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**HEALTH AND SAFETY RESEARCH DIVISION**

Waste Management Research and Development Programs  
(Activity No. AH 10 20 00 0; ONLWCO2)

**RESULTS OF THE INDEPENDENT VERIFICATION  
OF RADIOLOGICAL REMEDIAL ACTION AT  
196 SOUTH 2ND EAST STREET,  
MONTICELLO, UTAH (MS00135)**

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## ABSTRACT

In 1980 the site of a vanadium and uranium mill at Monticello, Utah, was accepted into the U.S. Department of Energy's (DOE's) Surplus Facilities Management Program, with the objectives of restoring the government-owned mill site to safe levels of radioactivity, disposing of or containing the tailings in an environmentally safe manner, and performing remedial actions on off-site (vicinity) properties that had been contaminated by radioactive material resulting from mill operations. During 1986, UNC Geotech, the remedial action contractor designated by DOE, performed remedial action on the vicinity property at 196 South 2nd East Street, Monticello, Utah. The Pollutant Assessments Group (PAG) of Oak Ridge National Laboratory was assigned the responsibility of verifying the data supporting the adequacy of remedial action and confirming the site's compliance with DOE guidelines. The PAG found that the site successfully meets the DOE remedial action objectives. Procedures used by PAG are described.

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**INTRODUCTION**

The mill at Monticello, Utah, was built in 1942 by the U.S. government through the Defense Plant Corporation to provide vanadium during World War II. Various government agencies operated the mill until 1947. In 1948 the Atomic Energy Commission (AEC) obtained the mill and operated it under contract through 1959 to provide both uranium and vanadium. Mill operations were terminated on January 1, 1960. In 1961 the mill tailings piles were leveled and graded, covered with rock and soil, and seeded with native grasses. During 1974 and 1975, the ore stockpiles were removed from the site, and the mill foundations were buried.

The Monticello mill site is a 78-acre tract along Montezuma Creek, south of the city of Monticello, in San Juan County, Utah. The site is bordered on the south and southeast by land held by the U.S. Bureau of Land Management. Other boundaries are the city of Monticello and private property.

During the AEC era, the mill processed approximately one million tons of uranium ore. Vanadium and uranium were the only substances extracted in the milling process. Other constituents of the ore remained in the tailings and were not separated prior to disposal. During the years of active mill operation, the mill tailings were normally moist, so erosion was minimal. However, throughout the mill's operating period, area residents used these tailings as fill material and as aggregate in mortar and concrete.

Under the authority of the Atomic Energy Act, the U.S. Department of Energy (DOE) initiated the Surplus Facilities Management Program (SFMP) in 1978 to ensure the safe caretaking and decommissioning of government facilities that had been retired from service but still had radioactive contamination. In 1980 the mill site at Monticello was accepted into the SFMP, and the Monticello Remedial Action Project (MRAP) was established to restore the government-owned mill site to safe levels of radioactivity, to dispose of or contain the tailings in an environmentally safe manner, and to perform remedial actions on off-site (vicinity) properties that had been contaminated by radioactive material resulting from mill operations. The Monticello mill site and the tailings remain in the custody of the DOE Grand Junction, Colorado, Projects Office. In 1983 remedial

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\*The verification of remedial action was performed by members of the Pollutant Assessments Group of the Health and Safety Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400 with Martin Marietta Energy Systems, Inc.

actions for vicinity properties were separated from MRAP with establishment of the Monticello Vicinity Properties (MVP) Project.<sup>1</sup>

During 1986, UNC Geotech, the remedial action contractor (RAC) designated by DOE, performed remedial action on the vicinity property that is the subject of this report, a private residence located at 196 South 2nd East Street, Monticello, Utah. The remedial action plan required excavation of all exterior contamination. When the excavation was completed, the property was resurveyed, including soil sampling, to ensure the removal of all contamination, backfilled with uncontaminated material, and restored to its original condition.<sup>2</sup>

The DOE adopted a policy to assign an independent contractor to verify the data supporting the adequacy of remedial action and to confirm the site's compliance with DOE guidelines. The Pollutant Assessments Group (PAG) of Oak Ridge National Laboratory (ORNL) has been assigned the responsibility of this task at the 196 South 2nd East Street site. This report describes the methods and results of that verification.

## PROCEDURES

### Objective

The objective of the verification activities was to confirm (1) that available documentation adequately and accurately describes the post-remedial-action radiological conditions of the entire property that is to be certified and (2) that the remedial action reduced contamination to within applicable DOE guidelines.

### Document Reviews

Review of the property completion report prepared by UNC Geotech<sup>2</sup> indicates the property was evaluated by the DOE on the basis of Environmental Protection Agency standards<sup>3</sup> and that excess residual radioactive materials were present. Thus it was appropriate to designate this property for remedial action.

The pre-remedial action survey performed by UNC Geotech identified 155 m<sup>3</sup> (203 yd<sup>3</sup>) of mill tailings 15 to 30 cm (6 to 12 in.) deep. However, during the actual removal process, some residual radioactive material was left in place to avoid damage to a mature tree. A total of 153 m<sup>3</sup> (200 yd<sup>3</sup>) of contaminated earth and uranium mill tailings, 20 to 46 cm (8 to 18 in.) deep, were removed.

A post-excavation survey performed by UNC Geotech, consisting of a surface gamma scan with a scintillometer and soil sampling, was performed prior to backfilling of the excavated area. Each 9.3-m<sup>2</sup> (100-ft<sup>2</sup>) grid block involved in the excavation was sampled, and these samples were blended to form six composite soil samples, representing an average over the designated areas.

## VERIFICATION OF REMEDIAL ACTION

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. Applicable DOE guidelines for protection against radiation are given in Table 1.

### Gamma Measurements

Surface gamma exposure rate measurements taken by UNC Geotech from the excavated areas prior to backfilling ranged from 15 to 26  $\mu\text{R/h}$ .

### Soil Sample Analysis

Soil samples were taken by UNC Geotech from the excavated area prior to backfilling. These samples were blended to form six composite soil samples representative of the designated areas. These samples were analyzed by UNC Geotech to determine the concentration of  $^{226}\text{Ra}$ . Concentrations of  $^{226}\text{Ra}$  ranged from 1.6 to 4.3 pCi/g and averaged 3.3 pCi/g. These concentrations are well below the guideline values for surface and subsurface soils (5 and 15 pCi/g, respectively) given in Table 1. An additional surface composite sample (ORNL sample No. X7, Table 2) was taken at the location of residual radioactive material left in place to avoid damage to a mature tree. This sample revealed a  $^{226}\text{Ra}$  concentration of 11.9 pCi/g. When averaged over a 100-m<sup>2</sup> surface area (using a background  $^{226}\text{Ra}$  value of 2.0 pCi/g), this reduces to an average concentration of 3.4 pCi/g, which is within the guidelines given in Table 1. The UNC Geotech soil samples were obtained by ORNL PAG, and a confirmatory analysis was performed. Results of UNC Geotech and ORNL soil sample analyses are given in Table 2.

### Radon Measurement Results

Radon decay-product concentration measurements for this site were determined by the alpha-track method. To monitor radon levels, UNC Geotech placed three Terradex Track Etch<sup>®</sup> detectors on the ground floor of the house for a period of one year (from 11-6-86 to 11-6-87). The average annual working level (WL) of radon progeny concentration, as determined by the Terradex Corporation, was 0.007. This value is below the guideline of 0.03 WL given in Table 1.

## CONCLUSION

Results of UNC Geotech soil sample analysis and confirmatory split soil sample analysis by ORNL show that radionuclide concentrations are within applicable DOE guidelines.

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<sup>®</sup>Track Etch is a registered trademark of Terradex Corporation.

Based upon the results of the post-remedial-action data, which are confirmed by the verification assessment data, these radiological measurements fall below the limits prescribed by DOE guidelines. It is concluded that the site successfully meets the DOE remedial action objectives.

## REFERENCES

1. M. W. Smuin, D. B. Ertel, and H. A. Pfuderer, *Verification of Remedial Actions on Vicinity Properties in Monticello, Utah*, Oak Ridge National Laboratory, ORNL-6556 (Draft), May 1989.
2. UNC Geotech, *Property Completion Report for Monticello Vicinity Property Remedial Action for DOE ID NO: MS-00135-RS, Address: 196 South Second East Street, Monticello, Utah 84535*, UNC Geotech, Grand Junction, Colorado, January 1988.
3. *Guidelines for Residual Radioactivity at Formerly Utilized Sites, Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, U.S. Department of Energy, March 1987.

Table 1. Applicable guidelines for protection against radiation

Mode of exposure	Exposure conditions	Guideline value
Radionuclide concentrations in soil	Maximum permissible concentration of the following radionuclides in soil above background levels, averaged over a 100-m <sup>2</sup> area <sup>226</sup> Ra	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm-thick soil layers more than 15 cm below the surface
Exposure to <sup>222</sup> Rn progeny	Average annual radon progeny concentration (including background)	0.03 WL

Source: Adapted from *Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, Rev. 2, U.S. Department of Energy, March 1987.

Table 2. Results of ORNL analysis of UNC Geotech soil samples from 196 South 2nd East Street, Monticello, Utah (MS00135)

ORNL sample No. <sup>a</sup>	UNC Geotech sample No. <sup>b</sup>	Depth (cm)	<sup>226</sup> Ra concentration (pCi/g)	
			ORNL	UNC Geotech
X1	MMU189	15-30	4.3	4.3
X2	MMU190	15-30	2.7	2.6
X3	MMU191	15-30	3.7	3.7
X4	MMU192	15-30	3.4	3.3
X5	MMU193	15-30	3.4	4.0
X6	MMU194	15-30	1.7	1.6
X7	MMU211 <sup>c</sup>	0-15	10.8	11.9

<sup>a</sup>An X-type sample is a split of the sample taken by the remedial action contractor.

<sup>b</sup>Soil samples were taken at each 9.3-m<sup>2</sup> (100-ft<sup>2</sup>) grid block and blended to form composite soil samples, which are representative of the designated areas.

<sup>c</sup>Individual soil sample of residual radioactive material left in place at grid coordinate 243208.