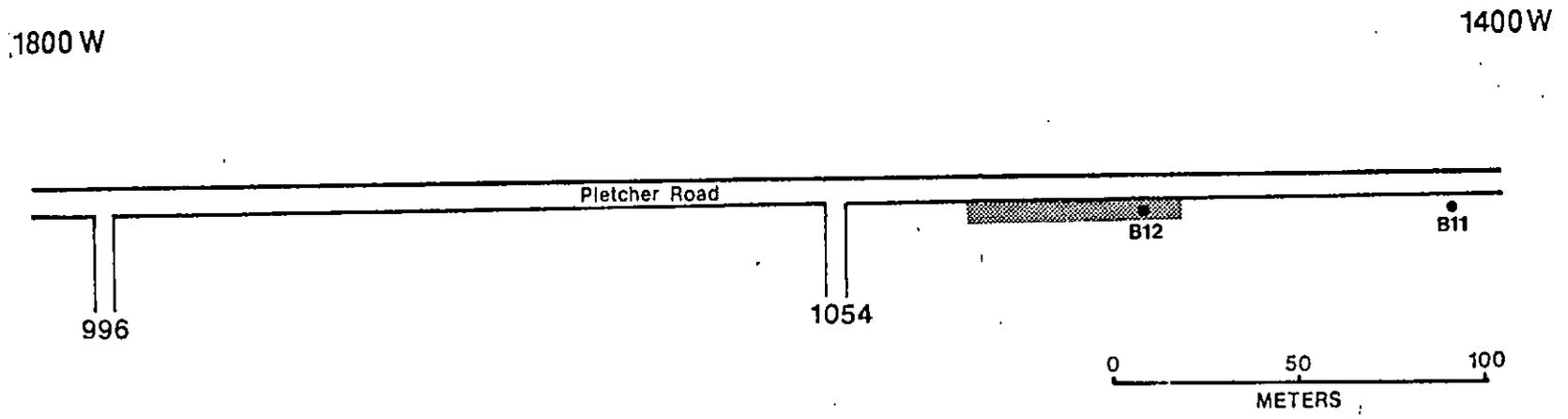
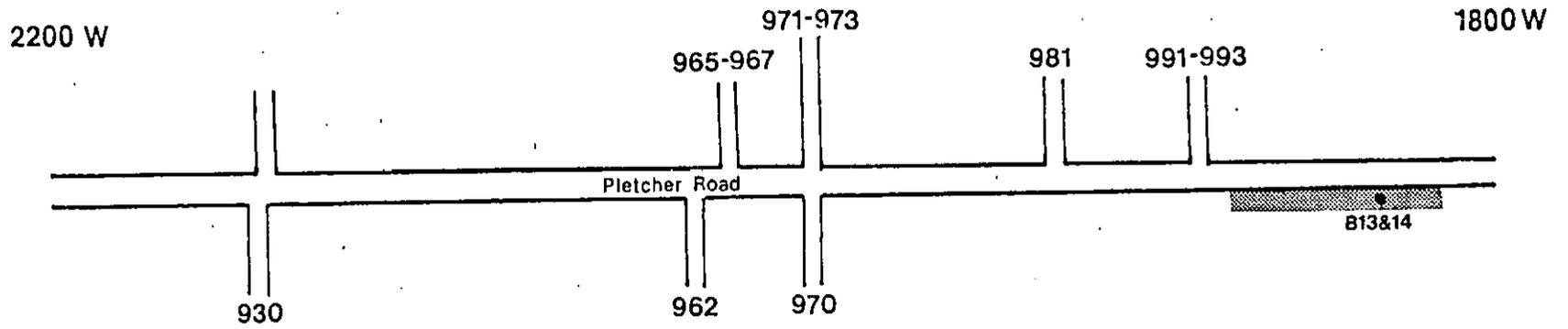
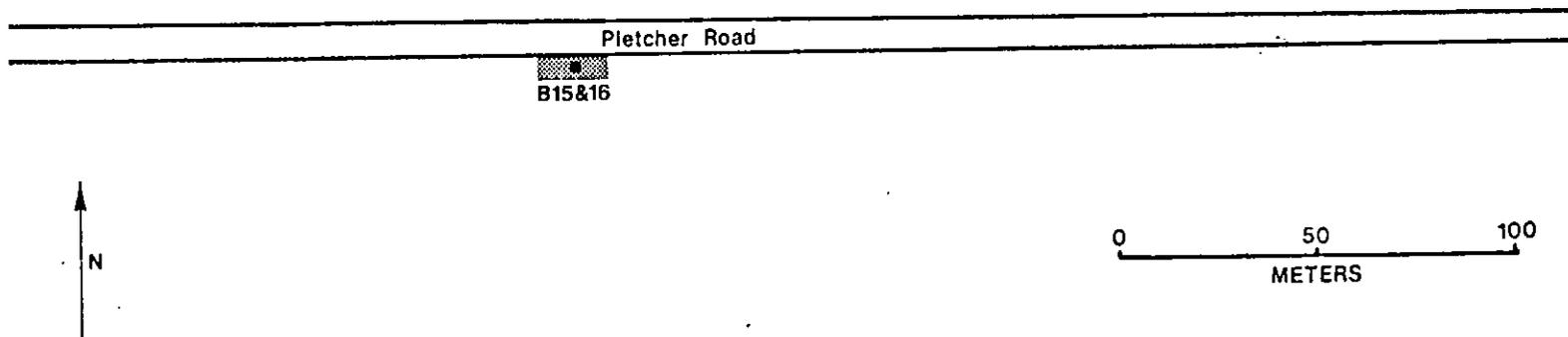


FIGURE 4. Sections of Pletcher Road, Indicating Locations of Elevated Radiation Levels. (Shading indicates generally elevated areas; dots are small, isolated hot-spots.)

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2600W

2200W



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FIGURE 5. Sections of Pletcher Road, Indicating Locations of Elevated Radiation Levels. (Shading indicates generally elevated areas; dots are small, isolated hot-spots.)

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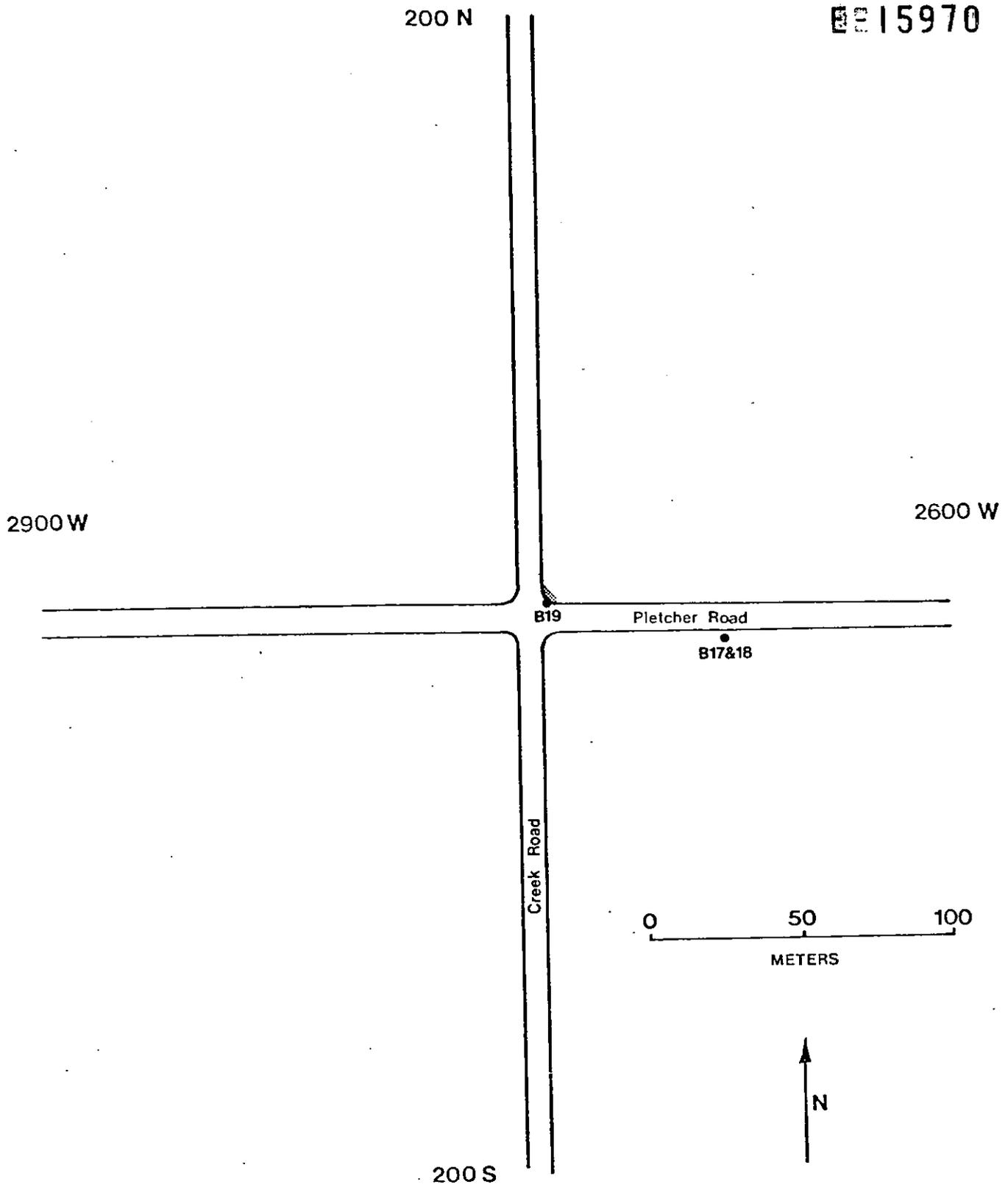


FIGURE 6. Intersection of Pletcher and Creek Roads, Indicating Locations of Elevated Radiation Levels. (Shading indicates generally elevated areas; dots are small, isolated hot-spots.)

TABLE 1

DIRECT RADIATION LEVELS SYSTEMATICALLY  
MEASURED ALONG PLETCHER ROAD

Location <sup>a</sup>	Exposure Rate at 1 m Above Surface ( $\mu$ R/h)	Exposure Rate at Surface Contact ( $\mu$ R/h)	Dose Rate at Surface Contact ( $\mu$ rad/h)
200E, 1N	6	7	7
200E, 6S	6	6	6
200E, 12S	6	8	9
200E, 20S	7	8	17
0, 1N	8	8	8
0, 6S	9	11	15
0, 12S	7	7	20
0, 20S	9	8	14
200W, 1N	8	8	15
200W, 6S	10	12	30
200W, 12S	9	10	21
200W, 20S	8	8	22
400W, 1N	11	14	24
400W, 6S	9	12	14
400W, 12S	10	11	15
400W, 20S	12	12	28
600W, 1N	14	20	83
600W, 6S	12	14	34
600W, 12S	9	9	13
600W, 22S	9	9	22
800W, 1N	12	18	51
800W, 6S	8	10	25
800W, 12S	9	10	24
800W, 22S	11	12	12
1000W, 1N	11	13	30
1000W, 12S	13	16	16
1200W, 1N	8	13	30
1200W, 12S	9	14	14
1400W, 1N	8	10	10
1400W, 12S	8	13	23
1600W, 1N	9	13	30
1600W, 12S	9	13	14

TABLE 1, cont.

DIRECT RADIATION LEVELS SYSTEMATICALLY  
MEASURED ALONG PLETCHER ROAD

Location	Exposure Rate at 1 m Above Surface ( $\mu\text{R/h}$ )	Exposure Rate at Surface Contact ( $\mu\text{R/h}$ )	Dose Rate at Surface Contact ( $\mu\text{rad/h}$ )
1800W, 1N	9	12	24
1800W, 12S	10	16	36
2000W, 1N	8	9	16
2000W, 12S	9	12	12
2200W, 1N	8	11	18
2200W, 12S	9	12	37
2400W, 1N	8	12	23
2400W, 12S	8	12	33
2600W, 1N	8	11	17
2600W, 12S	9	12	30
2740W, 4N	7	7	13
2740W, 200N	6	6	18
2740W, 15S	7	6	6
2740W, 200S	6	7	20
2750W, 4N	6	6	27
2750W, 200N	6	6	23
2750W, 15S	6	6	16
2750W, 200S	7	7	23
2900W, 1N	7	7	19
2900W, 6S	7	7	18

<sup>a</sup> Refer to Figures 2-6.

TABLE 2

DIRECT RADIATION LEVELS AT LOCATIONS  
IDENTIFIED BY THE WALKOVER SCAN

Location <sup>a</sup>	Exposure Rate ( $\mu\text{R}/\text{h}$ )		Surface Dose Rate ( $\mu\text{rad}/\text{h}$ )	Sample <sup>b</sup>	Contact Exposure Rate After Sampling ( $\mu\text{R}/\text{h}$ )
	Contact	1 m Above Surface			
8E, 17S	28	15	31	B1	22
6E, 15S	21	13	26	B2	22
4E, 12S	95	27	250	B3	95
20W, 6S	22	12	56	B4	25
192W, 12S	23	14	55	B5	27
205-300W, 1-2N	14-18	—	—	—	—
270W, 2N	20	9	20	B6	20
292-320W, 20-23S	17-24	—	—	—	—
302W, 21S	24	14	65	B7	22
318W, 21S	23	13	39	B8	23
500W, 2N	37	14	50	B9	35
1245W, 9S	21	14	26	B10	26
1415W, 8S	25	11	25	B11	22
1485-1550W, 8-10S	24-27	—	—	—	—
1490W, 10S	29	14	92	B12	38
1820-1870W, 9-10S	20-38	—	—	—	—
1840W, 10S	38	18	104	B13&B14	50
2420-2460W, 9-10S	24-27	—	—	—	—
2445W, 10S	28	16	34	B15&B16	34
2678W, 10S	53	17	44	B17&B18	44
2734W, 0N	76	25	118	B19	118

<sup>a</sup> Refer to Figures 2-6.

<sup>b</sup> Soil concentrations are presented in Table 4.

TABLE 3

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL  
SYSTEMATICALLY COLLECTED ALONG PLETCHER ROAD

Location	Radionuclide Concentrations (pCi/g)			
	Ra-226	U-235	U-238	Cs-137
200E, 4N	0.75 ± 0.23	<0.16	0.78 ± 0.68	0.63 ± 0.14
190E, 6S	0.95 ± 0.20	<0.29	<0.87	0.38 ± 0.12
200E, 12S	1.01 ± 0.23	0.38 ± 0.36	0.93 ± 0.62	0.32 ± 0.07
200E, 20S	0.80 ± 0.31	<0.21	<0.79	2.59 ± 0.38
10E, 4N	6.71 ± 0.54	0.54 ± 0.61	<0.54	0.99 ± 0.13
0, 6S	4.90 ± 0.48	<0.33	1.88 ± 2.09	0.61 ± 0.12
0, 12S	1.76 ± 0.24	<0.25	<0.70	0.44 ± 0.08
0, 20S	2.94 ± 0.51	<0.49	<1.43	2.92 ± 0.30
200W, 1N	2.96 ± 0.39	0.23 ± 0.57	0.92 ± 1.39	0.24 ± 0.07
200W, 6S	3.23 ± 0.51	<0.33	<1.00	3.09 ± 0.27
190W, 12S	1.45 ± 0.34	<0.27	<0.87	5.23 ± 0.37
200W, 20S	2.70 ± 0.40	0.34 ± 0.52	<0.80	2.06 ± 0.21
400W, 1N	3.19 ± 0.33	<0.33	<0.99	0.32 ± 0.09
400W, 6S	4.21 ± 0.45	<0.27	0.86 ± 1.16	1.15 ± 0.15
400W, 12S	2.58 ± 0.45	<0.36	<1.08	0.45 ± 0.14
400W, 20S	2.70 ± 0.38	<0.39	<1.19	0.75 ± 0.15
600W, 1N	4.25 ± 0.43	<0.40	<1.05	0.66 ± 0.13
600W, 6S	15.1 ± 0.8	1.05 ± 0.99	3.27 ± 1.61	1.56 ± 0.19
600W, 12S	1.70 ± 0.24	0.35 ± 0.32	0.95 ± 0.65	1.14 ± 0.14
600W, 22S	1.15 ± 0.24	<0.27	<0.91	0.19 ± 0.10
800W, 1N	6.06 ± 0.48	<0.26	<0.45	0.42 ± 0.09
800W, 6S	2.79 ± 0.40	<0.30	1.09 ± 1.95	0.68 ± 0.15
800W, 12S	1.98 ± 0.36	<0.25	<0.89	0.33 ± 0.13
800W, 22S	2.64 ± 0.36	<0.37	<1.15	0.62 ± 0.16
1000W, 1N	4.98 ± 0.49	<0.33	1.50 ± 2.50	2.48 ± 0.22
1000W, 12S	7.84 ± 0.58	1.45 ± 0.87	1.73 ± 2.89	1.30 ± 0.16
1200W, 1N	1.55 ± 0.38	<0.24	1.32 ± 1.65	0.59 ± 0.13
1200W, 12S	1.61 ± 0.34	<0.19	0.79 ± 0.77	0.52 ± 0.10
1400W, 1N	1.04 ± 0.28	<0.19	1.45 ± 1.77	0.49 ± 0.11
1400W, 12S	3.00 ± 0.38	<0.32	2.61 ± 2.14	1.22 ± 0.18

TABLE 3, cont.

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RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL  
SYSTEMATICALLY COLLECTED ALONG PLETCHER ROAD

Location	Radionuclide Concentrations (pCi/g)			
	Ra-226	U-235	U-238	Cs-137
1600W, 1N	1.20 ± 0.20	<0.26	<0.70	0.59 ± 0.10
1600W, 12S	2.23 ± 0.36	<0.36	<1.06	1.30 ± 0.17
1800W, 1N	1.56 ± 0.24	<0.17	0.62 ± 0.72	0.31 ± 0.10
1800W, 12S	1.50 ± 0.29	<0.18	1.40 ± 0.54	0.15 ± 0.05
2000W, 1N	0.95 ± 0.18	<0.12	0.33 ± 0.81	0.14 ± 0.06
1980W, 12S	7.74 ± 0.60	<0.54	<1.63	0.87 ± 0.17
2200W, 1N	1.05 ± 0.25	<0.20	<0.72	1.68 ± 0.17
2200W, 12S	1.84 ± 0.55	0.46 ± 0.51	1.39 ± 0.93	1.28 ± 0.16
2400W, 1N	1.31 ± 0.25	<0.29	1.57 ± 1.39	1.80 ± 0.17
2400W, 12S	2.93 ± 0.41	1.82 ± 0.48	1.30 ± 0.86	1.03 ± 0.19
2600W, 4N	2.24 ± 0.39	<0.25	<0.93	1.80 ± 0.22
2600W, 12S	3.09 ± 0.39	<0.38	<1.09	1.28 ± 0.16
2740W, 4N	1.13 ± 0.26	<0.17	1.26 ± 0.72	0.29 ± 0.10
2740W, 200N	0.93 ± 0.19	<0.13	0.60 ± 0.60	0.45 ± 0.08
2740W, 15S	0.48 ± 0.18	<0.17	0.67 ± 1.15	0.59 ± 0.30
2740W, 200S	1.11 ± 0.33	<0.38	0.95 ± 1.84	0.85 ± 0.20
2750W, 4N	0.59 ± 0.19	<0.09	<0.22	0.40 ± 0.07
2750W, 200N	0.91 ± 0.24	<0.24	<0.70	0.48 ± 0.12
2750W, 15S	1.39 ± 0.28	<0.28	2.34 ± 1.08	0.40 ± 0.13
2750W, 200S	1.76 ± 0.24	0.45 ± 0.43	<0.83	0.20 ± 0.08
2900W, 1N	0.34 ± 0.13	<0.20	<0.64	0.18 ± 0.07
2900W, 6S	0.68 ± 0.21	<0.24	<0.70	0.19 ± 0.09

<sup>a</sup> Errors are 2σ.

TABLE 4

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL  
FROM LOCATIONS OF ELEVATED DIRECT RADIATION

Sample No.	Location	Radionuclide Concentrations (pCi/g) <sup>a</sup>			
		Ra-226	U-235	U-238	Cs-137
B1	8E, 17S	14.6 ± 1.1 <sup>b</sup>	1.55 ± 1.80	4.78 ± 4.03	1.24 ± 0.34
B2	6E, 15S	11.6 ± 0.9	<0.77	3.74 ± 3.10	5.95 ± 0.38
B3	4E, 12S	206 ± 4	8.28 ± 3.22	40.7 ± 4.1	0.55 ± 0.25
B4	20W, 6S	17.8 ± 0.8	0.51 ± 0.96	0.68 ± 2.36	0.32 ± 0.09
B5	192W, 12S	8.70 ± 0.61	<0.31	<0.59	0.86 ± 0.15
B6	270W, 2N	13.1 ± 1.0	0.92 ± 0.96	1.01 ± 1.31	1.35 ± 0.19
B7	302W, 21S	22.4 ± 1.0	1.00 ± 1.02	4.83 ± 1.47	0.83 ± 0.15
B8	318W, 21S	12.9 ± 1.0	1.53 ± 1.07	2.01 ± 1.16	0.87 ± 0.15
B9	500W, 1N	23.0 ± 1.2	<0.97	8.08 ± 3.89	2.44 ± 0.30
B10	1245W, 9S	23.4 ± 0.8	0.89 ± 0.89	2.38 ± 1.61	1.98 ± 0.18
B11	1415W, 8S	12.8 ± 0.7	<0.37	<0.68	2.27 ± 0.20
B12	1490W, 10S	34.5 ± 1.3	1.98 ± 1.47	7.24 ± 4.07	0.61 ± 0.13
B13	1840W, 10S	30.6 ± 3.6	<0.22	<6.28	0.51 ± 0.43
B14	1840W, 10S	54.9 ± 1.5	1.52 ± 1.90	<3.40	1.77 ± 0.21
B15	2445W, 10S	25.0 ± 1.0	1.22 ± 0.93	4.92 ± 1.73	0.57 ± 0.12
B16	2445W, 10S	15.6 ± 0.8	2.27 ± 1.23	2.68 ± 3.72	0.36 ± 0.11
B17	2678W, 10S	75.6 ± 1.8	2.48 ± 2.12	6.73 ± 5.24	0.71 ± 0.19
B18	2678W, 10S	171 ± 3	5.62 ± 2.28	7.67 ± 3.66	0.76 ± 0.22
B19	2734W, 0N	50.8 ± 1.6	1.90 ± 1.73	<2.39	<0.10

<sup>a</sup> Direct radiation levels are presented in Table 2.

<sup>b</sup> Errors are 2σ.

TABLE 5

SUMMARY OF RADIATION GUIDELINES  
 APPLICABLE TO OFF-SITE PROPERTIES  
 AT THE NIAGARA FALLS STORAGE SITE

Mode of Exposure	Exposure Conditions	Guideline Value	Guideline Source	
1. External Gamma Radiation	Continuous exposure to individual in general population (whole body)	60 $\mu$ R/h	Nuclear Regulatory Commission (NRC Standards for Protection Against Radiation (10CFR20.105))	
2. Beta-gamma Dose Rate	Average dose rate on an area no greater than 1 m <sup>2</sup>	0.2 mrad/h	NRC Guidelines for Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for By-product, Source, or Special Nuclear Material	
	Maximum dose rate in any 100 cm <sup>2</sup> area	1.0 mrad/h		
3. Radionuclides in Soil	Concentration above background-averaged over an area of 100 m <sup>2</sup>	Ra-226	5 pCi/g (sur.) 15 pCi/g (subsurf.)	EPA Standards for Uranium Mill Tailings
		U-238	40 pCi/g	Interim Soil Limits for D&D Projects, LA-UR-79-1865-Rev, J.W. Healey et al.
		Th-232	20 pCi/g	
		Sr-90	100 pCi/g	
		Cs-137	80 pCi/g	
		U-enriched in U-235	30 pCi/g	NRC Branch Technical Position Paper (Federal Register, October 23, 1981)