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

Final Report of the Decontamination and Decommissioning of Building 52 at the Grand Junction Projects Office Facility

August 1996

U.S. Department of Energy
Grand Junction Projects Office

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Work Performed Under DOE Contract No. DE–AC04–86ID12584 for the U.S. Department of Energy

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Final Report of the Decontamination and Decommissioning of Building 52 at the Grand Junction Projects Office Facility

August 1996

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

Prepared by
Rust Geotech
Grand Junction, Colorado

Technical Coordination and Reports Project Number TCR–031–0005–00–000
Technical Coordination and Reports Document Number T0001500

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.

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DISCLAIMER

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 was the remedial action contractor.

Building 52 was found to be radiologically contaminated and was demolished in 1994. The soil area within the footprint of the building has been remediated in accordance with the identified standards and the area 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
Ra-226	Radium-226
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

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I. Introduction and Background

This report summarizes the results of the remedial action conducted on Building 52 at the U.S. Department of Energy Grand Junction Projects Office (DOE–GJPO) facility. This building was radiologically contaminated. Demolition was identified as the most cost-effective remedial action alternative and the building was demolished in 1994. 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, the North Pond and the South Pond, with associated wetlands, are located on the DOE–GJPO facility. A freshwater alluvial aquifer underlying the facility is in direct hydraulic contact with the ponds and the Gunnison River. A semi-arid 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. Outside the security 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 DOE facilities, including any necessary decontamination and decommissioning activities.

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

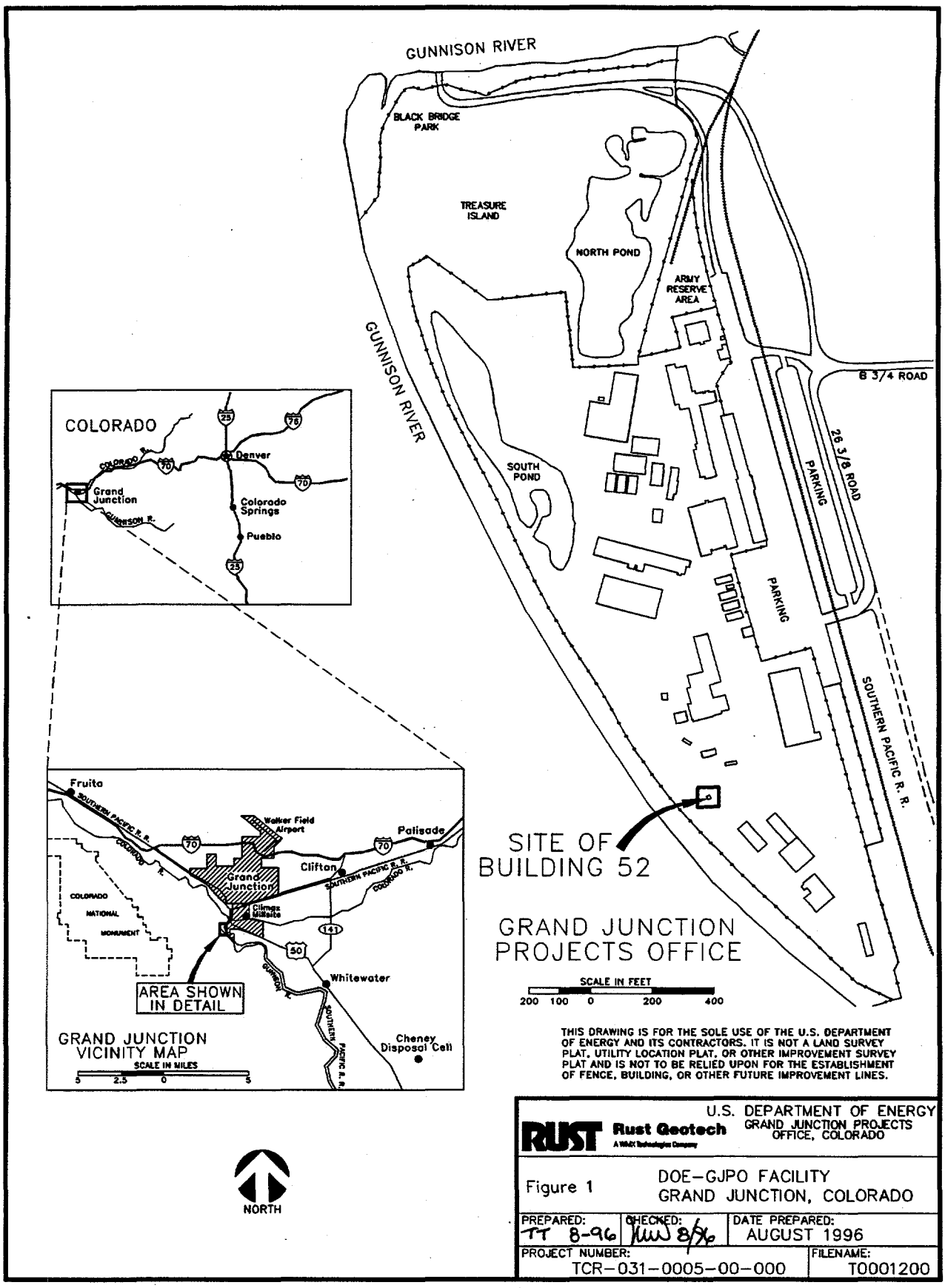

Figure 1. Site Map of the DOE-GJPO Facility, Grand Junction, Colorado

DOE–GJPO has specific responsibility for GJPORAP under the D&D Program. Rust Geotech was 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 52

Building 52 was a wood-frame structure covered with corrugated sheet-metal siding and roofing, with a wood floor and foundation. The building had a footprint of 126 square feet (ft^2) (11.7 meters square [m^2]). It was constructed in 1956 to store oil and grease for the pilot plant uranium-milling activities (Rust 1996). After the cessation of milling activities it was used for storage. Before 1990, it was used to store a small quantity of uranium mill tailings and a radium-226 (Ra-226) source. These sources were used to generate radon for radon flux measurements and experiments. The tailings were placed in an open soil-lined sump dug into the ground beneath the floor.

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, and 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 the *Quality Assurance Program for Nuclear Facilities,* NQA–1 (ASME 1989).

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 52 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 52.

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)	40 CFR 192[a] FUSRAP/SFMP Guidelines[b] DOE Order 5400.5[c]
Radon Decay-Product Concentration (interior areas)	40 CFR 192[a] FUSRAP/SFMP Guidelines[b] DOE Order 5400.5[c]

[a]Title 40, *U.S. Code of Federal Regulations* Part 192 (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.*

Characterization

Building 52 was routinely surveyed for radiological hazards (Rust 1993, Rust 1994a). The surveys included measurements of gamma exposure rates; and alpha and beta-gamma scans, direct measurements, and smears.

Radiological Contamination—The original characterization survey did not detect any removable alpha or beta activity in excess of the release guidelines. However, fixed (nonremovable) contamination was detected, with activities ranged as high as 194,300 disintegrations per minute per 100 square centimeters (dpm/100 cm^2). Gamma exposure rates exceeded 2,000 microroentgens per hour (μR/h), mostly due to the uranium mill tailings and Ra-226 source stored inside. The characterization surveys identified contamination in the interior walls, the floor, and the underlying soil.

Nonradiological Contamination—No hazardous nonradiological contamination was identified in or near Building 52.

Remedial Design

Remediation of Building 52 became part of the scope of GJPORAP after the ROD was approved. The selected remediation alternative was demolition. The objective of the remediation plan was to eliminate real and potential health hazards to workers, the public, and the environment. The remediation process involved demolishing the building, removing the floor, and remediating the underlying soil; following approved procedures using standard construction techniques. Radiologically contaminated materials were impounded at the Cheney Disposal Cell. After removal of uranium mill tailings and other associated contaminated material, the affected area was reconstructed. A plan for proper management of any nonradiological hazardous materials was in effect.

Decontamination Operations

Summary of Remedial Action—Building 52 was demolished in September 1994 (Rust 1994b). Excavation of soil beneath the building continued until gamma measurements indicated that all soil with elevated gamma activity was removed. Analyses of the underlying soil indicated that the remaining soil was not contaminated. The depth of the excavation ranged from 12 to 36 inches.

Radiological Contamination—The exterior areas adjacent to Building 52 were remediated in

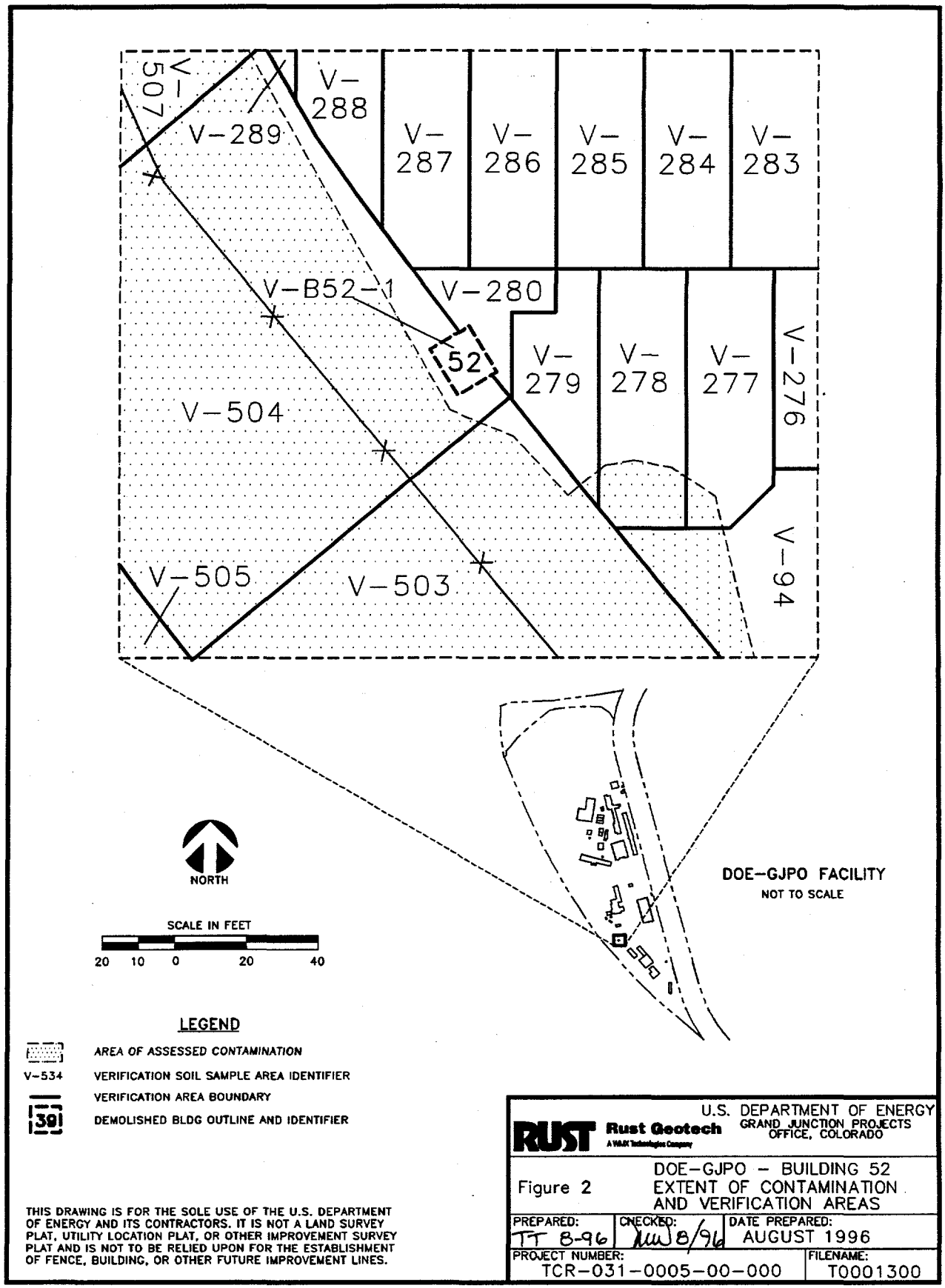

Figure 2. Extent of Contamination and Verification Areas

1989 during construction Phases IA and II/III (Figure 2). In 1994, radiological contamination, including building debris, was removed from within the area of Building 52, as indicated by the results of soil sample analyses and gamma exposure rate scans (Appendix Table B–1). All material from this remedial action was disposed at the Cheney Disposal Cell.

IV. Final Release Survey

The final status surveys of the soil underlying the location of Building 52 were conducted in accordance with the Rust *Health and Safety Manual* (Manual 103), Volume 1, the Rust *Field Assessments Procedures Manual*, and approved plans (DOE 1990c). This work was conducted prior to the adoption of the *Survey Plan for Releasing the Buildings at the Grand Junction Projects Office* (DOE 1995).

Oak Ridge National Laboratory at Grand Junction was the independent verification contractor (IVC) for GJPORAP. Oversight activities were conducted by RAC QA personnel and representatives of 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.* Calibrations used traceable standards and complied with 10 CFR 835, "Occupational Radiation Protection," DOE Order 5480.11, *Radiation Protection for Occupational Workers,* 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 Grids

Grids were not established in the area of Building 52. For Building 52, one verification area was established (Figure 2).

Scanning Results

No structural surfaces remain in this area; therefore, direct scanning for alpha or beta-gamma surface activity was not conducted.

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 soil sample comprised of 6 aliquots representing the 6 inches (15 cm) of soil from the floor of the excavation beneath the building was collected. The area represented by this sample extended to the footprint of Building 52 (Figure 2). This sample was analyzed for Ra-226 (Appendix Table B–1). As a cost-saving measure, analysis for total uranium was not conducted because the sample exhibited less than 2,500 dpm/100 cm^2 beta-gamma activity when scanned at the time of collection. This beta-gamma value correlates to a measurable uranium concentration within the authorized limit, as shown by extensive sampling conducted in other areas; and sample analyses results indicated that

Table 2. Background Values for the DOE–GJPO Facility

Criterion	Background Value	Source of Data
Gamma Exposure Rate—Exterior	14 µR/h	DOE 1986
Ra-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

uranium probably was not a contaminant of concern.

Exposure Rates

One hundred percent of the exposed soil surface was scanned for gamma activity. Gross gamma exposure rates ranged from 13 to 19 μR/h (Appendix Table B–1).

V. Cost and Schedule

Project costs and the schedule for remediation of Building 52 will be presented in a summary final report of GJPORAP interior area remediation activities.

VI. Occupational Exposure

The results of personnel and area monitoring of exposure to workers and the public to radiological and nonradiological hazards from GJPORAP-related activities indicated no above-background exposures to radioparticulates, including radon daughters, ionizing radiation, or other hazards.

VII. Waste Volumes

The remediation of Building 52 generated a total of 75 tons (68 metric tons), or approximately 47 yd^3 (36 m^3) of contaminated material, including building debris and soil. This material was disposed at the Cheney Disposal Cell.

VIII. Final Condition

All decontamination requirements identified in the ROD for GJPORAP have been satisfied for the soil at the former location of Building 52 (Table 3). The IVC will issue a Statement of Verification to signify concurrence that this portion of the remedial action achieved program objectives.

Radiologically contaminated material has been removed, and all remediated areas comply with the applicable provisions of 40 CFR 192, DOE Order 5400.5, and FUSRAP/SFMP guidelines. Suspected occurrences of nonradiological contamination were investigated; no nonradiological contamination was identified.

Remediated areas have been restored to comply with floodplain permits, the Endangered Species Act, and other applicable regulations. Groundwater sampling 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 final site conditions and to demonstrate that 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. Once all the interior areas are remediated, the facility will be managed as a LTSM site by DOE until restoration of the alluvial aquifer by natural flushing occurs.

IX. Lessons Learned

Lessons learned during remediation of Building 52 have been incorporated into subsequent operations. These lessons will be presented in a summary final report of the GJPORAP interior area remediation activities.

Table 3. Building 52 Certification Summary

Certification Criteria	Authorized Limit	Number of Observations	Results
Gamma Exposure Rate (habitable areas only)	< 20 µR/h above background.	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% of surface. Alpha and beta-gamma: none	Gamma: exposure rate range was 13 to 19 µR/h.[b] 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 cm² fixed, 1,000 dpm/100 cm² removable, averaged over 1 m².	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 m².	None	Not applicable (soil surface > 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 m².	1 composite sample comprising 6 aliquots.	Ra-226: 6.2 pCi/g[b] Th-230 : 9.9 pCi/g (estimated)[b, c]
	Total uranium: Shall not exceed 106 pCi/g above background[a] in any 15-cm layer, averaged over 100 m².	Samples scanned for beta-gamma activity.	Not tested (surface activity < 2,500 dpm/100 cm²).
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 rates and radionuclide concentrations include background.
[c]Gamma scans did not exceed background by more than 30 percent. While gamma activity is a direct indicator of Ra-226 only, a relationship between Ra-226 and Th-230 has been established for the DOE–GJPO facility. Using regression analysis of the analytical results of 315 pairs of assessment and verification soil samples, this relationship was found to be Th-230 = (1.42 x Ra-226) + 1.13 (DOE 1994). The mean Th-230 concentration of the soil beneath Building 52 is predicted with 95 percent confidence to be 9.9 pCi/g.
Note: Th–232 is not a contaminant of concern in soils at the DOE–GJPO facility (DOE 1994).

Key:

cm	=	centimeter(s)
dpm/100 cm²	=	disintegration(s) per minute per 100 square centimeters
m²	=	square meter(s)
pCi/g	=	picocuries per gram
Ra-226	=	radium-226
Th-230	=	thorium-230
µR/h	=	microroentgens per hour
WL	=	working level

X. References

10 CFR 835. U.S. Department of Energy, "Occupational Radiation Protection," *U.S. Code of Federal Regulations.*

40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *U.S. Code of Federal Regulations.*

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_____, 1994. *Grand Junction Projects Office Remedial Action Project, Justification for Certifying 47 Large-Area Verification Areas at the Grand Junction Projects Office,* GJ–GJPO–94–1, prepared by Rust Geotech for the U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado, November.

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DOE Order 5400.5, *Radiation Protection of the Public and the Environment,* Change 1.

DOE Order 5480.1B, *Environment, Safety, and Health Program for Department of Energy Operations,* Change 5.

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

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

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

Productivity/Quality Improvement Manual (Manual 109)

GJPORAP Construction Management

Operations Management Policy Manual (Manual 104)

Operations Department Construction Procedures Manual

Engineering

Engineering Support Procedures Manual

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, Volume 2 (Manual 103)

Health and Safety Desktop Procedures (Manual 303)

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."

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DOE Order 4700.5, *Project Control System Guidelines.*

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Appendix B

Final Radiological Conditions

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Table B–1 summarizes the post-excavation sampling and measurement results for the verification area encompassing the site of Building 52. The sample was acquired prior to backfilling. The sample is a composite comprising individual aliquots representing the 6-inch-deep soil layer at the bottom of the excavation. The sample was analyzed for radium-226 (Ra-226) using the Opposed Crystal System (OCS). The concentration of Ra-226 is expressed in picocuries per gram (pCi/g), and includes background. The post-excavation gamma exposure rate range is expressed in microroentgens per hour (μR/h). The remediated area is shown on Figure 2.

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

Verification Area	Gamma Exposure Rate (μR/h)	Soil Sample Ticket No.	Concentration (pCi/g)	Average Depth of Excavation (inches)
			Ra-226 (OCS)	
V–B52-1	13 – 19	NCH 838	6.2	30

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