

LEGIBILITY NOTICE

A major purpose of the Technical Information Center is to provide the broadest dissemination possible of information contained in DOE's Research and Development Reports to business, industry, the academic community, and federal, state and local governments.

Although a small portion of this report is not reproducible, it is being made available to expedite the availability of information on the research discussed herein.

HEALTH AND SAFETY RESEARCH DIVISION

Nuclear and Chemical Waste Programs
(Activity No. AH 10 15 01 0; ONLWCO2)

**RESULTS OF THE INDEPENDENT VERIFICATION
OF RADIOLOGICAL REMEDIAL ACTION AT
381 EAST 3RD SOUTH STREET,
MONTICELLO, UTAH (MS00140)**

J. W. Crutcher and M. W. Smuin

Date Published — October 1989

Work performed by the
POLLUTANT ASSESSMENTS GROUP

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831-6285
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC05-84OR21400

MASTER

CONTENTS

LIST OF TABLES	v
ACKNOWLEDGMENTS	vii
ABSTRACT	ix
INTRODUCTION	1
PROCEDURES	2
Objective	2
Document Reviews	2
VERIFICATION OF REMEDIAL ACTION	3
Gamma Measurements	3
Soil Sample Analysis	3
CONCLUSION	3
REFERENCES	4

LIST OF TABLES

1	Applicable guidelines for protection against radiation	5
2	Results of ORNL analysis of UNC Geotech soil samples from 381 East 3rd South Street, Monticello, Utah (MS00140)	6

ACKNOWLEDGMENTS

Research for this project was sponsored by the Division of Facility and Site Decommissioning Projects, U.S. Department of Energy. The authors wish to acknowledge G. A. Pierce for analysis of soil samples; D. T. Redding, S. M. Smith, and M. E. Mumby for technical reviews; and J. K. Williams and R. F. Carrier for valuable recommendations regarding the content and structure of the document.

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 381 East 3rd South 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.

**RESULTS OF THE INDEPENDENT VERIFICATION
OF RADIOLOGICAL REMEDIAL ACTION
AT 381 EAST 3RD SOUTH STREET,
MONTICELLO, UTAH (MS00140)***

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

*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.

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 381 East 3rd South 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.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 381 East 3rd South 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 167.4 m³ (219 yd³) of mill tailings from 15 to 46 cm (6 to 18 in.) deep. After the removal process had been initiated, previously unidentified contamination was found. A total of 251.5 m³ (329 yd³) of contaminated earth and uranium mill tailings, from 20 to 71 cm (8 to 28 in.) deep, were removed.

The original radiological assessment of the site identified possible contamination in an area in the crawl space of the mobile home located on this property. A soil sample was taken at the location of the highest gamma exposure rate. Analysis of the soil sample revealed a ²²⁶Ra concentration of 6.1 pCi/g. Because a mobile home is a movable structure, criteria for radionuclide concentrations in soil were applicable. The concentration of 6.1 pCi/g did not exceed the 5 pCi/g above background specified by DOE guidelines (background ²²⁶Ra concentration is ~2 pCi/g).² Additional gamma exposure rate measurements were taken, which indicated no contamination. As a precaution against

the possible buildup of radon gas, the skirting around the mobile home's crawl space was ventilated.

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. Samples were taken at each 9.3-m² (100-ft²) grid block in the area of excavation, and these samples were blended to form 11 composite soil samples.

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 24 $\mu\text{R/h}$. UNC Geotech measurements taken in the crawl space of the mobile home ranged from 14 to 18 $\mu\text{R/h}$.

Soil Sample Analysis

Soil samples representative of the 15-cm (6-in.) thick soil layer at the bottom of the excavation were taken by UNC Geotech prior to backfilling. These samples were blended to form 11 composite samples that were analyzed by UNC Geotech to determine the concentration of ²²⁶Ra. Concentration of ²²⁶Ra ranged from 1.2 to 4.5 pCi/g and averaged 2.1 pCi/g. One soil sample was taken at the location of the highest gamma exposure rate measurement in the crawl space of the mobile home. The ²²⁶Ra concentration was 6.1 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.

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.

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-00140-RS, Address: 381 East Third South 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 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

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 381 East 3rd South Street, Monticello, Utah (MS00140)

ORNL sample No. ^a	UNC Geotech sample No. ^b	Depth (cm)	²²⁶ Ra concentration (pCi/g)	
			ORNL	UNC Geotech
X1	MMV279	15-30	1.5	1.6
X2	MMV280	15-30	1.6	1.8
X3	MMV281	15-30	1.1	1.5
X4	MMV291	15-30	1.8	2.0
X5	MMV292	15-30	1.0	1.2
X6	MMV293	15-30	2.4	2.5
X7	MMV294	15-30	3.0	3.4
X8	MMV295	15-30	1.3	1.4
X9	MMV296	15-30	1.5	1.6
X10	MMV297	15-30	1.7	2.0
X11	MMV298	15-30	4.8	4.5
X12	MMV290	15-30	6.0	6.1

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

^bSoil samples were taken by UNC Geotech at each 9.3-m² (100-ft²) grid block and blended to form composite soil samples, which are representative of the designated areas.