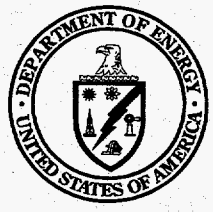
DOE/ID/12584–276
GJPO–GJ–36

U.S. Department of Energy
Grand Junction Projects Office Remedial Action Project

Final Report of the Decontamination and Decommissioning of Building 1 at the Grand Junction Projects Office Facility

August 1996



U.S. Department of Energy
Grand Junction Projects Office

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GJPO–GJ–36

Grand Junction Projects Office Remedial Action Project

Final Report of the Decontamination and Decommissioning of Building 1 at the Grand Junction Projects Office Facility

August 1996

Prepared for
U.S. Department of Energy
Albuquerque Operations Office
Grand Junction Projects Office

Prepared by
Rust Geotech
Grand Junction, Colorado

Technical Coordination and Reports Project Number TCR–031–0009–00–000
Technical Coordination and Reports Document Number T00025AB

Rust Geotech has been granted authorization to conduct remedial action under the Decontamination and Decommissioning Program. Remedial action was conducted in accordance with all applicable or relevant and appropriate requirements.

Work Performed Under DOE Contract No. DE–AC04–86ID12584
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Abstract

The U.S. Department of Energy (DOE) Grand Junction Projects Office (GJPO) occupies a 61.7-acre facility along the Gunnison River near Grand Junction, Colorado. This site was contaminated with uranium ore and mill tailings during uranium refining activities of the Manhattan Engineer District and during pilot milling experiments conducted for the U.S. Atomic Energy Commission's domestic uranium procurement program. The DOE Defense Decontamination and Decommissioning Program established the GJPO Remedial Action Project to clean up and restore the facility lands, improvements, and the underlying aquifer. The site contractor for the facility, Rust Geotech, also is the remedial action contractor.

Building 1 was found to be radiologically contaminated and was demolished in 1996. The soil beneath and adjacent to the building was remediated in accordance with identified standards and can be released for unlimited exposure and unrestricted use. This document was prepared in response to a DOE request for an individual final report for each contaminated GJPO building.

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Acronyms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*U.S. Code of Federal Regulations*
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
FUSRAP	Formerly Utilized Sites Remedial Action Program
GJPO	Grand Junction Projects Office
GJPORAP	Grand Junction Projects Office Remedial Action Project
IVC	independent verification contractor
LTSM	long-term surveillance and maintenance
QA	quality assurance
RAC	remedial action contractor
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SFMP	Surplus Facilities Management Program
U.S.C.	United States Code
V-area	verification area

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I. Introduction and Background

This report summarizes the results of the remedial action conducted on Building 1 at the U.S. Department of Energy Grand Junction Projects Office (DOE–GJPO) facility. Radiological contaminated was identified on the concrete foundation and floor of this building and asbestos was used extensively in its construction. Because the building was approaching obsolescence and the potential for additional contamination was high, it was demolished in 1996. The soil within the building footprint complies with applicable regulations and can be released for unrestricted use and unlimited exposure. After all Grand Junction Projects Office Remedial Action Project (GJPORAP) remedial action is completed, the facility is expected to be transferred to the Long-Term Surveillance and Maintenance (LTSM) Program to allow restoration of the aquifer. The remediation of the exterior land areas and the other buildings and associated utilities on the DOE–GJPO facility will be summarized in separate reports.

Description of Facility

The DOE–GJPO facility is located approximately 0.6 mile (1 kilometer) south and west of populated areas of the city of Grand Junction in Sections 26 and 27, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado (Figure 1). The facility occupies 61.7 acres* (25 hectares) of floodplain within an accretionary bend along the east bank of the Gunnison River.

The elevation of the DOE–GJPO facility is approximately 4,560 feet (1,390 meters). The facility is situated on silty sandy gravel underlain by mudstone bedrock. Two bodies of water with associated wetlands are located on the facility: the North Pond and the South Pond. A freshwater alluvial aquifer underlying the facility is in direct hydraulic contact with the ponds and the Gunnison River. A semiarid climate prevails.

Access to the occupied portion of the facility is restricted by security personnel and a fence. There are approximately 40 structures on the facility. Beyond the fence are vehicle parking lots to the east and an earthen dike along the Gunnison River to the west and north. The area adjacent to the facility to the north was formerly Black Bridge Park, now owned by DOE. The facility is bordered on the east by the Southern Pacific Railroad (formerly the Denver and Rio Grande Western Railroad) right-of-way.

DOE–GJPO facility lands were acquired by the U.S. War Department in 1943 for the Manhattan Engineer District. A refinery was operated on the site from 1943 to 1946 to treat and concentrate uranium oxide. The U.S. Atomic Energy Commission operated a uranium-concentrate sampling plant and assay laboratory on the site until 1974. Pilot-scale uranium ore mills were operated from 1953 to 1958, processing 30,000 tons (27,200 metric tons) of ore (DOE 1987a). Mill operations were the primary source of contaminated materials at the DOE–GJPO facility, resulting in the on-site burial of approximately 247,000 cubic yards (yd^3), or 189,000 cubic meters (m^3), of uranium ore tailings. Other potential sources of contamination included laboratory and vehicle-maintenance wastes and byproducts, and activities related to sampling and stockpiling uranium concentrates. Approximately 22 acres (8.9 hectares) of open land and 19 buildings were contaminated.

Description of Project

In 1984, the DOE–GJPO facility was accepted into the DOE Surplus Facilities Management Program (SFMP) for the purpose of eliminating health hazards resulting from uranium mill tailings and associated contaminated materials at the facility; and to bring contaminated portions of the facility, including the underlying aquifer, into compliance with applicable environmental regulations. In 1988, the facility was transferred to the DOE Decontamination and Decommissioning (D&D) Program. The D&D Program is responsible for the surveillance and maintenance of surplus

*Previous to the reacquisition of Black Bridge Park, the facility occupied approximately 56.4 acres.

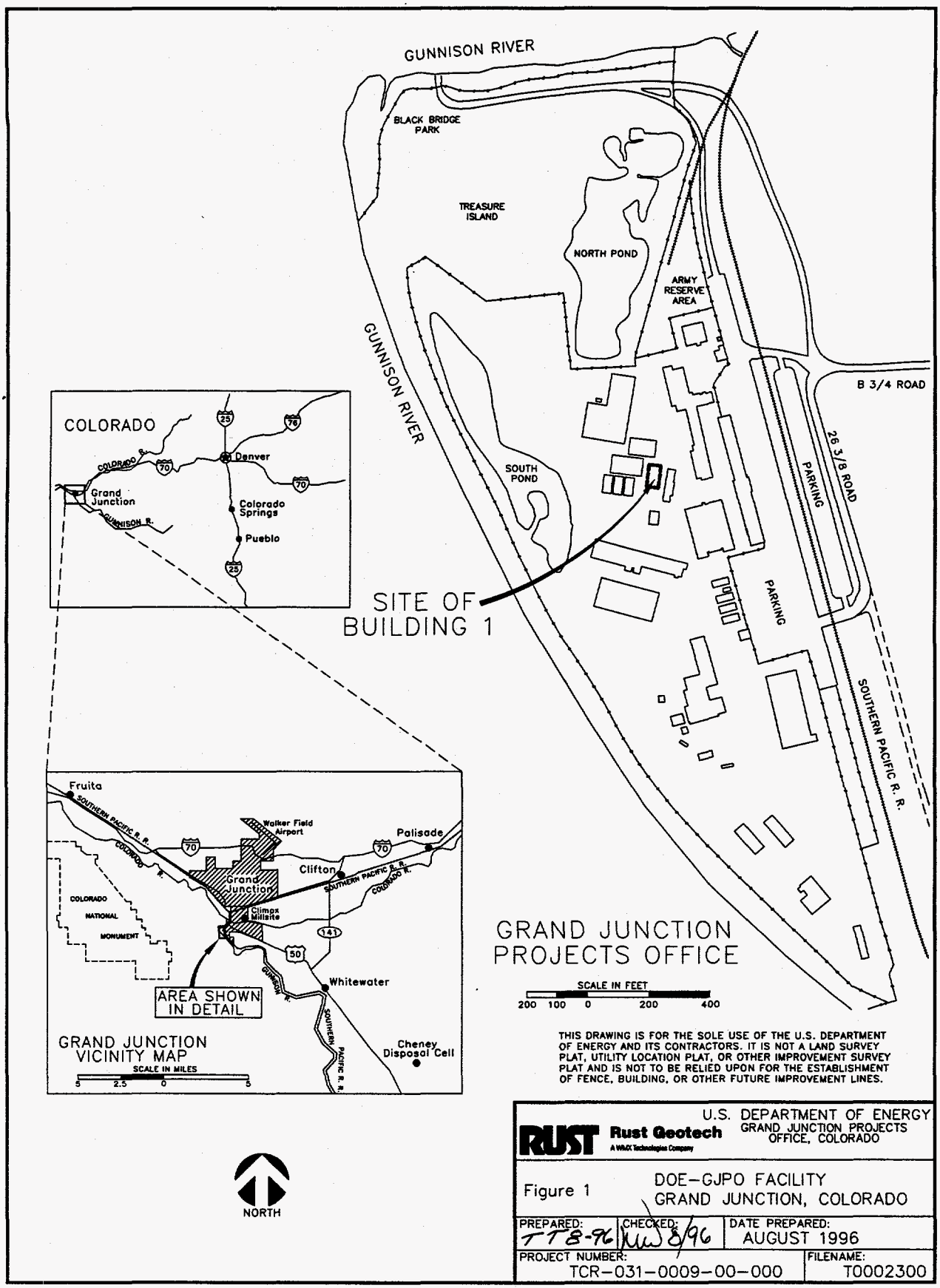

Figure 1. Site Map of the DOE–GJPO Facility, Grand Junction, Colorado

DOE facilities and performance of any necessary decontamination and decommissioning activities. DOE–GJPO has specific responsibility for GJPORAP under the D&D Program. Rust Geotech is the Remedial action contractor (RAC) for GJPORAP. The GJPORAP organization and implementation strategy was defined in the *Grand Junction Projects Office Remedial Action Project Remedial Action Plan* (DOE 1990c).

Description of Building 1

Building 1 was a steel frame structure with asbestos cement board siding and roof panels and a concrete floor and stem wall foundation. An annex was constructed on the south side with a wood frame, metal siding, and a shingle roof. The approximately 2,800 square feet (260 square meters [m^2]) building was constructed in 1943 as a part of the larger refinery structure to house boilers. All other portions of the refinery were removed during the 1950s, leaving only the boiler house and the annex. Subsequently, the building contained the steam boilers and backup generator for the facility. Steam pipe trenches extended from Building 1 to other structures on the facility. The two boilers and an above-ground diesel fuel tank located west of Building 46 were removed in 1995.

Basis for Remedial Action

In 1980, the U.S. Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 *United States Code* [U.S.C.] 9601). In 1986, Congress amended CERCLA with the Superfund Amendments and Reauthorization Act (SARA). Section 120 of SARA and Executive Order 12580, *Superfund Implementation*, directed DOE to coordinate with the U.S. Environmental Protection Agency to respond to actual or potentially imminent releases of hazardous substances into the environment at federally owned DOE facilities. D&D Program policy specifies that remedial action will be conducted in accordance with DOE Order 5480.1B, *Environment, Safety, and Health Program for Department of Energy Operations*, and all other applicable environmental regulations.

The DOE–GJPO facility was evaluated using the CERCLA Hazard Ranking System. Although the resulting score of 14.6 (DOE 1989b) did not qualify the facility for placement on the National Priorities List, remedial action under GJPORAP conformed to the applicable provisions of CERCLA, as amended by SARA, the Uranium Mill Tailings Radiation Control Act (42 U.S.C. 7901), the National Environmental Policy Act (42 U.S.C. 4321), and other applicable Federal and State regulations. Remedial action was conducted with an emphasis on maintaining all health and safety risks as low as reasonably achievable.

II. Decommissioning Criteria, Objectives, and Work Scope

Applicable Guidelines and Standards

Table 1 presents the guidelines that specify the authorized limits for GJPORAP. Remedial action activities were conducted in accordance with the Rust *Quality Assurance* [QA] *Manual* (Manual 101) and approved plans and procedures (Appendix A), which incorporate the applicable provisions of Title 10, *U.S. Code of Federal Regulations*, Part 830, Section 120 (10 CFR 830.120), "Quality Assurance Requirements."

III. Work Performed

Remedial Investigation/Feasibility Study and Record of Decision

The Remedial Investigation/Feasibility Study–Environmental Assessment for GJPORAP was released in 1989 (DOE 1989a). Building 1 was not included in this study because it was outside the original scope of GJPORAP. Consequently, remediation of this building was not addressed in the Record of Decision (ROD) (DOE 1990a).

Post-ROD Changes—An Explanation of Significant Differences will be prepared at the conclusion of GJPORAP remedial action

activities to address departures from the ROD, including the demolition of Building 1.

Characterization

The gamma exposure rate was measured in Building 1 in 1982 and the roof was surveyed in 1992. Building 1 was included in the 1993 comprehensive survey of the structures at the DOE–GJPO facility. In 1995, the excavation for replacement of a water line on the south and east sides of the building was investigated for nonradiological contamination; none was identified (Rust 1995c). Also in 1995, the foundation, floor slab, and underlying soil were characterized using gamma and beta-gamma surveys, borehole logging, and soil sample analysis.

Radiological Contamination—The gamma exposure rate in Building 1 was 12 microroentgens per hour (μR/h) (DOE 1982). Fixed beta-gamma contamination ranging as high as 2,197 disintegrations per minute per 100 square centimeters (dpm/100 cm²) was identified on the roof (Chem–Nuclear Geotech, Inc. 1992). Fixed beta-gamma activity of up to 110,550 dpm/100 cm² was detected on the auxiliary generator, and elevated beta-gamma activity was detected beneath the asbestos cement board siding (Chem–Nuclear Geotech, Inc. 1993). No contamination was detected in the soil but fixed beta-gamma surface activities as high as 48,240 dpm/100 cm² were detected on exposed and buried concrete surfaces (Rust 1995a, 1995b)

Nonradiological Contamination—Asbestos abatement occurred in 1988. One of the boilers was filled with concrete to fix friable asbestos and disposed at the Mesa County Landfill in 1995. Additional asbestos was identified in window putty, floor mastic, boiler gaskets, pipe insulation, and asbestos cement board siding.

Remedial Design

The remedial design for demolishing Building 1 called for dismantling the structure and, as a separate contract activity, removing the concrete foundation and floor slab. The soil area between Building 1 and Building 2 was excavated to access buried utilities suspected to be contaminated. Any contaminated underground utilities encountered during remedial action were removed. Uncontaminated concrete more than 4 feet beneath the final grade was buried in place. All materials were surveyed and uncontaminated materials were unconditionally released for salvage or for disposal at the Mesa County Landfill (one of the boilers was unconditionally released and sold in 1995). Radiologically contaminated materials were disposed at the Cheney Disposal Cell. After the removal of uranium mill tailings and other

Table 1. Applicable or Relevant and Appropriate Standards

Type of Occurrence	Standard
Contamination in Soil	40 CFR 192[a] FUSRAP/SFMP Guidelines[b] DOE Order 5400.5[c]
Surface Activity (structural surfaces)	FUSRAP/SFMP Guidelines[b] DOE Order 5400.5[c]
Gamma Exposure Rate (interior areas only)	40 CFR 192[a] FUSRAP/SFMP Guidelines[b] DOE Order 5400.5[c]
Radon Decay-Product Concentration (interior areas only)	40 CFR 192[a] FUSRAP/SFMP Guidelines[b] DOE Order 5400.5[c]

[a]40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings."
[b]*Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program* [FUSRAP] *and Remote Surplus Facilities Management Program Sites* (DOE 1987b).
[c]DOE Order 5400.5, *Radiation Protection of the Public and the Environment.*

associated contaminated material, the remediated area was reconstructed.

Building 1 was determined to not have historical significance and was exempt from National Historic Preservation Act requirements for documentation.

Decontamination Operations

Summary of Remedial Action—Assessed contamination in the exterior areas adjacent to Building 1 was remediated in 1989 during Construction Phase IB.

The above-ground structure of Building 1 was disassembled in January 1996. The concrete slab, foundation, utilities, and associated soil were removed in April 1996. The remediation process involved removing the asbestos cement board panels and metal siding, disassembling the steel and wood frame, and breaking up the foundation and floor slab. Contaminated materials were hauled by truck to the Cheney Disposal Cell. The portion of an underground utility room more than 4 feet below final grade, an abandoned steam pipe trench, and several concrete support blocks were found to be free of radiological contamination and were buried in place. Other uncontaminated materials were surveyed and unconditionally released in accordance with the Rust *Health and Safety Desktop Procedures Manual* (Manual 303) and either salvaged or disposed at the Mesa County Landfill. Asbestos-containing sealant was identified on an unearthed septic tank. The sealant and the windows with the asbestos-containing putty were found to be free of radiological contamination and were disposed at the Mesa County Landfill.

Radiological Contamination—Radiologically contaminated building debris and soil were removed from the area of Building 1, as indicated by the results of soil sample analyses and gamma exposure rate scans (Appendix B, Tables B–1 through B–3). The contaminated building debris was found to have fixed beta-gamma surface contamination in previously inaccessible areas ranging as high as 670,000 dpm/100 cm^2 and fixed alpha contamination of up to 7,380 dpm/100 cm^2. No removable surface contamination was detected (Rust 1996a).

Uranium was identified in soil beneath the west stem wall of Building 2. This material was left in place to avoid damaging the foundation of the building and will be removed as a separate remedial action.

Radiological Contamination with Associated Nonradiological Contaminants—Asbestos cement board panels, and asbestos-containing floor mastic was disposed at the Cheney Disposal Cell.

IV. Final Release Survey

The final status survey of the soil underlying the location of Building 1 was conducted in accordance with the *Survey Plan for Releasing the Buildings at the Grand Junction Projects Office for Unrestricted Use* (DOE 1995), as modified in October 1995 (Rust 1995d).

The excavated area around Building 1 was classified as an affected area because of the potential for contamination in the soils and utilities underlying the building. One survey unit of 830 m^2 was established, consisting of the postremediation soil surface. The remediated area is shown in Figure 2.

Oak Ridge National Laboratory at Grand Junction was the independent verification contractor (IVC) for GJPORAP. Oversight activities were conducted by representatives of the RAC QA group and the Colorado Department of Public Health and Environment.

Instrumentation

Radiation detection instruments were calibrated and used in accordance with the Rust *Field Assessments Procedures Manual*. The instruments were checked for current calibration and proper operation before and after each survey. Calibrations used traceable standards and complied with 10 CFR 835, "Occupational

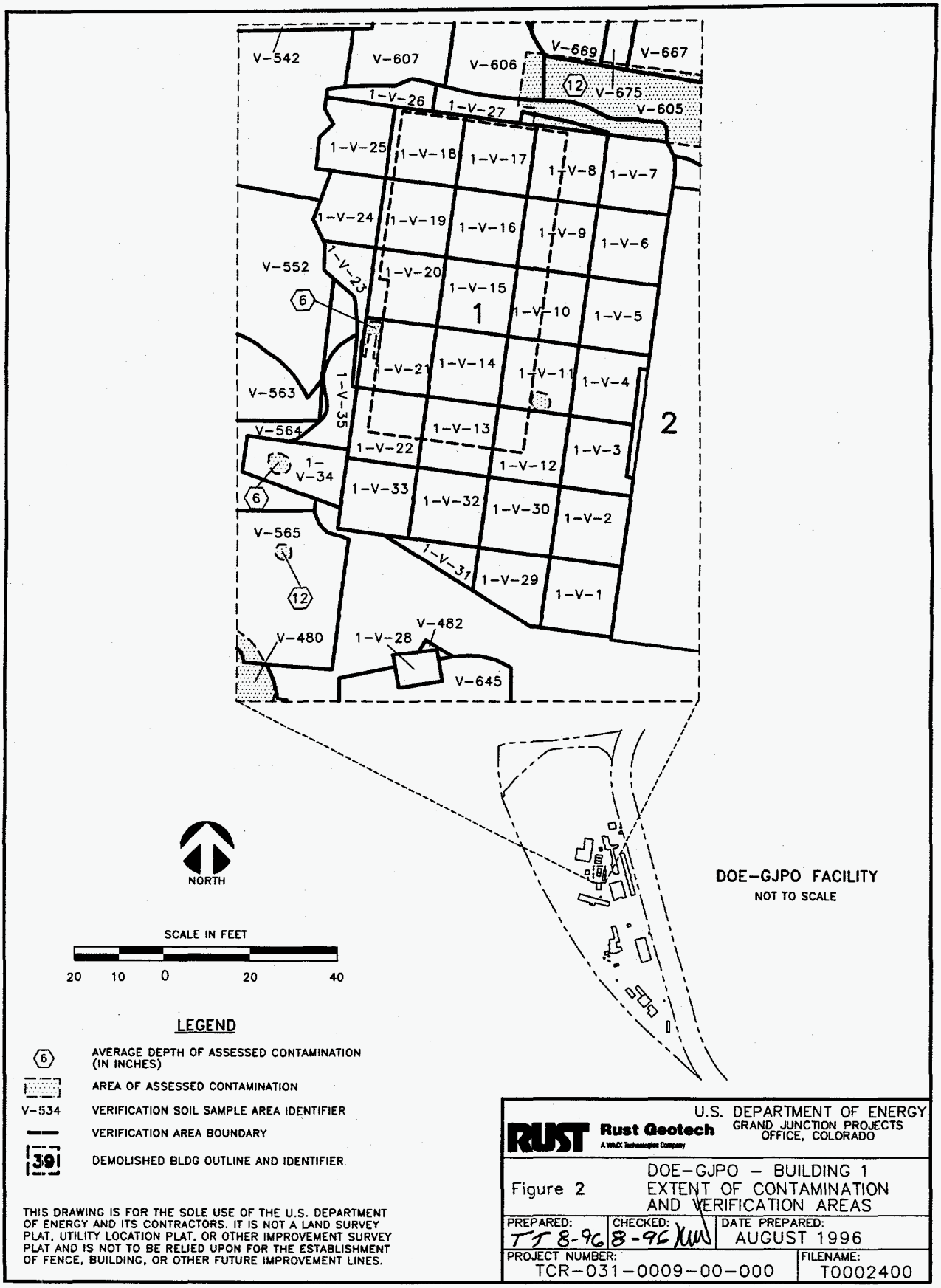

Figure 2. Extent of Contamination and Verification Areas

Radiation Protection," and DOE Order 5480.4, *Environmental Protection, Safety, and Health Protection Standards.*

Background Determinations

Background values determined for the DOE–GJPO facility are summarized in Table 2.

Reference Grid

A 5- by 5-meter grid was established over the remediated area associated with Building 1 and referenced to the documented location of the building. Thirty-five verification areas (V-areas) less than or equal to 25 m^2 each were defined.

Scanning Results

No structural surfaces remain in this area; therefore, direct scanning for alpha or beta-gamma surface activity was not conducted. One hundred percent of the exposed soil surface was scanned for gamma activity. Gross gamma exposure rates ranged from 13 to 20 µR/h, as indicated in Appendix B, Tables B–1 through B–3.

Direct Measurements

No structural surfaces remain in this area; therefore, direct measurements for alpha or beta-gamma surface activity were not taken.

Sample Results

A composite soil sample representing the first 6 inches (15 centimeters) of soil and comprising from two to six aliquots was collected systematically from each V-area. The results of analysis for radium-226 (Ra-226), thorium-230 (Th-230), and total uranium are presented in Appendix B, Table B–1. Additionally, individual soil samples were collected from Areas 1–V–5 and 1–V–12 where gamma exposure rates exceeded background by more than 30 percent. These were individually analyzed and the results were averaged mathematically with the corresponding composite sample (Appendix B, Tables B–2 and B–3).

The V-areas were grouped to represent areas of approximately 100 m^2 and the mean radionuclide concentrations were calculated. Also, the projected mean radionuclide concentrations were calculated for the entire remediated surface at the 95 percent confidence level. These results indicate that the soil within the remediated area complies with the authorized limits (Appendix B, Tables B–1 and B–4). The soil sample and gamma scan results for the V-areas, each 25 m^2 or less, demonstrate that the radionuclide concentrations in the re-mediated area do not exceed the hot spot criteria.

Exposure Rates

The postremediation surface was verified in accordance with exterior guidelines; therefore, discrete gamma exposure rate measurements were not taken.

V. Cost and Schedule

Project costs and the schedule for remediation of Building 1 will be presented in a summary final report of the GJPORAP remediation of the interior areas.

Table 2. Background Values for the DOE–GJPO

Criterion	Background Value	Source of Data
Gamma Exposure Rate—Exterior	14 µR/h	DOE 1986
Radium-226 Concentration in Soil	1.0 pCi/g	DOE 1990b
Thorium-230 Concentration in Soil	2.0 pCi/g	DOE 1990b
Total Uranium Concentration in Soil	2.0 pCi/g	DOE 1990b

Key: µR/h = microroentgens per hour; pCi/g = picocuries per gram

VI. Occupational Exposure

Results of personnel and area monitoring indicate that GJPORAP activities created no above-background emissions of nonradiological hazards, radioparticulates (including radon daughters), or ionizing radiation.

VII. Waste Volumes

The remediation of Building 1 generated a total of 1,250 tons (1,130 metric tons) of contaminated materials, representing a volume of approximately 900 yd^3 (690 m^3) of contaminated material (Rust 1996c). This material was disposed at the Cheney Disposal Cell.

VIII. Final Condition

All cleanup requirements identified for GJPORAP have been met for the soil at the former location of Building 1 (Table 3). The IVC will issue a Statement of Verification to signify concurrence that this portion of remedial action has achieved program objectives.

Radiologically contaminated material has been removed, and all remediated areas comply with the applicable provisions of 40 CFR 192, FUSRAP/SFMP guidelines, and DOE Order 5400.5. Suspected occurrences of nonradiological contamination were investigated and identified nonradiological contamination was remediated.

Remediated areas were restored to comply with floodplain permits, the Endangered Species Act, and other applicable regulations. Groundwater sampling under the LTSM Program will provide further assurance that contaminated materials currently managed on site will not pose any threat to human health or the environment. Sufficient data have been collected to document the final site conditions and to demonstrate that the cleanup levels specified in the ROD were attained. These data and associated information are available to the public and will be archived in the Certification Docket.

Because of the limitations of current technology and procedures for identifying and remediating radiologically contaminated materials, unknown deposits of contamination may be found in the future. The potential for encountering contamination during future construction activities will be determined and at-risk activities will be monitored for radiological and nonradiological contamination. The DOE–GJPO facility is routinely surveyed for radiation and other hazards.

No assessed hazardous substances were left in the remediated area; therefore, the area can be released for unrestricted use and unlimited exposure. At the time of this report, contamination is still present in other interior areas of the DOE–GJPO facility; access to these areas is controlled and will be addressed by future GJPORAP remedial actions. After the interior remedial action is completed, the facility will be managed as an LTSM site by DOE until restoration of the alluvial aquifer by natural flushing occurs.

IX. Lessons Learned

Lessons learned during remediation of Building 1 have been incorporated into subsequent operations. These lessons will be presented in a summary final report of the GJPORAP remediation of the interior areas.

Table 3. Building 1 Certification Summary

Survey Unit: Building 1 Excavation (affected area, exterior soil surface)			
Certification Criteria	**Authorized Limit**	**Number of Observations**	**Results**
Gamma Exposure Rate (habitable areas only)	< 20 µR/h above background.[a]	None	Not applicable (no habitable areas).
Radon Decay-Product Concentration (habitable areas only)	Annual average shall not exceed 0.02 WL, to the extent practicable, and in no case shall exceed 0.03 WL.	None	Not applicable: (no habitable areas).
Scans	Elevated activity will be investigated	Gamma: scanned 100 percent of surface. Alpha and beta-gamma: none	Gamma: two areas exceeded background by 30 percent; soil sample results meet criteria. Alpha and beta-gamma: not applicable: (no structural surfaces).
Surface Activity (structural surfaces only)	Alpha or beta-gamma activity shall not exceed 5,000 dpm/100 cm^2 fixed, 1,000 dpm/100 cm^2 removable, averaged over 1 m^2.	None	Not applicable (no structural surfaces).
Radionuclide Concentrations (soil surfaces only)	Ra-226 and Th-230: Shall not exceed 5 pCi/g above background[a] in the 15-cm surface layer, averaged over 100 m^2.	None	Not applicable (excavation > 15 cm deep).
	Shall not exceed 15 pCi/g above background[a] in any 15-cm-thick soil layer more than 15 cm below the surface, averaged over 100 m^2.	35 composite samples, each comprising at least 2 aliquots.	Ra-226: 1.9 pCi/g maximum,[b, c, d] μ_α = 1.6 pCi/g[b, c] Th-230: 2.4 pCi/g maximum,[b, c, d] μ_α = 1.8 pCi/g[b, c]
	Total uranium: Shall not exceed 106 pCi/g above background[a] in any 15-cm–thick layer, averaged over 100 m^2.	35 composite samples, each comprising at least 2 aliquots.	17.9 pCi/g maximum,[b, c, d] μ_α = 11.3 pCi/g[b, c]
Hot-Spot Criteria	Limit = (guideline value)(100/area)$^{0.5}$	As required	Maximum concentrations below hot-spot limit.

[a]Background activities are summarized in Table 2.
[b]Gamma exposure rate and radionuclide concentrations include background.
[c]Radionuclide concentrations were determined by laboratory analysis.
[d]These maxima were determined for the 100 m^2 areas designated in Appendix B, Table B–4.

Note: Th-232 is not a contaminant of concern at the DOE–GJPO facility (DOE 1994).

Key:

cm	=	centimeter(s)
dpm/100 cm^2	=	disintegrations per minute per 100 square centimeters
m^2	=	square meter(s)
pCi/g	=	picocuries per gram
Ra-226	=	radium-226
Th-230	=	thorium-230
Th-232	=	thorium-232
μ_α	=	upper limit of true mean concentration of 100 m^2 areas at the 95 percent confidence level, based on soil sample results
µR/h	=	microroentgens per hour
WL	=	working level

X. References

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DOE Order 5480.4, *Environmental Protection, Safety, and Health Protection Standards.*

DOE Order 5480.11, *Radiation Protection for Occupational Workers*, Change 2.

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Appendix A

Applicable Program and Quality Assurance Requirements and Procedures

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GJPORAP Program Management

Operations Management Policy Manual (Manual 104)

Project Control System Manual (Manual 107)

Management Policies Manual (Manual 100), Section 1, "General Administration," and Section 12, "Organization Functions and Responsibilities"

Remedial Action Statements of Work

Grand Junction Projects Office Desk Procedures Manual

Grand Junction Projects Office Remedial Action Project (GJPORAP), Grand Junction, Colorado, Community Relations Plan Update

Grand Junction Projects Office Remedial Action Project Quality Assurance Program Plan, P–GJPO–141

Grand Junction Projects Office Remedial Action Project Records Management Plan, P–GJPO–143

GJPORAP Construction Management

Operations Management Policy Manual (Manual 104)

Operations Department Construction Procedures Manual

Engineering

Engineering Process Planning Guidelines

AutoCAD Standards Manual

Assessment/Verification

Land Survey Support Procedures

AutoCAD Standards Manual

Environmental Procedures Catalog (Manual 116)

Laboratory Services

Analytical Laboratory

Analytical Chemistry Laboratory Administrative Plan and Quality Control Procedures

Analytical Chemistry Laboratory Handbook of Analytical and Sample Preparation Procedures, Volumes I, II, and III

Gamma-Ray Spectroscopy System Operations Methods Manual

Environmental Instrumentation Laboratory

Calibration Control Program for Measurement and *Test Equipment and Measurement Standards*

Electronics Laboratory Procedures

Quality Assurance

Quality Assurance Desk Instructions and Administrative Procedures Manual (Manual 301)

Health, Safety, and Security

Health and Safety Manual (Manual 103), Volumes 1 and 2

Grand Junction Projects Office Remedial Action Project Health and Safety Plan, P–GJPO–144

Contracts and Procurement

Management Policies Manual (Manual 100), Section 5, "Procurement"

Procurement Manual

Stores, Property, and Transportation (SPAT) Manual (Manual 114)

Rust Guide for Preparing a Purchase Requisition

Information Services

Computer Support

Information Services Manual (Manual 105)

Publications and Records

Management Policies Manual (Manual 100), Section 2, "Documentation Systems," and Section 13, "Records Management"

Human Resources

Training and Employee Development

Management Policies Manual (Manual 100), Section 3, "Human Resources"

Other Guidance

40 CFR 261, "Identification and Listing of Hazardous Waste."

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan."

A Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD Version 4.0, Argonne National Laboratory, June 1989.

"Approval of the Grand Junction Projects Office Remedial Action Project: National Environmental Policy Act and Comprehensive Environmental Response, Compensation, and Liability Act Documents" DOE, February 29, 1990.

"Calculation of Total Uranium Specific Activity From Total Uranium Chemical Concentration by Weight," Rust Geotech, November 11, 1994.

Community Relations in Superfund: A Handbook, EPA, January 1992.

Defense Decontamination and Decommissioning Program: Program Management Plan, DOE, December 1989.

DOE Order 4700.5, *Project Control System Guidelines.*

DOE Order 5400.4, *Comprehensive Environmental Response, Compensation, and Liability Act Requirements.*

DOE Order 5700.6C, *Quality Assurance.*

DOE Order 5820.2A, *Radioactive Waste Management.*

Exemption No. DOT–E 10594, Research and Special Programs Administration, U.S. Department of Transportation, May 28, 1992.

Environmental Implementation Guide for Radiological Survey Procedures, draft report, DOE, November 1992.

GJPORAP/IVC Project Management Summary, ORNL, May 1994.

Grand Junction Projects Office Remedial Action Project, Radiological Sampling and Verification Plan, Phase IVA, DOE, November 1993.

Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material, U.S. Nuclear Regulatory Commission, 1982.

Interim Final Guidance on Preparing Superfund Decision Documents: The Proposed Plan, The Record of Decision, Explanation of Significant Differences, The Record of Decision Amendment, EPA, July 1989.

Limits for Intakes of Radionuclides by Workers, International Commission on Radiological Protection (ICRP), August 1982.

Procedures for Completion and Deletion of National Priority List Sites, U.S. Environmental Protection Agency (EPA), October 1988.

Project Plan for the U.S. Department of Energy Grand Junction Projects Office Remedial Action Project, DOE, March 1986.

Proposed GJPORAP Release Criteria and Scope Impacts," DOE, July 20, 1989.

Public Participation in Environmental Restoration Activities, DOE, November 1991.

Quality Assurance Program for Nuclear Facilities, NQA–1, American Society of Mechanical Engineers, 1989.

Recommendations of the ICRP, ICRP, August 1987.

Record of Decision for Remedial Action at the Climax Uranium Company Uranium Mill Site, Grand Junction, Colorado, DOE, August 1988.

SFMP Resource Manual, DOE, 1989.

Verification and Certification Protocol for the Office of Environmental Restoration, Formerly Utilized Sites Remedial Action Program and Decontamination and Decommissioning Program, Rev. 3, DOE, November 1990.

Work Plan for Independent Verification of the Grand Junction Projects Office Remedial Action Project, Oak Ridge National Laboratory (ORNL), October 1991.

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Appendix B

Final Radiological Conditions

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Table B–1 summarizes the post-remediation sampling and measurement results for the site of Building 1. The samples were collected prior to backfilling and represent the 6-inch-deep soil layer at the bottom of the excavation. The results for Areas 1–V–5 and 1–V–12 are the weighted average of a composite and an individual sample (Tables B–2 and B–3). The remaining samples are composites comprising two to five aliquots. The samples were analyzed for radium-226 (Ra-226) using the Opposed Crystal System (OCS) and for Ra-226 using mass spectrometry, and thorium-230 (Th-230) and total uranium using inductively-coupled plasma mass spectrometry by the U.S. Department of Energy Grand Junction Projects Office analytical laboratory, in accordance with procedures specified in the analytical reports. Radionuclide concentrations are expressed in picocuries per gram (pCi/g) and include background. Gamma exposure rate ranges are expressed in microroentgens per hour (μR/h). Table B–4 presents average radionuclide concentrations for 100 m² areas of the remediated surface. The remediated area is shown on Figure 2.

Table B–1. Post-Remediation Sample/Measurement Results for Exterior Areas

Verification Area	Gamma Exposure Rate (μR/h)	Soil Sample Ticket No.	Concentration (pCi/g)				Average Depth of Excavation (inches)
			Ra-226 (OCS)	Ra-226 (lab)	Th-230 (lab)	Total Uranium (lab)	
1–V–1	14 - 18	NCK 789	3.2	1.7	2.2	17.4	36
1–V–2	14 - 17	NCK 790	2.4	1.6	1.7	8.0	36
1–V–3	14 - 18	NCK 791	2.8	1.4	2.2	20.9	36
1–V–4	14 - 18	NCK 792	3.9	2.0	3.5	31.8	36
1–V–5[a]	14 - 19		2.2	1.4	2.3	13.9	36
1–V–6	14 - 17	NCK 795	1.6	1.3	1.6	11.2	30
1–V–7	14 - 17	NCP 264	1.5	2.0	2.1	23.4	24
1–V–8	14 - 18	NCP 269	1.4	1.7	1.9	10.7	48
1–V–9	13 - 15	NCP 270	3.6	1.6	1.4	7.3	42
1–V–10	14 - 16	NCP 271	2.9	1.9	1.6	11.8	24
1–V–11	14 - 18	NCP 272	2.6	1.6	1.7	9.4	24
1–V–12[a]	14 - 20		3.0	2.2	1.7	9.5	12
1–V–13	14 - 16	NCP 275	2.3	1.2	1.1	6.0	48
1–V–14	13 - 17	NCP 276	2.4	1.9	1.4	6.8	36
1–V–15	13 - 15	NCP 277	2.2	1.7	1.6	6.2	36
1–V–16	13 - 17	NCP 278	1.9	1.3	1.6	9.4	60
1–V–17	14 - 17	NCP 279	3.0	1.4	1.2	4.5	48
1–V–18	13 - 15	NCP 280	2.3	1.3	1.1	4.4	42
1–V–19	13 - 15	NCP 281	2.4	1.4	1.1	3.5	39

[a]These results are the weighted average of the composite soil sample for the V-area (4 aliquots) and a sample collected where the gamma exposure rate exceeded background by 30 percent (1 aliquot).

Table B–1 (continued). Post-Remediation Sample/Measurement Results for Exterior Areas

Verification Area	Gamma Exposure Rate (µR/h)	Soil Sample Ticket No.	Concentration (pCi/g)				Average Depth of Excavation (inches)
			Ra-226 (OCS)	Ra-226 (lab)	Th-230 (lab)	Total Uranium (lab)	
1–V–20	15 - 16	NCP 282	2.8	1.1	1.2	5.0	36
1–V–21	13 - 15	NCP 283	1.3	1.6	1.7	8.4	36
1–V–22	14 - 16	NCP 284	3.4	3.2	3.6	21.8	48
1–V–23	14 - 18	NCP 285	2.8	1.9	1.3	5.5	36
1–V–24	13 - 17	NCP 286	2.5	2.5	1.2	3.7	36
1–V–25	13 - 16	NCP 287	1.6	1.3	1.2	4.0	36
1–V–26	13 - 15	NCP 288	2.8	1.4	3.5	34.3	36
1–V–27	14 - 17	NCP 289	2.9	1.7	1.6	14.2	48
1–V–28	14 - 18	NCP 290	2.0	1.7	2.0	13.9	12
1–V–29	13 - 16	NCP 291	2.4	1.6	2.3	7.2	6
1–V–30	13 - 16	NCP 292	3.1	1.7	1.7	5.7	12
1–V–31	13 - 16	NCP 293	2.2	1.4	2.0	6.7	6
1–V–32	13 - 16	NCP 294	2.2	1.6	2.5	20.8	9
1–V–33	13 - 16	NCP 295	2.9	1.6	2.9	19.3	9
1–V–34	13 - 15	NCP 296	2.8	1.4	1.6	4.7	6
1–V–35	14 - 17	NCP 297	1.6	1.1	1.0	3.7	42
Mean				1.6	1.8	11.3	
s				0.4	0.7	7.9	
μ_α [a]				1.8	2.0	13.6	

[a]Calculated using n = 35 samples, df = 34, and t-95% = 1.692.

Key:

μ_α	=	Upper limit of population mean at 95% confidence (from equation 8-13 of NUREG/CR 5849 [U.S. Nuclear Regulatory Commission, 1992])
df	=	Degrees of Freedom (n-1)
Mean	=	Arithmetic average of sample values
n	=	Number of samples
s	=	Sample standard deviation
t-95%	=	Student's t distribution statistic for n degrees of freedom at 95% confidence

Table B–2. Sample/Measurement Results for Area 1–V–5

Verification Area	Gamma Exposure Rate (µR/h)	Soil Sample Ticket No.	Concentration (pCi/g)				Average Depth of Excavation (inches)
			Ra-226 (OCS)	Ra-226 (lab)	Th-230 (lab)	Total Uranium (lab)	
1–V–5[a]	14 - 18	NCK 793	2.3	1.3	2.2	12.4	36
1–V–5[b]	18 - 19	NCK 794	1.9	2.0	2.6	19.6	36

[a]Composite soil sample comprising 4 aliquots collected systematically.
[b]Individual soil sample collected at the point of highest gamma activity.

Table B–3. Sample/Measurement Results for Area 1–V–12

Verification Area	Gamma Exposure Rate (µR/h)	Soil Sample Ticket No.	Concentration (pCi/g)				Average Depth of Excavation (inches)
			Ra-226 (OCS)	Ra-226 (lab)	Th-230 (lab)	Total Uranium (lab)	
1–V–12[a]	14 - 17	NCP 273	2.9	2.3	1.5	6.2	12
1–V–12[b]	18 - 20	NCP 274	3.4	1.9	2.4	22.5	24

[a]Composite soil sample comprising 4 aliquots collected systematically.
[b]Individual soil sample collected at the point of highest gamma activity.

Table B–4. Mean Concentrations of 100-m² Areas

100-m² Areas[a] V-Areas[b]	n	Concentration (pCi/g) Ra-226 (OCS) Mean	s	Ra-226 (lab) Mean	s	Th-230 (lab) Mean	s	Uranium (lab) Mean	s
V–1, V–2, V–29, V–30	4	2.8	1.49	1.7	0.08	2.0	0.32	9.6	5.30
V–3, V–4, V–11, V–12	4	2.1	1.41	1.8	0.35	2.3	0.85	17.9	10.75
V–5, V–6, V–9, V–10	4	2.6	0.86	1.5	0.27	1.7	0.39	11.1	2.72
V–7, V–8, V–17, V–27	4	2.2	0.87	1.7	0.22	1.7	0.39	13.2	7.90
V–15, V–16, V–19, V–20	4	2.3	0.38	1.4	0.23	1.4	0.26	6.0	2.50
V–13, V–14, V–21 ,V–22	4	2.4	0.86	1.9	0.86	2.0	1.13	10.7	7.40
V–28, V–31, V–32, V–33	4	2.3	0.39	1.6	0.11	2.4	0.44	15.2	6.40
V–18, V–24, V–25, V–26	4	2.3	0.51	1.6	0.57	1.8	1.17	11.6	15.16
V-23, V-34, V-35	3	2.4	0.69	1.5	0.37	1.3	0.32	4.6	0.90

[a]Contiguous V-Areas were grouped into 100 m² areas. Because all soil sample analyses results are below the authorized limits, the average radionuclide concentrations of any 100 m² area within the remediated surface will be below the authorized limits.
[b]Each V-Area identifier is preceded by "1–".

Key:
Mean = Arithmetic average of sample values (pCi/g)
n = Number of samples
s = Sample standard deviation (pCi/g)