COMPLETION REVIEW REPORT

FOR THE

REMEDIAL ACTION

AT THE

RIFLE, COLORADO
URANIUM MILL TAILINGS SITE

JANUARY 1998

DIVISION OF WASTE MANAGEMENT
U.S. NUCLEAR REGULATORY COMMISSION

TABLE OF CONTENTS

LIST OF FIGURES

RIFLE, COLORADO COMPLETION REVIEW REPORT

INTRODUCTION

The Rifle site is one of the 24 abandoned uranium mill tailings sites to be remediated by the U.S. Department of Energy (DOE) under the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). UMTRCA requires, pursuant to Section 104(f)(1), that the U.S. Nuclear Regulatory Commission concur with the DOE's determination that the remedial action has been properly completed. This Completion Review Report (CRR) documents the NRC staff's basis for its concurrence decision with respect to DOE's Certification Summary for the completion of the Rifle site.

1.0 BACKGROUND

1.1 UMTRCA

Title I of UMTRCA provides for remedial action at abandoned uranium mill tailings sites and associated vicinity properties. The purpose of this legislation is to protect the public health and safety and the environment from radiological and non-radiological hazards associated with the process related materials at these sites.

UMTRCA directs DOE to select and perform remedial actions at 24 abandoned uranium mill tailings sites to ensure compliance with the general environmental standards promulgated by the Environmental Protection Agency (EPA) under Section 275(a) of the Atomic Energy Act of 1954, as amended by UMTRCA. UMTRCA also requires DOE to obtain NRC's concurrence with DOE's selection and performance of the remedial actions. Following completion of the remedial actions, UMTRCA authorizes NRC to license the long-term custody, maintenance, and monitoring of the disposal sites to ensure continued protection of the public health and safety and the environment. Appendix B includes a more detailed discussion of this legislation.

1.2 CONCURRENCE PROCESS FOR THE SELECTION OF DOE'S REMEDIAL ACTIONS

To document its selection of the remedial action to be implemented at a particular site, DOE develops and issues a Remedial Action Plan (RAP). The RAP describes the series of activities and presents the design proposed by DOE to provide for the long-term protection of the public and the environment. Usually this involves cleanup of the processing site, adjacent windblown areas, and vicinity properties in addition to stabilization of the residual radioactive materials. In addition, DOE issues a Remedial Action Inspection Plan (RAIP), which establishes the quality control program of testing and inspection that will be employed for the remedial action. In accordance with UMTRCA Section 108(a)(1), the NRC staff reviews and concurs with the RAP and the RAIP, and any subsequent modifications. By its concurrence in the remedial action selection, the NRC staff concludes that the planned remedial actions will comply with EPA's applicable standards in 40 CFR 192, Subparts A, B, and C. The basis for the concurrence in DOE's selection of remedial action is documented in a Technical Evaluation Report (TER).

1.3 THE CONCURRENCE PROCESS FOR THE PERFORMANCE OF DOE'S REMEDIAL ACTIONS

The remedial action work is performed by DOE contractors under Federal procurement regulations. During construction, DOE inspects and documents activities in accordance with the UMTRA Project Quality Assurance Plan, the Remedial Action Inspection Plan (RAIP), and the RAP. In addition, the NRC staff conducts independent inspections during construction, as determined necessary.

Upon completion of the remedial action, DOE compiles construction records and prepares a completion report to document that remedial actions were performed in accordance with the RAP or RAP modifications, and the RAIP. Based on this information, DOE certifies that all provisions of the RAP have been satisfied and, therefore, that the remedial actions comply with the applicable EPA standards in 40 CFR 192.

Based on its review of DOE's documentation, and on its site visits and observations, NRC makes a concurrence decision with regard to DOE's remedial action completion determination for each site, and then documents the basis for this concurrence decision in the Completion Review Report (CRR). By its concurrence in the remedial action performance, the NRC staff concludes that the remedial action has been completed in accordance with the NRC approved design. NRC's concurrence with DOE's completion determination fulfills the Commission's responsibility under UMTRCA Section 104(f)(1).

1.4 RIFLE SITE

The Rifle uranium mill tailings sites are two separate tailings sites adjacent to the city of Rifle in Garfield County, Colorado, as shown in Figure 1.1. Figure 1.2 shows that the eastern site, known as Old Rifle, and the western site, known as New Rifle, are located 0.3 miles southeast and 2 miles southwest respectively, of the center of the city of Rifle. Both are north of the Colorado River.

The Old Rifle site covers 22 acres. It included the 13-acre tailings pile and the 9-acre mill area with ore storage and milling facilities. Prior to remediation, the assay building was the only building still standing, and the foundations of other mill structures were exposed or buried at the east end of the mill area. The contaminated materials at the site were originally estimated to be approximately 333,000 cubic yards (cy) of tailings, 168,000 cy of subpile contaminants, and 160,000 cy of windblown and mill area contaminants.

The New Rifle site covers 142 acres. It included 33 acres of tailings, a mill facility, water retention pond, and two ore storage ponds. The estimated contamination at the New Rifle site consisted of approximately 2,415,000 cy of tailings, 375,000 cy of subpile contaminants and 442,000 cy of windblown and mill area contaminants. Other contaminated materials include an estimated 203,000 cy of vicinity property materials and 34,000 cy of demolition debris from the processing site.

The designated disposal site, Estes Gulch, is located approximately 6 miles north of the city, 7 miles north of the Old Rifle tailings site and 9 miles north of the New Rifle talings area. Figures 1.1 and 1.2 show the location of the Estes Gulch disposal site.

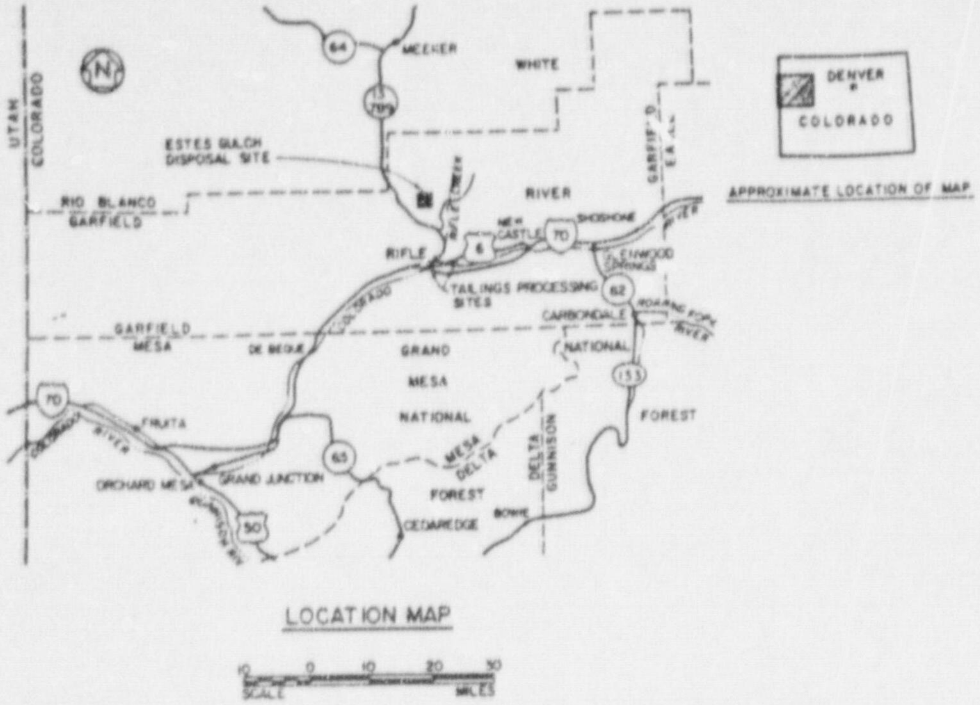

Figure 1.1: Location of the Rifle Processing Sites and Estes Gulch Disposal Site

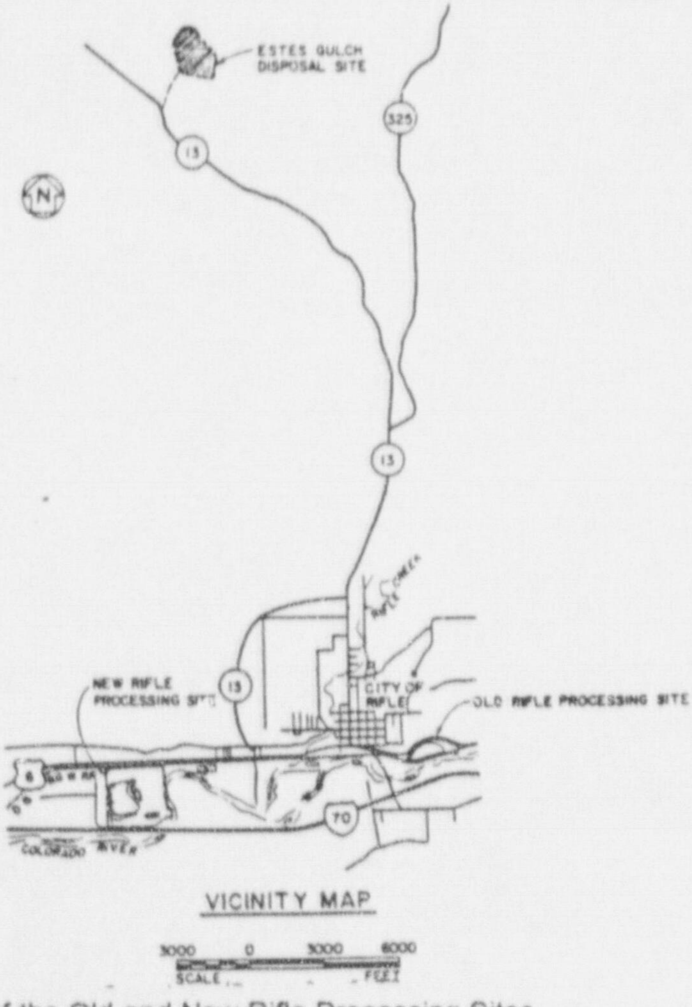

Figure 1.2: Location of the Old and New Rifle Processing Sites

The remedial action performed by DOE consisted of the following major activities:

1. All tailings and contaminated materials from the Old Rifle and New Rifle processing sites were relocated, consolidated, and stabilized into the Estes Gulch/Rifle disposal cell. The disposal cell covers approximately 95 acres and contains approximately 4,100,000 cy of contaminated material.

2. The stabilized embankment was constructed partially below the existing ground surface. The excavation for the below-grade portion of the embankment extends to within a few feet of the bedrock and/or may extend 2 to 3 feet into the highly weathered bedrock of the Wasatch formation.

3. A 1.5-foot-thick radon/infiltration barrier consisting of compacted silty and sandy clay with the upper 12 inches mixed with 4% bentonite was placed over the contaminants.

4. A frost barrier ranging in thickness from 6.8 feet to 18.6 feet and averaging 11.4 feet in thickness, was placed over the radon/infiltration barrier. A 6-inch-thick drain layer of relatively coarse material was constructed between the main frost barrier and another 6-12 inch layer of frost barrier material that was applied directly to the surface of the radon/infiltration barrier. The drain is intended to prevent the build up of hydraulic head over the radon/infiltration barrier, and the drain layer gradation will prevent migration into the drain of the finer materials from the frost and radon barriers. The additional layer of frost barrier material was added to the design through Project Interface Document (PID) 40 as a means of protecting the moisture content of the radon barrier during construction of the disposal cell.

5. The erosion protection for the topslope of the embankment consists of a 12-inch-thick layer of Type A riprap, with a D-5O minimum of 3.5 inches and a D-100 maximum of 6 Inches. The erosion protection for the embankment sideslopes including the toe ditch and berms consists of a 12-inch-thick layer of Type B riprap with a D-5O minimum of 5.7 inches and a D-10O maximum of 10 inches. The entire riprap layer is underlain by a 6-inch-thick drain layer to facilitate drainage of any surface runoff that may percolate down into it.

Figure 1.3 shows the as-built Estes Gulch disposal site.

The NRC was not involved with the actual remedial action activities which were performed by the DOE contractors. However, DOE obtained NRC concurrence with the site construction and design and a few significant modifications thereof as PIDs. NRC also performed on-site construction reviews to monitor the progress of the construction activity (see Appendix A).

1.5 COMPLETION REVIEW REPORT ORGANIZATION

The purpose of this Completion Review Report (CRR) is to document the NRC staff review of DOE's Rifle Completion Report (CR). Section 2 of this report presents the analysis of remedial action construction. This section is organized by technical discipline and addresses engineering and radiation protection aspects of the remedial action. Appendix A provides a listing of NRC staff visits to the Rifle site. Appendix B provides a detailed description of the requirements of UMTRCA and the resulting phased process of the UMTRA project.

2.0 ANALYSIS OF DOE REMEDIAL ACTION PERFORMANCE

2.1 PREVIOUS ACTIONS

NRC staff, based on its review of the RAP (DOE, 1992a, b, c, and d), and the RAIP (DOE, 1991)

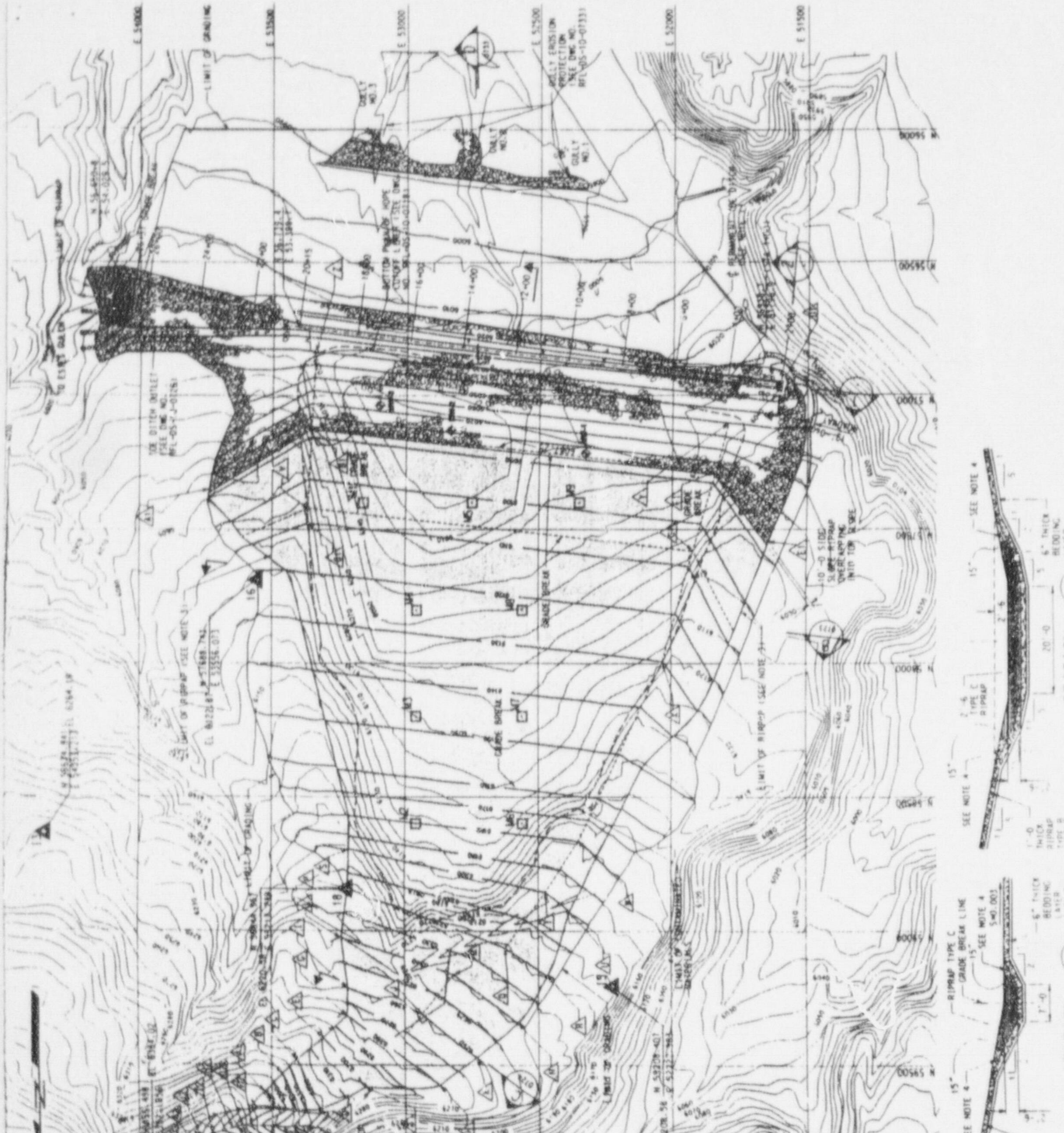

Figure 1.3: The As-built Estes Gulch Disposal Cell at Rifle

concurred that the remedial action, as designed, would meet the applicable EPA standards. This concurrence was based on technical findings that there is reasonable assurance that the selection of the remedial action would meet the standards for long-term stability, radon attenuation, water resources protection, and cleanup of contaminated land and buildings.

Staff reviews included assessments in the areas of geology, geotechnical engineering, surface water hydrology, and health physics. The NRC concurred on the final RAP and the RAIP in May, 1992. The basis for the NRC staff's concurrence in DOE's selection of remedial action at the Rifle site is documented in a TER issued in May 1992 (NRC, 1992).

2.2 REVIEW OF REMEDIAL ACTION PERFORMANCE

NRC staff's primary objective in reviewing DOE's certification of remedial action completion is to determine whether the remedial actions have been performed in a manner consistent with specifications provided in the RAP, RAP modifications or PIDs, and the RAIP, and if not, that deviations to these specifications still result in compliance with the EPA standards. In support of this action, the NRC staff participated in site reviews (See Appendix A), field observations, assessments of on-site data and records, and review of DOE Site Audit Reports. During remedial action construction activities, there were conditions encountered which required modifications of the original remedial action plan. These conditions and the associated design changes were submitted by DOE as eight Class I PIDs, i.e. those related to meeting the EPA standards, and were concurred in by the NRC staff. These PID's are listed in Section I of Volume I of the CR, summarized in Section II of Volume I, and are reflected in the as-built conditions presented in the CR.

The following sections present the results of the review of remedial action performance by individual technical discipline. Note that for the Rifle remedial action completion review, the pertinent technical disciplines are: 1) geotechnical engineering, 2) surface water hydrology and erosion protection, 3) radiation cleanup and control protection, and 4) groundwater resources protection.

2.2.1 GEOTECHNICAL ENGINEERING REVIEW RESULTS

The NRC staff reviewed the Rifle, Colorado, Final Completion Report, (DOE, 1997) to determine whether the geotechnical engineering aspects of the remedial action were completed in accordance with: (1) the applicable construction specifications in the RAP; (2) all RAP modifications; (3) the RAIP; and (4) the final design. Items reviewed included descriptions of construction operations, as-built drawings, laboratory and field testing data, and Remedial Action Contractor (RAC) inspection reports. In addition, the review was based on staff observations and review of records during on-site inspections.

During its review, the NRC staff noted the following:

1. Appropriate tests (gradation and Atterberg limits) and inspections were performed by DOE or its agents to ensure that the proper material type was placed in each phase of construction. Placement and compaction of construction materials were routinely inspected by DOE or its agents to ensure that the moisture and density requirements were met, and that the soil moisture was uniform throughout the compacted lifts. The loose thickness of the lifts was verified periodically by DOE or its agents to ensure compliance with the specification requirements for each particular type of material.

2. Laboratory and field testing by DOE or its agents was conducted in accordance with acceptable test procedures, and by trained and qualified personnel. Records indicating acceptable calibration of measuring and testing equipment are provided in the DOE CR.

3. The CR shows that frequencies of material testing and inspection comply with the frequencies specified in the RAIP and in the NRC Staff Technical Position on Testing and Inspection Plans (NRC, 1989).

4. Continuous inspections by DOE or its agents confirmed that the volume of organics included in the construction materials was limited to the range specified in the RAP.

5. The radon barrier layer was continually inspected by DOE or its agents to ensure that the specified lift thicknesses and compaction levels were achieved.

6. The material type, placement, and compaction methods specified for the radon barrier layer resulted in the desired permeability and density of the barrier.

7. As-built drawings adequately document that the completed remedial action is consistent with the NRC-approved design.

8. Final slope, elevation and compaction operations of the foundation soil and capillary break were adequately inspected to ensure that the final conditions were consistent with those stated in the RAP and final design.

Based on the above observations, and on the results of on-site inspections (see Appendix A) performed by NRC staff during construction, the NRC staff concludes that the geotechnical engineering aspects of construction were performed in accordance with the specifications identified in the RAP and RAIP.

2.2.2 SURFACE WATER HYDROLOGY AND EROSION PROTECTION REVIEW RESULTS

NRC staff reviewed the surface water hydrology and erosion protection aspects of remedial actions at Rifle to ensure that they were constructed in accordance with the applicable construction specifications as stipulated in the RAP, RAP modifications, RAIP, and the final design. Areas of review included construction operations, and laboratory and field testing. In addition, the review was also based on NRC observations of the remedial actions and review of records and testing during several NRC onsite inspections.

The remedial action design included erosion protection in several specific areas, including: (1) riprapped top and side slopes and drainage channels; and (2) riprapped toes. The top and side slopes and drainage channels of the cell were designed to prevent long-term erosion and gullying of the cell cover. The buried riprap toes were placed to prevent erosion and migration of gullies toward the cell.

The NRC staff reviewed each of these features and determined that testing, placement, and configuration complied with specifications in the RAP, RAP modifications, and the RAIP. The review was partially based on NRC staff observations and review of onsite records during the remedial actions, as well as assessment of the verification results presented in the DOE Completion Report. In addition, the NRC staff reviewed records of the placement of riprap on the top and side slopes of the cell.

During the review, the NRC staff noted the following:

1. Tests (gradation and durability) and inspections were performed by DOE or its agents to ensure that erosion protection materials were properly selected. The review of the documentation indicated that placement of materials was routinely inspected by DOE or its agents to ensure that the rock size and gradation specifications were met. Likewise, the thickness of the rock layers was verified periodically by DOE or its agents to ensure compliance with the specifications for the particular type of material.

2. Laboratory and field testing was conducted by DOE or its agents in accordance with specified test procedures.

3. Testing and inspection frequencies for materials used at the site for erosion protection were documented by DOE as complying with the frequencies specified in the RAIP.

Based on NRC staff observations and review of onsite records during remedial actions, as well as assessment of the verification results presented in the CR the NRC staff concludes that the required durability, gradation, and layer thickness testing was performed during the remedial action. Based on these tests, the riprap is of adequate size and quality and has been acceptably placed. The NRC staff concurs that the remedial action has been adequately completed at the Rifle site, with respect to erosion protection.

2.2.3 RADIATION CLEANUP AND CONTROL REVIEW RESULTS

The NRC staff reviewed radioactivity cleanup aspects of remedial actions at the Rifle sites to ensure that residual radioactive materials were cleaned up in accordance with specifications in the RAP and final design. Areas of radioactivity cleanup review included contaminated material excavation, cleanup verification procedures and data, and the use of supplemental standards. In addition, NRC reviewed the radioactivity (radon) control aspects of the remedial action. Construction data and the as-built details of the disposal cell cover were reviewed to ensure compliance with the RAP design for limiting radon releases (see Section 2.2.1), and the final radon attenuation calculation was reviewed to ensure compliance with the RAP design for limiting radon releases and with the long-term radon flux standard in 40 CFR 192.02. The review was based primarily on the staff's assessment of information presented in the Rifle CR.

The criteria for site cleanup and radon attenuation were established in the RAP and concurred in by NRC staff in the TER as providing assurance that the processing sites and disposal cell would meet the EPA requirements of 40 CFR Part 192. The criterion for remediation of radium (Ra-226) in soil requires cleanup at the processing sites and on adjacent lands to levels complying with the applicable EPA standards (40 CFR 192.12), such that the average radium concentrations above background in each 100 m^2 area (grid) do not exceed either 5 pCi/g in the top 15 cm of soil or 15 pCi/g in any underlying 15-cm layer.

The RAP indicated that the buildings and structures at both Rifle processing sites had been demolished and the resulting debris and nonhazardous materials were to be buried in the Estes Gulch disposal cell. Therefore, cleanup criteria were not specified in the RAP and verification of buildings and structures was not required.

For cases where significant concentrations of Th-230 would remain in the soil after the planned excavation and cleanup of the Ra-226, the RAP and TER indicated that, per the requirements of criterion (h) of 40 CFR 192.21, the DOE would impose supplemental standards, as follows. For thorium buried within eight feet of the final grade, the extent of thorium excavation would be based on 1000-year Ra-226 concentrations meeting the Ra-226 cleanup limits of 40 CFR 192. Thus, the Th-230 cleanup standard could vary, based on residual Ra-226 concentration. For Th-230 buried deeper than eight feet below grade, the concentration of Th-230 that could remain would be based on the calculated concentration of radon progeny that might exist in a slab-on-grade house built over the area containing the contaminated material. These supplemental standards applications for Th-230 were the only planned applications of supplemental standards at the Rifle sites that were specified in the RAP and TER.

For verification of land cleanup, a number of criteria were approved for the Rifle sites. The RAP indicated that the final radiological verification survey would be based on 100 m^2 areas. Verification for Ra-226 in soil would use the standard verification method, composite soil samples analyzed by gamma spectrometry. Other methods could be used if approved. Of particular relevance to topics discussed later in this review, the RAP (Appendix C, section C.3.4) provided a performance criterion for operation of the gamma spectrometry system used for the Ra-226 analyses: "At the concentrations of the standards, the Ra-226 verification must be performed such that the analytical results are within plus or minus 30 percent of true concentrations, at the 95 percent confidence level."

Because the soils underneath the New Rifle site included areas of cobbles, the RAP also discussed criteria to be used in the verification of cleanup when the subsoil consists of a percentage of cobbles sufficient to affect the measurement of the total radionuclide concentration. In such cases, excavation control and verification were to be based on bulk radionuclide concentrations calculated from measurements on the finer soil fraction. The TER noted that NRC staff had concurred with a generic procedure for correcting for radionuclides in cobbles, but a site-specific procedure was to be presented as a RAP modification.

The TER also provided criteria to be used in determining the frequency of Th-230 analyses for soil verification samples. Where Th-230 contamination (here Th-230 contamination means Th-230 in excess of Ra-226 contamination) was neither known nor expected, 4% of all verification samples collected from the processing sites were to be analyzed for Th-230 (in addition to the usual Ra-226 analysis). In areas of known Th-230 contamination, 10% of the verification grids were to be analyzed for Th-230. If significant Th-230 levels were found, further remedial action was to be considered. And, where excavation was required because of the Th-230 contamination, all verification grids were to be analyzed for Th-230.

The radon attenuation design provided in the RAP was revised, with the most recent revision based on PID-38. The most recent design calculation (in support of PID-38) was submitted by DOE in June 1996 (Arp 1996) and approved by NRC in July 1996 (Holonich 1996). The design calculation, number 06-570-14-02 (an enclosure to Arp 1996), was revision 2 of the calculation. The final design included a radon barrier of three layers: (1) a ½-ft layer of radon barrier material, followed by (2) a 1-ft layer of radon barrier material amended with 4% bentonite, all covered by (3) a layer of frost barrier material. For the radon attenuation calculations, the frost barrier was modeled as two layers, with the two described similarly, except that the uppermost layer was assumed to be degraded by frost penetration. The transmittal letters of the submittal (Arp 1996) and approval (Holonich 1996) both indicated that the frost barrier would have a minimum thickness of 7.5 ft, though the design calculations were based on a minimum thickness of 7 ft.

During the review of the CR, with respect to the above criteria and commitments, NRC staff noted the following:

1. **Site Cleanup:**

a) Adequacy of the extent of excavation:
It appears that excavation and verification of cleanup have generally been performed in the contaminated areas within the boundaries of the designated processing sites as described in the RAP.

b) Cleanup of buildings:
Section IV (page 8, section 2.0 of section D) of the CR indicates that all buildings located on the two processing sites were demolished and placed in the disposal cell.

c) Routine use of supplemental standards for Th-230 contamination:
Appendix J (page 2, section 1.1.3) of the CR indicates that the use of supplemental standards to areas of Th-230 contamination near the surface (within eight feet of the final grade) was consistent with the method described in the RAP. (Two areas existed where Th-230 contamination was more than 8 ft below the final grade. The supplemental standards used for these areas of deep Th-230 contamination are discussed under item number 3 in this section, "Nonroutine Applications of Supplemental Standards.")

2. **Soil Cleanup Verification:**

a) Verification method:
Approved procedures were used by DOE for soil cleanup verification measurements for essentially all of the sampling locations at both the Old Rifle and New Rifle sites. The CR (section 4.0, page 8 of Appendix J) indicated that seven grid locations on the New Rifle site did not have the final, equilibrated sample analysis performed on the Opposed Crystal gamma spectrometry system (OCS), a departure from the routine processing of the samples. Of these seven, five locations had samples that were sent to an offsite laboratory for quality assurance Ra-226 analyses, and the two remaining locations did have *initial* counts on the OCS. At all seven locations the backfill depth was at least 15 cm, so the applicable EPA cleanup standard was 15 pCi/g above background. The NRC staff concludes that the available information for these locations indicates a high degree of confidence that the EPA standard has been met.

b) Areal extent of verification:
Tables J.4 and J.6 of Appendix J of the CR, contain verification results that indicate that DOE cleaned up each of the contaminated areas within the designated boundaries of each of the Rifle sites.

c) Results of verification measurements:
Appendix J of the CR discusses the soil verification measurements and results. The reported Ra-226 concentrations and 1000-year Ra-226 concentrations for each of the samples were less than the standards for Ra-226 specified in the EPA regulations. Thus, the verification measurements seem to show that the EPA standards were met for soil cleanup of Ra-226 and for routine application of supplemental standards of Th-230 contamination. However, NRC had concerns regarding quality control and quality assurance measurements as discussed in the following comments—2.d) and 2.e).

d) Quality assurance measurements by outside laboratory:
The operating procedure for verification soil sampling, procedure OP-003-1, indicated that 4% of all verification samples would be sent to an outside vendor laboratory for quality

assurance (QA) analysis of the Ra-226 concentration. For the Rifle site, the outside laboratory used was Barringer. The data from the Barringer analyses are presented in Appendix J of the CR, along with the data from the onsite analyses. However, in subsection 5.2 of Section IV, Remedial Action Assessment, of Volume 1 of the CR, it is stated that it was difficult to compare the results of the Barringer data to the onsite OCS data. This difficulty was due to differences in analytical techniques, and because of the possibility that both the Barringer and OCS data could be biased low or high. Because of this difficulty, a comparison of the Barringer data to the OCS data was not performed.

The NRC staff agree that the direct comparison of the Barringer data to the OCS data may be inappropriate. This means that the primary quality assurance for the onsite OCS analyses must come from the analyses performed at the onsite laboratory, including the quality control measurements for the OCS, described below.

e) Quality control measurements for the OCS:
As indicated previously, the RAP included a performance criterion for operation of the gamma spectrometry system (the OCS) used for Ra-226 verification measurements: "At the concentrations of the standards, the Ra-226 verification must be performed such that the analytical results are within plus or minus 30 percent of true concentrations, at the 95 percent confidence level." It appears from the information provided in the CR that this performance criterion was not met for OCS instrument #6 at the Rifle site.

Appendix J of the CR briefly describes the measurements made and the results used to show compliance with this criterion. It was indicated (page 2 of Appendix J) that the error limits were empirically determined, using a National Institute of Standards and Technology traceable reference material having a Ra-226 concentration of 5.12 pCi/g that was routinely analyzed during the verification process. The soil verification procedure, OP-003-1, does not describe the way these measurements were to be taken and used, and the RAC procedure for operation of the OCS was not included in the CR. But, it is the understanding of the NRC staff based on conversations with DOE staff and the Remedial Action Contractor that these measurements were performed multiple times per day, and the results were to be plotted in quality control charts and used to continuously evaluate the performance of the OCS. As such, these were quality *control* measurements.

A summary of these OCS quality control (QC) measurements was provided in Table J.1 of Appendix J of the CR, and those data are repeated below in Table 1. The true concentration of the standard used for the QC checks was 5.12 pCi/g. Thus, the acceptable range of this value plus or minus 30% would be a range of 3.58–6.66 pCi/g. For OCS 6, the mean measurement was 4.3 pCi/g, and the 95% confidence interval (as expressed by the mean plus or minus 2 standard deviations) was the range 3.4–5.2 pCi/g. This indicates (as also described on page 9 of Appendix J) that the lower bound of the 95% confidence interval for OCS 6 fell outside the acceptable plus or minus 30% range.

Table 1. Summary of Rifle Site OCS QC Measurements

OCS number	Average result ± 2s [a]	Number of checks
1	5.2 ± 0.8	2121
2	5.2 ± 0.8	757
3	5.1 ± 0.8	726
4	4.6 ± 0.9	3429
5	4.6 ± 0.9	3701
6	4.3 ± 0.9	1301

[a] Here ± 2s means plus or minus 2 standard deviations (though the CR used the term sigma). Note that the true concentration of the standard used for the QC checks was 5.12 pCi/g.

The NRC staff was originally concerned that if the ± 30% performance criterion was intended for quality *control* purposes and was not met for OCS 6, it appeared that OCS 6 was not operating within acceptable bounds. This could have meant that the results from OCS 6 were questionable. However, in response to this concern, the DOE provided additional discussion about the efforts made to evaluate the performance of OCS 6 in Appendix J of the CR (Section 3.1, pages 10–11). This discussion indicated that an investigation was performed on OCS 6, and nothing was discovered which could have resulted in the low bias in the OCS QC measurements. In addition, the standard deviation of the OCS QC measurements (see Table 1) was very similar to that for the other OCS instruments used at the Rifle sites, indicating that OCS 6 was operating in the same general precision range. The CR then concluded that it appears that the accuracy of the instrument is what caused OCS 6 to fall outside the ± 30% performance criterion. The NRC staff agrees that it appears that the reason for OCS 6 not meeting the performance criterion was the accuracy of the instrument and that the instrument was otherwise operating correctly.

The CR then indicates (Section 3.2, page 11, of Appendix J) that since OCS 6 was operating with acceptable precision, the entire OCS 6 data set can be adjusted upward to compensate for the inaccuracy (the low bias). This correction was performed for the data with the highest measured Ra-226 concentrations, with the results reported in the CR (Section 3.3, page 11, Appendix J). This discussion indicates that OCS 6 measurements were biased low by 16%; the measured average was 4.3 pCi/g and the known average was 5.12 pCi/g. The maximum measured values from OCS 6 were given as 4.4 pCi/g for the top 15 cm of soil, and 13.4 pCi/g for soil in layers deeper than 15 cm. With application of a correction factor (presumably this would be a factor of 5.12 ÷ 4.3), corrected values were given as maxima of 5.2 pCi/g for the surface soils and 16.0 pCi/g for deeper soils. The CR concluded that the corrected values indicate that the EPA standards for Ra-226 had been met for those samples measured with OCS 6.

The NRC staff concludes that the corrected results indicate that there is a good degree of confidence that the EPA standards had been met for the samples analyzed with OCS 6.

From the data shown in Table J.1 of the CR (see Table 1 above), the NRC staff also evaluated the significance of the differences between the mean QC measurements for OCSs 4 and 5 and the true mean concentration of the reference material. Using a Student's t test, the mean concentrations measured by these two OCSs are significantly different from the true mean concentration ($p<0.05$). Since the data (Table 1) indicate that the ± 30% criterion was met for these OCSs, and the precision appears similar to that for the other OCSs, the NRC staff concludes that these OCSs were generally operating acceptably well, but with a slightly low bias. The CR does not contain any analysis of potential corrections that could be performed to account for the apparent low bias in OCSs 4 and 5 (although perhaps they were similar to what was done for the OCS 6 results).

The NRC staff has tried to estimate the impacts of such potential corrections, as follows. The results for OCSs 4 and 5 appear to be biased low by about −10.2%, and a correction factor would be 1.11 (5.12 pCi/g ÷ 4.3 pCi/g). From the CR it cannot be determined which verification measurements for Ra-226 were made using OCSs 4 and 5, so the NRC staff looked at all verification results (a worst case). From this review, staff determined that there could be at most eight verification grids (seven with at least 15 cm of backfill and one with less than 15 cm of backfill) for which the corrected results would exceed the EPA standards for Ra-226 in soil. Of these, the highest corrected concentration is 17.9 pCi/g and the surface sample would have a corrected concentration of 6.3 pCi/g (only marginally greater than the 6.2 pCi/g that the standard allows). The staff notes that the affected grids are generally isolated from each other, and that results from immediately adjacent verification grids are within the standards. It appears that the EPA standard for Ra-226 may not have been met for all verification grids (at worst eight grids might exceed the standard), but the average concentration of Ra-226 remaining on the site is significantly below (within) the standards. Since most of the affected grids have been covered with backfill,the staff considers it likely that future inhabitants of the site would be exposed to the residual radioactivity from many verification grids, so the impact (on potential dose) from isolated grids would be lessened. For these reasons, the NRC staff concludes that the intent of the EPA standards has been met and the residual concentrations are considered acceptable.

f) Corrections for cobbles in soil:
As described earlier, verification measurements for cobbly soils were to be based on bulk radionuclide concentrations. The TER noted that NRC staff had concurred with a generic procedure for corrections to estimate bulk radionuclide concentrations in cobbly soils, and that a site-specific procedure was to be submitted as a RAP modification. The CR summarizes the procedure used at the Rifle processing sites; the generic procedure, OP-003-4, was included as an attachment to Appendix J (page 252 and following); and pertinent site-specific data were also included. The method described in the procedure is summarized as follows: test pits are first developed in the areas of concern at sites, and samples from the test pits are analyzed to calculate statistical average radionuclide concentrations in the cobble materials and a lower bound (95% confidence) on the mass ratio of cobbles to fines (the RAC refers to this ratio as the mass partition function). Then, for verification, the concentration of Ra-226 (and Th-230 if necessary) is measured in the fines, and the statistical values of radionuclide concentrations in the cobbles and mass ratio of cobbles to fines are used to calculate the bulk Ra-226 (and 1000-year Ra-226) concentration. The bulk concentration is then compared to the EPA standard or to the generic supplemental standard for Th-230.

The draft CR indicates that 64 verification grids, all on the New Rifle site, required the use of the cobbles to fines correction to show compliance with the EPA standard (pages 6 and 7 of Appendix J). The measurement data for the radionuclide concentrations in the cobble fraction and for the mass ratios of cobbles to fines from the test pits are provided in Table J.7 of Appendix J of the CR. The test pit locations are shown in Figures J.1, J.2, and J.3 of Appendix J. The same figures also show the locations of the 64 grids where verification used the cobbles to fines correction. Of these verification grids, 4 grids were in subpile areas and

60 were in what was called the "non-contact ponds area." The following discussions cover two aspects of the corrections applied to cobbly soils: (1) the estimated radionuclide concentrations in the cobbles and (2) the estimated mass ratio of cobbles to fines in the verification grids.

For measurement of the radionuclide (Ra-226 and Th-230) concentrations in the cobbles, there were 10 test pits located offpile and 11 test pits located in subpile areas. The average radionuclide concentrations to be used were taken as the average from all 21 test pits. The NRC staff agrees that this approach was reasonable, since the radionuclide concentrations appeared relatively similar for the two different areas, and the concentrations were in the same range as background concentrations (the means were 1.1 pCi/g for Ra-226 and 0.8 pCi/g for Th-230).

Regarding the estimation of the mass partition function (the mass ratio of cobbles to fines), procedure OP-003-4 describes two alternatives for how the mass ratio of cobbles to fines may be determined for verification purposes. The first alternative (section 5.8 in the procedure) requires that the mass ratio of cobbles to fines be measured on the soil sampled for each verification grid. In the second alternative (section 5.9 in the procedure), the value used for the mass ratio of cobbles to fines is a "lower 95 percent confidence value" from the test pit measurements. The definition of this lower confidence value (given in section 5.4.1 in the procedure) describes a lower bound of a 95% confidence interval of the mean ratio. The discussion in the CR indicates that the corrections applied at the Rifle sites used the statistical value of the mass ratio of cobbles to fines, which is the method of the second alternative above.

Apparently there was not a formal modification to the RAP to incorporate a site-specific procedure for verification of cobbly soils. Instead, the DOE submitted a report on cobbly soils for the Rifle sites (DOE 1994). The NRC staff raised several concerns with the protocol that was set out in that document and submitted comments to DOE to that effect (Gillen 1994). A major concern was that the statistical procedure to be employed for estimating the mass partition function would still result in the bulk radionuclide concentrations being underestimated in a significant fraction of the verification grids. The staff's review of the preliminary DOE test pit data indicated that for 6 out of 17 of the test pits the radioactivity concentrations would be underestimated (Gillen 1994).

Responses to the NRC comments were provided by the DOE (Arp 1995). As part of the DOE response, the DOE indicated that the mass partition function for the southern part of the New Rifle site was calculated to be about 3, but that for conservatism, verification in that area would be performed using a mass partition function value of 1. Use of this value would have alleviated many of the NRC staff's concerns, and, in particular, should have eliminated the possibility that verification grids would have the bulk radioactivity underestimated.

However, during construction and verification at the New Rifle site, the value of 1 was not used for the mass partition function. Instead, as indicated by the CR, the method of the generic procedure was used, with details as follows.

The CR indicates that for measurements of the mass ratios of cobbles to fines, there were five test pits in the subpile area and five test pits in the non-contact ponds area. The locations of the five test pits in the subpile area generally encompassed the subpile verification grids for which the cobbles to fines correction was used. Since there were only four verification grids in the subpile area for which the cobbles to fines correction was used, the five test pits are considered by NRC staff to be acceptable. The locations of the five test pits in the non-contact ponds area also generally encompassed those verification grids in the non-contact ponds area for which the cobbles to fines correction was used. In this case there were 60 verification grids for which the cobbles to fines correction was used. Procedure OP-003-4 indicates that usually 30 test pits would be used for an entire site, but also indicates that fewer test pits may be used on smaller sites, and that for areas of less than 0.5 acres one test pit would be used. From Figures J.2 and J.3 of Appendix J to the CR, the verification grids for which the cobbles correction was applied in the non-contact ponds area cover an area of about 2 acres. The NRC staff thus concludes that the number of test pits in the non-contact ponds area was sufficient to develop the statistical value of the mass ratio of cobbles to fines in this area.

The NRC staff still had a concern with the procedure used to estimate the statistical value (the 95% confidence lower bound) of the mass partition function. Essentially, it was the same concern expressed in the 1995 NRC staff response to the DOE cobbles to fines report: that the statistical procedure used for estimating the mass partition function would result in the bulk radionuclide concentrations being underestimated in a significant fraction of the verification grids at Rifle. The method for determining the statistical lower bound (see procedure OP-003-4, attached to Appendix J of the CR) actually produces a *lower bound on the average* mass partition function, *rather than a lower bound on the individual* mass partition functions. This results in the likelihood that the bulk radionuclide concentrations would be underestimated in a significant fraction of the 64 verification grids. Since some of the verification results for 1000-year Ra-226 concentrations were relatively close to the radium standard (see Table J.5 of Appendix J to the CR), there is a chance that a few verification grids may have concentrations that would exceed the generic supplemental standard for Th-230 (i.e., that the 1000-year Ra-226 concentration should not exceed the Ra-226 standard). The statistical method used does, however, provide confidence that the *average* bulk concentration will not be underestimated (and, in fact, should be somewhat overestimated). All of the verification grids to which the cobbles correction was applied were backfilled with at least 15 cm of soil. Thus, it seems reasonable that the contaminant level to which people on the site may be exposed in the future would be better represented by the *average* concentration, rather than the concentrations for individual verification grids. Thus, the NRC staff concludes that the intent of the EPA standards has been met and the residual concentrations are considered acceptable.

g) Frequency of Th-230 measurements:
Section 1.1.6 of Appendix J (pages 4 and 5) of the CR describes when Th-230 verification analyses were performed at the Rifle sites. This section indicates that the required sampling frequency for Th-230 (discussed earlier in this fCRR, in section 2.2.3) was followed. The NRC staff concludes that Th-230 verification measurements were performed at the frequency required.

3. Nonroutine Applications of Supplemental Standards:

The nonroutine applications of supplemental standards for soil cleanup are described in Appendix K of the CR (MK-F 1997). These applications cover three categories or areas of the Rifle processing sites: (a) part of the river dike at the New Rifle site (described in section A of Appendix K), (b) a road berm at the Old Rifle site (section B of Appendix K), and (c) locations of elevated Th-230, at concentrations greater than allowed by the generic Th-230 supplemental standard (routinely used), at the New Rifle site (section C of Appendix K).

a) Supplemental standards for New Rifle river dike:
Appendix K of the CR indicates that about 600 ft of the river dike, which is roughly 10 ft in height, located on the east side of the New Rifle site, is contaminated with residual radioactive material. It was estimated that about 400 yd^3 of contaminated material remained in the dike (page 17 of Appendix K). Table A.2 of section A of Appendix K provides a summary of soil samples taken in 37 boreholes in the dike. The Ra-226 concentrations in these samples ranged up to 115 pCi/g.

Criteria for applying supplemental standards are provided in the EPA standards at 40 CFR 192.21. Section A.1 of Appendix K (page 9) recommends the use of supplemental standards and indicates that the applicable criterion for application to the river dike is criterion (a) of 40 CFR 192.21 (quoted from 40 CFR 192.21):

> (a) Remedial actions required to satisfy Subparts A or B would pose a clear and present risk of injury to workers or to members of the public, notwithstanding reasonable measures to avoid or reduce risk.

Section A.4.1.1 of Appendix K of the CR (page 14) indicates that to excavate some of the contaminated material in the river dike, the river channel would have to be diverted prior to excavation. This diversion would be accomplished by using sheet piling or a diaphragm wall, either adjacent to the dike or upstream of the dike. Appendix K later (section A.4.1.2, page 15) describes the safety hazards associated with this work. The risks to workers would be due to potential drowning or cold water exposure associated with placement of the diversion structure. The CR states that placement of these structures in water requires the use of a barge or boat, and workers to guide the structure materials into place. The deep, cold waters and swift currents of the Colorado River would contribute to the potential drowning and cold water exposure hazard, even with the use of life jackets and tie-off lines. The CR states that thus even with the use of measures to reduce the safety hazards, cleanup of the river dike poses a clear and present risk of injury to workers performing the operations. The NRC staff concurs that criterion (a) of 40 CFR 192.21 is applicable to conditions of the river dike, and that the use of a supplemental standard is appropriate.

The CR (section A.2, page 10 of Appendix K) also indicated that remediation was performed to the maximum extent possible, and the excavation was stopped as close to the edge of the dike as possible, without excavating into the structure of the dike. Because of its location, the residual contamination is unlikely to present any significant risk to people in the future, and the contamination is likely to be diluted should the material be moved (whether moved naturally or by man). Thus, the NRC staff concludes that the cleanup of the dike area at the New Rifle site has come as close to meeting the Ra-226 standards as is reasonable.

b) Supplemental standards for Old Rifle road berm:
Section B of Appendix K of the draft CR indicates that about 1600 ft of the road berm for State Highway 6 and 24, along the north side of the Old Rifle site, contains mill tailings contaminated material buried under clean fill. This area is proposed for application of supplemental standards for soil cleanup. It was estimated that about 24,000 yd^3 of contaminated material remained in the road berm (page 37 of Appendix K). Table B 2 of section B of Appendix K provides a summary of soil samples taken in 18 traverses of the exposed (after excavation to the extent performed) contaminated material in the berm. The Ra-226 concentrations in these samples ranged up to 1320 pCi/g.

Section B.1 of Appendix K (page 31) indicates that the applicable criterion from 40 CFR

192.21, for application of supplemental standards, is also criterion (a) (see above). The risks associated with remediation of the road berms to meet the Ra-226 standards are described in section B.4.1.2 of Appendix K (page 38) to the CR, as follows. The contamination within the road berm extends onto the adjacent vicinity property and supplemental standards are used as justification to leave the vicinity property contaminated material in place. Thus, remediation of the contaminated materials in the road berm on the Old Rifle site would require the use of sheet piles, cantilever H piles with timber lagging, soil nailing, or soil anchoring to reduce the crushing hazards and stabilize the vertical slope during excavation of contaminated materials. Use of these methods would require that at least one lane of the highway be closed during construction, resulting in potential traffic hazards even with a flagman present. There are also inherent construction hazards associated with the use of the slope stabilization methods. The CR concluded that even using the risk reduction measures described, remediation of the road berm would pose a clear and present risk of injury to workers performing the remediation and to members of the public traveling on the highway. The NRC staff concurs that criterion (a) of 40 CFR 192.21 is applicable to conditions of the road berm, and that the use of a supplemental standard is appropriate.

The CR (section B.2, page 32 of Appendix K) also indicated that remediation was performed to the maximum extent possible, with the excavation was stopped as close to the edge of the road as possible, without endangering workers by destabilizing the slope. Because of its location, the residual contamination is unlikely to present any significant risk to people in the future, and the contamination is likely to be diluted should the material be moved (whether moved naturally or by man). Thus, the NRC staff concludes that the cleanup of the road berm area at the Old Rifle site has come as close to meeting the Ra-226 standards as is reasonable.

c) Supplemental standards for nonroutine areas of elevated Th-230:
Section C of Appendix K of the CR indicates that for two 100-m^2 verification grids, nonroutine application of supplemental standards was made due to elevated Th-230 (elevated such that the 1000-year Ra-226 concentration would exceed the EPA standard of 15 pCi/g above background, i.e., the generic supplemental standard for Th-230 would be exceeded). Based on the criterion of 40 CFR 192.21(h), application of supplemental standards for these areas is required because the primary contamination is other than radium, and concentrations were (before cleanup) sufficient to cause a potentially significant radiation hazard. The two affected verification grids are close together in the excavated area under the non-contact ponds.

The RAP and TER provided a criterion that would be used to judge the acceptability of leaving concentrations of Th-230 in soil at concentrations which would lead to a 1000-year Ra-226 concentration in excess of 15 pCi/g. For contamination that would be buried (with clean backfill) deeper than 8 ft, residual levels of Th-230 would be acceptable if the expected radon progeny concentration in a slab-on-grade house built over the contamination would be no greater than 0.01 WL. DOE used an NRC-approved method for estimating radon progeny as set out in a generic protocol for Th-230 concentrations (Chernoff, 1993).

The 1000-year Ra-226 concentrations for the two grids were 18 and 16.4 pCi/g, and the contamination was to be backfilled with a total of 9 ft of uncontaminated material (page 78 of Appendix K). Since the Ra-226 concentrations are only slightly higher than the EPA standard of 16.2 pCi/g for the Rifle sites (15 pCi/g above background) and the contamination is deep, NRC staff expected that the analysis would show acceptable radon progeny concentrations. In fact, the calculated radon progeny concentration was 0.01 WL for both of the grids. Thus, the NRC staff concludes that the *methods* used for the calculations of radon progeny concentrations for the two grids and the results of the calculations are acceptable.

However, the NRC staff had concerns about the justification for some of the parameter values used in the calculations. The description of the parameter values used for the RAECOM code (page 75 of Appendix K) indicates that for the topsoil material, values were typically taken from the reference values given in the NRC's Regulatory Guide 3.64 (NRC 1989). The NRC staff considers this to be acceptable. However, values for the cobbly contaminated material and cobbly fill material were taken from a report described as: "Measurements of Radon Gas Diffusion in Cobbly Soils" (RAE-8944/3-1, September 1991). There was no justification provided in the CR for the use of values from this latter report for the cobbly material, and it appears that this report included data only from the Gunnison UMTRA Project site.

Additional justification for the parameter values used has been provided by the DOE in its responses to NRC comments on the April 1997 draft of the final CR (Arp 1997a). The DOE indicated that there were no site-specific radon flux parameters available for the cobbly materials (contaminated material or general backfill), and only limited information (actual density) was available for the topsoil materials. Since there were no distinct layers of cobbly materials in the disposal cell, parameters for cobbly materials could not be separated from parameters for any other type of materials. In addition, the parameters labeled "New Rifle Sub-pile" in calculation RFL 06-570-01-02 of the RAP were obtained from non-cobbly subpile layers. Therefore, the DOE indicates that the best available information was obtained from previously published values. The document: *Measurements of Radon Gas Diffusion in Cobbly Soils* was specifically prepared to address cobbly soils. Cobbly river gravel is very similar in general composition throughout the western U.S. due to the process that forms the materials. Therefore, the DOE concludes that it is logical to use measured values for cobbly materials even though the measurements were not made for New Rifle river cobbles.

The NRC staff concludes that the additional information provided by the DOE (Arp 1997a) is sufficient to justify the parameter values used in the radon flux calculations. Thus, the NRC staff concludes that the calculations are acceptable and that the residual concentrations in the two grids meet the supplemental standard for Th-230 in soil.

4. Radon Attenuation:

The CR includes the most recent calculation for the radon barrier design. This calculation is number 06-570-14-04, and is a further revision (revision 4) to the calculation submitted in support of PID-38. A comparison of the two calculations has shown only one change that affects the radon attenuation calculation. This change is in the layer thicknesses of the two parts of the frost barrier (the total frost barrier thickness was unchanged). In the PID-38 calculation, the unaffected layer of frost barrier was modeled with thickness 4.0 ft and the degraded layer was modeled with thickness 3.0 ft. In the CR calculation, the depth of frost penetration was increased (see page II-4 of calculation 06-570-14-04 in MK-F 1997) to 5.7 ft, of which 4.5 ft was the uppermost part of the frost barrier layer. The thickness of the unaffected part of the frost barrier was correspondingly decreased to 2.5 ft.

The calculations to support the CR were performed for a baseline case, which used nominal values of parameters, and for a worst case, which used the nominal values adjusted by plus or minus the standard error of the value, where the adjustment was always in the direction to produce higher exit flux. According to the calculation in the CR, the result of the changes in thickness of the frost barrier layers is that the calculated radon flux from the surface of the frost barrier layer of the disposal cell (the exit flux) increased about 11% (the revised results are summarized on page II-9 of calculation 06-570-14-04 in MK-F 1997). The results were a baseline exit flux of 3.48 pCi/m^{2}s and worst-case exit flux of 6.55 pCi/m^{2}s.

Because the change to the previously approved design was very limited, the NRC staff spot-checked the revised calculation by repeating the model calculation. The spot-check results were acceptably close to the values provided in the CR.

The NRC staff also notes that the thicknesses of the radon barrier and frost barrier layers assumed for the radon flux calculations (MK-F 1997) are less than the average, as-built thicknesses of these layers. The as-built thicknesses are described in a "Disposal Layer Thickness" table in Section II - Critical Review Summary, of Volume 1 of the CR. In particular, the average, as-built thickness of the frost barrier layers was 11.4 ft, significantly greater than the 7.0 ft used in the radon flux calculations. Because the as-built thicknesses of layers that provide radon attenuation are greater than used in the flux calculations, the calculations should *overestimate* the actual long-term average radon flux from the disposal cell.

Based on this review, the NRC staff concludes that there is adequate assurance that the long-term radon flux standard of 20 pCi/m^{2}s has been met.

Based on the above evaluations, the NRC staff concludes that commitments and requirements stated in the RAP and TER have generally been fulfilled and that the data in the CR and other documents provide reasonable assurance that the standards (or the intent of the standards) for soil cleanup and disposal cell radon control have been met at the Rifle processing sites and the Estes Gulch disposal site.

2.2.4 GROUNDWATER PROTECTION REVIEW RESULTS

The NRC staff has reviewed the groundwater hydrology and the groundwater resources protection aspects of the remedial actions taken by DOE at the Rifle site and as documented in the CR, to ensure that they were in compliance with EPA's groundwater protection standards in 40 CFR Part 192, Subparts A-C, and are consistent with the commitments made in the RAP. Areas of review included water resources protection standards for disposal, performance assessment, closure performance standards, and groundwater monitoring and corrective action program.

DOE concluded, and NRC concurred in the TER, that the proposed remedial action would comply with the EPA standards because the tailings contaminants will not migrate to the Point of Compliance (POC) in 1000 years. DOE estimated the vertical travel time from the bottom of the disposal cell to the uppermost aquifer to be over 1000 years. The estimated vertical travel time from the base of the disposal cell to a point just below the deepest exploratory borehole at the Estes Gulch site (544 feet) is in excess of the 200 year minimum design criterion established in UMTRCA. Consequently, DOE concluded that the proposed remedial action plan is in compliance with EPA's groundwater protection standards. The great depth and high degree of hydraulic isolation between the uppermost aquifer and the disposal cell make ambient groundwater quality characterization, Point of Compliance monitoring, and proposed corrective action plans inappropriate for demonstrating groundwater resource protection.

In the Rifle RAP, DOE committed to several water resources protection activities. These commitments included:

1. Construction of an impermeable geomembrane on the downslope side wall of the Estes Guich disposal cell subgrade.

2. Construction of a sand blanket, finger drains and 3 dewatering wells (standpipes) within the disposal cell at the low point of the bottom subgrade.

3. Actively pumping the dewatering wells if water levels approach the top of the installed geomembrane.

4. Installing piezometers in any paleochannel downslope of the disposal cell, which had been truncated by the disposal cell excavation.

5. Plugging and abandoning certain monitoring wells used for characterization at the Old and New Rifle former processing sites, and the Estes Gulch disposal site.

During the review, the NRC staff noted that the DOE provided confirmation of completion of the following commitments:

1. Geomembrane construction as evidenced by Drawing RFL-DS-10-0718.

2. Sand blanket finger drains and dewatering wells (standpipes) as shown in Drawings RFL-DS-10-0721; RFL-DS-10-0722; RFL-DS-10-0731; and RFL-DS-10-0732. Standpipes will be plugged and abandoned only after consultation with the State of Colorado and approval by NRC.

3. Pump if water approaches the top of the geomembrane as set out in Calculation 06-579-05-00.

4. The structures identified as a paleochannel during disposal cell excavation were determined to be old gully deposits, not streambed deposits. Since they were determined not to be water bearing and were actually less pervious than the surrounding alluvium, they were not considered to be a leachate pathway out of the disposal cell. Consequently, long term monitoring was not considered to be necessary so piezometers were not installed, as discussed in Section 4 of the Design Assessment.

5. DOE indicated that there may still be several wells at the disposal site that need to be abandoned, as referenced in its 1997 annual prelicensing inspection report for the Rifle site, transmitted by letter dated December 17, 1997. DOE will evaluate the status of these wells during its next inspection of the site, and perform well abandonment as necessary.

DOE has elected to postpone the groundwater remedial action activities at the two processing sites to a separate phase of the project, so related issues are not addressed in the CR.

Based on the review of the water resources protection information in the Rifle CR, the NRC staff concludes that the groundwater hydrology and the groundwater resources protection aspects of the remedial actions taken by DOE at the Rifle site and as documented in the CR, are in compliance with EPA's groundwater protection standards in 40 CFR Part 192, Subparts A-C, and are consistent with the commitments made in the RAP.

3.0 SUMMARY

NRC staff reviewed geotechnical engineering, surface water hydrology and erosion protection, and radiation protection and groundwater protection aspects of the remedial action performed at the Rifle uranium mill tailings site. The purpose of this review was to determine whether DOE had performed remedial actions at the site in accordance with specifications in the RAP, RAP modifications, and other supporting project documents, and thus with the EPA standards in 40 CFR Part 192, Subparts A-C. Based on its review of the CR and on observations made during periodic on-site construction visits, the NRC staff concludes that DOE performed remedial action at the Rifle site in accordance with the EPA standards. Therefore, NRC concurs with DOE's certification of completion of the remedial action of the old and new Rifle tailings sites.

4.0 REFERENCES

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APPENDIX A

NRC SITE VISITS TO THE

RIFLE UMTRA PROJECT SITE

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NRC SITE VISITS TO THE
RIFLE UMTRA PROJECT SITE

DATE	STAFF/DISCIPLINE	PURPOSE
9/84	T. Johnson/surface hydrology D. Gillen/geotech. engineer R. Pennefiil/project manager D. Martin/manager	Site evaluation review
8/3/88	J. Grimm/geologist L. Derring/hydrologist S. Wastler/project manager	Pre-RAP review visit
6/14/89	T. Johnson/surface hydrologist M. Weber/geo-hydrologist D. Gillen/geotech.engineer M. Fliegel/manager	Site visit/evaluation of rock
9/6-7/89	J. Grimm/geologist M. Dunkelman	Pre-construction review
5/3/90	T. Johnson/surface hydrologist D. Gillen/geotech.engineer A. Fan/hydrologist	Pre-RAP review visit
10/6/92	D. Rom/geotech/engineering M. Layton/hydrologist	On-site construction review
11/16-17/92	D. Rom/geotech/engineering	Observe excavated disposal cell/on-site construction review
8/5/93	D. Rom/geotech/engineering T. Johnson/surface hydrologist	On-site construction review
9/11/95	D. Rom/geotech.engineering J. Lambert/project manager	Observe radon barrier placement

APPENDIX B

UMTRCA, THE EPA STANDARDS, AND THE PHASED UMTRA PROJECT

APPENDIX B

UMTRCA, THE EPA STANDARDS, AND THE PHASED UMTRA PROJECT

Title I of UMTRCA defines the statutory authority and roles of the DOE, the NRC, and the EPA with regard to the remedial action program for inactive uranium mill tailings sites.

The Standards

UMTRCA charged the EPA with the responsibility for promulgating remedial action standards for inactive uranium mill sites. The purpose of these standards is to protect the public health and safety and the environment from radiological and non-radiological hazards associated with radioactive materials at the sites. UMTRCA required that EPA promulgate these standards by no later than October 1, 1982. After October 1, 1982, if the EPA had not promulgated standards in final form, DOE was to comply with the standards proposed by EPA under Title I of UMTRCA until such time as the EPA had promulgated its standards in final form.

The final EPA standards were promulgated with an effective date of March 7, 1983 (48 FR 602; January 5, 1983); see 40 CFR Part 192 - Standards for Remedial Actions at Inactive Uranium Processing Sites, Subparts A, B, and C. These regulations may be summarized as follows:

1. The disposal site shall be designed to control the tailings and other residual radioactive materials for up to 1000 years, to the extent reasonably achievable, and, in any case, for at least 200 years [40 CFR 192.02(a)].

2. Provide reasonable assurance that the disposal site design shall prevent radon-222 from residual radioactive material to the atmosphere from exceeding an average release rate of 20 picocuries per square meter per second, or from increasing the annual average concentration of radon-222 in air, at or above any location outside the disposal site, by more than one-half picocurie per liter [40 CFR 192.02(b)].

3. The remedial action shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site, the concentrations of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than 5 picocuries/gram averaged over the first 15 centimeters of soil below the surface and 15 picocuries/gram averaged over 15 centimeter thick layers of soil more than 15 centimeters below the surface [40 CFR 192.12(a)].

4. The objective of remedial action involving buildings shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL and the level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour [40 CFR 192.12(b)].

The portion of the EPA standards dealing with groundwater requirements, 40 CFR 192.20(a)(2)-(3) were remanded by the Tenth Circuit Court of Appeals on September 3, 1985. Based on this court decision, EPA was directed to promulgate new groundwater standards. EPA proposed these standards in the form of revisions to Subparts A-C of 40 CFR Part 192 in September 1987, and now is in the process of completing action to promulgate the final groundwater standards.

As mandated by Section 108(a)(3) of UMTRCA, however, the remedial action at the inactive uranium processing sites, is to comply with EPA's proposed standards until such time as the final standards are promulgated. DOE continues to perform remedial action at the inactive processing sites in accordance with NRC's concurrence with the remedial action approach based on the proposed EPA groundwater standards (52 FR 36000; September 24, 1987). Delaying implementation of the remedial action program would be inconsistent with Congress' intent of timely completion of the program. Modifications of disposal sites after completion of the remedial action to comply with EPA's final groundwater protection standards may be unnecessarily complicated and expensive and may not yield commensurate benefits in terms of human and environmental protection. Therefore, the Commission believes that sites where remedial action has been essentially completed prior to EPA's promulgation of final groundwater standards will not be impacted by the final groundwater standards. Although additional effort may be appropriate to assess and clean up contaminated groundwater at these sites, the existing designs of the disposal sites should be considered sufficient to provide long-term protection against future groundwater contamination. NRC does not view UMTRCA as requiring the reopening of those sites that have been substantially completed when NRC concurred with the selection of remedial action in accordance with applicable EPA standards, proposed or otherwise in place at the time such NRC concurrence was given.

DOE Selection (Design) Phase

For each site, UMTRCA requires that DOE select a plan of remedial action that will satisfy the EPA standards and other applicable laws and regulations, and with which the NRC will concur. For each site, this phase includes preparation by DOE of an Environmental Assessment or an Environmental Impact Statement, and a Remedial Action Plan (RAP). The RAP is structured to provide a comprehensive understanding of the remedial actions proposed at that site and contains specific design and construction requirements. To complete the first phase, NRC and the appropriate State or Indian tribe will review the RAP and then concur that the RAP will meet the EPA standards.

The Performance (Construction) Phase

In this phase the actual remedial action (which includes decontamination, decommissioning, and reclamation) at the site is done in accordance with the RAP. The NRC and the State/Indian tribe, as applicable, must concur in any changes to the concurred-in plan that arise during construction. At the completion of remedial action activities at the site, NRC concurs in DOE's determination that the activities at the site have been completed in accordance with the approved plan. Prior to licensing (the next phase), title to the disposed tailings and contaminated materials must be transferred to the United States and the land upon which they are disposed of must be in Federal custody to provide for long-term Federal control. Disposal sites on Indian land will remain in the beneficial ownership of the Indian tribe.

NRC concurrence in the DOE determination that remedial action at a processing site has been accomplished in accordance with the approved plan may be accomplished in two steps where residual radioactive material is not being moved from the processing site to a different disposal site. The Uranium Mill Tailings Remedial Action Amendments Act of 1988 allows for a two-step approach for Title I disposal sites. The Amendments Act will allow DOE to do all remedial actions, other than groundwater restoration, for the first step of closure and licensing. The second step, which can go on for many years, will deal with existing groundwater restoration. When groundwater restoration is completed, the Long-Term Surveillance Plan required under the licensing phase will be appropriately amended. For sites that are being moved, licensing will occur in one step. There is no groundwater restoration at the disposal site and the processing site will not be licensed after completion of remedial action.

The Licensing Phase

Title I of UMTRCA further requires that, upon completion of the remedial action program by DOE, the permanent disposal sites be cared for by the DOE or other Federal agency designated by the President, under a license issued by the Commission. DOE will receive a general license under 10 CFR Part 40.27 following: (1) NRC concurrence in the DOE determination that the disposal site has been properly reclaimed, and (2) the formal receipt by NRC of an acceptable Long-Term Surveillance Plan (LTSP). NRC concurrence with DOE's performance of the remedial action indicates that DOE has demonstrated that the remedial action complies with the provisions of the EPA standards in 40 CFR part 192, Subparts A, B, and C. This NRC concurrence may be completed in two steps as discussed above. There is no termination date for the general license.

Public involvement has been and will continue to be provided through DOE's overall remedial action program for Title I sites. The local public will have an opportunity to comment on the remedial action or closure plans proposed and implemented by DOE and to raise concerns regarding final stabilization and the degree of protection achieved. NRC fully endorses State/Indian tribe and public input in all stages of the program. At the time the LTSP is submitted, the NRC will consider the need for a public meeting in response to requests and public concerns.

The Surveillance and Monitoring Phase

In this phase, DOE and NRC periodically inspect the disposal site to ensure its integrity. The LTSP will require the DOE to make repairs, if needed.

One of the requirements in the EPA standards is that control of the tailings should be designed to be effective for up to 1000 years without active maintenance. Although the design of the stabilized pile is such that reliance on active maintenance should be minimized or eliminated, the NRC license will require emergency repairs as necessary. In the event that significant repairs are necessary, a determination will be made on a site specific basis regarding the need for additional National Environmental Policy Act actions, and health and safety considerations based on 10 CFR Parts 19, 20, and 21.

CERTIFICATION SUMMARY
URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT
RIFLE, COLORADO

The U. S. Department of Energy certifies that the remedial action performed in Rifle, Colorado, for the Uranium Mill Tailings Remedial Action Project is complete and meets all design criteria and technical specifications outlined in the surface Remedial Action Plan, as required under Public Law 95-604. The undersigned request that the U.S. Nuclear Regulatory Commission concur in this certification.

U.S. DEPARTMENT OF ENERGY

Juan D. Williams
Contracting Officer
Contracts and Procurement Division

11/17/97
Date

U.S. DEPARTMENT OF ENERGY

George J. Rael
Director
Environmental Restoration Division

Nov 17, 1997
Date

The U.S. Nuclear Regulatory Commission hereby concurs with the U.S. Department of Energy's completion of surface remedial action for the Uranium Mill Tailings Remedial Action Project located in Rifle, Colorado.

U.S. NUCLEAR REGULATORY COMMISSION

Joseph J. Holonich, Chief
Uranium Recovery Branch
Division of Waste Management
Office of Nuclear Materials Safety and Safeguards

8, 1997
Date