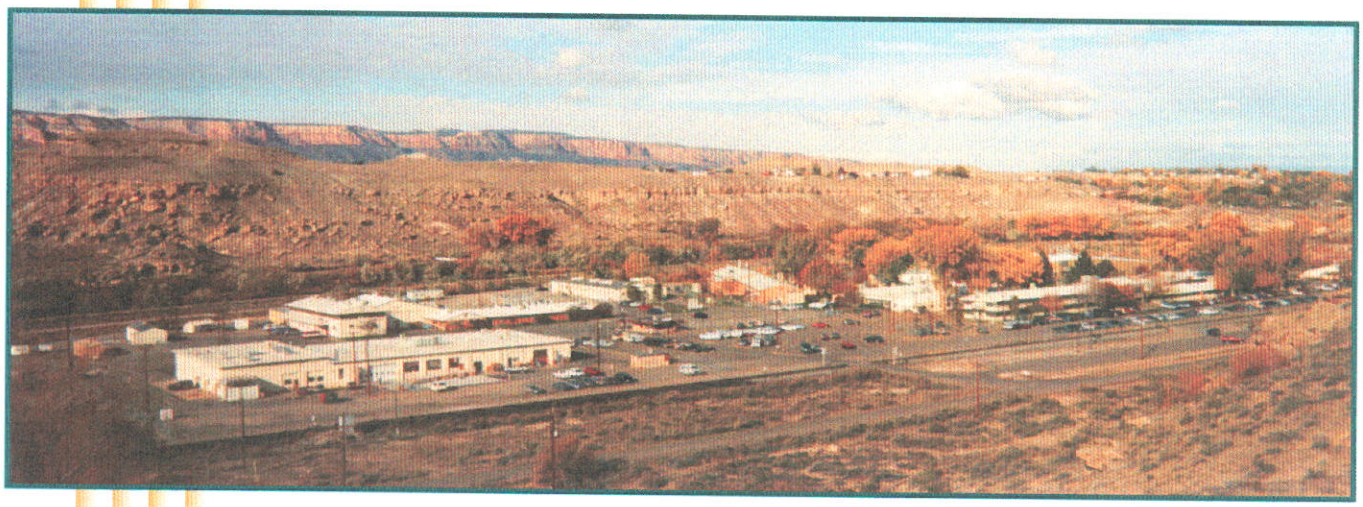
Final Request for Deferred Remediation Volume I

U.S. Department of Energy
Grand Junction Office Site



September 2001

STATE OF COLORADO

EXECUTIVE CHAMBERS

136 State Capitol
Denver, Colorado 80203-1792
Phone (303) 866-2471

Bill Owens
Governor

NOTICE OF DECISION UPON THE DEFERRAL APPLICATION

Findings of the Governor of the State of Colorado regarding early transfer of property at the Department of Energy's Grand Junction Office Site

I make the following findings to authorize the Department of Energy ("DOE") to transfer the property located at 2597 B ¼ Road in Grand Junction, Mesa County, Colorado, to the Riverview Technology Corporation ("RTC") and to defer inclusion in the quitclaim deed of the covenant required by Section 120(h)(3)(A)(ii)(I) of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"). This covenant requires that, prior to the transfer of property on which any hazardous substance was stored for one year or more and known to have been released or disposed of, DOE must take "all remedial action necessary to protect human health and the environment." Pursuant to section 120(h)(3)(C), this covenant may be deferred if an evaluation of the property determines that it can be safely used and DOE provides adequate assurances that it will satisfy its commitment to complete all remediation in a timely manner and provide for necessary restrictions on the use of the property.

I have reviewed the particulars of the proposed transfer and make the following findings:

1. The property is suitable for transfer for the mixture of commercial, industrial, office space and open space uses intended by RTC and these uses are consistent with the protection of human health and the environment. This finding is based on determinations made in DOE's Deferral Request and supporting documentation as well as an analysis of the Deferral Request conducted by the Colorado Department of Public Health and Environment ("CDPHE").

2. The quitclaim deed and agreement governing the transfer contain the response action assurances required by section 120(h)(3)(C)(ii) of CERCLA. These include assurances that DOE will impose all necessary restrictions on the use of the property, take all necessary response actions, and request adequate funding for the completion of all remedial actions.

3. DOE provided public notice of the transfer on March 25, 2001 in the Grand Junction Daily Sentinel, a newspaper in the general vicinity of the property. The public submitted comments to which DOE and CDPHE responded.

4. The deferral and transfer of the property will not substantially delay any necessary response actions at the property.

5. The deferral of the property will not increase, diminish or affect in any manner any rights or obligations of DOE (including any rights or obligations under sections 106, 107, and 120 of CERCLA existing prior to transfer) or the State with respect to the property.

6. The deferral of the property will not affect DOE's continuing obligation to pay State oversight costs.

Accordingly, pursuant to section 120(h)(3)(C) of CERCLA, I find the property suitable for transfer.

Bill Owens.

Bill Owens
Governor

8/15/01

Date

Errata Sheet

The following changes apply to the *Revised Request for Deferred Remediation U.S. Department of Energy Grand Junction Office Site,* October 6, 2000.

Page 1, Section 1.0, Paragraph 1. Sentence 2 should read as follows:

"The GJO site will be transferred to a nonprofit organization representing the City of Grand Junction and Mesa County (the Riverview Technology Corporation or RTC) in 2001, with the DOE remaining as a tenant at the site for the foreseeable future."

Page 13, Section 4.5. Sentences 1, 2, and 3 should be replaced by the following five sentences:

"DOE will leave a pair of radium foil sources on-site encased in a 300-foot deep borehole. The low-activity sources were used to calibrate borehole instrument depth meters. Foil with a radium-226 concentration of 29 picocuries per gram (pCi/g) is located at a depth of 81 feet, and foil with a radium-226 concentration of 3 pCi/g is located at a depth of 181 feet. The borehole was abandoned in accordance with well permit requirements and a plan approved by the State of Colorado. Abandonment included injection of concrete grout into and around the well casing to encase the foil, thus eliminating the potential for future exposure unless the well is excavated."

Page 18, Section 5.1.1, Paragraph 3. Delete Sentences 6 and 7: Linear trend line plots are not present in Attachment D, nor is there a Figure 8 in Attachment D.

Page 20, Section 5.1.2, Paragraph 1. Sentence 2 should read as follows:

"The remaining 36 wells were found to be redundant or unnecessary and none of them have been sampled since 1998."

Page 23, Section 5.3, Paragraph 1. Sentence 1 should read as follows:

"Upon notice of termination of DOE's lease of Building 20, DOE will prepare a design package (including schedule and budget) for demolition of Building 20, remediation of underlying contaminated soils/structures, and removal of waste materials to an acceptable repository (i.e., the Cheney Repository)."

Page 23, Section 5.3. Delete Paragraph 2 in its entirety.

Page 23, Section 5.4. Sentence 4 should read as follows:

"This remedy, of decontamination/demolition of structures, removal of contaminated soil/structural debris, and disposal at the Cheney Repository, has been followed during the entire site cleanup with the exception of Buildings 2 and 20, which utilized dose-based release for unrestricted use under DOE Order 5400.5."

Page 29, Section 6.2.3, Building 20. The two paragraphs should be replaced by the following paragraph:

"Grantee shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the west end of Building 20. Grantor is required to remediate all contamination under and around Building 20 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 20 as the most cost-effective process to complete the remedial action and hereby agrees to accept this approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building."

The following changes apply to the Draft *Enforceable Agreement between State of Colorado Department of Public Health and Environment and U.S. Department of Energy Grand Junction Office Under State of Colorado Executive Order D-013-98,* October 5, 2000.

Page 6, Section IV.C.2. The two paragraphs should be replaced by the following paragraph:

"Grantee shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the west end of Building 20. Grantor is required to remediate all contamination under and around Building 20 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 20 as the most cost-effective process to complete the remedial action and hereby agrees to accept this approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building."

Page 10, Section V.A.3. Paragraphs "a" and "b" should be replaced by the following paragraph:

"Grantee shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the west end of Building 20. Grantor is required to remediate all contamination under and around Building 20 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 20 as the most cost-effective process to complete the remedial action and hereby agrees to accept this approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building."

Page 10, Section V.B. Sentences 3, 4, and 5 should be replaced by the following two sentences:

"DOE is financially responsible for demolition of Buildings 12 and 20. The structures are not contaminated."

Page 12, Section V.K, Paragraph 3. Replace Sentences 2 and 3 with the following sentence:

"Demolition and remediation estimates for Buildings 12 and 20 will be developed during Fiscal Year 2001 and will be available to insert in the budget request when DOE has developed a definite schedule to vacate those buildings."

The following changes apply to the *Quitclaim Deed.*

Page 5, Section IV.C.3. Paragraphs 2 and 3 should be replaced by the following paragraph:

"*Restriction:* Except as provided in C.7, below, Grantee shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the west end of Building 20. Grantor is required to remediate all contamination under and around Building 20 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 20 as the most cost-effective process to complete the remedial action and hereby agrees to accept this approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building."

The following changes apply to the Draft Final *Long-Term Surveillance Plan for the U.S. Department of Energy Grand Junction, Colorado, Office Facility,* September 2000.

Page 1, Section 1.2, Paragraph 4. Sentence 1 should read as follows:

"The primary relevant and appropriate regulations and guidance for the remediation of the GJO facility are 40 CFR 192 and DOE Order 5400.5 (DOE 1989a and DOE 1989b).[1]"

Page 12, Paragraph 4. Sentence 3 should read as follows:

"Analytical laboratory results for soil samples collected from the deposit of contaminated soil had maximum concentrations of 177 pCi/g for radium-226, 148 pCi/g for thorium-230; and 269 pCi/g for total uranium."

Page 12, Second Full Paragraph. Sentence 4 should read as follows:

"A concrete sump integral to the Building 12 foundation has fixed surface contamination as high as 50,000 disintegrations per minute per 100 square centimeters."

Page 12, Sixth Full Paragraph. The paragraph should be revised to indicate the following information:

DOE will demolish Buildings 12 and 20 (in their entirety) when DOE operations in those buildings cease. The building structures have been released for unrestricted use, and the demolition debris will be hauled to a public landfill. Contaminated soil and debris was left under the west end of Building 20 for economic and structural reasons. The contaminated concrete slab

and soil under the south end of Building 12 was left in place for economic reasons. DOE will remediate the contaminated materials beneath the buildings and dispose of the material at Cheney Repository. The soil within the building footprints will be radiologically verified to comply with regulatory limits.

Plate 1:

The location of the 300-ft borehole with radium foil should be moved a couple hundred feet to the northwest.

The following changes apply to the specified areas of the final DR:

1. The first sentence in Section IV.A.2, paragraph 3 of the Enforceable Agreement, Section IV.C.1 paragraph 5 of the Quitclaim Deed, and paragraph 5 to Appendix E of the Long Term Surveillance Plan, Attachments A, B, and C respectively to the final DR has been modified and now states: "Grantee shall not engage in any use of the surface expressions of groundwater, except as described below, that might result in accidental consumption of the water, fish, or other aquatic species."

   The following paragraphs are also added to Section IV.A.2 of the Enforceable Agreement as paragraphs 4 through 6, Section IV.C.1 of the Quitclaim Deed as paragraphs 6 through 8, and to Appendix E of the Long Term Surveillance Plan as paragraphs 6 through 8 in the final DR.

   The Grantee may allow the U.S. Fish and Wildlife Service to utilize the surface water ponds on-site to raise Razorback Suckers (Xyrauchen texanus) prior to their introduction into the wild. No construction to the existing ponds is allowed unless specifically authorized by the Colorado Department of Public Health and the Environment. The U.S. Fish and Wildlife Service is the only agency authorized for this purpose, and the ponds may not be utilized for raising other fish species.

   The Razorback Suckers may be placed in the ponds each April and then later harvested from the ponds, not to exceed a duration of 8 months. The U.S. Fish and Wildlife Service will make every practical effort to remove all the fish from the ponds each growing season, and ensure that the fish are released into areas that are physically isolated from Northern Pike (Esox lucius) or other large predatory fish.

   The U.S. Fish and Wildlife Service will also ensure that its employees are adequately trained and protected from the hazards that they may encounter during the fish rearing operation. This training includes but is not necessarily limited to review of the Uranium Mill Tailings Management Plan and review of the most recent groundwater and surface water monitoring data for the site as provided for annually by the U.S. DOE.

2. Section 4.11 of the draft DR text, sentence 5 states "It (lead based paint) is not a CERCLA hazardous substance. This sentence is considered to be deleted from the final DR text.

3. Section IV.B of the Quitclaim Deed, Attachment B to the final DR, first sentence has been amended as follows: "Grantor warrants that all remedial action necessary to protect human health and the environment has been taken before the date of this conveyance, except as noted in Section IV.C below as required under 42 U.S.C. 9620(h)(3)(A)(ii)(I).

Request for Deferred Remediation
U.S. Department of Energy Grand Junction Office Site

1.0 Introduction

In accordance with State of Colorado *Executive Order D-013-98* and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the U.S. Department of Energy (DOE) is requesting the consent of the Governor's office for early transfer of the DOE site located in Mesa County near Grand Junction, Colorado, at 2597 B ¾ Road (known as the Grand Junction Office or GJO site).

This Request for Deferred Remediation application constitutes one portion of the process for obtaining regulator concurrence with the DOE proposal to defer remediation. The process includes, sequentially, (1) obtaining concurrence from the Colorado Department of Public Health and Environment that this request results in protection of human health and the environment and compliance with applicable laws and regulations, (2) providing an opportunity for public comment, (3) resolving public comments, and (4) obtaining the consent of the Governor's office. Pending said consent, the GJO site will be transferred. The GJO site will be transferred to a nonprofit organization representing the City of Grand Junction and Mesa County (the Riverview Technology Corporation or RTC) in late 2001, with the DOE remaining as a tenant at the site for the foreseeable future.

The Request for Deferred Remediation is organized to follow the specific requirements of the State of Colorado's *Executive Order D-013-98*. The Request itself primarily contains basis and background information. It also summarizes the information found in detail in Attachments A-G. The Request and all attachments constitute the entire application and should be reviewed as such. Each attachment is noted by a tab displaying the name and letter of the attachment.

This Request for Deferred Remediation application contains the following information (attachments are identified by the letter preceding the document title):

Errata Sheet
Request for Deferred Remediation
A. Enforceable Agreement
B. Quitclaim Deed, including Notice of Hazardous Substance Activity in Accordance with CERCLA 120(h)
C. *Long-Term Surveillance Plan for the Grand Junction Office Site* (June 2001)
D. *Ground Water/Surface Water/Sediment Compliance Action Plan*
E. *Riverview Technology Corporation Reuse Plan*
F. *Summary of Ecological Risk for the U.S. Department of Energy Grand Junction Office*
G. *Evaluation of Human Health Risks Associated with the Grand Junction Office Surface and Ground Water*
H. Public Comments and Responses

Copies of other documentation used as a basis for this document were provided to the Colorado Department of Public Health and Environment (CDPHE) in April 2000.

Additional copies of information may be obtained by contacting Dr. Cooper H. Wayman, Senior Legal Counsel for the DOE-GJO, at (970) 248-7620.

2.0 Legal Description of the Property

The property to be transferred is legally described in the Deed (Attachment B) as follows:

All that portion of Lot 1 lying West of the right-of-way of the Denver and Rio Grande Western Railroad Company, and all of lots 6 and 7, subject to right-of-way of the Denver and Rio Grande Western Railroad Company, all being in Section 27, Township 1 South, Range 1 West, Ute Meridian, Mesa County, Colorado, containing 55.71 acres of land more or less, together with the private railroad spur thereon, and all rights and appurtenance thereto, also all water and water rights used thereon or appurtenant thereto, including the private line from artesian well, and all rights in connection therewith, and all buildings and improvements thereon as recorded in Book 415, page 405;

And, that portion of G.L.O. Lot 1, Section 26, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado, lying west of the right-of-way of the Denver and Rio Grande Western Railroad Company containing 1.14 acres of land more or less, as recorded in Book 668, page 202;

Except: Parcel 1, located in G.L.O. Lot 7 of Section 27, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado, containing 2.68 acres of land more or less as conveyed to A. N. Applebaum and recorded in Book 1606, page 986; and

Except that portion to be reserved to the United States and called the Army Reserve Tract: containing 7.97 acres more or less.

This parcel then contains 46.20 acres calculated as follows: 55.71 acres (1943 Deed in Book 415, page 405) plus 1.14 acres (Deed in Book 668, page 202), minus 2.68 acres (Deed in Book 1606, page 986), minus 7.97 acres (Army Reserve Tract to be recorded) equals 46.20 acres of land more or less. Said Property and Army Reserve Tract are further shown and described in Exhibit A of the Deed (see Attachment B).

The Army Reserve Tract will remain under federal ownership and be transferred in 2001; the remainder of the Property will be transferred to private ownership in late 2001, pending approval of this request. The Property includes 22 buildings ranging from in-use office space to warehouse and light manufacturing areas. A small number of sheds and covered areas exist on the Property. Portions of the site are currently occupied by the Western Colorado Business Development Corporation Small Business Incubator Project under a lease signed in February 1999, which expires when ownership of the Property changes.

3.0 Information providing basis for a determination that the Property is suitable for transfer for the use intended by the transferee, and the intended use is consistent with protection of human health and the environment.

3.1 Basis for Request

Section 120(h) of CERCLA was enacted to protect citizens and communities from the costs of cleaning up contamination on land transferred to them by federal agencies. CERCLA 120(h) requires that federal agencies transferring property remain liable for all contamination occurring during federal ownership and the associated cleanup costs, regardless of the future ownership of the Property. These assurances of liability must be included in the Deed along with any restrictions required to ensure protection of human health and the environment.

To transfer a property prior to completion of all necessary remedial actions, the federal agency must provide for final cleanup of the property and all costs related to completing the remedial action. The federal agency must also apply any restrictions necessary to ensure that members of the public are not exposed to the hazards that remain behind. These provisions and restrictions must be included in the transfer documentation.

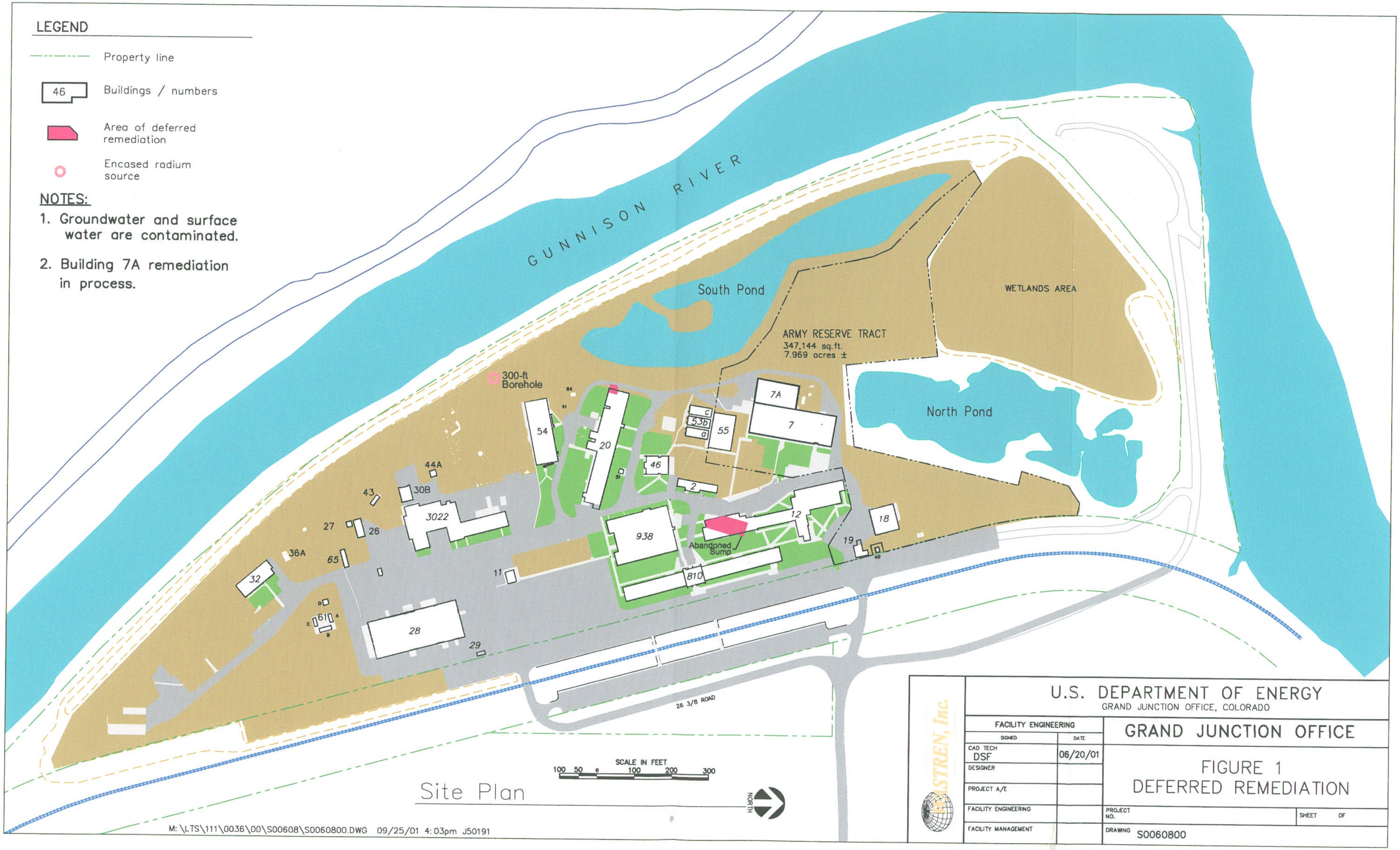
Under CERCLA 120(h), transfers of contaminated federal property not listed on the National Priorities List (NPL) under CERCLA are subject to the approval of the governor of the state where the property is located. Concurrence by the governor for transfer of the GJO site is required because contamination will remain on the site in the following forms:

- The ground water and surface expressions of ground water (the North Pond, South Pond, and wetland areas (Figure 1) are contaminated with constituents leached from stockpiled uranium ore and processing operations.
- Radioactive contaminants are present underneath portions of Buildings 12 and 20 (Figure 1). Building 7A is being demolished and any contamination found in soils will be removed and disposed by appropriate regulatory requirements.
- Two foil radioactive sources that have been encased in concrete in accordance with a State-approved well permit closure of a 300-foot well on the Property and will remain in place (Figure 1).

The DOE has determined that the GJO site meets the criteria for early transfer for the reasons described below.

1. DOE has completed all of the actions required by CERCLA 120(h), including:

    a. DOE has performed surveys of the site, reviewed historical information and records, current records, interviews with past employees, and has conducted a remedial investigation to determine the presence of contaminants at the site as part of the CERCLA process.
    b. DOE prepared a Record of Decision Summary identifying that soil contamination would be removed and appropriately disposed of, and ground water would be clean within 50–80 years by natural flushing.



LEGEND
Property line
46
Buildings / numbers
Area of deferred remediation
Encased radium source
NOTES:
1. Groundwater and surface water are contaminated.
2. Building 7A remediation in process.
GUNNISON RIVER
South Pond
North Pond
WETLANDS AREA
ARMY RESERVE TRACT
347,144 sq.ft.
7.969 acres ±
300-ft Borehole
Abandoned Sump
26 3/8 ROAD
7A
7
55
53b
54
20
46
2
12
18
19
938
810
44A
43
30B
3022
27
26
36A
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29
SCALE IN FEET
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Site Plan
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WASTREN, Inc.
U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION OFFICE, COLORADO
FACILITY ENGINEERING
SIGNED
DATE
CAD TECH
DSF
06/20/01
DESIGNER
PROJECT A/E
FACILITY ENGINEERING
FACILITY MANAGEMENT
GRAND JUNCTION OFFICE
FIGURE 1
DEFERRED REMEDIATION
PROJECT NO.
SHEET
OF
DRAWING
S0060800

c. DOE has included language in the Deed and transfer documentation that maintains DOE liability and responsibility for all future cleanup of DOE-generated contamination at the site, specifically the contamination identified in the bullets on Page 3.
d. The DOE has reserved all necessary rights of access and authority to complete required actions to ensure that contamination discovered in the future can be effectively remediated.
e. The DOE has imposed relevant and protective restrictions on the future use of the Property to ensure continued protectiveness, as stated in the Deed.

2. The DOE has removed all known contamination at the site (with the exceptions noted above) and has had the effectiveness of the remedies, which are protective of both human health and the environment, independently verified.
3. The DOE has conducted all removal actions in accordance with the remedy identified through the processes identified by both CERCLA and the National Environmental Policy Act (NEPA).
4. Each of the remaining sources of contamination described above has been managed in accordance with applicable regulations and DOE Orders; relevant and protective restrictions have been imposed on future use of the Property in the transfer documentation.
5. As detailed in this Request, the planned use for the site is a mixture of commercial, industrial, office space, and open space. DOE's planned institutional controls are protective, given the planned future use.
6. The remaining contamination should not present a risk to human health and the environment if managed by future owners in accordance with the Deed restrictions and monitored by DOE through the Long-Term Surveillance and Maintenance (LTSM) Program for the next 50 to 80 years, or until passive remediation of the ground water contamination is successful.
7. The DOE is entering into an Enforceable Agreement with CDPHE that contains a remedial action plan for the remaining on-site contamination and provides a funding mechanism for CDPHE oversight costs.

The following documents were provided to CDPHE as supporting documentation with DOE's draft Request for Deferred Remediation submittal on June 6, 2000. These documents form the basis for this determination:

- *Final Remedial Investigation/Feasibility Study—Environmental Assessment for the U.S. Department of Energy Grand Junction Projects Office Facility* (July 1989)
- *Grand Junction Projects Office Remedial Action Project Declaration for the Record of Decision and Record of Decision Summary* (April 1990)
- *Environmental Assessment of Facility Operations at the U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado* (April 1996)
- *Finding of No Significant Impact—Facility Operations at the U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado (April 1996)*
- *U.S. Department of Energy Grand Junction Office Facility Condition Assessment* (April 1998)

- *Environmental Assessment for the Transfer of the Department of Energy Grand Junction Office to Non-DOE Ownership* (April 2000)
- *Finding of No Significant Impact—Transfer of the Department of Energy Grand Junction Office to Non-DOE Ownership* (April 2000)
- *Final Summary Environmental Baseline Survey of the Grand Junction Office* (May 2000)

In addition, this revised submittal contains additional documents (see Section 1) relating to health and ecological risk, ground water compliance strategy, site reuse, and the latest version of the previously submitted LTSP.

4.0 Description of the nature and extent of contamination with supporting documentation.

4.1 History

The GJO site property was acquired by the U.S. War Department in August 1943 to refine uranium for the Manhattan Project. Uranium was milled, analyzed, and stored on the GJO facility from 1943 to 1975. Operations included ore processing, ore concentrating, research and analytical laboratories (chemistry, analytical, mineralogical, environmental and petrology), a radon chamber, drum storage, and vehicle and site maintenance activities. All known environmental contamination is believed to be the result of these past activities. According to historical records (maintained by DOE and its predecessor agencies, the Atomic Energy Commission, the Nuclear Regulatory Commission, and the Energy Research and Development Administration), approximately 32,000 tons of ore were processed between 1943 and 1958. The resulting tailings, consisting of approximately 178,000 cubic yards (yd^3) of material, were stored or used at many locations at the site.

4.2 Summary of GJO Site Completed Remedial Action, Removal, and Verification

In planning for cleanup of the facility, DOE-GJO complied with the NEPA process and also used the environmental management protocols of CERCLA (as required by DOE policy), although the site did not score high enough to qualify for placement on the NPL (*Grand Junction Projects Office Remedial Action Project Declaration for the Record of Decision and Record of Decision Summary* (April 1990)). A final Remedial Investigation/Feasibility Study-Environmental Assessment (RI/FS-EA) that addressed remediation of the facility was completed in 1989. The *Record of Decision* was completed in 1990.

As a result of the site investigations, the total volume of uranium mill tailings and tailings-contaminated material at the site was estimated at 250,000 yd^3. The tailings and related materials occupied approximately 20 acres. Removal of uranium mill tailings and contaminated soil began in late 1989, and most of the contamination was removed by 1994. During 1999 and the early part of 2000, DOE removed many old drain lines and other underground systems in which contamination was found to further reduce the potential for harm to human health and the environment.

In 1984, the DOE-GJO facility was accepted into the DOE Surplus Facilities Management Program (SFMP). The first comprehensive survey report was completed in 1986. This assessment was based on a 100-foot by 100-foot grid system that was established over the facility to define the extent of Ra-226 contamination. The assessment identified 17.8 acres of the facility with radiologically contaminated soil. This report is entitled *Radiologic Characterization of the Department of Energy Grand Junction Projects Office Facility*, prepared by Bendix Field Engineering Corporation for the Department of Energy SFMP Program (Henwood and Ridolfi, 1986, report GJ-41). This comprehensive assessment collected:

- 348 soil samples; analyzed for Ra-226, Thorium-232, and K-40
- 793 delta-gamma measurements (equivalent Ra-226)
- 205 exterior and 6 interior boreholes depth data
- 103 truck-mounted augers to bedrock in 1982
- 4 building surveys (Buildings 31, 33, 34, and 35)

The results from the assessment identified two separate contaminated areas of 31,440 yd^3 and 28,610 yd^3. It identified tailings used as fill to level low-lying areas along the dike and other areas.

In 1988, the facility was transferred to the DOE Decontamination and Decommissioning (D&D) Program. An additional comprehensive assessment was conducted in 1990. Results are reported in *Radiological Assessment for Construction Phase IB,* (DOE-GJO, April 9, 1990), and supplements the 1986 assessment. The 1990 assessment covered the facility areas inside the security fence (except the mill area on the southern end of the facility). It was conducted to more accurately determine the areal extent and quantity of contamination. In this assessment:

- 274 soil samples were collected and analyzed for Ra-226, K-40, Th-232, Th-230, total uranium, and some for Cs-137; and
- 649 sample locations were established to collect either delta-gamma measurements and/or depth borehole data.

The total volume of contaminated material was revised to 136,000 yd^3as a result of this assessment. Alpha and beta contamination were also detected near Building 2 and Building 7.

A radiological assessment of Black Bridge Park, at the north portion of the facility, is addressed in *Radiological Assessment for Black Bridge Park* (DOE-GJO, October 1989). Black Bridge Park and Treasure Island, on the northwest portion of the facility, were reassessed in 1993 to accurately determine the quantities of contaminated material and extent of Th-230 and total uranium. This report is entitled *Final Report and Recommendation, Grand Junction Projects Office Remedial Action Project Supplemental Radiological Characterization, Treasure Island and Black Bridge Park* (DOE-GJO, May 1993). The additional data collection was needed in part for the program changes that recognized clean-up criteria for Th-230 and total

uranium. Existing data were supplemented with exploratory trenching in areas of known or suspected contamination. The disposal trenches in the landfill area of Treasure Island were monitored and sampled for radiological and nonradiological contamination. This reassessment identified approximately 44,000 yd^3 of additional radiologically contaminated material.

In 1994, sediment samples were collected from the North Pond and analyzed for Ra-226, Th-230, Th-232, and total uranium. The results of the investigation are summarized in a memorandum entitled *Results of the Sampling of the North Pond, June and July 1994, U.S. Department of Energy Grand Junction Projects Office,* internal memorandum from S.J. Lindholm to C.L. Jacobson. This survey was used to augment the sediment sampling results from the 1986 site characterization. This sample analysis showed that all sample results were below the guideline limits.

The results of the initial characterization and all of the supplemental characterization data were used in the remedial design. Decontamination activities for the exterior areas of the DOE-GJO facility were initiated in July 1989 and were completed in January 1995.

Some decontamination activities took place before the Grand Junction Projects Office Remedial Action Project (GJPORAP) was initiated in 1989. These activities included the remediation in 1984 and 1985 of the area south and east of and adjacent to Building 7, the remediation in 1985 of a portion of the Army Lease Area north of Building 18, and the remediation in 1987 of several sections of sidewalk near Building 46. In 1988, five underground storage tanks located west of Building 28 and south of Building 33 were removed. Radiologically contaminated soil associated with these tanks was removed and stockpiled.

The contamination areas were confirmed and marked to indicate excavation boundaries. Technicians monitored the excavation by using scintillometers and by sampling soils to ensure that all contaminated material was removed with minimal over-excavation. When contamination was found to be more extensive than originally assessed, excavation continued horizontally and vertically until all contaminated material was removed. Areas that were assessed as free of contamination were rescanned and sampled, if necessary, to confirm the absence of contamination. The excavated areas went through a verification process that used a 10-foot by 10-foot grid system or a Large Area Verification procedure that used a 30-foot by 30-foot grid system. When a remediated area was verified to meet cleanup standards, the excavation was backfilled with uncontaminated material. A total of 416,133 tons of contaminated materials, representing a volume of approximately 255,250 $yd^3$and covering an area of approximately 22.6 acres, was removed. This material was disposed of at the Grand Junction (also known as Cheney), Colorado, Disposal Cell, a local repository approved to accept uranium mill tailings.

A survey in June and July 1999 to assess windblown contamination used a triangular grid system with spacing between the sample measurement location to provide a 95 percent certainty of finding a circular deposit with an area not greater than 100 square meters (m^2). Surface and subsurface beta-gamma measurements were

made to determine possible uranium contamination, and soil samples were collected immediately under the asphalt pavement. No elevated uranium windblown contamination was found during this survey; however, additional ore contamination was found in the parking lot east of Buildings 810 and 19. The deposits of ore were remediated.

During site remedial action activities, utility trenches were remediated if tailings were found. However, in some areas of the facility, utilities pass under areas that did not require remediation. The potential existed that tailings could have been used for pipe bedding or backfill and would be shielded by clean backfill, although this was not a standard construction practice at the GJO facility. Twelve locations were investigated in July 1999 to determine if the water, sanitary sewer, storm sewer, natural gas, and steam utilities were affected. Trench backfill and bedding material was scanned in the 12 locations. Since the utilities were laid in relatively long segments, it was assumed that if no mill tailings were identified in this investigation, then tailings were not used in the remaining utility trenches. If tailings were identified in the utility trenches, then additional locations would be investigated. The telecommunications lines were not investigated because of their relatively shallow depth and recent installation. No elevated readings were found in any of the utility investigations.

Many of the legacy septic tanks, dry wells, and sewer lines were either removed, as documented through field maps showing depths of remediation, or were abandoned when the current sewer system was installed. An investigation of the remaining septic tanks and exterior sewer lines was conducted from December 1999 through March 2000. All known septic tanks were surveyed for radiological contamination and to determine if they had been abandoned properly.

Each tank was exposed with a backhoe, along with the exterior side, entrance, and exit pipes if possible. If the tank had sludge, it was sampled for radiological constituents. Readings were collected of the interior and exterior walls of the tank, the entrance and exit pipes, and any possible leach field associated with the tank. In this investigation, 33 septic tanks were identified from historical utility drawings. Six of them are known to have been removed during GJPORAP remediation, and 27 tanks were searched for and 18 were found. The results of the investigation found that three tanks had not been abandoned properly. These tanks had no radiological contamination in the sludge, although one tank was found to have contaminated entrance and exit pipes and approximately 200 feet of associated drainpipe. The contaminated tank and drain system was located south of Building 32. This tank and the drainpipe were remediated, and the results have been presented in a close-out report. The improperly abandoned tanks were pumped and then filled with a concrete/soil mixture.

Each building on the facility has been evaluated through a systematic process involving radiological classification, characterization (to determine if residual radioactive material is present), remediation (if necessary), radiological verification and/or release survey, and preparation of a close-out report recommending release for unrestricted use. Nine radiologically contaminated buildings (Buildings 1, 6, 31, 34, 36, 37, 39, 44, and 52) were demolished during GJPORAP. Since these initial

demolitions, other buildings have been removed from the facility (Buildings 31A, 33, 35, and 56).

For all site structures, radiological contamination results collected from release surveys and verifications are statistically analyzed. The average levels are calculated and compared with the guideline values and conditions. If the averages exceed the applicable guideline values, further remediation is required, and follow-up measurements are performed to verify the effectiveness of the actions.

After the averages satisfy the guideline values and conditions, the results are further evaluated. The test uses the mean, standard deviation, sample size, and probabilities to provide a 95 percent confidence that the true mean activity level meets the guideline. This test is outlined in NUREG/CR-5849, *Manual for Conducting Radiological Surveys in Support of License Termination*, equation 8-13.

Independent (third-party) verifications were performed to verify the effectiveness of remedial actions conducted within the various remedial action programs. Oak Ridge National Laboratory–Grand Junction Office (ORNL-GJO) is the independent verification contractor (IVC) for remediation of the GJO facility.

The IVC confirmed that: the surveys; the sampling and analyses conducted before, during, and following remedial action; and the associated documentation presented an accurate and complete description of the condition of the site. The IVC also confirmed that remedial action reduced contaminant levels to below applicable radiological and hazardous waste guidelines for soil, water, and structures.

The IVC performed either a Type-A or Type-B independent verification. A Type-A verification consists of only a review of the verification documentation written by the remedial action contractor (RAC). A Type-B verification consists of a document review of the verification activities as well as an assessment of independent field measurements taken by the IVC to determine if the measurements are within guidelines and for comparison with measurements taken by the RAC.

ORNL-GJO has published individual verification reports for all buildings that have been decontaminated or demolished. In 1997, ORNL published the *Confirmatory Radiological Survey of the Grand Junction Projects Office Remedial Action Project Exterior Portions, 1989-1995* (Oak Ridge National Laboratory, April 1997).

4.3 Resource Conservation and Recovery Act (RCRA) Permits

DOE operations at the site today use the facility for office space and an analytical chemistry laboratory (located in Building 20) with associated waste management activities. DOE will continue to operate the analytical laboratory and will remain responsible for associated waste management. When, in the future, DOE decides to no longer operate the analytical laboratory, DOE will demolish Building 20 and remediate the contaminated materials remaining beneath the structure. In 1992, the GJO submitted Part A of a Hazardous Waste Permit Application to CDPHE to operate a waste storage area (Building 42). Through the submission of the

application, the GJO is allowed to operate as an Interim Status storage facility under RCRA. The application was revised in April 2000 to change the storage location to Building 61C so that Building 42 could be closed prior to site transfer. Hazardous wastes are stored in accordance with RCRA, including requirements for timely. disposal, if possible, primarily in Buildings 61A and 61C.

Building 42 has been closed in accordance with Part 265, Subpart G, of the Colorado Hazardous Waste Regulations. The building was demolished in July 2000. DOE is currently using Building 61C as the Interim Storage facility under the Part A application filed with the State in January 1992. A closure plan that meets the requirements of Part 265, Subpart G, of the Colorado Hazardous Waste Regulations, has been filed in accordance with the regulations.

DOE-GJO will lease the storage facility from the RTC for DOE's sole use and will maintain total liability for the maintenance and operation of the storage facility until it is formally closed on or before August 31, 2001. DOE will ensure that all operations are conducted in accordance with applicable regulations and will perform any clean-up actions that may be required as a result of historic or on-going operations.

Because DOE-GJO uses small quantities of hazardous materials, the facility has typically operated as a conditionally exempt small quantity generator (CESQG) under RCRA. However, because GJO has occasionally generated waste over CESQG quantity limits, the site maintains full compliance with all of the requirements of RCRA for large quantity generators. Once the site is transferred, DOE will not generate significant quantities of waste. The RTC, as owner, will be responsible for sewer effluent discharges and permits, except for sewer effluent discharges associated with analytical laboratory operations, for which DOE will remain responsible.

4.4 Remaining Ground Water/Surface Water/Sediment Contamination (see Tables 1 and 2)

Concentrations of uranium, gross alpha, molybdenum, arsenic, selenium, nitrate, chloride, iron, manganese, sulfate, and total dissolved solids in samples from the alluvial aquifer exceed ground water quality standards. The original ground water modeling of the alluvial aquifer predicts that concentrations of ground water contaminants will be below applicable standards within 50 to 80 years after removal of the contaminant source (uranium mill tailings), which was predominantly completed in 1994. The surface expressions of ground water (the North Pond, South Pond, and wetland areas) contain elevated quantities of some chemical constituents typically associated with uranium mill tailings (e.g., manganese, molybdenum, sulfate, and vanadium). Chloride concentrations in samples collected from the North Pond and wetland area, and sulfate concentrations in samples collected from the North Pond, South Pond, and wetland areas, exceeded applicable State standards for these analytes. Tables 1 and 2 identify the regulatory limits and constituents found to exceed the limits during the most recent monitoring episode.

DOE sampled the North Pond on 100-foot centers in 1986 and 1994 for radiological constituents, and sediments did not exceed regulatory limits (*Final Report of the*

Decontamination and Decommissioning of the Exterior Land Areas at the Grand Junction Project Office Facility, September 1995). The earth materials beneath the South Pond and wetland areas were remediated and verified to comply with regulatory limits. The excavations were backfilled with clean material. No excavation has occurred in the North Pond. DOE's planned remedial action for surface/ground water and sediments is detailed in Section 5.1.

Table 1. Summary of Contaminants Remaining in Ground Water

Contaminant of Concern/ Applicable Standard[1]		Known Levels of Contamination[2]	Potential Hazard/Comments
Common Ions (mg/L)			
Nitrate (as N)	10	16.74	The contamination remaining in the ground water does not present a hazard unless the ground water is exposed to the surface and used for some purpose. Any activities affecting ground water must be reviewed in accordance with the Deed restrictions. The passive remediation of the ground water should be complete in 50 to 80 years.
Total Dissolved Solids	2,138	5,690	
Metals (mg/L)			
Arsenic	0.05	0.23	See above.
Barium	1.0	0.0483	
Cadmium	0.01	0.0015	
Chloride	250	397	
Chromium (total)	0.05	0.0146	
Iron	0.3[4]	1.69	
Lead	0.05	<0.001	
Manganese	1.7[6]	5.26	
Molybdenum	0.1	0.229	
Selenium	0.01	0.122	
Silver	0.05	not analyzed[3]	
Sulfate	250[4]	1850	
Radionuclides (pCi/L)			
Gross Alpha (excluding radon and uranium)	15	113.59	See above.
Radium-226+228	5.0	0.57	
Uranium-234+238	30	1140.7	

[1] Uranium Mill Tailings Radiation Control Act, revised in 1986; Title 5, *Colorado Code of Regulations*, Part-1002–8; and EPA Region 3 Risk-based Concentration Table (October 2000).
[2] Concentrations are reported in the *U.S. Department of Energy Grand Junction Office Site Environmental Report for Calendar Year 1999* (GJO-2000-158-FOS, September 2000).
[3] Ground water was not analyzed for silver in 1999 because historical concentrations have been near background levels.
[4] Title 5, *Colorado Code of Regulations*, Part 1002-8, "Basic Standards for Ground Water."
[5] EPA Region 3 Risk-Based Concentration Table, October 2000 Update.

Table 2. Summary of Contaminants Remaining in Surface Water

Contaminant of Concern/ Applicable Standard[1]	Known Levels of Contamination[2]	Potential Hazard/Comments
Chloride/250 mg/L	North Pond-334 mg/L Wetland Areas-651 mg/L	The potential hazard for exposure is ingestion (drinking) of the water or fish, or prolonged exposure through swimming or wading. Both activities are controlled through restrictions in the Deed.
Sulfate/ 480 mg/L	North Pond-2,240 mg/L South Pond-1,600 mg/L Wetland Area-6,780 mg/L	See above.
Uranium/40 picocuries per liter (pCi/L)	North Pond-102 pCi/L South Pond-269 pCi/L Wetland Area-111 pCi/L	See above.

[1] Title 5, *Code of Colorado Regulations*, Part 1002–8
[2] Figures are reported in the *U.S. Department of Energy Grand Junction Office Site Environmental Report for Calendar Year 1998* (September 1999).

4.5 Remaining Radium Sources in Well

DOE will leave a pair of radium foil sources on-site encased in a 300-foot-deep well. The radium sources are low-activity sources that were used for the calibration of equipment. The well has been abandoned in accordance with a State-approved plan, and the sources are encased in concrete approximately 150 feet below the surface, eliminating the potential for future exposure unless the well is excavated. No further remediation is required by the State for these sources. DOE has placed a physical marker over the well to identify the location.

4.6 Remaining Soil Contamination Under Building 12 (see Table 3)

The contamination present beneath Building 12 is believed to consist of soil with elevated concentrations of radium-226 and uranium from an old mill slab. The contamination is believed to be present beneath the building based on the concentrations in soil found during the removal of portions of the former mill slab on the east and west exterior sides of Building 12. The triangular pieces of the slab that extended beyond the Building 12 footprint were removed in August 1999 and April 2000. All exterior portions of the deposit were removed except for a small concrete box that was structurally tied to the east Building 12 foundation. A single corehole was cut near the center of the former mill slab in March 2000. The core cut through 4 inches of Building 12 concrete, 4 inches of soil, and 6 inches of former mill slab concrete. Soil samples collected from the core did not exceed the radium, thorium, or total uranium concentration guidelines found in the *Survey Plan for Releasing the Buildings at the Grand Junction Projects Office for Unrestricted Use*, (GJPO-GJ-16, December 1995). The top surface of the core did display elevated fixed surface contamination measurements; however, this slab is covered with the Building 12 slab and 4 inches of soil, so no detectable readings can be seen inside the building. Additional coreholes were not possible at the time because of untraceable electrical conduit beneath the slabs that could cause electrical shock if cored through. Additional coreholes were drilled during a planned electrical outage in August 2000. This further defined the extent of contamination beneath the slab. Deposits beneath the former slab on the outside of Building 12 contain soil concentrations of

24 picocuries per gram (pCi/g) Ra-226; 100.6 pCi/g total uranium on the west side; 123 pCi/g Thorium-230 and 1,430 pCi/g total uranium on the east side.

Table 3. Summary of Contaminants Remaining Under Building 12

Contaminant of Concern/ Applicable Standard[1]	Known Levels of Contamination[2]	Potential Hazard/Comments
Thorium-230/ 15 pCi per gram (pCi/g)	123 pCi/g	The contamination presents a danger of exposure if disturbed. The remaining contamination is situated under the building. Activities that might disturb the soils will be subject to review by DOE. DOE will demolish the building and take appropriate remedial action when DOE no longer has a use for the building. There is no hazard to occupants of the building.
Uranium-106 pCi/g	1,430 pCi/g	See above.

[1]DOE Order 5400.5, *Radiation Protection of the Public and Environment.*
[2]Levels of contamination identified in areas proximate to Building 12.

A release survey was conducted in Building 12; no elevated gamma exposure rates were found, no elevated beta-gamma activity was found, and the average radon decay-product concentration for this building was 0.006 working level, which is below the 0.020 working level guideline. These measurements indicate that the mill slab and underlying soil do not pose any increased health risk to the workers inside Building 12.

DOE proposes to postpone remediation of contamination located underneath Building 12. Immediate removal of the contamination would require demolition of the building, which houses critical computer equipment. The contamination will remain in place and will be managed appropriately until DOE ceases to lease the building. At that time, DOE will demolish the building and will remove and dispose of all contamination. Requirements to complete the work are established in the Deed (Attachment B) and the Enforceable Agreement (Attachment A) and are discussed further in Section 5.2.

4.7 Remaining Soil Contamination Under Building 20 (see Table 4)

DOE recently discovered contamination underlying Building 20, the analytical laboratory, and has characterized the material to determine the levels of contamination and required remediation. The contamination present beneath the southwest corner of Building 20 consists of soil with elevated concentrations of radium-226 and uranium that was placed there as fill to bring up the elevation of a pond bank. The volume of the deposit is estimated at 95 yd^3 of soil and concrete rubble that has varying thickness, with the greatest thickness of contaminated soil being 8 feet. It extends inside the west wall of Building 20, approximately 5 feet to the east. The top of the deposit starts approximately 4.5 feet below the uncontaminated soil surface and goes down to a total depth of 13 feet at its thickest point. Maximum contaminant concentrations determined through analytical

laboratory analyses of soil samples were 177 pCi/g radium-226, 148 pCi/g thorium-230, and 269 pCi/g total uranium.

Table 4. Summary of Contaminants Remaining Under Building 20

Contaminant of Concern/ Applicable Standard[1]	Known Levels of Contamination	Potential Hazard/Comments
Thorium-230/ 15 pCi per gram (pCi/g)	148 pCi/g	The contamination presents a danger of exposure if disturbed. The remaining contamination is situated under the building. Activities that might disturb the soils will be subject to review by DOE and are subject to Deed restrictions. DOE will take appropriate remedial action when the new owner no longer has a use for the building. There is no hazard to occupants of the building.
Uranium/106 pCi/g	269 pCi/g	See above.
Radium-226/15 pCi/g	177 pCi/g	See above.

[1]DOE Order 5400.5, *Radiation Protection of the Public and Environment*

The depth, size, and concentrations of this deposit are estimated from 45 vertical drill rig investigations along the western exterior boundaries of the building, six angled drill rig investigations near the southwest corner of the building, and soil samples collected from the vertical face of the excavation on the west side of the building. The drilling and sampling occurred in May and June 2000. Because the deposit starts several feet below the surface, no detectable radiological readings have been found inside the building due to this deposit. This is supported by the *Building 20 Characterization Report* (DOE-GJO, May 1996). This report states that the gamma exposure rates and the indoor radon decay-product concentrations are both below the guideline values. Other measurements of exposure have been collected inside the building through long-term dosimeters placed on the east and west sides. No increase in exposure can be seen in comparison of the east and the west ends of the building. Based on these measurements, this deposit does not pose any increased health risk to the workers inside Building 20.

DOE will leave the contamination in place until DOE vacates the building. At that time, DOE will demolish the building and remediate the underlying contamination. Additional details are provided in Section 5.3 and in Attachments B and C.

4.8 Status of Buildings 7 and 7A

Buildings 7 and 7A were historically used for uranium oxide sample preparation and analysis. The structures and the associated soil were contaminated with uranium oxide and uranium mill tailings.

Building 7 was remediated in 1999, after which the structure and associated soils were surveyed in accordance with approved plans and using the best available technology. The building was verified to be free of contamination and was released

for unrestricted use and unlimited exposure. Transfer of the building to the U.S. Army is pending.

Building 7A was demolished in 2001. Contaminated soil in the footprint was excavated, and contaminated material was disposed of at the Grand Junction Disposal Site. Verification surveys indicate that the site (including associated Building 62 and the fan house) can be released for unrestricted use and unlimited exposure.

4.9 Remaining Friable Asbestos

Friable asbestos is present in limited quantities on the Property and is subject to the reporting requirements of CERCLA 120(h). The GJO facility has operated under an asbestos management plan since 1995. The asbestos management plan was created in compliance with the Asbestos Hazard Emergency Response Act (AHERA) and has been managed by an AHERA-certified management/planner. As part of the development of that plan, DOE undertook an extensive sampling and analysis project to identify and quantify the types and amounts of asbestos on the site. Asbestos abatement projects have been conducted in accordance with the Toxic Substances Control Act; State of Colorado Regulation 8, Part B, "Asbestos Control"; and applicable standards for worker protection under the Occupational Safety and Health Act. Remaining quantities of friable asbestos that are regulated under CERCLA are listed below in Table 5. The site transfer documentation clearly states that all asbestos remaining on-site (both friable and non-friable) is the responsibility of the owner (see Attachment B).

Table 5. Reportable Friable[a] Asbestos[b]

Location	Homogeneous Material Description	Material Condition	Quantity Linear or Sq. Ft.	Asbestos Content
Building 20	Soils in Trench	Fibers in Soil	341 sq. ft.	14%
GJO Site	Buried Debris (Various locations where pipe insulation was replaced during the 1970's and the removed insulation was reburied with the utility.)	Friable/Damaged[c]	Estimate 500 lf	25% to 30%

[a] "Friable" means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously non-friable material that becomes damaged to the extent that when dry may be crumbled, pulverized, or reduced to powder by hand pressure (40 CFR 763.83)
[b] The CAS Number for friable asbestos is 1332214; the Reportable Quantity is 1 pound. The linear footage is the result of physical inspection, the number of pounds cannot be estimated from available data.
[c] "Damaged" means asbestos-containing material that has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that its bond to the substrate (adhesion) is inadequate or which for any other reason lacks cohesion or adhesion qualities (40 CFR 763.83).

4.10 Remaining Non-reportable Friable Asbestos and Non-friable Asbestos

Buildings on the Property contain non-friable asbestos in the form of floor tiles, ceiling tiles, and mastic carpet adhesive. CERCLA 120(h) does not require the reporting of non-friable asbestos, and the materials present at the site are not considered to be a hazard unless disturbed (e.g., tile removal using destructive methods, sanding, scraping, or sandblasting). DOE has also identified a trench running along the northern portion of Building 810 on the east side that contains remnants of asbestos transite siding that was removed from Building 810 between 25 and 30 years ago. The siding is not friable at this time and does not present a hazard to human health or the environment. Removal actions using heavy equipment or destructive methods may render the transite friable.

Additionally, there are areas at the site where friable asbestos exists, but the friable asbestos has not been stored, released, or disposed of as defined by CERCLA 120(h). The materials are therefore non-reportable and are classified as "damaged" because damage may have occurred to portions of the materials; but the damage has not rendered the materials unusable for their intended purposes (for example, pipe insulation). In every instance, the materials are being managed in-place to mitigate any potential hazard. Table 6 lists the known locations of non-reportable, friable asbestos. The site transfer documentation states that all remaining asbestos is the responsibility of the new owner (see Attachment B).

Table 6. Non-reportable Friable[a] Asbestos[b]

Location	Homogeneous Material Description	Material Condition	Quantity Linear or Sq. Ft.	Asbestos Content
Building 18	Spray-on Ceiling Insulation	Friable/Damaged[c]	2,297 sq. ft.	20%
Building 20	Pipe Insulation	Friable/Damaged	3,133 lf	4%
Building 810	Pipe Insulation (South Crawlspace) Risers, Air Duct	Friable/Damaged	716 lf	25%
Building 938	Pipe Insulation, Risers	Friable/Damaged	48 lf	25%
Building 3022	Pipe Insulation (South Crawlspace) Risers	Friable/Damaged	690 lf	25%
GJO Site	Buried Pipe Insulation between Buildings 28 and 29 and between Buildings 1 and 56	Friable/Damaged	Estimate 500 lf	25% to 30%

[a] "Friable" means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously non-friable material that becomes damaged to the extent that when dry may be crumbled, pulverized, or reduced to powder by hand pressure (40 CFR 763.83)
[b] The CAS Number for friable asbestos is 1332214; the Reportable Quantity is 1 pound. The linear footage is the result of physical inspection, the number of pounds cannot be estimated from available data.
[c] "Damaged" means asbestos-containing material that has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that its bond to the substrate (adhesion)is inadequate or which for any other reason lacks cohesion or adhesion qualities (40 CFR 763.83).

4.11 Remaining Lead-based Paint

Because of the age of the buildings on the site, lead-based paint is presumed to be present on the exterior surfaces of all buildings. There are no data available to quantify the amount of paint remaining on the buildings. In most cases, the lead-based paint has been encased with non-lead-based paint and presents no danger to site occupants as long as it remains undisturbed (e.g., sanding, scraping, sand blasting). Reporting of remaining lead-based paint is discussed here at the request of CDPHE. It is not a CERCLA hazardous substance. The site transfer documentation clearly states that remaining lead-based paint is the responsibility of the new owner (see Attachment B).

5.0 Deferred Remediation

5.1 Ground Water/Surface Water/Sediments

The *Grand Junction Office Remedial Action Project Declaration for the Record of Decision and Record of Decision Summary* concluded that passive remediation of the ground water contamination was the most efficient and protective restoration method. Modeling indicated that natural flushing of the ground water underlying the site would remove all added contaminants to acceptable limits within a 50- to 80-year period.

5.1.1 Constituents of Concern

The selected remediation strategy is described in detail in Attachment C, *Long-Term Surveillance Plan (LTSP) for the U.S. Department of Energy Grand Junction, Colorado, Office Facility* (June 2001), and also in Attachment D.

Ground water and surface water have been monitored at the site since 1979. In 1992, the ground water monitoring network was reduced to 12 monitor wells. Also in 1992, quarterly sampling was reduced to sampling every 9 months to allow an annual assessment of compliance with ground water standards while still collecting data to assess the effect of seasonal fluctuations in contaminant concentrations. Many constituents have been analyzed over the years to establish a ground water quality baseline for the area. Monitoring results have been presented in annual site environmental reports since 1980.

Data for site ground water constituents of concern have been plotted to show trends over time (see Attachment D). Uranium is the principal constituent of concern in site ground water and, as a conservative species, is considered representative of current migration of site-related contaminants in ground water in the alluvial aquifer. Uranium in ground water plotted over time from 1982 through 1998 shows concentrations generally above the maximum concentration limit but consistently decreasing, indicating that natural flushing is occurring in the alluvial aquifer (Figure 2 in Attachment D). Concentrations of uranium, molybdenum, arsenic, and selenium (radium was consistently below the regulatory limit), plotted from January

1992 to June 1998, presents data for the period during and after surface remediation (Attachment D, Section 2.2). Results for uranium and molybdenum show consistently decreasing concentrations in ground water at most locations. Linear trend lines have been plotted for uranium in ground water from three monitor wells (8-4S, 11-1S, and GJ84-04) to show the projected decrease in concentrations over time. Trend-lines indicate that concentrations of uranium should decrease to below the standard well within the 100-year regulatory time frame. Migration of arsenic and selenium tends to be more retarded in site ground water, and trends are not yet obvious. Also, selenium occurs naturally in ground water in the Grand Junction area, and elevated concentrations are not necessarily site-related.

Monitoring will continue, and trends will be evaluated until concentrations of constituents of concern are below the standards. Statistical ground water data comparison methods will be implemented as discussed in Section 5.1.3.

Surface and ground water contaminants of concern are different because exposure pathways and receptors are different, and different mechanisms (e.g., evaporation in the wetland areas) affect constituent concentrations. However, the analyte list proposed in Attachment C, the LTSP, is the same for both surface and ground water (see Table 7). This list includes all constituents identified as potentially posing a risk and/or exceeding regulatory limits. Tables 2.2 and 2.3 of the LTSP identify the regulatory limits and constituents exceeding these limits, based on the latest monitoring data.

Table 7. Surface and Ground Water Analyte List

Analyte	Basis for Retention		
	Exceeds Regulatory Limit	Poses Ecological Risk	Poses Human Health Risk
Arsenic	X		X
Chloride	X		
Gross Alpha	X		
Iron	X		
Manganese	X	X	X
Molybdenum	X	X	X
Nitrate			X
Selenium	X		
Sulfate	X		X
Total dissolved solids	X		
Uranium	X	X	X

DOE has reevaluated the risks to human health and the environment, as requested by CDPHE (see Section 6). The ecological risk assessment concluded that ecological constituents of potential concern included uranium for ground water and molybdenum and uranium for surface waters. The human health risk identified arsenic, manganese, molybdenum, sulfate, and uranium as constituents of potential concern in site surface and ground water.

Table 7 summarizes the results of defining the list of analytes on the basis of regulatory compliance, ecological risk, and human health risk. Sample analysis will include these analytes and standard field parameters. Vanadium was deleted from the analyte list because the ecological and human health risk analyses did not identify this analyte as a constituent of concern, and vanadium concentrations in GJO site ground water have consistently been below the regulatory limit.

DOE does not have the analytical data to demonstrate that pond sediments will not accumulate contaminants from ground and surface water. Consequently, DOE will conduct sampling to establish baseline chemistry data for pond sediments. This task is included in Attachment C, the LTSP.

Sediment samples will be collected from the South Pond, the North Pond, and the wetland areas. Sample locations will be selected to represent worst case and average conditions (e.g., deep water, near shore, and intermittently inundated areas). Analytes will include arsenic, chloride, total chromium, gross alpha, magnesium, manganese, molybdenum, nitrate, selenium, sulfate, total uranium, and isotopic uranium. On the basis of the results, DOE will develop a program for further sediment monitoring.

5.1.2 Summary of Compliance Strategy (see Attachment D for additional details)

Until spring 2000, the ground water monitoring network at the GJO facility consisted of 12 wells (see *U.S. Department of Energy, Grand Junction Office, Ground Water Protection Management Program Plan* (November 1999) and the *Annual Site Environmental Report*. The remaining 36 wells were found to be redundant or unnecessary and have not been sampled since 1995. In December 1999, the ground water monitoring program at the GJO facility was re-evaluated. The evaluation included a review of the alluvial aquifer model, sample results, and trends. As summarized below and in Attachment D, only a subset of the sampling locations were considered necessary for monitoring aquifer conditions, including the progress of aquifer flushing. The sampling network also is adequate to ascertain that there is no potential impact to human health and the environment.

The six monitor wells selected for the monitoring network (8-4S, 11-1S, 6-2N, 14-13NA, GJ84-04, and 10-19N) are distributed on-site and along the downgradient edges of the facility near the Gunnison River (see Figure 1, Attachment D, for graphic). The other six monitor wells did not enhance or add value to the network because concentrations have been consistently low since 1982 (GJ84-09 and 5-12NA), the wells were located too near the Gunnison River to provide useful data (14-6NA), or were located near other wells or were in the interior of the site where activity is less relevant (10-2NA, 11-12NA, GJ87-15).

The analytes to be monitored in ground water during each sampling event include the constituents of concern and other constituents that may be useful in assessing site conditions. In addition to these analytes, standard water quality indicators (pH, alkalinity, conductivity, temperature, and turbidity) will be measured during each sampling event.

Ground water monitoring at the GJO facility will be conducted annually, in late winter, for a minimum period of 5 years (through 2005). At the end of this period, DOE will evaluate monitoring results in consultation with the CDPHE to determine the requirements for future monitoring at the site. This will include a statistical evaluation of contaminant concentration trends. Criteria for modifying or terminating ground water and surface water monitoring will include (1) continued decrease in concentrations of constituents of concern as predicted and observed, (2) compliance with regulatory limits, and (3) no unacceptable risks to human health and the environment resulting from site-related contamination. Modification may include changing the number or location of sample points or the suite of analytes. The DOE will receive approval from the CDPHE prior to modification or termination of monitoring. The compliance strategy for surface waters at the GJO facility is also monitored natural flushing. The surface-water monitoring network includes two locations in the Gunnison River and one location each in the North Pond, South Pond, and wetland areas. The analytes to be monitored in surface water during each sampling event are the same for ground water. Surface water quality must comply with the State's water quality standards for the Gunnison River. The frequency and duration of surface-water monitoring will be the same as for the ground water monitoring. Trend analyses will be performed on surface-water sampling results in conjunction with analysis of ground water sampling results.

In 2001, DOE will conduct sampling to establish baseline chemistry data for pond and wetland areas sediments. These locations will be sampled again when ground and surface water complies with regulatory limits to verify that pond and wetland area sediments also comply with applicable limits. Sample locations will be selected to represent worst case and average conditions (e.g., deep water, near shore, and intermittently inundated areas). Analytes will include arsenic, chloride, total chromium, gross alpha, magnesium, manganese, molybdenum, nitrate, selenium, sulfate, total uranium, and isotopic uranium. On the basis of the initial results, DOE will revise the LTSP to present sampling locations and results, and, if necessary, invoke a program for further sediment monitoring.

5.1.3 Ground Water/Surface Water Connectivity and Statistical Analysis

Water levels in the ponds and wetland areas fluctuate with both the ground water and river water levels. There is practically no resistance to flow through the porous granular materials that make up the alluvial aquifer. (Conductivities ranged from 30 to 45 feet per day before remediation. Excavations were backfilled with clean granular river-run material.) Fresh water is introduced into the ponds as the river rises, which will dilute the concentrations of constituents in the surface water. Uranium concentrations of surface waters are decreasing, as shown in Attachment D.

This mechanism will eventually cause the surface waters to flush clean of contaminants. These high conductivities and the close proximity of the river, the aquifer, and the surface bodies also ensure that water in these features will quickly establish a common elevation. Consequently, hydraulic head will not prevent an influx of clean water each spring. This annual exchange of water should also dissolve to a state of equilibrium any available contaminants in sediments. Model inputs were

reviewed and found to remain valid in the post-remedial action configuration of the aquifer.

Evaluation of ground water monitoring data indicates that the concentration of a constituent may vary between sampling events and may not consistently decrease in subsequent sampling events. On the basis of the observation that the concentrations of multiple species covaries, this phenomenon probably reflects seasonal fluctuations of the ground water regime within the alluvial aquifer and the consequent changes in fresh water influx and dilution. These short-term variations are superimposed over the long-term trends, which are of significance in the overall assessment of compliance with ground water protection standards. Simple linear trend analysis (least squares) indicates that, overall, contaminant concentrations are decreasing with time since source control was achieved in 1994 (Attachment D).

As long as an overall negative trend in analyte concentrations is observed, DOE proposes not to undertake a rigorous statistical analysis of ground water quality on an annual basis. In 2005, DOE will evaluate monitoring data to confirm distribution assumptions and to conduct a rigorous analysis to identify statistically significant changes in ground water quality. This analysis will employ statistical methods such as those described at 6 CCR 1007-3, Subpart F, 264.97(h), or described in EPA guidance. DOE will provide a justification of the selection of a statistical analysis method and will report findings to CDPHE.

5.2 Soil Contamination Under Building 12

Upon notice of termination of DOE's lease of Building 12, DOE will prepare a remedial design package (including schedule and budget) for demolition of Building 12, remediation of contaminated soils, and disposal of waste material at an approved disposal site (i.e., the Grand Junction Disposal Cell). Once the design is concurred in by CDPHE, DOE will commence demolition, soil removal, and disposal of waste.

5.3 Soil Contamination Under Building 20

DOE will lease Building 20 from the RTC. When DOE decides to vacate the building, DOE will prepare a remediation design (including schedule and budget) to demolish Building 20, remove contaminated materials beneath the building to within regulatory limits, and properly dispose of the contaminated materials. DOE will obtain regulator approval of the remediation design.

5.4 Compliance with the CERCLA Process (see also Enforceable Agreement, Attachment A)

DOE will continue to follow the intent of the CERCLA process on this non-NPL site, as has been done to date. The selected remedy for site ground water (and the interconnected surface water expressions) is identified in the *Grand Junction Projects Office Remedial Action Project Declaration for the Record of Decision and Record of Decision Summary* (April 1990), as natural flushing in a 50- to 80-year time frame.

The selected remedy included decontaminating the three contaminated buildings known at the time, removing contaminated soil, and disposing of all wastes at the Grand Junction Disposal Cell. This remedy, of decontamination/demolition of structures, removal of contaminated soil/structural debris, and disposal at the Grand Junction Disposal Cell, has been followed during the entire site cleanup. The final cleanup identified above constitutes implementation of remedial action specified in the *Record of Decision.*

6.0 Detailed description of the Reuse Plan (approved by the local land-use authority), along with corresponding identification of specific exposure pathways and reasonable anticipated-use scenarios; and assessment of risk, pertinent to the parcel proposed for early transfer, which considers unrestricted use and reasonably anticipated use scenarios pursuant to the Reuse Plan for the parcel.

6.1 Planned Use of GJO Site

The RTC's planned use for the site is included in Attachment E. In summary, the planned use is for a mixture of commercial, industrial, office space and open space. The site would include manufacturing, research and development, technology applications, retail and wholesale sales, and office space associated with the above. It is likely that an environmental analytical chemistry laboratory would be located on the site. Planned tenants are the Western Colorado Business Development Corporation's operation of a small business incubator and the DOE GJO operation, which includes office space for federal and contractor staff and operation of the analytical laboratory. Future occupants may be governmental or private entities. Land use would be similar to existing uses on the site.

6.2 Re-evaluation of Human Health and Ecological Risk

GJO has re-evaluated the health and ecological risks associated with contamination remaining on-site, considering unrestricted use, as summarized below (see Attachments F and G). These identified risks form the baseline for then looking at the new owner's intended use of the site and the institutional controls proposed to be protective during such uses.

6.2.1 Human Health Risks (see Attachment G)

An analysis of risks associated with contaminated surface and ground water at the GJO was performed for both unrestricted and reasonable-use scenarios. Data used for the analysis were collected in 1999 as part of the annual monitoring efforts and represent the most current picture of the site. These data were reviewed and screened to develop a list of constituents for which quantitative risks were calculated. Parameters were eliminated from further evaluation if: (1) the majority of samples were below detection or no different from background (e.g., cadmium and lead in ground water); (2) if they are essential nutrients (e.g., calcium and magnesium); or (3) if all samples were well below established toxicity levels (e.g., chromium and iron in ground water). The constituents that remained after this screening process for ground water were arsenic, chloride, manganese, molybdenum, nitrate, selenium,

sulfate, uranium, and vanadium. For surface water, the constituents that passed the screening process were chloride, manganese, molybdenum, sulfate, and uranium. Chloride and sulfate were excluded from quantitative risk calculations due to lack of toxicity data. The remaining constituents were retained for quantitative risk calculations.

Risks were calculated using standard EPA equations and exposure parameters (see Attachment G). Both carcinogenic and noncarcinogenic risks were assessed. Six different exposure scenarios were evaluated in all–two for ground water and four for surface water. Each of these scenarios is described and results are discussed below.

The following exposure scenarios were evaluated for the GJO site:

- Residential ingestion of ground water. This reflects the worst-case unrestricted use of ground water. This scenario is based on a resident who gets all drinking water from ground water at the site. The exposure point concentrations used in calculations is the 95 percent upper confidence level on the mean (UCL95) of results from the 12 plume monitoring wells on the site. This is a reasonable worst-case estimate.

- Residential ingestion of radium-226 contaminated soil and radon inhalation. This scenario assumes that the contaminated soil is exposed and uncontrolled and that a residential structure is built over contaminated soil.

- Occupational ingestion of ground water. Given the probable future use of the site, this scenario reflects a more probable unrestricted use scenario. The assumption is that a worker ingests ground water from an on-site well on a regular basis. The UCL95 was used for the exposure point concentrations in this scenario.

- Occupational exposure to surface water-dermal exposure pathway. This scenario represents exposure that could occur if the North and South ponds on the site were used in some way by future site workers (e.g., as process water in some type of operation). Risks were not calculated for the wetland areas because it is assumed this area would remain protected. Maximum concentrations detected were used in these calculations because of the limited data for surface water.

- Incidental exposure to surface water by children playing. This exposure could occur if the area was available for use by children for play. It assumes both minor surface water ingestion as well as dermal exposure. Risks were calculated for the North Pond, South Pond, and wetland areas. Maximum concentrations were used.

- Ingestion of fish from the North Pond. Fish in the North Pond are classified as non-game species and are unlikely to be caught for consumptive purposes. However, this pathway was evaluated for information purposes. This exposure scenario is based on conservative assumptions associated with recreational fishing. One assumption is that contamination accumulates in fish and is subsequently consumed by humans. Two calculations were done for uranium.

One assumes that no biomagnification occurs (concentration of fish is the same as the ground water), and the other assumes a 55-fold concentration. The values reflect the range of bioconcentration factors (BCFs) obtained for uranium in a study of the Baltic Sea (information obtained on the Internet). No BCFs were available for manganese; calculations were done using the same BCFs as uranium for information purposes. Manganese concentrations were less than half of that established by EPA as a recommended water quality criteria for the consumption of organisms (63 FR 68354). Risks posed by molybdenum were not calculated due to lack of BCFs and recommended water quality criteria. Maximum concentrations of uranium and manganese were used in the calculations.

- Ingestion of fish from the South Pond. Assumptions associated with the South Pond calculations were the same as those for the North Pond.

For use of ground water in a residential or occupational setting, both carcinogenic and noncarcinogenic risks exceed EPA's acceptable criteria (acceptable being Hazard Quotient < 1 and carcinogenic risk between 10^{-4} and 10^{-6}). This confirms the need for institutional controls to prohibit unrestricted access at the present time. Risks for residential use are greater than those for occupational exposure.

Direct exposure to surface water, either in an occupational or recreational setting, are not likely to result in any unacceptable risk based on the assumptions made in the calculations. Risks in an occupational setting are very low, even when based on conservative assumptions. Risks are slightly higher for the children-playing scenario; highest risks are associated with the wetland areas where contaminants are more highly concentrated. These results suggest that future use of the surface water in a park-like setting or a similarly less restrictive manner would be acceptable from a human health perspective.

Risks associated with fish consumption are inconclusive. Calculations show that there *could* be some risk associated with uranium accumulation. If a low BCF for uranium is appropriate, both carcinogenic and noncarcinogenic risks are acceptable. If, however, a high-end BCF is more reasonable, both carcinogenic and noncarcinogenic risks are unacceptable. The risks associated with fish from the North Pond are marginal; those associated with the South Pond are slightly higher, but still relatively low. These calculations are based on the consumption of 8 ounces of contaminated fish per week throughout the year. This suggests that occasional consumption of fish from the ponds would be relatively safe.

The following table summarizes, from a health-based risk, the importance and effectiveness of DOE's institutional controls for protecting human health during the new owner's planned use of the site.

Table No. 8. Summary of Human Health Risk Calculations—Grand Junction Office Surface and Ground Water Use[1]

Exposure Scenario	Receptors	Contaminants	Assumptions	Proposed Institutional Controls	Risks w/o institutional controls	Comments
Residential ingestion of ground water	Residents using on-site wells	As, Cl, Mn, V, Se, SO_4, Mo, NO_3, U	All drinking water is from on-site wells; UCL95 of plume wells used in calculations	Prohibition on use of ground water for any purpose through deed restriction.	HI = 12.13 Carcinogenic risk = 2.3E-02	Greatest risks from As, U. Prohibition of ground water use would eliminate pathway and reduce risks to zero.
Occupational ingestion of ground water	Workers at the site using on-site wells for drinking water during the work day	As, Cl, Mn, V, Se, SO_4, Mo, NO_3, U	Half of drinking water consumed during the work day is obtained from on-site wells; UCL95 of plume wells used in calculations	Prohibition on use of ground water for any purpose through deed restriction.	HI = 4.36 Carcinogenic risk = 5.6E-3	Greatest risks from As, U. Prohibition of ground water use would eliminate pathway and reduce risks to zero.
Occupational incidental surface water exposure	Workers using surface water in some industrial process	Cl, Mn, Mo, SO_4, U	Dermal contact only; contact occurs for entire work day. Wetland area assumed unavailable for use. Maximum concentrations used in calculations.	Signage notifying public that use of surface water for swimming, fishing or drinking is prohibited.	North Pond: HI =.002; Carcinogenic risk = 1.2E-7 South Pond: HI=.005; Carcinogenic risk = 2.5E-7	Risk results indicate that surface water could be used in an industrial process with no unacceptable risk. Institutional controls would not be required to reduce this exposure.
Incidental surface water ingestion/dermal contact—recreational setting	Children playing in the ponds and wetland areas	Cl, Mn, Mo, SO_4, U	Children wade/splash in ponds and wetland areas contacting arms and legs; some incidental ingestion of surface water occurs. Maximum concentrations used in calculations. Exposure occurs 1/3 of the year.	Signage notifying public that use of surface water for swimming, fishing or drinking is prohibited.	North Pond: HI =.033; Carcinogenic risk = 2.9E-7 South Pond: HI =.065; Carcinogenic risk = 6.0E-7	No unacceptable risks are associated with this use of surface water. Results indicate that use of surface water in a recreational scenario (e.g., park, bike path) would be acceptable without restrictions.

Table No. 8. Summary of Human Health Risk Calculations—Grand Junction Office Surface and Ground Water Use[1] **(continued)**

Exposure Scenario	Receptors	Contaminants	Assumptions	Proposed Institutional Controls	Risks w/o institutional controls	Comments
Ingestion of fish from North Pond	Recreational fishermen and their families	U, Mn	U and Mn accumulate in fish living in the North Pond. Receptors ingest 8 oz. of contaminated fish per week. Bioaccumulation factors (BCF) of 1 and 55 used in calculations. Maximum concentrations used in calculations.	Signage notifying public that use of surface water for swimming, fishing or drinking is prohibited. Fish in ponds classified as non-game species.	For BCF of 1: HI=.03; Carcinogenic risk = 1.9E-6 For BCF of 55: HI = 1.5; Carcinogenic risk = 1.0E-4	If BCF at low end is appropriate, risks associated with this pathway would be acceptable. At high BCFs, risks are marginally high. Results suggest that occasional ingestion of fish from the pond would be acceptable, but reliance on pond as a major food source would not be. Some type of institutional control could be warranted. Most of risk is from U.
Ingestion of fish from South Pond	Recreational fishermen and their families	U, Mn	U and Mn accumulate in fish living in the North Pond. Receptors ingest 8 oz. of contaminated fish per week. Bioaccumulation factors (BCF) of 1 and 55 used in calculations. Maximum concentrations used in calculations.	Signage notifying public that use of surface water for swimming, fishing or drinking is prohibited. Fish in ponds classified as non-game species.	For BCF of 1: HI =.06; Carcinogenic risk = 3.8E-6 For BCF of 55: HI =3.03; Carcinogenic risk = 2.1E-4	If BCF at low end is appropriate, risks associated with this pathway would be acceptable. At high BCFs, risks are marginally high. Results suggest that occasional ingestion of fish from the pond would be acceptable, but reliance on pond as a major food source would not be. Some type of institutional control could be warranted. Most of risk is from U.
Residential ingestion of radium-226 contaminated soil.	Residents, including children and adults	Radium-226	The contaminated soil is uncontrolled in a residential setting.	DOE will maintain control of occurrences and will remediate soil when buildings are demolished.	1.38E-4	Does not include uranium in soil or radon inhalation. Institutional controls will prevent completion of exposure pathways.

[1] *See Attachment G for explanation of Risk Indices*

6.2.2 Evaluation of Ecological Risk (see Attachment F)

An evaluation of the ecological risk from contaminated surface and ground water was performed. Table 9 summarizes ecological risks at the GJO. It is anticipated that constituent concentrations will continue to decrease through time. Healthy populations of algae, bullfrogs, and fish in the ponds have been observed for the past several years and most recently on August 8, 2000 (personal observations, R. Bleil, MACTEC-ERS). Contaminant levels do not appear to be affecting the ponds or wetland ecosystems, although comparisons to ecological benchmarks indicate potential risk to some wildlife receptors may occur from chronic and continuous exposures to molybdenum and uranium in these surface water bodies (continuous exposure to waters at the wetland areas is not possible because it is only seasonally wet). Due to evaporative loss, these water bodies exhibit relatively high levels of salinity, as indicated by the high TDS and elevated concentrations of calcium, magnesium, potassium, sodium, chloride, and sulfate. High salinity is a common characteristic of enclosed water bodies in arid regions of the southwest and is not expected to adversely affect ecological resources at the GJO.

Table 9. Summary of Ecological Risk Considerations and Final E-COPCs

Medium	Ecological Community	Exposure Pathway	Representative Nonsensitive Receptors	Sensitive Receptors[a]	Final E-COPCs[b]
Ground water	GJO site	Food chain, root uptake	Herbivores, omnivores, plants	None	Manganese, uranium
Surface water	North Pond, South Pond, Wetland	Direct ingestion, food chain	Omnivores (e.g., muskrat), aquatic receptors (e.g., fish)	Bald eagle, southwestern willow flycatcher	Molybdenum, uranium

[a]Includes threatened or endangered plant and animal species, migratory birds.
[b]"Constituents of Potential Concern"; selected because concentrations exceed a standard, benchmark, or value that may result in ecological risk.

Both the Colorado Division of Wildlife and U.S. Fish and Wildlife Service have been routinely consulted as part of the GJO facility remediation and site operations. In addition, the habitat provided for key threatened and endangered and indicator species is not unique and is generally less desirable than that of surrounding areas, primarily due to lack of vegetation density and diversity and the presence of human activity. Therefore, the potential for adverse effects to the bald eagle and southwestern willow flycatcher is minimal. Based on contaminant trends and recent field observations of ecological receptors in the South Pond and North Pond, the potential for ecological risk to sensitive and nonsensitive plant and wildlife receptors also appears to be minimal. The constituents of concern are included in the analyte list to be monitored for the long-term.

6.2.3 Risk from Soil Contaminants Under Buildings 12 and 20 and Foil Source

Risk assessments are not being performed on the remaining subsurface contamination beneath Buildings 12 and 20. Actual data collected for the last several years show exposure rates and inside the buildings to be within acceptable limits (see Section 4.6 and 4.7). Contamination is beneath either a concrete slab or under at least a foot of soil, and both areas have floor and sub-floor structures over this. The GJO has included the following institutional controls to protect building occupants under the new owner's planned usage scenario, as stated in the Deed (Attachment B). "Grantee" refers to the RTC; "Grantor" refers to DOE.

Building 12

Grantee shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the south end of Building 12. Grantor is required to remediate all contamination under and around Building 12 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 12 as the most cost-effective process to complete the remedial action and hereby agrees to accept this remediation approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building.

Building 20

Grantee and its assigns shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in disturbance of soils or structures underlying the south end of Building 20. Prior to altering the structural integrity of the floor at the south end of Building 20, such permission must be obtained. When Grantor decides to vacate the building, Grantor will demolish the building and remediate contaminated materials beneath the building to within regulatory limits.

Foil Sources in Abandoned Well

Grantee acknowledges that there is known contamination in the form of two foil radium sources encased in an abandoned well at the site. The well was abandoned in accordance with State of Colorado requirements, and the sources were encased in the well with the approval of the State.

Grantee shall not engage in any activity that disturbs the seal on the well encasement or the well itself without the express written consent of CDPHE and the Grantor.

Grantee is responsible for ensuring that the restrictions and Grantor's rights of access related to the above, and stated in the Deed, are stated in the instrument of conveyance if Grantee passes ownership to another entity. Grantee is responsible for notifying Grantor's LTSM Program of such transfer. Grantee acknowledges its landlord responsibilities to monitor tenants' activities to ensure protection of

Building 12 and 20 floors, to allow for safe soil excavation on the Property, to protect the abandoned well identified above, and to be protective of Grantee's remaining ground water monitoring wells.

7.0 Quitclaim Deed

Attachment B consists of the Quitclaim Deed. As of this Request for Deferred Remediation application submittal, the Offer to Purchase and Deed are essentially complete. DOE and the RTC are in final negotiations regarding the liability clauses.

In compliance with State of Colorado *Executive Order D-013-98*, the Quitclaim Deed includes, as Exhibit B, the CERCLA Notice of Hazardous Substances.

The Quitclaim Deed, in Section IV.C., identifies the remaining areas of contamination, restrictions on use by new owner, and DOE's commitment to remediate (including general time frame). This section of the Deed also refers to the Enforceable Agreement and CDPHE's oversight authority under CERCLA 120(h). This section then discusses the new owner's responsibilities to abide by the institutional controls, to notify DOE if the Property changes hands, and summarizes the planned site usage.

In Section IV.C., the Quitclaim Deed identifies DOE's responsibility to remediate. Section IV.E. states that the owner shall not disrupt DOE from any monitoring or restoration activity.

The requirements of Section VIII.D. have been completed.

Section IX.B states that the land ownership may revert to the federal government if there is just cause, after first being considered by the City and County.

Section IX.C. states that the conveyance of the Property is contingent upon State approval of the Request for Deferred Remediation.

The Executive Order's requirements that DOE provide assurance of funding and guarantee of timeliness are placed in the Enforceable Agreement (Attachment A). DOE's commitment to have a public comment period is found in the Request for Deferred Remediation, Section 9.0.

8.0 Enforceable Agreement

Attachment A contains the Enforceable Agreement between DOE and CDPHE. The Agreement outlines the requirements for DOE to conduct remediation on areas of the GJO site still containing contamination as described in previous sections of this Request. The Enforceable Agreement is organized to show adherence to the requirements of State of Colorado *Executive Order D-013-98*. The Enforceable Agreement includes an enforceable clean-up plan; identifies clean-up responsibilities; ensures DOE's financial obligations; reiterates the land-use restrictions placed on the new owner in the Deed; describes the enforcement authority to be used by CDPHE; contains language from the Deed stating that institutional controls are binding upon future owners; contains language from the Deed that

DOE is assured a right-of-access to monitor and conduct remediation; states that DOE will not raise sovereign immunity as a defense against the State's enforcement authority; and provides for a grant to provide funding for CDPHE's oversight of DOE's activities.

Upon approval of this Request for Deferred Remediation by the Governor of the State of Colorado, a grant will be executed with CDPHE to cover estimated CDPHE oversight activities for Fiscal Year 2001. Funding will be provided on an annual basis.

9.0 Public Participation and Comment

The initial Remedial Action Plan for the site was subject to the public participation requirements of both CERCLA and NEPA in 1989 when the remedial action for the site was determined. DOE addressed all comments that were received. Two additional opportunities for public comment were available for the *Environmental Assessment of Facility Operations at the U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado*, in April 1996, and for the *Environmental Assessment for the Transfer of the Department of Energy Grand Junction Office to Non-DOE Ownership* (April 2000). The State of Colorado was included in both comment periods and had no specific comments on the selected remedies.

A public comment period was "noticed" in the *Daily Sentinel,* Grand Junction, Colorado, from March 25, 2001, through April 24, 2001. All responses to the public comments have been completed. Notice of the comment period was provided to local governments, citizens or restoration advisory boards, local redevelopment authorities, and to all individuals and organizations that have expressed a prior interest in such matters.

Enforceable Agreement
between
State of Colorado Department of Public Health and Environment
and
U.S. Department of Energy Grand Junction Office
Under State of Colorado Executive Order D-013-98

I. Purpose

A. This Enforceable Agreement (Agreement) is entered into for the purpose of stating the Department of Energy's (DOE's) commitment to remediate those aspects of the Grand Junction Office (GJO) site, under new ownership by the Riverview Technology Corporation (RTC), having contamination remaining above regulatory standards and/or presenting a potential health risk to the public or the environment. This Agreement concerns only contamination existing prior to the date of deed transfer on the site.

B. This Agreement summarizes the controls placed by DOE upon the site, both physical and through land conveyance documents, to ensure protection of human health and the environment.

C. This Agreement identifies the remedial action strategy to be followed by DOE as it remediates the remaining contamination.

D. This Agreement provides for the State of Colorado Department of Public Health and Environment (CDPHE) to enforce any and all aspects of DOE's remaining remediation efforts and provides that funding will be transferred to CDPHE via a grant from DOE.

II. Legal Basis for the Agreement

A. Background

Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120(h), to protect citizens and communities from the costs of cleaning up contamination on land transferred to them by federal agencies. Under Section 120(h)(3)(C), transfers of contaminated federal property not listed on the National Priorities List (NPL) are subject to the approval of the governor of the state where the property is located. Accordingly, the Governor of Colorado issued Executive Order D-013-98 requiring that, among other things, the Director of the Colorado Statewide Defense Initiatives (Director) together with the CDPHE develop evaluation criteria and review procedures for requests by federal agencies to transfer property prior to final remediation. In response to the Executive Order, the Director and CDPHE issued the "Joint Policy Establishing Evaluation Guidelines and Review Procedures Pertaining to Deferral Requests" (Joint Policy). In accordance with the Joint Policy, DOE worked closely with CDPHE to create the Request for Deferred Remediation for the site.

This Enforceable Agreement fulfills, in part, the requirements of the Executive Order and provides a legal mechanism for CDPHE to provide oversight of the contamination that will remain at the site following transfer. The enforceable cleanup plan set forth in Section V.A may be changed for good cause upon written concurrence of the parties.

B. Basis for CDPHE Enforceability

1. CERCLA 120(h)(3)(A)(ii) requires that any deed transferring property owned by a federal agency on which hazardous waste was stored, released or disposed of contain a covenant warranting that: 1) the federal agency has concluded all necessary remediation before the date of transfer and 2) the federal agency is responsible for all future remediation found to be necessary after the date of transfer.

   In the event, however, that the federal agency desires to transfer the property prior to the completion of all remediation, Section 120(h)(3)(C) requires the federal agency to include in the conveyance document or deed certain "assurances" that the agency will fully remediate the property. These assurances are designed to protect human health and the environment and include provisions for: 1) all necessary restrictions on the use of the property, including those that will ensure that remedial investigations, response actions, and oversight activities will not be disrupted and 2) all necessary response actions, including the identification of schedules for investigation and completion of such actions. These assurances are enforceable as a "standard, regulation, condition, requirement, or order" within the meaning of CERCLA Section 310(a). Accordingly, the State has the authority to file suit against DOE under CERCLA's citizen suit provision, Section 310(a), in the event DOE fails to abide by the assurances set forth in Section 120(h)(3)(C).

2. The State will be included as a third-party beneficiary in the transfer deed. The Deed will include the covenants and assurances mandated by sections 120(h)(3)(A)(ii)(II) and 120(h)(3)(C)(ii). A consent by the Governor to the deferred remediation is necessarily in justified reliance on DOE's covenants and assurances as set forth in the transfer deed and this Enforceable Agreement.

III. Background

A. Description of Property. The DOE is transferring the Property located at 2597 B ¾ Road in Grand Junction, Mesa County, Colorado, to the RTC (a nonprofit corporation sanctioned by the City of Grand Junction, Colorado, and the County of Mesa, Colorado, and created for the purpose of receiving and managing the Property). Following transfer of the site to the RTC, the DOE intends to continue to lease portions of the site in support of the current GJO mission, which is to provide project management, engineering, scientific support, and implementation of the federal government's environmental restoration programs.

The Property is legally described as follows:

All that portion of Lot 1 lying West of the right-of-way of the Denver and Rio Grande Western Railroad Company, and all of lots 6 and 7, subject to right-of-way of the Denver and Rio Grande Western Railroad Company, all being in Section 27, Township 1 South, Range 1 West, Ute Meridian, Mesa County, Colorado, containing 55.71 acres of land more or less, together with the private railroad spur thereon, and all rights and appurtenance thereto, also all water and water rights used thereon or appurtenant thereto, including the private line from artesian well, and all rights in connection therewith, and all buildings and improvements thereon as recorded in Book 415, page 405;

And, that portion of G.L.O. Lot 1, Section 26, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado, lying west of the right-of-way of the Denver and Rio Grande Western Railroad Company containing 1.14 acres of land more or less, as recorded in Book 668, page 202;

Except: Parcel 1, located in G.L.O. Lot 7 of Section 27, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado, containing 2.68 acres of land more or less as conveyed to A. N. Applebaum and recorded in Book 1606, page 986; and

Except: That portion to be reserved to the United States and called the Army Reserve Tract: containing 7.97 acres more or less;

This parcel then contains 46.20 acres calculated as follows: 55.71 acres (1943 Deed in Book 415, page 405) + 1.14 acres (Deed in Book 668, page 202) - minus - 2.68 acres (Deed in Book 1606, page 986) - minus - 7.97 acres (Army Reserve Tract to be recorded) equals 46.20 acres of land more or less.

B. History of Contamination. The GJO facility lands were acquired by the U.S. War Department in August 1943 to refine uranium for the Manhattan Project. Uranium was milled, analyzed, and stored on the GJO facility from 1943 to 1975. All known environmental contamination is believed to be the result of these past activities. According to historical records, approximately 32,000 tons of ore were processed between 1943 and 1958. The resulting tailings, consisting of an approximate volume of 178,000 cubic yards of material, were stored or used at many locations at the site.

In planning for cleanup of the facility, DOE-GJO complied with the National Environmental Policy Act (NEPA) process and followed the environmental management protocols of CERCLA, in accordance with DOE policy, even though the site did not qualify for placement on the NPL. A final Remedial Investigation/ Feasibility Study–Environmental Assessment that addressed remediation of the facility was completed in 1989.

A Record of Decision was issued in 1990 that established the approved remedial action as removal of soil contamination to regulatory standards, decontamination of three contaminated structures, and natural flushing of contaminated ground water. Ground water contaminants were predicted to achieve regulatory standards within 50–80 years. All contaminated materials were to be disposed of at the Grand Junction (also known as Cheney), Colorado, Disposal Cell, a local, licensed repository for uranium mill tailings.

The site's soils were declared clean and releasable to the public by DOE's Independent Verification Contractor (IVC), Oak Ridge National Laboratory (now known as AIMTech), in 1997. During the early 1990s, DOE began investigating all site structures to determine whether additional radioactive contamination from mill tailings existed. As a result, certain structures have been demolished, and numerous structures have been verified as clean by the IVC after remediating specific areas of contamination, following the regulatory standards set forth in the original Record of Decision.

IV. Description of Remaining Contamination and Specific Institutional Controls in Quitclaim Deed (see Figure 1). (Note: This section is taken from the Deed. "Grantor" refers to DOE and "Grantee" refers to the RTC.)

A. Contamination in Ground Water and Surface Expressions of Ground Water

1. Contamination. The ground water underlying the site and the surface expressions of the ground water (the North Pond, South Pond, and wetland areas) are known by both parties to be contaminated with elevated levels of certain constituents resulting from the historical stockpiling of uranium ore and the disposal of process wastes from milling and concentrating activities. Following removal of the source of contamination, the accepted remedial action for eliminating the contamination is the natural flushing of the ground water over a period of 50–80 years (anticipated to be within regulatory standards between the years 2050 and 2080). Risk assessments performed concluded that the contaminants posed a threat to human health only if ingested by drinking the water.

2. Restriction. The Grantee shall not engage in any disturbance or use of any untreated ground water underlying the Property, including the drilling of wells, the excavation of soils that expose ground water, or the diversion of ground water through any means without express written consent of the CDPHE and the Grantor, its successors or assigns. This also includes, but is not limited to, restrictions on excavation of the underlying soils for their gravel content. Any request for consent to disturb or use any untreated ground water underlying the Property must include water quality data and a human health and ecological risk evaluation.

LEGEND

Property line

46 Buildings / numbers

Area of deferred remediation

Encased radium source

NOTES:

1. Groundwater and surface water are contaminated.
2. Building 7A remediation in process.

GUNNISON RIVER

South Pond

ARMY RESERVE TRACT
347,144 sq.ft.
7.969 acres ±

WETLANDS AREA

North Pond

300-ft Borehole

54 20 44A 30B 43 27 26 36A 65 32 61 28 29 3022 938 Abandoned Sump 11 46 2 55 53b c a 7A 7 12 18 19 40 810

25 3/8 ROAD

SCALE IN FEET
100 50 0 100 200 300

NORTH

Site Plan

M:\LTS\111\0036\00\S00608\S0060800.DWG 09/25/01 4:03pm J50191

STREN, Inc.

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION OFFICE, COLORADO

FACILITY ENGINEERING

	SIGNED	DATE
CAD TECH	DSF	06/20/01
DESIGNER		
PROJECT A/E		
FACILITY ENGINEERING		
FACILITY MANAGEMENT		

GRAND JUNCTION OFFICE

FIGURE 1
DEFERRED REMEDIATION

PROJECT NO.

SHEET OF

DRAWING S0060800

Grantor will construct signs at the South Pond, North Pond, and wetland areas to notify the public that no swimming, fishing, or drinking of the waters is permitted. Grantee and successors must maintain the signs until the State of Colorado approves the removal of the notification signs. Grantor will continue to monitor the water quality of the ponds, and, when the water quality meets State standards, request the State to approve removal of the notification signs.

Grantee shall not engage in any use of the surface expressions of ground water that might result in accidental consumption of the water, fish, or other aquatic species. This includes, but is not limited to, restrictions on fishing, swimming, activities that result in prolonged human contact with the water, hatchery operations for production of fish or other aquatic species for human consumption, and other recreational uses.

B. Building 12 Soil Contamination

1. Contamination. Grantor acknowledges that there is known contamination on the Property underlying the south end of Building 12 and covenants to remain solely responsible for the complete decontamination of these conditions, as well as any later-discovered contamination. The contamination, believed to be the residue of a stockpile of uranium ores, poses a potential threat of radioactive exposure to individuals excavating the soils. There is no threat to persons occupying the building and conducting routine business activities, nor is there any indication the residual contamination is impacting the ground water.

2. Restriction. Grantee shall not, under any circumstances without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the south end of Building 12. Grantor is required to remediate all contamination under and around Building 12 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 12 as the most cost-effective process to complete the remedial action and hereby agrees to accept this remediation approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building.

C. Building 20 Soil Contamination

1. Contamination. Grantor acknowledges that there is known contamination on the Property beneath the southwest corner of Building 20 and covenants to remain solely responsible for the complete decontamination of the soils. The contamination, believed to be from mill tailings used as fill material to raise the elevation of a pond bank prior to erection of the building, poses a potential threat to individuals excavating the soils from exposure to radioactive materials. There is no threat to persons occupying the building and conducting routine business activities, nor is there any indication the residual contamination is impacting the ground water.

2. Restriction. Grantee and its assigns shall not, under any circumstances without express written permission of CDPHE and the Grantor, engage in any activity that would result in disturbance of soils or structures underlying the south end of Building 20. Prior to altering the structural integrity of the floor at the south end of Building 20, such permission must be obtained. When Grantor decides to vacate the building, Grantor will demolish the building and remediate contaminated materials beneath the building to within regulatory limits.

D. Building 7 Structural and Soil Contamination

1. Contamination. Grantor acknowledges that known contamination remains in a portion of this structure and covenants to remain solely responsible for the complete decontamination of the structure and the underlying soil. Surface contamination has been identified in the walls and structural roof members, on equipment, and in ductwork. Soil contamination beneath the building is expected on the basis of historical knowledge and one core hole. The contamination is derived from sample preparation activities conducted in this building in the 1950s through the mid 1970s in support of Federal uranium procurement activities. The contamination does not pose a health risk to current building occupants because it is either fixed, of low activity, or inaccessible.

2. Restriction. Grantor shall retain control of this structure until it has been remediated and the area can be released for unrestricted use.

E. Foil Sources in Abandoned Well

1. Contamination. Grantee acknowledges that there is known contamination in the form of two foil radium sources encased in an abandoned well at the site. The well was abandoned in accordance with State of Colorado requirements, and the sources were encased in the well with the approval of the State.

2. Restriction. Grantee shall not engage in any activity that disturbs the seal on the well encasement or the well itself without the express written consent of CDPHE and the Grantor.

V. Commitments

A. Cleanup Plan

DOE established an enforceable cleanup plan as described below. This plan can be modified by DOE, with concurrence from CDPHE.

1. Ground Water/Surface Water/Sediments

The selected remediation strategy is for natural flushing of the ground water, which has been predictively modeled to reduce constituents to acceptable levels within 50–80 years. As described in the *Draft Final Long-Term Surveillance*

Plan for the U.S. Department of Energy Grand Junction, Colorado, Office Facility (September 2000), found as Attachment C to the Request for Deferred Remediation application. Site ground water is regulated under State of Colorado Title 5, *Code of Colorado Regulations*, Part 1002-8, "Basic Standards for Ground Water," including secondary drinking water and agricultural standards; 40 CFR 192; and risk-based limits established by EPA Region 3 for manganese and vanadium.

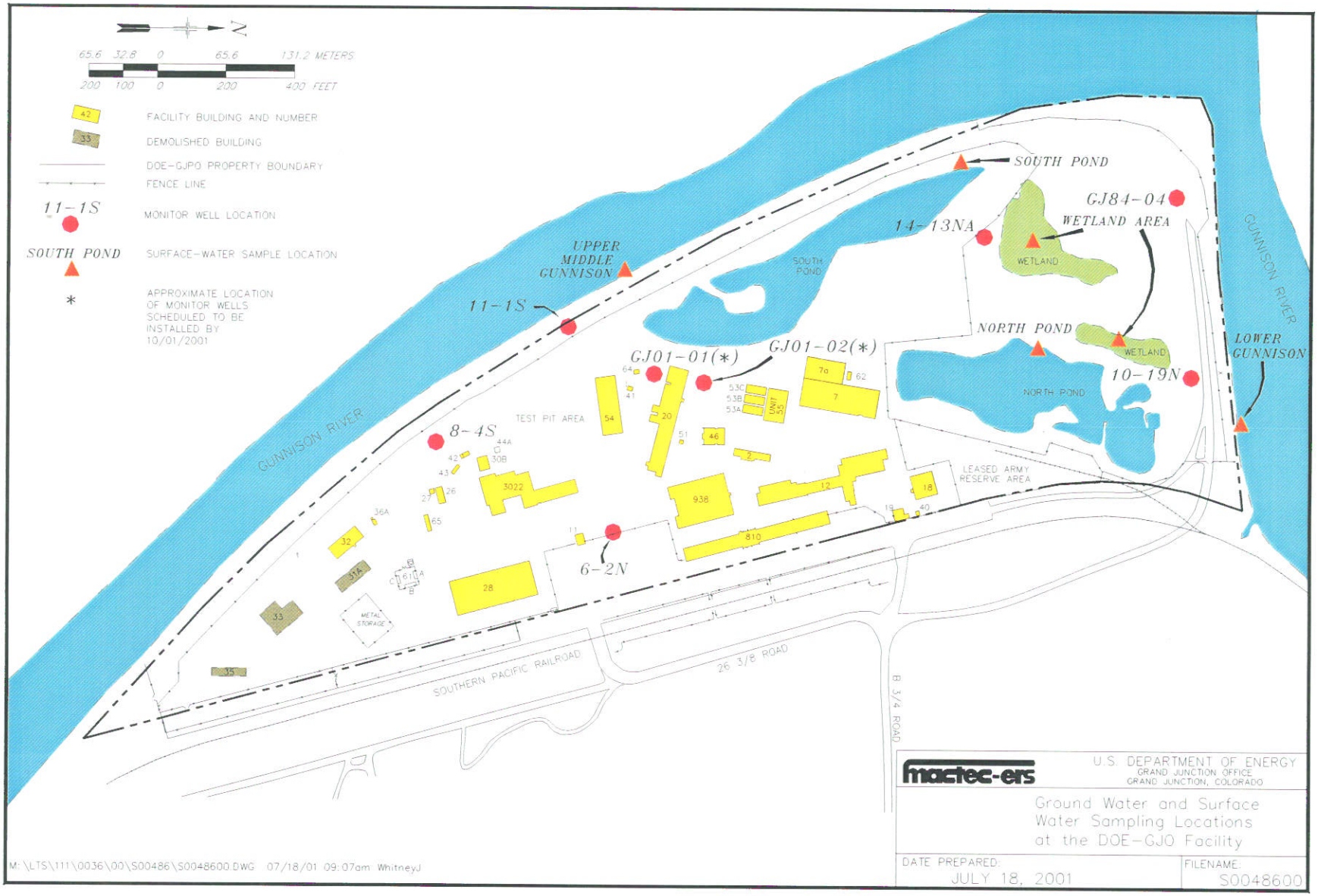
The ground water monitoring network consists of 6 monitor wells (8-4S, 11-1S, 6-2N, 14-13NA, GJ84-04, and 10-19N) that are distributed on-site and along the downgradient edges of the facility near the Gunnison River (see Figure 2).

The analytes to be monitored in ground water during each sampling event include the constituents of concern and other constituents that may be useful in assessing site conditions (see Table 1). In addition to these analytes, standard water quality indicators (pH, alkalinity, conductivity, temperature, and turbidity) will be measured during each sampling event.

Table 1. Surface and Ground Water Analyte List

Analyte	Basis for Retention		
	Exceeds Regulatory Limit	Poses Ecological Risk	Poses Human Health Risk
Arsenic	X		X
Chloride	X		
Gross Alpha	X		
Iron	X		
Manganese	X	X	X
Molybdenum	X	X	X
Nitrate			X
Selenium	X		
Sulfate	X		X
Total dissolved solids	X		
Uranium	X	X	X

Ground water monitoring at the GJO facility will be conducted annually, in late winter, for a minimum period of 5 years (through 2005). At the end of this period, DOE will evaluate monitoring results in consultation with the CDPHE to determine the requirements for future monitoring at the site. This will include a statistical evaluation of contaminant concentration trends. Criteria for modifying or terminating ground water and surface water monitoring will include (1) continued decrease in concentrations of constituents of concern as predicated and observed, (2) compliance with regulatory limits, and (3) no unacceptable risks to human health and the environment resulting from site-related contamination. The DOE will receive approval from the CDPHE prior to modification or termination of monitoring. Modification may include changing the number or location of sample points or the suite of analytes.


N
65.6 32.8 0 65.6 131.2 METERS
200 100 0 200 400 FEET
42
FACILITY BUILDING AND NUMBER
33
DEMOLISHED BUILDING
DOE-GJPO PROPERTY BOUNDARY
FENCE LINE
11-1S
MONITOR WELL LOCATION
SOUTH POND
SURFACE-WATER SAMPLE LOCATION
*
APPROXIMATE LOCATION OF MONITOR WELLS SCHEDULED TO BE INSTALLED BY 10/01/2001
SOUTH POND
GJ84-04
WETLAND AREA
14-13NA
WETLAND
UPPER MIDDLE GUNNISON
11-1S
GUNNISON RIVER
NORTH POND
WETLAND
LOWER GUNNISON
GJ01-01(*)
GJ01-02(*)
10-19N
NORTH POND
TEST PIT AREA
8-4S
LEASED ARMY RESERVE AREA
6-2N
SOUTHERN PACIFIC RAILROAD
26 3/8 ROAD
B 3/4 ROAD
mactec-ers
U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION OFFICE
GRAND JUNCTION, COLORADO
Ground Water and Surface Water Sampling Locations at the DOE-GJO Facility
DATE PREPARED:
JULY 18, 2001
FILENAME:
S0048600
M:\LTS\111\0036\00\S00486\S0048600.DWG 07/18/01 09:07am WhitneyJ

The compliance strategy for surface waters at the GJO facility is also monitored natural flushing. The surface-water monitoring network includes two locations in the Gunnison River and one location each in the North Pond, South Pond, and wetland areas (see Figure 2). The analytes to be monitored in surface water during each sampling event are the same for ground water. Surface water quality must comply with the State's water quality standards for the Gunnison River. The frequency and duration of surface-water monitoring will be the same as for the ground water monitoring. Trend analyses will be performed on surface-water sampling results in conjunction with analysis of ground water sampling results.

In 2001, DOE will conduct sampling to establish baseline chemistry data for pond and wetland areas sediments. These locations will be sampled again when ground and surface water complies with regulatory limits to verify that pond and wetland areas sediments also comply with applicable limits. Sample locations will be selected to represent worst-case and average conditions (e.g., deep water, near shore, and intermittently inundated areas). Analytes are identified in the *Long-Term Surveillance Plan* (LTSP) and include arsenic, chloride, total chromium, gross alpha, magnesium, manganese, molybdenum, nitrate, selenium, sulfate, total uranium, and isotopic uranium. On the basis of the initial results, DOE will revise this LTSP to present sampling locations and results, and, if necessary, invoke a program for further sediment monitoring. The DOE will receive approval from the CDPHE for the sampling plan and, if necessary, any program designed to monitor sediment contamination.

2. Soil Contamination Under Building 12

Upon notice of termination of DOE's lease of Building 12, DOE will prepare a remedial design package (including schedule and budget) for demolition of Building 12, remediation of contaminated soils, and disposal of waste material at an approved disposal site (i.e., the Grand Junction Disposal Cell). Once the design is approved by CDPHE, DOE will commence demolition, soil removal, and disposal of waste.

3. Soil Contamination Under Building 20

   a. If, within 3 years of the date of the Property sale to the RTC, the RTC determines that Building 20 is to be demolished, DOE will prepare a design package (including schedule and budget) for demolition of Building 20, remediation of underlying contaminated soils/structures, and removal of waste materials to an acceptable repository (i.e., the Grand Junction Disposal Cell). Demolition of the structure, removal of contaminated soil, and disposal of materials will take place after regulatory approval of the design package.

b. If, following year 3 of DOE transfer of ownership, Building 20 is vacant for longer than 6 months, the current owner will demolish the structure, and, upon completion, DOE will remediate contaminated materials under and around the structure. The DOE will prepare a design package (including schedule and budget) for remediation and disposal of waste at an approved repository (i.e., the Grand Junction Disposal Cell). Upon regulatory approval of the design package, DOE will remediate and dispose of contaminated materials.

4. Structural and Soil Contamination in Building 7

DOE plans to remediate the contaminated portion of Building 7 in 2001. Remediation will include demolition of the contaminated portion of the structure and removal of contaminated underlying soil. As much as 3,000 cubic yards of contaminated materials will be disposed of in the Grand Junction Disposal Cell. Associated with this activity will be disposal of approximately 1,100 cubic yards of stockpiled, contaminated materials.

5. Compliance with the CERCLA Process

DOE will continue to follow the intent of the CERCLA process on this non-NPL site, as has been done to date. The selected remedy for site ground water is identified in the *Grand Junction Projects Office Remedial Action Project Declaration for the Record of Decision and Record of Decision Summary* (April 1990) as natural flushing in a 50–80-year timeframe. The same document identifies, for the three contaminated buildings known at the time, that decontamination would be performed, and all wastes at the site would be disposed at the Grand Junction Disposal Cell. This remedy, of decontamination/demolition of structures, removal of contaminated soil/structural debris, and disposal at the Grand Junction Disposal Cell, has been followed during the entire site cleanup. The final cleanup identified in V.A, B, and C constitutes implementation of remedial action identified in the Record of Decision.

6. DOE commits that all necessary remedial actions will be taken in accordance with the specifics identified in this cleanup plan.

B. The Quitclaim Deed specifies that the Grantee shall allow DOE to perform any and all investigations, monitoring, and remedial actions necessary to meet DOE's commitment to remediate the site from contamination identified above. Further, restoration of surface/ground water, sediments, and contaminated material beneath Buildings 12 and 20 is the financial responsibility of DOE. DOE is financially responsible for demolition of Building 12 and Building 20.

C. The Quitclaim Deed specifies that DOE is responsible for remediating any previously unknown contamination attributed to its activities on the site. The Grantee is responsible for conducting remedial actions related to contamination that can be directly caused by its activities or its tenants' activities, subsequent to date of the deed transfer. Such activities are not within the scope of this Agreement.

D. The Offer to Purchase identifies the RTC's planned use of the Property and specifies that, if usage changes, DOE must re-evaluate its institutional controls for protectiveness of public health and the environment. If cleanup standards change, the responsibility for cleanup will be renegotiated.

E. The Quitclaim Deed specifies that DOE's institutional controls shall remain in-place regardless of site ownership. The Deed specifies that the RTC is also responsible for ensuring that the Deed restrictions are contained in successive transfers and that the RTC will notify DOE prior to transfer of the Property to another owner.

The Deed specifically states DOE's commitment to remediate contamination remaining on-site from DOE activities prior to the date of transfer, regardless of who owns the site in the future.

DOE concurs with the State of Colorado requirement that the United States, State of Colorado, and local governing bodies are third-party beneficiaries for the purposes of enforcing the land use restrictions until such time as the restrictions are determined by CDPHE to no longer be necessary to protect human health and the environment.

F. The Quitclaim Deed specifies that the RTC (and its successors and assigns) must allow DOE to perform its environmental response duties, as stated above in Section IV.B.

G. The Quitclaim Deed includes several indemnification clauses. DOE is responsible for remediations of "Site Substance(s)," as defined in the Deed, that were a result of DOE activities prior to site transfer. The Grantee is responsible for remediation of "Site Substance(s)" occurring during its ownership.

H. DOE commits that it will comply with this Enforceable Agreement and will not raise sovereign immunity as a defense to any action to enforce the Agreement.

I. DOE acknowledges that the Request for Deferred Remediation, in accordance with federal law, shall not increase, diminish, or affect in any manner any rights or obligations of a federal agency with respect to property proposed for transfer.

J. DOE commits that funding will be provided to CDPHE via a negotiated financial assistance agreement to cover costs for the agency to oversee implementation of DOE's institutional controls, monitoring and restoration activities associated with this Enforceable Agreement.

K. DOE commits that funding for monitoring, remedial action, and State oversight activities will be provided for via DOE's established annual budget request process.

Monitoring at the GJO facility is included in the scope and budget projections defined in the *Long-Term Surveillance and Maintenance (LTSM) Program Project Baseline Summary*. This document identifies a budget requirement of $128,000 per year for stewardship activities at the GJO facility, including environmental water monitoring, site inspections, management of institutional controls, and reporting.

Scope and budget for remediation of the radiological contamination remaining beneath Buildings 12 and 20 will be included in the budgeting submittals for stewardship operations at the GJO facility under the LTSM Program. Remediation estimates for Building 20 have been developed and will be inserted in the budget request when DOE is notified by the owner of a definite schedule to abandon that building. An estimate to demolish Building 12 will be developed during Fiscal Year 2001 and will be available to insert in the budget request when DOE has developed a definite schedule to vacate that building.

DOE funding is contingent upon congressional appropriations. However, DOE has committed to fund stewardship activities at least through 2070.

L. DOE commits to submitting an annual report to CDPHE summarizing monitoring activities (including ground water and surface water remediation trends), inspection activities, and any remediation activities. CDPHE commits to providing any comments to DOE within 45 days of receipt of the annual report.

for Donna Bergman-Tabbert, Manager
Department of Energy–Grand Junction Office

7/11/2001
Date

Jeff Edson, Manager
Remediation and Restoration Unit
Colorado Department of Public Health and Environment

8-1-01
Date

Quitclaim Deed

State of Colorado

County of Mesa

Know All By These Presents:

This Quitclaim Deed is made this the 19th day of SEPTEMBER 2001, by and between the United States of America, also referred to as the Government, acting by and through the Secretary of Energy (hereinafter sometimes called "Grantor"), under and pursuant to authority of the Atomic Energy Act of 1954, Section 161(g), 42 U.S.C. 2201(g), and rules, orders, and regulations issued pursuant thereto, and the Riverview Technology Corporation (RTC), a Colorado Corporation, 2591 B ¾ Road, Grand Junction, Colorado, 81503 (hereinafter sometimes called "Grantee").

I. Conveyance of the Fee Estate

Grantor, for and in consideration of: (1) of the sum of Ten Dollars ($10.00) and other valuable consideration, duly paid by Grantee; and, (2) the specific agreements hereinafter made by Grantee, for itself and its successors and assigns, to abide by and take subject to all reservations, restrictions, covenants, exceptions, notifications, conditions and agreements hereinafter set forth in this Quitclaim Deed, does hereby convey, remise, release and forever quitclaim to the Grantee, its successors and assigns, under and subject to the reservations, restrictions, covenants, exceptions, notifications, conditions and agreements hereinafter set forth, all right and title in and to that certain property situate, lying, and being in Mesa County, State of Colorado, as described below (hereinafter referred to as the "Property"):

All that portion of Lot 1 lying West of the right-of-way of the Denver and Rio Grande Western Railroad Company, and all of lots 6 and 7, subject to right-of-way of the Denver and Rio Grande Western Railroad Company, all being in Section 27, Township 1 South, Range 1 West, Ute Meridian, Mesa County, Colorado, containing 55.71 acres of land more or less, together with the private railroad spur thereon, and all rights and appurtenance thereto, also all water and water rights used thereon or appurtenant thereto, including the private line from artesian well, and all rights in connection therewith, and all buildings and improvements thereon as recorded in Book 415, page 405;

And, that portion of G.L.O. Lot 1, Section 26, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado, lying West of the right-of-way of the Denver and Rio Grande Western Railroad Company containing 1.14 acres of land more or less, as recorded in Book 668, page 202;

Except: Parcel 1, located in G.L.O. Lot 7 of Section 27, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado, containing 2.68 acres of land more or less as conveyed to A. N. Applebaum and recorded in Book 1606, page 986; and

Except: That portion to be reserved to the United States and called the Army Reserve Tract: containing 7.97 acres more or less, further described in Exhibit A of the deed.

This parcel then contains 46.20 acres calculated as follows: 55.71 acres (1943 Deed in Book 415, page 405) plus 1.14 acres (Deed in Book 668, page 202) - minus - 2.68 acres (Deed in Book 1606, page 986) - minus - 7.97 acres (Army Reserve Tract to be retained by the United States when the transfer to the Grantee in this Deed is made) = 46.20 acres more or less. The legal description of this Property and the Army Reserve Tract are described in Exhibit A of the Deed.

All personal property not needed by the Grantor will be conveyed by a Bill of Sale. Contaminated analytical laboratory equipment will be retained by Grantor. Personal property conveyed to the Grantee shall not be subject to the Excess Profits Covenant of this Agreement.

To Have And To Hold the same, together with: (1) all water rights, if any, located within the boundaries of the Property; (2) all improvements, hereditaments, appurtenances therein and all reversions, remainders, issues, profits and other rights belonging or related thereto, either in law or in equity, for the use, benefit and behalf of the Grantee, its successors and assigns forever; and (3) all mineral rights and interest not previously conveyed of record.

II. Definitions

A. "DOE" and/or "Grantor" means the United States Department of Energy and all predecessor agencies (e.g., the Atomic Energy Commission, the Nuclear Regulatory Commission and the Energy Research and Development Administration) and includes DOE officers, employees, and agents acting in their official capacity.

B. "RTC," "Grantee," and/or "Purchaser" means the nonprofit corporation, known as the Riverview Technology Corporation, incorporated in the State of Colorado, and its officers, directors, officials, employees, agents, tenants, appointees, contractors, heirs, successors, and assigns, as related to the Property.

C. "Site Substance(s)" specifically excludes any constituents identified as Grantee's responsibility in the Offer to Purchase and Acceptance Agreement. "Site Substance(s)" means:

1. Any petroleum, petroleum product oil, oil product, gasoline, or similar substance that has been stored on the Property at any time prior to transfer;

2. Any hazardous substance, as defined in CERCLA (42 USC 9601), Section 101(14);

3. Any hazardous waste, as defined in RCRA (42 USC 6903), Section 1004(5);

4. Any radioactive waste, including: (a) Solid or fluid materials of no value that contain radioactivity; discarded items such as clothing, containers, equipment,

rubble, residues, or soils contaminated with radioactivity; (b) Soils, rubble, equipment, or other items containing induced radioactivity such that the levels exceed safe limits for unconditional release; (c) Any waste that contains radioactive material in concentrations that exceed those listed in 10 CFR 20, Appendix B, Table II, Column 2; and (d) Solid, liquid, or gaseous material that contain radionuclides regulated under the Atomic Energy Act of 1954, as amended, and of negligible economic value considering costs of recovery;

5. Uranium Mill Tailings Radiation Control Act (42 USC 7911, P.L. 95-604, 1978): Any of those materials defined in Section 101 (7) as "residual radioactive material (RRM)" or in Section 101 (8) as "tailings";

6. Toxic Substances Control Act (15 USC § 2601, *et seq.*): Any of the materials regulated therein, including PCBs as defined as "polychlorinated biphenyls" in 40 CFR Part 761; and

7. Federal Insecticide, Fungicide and Rodenticide Act (7 USC § 136, *et seq.*): Any of the materials defined as registered pesticides in Section 136 ("special nuclear material" (Section 2014(aa)).

III. General Government Reservations to Conveyance

This Quitclaim Deed covering the Property described above is expressly made subject to the following reservations in favor of Grantor, and its assigns:

(A) **Save and Except** and there is hereby reserved unto Grantor, and its assigns, all rights and interests that have been previously reserved to Grantor in any patent(s) covering the Property.

IV. CERCLA Covenant, Reservation, Agreements, and Use Restrictions

(A) Grantor herein provides to Grantee notice of previous history of hazardous substance(s) activity on the Property as Exhibit B which reflects the following information available to Grantor: (1) the type and quantity of hazardous substances that were known to have been released or disposed of or stored for one (1) year or more on the Property; (2) the time such storage, release or disposal took place; and (3) a description of remedial action taken as required under Section 120(h) of CERCLA and 42 U.S.C. § 9620(h)(3)(A)(i).

(B) Grantor warrants that all remedial action necessary to protect human health and the environment has been taken before the date of this conveyance, except as noted in Section IV(C) below, as required under 42 U.S.C. 9620(h)(3)(A)(ii)(I). For contamination that is not yet remediated and for which Grantor is potentially responsible, Grantor warrants that Grantor will comply with all of the provisions for deferral of the requirements in 42 U.S.C. § 9620(h)(3)(A)(ii)(I) as set forth in 42 U.S.C. § 9620(h)(3)(C). Accordingly, Grantor provides the "response action

assurances" required by 42 U.S.C. § 9620(h)(3)(C)(ii) as set forth in this Section IV (C), (D) and (E) below.

(C) Declaration of Contamination, Conditions, Restrictions on Use, and Grantor Commitment to Remediate Certain Areas.

1. Contamination in Ground Water and Surface Expressions of Ground Water

Contamination: The ground water underlying the Property and the surface expressions of the ground water (the North Pond, South Pond, and wetland areas) are known by both parties to be contaminated with elevated levels of certain constituents resulting from the historical stockpiling of uranium ore and the disposal of process wastes from milling and concentrating activities. Following removal of the source of contamination, the accepted remedial action for eliminating the contamination is the natural flushing of the ground water over a period of 50–80 years (anticipated to be within regulatory standards between the years 2050 and 2080). Risk assessments performed concluded that the contaminants posed a threat to human health only if ingested by drinking the water.

Restriction: Except as provided in Subsection C.7 below, Grantee shall not engage in any disturbance or use of any untreated ground water underlying the Property, including the drilling of wells, the excavation of soils that expose ground water, or the diversion of ground water through any means without express written consent of the State of Colorado Department of Public Health and Environment (CDPHE) and the Grantor. This also includes, but is not limited to, restrictions on excavation of the underlying soils for their gravel content. Any request for consent to disturb or use any untreated ground water underlying the Property must include water quality data and a human health and ecological risk evaluation.

Grantor installed 13 warning signs at reasonable access routes to the South Pond, North Pond, and wetland area to notify the public that no swimming, fishing, or drinking of the waters is permitted (Exhibit C). Grantee and successors must maintain the signs until the State of Colorado approves the removal of the notification signs. Grantor will continue to monitor the water quality of the ponds and, when the water quality meets State standards, request the State to approve removal of the restrictions, including the notification signs.

Grantee shall not engage in any use of the surface expressions of ground water that might result in accidental consumption of the water, fish, or other aquatic species. This includes, but is not limited to, restrictions on fishing, swimming, activities that result in prolonged human contact with the water, hatchery operations for production of fish or other aquatic species for human consumption, and other recreational uses, unless this is modified per the Errata Sheets 3–5 to the Request for Deferred Remediation (approved by Governor Owens on August 15, 2001).

2. Building 12 Soil Contamination

Contamination: Grantor acknowledges that there is known contamination on the Property underlying the south end of Building 12 (see Exhibit C); Grantor covenants to remain solely responsible for the complete remediation of these conditions, as well as any later-discovered contamination. The contamination, believed to be the residue of a stockpile of uranium ores, poses a potential threat of radioactive exposure to individuals excavating the soils. There is no threat to persons occupying the building nor to the conducting of routine business activities, nor is there any indication the residual contamination is impacting the ground water.

Restriction: Except as provided in Subsection C.7 below, Grantee shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the south end of Building 12. Grantor shall remediate all contamination under and around Building 12 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 12 as the most cost-effective process to complete the remedial action and hereby agrees to accept this remediation approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building.

3. Building 20 and Laboratory Sample Preparation Building

Contamination: Grantor acknowledges that there is known contamination on the Property beneath the southwest corner of Building 20 (see Exhibit C). Grantor covenants to remain solely responsible for the complete remediation of the soils under Building 20 and any contaminated soils underneath the Laboratory Sample Preparation Building. The known contamination under Building 20, believed to be from mill tailings used as fill material to raise the elevation of a pond bank prior to construction of Building 20, poses a potential threat to persons excavating the soils from exposure to radioactive materials. There is no known threat to persons occupying the building or to the conducting of routine business activities, nor is there any indication that the contamination is impacting the ground water.

Restriction: Except as provided in Subsection C.7, below, Grantee and its assigns shall not, under any circumstances, without express written permission of CDPHE, Grantor, or as set forth in the Contingency Plan, engage in any activity that would result in disturbance of soils or structures underlying the south end of Building 20. Prior to altering the structural integrity of the floor at the south end of Building 20, such permission must be obtained. When Grantor decides to vacate the building, Grantor will demolish the building and remediate contaminated materials beneath the building to within regulatory limits.

The Grantor plans to continue to operate the laboratory in Building 20 and consequently prepare samples and conduct sample preparation activities in the Laboratory Sample Preparation Building. At such time in the future when Grantor

ceases operation of the laboratory, Grantor shall demolish Building 20 and remediate any contaminated soils underneath the building. The Grantor shall also remediate any contamination resulting in the Laboratory Sample Preparation Building and from sample preparation activities.

4. Foil Sources in Abandoned Well

Contamination: Grantee acknowledges that there is known contamination in the form of two foil radium sources encased in an abandoned well at the site (see Exhibit C for location). The well was abandoned in accordance with State of Colorado requirements, and the sources were encased in the well with the approval of the State.

Restrictions: Grantee shall not engage in any activity that disturbs the seal on the well encasement or the well itself without the express written consent of CDPHE and the Grantor.

5. Enforceable Agreement

Grantor has entered into an enforceable agreement with CDPHE in accordance with State of Colorado Executive Order D.013.98 and CERCLA 120(h). The agreement establishes the Grantor's cleanup plans for Building 12, Building 20, and the ground water (with the exception of the Foil Sources), reiterates the land-use controls placed upon the Grantee and successors, specifies the monitoring of contaminated areas by the Grantor, and provides a funding mechanism for the Grantor to reimburse CDPHE for oversight activities.

6. Grantee's Responsibilities

Grantee is responsible for assuring that the restrictions in this section and Grantor's rights of access related to the above and stated in this Deed, are stated in each subsequent instrument of transfer if Grantee passes ownership to another entity. Grantee is responsible for notifying Grantor's Long-Term Surveillance and Maintenance Program of such transfer. Grantee acknowledges its landlord responsibilities to monitor tenants' activities to ensure protection of Building 12 and 20 floors, to allow for safe soil excavation on the Property, to protect the abandoned well identified above, and to be protective of Grantor's remaining ground water monitoring wells.

Grantor acknowledges that planned use of the Property is for a mixture of commercial, industrial, office space, and open space, as stated in Grantee's Reuse Plan. Grantee's planned use is not restricted except as herein noted.

7. Contingency Plan

Grantor and Grantee shall agree to a Contingency Plan outlining the process for Grantee to follow if contaminated soil or ground water is encountered in a situation deemed to be an emergency. CDPHE has approved the plan (Exhibit D).

(D) Grantor hereby reserves, and Grantee accepts on behalf of itself and its successors and assigns, a right of access to all portions of the Property for environmental investigation, remediation or other corrective action found to be necessary regarding Site Substances (as defined in Section II) located on this Property as of the date of transfer. This reservation includes the right of access to and use of available utilities at reasonable cost to Grantor. These rights shall be exercisable in any case in which a remedial action, response action or corrective action is found to be necessary after the date of this conveyance, or in which access is necessary to carry out a remedial action, response action, or corrective action on adjoining property. Pursuant to this reservation, the United States of America, and its respective officers, agents, employees, contractors and subcontractors shall have the right to enter upon the Property and conduct investigations and surveys, to include drilling, borings, data and records compilation and other activities related to environmental investigation, and to carry out remedial or removal actions as required or necessary, including but not limited to the installation and operation of monitoring wells, pumping wells, and treatment facilities, and use of other actions deemed necessary by the Grantor to comply with all federal and state statutes, regulations or any court order. Grantee acknowledges that the removal of contamination may necessitate destruction of certain improvements at the Property and agrees to enter into negotiation with Grantor to determine appropriate and reasonable reparations.

(E) Grantee covenants and agrees for itself, its successors and assigns and every successor in interest to the Property, or part thereof, that while the respective parties identified in this paragraph and/or any party occupying the Property are in possession of the Property, they shall not disrupt or prevent the United States of America and its officers, employees, agents, contractors and subcontractors, and any other authorized party or entity from conducting required remedial investigations, response actions and oversight activities or from the proper and necessary construction, upgrading, operating, maintaining and monitoring of any ground water, surface water, or sediment treatment facilities or monitoring network on the Property or adjoining property.

(F) Grantor will submit a budget request to the Director of the Office of Management and Budget for the investigation and completion of all necessary response actions in accordance with CERCLA Subsection 120(h)(3)(C)(ii)(IV).

V. Specific Environmental Notices, Exceptions, Restrictions and Covenants Affecting the Property

This Quitclaim Deed covering the Property is expressly made subject to the following environmental notices, exceptions, restrictions and covenants affecting the Property to the extent and only to the extent the same are valid and affect the Property:

(A) **Notice that the Property Contains Improvements that may Contain Asbestos**

(1) Grantee is hereby warned that the Property contains asbestos-containing materials. Unprotected or unregulated exposures to asbestos in product manufacturing, shipyard, and building construction workplaces have been associated with asbestos-related diseases. Both the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) regulate asbestos because of the potential hazards associated with exposure to airborne asbestos fibers. Both OSHA and EPA have determined that such exposure increases the risk of asbestos-related diseases, which include certain cancers and which can result in disability or death.

(2) Grantee has been invited, urged and cautioned to inspect the Property as to its asbestos content and condition and any hazardous or environmental conditions relating thereto. Grantee shall be deemed to have relied solely on its own judgment in assessing the overall condition of all or any portion of the Property, including, without limitation, any asbestos hazards or concerns.

(3) Except as otherwise provided in this Deed, no warranties either express or implied are given with regard to the condition of the Property, including, without limitation, whether the Property does or does not contain asbestos or is or is not safe for a particular purpose.

(4) The description of the Property set forth in this Quitclaim Deed and any other information provided herein with respect to said Property is based on the best information available and is believed to be correct, but an error or omission, including but not limited to the omission of any information, shall not constitute grounds or reason for nonperformance of the contract of sale, or any claim by the Grantee against the Government, except as otherwise provided or as necessary to implement the terms hereof and the stated purposes of this Deed.

(5) Grantor assumes no liability for damages for personal injury, illness, disability or death, to the Grantee, or to the Grantee's successors, assigns, employees, invitees, or any other person subject to Grantee's control or direction, or to any other person, including members of the general public, arising from or incident to the purchase, transportation, removal, handling, use, disposition or other activity causing or leading to contact of any kind whatsoever with asbestos on the Property which is the subject of this sale, whether the Grantee, its successors or assigns has or have properly warned or failed properly to warn the individual(s) injured.

(6) Grantee further agrees that in its use and occupancy of the property it will comply with all federal, state, and local laws relating to asbestos.

(B) **Notice that the Property Contains Improvements that may Contain Lead-based Paint**

Effective upon transfer pursuant to this Deed, Grantee, for itself, its heirs and assigns and every successor in interest to the Property herein described, or any part thereof, based on the representations from Grantor to the Grantee, hereby releases and waives any and all claims it may have against the United States of America with respect to any and all loss, judgment, claims, demands, expenses or damages, of whatever nature or kind which might arise or be made against the United States of America as a result of lead-based paint having been present on the Property herein described, as of the date of transfer.

(C) **Notice of Wetland Area and Floodplain**

Grantee agrees and covenants for itself, its successors and assigns, that any development of the above-described Property will be subject to all applicable floodplain and wetland regulations and other applicable federal, state and local statutes and ordinances relating to floodplains and wetland. Before engaging in any ground disturbance activity that would adversely affect the extent, condition and function of the floodplain or wetland areas, Grantee agrees to obtain prior authorization from the United States Army Corps of Engineers and/or other relevant authorities pursuant to Section 404 of the Federal Clean Water Act and relevant floodplain requirements.

Effective upon transfer pursuant to this Deed, Grantee, for itself, its heirs and assigns and every successor in interest to the Property herein described or any part thereof, based on the representations from Grantor to Grantee, hereby releases and waives any and all claims it may have against the United States of America with respect to any and all loss, judgment, claims, demands, expenses or damages of whatever nature or kind which might arise or be made against the United States of America as a result of the Property herein described lying in a floodplain or being flooded.

(D) **Notice of Federal Aviation Administration Restrictions**

Grantee covenants for itself, its successors and assigns and every successor in interest to the Property herein described, or any part thereof, that any construction or alteration at the Property will not be undertaken without providing appropriate notice to the Federal Aviation Administration pursuant to 14 CFR 77.13 unless the exemption of Subsection 14 CFR 77.15 applies to such construction.

VI. General Exceptions to Conveyance

This sale is made subject to the following exceptions, which have been disclosed in Schedule B of The Commitment for Title Insurance No. 999-04-003L-C2, issued by Western Colorado Title Company on April 1, 1999, at 8:00 a.m. This commitment was obtained by the Grantor for planning purposes and will be made available to the purchaser upon request. The Quitclaim Deed shall contain the following exceptions:

(A) Rights or claims of parties in possession not shown by the public record.

(B) Easements, or claims of easements, not shown by the public records.

(C) Discrepancies, conflicts in boundary lines, shortage in area, encroachments, and any facts that a correct survey and inspection of the premises would disclose and which are not shown by the public records.

(D) Any lien, or right to a lien, for services, labor, or material heretofore or hereafter, furnished, imposed by law and not shown by the public records.

(E) Taxes and assessments which are a lien or due and payable, and any tax, special assessments, charges or lien imposed for water or sewer service, or for any other special taxing district or any unredeemed tax sales.

(F) Reservation, as set forth in United States Patent recorded August 3, 1895, in Book 11 at page 400, as follows: "Herein described property subject to the right of the proprietor of a vein or lode to extract and remove his ore therefrom should the same be found to intersect said premises." (Affects NE ¼ NE ¼ of Lot 1)

(G) Reservation, as set forth in United States Patent recorded August 3, 1895, in Book 11 at page 399, as follows: "Herein described property subject to the right of the proprietor of a vein or lode to extract and remove his ore therefrom should the same be found to intersect said premises." (Affects SE ¼ NE ¼ of Lot 7 and NE ¼ SE ¼ of Lot 6)

(H) Right-of-Way for road across subject property per document in Road Book 3 at page 146.

(I) Right-of-Way 200 feet wide across the E ½ E ½ of said Section 27 as evidenced by documents recorded September 24, 1976 in Book 1061 at page 469.

(J) Private Way License, for private road crossing, including the terms and conditions thereof recorded September 29, 1982, in Book 1393 at page 272.

(K) Right-of-Way for the Denver and Rio Grande Western Railroad across subject property.

VII. Miscellaneous Covenants/Grantor

(A) Except to the extent that the Grantee, its successors or assigns, are determined to be a potentially responsible party, any response action or corrective action found to be necessary after the date of this Deed regarding any Site Substance(s) relative to the hereinabove and conveyed Property shall be conducted by the United States of America, if it be determined that such Site Substance(s) contaminated the hereinabove described and conveyed Property **prior** to the date of this Quitclaim Deed, and the United States of America is a responsible party; notwithstanding any language in this Subsection A, the provisions of Subsection VIII C shall control.

VIII. Miscellaneous Covenants/Grantee

Grantee, for itself and its successors and assigns, covenants and agrees to abide with the agreements and covenants running with the land identified in this Quitclaim Deed. In addition, the United States of America shall be deemed a beneficiary of each of the agreements and covenants without regard to whether it remains the owner of any land or interest therein in the locality of the Property hereby conveyed and shall have a right to enforce each of the agreements and covenants in any court of competent jurisdiction. Notwithstanding the foregoing except with respect to the requirements of 42 U.S.C. 9620(h), Grantor, and its assigns shall have no affirmative duty to any successor in title to this conveyance to enforce any of the agreements and covenants.

(A) Except as otherwise provided in this Deed, the Property is conveyed "as is" and "where is" without any representation or warranty on the part of Grantor to make any alterations, repairs or additions. Grantee, for itself and its successors and assigns, further acknowledges that Grantor has made no representations or warranty concerning the condition and state of repair of the Property nor has Grantor made any other agreement or promise to alter, improve, adapt or repair the Property not otherwise contained herein.

(B) The following covenant shall run with the land for a period of three (3) years from the date of conveyance:

(1) With respect to the property described in this Deed, if at any time within a three-year (3-year) period from the date of transfer of title by the Grantor, the Grantee, or its successors or assigns, shall sell or enter into agreements to sell the property, either in a single transaction or in a series of transactions, it is covenanted and agreed that all proceeds received or to be received in excess of the Grantee's or a subsequent seller's actual allowable costs will be remitted to the Grantor. In the event of a sale of less than the entire property, actual allowable costs will be apportioned to the property based on a fair and reasonable determination by the Grantor.

(2) For purposes of this covenant, the Grantee's or a subsequent seller's allowable costs shall include the following:

(a) The purchase price of the real property;

(b) The direct costs actually incurred and paid for improvements which serve only the property, including road construction, storm and sanitary sewer construction, other public facilities or utility construction, building rehabilitation and demolition, landscaping, grading, and other site or public improvements;

(c) The direct costs actually incurred and paid for design and engineering services with respect to the improvements described in (2)(b) of this section; and,

(d) The finance charges actually incurred and paid in conjunction with loans obtained to meet any of the allowable costs enumerated above.

(3) None of the allowable costs described in (B)(2) of this section will be deductible if defrayed by federal grants or if used as matching funds to secure federal grants.

(4) In order to verify compliance with the terms and conditions of this covenant, the Grantee, or its successors or assigns, shall submit an annual report on request for each of the subsequent three (3) years to the Grantor on the anniversary date of this Deed. Each report will identify the property involved in this transaction and will contain such of the following items of information as are applicable at the time of submission:

(a) A description of each portion of the property that has been resold;

(b) The sale price of each such resold portion;

(c) The identity of each purchaser;

(d) The proposed land use; and,

(e) An enumeration of any allowable costs incurred and paid that would offset any realized profit.

(f) If no resale has been made, the report shall so state.

(5) The Grantor may monitor the property and inspect records related thereto to ensure compliance with the terms and conditions of this covenant regarding resale and may take any actions which it deems reasonable and prudent to recover any excess profits realized through the resale of the Property.

(C) Liability for Environmental Conditions. Grantor agrees to release, indemnify and hold harmless the Grantee, the City of Grand Junction, and the County of Mesa, their officers, directors, officials, employees, agents, tenants, appointees, successors, assigns, and contractors of each, from and against all liability, claims, suits, actions, administrative proceedings, orders, damages, costs, assessments, fines and penalties, including court costs and reasonable expert witness and attorneys' fees, arising out of or relating to any claims for damages arising from the release or threatened release at the Property of any "Site Substances," as defined in this Quitclaim Deed, as a result of any activities which occurred prior to the date of transfer, subject to the following conditions:

(1) If any suit or claim is filed or made against the Grantee or its tenants, the Grantee or its tenants shall forthwith notify the Grantor's Long-Term Surveillance and Maintenance Program at 2597 B ¾ Road, Grand Junction, Colorado 81503, and

promptly furnish copies of all pertinent documents received. Should this address change, the Grantor will forthwith notify the Grantee in writing. In addition, the Grantee or its tenants shall authorize the Grantor or other Government representatives to collaborate with the Grantee or its tenants in settling or defending the suit or claim.

(2) The Grantor may avoid its duty to defend, hold harmless, and indemnify a claim by the Grantee or its tenants (as defined in Subsection C) if the claim results only from the Grantee's or tenants' actions or inactions occurring after the date of the transfer of title of the Property. If there is a dispute regarding whether the Grantee or its tenants' actions or inactions caused damages, or the proportion of such action or inaction which caused some or all of the damages, Grantor shall provisionally defend and hold harmless the Grantee or its tenants. If it is determined in any final judicial or administrative proceeding that the Grantee's or its tenants' actions or inactions caused or contributed to the claim, the Grantee or its tenants shall reimburse the Grantor for costs paid by the Grantor in an amount proportional to the percentage of fault, negligence or responsibility allocated to the Grantee, its tenants, and the licensees and invitees of Grantee and its tenants, by the judgment, decision, determination, or settlement. Until a point in time when all of the ground water underlying the Property meets applicable standards (estimated to take 50–80 years from the date hereof), if during such administrative or judicial or equivalent process, fault is not clear or proved by a preponderance of the evidence, the Grantor agrees to indemnify the Grantee, as set forth herein.

(3) The CERCLA 120(h) list, and any necessary revisions thereto and deed restrictions as augmented and supplemented from time to time as new information becomes available as provided in the Quitclaim Deed, shall be used by the Parties as a basis for determining the condition of the Property as of the date of transfer pursuant to this Quitclaim Deed and whether any claim for damages directly arises from the release or threatened release of any Site Substance(s) at the Property as a result of activities at the Property prior to the date of transfer.

(4) The Grantor's duty to defend and hold the Grantee and its tenants harmless is subject to the availability of appropriated funds. Nothing in this Quitclaim Deed shall be construed as implying that the Congress will, at a later date, appropriate funds sufficient to meet any of these requirements.

(5) For the purposes of this Subsection C, the term "Grantor," as defined in this Deed, includes the DOE and every person and entity that, prior to the date of transfer, had a contractual relationship, direct or indirect, with the DOE.

(6) No other provision of this Quitclaim Deed shall be construed to have impliedly or otherwise amended, changed or modified any term, provision or duty described in this section; the provisions of this Subsection C shall control over any other term, section or provision.

(D) Grantee has inspected the described and conveyed Property and has satisfied itself that, based on the representations of the Grantor and Grantee's physical inspection, the Property is free of any Site Substance(s) (as defined in Section II), except as described herein.

IX. **Special Terms of Sale**:

(A) Upon conveyance, the subject parcel may become subject to all applicable laws, ordinances, and regulations, which may not have applied while title remained in the United States, including building and zoning ordinances and post conveyance taxes which previously were not in effect.

(B) In the event that circumstances for reversion of the Property arise, the Property shall first revert to ownership by either the City of Grand Junction, Colorado, or the County of Mesa, Colorado, then the Property shall revert to the Grantor if it so desires. Grantor's responsibilities, promises and obligations, set forth herein, reside with and bind the Grantor regardless of reversion.

(C) Conveyance of the Property by Quitclaim Deed is contingent upon approval by the Governor of the State of Colorado of the Grantor's Request for Deferred Remediation.

(D) Grantor, pending approval from the Union Pacific Railroad Company, assigns to Grantee the existing lease (Folder #01778-11) with Union Pacific Railroad Company for parking space. Grantee accepts assignment as a condition of this Quitclaim Deed.

X. **Third-Party Beneficiary**

The State of Colorado is a third-party beneficiary of this Quitclaim Deed between Grantor and Grantee. The consent by the Governor of Colorado to the deferred remediation is in justified reliance on the Grantor's "response action assurances" mandated by 42 U.S.C. § 9620(h)(3)(C)(ii) and as set forth in Section IV (C), (D) and (E), as well as Grantor's covenant warranting additional remediation mandated by 42 U.S.C. § 9620(h)(3)(A)(ii)(II) and as set forth in Section VII (A).

In Witness Whereof, the United States of America has caused these presents to be executed this 19th day of SEPTEMBER, 2001.

United States of America
Acting by and through the
Secretary of Energy

By: Donna Bergman-Tabbert

The State of Colorado)
)
County of Mesa)

Before Me, a Notary Public in and for the State of Colorado, on this day personally appeared DONNA BERGMAN-TABBERT, known to me to be the person whose name is subscribed to the foregoing Quitclaim Deed, and known to me to be the Donna Bergman-Tabbert, GJO Manager for Dept of Energy, and acknowledged to me that the same was the act and deed of the United States of America and of the Secretary of Energy and that he/she executed the same as the voluntary act of the United States of America and of the Department of Energy for the purposes and consideration therein expressed and in the capacity therein stated.

Given Under My Hand and Seal of Office at 551 Grand Ave, Grand Jct, Co 81501, this 19th day of September, 2001.

NOTARY PUBLIC
SUSAN J OTTMAN
STATE OF COLORADO

My Commission Expires
November 2, 2001

Notary Public, State of Colorado

Page 12, Section V.K, Paragraph 3. Replace Sentences 2 and 3 with the following sentence:

"Demolition and remediation estimates for Buildings 12 and 20 will be developed during Fiscal Year 2001 and will be available to insert in the budget request when DOE has developed a definite schedule to vacate those buildings."

The following changes apply to the *Quitclaim Deed.*

Page 5, Section IV.C.3. Paragraphs 2 and 3 should be replaced by the following paragraph:

"*Restriction:* Except as provided in C.7, below, Grantee shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the west end of Building 20. Grantor is required to remediate all contamination under and around Building 20 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 20 as the most cost-effective process to complete the remedial action and hereby agrees to accept this approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building."

The following changes apply to the Draft Final *Long-Term Surveillance Plan for the U.S. Department of Energy Grand Junction, Colorado, Office Facility,* September 2000.

Page 1, Section 1.2, Paragraph 4. Sentence 1 should read as follows:

"The primary relevant and appropriate regulations and guidance for the remediation of the GJO facility are 40 CFR 192 and DOE Order 5400.5 (DOE 1989a and DOE 1989b).[1]"

Page 12, Paragraph 4. Sentence 3 should read as follows:

"Analytical laboratory results for soil samples collected from the deposit of contaminated soil had maximum concentrations of 177 pCi/g for radium-226, 148 pCi/g for thorium-230; and 269 pCi/g for total uranium."

Page 12, Second Full Paragraph. Sentence 4 should read as follows:

"A concrete sump integral to the Building 12 foundation has fixed surface contamination as high as 50,000 disintegrations per minute per 100 square centimeters."

Page 12, Sixth Full Paragraph. The paragraph should be revised to indicate the following information:

DOE will demolish Buildings 12 and 20 (in their entirety) when DOE operations in those buildings cease. The building structures have been released for unrestricted use, and the demolition debris will be hauled to a public landfill. Contaminated soil and debris was left under the west end of Building 20 for economic and structural reasons. The contaminated concrete slab

and soil under the south end of Building 12 was left in place for economic reasons. DOE will remediate the contaminated materials beneath the buildings and dispose of the material at Cheney Repository. The soil within the building footprints will be radiologically verified to comply with regulatory limits.

Plate 1:

The location of the 300-ft borehole with radium foil should be moved a couple hundred feet to the northwest.

The following changes apply to the specified areas of the final DR:

1. The first sentence in Section IV.A.2, paragraph 3 of the Enforceable Agreement, Section IV.C.1 paragraph 5 of the Quitclaim Deed, and paragraph 5 to Appendix E of the Long Term Surveillance Plan, Attachments A, B, and C respectively to the final DR has been modified and now states: "Grantee shall not engage in any use of the surface expressions of groundwater, except as described below, that might result in accidental consumption of the water, fish, or other aquatic species."

   The following paragraphs are also added to Section IV.A.2 of the Enforceable Agreement as paragraphs 4 through 6, Section IV.C.1 of the Quitclaim Deed as paragraphs 6 through 8, and to Appendix E of the Long Term Surveillance Plan as paragraphs 6 through 8 in the final DR.

   The Grantee may allow the U.S. Fish and Wildlife Service to utilize the surface water ponds on-site to raise Razorback Suckers (Xyrauchen texanus) prior to their introduction into the wild. No construction to the existing ponds is allowed unless specifically authorized by the Colorado Department of Public Health and the Environment. The U.S. Fish and Wildlife Service is the only agency authorized for this purpose, and the ponds may not be utilized for raising other fish species.

   The Razorback Suckers may be placed in the ponds each April and then later harvested from the ponds, not to exceed a duration of 8 months. The U.S. Fish and Wildlife Service will make every practical effort to remove all the fish from the ponds each growing season, and ensure that the fish are released into areas that are physically isolated from Northern Pike (Esox lucius) or other large predatory fish.

   The U.S. Fish and Wildlife Service will also ensure that its employees are adequately trained and protected from the hazards that they may encounter during the fish rearing operation. This training includes but is not necessarily limited to review of the Uranium Mill Tailings Management Plan and review of the most recent groundwater and surface water monitoring data for the site as provided for annually by the U.S. DOE.

2. Section 4.11 of the draft DR text, sentence 5 states "It (lead based paint) is not a CERCLA hazardous substance. This sentence is considered to be deleted from the final DR text.

NOTICE
Regarding what is commonly known as
the DOE Site,
Now to be known as the RTC property.

The purpose of this Notice is to generally describe the other documents and information that must be read to fully understand the state of title, and other important information available with regard to what has been known locally as the United States Department of Energy Grand Junction Site.

Said Site is a part of Lot 1, all of Lots 6 and 7, section 27 AND a part of G.L.O. Lot 1 in Section 26, all in Township 1 South, Range 1 West of the Ute Meridian, Mesa County, CO.
The street address of the Site has been 2597 B ¾ Road, Grand Junction, CO 81503. The acreage of the Site being transferred to the RTC is approximately 46 acres.
The RTC is the Riverview Technology Corporation, Inc., a Colorado not for profit corporation, the address of which is presently c/o Western Colorado Business Development Corp., 2591 B ¾ Road, Grand Junction, CO 81503.

This notice is intended to supplement that Quit Claim Deed recorded at Book 2938 pages 153[redacted] of the Mesa County Clerk and Recorder's records, including the three "Errata sheets" recorded at Book 2938 Pages, which Errata Sheets are a part of "Final Request for Deferred Remediation," signed August 15, 2001 by Governor Owens.

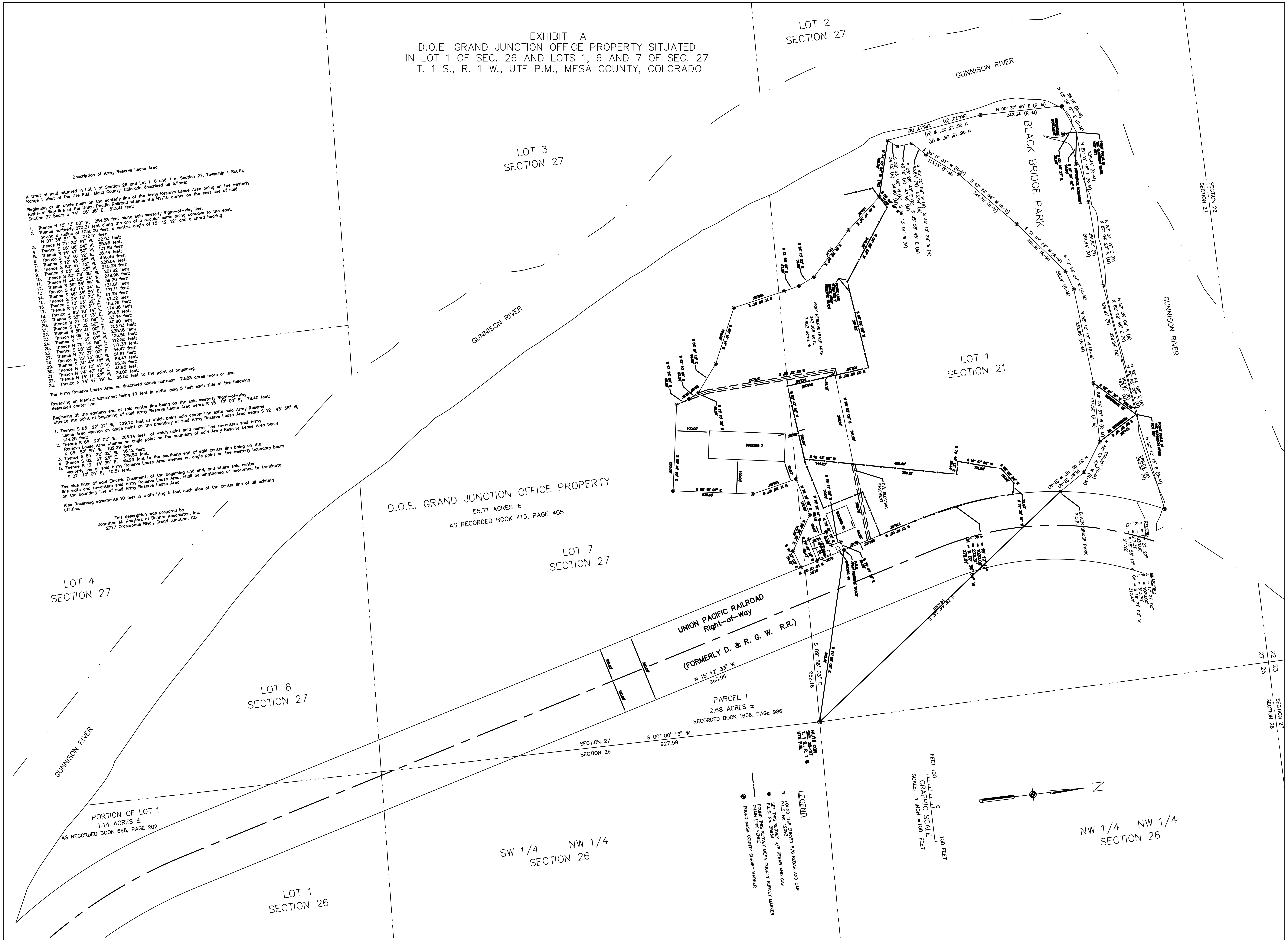
To understand the agreements, restrictions, duties, obligations and limitations that apply to the property described in that Quit Claim Deed the following additional documents and information is necessary:
1. A two volume, loose-leaf, set.
Volume One contains Errata Sheets (pages 1-5), DOE's request to the Governor termed "Request for Deferred Remediation" (pages 1-31); and attachments labelled "A" through "H."
Volume two contains:

a. the Purchase and Sale Agreement between the DOE and the RTC;
b. the Lease agreement between the DOE and the RTC;
c. the "Contingency Plan;"
d. Uranium Mill Tailings Management Plan (UMTMP).

A set of these two volumes will be permanently available for public review at the following locations:
-U.S. Department of Energy (Grand Junction Projects Office), 2597 B ¾ Road, Grand Junction, CO 81503. If this office closes, the DOE will notify the City of Grand Junction City Clerk and the Clerk to the Board of County Commissioners of Mesa County, specifying the new location of the two volumes;
-The City Clerk of the City of Grand Junction, 250 North Fifth St., Grand Junction, CO 81501;
-Mesa County Library District, Main Library in Grand Junction, 530 Grand Ave., Grand Junction, Co 81501;
-Colorado Department of Public Health and Environment, 222 South 6th St., Grand Junction, CO 81501.

EXHIBIT A

D.O.E. GRAND JUNCTION OFFICE PROPERTY SITUATED
IN LOT 1 OF SEC. 26 AND LOTS 1, 6 AND 7 OF SEC. 27
T. 1 S., R. 1 W., UTE P.M., MESA COUNTY, COLORADO



Description of Army Reserve Lease Area

A tract of land situated in Lot 1 of Section 26 and Lot 1, 6 and 7 of Section 27, Township 1 South, Range 1 West of the Ute P.M., Mesa County, Colorado described as follows:

Beginning at an angle point on the easterly line of the Army Reserve Lease Area being on the westerly Right-of Way line of the Union Pacific Railroad whence the N1/16 corner on the east line of said Section 27 bears S 74° 56' 08" E, 513.41 feet;

1. Thence N 15° 13' 00" W, 254.83 feet along said westerly Right-of-Way line;
2. Thence northerly 273.31 feet along the arc of a circular curve being concave to the east, having a radius of 1030.00 feet, a central angle of 15 12' 12" and a chord bearing N 07° 36' 54" W, 272.51 feet;
3. Thence N 77° 30' 51" W, 32.93 feet;
4. Thence S 56° 06' 54" W, 55.96 feet;
5. Thence S 16° 47' 50" W, 131.88 feet;
6. Thence S 76° 40' 12" E, 38.44 feet;
7. Thence S 12° 43' 55" W, 450.46 feet;
8. Thence S 83° 47' 42" W, 220.04 feet;
9. Thence N 05° 52' 55" W, 245.98 feet;
10. Thence S 83° 08' 08" W, 261.62 feet;
11. Thence N 54° 55' 34" W, 249.98 feet;
12. Thence S 59° 56' 59" W, 39.20 feet;
13. Thence S 40° 14' 34" E, 134.81 feet;
14. Thence S 46° 35' 59" E, 171.11 feet;
15. Thence S 24° 15' 22" E, 51.98 feet;
16. Thence S 12° 53' 39" E, 47.32 feet;
17. Thence S 11° 03' 51" E, 156.26 feet;
18. Thence S 65° 10' 14" E, 174.08 feet;
19. Thence S 52° 01' 13" E, 99.68 feet;
20. Thence S 27° 10' 09" E, 33.34 feet;
21. Thence S 17° 22' 50" E, 40.60 feet;
22. Thence S 80° 41' 00" E, 255.03 feet;
23. Thence N 09° 19' 07" E, 235.18 feet;
24. Thence N 11° 59' 07" W, 136.55 feet;
25. Thence N 76° 14' 59" E, 112.80 feet;
26. Thence S 58° 22' 42" E, 117.33 feet;
27. Thence N 71° 37' 03" E, 54.47 feet;
28. Thence N 15° 13' 00" W, 51.91 feet;
29. Thence S 74° 47' 19" W, 68.47 feet;
30. Thence N 15° 12' 41" W, 55.18 feet;
31. Thence N 74° 47' 19" E, 41.95 feet;
32. Thence N 15° 11' 23" W, 30.00 feet;
33. Thence N 74° 47' 19" E, 26.50 feet to the point of beginning.

The Army Reserve Lease Area as described above contains 7.883 acres more or less.

Reserving an Electric Easement being 10 feet in width lying 5 feet each side of the following described center line:

Beginning at the easterly end of said center line being on the said westerly Right-of-Way whence the point of beginning of said Army Reserve Lease Area bears S 15 13' 00" E, 79.40 feet;

1. Thence S 85 22' 02" W, 229.70 feet at which point said center line exits said Army Reserve Lease Area whence an angle point on the boundary of said Army Reserve Lease Area bears S 12 43' 55" W, 144.25 feet;
2. Thence S 85 22' 02" W, 266.14 feet at which point said center line re-enters said Army Reserve Lease Area whence an angle point on the boundary of said Army Reserve Lease Area bears N 05 52' 55" W, 102.29 feet;
3. Thence S 85 22' 02" W, 16.12 feet;
4. Thence S 02 37' 26" E, 379.50 feet;
5. Thence S 12 15' 39" E, 48.29 feet to the southerly end of said center line being on the westerly line of said Army Reserve Lease Area whence an angle point on the westerly boundary bears S 27 10' 09" E, 10.51 feet.

The side lines of said Electric Easement, at the beginning and end, and where said center line exits and re-enters said Army Reserve Lease Area, shall be lengthened or shortened to terminate on the boundary line of said Army Reserve Lease Area.

Also Reserving easements 10 feet in width lying 5 feet each side of the center line of all existing utilities.

This description was prepared by
Jonathan M. Kobylarz of Banner Associates, Inc.
2777 Crossroads Blvd., Grand Junction, CO

DRAWN BY: JMK	REVIEWED DATE: FOR	
DESIGNED BY: N/A		
CHECKED BY: JMK	REVIEWED DATE: FOR BANNER ASSOCIATES, INC.	

AMERICAN CONSULTING ENGINEERS COUNCIL of COLORADO

BANNER

BANNER ASSOCIATES, INC. • CONSULTING ENGINEERS & SURVEYORS
2777 CROSSROADS BOULEVARD • GRAND JUNCTION, CO 81506 • (970) 243-2242

REVISION	DATE	DESCRIPTION	BY	CH'D

WASTREN, INC. — GRAND JUNCTION, COLORADO

D.O.E. GRAND JUNCTION OFFICE PROPERTY SITUATED
IN LOT 1 OF SEC. 26 AND LOTS 1, 6 AND 7 OF SEC. 27
T. 1 S., R. 1 W., UTE P.M., MESA COUNTY, COLORADO

SCALE:	JOB NO:	DATE:
1" = 100'	40066.01-01	9-28-2000

SHEET NO: 1 OF 1

Exhibit B

Notice of Hazardous Substance Activity

The information contained in this notice is required under the authority of regulations promulgated under Section 120(h) of the Comprehensive Environmental Response, Liability, and Compensation Act (CERCLA, or "Superfund"), 42 U.S.C. 9620(h).

The U.S. Department of Energy (DOE) intends to transfer ownership of the following federal real property (Property) to the Riverview Technology Corporation (RTC), a nonprofit, Colorado corporation:

> All that portion of Lot 1 lying West of the right-of-way of the Denver and Rio Grande Western Railroad Company, and all of lots 6 and 7, subject to right-of-way of the Denver and Rio Grande Western Railroad Company, all being in Section 27, Township 1 South, Range 1 West, Ute Meridian, Mesa County, Colorado, containing 55.71 acres of land more or less, together with the private railroad spur thereon, and all rights and appurtenance thereto, also all water and water rights used thereon or appurtenant thereto, including the private line from artesian well, and all rights in connection therewith, and all buildings and improvements thereon as recorded in Book 415, page 405;
>
> And, that portion of G.L.O. Lot 1, Section 26, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado, lying west of the right-of-way of the Denver and Rio Grande Western Railroad Company containing 1.14 acres of land more or less, as recorded in Book 668, page 202;
>
> Except: Parcel 1, located in G.L.O. Lot 7 of Section 27, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado, containing 2.68 acres of land more or less as conveyed to A. N. Applebaum and recorded in Book 1606, page 986; and
>
> Except that portion to be reserved to the United States and called the Army Reserve Tract: containing 7.97 acres more or less, as further described in Exhibit A.
>
> This parcel then contains 46.20 acres calculated as follows: 55.71 acres (1943 Deed in Book 415, page 405) plus 1.14 acres (Deed in Book 668, page 202) - minus - 2.68 acres (Deed in Book 1606, page 986) - minus - 7.97 acres (Army Reserve Tract to be retained by the United States when the transfer to the **Grantee** in this Deed is made) equals 46.20 acres, more or less. The legal description of this Property and the "Army Reserve Tract" are described in Exhibit A of the Deed.

Title 40 *Code of Federal Regulations* (CFR), Part 373.3, requires notification by the federal entity of any hazardous substance (as defined by CERCLA Section 101) that was stored on the property for 1 year or more in quantities in excess of 1,000 kilograms or the hazardous substance's reportable quantity, whichever is greater; the reporting of any hazardous substance

that was released in quantities that exceed the hazardous substance's reportable quantity; and the reporting of any substance disposed on the property. This notice is provided because hazardous substances were formerly released or stored at the Property.

The Grand Junction Office (GJO) facility lands were acquired by the U.S. War Department in August 1943 to refine uranium for the Manhattan Project. Uranium was milled, extracted from ore, analyzed, and stored on the GJO facility from 1943 to 1975. All known environmental contamination is believed to be the result of these past activities. According to historical records (maintained by DOE and its predecessor agencies, the Atomic Energy Commission, the Nuclear Regulatory Commission, and the Energy Research and Development Administration), approximately 29,024 metric tons (32,000 short tons) of ore was processed at the site between 1943 and 1958. The resulting tailings, consisting of approximately 136,100 cubic meters (m^3) (178,000 cubic yards [yd^3]) of material, were stored or used at many locations at the site.

The total volume, 178,000 yd^3 of tailings material released or stored at the Property, equates to approximately 569,600,000 pounds (258,366,213 kilograms). These materials were spread over approximately 17.7 acres of the 55.24-acre GJO facility. The estimated quantity of all radiological materials (expressed as Curies) disposed of at the GJO facility totals 233.98. This number includes activities for radionuclides in the uranium decay series, namely, bismuth-210, lead-210, polonium-210, radium-226, radon-222, thorium-230, uranium-234, and uranium-238.

Metals and other contaminants associated with uranium ore are also present in the material removed from the Property during remediation. Chemical and radioactive characterization of the mill tailings is provided in Section 3 of the *Final Remedial Investigation/Feasibility Study—Environmental Assessment for the U.S. Department of Energy Grand Junction Projects Office Facility* (RI/FS-EA) (July 1989). Because the characterization samples were not statistically representative, no quantitative comparison was possible. However, the RI/FS-EA also states that the tailings materials were "presumed to be similar in content to the tailings materials found at the Climax Mill Site." Table 3.1 of the *Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Site at Grand Junction, Colorado* (UMTRA-DOE/AL-050505, September 1991) provides the basis for the estimations of pounds in Table 1.

Large quantities of processing chemicals were used at the site during the milling operations between 1943 and 1975. DOE conducted a thorough search of available records but did not discover specific information on the length of time the chemicals were stored at the site. DOE is taking a conservative approach by reporting in Table 1 the total estimate of quantities used and presuming the chemicals were stored at the site for periods longer than the 1-year limitation specified in 40 CFR Part 373.3.

The ground water underlying the site and the surface expressions of ground water (the North and South Ponds and the wetland areas) are also contaminated with some of the hazardous substances identified in Table 1 as a result of the processes described above. In accordance with the remedy selected during the RI/FS-EA process, the waters will be passively remediated through natural flushing over the next 50 to 80 years. A complete listing of the constituents present in the ground and surface water is presented in the *Annual Site Environmental Report for Calendar Year 1999.*

Table 1. Notification of Hazardous Substances Released, Stored, or Disposed on the Property Between 1943 and 1975

Hazardous Substance	CAS Number[1]	Regulatory Synonym	Quantity Kilograms	Quantity Pounds	RQ[1]	Disposition R[1]	Disposition S[1]
Tailings-Related Materials							
Antimony	7440360	None listed	1.55	3.41	1	X	
Arsenic	7440382	None listed	23.77	52.40	1	X	
Beryllium	Not listed	None listed	.77	1.70	1	X	
Cadmium	7440439	None listed	2.84	6.26	1	X	
Chromium	Not listed	None listed	1.29	2.84	1	X	
Cobalt compounds	Not listed	None listed	23.25	51.26	1	X	
Copper	7440508	None listed	12.66	27.91	1	X	
Lead	7439921	None listed	1.29	2.84	1	X	
Nickel	7440020	None listed	88.36	194.80	1	X	
Selenium	7782482	None listed	18.86	41.58	1	X	
Silver	7440224	None listed	1.29	2.84	1	X	
Zinc	7440666	None listed	65.62	144.67	1	X	
Process-Related Hazardous Substances presumed Stored at the Site for More Than One Year							
Ammonia	7664417	None listed	9,071	20,000	100		X
Potassium permanganate	7722647	None listed	4,536	10,000	100		X
Sodium hydroxide	1310732	None listed	130,634	288,000	1000		X
Sulfuric acid	7664939	None listed	1,147,588	2,530,000	1000		X

[1]Chemical Abstracts Services Registry Number
[2]Reportable Quantity as defined in CERCLA, reported in pounds.
[3]The notice required by 40 CFR 373.1 for the known release of hazardous substances applies only when hazardous substances are or have been released in quantities greater than or equal to the substances CERCLA reportable quantity found at 40 CFR 302.4.
[4]The notice required by 40 CFR 373.1 for the storage of 1 year or more of hazardous substances applies only when hazardous substances are or have been stored in quantities greater than or equal to 1,000 kilograms or the hazardous substance's CERCLA reportable quantity found at 40 CFR 302.4, whichever is greater. Acutely hazardous wastes that are stored for 1 year or more are subject to the notice requirement when stored in quantities greater than or equal to one kilogram.

Asbestos

CERCLA requires notification of friable asbestos that has been stored, released, or disposed of on the property. Table 2 lists the quantities of friable asbestos known to have been released on the property and subject to reporting under CERCLA 120(h). The GJO facility has operated under an Asbestos Management Plan since 1995. The Asbestos Management Plan was created in compliance with the Asbestos Hazard Emergency Response Act (AHERA) and is managed by an AHERA-certified management/planner. As part of the development of that plan, DOE undertook an extensive sampling and analysis project to identify and quantify the types and amounts of asbestos on the site. Asbestos abatement projects have been conducted in accordance with the Toxic Substances Control Act; State of Colorado Regulation 8, "Part B, Asbestos Control"; and applicable standards for worker protection under the Occupational Health and Safety Act.

Table 2. Reportable Friable[a] Asbestos[b]

Location	Homogeneous Material Description	Material Condition	Quantity Linear or Sq. Ft.	Asbestos Content
Building 20	Soils in Trench	Fibers in Soil	341 sq. ft.	14%
GJO Site	Buried Debris (Various locations where pipe insulation was replaced during the 1970's and the removed insulation was reburied with the utility.)	Friable/Damaged[c]	Estimate 500 lf	25% to 30%

[a] "Friable" means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously non-friable material that becomes damaged to the extent that when dry may be crumbled, pulverized, or reduced to powder by hand pressure (40 CFR 763.83)

[b] The CAS Number for friable asbestos is 1332214; the Reportable Quantity is 1 pound. The linear footage is the result of physical inspection, the number of pounds cannot be estimated from available data.

[c] "Damaged" means asbestos-containing material that has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that its bond to the substrate (adhesion) is inadequate or which for any other reason lacks cohesion or adhesion qualities (40 CFR 763.83).

Lead-Based Paint

Because of the age of the buildings at the site, lead-based paint is presumed to be present on the surfaces of all buildings. There are no data available to quantify the amount of paint remaining on the buildings. In most cases, the lead-based paint has been encased with non-lead-based paint and presents no danger to site occupants as long as it remains undisturbed (e.g., sanding, scraping, or sandblasting).

Additional Disclosures Not Required By CERCLA 120(h)

Asbestos

Buildings on the property contain non-friable asbestos in the form of floor tile, ceiling tiles, and mastic carpet adhesive. CERCLA 120(h) does not require the reporting of non-friable asbestos, and the materials present at the site are not considered to be a hazard unless disturbed (e.g., tile removal using destructive methods, sanding, scraping, or sandblasting). The DOE has also

identified a trench running along the northern portion of Building 810 on the east side that contains remnants of asbestos transite siding that was removed from Building 810 between 25 and 30 years ago. The siding is not friable at this time and does not present a hazard to human health or the environment. Removal actions using heavy equipment or destructive methods may render the transite friable.

Additionally, there are areas at the site where friable asbestos exists, but the friable asbestos has not been stored, released, or disposed of as defined by CERCLA 120(h) The materials are classified as "damaged" because damage may have occurred to portions of the materials, but the damage has not rendered the materials unusable for their intended purposes (for example, pipe insulation). In every instance, the materials are being managed in place to mitigate any potential hazard. Table 3 lists the known locations of non-reportable friable asbestos.

Table 3. Non-reportable Friable[a] Asbestos[b]

Location	Homogeneous Material Description	Material Condition	Quantity Linear or Sq. Ft.	Asbestos Content
Building 18	Spray-on Ceiling Insulation	Friable/Damaged[c]	2,297 sq. ft.	20%
Building 20	Pipe Insulation	Friable/Damaged	3,133 lf	4%
Building 810	Pipe Insulation (South Crawlspace) Risers, Air Duct	Friable/Damaged	716 lf	25%
Building 938	Pipe Insulation, Risers	Friable/Damaged	48 lf	25%
Building 3022	Pipe Insulation (South Crawlspace) Risers	Friable/Damaged	690 lf	25%
GJO Site	Buried Pipe Insulation Between Buildings 28 and 29 Between Buildings 1 and 56	Friable/Damaged	Estimate 500 lf	25% to 30%

[a] "Friable" means that the material, when dry, may be crumbled, pulverized, or reduced to powder by hand pressure, and includes previously non-friable material that becomes damaged to the extent that when dry may be crumbled, pulverized, or reduced to powder by hand pressure (40 CFR 763.83)
[b] The CAS Number for friable asbestos is 1332214; the Reportable Quantity is 1 pound. The linear footage is the result of physical inspection, the number of pounds cannot be estimated from available data.
[c] "Damaged" means asbestos-containing material that has deteriorated or sustained physical injury such that the internal structure (cohesion) of the material is inadequate or, if applicable, which has delaminated such that its bond to the substrate (adhesion) is inadequate or which for any other reason lacks cohesion or adhesion qualities (40 CFR 763.83)

Polychlorinated Biphenyls

The older light ballasts on the property may contain minute amounts of polychlorinated biphenyls (PCBs). The ballasts have been removed whenever possible and replaced with non-PCB-containing ballasts. The light ballasts do not present a hazard unless a leak occurs. When removed from service, the PCB-containing ballasts (whether leaking or not) must be managed and disposed of in accordance with the Toxic Substances Control Act.

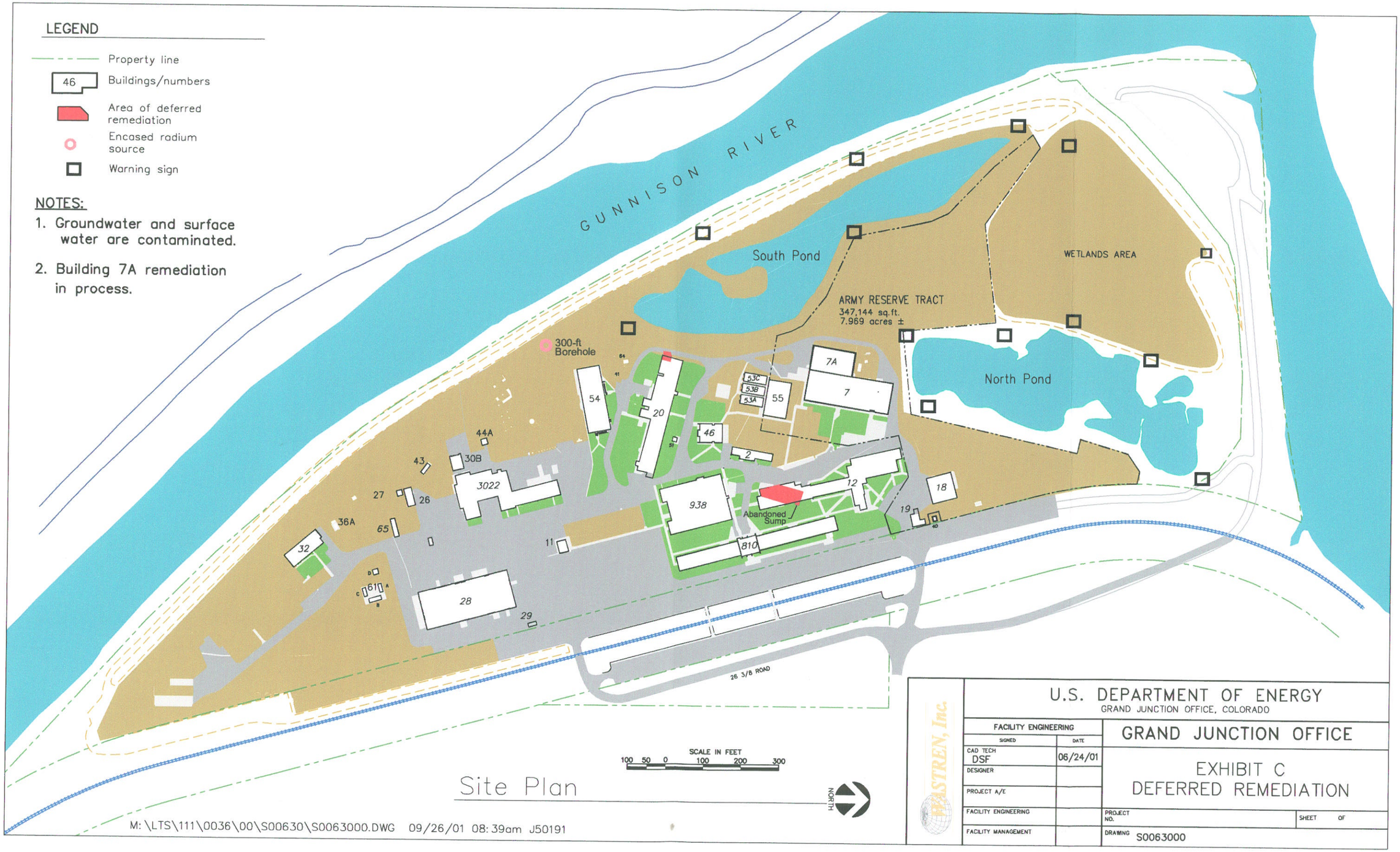
Additionally, the U.S. Department of Energy stored approximately 61 cubic yards of uranium mill tailings contaminated with PCBs from 1989 until 1998, when the tailings were sent to the Grand Junction Disposal Cell in Mesa County for disposal.

LEGEND

- Property line
- 46 — Buildings/numbers
- Area of deferred remediation
- Encased radium source
- Warning sign

NOTES:

1. Groundwater and surface water are contaminated.
2. Building 7A remediation in process.



Site Plan

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	U.S. DEPARTMENT OF ENERGY GRAND JUNCTION OFFICE, COLORADO	
FACILITY ENGINEERING		GRAND JUNCTION OFFICE
SIGNED	DATE	
CAD TECH DSF	06/24/01	EXHIBIT C DEFERRED REMEDIATION
DESIGNER		
PROJECT A/E		
FACILITY ENGINEERING		PROJECT NO. / SHEET OF
FACILITY MANAGEMENT		DRAWING S0063000

WESTREN, Inc.

Exhibit D

CONTINGENCY PLAN: AGREEMENT REGARDING DISTURBANCE OF THE GROUND/SURFACE AT THE DOE COMPOUND

Introduction/Recitals.

The U.S. Department of Energy (DOE) will soon convey a portion of the Grand Junction Office site, located at 2597 B 3/4 Road in Grand Junction, Colorado (Compound), to the Riverview Technology Corporation, Inc. (RTC). According to the DOE, parts of the Compound are contaminated, as disclosed in the deed and other agreements signed by DOE and RTC ("the Transfer Documents"). The RTC accepts that it cannot obtain title to the Compound without taking title subject to restrictions, limitations, and obligations ("institutional controls") structured to protect human health and the environment. Namely, the RTC has agreed not to take any action that will knowingly disturb contaminated areas without the prior approval of DOE and Colorado Department of Public Health and Environment (CDPHE), except as provided herein.

NOW THEREFORE BE IT AGREED:

1. General Provisions.

   (a) RTC's present plans for the use of the Compound include office uses, leases to other tenants, and public open space. These uses may change over time, and some existing buildings may be demolished, with new buildings and facilities being constructed. Therefore, both for existing structures and future uses, underground water, sewer, power, irrigation and other utilities will have to be repaired, and eventually, replaced. New facilities and buildings will need below grade foundation work and utility connections/work both in the regular course of business and in emergencies.

   (b) This contingency plan sets forth how the parties expect such work to be performed, including during an emergency.

   (c) As provided in the Transfer Documents, the RTC is specifically prohibited from disturbing areas of known contamination, including any activity that will expose contaminated ground water without the written consent of DOE, except as provided in this agreement.

(d) It is the intention of the parties to this Agreement regarding disturbance of the ground surface at the DOE compound that the scope of this plan be narrowly defined to apply to "emergencies or activities that are likely to expose contaminated ground water and/or sediments." It is not the intention of the parties to create any additional right of approval by the DOE or CDPHE.

2. Definitions. For purposes of this agreement, the following words and phrases shall have the meanings set forth.

(a) "Contaminated ground water" means only that ground water that is below the surface of the compound and that contains contaminants (as identified in the Transfer Documents and Sales Agreement) in excess of applicable state standards.

(b) "Emergency" means a situation that occurs unexpectedly that will cause damage to persons or property or the environment if not controlled immediately, and the methods of control are reasonably likely to expose contaminated ground water.

(c) "RTC" means the Riverview Technology Corporation, Inc. and it successors, transferees and assigns.

(d) "Transfer Documents" means the offer to Purchase and Sale Agreement, the lease and other closing documents.

3. Emergency Response Procedure.

(a) In the event of an emergency as defined herein, the RTC or its designee, such as a site manager, shall give notice of the emergency as soon as possible (normally within one hour of discovery of the emergency) by calling the telephone numbers listed in the Grand Junction telephone directory for any person answering telephone(s) for the DOE-GJO and the CDPHE Hazardous Materials and Waste Management Division. Such notification shall include sufficient information for the DOE-GJO Emergency Manager and/or the CDPHE representative to determine whether oversight of the response is required. The DOE-GJO Emergency Manager and/or CDPHE (or the designee of either) may inspect the site of the emergency and observe the response actions. The DOE-GJO or CDPHE reserve the right to insist that emergency response work stop if necessary to protect human health or the environment.

(b) If the work performed in response to the emergency exposes contaminated ground water, the RTC will manage the exposed contaminated ground water in accordance with applicable State of Colorado regulations. This would include the discharge of the ground water to the ground surface during the emergency.

4. Non-Emergency Work.

(a) Before and while performing non-emergency work that will likely expose contaminated ground water: (a) the RTC will proceed with the mitigation effort, utilizing the protocols listed below; and (b) RTC will sample exposed ground water to determine if such water is contaminated with substances/materials listed by the DOE in the transfer documents. If no DOE (including its agents' and contractors' and subcontractors') laboratory or equivalent facility is located within 150 air miles of the Compound, the RTC shall pay for such costs of sampling and analysis. This subsection does not apply during an emergency.

(b) During emergencies and non-emergencies, the RTC will abide by the Uranium Mill Tailings Management Plan (UMTMP) published by CDPHE for managing mill tailings encountered during construction activities in Western Colorado. A copy of the present UMTMP is attached as **Exhibit E.**

(c) Except as provided herein, the RTC shall not engage in any disturbance or use of any contaminated ground water underlying the Compound, including the drilling of wells, the excavation of soils that expose ground water, excavation of the underlying soils for their gravel content, or the diversion of ground water through any means without the written consent of the CDPHE and the DOE, which shall not be unreasonably withheld.

(d) Except as required during an emergency, the RTC shall give thirty (30) days written notice to the DOE and to the CDPHE before commencing any activity that is reasonably likely to expose contaminated ground water. The notice shall consist of a written letter of transmittal and a copy of the project plan as specified in Section 5 of this contingency plan.

5. Project Plan.

(a) The project plan shall be of sufficient detail to allow DOE and CDPHE to reasonably review the plan, guided by the goals of allowing the RTC's use of the Compound while protecting the safety and health of workers and site occupants as well as protecting against the spread of contamination to uncontaminated areas. DOE and CDPHE shall approve the plan within 30 days of mailing of the notice, and delivery of an adequate project plan, and either approve within said period or state with specificity what needs to change with the plan to obtain approval.

(b) An adequate project plan that proposes digging or disturbing the soils within an area as shown on the most recent DOE plume map described in Section 8 and at a depth that will likely encounter groundwater shall include water quality data and a human health and ecological risk evaluation.

6. Modification of this Contingency Plan.

This contingency plan may only be modified by written consent of all parties.

7. Training.

In accordance with the UMTMP and for as long as possible, CDPHE shall train those persons designated by the RTC regarding the protocols of this Agreement and regarding the dangers from radiation for workers exposed to ionizing radiation from uranium mill tailings.

8. Groundwater Maps.

DOE represents that the attached map accurately reflects the current data regarding groundwater contamination of the Compound, and the surface areas within which the provisions of this agreement shall apply. The parties acknowledge that the areas of concern are decreasing faster than originally predicted. DOE agrees to continue to monitor the groundwater monitoring wells, and to annually map such new data in the same or better form as the attached maps and to deliver copies thereof to the RTC and CDPHE on or before each July 1, beginning July 1, 2002. The RTC may rely on the information contained in such maps or diagrams as indications of ground water quality.

9. Building 20 Monitoring

Until Building 20 is demolished as specified in the Enforceable Agreement, Attachment A to the Deferral Request, the DOE agrees, as a best-management practice, to provide monitoring to any individuals(s) performing maintenance or normal repair work in confining locations. The amount and type of monitoring of the location and the individuals(s) will be directly related to the requirement of protection of one's health and safety based on available risk analysis data. CDPHE and RTC shall be kept informed throughout such process.

10. Successors and Assigns.

The provisions of this agreement shall bind the successors, transferees and assigns of the RTC. Once the RTC has conveyed all of its right, title and its interest in the Compound, the RTC shall no longer be liable under this agreement and the subsequent title holder shall, upon transfer of title, be fully liable and obligated as though it was the RTC, providing actual notice of said transfer is delivered to the DOE-GJO in a timely manner.

DOE

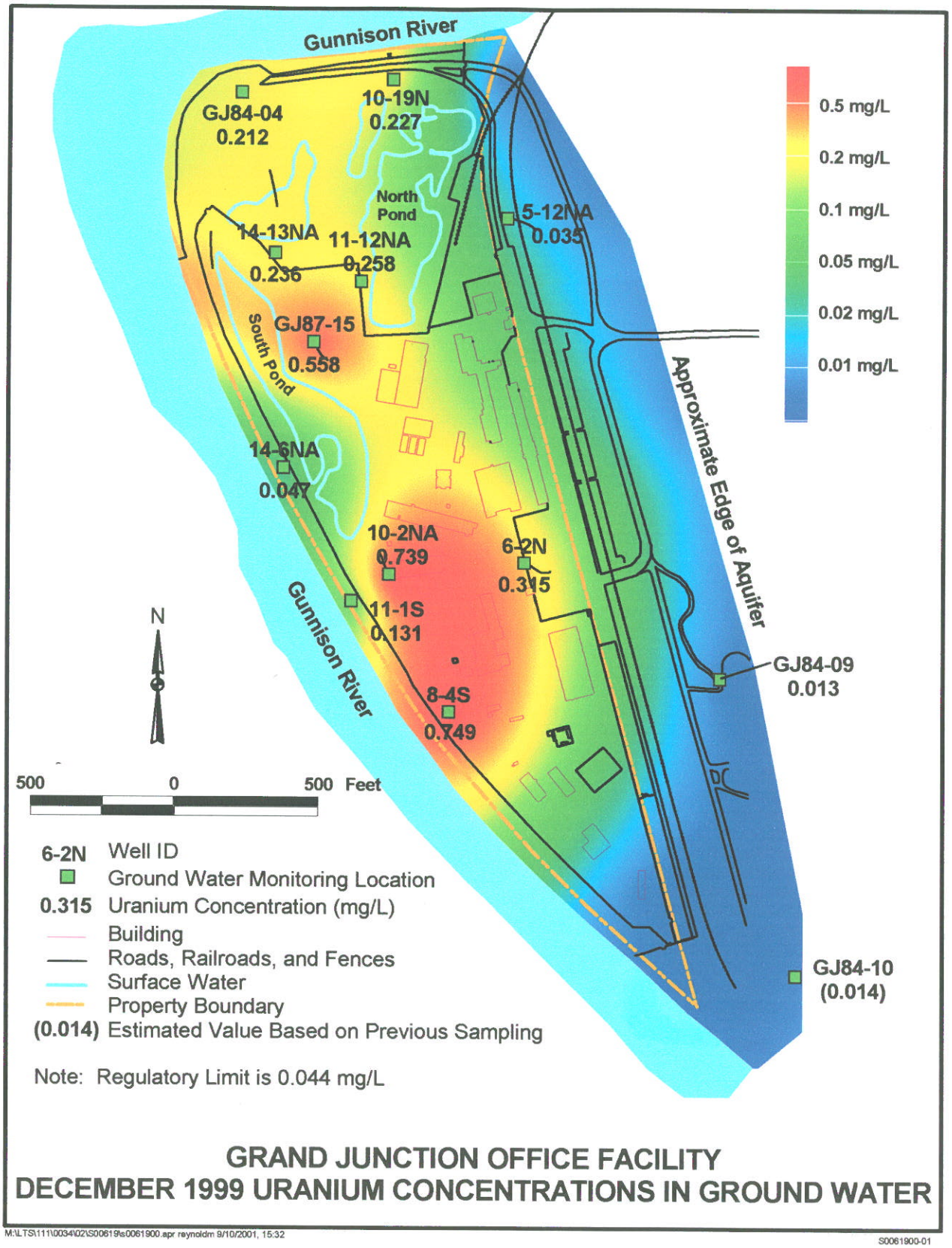
By: R Weiner 7/11/2001
for Donna Bergman-Tabbert
GJO Manager
2597 B ¾ Road
Grand Junction CO 81503
970/248-6001

CDPHE

By: _____
Jeff Edson, Remediation
Restoration Unit Leader
Federal Facilities Program
CDPHE
4300 Cherry Creek Dr. South
Denver CO 80246
303/692-3300

RTC

By: _____ Vice-Chair
FOR Pat Tucker
Riverview Technology Corp., Inc.



GRAND JUNCTION OFFICE FACILITY
DECEMBER 1999 URANIUM CONCENTRATIONS IN GROUND WATER

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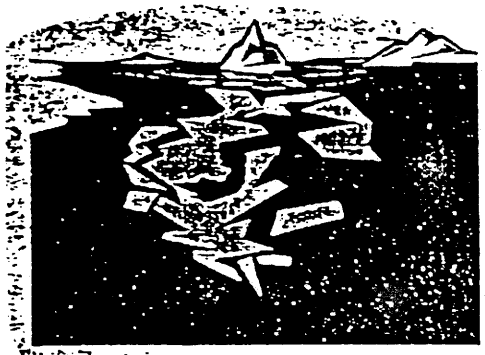
Exhibit E

URANIUM MILL TAILINGS MANAGEMENT PLAN

FOR MANAGING URANIUM MILL TAILINGS ENCOUNTERED DURING CONSTRUCTION ACTIVITIES IN WESTERN COLORADO

SEPTEMBER 1998



"The tip of the iceberg"

URANIUM MILL TAILINGS MANAGEMENT PLAN

FOR MANAGING URANIUM MILL TAILINGS ENCOUNTERED DURING CONSTRUCTION ACTIVITIES IN WESTERN COLORADO

SEPTEMBER 1998

For Information or Assistance Contact:

Colorado Department of Public Health and Environment
222 South 6th Street, Rm. 232
Grand Junction, Colorado 81501

Jim Hams
(970) 248-7170

Anna Etchart
(970) 248-7164

Colorado Department of Public Health and Environment

TABLE OF CONTENTS

INTRODUCTION

PURPOSE

The purpose of this plan is to assign responsibilities and procedures for managing uranium mill tailings encountered or disturbed during construction activities in western Colorado communities. All work procedures are designed to minimize worker contact with radioactive contaminated materials and comply with the ALARA principle, keeping radiation exposures As Low As Reasonably Achievable. All work will be performed in accordance with *Colorado Rules and Regulations Pertaining to Radiation Control,* (Regulations) 6CCR-100-7, January 1997.

HISTORY

Beginning around the turn of the century, ore deposits bearing radioactive elements were being sought in the United States. Western Colorado and adjoining states in the Four Corners Areas, being rich in these deposits, were heavily prospected. Radium, and later vanadium were the primary radioactive materials sought and produced by the early mines and mills. In the 1940s, the demand for uranium rapidly grew as research progressed for development of atomic weapons and energy. After World War II, the continued research and arms race accelerated the demand for uranium, which produced a uranium boom lasting through the 1950s and into the 1960s.

Many hundreds of mines were explored and often developed for ores. Many mill pilot plants, and later operating mill sites, were built to crush ore and separate uranium compounds from the waste materials. The mills produced a uranium product called "yellowcake" and waste tailings sands. These tailings contained most of the original natural radioactivity of the ore, since only one of the radioactive constituents was recovered in the milling process.

The waste tailings were piled at the mills, but erosion from wind and water invariably spread the tailings to adjacent areas. In addition, tailings from many of the mills were transported off site and used for construction or as fill materials. As the mills fell into disuse and obsolescence, and as the uranium boom faded, more of the tailings were eroded away or removed for construction. It was not demonstrated until later that exposure to radioactive materials occurring in uranium mill tailings was a problem.

The Public Health Service (PHS) and the Colorado Department of Health (CDH) began studies that demonstrated the magnitude of the problem caused by the presence of uranium mill tailings in residential areas. The problem results primarily from radon gas, produced by natural radioactive breakdown of radium contained in the tailings. In places

where uranium mill tailings were used for construction, radon can seep into buildings (homes, offices, schools) and can build up to high concentrations. Previous research studies have demonstrated that people breathing air containing elevated levels of radon are at greater risk of lung cancer.

The association between elevated radon and lung cancer was documented during uranium mine studies conducted by the PHS in the 1950s. In the 1960s, the CDH and PHS expanded the studies to include areas around mill sites. The studies concluded that excessive radiation exposure could result from indiscriminate use of tailings and that persons were at increased risk due to the presence of the uranium mill tailings. By this time, tons of tailings had been removed from the Climax Uranium Mill in Grand Junction, Colorado, and used in residential areas for construction. The CDH soon issued an order to cease this practice.

Because of the availability and many possible uses of uranium mill tailings as a sand, the dispersal and misuse was widespread. Some examples of uranium mill tailings use were: soil attenuation, concrete mix, bedding for concrete and utilities, stucco, and brick production.

Experience has shown that as construction and demolition activities occur, new uranium mill tailings deposits will be discovered and disturbance of known deposits will occur. New construction within such deposits increases potential exposure to gamma radiation and radon.

GJRAP

Concerns about health risks and property values grew as the extent of the uranium mill tailings misuse became public. Nationwide publicity announced and often exaggerated the problem. Congressional hearings were conducted, and in 1972, Public Law 92-314 created the Grand Junction Remedial Action Program (GJRAP) to reduce radiation exposures inside structures affected by uranium tailings. The U.S. Surgeon General published cleanup guidelines for the voluntary project. During the 15-year program, 594 structures in Mesa County underwent remedial action.

UMTRAP

From the late 1960s it was known that the misuse of uranium tailings was not unique to the Grand Junction, Mesa County area. In 1978, the U.S. Congress passed Public Law 95-604, the Uranium Mill Tailings Radiation Control Act. This law enabled the creation of the Uranium Mill Tailings Remedial Action Project (UMTRAP) and required the Environmental Protection Agency (EPA) to develop cleanup standards. The U.S. Department of Energy (DOE) was assigned to manage the project in cooperation with

States and Tribes. The project extended the assessment and cleanup of uranium tailings nation-wide for both structure interiors (as in GJRAP) plus exterior deposits. By 1998, when final authorization ends for the UMTRAP surface cleanup, approximately 5,000 properties and nine uranium mill sites will have been cleaned up in Colorado. In Colorado alone, approximately 15 million cubic yards of uranium tailings were removed to controlled disposal sites.

Nine uranium mill sites in western Colorado qualified for remedial action under Title I of the UMTRA Project. These sites were located in Grand Junction, Gunnison, Rifle (2), Durango, Maybell, Naturita, and Slick Rock (2). These were inactive or abandoned sites, which had sold uranium to the U.S. Atomic Energy Commission exclusively. The DOE performed site assessments and environmental impact studies and developed options for permanent, environmentally safe, storage of radioactive contaminated materials.

Disposal cells were constructed utilizing strict groundwater, geologic, and erosion criteria. The cells were designed to last for 200-1,000 years. Therefore, erosion resistant, natural materials were used in the construction of the cells. The typical cell was excavated into low permeability bedrock and filled with compacted uranium mill tailings. A very low permeability layer was added on top of the uranium mill tailings as a cover to contain the radon gas and limit the entry of water. The cells were capped by an erosion resistant rock layer.

All of the Colorado cells, except for the Maybell site in Moffit County, were located away from the mill sites to situate the tailings out of flood waters and shallow groundwater. The Maybell tailings pile was reengineered and reworked to provide compaction and erosion protection and capped in place. All of the disposal cells will be monitored and maintained under the Long Term Surveillance and Maintenance Program managed by the DOE.

The disposal cell for Mesa County, known as the Cheney disposal cell, will not be totally capped and closed until well into the next century due to the 1996 reauthorization requirements of UMTRCA, Public Law 104-259. Recognizing the need for long term management and storage of the remaining uncontrolled tailings, Congress reauthorized the requirements of UMTRCA and required the Cheney site to remain available for UMTRA Project contaminated materials until 2023, or until the cell is filled to capacity. The DOE will continue to maintain, operate, and fund the Cheney cell. The Cheney cell will be the only UMTRAP site remaining open and available to receive uranium tailings after the year 1998.

MANAGEMENT OF UNCONTROLLED URANIUM TAILINGS

UNCONTROLLED URANIUM MILL TAILINGS

Despite widespread publicity, two cleanup programs (GJRAP and UMTRAP) extending over 25 years, and thousands of property investigations, uranium mill tailings remain in many western Colorado communities. It is suspected that up to one million cubic yards of tailings remain outside of the controlled disposal cells.

Over 40,000 properties have been surveyed in Colorado for uranium mill tailings. Because of the voluntary nature of the project and difficulty in finding hidden, shielded deposits, such as beneath soils or under foundations, not all properties were checked, and not all deposits were found. Occasionally, an owner would refuse to participate after tailings were found.

TAILINGS EXCLUDED FROM EXTERIOR REMOVALS

The EPA standards resulted in a cut-off limit for the amount of uranium mill tailings that must be present to qualify for UMTRAP. The EPA standards for exteriors allowed deposits to be averaged over 100 square meters. Thus, a small area of elevated contamination was often averaged with uncontaminated areas, resulting in small quantities of uranium mill tailings being left in place.

TAILINGS EXCLUDED FROM INTERIOR REMOVALS

The EPA standards for interiors addressed the interior average gamma exposure rate and the annual average radon levels. Contaminated structural materials, such as foundations or tailings under slabs, were often left in place if the interior radiation levels were below the standards.

EPA SUPPLEMENTAL STANDARDS

The EPA cleanup standards allowed for a variance from meeting standards in certain situations. This variance was called "supplemental standards." The most common use of supplemental standards was in situations where the cost of tailings was excesssive, and the health risks of leaving the tailings small. The use of supplemental standards resulted in tailings being left in place. Approval of supplemental standards by the Colorado

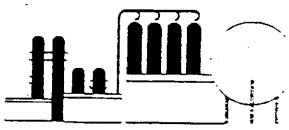
Department of Public Health and Environment (CDPHE), formerly the Colorado Department of Health, and the Nuclear Regulatory Commission (NRC) required that the deposit was in such an area that current and future land use would result in minimal radiation exposures to the public. Often some partial removal would take place to remove surface contamination but leave uranium mill tailings at depth.

Examples of areas containing uranium mill tailings left in place through the application of supplemental standards include railroad tracks, city streets and curb/gutter, steep slopes, river islands, and utility lines. Grand Junction, Colorado, has the greatest number of supplemental standards areas , but such areas also exist in the Maybell, Durango, Rifle, Gunnison, Naturita and Slick Rock communities.

TAILINGS MANAGEMENT PLAN

The need for a management plan to control the uranium tailings still remaining in communities after the cleanup programs has been known for many years. It was obvious that the statutes and standards did not consider the amounts that could be left and their impact due to new construction after the GJRAP and UMTRAP expired. One of the requirements of the management plan is that it would have to be relatively simple and useable by all of the communities impacted by the tailings. The main elements of the management plan would be: the availability of a long-term disposal site, assignment of responsibilities, development of procedures to limit radiation exposure, development of excavation and transportation procedures, and the availability of an interim storage facility, which would be useable by the local governments, utilities, and citizens on short notice. These provisions are addressed in the following sections.

INTERIM STORAGE FACILITY



THE FACILITY

The interim storage facility (ISF) is a temporary holding area for uranium mill tailings. The facility is owned by the City of Grand Junction and operated in coordination with the CDPHE. The facility is located at 2553 River Road, Grand Junction, Colorado. A map showing the location is in Appendix E.

The ISF will provide a temporary, secure, and safe storage for uranium mill tailings excavated during construction activities in Colorado communities. The tailings will ultimately be transported to the Cheney disposal cell south of Grand Junction, Colorado.

The ISF consists of an abandoned sewage treatment plant concrete structure 75 feet in diameter and surrounded by concrete walls approximately 10 feet high. The bottom is a concrete slab, sloping to the center for drainage. A slot has been cut through the walls wide enough to admit a dump truck. A concrete ramp provides access to the entrance. The entrance is protected by a lockable gate. All holes in the bottom were sealed to make a water tight storage area.

The facility also includes a shed for storage of decontamination materials, including brooms, shovels, a high pressure water sprayer (HOTSY), and radiation detection instruments to verify decontamination. The City has provided a water line extension for decontamination spray or dust control.

UNLOADING

No unauthorized personnel will be allowed to enter the ISF, unless they remain inside the truck. Authorized entrance requires training and exposure documentation.

The CDPHE will be responsible for access control, decontamination, and exposure logging. In the absence of CDPHE, such as an emergency water main break, the City of Grand Junction may assume these duties for its own use of the ISF.

The hauling truck will back into the facility to place the load as close as possible to the back wall. Debris brought to the ISF must be sized as small as possible to allow for compaction at the Cheney site. No debris may exceed 3 feet cubed or 10 feet in length.

DECONTAMINATION

The truck bed will be inspected for visible uranium mill tailings contamination, soil and

debris remaining after dumping. Material that did not dislodge will be pushed out with shovels or brooms. The truck will then proceed to the entrance for inspection of tires and undercarriage. The truck engine will be shut off, placed in gear, and the wheels chocked. All visible contamination will be removed from the tires and undercarriage.

A record of the use of the ISF will be kept. The log book will be kept in the ISF shed when not in use. Log book records will be transferred to the CDPHE office quarterly for permanent storage. The log book (see Appendix F) will have the following entries:

Date
Origin of contamination (street address)
Estimated cubic yardage
Name of driver
Truck identification
Frisking results
Inspection for hazardous wastes

The truck tires and tailgate will undergo frisking according to the frisking procedure in Appendix B. If the tailgate or tires will not pass the frisking limits, the HOTSY will be used to further decontaminate the vehicle. If material cannot be dislodged from the bed, it can also be sprayed out at this point. After washing, the tires and tailgate will again be frisked. All water or dislodged material will drain into the ISF. No uranium mill tailings contamination shall be allowed to escape the containment of the ISF.

Individuals that have had physical contact with the uranium mill tailings will have all visible contamination removed by sweeping. The individual will undergo a full body frisk with the frisking meter. If the frisking limits are exceeded, further sweeping or washing will occur, followed by another frisking. If clothing will not decontaminate visibly or pass the frisking survey, the clothing will be changed out with coveralls from the storage shed. Contaminated clothing can be later washed in a tub at the ISF until decontamination is verified by frisking.

When the load is dumped, decontamination complete, and log books filled out, the truck and users may leave the ISF access area. All materials used in decontamination will be returned to the shed. The gate and shed will be locked. The truck may then exit the site.

INSPECTION

The ISF will be inspected monthly by CDPHE during the first six months of use. Then quarterly inspections will be held to survey the exterior of the ISF to assure contamination is contained within the concrete walls. Visual inspections will be made during every visit to look for obvious defects.

RESPONSIBILITIES

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

The CDPHE is responsible for the overall oversight of the Uranium Mill Tailings Management Plan. The CDPHE has over 20 years experience in the management of uranium mill tailings, including expertise in all developments of scientific knowledge, clean up programs, record keeping, public information, and health physics.

PUBLIC RECORDS AND DOCUMENTATION

The CDPHE will maintain and update uranium mill tailings records available to the general public and local government agencies. The CDPHE will produce or update property records as the conditions change due to excavation of the uranium mill tailings. The CDPHE will provide personnel to interpret records and give health risk information to the public regarding the presence of uranium mill tailings on properties.

The CDPHE will keep records of uranium mill tailings excavated, received at the ISF, and transported to Cheney. The CDPHE will maintain records for decontamination of personnel and equipment.

The CDPHE will provide all required reports to the DOE.

The CDPHE will develop, update, and disseminate the Uranium Mill Tailings Management Plan.

INSPECTIONS

The CDPHE will provide inspections of new building areas and demolition sites and make recommendations to the City and County Planning Department for all building permits in Mesa County.

The CDPHE will coordinate inspections for new construction inspections in other communities as time permits and if requested.

The CDPHE will maintain and update the building permit uranium mill tailings inspection procedures.

EXCAVATION CONTROL

The CDPHE will provide excavation control for uranium mill tailings removals by private citizens.

TECHNICAL EXPERTISE

The CDPHE will provide technical expertise to communities, local governments, or private citizens in identifying, handling, and management of uranium mill tailings.

INTERIM STORAGE FACILITY

The CDPHE will manage all operations and record keeping at the ISF. The CDPHE will conduct monthly radiological surveys, for the first six months of use, of the ISF to insure its proper operation and containment of material. Quarterly inspections will be conducted thereafter. Spot checks will occur during heavy use, high winds, or rain.

RADIOLOGICAL SURVEY INSTRUMENTS

The CDPHE will provide radiological survey instruments to local governments and individual citizens as requested. The CDPHE will maintain and calibrate the instruments annually and provide training in the use of the instruments.

TRAINING

The CDPHE will provide yearly training to workers excavating tailings. The CDPHE will provide on-site briefings as needed. The CDPHE will be available to explain technical problems, options, radiation health risks, or any part of the Uranium Mill Tailings Management Plan.

REVISIONS TO THE TAILINGS MANAGEMENT PLAN

The Uranium Mill Tailings Management Plan is intended to be used as technical information and field guidance and procedures. CDPHE will retain the responsibility for the maintenance, distribution, and revision of this manual.

HAZARDOUS WASTE

The CDPHE will conduct inspections for hazardous wastes that could be commingled with uranium mill tailings. The CDPHE will provide expertise on segregation, testing, and storage of commingled waste. The CDPHE will provide to DOE documentation that materials transported to the Cheney disposal site do not contain commingled waste.

LOCAL GOVERNMENTS AND PUBLIC UTILITIES (LGPU)

The local governments and public utilities have the responsibility to carry out the procedures designed to locate uranium mill tailings in construction areas and excavate and transport contaminated material with as little impact and radiation exposures as possible. The local governments and utilities will recognize the need for cooperation and coordination with CDPHE and DOE with the understanding that some inconvenience and costs are involved.

TRAINING

The LGPU will require and assign radiation training as required for workers potentially exposed to ionizing radiation from uranium mill tailings. Training requirements are described later in this document.

COSTS

The costs of excavation, handling, and transporting of uranium mill tailings by the LGPU will be borne by the LGPU. The LGPU may apply for grants, in accordance with HB 97-1248, through DOLA, from the local energy impact fund, to cover these costs.

ENFORCEMENT OF PROCEDURES

The LGPU will be responsible for monitoring and enforcement of procedures involving workers under their direct control. The supervisors will observe operations and enforce the written procedures of the Uranium Mill Tailings Management Plan.

POINT OF CONTACT

The LGPU will identify personnel responsible for contact and coordination with CDPHE.

INSTRUMENTS

The LGPU will maintain the radiological detection instruments provided by CDPHE in good working order. The instruments are expensive and require proper care and usage. The instruments will be kept on hand for ease of checking potentially contaminated areas. The instruments will be returned to CDPHE quarterly for an operations check.

Surveys must be performed in accordance with Appendix D and CDPHE training.

HAZARDOUS WASTE

The LGPU will notify CDPHE of unusual coloration, smells, or materials such as batteries or transformers discovered in excavations. Coordination with CDPHE shall be made prior to the removal of such materials or soils as they may contain hazardous wastes or substances (asbestos) requiring special storage, handling, or treatment if excavated. If such materials are inadvertently excavated and taken to the ISF, they must be segregated from the other materials as the wastes may have to be returned for treatment or management.

RECORDS CHECK

The LGPU is responsible for checking available records or maps prior to a planned excavation activity. Up-front knowledge of tailings locations will enable subcontractors to more accurately bid projects. The DOE will provide maps of streets and utilities that have supplemental standards in place. The CDPHE will have copies of the supplemental standards data base after 1998. CDPHE also will retain the records of several thousand properties assessed or cleaned up in UMTRAP communities.

PERMITS

The local governments control work in public right-of-ways by permits. Work permitted in an area of known tailings involvement will have the statement "tailings procedures in effect" written on the work order and a requirement for coordination with CDPHE.

EXCAVATION CONTROL

The local governments and public utilities supervising excavations into deposits of uranium mill tailings will control over excavation. Overexcavation is the removal of uncontaminated materials or mixing of uncontaminated materials with uranium tailings for transport to the Interim Storage Facility. Overexcavation is controlled by radiological surveys and segregation of contaminated and uncontaminated material. The excavation tool should fit the job to prevent overexcavation.

INTERIM STORAGE FACILITY

The City of Grand Junction will be responsible for providing and maintaining all infrastructure necessary for operation of the ISF, including an operating water line and "HOTSY" pressure sprayer at the ISF. The City will also provide a gate and lock for security of the ISF and equipment shed.

TRANSPORT TO CHENEY

The City of Grand Junction will be responsible for transport of the uranium mill tailings to the DOE Cheney disposal site either from the ISF or direct transport from an excavation. All training and procedures required by the DOE for entering the Cheney site will be adhered to.

UNITED STATES DEPARTMENT OF ENERGY (DOE)

LONG TERM SURVEILLANCE AND MAINTENANCE

The DOE is responsible for the long term operation, surveillance and maintenance of the Cheney disposal cell. All costs associated with the operation and maintenance of Cheney is at DOE expense.

OPERATION OF CHENEY

The DOE is responsible for providing resources and coordination necessary to receive uranium mill tailings at Cheney periodically from the stockpile at the City Interim Storage Facility. Currently, it is projected that materials will be trucked from the ISF to Cheney at least once a year for a two-to-three-week period.

The DOE is responsible for providing resources and coordination necessary to receive uranium mill tailings at Cheney during large planned construction projects, such as sewer line replacement in a supplemental standards area. This is anticipated to occur no more than once a year. Planned disturbance of large quantities of uranium mill tailings would be trucked directly to Cheney without using the ISF.

CONTACT PERSON

The DOE shall provide a point of contact for coordinating and planning with the cities and CDPHE. The point of contact will receive any reports that DOE requires.

TRAINING

The DOE will provide radiation training for the CDPHE and potentially exposed workers involved with uranium mill tailings projects, as long as it is being offered at the Grand Junction Office for other site activities.

MAPS

The DOE will provide to the CDPHE and local governments maps delineating supplemental standards areas.

PRIVATE PROPERTY OWNERS

In Mesa County, private owners or their contractors will notify the CDPHE of a request for a building or demolition permit through the Mesa County Planning Department. The owners or contractors will follow the recommendations issued to the Planning Department by CDPHE through the Building Permit Survey (BPS) Program.

The owners will bear the costs of excavating, stockpiling, and transporting of uranium mill tailings contaminated materials to the ISF.

The owners or their contractors will follow the ALARA principle throughout all work with uranium mill tailings.

HEALTH AND SAFETY

IONIZING RADIATION EXPOSURE CONCERNS

Uranium mill tailings consist of sand wastes generated from the milling of uranium ores to extract "yellowcake," a uranium oxide compound. These tailings contain most of the original radioactivity found in the unprocessed ores. Radioactive radium, thorium, lead, and other elements in tailings are unstable and decay by ejecting alpha and beta particles from the nucleus and by releasing excess energy as gamma radiation.

The radiation from the decaying tailings atoms is ionizing radiation, which has the capability to strip electrons from the molecules of living cells, causing disruptions and possibly damage to the cell DNA. Ionizing radiation has the capability to cause cancer in living tissues.

The main radiation exposures from uranium mill tailings are from direct exposure to gamma radiation, inhalation of radon, and inhalation of airborne radioactive particles. Gamma radiation, similar to an X-ray, is a penetrating external exposure source. It can penetrate skin and cause damage to the entire body, therefore, all organs are at risk.

Current radiation protection standards and radiation exposure health effects estimations are based upon the premise that any radiation dose, no matter how small, can result in detrimental health effects, such as cancer and genetic damage. Further, it is assumed that these effects are produced in direct proportion to the dose received. These two assumptions lead to a dose-response relationship, often referred to as the linear, no-threshold model, for estimating health effects from radiation doses. There is, however, substantial scientific evidence that this model is an oversimplification of the dose-response relationship and results in an overestimation of health risks in the low dose range.

The expected gamma radiation exposure from the uranium tailings, as calculated from health risk analyses, will be less than the Regulatory 100 millirem yearly exposure limit for the general public, classified as non-radiation workers. The exposure to gamma radiation from uranium tailings is substantially reduced when the tailings are mixed with soils or shielded by fill dirt. Exposure is also markedly reduced as distance from the source is increased.

Radon is formed when the radium in the tailings decays. The radon decays by ejecting alpha and beta particles and forms a series of short-lived radioactive products. The process eventually ends with the formation of a stable form of lead which is not

radioactive. The particles ejected by radon and its products cannot travel very far in air and cannot penetrate skin, thus are not an external hazard. However, if inhaled, the particles released by radon and its products can cause damage to the lungs that could eventually result in lung cancer. Radon is found naturally in air in small amounts. Radon becomes an excess health hazard when it accumulates in buildings or mines to higher levels and is breathed for extended times.

A third potential source of radiation exposure is radioactive particles associated with the tailings which can become airborne. Once airborne, these particles can be inhaled, with subsequent exposure to the respiratory tract. Airborne particulate contamination is routinely controlled to negligible concentrations by the application of water mists or sprays to equipment or tailings releasing dust.

The radiation exposures to utility workers excavating uranium mill tailings are greatest in the trenches. Radon is heavier than air and before dispersal occurs, will be at higher levels at the bottom of the trench. The radon levels would probably be greatest when the trench is opened up and lessen somewhat later due to mixing with air. Gamma radiation exposure is also more likely in a contaminated trench. There may be pure tailings in the bedding of the utility line and tailings mixed with the soils in the walls of the trench. The result is radiation exposure to workers from the sides as well as the bottom of the trench.

RADIATION RISK ANALYSIS

The DOE prepared a health risk analysis in 1989 for utility workers entering trenches that contain uranium mill tailings. The analysis calculated potential worst case exposures to workers in trenches and compared them to the regulatory limit which existed at that time of 100 millirem per year above background for non-radiation workers required by the Code of Federal Regulations (CFR), Title 10, Part 20. In the United States, background radiation varies from 100 to 1,000 millirems per year.

The analysis estimated 39 hours average exposure from contaminated water lines. It was assumed that an individual worker would be in the trench only 25 % of the time due to scheduling rotations. Thus, 10 hours per year of exposure was allotted to water line repairs.

Approximately eight hours of exposure was allotted to sewer line work with an individual spending only 10 % of the time in a contaminated trench. Extra exposures were added to account for potential manhole repair. Therefore, two hours of exposure were calculated for sewer lines.

Twelve total hours of yearly potential exposure at the highest, worst case, radiation levels detected in trenches gives an estimated exposure of 9.6 millirem to a utility worker, or 1/10 of the 100 millirem limit.

No exposure limit or regulation exists for radon in outside air, except for uranium and thorium mill tailings disposal cells. The radon limit for miners is four working level months per year. The Environmental Protection Agency (EPA) has set a voluntary suggested indoor action level at 0.02 Working Levels (WL) . This equates to **about one working level month per year**. The highest radon levels encountered in trenches during the analysis was 0.058 WL The potential annual working level months per year after exposure to 0.058 working levels for 12 hours is **0.004 working level months per year.** far short of the EPA indoor action level.

The conclusion of the DOE health risk analysis is that " there is no clear present or future health risk to utility workers in Mesa County due to potential gamma or radon exposure, even based upon the worst-case scenarios."

AS LOW AS REASONABLY ACHIEVABLE (ALARA)

For gamma radiation exposure from uranium mill tailings for non-radiation workers, the limit of 100 millirem per year in the Regulations, Part 4.14.1, Radiation Dose Limits for Individual Members of the Public, is required. EPA is currently considering lowering this limit to 15 millirem per year, while the Nuclear regulatory Commission believes that 30 millirem per year should be used (as applied in the decommissioning of facilities). The allowable exposure for radiation workers is 100 millirem per year. The Tailings Management Plan supports adherence to the ALARA philosophy, as stated in Part 4.5 of the Regulations, to limit exposure to levels less than the regulatory requirement.

ALARA is an approach to radiation protection to manage and control exposures (both individual and collective to the work force and the general public) and release of radioactive materials to the environment at levels as low as is practical, taking into account social, technical, economic, practical, and public policy considerations. As used in this context, ALARA is not a dose limit but a process, which has the objective of attaining doses as far below the applicable controlling limits as is reasonably achievable.

The ALARA principle will be the primary philosophy and tool for controlling radiation exposures during all activities of managing uranium mill tailings. The ALARA principle will be implemented by use of the following requirements:

EXPOSURE CONTROL

The upper limit of gamma exposure allowed will be 15 millirem per year. A log will be kept by CDPHE of individuals exposed in the ISF controlled area. Using the average tailings activity, approximately 300 hours of trench work is allowable per yer under this exposure limit. The LGPU and CDPHE will consider additional rotations out of trench work when any individual worker has accumulated 100 hours of work in contaminated trenches in any given year.

A 10 foot control area will be maintained around exposed tailings. Only trained personnel will be allowed into the controlled area. The ISF will also be considered a controlled area requiring training and exposure documentation for entry.

Individuals entering the controlled area will limit as much as possible the time spent there. Individuals will position their work as far from the contaminated areas as possible. Only necessary equipment or tools will be allowed into the controlled area. Uranium mill tailings contaminated areas will be fenced off from the public during non work times. No unauthorized entry into the controlled areas is allowed by the public.

Dust and radioactive particulates will be controlled by spraying water. No visible dust is allowed to leave the controlled area. No eating, chewing, smoking, or drinking is allowed in the controlled area.

Haul trucks will be tarped to prevent materials blowing out. A plastic sheet diaper will be positioned in the tailgate to contain wet tailings. If a spill occurs, the spill procedure will be in effect.

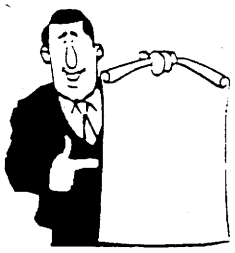
All equipment and personnel in contact with tailings will undergo decontamination. Haul trucks and contaminated personnel will be frisked with a radiation meter to verify decontamination.

Tailings deposits excavated from the top two feet of an excavation should not be replaced into the hole. These tailings should be removed and transported to a controlled stockpile or to the ISF. Clean fill should replace tailings deposits on the surface.

TRAINING

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE)

The CDPHE employees coordinating the Uranium Mill Tailings Management Plan, and with a potential for radiological exposures in the work place, will receive training and be proficient in the following areas:



40 Hour Hazardous Waste Training and
Yearly Refresher Training

Radiological Worker Training and
Yearly Refresher Training

The CDPHE will develop and update the curriculum for training of local government and public utilities workers or private owners. The curriculum will include:

Basic Health Physics
Radiation Exposure Limits and Monitoring
Excavation and Transport Procedures
Survey Meter Operation
The ALARA Principle
Decontamination Procedures

LOCAL GOVERNMENTS AND PUBLIC UTILITIES (LGPU)

The LGPU workers with a potential to be radiologically exposed by uranium mill tailings shall receive training in the following areas:

Radiological Worker Training and
Yearly Refresher Training

The LGPU workers shall attend on-site briefings to review uranium mill tailings management procedures before beginning work in an area known to contain uranium mill tailings. The briefings will be conducted by the CDPHE or LGPU supervisors.

EXCAVATION PROCEDURES

RADIATION SURVEY

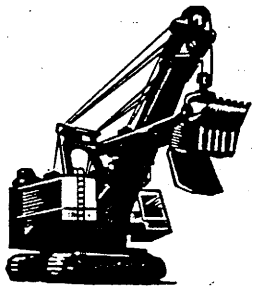
A gamma radiation survey instrument will be accessible to excavation crews. The instrument will be provided by CDPHE and will be capable of detection of uranium mill tailings in the range of 0-1000 microroentgen per hour (μR/h).

A field operations check on the instrument will be performed before surveying for uranium tailings contamination.

IDENTIFYING CONTAMINATED MATERIAL

Contamination from uranium mill tailings will be identified as areas 30 percent above the normal gamma radiation background. Fifteen μR/h shall be considered the average meter reading for western Colorado soils. The background gamma plus 30 percent is 20 μR/h , which shall be considered contaminated with uranium tailings.

Uranium mill tailings contamination may be in surface deposits or buried in utility trenches. The DOE supplemental standards maps may be used to identify potential areas of contamination. Prior to surface penetration, a check shall be made with the meter. After a trench is excavated, the meter shall be lowered for spot checks along the length. Suspicious gray or purple sands should be checked. Tailings are often mixed with soils and appear to be normal dirt.



EXCAVATION

CONTROLLED AREAS

If tailings are identified, a controlled area shall be considered extending 10 feet from the edge of the deposit. At that time, tailings excavation procedures and ALARA principles immediately become effective. The supervisor is responsible for enforcement of the procedures.

ALARA PRINCIPLE

The ALARA Principle will be the overall philosophy and procedure for controlling radiation exposures while managing uranium mill tailings. These principles are stated in

a previous section of the Uranium Mill Tailings Management Plan.

HAZARDOUS WASTES

Uranium mill tailings contaminated areas shall be inspected for visible discoloration, odd smells, or for materials such as batteries or transformers. Mixing of hazardous wastes with the tailings may cause the deposit to be considered a commingled waste. Commingled wastes, if above regulatory limits, and untreated, cannot be hauled to the Cheney disposal site. Such wastes are regulated with specific handling and storage requirements. The CDPHE shall be notified immediately upon suspicion of such wastes. These deposits shall not be excavated unless absolutely necessary and then shall be segregated and stored separately from the other tailings or soils.

AVOIDING OVER EXCAVATION

Disturbance or excavation of tailings shall be avoided if possible. If uranium mill tailings need to be excavated, the minimum should be disturbed or removed. Over excavation causes extra handling costs and fills the limited permanent storage room available in the Cheney disposal cell. Equipment appropriate for the job size is required.

Uncontaminated over burdens shall be removed and segregated from uranium mill tailings below. Only uranium mill tailings contaminated materials shall be transported to the ISF or Cheney. Care shall be taken to avoid mixing contaminated soils with uncontaminated soils. The radiation meter shall be used to identify soils in question.

The uranium mill tailings contaminated areas considered for removal shall be visibly marked for the machine operator. This is to segregate the contaminated material and avoid mixing. Spray paint, colored flags, or fencing are appropriate to delineate the uranium mill tailings contaminated areas.

No trash, wood, or tires shall be shipped to the ISF or Cheney. Such materials shall be decontaminated and disposed of in the local landfill. Uranium mill tailings contaminated concrete or asphalt shall be sized properly to allow compaction at Cheney. No debris shall be larger than 3 feet cubed in size. No pipe shall be longer than 10 feet in length.

Tailings excavated shall be returned to the hole if possible. An exception is for surface deposits. Tailings removed from the top two feet of the surface should not be replaced. Clean fill will replace the contaminated soils removed.

STOCKPILING

Stockpiling of uranium mill tailings contaminated material should be avoided if possible, but is allowed. Stockpiling may cause concerns to property owners. The owner's permission shall be sought before stockpiling on private property. Stockpiled material shall be fenced from public access.

ASPHALT

When rotomilling asphalt over uranium mill tailings contaminated soils, care shall be taken to not penetrate into the tailings. If tailings are mixed with the asphalt, the asphalt should be inspected with a meter. If the mixture shows a meter reading of 30 percent above the radiological soils gamma background, it is considered contaminated.

Asphalt removed in chunks over uranium mill tailings contaminated soils should be inspected on the underside with the survey meter.

WATER MAIN BREAKS

If uranium mill tailings are washing away due to a water line break, controlling dams shall be established to halt the spread of contamination. A meter survey downstream should be conducted to insure that any contaminated materials spread by the break have been cleaned up.

DECONTAMINATION

All equipment used for excavation or hauling of tailings shall be inspected and decontaminated. Visible tailings shall be swept or sprayed away. Uranium mill tailings contamination removed shall be returned to the excavation or placed in the ISF.

Workers in contact with tailings shall be decontaminated. Visible tailings shall be swept or washed away. These workers shall be frisked with the beta-gamma meter for verification of decontamination (See Appendix B). If clothing will not pass the frisk, the workers shall change into clean coveralls. Contaminated clothing shall be taken to the ISF for further decontamination and frisking.

CEASE WORK

Work shall cease when the supervisor or CDPHE determines that the procedures are not or cannot be followed. An example is high winds making it impossible to control dust, a truck that leaks tailings, or non cooperation of workers.

TRANSPORT OF TAILINGS

REGULATIONS

Transportation of radioactive material over public roads in Colorado is regulated under CFR, Title 49, Parts 171-178 and 390-397, and Part 17 of the Regulations, which mirror 49 CFR. Generally, uranium decay series material is low specific activity (LSA), as the LSA-I group is defined by the International Atomic Energy Agency (AEA) and U.S. Department of Transportation (DOT).

The DOT defines a concentration of radioactivity above which material like uranium mill tailings is considered radioactive for purposes of the transportation regulations. At present, the DOT defines any material with radioactivity greater than 70 Becquerel per gram (B/g) as radioactive for transport purposes. For uranium mill tailings, 70 B/gm total activity is calculated to be less than approximately 174 pCi/g radium-226. If a truck load of tailings material averages overall below less than 174 pCi/g radium-226, it is not considered radioactive material for purposes of transportation under 49 CFR and Part 17 of the Regulations. From our experience in the UMTRA Program, tailings excavated from streets or other properties are usually mixed and not pure mill tailings and do not exceed 174 pCi/g radium-226. The LGPU should assume that excavated materials are not classified as radioactive under DOT regulations.

HAULING

The ALARA principle will be followed during transportation of tailings. This will be insured by tarping and not overfilling loads to prevent dust or spillage. If very wet contamination is to be loaded, a plastic sheet diaper will be placed in the rear of the truck bed in a manner to exclude leaking out the tail gate. Wet loads should not be piled any higher than the sidewall of the truck.

Tailings being hauled to the ISF will be transported by the most direct route possible with no off-road stops.

SPILL PROCEDURE

If a spill from the haul truck occurs, the supervisor and CDPHE will be notified as soon as possible. The spill will be isolated and protected from further dispersal. Traffic safety has priority over isolating or recovering the spill.

As soon as possible, the spill will be isolated with traffic cones. A safety flagger may be necessary to control traffic and protect the cleanup workers.

The spill will be swept up and put into a container appropriate to its size and transported to the ISF for disposal. The area is considered clean if no visible contamination is seen. If the spill was onto a dirt road, the radiation survey meter will be used to verify the spill cleanup. If no readings above 20 μR/h are noted on the gamma survey meter, the area is considered clean.

APPENDIX A

DEFINITIONS

Access Control: A designated entrance/exit point to a controlled area.

ALARA: Acronym for "As Low as Reasonably Achievable," a basic concept of radiation protection that specifies that radioactive discharges from nuclear plants and radiation exposures to personnel be kept as far below regulatory limits as feasible.

Alpha Particle: A positively charged particle ejected spontaneously from the nucleus of some radioactive elements. It is identical to a helium nucleus and has a mass number of 4 and a electrostatic charge of +2. It has low penetrating power and short range. The most energetic alpha particle will generally fail to penetrate the skin. Alphas are hazardous when an alpha-emitting isotope is introduced into the body.

Beta Particle: A charged particle emitted from a nucleus during radioactive decay. A negatively charged beta is identical to an electron. A positively charged beta particle is called a positron. Large amounts of beta radiation may cause skin burns. Beta emitters are harmful if they enter the body. Beta particles are easily stopped by a thin sheet of metal or plastic.

Cheney Disposal Cell: The UMTRA Project disposal cell, operated by DOE, located about 15 miles south of Grand Junction on U.S. Highway 50, which will remain open until the year 2023 or until filled. This will be the only permanent UMTRA Project disposal cell available to uranium mill tailings disturbed by construction activities after 1998.

Contamination: Unwanted radioactive materials (uranium mill tailings) that are present on/in a particular object or area.

Controlled Area: Any area to which access is managed in order to protect individuals from exposure to radiation and/or radioactive material. Individuals who enter a controlled area are not expected to receive a total effective dose equivalent of more than 100 millirem in one year.

Decontamination (Decon): The reduction or removal of contaminating radioactive material from a structure, area, object, or person.

Frisk: A radiological survey of personnel or equipment utilizing a portable radiation detector.

Gamma Ray: High-energy, short wavelength electromagnetic radiation (a packet of energy) emitted from the nucleus of an unstable atom. It is very penetrating and is best stopped by dense materials such as lead. They are similar to x-rays but are usually more energetic.

Interim Storage Facility (ISF): The facility located in Grand Junction available for temporary storage of uranium mill tailings disturbed during construction activities. The ISF is located on City of Grand Junction property on Highway 141 and managed by the Colorado Department of Public Health and Environment.

Radiation: Particles (alpha, beta, or neutrons), or photons (gamma) emitted from the nucleus of an unstable (radioactive) atom as a result of radioactive decay.

Radioactive: Exhibiting radioactivity or pertaining to radioactivity.

Radioactivity: The spontaneous emission of radiation, generally alpha or beta particles often accompanied by gamma rays, from the nucleus of an unstable atom.

UMTRAP: Acronym for Uranium Mill Tailings Remedial Action Project, the nation-wide uranium tailings cleanup project managed by the U.S. Department of Energy.

UMTRCA: Acronym for Uranium Mill Tailings Radiation Control Act, as per Public Law 95-604 and amendments. The federal law authorizes the Uranium Mill Tailings Remedial Action Project and the continued operation of the Cheney disposal cell.

Uranium Mill Tailings: Naturally occurring radioactive residues from the processing of uranium ore into yellowcake in a mill. Although the milling process recovers about 93 percent of the uranium, the residues, or tailings, contain several radioactive elements, including uranium, thorium, radium, and polonium.

Yellowcake: A product of uranium milling process, yellowcake is a solid uranium oxide compound (U_3O_8) that takes its name from its color and texture. Yellowcake is the feed material for fuel enrichment and fuel pellet fabrication.

APPENDIX B

FRISKING AND DECONTAMINATION PROCEDURE

FRISKING

PURPOSE

This procedure establishes the requirements for decontamination frisking prior to exiting the access area of the ISF. Frisking for contamination will limit inadvertent exposure of the workers and the general public to radioactive material and prevent the spread of contamination beyond controlled areas.

APPLICABILITY

This procedure applies to all people exiting the controlled area of the ISF.

PRECAUTIONS

All personnel who enter a controlled area (the ISF or an excavation into tailings) are expected to keep their exposures to radiation and radioactive materials as low as reasonably achievable (ALARA).

Personnel or equipment may not leave the ISF with any detectable radioactive contamination.

FRISKING SURVEY METER

A portable monitor, such as the Ludlum Model 44-9, pancake GM beta-gamma detector, or equivalent, shall be used for frisking. The frisking instrument shall have a valid calibration and be functionally checked before using this procedure.

EQUIPMENT FOR FRISKING AND DECONTAMINATION

Frisking Meter
Broom
Sturdy Brush
Wash Tub
Mild Soap
Laundry Soap
Hotsy Sprayer
Frisking Log

FRISKING PROCEDURE

Personnel shall frisk using the techniques defined. Personal items such as flashlights, notebooks, or hats shall be subject to the same frisking requirements as the person carrying them.

Verify the instrument is in service, set to the proper scale, and the audio output can be heard during frisking.

Hold the probe less than half an inch from the surface being surveyed.

Move the probe slowly over the surface, approximately two inches per second.

If the count rate increases during frisking, pause for 5 to 10 seconds over the area to provide adequate time for instrument response.

If the count rate increases beyond background, the area shall be decontaminated and frisked again.

PERSONNEL FRISKING ORDER

Frisk the hands before picking up the probe.

Frisk in the following order:

- Head-(pause at the mouth and nose for five seconds)
- Neck
- Arms- (pause at the elbows)
- Chest and abdomen
- Back, hips, and seat of pants
- Legs- (pause at the knees and cuffs)
- Shoes
- Shoe bottoms
- Personal items (hat, gloves)

DECONTAMINATION

PERSONNEL DECONTAMINATION

Skin contamination may be removed by washing with lukewarm water and mild soap.

If contamination cannot be removed, contact the CDPHE.

Personnel may flush ears/eyes with cool, clear water to decon those areas. If flushing is not

successful, qualified medical personnel shall direct additional decon efforts.

Clothing and shoes may be brushed clean. If clothing will not decontaminate with brushing, it shall be removed and exchanged with the supplied coveralls in the access shed.

Contaminated clothing will be placed in the wash tub for laundering on site. Contaminated water will be poured into the ISF for evaporation. Wash and rinse water is available at the ISF facility. After washing and rinsing, the clothing will be dried before refrisking. When the clothing no longer demonstrates contamination, it can be removed from the access area.

Contaminated shoes may be brushed and washed without removing.

EQUIPMENT AND TRUCK DECONTAMINATION

Prior to frisking a truck, the vehicle engine will be shut off, placed in 1st gear, and have the wheels chocked. No person shall physically go beneath a piece of equipment to perform inspections or decontamination.

All visible contamination shall be swept or washed into the ISF. Tailgate areas and tires will be frisked with the probe at two inches per second and with the probe half inch from the surface.

If the instrument rate count registers above background, further brushing and washing will be done.

EXITING THE ISF

Return the frisk probe to its holder. The probe shall be placed face up to allow the next person to monitor his/her hands before holding the probe.

After decon of equipment and personnel and successful frisking, personnel may leave the controlled area, sign out on the access/frisking log, secure the gate and shed, and exit the area.

APPENDIX C

BUILDING PERMIT SURVEYS

Building Permit Survey History

In 1971, the Colorado Department of Public Health and Environment (CDPHE), formerly the Colorado Department of Health (CDH), began a cooperative program with the Mesa County Planning Department to conduct radiation surveys at new construction sites. The radiation surveys were integrated into the building permit process and was therefore called the Building Permit Survey Program.

As discussed in the History section of the Uranium Mill Tailings Management Plan, radioactive tailings were used in Mesa County and other uranium mill towns for building materials and fill dirt. The release of uranium tailings had ceased in 1966, while rapid building in Mesa County was occurring due to the oil shale boom. Many structures were modified or built over tailings Therefore, potential health risks were being created due to the increased gamma radiation and radon exposure.

The surveys are performed by CDPHE before a building permit is issued. The surveys include the footprint of the proposed building, plus 10 feet extra around the perimeter. After the survey, an inspection form is filled out indicating that no radioactive materials were found or with recommendations for removal, or other options, if tailings are found.

The form is given to the owner (or contractor) with a copy entered into the CDPHE database. If tailings are found, a map is drawn indicating the areas of concern.

When tailings are removed from a building site, another form and map is filled out declaring the removal of the contamination, which allows the issuance of the building permit. Copies of the information are entered into the CDPHE database for reference and documentation.

The survey is considered valid for six months after which another survey may be necessary if the structure hasn't been constructed. This is because within six months the site could have been recontaminated.

The surveys include all structures that could possibly be converted into living spaces. During the oil shale boom, people were known to live in sheds or any space available. Thus, sheds and garages as well as business sites and houses are inspected. Areas such as patios, carports and porches are also inspected as these are often enclosed later as part of the living space.

Currently, the CDPHE no longer surveys 100 percent of demolition sites or building sites in Mesa County. Procedures now concentrate the surveys on properties or areas with a known history of tailings. Much of the building currently in Mesa County is new subdivisions in former fields. These are spot checked with surveys until it is determined that tailings are unlikely to be encountered.

Procedures for the Requirement of a Building Permit Survey

Upon receiving a request for a building permit survey, a record review will be performed by CDPHE to ascertain the need for a field survey. The review will include the gamma printout data books, and, if necessary, the DOE microfiche records for the location.

The following criteria will result in the execution of a field survey:

1. The property has a historical tailings or ore involvement. Historical tailings properties will always be surveyed, even if remedial action took place. Remedial actions did not always find or completely remove tailings.

2. Tailings are on an adjacent property. Adjacent properties will be surveyed if it is in an area where extensive tailings were used.

3. For information: Information surveys are in areas where previous surveys were not performed. The inspector will perform surveys on several properties in the new area (subdivisions) and determine from a visual look which properties in the area may need surveys when they are requested due to radiation readings, fill areas, or geography.

If it is determined that a survey is not to be performed, the secretary will fill out a Building Permit Records (BPR) card, print out a BPR form in duplicate, sign the form, and give one copy to the requestor. The other copy is filed and entered into the database. The BPR form indicates that "no field survey is required based upon a record review of the vicinity of the building site. No tailings deposits were identified from available records that would affect the construction site."

In communities outside of Mesa County, the CDPHE will give assistance to monitor construction and demolition sites with a history of tailings involvement. CDPHE data and files may be used to determine if a site needs a radiation survey. CDPHE may perform site visits to conduct the surveys if the data base information is inconclusive.

APPENDIX D

GAMMA RADIATION SURVEY PROCEDURES

GAMMA RADIATION SURVEYS

OBJECTIVES OF GAMMA SURVEYS

The objective of a gamma survey is to determine if radioactive materials, especially uranium mill tailings, are present on individual properties, to acquire sufficient data to evaluate the gamma levels and health risks, and to document the location and conditions of radioactive materials. Uranium mill tailings are the primary radioactive materials being surveyed, due to their radium content and potential to cause elevated radon gas in structures. The gamma surveys may locate natural soils, rocks, or ores that have elevated gamma radiation and have the potential to increase indoor radon levels. The gamma survey may also locate and identify other radioactive sources such as ore or petrified wood, which may not have a potential to increase radon, but increases health risks through gamma exposure.

BACKGROUND GAMMA RADIATION

Background radiation is the natural radioactivity of an area. Background radiation varies due to the influence of natural mineral deposits, building materials, and elevation. In western Colorado, the background levels can range from 8 to 30 microroentgens per hour (μR/h). The most common outside background levels in Mesa County are 10 to 15 μR/h. Fifteen μR/h shall be considered background in Mesa County, Colorado. A meter reading 30 percent higher than the local background level could be significant and require investigation.

NON-TAILINGS GAMMA SOURCES

There are many different radiation-producing materials besides uranium mill tailings that may be encountered during a gamma survey. Luminous-dial compasses, clocks, aircraft instruments, propane tanks, petrified wood, dinosaur bones, and ore samples may emit gamma radiation levels above 20 μR/h. In Durango, outcroppings of granite rocks may demonstrate elevated gamma radiation. These objects may act as point sources, as the gamma field drops off rapidly when the survey meter is moved away. Coal ash and some shales give a meter reading above 20 uR/h, but seldom appear as point sources. Firebrick inside fireplaces may indicate 35 uR/h. Some bricks and tiles may indicate 20 μR/h due to the materials used in their manufacture.

INTERPRETATION OF READINGS

SHINE

Radiation detected that is from a source some distance away is called shine. Shine will make it more difficult to determine the levels of radiation from nearby objects. The meter readings are higher than if the shine radiation did not exist. An example of a shine source is a large pile of radioactive tailings, or large radioactive ore pile. Shine fields are also created by strong local radioactive sources such as density gauges or metal weld x-ray devices.

To check for shine, the meter reading can be compared at ground level, waist level, and overhead. If a shine field is present, the meter will detect about the same radiation levels at waist and surface levels.

Lead shielding can be used to help interpret meter readings in a shine field. A lead shield may be wrapped around the sides of the meter to block the shine.

A comparison of shielded meter readings and unshielded readings, called a differential, may help distinguish localized elevated gamma levels from shine. A sheet of lead is placed between the instrument and the suspected area, and a meter reading is taken. The shield is removed, and a second meter reading is taken. The difference between the shielded and unshielded reading is the differential. The differential should not be greater than six, which is about 30 percent, for background radiation areas around 15 μR/h. If the differential is greater than six, the area under the shielding may be contaminated with a radioactive source. This technique loses accuracy when higher gamma fields are encountered.

CDPHE will provide assistance if a shine field is suspected and the meter readings are difficult to interpret.

GEOMETRY

A meter reading in a hole or trench may indicate higher radiation levels than a flat surface. The meter receives gamma radiation from many directions in a hole, while a surface reading mainly detects the area directly beneath it.

SHIELDING

Dense materials shield gamma radiation from detection. Examples are rock road base, asphalt, concrete, and hard packed soils. The amount of shielding depends upon the thickness. Radiation surveys over asphalt or concrete need to be performed more slowly so that the technician can observe small fluctuations on the meter. While normal soils, at 15 μR/h usually indicate no contamination, this reading on asphalt may indicate a shielded radioactive deposit.

STANDARD GAMMA SURVEY PROCEDURE

SURVEY INSTRUMENTS

The survey instruments used by the CDPHE and loaned to LGPU and private citizens are adequate to locate uranium mill tailings situated close to the ground surface. If a deposit is heavily shielded, the meter may not indicate any change from background radiation. The meters are calibrated yearly and should be given an operations check before use. Many of the instruments have been calibrated and electronically modified to give a fast response time. Instruments with an audio device are the easiest to use as one can notice the faster change in the sound (clicking speed), which is an indication of a radioactive source. The instruments are designed to give a meter reading in microroentgen per hour. A correction factor is necessary to convert to a true microroentgen per hour. The correction factor is: Meter Reading x 0.56 + 6 = True microroentgen per hour. For simplicity sake, the meter reading and not true microroentgen will be used to indicate the presence of tailings contamination. Therefore, if the surveyors meter shows 20 μR/h on the scale, this is considered 30 percent above background of 15 μR/h and that tailings contamination is present.

PERMISSION TO SURVEY

Permission to access private property must be obtained before a survey is undertaken. The owner or owner representative may give a verbal or written permission to enter a property. The surveyor should identify himself to residents on the property and state the purpose of the survey.

HEALTH AND SAFETY

Performing a gamma radiation survey is not entirely risk free. The major hazards are potential physical injuries due to falling or being trapped in a confined space. The surveyor should comply with OSHA confined space entry requirements. Prior to entering any crawlspace, the surveyor should notify a co-worker of the location and intent to survey. Some crawlspaces are too tight to enter safely. If such areas must be checked for a radiation source, an extension pole attached to a meter with audio capability would allow limited probing into the tight areas.

No hole or trench deeper than 4 feet or with sides steeper than a 45 degree angle should be entered unless the sidewall stability conforms to OSHA standards. These areas, as well as vertical cliffs, can be surveyed by lowering the meter on a rope and listening to the audio or observing the meter face with binoculars (soap on a rope technique).

Head injuries can be avoided by not watching the meter while walking. Tree limbs, air conditioners, pipes, and other extending objects are commonly at head level around houses. Using meters with the audio capability and watching the path of the survey will avoid injury.

Dogs are potentially a risk when surveying. Always ask the residents if there are dogs present and to place them indoors or tie them up, if they are likely to bite. Always be watching for dogs when entering a property.

Exposure to gamma radiation is a potential health risk to the surveyor. During the many years that CDPHE conducted gamma surveys, it was rare that any exposures above background were recorded by the monitoring badges worn by surveyors. It would be possible to receive limited gamma exposure if uranium ore samples were carried around in a vehicle. If ore is transported, it should be placed as far away from occupants as possible and removed from the vehicle and properly disposed of as soon as possible.

If the surveyor detects a radiation source above 1, 000 microroentgen per hour (one milliroentgen) , and the source is not obviously ore or uranium mill tailings, the surveyor should back out and notify the CDPHE. Such sources could be radium sources or instruments such as moisture density gauges used by the Colorado Department of Transportation.

The surveyor is expected to adhere to the ALARA principle and keep all radiation exposures As Low As Reasonably Achievable.

GENERIC SURVEY PROCEDURES

All gamma surveys will use generic procedures that address situations commonly encountered. These are centered around the readiness of the survey meter, interpretation of findings, and investigating shielded radiation sources.

The survey meter must be checked for operation before use. The meter battery level and meter scales can be compared with historical levels by using known radioactive sources. If the instrument is in the field, and no radioactive check source is available, the meter can be placed on the ground and comparisons made between the different scales.

Before surveying, the area background must be determined. Background is the normal radiation level in an uncontaminated area. Radiological contamination may be assumed if the meter registers 30 percent above background. However, holes or trenches may register 30 percent above background and not be contaminated due to the geometry. Interpretation of meter readings in trenches and holes is difficult and usually requires experience and a judgement call. It is not unusual for a water meter pit to read 20 μR/h on the survey meter and not be contaminated. If a water meter pit reads 30 μR/h on the survey meter, one should be suspicious of possible uranium tailings.

The survey should be conducted at a slow walk. Specific spots may be checked by hesitating, placing the meter on the ground, and noting the reading. The meter should be carried no more than one to four inches from the surface when walking with no wide arcing swings. The meter is placed in fast response mode on the lower scale with the audio switch on.

When surveying areas with tall vegetation (weeds), the meter will have to be alternately lifted and lowered rather than maintaining a constant one to four inches from the surface.

Shielding will hide radioactive sources from detection. The survey may detect borderline elevated readings. These areas should be explored by removing some of the shielding. Dirt or gravel may be kicked aside or shoveled away. Asphalt and concrete may be checked from the edge where an inspection hole can be dug. Wood piles and debris can sometimes be moved enough to find a spot to lower the meter to the ground. Water meter pits and manholes can be inspected by removing the cover and lowering the meter. Large manhole covers are heavy and may need a shovel or crowbar to pry it off.

SPECIFIC SURVEY PROCEDURES

BUILDING PERMIT SURVEY (NEW STRUCTURE)

In Mesa County, a cooperative program exists between the CDPHE and the City/County Planning Department to screen proposed building sites for uranium mill tailings. The generic survey procedures apply. Ten foot survey grids extending an extra 10 feet beyond the site footprint are adequate to screen for radioactive materials.

The CDPHE requests that the builder stake out the site footprint. If the site is not staked or marked, the surveyor can often over survey the area to insure inclusion of the building area.

If no unusual gamma radiation above background is detected, the BPS form is completed, signed, and given to the builder for inclusion with paperwork submitted to the Planning Department for a building permit.

If elevated gamma radiation is detected, the surveyor will explore the area to determine the source. The elevated gamma area may be checked by digging out shovel scoops. This method often determines that the source of elevated gamma is a small ore rock or that the source is not extensive.

If an extensive gamma source is discovered that cannot be removed by a few shovel scoops, the BPS form is filled out to reflect the finding, a map is drawn to locate and document the area, and the builder notified.

The CDPHE presents options to owners to mitigate radiation sources discovered on building sites. The main concern is mitigation of potential radon sources inside the structure. The secondary concern is mitigation of gamma radiation exposure through the floors of the structure. The option usually recommended is the complete removal of the source of radiation.

BUILDING PERMIT SURVEY (DEMOLITION)

Structures being demolished in Mesa County are controlled through the permit system of the County Planning Department. Structures planned for destruction should be surveyed to locate any potential uranium mill tailings contamination in the building materials.

The lower levels and all floors made from concrete should be scanned using 5 foot grids. The inspection should also include closets, bathrooms, and kitchens.

Areas to survey include the following:

Lower Level Floors	Cinder Blocks
Foundations	Stucco
Brick and Mortar	Sidewalks
Driveways	Rock Walls/ Fences
Sandboxes	Rock Gardens
Planters	Patios
Garages	Carports

If radioactive sources are discovered, the survey form is filled out and the owner or contractor notified. Options are discussed to separate radioactive contaminated materials from other debris. The radioactive materials can be located by the survey meter and marked with paint. Contaminated materials should be segregated and stockpiled or taken to the ISF.

GAMMA RADIATION SURVEY FOR INFORMATION

The CDPHE has a vast database containing the radiological conditions on thousands of properties in western Colorado. However, many properties were never surveyed and no information is available. Thus, the CDPHE will occasionally conduct a gamma survey on a property for information purposes.

Surveys on an entire property presents a problem because of the size of the area. The grids for survey must be appropriate to the area. If the area is no larger than two acres, 10 foot grids are appropriate. For very large areas, grids as large as 50 feet may be appropriate.

In the case of very large properties, the areas one inspects may be more important than walking the entire site on grids. The larger the grid size, the greater the chance of overlooking a radiation source.

On very large properties, disturbed areas, likely dump areas, roads and gates should be inspected. Any structures should be checked using the techniques for demolition sites. Lawns, gardens, and septic systems should be checked. All concrete, metal debris, hoses, and fiberglass panels should be inspected.

If a line of elevated gamma readings is detected, it may indicate a buried utility line packed in uranium mill tailings.

STREETS, ALLEYS, AND UTILITY LINE CONSTRUCTION

Prior to construction involving streets, alleys, or utility lines, the contractors should consult DOE maps delineating supplemental standard areas. The areas can be surveyed by city workers or their contractors using instruments on loan from the CDPHE. Identified uranium mill tailings contaminated areas can be marked with paint. As trenches and excavations are opened, the meter can be lowered down to better determine if the subsurface material is contaminated. If the contamination is to be removed, it must be segregated from other materials and returned to the excavation or transported to the ISF.

Surveys over concrete or asphalt should be conducted at a slow walk to give the meter time to respond. The meter must be in the fast response mode. Concrete and asphalt shields radioactive materials below, and meter changes may be only slightly higher than background.

PRIVATE REMOVALS

Private removals are remedial actions performed by a property owner or his contractors to clear an area, or entire property, of radioactive uranium mill tailings. The material may have been identified by the Building Permit Survey, by an information survey, or street/utility line construction.

For private citizens, the CDPHE will identify and delineate uranium mill tailings for removal. The identified contamination will be excavated and segregated from clean material by stockpiling on site or removal from the property to the ISF. Qualified trucking contractors are allowed to transport uranium mill tailings contamination directly to the Cheney cell. This may be the preferred option if the work is considered cost effective and timely. After 1998, this option would only be available for transport of large quantities because special arrangements with the DOE to open the Cheney cell would be required. Smaller amounts would be transported to the ISF.

For private citizens, the removals of uranium mill tailings will be monitored by the CDPHE to guide and document the excavation. The CDPHE will perform excavation control, health and safety guidance, and operate the ISF. The CDPHE will document and map the results of the removal.

DOCUMENTATION MAPS

In Mesa County, maps are required for the documentation of radioactive contamination discovered or removed during a Building Permit Survey, information survey, or private removal. CDPHE will map and document any uranium tailings discovered, disturbed, or removed from the communities in western Colorado that were not already mapped as supplemental standards areas.

The map will include the following information in the upper right corner:

Location Number (assigned by CDPHE)
Street Address, Date, and Name of Surveyor

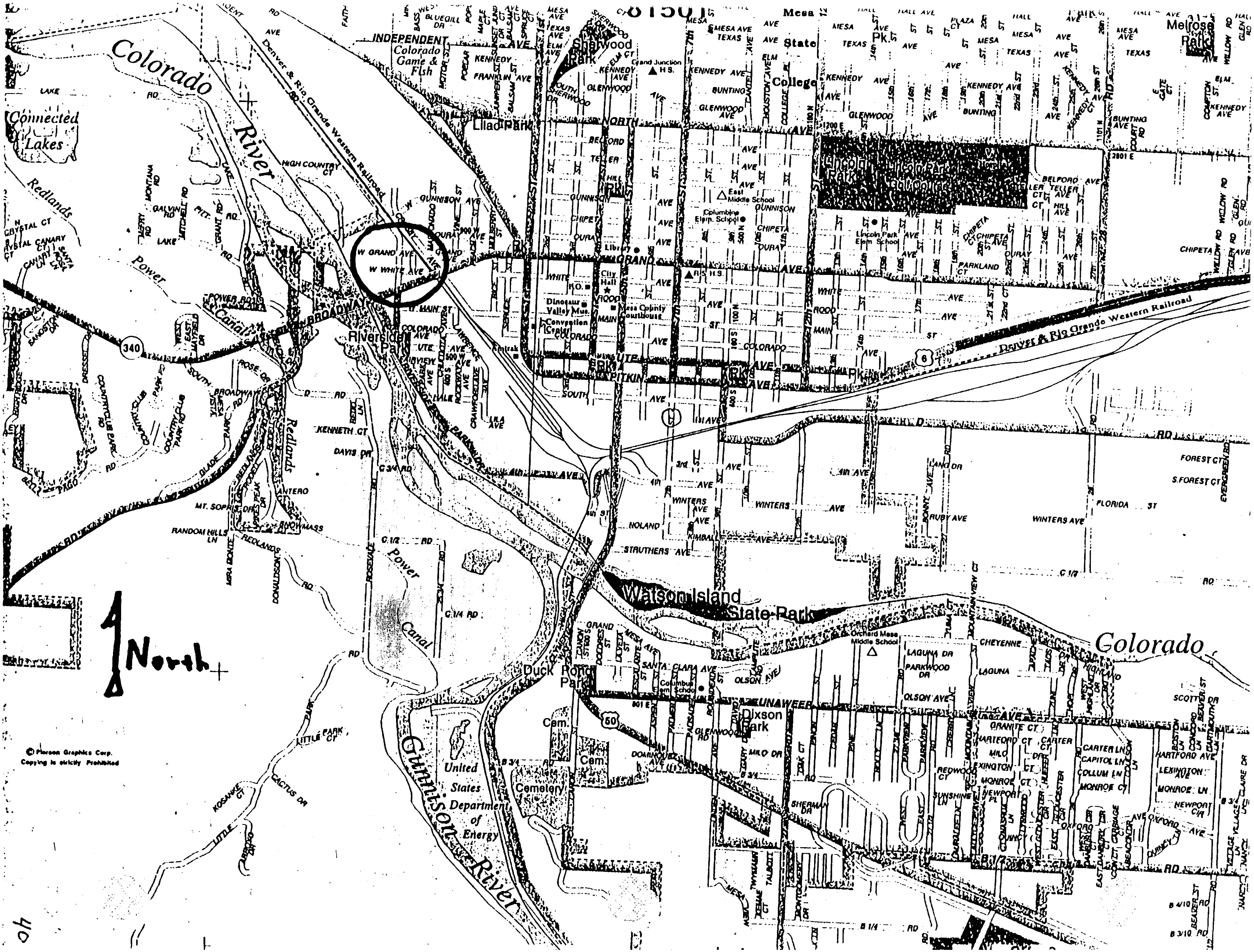
The map will include a legend with an arrow indicating north. Permanent and semipermanent reference points, such as structures, streets, driveways, streets, power poles, or irrigation ditches, will be drawn on the map.

Areas of radiation contamination should be indicated by shading with cross marking. The meter readings for the contamination should be written in the contaminated area. If the area is too small to write in, the meter reading should be indicated by an arrow drawn to the contaminated area.

If a private removal of radioactive contamination occurs, the documentation will include a map showing the conditions of the area after excavation. If the area is large, a range of readings, plus the average gamma reading, will be shown. Areas still demonstrating elevated gamma readings will be identified by the gamma reading and an arrow pointing to the spot.

APPENDIX E

MAPS


Colorado River
Denver & Rio Grande Western Railroad
Connected Lakes
Redlands Power Canal
Colorado Game & Fish
Sherwood Park
Grand Junction H.S.
Mesa State College
Lilac Park
Lincoln Park
East Middle School
Columbine Elem. School
Lincoln Park Elem School
Library
City Hall
R-5 H.S.
Dinosaur Valley Mus.
Mesa County Courthouse
Convention Center
Amtrak
W GRAND AVE
W WHITE AVE
BROADWAY
Riverside Park
Redlands
Power Canal
Watson Island State Park
Orchard Mesa Middle School
Duck Pond Park
Columbus Elem School
Dixson Park
Cem.
Cemetery
United States Department of Energy
Gunnison River
Colorado
North
© Pearson Graphics Corp.
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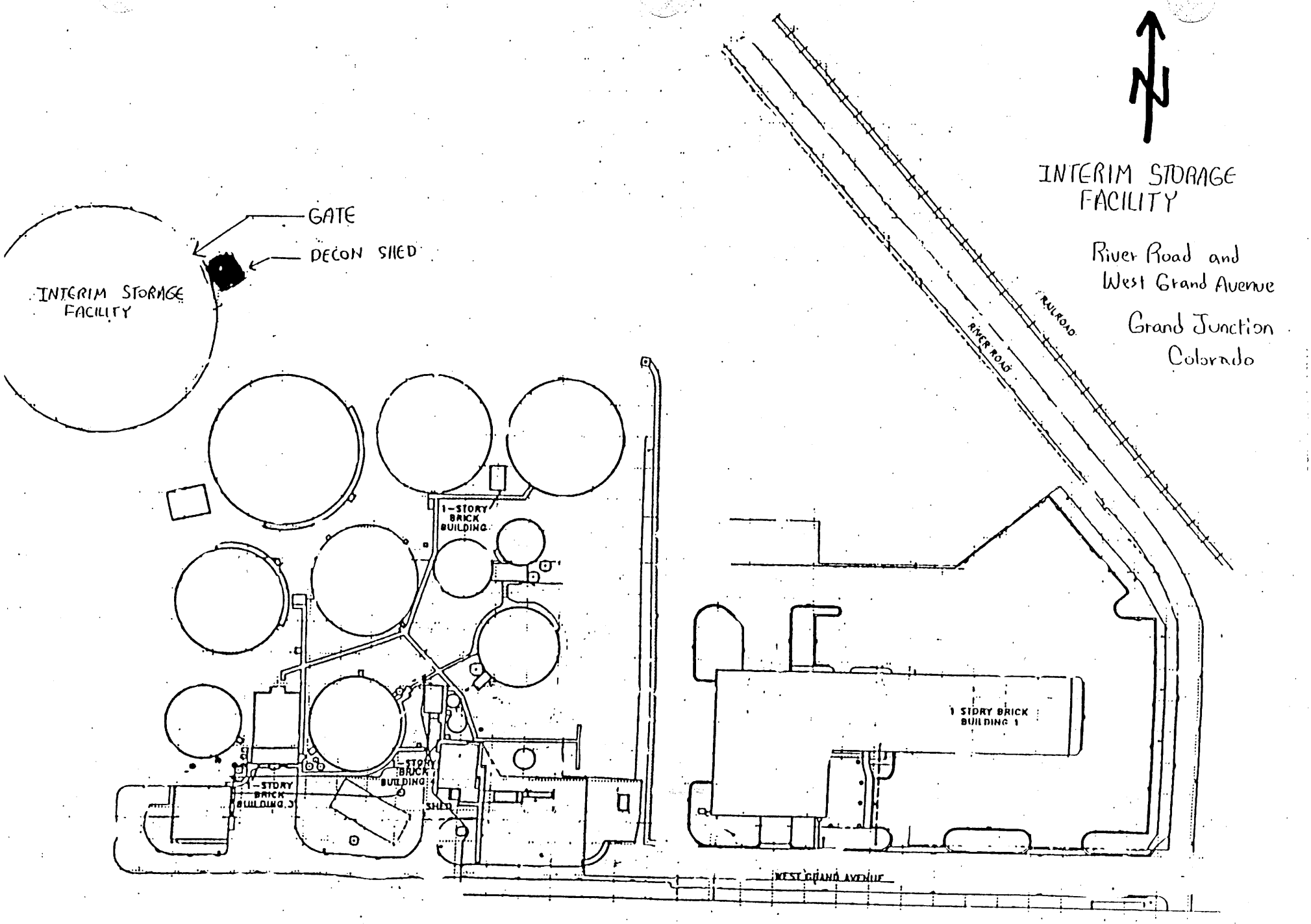
INTERIM STORAGE FACILITY
River Road and West Grand Avenue
Grand Junction Colorado
N
GATE
DECON SHED
INTERIM STORAGE FACILITY
RAILROAD
RIVER ROAD
1-STORY BRICK BUILDING
1-STORY BRICK BUILDING
1-STORY BRICK BUILDING
SHED
1 STORY BRICK BUILDING 1
WEST GRAND AVENUE

APPENDIX F

FORMS

APPENDIX F

REVISION NO. _____

PERSONNEL GAMMA RADIATION EXPOSURE LOG

PAGE _____

URANIUM MILL TAILINGS MANAGEMENT PLAN

INTERIM STORAGE FACILITY

PERSONNEL GAMMA RADIATION EXPOSURE LOG

DATE	NAME	SOCIAL SECURITY NUMBER	EMPLOYER	LOCATION (ISF)	HIGHEST GAMMA	TIME		TIME		TIME		FRISK	
						IN	OUT	IN	OUT	IN	OUT	YES	NO

APPENDIX F

REVISION No. 0

ISF USE and FRISKING LOG

PAGE ____

URANIUM MILL TAILINGS MANAGEMENT PLAN

INTERIM STORAGE FACILITY USE
and
EQUIPMENT FRISKING LOG

DATE	OPERATOR	VEHICLE I.D.	CUBIC YARDS OF TAILINGS	ORIGIN OF CONTAMINATION	HAZARDOUS WASTE INSPECTION		EQUIPMENT FRISK	
					YES	NO	YES	NO

APPENDIX G

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Long-Term Surveillance and Maintenance Program

Long-Term Surveillance Plan for the U.S. Department of Energy Grand Junction, Colorado, Office Facility

June 2001

Prepared by
U.S. Department of Energy
Grand Junction Office
Grand Junction, Colorado

Work Performed Under DOE Contract Number DE-AC13-96GJ87335
Task Order Number MAC 00-06
Document Number S0023100

Contents

Figures

Tables

Plate

Appendices

1.0 Introduction

1.1 Purpose and Scope

This Long-Term Surveillance Plan (LTSP) is a technical plan that explains how the U.S. Department of Energy (DOE) will fulfill its stewardship obligation at the DOE Grand Junction Office (GJO) facility near Grand Junction, Colorado.

This LTSP addresses only that portion of the GJO facility transferred to non-federal ownership. This plan will be revised, as necessary, when other portions of the property are transferred to other entities.

This LTSP is in effect as of October 1, 2000. This LTSP will remain in effect until all identified hazardous materials for which DOE is responsible have been remediated to within regulatory limits and the site can be released for unrestricted use and unlimited exposure.

1.2 Legal and Regulatory Requirements

DOE holds title to and responsibility for the radioactive and other hazardous materials generated at the GJO facility prior to October 1, 2000.

DOE acquired the radioactive materials under authority of the Atomic Energy Act of 1954 (Public Law 83-703). Most of the radioactive materials consisted of uranium mill tailings, which are similar to materials regulated either as residual radioactive material under Title 40 *Code of Federal Regulations* Part 192 (40 CFR 192) or regulated as 11(e)(2) byproduct material under the Atomic Energy Act of 1954. Other radioactive materials at the GJO facility included refined uranium oxide (yellowcake) and incidental laboratory waste. Radioactive materials that were removed from the GJO facility were accepted for codisposal with Uranium Mill Tailings Radiation Control Act (UMTRCA) Program residual radioactive materials at the Grand Junction (also known as the Cheney), Colorado, Disposal Site, in accordance with the GJO facility Record of Decision (DOE 1989b). Some radioactive materials remain on the GJO facility and are managed by DOE.

Regulated nonradiological hazardous materials were removed and disposed of or managed as they were encountered.

The primary relevant and appropriate regulations and guidance for the remediation of the GJO facility are 40 CFR 192 and DOE Order 5400.5 (DOE 1989a and 1989b).[1] These regulations specify release limits for radium, uranium, and thorium in soil; radon concentration, surface contamination limits in structures; direct gamma exposure; and total effective dose. Site ground water is regulated under State of Colorado Title 5, *Code of Colorado Regulations*, Part 1002-8 (5 CCR 1002-8), "Basic Standards for Ground Water," including secondary drinking water and

[1] While GJO facility restoration was under the authority of the Surplus Facilities Management Program (SFMP), the standards conveyed in the *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites* were found to be applicable. These guidelines were superseded by DOE Order 5400.5.

agricultural standards; 40 CFR 192; and risk-based limits specified by EPA Region 3. Site surface water is regulated under 5 CCR 1002-8, "Classifications and Numerical Standards for the Gunnison and Lower Dolores River Basins." Ground water standards are discussed in more detail in Section 3.6.1.

DOE conducted remediation of the GJO facility in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), as prescribed by DOE policy. A portion of this federal property was transferred to private ownership in accordance with applicable provisions of CERCLA Section 120(h). Some regulated materials remain on the GJO facility; these materials are managed by DOE. DOE responsibilities for this material are defined in Section 1.3, "Role of DOE." The nature of the contamination remaining on the GJO facility is described in Section 2.3, "Final GJO Facility Conditions."

In 2001, DOE sold a portion of the GJO facility to the Riverview Technology Corporation (RTC). A portion of the GJO facility will be transferred to the U.S. Army as early as 2001. DOE has certain obligations under CERCLA regarding transfer (conveyance) of this property to other entities because the property has a prior history of release and storage of hazardous substances. The following requirements were addressed in the sales contract between DOE and the RTC (DOE 2001e) and are made a part of the Deed (DOE 2001d):

1. DOE submitted information to the property recipient concerning (1) the type and quantity of hazardous substances that were known to have been released or disposed of or stored for 1 year or more on the property; (2) the time such disposal, release, or storage took place; and (3) a description of remedial action taken that was required under Section 120(h)(1) of CERCLA (42 U.S.C. § 9620(h)(3)(A)(i)).

2. DOE warranted that all remedial action necessary to protect human health and the environment had been taken or was in place before the date of the conveyance, with exceptions noted in the Deed.

3. DOE identified two areas where radioactive contamination remains, identified the protective controls in place to protect human health and the environment, and identified the remediation plan for these areas. These areas of deferred remediation are addressed in a CERCLA 120(h) request for deferred remediation to the State of Colorado.

4. DOE reserved a right of access to all portions of the property for environmental investigation, remediation, or other corrective action. This reservation includes the right of access to and use of available utilities at reasonable cost to DOE. These rights are exercisable in any case in which a remedial action, response action, or corrective action is found to be necessary after the date of the conveyance, or in which access is necessary to carry out a remedial action, response action, or corrective action on adjoining property. Pursuant to this reservation, the United States of America and its respective agencies, officers, agents, employees, contractors, and subcontractors shall have the right to enter upon the property and conduct investigations and surveys, to include drilling, borings, data and records compilations, and other activities related to environmental investigation; and to carry out remedial or removal actions as required or necessary, including but not limited to the

installation and operation of monitoring wells, pumping wells, and treatment facilities, and use of other actions deemed necessary by DOE to comply with all federal and state statutes, regulations, or any court order.

This LTSP adopts the approach outlined in the *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites*, which defines the content of a site-specific LTSP and the general requirements for the long-term custody and care for a typical remediated uranium mill tailings site (DOE 2001a), as shown in Tables 1-1 and 1-2.

Table 1-1. Requirements for the GJO Facility LTSP

	Requirement[a]	Location in this LTSP
1	Legal description of site	Section 2.1
2.	Description of final site conditions	Sections 2.3, 2.4, 2.5, 2.6, and 2.7
3.	Description of the long-term surveillance program	Section 3.0
4.	Criteria for follow-up inspections	Section 3.5.1
5.	Criteria for maintenance and emergency measures	Section 3.6

[a]These requirements are specified in *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites* (DOE 2001a)

Table 1-2. Requirements for the Long-Term Custodian at the GJO Facility

	Requirement[a]	Location in this LTSP
1.	Implementing changes to the LTSP	Section 3.1
2.	DOE permanent right-of-entry	Sections 1.2 and 3.1

[a]These requirements are specified in *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites* (DOE 2001a).

1.3 Role of DOE

In 1988, DOE designated the DOE-GJO as the program office for long-term surveillance and maintenance of all DOE remedial action sites, disposal sites, and other sites, as assigned, in order to establish a common office for the security, surveillance, monitoring, and maintenance of these sites. DOE established the Long-Term Surveillance and Maintenance (LTSM) Program at the GJO to carry out this responsibility.

Responsibility for stewardship of the GJO facility has been assigned to the LTSM Program. By extending long-term stewardship to the GJO facility, DOE ensures continuing protection of the public and the environment and ongoing regulatory compliance for this location.

The LTSM Program is responsible for the preparation, revision, and implementation of this LTSP, which includes procedures for site inspection, monitoring, and maintenance. The LTSM Program also is responsible for complying with reporting requirements and for maintaining records pertaining to this site.

DOE is responsible for managing contamination left on site after site transfer. These occurrences are described in Section 2.3, "Final GJO Facility Conditions." DOE will maintain protectiveness by adhering to the provisions described in Section 3, "Long-Term Stewardship Program." Stewardship activities include inspections, monitoring, and reporting, as described in that section.

As stipulated in the Request for Deferred Remediation (DOE 2001c), DOE will demolish and remediate the contaminated portion of Building 12 before DOE vacates the building and will remediate the contamination beneath Building 20 when that structure is abandoned. DOE has received approval to defer remediation of the regulated materials associated with the buildings, as provided for by State of Colorado Executive Order D013 98, "Evaluation of Requests for Transfer of Contaminated Property" and in accordance with CERCLA Section 120(h) (Colorado 2001).

2.0 Grand Junction Office Facility

2.1 Description of Site

2.1.1 Location and Property Ownership

The GJO facility is located at 2597 B 3/4 Road, Grand Junction, Colorado, approximately 0.6 miles (1.1 kilometers) from downtown Grand Junction (Figure 2-1). The property lies in Sections 26 and 27, Township 1 south, Range 1 west, Ute Principal Meridian, in Mesa County, Colorado. The GJO facility occupies approximately 54.17 acres (21.92 hectares) along the Gunnison River, which abuts the property on the north and west sides. Property adjacent to the east side of the GJO facility is owned by the Union Pacific Railroad: east of that is a city of Grand Junction municipal cemetery.

The property was acquired by the U.S. War Department in 1943, and subsequently was administered by the Atomic Energy Commission, the Energy Research and Development Administration, and DOE. In 2001, a portion of the property (46.20 acres or 18.70 hectares) was transferred to the RTC, a non-profit business development entity sponsored by Mesa County and the City of Grand Junction. The remainder of the property (7.97 acres or 3.23 hectares) will be transferred to the U.S. Army. This LTSP addresses only the portion of the GJO facility transferred to the RTC.

The legal description of the property is presented in Appendix A and shown on Plate 1. Real estate correspondence and instruments are maintained by the Property Management Branch, DOE Albuquerque Operations Office.

Directions to the site from Walker Field Airport, in Grand Junction, are presented in Table 2-1.

Table 2-1. Directions and Mileage from Walker Field Airport to Site

Mileage	Route
0.0	At the Airport exit, turn left on to H Road
0.5	At traffic light, turn right on to Horizon Drive
5.3	At traffic light, turn left on to 7th Street
9.6	At traffic light, turn right on to Ute Avenue
10.0	At traffic light, turn left on to 5th Street
12.2	At traffic light, turn right on to Canon Street
12.7	Turn right on to B 3/4 Road, follow down hill to GJO Facility

The site is accessed from the east using B-3/4 Road, the only public road leading to the GJO facility (Figure 2-1 and Plate 1).

The site is used for light industrial and commercial activities. Occupants include the Western Colorado Business Development Corporation Small Business Incubator and DOE, which operates an analytical laboratory and conducts project management and technical support operations at the site. Principal land uses in areas adjacent to and near the site include the municipal cemetery, agriculture, and gravel extraction. The closest residence is within 0.1 mile of the facility.

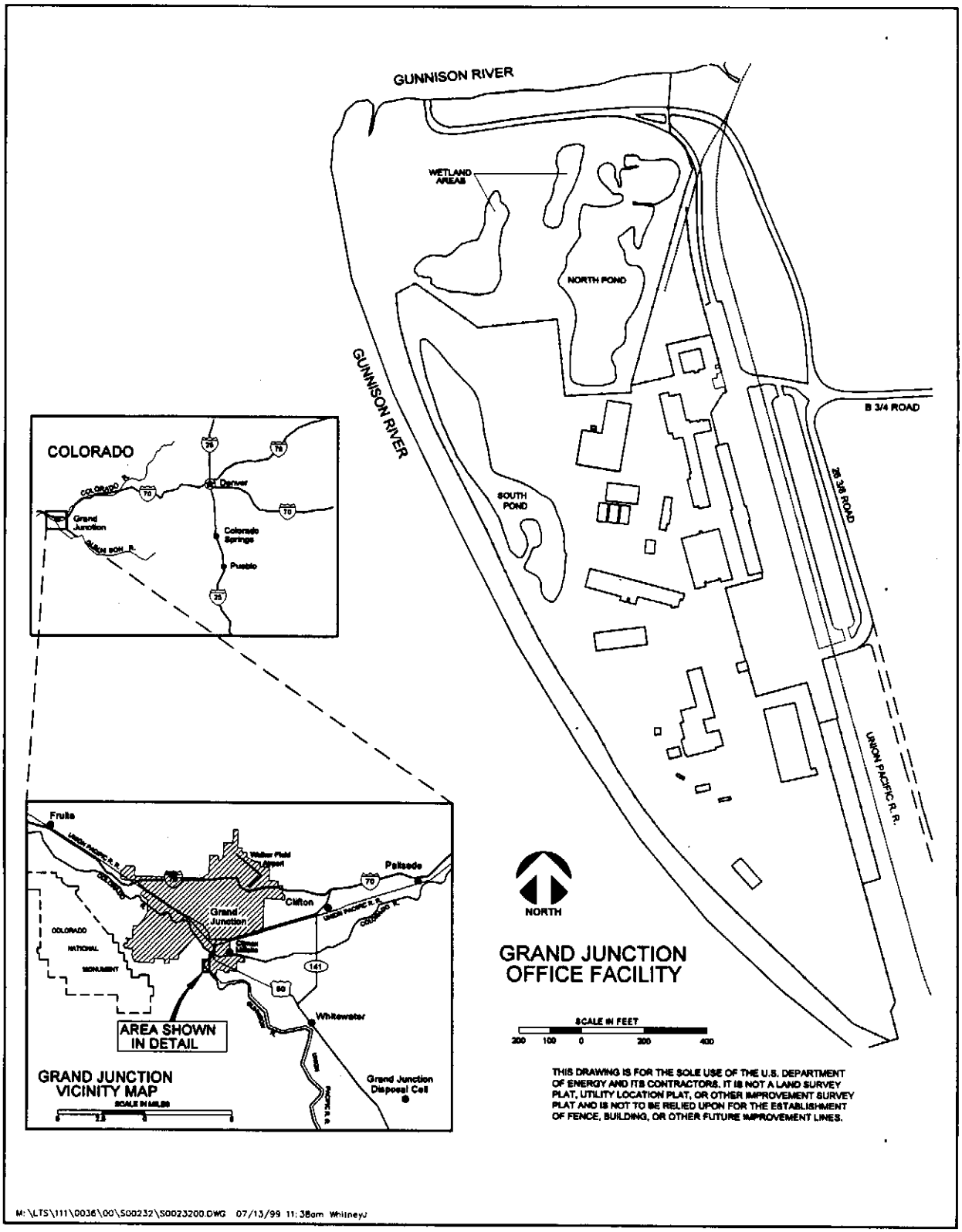

Figure 2-1. Location of the GJO Facility

Because of the earthen flood control dike, the GJO facility is considered to be out of the 100-year flood plain, but lies within the 1,000-year flood plain.

DOE-owned calibration models for borehole radiological measurements are located on the GJO facility. The LTSM Program controls access to and maintains these models.

2.1.2 Topography and Geology

The GJO facility is located in the Canyonlands portion of the Colorado Plateau physiographic province. Principal structural features in the area include the Grand Valley, which contains the Colorado River drainage; the Uncompahgre Plateau to the south, a broad uplifted area of sedimentary rocks and a Precambrian core; the Grand Mesa to the east, a basalt-capped sedimentary highland with elevations as high as 11,000 feet (3,353 m) above sea level; and the Book Cliffs to the north, an erosional escarpment that extends into Utah. The GJO facility is located at the boundary between the Grand Valley and the Uncompahgre Plateau. Elevation of the site is approximately 4,560 ft (1,390 m) above mean sea level.

The site is situated within an accretionary bend of the Gunnison River approximately 0.5 mile (800 m) up stream from its confluence with the Colorado River. At the GJO facility, the Gunnison River canyon is 1,500 to 2,200 feet (457 to 671 m) wide and 60 to 160 feet (18 to 49 m) deep. The Brushy Basin Member of the Morrison Formation and the overlying Burro Canyon Formation are exposed in the canyon walls. The strata at this location dip approximately 3 degrees northeast as part of local monoclines located at the north edge of the Uncompahgre uplift (Figure 2-2). Several small, local faults occur along the anticlinal hinge of these monoclines. Other faults occur in the sedimentary rocks adjacent to the GJO facility; these faults likely will not allow hydraulic communication with lower permeable strata because clays in the Morrison Formation will seal the fault planes.

Sandy loam soil at the site ranges in thickness from several inches to several feet. The soil is underlain by as much as 32 feet (9.8 m) of Quaternary river alluvium, which rests on top of Brushy Basin Member bedrock.

2.1.3 Hydrology

The alluvial sediments beneath the site comprise an unconfined aquifer consisting of two facies, a silty sand unit overlying a basal unit of poorly sorted, unconsolidated sands and gravels. These units are laterally consistent across the GJO facility. This aquifer is in direct hydraulic contact with the Gunnison River. The alluvial aquifer is bounded on the east by Brushy Basin Member silts, shales, and sandstones, and on the west and north by the Gunnison River (Figure 2-3). The alluvial aquifer continues up gradient along the east bank of the river. Brushy Basin strata beneath the alluvial sediments form an aquitard. Depth to ground water ranges from 5 to 10 feet (1.5 to 3 meters) over much of the GJO facility.

At the north end of the GJO facility, a portion of remediated land was not backfilled, resulting in a depression that is recharged by ground water. A portion of this area lays below the low-water level in the river and is inundated or saturated year-round, creating 1.45 acres (3.6 hectares) of jurisdictional wetland. Other portions of this area dry out during periods of low water.

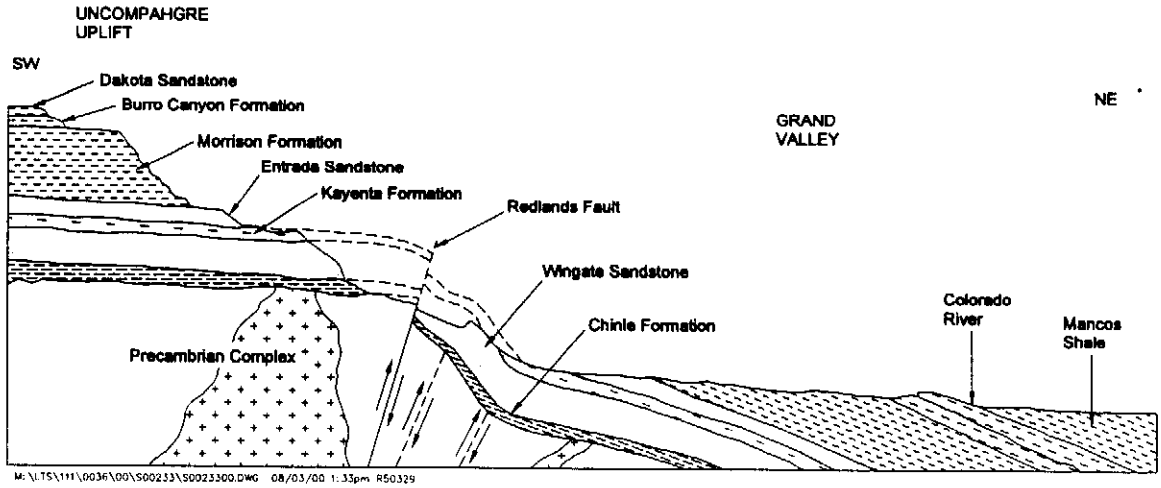

Figure 2-2. Geological Cross Section of the GJO Facility Region

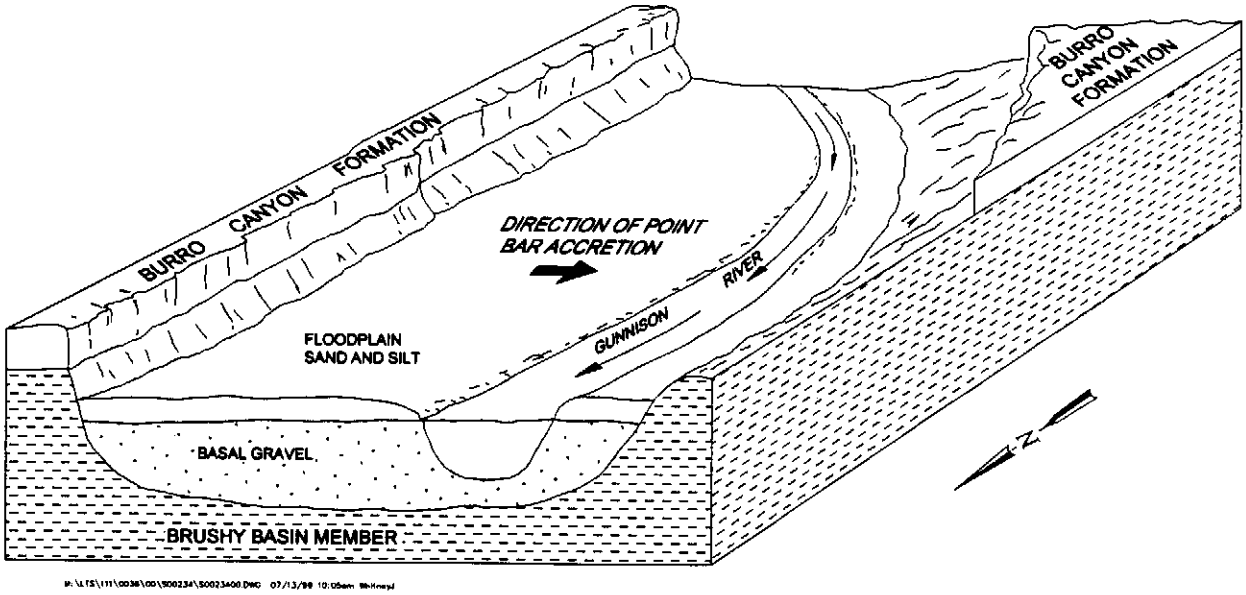

Figure 2-3. Block Diagram of the Hydrologic System at the GJO Facility

Aquifer pumping tests indicate that the alluvial aquifer has hydraulic conductivities ranging between 30 and 45 feet (9.1 and 13.7 meters) per day. Specific yield values of approximately 0.05 over a saturated thickness of 14 feet (4.3 meters) were determined by using pump tests. Water level measurements indicate that the general gradient is from south to north.

The aquifer was modeled during preparation of the Remedial Investigation (DOE 1989a). Field observations indicated that a simple depositional model would adequately represent the aquifer. The basal sands and gravels were deposited as the Gunnison River migrated from east to west. This process resulted in erosion of older alluvial sediments to the west and deposition of newer

sediments behind the river channel. The migration process resulted in a laterally consistent layer of imbricated gravel, sand, and silt. Periodic over-bank flooding resulted in deposition of finer sediments on top of the coarser channel fill deposits (Figure 2-3). The confining canyon walls caused swift flows, resulting in generally coarse, high-energy deposits of basal gravel.

The ground water flow regimen, as defined through observation and modeling, was used to predict contaminant fate and transport. The water level in the alluvial aquifer responds to the water level in the Gunnison River. River water levels fluctuate seasonally, reaching their highest levels in late spring as mountain snow melt in the upper watersheds feeds the river. Flow rates are lowest in late winter. This annual fluctuation results in a regular surging of ground water through the alluvial aquifer. As water levels rise in the spring, ground water levels increase at the north and west aquifer boundaries and move perpendicular to the river channel towards the center of the aquifer. As water levels in the river subside in the late summer, site ground water flow direction reverses and ground water discharges to the river. Ground water flow is generally northward during normal flow periods. Site drainage causes precipitation to flow into the South Pond and the North Pond, resulting in minor aquifer recharge.

2.1.4 Climate and Vegetation

The climate at the Grand Junction site is semiarid with about 8.8 in. (22.4 cm) of precipitation annually. Precipitation is characterized by brief, sometimes heavy, summer thunderstorms and light winter snowfalls. Winds measured at Walker Field Airport flow predominantly from east-southeast or northwest at an average velocity of approximately 5 miles per hour [2.5 meters per second (m/s)]; local topographical features influence wind direction. Temperatures range from average highs of 92 degrees Fahrenheit (33 degrees Celsius) in the summer to average lows of 16 degrees Fahrenheit (-9 degrees Celsius) in the winter.

Almost the entire GJO facility has been disturbed as a result of conducting remedial action, constructing improvements, or historical agricultural activities. Approximately 23.6 acres (9.6 hectares) of the 61.14-acre (24.74 hectare) site has been landscaped or is covered with gravel or asphalt. The unlandscaped areas have been revegetated with native and adapted species.

Riparian, wetland, and semiarid grassland plant ecology zones are present at the site. The riparian areas support cottonwood trees, silver buffaloberry, skunkbush sumac, willow, Russian olive, Siberian elm, and several grasses. Plant species in wetland areas include tamarisk, cattail, willow, sedge, bulrush, creeping spikerush, and alkali grass. The semiarid grassland vegetation is dominated by crested wheatgrass, inland saltgrass, Indian ricegrass, blue grama, galleta grass, and several perennial wildflowers.

2.2 Site History

2.2.1 Operations History

The GJO facility property was used for agriculture and gravel extraction prior to acquisition by the Federal Government.

DOE-GJO lands were acquired by the U.S. War Department in 1943 for use by the Manhattan Engineer District. A refinery was operated on the site from 1943 to 1946 to treat and concentrate uranium oxide, a byproduct of vanadium production in the area. As much as 2,360,000 pounds (1,070 metric tons) of uranium oxide and a comparable amount of vanadium oxide concentrate were produced and shipped off site for further processing. Wastes from this refinery included dust losses, a few hundred tons of alumina cake, and liquid discharges (DOE 1987).

In late 1947, the U.S. Atomic Energy Commission (AEC) established the Colorado Raw Materials Office on site to manage the domestic uranium procurement program. An exploration office also was located in the city of Grand Junction, which led to the combination of procurement and exploration functions within the AEC Grand Junction Operations Office. This office was responsible for receipt, sampling, and analysis of uranium and vanadium concentrates purchased from ore processing operations in the western United States. AEC operated a uranium-concentrate sampling plant and assay laboratory on site until 1974. Between 1948 and 1971, a total of approximately 345,000,000 pounds (16, 000 metric tons) of uranium oxide and 29,000,000 pounds (13,200 metric tons) of vanadium oxide passed through the GJO facility in steel drums. The remaining stockpiled vanadium and uranium were shipped off site in 1967 and 1975, respectively (DOE 1987).

A research program to test experimental uranium-ore milling techniques was initiated at the GJO facility in 1953. Operations were conducted in a small pilot mill from 1953 to 1954 near the present location of Building 46. In 1954, a larger pilot mill commenced operations on the southern end of the property. Milling operations ceased in 1958, after approximately 30,000 tons (27,200 metric tons) of ore had been processed (DOE 1987). Most of the small pilot plant and the structures associated with the large pilot mill complex were demolished during remedial action.

The pilot milling operations were the primary source of contaminated materials buried at the GJO facility. Other potential sources of contamination include former laboratory and vehicle maintenance activities and activities related to sampling and stockpiling uranium oxide concentrates.

Surplus uranium ore, uranium mill tailings, and contaminated equipment were disposed of on site. Historical data indicated that tailings and other waste from the pilot mills and sampling plant were disposed of to the west of the original pilot plant (near Building 46) and in the vicinity of the large mill buildings. Nonhazardous waste materials were buried in the landfill area northwest of Building 7. The drains from the analytical laboratory discharged into the South Pond, and storm water runoff drained into the North Pond. An estimated 100,000 cubic yards (76,500 cubic meters) of tailings and contaminated soils were stabilized on site, and another 300 cubic yards (230 cubic meters) of contaminated process equipment was buried at the GJO facility. Nearly 18 acres (7 hectares) of the GJO facility was assessed as contaminated. Leaching of stockpiled and buried tailings resulted in ground water contamination.

2.2.2 Remedial Action History

The GJO facility was accepted into the Surplus Facilities Management Program (SFMP) in 1984. In 1988, the facility was transferred to the Defense Decontamination and Decommissioning

(D&D) Program. In 1990, remediation authority and responsibility for the site was transferred to the DOE Office of Environmental Restoration.

Site surveys for radiological contamination were conducted in 1980 and 1981. Ground water monitor wells were installed in 1982, 1984, 1985, 1987, and 1994. Remedial action site investigations and characterization studies formally commenced in 1984 when the GJO facility was accepted into the SFMP. The resulting data were analyzed in preparation for development of a National Environmental Policy Act- (NEPA-) compliant Environmental Assessment. With the passage of the Superfund Amendments and Reauthorization Act in 1986 and the subsequent implementation of Executive Order 12580, "Superfund Implementation," the GJO facility was evaluated in accordance with CERCLA. Although the resulting Hazard Ranking System score was below the value required for inclusion on the National Priorities List, the GJO facility remediation followed the CERCLA process in accordance with DOE policy. A Finding of No Significant Impact was issued by DOE in 1990 (DOE 1990). The remediation as conducted as the Grand Junction Office Remedial Action Program (GJORAP).[2]

Site ground water was characterized and modeled in the CERCLA-compliant Remedial Investigation. Modeling results indicate that the ground water will flush clean of contaminants in 50 to 80 years, which is within the 100 year compliance period specified in 40 CFR 192 (DOE 1989a). The compliance period began with the signing of the ROD in 1989 (DOE 1989b).

The selected remedial action alternative was removal of contaminated soils and building debris and codisposal with residual radioactive material from Grand Junction-area UMTRA Project activities, and remediation of the ground water contamination through natural flushing (DOE 1989b).

Remediation of the GJO facility commenced in 1986. Remediation of assessed contamination in exterior land areas was completed in 1994. Remediation of one building (Building 7) commenced in spring 2001. Remediation of affected portions of Buildings 12 and 20 is deferred, as described in Section 1.3. Remediation of remaining GJO facility buildings is complete. Site surface and ground water will be remediated through natural flushing.

2.3 Final GJO Facility Conditions

Site ground water and surface water contain contaminants in concentrations exceeding regulatory limits. Institutional controls[3] have been established as part of the remedy to prevent use of and exposure to contaminated water.

GJO facility buildings have been surveyed. Minor quantities of radioactive materials that remain in two buildings have been deregulated. Building 2 (the original shower and change room) and Building 20 (the analytical laboratory) have known deposits of uranium oxide within the

[2]The name of the facility was changed from the Grand Junction Projects Office in 1996; the former name for the environmental restoration activity at this location was the Grand Junction Projects Office Remedial Action Project (GJPORAP).

[3]The term "institutional controls" refers to non-engineering measures–usually, but not always, legal controls–designed to prevent or limit exposure to hazardous substances left in place at a site or to assure effectiveness of the remedy (EPA undated).

buildings. These two buildings were released on the basis of excessive cost for remediation that poses no risk to occupants, the public, or the environment (DOE 1997 and DOE 2000f). All materials in these buildings are deregulated because they do not exceed risk-based release limits, and no contamination remains. This determination complies with DOE policy to keep exposures As Low As Reasonably Achievable.

In addition, uranium and radium contamination remains in soils and on subgrade structures beneath portions of Buildings 12 and 20.

A concrete slab believed to be the remains of a former uranium mill exists beneath the south end of Building 12. Portions of the slab and underlying soil outside the building footprint were removed and found to contain radium-226, thorium-230, and uranium in excess of regulatory limits. A trench was defined beneath the east end of the slab that contained soil with a uranium concentration of 1,430 picocuries per gram (pCi/g) (DOE 2000c); this trench appears to continue beneath the building. A concrete sump integral to the Building 12 foundation has fixed surface contamination as high as 50,000 disintegrations per minute per 100 square centimeters. Preliminary investigations identified soil with elevated concentrations of uranium within the building footprint (DOE 2000b).

A release survey conducted in Building 12 indicated that gamma exposure rates and beta-gamma activity did not exceed background, and the average radon decay-product concentration for this building was 0.006 working level, which is below the 0.020 working level guideline. These measurements indicate that the mill slab and underlying soil do not pose any increased health risk to occupants of Building 12.

Building 20 was used as a laboratory since 1953. Approximately 95 cubic yards of contaminated soil and concrete rubble was identified beneath the southwest corner of the building (DOE 2000d). Analytical laboratory results for soil samples collected from the deposit of contaminated soil had maximum concentrations of 177 pCi/g for radium-226, 148 pCi/g for thorium-230; and 269 pCi/g for total uranium (DOE 2000e).

Gamma exposure rates and radon decay-product concentrations inside Building 20 are less than the guideline values. Other measurements of exposure have been collected inside of the building through long-term dosimeters placed on the east and west sides of the building. Gamma exposure in the west end of the building, near the contamination, was not greater than the gamma exposure at the east end of the building. On the basis of these measurements, this deposit does not pose an increased health risk to the occupants of Building 20.

DOE will demolish Buildings 12 and 20 (in their entirety) when DOE operations in those buildings cease. The building structures have been released for unrestricted use, and the demolition debris will be hauled to a public landfill. Contaminated soil and debris was left under the west end of Building 20 for economic and structural reasons. The contaminated concrete slab and soil under the south end of Building 12 was left in place for economic reasons. DOE will remediate the contaminated materials beneath the buildings and dispose of the material at the Grand Junction Disposal Site. The soil within the building footprints will be radiologically verified to comply with regulatory limits.

Building 7A (the former sample plant) is contaminated with uranium oxide and will be demolished in spring 2001.

Exterior land areas have been remediated and comply with applicable clean up standards (DOE 1995b). These areas are released for unrestricted use.

Asbestos has been identified in buildings, and may be associated with abandoned underground steam lines (DOE 1995c). Polychlorinated biphenyls (PCBs) have been identified in fluorescent light ballasts (DOE 1995d). DOE has disclosed the existence of these substances to the new owner and has no further obligation for management or disposal of these substances.

2.4 Ground Water Conditions

Ground water occurs under unconfined conditions in the alluvial aquifer (uppermost aquifer) beneath the GJO facility. Depth to ground water ranges from 5 to 10 feet (1.5 to 3 meters) beneath the surface, and generally flows to the north. Ground water has been monitored regularly to determine compliance with Federal and state ground-water quality regulations.

Ground water at the GJO facility must comply with the more stringent of the limits established for potentially useable water in 40 CFR 192 and 5 CCR 1002-8, "Basic Standards for Ground Water." Ground water standards are discussed in more detail in Section 3.6.1.

2.4.1 Background Ground Water Characteristics

Water samples were collected from the alluvial aquifer up gradient from the GJO facility. The results of analysis for regulated analytes in 1999 are shown in Table 2-2. These results indicate that the unaffected water quality in the alluvial aquifer is similar to that of the Gunnison River, although major cation concentrations increase with residence time.

In 1997, water samples collected by the independent verification contractor were analyzed for Target Compound List volatile organic compounds, semivolatile organic compounds, pesticides, and PCBs. Most of these compounds were not detected in the samples and none of the detected constituents exceeded ground water standards (DOE 1998).

2.4.2 Ground Water Contamination

Site ground water was contaminated by leaching of uranium mill tailings before the tailings were removed from the property. Contaminants exceeding Federal or State standards, as of 1999, include nitrate, total dissolved solids, arsenic, molybdenum, selenium, gross alpha, uranium, chloride, iron, manganese, and sulfate.

Nitrate and arsenic contamination is localized near the South Pond, in the area of the former tailings pile. Elevated total dissolved solids levels appear to be concentrated at the north end of the alluvial aquifer. Molybdenum and uranium contamination is widespread across the entire property. Selenium contamination distribution is sporadic and local, being historically highest in well 6-2N and west of the North Pond (Plate 1). Iron, chloride, manganese, and sulfate distributions will be defined when a rigorous ground water evaluation is performed (see Section 3.6.1).

Table 2-2. Ground Water Standards and 1999 Ground Water Analysis Results[a]

Constituent	Standard[b,c]	Maximum Up-Gradient Concentrations	Maximum On-Site Concentrations	Maximum Down- Gradient Concentrations
Nitrate	10	0.018	18.55*	<0.289
Total dissolved solids	2,444	1,980	5,220*	2,900*
Aluminum	5	1.147[g]	1.35[f]	1.35[h]
Antimony[e]	0.006			
Arsenic	0.05	0.002	0.23*	0.0084
Barium	1.0	0.022	0.048	0.035
Beryllium	0.004	<0.001	0.001[f]	<0.001[h]
Boron[e]	0.75			
Cadmium	0.01	<0.001	0.0015	<0.001
Chloride	250	82.5	397	166
Chromium (total)	0.05	0.0063	0.0146	0.016
Cobalt	0.05	<0.025	0.016[f]	0.006[h]
Copper	0.2	0.056	0.16[f]	0.011[h]
Fluoride	2	1.1	Not available	1.73[i]
Iron	0.3	0.205	1.69	0.88
Lead	0.05	<0.001	<0.001	<0.001
Lithium[e]	2.5			
Manganese	1.7	0.362	5.26	3.57
Mercury	0.002	-	-	-
Molybdenum	0.1	0.0068	0.299*	0.149*
Nickel	0.1	0.005[g]	0.023[f]	0.015[h]
Nitrite	1	0.018	18.55	<0.289
Selenium	0.01	<0.001	0.122*	0.0104*
Silver	0.05	-	-	-
Sulfate	250	1120	1850	2820
Thallium[e]	0.002			
Vanadium	0.33	<0.01	0.141	0.018
Zinc	2	0.78[f]	0.056[f]	0.16[h]
Gross alpha[d]	15	<17.98	47.36*	6.295
Ra226+228	5.0	0.34	1.38	1.23
Th 230+232	60	-	-	-
Uranium 234+238	30.0	8.39	584.44*	167.08*

[a]From DOE 2000g.
[b]All concentrations expressed in mg/L except radionuclides, which are expressed in pCi/L.
[c]Standards found at 5 CCR 1002-8, 40 CFR 192, or EPA Region 3 Risk-Based Concentration Table, October 2000 update.
[d]Does not include radon or uranium.
[e]Not analyzed because this analyte is not a constituent of concern, based on process knowledge of GJO and other uranium ore processing sites.
[f]Historical maximum since 01/01/1995. This parameter not analyzed since 1996.
[g]Maximum upstream concentration. Upgradient concentration not available.
[h]Historical maximum since monitoring began. This parameter not analyzed since 1996.
[i]1985 result. Not monitored since that time. Only results for upgradient and background wells reported.
An asterisk (*) indicates an out of compliance result; a dash (-) indicates a constituent that is not analyzed because it historically does not exceed the standard.

2.5 Surface-Water Conditions

Surface water exists at the GJO facility in the North Pond, South Pond, wetland areas, and Gunnison River. These bodies are monitored regularly to determine compliance with State surface water quality regulations. Site surface water is in direct hydraulic contact with site ground water and the three bodies of water within the GJO facility boundary exhibit contaminant levels that reflect ground water contamination. Monitoring Gunnison River water serves the additional purpose of determining if ground water flushing is adversely affecting river water quality.

Water quality standards for the Gunnison River are found at 5 CCR 1002-8, "Classifications and Numerical Standards for the Gunnison and Lower Dolores River Basins," on the basis of the following four use classifications: (1) Recreation, Class I, (2) Cold Water Aquatic Life, Class I, (3) Domestic Water Supply, and (4) Agriculture (Table 2-3). This standard does not specify a regulatory limit for radium-226, gross alpha, or gross beta for the Gunnison River. The State surface water standard for radium-226 + 228 is 5 pCi/L. Some of the limits are derived from background surface-water quality measurement results.

2.5.1 Background Surface Water Characteristics

Background surface-water quality samples were collected from the upstream Gunnison River sampling location and analyzed for metals, major cations, major anions, radionuclides, and total dissolved solids. Surface measurements of alkalinity, turbidity, pH, conductivity, and temperature were made at the time of collection.

Historically, uranium concentrations in the Gunnison River samples have been generally constant for all sampling locations, and all results were below the standard of 40 pCi/L. The samples were analyzed also for gross alpha, gross beta, and radium-226 activity. All results were near detection limits (DOE 2000g). Background water quality data are presented as upstream sample location results in Table 2-3.

2.5.2 Surface-Water Contamination

In 1999, surface water in the North Pond, South Pond, and wetland areas exceeded State standards for one or more of the following constituents or properties: chloride, chromium, manganese, pH, sulfate, and total uranium (Table 2-3).

Table 2-3. Surface Water Standards and 1999 Surface Water Analysis Results[a]

Constituent	Standard[b,c]	Gunnison River			On-Site Surface Water		
		Upstream	Adjacent to Site	Down-stream	North Pond	South Pond	Wetland Area
Chloride	250	9.8	9.88	10.1	326*	136	2,260
Nitrate	10	0.761	0.761	0.723	0.020	0.117	0.181
Nitrite	0.05	-	-	-	-	-	-
Sulfate	480	310	313	317	2,180*	1,800*	20,400*
Total dissolved solids	N/A	643	640	635	3,950	2,970	35,900
Dissolved oxygen	7.0	-	-	-	-	-	-
pH	6.5-9.0	8.15 – 8.4	8.2 – 8.64	8.56 – 8.64	8.33 – 8.41	8 – 8.78	8.84 – 10.1*
Fecal coliform	200	-	-	-	-	-	-
Arsenic	0.05	0.00058	0.005	0.0055	0.0043	0.0028	0.0063
Cadmium	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium-6	0.011	0.0053	0.0123*	0.0057	0.0054	0.047*	0.0099
Copper	0.012	-	-	-	-	-	-
Iron	0.3	0.0072	0.0096	0.0034	<0.009	0.0698	<0.009
lead	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	0.05	0.0516*	0.0668*	0.0614*	0.040	0.0526*	0.503*
Mercury	0.0001	-	-	-	-	-	-
Nickel	0.098	-	-	-	-	-	-
Selenium	0.008	0.0072	0.0073	0.0072	0.0045	0.0017	0.0012
Silver	0.003	-	-	-	-	-	-
Zinc	0.137	-	-	-	-	-	-
Uranium	40	5.22	4.74	5.15	149.8*	307.1*	1,319.0*
Radium 226 + 228	5.0	0.44	0.39	1.25	<0.98	<1.35	<1.11
Gross Alpha	N/A	5.47	7.46	5.47	147.8	300.3	1,129
Gross Beta	N/A	<5.95	6.75	<5.45	65.0	144	524.7

[a]From DOE 2000g.
[b]All concentrations presented in mg/L except uranium, gross alpha, gross beta, and radium 226 + 228, which are presented in pCi/L; pH, which is unitless; and fecal coliform, which is presented as colonies per 100 milliliters.
[c]Standards are found at 5 CCR 1002-8.

An asterisk (*) indicates an out of compliance result; a dash (-) indicates a constituent that is not analyzed because it historically does not exceed the standard.

2.6 Institutional Controls

Institutional controls have been applied to the GJO facility to prevent inadvertent exposure to contaminated media. The controls include:

- Restrictions on the use of ground water, surface water, and aquatic life in the ponds and wetland areas;
- Controls to prevent disturbing the well containing radium foil; and
- Controls to prevent disturbing soil and structures associated with identified contamination beneath Buildings 12 and 20.

The controls and obligations of involved parties are defined in deed restrictions that are attached to the Deed and title and recorded in the Records of Mesa County. These controls will survive subsequent property transfers. These institutional controls will be monitored by the LTSM Program and enforced by the State of Colorado Department of Public Health and Environment (CDPHE) through CERCLA authorities, as specified in the sale and transfer agreements. These controls are presented in Appendix F and summarized below.

Surface Water and Ground Water—To prevent exposure to contaminated ground and surface water, the LTSM Program will notify owners through deed restrictions and annual reports of water quality and of prohibitions against water use; maintain warning signs around the ponds and wetland areas; and inspect the site annually and access state records for well permit information.

Controls prohibiting use of site ground water and surface water will remain in effect until water quality complies with regulatory limits; these controls must survive any subsequent property transfers (see Section 3.6, "Environmental Monitoring").

Well Containing Radium Foil—To ensure that the radium foil remains sealed and isolated, the LTSM Program will notify owners through deed restrictions and annual reports of the presence of the sealed well and of prohibitions against causing subsurface disturbances in the area, and will maintain a warning plaque at the ground surface above the well.

Controls prohibiting disturbance of the radium foil in the sealed well will remain in effect in perpetuity.

Contamination Beneath Buildings 12 and 20—To prevent exposure to contaminated soil and subgrade structures, the LTSM Program will notify owners through deed restrictions and annual reports of prohibitions against structural modifications to Building 20; control access to Building 12 and demolish the affected portion of the building upon vacation; and inspect the site annually, including the affected portion of Building 20.

Controls prohibiting disturbance of soils and structures associated with the contaminated portions of Buildings 12 and 20 will be enforced by DOE until contaminated materials have been removed from the GJO facility and the affected areas have been verified to comply with regulatory limits.

Property records have been annotated to document the DOE right of access; the history of site operations, the nature of site contaminants, the remedial actions conducted by DOE; and use restrictions imposed on property owners. Property record annotations will also include a covenant warranting that remedial action is complete or has been deferred, and if additional remedial action is found to be necessary after site transfer, it will be conducted by the United States of America (see 42 USC 9620(h) and EPA undated). Site remedial action records will be maintained by the LTSM Program at least until the site can be released for unrestricted use and unlimited exposure.

2.7 Site Drawings and Photographs

At the completion of remedial action, GJO site conditions were documented with as-built drawings and maps. Aerial photographs are taken regularly of the GJO facility. These documents are included in GJO facility records.

2.7.1 Site Map

The GJO facility map (Plate 1) shows the approximate site property boundary, fences, structures, roads inside and near the property boundary, monitor wells, survey monuments, section, township, range, and principal meridian. The map has a scale of 1 in. = 100 ft (1:1,200). Map data are maintained in a geographical information system database.

The site map data will be used to generate a base map for site inspections. After each inspection, a new inspection map will be prepared that shows the location of items of interest noted during previous inspections. Each site inspection map will indicate the year of the inspection and inspection purpose.

2.7.2 Site As-Built Drawings and Maps

As reclamation progressed, as-built conditions at the site were documented in as-built drawings and maps. These drawings and maps are included in the GJO facility final reports (Appendix B) which are archived in the permanent site file. The as-built map data will comprise the initial site base map data.

2.7.3 Site Baseline Photographs

Photographs taken during various phases of GJO facility remediation and a photographic record of final site conditions are maintained in the GJO facility permanent site file. These photographs provide a visual record to complement the as-built drawings and maps.

The site will be extensively photographed on the ground by LTSM Program personnel during the verification and orientation inspection of the site. This will occur as stewardship responsibility for the site is transferred to the LTSM Program. This initial set of photographs will serve as site baseline photographs.

2.7.4 Site Aerial Photographs

Aerial photographs of the GJO facility (in black and white or color) have been taken numerous times during operation of the mills and during reclamation of the GJO facility. The photographs provide a continuous record for monitoring changing conditions (e.g., erosion, vegetation, and land use) over time and are preserved in the permanent site file.

2.7.5 Site Inspection Photographs

Photographs will also be taken during subsequent annual site inspections to document current conditions, especially new or changed conditions, at the site. Comparison of current photographs

with the baseline set of photographs will be useful to document steady or changing conditions at the site over time.

2.8 Specific Site-Surveillance Features

Buildings 12 and 20, warning signs and a warning monument, a survey monument, surface waters, and monitor wells comprise the specific site-surveillance features at the GJO facility. These features are shown on Plate 1.

2.8.1 Warning Signs

DOE has installed and will maintain 13 warning signs around the South Pond, North Pond, and wetland areas (Plate 1). These signs inform the public that surface waters are contaminated and that swimming in, taking fish from, extracting, and drinking the surface waters is prohibited. DOE will inspect these signs until processing-related contaminants have flushed out of surface waters and the State of Colorado concurs that surface waters are safe for unrestricted use. Warning signs present the 24-hour telephone number for DOE-GJO and the LTSM Program ((970) 248-6070).

A ground-level monument was installed over the well containing the radium foil.

2.8.2 Monitor Wells

The ground water monitor well network consists of 6 monitor wells located inside or adjacent to the GJO facility property (Plate 1). These wells are completed in the alluvial aquifer. Construction details and lithologic logs for the wells are archived in GJO facility records. Sampling frequency and analytes for the wells are summarized in Section 3.6, "Environmental Monitoring."

3.0 Long-Term Stewardship Program

3.1 Stewardship Overview

DOE will conduct stewardship activities at the GJO facility to protect human health, safety, and the environment and to comply with applicable regulations and DOE policy. DOE owns and is responsible for the regulated radiological substances and the contaminants in ground and surface water that remain on the GJO facility. The State of Colorado, as regulator, has authority to oversee DOE stewardship activities at this site and will concur in changes to this LTSP. DOE retains the right of access to the GJO facility to conduct stewardship activities for the duration of these activities. This right is established in the transfer agreement (DOE 2001e).

DOE will monitor ground water and surface water at the site to ensure compliance with State of Colorado and Federal standards. Existing ground water and surface water conditions are described in Sections 2.4 and 2.5. The compliance strategy for site ground water is presented in Section 3.7.1, along with details of the monitoring program. Surface water monitoring is discussed in Section 3.7.2.

DOE will manage radiological contamination left in place beneath Buildings 12 and 20. Management is accomplished through inspections and maintaining access controls and other institutional controls.

DOE will monitor institutional controls and take necessary action to ensure the effectiveness of or to enforce those controls. Institutional controls in effect at the GJO facility are described in Section 2.6, "Institutional Controls."

Specific long-term stewardship requirements are presented in Table 3-1.

Table 3-1. Long-Term Stewardship Requirements

Requirement	Section
Routine site inspection	3.2
Routine Inspection report	3.3
Follow-up inspections and inspection reports, as necessary	3.4
Routine site maintenance, as necessary	3.5
Emergency measures	3.5
Environmental monitoring	3.6
Institutional controls monitoring	3.7
Regulatory compliance monitoring	3.8

3.2 Routine Site Inspections

3.2.1 Frequency of Inspections

The GJO facility will be inspected by DOE to confirm that institutional controls remain effective and to determine if maintenance or monitoring is needed.

DOE will inspect the GJO facility once each calendar year. The date of the inspection may vary from year to year to enable inspectors to observe the GJO facility in different seasons. Variation

to this inspection frequency will be explained in the inspection report. DOE will notify CDPHE and the site owner of the inspection at least 30 days before the scheduled inspection date.

3.2.2 Inspection Procedure

For the purposes of inspection, the GJO facility will be divided into sections called transects. Each transect will be inspected individually. Proposed transects for the first inspection of the GJO facility are presented in Table 3-2.

Table 3-2. Transects Used During Initial Inspection of the GJO Facility

Transect	Description
Site Interior (inside RTC property boundary).	Includes the South Pond, North Pond, wetland areas, the affected portions of Buildings 12 and 20, monitor wells, and the radium foil well. The proposed Army Reserve Area is excluded.
Areas beyond GJO Facility boundary.	Includes one survey monument and outlying areas up to 0.25 mi (0.4 km) beyond the GJO Facility.

The site interior transect will be inspected for evidence of ground water and surface water use. Within each transect, the condition of specific site-surveillance features (Section 2.8), such as warning signs and monitor wells will be inspected for change, deterioration, and other effects such as vandalism. Inspectors will physically inspect the affected portions of Buildings 12 and 20 and note any indication that the floor has been penetrated. Inspectors will note changes to the area surrounding the site, especially within 0.25 mi (0.4 km) of the site perimeter. Significant changes within this area could include development or expansion of gravel extraction, human habitation, erosion, or road building.

It may be necessary to document some observations with photographs. Such observations may be evidence of vandalism or water use. An example Field Photograph Log is included in Appendix C.

3.2.3 Inspection Checklist

The inspection is guided by the inspection checklist. The initial site-specific inspection checklist for the GJO facility is presented in Appendix D. The inspection checklist addresses preparation for the inspection, health and safety concerns, and performance of the inspection. Inspectors also will have the drafted site inspection map from the previous inspection. The map graphically depicts the locations of noted observations from previous inspections and is used to record field notes, photograph locations, and other annotations of inspection findings. The field map becomes a part of the permanent site record.

The checklist is reviewed and revised as necessary prior to each routine inspection. At the conclusion of a routine site inspection, inspectors will note revisions to the checklist in anticipation of the next routine site inspection. Revisions to the checklist may include inspection instructions addressing new discoveries or changes in site conditions or updated telephone numbers and directions to local medical facilities.

3.2.4 Personnel

Typically, annual inspections will be performed by two inspectors. Inspectors will be experienced engineers or scientists who have the required knowledge, skills, and abilities to evaluate site conditions and recognize imminent or actual problems.

Inspectors will be assigned for a given inspection episode of the GJO facility on the basis of site conditions and inspector expertise. Areas of expertise include civil, geotechnical, and geological engineering; geology, hydrology, biology, and environmental science (e.g., ecology, soils, or range management). If conditions warrant, more than two inspectors may be assigned to the inspection to evaluate serious or unusual problems and make appropriate recommendations.

3.3 Routine Inspection Reports

Results of routine site inspections will be reported to DOE program management, CDPHE, and the site owner(s). The report also will address monitoring results for the previous 12 months.

3.4 Follow-up Inspections

Follow-up inspections are unscheduled inspections that are conducted in response to threatening or unusual site conditions.

3.4.1 Criteria

Criteria for follow-up inspections of the GJO facility are adopted from 10 CFR 40.28 (b)(4). The LTSM Program will conduct follow-up inspections if the following occurs:

1. A condition is identified during the routine site inspection, or other site visit, that requires personnel with specific expertise to return to the site to evaluate the condition; or

2. DOE is notified by a citizen, employee, or federal, state, or local agency that conditions at the site are substantially changed.

Once a condition or concern is identified at the site, LTSM Program personnel will evaluate the information and decide whether to respond with a follow-up inspection.

Specific conditions that may necessitate a follow-up inspection include intrusion, violation of institutional controls, vandalism, or the need to revisit the site to evaluate, define, or conduct maintenance tasks. Conditions that may require a more immediate follow-up inspection include extreme weather or seismic events and disclosure of deliberate human activity that threatens the integrity of institutional controls. DOE will act responsibly but will exercise flexibility and will evaluate risk when scheduling follow-up inspections. Urgency of the follow-up inspection will be in proportion to the seriousness of the condition.

In the event of an incident or activity that threatens or compromises institutional controls or poses a risk of exposure to or release of known contaminants, DOE may, as appropriate, notify CDPHE, begin the DOE occurrence notification process (DOE Order 232.1), respond with an

immediate follow-up inspection, and begin emergency measures (Section 3.6) to contain or prevent dispersion of hazardous materials from the GJO facility. At any time, DOE may request the assistance of local authorities to confirm the seriousness of a condition at the site before scheduling a follow-up inspection or initiating other action.

The LTSM Program has arranged for these government agencies to notify DOE in the event of human intrusion or unusual-to-catastrophic natural events in the vicinity of the site: the Mesa County Sheriff's Department in Grand Junction and the U.S. Geological Survey National Earthquake Information Center in Denver, Colorado. These agencies will contact DOE should an event occur that might affect the control of known contaminants or condition of site surveillance features at the GJO facility. Agency notification agreements are presented in Appendix E.

To facilitate DOE notification and to address citizen concerns, warning signs posted near contaminated surface waters display a 24-hour DOE-GJO telephone number. The public may use the 24-hour number to request information about the site or to advise DOE of problems at the site. DOE may conduct follow-up inspections in response to information provided by the public.

3.4.2 Personnel

Inspectors assigned to follow-up inspections will be selected on the same basis as for routine site inspections. (See Section 3.3.4.)

3.4.3 Reports of Follow-up Inspections

Results of follow-up inspections will be included in the next annual inspection report (Section 3.4). Separate reports will not be prepared unless DOE determines it advisable to notify CDPHE or another outside agency of a problem at the site.

If follow-up inspections are required for more serious or emergency reasons, DOE will submit to CDPHE a preliminary report of the follow-up inspection within 60 days.

3.5 Routine Site Maintenance and Emergency Measures

3.5.1 Routine Site Maintenance

Assessed contaminated materials were removed from the GJO facility except as noted previously. DOE will maintain site access controls for DOE-leased portions of the GJO facility as part of DOE operations; this activity is not in the scope of LTSM Program activities at this location. The LTSM Program will conduct any required well maintenance and abandonment. Other maintenance tasks might include sign replacement and maintenance of the calibration model facility.

3.5.2 Emergency Measures

Emergency measures are the actions DOE will take in response to an incident that may result in exposure to or release of known contamination for which DOE is responsible.

3.5.3 Criteria for Routine Site Maintenance and Emergency Measures

Criteria for triggering a given DOE response for each progressively more serious level of intervention are not easily defined because the nature and scale of all potential problems can not be foreseen. The difference between routine maintenance and emergency responses is primarily one of urgency and degree of threat or risk.

3.5.4 Reporting Maintenance and Emergency Measures

Routine maintenance completed during the previous 12 months will be summarized in the next routine inspection report. Although the probability of such an occurrence is low, DOE will notify the CDPHE within 4 hours of discovery of any potential or actual exposure to or release of regulated hazardous materials. The phone number for the 4-hour contact to CDPHE is in the Inspection Checklist (Appendix D).

3.6 Environmental Monitoring

Environmental monitoring results will be reported in the routine inspection report.

3.6.1 Ground Water Monitoring

The compliance strategy to meet the more stringent of applicable Federal and State of Colorado ground water protection standards is natural flushing (monitored natural attenuation). Ground water flow and transport modeling predicted that cleanup of ground water in the uppermost (alluvial) aquifer will occur within a 50 to 80 year timeframe (DOE 1989a). This strategy is described in the Record of Decision (DOE 1989b) and evaluated in *Evaluation of Ground Water and Surface Water Monitoring for the Grand Junction Office Facility* (DOE 2000a).

The State of Colorado is the primary regulator for ground water and surface water compliance at the GJO facility. Ground water quality must comply with the basic standards for ground water found in 5 CCR 1002-8, and also with ground water standards specified in 40 CFR 192.

The ground water monitoring network consists of 6 monitor wells (8-4S, 11-1S, 6-2N, 14-13NA, GJ84-04, and 10-19N) that are distributed onsite and along the downgradient edges of the facility near the Gunnison River (Figure 3-1 and Plate 1).

The analytes to be monitored in ground water during each sampling event are shown in Table 3-3 and include the constituents of concern and other constituents that may be useful in assessing site conditions. These were identified on the basis of historical monitoring results (Table 2-2) and the ecological and human health risk assessment (DOE 2001c). Many other constituents have been analyzed in the past and have been deleted from the list because they have historically been below regulatory limits or concentrations co-vary with the selected analytes and are not required to assess the progress of natural flushing. In addition to these analytes, standard water quality indicators (pH, alkalinity, conductivity, temperature, and turbidity) will be measured during each sampling event.

Table 3-3. Analytes to be Monitored in Ground Water and Surface Water at the GJO Facility

Analyte	Basis for Analyte Selection		
	Exceeds Regulatory Limit	Poses Ecological Risk	Poses Human Health Risk
Arsenic	X		X
Chloride	X		
Chromium	X		
Gross Alpha	X		
Magnesium		X	
Manganese	X	X	X
Molybdenum	X	X	X
Nitrate	X		
Selenium	X		
Sulfate	X		X
Total dissolved solids	X		
Total Uranium	X	X	X

The LTSM Program will conduct ground water monitoring at the GJO facility annually, in late winter, for a minimum period of 5 years (through 2005). At the end of this period DOE will evaluate monitoring results in consultation with the State of Colorado to determine the requirements for future monitoring at the site. This will include a statistical evaluation of contaminant concentration trends. Criteria for modifying or terminating ground water and surface water monitoring will include (1) continued decrease in concentrations of constituents of concern as predicted and observed, (2) compliance with regulatory limits, and (3) no unacceptable risks to human health and the environment resulting from site-related contamination. DOE will receive approval from the State of Colorado prior to modification or termination of monitoring. (DOE 2001b) Modification may include changing or adding additional sample locations or changing the suite of analytes. Additional verification sample locations may be needed to demonstrate site-wide compliance with applicable standards, including addition of sample locations in the property interior.

3.6.2 Surface Water Monitoring

The compliance strategy for surface waters at the GJO Facility is monitored natural flushing. Monitoring and evaluation for surface waters will be the same as for ground water.

The surface-water monitoring network includes two locations in the Gunnison River, and one location each in the North Pond, South Pond, and wetland areas (Figure 3-1 and Plate 1). The analytes to be monitored in surface water during each sampling event are the same for ground water (Table 3-3). Surface water quality must comply with the water quality standards for the Gunnison River found at 5 CCR 1002-8. The frequency and duration of surface-water monitoring will be the same as for the ground water monitoring. Trend analyses will be performed on surface water sampling results in conjunction with analysis of ground water sampling results.

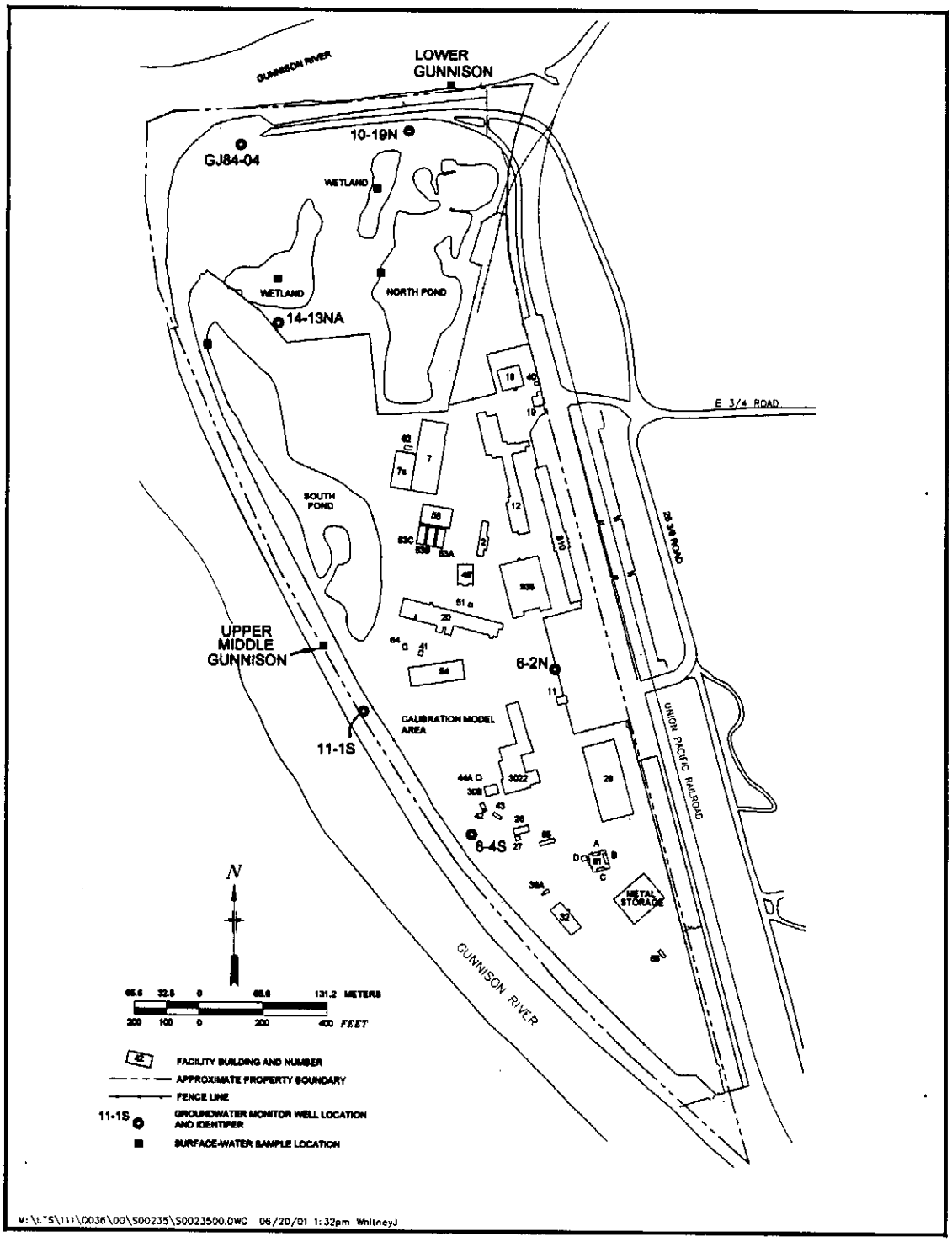

Figure 3-1. Ground Water and Surface Water Monitoring Locations

3.6.3 Sediment Monitoring

In 2001, DOE will conduct sampling to establish baseline chemistry data for pond and wetland area sediments. These locations will be sampled again when ground and surface water complies with regulatory limits to verify that pond and wetland areas sediments also comply with applicable limits. Sample locations will be selected to represent worst case and average conditions (e.g., deep water, near shore, and intermittently inundated areas). Analytes will include those shown in Table 3-3, as appropriate, plus isotopic uranium. On the basis of the initial results, DOE will revise this LTSP to present sampling locations and results, and, if necessary, invoke a program for further sediment monitoring.

3.7 Institutional Controls Monitoring

At the time of the routine site inspection, and at other times as necessary, LTSM Program personnel will evaluate institutional controls applied to the GJO facility and will take appropriate action if those controls are found to not fully protect human health and the environment. The evaluation will include the following:

- Inspect the site for evidence of ground or surface water use;
- Inspect the affected portions of Buildings 12 and 20 for evidence of construction or demolition (owner's permission is required for access to Building 20); and
- Contact the Colorado State Engineer's Office for a report of well permit applications for the GJO facility.

DOE will take appropriate action on the basis of the results of this monitoring to ensure that the regulated materials for which DOE is responsible are controlled. The results of this monitoring will be presented in the routine inspection report.

3.8 Regulatory Compliance Monitoring

At the time of the routine site inspection, the LTSM Program will demonstrate that DOE remains in compliance with regulations governing stewardship activities at the GJO facility. Those regulations are specified in Section 1.2, "Legal and Regulatory Requirements."

An evaluation of regulatory compliance may be required at other times, as well, in response to unusual or nonroutine occurrences. The results of this monitoring will be presented in the routine inspection report. Instances of noncompliance will be reported to regulators in accordance with the procedures set forth in Section 3.5.4, "Reporting Maintenance and Emergency Measures."

3.9 Records

The LTSM Program maintains site records in a permanent site file. These records are available for inspection by government agencies or the public.

All LTSM Program records are maintained in full compliance with DOE and National Archives and Records Administration requirements:

1. DOE Order 1324.2A, "Records Disposition"

2. 36 CFR Parts 1220-1236, "National Archives and Records Administration"

3.10 Quality Assurance

The long-term custody of the GJO facility and all activities related to the annual surveillance and maintenance of the site will comply with DOE Order 414.1A, "Quality Assurance [QA]," the DOE contractor's *Long-Term Surveillance and Maintenance Program Quality Assurance Program Plan* (DOE 1999), and the draft "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs" (ASQC 1994).

QA requirements will be transmitted through procurement documents to subcontractors when appropriate.

3.11 Health and Safety

Health and safety procedures for LTSM Program activities are consistent with DOE orders, regulations, codes, and standards. LTSM Program activities are conducted in accordance with the DOE-GJO site-wide Health and Safety Manual.

Immediate health and safety concerns are listed in the Inspection Checklist (Appendix D). Also in the Health and Safety section of the Inspection Checklist are 24-hour emergency phone numbers for fire, hospital and ambulance, and sheriff. Directions from the site to the nearest hospital with an emergency room are also included. The checklist is updated before each routine inspection to advise assigned personnel of new and continuing health and safety considerations. A Job Safety Analysis is prepared before each routine inspection and is presented as part of a pre-inspection briefing held several days before the inspection. At the briefing, personnel who will be on site review the Job Safety Analysis and are instructed on hazards that may be present at the site and on health and safety procedures that must be followed.

Subcontractors are advised of health and safety requirements through appropriate procurement documents. Subcontractors must submit health and safety plans for all actions subject to Occupational Safety and Health Administration (OSHA) requirements. Subcontractor health and safety plans will be reviewed and approved before the contract is awarded. Proposals from subcontractors without an adequate health and safety plan will be rejected.

4.0 References

American Society for Quality Control (ASQC), 1994. *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*, draft, ANSI/ASQC E4-19XX, Energy and Environmental Quality Division, Environmental Issues Group, January 1994.

ASP (American Society of Photogrammetry), 1980. *Manual of Photogrammetry*, fourth edition, American Society of Photogrammetry, Falls Church, Virginia.

Colorado Department of Public Health and Environment (CDPHE), 2001. Approval of Application for Deferred Remediation, not finalized.

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U.S. Department of Energy (DOE), 1995d. *Grand Junction Projects Office Facility, Grand Junction Projects Office Remedial Action Project, Monticello Mill Tailings Site, Environmental Monitoring Plan*, P-GJPO-109, Revision 2, Grand Junction Projects Office, Grand Junction, Colorado, November. [last updated October 1999]

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———, 2001d. Deed for the portion of the Grand Junction Office facility transferred by DOE to the Riverview Technology Corporation, not yet executed.

———, 2001e. "Offer to Purchase and Acceptance," [sales contract conveying the GJO facility from DOE to the Riverview Technology Corporation, including Terms and Conditions for Sale No. 7-B-CO-463 B], Grand Junction Office, Grand Junction, Colorado, not finalized.

U.S. Environmental Protection Agency, no date. *Institutional Controls and Transfer of Property under CERCLA Section 120(h)(3)(A), (B), or (C).*

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DOE Orders

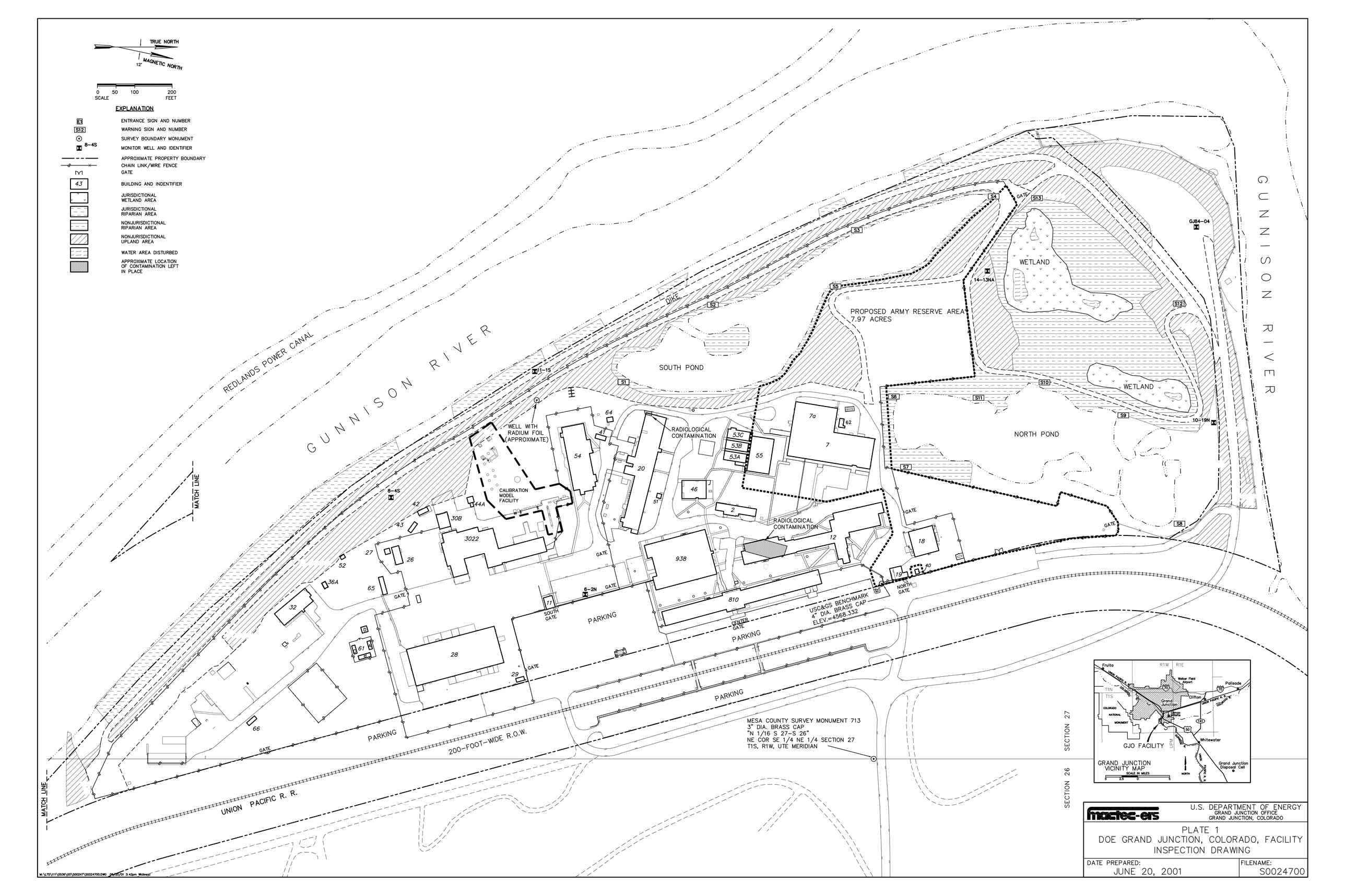
Order 232.1, "Occurrence Reporting and Processing of Operations Information," October 30, 1995.
Order 414.1A, "Quality Assurance"
Order 1324.2A, "Records Disposition"
Order 5400.1, "General Environmental Protection Program," June 29, 1990
Order 5400.5, "Radiation Protection of the Public and the Environment," June 5, 1990

Code of Federal Regulations

10 CFR 40. "Domestic Licensing of Source Material"
40 CFR 192, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings"

Colorado Code of Regulations

5 CCR 1002-8, "Colorado Ground Water Standards"



U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION OFFICE
GRAND JUNCTION, COLORADO

PLATE 1
DOE GRAND JUNCTION, COLORADO, FACILITY INSPECTION DRAWING

DATE PREPARED: JUNE 20, 2001

FILENAME: S0024700

Appendix A
Legal Description of the GJO Facility and Real Estate Documentation

The property transferred by DOE to the Riverview Technology Corporation by quit claim deed (Records of Mesa County, Book ____, Page ___) is described as follows:

All that portion of Lot 1 lying West of the right-of-way of the Denver and Rio Grande Western Railroad Company, and all of lots 6 and 7, subject to right-of-way of the Denver and Rio Grande Western Railroad Company, all being in Section 27, Township 1 South, Range 1 West, Ute Meridian, Mesa County, Colorado containing 55.71 acres of land more or less, together with the private railroad spur thereon, and all rights and appurtenance thereto, also all water and water rights used thereon or appurtenant thereto, including the private line from artesian well, and all rights in connection therewith, and all buildings and improvements thereon as recorded in Book 415, Page 405;

And, that portion of G.L.O. Lot 1, Section 26, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado lying west of the right-of-way of the Denver and Rio Grande Western Railroad Company containing 1.14 acres of land more or less, as recorded in Book 668, Page 202;

Except: Parcel 1, located in G.L.O. Lot 7 of Section 27, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado containing 2.68 acres of land more or less as conveyed to A. N. Applebaum and recorded in Book 1606, Page 986; and

Except that portion to be reserved to the United States and called the Army Reserve Tract: containing 7.97 acres more or less;

This parcel then contains 46.20 acres calculated as follows: 55.71 acres (1943 Deed in Book 415, Page 405) plus 1.14 acres (Deed in Book 668, Page 202) - minus - 2.68 acres (Deed in Book 1606, Page 986) - minus - 7.97 acres (Army Reserve Tract to be recorded) equals 46.20 acres of land more or less.

(Note: book and page references refer to records of Mesa County, Colorado. The book and page reference for the quit claim deed will be inserted when that document is entered into the public records.)

Appendix B
Grand Junction Office Remedial Action Program
Final Reports

Final Report of the Decontamination and Decommissioning of the Exterior Land Areas at the Grand Junction Projects Office Facility, DOE/ID/12584-220, GJPO-GJ-13, Grand Junction Projects Office, Grand Junction, Colorado, September 1995.

Final Report of the Decontamination and Decommissioning of Building 1 at the Grand Junction Projects Office Facility, DOE/ID/12584-276, GJPO-GJ-36, Grand Junction Projects Office, Grand Junction, Colorado, August 1996.

Technical Basis for Radiological Release of Grand Junction Office Building 2, GJO-97-12-FOS, GJO-GJ-45, Grand Junction Projects Office, Grand Junction, Colorado, July 1997.

Final Report of the Decontamination and Decommissioning of Building 6 at the Grand Junction Projects Office Facility, DOE/ID/12584-254, GJPO-GJ-25, Grand Junction Projects Office, Grand Junction, Colorado, July 1996.

Closeout Report of the Decontamination and Decommissioning of the South Bay (Phase I) of Building 7 at the Grand Junction Office Facility, GJO-99-98-FOS, Grand Junction Office, Grand Junction, Colorado, April 1999.

Closeout Report of the Decontamination and Decommissioning of the Center and North Sections (Phase II) of Building 7 at the Grand Junction Office Facility, GJO-99-119-FOS, Grand Junction Office, Grand Junction, Colorado, December 1999.

Final Report of the Radiological Release Survey of Building 11 at the Grand Junction Office Facility, GJO-97-15-FOS, GJO-GJ-46, Grand Junction Projects Office, Grand Junction, Colorado, September 1997.

Final Report of the Decontamination and Decommissioning of Building 18 at the Grand Junction Projects Office Facility, DOE/ID/12584-278, GJPO-GJ-39, Grand Junction Projects Office, Grand Junction, Colorado, September 1996.

Final Report of the Radiological Release Survey of Building 19 at the Grand Junction Office Facility, GJO-97-16-FOS, GJO-GJ-47, Grand Junction Projects Office, Grand Junction, Colorado, September 1997.

Building 20 closeout documentation is pending.

Closeout Report of the Radiological Release Survey of Building 26 at the Grand Junction Office Facility, GJO-99-82-FOS, Grand Junction Office, Grand Junction, Colorado, January 1999.

Radiological Survey Map, Building 27, Grand Junction Office, Grand Junction, Colorado, March 1, 2000.

Closeout Report of the Decontamination and Decommissioning of Building 28 at the Grand Junction Office Facility, GJO-99-83-FOS, Grand Junction Office, Grand Junction, Colorado, January 1999.

Final Report of the Radiological Release Survey of Building 29 at the Grand Junction Office Facility, GJO-97-17-FOS, GJO-GJ-48, Grand Junction Projects Office, Grand Junction, Colorado, September 1997. (A final radiological release survey will be required when DOE-GJO vacates this building.)

Closeout Report of the Radiological Release Survey of Building 30 at the Grand Junction Office Facility, GJO-99-84-FOS, Grand Junction Office, Grand Junction, Colorado, January 1999.

Final Report of the Radiological Release Survey of Building 30B at the Grand Junction Office Facility, GJO-97-18-FOS, GJO-GJ-49, Grand Junction Projects Office, Grand Junction, Colorado, September 1997. (A final radiological release survey will be required when DOE-GJO vacates this building).

Final Report of the Decontamination and Decommissioning of Building 31 at the Grand Junction Projects Office Facility, DOE/ID/12584-257, GJPO-GJ-28, Grand Junction Projects Office, Grand Junction, Colorado, July 1996.

Closeout Report of the Decontamination and Decommissioning of Building 31A at the Grand Junction Office Facility, GJO-99-107-FOS, Grand Junction Office, Grand Junction, Colorado, September 1999.

Closeout Report of the Decontamination and Decommissioning of Building 32 at the Grand Junction Office Facility, GJO-2000-150-FOS, Grand Junction Office, Grand Junction, Colorado, July 2000. (A final radiological release survey will be required when DOE-GJO vacates this building.)

Closeout Report of the Decontamination and Decommissioning of Building 33 at the Grand Junction Office Facility, GJO-99-108-FOS, Grand Junction Office, Grand Junction, Colorado, September 1999.

Final Report of the Decontamination and Decommissioning of Building 34 at the Grand Junction Projects Office Facility, DOE/ID/12584-274, GJPO-GJ-34, Grand Junction Projects Office, Grand Junction, Colorado, August 1996.

Closeout Report of the Decontamination and Decommissioning of Building 35 at the Grand Junction Office Facility, GJO-99-109-FOS, Grand Junction Office, Grand Junction, Colorado, September 1999.

Final Report of the Decontamination and Decommissioning of Building 36 at the Grand Junction Projects Office Facility, DOE/ID/12584-275, GJPO-GJ-35, Grand Junction Projects Office, Grand Junction, Colorado, August 1996.

Closeout Report of the Decontamination and Decommissioning of Building 37 at the Grand Junction Office Facility, Grand Junction Office, Grand Junction, Colorado, July 1999.

Final Report of the Decontamination and Decommissioning of Building 39 at the Grand Junction Projects Office Facility, DOE/ID/12584-258, GJPO-GJ-29, Grand Junction Projects Office, Grand Junction, Colorado, July 1996.

Closeout Report of the Radiological Release Survey of Building 40 at the Grand Junction Office Facility, GJO-99-120-FOS, Grand Junction Office, Grand Junction, Colorado, November 1999.

Closeout Report of the Radiological Release Survey of Building 41 at the Grand Junction Office Facility, GJO-99-121-FOS, Grand Junction Office, Grand Junction, Colorado, November 1999.

Closeout Report of the Radiological Release Survey of Building 43 at the Grand Junction Office Facility, GJO-99-122-FOS, Grand Junction Office, Grand Junction, Colorado, November 1999.

Final Report of the Decontamination and Decommissioning of Building 44 at the Grand Junction Projects Office Facility, DOE/ID/12584-260, GJPO-GJ-30, Grand Junction Projects Office, Grand Junction, Colorado, July 1996.

Radiological Survey Map, Building 44A, DOE Grand Junction Office, Grand Junction, Colorado, January 19, 2000.

Closeout Report of the Decontamination and Decommissioning of Building 46 at the Grand Junction Office Facility, GJO-99-85-FOS, Grand Junction Office, Grand Junction, Colorado, January 1999.

Closeout Report of the Radiological Release Survey of Building 51 at the Grand Junction Office Facility, GJO-99-123-FOS, Grand Junction Office, Grand Junction, Colorado, November 1999.

Final Report of the Decontamination and Decommissioning of Building 52 at the Grand Junction Projects Office Facility, DOE/ID/12584-261, GJPO-GJ-31, Grand Junction Projects Office, Grand Junction, Colorado, September 1996.

Building 53C is occupied by Oak Ridge National Laboratory, which will be responsible for documenting that the structure can be released for unrestricted use.

Final Report of the Radiological Release Survey of Building 54 at the Grand Junction Office Facility, GJO-97-19-FOS, GJO-GJ-50, Grand Junction Projects Office, Grand Junction, Colorado, September 1997.

Building 55 is occupied by Oak Ridge National Laboratory, which will be responsible for documenting that the structure can be released for unrestricted use.

Final Report of the Radiological Release Survey of Building 56 at the Grand Junction Office Facility, GJO-97-20-FOS, GJO-GJ-51, Grand Junction Projects Office, Grand Junction, Colorado, September 1997.

Closeout Report of the Radiological Release Survey of Buildings 61A, 61B, and 61C at the Grand Junction Office Facility, GJO-2000-151-FOS, Grand Junction Office, Grand Junction, Colorado, July 2000. (A final radiological release survey will be required when DOE-GJO vacates these buildings).

Radiological Survey Map, Building 61D, DOE Grand Junction Office, Grand Junction, Colorado, January 19, 2000.

Radiological Survey Map, Building 64, DOE Grand Junction Office, Grand Junction, Colorado, January 19, 2000.

Radiological Survey Map, Building 65, Grand Junction Office, Grand Junction, Colorado, December 30, 1999.

Radiological Survey Map, Building 66, Grand Junction Office, Grand Junction, Colorado, December 29, 1999.

Closeout Report of the Radiological Release Survey of Building 810 at the Grand Junction Office Facility, GJO-2000-135-FOS, Grand Junction Office, Grand Junction, Colorado, January 2000.

Closeout Report of the Decontamination and Decommissioning of Building 938 at the Grand Junction Office Facility, GJO-2000-134-FOS, Grand Junction Office, Grand Junction, Colorado, January 2000.

Closeout Report of the Decontamination and Decommissioning of the Abandoned Septic Tanks at the Grand Junction Office Facility, GJO-2000-149-FOS, Grand Junction Office, Grand Junction, Colorado, June 2000.

Closeout Report of the Decontamination and Decommissioning of the Buried Utilities and Soil Under Pavement at the Grand Junction Office Facility, GJO-99-131-FOS, Grand Junction Office, Grand Junction, Colorado, July 2000.

Appendix C
Field Photograph Log

FIELD PHOTOGRAPH LOG

Page 1 of ___

Site: _____ Roll No.__ (of __)

Date: _____ Time of Day: Fm _____ To _____

Weather Conditions: _____

Film Data: Size _____ ISO _____ Exposures ____

Frame[a]	Azimuth[b]	PL No.[c]	Subject/Description
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			

Inspector: _____ _____

Signature Printed Name

[a]Adjusted to match frame number on negative.
[b]Declination angle:
[c]Photograph location number. Assigned when inspection report is written. See inspection report, Plate 1, for map of photograph locations.

FIELD PHOTOGRAPH LOG

Site: _____ Roll No. ___ (of ___)

Date: _____ Time of Day: Fm _____ To _____

Weather Conditions: _____

Film Data: Size _____ ISO _____ Exposures ____

Frame[a]	Azimuth[b]	PL No.[c]	Subject/Description
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			

Inspector: _____ _____

Signature Printed Name

[a]Adjusted to match frame number on negative.
[b]Declination angle:
[c]Photograph location number. Assigned when inspection report is written. See inspection report, Plate 1, for map of photograph locations.

Appendix D
Routine Site Inspection Checklist

Inspection Checklist
Routine Site Inspection

Site: U.S. Department of Energy Grand Junction Office Facility

Date Prepared:

Date of Inspection:

Type of Inspection: Routine Inspection

I. General Instructions

A. This inspection checklist incorporates general and site-specific requirements for routine inspections of the subject site. Routine inspections typically will be conducted once every 12 months.

This checklist may be revised in response to new requirements, as dictated by results of previous inspections and maintenance requirements, or as new information about the site is received.

B. The purpose of the checklist is to support

- Planning for the inspection
- Inspection of the site
- Evaluation of the completeness of the inspection before the inspection party leaves the site
- Preparation of the inspection report
- Evaluation of site regulatory compliance and institutional controls effectiveness

C. This checklist is provided for the convenience of those planning and conducting the inspection. Other information, materials, or guidance may be used in place of or in addition to the checklist if site conditions or institutional requirements warrant.

II. Preparation for the Inspection

A. Review inspection guidance documents:

- *Guidance for Implementing the Long-Term Surveillance Program for UMTRA Project Title I and Title II Disposal Sites* (DOE 2001b).
- *Long-Term Surveillance Plan* [LTSP] *for the DOE Grand Junction Grand Junction Office Facility near Grand Junction, Colorado* (June 2001).

B. Review previous inspection reports, field notes from previous inspections, maps and drawings of the site, and other documents as necessary to become familiar with site history, current conditions at the site, and the results of recent inspections and maintenance. Obtain copies of maps, plans, and other documents required for the inspection, including but not limited to:

- Pertinent documents from the site file, such as the *Final Report of the Decontamination and Decommissioning at the Exterior Land Areas at the Grand Junction Projects Office Facility*
- Other GJORAP final reports for individual buildings
- Institutional controls and transfer agreements

Review site access procedures and protocols. Complete actions required to enter the site.

Notify affected agencies.

C. Review specific observations to be made and problems to be studied or resolved during the coming inspection. (See Subsection E of this Section.)

D. Assemble and pack field equipment required for the inspection of the GJO facility:

- Camera
- Spare batteries
- Camera accessories
- Film, three rolls of 36-exposure (or equivalent) color print film
- Photograph scale/north arrow
- Brunton compass
- 50-foot tape
- 10- to 20-foot tape
- Covered clipboard
- Canteens or other provision for water in hot weather
- Sun protection
- Field photograph forms
- Hand-held level
- Orange field notebook
- Black, indelible, felt-tip marker with broad point
- Bolt cutters
- First aid kit
- Sign board

E. General Surveillance

1. Specific Site-Surveillance Features

- Survey monuments (2)
- Warning signs around the bodies of surface water (13) and monument near the sealed well containing radium foil.
- Monitor wells (6)

2. Transects

- RTC site interior, including the affected interior areas of Buildings 12 and 20, the radium foil well; the South Pond, North Pond, wetland areas, and site surveillance features
- Outlying areas up to 0.25 mi (0.4 km) outside the site property

For all transects:

- Condition of site surveillance features
- Evidence of ground water or surface water usage

Area Within 0.25 mi (0.4 km) of the site

- Change in land use
- New construction or development
- Earth movement, erosion, or changes in nearby drainages

3. Maintenance

III. Site Inspection

A. The checklist is not intended to be exhaustive or constraining. The inspection team is free to exercise judgement to make other observations as site conditions warrant.

B. Before the inspection of the site is completed and before the inspection team leaves the site, the inspection team should ensure that inspection objectives have been attained, the site has been fully inspected and evaluated, and that sufficient photographs and measurements have been obtained.

C. Regulated Materials: Look for floor penetrations or exterior excavations in or near the affected portions of Buildings 12 and 20. Check for indication of surface water or ground water use.

D. Health and Safety

Review site conditions before entering site. Known hazards at this location include the following:

The dike and river bank area, especially during peak run off
Asbestos present in pipe lagging, transite building materials, flooring, acoustic insulation, putty, and other occurrences
Confined spaces
Contaminated ground and surface water
PCB-containing light ballasts
On-site traffic
Poisonous plants, insects, and reptiles

The GJO facility site is usually hot and dry in summer and cold and dry in winter. Occasional thunderstorms occur in late summer and light snows occur in winter. Personnel should make provisions for the following seasonal conditions:

Summer:

- Sun protection (a hat is advised).
- Drinking water (personal canteens recommended)
- Rain gear

Winter:

- Warm clothing, preferably layered.

Safety shoes are not required at this site. However, sturdy boots with high ankle support are recommended.

Emergency contacts and phone numbers for the GJO facility are as follows:

- Emergency Medical Service/Ambulance
  911

- Fire
  911

- Sheriff/Police
  (970) 242-6707 Mesa County Sheriff
  (970) 248-7277 or 911 for Colorado State Police

- Colorado Department of Public Health and Environment
  (970) 248-7164

Inspectors should locate the nearest telephone before commencing inspection activities.

Directions from the site to St. Mary's Hospital are as follows:

- From the GJO facility proceed up the hill past the cemetery, follow the road around to the left to the traffic light at Highway 50.
- Turn left and cross the Colorado River and the railroad tracks, continue straight on 5th Street through downtown and across North Avenue, past the High School to the stop sign at Orchard Avenue.
- Turn right onto Orchard Avenue, proceed to the traffic light at 7th Street.
- Turn left onto 7th Street, look for the sign about 3 blocks up on the left indicating the emergency entrance to the hospital.

IV. Inspection Closeout Summary

A. At the end of the inspection and before leaving the site, the inspection team should:

1. Satisfy itself that it has sufficient information (photographs, notes, measurements, sketches, etc.) to describe and evaluate findings and observations for the site inspection report.

2. Summarize, in the field notes or elsewhere, the following information:

   - Serious problems or threatening factors that require immediate attention or follow-up action;
   - Actual or potential problems not requiring immediate attention but that require further observation possibly including a follow-up inspection; and
   - Changes recommended for this checklist before the next inspection.

B. If serious problems are identified during the inspection, the inspection team should:

1. Immediately notify the DOE-GJO Project Manager (248-6037) and the Contractor LTSM Project Manager (248-6568).

2. Follow GJO procedures for compliance with DOE Order 232.1, "Occurrence Reporting and Processing of Operations Information."

C. Reporting.

Describe pertinent changes to site conditions, results of institutional controls evaluation, and evaluation of regulatory requirements for this site. Note that table value standards are derived on the basis of background water analysis results, and that other water quality limits can change frequently. LTSM Program personnel reviewing water analysis results are advised to confirm current water quality standards.

Appendix E
Institutional Controls

The following institutional controls were included in the transfer documents conveying a portion of the GJO facility to the Riverview Technology Corporation. Institutional controls addressing water use restrictions on the Army Reserve area will be added when those agreements are finalized.

1. Contamination in Ground Water and Surface Expressions of Ground Water

Contamination: The ground water underlying the site and the surface expressions of the ground water (the North Pond, South Pond, and wetland areas) are known by both parties to be contaminated with elevated levels of certain constituents resulting from the historical stockpiling of uranium ore and the disposal of process wastes from milling and concentrating activities. Following removal of the source of contamination, the accepted remedial action for eliminating the contamination is the natural flushing of the ground water over a period of 50 to 80 years (anticipate to be within regulatory standards between the years 2050 and 2080). Risk assessments performed concluded that the contaminants posed a threat to human health only if ingested by drinking the water.

Restriction: Grantee shall not engage in any disturbance or use of any untreated ground water underlying the Property, including the drilling of wells, the excavation of soils that expose ground water, or the diversion of ground water through any means without express written consent of the State of Colorado Department of Public Health and Environment (CDPHE) and the Grantor, its successors or assigns. This also includes, but is not limited to, restrictions on excavation of the underlying soils for their gravel content. Any request for consent to disturb or use any untreated ground water underlying the Property must include water quality data and a human health and ecological risk evaluation.

Grantor will construct signs at the South Pond, North Pond, and wetland areas to notify the public that no swimming, fishing, or drinking of the waters is permitted. Grantee and successors must maintain the signs until the State of Colorado approves the removal of the notification signs. Grantor will continue to monitor the water quality of the ponds and, when the water quality meets State standards, request the State to approve removal of the notification signs.

Grantee shall not engage in any use of the surface expressions of ground water that might result in accidental consumption of the water, fish, or other aquatic species. This includes, but is not limited to, restrictions on fishing, swimming, activities that result in prolonged human contact with the water, hatchery operations for production of fish or other aquatic species for human consumption, and other recreational uses.

2. Building 12 Soil Contamination

Contamination: Grantor acknowledges that there is known contamination on the Property underlying the south end of Building 12 (see Exhibit D); and covenants to remain solely responsible for the complete decontamination of these conditions, as well as any later–discovered contamination. The contamination, believed to be the residue of a stockpile of uranium ores, poses a potential threat of radioactive exposure to individuals excavating the soils. There is no threat to persons occupying the building and conducting routine business activities, nor is there any indication the residual contamination is impacting the ground water.

Restriction: Grantee shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the south end of Building 12. Grantor is required to remediate all contamination under and around Building 12 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 12 as the most cost-effective process to complete the remedial action and hereby agrees to accept this remediation approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building.

3. Building 20 Soil Contamination

Contamination: Grantor acknowledges that there is known contamination on the Property beneath the southwest corner of Building 20 (see Exhibit D); and covenants to remain solely responsible for the complete decontamination of the soils. The contamination, believed to be from mill tailings used as fill material to raise the elevation of a pond bank prior to erection of the building, poses a potential threat to individuals excavating the soils from exposure to radioactive materials. There is no threat to persons occupying the building and conducting routine business activities, nor is there any indication the residual contamination is impacting the ground water.

Restriction: Grantee and its assigns shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in disturbance of soils or structures underlying the south end of Building 20. Prior to altering the structural integrity of the floor at the south end of Building 20, such permission must be obtained. When Grantor decides to vacate the building, Grantor will demolish the building and remediate contaminated materials beneath the building to within regulatory limits.

4. Foil Sources in Abandoned Well

Contamination: Grantee acknowledges that there is known contamination in the form of two foil radium sources encased in an abandoned well at the site (see Exhibit D for location). The well was abandoned in accordance with State of Colorado requirements and the sources were encased in the well with the approval of the state.

Restrictions: Grantee shall not engage in any activity that disturbs the seal on the well encasement or the well itself without the express written consent of CDPHE and the Grantor.

5. Enforceable Agreement

Grantor has entered into an enforceable agreement with CDPHE in accordance with State of Colorado Executive Order D.013.98 and CERCLA 120(h). The agreement establishes the Grantor's clean-up plans for the above (with the exception of C.4 [the well with radium foil sources]), reiterates the land use controls placed upon the Grantee and successors, specifies the monitoring of contaminated areas by the Grantor, and provides a funding mechanism for the Grantor to reimburse CDPHE for oversight activities.

6. Grantee's Responsibilities

Grantee is responsible for assuring that the restrictions and Grantor's rights of access related to the above and stated in this Agreement and in the Deed, are stated in the instrument of conveyance if Grantee passes ownership to another entity. Grantee is responsible for notifying Grantor's Long Term Surveillance and Maintenance Program of such transfer. Grantee acknowledges its landlord responsibilities to monitor tenants' activities to assure protection of Building 12 and 20 floors, to allow for safe soil excavation on the Property, to protect the abandoned well identified above, and to be protective of Grantee's remaining ground water monitoring wells.

Grantee acknowledges that planned use of the Property is for a mixture of commercial, industrial, office space, and open space, as stated in Grantee's reuse plan. Grantee's planned use is not restricted except as herein noted.

Long-Term Surveillance and Maintenance Program

Ground Water, Surface Water, and Sediment Compliance Action Plan for the U.S. Department of Energy Grand Junction, Colorado, Office Facility

June 2001

Prepared by
U.S. Department of Energy
Grand Junction Office
Grand Junction, Colorado

Work Performed Under DOE Contract Number DE-AC13-96GJ87335
Task Order Number MAC 00-06
Document Number S0047400

Contents

Figures

Tables

1.0 Introduction

The purpose of this Ground Water, Surface Water, and Sediment Compliance Action Plan is to summarize the ground water protection compliance strategy for the U.S. Department of Energy (DOE) Grand Junction Office (GJO) facility in Colorado. Past activities at the GJO facility resulted in contamination of ground water in the shallow alluvial aquifer beneath the site and surface water in ponds and the wetland areas on the site. Conditions at the GJO facility were characterized and the Final Remedial Investigation/Feasibility Study was issued in 1989 (DOE 1989a). The preferred remediation alternative was complete removal of all contaminated materials and co-disposal with Uranium Mill Tailings Remedial Action (UMTRA) Project residual radioactive materials at the Grand Junction (also known as the Cheney) Disposal Site, in accordance with the GJO facility Record of Decision (DOE 1989b). Removal of uranium mill tailings and contaminated soil from the site begin in late 1989 and was completed in June 1994. Some radioactive materials remain on the GJO facility and are managed by DOE.

2.0 Ground Water Compliance

The compliance strategy for ground water protection in the uppermost aquifer (alluvial aquifer) at the GJO facility is natural flushing with continued monitoring. This is based on contaminant transport modeling described in Section 4.3.2 of the Remedial Investigation (DOE 1989a) predicting that the shallow alluvial aquifer would flush itself of contaminants in 50 to 80 years after contaminated soils and tailings were removed, which is within compliance of the 100-year cleanup period specified in Title 40, Code of Federal Regulations, Part 192 (DOE 1989b). This compliance strategy will be implemented in conjunction with continued ground water and surface water monitoring, and institutional controls.

Description of site conditions, ground water and surface water contamination, potential human health and environmental risk, and the applicability of natural flushing are summarized below. Features of the GJO facility are shown in Figure 1. Detailed information is available in the referenced site documents.

2.1 Site Conditions

Shallow ground water occurs under unconfined conditions in the alluvial aquifer beneath the GJO facility. The alluvial deposits are approximately 30 feet thick and overlie bedrock units of the Jurassic Morrison Formation (aquitard). Ground water ranges in depth from 5 to 10 feet beneath the surface, and generally flows to the north. The hydraulic conductivity of the alluvial aquifer is approximately 40 feet/day, based on an aquifer pumping test performed at the site. Recharge to the alluvial aquifer occurs mainly through fluctuations in the Gunnison River and, to a much lesser extent, precipitation. Ground water discharges into the Gunnison River along the north and west boundaries of the facility.

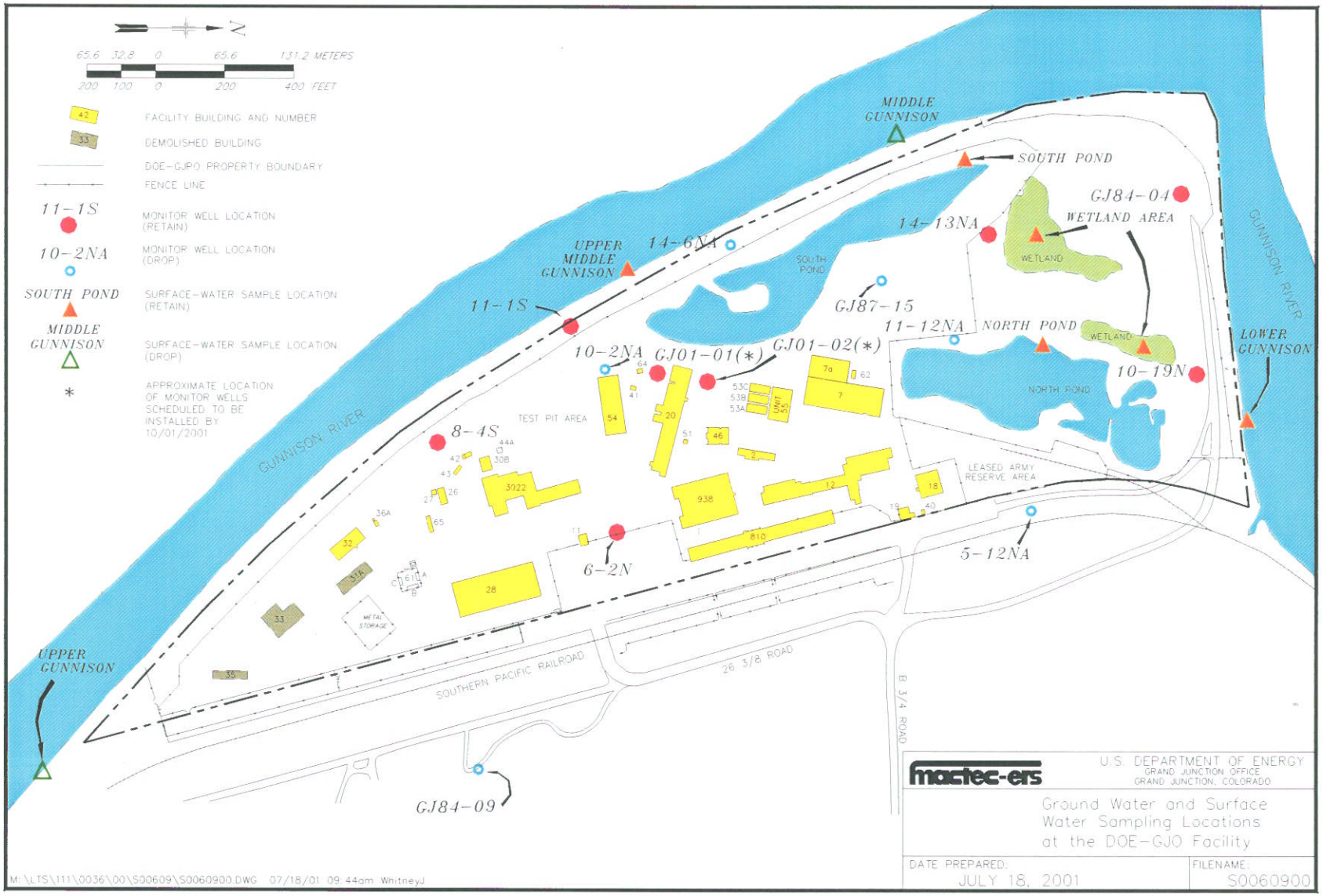


Figure 1. Ground Water and Surface Water Sampling Locations at the DOE-GJO Facility

Surface water exists at the GJO facility in the North Pond, South Pond, wetland areas, and the Gunnison River. There is interaction between ground water in the alluvium and surface water in the Gunnison River and in the ponds and wetland areas on the site.

2.2 Ground Water and Surface Water Contamination

Past activities at the GJO facility resulted in contamination of ground water in the alluvial aquifer beneath the site and on-site surface water. Removal of uranium mill tailings and contaminated soil from the site began in late 1989 and was completed in June 1994. The constituents of concern (COC) in ground water which exceed regulatory standards are arsenic, molybdenum, selenium, radium, and uranium. COCs for surface water are chloride, sulfate, pH, chromium, manganese, and uranium.

Ground water quality data for the COCs have been plotted to show trends over time (DOE 2000a). Uranium is the principal COC in ground water, and as a conservative species is considered representative of current migration of site-related contaminants in ground water in the alluvial aquifer. Uranium in ground water plotted versus time from 1982 through 1998 shows concentrations generally above the maximum concentration limit (MCL) (30 picocuries per liter [pCi/L] for combined uranium-234+238 activity), but an overall decrease indicating that natural flushing is occurring in the alluvial aquifer (Figure 2). Uranium is reported as an activity in pCi/L to be consistent with the Site Environmental Report (DOE 2000d).

Concentrations of uranium, molybdenum, arsenic, and selenium (radium was consistently below the MCL) in ground water were plotted from January 1992 to June 1998, which shows the period during and after surface remediation (Figure 3 and DOE 2000a). Results for uranium and molybdenum show consistently decreasing concentrations in ground water at most locations. Migration of arsenic and selenium tends to be more retarded in ground water and thus trends are not yet obvious (DOE 2000a). Also, selenium occurs naturally in ground water in the Grand Junction area and elevated concentrations are not necessarily site-related.

Surface water quality in the Gunnison River and from North and South Ponds and the wetland area was also plotted to show trends over time (Figure 4). Total uranium (uranium-234+235+238 in pCi/L) in surface water plotted versus the same time period as for ground water also shows a decrease in concentrations. Uranium concentrations in the ponds and wetland area are similar to those in ground water, which is expected, since the surface water is connected to and recharged by ground water. Concentrations of total uranium in the Gunnison River have consistently been below the MCL at all sampling points. Only uranium in surface water was plotted as trends of other COCs are expected to be similar to ground water concentrations.

2.3 Human Health and Environmental Risk

There do not appear to be any unacceptable risks to human health and the environment from contaminated ground water and surface water at the GJO facility as long as institutional controls are in effect. Ground water modeling predicts concentrations of COCs will decrease to below standards within 50 to 80 years, and observation of water quality data indicates that concentrations are decreasing as predicted.

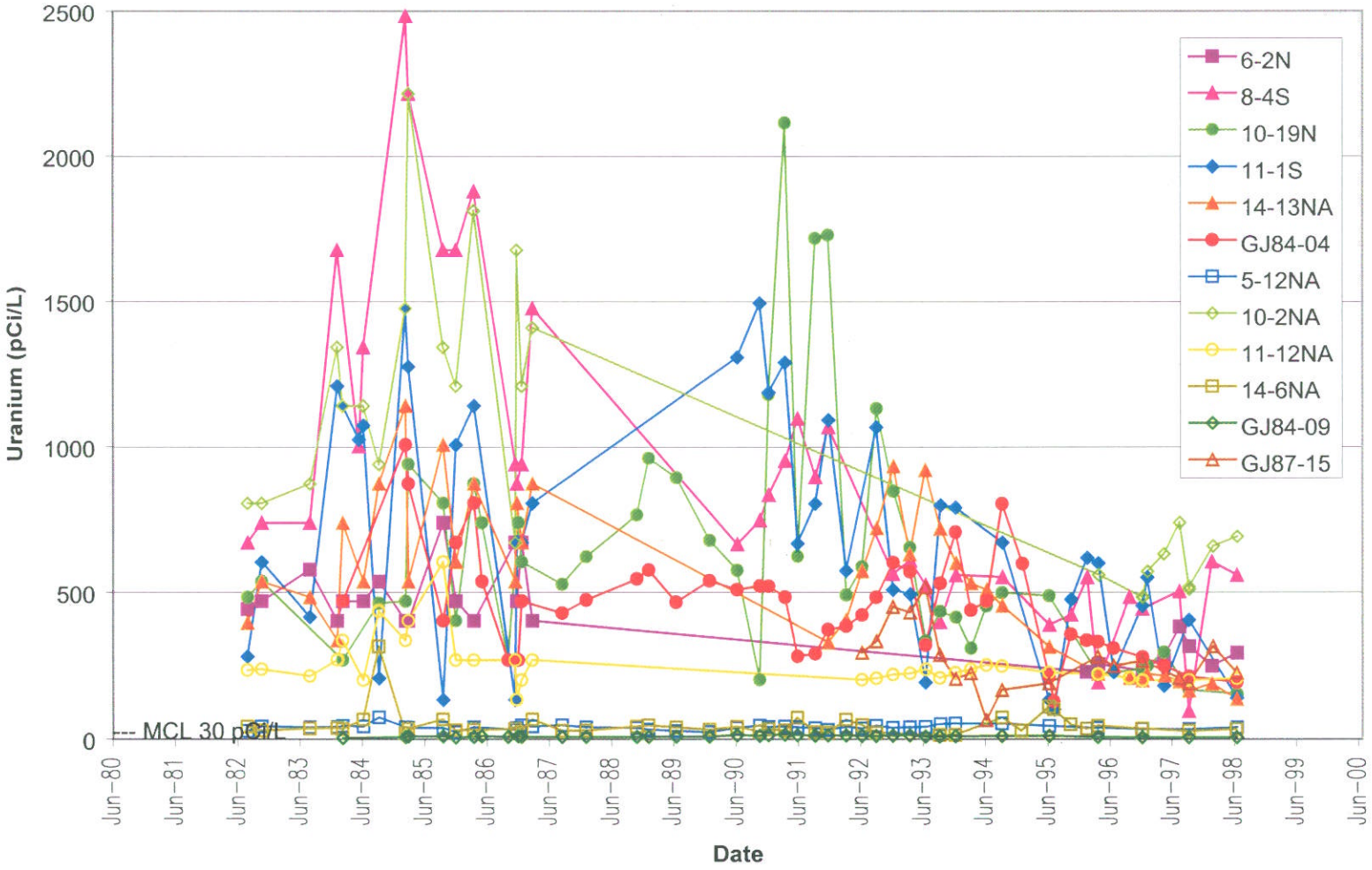


Figure 2. Uranium in Ground Water – 1982 through 1998

Grand Junction Office Facility

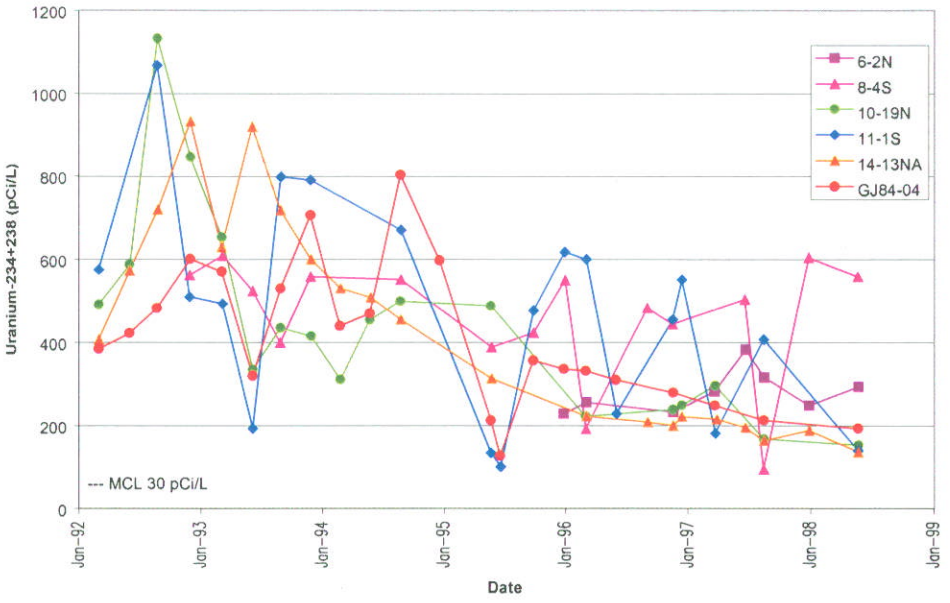


Figure 3. Uranium in Ground Water – 1992 through 1998, Grand Junction Office Facility

2.4 Applicability of Natural Flushing

The results of ground water flow and transport modeling indicate that once the sources of uranium are removed the aquifer should clean itself to the State of Colorado standard for uranium in 50 to 80 years (DOE 1989a). All other contaminants are assumed to be less mobile than uranium and therefore will be removed from the ground water either by natural sorptive processes, precipitation, or discharge into the Gunnison River. Thus, the 50 to 80 years predicted for the aquifer to flush itself is a conservative estimate that applies to all COCs (DOE 1989b).

Based on predictions and observations to date the natural flushing compliance strategy in conjunction with institutional controls and continued monitoring will be protective of human health and the environment.

3.0 Implementation

The ground water protection compliance strategy of natural flushing at the GJO facility will be implemented in conjunction with ground water and surface water monitoring and institutional controls. Reporting requirements, quality assurance, and health and safety procedures will be carried out in accordance with DOE orders, regulations, codes, and standards, as specified in the Long-Term Surveillance Plan (LTSP) (DOE 2000c).

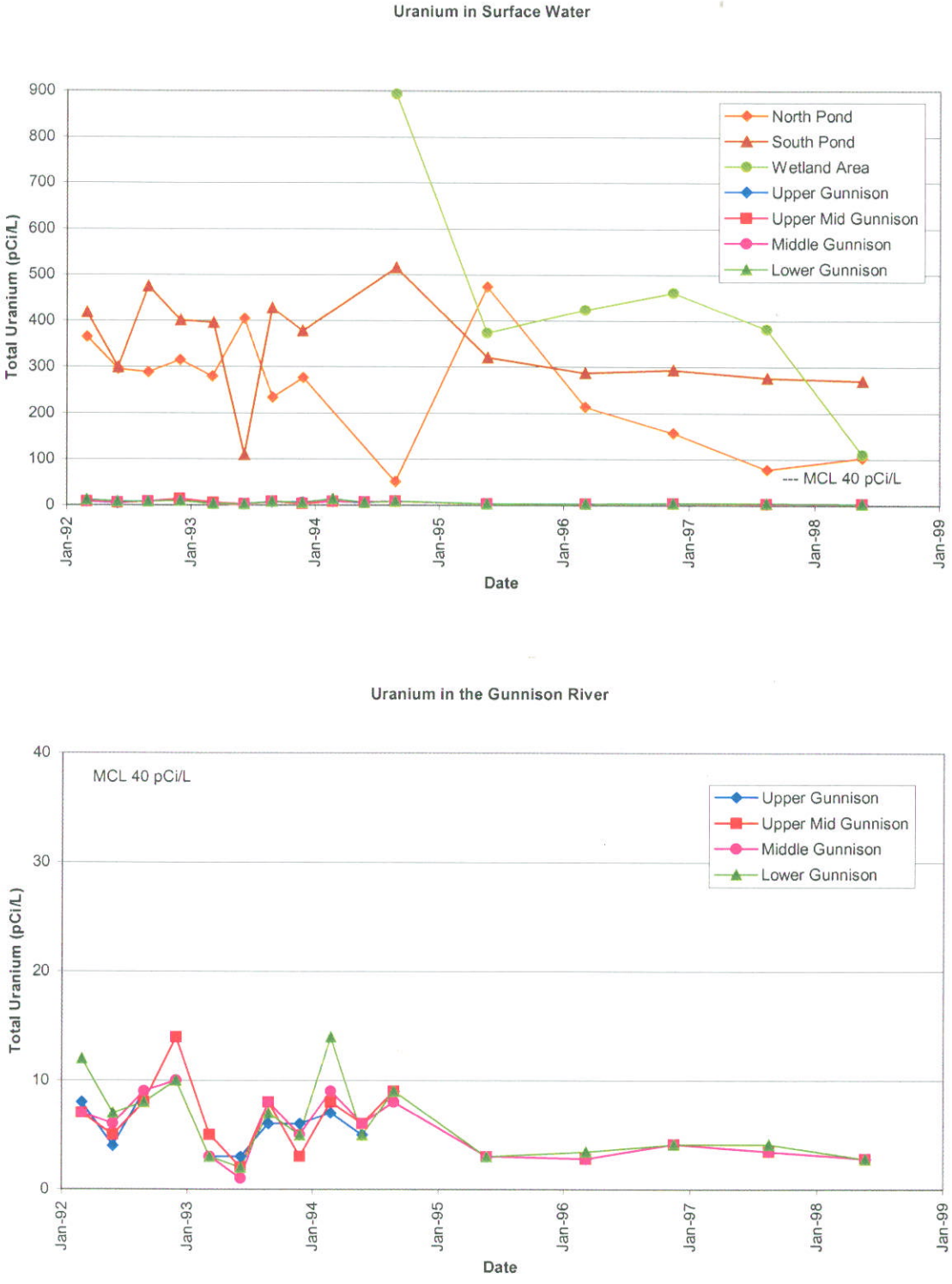


Figure 4. Uranium in Surface Water
Grand Junction Office Facility

3.1 Monitoring

The objectives and regulatory requirements for ground water and surface water monitoring at the GJO facility are specified in the *Ground Water Protection Management Program Plan* (GPMP) (DOE 1999c) and the *Environmental Monitoring Plan* (EMP) (DOE 1999b). Many of the objectives of the GPMP have been met and currently the program is dedicated primarily to overseeing site activities and monitoring ground water quality to ensure continued compliance and to evaluate the effectiveness of natural flushing. Requirements for surface water and ground water environmental surveillance are shown in Tables 4-1 and 5-1, respectively, in the EMP (DOE 1999b).

A monitoring program has been in place since the early 1980s to assess contamination and demonstrate post-remediation cleanup of ground water. Ground water and surface water will continue to be sampled from representative locations. COCs and standard water quality indicators will be analyzed to assess the progress and viability of the natural flushing compliance strategy. The State of Colorado is the primary regulator for ground water and surface water compliance at the GJO facility. Site ground water is regulated under State of Colorado Title 5 *Code of Colorado Regulations* Part 1002-8 (5 CCR 1002-8), "Basic Standards for Ground Water" and 40 CFR 192. Site surface water is regulated under 5 CCR 1002-8, "Classifications and Numerical Standards for the Gunnison and Lower Dolores River Basins."

3.1.1 Ground Water Monitoring

The ground water monitoring network consists of 6 monitor wells (8-4S, 11-1S, 6-2N, 14-13NA, GJ84-04, and 10-19N) that are distributed onsite and along the downgradient edges of the facility near the Gunnison River (Figure 1). Monitor wells in the alluvium are screened above the bedrock contact at depths of 30 feet or less. This network provides adequate information to track the progress of natural flushing and to ascertain that there is no potential impact to human health and the environment. Ground water samples have been collected from 12 monitor wells through 1999 (DOE 2000d). Based on a recent review of existing water quality data the monitor well network was reduced to the 6 wells shown above, which were determined to provide representative data to fulfill the objectives of the monitoring program (DOE 2000a). The remainder of the monitor wells at the GJO facility have been decommissioned.

The analytes to be monitored in ground water during each sampling event include the COCs and other constituents that may be useful in assessing site conditions and compliance with standards (Table 1). These were identified on the basis of historical monitoring results and the ecological and human health risk assessment (DOE 2000e). Many other constituents have been analyzed in the past and have been deleted from the list because they have historically been below regulatory limits or concentrations co-vary with the selected analytes and are not required to assess the progress of natural flushing (DOE 2000a and 2000d). Chemical uranium is selected instead of isotopic uranium analyses because the uranium isotopes at the site have been shown to be in relative natural abundance and no processes were implemented at the GJO facility that would cause significant preferential movement of a given isotope to occur (DOE 2000a). In addition to these analytes, standard water quality indicators (pH, alkalinity, conductivity, temperature, and turbidity) will be measured during each sampling event.

Table 1. Analytes to be Monitored in Ground Water and Surface Water at the GJO Facility

Analyte	Basis for Analyte Selection		
	Exceeds Regulatory Limit	Poses Ecological Risk	Poses Human Health Risk
Arsenic	X		X
Chloride	X		
Chromium	X		
Gross Alpha	X		
Magnesium		X	
Manganese	X	X	X
Molybdenum	X	X	X
Nitrate	X		
Selenium	X		
Sulfate	X		X
Total dissolved solids	X		
Uranium	X	X	X

DOE will conduct the monitoring program on an annual basis at the same time every year so that seasonal fluctuations in ground water can be minimized. Evaluation of previous sampling events indicates that elevated contaminant levels are most prevalent during the winter months. This would reflect low-stream flow and aquifer recharge conditions when concentrations of COCs would tend be elevated. Through 1999 samples were collected at a 9-month sampling frequency to allow an annual assessment of compliance with ground water standards and to allow for seasonal fluctuations in contaminant concentrations (the schedule resulted in four sampling rounds over a 3-year period). At the request of the State of Colorado, DOE will conduct the monitoring program at the same time every year so that seasonal fluctuations in ground water can be minimized.

The LTSM Program will conduct ground water monitoring at the GJO facility annually for a minimum period of 5 years (through 2005). At the end of this period DOE will evaluate monitoring results in consultation with the State of Colorado to determine the requirements for future monitoring at the site. Criteria for modifying or terminating ground water and surface water monitoring will be (1) continued decrease in concentrations of COCs as predicted and observed, (2) compliance with regulatory limits, and (3) no unacceptable risks to human health and the environment resulting from site-related contamination. Modification may include changing or adding additional sample locations or changing the suite of analytes. DOE will receive approval from the State of Colorado prior to modification or termination of monitoring.

Evaluation of data trends from previous ground water monitoring indicates that concentrations of COCs may vary between sampling events and are not consistently lower than the previous sampling event (DOE 2000a). These short-term variations are anticipated, but the long-term trends are of significance in the overall assessment of compliance with the ground water protection standards. Statistical methods for evaluation of ground water monitoring data will be

used as appropriate to assess variations in concentrations of COCs over time. Examples of statistical methods are found in 6 CCR 1007-3, Subpart F, 264.97(h). Monitoring and assessment of water quality data will continue until there is reasonable assurance that the compliance objectives have been met. If results of water quality sampling over time indicate that ground water may not be cleaning up as predicted, the ground water flow and transport modeling may be revised and the compliance strategy reevaluated.

3.1.2 Surface Water Monitoring

Surface water at the GJO facility is in direct hydraulic contact with the ground water in the alluvial aquifer. Consequently, surface water on the GJO facility (North Pond, South Pond, and wetland areas) exhibits elevated levels of uranium in response to recharge by the alluvial aquifer. On-site surface water also exhibits elevated levels of chloride, sulfate, manganese, chromium, and pH. Additional verification sample locations may be needed to demonstrate site-wide compliance with applicable standards, including addition of sample locations in the property interior. The Gunnison River has been sampled to determine the quality of the water flowing into the aquifer and to detect any degradation of downstream reaches of the river as a result of contaminants flushing out of the alluvial aquifer.

The surface-water monitoring network includes two locations in the Gunnison River, and one location each in the North Pond, South Pond, and wetland areas (Figure 1). This monitoring will provide adequate information to demonstrate that contaminated ground water discharging from beneath the site does not degrade water quality in the Gunnison River and to assess the natural flushing progress and identify any potential impact from elevated concentrations of the COCs in on-site surface water (DOE 2000a).

The analytes to be monitored in surface water during each sampling event are the same for ground water (Table 1). Surface water quality must comply with the water quality standards for the Gunnison River found at 5 CCR 1002-8. The frequency and duration of surface-water monitoring will be the same as for the ground water monitoring. Trend analyses will be performed on surface water sampling results in conjunction with analysis of ground water sampling results.

3.1.3 Sediment Monitoring

Baseline data have not been collected on sediments of the North Pond, South Pond, and wetland areas. In 2001, DOE will conduct sampling to establish baseline chemistry data for pond and wetland area sediments. These locations will be sampled again when ground and surface water complies with regulatory limits to verify that pond and wetland area sediments also comply with applicable limits. Sample locations will be selected to represent worst case and average conditions (e.g., deep water, near shore, and intermittently inundated areas). Analytes will include arsenic, chloride, total chromium, gross alpha, magnesium, manganese, molybdenum, nitrate, selenium, sulfate, total uranium, and isotopic uranium. On the basis of the initial results, DOE will revise the LTSP to present sampling locations and results, and, if necessary, invoke a program for further sediment monitoring.

DOE sampled the North Pond on 100-feet centers in 1986 and 1994 for radiological constituents, and sediments did not exceed regulatory limits (DOE 1995). The earth materials beneath the South Pond and wetland areas were remediated and verified to comply with regulatory limits. The excavations were backfilled with clean material. No excavation has occurred in the North Pond.

3.2 Institutional Controls

Institutional controls have been applied to the GJO facility to prevent inadvertent exposure to contaminated media. The controls include restrictions on the use of ground water, surface water, and aquatic life in the ponds and wetland areas. The controls and obligations of involved parties are defined in deed restrictions that are attached to the deed and title and recorded in the Records of Mesa County. These institutional controls will survive subsequent property transfers and will be monitored by the LTSM Program and enforced by the Colorado Department of Public Health and Environment (CDPHE) via CERCLA authority, as described in an Enforceable Agreement between DOE and the agency.

To prevent exposure to contaminated ground and surface water, the LTSM Program will notify owners through deed restrictions and annual reports of water quality and of prohibitions against water use; maintain warning signs around the ponds and wetland areas; and inspect the site annually and access state records for well permit information. Controls prohibiting use of site ground water and surface water will remain in effect until water quality complies with regulatory limits. Effectiveness of the institutional controls will be verified by the LTSM Program activities.

4.0 References

U.S. Department of Energy (DOE), 1989a. *Final Remedial Investigation/Feasibility Study Report for the U.S. Department of Energy Grand Junction (Colorado) Projects Office Facility*, UNC/GJ-GRAP-1, April.

———, 1989b. *Declaration for the Record of Decision and Record of Decision Summary* for the Grand Junction Projects Office Remedial Action Project , April.

———, 1995. *Final Report of the Decontamination and Decommissioning of the Exterior Land Areas at the Grand Junction Projects Office Facility*, DOE/ID/12584-220, GJPO-GJ-13, September.

———, 1999a. *Site Environmental Report for Calendar Year 1998* for the U.S. Department of Energy Grand Junction Office, GJO-99-106-FOS, September.

———, 1999b. *Environmental Monitoring Plan* for the Grand Junction Office Facility Remedial Action Project, GJO-99-125-FOS, Revision 3, October.

———, 1999c. *Ground Water Protection Management Program Plan* for the U.S. Department of Energy Grand Junction Office, GJO-99-126-FOS, November.

———, 2000a. *Grand Junction Office Facility (GJO) Evaluation of Ground Water and Surface Water Monitoring for LTSM*, Internal Technical Report, January.

———, 2000b. *Final Environmental Assessment for the Transfer of the Department of Energy Grand Junction Office to Non-DOE Ownership*, DOE/EA-1338, April.

———, 2000c. *Long-Term Surveillance Plan for the U.S. Department of Energy Grand Junction, Colorado, Office Facility*, Document Number S00231AC, GJO-2000-145-TAR, September.

———, 2000d. *Site Environmental Report for Calendar Year 1999* for the U.S. Department of Energy Grand Junction Office, GJO-2000-158-FOS, September.

———, 2000e. *Request for Deferral of Remedial Action*, (includes a human health and ecological risk assessment), U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, draft.

Reuse Plan for the Former DOE Grand Junction Office Facility

Riverview Technology Corporation

The Riverview Technology Corporation (RTC) is negotiating to acquire, from the DOE, its Grand Junction Office Facility, consisting of 53.17 acres more or less, for the purposes of economic development. The existing Mesa County zoning is light industrial and the RTC has no plan to pursue zoning changes in the foreseeable future. The RTC is a non-profit entity created to represent the City of Grand Junction and Mesa County for the purpose of developing economic benefits associated with the existing DOE office.

Planned usage is for a mixture of commercial, industrial, office space and open space. The site would include manufacturing, research and development, technology applications, retail and wholesale sales, and office space associated with the above. It is likely that an environmental analytical chemistry laboratory would be located on the site. Planned tenants are the Western Colorado Business Development Corporation's operation of a small business incubator, DOE's Grand Junction Office that includes federal and contractor staff, and an un-named operator of the existing analytical laboratory. Future occupants may be governmental or private entities. Land use would be similar to existing uses on the site.

In the near term, open space would likely exist as is, but areas could be built upon for business expansion and new construction could also replace existing structures. However, in the long term, it is anticipated that if DOE should opt to not remain as a tenant, the buildings previously occupied would either be demolished and open space, such as a park, would be created; or, some redevelopment for light industrial/office type uses might occur.

Date: 9/27/00

Knute Knudson,
Chair, Riverview Technology Corporation

Doralyn B Genova

Date: Sept. 27, 2000

Doralyn Genova,
Mesa County Commissioner

Date: 11-7-2000

~~Janet Terry~~,
Grand Junction City Councilperson

Summary of Ecological Risk for the U.S. Department of Energy Grand Junction Office

Prepared by
U.S. Department of Energy
Grand Junction Office
Grand Junction, Colorado

Document Number S0047300

Ecological Risk

Introduction

This section addresses requirements of the Colorado Executive Order guidelines to evaluate both unrestricted use and reasonably anticipated uses as related to ecological risk. The purpose of an ecological risk evaluation is to assess the likelihood that adverse ecological effects are occurring or may occur as a result of exposure to contamination or other stressors (EPA 1992). At the Grand Junction Office (GJO), the key stressors are radionuclides and chemical contaminants. Because ecological risk assessment is an emerging science, little ecotoxicological data exist for most chemicals and their effects on ecological receptors. Evaluating the individual and synergistic effects of physical, chemical, and biological stressors (e.g., predation, drought, and disease) produces considerable uncertainty.

Ecological risk occurs in the presence of a source and a complete exposure pathway for ecological receptors. A simplified ecological risk scenario gives an overview of the ecological risk assessment process:

Source→	**Release→**	**Contaminated media→**	**Pathway→**	**Receptor→**	**Effect**
(mill tailings, RRM)	(into soil and ground water)	(ground water, surface water, and sediments)	(ingestion or absorption)	(plants and wildlife)	(no effect, mortality, or nonlethal effects)

Components of ecological risk assessment, such as media, contaminant concentrations, pathways, and receptors, have been evaluated since 1984 at the GJO site (DOE 2000). Although the GJO is not a CERCLA–regulated site, DOE has used applicable protocols outlined in EPA's guidelines for ecological risk assessment and DOE's screening-level guidance to evaluate ecological risks. In achieving compliance with state and federal regulations, and in evaluating risks posed by potential contaminants, DOE has consulted frequently with federal and state agencies, including the Army Corps of Engineers, U.S. Fish and Wildlife Service, Colorado Division of Wildlife, and the Colorado Department of Public Health and Environment.

Because the *Environmental Assessment for the Transfer of the Department of Energy Grand Junction Office to Non-DOE Ownership* (the site transfer EA, DOE 2000) and other documents describe the site setting, history, and affected environment, only information pertinent to ecological risk is discussed in this section.

Ecological Setting

The GJO is located in a relatively rural setting immediately south and west of the Grand Junction city limits and about 0.5 mile south of the confluence of the Gunnison and Colorado Rivers. Key ecological areas include the Gunnison River, which borders the site to the west, two ponds (the North and South Ponds), and a Corps of Engineers jurisdictional wetland within the GJO site boundary. These areas compose about 40 percent of the site acreage, which is currently designated recreational/open space. Figure 1 shows the location and size of these areas; the site

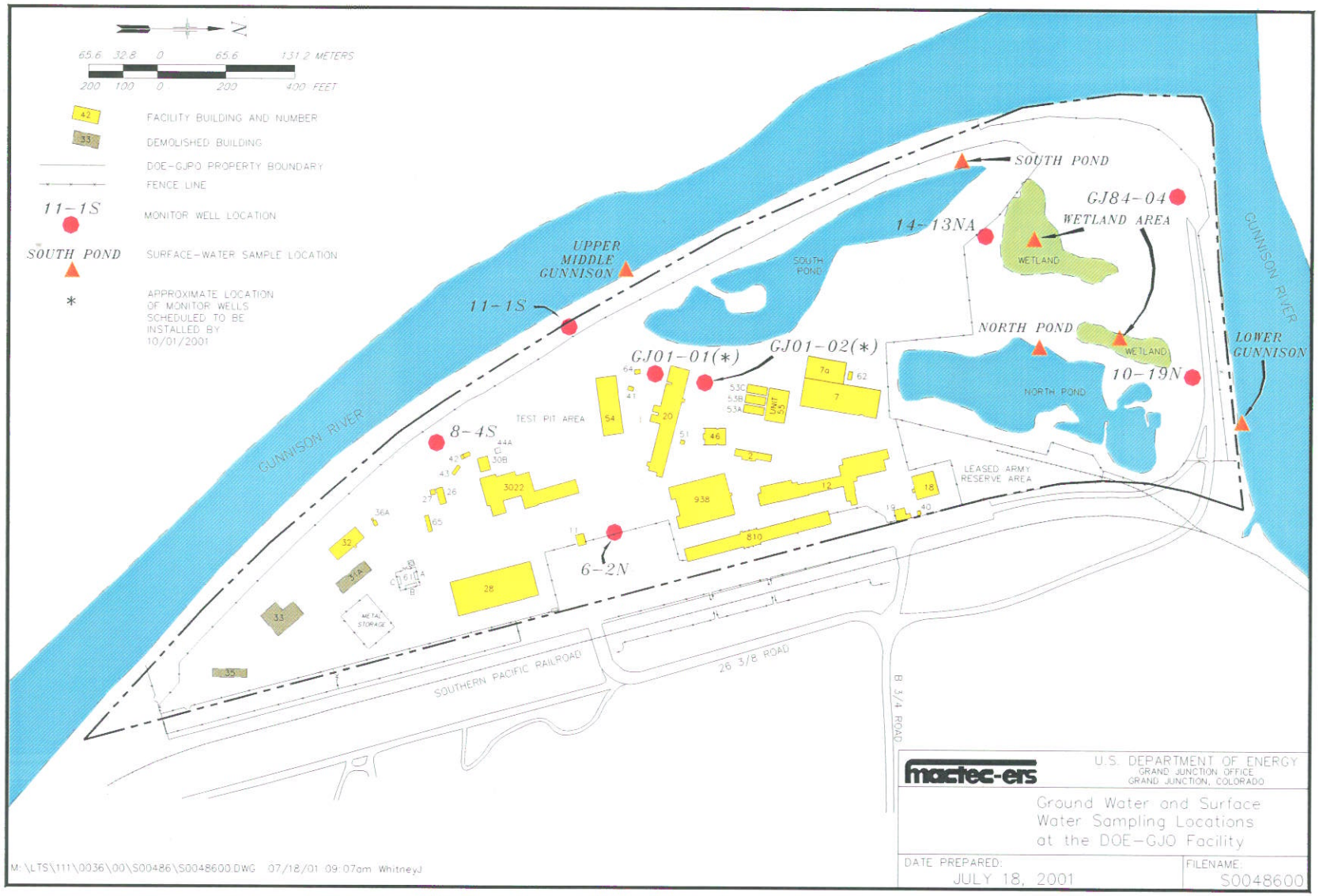


Figure 1. Key Ecological Areas

transfer EA describes the affected environment. When a dike was completed between the site and the Gunnison River in 1995, the site, including the North and South Ponds and the Wetland, were no longer considered to be within the 100-year floodplain. The Wetland has standing water only 4–5 months of the year. Vegetation in these areas is low density and is consistent with that found in riparian and disturbed areas. Various species of avian, terrestrial, and aquatic wildlife have been observed in less disturbed areas of the site. However, the potential for long-term wildlife habitat is uncertain and will depend on future uses of the site. Currently, faunal abundance, diversity, density, and frequency of visitation are limited because of the level of ongoing disturbances and human activity at the GJO.

Potential Contamination Sources

Potential contamination sources at the site include wastes regulated under the Resource Conservation and Recovery Act, the Toxic Substances Control Act (asbestos and PCBs), and the Atomic Energy Act (uranium mill tailings and by-product material). RCRA and TSCA regulated constituents were managed routinely as part of site operations, and no evidence exists that these constituents have affected media that ecological receptors would be exposed to. Therefore, only AEA wastes are considered as potential contaminant sources for ecological risk.

Contaminated Media

Following completion of the *Remedial Investigation/Feasibility Study–Environmental Assessment for the U.S. Department of Energy Grand Junction Projects Office* (RI/FS-EA) (DOE 1989a), remediation of soils and buildings began under the Grand Junction Projects Office Remedial Action Project (GJPORAP). Soil cleanup was completed in 1994; remediation of buildings is ongoing. Contaminated soils and sediments at the GJO were cleaned up to applicable standards (DOE 1993) and were eliminated as media of concern. Sampling and analysis of surface water, ground water, and air began in 1984 and continued during and after remediation. Air monitoring, which began in 1985, showed that airborne concentrations of radionuclides were well below regulatory standards and posed no risk (DOE 1993). Therefore, air is also eliminated as a medium of concern.

Contaminants have historically leached through the soil and contaminated the alluvial aquifer beneath the site. Ground water modeling done at the time of the RI/FS-EA indicated that the ground water contaminants may take 50–80 years to flush to acceptable concentrations. The *GJPORAP Declaration for the Record of Decision and Record of Decision Summary* (ROD) (DOE 1989b) stated that DOE's compliance strategy complied with EPA's proposed ground water regulations mandated by the Uranium Mill Tailings Radiation Control Act (UMTRCA). The regulations were finalized January 11, 1995 (60 FR 2854). The period of anticipated flushing complies with EPA's ground water regulations, which allows for natural flushing if (1) contaminants will flush to background or maximum concentration limits within 100 years, (2) concentration limits will be met at the end of the natural flushing period, and (3) institutional controls are in place that are protective of human health and the environment. For contaminant standards not listed in 40 CFR 192 ground water standards, standards under the Safe Drinking Water Act (SDWA) (40 CFR 141 and 143) and State of Colorado ground water standards (5 CCR 1002-41) are evaluated for ecological risk assessment purposes. However, the standards under the SDWA are not applicable as ground water remediation standards within the context of the Long-Term Surveillance Plan.

Because ground water is hydraulically connected to the two ponds, the Wetland, and the Gunnison River, surface water is also considered a medium of concern. Standards applicable to surface water include EPA standards in 40 CFR 131 and State of Colorado standards in 5 CCR 1002-8.

Therefore, ground water and surface water are the media of concern because both direct and indirect pathways to ecological receptors are possible.

Data Needs

A review of contaminant concentrations, ecological receptors, and exposure pathways was conducted to evaluate the potential for radionuclides and other constituents in ground water and surface water to pose ecological risks. Ground water and surface water contaminant concentrations that exceed background, a regulatory standard, or an ecological risk benchmark are the focus for evaluating potential ecological risks. Data reviewed to make this determination include ground water and surface water data collected from 1984 to the present. Sampling locations were established in the alluvial aquifer, the Gunnison River, the North Pond, the South Pond, and the Wetland located at the north end of the site. Sampling locations and analytical results are documented annually in accordance with DOE policy and procedures in the annual site environmental report, which is available to the public.

In addition to abiotic (media) sampling, the *Radiological Surveillance of Biota at the Grand Junction Projects Office Facility* (DOE 1993) documents biota characterization that was conducted at the facility during remedial action under GJPORAP. Biota sampling included fish and vascular plants, including cottonwoods, grasses, and forbs. Because the source of contamination in soils was still influencing ground water at the time of sampling, the results of that characterization should reflect conditions of higher contamination than the present.

Nature and Extent of Ground Water and Surface Water Contamination

Ground water beneath and near the site and surface water of the Gunnison River, North Pond, South Pond, and the Wetland have been sampled at least once per year for the past several years.

Ground Water

Contaminants in ground water are expected to flush to acceptable concentrations within 50 to 80 years, and concentrations already show a steadily decreasing trend. The site transfer EA stated that arsenic, molybdenum, nitrate, selenium, total dissolved solids (TDS), uranium, and gross alpha concentrations still exceed regulatory ground water standards based on 1998 data (DOE 2000). A review of 1999 ground water data indicated that concentrations of gross alpha, gross beta, arsenic, chloride, manganese, molybdenum, nitrate, selenium, TDS, and uranium concentrations exceeded regulatory standards within the context of ecological risk assessment.

Arsenic and chloride concentrations each exceeded standards at only one location, and in both cases those locations are downgradient near the Gunnison River, indicating that these constituents have naturally flushed and are no longer influencing the site. Likewise, selenium concentrations exceeded the UMTRCA ground water standard at only one location where

ecological receptors could be exposed and is not considered a significant risk. Nitrate concentrations exceeded the standard only slightly at two locations, both of which are within the DOE building complex and do not appear to be influencing areas where plants or wildlife could be exposed. Molybdenum concentrations slightly exceeded standards at 4 of the 9 sampling locations. Three of the four locations that exceeded the standard are at the downgradient perimeter of the site, which indicates that the molybdenum has essentially flushed from the aquifer. Existing concentrations of molybdenum and the lack of exposure pathways indicates a low potential for adverse effects to ground water quality or ecological receptors.

Manganese and uranium concentrations exceeded the standards significantly at most of the ground water sampling locations, and these constituents are therefore considered the ecological contaminants of potential concern (E-COPCs) for ground water. Gross alpha and gross beta concentrations also exceeded their ground water standards significantly at most of the sampling locations; however, because alpha and beta radiation originating in ground water is not expected to contact biological tissues (with the possible exception of deep roots), gross alpha and gross beta are not considered to be E-COPCs for ground water.

Table 1 summarizes applicable federal and state ground water standards on the basis of constituents of concern. To facilitate the analysis of potential risk to ecological receptors, these constituents are separated into three groups: radiological constituents (reported in picocuries per liter [pCi/L]), toxic metals, and cations and anions with very low toxicity to biota. This last group includes nutrients (calcium, magnesium, potassium, and sodium) and other dominant constituents of natural salts (chloride, nitrate, and sulfate). Because TDS is dominated by the constituents of this last group, it is included in that group. Table 1 also shows predicted ecological risk benchmarks for ground water based on potential risk to plants exposed to the constituent in ground water or to an herbivore (e.g., a muskrat) that ingests plant material in which the constituent has accumulated (the lesser of the two benchmarks is shown). Because of a lack of toxicity information or bioaccumulation information for the radiological constituents and for the relatively nontoxic cations and anions, ecological benchmarks for ground water were limited to the toxic metals. SDWA standards are used only within the context of a relative benchmark in the absence of a state or federal ground water standard and only for purposes of evaluating ecological risk. SDWA standards are not applicable as ground water remediation standards within the context of the Long-Term Surveillance Plan.

Surface Water

Gunnison River: Contaminant concentrations in the Gunnison River have shown a significant decrease from 1980 to the present (DOE 2000). Presently, concentrations of all site-related contaminants are within the range of background, and none exceed any federal or state water quality standards. Therefore, the Gunnison River can be eliminated as an ecological area of concern.

North and South Ponds and Wetland Surface Water: These areas are grouped together because they receive inflow from the contaminated alluvial aquifer and also from the Gunnison River. Results of the sampling indicate that concentrations of 15 constituents exceeded background, a federal or state standard, or an ecological benchmark (DOE 1999). Table 2 summarizes the surface water standards and ecological benchmarks for sampled constituents. As with ground water, the ecological benchmarks for surface water shown in Table 2 are based on the minimum

benchmark among a range of potential exposed receptors. For surface water, these include aquatic organisms (including fish), plants, herbivores (represented by the muskrat), omnivores (represented by the raccoon), insectivores (represented by the killdeer), and piscivores (represented by the great blue heron). These benchmarks are based on highly conservative exposure scenarios, including the assumption that food and water consumed by the wildlife receptors are derived from the contaminated source.

Table 1. Ground Water Standards and Benchmarks Applicable to On-Site Ecological Receptors

Analyte	Federal Standard	Colorado State Standard	Ecological Benchmark[a]
Radiological Analytes (pCi/L)			
Gross Alpha	15[b]	15[c,d]	–
Gross Beta	8[b]	8[d]	–
Radium-226+228	5[b]	5[d,e]	–
Toxic Metals (µg/L)			
Arsenic	50[b]	50[d]	1[f] (plants)
Cadmium	10[g]	5[d]	100[f] (plants)
Chromium	50 (for Cr^{6+})[g]	100[d]	50[f] (plants)
Manganese	50[i]	50[d,j]	4,000[f] (plants)
Molybdenum	100[g]	–	177[h] (muskrat)
Selenium	50	?	15.3[h] (muskrat)
Uranium	44[g] (30 pCi/L)	–	3,070[h] (muskrat)
Vanadium	–	–	200[h] (plants)
Nutrients and Relatively Nontoxic Cations and Anions (mg/L)			
Calcium	–	–	–
Chloride	250[i]	250[d,j]	–
Magnesium	–	–	–
Nitrate	10 (as N)[b,g]	1 (as N)[d]	–
Potassium	–	–	–
Sodium	–	–	–
Sulfate	250[i]	250[d,j]	–
Total Dissolved Solids (TDS)	500[i]	2,475[k]	–

[a]The ground water pathway is limited to plants and herbivores. The receptor on which the benchmark is based is shown in parentheses. Muskrat is used to represent herbivorous mammals.
[b]Safe Drinking Water Act (SDWA) primary drinking water standard.
[c]Excluding radon and uranium.
[d]Human health standard.
[e]Based on 4 millirem per year using strontium-90.
[f]Plant toxicity benchmark for solution in water from Efroymson et al. (1997a).
[g]Uranium Mill Tailings Radiation Control Act.
[h]Based on modeled uptake through ingestion.
[i]SDWA unenforceable secondary standard.
[j]State secondary drinking water standard.
[k]1.25 x background; background is 1,980 mg/L at Location GJ 84-09.
"–" = No standard or benchmark.

Table 2. Surface Water Standards and Benchmarks Applicable to On-Site Ecological Receptors

Analyte	Federal Standard	Colorado State Standard (5 CCR 1002-31)	Ecological Benchmark[a]
Radiological Analytes (pCi/L)			
Gross Alpha	15 (40CFR 131)	–	4,000-4,550[b] (fish)
Gross Beta	–	–	NA[c]
Radium-226+228	–	5	160[d] (fish)
Toxic Metals (µg/L)			
Arsenic	150 (NAWQC[e])	150	1[f] (plants)
Cadmium	2.2 (NAWQC[e])	5	1.45[g] (great blue heron)
Chromium	11 (NAWQC[e] for Cr^{6+})	11	2.07[g] (killdeer, based on Cr^{3+})
Manganese	–	50 (drinking water standard)	120[h] (aquatic life)
Molybdenum	–	–	159[g] (muskrat)
Selenium	5 (NAWQC[e])	5	8[g] (killdeer)
Uranium	–	40	2.6[h] (aquatic life)
Vanadium	–	–	1.24[g] (raccoon)
Nutrients and Relatively Nontoxic Cations and Anions (mg/L)			
Calcium	–	–	NA[i]
Chloride	–	250 (drinking water standard)	NA[i]
Magnesium	–	–	NA[i]
Nitrate	44	–	177[j] (aquatic life)
Potassium	–	–	NA[i]
Sodium	–	–	NA[i]
Sulfate	–	250 (drinking water standard)	NA[i]
Total Dissolved Solids (TDS)	–	–	2,000–10,000[k]

[a]Receptor on which the benchmark is based is shown in parentheses. The great blue heron is used to represent piscivorous birds, killdeer is used to represent insectivorous birds, muskrat is used to represent herbivorous mammals, raccoon is used to represent omnivorous mammals.
[b]Gross alpha benchmarks are based on multimedia benchmarks for uranium isotopes from Bechtel-Jacobs Company (1998); 4,000 pCi/L is the benchmark for U-233, and 4,550 pCi/L is the benchmark for U-238.
[c]Risk associated with beta radiation from the uranium decay chain are considered negligible.
[d]Based on multimedia benchmark for Radium-226 from Bechtel-Jacobs Company (1998).
[e]National Ambient Water Quality Criteria (chronic) for freshwater aquatic life.
[f]Based on plant toxicity benchmark for solution in water from Efroymson et al. (1997a).
[g]Based on modeled uptake by direct ingestion and through the food chain.
[h]Secondary (Tier II) value from Efroymson et al. (1997b).
[i]Analyte is of low toxicity and is a common constituent of natural salts.
[j]Guideline from British Columbia (Haines et al. 1994)
[k]Range of tolerances to salinity (i.e., tolerance to high osmotic potential) for freshwater aquatic species based on information in Wetzel (1975).
NA = Not applicable
"–" = No standard

Table 3 summarizes constituents that exceeded standards and benchmarks on the basis of 1999 data. These data are considered appropriate, as they reflect the decreasing trend in contaminant concentrations.

Table 3. Surface Water Locations and Constituents That Exceeded Background, Standards, or Benchmarks Based on 1999 Data

Constituent	Exceeded Background			Exceeded Regulatory Standard			Exceeded Aquatic Ecological Benchmark		
	NP	SP	W	NP	SP	W	NP	SP	W
Gross Alpha	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Gross Beta	Yes	Yes	Yes	–	–	–	NA	NA	NA
Arsenic	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Calcium	Yes	Yes	Yes	–	–	–	–	–	–
Chloride	Yes	Yes	Yes	Yes	No	Yes	NA	NA	NA
Chromium	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes
Magnesium	Yes	Yes	Yes	–	–	–	NA	NA	NA
Manganese	No	No	Yes	No	No	Yes	No	No	Yes
Molybdenum	Yes	Yes	Yes	–	–	–	No	No	Yes
Potassium	Yes	Yes	Yes	–	–	–	NA	NA	NA
Sodium	Yes	Yes	Yes	–	–	–	NA	NA	NA
Sulfate	Yes	Yes	Yes	Yes	Yes	Yes	NA	NA	NA
TDS	Yes	Yes	Yes	–	–	–	No	No	Yes
Uranium	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vanadium	Yes	Yes	Yes	–	–	–	Yes	Yes	Yes

NOTES: NP = North Pond; SP = South Pond; W = Wetland; "–" = No standard exists.
NA = Not applicable; low toxicity, common in salts.

Key Ecological Receptors

Ecological risk assessments typically place emphasis on the individuals of a species if the species is threatened or endangered, and evaluate risks to populations if the species is not considered sensitive. For nonsensitive species, the assessment typically emphasizes risks at the population level.

Threatened and Endangered Species

Threatened and endangered (T&E) wildlife species in the GJO vicinity that could be affected by elevated concentrations of contaminants in surface waters include the Colorado pikeminnow, razorback sucker, humpback chub, bonytail chub, bald eagle, and southwestern willow flycatcher (DOE 2000). No known T&E plant species exist on the site. State of Colorado species of special concern in the vicinity of the site include the Grand Junction milkvetch and the snowy egret. The milkvetch is not known to grow on the site, and the snowy egret has not been sighted or documented as even an infrequent visitor to the site. Neither the milkvetch nor the snowy egret is considered a potential ecological receptor.

The four endangered fish identified potentially reside only in the Gunnison River and not in on-site surface waters. The Colorado Division of Wildlife has identified the Colorado pikeminnow and razorback sucker as being the most likely to inhabit the Gunnison River near the site (R. Bleil, MACTEC-ERS, personal communication with Anita Martinez, Colorado Division of Wildlife, August 4, 2000). Site-related contamination is not adversely affecting the Gunnison River, and all T&E fish species can therefore be eliminated as potential ecological receptors.

Potential habitat for the southwestern willow flycatcher exists in the riparian vegetation along the Gunnison River. Bald eagles are observed frequently in the vicinity of the site, particularly in

the spring. Because these species could access the ponds and Wetland, both will be retained as potential ecological receptors.

Nonsensitive Species

Dominant vegetation in less disturbed areas of the site includes sparse to moderately dense populations of cottonwood, Russian olive, tamarisk, elm, rabbitbrush, and other grasses and forbs. Common reed, bulrush, willow, and cattail dominate the Wetland.

Appendices B and C of the site transfer EA identify fauna anticipated to be found in the site area. Wildlife most likely to be observed on a regular basis in less disturbed areas of the site include various species of birds, mammals, amphibians, reptiles, and fish. Key bird species include geese, ducks, and magpie. Key mammal species include deer mice, prairie dog, cottontail, raccoon, skunk, red squirrel, and occasionally coyote and mule deer. The key amphibian species is the bullfrog. Key reptiles include the garter snake, bullsnake, and eastern fence lizard. Key fish species are minnows and carp.

Exposure Pathways

An exposure pathway exists if ecological receptors are likely to come in contact with a potentially harmful contaminant. Exposure pathways will be addressed on the basis of ground water and surface water as the contaminated media of concern. Although it is recognized that ground water is influencing site surface water, surface water will be treated separately for risk assessment purposes. Only the most likely scenarios are presented below.

Sediment was not considered as a medium of concern. Contaminated soil and sediment have been remediated at this site, and the current source of E-COPCs is ground water. Some partitioning of E-COPCs from surface water and ground water into sediment is expected to occur; however, in general, ecological exposure pathways are dominated by E-COPCs in water (including sediment pore water) rather than those adsorbed to sediment particles.

Ground Water

Assuming that institutional controls will prevent future direct access to ground water, there would be no direct exposure pathway from ground water to terrestrial wildlife. However, plants that root into contaminated ground water (phreatophytes) could take up contaminated water, and the possibility for bioaccumulation exists. If terrestrial receptors ingest plants that bioaccumulate contaminants, the potential for an ingestion pathway exists for terrestrial receptors such as herbivores. Therefore, plant uptake through direct contact with ground water will be maintained as a primary potential pathway, and ingestion of plants by herbivores will be retained as a secondary potential pathway.

Surface Water

Surface water in the North Pond, South Pond, and the Wetland (when water is present) provide several potential exposure pathways to various receptors. Both fish and amphibians could be exposed to contaminants by direct contact with the water, ingestion of water, and ingestion of algae and insects in the ponds. Terrestrial and avian receptors could be exposed by ingesting water from the ponds. Depending on the species, some may be exposed as a result of ingesting fish, amphibians, invertebrates, and plants living in the ponds. For example, a bald eagle may occasionally hunt in the area and could possibly take a fish from the ponds. Insectivorous birds (possibly including the southwestern willow flycatcher) may feed on insects that were exposed to the water in the ponds as larvae.

Ecological Impacts

The focus of this assessment is on areas where ecological receptors may be exposed, such as the ponds and the Wetland. The magnitude, frequency, and duration of exposure to site-related contaminants are critical to determining potential ecological risks. Magnitude deals primarily with the concentration of contaminants and their spatial and temporal distribution. A comparison of 1998 and 1999 data to historical data (1980–1997) shows that all contaminant concentrations in ground water and surface water are decreasing. Current trend analysis indicates that many of the contaminants will flush much faster than the 50–80 years originally projected.

Frequency of exposure is the number of times a receptor will be exposed to a contaminant over time. Duration of exposure considers the time period during which a receptor is exposed. Both frequency and duration are dependent upon the exposure pathway, which in turn is dependent upon behavioral and habitat requirements (e.g., food, water, nesting, seasonal, roosting) of the receptor. Frequency and duration of exposure are also dependent upon other physical and biological stressors, such as human activity at the site.

An implicit assumption in a screening-level assessment is that media standards, such as water quality standards, are protective of ecological receptors. Although this is generally shown to be the case in Tables 1 and 2 for those constituents with both regulatory standards and ecological benchmarks, there are some notable exceptions. The water standards for arsenic may not be protective of plant growth, and the ground water standard for selenium may still result in concentrations in plants that may produce risk to herbivores. Also, the ambient water quality criterion for chromium may produce risk to insectivorous birds, such as the killdeer, and the Tier II screening value for uranium in water is significantly less than the Colorado standard for this element.

When toxicity benchmarks or standards are unavailable, observations of the abundance, density, distribution, and behavioral characteristics of receptors serve as indicators of ecological stresses caused by contaminants. Receptors whose entire home range is influenced by contamination—plants, amphibians, and fish in the ponds, for example—would likely experience the greatest frequency and duration of exposure. Conversely, receptors with large home ranges (e.g., eagles, hawks, and large mammals), seasonal receptors (e.g., migratory birds), and receptors not adapted to human activity would likely experience only incidental and infrequent exposure.

Ground Water Risk

Manganese and uranium have been identified as E-COPCs for ground water because elevated concentrations may affect plants with roots in ground water, and terrestrial herbivores may feed on contaminated plant material. The 1993 biota surveillance conducted sampling of cottonwood trees, herbaceous plants (grasses and forbs), and other potential receptors in contaminated areas of the site. This sampling was conducted during the time that the contaminant source was being removed. Contamination available for plant uptake should have been reduced following remediation of soils, which was completed in 1994.

Cottonwoods are a good indicator of plant contamination because of their deep root structure. The 1993 sampling of cottonwood, grasses, and forbs was conducted at the perimeter of the north pond, where contamination was most likely to be available for uptake by plants. The biota surveillance showed that a pathway exists between ground water and plants, because samples of on-site plants had concentrations of contaminants that were elevated compared to background concentrations. However, the data also suggested that concentrations of the radiological contaminants were not elevated enough to adversely affect the exposed plant or the herbivores that may feed on the plants. Because contaminant concentrations are decreasing steadily through natural flushing, no adverse ecological effects are anticipated from ground water.

Surface Water Risk

In a qualitative evaluation of risk, concentrations in a suspected contaminated area are usually compared to those in a background area as a first step in determining potentially adverse effects. Because a suitable reference area near the site was unavailable, contaminant concentrations in on-site surface water were compared to those in the Gunnison River upstream of the site. However, this comparison produced several uncertainties. For example, stagnant surface water on the site is expected to have higher temperatures, higher pH values, higher salinity, and higher TDS levels dominated by naturally occurring constituents such as calcium, chloride, iron, magnesium, and sodium that concentrate through evaporation. These factors will be considered in evaluating risks at the GJO.

If E-COPC concentrations exceed background they are compared to federal and state regulatory standards such as the national Ambient Water Quality Criteria. Surface water standards are presumed to be protective of the aquatic environment and are often used as ecological benchmarks in a screening-level risk assessment.

Radium-226, cadmium, nitrate, and selenium were eliminated as E-COPCs because their concentrations did not exceed background in any of the on-site surface water samples. Manganese concentrations exceeded background at only one location in the Wetland downgradient of the site. Chromium concentrations exceeded background in two locations—the South Pond and the Wetland. However, only one location in the South Pond had a chromium level that exceeded the surface water quality standard. Therefore, both chromium and manganese can be eliminated as E-COPCs because they are not expected to have a significant effect on ecological receptors.

Concentrations of thirteen constituents—gross alpha, gross beta, arsenic, calcium, chloride, magnesium, molybdenum, potassium, sodium, sulfate, TDS, uranium, and vanadium—exceeded

concentrations in the Gunnison River background samples. Of these, molybdenum and uranium are retained as the final E-COPCs. Table 4 provides the rationale for determining the final E-COPCs for surface water at the site.

Table 4. Revised E-COPC List and Rationale Based on 1999 Surface Water Data

Constituent	Conc. Range[a]	Loc.[b]	Retain	Rationale
Radiological Constituents				
Gross Alpha	90–1,130 pCi/L	NP, SP, W	No	Gross alpha (assumed to be entirely from uranium) is well below the benchmarks for uranium isotopes.
Gross Beta	61–525 pCi/L	NP, SP, W	No	Risk associated with beta radiation from the uranium decay chain are considered negligible.
Toxic Metals				
Arsenic	NA	NA	No	Arsenic concentrations were well below the surface water standard and below the lowest benchmark for wildlife receptors (116 µg/L for the raccoon). The benchmark for plants (1 µg/L) is of low confidence.
Molybdenum	96–1,130 µg/L	SP, W	Yes	No standard but significantly elevated levels in the Wetland compared to background (3 µg/L). Some concentrations exceed the ecological benchmark of 159 µg/L.
Uranium	148–1,920 µg/L	NP, SP, W	Yes	Uranium concentrations exceed the state standard of 40 µg/L and the ecological benchmark (Tier II screening value) of 2.6 µg/L. Some concentrations exceeded the lowest wildlife benchmark of 670 µg/L.
Vanadium	5.8–8.1 µg/L	NP, W	No	Vanadium levels do not significantly exceed background of 1.5 µg/L and are not believed to be a widespread contamination problem. Ecological benchmark of 1.24 µg/L is dubious because it is less than the background concentration.
Nutrients and Relatively Nontoxic Cations and Anions				
Calcium	NA	NA	No	• Considered an essential environmental nutrient. • Is not a site-related contaminant. • Does not have a surface water standard.
Chloride	310–2,260 mg/L	NP, W	No	High concentrations in the Wetland compared to state standard (250 mg/L if used as drinking water). No aquatic life standard; however, potential toxicity is considered to be low. Adverse ecological effects are more likely to be the result of high osmotic potential due to water salinity.
Magnesium	82–962 mg/L	NP, SP, W	No	No standard but concentrations in the North Pond and Wetland are significantly elevated above background (27 mg/L). Considered an essential environmental nutrient with low potential toxicity. Adverse ecological effects more likely to be the result of high osmotic potential due to water salinity.
Potassium	17.3–217 mg/L	NP, SP, W	No	No standard but significantly elevated levels in the Wetland compared to background (3.3 mg/L). Considered an essential environmental nutrient with low potential toxicity. Adverse ecological effects more likely to be the result of high osmotic potential due to water salinity.

Table 4. Revised COPC List and Rationale Based on 1999 Surface Water Data (continued)

Sodium	467–9,700 mg/L	NP, SP, W	No	No standard but significantly elevated levels in the Wetland compared to background (58 mg/L). Considered an essential environmental nutrient with low potential toxicity. Adverse ecological effects more likely to be the result of high osmotic potential due to water salinity.
Sulfate	1,660–2,040 mg/L	NP, SP, W	No	No aquatic life standard; a drinking water standard of 250 mg/L exists. However, a literature search and field observations at other sites indicate that sulfate levels up to 2,200 mg/L will not adversely affect ecological receptors.
TDS	35,000 mg/L	W	No	The high TDS is believed to be a result of naturally occurring constituents that concentrate through evaporation.

[a]Range of concentration if concentration exceeded background, a standard, or a benchmark.
[b]Locations where concentrations exceeded background, a standard, or a benchmark.
NP = North Pond, SP = South Pond, W = Wetland.

Conclusions

Table 5 summarizes ecological risks at the GJO. It is anticipated that constituent concentrations will continue to decrease through time. Healthy populations of algae, bullfrogs, and fish in the ponds have been observed for the past several years and most recently on August 8, 2000 (personal observations, R. Bleil, MACTEC-ERS). Contaminant levels do not appear to be affecting the ponds or Wetland ecosystems, although comparisons to ecological benchmarks indicate potential risk to some wildlife receptors may occur from chronic and continuous exposures to molybdenum and uranium in these surface water bodies (continuous exposure to waters at the Wetland is not possible because it is only seasonally wet). Due to evaporative loss, these water bodies exhibit relatively high levels of salinity, as indicated by the high TDS and elevated concentrations of calcium, magnesium, potassium, sodium, chloride, and sulfate. High salinity is a common characteristic of enclosed water bodies in arid regions of the Southwest and is not expected to adversely affect ecological resources at the GJO.

Table 5. Summary of Ecological Risk Considerations and Final E-COPCs

Media	Ecological Community	Exposure Pathway	Representative Nonsensitive Receptors	Sensitive Receptors[a]	Final E-COPCs[b]
Ground water	GJO site	Food chain, root uptake	Herbivores, omnivores, plants	None	Manganese, uranium
Surface water	North Pond, South Pond, Wetland	Direct ingestion, food chain	Omnivores (e.g., muskrat), aquatic receptors (e.g., fish)	Bald eagle, southwestern willow flycatcher	Molybdenum, uranium

[a]Includes threatened or endangered plant and animal species, migratory birds.
[b]Selected because concentrations exceed a standard, benchmark, or value that may result in ecological risk.

Both the Colorado Division of Wildlife and U.S. Fish and Wildlife Service have been routinely consulted as part of the GJORAP remediation and site operations. In addition, the habitat provided for key T&E and indicator species is not unique and is generally less desirable than that of surrounding areas, primarily due to lack of vegetation density and diversity and the presence

of human activity. Therefore, the potential for adverse effects to the bald eagle and southwestern willow flycatcher is minimal. Based on contaminant trends and recent field observations of ecological receptors in the South Pond and North Pond, the potential for ecological risk to sensitive and nonsensitive plant and wildlife receptors also appears to be minimal.

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Evaluation of Human Health Risks Associated with Contamination Remaining at the Grand Junction Office

Introduction

This document contains an analysis of risks associated with contaminated surface and ground water and soil at the Grand Junction Office for both unrestricted and reasonable use scenarios. Data used for the analysis were collected in 1999 (see Appendix A) and represent the most up-to-date picture of the site. These data were reviewed and screened to develop a list of constituents for which quantitative risks were calculated. Parameters were eliminated from further evaluation if: (1) the majority of samples were below detection or no different from background (e.g., cadmium and lead in ground water), (2) if they are essential nutrients (e.g., calcium and magnesium), or (3) if all samples were well below established toxicity levels (e.g., chromium and iron in ground water). The constituents that remained after this screening process for ground water were arsenic, chloride, manganese, molybdenum, nitrate, selenium, sulfate, uranium, and vanadium. For surface water the constituents that passed the screening process were chloride, manganese, molybdenum, sulfate, and uranium. Chloride and sulfate were excluded from quantitative risk calculations due to lack of toxicity data. The remaining constituents were retained for quantitative risk calculations.

Risks were calculated using standard EPA equations and exposure parameters (EPA 1989a and EPA 1989b) in Excel spreadsheets. Calculations are attached and exposure parameters are included in Table 1 and some tables included in Appendix B. Both carcinogenic and noncarcinogenic risks were assessed. Three different exposure scenarios were evaluated in all—two for adults and one for children. Risks were calculated for exposure to both ground water and surface water for all three scenarios. Risks were also calculated for exposure to contaminated soil (assuming lifetime exposure) and for consumption of fish caught in the North or South ponds. Each of these scenarios is described and results are discussed below. Summary risk calculations are presented in Table 2.

Exposure Scenario Descriptions

The following exposures were evaluated for the GJO site:

- Residential exposure of adults to ground water and surface water. This scenario assumes an adult receives all drinking water from the alluvial aquifer at the GJO. The exposure point concentrations used in calculations is the 95% upper confidence level on the mean (UCL95) of results from the 12 plume monitoring wells on the site. These calculations are presented in Table B-1. Exposure to surface water is assumed through recreational use for gardening or other activities. Though this may not be a reasonable use, it provides some estimate of risk. It was assumed that gardening occurs for two days a week (weekends for most weeks) at the duration of one hour per day. This is a conservative estimated based on EPA data (1989b). Dermal contact and incidental ingestion are considered. The maximum surface water concentration from the North Pond, South Pond or wetland area was used. Calculations are presented in

Appendix B-2. Risks calculated for this scenario are based on conservative assumptions and represent a reasonable worst-case estimate.

Table 1. Exposure Intake Equations and Default Assumptions

Residential Exposure Scenario – Ground Water Ingestion

Chemicals: Intake (chronic daily in mg/kg-d) = (Cw * IRw *EF * ED)/(BW * AT)

Radionuclides: Intake (lifetime in picocuries) = Cw * IRw * EF * ED

Where

Cw = contaminant concentration in water

IRw = ingestion rate for water (2 liters per day default for adults; 1.5 liter for children; 0.64 liter per day for infants)

EF = exposure frequency (350 days per year)

ED = exposure duration (30 years for adults, 7 years for children, and 1 year for infants)

BW = body weight (70 kilograms for adults; ; 38.4 for children4 kilograms for infants)

AT = averaging time (365 days * ED for noncarcinogens; 365 days * 70 years for carcinogens)

Incidental/Occupational Exposure Scenario – Surface Water Ground Water

Ingestion of Chemicals from water: Intake (mg/Kg-d) = (Cw * IRw *EF * ED)/(BW * AT)

Absorption of Chemicals from water: Intake (mg/Kg-d) = (Cw*SA*PC*ET*EF*ED*CF)/(BW*AT)

Where

Cw = contaminant concentration in water

IRw = ingestion rate for water (0.05 liter per day for children and 0.01 liter per day adults incidental surface water; 1 liter occupational ground water)

EF = exposure frequency (3 months per year at 7 days per week = 90 days plus 3 months per year on weekends = 24 days; total = 114 days per year for children playing. 250 days per year for site worker)

ED = exposure duration (7 years for children aged 6-12 years playing on floodplain; 30 years for golf course worker)

ET = Exposure time (1 hr/d for children playing; 8 hr/d for site worker)

BW = body weight (38.3 kilograms for children aged 6-12 years; 70 kg for adult)

AT = averaging time (365 days * ED for noncarcinogens; 365 days * 70 years for carcinogens)

SA = skin surface area available for contact (497 cm^2 body surface area for children 6-12 years old; 312 cm^2 for man's arms and hands)

PC = dermal permeability constant (0.001 cm/hr; same rate as water)

CF = volumetric conversion factor for water (1 L/1000 cm^2)

RfD=reference dose (chemical specific; mg/kg-day); HQ=Intake/RfD

SF=slope factor (chemical spedific; unitless); Risk=intake x slope factor

All exposure factors from EPA 1989b unless otherwise noted; toxicity data from IRIS or best available source.

Table 2. Cumulative Risks Summed Across Contaminants and Pathways

idential Exposure-Adults			
ntaminant	GW HQ	SW HQ	Total HQ
Noncarcinogens			
Arsenic	5.02	na	5.02
Manganese	1.7	0.00043	1.70043
Vanadium	0.14	na	0.14
Selenium	0.26	na	0.26
Molybdenum	0.93	0.00912	0.93912
Nitrate	0.11	na	0.11
Uranium	4.08	0.02583	4.10583
HIs	12.24	0.03538	
	Cumulative HI		12.27538
Carcinogens	GW Risk	SW Risk	Soil Risk	Total Risk
U234+238	3.43E-04	2.10E-06		3.45E-04
Arsenic	9.75E-03	na		9.75E-03
Radium-226	na	na	1.38E-04	1.38E-04
Risk Totals	1.01E-02	2.10E-06	1.38E-04	
		Cumulative Risk		1.02E-02

Residential Exposure-Children			
Contaminant	GW HQ	SW HQ	Total HQ
ncarcinogens			
Arsenic	6.89	na	6.89
Manganese	2.33	0.004	2.334
Vanadium	0.19	na	0.19
Selenium	0.35	na	0.35
Molybdenum	1.28	0.097	1.377
Nitrate	0.15	na	0.15
Uranium	5.6	0.263	5.863
HIs	16.79	0.364	
	Cumulative HI		17.154
Carcinogens	GW Risk	SW Risk	
U234+238	6.00E-05	na	
Arsenic	4.46E-03	na	
Risk totals	4.52E-03		

Occupational Exposure-Adults			
Contaminant	GW HQ	SW HQ	Total HQ
Noncarcinogens			
Arsenic	1.79	na	1.79
Manganese	0.61	0.002	0.612
Vanadium	0.05	na	0.05
Selenium	0.09	na	0.09
Molybdenum	0.33	0.053	0.383
Nitrate	0.04	na	0.04
Uranium	1.46	0.15	1.61
HIs	4.37	0.205	
	Cumulative HI		4.575
Carcinogens	GW Risk	SW Risk	Total Risk
U234+238	1.22E-04	1.24E-05	1.34E-04
Arsenic	3.48E-03	na	3.48E-03
Risk Total	3.60E-03	1.24E-05	
	Cumulative Risk		3.61E-03

The surface water pathway includes both ingestion and dermal exposure.

Table 3. Summary of Human Health Risk Calculations—Grand Junction Office Surface and Ground Water Use

Exposure Scenario	Receptors	Contaminants	Assumptions	Risks w/o institutional controls	Comments
Residential ingestion of ground water	Adult residents using on-site wells	As, Cl, Mn, V, Se, SO_4, Mo, NO_3, U	All drinking water is from on-site wells; UCL95 of plume wells used in calculations	HI=12.24 Carcinogenic risk= 1.1E-02	Greatest risks from As, U. Prohibition of ground water use would eliminate pathway and reduce risks to zero.
Recreational use of surface water	Adults using surface water for gardening or similar purposes	Cl, Mn, Mo, SO_4, U	Dermal contact and incidental ingestion. Maximum surface water concentration used	HI=0.035 Carcinogenic risk= 2.1E-06	No unacceptable risks are associated with this use of surface water. Surface water could be used without restriction.
Occupational ingestion of ground water	Workers at the site using on-site wells for drinking water during the work day	As, Cl, Mn, V, Se, SO_4, Mo, NO_3, U	Half of drinking water consumed during the work day is obtained from on-site wells; UCL95 of plume wells used in calculations	HI=4.37 Carcinogenic risk= 3.6E-3	Greatest risks from As, U. Prohibition of ground water use would eliminate pathway and reduce risks to zero.
Occupational incidental surface water exposure	Workers using surface water in some industrial process	Cl, Mn, Mo, SO_4, U	Dermal contactand incidental ingestion; contact occurs for entire work day. Maximum concentrations used in calculations.	HI=0.205 Carcinogenic risk=1.24E-5	Risk results indicate that surface water could be used in an industrial process with no unacceptable risk. Institutional controls would not be required to reduce this exposure.
Residential ground water ingestion	Children using on-site wells for drinking water	As, Cl, Mn, V, Se, SO_4, Mo, NO_3, U	All drinking water is from on-site wells; UCL95 of plume wells used in calculations	HI=16.79 Carcinogenic risk= 4.52-E03	Greatest risks from As, U, Mn. Prohibition of ground water use would eliminate pathway and reduce risks to zero.
Incidental surface water ingestion/dermal contact—recreational setting	Children playing in the ponds and wetland area	Cl, Mn, Mo, SO_4, U	Children wade/splash in ponds and wetland area contacting arms and legs; some incidental ingestion of surface water occurs. Maximum concentrations used in calculations. Exposure occurs 1/3 of the year.	HI=0.364	No unacceptable risks are associated with this use of surface water. Results indicate that use of surface water in a recreational scenario (e.g., park, bike path) would be acceptable without restrictions.

Table 3. Summary of Human Health Risk Calculations—Grand Junction Office Surface and Ground Water Use

Exposure Scenario	Receptors	Contaminants	Assumptions	Risks w/o institutional controls	Comments
Ingestion of fish from North Pond	Recreational fishermen and their families	U, Mn	U and Mn accumulate in fish living in the North Pond. Receptors ingest 8 oz. of contaminated fish per week. Bioaccumulation factors (BCF) of 1 and 55 used in calculations. Maximum concentrations used in calculations.	For BCF of 1: HI=0.03; Carcinogenic risk= 1.9E-6 For BCF of 55: HI=1.5; Carcinogenic risk = 1.0E-4	If BCF at low end is appropriate, risks associated with this pathway would be acceptable. At high BCFs, risks are marginally high. Results suggest that occasional ingestion of fish from the pond would be acceptable, but reliance on pond as a major food source would not be. Some type of institutional control could be warranted. Most of risk is from U.
Ingestion of fish from South Pond	Recreational fishermen and their families	U, Mn	U and Mn accumulate in fish living in the North Pond. Receptors ingest 8 oz. of contaminated fish per week. Bioaccumulation factors (BCF) of 1 and 55 used in calculations. Maximum concentrations used in calculations.	For BCF of 1: HI=.06; Carcinogenic risk= 3.8E-6 For BCF of 55: HI=3.04; Carcinogenic risk = 2.1E-4	If BCF at low end is appropriate, risks associated with this pathway would be acceptable. At high BCFs, risks are marginally high. Results suggest that occasional ingestion of fish from the pond would be acceptable, but reliance on pond as a major food source would not be. Some type of institutional control could be warranted. Most of risk is from U.
Incidental ingestion of soil	Children and adults coming in contact with contaminated soil	Ra-226	Inidental ingestion of soil	Carcinogenic risk= 1.38E-04	Calculations indicate direct contact with soil would be unacceptable. However, soils are not currently exposed. Continued control would eliminate risks.

- Ingestion of fish from the North and South ponds. Fish in the North and South ponds are classified as nongame species and are unlikely to be caught for consumptive purposes. However, this pathway was evaluated for information purposes. This exposure scenario is based on conservative assumptions associated with recreational fishing. One assumption is that contamination accumulates in fish and is subsequently consumed by humans. Two calculations were done for uranium. One assumes that no biomagnification occurs (concentration of fish is the same as the ground water) and the other assumes a 55-fold concentration. The values reflect the range of bioconcentration factors (BCFs) obtained for uranium in a study of the Baltic Sea (information obtained on the Internet). No BCFs were available for manganese; calculations were done using the same BCFs as uranium for information purposes. Manganese concentrations were less than half of that established by EPA as a recommended water quality criteria for the consumption of organisms (63 FR 68354). Risks posed by molybdenum were not calculated due to lack of BCFs and recommended water quality criteria. Maximum concentrations of uranium and manganese were used in the calculations. Calculations are presented in Tables B-3 and B-4. Because this exposure pathway could occur whether or not a residence was present at the site, risks were not summed with residential exposures. However, these risks could be additive with any scenario evaluated.

- Occupational exposure to adults. Given the probable future use of the site, this scenario reflects a more probable unrestricted use scenario. The assumption is that a worker ingests ground water from an onsite well on a regular basis. The UCL95 was used for the exposure point concentrations in this scenario. The scenario also dermal contact and incidental ingestion of surface water, perhaps through groundskeeping or similar activities. The maximum concentration of surface water from the North Pond, South Pond, or Wetland was used. Conservative exposure assumptions were used. Risks calculated represent a reasonable worst case scenario. Calculations are presented in Tables B-5 and B-6.

- Exposure to contaminated soil through incidental ingestion. Contaminated soil was left in place associated with Building 20. A scenario was evaluated for incidental ingestion of soil and exposure to radium-226 from childhood through adulthood. Lifetime excess cancer risks were calculated. These risks would be additive to either a residential or occupational scenario. Calculations are presented in Table B-7.

- Residential exposure to ground water and surface water by children. This scenario assumes children living in a residence consume all drinking water from the alluvial aquifer. Calculations for a child's exposure used exposure factors from EPA (1989b) for children aged 6-12 years. The UCL95 for ground water was used in the calculations presented in Table B-8. The scenario also assumes that children regularly play in surface water bodies. Minor surface water ingestion as well as dermal exposure are assumed. Maximum concentrations from the North pond, South pond or wetland were used. Calculations are presented in Table B-9. These exposures represent a reasonable worst-case scenario.

Results

Cumulative risks for each exposure scenario are presented in Table 2. The cumulative risks are summed across contaminants and pathways. The greatest contributor to risk is the ground water ingestion pathway for both residential and occupational exposure. Carcinogenic and noncarcinogenic risks are unacceptable for unrestricted use of groundwater and surface water in both a residential and occupational scenario, indicating some need for restrictions on use of ground water and/or surface water. Table 3 discusses each exposure pathway separately. This discussion is provided to assist in making decisions regarding pathway-specific restrictions.

For use of ground water in a residential or occupational setting, both carcinogenic and noncarcinogenic risks exceed EPA's acceptable criteria (acceptable being HQ < 1 and carcinogenic risk between 10^{-4} and 10^{-6}). This confirms the need for institutional controls to prohibit unrestricted access at the present time. Risk for residential use are greater than those for occupational exposure. Risks for children are slightly higher than those for adults. Calculations show that exposure to carcinogens in ground water only during childhood still result in an unacceptable excess lifetime cancer risk.

Direct exposure to surface water alone, either in an occupational or recreational setting, are not likely to result in any unacceptable risk for children or adults based on the assumptions made in the calculations. Risks in an occupational setting are very low even based on conservative assumptions. Risks are slightly higher for the children playing scenario; highest risks would be associated with the wetland area where contaminants are more highly concentrated. These results suggest that future use of the surface water in a park-like setting or a similarly less restrictive manner would be acceptable from a human health perspective.

Risks associated with fish consumption are inconclusive. Calculations show that there *could* be some risk associated with uranium accumulation. If a low BCF for uranium is appropriate, both carcinogenic and noncarcinogenic risks are acceptable. If, however, a high-end BCF is more reasonable, both carcinogenic and noncarcinogenic risks are unacceptable. The risks associated with fish from the North pond are marginal; those associated with the South pond are slightly higher, but still relatively low. These calculations are based on the consumption of 8 ounces of contaminated fish per week throughout the year. This suggests that occasional consumption of fish from the ponds would be relatively safe.

Soil ingestion calculations were done for Ra-226 only, as uranium data was reported as total uranium and isotopic proportions were not available. EPA default factors for soil ingestion rates in a residential scenario were used. Risks based on potential exposure to radon in a residential structure built on contaminated soil were not calculated as this would involve a number of assumptions in order to estimate a potential exposure concentration. However, because UMTRA standards are exceeded it can be expected that potential radon exposure would exceed acceptable risks, as the standards are based on build up of radon gas through radioactive decay. Current uses of Buildings 12, 20, and 7 are acceptable for workers based on actual radiation surveys conducted on those buildings.

Overall results of the risk calculations show that contaminants producing the greatest cumulative noncarcinogenic risks are uranium, molybdenum, arsenic, and manganese. Uranium and arsenic exceed EPA's acceptable risk range for both residential and occupational exposures. The largest

portion of the risk in both scenarios is driven by use of ground water as drinking water. If residual soil contamination was exposed through demolition of Buildings 12, 7, and 20 and was present in a residential scenario, risks associated with soil ingestion would exceed acceptable risks based on maximum detected concentrations of Ra-226 in soil. It can also be expected that risks associated with exposure to radon gas would be unacceptable in a residential structure built on unremediated soils. The risk assessment supports the need for institutional controls to limit exposure to contaminated ground water and soil; if these pathways could be eliminated, limited exposure (e.g., incidental ingestion and dermal exposure) to surface water alone would not present an unacceptable risk.

References

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Appendix A

GJO 1999 Analytical Data

Table A-2. Surface-Water Chemistry Data Collected At and Near the GJO Facility During 1999[a]

Sample Location	Ticket Number	Sample Date	Radiological Data			Non-Radiological Data					
			Alpha (pCi/L)[b]	Beta (pCi/L)	Ra-226 (pCi/L)	Alkalinity (as $CaCO_3$) (ppm)	As (µg/L)	Ba (µg/L)	Ca (µg/L)	Cd (µg/L)	CDT[c] (µmhos/cm)
		Standard	-	-	5.0	-	50	-	-	1	-
Lower Gunnison	NDE-046	03/11/1999	5.47	<5.45	1.25	138	<1	50.2	83100	<1	990
	NDK-018	12/16/1999	<5.18	<5.28	<0.81	148	0.55	50.2	81400	<0.3	774
Middle Gunnison	NDE-045	03/11/1999	<5.37	<5.42	0.35	110	<1	52.4	85300	<1	901
	NDK-017	12/16/1999	<5.16	6.75	<0.68	140	0.49	44.2	71300	<0.3	804
North Pond	NDE-049	03/11/1999	147.8	61.01	<0.59	228	4.3	13.1	187000	<1	4320
	NDK-020	12/17/1999	90.44	65.04	<0.98	137	3.7	<14.1	192000	<0.3	4620
South Pond	NDE-047	03/11/1999	234.3	132.8	0.5	110	<1	29.9	288000	<1	3630
	NDE-048	03/11/1999	300.3	144	0.76	-	1	26.9	292000	<1	-
	NDK-021	12/17/1999	183.56	107.94	<1.35	104	2.8	30.6	238000	<0.3	3120
	NDK-022	12/17/1999	174.25	111.1	<0.93	-	3	35.5	237000	<0.3	-
Upper Gunnison	NDE-042	03/10/1999	<5.69	<5.95	0.44	108	<1	45.9	83000	<1	900
	NDK-015	12/16/1999	<4.96	<4.93	<1.37	104	0.58	51.3	76300	<0.3	887
Upper Mid Gunnison	NDE-044	03/10/1999	<5.31	<5.43	0.39	106	<1	46.6	82400	<1	900
	NDK-016	12/16/1999	7.46	<5.3	<1.28	121	0.5	49.4	74100	<0.3	820
Wetland Area	NDE-050	03/11/1999	1129	524.7	<0.59	211	3.7	19.6	532000	<1	3100
	NDK-019	12/16/1999	477.27	<342.48	<1.11	348	6.3	24.3	407000	<0.3	23700

[a] A "<" symbol indicates that the maximum concentration was below the detection limit (number shown is detection limit). A "~" indicates an approximate value (the value was outside the limits for which the instrument was calibrated).

[b] Values with units of pCi/L multiplied by 10^{-9} will yield values with units of µCi/mL for comparison with the Derived Concentration Guides listed in Chapter 3 of DOE Order 5400.5.

[c] Conductivity measured in micromhos per centimeter.

Table A-2 (continued). Surface-Water Chemistry Data Collected At and Near the GJO Facility During 1999[a]

Sample Location	Ticket Number	Sample Date	Non-Radiological Data								
			Cl (µg/L)	Cr (µg/L)	Fe (µg/L)	K (µg/L)	Mg (µg/L)	Mn (µg/L)	Mo (µg/L)	Na (µg/L)	NO_3 (µg/L)
		Standard	250000	11	300	-	-	50	-	-	44270
Lower Gunnison	NDE-046	03/11/1999	10100	4.7	3.4	3230	34200	61.4	3.1	58700	2590
	NDK-018	12/16/1999	6690	5.7	<9	3090	29900	25	2.3	50100	3200
Middle Gunnison	NDE-045	03/11/1999	9880	4	9.6	3310	35100	66.8	2.8	58900	2650
	NDK-017	12/16/1999	6290	<2.5	<9	2730	26100	16.6	2.1	42900	3370
North Pond	NDE-049	03/11/1999	310000	3.7	<3	22700	157000	40	12.1	678000	89.6
	NDK-020	12/17/1999	326000	5.4	<9	23700	178000	11.5	9.3	753000	<80
South Pond	NDE-047	03/11/1999	136000	<2	11.3	17200	86000	51.3	96.3	469000	450
	NDE-048	03/11/1999	136000	14.6	18.6	17300	86700	52.6	97.5	471000	519
	NDK-021	12/17/1999	116000	5.3	<9	19100	83300	0.8	124	475000	98.9
	NDK-022	12/17/1999	116000	47	69.8	18500	82100	30.8	123	467000	100
Upper Gunnison	NDE-042	03/10/1999	9800	5.3	7.2	3340	34400	51.6	4.3	58200	2520
	NDK-015	12/16/1999	6240	2.9	<9	2930	27800	18	2.9	45600	3370
Upper Mid Gunnison	NDE-044	03/10/1999	9750	5.8	5	3300	34200	53.8	3.1	58400	2450
	NDK-016	12/16/1999	6130	12.3	<9	2840	27000	16.9	2.5	44100	3340
Wetland Area	NDE-050	03/11/1999	2260000	<2	4.3	157000	962000	503	1130	9130000	<340
	NDK-019	12/16/1999	2130000	9.9	<9	217000	935000	3.5	340	9700000	<800

[a] A "<" symbol indicates that the maximum concentration was below the detection limit (number shown is detection limit). A "~" indicates an approximate value (the value was outside the limits for which the instrument was calibrated).

Table A-2 (continued). Surface-Water Chemistry Data Collected At and Near the GJO Facility During 1999[a]

Sample Location	Ticket Number	Sample Date	Non-Radiological Data							
			Pb (µg/L)	pH	Se (µg/L)	SO_4 (µg/L)	TDS[d] (mg/L)	Temperature (°C)	U[e] (µg/L)	V (µg/L)
		Standard	4	6.5-9.0	8	480000	-	-	58.22	-
Lower Gunnison	NDE-046	03/11/1999	<1	8.64	7.2	317000	635	7.4	7.5	1.7
	NDK-018	12/16/1999	<0.3	8.56	4.9	240000	545	0.8	6.4	<1
Middle Gunnison	NDE-045	03/11/1999	<1	8.64	7.1	313000	638	7.1	6.8	1.9
	NDK-017	12/16/1999	<0.3	8.43	5.2	241000	537	0.8	5.8	<1
North Pond	NDE-049	03/11/1999	<1	8.33	3.8	1940000	3560	15.5	218	8.1
	NDK-020	12/17/1999	<0.3	8.47	4.5	2180000	3950	2	148	6.4
South Pond	NDE-047	03/11/1999	<1	8	1.7	1800000	2970	10.7	447	<1
	NDE-048	03/11/1999	<1	-	1.7	1790000	2940	-	447	1.1
	NDK-021	12/17/1999	<0.3	8.78	1.3	1660000	2710	5	347	2
	NDK-022	12/17/1999	<0.3	-	1.3	1660000	2700	-	350	1.1
Upper Gunnison	NDE-042	03/10/1999	<1	8.4	7.2	310000	643	9.7	7.6	<1
	NDK-015	12/16/1999	<0.3	8.15	5	241000	522	0.2	5.8	1.5
Upper Mid Gunnison	NDE-044	03/10/1999	<1	8.56	7.3	310000	640	11.3	6.9	1.5
	NDK-016	12/16/1999	<0.3	8.2	4.9	240000	535	1.3	6.2	1.3
Wetland Area	NDE-050	03/11/1999	<1	8.84	1.2	20300000	35000	11.4	1920	1
	NDK-019	12/16/1999	0.35	10.1	1.1	20400000	35900	2.5	662	5.8

[a] A "<" symbol indicates that the maximum concentration was below the detection limit (number shown is detection limit). A "~" indicates an approximate value (the value was outside the limits for which the instrument was calibrated).

[d] Total dissolved solids.

[e] Uranium standard (40 pCi/L) converted to µg/L for comparison purpose. The conversion assumes equilibrium and an activity of 0.687 pCi/µg.

Table A-3. Groundwater Chemistry Data Collected At and Near the GJO Facility During 1999[a]

Sample Location	Ticket Number	Sample Date	Radiological Data: Alpha (pCi/L)[b,d]	Beta (pCi/L)	Ra-226 (pCi/L)	Non-Radiological Data: Alkalinity (as $CaCO_3$) (ppm)	As (µg/L)	Ba (µg/L)	Ca (µg/L)	Cd (µg/L)	CDT[c] (µmhos/cm)	Cl (µg/L)
		Standard	-	-	5.0	-	50	1000	-	10	-	-
10-19N	NDE-033	03/03/1999	158.8	83.63	0.35	339	2	26	299000	1.5	5960	363000
	NDK-012	12/15/1999	203.31	57.37	<0.75	380	2.7	<14.1	314000	<0.3	5410	397000
10-2NA	NDE-041	03/04/1999	539.5	232.7	0.25	282	<1	20.6	238000	<1	2960	110000
	NDK-004	12/14/1999	434	172.36	<1.19	285	<0.4	37	209000	<0.3	1906	104000
11-12NA	NDE-035	03/03/1999	178.5	91.41	0.33	323	19.9	22.6	206000	<1	2570	108000
	NDK-009	12/15/1999	162.04	68.86	<1.13	325	26.7	32.5	219000	<0.3	2351	114000
11-1S	NDE-029	03/02/1999	161.7	69.8	0.5	192	<1	26.1	65000	<1	1070	15700
	NDK-007	12/14/1999	62.19	34.56	<0.83	205	0.48	21.5	64000	<0.3	865	6900
14-13NA	NDE-034	03/03/1999	111.2	67.72	0.38	146	6.6	15.1	367000	<1	3810	126000
	NDK-010	12/15/1999	138.32	81.4	<1.06	177	9.6	33	340000	<0.3	3280	126000
14-6NA	NDE-031	03/03/1999	42.06	25.14	0.69	179	230	48.3	101000	<1	1055	10500
	NDK-008	12/14/1999	22.81	18.01	<0.72	175	229	42.5	94600	<0.3	899	6610
5-12NA	NDE-036	03/04/1999	40.92	<24.12	0.52	321	<1	23.3	310000	<1	3250	154000
	NDK-011	12/15/1999	24.21	<22.98	<0.77	284	<0.4	35.3	298000	<0.3	2650	166000
6-2N	NDE-039	03/04/1999	176.8	110.6	<0.61	230	1	28.3	245000	<1	3070	88400
	NDK-002	12/13/1999	208.49	94.16	<0.6	259	1.1	34.7	250000	<0.3	1947	86900
8-4S	NDE-038	03/04/1999	529.1	231.1	1.38	259	<1	23.3	235000	<1	2700	110000
	NDK-003	12/14/1999	415.64	176.72	<1.09	296	1.3	29.2	210000	<0.3	2190	98500

[a] A "<" symbol indicates that the maximum concentration was below the detection limit (number shown is detection limit). A "~" indicates an approximate value (the value was outside the limits for which the instrument was calibrated).

[b] Values with units of pCi/L multiplied by 10^{-9} will yield values with units of µCi/mL for comparison with the Derived Concentration Guides listed in Chapter 3 of DOE Order 5400.5.

[c] Conductivity measured in micromhos per centimeter.

[d] Gross alpha data is not converted for radon and uranium contributions; therefore standard not provided in table. See section 6.3.1 for discussion.

Table A-3 (continued). Groundwater Chemistry Data Collected At and Near the GJO Facility During 1999[a]

Sample Location	Ticket Number	Sample Date	Radiological Data: Alpha (pCi/L)[b,d]	Beta (pCi/L)	Ra-226 (pCi/L)	Non-Radiological Data: Alkalinity (as $CaCO_3$) (ppm)	As (µg/L)	Ba (µg/L)	Ca (µg/L)	Cd (µg/L)	CDT[c] (µmhos/cm)	Cl (µg/L)
		Standard	-	-	5.0	-	50	1000	-	10	-	-
GJ84-04	NDE-032	03/03/1999	111	66.83	0.59	186	6	22.7	250000	<1	3600	108000
	NDK-013	12/15/1999	99.6	57.43	1.23	199	8.4	33.1	219000	<0.3	2520	97900
	NDK-014	12/15/1999	112.95	63.53	<0.8	-	8.3	27.3	223000	<0.3	-	99000
GJ84-09	NDE-037	03/04/1999	<16.62	<17.05	0.34	215	1.7	21.7	164000	<1	2524	71500
	NDK-001	12/13/1999	<17.98	<17.35	<0.76	205	2	20.3	188000	<0.3	2570	82300
GJ87-15	NDE-027	03/02/1999	301.2	163.7	0.59	222	44.9	13	397000	<1	3930	135000
	NDE-028	03/02/1999	306.7	162.4	0.19	-	43.9	24	389000	<1	-	137000
	NDK-006	12/14/1999	345.03	148.14	<0.8	281	54.4	24.3	340000	<0.3	3300	142000

[a] A "<" symbol indicates that the maximum concentration was below the detection limit (number shown is detection limit). A "~" indicates an approximate value (the value was outside the limits for which the instrument was calibrated).

[b] Values with units of pCi/L multiplied by 10^{-9} will yield values with units of µCi/mL for comparison with the Derived Concentration Guides listed in Chapter 3 of DOE Order 5400.5.

[c] Conductivity measured in micromhos per centimeter.

[d] Gross alpha data is not converted for radon and uranium contributions; therefore standard not provided in table. See section 6.3.1 for discussion.

Table A-3 (continued). Groundwater Chemistry Data Collected At and Near the GJO Facility During 1999[a]

Sample Location	Ticket Number	Sample Date	Non-Radiological Data									
			Cr (µg/L)	Fe (µg/L)	H_2O Depth (feet)	K (µg/L)	Mg (µg/L)	Mn (µg/L)	Mo (µg/L)	Na (µg/L)	NO_3 (µg/L)	Pb (µg/L)
		Standard	50	-	-	-	-	-	100	-	44270	50
10-19N	NDE-033	03/03/1999	<2	720	13.53	17500	182000	2880	66.4	979000	<85	<1
	NDK-012	12/15/1999	<2.5	877	12.74	23800	199000	2960	70.2	1120000	<200	<0.3
10-2NA	NDE-041	03/04/1999	11.2	<3	11.2	9800	95400	795	185	338000	82100	<1
	NDK-004	12/14/1999	9.4	<9	10.6	10000	82700	594	190	320000	61800	<0.3
11-12NA	NDE-035	03/03/1999	6.6	<3	5.72	8530	69700	712	22.7	295000	31600	<1
	NDK-009	12/15/1999	<2.5	<9	5.19	9750	74700	768	22.6	321000	27200	<0.3
11-1S	NDE-029	03/02/1999	4.8	<3	16.82	4550	28400	22.4	114	136000	<17	<1
	NDK-007	12/14/1999	<2.5	<9	16.26	4130	26500	45	62.1	81200	<40	<0.3
14-13NA	NDE-034	03/03/1999	3	<3	6.15	20100	80300	4860	243	494000	<34	<1
	NDK-010	12/15/1999	<2.5	<9	5.71	22700	74900	4640	252	485000	<80	<0.3
14-6NA	NDE-031	03/03/1999	6.3	1690	19.55	11900	24200	2170	23.5	88100	<17	<1
	NDK-008	12/14/1999	14.6	1520	18.89	11400	22600	1940	20.7	73300	<40	<0.3
5-12NA	NDE-036	03/04/1999	<2	<3	10.2	7080	118000	446	12.7	344000	1280	<1
	NDK-011	12/15/1999	15.8	<9	9.43	7460	113000	557	14.7	338000	<80	<0.3
6-2N	NDE-039	03/04/1999	7.9	<3	14.25	10400	75700	1590	54.3	404000	44300	<1
	NDK-002	12/13/1999	<2.5	<9	13.45	11400	77400	1610	52.4	421000	47000	<0.3
8-4S	NDE-038	03/04/1999	2.4	<3	11.82	8460	73200	562	215	302000	55400	<1
	NDK-003	12/14/1999	14	<9	11.09	8650	62200	629	234	280000	47100	<0.3

[a] A "<" symbol indicates that the maximum concentration was below the detection limit (number shown is detection limit). A "~" indicates an approximate value (the value was outside the limits for which the instrument was calibrated).

Table A-3 (continued). Groundwater Chemistry Data Collected At and Near the GJO Facility During 1999[a]

Sample Location	Ticket Number	Sample Date	Non-Radiological Data									
			Cr (µg/L)	Fe (µg/L)	H_2O Depth (feet)	K (µg/L)	Mg (µg/L)	Mn (µg/L)	Mo (µg/L)	Na (µg/L)	NO_3 (µg/L)	Pb (µg/L)
		Standard	50	-	-	-	-	-	100	-	44270	50
GJ84-04	NDE-032	03/03/1999	4.2	19.8	9.52	12300	64000	3570	149	538000	<34	<1
	NDK-013	12/15/1999	<2.5	19	8.89	12600	56300	3340	140	484000	<80	<0.3
	NDK-014	12/15/1999	13.1	10.9	-	13000	57100	3400	145	490000	<80	<0.3
GJ84-09	NDE-037	03/04/1999	6.3	195	21.17	9110	29000	362	6.8	411000	<17	<1
	NDK-001	12/13/1999	<2.5	205	20.08	10100	32400	294	6.1	426000	<80	<0.3
GJ87-15	NDE-027	03/02/1999	11.3	<3	7.93	18200	86900	5260	274	486000	3720	<1
	NDE-028	03/02/1999	5.8	<3	-	18000	85200	5140	275	498000	3790	<1
	NDK-006	12/14/1999	<2.5	<9	5.83	20700	75300	4460	299	486000	1780	<0.3

[a] A "<" symbol indicates that the maximum concentration was below the detection limit (number shown is detection limit). A "~" indicates an approximate value (the value was outside the limits for which the instrument was calibrated).

Table A-3 (continued). Groundwater Chemistry Data Collected At and Near the GJO Facility During 1999[a]

Sample Location	Ticket Number	Sample Date	Non-Radiological Data							
			pH	Se (µg/L)	SO_4 (µg/L)	TDS[d] (mg/L)	Temperature (°C)	Turbidity (NTU)[e]	U[f] (µg/L)	V (µg/L)
		Standard	-	10	-	2444	-	-	44.70	-
10-19N	NDE-033	03/03/1999	7.14	<1	2620000	5020	12.2	3.94	251	<1
	NDK-012	12/15/1999	7.22	0.48	2820000	5220	14.6	3.66	227	<1
10-2NA	NDE-041	03/04/1999	7.11	91.8	1140000	2420	15.6	1.61	871	3.7
	NDK-004	12/14/1999	7.14	87.3	1030000	2090	15.9	3.73	739	3.9
11-12NA	NDE-035	03/03/1999	7.16	63.1	891000	2010	13.7	0.56	265	133
	NDK-009	12/15/1999	7.15	62.9	934000	2110	15.3	0.23	258	141
11-1S	NDE-029	03/02/1999	7.55	2.6	307000	735	13.8	4.11	256	6.2
	NDK-007	12/14/1999	7.4	0.52	263000	598	14.3	2.96	131	3.9
14-13NA	NDE-034	03/03/1999	7.13	<1	1850000	3250	13.1	0.3	226	11.7
	NDK-010	12/15/1999	7.1	0.78	1830000	3180	15.4	0.3	236	13.5
14-6NA	NDE-031	03/03/1999	7.37	<1	332000	737	13.5	1.98	54.4	3.2
	NDK-008	12/14/1999	7.24	<0.1	290000	645	14.6	0.86	46.8	2.2
5-12NA	NDE-036	03/04/1999	7.24	10.4	1370000	2760	14.3	0.36	50.4	3.5
	NDK-011	12/15/1999	7.15	1.5	1260000	2670	14.7	0.18	34.8	2
6-2N	NDE-039	03/04/1999	7.5	122	1330000	2530	18.5	0.28	327	10.3
	NDK-002	12/13/1999	7.34	118	1280000	2470	17	0.7	315	11.4
8-4S	NDE-038	03/04/1999	7.17	75.5	925000	2130	12.7	4.07	847	8
	NDK-003	12/14/1999	7.03	70.6	907000	1880	14.1	4.65	749	10

[a] A "<" symbol indicates that the maximum concentration was below the detection limit (number shown is detection limit). A "~" indicates an approximate value (the value was outside the limits for which the instrument was calibrated).

[d] Total dissolved solids.

[e] Nephelometric turbidity units.

[f] Uranium standard (30 pCi/L) converted to total uranium for comparison purpose. The conversion assumes equilibrium and an activity of 0.671 pCi/µg.

Table A-3 (continued). Groundwater Chemistry Data Collected At and Near the GJO Facility During 1999[a]

Sample Location	Ticket Number	Sample Date	Non-Radiological Data							
			pH	Se (µg/L)	SO_4 (µg/L)	TDS[d] (mg/L)	Temperature (°C)	Turbidity (NTU)[e]	U[f] (µg/L)	V (µg/L)
		Standard	-	10	-	2444	-	-	44.70	-
GJ84-04	NDE-032	03/03/1999	7.13	<1	1630000	2900	13.4	1.23	249	15.7
	NDK-013	12/15/1999	7.11	0.15	1480000	2600	14.3	0.31	212	17.5
	NDK-014	12/15/1999	-	0.14	1500000	2600	-	-	219	17.8
GJ84-09	NDE-037	03/04/1999	7.44	<1	980000	1930	14.7	1.4	10	<1
	NDK-001	12/13/1999	7.08	<0.1	1120000	1980	14.4	0.32	12.5	<1
GJ87-15	NDE-027	03/02/1999	7.18	5.3	1830000	3380	12.7	4.24	574	86.7
	NDE-028	03/02/1999	-	5.3	1830000	3360	-	-	570	84.4
	NDK-006	12/14/1999	7.01	4.4	1750000	3120	16.2	4.42	558	98.1

[a] A "<" symbol indicates that the maximum concentration was below the detection limit (number shown is detection limit). A "~" indicates an approximate value (the value was outside the limits for which the instrument was calibrated).

[d] Total dissolved solids.

[e] Nephelometric turbidity units.

[f] Uranium standard (30 pCi/L) converted to total uranium for comparison purpose. The conversion assumes equilibrium and an activity of 0.671 pCi/µg.

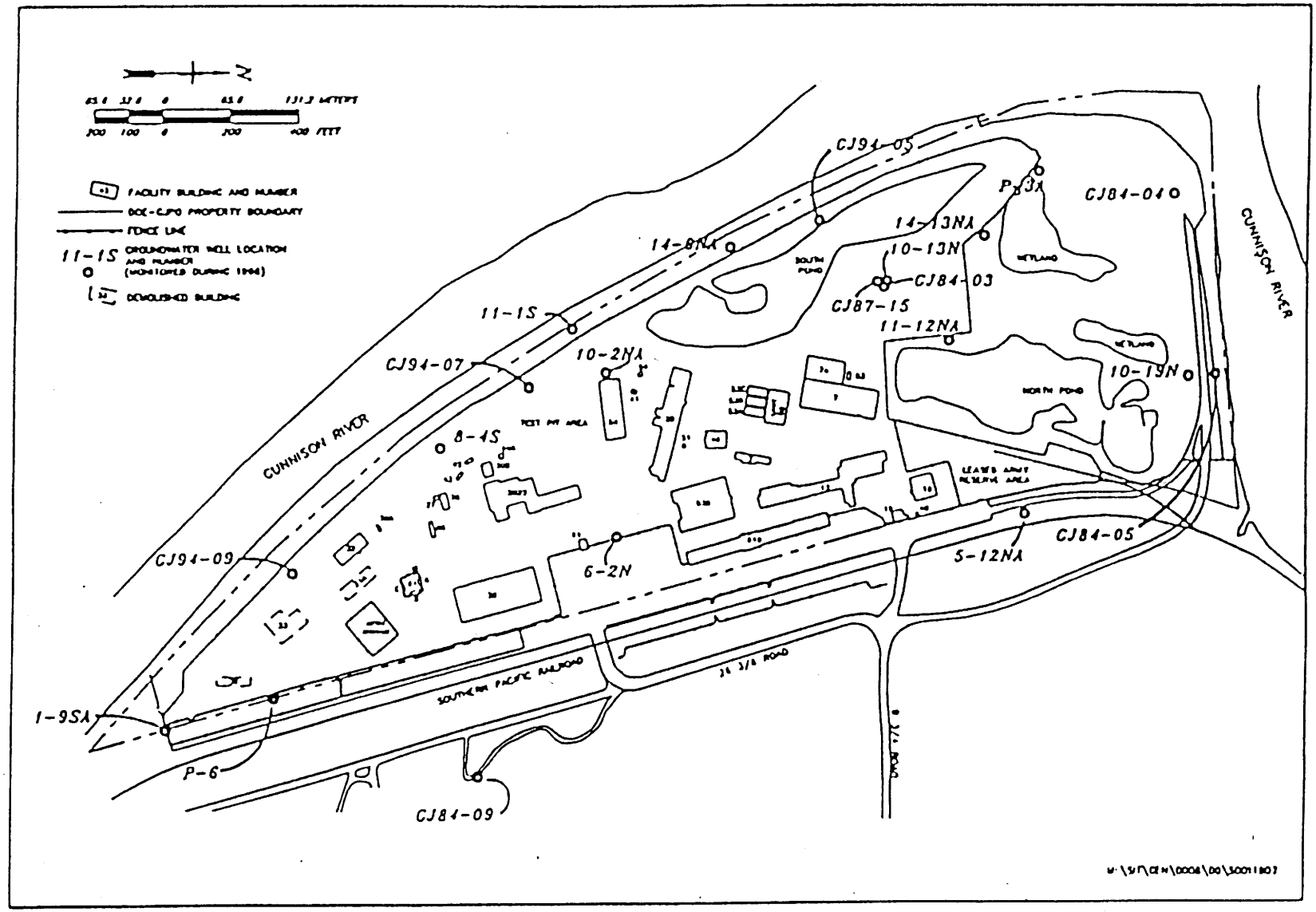

Figure 6–3. Ground Water Sampling Locations at the DOE–GJO Facility

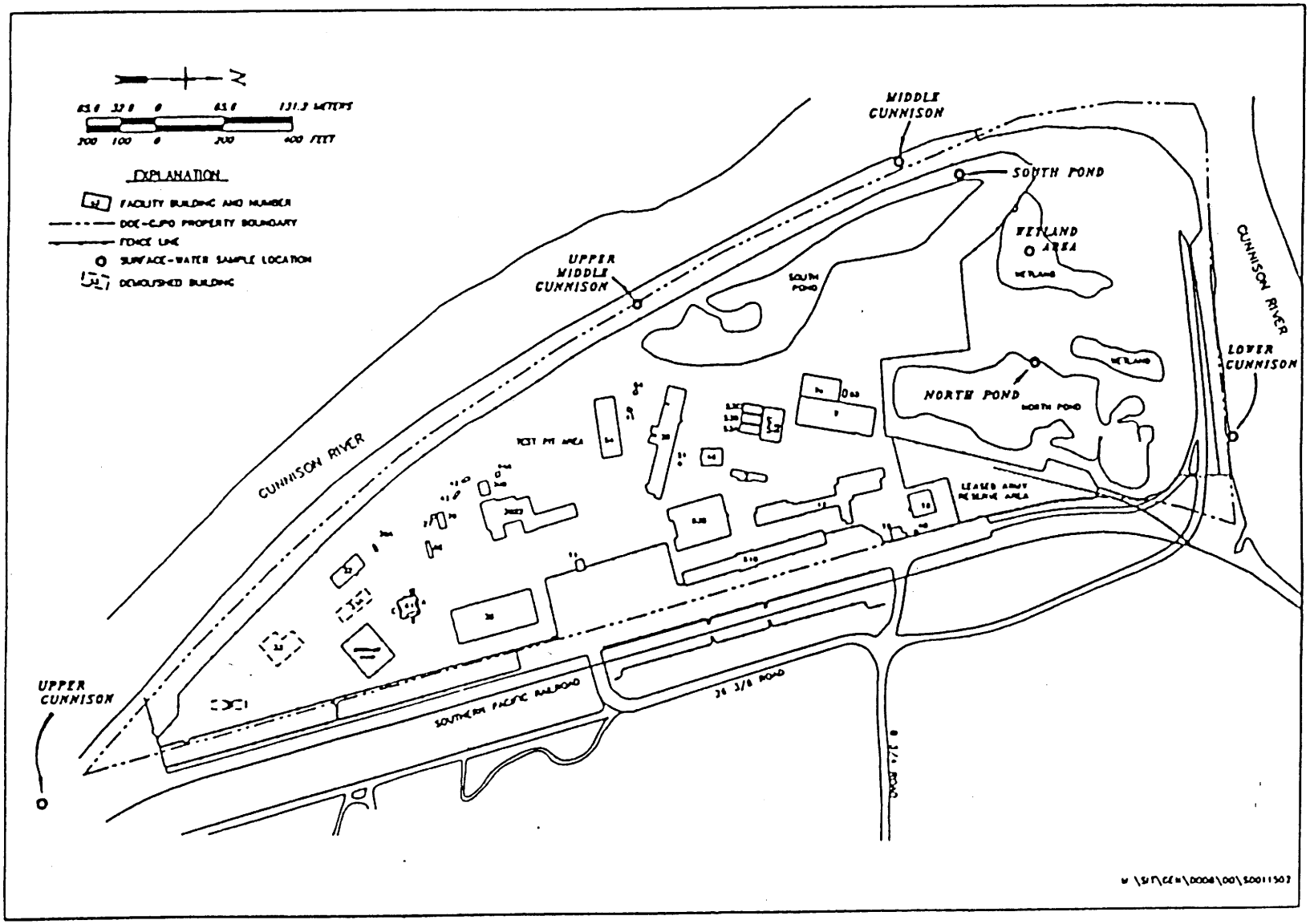

Figure 3–3. Surface Water Sampling Locations At and Near the DOE–GJO Facility

Appendix B

Risk Calculation Spreadsheets

Table B-1. GJO- Residential Ground Water Ingestion Risk Calculations-Adults

Non-Carcinogens - Ground Water Ingestion Only

Contaminant	Cw95*	IRw	EF	ED	BW	AT	Intake	RfD**	HQ
	mg/L	L/d	d/y	y	kg	d	mg/kg-d	mg/kg-d	
Arsenic	0.055	2	350	30	70	10950	0.002	0.0003	5.02
Manganese	2.91	2	350	30	70	10950	0.080	0.047	1.70
Vanadium	0.046	2	350	30	70	10950	0.001	0.009	0.14
Selenium	0.047	2	350	30	70	10950	0.001	0.005	0.26
Molybdenum	0.17	2	350	30	70	10950	0.005	0.005	0.93
Nitrate	27.2	2	350	30	70	10950	0.745	7	0.11
Uranium	0.447	2	350	30	70	10950	0.012	0.003	4.08

Carcinogens - Ground Water Ingestion Only

Contaminant		CW-95*	IR	EF	ED	BW	AT	Intake	SF**	Risk
U234+238 (pCi/L)		306.642	2	350	30	na	na	6.44E+06	5.32E-11	3.43E-04
Arsenic		5.50E-02	2	350	30	70	25550	0.001	15.1	9.75E-03

*UCL95

**Reference Doses (RfD) and Slope Factors (SF) from best available EPA sources (IRIS and HEAST databases)

Table B-2. GJO - Incidental Surface Water Ingestion/Dermal Exposure Pathway--Recreational--Adults

Contaminant	Cw-max	Sa	Pc	Cf	ET	EF	ED	IRw	BW	AT	Intake ingested	Intake absorbed	Total dose	RfD	HQ
	mg/L	cm2	cm/hr	L/cm3	hr/d	d/y	yr	L/d	kg	d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d
Manganese	0.503	312	0.001	0.001	1	100	30	0.01	70	10950	0.00002	0.000001	0.000020	0.047	0.00043
Molybdenum	1.13	312	0.001	0.001	1	100	30	0.01	70	10950	0.00004	0.000001	0.000046	0.005	0.00912
Uranium	1.92	312	0.001	0.001	1	100	30	0.01	70	10950	0.00008	0.000002	0.000077	0.003	0.02583

Carcinogens - Surface Water Ingestion Only

Contaminant		CW-max	IR	EF	ED	BW	AT	Intake	SF	Risk
U234+238 (pCi/L)		1317.12	0.01	100	30	na	na	3.95E+04	5.32E-11	2.10E-06

Reference Doses (RfD) and Slope Factors (SF) from best available EPA sources (IRIS and HEAST databases)

Table B-3. GJO - INGESTION OF FISH FROM NORTH POND

Intake = CF x IR x EF x ED / BW x AT

where[1]:

Intake is in (mg/kg-d)

FI = fraction of contaminated fish ingested

CF concentration of contaminant in fish (=BCF X water concentration -- maximum concentration detected in pond is 0.075 mg/L U)

ED = exposure duration (years); 30 yrs for adult;default

EF = exposure frequency (d/yr); 350 days/yr; default

BW = body weight (kg); 70 kg adult; default

AT = averaging time; ED x 365 d/yr non-carc.

IR = Fish ingestion rate-based on average consumption of 2 8oz portions per week (0.054 kg per day for an adult)

Fish Ingestion - Non Carcinogens

Contaminant		CF	FI	IR	EF	ED	BW	AT	Intake	RfD[2]	HQ
Uranium	BCF=1	0.218	0.5	0.054	350	30	70	10950	8.06301E-05	0.003	0.03
	BCF=55	11.99	0.5	0.054	350	30	70	10950	0.004434658	0.003	1.48
Manganese	BCF=1	0.04	0.5	0.054	350	30	70	10950	1.47945E-05	0.14	0.00
	BCF=55	2.2	0.5	0.054	350	30	70	10950	0.000813699	0.14	0.01

Fish Ingestion - Carcinogens

Contaminant		CF	FI	IR	EF	ED	BW	AT	Intake	SF[2]	Risk
U234+238[3]	BCF=1	150	0.5	0.054	350	30	na	na	4.25E+04	4.36E-11	1.85E-06
	BCF=55	8225	0.5	0.054	350	30	na	na	2.33E+06	4.36E-11	1.02E-04

[1] All exposure factors are from EPA 1989b

[2] Data are from EPA's Integrated Risk Information System (IRIS); other values are from EPA Region III Risk-Based Concentration Table

[3] assumes 1 mg U = 686 pCi of U234 + U238; SF used is average of U234 and U238

Table B-4. GJO - INGESTION OF FISH FROM SOUTH POND

Intake = CF x IR x EF x ED / BW x AT

where[1]:

Intake is in (mg/kg-d)

FI = fraction of contaminated fish ingested

CF concentration of contaminant in fish (=BCF X water concentration -- maximum concentration detected in pond is 0.075 mg/L U)

ED = exposure duration (years); 30 yrs for adult;default

EF = exposure frequency (d/yr); 350 days/yr; default

BW = body weight (kg); 70 kg adult; default

AT = averaging time; ED x 365 d/yr non-carc.

IR = Fish ingestion rate-based on average consumption of 2 8oz portions per week (0.054 kg per day for an adult)

Fish Ingestion - Non Carcinogens

Contaminant		CF	FI	IR	EF	ED	BW	AT	Intake	RfD[2]	HQ
Uranium	BCF=1	0.447	0.5	0.054	350	30	70	10950	0.000165329	0.003	0.06
	BCF=55	24.585	0.5	0.054	350	30	70	10950	0.009093082	0.003	3.03
Manganese	BCF=1	0.0526	0.5	0.054	350	30	70	10950	1.94548E-05	0.14	0.00
	BCF=55	2.893	0.5	0.054	350	30	70	10950	0.001070014	0.14	0.01
										HI=	

Fish Ingestion - Carcinogens

Contaminant		CF	FI	IR	EF	ED	BW	AT	Intake	SF[2]	Risk
U234+238[3]	BCF=1	307	0.5	0.054	350	30	na	na	8.70E+04	4.36E-11	3.79E-06
	BCF=55	16865	0.5	0.054	350	30	na	na	4.78E+06	4.36E-11	2.08E-04

[1] All exposure factors are from EPA 1989b

[2] Data are from EPA's Integrated Risk Information System (IRIS); other values are from EPA Region III Risk-Based Concentration Table

[3] assumes 1 mg U = 686 pCi of U234 + U238; SF used is average of U234 and U238

Table B-5. GJO- Occupational Ground Water Ingestion Risk Calculations-Adults

Non-Carcinogens - Ground Water Ingestion Only

Contaminant	Cw95*	IRw	EF	ED	BW	AT	Intake	RfD**	HQ
	mg/L	L/d	d/y	y	kg	d	mg/kg-d	mg/kg-d	
Arsenic	0.055	1	250	30	70	10950	0.001	0.0003	1.79
Manganese	2.91	1	250	30	70	10950	0.028	0.047	0.61
Vanadium	0.046	1	250	30	70	10950	0.000	0.009	0.05
Selenium	0.047	1	250	30	70	10950	0.000	0.005	0.09
Molybdenum	0.17	1	250	30	70	10950	0.002	0.005	0.33
Nitrate	27.2	1	250	30	70	10950	0.266	7	0.04
Uranium	0.447	1	250	30	70	10950	0.004	0.003	1.46

Carcinogens - Ground Water Ingestion Only

Contaminant		CW95	IR	EF	ED	BW	AT	Intake	SF**	Risk
U234+238 (pCi/L)		306.642	1	250	30	na	na	2.30E+06	5.32E-11	1.22E-04
Arsenic		5.50E-02	1	250	30	70	25550	0.000	15.1	3.48E-03

*UCL95

**Reference Doses (RfD) and Slope Factors (SF) from best available EPA sources (IRIS and HEAST databases)

Table B-6. GJO - Surface Water Incidental Exposure - Dermal Exposure Pathway (Hypothetical Site Worker)												
										Intake		
Contaminant	Cw-max	Sa	Pc	Cf	ET	EF	ED	BW	AT	absorbed	RfD	HQ
	mg/L	cm2	cm/hr	L/cm3	hr/d	d/y	yr	kg	d	mg/kg-d	mg/kg-d	mg/kg-d
Non-carcinogenic												
Manganese	0.503	312	0.001	0.001	8	250	30	70	10950	0.00001	0.047	0.000261
Molybdenum	1.13	312	0.001	0.001	8	250	30	70	10950	0.00003	0.005	0.00552
Uranium	1.92	312	0.001	0.001	8	250	30	70	10950	0.00005	0.003	0.015631
											HI=	0.021411
Carcinogenic											Slope Factor	Risk
Uranium (pCi/L)	1317.12	312	0.001	0.001	8	250	30	na	na	24656.486	4.36E-11	1.08E-06
Non-Carcinogens - Surface Water Ingestion Only (Site Worker)												
Contaminant		**CW**	**IR**	**EF**	**ED**	**BW**	**AT**	**Intake**	**RfD**	**HQ**		
Manganese		0.503	0.05	108	30	70	10950	0.0001063	0.047	0.002		
Molybdenum		1.13	0.05	108	30	70	10950	0.0002388	0.005	0.048		
Uranium		1.92	0.05	108	30	70	10950	0.0004058	0.003	0.135		
									HI=	0.185		
Carcinogenic												
Contaminant		**CW-max**	**IR**	**EF**	**ED**	**BW**	**AT**	**Intake**	**SF****	**Risk**		
U234+238	UCL95	1317.12	0.05	108	30	na	na	2.13E+05	5.32E-11	1.14E-05		
								Total Risk	1.24E-05			
Exposure factors and default values from EPA 1989												
Toxicological data are mainly from EPA's Integrated Risk Information System (IRIS); other values are from EPA Region III Risk Based Concentration Table												
Carcinogenic risks for uranium assumes 1 mg U = 686 pCi of U234 + U238; SF is average of U234 and U238												
Concentrations used are maximum from North Pond, South Pond, or wetland												

Table B-7. Soil Ingestion Risk Estimate-Carcinogenic Risks from Radium-226

Maximum concentration of radium in soil is 364 pCi/g (or .365 pCi/mg) associated with Bldg. 20
Ra-226 Slope factor is 2.95E-10 excess cancer risk per pCi ingested (EPA guidance, Nov. 1995)
From ages 1-6 an average soil ingestion rate is 200 mg/d
From ages 7-30 an average soil ingestion rate is 100 mg/d

Total pCi ingested from ages 1-6 would be 200 mg/d x 0.365 pCi/mg x 365 d/y x 6 yrs =	159870
Total pCi ingested from ages 7-30 would be 100 mg/d x 0.365 pCi/mg x 365 d/y x 23 yrs =	306417.5
Total pCi =	466287.5
Risk =	1.38E-04

Table B-8. GJO- Residential Ground Water Ingestion Risk Calculations-Children

Non-Carcinogens - Ground Water Ingestion Only

Contaminant	Cw95*	IRw	EF	ED	BW	AT	Intake	RfD**	HQ
	mg/L	L/d	d/y	y	kg	d	mg/kg-d	mg/kg-d	
Arsenic	0.055	1.5	350	7	38.3	2555	0.002	0.0003	6.89
Manganese	2.91	1.5	350	7	38.3	2555	0.109	0.047	2.33
Vanadium	0.046	1.5	350	7	38.3	2555	0.002	0.009	0.19
Selenium	0.047	1.5	350	7	38.3	2555	0.002	0.005	0.35
Molybdenum	0.17	1.5	350	7	38.3	2555	0.006	0.005	1.28
Nitrate	27.2	1.5	350	7	38.3	2555	1.021	7	0.15
infants	27.2	0.64	350	1	4	365	4.173	7	0.60
Uranium	0.447	1.5	350	7	38.3	2555	0.017	0.003	5.60

Carcinogens - Ground Water Ingestion Only (Childhood exposure only- lifetime excess risk)

Contaminant		CW*	IR	EF	ED	BW	AT	Intake	SF**	Risk
U234+238	UCL95	306.642	1.5	350	7	na	na	1.13E+06	5.32E-11	6.00E-05
(pCi/L)										
Arsenic		5.50E-02	1.5	350	7	38.3	25550	0.000	15.1	3.12E-03

**Reference Doses (RfD) and Slope Factors (SF) from best available EPA sources (IRIS and HEAST databases)

Table B-9. INTAKE/RISK CALCULATION SPREADSHEET (Surface Water/Sediment)

GJO-Surface water exposure--Children Playing

Non-Carcinogens - Surface Water Ingestion Only (Children)

Contaminant		CW-max*	IR	EF	ED	BW	AT	Intake	RfD[2]	HQ		
Manganese		0.503	0.05	114	7	38.3	2555	0.000205	0.047	0.004		
Molybdenum		1.13	0.05	114	7	38.3	2555	0.000461	0.005	0.092		
Uranium		1.92	0.05	114	7	38.3	2555	0.000783	0.003	0.261		
									HI=	0.357		

[1] All exposure factors are from EPA 1989b

[2] Conversion factor (10E-6 kg/mg)

[3] Data are mainly from EPA's Integrated Risk Information System (IRIS); other values are from EPA Region III Risk-Based Concentration Table

Naturita - Incidental Exposure - Dermal Exposure Pathway (Child)

Contaminant	Cw-max*	Sa	Pc	Cf	ET	EF	ED	BW	AT	Intake absorbed	RfD	HQ
	mg/L	cm2	cm/hr	L/cm3	hr/d	d/y	yr	kg	d	mg/kg-d	mg/kg-d	mg/kg-d
Non-carcingenic												
Manganese	0.503	497	0.001	0.001	1	114	7	38.5	2555	0.00000	0.047	4.31497E-05
Molybdenum	1.13	497	0.001	0.001	1	114	7	38.5	2555	0.00000	0.005	0.000911205
Uranium	1.92	497	0.001	0.001	1	114	7	38.5	2555	0.00001	0.003	0.002580403
											HI=	0.003534758

*Maximum surface water concentration from North pond, South pond, or wetland

RESPONSE TO COMMENTS

UNITED STATES DEPARTMENT OF ENERGY GRAND JUNCTION OFFICE DEFERRAL REQUEST

The Division received several comments to the United States Department of Energy (DOE) Grand Junction Office Deferral Request (DR). The following Response to Comments provides responses to specific comments or groups of related comments. For each comment, the comment or group of related comments are listed first in bold, followed by a brief response. Some comments were received which resulted in changes to the DR. These changes to the DR are summarized on the attached errata sheet, and are understood to be incorporated into the Final DR by reference.

General Comments

1. **Why wait to clean up under buildings 12 and 20 when Cheney will be closed? Tougher clean-up standards will undoubtedly be required in the future. Why not use currently available expertise for clean up now? Will the Cheney Repository be open to accept the remediation wastes from Buildings 12, 20, etc. when DOE decides to vacate? What assurances do we have for this? In the past other buildings such as 6, 36, 34, 31, and 35 were hauled to Cheney. Why will buildings 12 and 20 be allowed to be hauled to a regular landfill?**

   Response

   DOE will lease Buildings 12 and 20 for the foreseeable future from the new site owner, the Riverview Technology Corporation (the RTC). Building 12 will continue to house the computer center for buildings that will be leased by DOE (Buildings 2, 12, 20, 32, 46, 810, and 938). Building 20 houses the analytical laboratory that will continue to be operated by DOE. Because known contamination is present under the buildings, DOE has determined that it will be more cost effective to demolish the buildings and remediate the contaminated soil after DOE discontinues operations in those buildings.

   DOE–GJO plans to use its technical assistance contractor to monitor remediation operations. This contractor will have the necessary expertise by the nature of the scope of the contract.

   Cheney Repository is scheduled to remain open until the year 2023. And it is anticipated that Buildings 12 and 20 will be demolished well before the Cheney closure date. The radiological contamination in materials under Buildings 12 and 20 will be accepted by Cheney. If the use of Buildings 12 and 20 extends beyond the active life of Cheney, then the radiological contamination in materials under Buildings 12 and 20 will be transported and disposed at another permitted disposal facility in accordance with applicable state and federal regulations.

Buildings 6, 31, 34, 35, 36, and other buildings at the facility (Buildings 1, 31A, 37, 39, 44, and 52) were demolished and hauled to Cheney because they were radiologically contaminated, remediation was not cost-effective, and the buildings were no longer useful to DOE. The Building 12 and 20 structures have been released for unrestricted use by the public based on approved radiological release surveys and/or analysis of the risk to human health and the environment. Therefore, demolition debris from these structures can be transported and disposed of in a Subtitle D, Solid Waste Landfill.

Please also see related General Comments 9, 13, 15, and 17, and Specific Comments 2, 7, 19 and 21.

2. **The radioactive contamination at GJP is considered Mill Process waste only, even though Transuranic Waste has been accepted at the facility for several years. TRU isotopes have been identified in sample points at the facility. Disposal of the TRU at Cheney is being buried in a repository not originally designed for TRU isotopes. Is Cheney adequate to take all the remediation wastes generated in the future?**

Response:

The sample plant formerly located in Building 7A, and Building 20 have been evaluated for transuranic isotopes. These investigations have indicated that these isotopes are at levels below minimum detectable concentrations and/or below free-release limits. Therefore, there are no transuranic wastes at the DOE–GJO facility that will be hauled to Cheney.

3. **When can you use supplemental standards or other standards other than 40 CFR for clean-up? Different standards were used for different areas of the facility such as for Building 2. What's left in place if you use supplemental – standards? Is this still considered to be protective of human health and the environment under a unrestricted use scenario?**

Response:

Under the Atomic Energy Act (AEA) of 1954, as amended, DOE is responsible for implementing and enforcing all regulations governing the monitoring and control of radionuclides released by DOE operations. DOE issued DOE Order 5400.5 "Radiation Protection of the Public and the Environment" in 1990 under the authority of the AEA. DOE Order 5400.5 was developed specifically for DOE operations and incorporates applicable regulatory requirements established by the NRC and the EPA (10 CFR Parts 60 and 72, and 40 CFR Parts 191 and 192).

The radiological release guidelines used for the clean-up of the DOE–GJO facility are provided in DOE Order 5400.5. This Order incorporated the soil clean-up and interior radon and gamma exposure rate standards in 40 CFR 192, and building surface release standards from the Formerly Utilized Sites Remedial Action Project (FUSRAP) under which the GJO remedial action project initially operated. While DOE Order 5400.5 is not considered regulation, the order is accepted as appropriate guidance for clean-up of radioactive contaminated remedial action projects.

Supplemental standards, which is a provision of 40 CFR 192, were not applied to any location on the DOE–GJO facility. A radiation dose-based analysis, which is a provision of DOE Order 5400.5, was used to release Building 2 for unrestricted use by the public. The only known radiological contamination remaining on the facility is present under Buildings 12, 20, and 7, in the ground water under the facility, and in surface water of North Pond, South Pond, and the wetlands. Building 7 is on the Army Reserve Tract, and will not be part of this property transfer. DOE is committed to remediating all these locations. This commitment is detailed in the Enforceable Agreement and other sections of the DR.

4. **Lead Based Paint, asbestos, mercury vapor florescent tubes and PCB Ballast are all materials that are currently managed on-site. When site is torn down who will be responsible for the management of these wastes? Has the facility been assessed for LBP contamination, i.e. soils under drip lines, etc.?**

Response:

Management of lead-based paint, asbestos, mercury vapor tubes, and PCB ballast in light fixtures will be the responsibility of the new owner, the RTC when these materials become wastes during capitol construction or routine maintenance activities. The Quitclaim Deed discloses that these materials are present at the site due to the age of the facility, and the RTC acknowledges this responsibility.

The DOE currently has a Lead Based Paint (LBP) Program in place to manage and maintain LBP present at the facility appropriately. As such, there are no locations at the facility where LBP is peeling from either interior or exterior surfaces, so there has been no need to test soil under drip lines for the presence of lead.

5. **Significant "depth-of-contamination investigations" are usually performed on tight grid patterns never to exceed 100 feet from borehole to borehole. The GJO facility was characterized by borehole on 100 meter gridding 3 times less stringent then that used at most other sites. Why does this facility share this variance? Areas of contamination have been identified which were previously declared remediated. How effective was the characterization effort?**

Response:

The initial characterization of the facility was conducted on a 100-foot by 100-foot grid. Boreholes were drilled and sampled at the grid locations and at locations suspected to contain mill tailings. Additional characterization activities addressed all land and building surfaces. Remediation of assessed deposits of contamination continued vertically and laterally until the excavated soil surfaces met release requirements for concentrations of radium-226, thorium-230, and total uranium.

The radiological characterization and remediation of the facility were conducted in accordance with approved procedures. Therefore, the open land areas on the site were approved and released for unrestricted use. Small pockets of contaminated soil have been encountered and remediated as a result of subsequent investigations and excavations, but these deposits did not present a risk to human health or environment; they were remediated to reduce potential radiological exposure to as low as reasonably achievable (ALARA).

6. **GJO was once a "yellowcake" production facility, yellow cake is primarily a beta emitter, beta emitters were not surveyed for in majority of release surveys on property. Most surveys were gamma only. How effective is the clean-up with this in mind?**

Response:

Most of the radiological contamination in the soil was uranium mill tailings and ore. These materials can be identified by gamma scintillometers. Soil sampling for verification of remediated areas included analysis for uranium, which would have detected the presence of yellowcake. No verification samples collected throughout the remediation project exceeded the authorized limit for uranium, so if yellowcake had been present in the soil it has been removed.

To determine whether windblown yellowcake had been trapped on exterior surfaces that were subsequently covered by asphalt or concrete pavement, approximately 270 locations were cored and the soil/pavement contact was measured for beta-gamma activity. The measurements did not indicate the presence of windblown contamination, which was verified by the analytical results of representative soil samples.

The only yellowcake found on the facility was associated with buildings. Contaminated buildings were remediated or demolished, and all the buildings remaining on the site have been surveyed for radiological contamination and have been released for unrestricted use.

7. **Who (what professional organization) will monitor excavations, demolitions, and facility upgrades to ensure that contamination is not encountered and inadvertently spread (even to workers homes) after the DOE leaves? It is important to monitor these activities on a daily basis to identify worker health and safety requirements.**

Response:

According to the DR and associated legal land transfer documents, DOE will be responsible for remediating the ground water, surface water, and the known contamination under Buildings 12 and 20 at the facility. All other areas on the facility have been released for unrestricted use in accordance with approved federal standards and guidelines and therefore a risk to public health or the environment does not exist. Consequently, monitoring of routine daily activities conducted by the new owner of the facility will not be required.

As previously mentioned, all know contamination at the site has been remediated or is identified in the DR. Exhibit D to the Quitclaim Deed in the DR describes an contingency plan/agreement between the RTC, DOE, and Colorado Department of Public Health and Environment (CDPHE). "The Contingency Plan: Agreement Regarding the Disturbance of the Ground/Surface at the DOE Compound" describes the procedures that the RTC, DOE, and CDPHE have agreed to regarding emergency excavations and planned capital construction activities at the facility. The procedures by reference to the "Uranium Mill Tailings Management Plan (UMTMP)" published by CDPHE, include health and safety monitoring and training for workers involved in emergency excavation activities or capital construction activities. The UMTMP has been prepared to ensure that workers involved in intrusive activities at former uranium mill sites will be trained on the hazards that they may encounter, and monitored as necessary to ensure that they are not unnecessarily exposed to any radiological hazards that may exist.

Please also see related General Comment 15.

8. **Are the buildings currently up to code, and if not, are they worth the costs of upgrading and renovating?**

Response:

Most of the buildings on the facility are over 40 years old and have systems that do not comply with current building codes. It will be the responsibility of the new owner to determine the cost effectiveness of retaining the buildings and to comply with code requirements as the buildings are remodeled or renovated.

9. **How specifically will buildings 12 and 20 be remediated? Who will scan for final contamination or during demolition, what standards will be used, will the buildings be remediated to ensure that they are protective of human health and the environment? Will asbestos and LBP be managed appropriately?**

Response:

According to the DR and associated legal land transfer documents, DOE will be responsible for demolishing buildings 12 and 20 when DOE no longer needs to use the buildings and before termination of building leases. The building structures have been released for unrestricted use, so the demolition debris may be transported and disposed of in a Subtitle D, public landfill. DOE will manage and dispose of the asbestos and lead-based paint materials appropriately, as required by law. DOE has also committed to remediating all radiological contamination found under the buildings and will be responsible for verifying that applicable radiological release requirements are met. DOE-GJO plans to use its technical assistance contractor to monitor remediation operations. This contractor will have the necessary expertise by the nature of the scope of the contract.

Please also see related General Comments 1 and 15.

10. **Originally there were 30 wells on site, now there are 6. These wells are probably not the hot wells. What about contaminated sediments in the ponds? Drains from the analytical labs use to drain into the South Pond. Were these lines remediated? Is the groundwater the only contamination in the ponds or will the sediments be remediated? If so how will this be determined?**

Response:

The first ground water monitor wells were installed 1982, and additional wells were constructed over the next 10 years. From a maximum of 48 monitored wells, the number of monitored wells was reduced to 12 in 1992. DOE–GJO determined that the other 36 wells were redundant or unnecessary. This network was further reduced to six wells in 2000, including the well indicating the highest concentration of uranium, following an assessment of the monitoring. It was determined by DOE–GJO that the other six wells did not enhance or add value to the network because concentrations of constituents of concern in the ground water have been consistently low throughout their monitoring duration; some of the wells were located too near the Gunnison River to provide useful data; some were located near other wells; or some were in the interior of the site where activity is less relevant. Consequently, 42 monitor wells were abandoned in 2000.

Based on the presence of known radiological contamination below the southwest corner of Building 20, DOE–GJO plans to construct two new monitor wells adjacent to Building 20 in 2001.

DOE–GJO plans to conduct annual monitoring of the eight wells through 2005, at which time DOE–GJO will evaluate monitoring results in consultation with the CDPHE to determine the requirements for future monitoring at the site.

DOE-GJO acknowledges that additional groundwater data may have to be collected in the future to demonstrate site-wide compliance with applicable state or federal groundwater standards or to demonstrate that site groundwater conditions do not exceed background water quality conditions. Collection of the additional groundwater data may involve the installation of additional groundwater wells or utilization of other groundwater sampling technologies.

The old drain line into South Pond has been removed, and the entire area where South Pond is located has been remediated. In fact, the current configuration of South Pond is a result of remedial action activities.

The North Pond sediments were evaluated and found to comply with release requirements. DOE–GJO plans to sample the North Pond and South Pond sediments as part of the ground water monitoring project.

11. **Free scanning was allowed in the past, now this is no longer allowed, why is this? The current position of the DOE is that we don't want to find anymore contamination. Why is it everytime someone digs, contamination is found. Verification maps are available which show contamination found in soil, which were also identified during verification. This contamination was left behind.**

Response:

Except for known contamination under Buildings 12 and 20, all assessed contamination was remediated and all areas comply with federal release requirements. No assessed contamination was left behind, as documented by final verification maps and closeout reports. According to the Enforceable Agreement in the DR and other associated legal land transfer documents, DOE will be responsible for remediating any radiological contamination found by the new owner in the future that is attributable to DOE operations prior to the transfer.

12. **Has the DOE evaluated the economic impact to GJ if this transfer is allowed? The federal government gets favorable utility rates as a owner not as a renter. Increased rent and utility costs for duration of DOE's presence while still being responsible for the cost of cleanup does not make a lot of sense. The facility would be better served as a recreational area and not a commercial area. Has the RTC evaluated this use?**

Response:

DOE–GJO analyzed the cost and benefit of transferring the site to the RTC, based on RTC's plans to have a multi-tenant commercial site. DOE will be saving an average of nearly $1 million annually, when considering DOE's predicted landlord costs, including utilities.

The RTC evaluated numerous uses of the GJO site before entering into formal negotiations with DOE–GJO for sale of the site.

13. **The following questions or comments are concerned with specific areas or buildings at the facility**

Building 2—Supplemental standards used for release. Contamination still exists under the concrete cap that was poured to cover the floor drains. Contaminated drainlines were identified on the westside of the building that were not remediated. Will future construction activities in this building be monitored, if not why?

Response:

Building 2 houses the DOE–GJO telecommunications center and supply warehouse. DOE plans to lease this building from the new owner after property transfer. There are several inaccessible areas (behind walls and in an abandoned floor drain line) that exhibit surface radiological activity in excess of authorized limits set forth in DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. Remediation of the building or demolition to accomplish remediation would have required relocation of the telecommunications equipment at a significant cost to DOE. Therefore, in accordance with a provision of DOE Order 5400.5, DOE–GJO requested and received approval from DOE Headquarters (DOE-HQ) and the DOE Albuquerque Operations Office (DOE-AL) to pursue a risk-based analysis of the building with the goal of applying supplemental limits.

Use of the supplemental limits under DOE Order 5400.5 is not the same as the supplemental standards described in 40 CFR 192. A supplemental limit is applied when authorized limits cannot be met because they are unnecessarily restrictive or costly. A supplemental limit must still achieve the basic dose limits set forth in DOE Order 5400.5 for both current and potential unrestricted uses of the property. Therefore, although material in a given area exceeds authorized limits, additional analysis is performed to demonstrate that the material does not exceed dose limits directly related to the health risk posed to workers who may handle the material or the general public.

In contrast, supplemental standards under 40 CFR 192 are applied to site remediation when it has been determined that remediation of an area would pose a clear and present risk of injury to workers or the general public, the remaining contamination although unacceptable does not pose a clear present or future risk, or the cost of remedial action is unreasonably high relative to the long-term benefits of completing the remediation. In any case, the contaminated material which is left in place is considered to be radiologically contaminated and land use restrictions or other restrictions concerning the management of the material are implemented to ensure that workers and the public are protected from health risks. A location in which supplemental standards has been applied cannot be released for unrestricted use.

Approval of supplemental limits is based on both a cost/benefit analysis and a radiation dose assessment to predict that dose limits will not be exceeded for both current and potential unrestricted uses of the building or its materials. Radiological measurements and radiation dose analysis modeling were conducted to evaluate the radiation dose to members of the public who might occupy or demolish the building, and dose related to disposal of demolition debris in a sanitary landfill. The modeling indicated that the dose for building use and disposal was below the approved limits and, therefore, did not pose a risk to the public or the environment.

Upon review of this analysis, DOE-HQ recommended that DOE-AL approve the request for supplemental limits. In a memorandum dated November 17, 1997, DOE-AL approved the request by DOE-GJO for supplemental limits for Building 2. Therefore, Building 2 is approved for unrestricted use, with no radiological controls or restrictions required for its current use, during demolition, or for disposal of demolition debris at a public landfill.

By definition of the dose-based analysis and radiological release for unrestricted use, the areas identified with elevated radiological activity within the building are not considered to be contaminated. Radiological monitoring during remodeling or demolition activities is therefore not necessary.

Building 28—Soil contamination was identified under where the new loading [dock] was going on the westside of the building. No remediation was done.

Response:

The east of Building 28 was radiologically characterized as part of the open land area remediation project in the early 1990s, and boreholes were drilled and sampled during building characterization and release activities in 1997. All results of those investigations indicated soil concentrations of radionuclides at or below background levels along the east side of the building; therefore, no contaminated soil was identified and no remediation of this area was necessary.

Building 938—SE Attic Area had a radon peak in the insulation. Other buildings have the same insulation, why is there not other radon hits in other areas of the building.

Response:

No radon measurements were taken in the attic because radon concentrations were measured only in habitable and occupied portions of the buildings. Radon is heavier then air, and would not be expected to be present in the attic areas of buildings if it were not present in the habitable and occupied portions of the buildings. Elevated beta-gamma activity was measured in the attic of Building 938. Sample analysis indicated that the elevated activity was attributable to natural activity in the vermiculite insulation and not due to radiological contamination. The insulation was not removed because it was not radiologically contaminated and because the radon concentration and gamma exposure rates inside the building were below authorized limits for radiological release. Similar elevated activity from vermiculite insulation was found in Building 32, which was demolished in 1998.

Boneyard—Posts which were in contaminated concrete were removed last year along with some dirt, but the remaining contamination not chased because the contamination could be "averaged away".

Response:

One post hole was found to have radiologically contaminated soil, and this soil was remediated. Because contamination was found in one post hole, all of the post holes were investigated. No concentrations exceeding authorized limits were identified, so no contamination was left.

Building 20—Trench has contamination that is not identified in DR.

Response:

Building 20 is the DOE–GJO Analytical Chemistry Laboratory. DOE plans to lease this building from the new owner and continue operating a analytical laboratory which is currently in the building, after property transfer. The subfloor utility trench and other locations in the building exhibit surface radiological activity in excess of authorized limits set forth in DOE Order 5400.5. Remediation options to bring all components of the building into compliance with the authorized limits would temporarily disrupt laboratory operations and possibly cause clients to use another laboratory. Therefore, an option to release the building for unrestricted use based on an analysis of total effective radiological dose in accordance with a provision of DOE Order 5400.5 without a requirement for remediation or disposal of radiologically contaminated building materials was pursued.

Radiological measurements and radiation dose analysis modeling were conducted to evaluate the radiation dose to members of the public who might occupy or demolish the building. Dose analysis modeling was also conducted to evaluate the disposal of demolition debris in a sanitary landfill. The modeling indicated that the dose for building use and disposal was below the approved limits and, therefore, did not pose a risk to human health or the environment. Upon review of all activities and results of the Building 20 analysis, DOE–AL granted approval to DOE–GJO for release of the Building 20 structure from further radiological controls on December 18, 2000. DOE–AL further authorized that the building may be transferred to non-DOE ownership without regard to any residual radioactive materials.

By definition of the dose-based analysis and radiological release for unrestricted use, the locations of elevated radiological activity in Building 20 are not considered to be contamination because they present no risk to public health or the environment, and there is no requirement for remediation.

As a best-management practice, the DOE will provide monitoring to any individual(s) performing required maintenance work in confining locations of the building. The amount and type of monitoring for the individual(s) will be directly related to the requirement of what is necessary to ensure proper protection and the health and safety of the individual(s).

Other—South East perimeter fence, south end of the site along banks of Gunnison contamination was discovered but not remediated.

Response:

Soil verification activities indicated that all areas along the dike complied with authorized limits for radiological release for unrestricted use. No assessed contamination remains along the banks of the Gunnison River.

Building 7 (Army Reserve Trenches)—West side of building during installation of grease pit, soil contamination was found. The contractor removed his backhoe from the site without surveying out. Is this a problem? Contamination was found in this area despite the fact that the area was previously released. This contamination was found in a suspected vein of contamination that runs along the whole length of the compound.

Response:

A small deposit (approximately 1 cubic yard) of contaminated soil was encountered at the bottom of a drain line trench during excavation by an Army Reserve subcontractor. The backhoe bucket was scanned and found to be free of contamination. DOE remediated the deposit before allowing the subcontractor to continue the drain line installation work.

This deposit, which was not previously identified, was encountered several feet below remediated soil. After removal of the deposit all excavated surfaces were scanned and sampled. There was no indication that the contamination deposit continued beyond the excavation.

14. **The lack of public participation in this process and notification is of concern. Meetings were not advertised, the public was not consulted on the pros and cons of the transfer, and it is not clear that the public understands the potential liabilities associated with taking title to the facility (liabilities of asbestos and lead-based paint are examples). Nor is it clear that the true potential for further discovery of residual radioactivity is properly described."**

Response:

In accordance with the Evaluation Guidelines and Review Procedures Pertaining to Deferral Requests, and pursuant to State of Colorado *Executive Order D–013–98*, the Governor of the State of Colorado offered the public the opportunity to submit written comments on the Revised Request for Deferred Remediation (Deferral Request). The public comment period was in effect from March 25, 2001, through April 24, 2001, as advertised in *The Daily Sentinel* on March 25, 2001. During this time the public had the opportunity to review the Deferral Request and a Fact Sheet at one of four locations, including three locations in Grand Junction. The Fact Sheet indicated that a public meeting could be requested in writing anytime during the public comment period. No public meetings were requested.

The Deferral Request describes the known radiological contamination left on the property (Sections 4.4 through 4.7), the institutional controls that will be in place to prevent the unknowing exposure of contamination to humans, and the plans for remediating the contamination (Section 5.0).

The Deferral Request (Sections 4.8 through 4.10) describes the remaining friable asbestos subject to reporting requirements of CERCLA 120(h), non-reportable friable asbestos, non-friable asbestos, and lead-based paint on the facility. The Quitclaim Deed (Section V) identifies the Grantee of the property as responsible for all remaining asbestos containing materials and lead-based paint.

The Deferral Request addresses the locations and management of the known radiological contamination on the facility (ground water, surface water, concrete and soil under the south end of Building 12, soil under the southwest corner of Building 20, and two radium foils in an abandoned 300-foot deep borehole). In Section IV (B) of the Quitclaim Deed, the Grantor (DOE) warrants that all remedial action necessary to protect human health and the environment has been taken before the date of conveyance of the property, except for the known radiological contamination identified above.

Please also see related General Comments 11 and 20.

15. **DOE should also be liable for disposition of the known residual radioactive contamination in buildings 2 and 20. The DOE "release" from control of building 20 in particular is inappropriate, based on improper characterization techniques, resulting in questionable modeling parameters used to set "risk-based" release limits, that is not ALARA or consistent with the Record of Decision (ROD) (DOE 1989 [*Grand Junction Projects Office Remedial Action Project, Declaration for the Record of Decision and Record of Decision Summary,* Grand Junction Projects Office, Grand Junction, Colorado, April]). The statement that the building is free of contamination (radioactivity where it is not wanted) is absolutely false. Contamination remains in building 20 in the utility trench, and in utility chases behind the walls. DOE's refusal to properly fund characterization of these areas based on cost and a desire to keep the lab operational is a consequence of self-regulation, and would never be allowed elsewhere. Waiting until the end of a ten-year plus project to tackle this complex building should not be rewarded by allowing liability for contamination in the building to transfer to another entity. Remediation could have occurred over time without disrupting activities if DOE wanted to clean the building. Instead, they spent over $250,000 on deriving the limits and performing surveys, and only spent $30,000 on ALARA cleanup activities. DOE should be liable for the residual contamination under the consent for deferred remediation. If they are responsible for demolition of the building, they can easily take liability for the residual contamination in the buildings. It should also be noted that the laboratory has been analyzing samples for tritium from Los Alamos National Laboratory (LANL), as well as samples for plutonium from the LANL forest fires last year. Neither plutonium nor tritium data are provided in the release surveys."**

Response:

Building 2: Building 2 houses the DOE–GJO telecommunications center and supply warehouse. DOE plans to lease this building from the Grantee after property transfer. There are several inaccessible areas (behind walls and in an abandoned floor drain line) that exhibit surface radiological activity in excess of authorized limits set forth in DOE Order 5400.5, *Radiation Protection of the*

Public and the Environment. Remediation of the building or demolition to accomplish remediation would require relocation of the telecommunications equipment at a significant cost to DOE. Therefore, in accordance with a provision of DOE Order 5400.5, DOE–GJO requested and received approval from DOE Headquarters (DOE-HQ) and the DOE Albuquerque Operations Office (DOE-AL) to pursue a risk-based analysis of the building with the goal of applying supplemental limits.

Approval of supplemental limits is based on both a cost/benefit analysis and a radiation dose assessment to predict that dose limits will not be exceeded for both current and potential unrestricted uses of the building or its materials. Radiological measurements and radiation dose analysis modeling were conducted to evaluate the radiation dose to members of the public who might occupy or demolish the building, and dose related to disposal of demolition debris in a sanitary landfill. The modeling indicated that the dose for building use and disposal was below the approved limits and, therefore, did not pose a risk to the public or the environment.

Upon review of this analysis, DOE-HQ recommended that DOE-AL approve the request for supplemental limits. In a memorandum dated November 17, 1997, DOE-AL approved the request by DOE-GJO for supplemental limits for Building 2. Therefore, Building 2 is approved for unrestricted use, with no radiological controls or restrictions required for its current use, including any maintenance activities that may be required, during demolition, or for disposal of demolition debris at a public landfill.

The process to release the building for unrestricted use based on the dose analysis is in accordance with ALARA and is a method allowed by DOE Order 5400.5. Although DOE Order 5400.5 was not included in the ROD, it was included in the facility environmental assessment for the site remedial action project (*Environmental Assessment of Facility Operations at the U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado,* June 1996).

Please also see related General Comments 1 and 3.

Building 20: Building 20 is the DOE–GJO Analytical Chemistry Laboratory. DOE plans to lease this building from the Grantee and continue operating the laboratory after property transfer. There are several locations within the building (e.g., along pipe chases under sinks), in the subfloor utility trench, and in drain lines that exhibit surface radiological activity in excess of authorized limits set forth in DOE Order 5400.5. Remediation options to bring all components of the building into compliance with the authorized limits, particularly the utility trench and drain lines, would temporarily disrupt laboratory operations (and possibly cause clients to use another laboratory) yet still not allow for release of the building for unrestricted use due to its continued use as a laboratory that analyzes radiological samples.

Therefore, an option to release the building for unrestricted use without a requirement for remediation or disposal of radiologically contaminated building materials was pursued. Due to the potential for contamination in Building 20, its planned continued use as a DOE-GJO analytical laboratory, and the plans to transfer the building to the public, a working group was organized to include representatives of the identified stakeholders. Utilization of the working group in the development of derived concentration guideline levels (DCGLs), sampling and analysis plans (SAPs), and final release surveys was conducted to ensure that the process used to release Building 20 for unrestricted use was accomplished to the satisfaction of all the stakeholders. The working group was assembled with members of DOE–EH, DOE–EM, DOE–AL, DOE–GJO, EPA, the State of Colorado, the City of Grand Junction, Mesa County, and the Joint Utilization Commission (now incorporated as the Riverview Technology Corporation—the Grantee) to develop release guidelines and associated documents.

The working group agreed to a total effective dose equivalent (TEDE) criterion for free release of Building 20 (25 millirem per year, which also is the annual dose limit adopted by the State of Colorado [6 CCR 1007]), and adopted the methodology contained in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM-NUREG-1575, EPA 402-R-97-016) for developing free release criteria, collecting appropriate samples and survey data, and evaluating the results.

With the approval of the working group, DCGLs were calculated to represent average radiological concentrations below which future beneficial use and occupancy of the building, demolition of the building, and disposal of building materials and debris would result in annual public radiation doses below the agreed-upon TEDE. A Sampling and Analysis Plan (SAP) was developed in accordance with the MARSSIM and the approval of the working group. Radiological measurements were then taken in accordance with the SAP. An analysis of the resulting data indicated that the maximum potential future dose resulting from exposure to residual radioactivity associated with the Building 20 structure is less than 1 millirem per year, which is significantly below the regulated limit of DOE's radiation dose contribution to members of the general public (100 millirem per year—DOE Order 5400.5) and the TEDE (*Grand Junction Office Building 20 Final FY 2000 Status Survey Report—Evaluation and Interpretation of the Residual Final Status Survey Results,* U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, October 2000).

Samples collected from the ventilation system and from drain lines were analyzed for transuranic nuclides (plutonium, americium, and uranium decay-chain isotopes) and were found not to have detectable quantities of the nuclides. Therefore, it was concluded that transuranic nuclides would not be considered in the derivation of the DCGL or the final release survey (*Grand Junction Office Building 20 Development of the Derived Concentration Guideline Level,* U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado,

February 2000). Routine sampling for tritium has indicated levels below minimum detectable activity; therefore, tritium was not considered in the derivation of the DCGL or the final release survey.

Upon review of all activities and results of the Building 20 analysis, DOE–AL granted approval to DOE–GJO for release of the Building 20 structure from further radiological controls on December 18, 2000. DOE–AL further authorized that the building may be transferred to non-DOE ownership without regard to any residual radioactive materials. This authorization does not apply to non-real property contained within the building.

The process to release the building for unrestricted use based on the dose analysis is in accordance with ALARA and is a method allowed by DOE Order 5400.5. Although DOE Order 5400.5 was not included in the ROD, it was included in the facility environmental assessment for the site remedial action project (*Environmental Assessment of Facility Operations at the U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado,* June 1996).

As a best-management practice, the DOE will provide monitoring to any individual(s) performing required maintenance work in confining locations of the building. The amount and type of monitoring for the individual(s) will be directly related to the requirement of what is necessary to ensure proper protection and the health and safety of the individual(s).

16. **"DOE has not collected sufficient groundwater information for the southern part of the facility to adequately characterize the residual plume and its behavior since remediation. According to discussion with former Wastren (sic) officials, the DOE decision to abandon the majority of the wells was not based on technical or scientific merit, but rather due to budget savings and a concern over future liability for the wells. A recent study by AIMTech (2001**

[*An Evaluation of Natural Flushing at the DOE-GJO Site Using Visual Three-Point Plus,* AIMTech Grand Junction Operations, Grand Junction, Colorado, January]) suggests that the assumptions of groundwater flow in the RI/FS and ROD may not be correct, although it does support attenuation within the allowable time frame. Impacts of remediation on groundwater flow, including expansion of the south pond, creation of the wetlands area where the Treasure Island landfill used to be, and replacement soils along the dike ditch have not been evaluated. Whole interior sections of the facility have never had wells and there is no knowledge of the condition of the groundwater in those areas. The fact that there have been no wells anywhere near the analytical laboratory for 50 years brings the robustness of the whole groundwater-monitoring program at GJO into question."

Response:

As stated in the Deferral Request (Section 5.1), constituents of concern in the ground water have been monitored in various wells on the facility. The first wells were installed 1982, and additional wells were added through 1991. From a maximum of 48 monitored wells, the number of monitored wells was reduced to 12 in 1992. DOE–GJO determined that the other 36 wells were redundant or unnecessary. This network was further reduced to six wells in 2000, following an assessment of the monitoring program (*Grand Junction Office Facility (GJO) Evaluation of Ground Water and Surface Water Monitoring for LTSM,* U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, January 2000). It was determined by DOE–GJO that the other six wells did not enhance or add value to the network because concentrations have been consistently low throughout their monitoring duration; some of the wells were located too near the Gunnison River to provide useful data; some were located near other wells; or some were in the interior of the site where activity is less relevant. Consequently, 42 monitor wells were abandoned in 2000, in part based on the well network evaluation and in part based on economic and liability concerns. A technical justification for the current monitoring network was included as an amendment to the Deferral Request.

The assumptions of ground water flow that were used in the development of the RI/FS and ROD were reviewed and considered valid for the post-remedial action configuration of the aquifer. Therefore, based on monitoring results, DOE–GJO contends that the remedy by natural flushing is valid. This observation is supported by the AIMTech ground water study (*An Evaluation of Natural Flushing at the U.S. Department of Energy – Grand Junction Office Using Visual Three-Point Plus,* AIMTech Grand Junction Operations, Grand Junction, Colorado, January 2001). DOE–GJO plans to conduct annual monitoring of eight wells (six existing wells plus two new wells mentioned below) through 2005, at which time DOE–GJO will evaluate monitoring results in consultation with the CDPHE to determine the requirements for future monitoring at the site.

Based on the presence of known radiological contamination below the southwest corner of Building 20, DOE–GJO has approved budget for the construction of two new monitor wells adjacent to Building 20. These wells are scheduled for construction in 2001. DOE–GJO also recognizes that additional sampling locations may periodically be needed to address specific issues in their continuing effort to comply with water quality regulations (*Technical Justification for the Monitoring Network at the DOE GJO Facility,* amendment to the Deferral Request).

Please also see related General Comment 10.

17. **"The remaining soil under building 20 contains elevated levels of uranium as well as radium-226. Additionally, the potential for more residual contamination exists under the building. Drain lines that were accessible from along side the building were remediated and hundreds of yards of contaminated soils from leaking drain lines had to be removed. Lateral drain lines still exist under the buildings and those soils could not be assessed. All pertinent sections of the document should reflect DOE liability for remediation of the drain system under the building and any associated contaminated soils in addition to the identified deposit associated with Building 20."**

Response:

The Deferral Request specifically addresses the known contamination under the southwest corner of Building 20 and DOE-GJO's obligation to remediate that deposit after the building is demolished (Sections 5.3 and 6.2.3). DOE further stipulates that it will remediate all contamination under and around the structure after building demolition (Section 6.2.3). Therefore, if radiologically contaminated soil is encountered when the drain lines are removed, DOE will remediate the soil to levels which are protective of human health and the environment under a unrestricted use scenario. Standards listed in 40 CFR 192 or DOE Order 5400.5 will be adequate for this purpose.

17. **The risk assessment should consider the full suite of radionuclides present in the contaminated soils (U-238, U-234, U-235, Pa-234, Th-234, Th-230, Ra-226, Pb-210, Po-210, et al.). Uranium, Th-230, and Ra-226 were the contaminants of concern at the site, and some data should be available for all these nuclides. Since these soils are associated with laboratory activities, equilibrium cannot be assumed for the whole series. Hundreds of samples were archived from the GJORAP project, hopefully including the residual deposits, and can easily be analyzed for isotopic analysis. ORNL/AIMTech maintains the GJORAP soil archive (AIMTech 2001a [*Interim Soil Sample Archive Report for the Grand Junction Office Remedial Action Project at the U.S. Department of Energy Grand Junction Office,* Grand Junction, Colorado, February]).**

Response:

The structures and interiors of Buildings 12 and 20 comply with requirements for release for unrestricted use, and analysis of additional radionuclides in the underlying soils would not change this status. A risk analysis of the soil under Building 20, based on radium-226 concentration in the soil, indicated that if the residual soil contamination was exposed through demolition, risks associated with soil ingestion would exceed acceptable risks. It can also be expected that risks associated with exposure to radon gas would be unacceptable in a residential structure built on soils that have not been remediated. Adding the other

radionuclides into the risk assessment would only increase the calculated health risk beyond its already unacceptable limit. For this reason, the DOE has committed to cleanup the contamination under Buildings 12 and 20 after the use of the buildings is no longer required.

19. **Supplemental standards were applied on the dike in order to save large trees along the river. There is no mention of the fact that residual radioactive material remains on the dike in the documentation. Other areas were area-averaged to meet criteria, an accepted practice. See the closeout report for the outdoor areas.**

Response:

Except for the known deposits under Buildings 12 and 20, all assessed and remediated areas comply with soil release guidelines for radium-226, thorium-230, and total uranium, as documented in the site closeout reports. Supplemental standards, a provision of 40 CFR 192, were not applied at any location on the facility.

Several locations on the facility, including three along the dike associated with large trees, had concentrations of radium-226 and/or thorium-230 in small deposits that required calculations to ensure that soil concentrations complied with 100 square meter area averaging and hot spot limit criteria in accordance with 40 CFR 192 and DOE Order 5400.5. The calculations verified that the soil complied with the release guidelines, so the deposits did not require removal or radiological controls. The calculations and demonstration of compliance for release for unrestricted use are provided in site closeout reports.

20. **There is no discussion of radiological monitoring of intrusive building remodeling and excavations. Due to the potential for residual contamination to be found in un-assessed or inaccessible areas, monitoring is recommended for worker and occupant protection.**

Response:

The Deferral Request addresses the locations and management of the known radiological contamination on the facility (ground water, surface water, concrete and soil under the south end of Building 12, soil under the southwest corner of Building 20, and two radium foils in an abandoned 300-foot deep borehole). In Section IV (B) of the Quitclaim Deed, the Grantor (DOE) warrants that all remedial action necessary to protect human health and the environment has been taken before the date of conveyance of the property, except for the known radiological contamination identified above. This assertion is based on successful compliance with all applicable remedial action and radiological release requirements and guidelines for the facility open land areas and structures.

Therefore, DOE is not required to monitor excavations or building remodeling conducted by the Grantee.

Please also see related General Comment 7.

21. **The Fish and Wildlife Service would like to pursue use of the ponds on-site for the purpose of rearing endangered razorback suckers. The fish would be place in the ponds each April at approximately 4 inches and then harvested from the ponds in October, by which time they should be about 10 inches in length. The fish would then be stocked into the Gunnison and/or the Colorado River. These are endangered fish and consequently are not allowed to be kept by anglers. They are not for human consumption. Institutional controls in the DR do not allow this type of activity. The Fish and Wildlife Service is requesting that if deemed acceptable, the DR be amended to allow this specific activity at the GJO facility.**

Response:

The Division has evaluated the U.S. Fish and Wildlife Service request to raise the endangered Razorback Suckers in the ponds at the GJO facility. The Division has considered the following in completing this evaluation: 1. Razorback suckers (Xyrauchen texanus) will be the only fish species raised in the ponds. Razorback Suckers are an endangered species. The potential for human consumption of the fish after re-introduction is minimal since it is illegal to keep Razorback Suckers, and they are considered undesirable to eat by most anglers. 2. The fish will be reared in the ponds for no longer than 7 months. Biomagnification of any toxins in the fish is minimal based on this duration. 3. The introduction point of the fish into the wild will be physically isolated from larger predatory game fish. The potential for biomagnification in higher trophic levels species consuming these fish is minimal. 4. And, the contaminants and their respective concentrations in the surface water ponds at the facility.

Based on an evaluation of this request, the Division believes that the Razorback Suckers can be reared in the ponds and later released to the wild by the U.S. Fish and Wildlife Service without creating a threat to human health or the environment. The final DR has therefore been amended, as described below, to allow the U.S. Fish and Wildlife Service to raise the Razorback Suckers in the ponds at the GJO facility. Note that the request is being allowed provided that the U.S. Fish and Wildlife Service comply with the conditions for the request also outlined below.

The first sentence in Section IV.A.2, paragraph 3 of the Enforceable Agreement, Section IV.C.1 paragraph 5 of the Quitclaim Deed, and paragraph 5 to Appendix E of the Long Term Surveillance Plan, Attachments A, B, and C respectively to the final DR has been modified and now states: "Grantee shall not engage in any use of the surface expressions of groundwater, except as described below, that might result in accidental consumption of the water, fish, or other aquatic species."

The following paragraphs are also added to Section IV.A.2 of the Enforceable Agreement as paragraphs 4 through 6, Section IV.C.1 of the Quitclaim Deed as paragraphs 6 through 8, and to Appendix E of the Long Term Surveillance Plan as paragraphs 6 through 8 in the final DR.

The Grantee may allow the U.S. Fish and Wildlife Service to utilize the surface water ponds on-site to raise Razorback Suckers (Xyrauchen texanus) prior to their introduction into the wild. No construction to the existing ponds is allowed unless specifically authorized by the Colorado Department of Public Health and the Environment. The U.S. Fish and Wildlife Service is the only agency authorized for this purpose, and the ponds may not be utilized for raising other fish species.

The Razorback Suckers may be placed in the ponds each April and then later harvested from the ponds, not to exceed a duration of 8 months. The U.S. Fish and Wildlife Service will make every practical effort to remove all the fish from the ponds each growing season, and ensure that the fish are released into areas that are physically isolated from Northern Pike (Esox lucius) or other large predatory fish.

The U.S. Fish and Wildlife Service will also ensure that its employees are adequately trained and protected from the hazards that they may encounter during the fish rearing operation. This training includes but is not necessarily limited to review of the Uranium Mill Tailings Management Plan and review of the most recent groundwater and surface water monitoring data for the site as provided for annually by the U.S. DOE.

Specific Comments to DR Text

1. **1.0 Introduction, ¶ 1, last sentence. Please revise transfer until 2001, with DOE remaining as a tenant for the near term (oversight of the facility has been transferred to DOE/Idaho, and there is no guarantee that DOE/GJO staff will remain).**

Response:

The appropriate change will be noted on an errata sheet.

2. **Page 3. Bullet list. Add a bullet with "Residual uranium in the form of surface contamination in buildings 2 and 20." Although released from DOE control by DOE, the release process used in the buildings may not have been appropriate for free release, rather than continued DOE use without controls. At a minimum, a public review of the different processes used to release buildings 2 and 20 should be undertaken. It is not clear that the dose-based release of the building is consistent with the ROD, and was certainly not in the original scope of the project.**

Response:

In accordance with the DOE-approved dose modeling and releases for unrestricted use for Buildings 2 and 20, the radiological activity on surfaces of those structures is not considered as radiological contamination. There are no restrictions for building occupation, demolition, or disposal of building materials based on residual radioactive material. See Response G2.

3. **Page 3. 1.b. In fact, the ROD stated that the three main mill buildings would be decontaminated by cleaning to free release standards. The ROD was based on poor characterization to the point that many site buildings were contaminated, most of them occupied by professional and clerical workers, and only were added to the scope of the project when the Independent Verification Contractor (IVC) drafted a letter to DOE headquarters. Examples are, but not limited to Buildings 6, 7, and 28.**

Response:

The ROD included decontamination of surplus mill buildings to remove alpha contamination (Buildings 31, 33, and 35). Efforts to decontaminate these buildings proved to be cost prohibitive, so DOE–GJO decided to demolish them.

DOE–GJO implemented DOE Order 5400.5 after approval of the ROD. DOE Order 5400.5 incorporated soil and structure release requirements from 40 CFR 192 and FUSRAP guidance, thus meeting the intent of the decontamination required by the ROD. DOE–GJO developed a site-specific building release plan

to ensure that surface radiological activity, interior gamma exposure rates, and interior radon concentrations complied with the authorized limits set forth in DOE Order 5400.5 (*Survey Plan for Releasing the Buildings at the Grand Junction Projects Office for Unrestricted Use*, U.S. Department of Energy, Grand Junction, Colorado, December 1995). The environmental assessment of the facility incorporated DOE Order 5400.5 as an environmental restoration guideline (*Environmental Assessment of Facility Operations at the U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado,* June 1996). Consequently, some structures were demolished, and the remaining structures were radiologically characterized, remediated if necessary, and radiologically surveyed for release for unrestricted use.

4. **Page 5. 2. The statement is correct, that assessed contamination has been removed. It must be emphasized that the potential exists for deposits of contamination to still exist. The mill tailings assessment process is heavily dependent on detection of gamma rays given off from the tailings. Those gamma rays are attenuated (no longer easily detectable) with as little as six inches of soil or other covering material. Soil samples and borings were collected on a spacing that was not robust enough to detect includable deposits. DOE did not fund intensive characterization, particularly of buried utilities, such that a defensible release of the utilities was impossible. Rather, the IVC statement reflected that characterization of the utilities did not indicate contamination. Likewise, uranium contamination is difficult to detect through thick coverings. Intrusive surveys of buildings were severely curtailed after the last change of contractors (FY '98).**

Response:

Most soil surfaces were characterized by use of a gamma scintillometer, which was used as a tool to indicate the potential presence of elevated concentrations of radium-226 in the top 15-centimeter layer of soil. When gamma exposure rates exceeded 130 percent of background, soil samples were collected and analyzed for radionuclide concentrations. The initial site characterization included soil boreholes and samples on a 100-foot by 100-foot grid over the entire site, and boreholes and samples at locations suspected to contain buried mill tailings based on the historical use of the site. This initial characterization identified all the major deposits of soil contamination on the facility, and subsequent remediation of those deposits continued vertically and laterally into UN-assessed materials as required to remove the deposits (*Final Report of the Decontamination and Decommissioning of the Exterior Land Areas at the Grand Junction Projects Office Facility,* U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado, September 1995).

The known buried utilities were sufficiently characterized. When contamination inside or around utilities was encountered during remediation of open land areas, the contaminated materials were removed and the utilities were replaced if necessary. Buried utilities located in areas that were not remediated subsequently were exposed and characterized at representative locations. The entire lengths of the utilities were not excavated and characterized due to excessive cost and because of the valid assumption (based on normal construction practices) that if mill tailings were used as utility trench backfill that it would be present along substantial lengths of the utility trench and not in isolated pockets. Only one set of abandoned drain lines that served a former mill building was found to be contaminated, and the lines and associated contaminated bedding materials were remediated (*Closeout Report of the Decontamination and Decommissioning of the Buried Utilities and Soil Under Pavement at the Grand Junction Office Facility,* U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, July 2000). All septic tanks identified on historical maps of the facility (a total of 33 tanks) were investigated for radiological contamination. A total of 18 septic tanks were found to still be in existence, and one tank with its associated piping was found to be radiologically contaminated and was subsequently remediated (*Closeout Report of the Decontamination and Decommissioning of the Abandoned Septic Tanks at the Grand Junction Office Facility,* U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, June 2000).

Uranium contamination is difficult to detect through thick coverings. Project experience indicated that elevated radium-226 concentrations in the soil were often associated with elevated concentrations of uranium. The majority of soil samples collected to verify that excavated surfaces met release criteria were analyzed for total uranium, and in no sample was the authorized limit exceeded (*Final Report of the Decontamination and Decommissioning of the Exterior Land Areas at the Grand Junction Projects Office Facility,* U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado, September 1995). Soil surfaces covered by asphalt or concrete pavement after mill operations ceased were investigated for the presence of windblown uranium contamination that might have been trapped by the pavement. A statistical sampling plan and analysis did not indicate the presence of uranium contamination (*Closeout Report of the Decontamination and Decommissioning of the Buried Utilities and Soil Under Pavement at the Grand Junction Office Facility,* U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, July 2000).

Intrusive surveys were conducted (cores into walls, roof materials, and through floors) in buildings that were considered affected by the milling, analysis, or brokerage of radioactive materials in accordance with the building release plan. The unaffected buildings only required evaluation of the accessible surfaces. Sufficient intrusive data were collected to release the buildings for unrestricted use in accordance with DOE Order 5400.5.

4. **Page 5. 3. It is not clear that this statement is correct. The ROD called for free release of the facility under UMTRCA standards, and did not anticipate using dose- or risk-based release. A surface criterion was adopted from NRC Reg. Guide 1.86, which is not dose- or risk-based. The adoption of DOE Order 5400.5 in ~1991 is to be commended, but was not considered in the remedy selection. The CERCLA process was not thoroughly followed. There was no designation of operable units, no public meetings when scope and remedy underwent significant change (i.e., removal of the Treasure Island landfill, inclusion of the remainder of the buildings), and no explanation of significant differences or ROD amendment. The project was divided into phases, but was only for project planning, and had little to do with identifying and mitigating hazards. In fact, the phases changed significantly over the years from 4 phases at first to over 7 phases by 1996.**

Response:

The statement in the Deferral Request states that the remedy identified in the ROD (cleanup of soil, mill buildings, and ground water) followed CERCLA and NEPA processes, and does not refer to radiological release guidance (i.e., 40 CFR 192 and DOE Order 5400.5). DOE–GJO complied with the NEPA process for facility remediation, and elected to use the management protocols of CERCLA (as amended by SARA). The DOE–GJO facility is not a CERCLA Site or a Voluntary CERCLA Site, so DOE–GJO was not required to implement all aspects of the CERCLA process. The remedial action project evolved, as unexpected conditions were encountered and as new federal guidance was established, and adoption of DOE Order 5400.5 was a part of that process. Although DOE Order 5400.5 was not included in the ROD, it was included in the facility environmental assessment for the site remedial action project (*Environmental Assessment of Facility Operations at the U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado,* June 1996). DOE-Order 5400.5 includes a provision for releasing buildings using a dose-based analysis, as was applied for Buildings 2 and 20.

6. **Page 5. 4. This statement brings home the problem with the dose-based release of building 20 (and 2). Currently, the contamination in the pipe chase is posted with notices of radioactive contamination, requires monitoring to access the areas, and frisking of personnel and equipment before leaving the area. Under the "free release" claimed by DOE, these areas now require none of the aforementioned controls. Any person can come in contact with these materials and not have any notification or controls. This is inappropriate.**

Response:

The buildings meet the requirements for release for unrestricted use. As a best-management practice, the DOE will provide monitoring to any individual(s) performing required maintenance work in confining locations of the building. The amount and type of monitoring for the individual(s) will be directly related to the requirement of what is necessary to ensure proper protection and the health and safety of the individual(s).

Please also see related General Comment 15.

7. **Page 5. 6. This statement is still valid if the residual surface contamination in Buildings 2 and 20 is brought under the consent decree, and the wording amended to call for DOE liability for demolition of the buildings. DOE should be liable for the remediation of these areas at the useful end of the buildings.**

Response:

Remediation of the Building 2 and Building 20 structures is not required. DOE plans to demolish Building 20 after laboratory operations cease and dispose of the debris at a Subtitle D, solid waste public landfill. If Building 2 is demolished by the Grantee, its debris can be disposed of at a public landfill also.

Please also see related General Comment 15 and Specific Comment 2.

8. **Page 5. Bullet list. It is not clear why none of the project completion reports, IVC reports, or other documents required by the Certification Docket were presented for review. Although they were generated after remedy selection, they are the documents that support remedy implementation and changes to the remedy.**

Response:

A list of all closeout reports is provided in Attachment C (*Long-Term Surveillance Plan*) of the Deferral Request. CDPHE is provided with a copy of each closeout report after DOE–GJO approval of the report. Copies of all documents required by the Certification Docket, including IVC reports, are retained in the GJORAP Administrative Record and the GJORAP Information Repository, both of which are available for public review at the DOE–GJO Technical Library and the Mesa County Public Library.

9. **Page 6, 4.2, ¶ 2, sentence 1. The RI/FS (DOE 1989a [Final Remedial Investigation/ Feasibility Study for the U.S. Department of Energy Grand Junction (Colorado) Projects Office Facility, Grand Junction Projects Office, Grand Junction, Colorado, July]) and ROD were based on estimates of 86,000 yd^3. The additional investigations described later brought the estimate up.**

Response:

The estimated volume of contaminated soil based on exterior land area characterization activities conducted in 1986 through 1990 was approximately 136,000 cubic yards. Remediation of assessed deposits continued vertically and laterally into un-assessed areas as necessary until release criteria were met, resulting in the remediation of approximately 250,000 cubic yards of contaminated soil (*Final Report of the Decontamination and Decommissioning of the Exterior Land Areas at the Grand Junction Projects Office Facility,* U.S. Department of Energy Grand Junction Projects Office, Grand Junction, Colorado, September 1995).

10. **Page 10. ¶ 4. The IVC confirmed that areas assessed as contaminated were remediated, but that the potential for contamination remains in inaccessible areas. This statement is in virtually all reports, except for buildings that were demolished.**

Response:

Please see response to General Comment 20.

11. **Page 11. ¶3. Consider adding a statement that future tenants will be required to get appropriate permits if they generate hazardous waste.**

Response:

Any permits required by new tenants are the responsibility of the new tenants. All hazardous waste generated at the facility by the new owner must be managed in accordance with the Colorado Hazardous Waste Regulations.

12. **Page 13, 4.5. Please state the activity of the radium sources.**

Response:

Indicator foil with a radium-226 concentration of 29 picocuries per gram (pCi/g) is located at a depth of 81 feet, and foil with a radium-226 concentration of 3 pCi/g is located at a depth of 181 feet. The borehole was abandoned in accordance with requirements of the State of Colorado. Abandonment included the injection of concrete grout into and around the well casing to encase the foil from contact with the geologic formation and associated ground water. This change will be noted on an errata sheet.

13. **Page 15. 1st ¶. Add after last sentence, and to all other appropriate places in the documents verbiage obligating DOE to remediate any contaminated soils under the building not yet assessed. Hundreds of yards of contaminated soils had to [be] remediated due to leaking drain lines that were accessible (see the Building 20 completion report), or the IVC report (AIMTech 2001c [*Final Confirmatory Radiological Survey Report for Independent Verification Activities for Building 20 at the U.S. Department of Energy Grand Junction Office,* AIMTech Grand Junction Operations, Grand Junction, Colorado, February]).**

Response:

The Deferral Request stipulates that DOE–GJO will remediate all contamination under and around the structure (Section 6.2.3). Therefore, if radiologically contaminated soil is encountered when the drain lines are removed, DOE will remediate the soil.

14. **Page 18, 5.1.1, ¶ 2, sentence 2. The reduction to 12 wells created a deficiency in the monitoring program in that no wells were sampled from the area (approximately) south of building 26. This is the area where the second mill was located, and location of a significant source term (prior to remediation). The IVC did continue to monitor wells over the full area of the facility until DOE cut its funding in 1998. Attached are graphics showing the original estimation of the uranium plume (adopted from the ROD), and contours of data obtained from Wastren (sic) as well as ORNL sampling events. Clearly, the lack of data from the southern end of the facility should be a concern.**

Response:

It is DOE–GJO's position based on monitoring results to date that the remaining six monitor wells with the addition of two new wells planned for installation near Building 20 are sufficient to verify natural flushing of the aquifer. The monitoring results will be statistically evaluated in 2005 to determine future monitoring requirements, which could include additional sampling points (*Technical Justification for the Monitoring Network at the DOE GJO Facility,* amendment to the Deferral Request). As indicated in Response G3, wells that were considered unnecessary for continued monitoring were abandoned, including all the wells south of Building 26.

Please also see related General Comment 10.

15. **Page 20, 5.1.2, ¶ 1, sentence 2. This sentence should be revised. ORNL had 9 wells installed along the perimeter of the facility in the early 1990s, and were included in its sampling regime (along with selected site wells). The ORNL sampling activities were curtailed by DOE in 1998. The supposed evaluation of the program in 1999 did not involve input from the IVC. This statement is also incorrect because of a lack of wells or information in the center of the facility, including the area near the analytical laboratory. Since the movement of groundwater is through the facility to the north, the current system may not be adequate to monitor progress.**

Response:

ORNL continued to monitor nine wells through 1998 (confirmed by AIMTech). The date correction from 1995 to 1998 will be noted on an errata sheet.

Please refer to responses to General Comments 10 and 16, and Specific Comment 14 to address the remainder of the comment.

16. **Page 21, 5.1.3, ¶ 1, sentence 4. This is not necessarily the case. Clean backfill consisted of a variety of materials, from pit run to road base, and compaction to specific parameters was required. There has been no assessment of impacts on groundwater flow from these replacement materials to this reviewer's knowledge.**

Response:

Excavations were backfilled with pitrun and roadbase materials, and at some locations compaction to specific parameters was required. These backfill materials would be expected to have lower hydraulic conductivity than the underlying alluvial gravels that were originally tested; however, most backfill was placed in excavations that were above the water table.

The assumptions of ground water flow that were used in the development of the RI/FS and ROD were reviewed by DOE–GJO and considered valid for the post-remedial action configuration of the aquifer. Therefore, based on monitoring results, DOE–GJO contends that the remedy by natural flushing is valid. This observation is supported by the AIMTech ground water study (*An Evaluation of Natural Flushing at the U.S. Department of Energy – Grand Junction Office Using Visual Three-Point Plus*, AIMTech Grand Junction Operations, Grand Junction, Colorado, January 2001).

17. **Page 21, 5.1.3, ¶ 2. The ORNL groundwater verification report (AIMTech 2001) included weekly water level measurements of the river (staff gauges were installed) and all the wells on site (before they were abandoned) for a significant period of time and has some interesting findings with respect to groundwater flow. This report should be considered in the evaluation of the groundwater regime.**

Response:

All pertinent ground water data will be considered by DOE–GJO as part of the evaluation of ground water remediation planned for 2005.

18. **Page 22. 5.3. Amend verbiage to include any un-assessed soil contamination that may be under the building associated with the drain system.**

Response:

The Deferral Request stipulates that DOE–GJO will remediate all contamination under and around the structure (Section 6.2.3). Therefore, if radiologically contaminated soil is encountered when the drain lines are removed, DOE will remediate the soil.

19. **Page 23, 5.4, 1st ¶, sentence 4. Add "with the exception of Buildings 2 and 20, which utilized dose-based release under DOE Order 5400.5" (which was not in effect when the ROD was drafted).**

Response:

A change will be noted on an errata sheet.

20. **Page 25, bullet. It should be noted for informational purposes that according to the historical report in the RI/FS (McGinley), the North Pond was used for recreational purposes (picnicking and fishing) before site operations commenced in WWII.**

Response:

The comment does not contribute to or alter the conclusions concerning the human health risk evaluation of the North Pond.

21. **Page 29, Building 20. Please adjust the wording to address potential (un-assessed) soil contamination under the building from the drain system.**

Response:

The Deferral Request stipulates that DOE–GJO will remediate all contamination under and around the structure (Section 6.2.3). Therefore, if radiologically contaminated soil is encountered when the drain lines are removed, DOE will remediate the soil.

Specific Comments to *Enforceable Agreement in DR*

1. **Page 3. B, ¶ 4, sentence 1. The IVC statement stated that all areas that were assessed as contaminated were remediated, but the potential exists for additional deposits to exist. Ditto for the IV statements for the remaining buildings. The IVC has consistently noted that the potential for residual contamination exists.**

   Response:

   In accordance with the DR and CERCLA, DOE acknowledges that if contamination is found in the future that is a result of DOE operations, the contamination will be remediated and otherwise dealt with by the DOE.

   Please also see related General Comment 20.

2. **Page 6. C, ¶ 1. Add wording to include DOE liability for residual contamination under Building 20 associated with the drain system. Also add surface uranium contamination in the building.**

   Response:

   The Deferral Request stipulates that DOE–GJO will remediate all contamination under and around the structure (Section 6.2.3). Therefore, if radiologically contaminated soil is encountered when the drain lines are removed, DOE will remediate the soil.

   Please see response to General Comment 15 to address the remainder of this comment.

3. **Page 12. K. ¶ 2. Add wording that monitoring will also cover intrusive remodeling and subsurface excavations by radiation control technicians sufficiently trained to perform monitoring.**

   Response:

   DOE–GJO is only required to monitor the ground water.

   Please see response to General Comment 20.

Specific Comments to *Quitclaim Deed in DR*

1. **Page 5. 3. Building 20. Please add changes to include potential soil contamination under the building from the drain system and the fixed uranium contamination in the building (and the fixed contamination in Building 2).**

   Response:

   The Deferral Request stipulates that DOE–GJO will remediate all contamination under and around the structure (Section 6.2.3). Therefore, if radiologically contaminated soil is encountered when the drain lines are removed, DOE will remediate the soil.

   Buildings 2 and 20 are approved for unrestricted use, with no radiological controls or restrictions required for its current use, during demolition, or for disposal of demolition debris at a public landfill.

   Please see response to General Comment 15.

2. **Page 12. E. Please provide a caveat for radioactive or hazardous materials that have not been assessed.**

   Response:

   There does not appear to be a paragraph E on Page 12.

   Please see related General Comment 20 to address this comment.

3. **Page 13. IX. A. Please be aware that if radioactive material is assessed on the facility (for example in a utility area), a general or specific license to possess and store radioactive material may be required from the Colorado Department of Public Health & Environment.**

   Response:

   The DOE has committed to removing all areas of identified contamination at the facility when use of buildings overlying certain areas of contamination is no longer required. Based on this commitment, which is legally binding and documented in the DR, CDPHE does not believe a specific license for the remaining radioactive material would be required.

A Colorado license is required for any analytical laboratory that receives potentially contaminated samples and utilizes radioactive standards on a commercial basis. The DOE laboratory on-site operates for the sole purpose of providing analytical services to the DOE or other Federal Agencies. If the DOE laboratory begins to accept samples for analysis on a commercial basis, or another laboratory is opened on-site by another owner, then that facility must abide by all applicable state and federal regulations which may include obtaining a Colorado license to possess and store radioactive materials.

Specific Comments to *Long-Term Surveillance Plan in DR*

1. **Page 1. 1.2. 4th ¶. DOE Order 5400.5 is not a regulation (nor was the FUSRAP/SFMP guidance – self regulation). 10 CFR 834 will codify the requirements of the Order, maybe someday."**

   Response:

   DOE Order 5400.5 was a guidance document adopted by DOE–GJO for remediation and release of the facility, because it superceded the *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program* [FUSRAP] *and Remote Surplus Facilities Management Program Sites* [SFMP], which had been in effect when the site remedial action project was administered under the SFMP. The change will be noted on an errata sheet, and the LTSP will be revised accordingly.

2. **Page 2. 2. See previous comments about the residual contamination in buildings 2 and 20 and potential soil contamination under 20.**

   Response:

   Please see responses to General Comment 20, Specific Comment 2, and responses to comments 2 and 1 on the Enforceable Agreement and Quitclaim Deed respectively.

3. **Page 9. 1st ¶. The AIMTech 2001 report "An Evaluation of Natural Flushing at the DOE-GJO Site Using Visual Three-Point Plus" should be consulted for additional information with respect to recharge.**

   Response:

   All pertinent ground water data will be considered by DOE–GJO as part of the evaluation of ground water remediation planned for 2005.

4. **Page 12. 1st ¶. The fact that DOE has released these building from their control does not mean in any way that the areas aren't contaminated.**

   Response:

   As determined by dose-based analyses in accordance with approved procedures, Buildings 2 and 20 are not radiologically contaminated and have been approved for release for unrestricted use.

   Please also see response to General Comment 15.

5. **Page 12. 4th ¶. Sentence 3. These values are different than those stated by DOE in the other documents. Please reconcile.**

Response:

The indicated values may have been preliminary and are incorrect. Analytical laboratory results for soil samples collected from the deposit of contaminated soil under the southwest corner of Building 20 had maximum concentrations of 177 pCi/g for radium-226, 148 pCi/g for thorium-230; and 269 pCi/g for total uranium (*Grand Junction Office Analytical Laboratory Analytical Results,* Requisition No. 17063, Sample Nos. 268341 and 268357). These analytical results verify that the deposit exceeds authorized limits for all three constituents. The changes will be noted on an errata sheet, and the LTSP will be revised accordingly.