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**RESULTS OF THE INDEPENDENT VERIFICATION
OF RADIOLOGICAL REMEDIAL ACTION AT
280 SOUTH 3RD EAST STREET,
MONTICELLO, UTAH (MS00099)**

J. W. Crutcher and M. J. Wilson

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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 1985 and 1986, UNC Geotech, the remedial action contractor designated by DOE, performed remedial action on the vicinity property at 280 South 3rd 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 actions for vicinity

*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.

properties were separated from MRAP with establishment of the Monticello Vicinity Properties (MVP) Project.¹

During 1985 and 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 280 South 3rd East Street, Monticello, Utah. The remedial action plan required excavation of all exterior and interior 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.²

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 280 South 3rd 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 Geotech² indicates the property was evaluated by the DOE on the basis of Environmental Protection Agency standards³ 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 470 m³ (615 yd³) of mill tailings 15 to 30 cm (6 to 12 in.) deep. However, during the actual removal process, a total of 597 m³ (781 yd³) of contaminated earth and uranium mill tailings, 25 to 41 cm (10 to 16 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 areas. Samples representative of the bottom 15-cm (6-in.) soil layers of the excavated areas were taken, and these samples were blended to form 16 composite soil samples, which represent an average over the verification 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

Exterior surface gamma exposure rate measurements taken by UNC Geotech from the excavated areas prior to backfilling ranged from 14 to 25 $\mu\text{R/h}$. Interior surface gamma exposure rate measurements ranged from 12 to 15 $\mu\text{R/h}$ for the remediated portion of the basement and from 11 to 15 $\mu\text{R/h}$ for the rest of the basement.

Soil Sample Analysis

Soil samples representative of the excavated areas were taken by UNC Geotech prior to backfilling. These samples were collected from the bottom 15-cm (6-in.) soil layers and were blended to form 16 composite soil samples representative of an average over the exterior verification areas. Analysis by UNC Geotech of these composite samples revealed ^{226}Ra concentrations ranging from 1.0 to 4.6 pCi/g. At the request of the property owner, residual radioactive materials were left in place around mature fruit trees. Five individual soil samples were taken of this material, revealing ^{226}Ra concentrations ranging from 10 to 12 pCi/g. When averaged over a 100-m² area (as specified by DOE guidelines in Table 1), this resulted in average concentrations from 2.2 to 2.8 pCi/g. These 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 (RDC) measurements for this site were determined by the alpha-track method. To monitor radon levels, UNC Geotech placed three Terradex Track Etch[®] detectors in the basement of the house located on this property for a period of approximately 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 0.009, a value well below the 0.03-WL guideline 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.

[®]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-00099-RS, Address: 280 South Third East Street, Monticello, Utah 84535*, UNC Geotech, Grand Junction, Colorado, April 1989.
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 ² area ²²⁶ 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 ²²² 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 280 South 3rd East Street, Monticello, Utah (MS00099)

ORNL sample No. ^a	UNC Geotech sample No. ^b	Depth (cm)	²²⁶ Ra concentration (pCi/g)	
			ORNL	UNC Geotech
X1	MMU221	15-30	1.0	1.0
X2 ^c	MMU222 ^c	0-15	11	12
X3	MMU223	15-30	1.0	1.2
X4	MMU224	15-30	1.0	1.2
X5	MMU225	15-30	1.2	1.4
X6 ^c	MMU251 ^c	0-15	9.7	11
X7	MMU252	15-30	1.5	1.8
X8	MMU253	15-30	1.2	1.2
X9	MMU254	15-30	2.0	2.1
X10	MMU255	15-30	2.8	3.0
X11	MMU256	15-30	1.9	2.1
X12	MMU258	15-30	1.5	1.9
X13 ^c	MMU259 ^c	0-15	9.1	11
X14 ^c	MMU260 ^c	0-15	9.3	10
X15 ^c	MMU261 ^c	0-15	9.8	11
X16	MMU262	15-30	2.8	3.2
X17	MMU263	15-30	1.6	1.8
X18	MMU264	15-30	3.0	3.3
X19	MMU265	15-30	2.2	2.5
X20	MMU266	15-30	3.8	4.3
X21	MMU267	15-30	4.0	4.6

^aAn X-type sample is a split of the sample taken by the remedial action contractor.

^bSoil samples representative of the bottom 15-cm (6-in.) soil layers of the excavated areas were taken by UNC Geotech, and these samples were blended to form composite soil samples, which represent an average over the verification areas.

^cComposite soil samples were taken of residual radioactive materials left in place around trees.

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