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ATTACHMENT

COMPLETION VERIFICATION REPORT
FOR REMEDIAL ACTIONS AT THE CANONSBURG PROCESSING SITE
(87/10/05)

Chapter 1. Introduction

Title I of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) provides for a seven-year program of remedial action at abandoned uranium mill tailings sites and associated vicinity properties. UMTRCA directs the U.S. Department of Energy to select and perform remedial actions at 24 abandoned uranium mills (UMTRAP sites) to ensure compliance with general environmental standards promulgated by the U.S. Environmental Protection Agency. UMTRCA also requires NRC to concur with DOE's selection and performance of the remedial actions at the UMTRAP sites. Following completion of the remedial actions, UMTRCA directs 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.

After a brief description of the NRC and DOE implementation procedures under UMTRCA Title I, this chapter summarizes EPA's standards in 40 CFR Part 192 for control and cleanup of residual radioactive materials at inactive uranium tailings sites and identifies the conditions of NRC's concurrence with DOE's certification of completion of remedial actions at the designated processing site located in Canonsburg, Pennsylvania. Chapter 2 provides the basis for NRC's conditional concurrence with DOE's completion of remedial actions at Canonsburg. Appendix A of the Completion Verification Report (CVR) provides a detailed comparison of the specifications for remedial action with the remedial actions performed at the site, including audits, inspections, and tests to verify compliance with remedial action specifications and criteria. Appendices

B and C complete the CVR by summarizing the NRC review and approval process in chronological order and providing a list of references that supported this review process.

Implementation Procedures

Upon selection of the remedial actions to be implemented at a particular site, DOE develops and issues a Remedial Action Plan (RAP) to fulfill the requirement in UMTRCA Section 108(a) to select remedial actions in accordance with applicable EPA standards. The RAP describes the series of activities required to stabilize residual radioactive materials at processing sites and provide for the long-term protection of the public and the environment. In addition to describing the responsibilities of program participants, the RAP provides the final conceptual design, health and safety provisions, public participation and information plans, and a description of the basic elements of post-remedial action maintenance and surveillance. After review and approval, NRC concurs with the RAP and DOE's selection of remedial actions based on the finding that the planned remedial actions comply with EPA's standards in 40 CFR Part 192, Subparts A, B, and C. Coincident with RAP concurrence, NRC documents the basis for its concurrence decision in a Technical Evaluation ~~Report~~ Memorandum.

The conceptual design in the RAP provides the basis for developing a final site design, including detailed engineering plans and specifications for construction. NRC reviews the detailed engineering plans to ensure that planned actions are consistent with the specifications of the RAP. During performance of the remedial actions, DOE implements quality assurance procedures to assurance adherence to design specifications. These procedures include monitoring, inspections, and periodic audits. NRC participation in such activities provides for ongoing consultation during performance of the

remedial actions, which provides for timely identification of potential health and safety issues. DOE may also seek NRC concurrence on modifications to the RAP that were necessitated by changes in site conditions encountered during construction or changes in construction procedures. Once approved, these modifications amend or replace portions of the RAP.

At the completion of remedial actions, DOE conducts a thorough review of the remedial action contractor's records and completion report to verify that remedial actions were performed in accordance with the RAP or RAP modifications. Based on this review, DOE certifies that the provisions of the RAP have been satisfied and, therefore, DOE's remedial actions fully comply with the EPA standards in 40 CFR Part 192. NRC reviews DOE's certification to ensure that the performance of the remedial actions complies with the specifications in the RAP and RAP modifications and to ensure that DOE's remedial actions comply with the EPA standards. After review and approval, NRC concurs with the completion of remedial actions for the site and documents the basis for this concurrence in a Completion Verification Report (CVR). NRC's concurrence with DOE's certification fulfills the Commission's responsibility under UMTRCA Section 104(f)(1). In addition to supporting NRC's concurrence with DOE's certification, the CVR partially fulfills NRC's responsibilities under UMTRCA Section 114(e) to ensure that the decision making process is documented systematically and made available to the public for convenient use.

Once remedial actions have been completed, title to the disposal sites is transfered to DOE for long-term custody, maintenance, and surveillance. DOE develops a site-specific Surveillance and Maintenance Plan (SMP), which describes the program of surveillance, monitoring, and maintenance activities proposed to ensure continued protection of the public and the environment from hazards associated with the tailings. After NRC review and concurrence, the

SMPs are incorporated into a general NRC license to be issued to DOE for long-term custodial care of the stabilized uranium tailings. NRC issues the license under UMTRCA Section 104(f)(2) to protect the public health, safety, and the environment. In addition to requiring monitoring, maintenance, and emergency measures, the NRC may also require DOE to take other actions deemed necessary by the Commission to comply with applicable EPA standards in 40 CFR Part 192. Performance of these other measures, however, is contingent upon explicit authorization by the U.S. Congress.

EPA Standards

Under Section 275(a) of the Atomic Energy Act of 1954, as amended by UMTRCA, EPA promulgated general environmental standards for control and cleanup of residual radioactive materials at inactive uranium mill sites and associated vicinity properties. These standards were published in final form in January 1983 at 40 CFR Part 192, Subparts A, B, and C. The standards provided requirements for long-term stability and radiation protection, as well as implementation guidance for groundwater protection. In response to several legal challenges, the Tenth Circuit Court of Appeals in 1985 upheld all portions of these standards except the implementation guidance for groundwater protection in Subpart C. The Court remanded EPA to promulgate groundwater protection standards that treat toxic constituents in the tailings consistently with the EPA standards for active uranium mills in Subpart D of 40 CFR Part 192. EPA published proposed groundwater protection standards for inactive uranium mills in September 1987 as revisions to 40 CFR Part 192. In accordance with Section 275(b) of the Atomic Energy Act, these proposed groundwater protection standards are effective until EPA promulgates the final revisions.

The following discussion summarizes the EPA standards that were effective when NRC concurred in DOE's RAP for Canonsburg (May 1984), including a general description of EPA's implementation guidance for groundwater protection in the portion of Subpart C that was remanded by the Tenth Circuit Court. DOE's planned remedial actions, as concurred with by the NRC, were consistent with the implementation guidance that was in effect prior to September 1985. In the future, however, DOE will be required to propose additional remedial actions necessary to demonstrate compliance with the new revisions. Therefore, the following discussion will be revised after DOE proposes and completes performance of the additional actions required to provide for groundwater protection at the Canonsburg site.

NRC's conditional concurrence with DOE's certification of completion of remedial actions at the Canonsburg site means that, with the exception of the conditions noted in the following section, the NRC staff has performed the following actions:

1. Verified that the remedial actions have been performed consistently with specifications provided in the RAP and RAP modifications or that deviations to these specifications do not significantly affect compliance with the EPA standards;

2. Concluded that the remedial actions comply, with reasonable assurance, with the EPA standards in 40 CFR Part 192, Subparts A, B, and C; and

3. Determined that the site has been sufficiently prepared to initiate long-term custody to ensure protection of the public health and safety and the environment.

Specifically, NRC's completion concurrence is based on findings discussed below in each of four review areas relevant to the EPA standards in 40 CFR Part 192.

Long-term Stability

The EPA standards in 40 CFR Part 192.02(a) require that control of the tailings be designed to be effective for up to 1000 years, to the extent reasonably achievable and, in any case, for at least 200 years.

Based on its review, the NRC staff conclude that the remedial actions performed by DOE at the Canonsburg site comply with this requirement, except as noted, because the encapsulation cell on site has been designed and constructed to protect against surface erosion, anticipated geologic processes, and engineering failure. Specifically the staff concluded that

(1) flood analyses and investigations adequately characterize the flood potential of the site,

(2) analyses of hydraulic design of the site are appropriately documented and employ an acceptable level of conservatism, and

(3) the remedial actions assure compliance with the long-term stability provisions of the EPA standards in 40 CFR Part 192, Subpart A with respect to surface water hydrology and erosion protection considerations, except as noted in concurrence condition number 1.

(4) stratigraphic, geomorphic, seismic and tectonic investigations adequately characterize the site to support conclusions regarding geologic and geotechnical stability,

(5) investigations performed at the site are adequate to justify the soil and rock properties of the subsoils, tailings, and borrow materials sufficient to demonstrate geotechnical stability of the tailings embankment,

(6) analyses and construction of the tailings embankment provide reasonable assurance of compliance with the long-term geotechnical stability provisions of the EPA standards in 40 CFR Part 192, Subpart A,

(7) design and construction of the tailings embankment employ adequate margins of safety to ensure long-term geotechnical stability in compliance with 40 CFR Part 192, Subpart A.

Radon Attenuation

The EPA standards in 40 CFR Part 192.02(b) require that control of residual radioactive material be designed to provide reasonable assurance that releases of radon-222 from the material to the atmosphere will not (1) exceed an average release rate of 20 pCi/m^2-s or (2) increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than 0.5 pCi/l. DOE's design incorporates a multiple-layer radon barrier comprised of compacted earthen materials that inhibit diffusion of radon into the atmosphere.

Based on its review, the NRC staff conclude that the remedial actions performed by DOE at the Canonsburg site comply with this requirement because the disposal site has been designed and constructed to limit radon-222 releases to below the average release rate of 20 pCi/m^2-s and that this limit will not be exceeded for up to 1000 years, to the extent

reasonably achievable, and, in any case, for at least 200 years. Specifically, the staff concluded that

(1) parameter values used in analyses to design the radon barrier to demonstrate compliance with the EPA standards in 40 CFR Part 192, Subpart A, have been adequately justified on the basis of site-specific investigations, and

(2) the radon barrier has been designed and constructed in a manner that provides reasonable assurance of compliance with the 20 pCi/m^2-s average release limit for the duration of the design period specified in §192.02(a).

Water Protection

EPA's implementation guidance in Subpart C of 40 CFR Part 192 admonished DOE to conduct site-specific assessment of background groundwater quality, the extent of groundwater contamination, and the rate, direction, and attenuation of contaminated groundwater migration. Based on this assessment, the guidance suggested that DOE select and conduct remedial actions sufficient to meet appropriate water quality standards consistent with regulatory considerations in EPA's hazardous waste management system (40 CFR Part 264).

Based on its review of the RAP, NRC staff concurred with the planned remedial actions on the basis that existing and projected future groundwater contamination would not pose significant hazards to humans and the environment. As discuss above, however, the NRC staff will not concur that remedial actions comply with the groundwater protection provisions in

40 CFR Part 192, until after EPA promulgates these provisions and DOE adequately demonstrates compliance.

Cleanup of Contaminated Land

The EPA standards in 40 CFR Part 192.12(a) require that remedial actions be conducted to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site, the concentration of radium-226 in earthen materials outside the encapsulation cell and disposal site averaged over any area of 100 m^2 does not exceed the background level by more than (1) 5 pCi/g averaged over the first 15 cm of soil below the surface and (2) 15 pCi/g averaged over any 15-cm thick layer of soil more than 15 cm below the surface.

Based on its review, the NRC staff concludes that DOE's remedial actions at the Canonsburg site do not comply with the EPA standards in 40 CFR Part 192.12(a) for cleanup of residual radioactive material at the Canonsburg site. DOE's cleaned up the Canonsburg site to meet alternative criteria for radium-226 concentrations in soils as follows: (1) 44 pCi/gm in Area A, (2) 22 pCi/gm in Area B (with the exception of a lens of contaminated material that was stabilized in place), and (3) 15 pCi/gm in Area C. Assessments of compliance with these limits considered the long-term ingrowth of radium-226 resulting from thorium-230 decay because the thorium and radium are currently not in isotopic equilibrium. DOE encapsulated residual radioactive material in excess of 100 pCi/gm Ra-226 in the disposal cell at Canonsburg. Specifically, DOE has not demonstrated compliance with the EPA standards in 40 CFR Part 192.12(a) for cleanup of Ra-226 in earthen materials averaged over any 15-cm layer more than 15 cm below the land surface in those portions of Area B that

have not been included in the disposal site. Area A is fully contained within the disposal site (i.e., boundary of permanent fencing) and thus is not subject to the 15 pCi/gm cleanup standard in Part 192.12(a)(2) because it does not satisfy the definition of "land" provided in Part 192.11. Unlike Areas A and B, Area C has been cleaned up to comply with the 15 pCi/gm Ra-226 concentration limit because DOE proposes to release this area for unrestricted use.

Conditions of Concurrence

Under Section 104(f)(1) of UMTRCA, NRC concludes that DOE has not completed remedial actions at the designated uranium processing site located in Canonsburg, Pennsylvania. Consequently, the staff only conditionally concurs with DOE's certification of completion subject to the following conditions:

(1) DOE needs to demonstrate that the quality and placement of rock riprap used to protect the encapsulation cell from surface water erosion is sufficient to ensure long-term stability of the site in accordance with the EPA standards in 40 CFR Part 192.02(a). This issue was identified as an unresolved construction issue based on NRC staff observations of the Canonsburg site in a letter to DOE dated July 1, 1987. In response to this letter and discussions among DOE and NRC staff, DOE is presently reassessing the quality and placement of rock riprap at the Canonsburg site. Therefore, NRC's concurrence with DOE's certification of completion of remedial actions at Canonsburg is contingent upon a future demonstration by DOE that remedial actions performed to date to protect the residual radioactive materials from erosion, and any additional actions found necessary, comply with EPA's long-term control standard in 40 CFR Part 192.02(a).

(2) DOE needs to demonstrate compliance with EPA's revised groundwater protection standards in 40 CFR Part 192, Subparts A-C. EPA published proposed revisions to the standards on September 24, 1987, which was three years after NRC first concurred with planned remedial actions at Canonsburg. DOE has not demonstrated at this time that the disposal cell has been designed and will perform in accordance with the proposed standards and that existing groundwater contamination at the site has been corrected to comply with the proposed standards. Therefore, NRC's concurrence with DOE's certification of completion of remedial actions at Canonsburg is contingent upon a future successful demonstration by DOE that remedial actions performed to date, including any additional future actions, comply with the revised groundwater protection standards in 40 CFR Part 192.

(3) DOE needs to demonstrate that any portion of the processing site that is not part of the disposal site has been cleaned up to meet the standards in 40 CFR Part 192.12(a). DOE has adopted criteria for Areas A and B that allow higher maximum concentrations of Ra-226 in soil than the limits provided in Part 192.12(a)(2). Although Area A is part of the disposal site and not subject to compliance with the cleanup standard, DOE proposes to release portions of Area B that may not have been cleaned up to comply with the 15 pCi/1 limit provided in Part 192.12(a)(2). Therefore, NRC's concurrence with DOE's certification of completion of remedial actions at Canonsburg is contingent upon a successful future demonstration by DOE that cleanup actions at the Canonsburg site comply with the Ra-226 concentration limits provided in 40 CFR Part 192.12(a).

(4) DOE needs to demonstrate that additional residual radioactive material resulting from Vicnity Property (VP) cleanup will not be disposed of at

the Canonsburg site. DOE will most likely continue to need a depository for residual radioactive material because VPs will probably continue to be found after certification. However, continued disposal of these materials may alter the basis for NRC's concurrence that remedial actions at Canonsburg comply with the EPA standards in 40 CFR Part 192. Therefore, NRC's concurrence with DOE's certification of completion of remedial actions at Canonsburg is contingent upon a future demonstration by DOE that additional residual radioactive materials will not be disposed of at the Canonsburg site after a given termination date imposed by regulation.

(5) DOE needs to demonstrate that effective and enforceable institutional restrictions are in place for Area C (1) to protect the integrity of monitoring installations in this area from misuse, damage, and other deleterious actions and (2) to prevent subsurface intrusion until the groundwater monitoring program verifies that the disposal site is not causing significant groundwater contamination in this area. DOE has informed NRC that it is pursuing a land-use restriction imposed by the General Assembly of the Commonwealth of Pennsylvania. Although this has not yet been accomplished, it is expected to be imposed by a legislative transfer bill that was introduced in the 1987 session of the General Assembly (House Bill No. 1144). The land-use restriction against subsurface intrusion may be removed in the future if such action would comply with the revised EPA groundwater protection standards and if site monitoring confirms that significant groundwater contamination is not occurring in this area as a result of the disposal site. Therefore, NRC's concurrence with DOE's certification of completion of remedial actions is contingent of successful future imposition of institutional restrictions for Area C to protect monitoring installations and prevent subsurface intrusion.

The conditions listed above must be fulfilled prior to NRC's full concurrence with DOE's certification that remedial actions have been completed at the designated processing site at Canonsburg, Pennsylvania. NRC will not license the Canonsburg disposal site until after the concurrence conditions have been fulfilled.

In addition, NRC's conditional concurrence with completion of remedial actions at Canonsburg does not include concurrence with completion of remedial actions at the Burrell Township disposal site. The quantity of residual radioactive material being disposed at the Burrell Township site is large enough to consider this site a significant VP. Therefore, completion of remedial actions for the Burrell site must be independently determined. DOE has not yet submitted to NRC a completion report for the Burrell site. NRC's decision regarding concurrence with completion of remedial actions at Canonsburg has no bearing on DOE's need to acquire separate NRC concurrence with completion of such actions for the Burrell Township disposal site.

Chapter 2. Basis for NRC Concurrence

NRC has concurred with DOE's certification of completion of remedial actions at the designated processing site in Canonsburg, Pennsylvania, subject to the conditions listed in Chapter 1. NRC's decision to conur is based on comprehensive reviews of all documentation submitted by DOE to support the selection and performance of remedial actions, most notably the Remedial Action Plan and Remedial Action Completion Report. These reviews were performed by the NRC staff in the Office of Nuclear Material Safety and Safeguards located in Silver Spring, Maryland from 1981 through 1987. Staff reviews included participation by experts in the areas of health physics and radiation protection, geotechnical engineering, surface water hydrology, groundwater hydrology, geology, and geochemistry. The concurrence decision is based on detailed reviews performed by each of these technical disciplines as outlined below:

Geotechnical Engineering - included evaluation of liquefaction potential, slope stability, radon diffusion, settlement, materials properties and testing, construction procedures, as-built drawings, and other geotechnical aspects of the construction.

Surface Water Hydrology - included evaluation of hydrologic site characteristics, geomorphology, flooding determinations, dam failures, erosion protection, construction and placement of erosion protection features, and other aspects of the remedial action.

Ground-water hydrology - included evaluation of geologic and hydrogeologic site characteristics, characteristics of contaminated soils and groundwater, hydraulic performance of the encapsulation cell, groundwater flow and contaminant transport, attentuation of contaminants, and other aspects of the remedial actions.

Geology and geophysics - included evaluation of stratigraphy, structure, seismic activity, and geomorphology in support of geotechnical engineering, surface water hydrology, and groundwater hydrology.

Radiological - included evaluation of radon attenuation and diffusion through cover materials, characterization of the extent of radiological contamination, verification of residual radioactive material cleanup, and other radiological aspects of the remedial action.

After NRC concurrence with the RAP, NRC staff reviewed and concurred with 2 modifications to the specifications in the RAP on January 24 and 28, 1986, to accomodate changes propcsed by DOE. These changes were necessitated by differences between predicted and actual site conditions (e.g., extent of contamination), construction complications, and optimization of site design. NRC staff also reviewed and concurred with DOE's Remedial Action Inspection Plan on December 5, 1985 During performance of the remedial actions, the NRC staff participated in numerous site inspections, field observations, assessments of onsite data and records, and review of the DOE Site Audit Reports. Further, NRC staff reviewed the final draft Completion Report for the Canonsburg processing site, which was submitted to NRC in October 1986. These reviews and evaluations collectively support the NRC's finding that, with the exception of the conditions noted in Chapter 1, DOE has completed remedial actions at Canonsburg in accordance with the specifications and design criteria provided in the RAP and RAP modifications and that these actions comply with the EPA standards in 40 CFR Part 192, Subparts A, B, and C.

Geotechnical Engineering

The geotechnical engineering aspects of the Canonsburg Certification Report were reviewed to determine whether those aspects of the remedial action at the Canonsburg disposal site were constructed in accordance with the applicable construction specifications, ~~as stipulated in the approved~~ Curred Remedial Action Plan (RAP), RAP modifications, RAIP and final design. Items reviewed included descriptions of construction operations, as-built drawings, laboratory and field testing data, Remedial Action Contractor (RAC) inspection reports, and

DOE and RAC Quality Assurance Audits. In addition, the review was based on staff observations and review of records during onsite inspections.

Based on its review, the NRC staff concludes the following:

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

2. Laboratory and field testing was conducted in accordance with acceptable test procedures and by trained and qualified personnel. Records showing acceptable calibration of measuring and testing equipment are included in the Completion Report.

3. The Completion Report shows that frequencies of materials testing and inspection comply with the frequencies specified in the RAIP and in the NRC Staff Technical Position on Testing and Inspection Plans.*

*Draft Staff Technical Position on Testing and Inspection Plans During Construction of DOE's Remedial Action at Inactive Uranium Mill Tailings Sites. WM-8XXX. USNRC. June, 1985.

4. Continuous inspections verified that the volume of organics included in the construction materials was limited to the amount specified in the RAP.

5. Radon barrier layer B was continually inspected to assure that the specified amount of bentonite was uniformly blended into the soil.

6. Test fills constructed at the borrow and disposal sites adequately verified that the material, placement, and compaction method requirements

specified for the liner and radon barrier layers result in the desired permeabilities and densities in the as-built encapsulation cell.

7. As-built drawings adequately document that the remedial action was completed consistently with the approved design.

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

Based on the above conclusions, and on the results of onsite inspections (see Appendix 1) 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 Remedial Action Plan (RAP) and Remedial Action Inspection Plan (RAIP), which NRC concurred with. In addition, the NRC staff concurs that the remedial actions comply with reasonable assurance, with EPA's standards in Subpart A of 40 CFR Part 192 with respect to geotechnical aspects of the design and construction of the encapsulation cell and appertenances at the Canonsburg site.

Surface Water Hydrology and Erosion Protection

NRC staff reviewed the surface water hydrology and erosion protection aspects of remedial actions at Canonsburg to ensure that those aspects of the remedial action at the Canonsburg disposal site 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, laboratory and field testing, and Quality Assurance Audits. In addition, the review was based on NRC observations of the remedial actions and reviews of records and testing during several onsite inspections.

Based on its review, the NRC staff concludes the following:

[TED NOTE: Add conclusions here about what they did correctly]

1. Appropriate tests (gradation and durability) and inspections were performed to assure that erosion protection materials were properly placed. Placement of materials was routinely inspected to assure that the rock size and gradation specifications were met. The thickness of the rock layers was verified periodically to ensure compliance with the specifications for the particular type of material.

2. Laboratory and field testing was conducted in accordance with acceptable test procedures and by trained and qualified personnel.

3. Frequencies of materials testing and inspection comply with the frequencies specified in the RAIP.

4. Visual inspections by the NRC staff of the completed work indicate that the quality of the rock tested may not be representative of the rock that was actually placed. Visual observations indicate that poor quality rock was placed in the diversion ditches.

5. Visual observations by the NRC staff indicate that the rocks were not placed in a manner which assures that adequate areal coverage has been

achieved. There was one large area where the specified rock was not placed. [TED NOTE: Is this consistent with conclusion #1?]

Based on the preceding conclusions, the NRC staff concludes that the selection and placement of rock riprap used for erosion protection was not performed in accordance with the NRC-approved specifications and criteria identified in the RAP and the RAIP. Until this issue is resolved sufficiently, the NRC staff cannot concur that remedial actions at Canonsburg comply with EPA's standards in Subpart A of 40 CFR Part 192 with respect to erosion protection.

Groundwater Protection

The groundwater protection aspects of the Canonsburg Completion Report were reviewed against applicable sections of the Remedial Action Plan (RAP) and subsequent modifications, as concurred with by NRC. Areas of review included groundwater monitoring, encapsulation cell construction, residual radioactive materials characterization, construction operations, and appropriate quality assurance audits. The EPA implementation guidance in Subpart C of 40 CFR Part 192 was remanded by the Tenth Circuit Court of Appeals after NRC concurred with the RAP for Canonsburg. Compliance with the revised EPA standards for groundwater protection will be determined after EPA promulgates standards and DOE completes additional actions, if necessary, required to comply with the revised standards. The discussion below provides the current NRC staff observations of groundwater protection aspects at the Canonsburg processing site.

1. In 1984, DOE monitored groundwater quality less frequently than specified in the RAP. In 1986, DOE did not monitor groundwater quality at Canonsburg. However, comparisons of dissolved constituent concentrations from earlier periods (1979-1983) with data concentration data from 1985 indicate that groundwater quality was not significantly impact by the encapsulation cell through 1985.

2. Surface water effluent was sampled according to frequency requirements in the NPDES permit (Ref.?). Although nonradiological constituents and Ra-226 were analyzed in the samples, Th-230 concentrations were not determined. Therefore, DOE has only partially complied with the requirements of the NPDES discharge permit for the Canonsburg site.

3. Records of DOE's cleanup of residual radioactive materials contaminated with chromic acid adequately demonstrate that the materials disposed of in the encapsulation cell, with one exception, did not fail EPA's EP toxicity test (40 CFR Part 261.XX). Based on the low concentration of chromium anticipated to leach from these materials, therefore, leachate from the encapsulation cell should not cause significant impacts on the quality of surface water in Chartiers Creek.

4. Hydraulic properties of the materials utilized in the cover and liner were tested and inspected as specified in the RAIP. Based on acceptable construction of the cover and liner, the NRC staff conclude that the encapsulation cell has been designed and constructed to limit potential adverse impacts on surface water quality in Chartiers Creek. Further verification of the design, construction, and properties of the cover and liner systems are provided in the "Geotechnical Engineering" section of this chapter.

5. Decay of organic materials placed in the encapsulation cell should not significantly affect the hydraulic properties of the materials used to construct the cell or the mobility of contaminants released from the residual radioactive materials. Thus, the NRC staff conclude that placement of organic materials, in accordance with specified limits, should not significantly affect surface water quality of Chartiers Creek [cf. Letter from NRC to DOE, June 10, 1985]. Potential effects of organic material encapsulation are discussed in Chapter 3, RAP Feature No. 4.

As stated previously, the NRC staff cannot conur that DOE's remedial actions have with groundwater protection provisions of the EPA standards until after EPA promulgates the standards and DOE completes additional remedial actions, if necessary, to demonstrate compliance with the standards.

Geology and Geomorohology

Geologic aspects of the site were studied and described in the Processing Site Characterization Report (DOE, 1984). Based on its review, the staff concluded that natural geologic conditions and processes with two exceptions were not significant issues with respect to stability of the disposal site and compliance with the EPA standards in Subpart A of 40 CFR Part 192. Consistent with this conclusion, the RAP did not include specifications with respect to geologic and geomorphologic conditions. Therefore, geologic considerations were not significantly evaluated by the NRC staff in its review of the completion of remedial actions.

The two exceptions included (1) seismic stability of the encapsulation cell and (2) protection of the residual radioactive materials from erosion resulting from flooding or channel modifications of Chartiers Creek. The completion verification review of seismic stability is included in the Geotechnical Engineering review section. The NRC staff's erosion protection review is described in the surface water hydrology section.

NRC staff conducted site visits and inspections during performance of remedial actions at Canonsburg. These visits and inspection did not yield any new observations of geologic and geomorphic conditions or processes that would require modifications to the remedial actions to comply with the EPA standards in Subpart A of 40 CFR Part 192.

Radiation Protection

The NRC staff reviewed radiation protection aspects of remedial actions at Canonsburg to ensure that cleanup of residual radioactive materials was performed in accordance with specifications in the RAP and RAP modifications, RAIP, and the final design. Areas of review included contaminated material excavation, verification of cleanup, laboratory and field testing, and quality assurance audits. In addition, the review was partially based on NRC staff observations and review of on-site records during the remedial actions.

Based on its review of remedial actions at Canonsburg, the NRC staff concludes the following:

1. DOE performed the remedial actions in accordance with the Ra-226 cleanup criteria provided in the RAP. The criteria were established in a manner that accounted for the gradual ingrowth of Ra-226 as a result of Th-230 decay. The criteria for Ra-226 concentrations in earthen materials over any 100 m^2 area for any 15-cm thick layer that is at least 15 cm below the land surface are as follows:

   Area A - 44 pCi/gm Radium-226
   Area B - 22 pCi/gm Radium-226
   Area C - 15 pCi/gm Radium-226

   Residual radioactive material on the site which was in excess of 100 pCi/gm Ra-226 was encapsulated in the disposal cell. The NRC staff concludes that DOE's remedial actions satisfy the EPA standards in 40 CFR Part 192 for cleanup of Ra-226 in the top 15 cm of soil because DOE placed at least 60 cm of uncontaminated fill across areas used for disposal of VP materials with Ra-226 concentrations below 100 pCi/l. However, the NRC staff concludes that the remedial actions do not comply with EPA's standards for cleanup of Ra-226 in soils below 15-cm from the land surface because the criteria listed above exceed the limit provided in the EPA standards. With an average background concentration of 1.3 pCi/gm Ra-226, the cleanup standard for Ra-226 in earthen materials outside the encapsulation cell should have been 16.3 pCi/l averaged over any 100-m^2

area for any 15-cm layer more than 15 cm below the land surface. DOE has not demonstrated the need to use supplemental standards for the cleanup of residual radioactive materials at the Canonsburg site based on the criteria provided in 40 CFR Part 192.21. Therefore, DOE's remedial actions do not comply with the EPA standards in 40 CFR Part 192.12(a) for cleanup of Ra-226 in any 15-cm layer more than 15 cm below the land surface. To resolve this issue, DOE must demonstrate that residual radioactive materials have been cleaned up to comply with the EPA standards in 40 CFR Part 192.12(a) in all areas that are not part of the disposal site (e.g., portions of Area B outside of the permanent fencing).

2. During performance of remedial actions, DOE proposed to stabilize a lens of contaminated material (4 feet thick over approximately 1.6 acres) in place in Area B. Because the lens extends beneath the encapsulation cell, which was already under construction at the time the lens was discovered, the removal of this material would have jeopardized the stability of the encapsulation. NRC staff reviewed DOE's assessment of radon release, stability characteristics, and potential for groundwater contamiation associated with the lens. Based on its review, the NRC staff concluded that (1) removal of the lens may jeopardize the stability of the encapsulation cell, (2) stability of the encapsulation cell would not be significantly reduced because of the lens, (3) the lens could be stabilized in a manner that complied with the radon release standard in 40 CFR Part 192.02(a), and (4) the lens would not cause significant contamination of Chartiers Creek as a result of leaching and groundwater transport to the creek. Although the design radon flux for the lens was projected to be 30 pCi/m^2-s, the NRC staff agreed with DOE's determination that the average radon flux for the site would be approximately 10.6 pCi/m^2-s. Therefore, the staff concurred with DOE's proposal to stabilize the lens of residual radioactive material in place in Area B.

3. DOE has disposed of Vicinity Property (VP) material at the Canonsburg disposal site west of the encapsulation cell because concentrations of Ra-226 in this material was less than the 100 pCi/gm criterion for inclusion in the cell. Because VPs will probably continue to be found after certification that remedial actions are complete at Canonsburg, DOE

will most likely continue to need a depository for contaminated material from the VPs. However, continued disposal of these materials at Canonsburg could potentially destabilize the encapsulation cell and jeopardize compliance of the site with the EPA standards. Therefore, DOE needs to terminate disposal of residual radioactive materials from VPs at the Canonsburg site by a date imposed by regulation.

4. DOE has demonstrated that Area C has been cleaned up to comply with the Ra-226 concentration limits provided in 40 CFR Part 192.12(a). In addition, DOE has demonstrated that Area C has been backfilled with at least 60 cm of uncontaminated backfill materials. Based on these demonstrations, DOE requested NRC concurrence in release of Area C for unrestricted use. Upon review of this request, NRC staff expressed the following two conditions on the release of this area for unrestricted uses:

   - Protection of the integrity of monitoring installations in Area C from potential misuse, damage, and other deleterious actions.

   - Prevention of any subsurface intrusion until the groundwater monitoring program verifies that the disposal site is not causing significant groundwater contamination beneath Area C.

   These conditions would be implemented by a land-use restriction imposed by the General Assembly of the Commonwealth of Pennsylvania. This has not been accomplished yet, but it is expected to be effected by a legislative transfer bill that was introduced in the 1987 session of the General Assembly (House Bill No. 1144). The prohibition on subsurface intrusion may withdrawn in the future if such action is consistent with the EPA standards for groundwater protection at Canonsburg and if the groundwater monitoring program verifies that significant groundwater contamination does not exist.

5. The techniques used for verifying radiological cleanup at the processing site comply with DOE's summary protocols and the Vicinity Property M.....I....M.... (VPMIM) procedures, with which NRC had previously

concurred. With the exceptions noted previously in this section, DOE's radiological survey records verify compliance with EPA's cleanup standards in Subpart B of 40 CFR Part 192.

Therefore, the NRC staff concludes that remedial actions at the Canonsburg processing site do not comply with the EPA standards in 40 CFR Part 192 for the reasons stated above.

Summary

The NRC staff reviewed geotechnical engineering, surface water hydrology, groundwater hydrology, geology, geomorphology, and radiation protection aspects of remedial actions at the designated processing site in Canonsburg, Pennsylvania. The purpose of these reviews were to ensure that DOE performance remedial actions at the site in accordance with specifications in the RAP, RAP modifications, and other supporting project documents and to ensure that these actions comply with EPA standards for cleanup and disposal of residual radioactive materials at designated processing sites. Based on these comprehensive reviews, the NRC staff concludes that, with several exceptions, DOE has performed remedial actions at the Canonsburg site in accordance with specifications and that these actions comply with EPA's standards in 40 CFR Part 192, Subparts A-C. The exceptions remain as open issues that must be resolved by DOE prior to full NRC concurrence with certification of compliance with the EPA standards and licensing of the Canonsburg disposal site. They have been documented in Chapter 1 as conditions for NRC's concurrence with DOE's certification of completion of remedial actions. This Completion Verification Report will be revised in the future when DOE has resolved these open issues prior to NRC concurrence with DOE's certification.

REFERENCES:

1. U.S. DOE, "Canonsburg Uranium Mill Tailings Site Remedial Action Completion Report." Volumes I, II and III, October 1986.

2. U.S. DOE, "Report of Final Audit, Remedial Action Construction, UMTRA Project, Canonsburg, Pennsylvania," October 1986.

3. Themelis, J.G., DOE/AL to D. Martin, NRC,
   Subject: "Forwards Pennsylvania DER letter describing intention to limit access to Area C and protect monitoring installation," December 24, 1986.

4. MK-Ferguson Co., "UMTRA Project Annual Environmental Monitoring Summary, 1985, Canonsburg, Pennsylvania," September 1986.

5. Oldham, J.G., MK-Ferguson to G. Gnugnoli, NRC,
   Subject: "Forwards test reports for waste water treatment discharges," October 31, 1986.

6. U.S. DOE, "Remedial Action Plan for Stabilization of the Inactive Uranium Mill Tailings Site at Canonsburg, Pennsylvania," October 1983.

7. Page,R. G., NRC to J. A. Morley, DOE/AL Subject: "NRC Concurrence with the Canonsburg, PA, RAP," May 18, 1984.

8. U.S. DOE, "RAP Modification No. 2, Canonsburg, PA," September 1985.

9. U.S. DOE, "RAP Modification No. 3, Canonsburg, PA," November 1985.

10. Crow, W.T., NRC to J.G. Themelis, DOE/AL,
    Subject: "Forwards NRC staff evaluations of DOE proposed Canonsburg, PA RAP modifications of April 1985," June 10, 1985.

11. Crow, W.T., NRC to J.G. Themelis, DOE/AL,

Subject: "Forwards resolution of outstanding items of concern and requests for further information with regard to RAP modifications at Canonsburg, PA," September 6, 1985.

12. Crow, W.T., NRC to J.G. Themelis, DOE/AL,
Subject: "Forwards NRC conditional concurrence with Canonsburg, PA RAP Modification No. 2," November 22, 1985.

13.. Higginbotham, L.B., NRC to J.G. Themelis, DOE/AL,
Subject: "Forwards NRC concurrence with Canonsburg, PA RAP Modification No. 3," January 24, 1986

14. U.S. DOE, "RAP Modification No. 2, Revision 1, Canonsburg, PA," December 1985.

15. Higginbotham, L.B., NRC to J.G. Themelis, DOE/AL,
Subject: "Forwards NRC concurrence with revised RAP Modification No. 2 for Canonsburg, PA," January 28, 1986.

16. U.S. DOE, "Canonsburg, PA Remedial Action Inspection Plan, Revised," October 14, 1985.

17. Crow, W.T., NRC to J.G. Themelis, DOE/AL,
Subject: "NRC conditional concurrence with the Canonsburg, PA, RAIP," December 5, 1985.

18. U.S. DOE, "Processing Site Characterization Report, Canonsburg, PA," May 1984.

19. Report of Analysis. EDA Instruments, Inc., Log No. 4064, November 8, 1984.

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 1. Subgrade

Reviewer(s): S. Smykowski
Date: 5/19/87

	RAP Requirements	Verification
a.	Preparation	
	(1) Excavation to approximately horizontal ~~layer~~ grade for full length and width of site (Design Specifications, p. 2225-5)	(1) As-Built Drawing No. CAN-PS-10-0014 verifies grade meets specification , Compaction control was provided by testing
	(2) Compaction (Design Specifications, p. 2225-6) • min. 90% of maximum as per ASTM D698 test for upper 6" original ground surface ~~6" original ground surface~~ • min. 95% of maximum as per ASTM D698 test for placement of select soil.	(2) • "Compacted using a vibratory roller in accordance w/ASTM-D-1556" (Completion Report, p. E-3) af maximum as per ASTM D698 test. Determined • Average percent Compaction = 98% from 84 density tests performed per ASTM D-~~698~~ 1556 (Completion Report, pp. E-3 and E-5)
	Test Frequency	
	(1) moisture/density: • 1 per 1500 yd² (original ground) • 1 per 500 yd³ (select soil) (Design Specifications, p.2225-6)	(1) • Original Ground: $\frac{39 \text{ density tests}}{33{,}396 \text{ yd}^2} = \frac{1 \text{ test}}{856 \text{ yd}^2}$ (Completion Report p. E-3) • Select Soil: $\frac{45 \text{ tests}}{17{,}257 \text{ yd}^3} = \frac{1 \text{ test}}{383 \text{ yd}^3}$ (Completion Report p. E-3) Note: Density test locations and data provided (Completion Report p. E-~~3~~ 4).

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 2. Capillary Break (pg. 1 of 2)

Reviewer(s): S. Smykowski
Date: 5/19/87

	RAP Requirements	Verification
a.	Configuration	
	(1) Areal Extent Design Construction Drawing CAN-PS-10-0020	(1) Areal Extent verified in As-built Drawing CAN-PS-10-0020
	(2) Thickness = 12" (RAP, p. F-27)	(2) Thickness verified from site visits and As-built Drawing CAN-PS-10-0020
b.	Material:	
	(1) "Sand typical of concrete sand" (RAP, p. F3-13). See gradation Specification sizes (Design Specifications, p. 02232-3)	(1) "Test and inspection records verify that all specified requirements have been met." (Completion Report p. E-6)
c.	Placement	
	(1) Compaction: Minimum 70% relative density ASTMD-2049 (RAP, p. F3-13)	(1) All 23 relative density test results greater than 74% (Completion Report p. E-7) Note: Density test locations and data provided (Completion Report p. E-7)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 2. Capillary Break (pg. 2 of 2)

Reviewer(s): S. Smykowski
Date: 5/19/87

	RAP Requirements	Verification
c.	Placement: (Continued)	
	(2) Lift thickness - one 12" lift minimum (RAP p F3-13)	(2) Only 1 lift placed due to required thickness of 12". (As-built Drawing CAN-PS-10-0020)
d.	Test Frequency	
	(1) Moisture/density: 1 per 500 yd^3 (Design Specifications p. 2225-7)	(1) $\frac{\text{23 density tests}}{\text{11,132 } yd^3 \text{ placed}}$ = 1:484 yd^3 (Completion Report, p E-6)
	(2) Gradation: 1 per 2,000 yd^3 (Design Specifications, p. 2225-7)	(2) $\frac{\text{11 gradation tests}}{\text{11,132 } yd^3 \text{ placed}}$ = 1:1012 yd^3 (Completion Report, p E-6)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 3. Liner (pg. 1 of 3)

Reviewer(s): S. Smykowski
Date: 5/20/87

RAP Requirements	Verification
a. Configuration:	
(1) Areal Extent: Design Construction Drawing CAN-PS-10-0020	(1) Areal Extent verified by As-built Drawing CAN-PS-10-0020
(2) Thickness = 24 inches (RAP, p. F2-68)	(2) Thickness of 24" verified by As-built Drawing CAN-PS-10-0020
b. Material:	
(1) Gradation - min 35% passing No. 200 Sieve, max size 3" and max 5% passing 1" Sieve (Design Specifications p. 02232-3)	(1) Only one gradation/classification test failed. Material was discarded. (Completion Report p. E-9)
(2) Atterberg Limits: PI $\geq$ 8	(2) Only one gradation/classification test failed. Material was discarded. (Completion Report p. E-9)
(3) No additives required	(3) N/A

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 3. Liner (pg. 2 of 3)

Reviewer(s): S. Smykowski
Date: 5/20/87

	RAP Requirements	Verification
c.	Placement:	
	(1) Lift thickness - Not to exceed 12" loose (RAP, p. F3-13)	(1) "Continuously monitored to ensure that the loose lift thickness did not exceed 8 inches." (Completion Report p. E-9). (8" is acceptable)
	(2) Compaction: · minimum 95% D698 ~~density~~ (RAP, p. F3-13)	(2) · Test fills #2 and #3 were constructed to assure that 6 passes of the compactor provided the required minimum degree of compaction. The RAC monitored the number of passes (6) of the compactor. (Completion Report p. E-8)
	· minus 2 to optimum moisture (RAP, p. F3-13)	· Moisture tests verified that the material was placed at minus 2 to optimum moisture. (Completion Report, p. E-8)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 3. Liner (pg. 3 of 3)

Reviewer(s): S. Smykowski
Date: 5/20/87

	RAP Requirements	Verification
c.	Placement: (Continued)	
	(3) Permeability $\leq 5 \times 10^{-6}$ cps and at least 10 times more permeable than cover (RAP, p. F2-68)	(3) Test fills verified that the proposed methods of compaction would result in the desired permeability. The method of compaction, 6-passes per lift of a vibratory smooth drum roller, was continuously monitored during construction. (Completion Report p. E-8)
d.	Test Frequency.	
	(1) Gradation: 1 per 2,000 yd^3 (Design Specifications p. 02225-7)	(1) 1 test performed per 1,982 yd^3 placed (Completion Report p. E-9)
	(2) Classification: 1 per 2,000 yd^3 (Design Specifications p. 02225-7)	(2) 1 test performed per 1,982 yd^3 placed (Completion Report p. E-9)
	(3) Moisture/Density: 6 passes of compactor per lift (Design Specifications p. 2232-8)	(3) "The compaction equipment .. was operated to provide coverage of 6 passes per lift" (Completion Report p. E-8)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 4. Tailings/Contaminated Material (pg. 1 of 3)

Reviewer(s): S. Smykowski
Date: 5/20/87

	RAP Requirements	Verification
a.	Configuration:	
	(1) Areal Extent - Construction Drawing CAN-PS-10-0020	(1) Verified by As-built Drawing CAN-PS-10-0020
	(2) Slopes: • max 5H:1V sides slopes (RAP, p. F3-12) • minimum 50H:1V top slopes (RAP, F3-12)	(2) As-built Drawing CAN-PS-10-0020 verifies slope angles.
b.	Placement:	
	(1) Lift thickness - max. 12" loose lift (RAP, p. F3-13)	(1) "...continuously monitored to ensure that the lifts did not exceed 10 inches loose depth." (Completion Report p. E-10) (10" is acceptable)
	(2) Compaction - minimum 90% of maximum as per ASTM D698 density test (RAP, p. F3-13) or 70% relative density • No moisture specification identified in the RAP.	(2) 40 areas required rework in order to meet the compaction specification. During construction, the RAC reported that all density tests passed. However, while performing verification of the test calculations, they discovered that there were 2

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 4. Tailings/Contaminated Material (pg. 2 of 3)

Reviewer(s): S. Smykowski
Date: 5/20/87

RAP Requirements	Verification
	density tests which were reported as passing, but upon correcting calculation errors, became failing tests. A nonconformance report was prepared, and it was determined that there would be no detrimental effect caused by the low densities (84% and 82%). The staff agrees with DOE's determination, based on the locations of the failing tests and the degree of compaction that was actually achieved. (Completion Report p. E-10)
(3) Organic Distribution: • Well distributed and $\leq$ 5% organics by volume (RAP, Modification No. 2)	(3) "Continuous inspection was provided to assure that the organics were well distributed and that the volume did not exceed 5%." (Completion Report p. E-10) N.B. Site inspections also verified uniform distribution of organics.

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 4. Tailings/Contaminated Material (pg. 3 of 3)

Reviewer(s): S. Smykowski
Date: 5/20/87

	RAP Requirements	Verification
c.	Test Frequency:	
	Moisture/Density: 1 per 500 yd^3 (Design Specifications, p. 2232-9)	Based on telephone conversation between Steve Smykowski (NRC) and Don Summers (RAC) (May 27, 1987), the moisture/density test frequency was 1 test per 505 yd^3 placed. Although the frequency slightly exceeds the requirements, the staff feels that the remedial actions still provide the degree of safety required by the EPA standards. (Telephone conversation record dated 5/27/87.)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 5. Radon Barrier (pg. 1 of 3)

Reviewer(s): S. Smykowski
Date: 5/21/87

	RAP Requirements	Verification
a.	Configuration:	
	(1) Areal Extent - Construction Drawing CAN-PS-10-0020	(1) Verified in As-built Drawing CAN-PS-10-0020
	(2) Thickness - Barrier A: 24" (RAP, p. F2-68) Barrier B: 12" (RAP, p. F2-68)	(2) Verified in As-built Drawing CAN-PS-10-0020
b.	Material:	
	(1) Gradation: · Maximum particle size 6" (Design Specifications, p. 02225-2) · No more than 5% greater than 3" (Design Specifications, p. 02225-2) · At least 30% passing No. 200 sieve (Design Specifications, p. 02225-2)	(1) Only one gradation/classification test failed. Material was ~~discarded~~ not used for radon barrier. All other tests passed the specifications. (Completion Report p. E-9)
	(2) Classification: · Atterberg Limits PI $\geq$ 8 for CL, CH soils (Design Specifications, p. 02232-3)	(2) See above Item b(1). (Completion Report p. E-9).

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 5. Radon Barrier (pg. 2 of 3)

Reviewer(s): S. Smykowski
Date: 5/21/87

RAP Requirements	Verification
(3) Additives: · Radon Barrier B required the addition of 10% bentonite by weight (RAP, Modification No. 2)	(3) IMC Rainbow Seal bentonite was blended to Barrier B to 10% by weight (Completion Report p. E-8). N.B. Site inspections verified uniform blending of bentonite.
· Radon Barrier A - no additive (RAP, Modification No. 2)	No additives were blended to Barrier A.
(4) Permeability: $K \leq 1 \times 10^{-7}$ cps (RAP, p. F2-68)	(4) Test fills #2 and #3 verified that the proposed methods of compaction would result in the desired permeability. The method of compaction, 6 passes per lift ~~of~~ using a tamping foot compactor, was continuously monitored during construction. (Completion Report p. E-8)
c. Placement:	
(1) Lift thickness - not to exceed 12" loose (RAP, p. F3-13)	(1) "Continuously monitored to ensure that the loose lift thickness did not exceed 8 inches." (Completion Report p. E-9)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 5. Radon Barrier (pg. 3 of 3)

Reviewer(s): S. Smykowski
Date: 5/21/87

RAP Requirements	Verification
(2) Compaction: • minimum 95% density of D698 maximum as per ASTM test density (RAP, p. F3-13) • +1 to +3 % above optimum moisture (RAP, p. F3-13)	(2) • Moisture tests verified that the material was placed at +1 to +3 % above optimum moisture, which falls within the specifications. (Completion Report p. E-8) • Test fills 2 and 3 were constructed to assure that 6 passes of the compactor provided the required minimum degree of compaction. The RAC monitored the number of passes (6) of the compactor. (Completion Report p. E-8)
d. Test Frequency:	
(1) Gradation: 1 per 2,000 yd^3 (Design Specifications, p. 02225-7)	(1) 1 test performed per 1,982 yd^3 placed. (Completion Report p. E-9)
(2) Classification: 1 per 2,000 yd^3 (Design Specifications p. 02225-7)	(2) 1 test performed per 1,982 yd^3 placed (Completion Report p. E-9)
(3) Moisture/Density: 6 passes per lift of compactor (Design Specifications p. 2232-8)	(3) "Compaction control for radon barrier A and B was accomplished by monitoring the number of passes (6) by the same tamping foot compactor that was used on the test fills." (Completion Report p. E-8)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 6. Bedding Layer (pg. 1 of 2)

Reviewer(s): S. Smykowski
Date: 5/21/87

	RAP Requirements	Verification
a.	Configuration:	
	(1) Areal Extent: Construction Drawing CAN-PS-10-0020	(1) Verified in As-built Drawing CAN-PS-10-0020
	(2) Thickness: 9"	(2) Verified in As-built Drawing CAN-PS-10-0020
b.	Material:	
	(1) Gradation: See Design Specifications, p. 02270-3	(1) "There was one failing gradation test. The material was removed and used as choking material for the riprap." All other gradation tests passed the specifications. (Completion Report p. E-42)
	(2) Durability: (Design Specifications, p. 02270-3)	(2)
	• ASTM C131-LA Abrasion - less than 55% loss of weight after 500 revolutions	• 26.2% loss (Completion Report, p. E-42)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 6. Bedding Layer (pg. 2 of 2)

Reviewer(s): S. Smykowski
Date: 5/21/87

RAP Requirements	Verification
• ASTM C88 - Soundness - not to exceed 10% loss/5 cycles	• 1.0% loss (Completion Report, p. E-42)
• ASTM C127 - Specific Gravity(G_s) > 2.53	• G_s = 2.67 (Completion Report, p. E-42)
c. Placement:	
(1) Lift thickness: $\leq$ 12" (Design Specifications, 02270-6)	(1) "The lift thickness was continuously monitored to ensure that the lifts did not exceed 12" loose depth." (Completion Report p. E-42)
(2) Density: Compacted with 4 passes of the compactor (Design Specifications, 02270-6)	(2) "Compaction control was accomplished by monitoring the number of passes (4) by a vibratory smooth drum roller." (Completion Report p. E-42)
d. Test Frequency:	
Gradation: 1 per 2,000 yd^3 (Design Specifications, 02225-7)	$\frac{\text{6 passing gradation tests}}{\text{12,020 } yd^3 \text{ placed}}$ = 1 per 2,003 yd^3 (Completion Report, p. E-42), Acceptable

UMTRAP Completion Report Review

Not Geotech.

Site: Canonsburg
RAP Feature: 7. Rock Cover (pg. 1 of 2)

Reviewer(s): T. Johnson
Date: 7/07/87

	RAP Requirements	Verification
a.	Configuration	
	(1) Areal Extent - Design Specification Construction Drawing CAN-PS-10-0020	(1) As-built Drawing CAN-PS-10-0020 verifies placement
	(2) Thickness - Design Specification Construction Drawing CAN-PS-10-0020	(2) As-built Drawing CAN-PS-0020 verifies thickness N.B. NRC site visits also confirmed extent and thickness of coverage
b.	Materiai Properties	
	(1) Gradation - Design Specifications p. 02270-4, 5	(1) Tests indicate gradation within specifications (Completion Report p. E-45, 46)
	(2) Durability - Design Specifications p. 02270-4	(2) Tests indicate durability with specifications (Completion Report p. E-45, 46) N.B. Site visit (6/17/87) indicated that rock placed may not be representative of rock tested. (Trip report dated July 1, 1987)
c.	Placement - Design Specifications p. 02270-6, 7 - RAIP - Section 6.4.4	Completion Report (p. E-46) assents that no reworking was necessary and that all work was performed in accordance with specification requirements.

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 7. Rock Cover (pg. 2 of 2)

Reviewer(s): T. Johnson
Date: 7/07/87

	RAP Requirements	Verification
		N.B. site visit (6/17/87) noted areas of improperly placed thickness (Trip Report dated July 1, 1987)
d.	Test frequency - RAIP - Section 6.2	Rip rap test frequency exceeded requirements (Completion Report p. E-46)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 8. Topsoil/Vegetation (pg. 1 of 1)

Reviewer(s): T. Johnson
Date: 7/09/87

RAP Requirements	Verification
a. Configuration	
(1) Areal Extent - Design Specification Construction Drawing CAN-PS-10-0020	(1) As-built Drawing CAN-PS-10-0020 verifies placement of topsoil
(2) Thickness of topsoil - Design Specification Construction Drawing CAN-PS-10-0020	(2) As-built Drawing CAN-PS-10-0020 verifies thickness of topsoil
b. Placement	
(1) Topsoil (Select Soil) - Design Specifications, p. 02232-9	(1) All tests passed except for one (Completion Report p. E-47)
(2) Seeding - Design Specifications, p. 02930-1, 2, 3	(2) No written verification of seeding regine was provided. Vegetation progress noted on 6/7/87 site visit (Trip Report dated July 1, 1987) N.B. Vegetation cover is not required to meet EPA standards

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 9. Ditches (pg. 1 of 2)

Reviewer(s): T. Johnson
Date: 7/07/87

	RAP Requirements	Verification
a.	Configuration	
	(1) Areal Extent - Design Specification Construction Drawing CAN-PS-10-0020	(1) As-built Drawing CAN-PS-10-0020 verifies placement of ditches
	(2) Dimension of Ditches - Design Specification Construction Drawing CAN-PS-10-0020.	(2) As-built Drawing CAN-PS-10-0020 verifies dimensions and thickness N.B. NRC site visits also confirmed extent and dimensions of ditch placement
b.	Material Properties	
	(1) Gradation - Design Specifications p. 02270-4, 5	(1) Tests indicate gradation within specifications (Completion Report p. E-45, 46)
	(2) Durability - Design Specifications p. 02270-4	(2) Tests indicate durability within specifications (Completion Report p. E-45, 46) N.B. site visit (6/17/86) indicated that rock placed may not be representative of rock tested (Trip report dated July 1, 1987)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 9. Ditches (pg. 2 of 2)

Reviewer(s): T. Johnson
Date: 7/07/87

	RAP Requirements	Verification
c.	Placement - Design Specifications p. 02270-6, 7 - RAIP - Section 6.4.4	Completion Report (p. E-46) asserts that no reworking was performed in accordance with specification requirements. N.B. site visit (6/17/87) noted areas of improperly places thickness (Trip report dated July 1, 1987)
d.	Test Frequency - RAIP - Section 6.2	Riprap test frequency exceeded requirements (Completion Report p. E-46)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 10. Soil Cleanup (Radiological) (pg. 1 of 4)

Reviewer(s): D. Sollenberger
Date: 8/11/87

	RAP Requirements	Verification
a.	Instrumentation/Procedures	
	(1) Soil analysis by gamma-ray spectrometry prior to backfilling (RAP p. D-8)	(1) The Opposed Crystal System (OCS) was used with a minimum detectable activity of 1.3 pCi/g Ra-226. The OCS was checked for calibration routinely with standards provided by the Technical Measurements Center. (Completion Report, p. III-9, 10)
	(2) 100-m^2 parcels with 19-24 plugs (15 cm deep) per unit parcel and analyzed for Ra-226 content. (RAP p. D-8)	(2) The entire processing site was divided into 10-foot grids and sampled per procedure RAC-015. (Completion Report, Appendix J, Section 3.0.) Verification--Post Remedial Action Concentration Maps (Completion Report, Appendix J). Verification--Description Summary (Completion Report, p. III-10, 11)
	(3) Quality Control/Quality Assurance Program (RAP p. D-9, 10)	(3) A quality control (QC) program of 10% third-party analysis was performed. The results of the QC program indicated acceptable correlation with the OCS counting. (Completion Report, Appendix J, Table J.2)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 10. Soil Cleanup (Radiological) (pg. 2 of 4)

Reviewer(s): D. Sollenberger
Date: 8/11/87

RAP Requirements	Verification
a. Site-Specific Radiological Cleanup Criteria	
(1) Projected 100 pCi/g Ra-226 limit for excavation and encapsulation. (RAP, Appendix B.7)	(1) All materials in excess of 100 pCi/g Ra-226 (includes ingrowth from Th-230 for control period) were placed in the encapsulation cell, except for a contaminated soil lens to be discussed in 10.b.(3). (Completion Report, Appendix J, Verification Measurements.)
• Area A limit adjusted to 44 pCi/g (PSCR, Attachment 2)	• All soil analysis samples for Area A indicated concentrations within this criteria, except for one value of 62.5 pCi/g. This corresponded to a location under the encapsulation cell, and is not considered a significant deviation. (Completion Report, Appendix J, Figure III.3.)
• Area B limit adjusted to 22 pCi/g (15 pCi/gm for outside of the fence) PSCR, Attachment 2)	• All soil analysis samples for Area B indicated concentrations below the criterion. DOE will return ownership of the Area B parcel outside the fence. (Completion Report, Appendix J, Figure III.4.)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 10. Soil Cleanup (Radiological) (pg. 3 of 4)

Reviewer(s): D. Sollenberger
Date: 8/11/87

	RAP Requirements	Verification
b.	(1) continued	
	· Area C limit selected to be 15 pCi/g (PSCR, Attachment 2)	· All soil analysis samples for Area C indicated concentrations below the criterion, except for one value of 15.8 pCi/g above background. This was not considered to be significant. Area C was backfilled with clean material averaging less than 3 pCi/g Ra-226. (Completion Report, p. III-16 and Appendix J, Figure III.5.)
	(2) All other areas of the site to be cleaned to meet the EPA soil cleanup standards · 5 pCi/g Ra-226 top 6" surface · 15 pCi/g Ra-226 for any subsurface 6" layer	(2) Supplemental data submitted by DOE (R. Richey to D. Sollenberger, 8/14/87) indicates values outside of Areas A, B, and C on the site are below 15 pCi/g DOE covered these areas with at least two feet of clean fill material. The total site was graded and contoured to facilitate surface water drainage. None of the original site surface remains exposed following completion of the remedial action. (Completion Report, Section III.)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 10. Soil Cleanup (Radiological) (pg. 4 of 4)

Reviewer(s): D. Sollenberger
Date: 8/11/87

	RAP Requirements	Verification
b.	Continued	
	(3) Exceptions to site-specific radiological standards.	
	• Contaminated soil lens in Area B averaging 650 pCi/g will be left in place. (RAP Modification No. 2, Change No. 3.)	• This material was left in place without any specific radiologic criteria. No radiological verification is required. (NRC concurrence provided by formal transmittal, 1/28/86.)

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 11. Other Site-Specific Features (pg. 1 of 3)

Reviewer(s): M. Young
Date: 7/06/87

	RAP Requirements	Verification
I.	Ground-Water Quality Measurement & Analysis	
	a. Frequency	
	Sampling at least quarterly throughout the construction period (RAP, p. E-22)	One sampling round conducted on 8/9/84; quarterly sampling in 1985 and none in 1986. Sampling frequency in 1984 was less than that specified in RAP; however, comparison of dissolved constituent levels from 1979-1983 (FEIS, p. F. 1-6) and 1985 (UMTRAP Annual Environmental Monitoring Summary) indicates no significant ground-water impact from remedial actions through 1985. No conclusions can be made for later periods, since no data was collected or analyzed. NRC staff cannot speculate on ground-water quality trends, due to lack of post-1985 data.
	b. Analyzed Constituents	
	Analysis for Th-230, Ra-226 or other constituents agreed to by DOE and the Commonwealth of Pennsylvania. (RAP, p. E-22)	UMTRAP Annual Environmental Monitoring Summary indicated data collection results for Th-230 and Ra-226 for ground-water samples from monitoring wells. Additional analysis was provided by W. Deutsch (TAC) to M. Young transmitted on 3/10/87.

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 11. Other Site-Specific Features (pg. 2 of 3)

Reviewer(s): M. Young
Date: 7/06/87

	RAP Requirements		Verification
II.	Surface Water Quality Measurement & Analysis	II.	
	a. Frequency Sampling in accordance with NPDES permit issued on May 3, 1984.	a.	NRC staff verified bi-monthly collection of data. (October 31, 1986 letter, J. Oldham to G. Gnugnoli) N.B.: NRC has no regulatory authority over compliance with NPDES permits.
	b. Analysed Constituents Analyse for Ra-226 and Th-230 as a minimum (RAP, p. E-22)	b.	Laboratory analysis of waste water (transmitted October 31, 1986) indicated that Th-230 was omitted from data analysis during the period of the NPDES permit. Confirmatory verification of Th-230 levels in discharged waste water is not directly possible. However, NRC staff judgment concludes that large Th-230 releases were unlikely, based on the low concentrations of other dissolved constituents analyzed in the effluent prior to discharge.

UMTRAP Completion Report Review

Site: Canonsburg
RAP Feature: 11. Other Site-Specific Features (pg. 3 of 3)

Reviewer(s): M. Young
Date: 7/06/87

RAP Requirements	Verification
III. Chromium Waste Cleanup Criterion: Cleanup of chromium contaminated tailings and soil to 5 ppm. Liquid releases to offsite areas do not exceed .05 ppm. (PA DER limit)	III. NRC staff review of verification grid (Drawing CAN-PS-10-0044, Certification Report, Appendix J) confirmed concentrations for all grid cells to be at or below 5 ppm, except one. The one cell, which is below 10 ppm, is located within the present boundaries of the encapsulation cell. Following review of water transport pathways (RAP Modification No. 2 - Revision 1, Enclosure 2) and review of sensitivity analysis of water impacts (Evaluation and Handling of Hazardous Wastes at the Canonsburg UMTRA site, M-K, 4/85), levels of chromium do not pose an unacceptable environmental risk.