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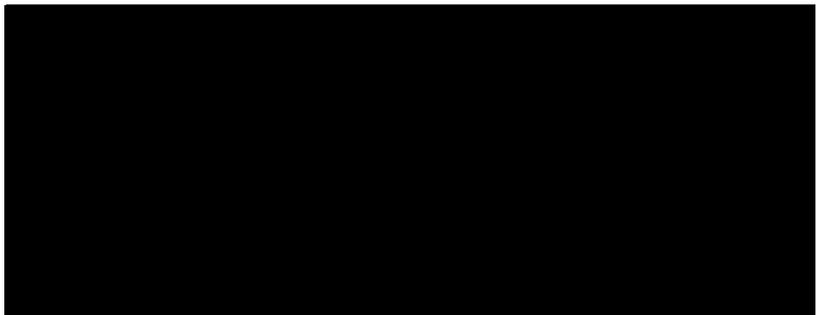
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**SURFACE RADIOLOGICAL INVESTIGATIONS  
AT SOLID WASTE STORAGE AREA  
NO. 1 (SWSA 1)**

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Storage Area No. 1 (SWSA 1)

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ENVIRONMENTAL RESTORATION  
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**HEALTH AND SAFETY RESEARCH DIVISION**

Nuclear and Chemical Waste Programs  
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STORAGE AREA NO. 1 (SWSA 1)**

J. K. Williams, J. A. Roberts, and M. S. Uziel

Date of Issue – February 1988

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# **SURFACE RADIOLOGICAL INVESTIGATIONS AT SOLID WASTE STORAGE AREA NO. 1 (SWSA 1)**

## **INTRODUCTION**

A surface radiological scoping survey of the Solid Waste Storage Area No. 1 (SWSA 1) was conducted in November 1987 by the Environmental Assessments group of the Health and Safety Research Division (HASRD) of the Oak Ridge National Laboratory (ORNL) at the request of the Remedial Action Program (RAP) of ORNL. The purpose of this activity was (1) to identify surface contamination as determined from gamma exposure rate measurements and (2) to make recommendations for corrective actions to limit human exposures to radioactivity and minimize the dispersion of contamination.

SWSA 1 (2624) has been assigned to Waste Area Group (WAG) number 1.0 (Main Plant Area) and given the Solid Waste Management Unit (SWMU) identification number 1.46 by the RAP.<sup>1</sup> An aerial view of the Solid Waste Disposal Areas on the Oak Ridge Reservation (ORR) is shown in Fig. 1.

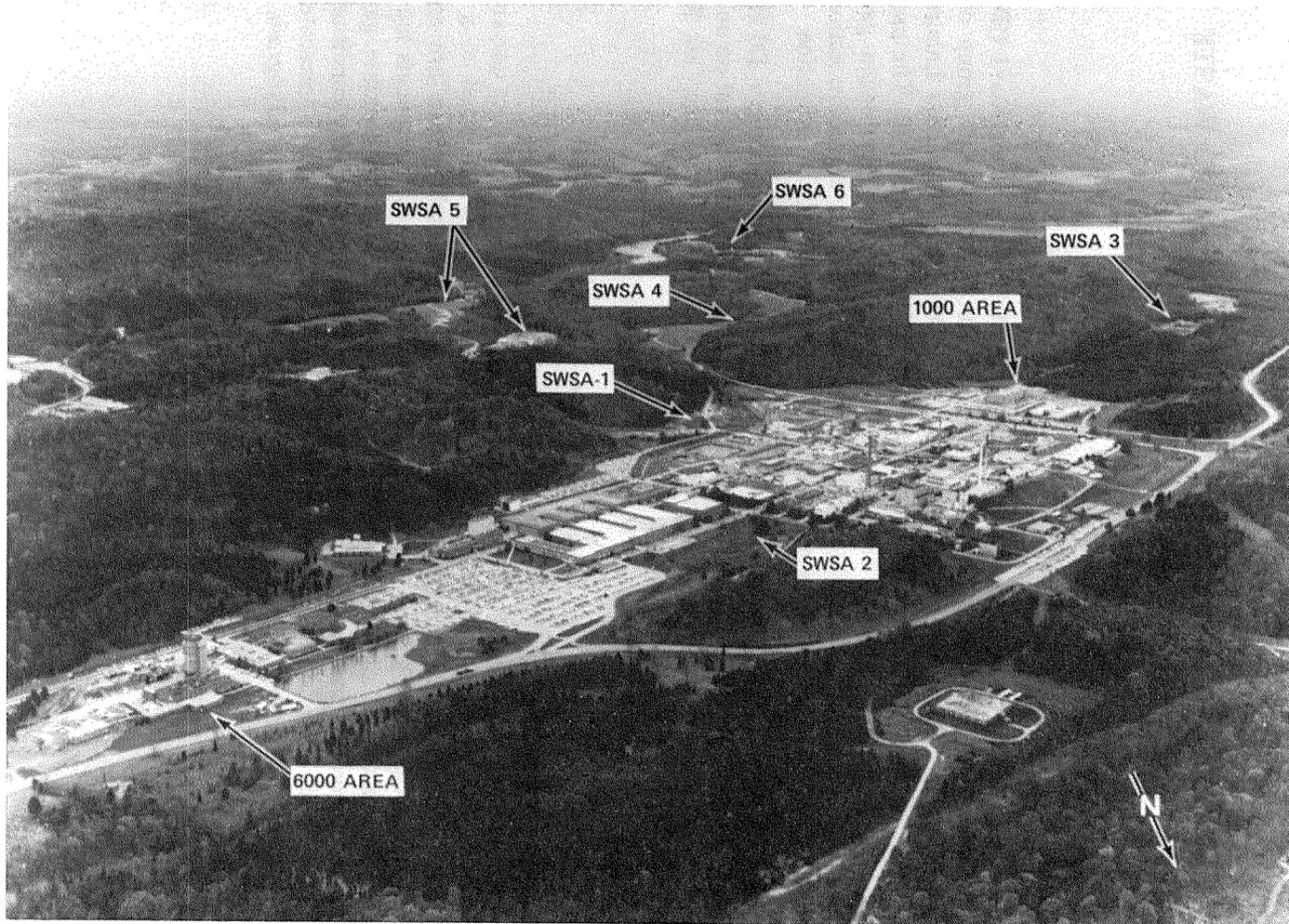
## **SURVEY METHODS**

A portable survey meter with a NaI scintillation probe was used to detect contamination associated with gamma radiation. The scintillation probe was connected to a Victoreen Model 470 Thyac III rate meter. Because NaI gamma scintillators are energy dependent, measurements of gamma radiation levels made with these instruments must be normalized to pressurized ionization chamber (PIC) measurements to estimate gamma exposure rates. Radiation measurements at SWSA 1 were taken under dry conditions. A comprehensive description of the survey methods and instrumentation is presented in *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (April 1987).<sup>2</sup>

## **SURVEY SITE**

### **SITE HISTORY**

SWSA 1 is located southwest of the fence surrounding the main plant area at ORNL grid coordinates (measured in feet) North 20,980 and East 30,710.<sup>2,3</sup> SWSA 1 is in Bethel Valley at the foot of Haw Ridge with its closest edge approximately 7.6 m (25 ft) south of White Oak Creek. The site is triangular in shape (Fig. 2) and encompasses approximately 4000 m<sup>2</sup> (1 acre).<sup>4</sup> The burial ground lies in the path of surface water drainage



**Fig. 1. Aerial view of the Solid Waste Storage Areas and other sites on the Oak Ridge Reservation.**

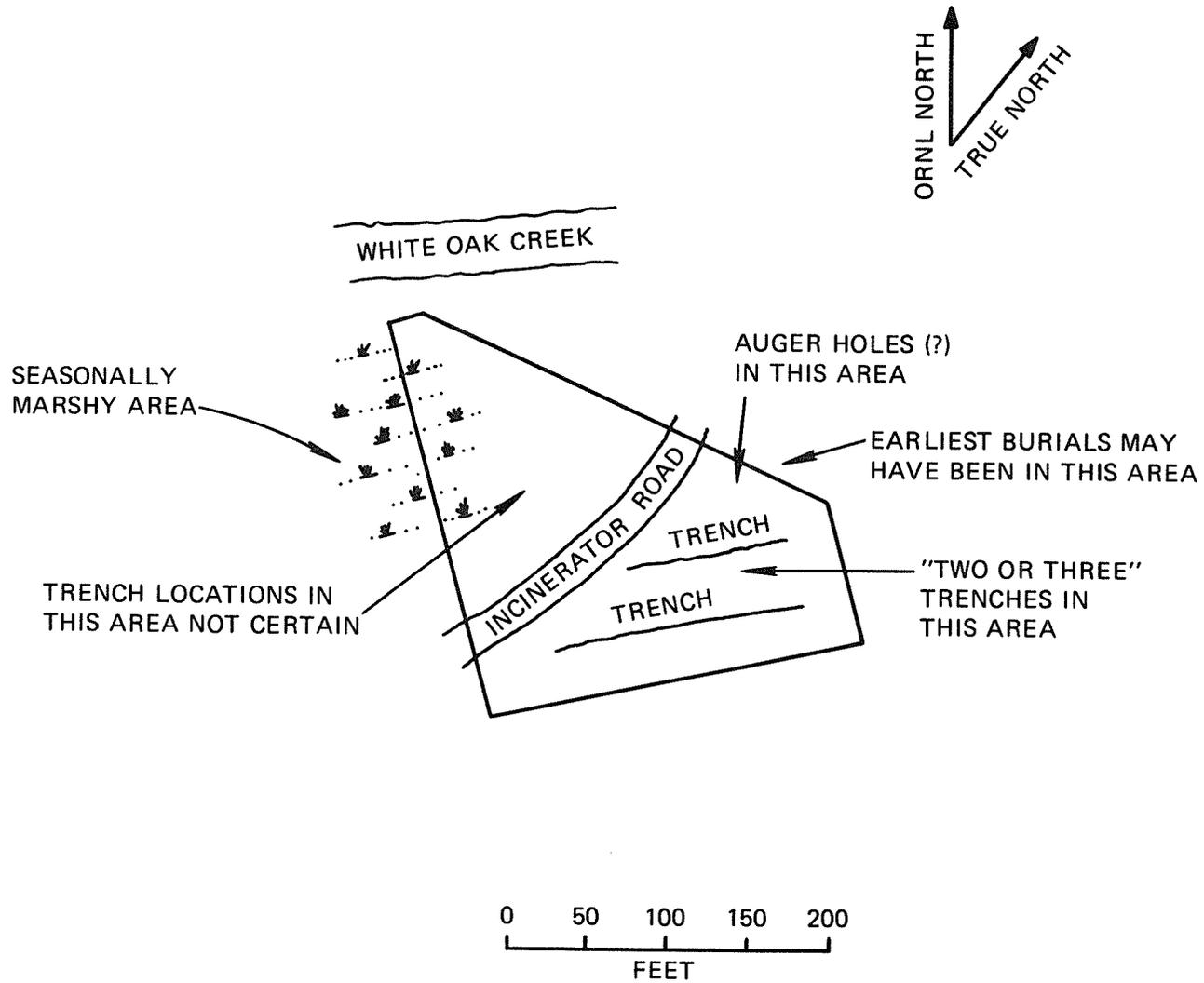


Fig. 2. Schematic diagram of SWSA 1 during operation (Bates, 1983).

from Haw Ridge to White Oak Creek, causing marshes to develop in the topographically low portions of the area following periods of heavy rains and wet seasons.<sup>5</sup>

The site probably was selected on the basis of its proximity to ORNL with no consideration given to the possibility that contaminants might leak into the nearby water system.<sup>6</sup> The site was commissioned in 1943 and closed in 1944.<sup>2</sup> The earliest record of burials dates from April 1944 when cans with red tops were placed in the 706-A Building for the collection of waste materials that could not be disposed of through the drains.<sup>7</sup> According to an oral account, the first cans were dumped in a long curving ravine at the foot of Haw Ridge.<sup>6</sup> Inspection of the topographic maps made in 1942 by the Stone and Webster Engineering Corporation suggests that this is the shallow depression that lies immediately east and outside of the area now designated as SWSA 1. According to another account, the cans were first placed in auger holes at the east end of SWSA 1.<sup>6</sup> Later, a small number of trenches were excavated to receive the waste.<sup>6</sup> The site was abandoned when water was found in an excavated trench in the northern section.<sup>8</sup> No records are available to show the quantity or type of waste in this burial ground,<sup>9,10</sup> but it is estimated that only 2000 to 4000 Ci of solid radioactive waste was buried there.<sup>4,10</sup>

In 1946 the site was surveyed for surface contamination. Seven soil samples were collected and analyzed for alpha activity. Only two areas had radioactive contamination above background levels.<sup>5</sup>

In 1975, Duguid analyzed water samples from two wells and one surface seep near SWSA 1.<sup>11</sup> One of the wells contained low concentrations of <sup>90</sup>Sr (0.4 dpm/mL), but SWSA 1 was not considered to be a major contributor of <sup>90</sup>Sr to White Oak Creek. The analysis further indicated that little or no <sup>137</sup>Cs was transported from the burial ground, and no transuranic elements were present in detectable quantities in the groundwater.<sup>11</sup>

SWSA 1 is currently surrounded by a metal chain and posts, grassed, and maintained by Operations Division personnel. An access road to the newly constructed High Temperature Materials Laboratory and the south parking lot passes through the area. Groundwater movement in the area is to White Oak Creek and is, therefore, monitored via the ORNL Stream Monitoring System.<sup>4</sup> An aerial view of SWSA 1 is shown in Fig. 3. Figures 4 and 5 are recent (August 1987) photographs of the site.

## SURVEY RESULTS

### BACKGROUND LEVELS

Typical radiation levels at ORNL sites vary because of past and present research and development activities, particularly those activities directly involved with radioactive materials. In February 1987, uncontaminated areas on the ORR were investigated for levels of external background gamma radiation. These data are presented in Table 1 for comparison with the present survey results. Figure 6 shows the locations of these background measurements. All gamma values presented in this report are gross readings; background radiation levels have not been subtracted.



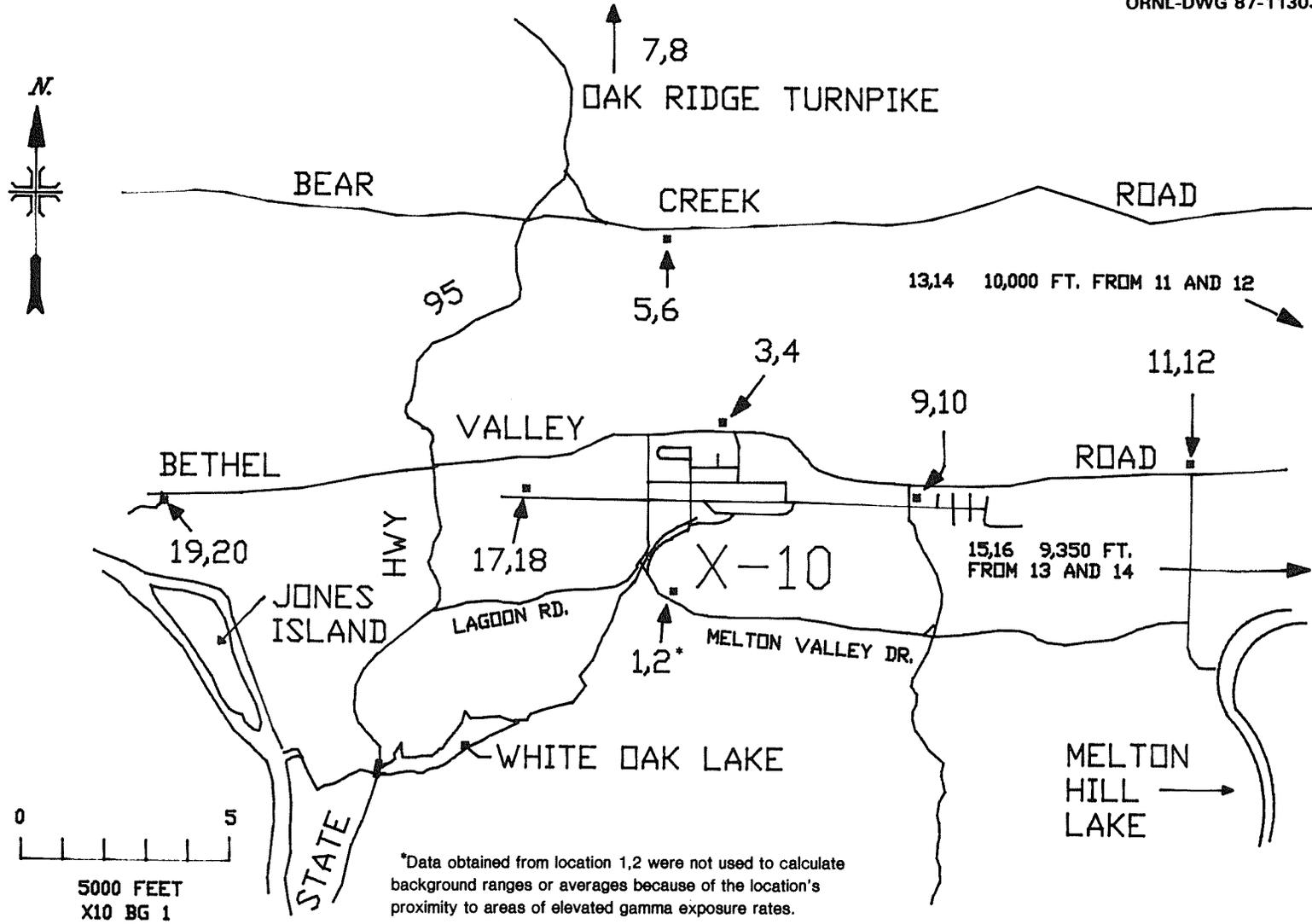
**Fig. 3. Aerial view of SWSA 1.**



**Fig. 4. View of SWSA 1 looking northwest (August 1987).**



**Fig. 5. View of SWSA 1 looking north (August 1987).**



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Fig. 6. Locations of gamma exposure rate measurements in uncontaminated areas on the Oak Ridge Reservation.  
 ■ Indicates measurement location and number (see Table 1 for exposure rates).

**Table 1. Background radiation levels measured in uncontaminated areas on the Oak Ridge Reservation**

| Type of radiation <sup>a</sup>   | Radiation level |         |
|--|-----------------|---------|
|  | Range           | Average |
| Gamma exposure rate at 1 m above ground surface ( $\mu\text{R}/\text{h}$ ) | 8-13            | 10      |
| Gamma exposure rate at ground surface ( $\mu\text{R}/\text{h}$ )           | 10-17           | 13      |

<sup>a</sup>Values were obtained from 18 measurements taken from 9 locations on the Oak Ridge Reservation. (See Fig. 6 for locations.)

## GAMMA EXPOSURE RATE MEASUREMENTS

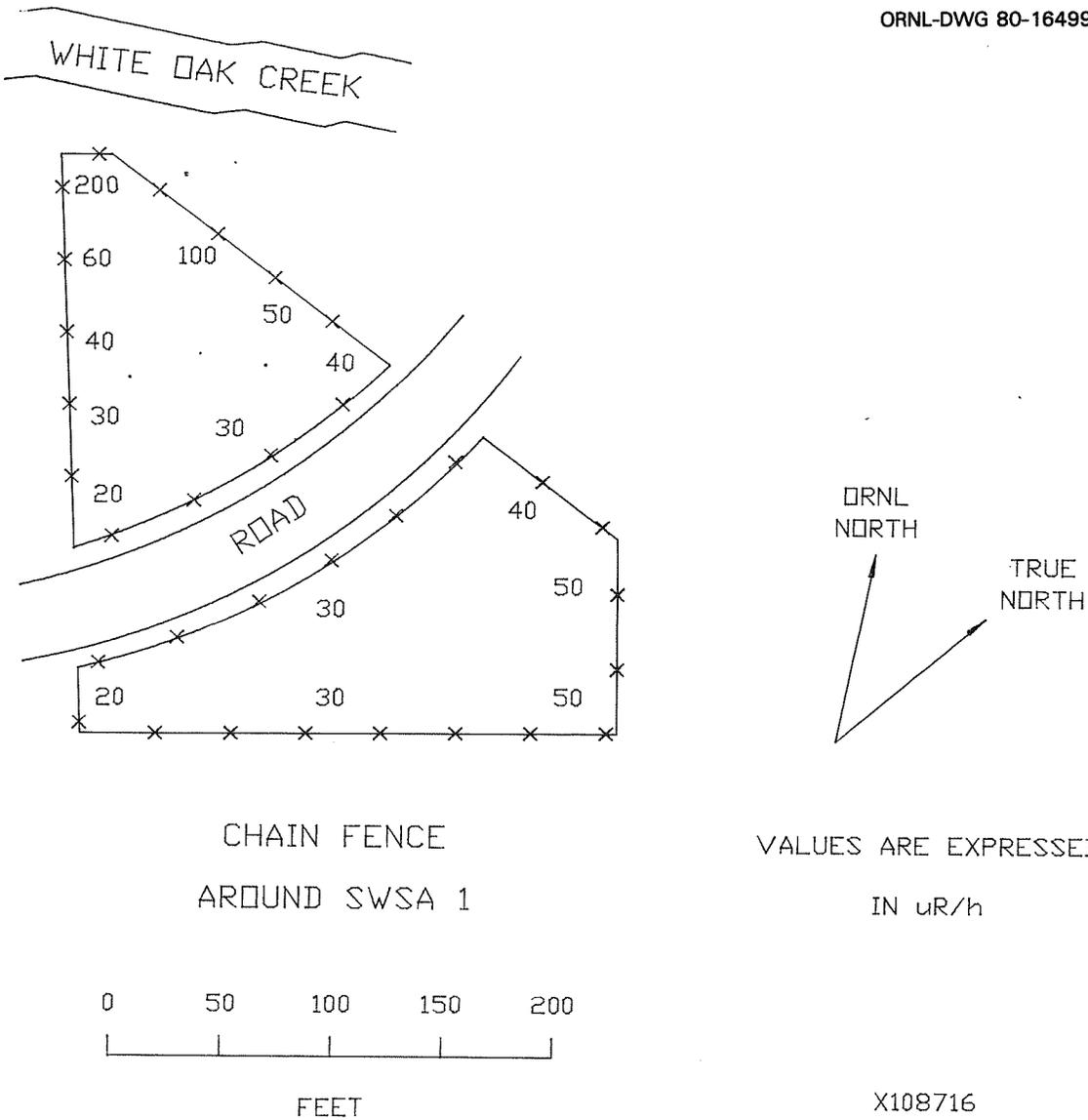
Gamma exposure rates at 1 m (3.3 ft) above the ground surface were significantly confounded by radiation emanating from nearby White Oak Creek. Surface measurements were taken to more accurately determine on-site radiation levels. The results of surface measurements are shown in Fig. 7. Generally, the scan of the surface revealed elevated gamma levels ranging from 20 to 200  $\mu\text{R}/\text{h}$ . For comparison, typical ORR background levels at the ground surface averaged 13  $\mu\text{R}/\text{h}$ . The highest gamma levels (200  $\mu\text{R}/\text{h}$ ) were found at the west end of SWSA 1 near White Oak Creek. Gamma levels up to 50  $\mu\text{R}/\text{h}$  were detected at the east end of SWSA 1.

## RECOMMENDATIONS FOR CORRECTIVE ACTIONS

Results from this survey show that most of the surface gamma radiation at SWSA 1 is due to radiation emanating from nearby White Oak Creek. Measurements of gamma levels determined that exposure rates at the surface were generally elevated above typical ORR background values (13  $\mu\text{R}/\text{h}$ ), ranging from 20 to 200  $\mu\text{R}/\text{h}$ .

Currently (12/15/87), a metal chain and posts (painted green) mark the perimeter of SWSA 1, with several "Radiation Hazard - Keep Out" signs attached. Based on ORNL Health Physics guidelines,<sup>12</sup> this type of radiation control measure is appropriate for the site. However, a few minor problems should be corrected. Some chain links with attached signs are separated from the metal posts and lie on the ground. Additionally, some portions of the chain are covered with brush, vines, etc. This vegetation should be cleared from the controlled area. No other surface-related problems (e.g., subsidence, bathtubting trenches) were observed at SWSA 1.

Of concern are the ongoing excavations at the southern boundary of SWSA 1. This activity may cause an increase in soil erosion, runoff, and subsequent leaching of buried



**Fig. 7. Surface gamma exposure rate measurements ( $\mu\text{R/h}$ ) at SWSA 1.**

contaminants. Although it is believed that mostly solid radioactive wastes are buried at SWSA 1, the possibility exists for contaminant leaching due to lateral and/or downslope surface runoff. Runoff control procedures (e.g., drainage ditches or culverts to divert surface water from SWSA 1) and land stabilization measures (e.g., revegetation) should be considered for excavated areas adjacent to SWSA 1.

Soil sampling and radionuclide analyses would be required to fully characterize the radiological status of SWSA 1 and determine the most appropriate methods for effective corrective and/or remedial measures. Maintaining institutional control of the site (for a specified period of time) would allow for the natural decay of radioactive materials. Periodic monitoring of surface soil and water, on-site vegetation, and groundwater is recommended.

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