SHIELDALLOY METALLURGICAL CORPORATION

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March 17, 2009

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
FSME/DWMEP/DURLD
11545 Rockville Pike
Rockville, MD 20852-2738

Re: Response to "Supplemental Request for Additional Information for Environmental Review of Proposed Decommissioning Plan for Shieldalloy Metallurgical Corporation, Newfield, New Jersey"
(License No. 5MB-743)

Sir/Madam:

Shieldalloy Metallurgical Corporation (SMC) is in receipt of the NRC's February 17, 2009 request for additional information involving engineered barrier design, mixed waste and ALARA issues at Shieldalloy's Newfield, NJ facility (Docket No. 40-7102, License No. SMB-743). The purpose of this letter is to respond to your request. Specifically, the enclosure to this letter transmits additional information, proposed modifications to the "Decommissioning Plan for the Newfield Facility" (Report No. 94005/0-28247, Rev. 1a), hereinafter referred to as the "DP," and other commitments pertinent to your inquiries.

If you have any questions or if I can provide you with additional information, I can be reached at (856)362-8680.

Sincerely,

David R. Smith
Radiation Safety Officer

enclosure
cc:

Rebecca Tadesse – U.S. Nuclear Regulatory Commission
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Mark Roberts – USNRC Region I

NMSS01

ENCLOSURE
Shieldalloy Metallurgical Corporation Response to the USNRC's Supplemental Request for Additional Information of February 17, 2009 Mixed Waste Request for Additional Information

RAI No. 1a: Identify what hazardous wastes have been determined to be present onsite at the Shieldalloy facility.

SMC Response: There are no hazardous wastes present at SMC's Newfield facility. The following historical information is provided to support this assertion.

In 1995, a series of six former wastewater treatment lagoons (designated as B-1, B-2, B-3, B-5, B-11 and B-12) were remediated and closed as part of the Phase One Lagoon Closure Project. The lagoons contained mostly rain water. As part of the remediation, liners, residual solids and underlying soils were removed and disposed of as bulk industrial remediation waste. Relatively small quantities of those materials were classified as characteristically hazardous wastes and were manifested and disposed of off site, accordingly.

Several years later, the Phase Two Lagoon Closure Project addressed the three remaining large lagoons, B-6, B-7 and B-8. Once again, the liners and contaminated soils beneath them were removed. Because the lagoons held chromium hydroxide sludge, the wastes were handled as characteristically hazardous wastes and properly manifested and disposed of off site.

Other characteristically hazardous wastes (D wastes) have been generated by SMC at the Newfield facility during its years of operation, all of which were identified, classified, manifested and disposed of properly off-site. These included lead aluminum dross from D.115 (Aluminum Master Alloys Department), chromium-contaminated remediation wastes associated with the demolition of Building D.106 (Chrome Oxide Production Department), chromium hydroxide sludge & filter cake from Buildings D.214, D.215 and D.216 (ground water remediation) and wastewater generated in Building D.202 (QA/QC laboratory – wet chemistry analysis). There have never been any listed hazardous wastes (F, K, P or U wastes) generated by SMC at the Newfield site

All wastes generated at the facility, both non-hazardous and hazardous, have been managed and disposed of properly and in accordance with applicable Federal and State laws and regulations. Since the completion of the aforementioned remediation projects and disposal campaigns, there have been no hazardous wastes present at the Newfield site.

Action to be Taken: None required. However, the aforementioned historical information will be incorporated into Section 12.3 of Rev. 1b of the DP.

RAI No. 1b: Identify the sampling and analysis and other actions SMC has taken to identify the absence or presence of mixed waste in pipe and drain lines, septic fields, surface and sub-soil surfaces, slag, baghouse dust, equipment and other facility buildings, structures, components, and process byproducts.

SMC Response: Sampling and analysis for mixed waste in piles, drain lines, septic fields and the other items listed in the RAI are neither necessary nor required. In support of that position, the following information is provided.

The receipt of, handling, production, shipping and storage of source material was done in accordance with USNRC license No. SMB-743 and the SMC Radiation Protection Program Plan. None of the radiologically-restricted areas named on the license (i.e., D.203 A and G warehouses, where materials were received, or D.111, where material was processed into niobium alloy) ever held or generated characteristically hazardous waste.

The niobium alloys manufactured in D.111 were taken to the Crushing Department (D.112) for size reduction to meet customer specifications, or to prepare the alloy for feed stock in the Metals Grinding and Powders Department (D.101). These niobium alloys did not contain licensable radioactivity, thus no radioactive wastes or byproducts were ever generated from the departments that handled or processed niobium alloys after they left D.111.

Since the raw materials used in the D.111 smelting and manufacturing operations did not contain constituents that might be classified as characteristically hazardous waste, no hazardous waste was generated in that building, nor is there any in the slag and baghouse dust resulting from the D.111 operations.

The various slags and the baghouse dust produced in D.111 were all transported to the Storage Yard, where they remain to this day. The general practice followed in D.111 over the years was to segregate byproduct materials from similar production runs into separate piles, when possible. There were several alloys (i.e. ferrovanadium) manufactured in D.111 that used non-licensable raw materials, and whose byproducts did not contain licensable radioactivity. Nonetheless, because they were produced in D.111, a restricted area, they were stockpiled in the Storage Yard in their own segregated piles.

As described in our response to RAI 1a, there were never any listed wastes (F, K, P or U wastes) generated in any of the process streams at the SMC site. In addition, the elevated temperatures of the various metallurgical kilns and furnaces used in the manufacturing processes ensured no organic materials remained in any of the waste streams.

The slag generated during aluminothermic chrome production was tested by SMC for EP Toxicity characteristics as a result of a dispute between SMC and NJDEP regarding the storage and handling of the resulting slag. The test results clearly demonstrated that the slag was not characteristic hazardous waste, but in a settlement agreement reached with the NJDEP, SMC agreed to manage the chrome slag in a manner that would prevent exposure to rain water until such time as it was sold or removed from the site. SMC has an extensive historical record of selling chrome slag for beneficial reuse, thus it should not be considered a waste.

All of the metallurgical operations at the site were dry production and manufacturing. As a result, none of the production buildings have floor drains or septic systems. The only septic systems on site were designated for sanitary use (i.e., personnel showers, toilets, sinks) exclusively. Thus there has been and continues to be no justification for sampling the septic systems for the presence of hazardous, radioactive or mixed waste.

Action to be Taken: None required. However, the aforementioned information will be incorporated into Section 12.3 of Rev. 1b of the DP.

RAI No. 1c: Indicate whether mixed waste is currently present onsite and, if so, where is it located.

SMC Response: There is no mixed waste present at the Newfield site.

Action to be Taken: None required.

RAI No. 1d: Indicate how the mixed waste will be and/or was disposed.

SMC Response: See response to RAI No. 1c.

Action to be Taken: None required.

RAI No. 1e: Indicate whether the radioactive material under the engineered barrier cover could include both hazardous waste and radioactive waste.

SMC Response: As indicated in our response to RAI No. 1a and 1b, there is no evidence of hazardous waste ever having been present in the Storage Yard. Therefore, there is no justification for anticipating that hazardous waste will be consolidated under the engineered barrier. In the unlikely event that unidentifiable materials are encountered during the consolidation process, they will be segregated, sampled and tested for hazardous constituents. If the test results are positive for a characteristically hazardous waste, the segregated materials will be properly packaged, manifested and disposed of offsite. If not, the materials will be returned to the consolidation process.

Action to be Taken: The commitment to segregate, sample and test materials that appear to be unidentifiable in nature during the consolidation process will be captured in Chapter 8, "Planned Decommissioning Activities", of Rev. 1b of the DP.

ENCLOSURE

Shieldalloy Metallurgical Corporation Response to the USNRC's Supplemental Request for Additional Information of February 17, 2009 ALARA and Criteria for Release of Material and Equipment

RAI No. 1: In its ALARA evaluation for compliance with §20.1403(a), SMC should include consideration of the need for and practicality of radon mitigation techniques in structures as part of the institutional controls proposed for the site.

SMC Response: Because the concentration of emanating radon drops rapidly with distance from the source, the radon dose pathway is only applicable to the restricted area at the Newfield site if a structure (home or employee-occupied industrial building) is constructed on top of or on a slope of the engineered barrier in a way that would permit the radon from the surface below to be trapped within the structure. Structures located elsewhere on the property would not be impacted by radon emanation from the material consolidated underneath the engineered barrier. The institutional controls for the restricted area at the remediated SMC site will include deed restrictions on construction. Also, the likelihood of constructing a home or business on top of the rock-covered engineered barrier when there is grass-covered flat land close by is very low, and because the purpose of the Long Term Control (LTC) license that will be in place after decommissioning is complete is "to provide the legally enforceable and durable institutional controls required by 10 CFR 20.1403(b) to ensure the long-term protection of the public health, safety, and the environment", the likelihood of any construction within the restricted area is negligible. As such, an ALARA evaluation to determine the practicality or cost-effectiveness of radon mitigation techniques within the restricted area is not necessary.

Action to be Taken: None required.

RAI No. 2: Provide an ALARA evaluation for the unrestricted-use portion of the proposed site decommissioning, to show how SMC plans to comply with the ALARA provision of §20.1402. NRC staff guidance on ALARA for license termination criteria is provided in Chapter 6 and Appendix N of NUREG-1757, Vol. 2, Rev. 1.

SMC Response: Concur.

Action to be Taken: Chapter 5 of the "Derived Concentration Guideline Levels for the Newfield Site" (Report No. 94005/G-29357) contains the ALARA analysis for the unrestricted area DCGLs. That report will be included, in its entirety, in Rev. 1b of the DP.

RAI No. 3: Provide additional quantification of the regulatory costs for the different decommissioning options being evaluated as part of the ALARA evaluation for the eligibility criteria of §20.1403(a).

SMC Response: Licensing and oversight fees imposed by the USNRC for calendar years 2007 and 2008 were $743,653 and $1,090,412, respectively. The majority of these charges were associated with decommissioning plan review. For the License Termination (LT) option (i.e., off-site disposal of all materials at the Energy Solutions, Inc. site in Clive, Utah, followed by release of the entire property for unrestricted use), only minor reductions in annual fees until the DP is approved are anticipated. That is due to the fact that the DP requirements would be similar in type/magnitude to the current requirements, with only Chapter 16, "Restricted Use and Alternate Criteria" being no longer necessary. No changes to the annual fees are anticipated for the partial off-site disposal options since the restricted use option would remain applicable. With no other regulatory guidance available on this topic, SMC proposes to use license/oversight fees from calendar years 2007 and 2008 as the basis for estimating these costs for the ALARA evaluation.

Action to be Taken: The following information will be included in Section 7.3.8 of Rev. 1b of the DP: For the LTC and partial off-site disposal options, an annual licensing and regulatory oversight fee of $900,000, based upon fees charged to SMC by the USNRC during calendar year 2007 and 2008, is assumed. For the LT option, a reduced amount of $600,000 is assumed because restricted use would no longer be applicable, thus eliminating one of the key chapters in the DP. The operating and maintenance costs associated with the LTC Plan will be as presented in Chapter 15 of Rev. 1b of the DP.

RAI No. 4: In Table 17.4 of the DP, SMC provides an argument for excluding the radon pathway (in addition to the argument based on the Statements of Consideration for the LTR, discussed in a previous RAI 1 above). In the Table, it was stated: "in addition, the source term found is not a significant producer of radon due to the relatively long half-life of the thorium isotopes found in the slag." The fact that the source term includes long half-life isotopes does not preclude radon from being produced or being a contributor to dose. In fact, the long half life of the thorium isotopes (along with the relatively short half life of the radon isotopes) means that radon will be produced for a long time. Therefore, the argument proposed in Table 17.4 is not justified. In its revision to the DP, SMC should correct this technical inaccuracy. See also the related Request for Additional Information (RAI) 1 above regarding ALARA and the radon pathway.

SMC Response: Concur.

Action to be Taken: The reference to half-lives of thorium isotopes will be deleted in justifications for dose modeling input parameters in Rev. 1b of the DP.

RAI No. 5: Reevaluate the estimates of Rn-222 emissions from the slag piles and revise the emission estimates and dose calculations if appropriate. If no revisions are made, provide additional justification for the emission estimates and dose calculations.

SMC Response: Concur.

Action to be Taken: The radon emission rate estimates from both the slag and the baghouse dust stockpiles will be presented in the Source Term Document. The Source Term Document will appear as an appendix to Rev. 1 of the DP.

RAI No. 6: Provide justification for the criteria to be used for release of surface-contaminated and volumetrically contaminated materials and equipment. If SMC proposes use of the criteria in ANSI/HPS N13.12 or other criteria not previously approved by NRC staff, SMC should provide independent justification, including a dose assessment, following the guidance in Section 15.1 1 of NUREG-1757, Vol.1, Rev. 2, and the approach of 10 CFR 20.2002.

SMC Response: One set of criteria that is used to evaluate solid materials before they are released is contained in Regulatory Guide 1.86, entitled "Termination of Operating Licenses for Nuclear Reactors" (Reg. Guide 1.86). Section 15.11 of NUREG-1757 states that the values in Table 1 of Reg. Guide 1.86 "may be applied by licensees for use in demonstrating that solid material with surface contamination can be safely released with no further regulatory control."

Analysis of the key elemental constituents in licensed radioactivity at the SMC site shows that it is comprised of approximately 65.5% natural thorium and 34.5% natural uranium. Therefore, the gross activity release criterion for equipment and material surfaces, based upon the values in Table 1 of Reg. Guide 1.86, may be determined as follows:[1]

$$Gross\ Activity\ DCGL = \frac{1}{\frac{f_{Th-nat}}{DCGL_{Th-nat}} + \frac{f_{U-nat}}{DCGL_{U-nat}}}$$

where f = the element fraction and DCGL = the applicable criterion from Table 1 of Reg. Guide 1.86 (dpm/100 cm^2). The following activity results are obtained: Average = 1,381 dpm/100 cm^2; Maximum = 4,144 dpm/100 cm^2; Removable = 276 dpm/100 cm^2.

To date, there has been no clear guidance from the USNRC on volumetric release. Instead, the agency has traditionally approved volumetric release criteria on a case-by-case basis. Therefore, as recommended by the USNRC in this RAI, SMC has reviewed the information in NUREG-1640, "Radiological Assessment for Clearance of Materials from Nuclear Facilities", and has elected to use the normalized effective dose conversion factors that appear in Appendix I-2 of Volume 4 of that NUREG as the basis for setting reasonably conservative volumetric release criteria.

The only releasable material at the Newfield site with the potential for volumetric contamination is in the demolition concrete stockpiles, which are staged in an

[1] NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)", Rev. 1, Eq. 4-4.

unrestricted area for eventual recycling at a concrete processing firm.[2] Therefore, the 95th-percentile, mass-based effective dose coefficients from all pathways (i.e., external exposure, inhalation and ingestion) for the concrete processing scenario (Table I2.1 of NUREG-1640), result in the following element-adjusted dose coefficients:

Element	Radionuclide	Elemental Fraction	Table I2.1 Dose Coefficient (μSv/y per Bq/g)	Fraction-adjusted Dose Coefficient (mrem/y per pCi/g)
U-nat	Ra-226	0.345	2.4e+02	3.1e-01
	Pb-210	0.345	2.3e+01	2.9e-02
	Th-230	0.345	1.1e+01	1.4e-02
	U-234	0.345	2.4e+00	3.1e-03
	U-238	0.345	5.2e+00	6.6e-03
			Total	*3.6e-01*
Th-nat	Th-228	0.655	2.0e+02	4.8e-01
	Th-232	0.655	1.2e+01	2.9e-02
	Ra-228	0.655	1.3e+02	3.2e-01
			Total	*8.3e-01*

The volumetric DCGLs, based upon a dose objective of 25 millirem TEDE, are thus determined as follows:

$$DCGL_{U-nat} = \frac{25\ mrem}{year} \times \frac{1\ pCi/g}{3.6x10^{-1}\ mrem/year} = \frac{69\ pCi}{gram}$$

and

$$DCGL_{Th-nat} = \frac{25\ mrem}{year} \times \frac{1\ pCi/g}{8.3x10^{-1}\ mrem/year} = \frac{30\ pCi}{gram}$$

Action to be Taken: The report entitled "Derived Concentration Guideline Levels for the Newfield Site" (Report No. 94005/G-29357) will be modified to include the aforementioned equipment/material and volumetric release criteria. That report will be included, in its entirety, in Rev. 1b of the DP.

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[2] These stockpiles, that are the result of Building D.111/D.102-112 demolition, were surveyed and released for unrestricted use (see PARS Environmental, Inc. Project Report No. 61-01, "Final Report of the Decontamination and Disassembly of D102/112 and D111 Production Departments and Flex-Kleen Baghouse", November 24, 2003).

ENCLOSURE
Shieldalloy Metallurgical Corporation Response to the
USNRC's Supplemental Request for Additional Information of February 17, 2009
Engineered Barrier Design Document

General

RAI No. 1: Consider using a more realistic term such as "reduce", "inhibit", or "minimize" wherever the term "prevent" has been used in the text and appendices.

SMC Response: Concur.

Action to be Taken: The text of Rev. 1b of the DP will be reviewed and, where appropriate, the term "prevent" will be replaced with an alternate term.

RAI No. 2: SMC needs to conduct and provide the results of a geotechnical subsurface characterization program. As an alternative to providing a new subsurface investigation, SMC could provide information from previous subsurface investigations in the immediate area of the proposed disposal cell. As an alternative to an immediate identification and assessment of borrow materials, SMC has indicated in its QA/QC Construction Plan that it will test and report on borrow material characteristics prior to their placement. However, SMC should include a statement up front in Section 8.3.1 that it will test borrow materials once the borrow sources are identified and provide appropriate test results to demonstrate that conservative assumptions were used in the geotechnical analysis and material specifications will be met.

SMC Response: Concur.

Action to be Taken: A geotechnical subsurface investigation program, conducted in accordance with the Geotechnical Investigation Work Plan that was provided to the NRC on December 18, 2008, has been performed to characterize existing subsurface conditions in the Storage Yard area where the stockpiled materials will be consolidated and the engineered barrier will be constructed. The results of this study are currently being evaluated and will be presented within Rev. 1b of the DP. Also, Section 8.3.1 of Rev. 1b of the DP will be revised to indicate that borrow materials, once identified, will be tested to ensure the materials meet the conservative assumptions used in the geotechnical analysis and the technical specifications.

RAI No. 3: Shieldalloy should propose plans for sampling the soils under the slag and baghouse dust piles after they have been moved, but before the underlying soil/slag mixed layer is removed to the established derived concentration guideline level (DCGL). The purpose of this subsurface sampling would be to obtain a vertical profile of samples of the soil/slag mixed layer and underlying undisturbed soil layers to confirm results of samples previously taken in the subsurface under the edges of piles.

SMC Response: As documented in the Ground Water Impacts Analysis Report (TRC, December 2008), there is no evidence that undisturbed soil beneath the slag piles exhibits evidence of leached radioactivity. The preliminary results from the on-going slag characterization and SPLP testing further support the conclusion that radioactivity does not leach from the slag and other Storage Yard materials when subject to rainfall. We anticipate the final results will provide additional support for that conclusion. Rev. 1b of the DP will combine this information, including full results from the leach testing program, with an evaluation of ground water quality to demonstrate that the leaching of radioactivity from the existing Storage Yard materials is not an issue of concern. Further analysis of subsurface soils in the Storage Yard in order to prove all negative findings to date is not necessary. As part of the construction process, the areas surrounding the slag piles from where slag has been relocated will be excavated, as necessary, to meet the applicable DCGLs.

Action to be Taken: It is expected that Rev. 1b of the DP will demonstrate through the subsurface soil and ground water studies that leaching of radioactivity from the Storage Yard materials is not a current concern and, when combined with the slag characterization studies and the proposed consolidation of the Storage Yard materials beneath the engineered barrier, will not present a future concern.

<u>Section 8.3</u>

RAI No. 4: Remove the reference to 10 CFR Part 61.52 on page 2 of Section 8.3 and reference the NRC decommissioning requirements for restricted use in License Termination Rule in 10 CFR 20.1403, along with the supporting guidance in NUREG-1757, Vol. 2, Rev. 1, Section 3.5 on Use of Engineered Barriers.

SMC Response: Concur.

Action to be Taken: The text will be revised as requested.

RAI No. 5: NUREG-1757 vol. 2, Rev. 1, Section 3.5 discusses the use of a risk-informed graded approach for developing the design of engineered barriers under NRC's License Termination Rule (LTR) in 10 CFR 20 Subpart E. A discussion of how the <u>risk-informed</u> approach was used to develop the design so that it contributes to compliance with both the 25 and 100 mrem/yr dose criteria of the LTR should be provided. Also describe how the approach was <u>graded</u> so that more robust components of the design were incorporated in order to address the need for long-term protection for the long-lived radionuclides. For example, the design approach of the erosion protection layer used the NRC guidance in NUREG-1623 for designing the rock cover based on the PMP and PMF to provide a more robust and passive design that would not rely on active ongoing maintenance.

SMC Response: Concur.

Action to be Taken: Additional details on the risk-informed graded approach, including the functions of the various components of the engineered barrier, their individual contributions to the overall function of the barrier, and how each contributes to compliance with the dose criteria of the LTR, will be presented in Rev. 1b of the DP. Where redundancies or conservative design bases have been used, these will be discussed as contributing to the overall protection afforded by the robust engineered barrier.

RAI No. 6: Revise Figure 18.6 by changing the restricted use area boundary that incorporates the new footprint of the engineered barrier or change the footprint. The revised boundary should also consider the long-term monitoring plans when revised to include the location of future groundwater monitoring wells and the need to maintain controls on these wells.

SMC Response: Concur.

Action to be Taken: The figure will be revised within Rev. 1b of the DP to indicate that the restricted area boundary under the LTC alternative will be different than the current restricted area boundary. The revised figure will show new footprint of the engineered barrier and any additional area needed to support long-term monitoring and maintenance activities within the restricted area.

RAI No. 7: Explain that both the 25 mrem/yr and 100 mrem/yr LTR dose criteria are applicable to the engineered barrier design and how the design was developed to contribute to compliance with the applicable dose criteria. This is fundamental to the risk-informed approach.

SMC Response: Concur.

Action to be Taken: This explanation will be provided in Rev. 1b of the DP.

RAI No. 8: After the results of the leach rate tests are available, explain how performance of the source term and overall engineered barrier is allocated for compliance with both the 25 and 100 mrem/yr dose criteria and for both the direct exposure and groundwater exposure pathways. In other words, do a sensitivity analysis with and without the engineered barrier.

SMC Response: Concur.

Action to be Taken: Rev. 1b of the DP will contain an analysis of the importance of the engineered barrier relative to the direct exposure and ground water pathways and their impact on the dose modeling results. A sensitivity analysis with and without the engineered barrier will be performed.

RAI No. 9: A new section before Section 8.3.4 on Final Status Survey should be added to commit to developing a Construction Completion Report and submitting it to NRC together with the Final Status Survey Report and the Long Term Control Plan after completing decommissioning activities. The Completion Report for the Cabot site should be used as a recent example and has already been provided to Shieldalloy. It is noted that this example is simpler than expected for the Shieldalloy engineered barrier because the Cabot engineered barrier was only designed for erosion protection and did not have the other barrier components that are being proposed for the Shieldalloy engineered barrier. Furthermore, the Completion Report should address construction of the entire engineered barrier including co-location and placement of contaminated materials and cover layers. For SMC consideration, an example Completion Report contents is given below that is based on similar reports that have been submitted to NRC by uranium mill tailings licensees as well as the decommissioning of the Cabot site.

Introduction
Site History and Background Information
Overview of Construction Activities and Associated Quality Control Testing
Completed Site Cleanup Decommissioning Activities
Contaminated Material Co-Location Activities and Test Results
Clay Barrier Placement and Test Results
Biointrusion/Drainage layer Placement and Test Results
Geotextiles Placement and Test Results
Cover soil Layer Placement and Test Results 10. Bedding Layer Placement and Test Results
Erosion Control Layer Placement and Test Results
Other Decommissioning
Activities
Summary and Conclusions
References

SMC Response: Concur.

Action to be Taken: This issue will be addressed in Rev. 1b of the DP by restating information already contained within Appendix C of the Engineered Barrier Design Submittal (Rev. 1b Interim) and building upon that information as necessary.

RAI No. 10: Resolve the inconsistency in discussions related to the characterization and potential removal of contaminated surface soils adjacent to the engineered barrier footprint and provide the applicable DCGL or reference where the DCGL would be provided in the DP.

SMC Response: Concur.

Action to be Taken: This issue will be addressed in Rev. 1b of the DP. The two referenced sections of text will be revised to clarify that surface soil adjacent to the consolidated pile will be characterized, remediated as necessary to meet the applicable DCGLs, and then subject to final status survey. Remediated soil will be placed onto the consolidated pile. The applicable DCGL and its technical basis will be described in "Derived Concentration Guideline Levels for the Newfield Site" (Report No. 94005/G-29357), which will be included in its entirety as an appendix to Rev. 1b.

RAI No. 11: With respect to the bulleted list of design considerations, SMC should indicate that the goal to minimize the need for handling materials to lower construction costs is only a consideration when there is no impact on the overall stability of the storage system.

SMC Response: Concur.

Action to be Taken: The referenced bullet will be revised as follows in Rev. 1b of the DP:

- Minimize need for material handling (loading, transfer, and installation) to lower construction costs and simplify logistics where possible without impacting the overall stability of the storage system.

RAI No. 12: SMC should add a description of the cover soil layer material requirements to this section.

SMC Response: Concur.

Action to be Taken: A description of the makeup of the cover soil layer will be added to this bulleted section within Rev. 1b of the DP.

RAI No. 13: SMC needs to provide discussion of the detailed methods that would be used to ensure all voids are filled. In addition, SMC needs to provide information on the basis for selection of this approach in lieu of crushing and/or mixing the contaminated materials to form a uniform mixture that could be compacted to form a completely stable base for the engineered barrier. As an alternative, SMC could provide a different process for co-locating the contaminated materials. In addition, SMC needs to include in the construction specifications a requirement for ensuring that decomposable trash materials are uniformly spread throughout the cell to avoid creation of large voids upon decomposition.

SMC Response: Concur.

Action to be Taken: An appropriate alternative method of co-location that appropriately addresses voids and potential differential settlement will be selected and described in Rev. 1b of the DP. Specifications will be amended or supplemented as appropriate to support the alternative methodology.

<u>Appendix A (Earthwork Specifications)</u>

RAI No. 14: SMC should consider possible revisions to the proposed process for placement of contaminated materials as described in various sections throughout the documentation in accordance with the response to RAI 13.

SMC Response: Concur.

Action to be Taken: As indicated in the response to RAI No. 13, the construction specifications will be amended or supplemented to provide consistency with any alternative methods proposed in Rev. 1b of the DP.

RAI No. 15: SMC should commit to pre-compaction standard count testing to ensure the nuclear gauge will work effectively in the contaminated material environment, and to enable accurate calibration of the equipment.

SMC Response: Concur.

Action to be Taken: The specifications within Rev. 1b of the DP will be revised to specify pre-compaction standard count testing and equipment precision/accuracy.

RAI No. 16: To be consistent with paragraph 1.4.1, the line items for compaction, Atterberg Limits, and conductivity in the Section 3.2.2 table should specify "once for every 5000 cubic yards" rather than "Initial test (one time)." SMC needs to correct this inconsistency.

SMC Response: Concur.

Action to be Taken: The specifications within Rev. 1b of the DP will be revised to indicate that the applicable line items are performed once every 5,000 cubic yards.

RAI No. 17: Detailed gradations showing the complete gradation bands and the minimum D50 for each layer thickness and rock size are needed for the NRC staff to complete its review. It should be emphasized that the required D50 to resist erosion should represent the minimum D50 of the rock gradation. Guidance for providing more detailed gradations may be found in NUREG-1623, Appendix F. SMC should revise the gradations to be used for each layer thickness, provide the gradation bands, and specify the minimum D50 values.

SMC Response: Concur.

Action to be Taken: The specifications within Rev. 1b of the DP will be revised to incorporate these recommendations.

RAI No. 18: Resolve the inconsistencies in the radiological requirements for the clay and the rock presented in the specifications and provide a technical basis for the value(s) selected. Consider using background as the specification for both clay and rock. If site background is not used provide a basis for the selected value and describe how a value greater than background would be considered in the dose assessment.

SMC Response: Concur.

Action to be Taken: The radiological characteristics of both rock and clay will be evaluated as part of the quality control process during the construction phase. SMC will use rock and clay that exhibit radiological characteristics equivalent to or less than background. The diabase rock was previously analyzed for radionuclide content as part of the Cabot project, with results reported in the engineered barrier design basis document (DP, Rev 1b Interim, Appendix B, Attachment 2). They show diabase rock is low in natural uranium and thorium, with the parents of the uranium and thorium series exhibiting concentrations of approximately 1.2 pCi/g each.

The National Council on Radiation Protection reports the natural background of radioactive constituents in clay (National Council on Radiation Protection and Measurements, *Exposure of the Population in the United states and Canada from Natural Background Radiation*, NCRP Report 94, Table 4.3, December 30, 1987) to be 1.8 pCi/g for uranium and 1.0 pCi/g for thorium. The results of the tests of the clay used for the engineered barrier at Newfield will be compared to these nominal values.

In the event that the stone or clay selected for the cover exhibits a significant increase from the Dyer Quarry samples for rock or the national averages for clay reported in NCRP 94, SMC will establish a site-specific background for the supply locations. SMC then will verify that the construction materials exhibit radiological characteristics that are consistent with the established background value.

RAI No. 19: It should be noted in the Section 3.3.1, Appendix C, and appropriate procedures that rock production and placement schedules would account for the rock durability testing time in order to avoid placing rock on the engineered barrier before it is accepted.

SMC Response: Concur.

Action to be Taken: The specifications and Quality Assurance/Quality Control Construction Plan within Rev. 1b of the DP will be revised to address this recommendation.

RAI No. 20 (Appendix B, Attachment 1): Staff notes that the method used to size the riprap for the perimeter drainage channels was the Connecticut Department of Transportation (CTDOT) method. Based on a check of the rock sizes using this method, the staff considers that the rock sizes may be too small, when compared with some other methods. Since NUREG-1623 provides acceptable methods for rock sizing, SMC should check the CTDOT riprap sizing method used and compare the results with NUREG-1623 methods. If necessary, the rock sizes should be revised.

SMC Response: Concur.

Action to be Taken: A discussion of rock sizing will be included in Rev. 1b of the DP.

RAI No. 21: The perimeter drainage channels are designed to convey flows around the disposal cell. With the large amount of channel curvature proposed, the riprap design needs to include an allowance for increased shear stresses on outside of these bends. Guidance for determining increased shear stresses and rock sizes on the outside of bends may be found in NUREG- 1623. SMC should either modify the channel rock sizes at those locations where curvature occurs or should justify that the currently-proposed design is adequate.

SMC Response: Concur.

Action to be Taken: The selection of channel rock sizes will be addressed in Rev. 1b of the DP.

RAI No. 22: SMC proposes to construct trapezoidal perimeter drainage channels with a bottom width of two feet. Based on staff experience with the construction of rock-lined channels, it appears that it may be difficult to construct a channel with such a small bottom width, especially since the rock sizes may be larger than 12-18 inches. SMC should provide further discussion regarding their procedures for constructing the channel. SMC should also evaluate the possibility that it may be difficult to meet placement specifications and re-design the channel, if necessary.

SMC Response: Concur.

Action to be Taken: The channel construction procedures will be evaluated and, if necessary, the channel will be re-designed to address construction concerns within Rev. 1b of the DP.

RAI No. 23: SMC should provide additional information and calculations to demonstrate how the aprons were designed. The revised calculations and design should provide: the design velocities for the riprap of the apron; the minimum flare angle (based on the velocity) of the apron as it increases in width in a downstream direction; velocities and possible scour depths at the downstream end of the aprons; and rock sizes for the apron and the toe of the apron. Additionally, SMC should provide detailed drawings of aprons. These detailed drawings should show the aprons, with particular emphasis on their location and the manner in which the diversion channel transitions from a trapezoidal channel to a horizontal rock apron.

SMC Response: Concur.

Action to be Taken: Additional information on the apron design will be provided within Rev. 1b of the DP.

RAI No. 24: It is not clear how a Probable Maximum Flood (PMF) event would affect the storm water detention area south of the disposal cell and, in particular, how the detention area design will affect the design of the disposal cell. For example, the PMF could erode and damage the culvert and/or form a large gully or a preferred flow path. SMC should provide further analyses of the effects of a PMF and how the disposal cell design may be impacted by such an event.

SMC Response: The storm water detention area was established mainly to meet State of New Jersey Criteria for management of the 100-year storm. It has been designed to pass the PMF via a long weir that will not result in erosion that could impact the disposal cell.

Action to be Taken: Further details on the design of the detention area will be provided in Rev. 1b of the DP.

RAI No. 25: Appendix B provides a technical basis discussion for each of the engineered barrier components/layers, but does not discuss shielding and the basis for determining the appropriate thickness of the cover to limit direct exposure and comply with both the 25 mrem/yr and 100/500 mrem/yr. dose criteria. Add a discussion that provides the technical basis for the components of the engineered barrier that are intended to provide shielding of direct exposure or summarize here and reference the appropriate chapter of the DP where the basis is given.

SMC Response: Concur.

Action to be Taken: This information will be summarized in the cap design section of Rev. 1b of the DP and a reference will be provided to the dose modeling chapter, where additional discussion will be provided.

RAI No. 26: Section 1.1 on page B-1 references performance objectives from NUREG-1623, including item #4, specifically for "meeting radon release limits." The manner in which this performance objective is worded on page B-1, it could be inferred that the erosion barrier itself is designed to meet radon release limits. This is not the case. Instead the discussion in NUREG-1623 on page 7-8 means that erosion protection is needed to prevent gullies in the radon barrier that could expose uranium mill tailings and result in higher radon releases. Reword item 4) as follows: "preventing exposure of tailings by erosion and resulting higher radon releases."

SMC Response: NUREG-1623 is based on design objectives for long-term stabilization of uranium mill tailings. It is agreed that erosion protection is needed to prevent gullies in the engineered barrier that could expose the underlying materials and result in higher radon releases; however, exposure of tailings is not an issue at this site. To minimize any confusion that could result from referencing the exposure of "tailings", alternative text will be provided.

Action to be Taken: Item 4 in Section 1.1 of Appendix B will be revised as follows: "preventing exposure of materials beneath the engineered barrier due to erosion and resultant higher radon releases," with the revised text captured in Rev. 1b of the DP.

RAI No. 27: Section 1.1 on page B-1, paragraph 2 indicates that "By designing to protect against erosion under PMP and PMF conditions, protection will also be provided under less severe, more common storm events." While correct, further discussion is needed of how this design approach would minimize future long-term maintenance. Add a discussion of how the PMP and PMF design approach would also minimize future maintenance. See NUREG-1623 for discussions of various approaches.

SMC Response: Concur.

Action to be Taken: A discussion of the effect of the PMP and PMF design approach on minimizing maintenance will be included in Rev. 1b of the DP.

RAI No. 28: SMC should include a discussion of what the determining factors are for setting the period for monitoring clay barrier moisture at 10 years, as opposed to a longer period. Provide a technical basis for using irrigation such as a reference to where this approach has been successfully used before. Also discuss how the amount and timing would be determined and excess irrigation avoided. Finally, discuss the long-term uncertainty associated with desiccation and hydraulic degradation.

SMC Response: The ten year moisture monitoring period is intended to provide sufficient baseline data for assessing clay barrier performance and the need for possible further moisture monitoring and surface infiltration enhancements. For example, annual data could be reviewed and correlations between seasonal variations and important periods or conditions established. Sufficient statistical data will be provided by monitoring of clay barrier moisture over a period of 10 years.

Action to be Taken: Additional discussion will be provided within Rev 1b of the DP to clarify the intended approach regarding moisture monitoring and maintenance and sufficiency of the cap design. Technical references will be incorporated as appropriate to further justify the design approach.

RAI No. 29: Based on infiltration analyses and dose modeling results (see RAIs 35 and 36), each component of the total engineered barrier system should be listed and its contribution to the infiltration estimate and dose reduction should be given, both for as designed and degraded conditions. This would provide a clear summary of the calculations and dose modeling/sensitivity analyses for each component and provide an overview of how all the components are estimated to perform by reducing infiltration and contributing to compliance. Furthermore, this approach would allow alternative total infiltration values to be estimated by removing components that might be uncertain for some reason, such as questionable performance of the clay layer over the long term. Similarly, another component could be added or modified, such as using a rock/soil/vegetative erosion protection/ET surface component that would then have a higher estimate of surface runoff and ET than the rock-only erosion protection layer. For each of these alternative designs/systems for infiltration control, the resulting alternative total infiltration values could be used to calculate dose, thereby, estimating the contribution of the alternative engineered barrier systems on compliance with both the 25 and 100/500 mrem/yr dose criteria. Such an approach would be more risk-informed by providing risk insights from alternative designs and assumptions about degradation. The advantages and disadvantages of each component should also be discussed, both from a performance standpoint but also long-term monitoring and maintenance.

SMC Response: The original approach to estimating infiltration was based, in part, on certain restrictions associated with the use of the RESRAD computer code, which does not allow for the direct representation of different layers within a multi-layer engineered barrier. The original approach was also confirmed with an alternative infiltration analysis using Darcy's Law. However, the need to further analyze the contribution of each individual layer to infiltration under various conditions as part of the risk-informed approach is acknowledged.

Action to be Taken: More detailed, multi-layer analyses of infiltration for the as-built and degraded conditions, and associated sensitivity analyses, will be provided within Rev. 1b of the DP. Advantages and disadvantages of proposed components of the barrier will be discussed, and associated contributions to dose reduction and compliance with stated goals will be summarized.

RAI No. 30: Attachment 2, p. 1 states that "The main purpose of selecting a durable rock material is to sustain the forces of weathering (known as rock durability) for a period of at least 1,000 years." Sustain is the incorrect term to use; instead, NRC guidance uses the term "withstand" the forces of weathering. Revise the term as suggested above.

SMC Response: Concur.

Action to be Taken: The text will be revised in Rev. 1b of the DP as requested.

RAI No. 31: Add a discussion of the petrographic analyses conducted by PENNDOT and SMC that identified small amounts of the secondary mineral sericite that resulted from the alteration of feldspars. Explain the origin of this secondary mineral, the small amounts observed, and conclusions regarding future rock durability. Include the conclusion of the April 28, 2008, petrographic report prepared for SMC that the sericitic alterations did not affect the overall integrity, density, and good quality of the rock.

SMC Response: Concur. It should be noted that sericite is a common alteration mineral of orthoclase or plagioclase feldspars in diabase rock that have been subjected to hydrothermal alteration. The petrographic analysis of the rock sample indicated that the sericitic alterations were present in trace amounts and that they have not affected the overall integrity, density, and good quality of the rock material. This conclusion is supported by the rock durability testing results and diabase analogues. Furthermore, it would be expected that, given the age of the Dyer quarry diabase (i.e., York Haven diabase of Triassic age – 200 to 250 million years old), the trace amount of sericite will not adversely affect the quality of the rock over the next 1,000 years.

Action to be Taken: A discussion of the petrographic analyses conducted by PENNDOT and SMC regarding sericite will be included in Rev. 1b of the DP.

RAI No. 32: In the section on Direct and Indirect Evidence for Resistance to Weathering on p. 10-11, natural analogue rocks are discussed from climates different than New Jersey. Reconsider adding some of the diabase analogues from the Cabot information provided because they are the same or similar diabase in a similar climate (New York and Pennsylvania). While the erratics from the western US and Turkey might be of general use, they are in a more arid climate than New Jersey and that is why the New York Central Park erratics would provide a stronger example from a similar climate. However, explain that the more arid examples are useful even though they are in arid climates because of the long time period they indicate (approx. 10,000 yrs) relative to the regulatory time period of 1000 years. Furthermore, the example from Turkey indicates that the striations withstood many years of exposure. An approximate time is needed because the term "many" is unclear. Revise as suggested above.

SMC Response: Concur.

Action to be Taken: A discussion of the diabase analogues from the Cabot information provided will be incorporated into Rev. 1b of the DP.

RAI No. 33: SMC states it may use irrigation or construct permeable zones in the cover soil to maintain acceptable soil moisture levels. SMC does not include the potential use of irrigation or construction of permeable zones in the cover soil in its evaluation of infiltration for RESRAD dose modeling found in Section 1.7 of this document. To-date SMC has not included the use of irrigation in its dose modeling evaluations in the DP. The use of irrigation or construction of permeable zones in the cover soil has the potential for increasing the infiltration rate. SMC should include the potential use of irrigation or construction of permeable zones in the cover soil in its evaluation of infiltration for RESRAD dose modeling found in Section 1.7 of this document.

SMC Response: Irrigation or the construction of permeable zones would be implemented only under conditions where, based upon monitoring results, the clay of the engineered barrier requires additional hydration. Irrigation would not be conducted under conditions where saturation of the clay barrier and subsequent infiltration into the underlying materials would occur. The construction of permeable zones would only occur if long-term monitoring indicated that such zones would maintain hydration of the barrier without increasing infiltration through the barrier.

Action to be Taken: The RESRAD model will be used to evaluate the sensitivity of the resulting dose to potential infiltration through the barrier under an "all controls fail" scenario.

RAI No. 34: SMC should use the actual evapotranspiration in its infiltration analysis. The analysis should address the amount of evaporation or evapotranspiration that is estimated to occur from each component (layer) of the engineered barrier, particularly the cover soil and biointrusion/drainage layers. The estimate of actual evapotranspiration should consider how the individual layers of the barrier degrade over time under both the controls in-place and controls-fail conditions. SMC should justify the methods used to calculate actual evapotranspiration and the assumptions used in those calculations. SMC should provide its method for determining the values of the evapotranspiration coefficient that will be used in the RESRAD dose modeling under the controls in-place and all controls-fail conditions. SMC should discuss how these values will be used in the RESRAD dose modeling. SMC should also perform a sensitivity analysis on this parameter in the dose analysis and provide justification for the range of values used for the parameter in the sensitivity analysis.

> **SMC Response:** The need to further analyze the contribution of each individual layer to infiltration under various conditions as part of the risk-informed approach is acknowledged.
>
> **Action to be Taken:** More detailed, multi-layer analyses of infiltration for the as-built and degraded conditions, and associated sensitivity analyses, will be provided within Rev 1b of the DP. The methods and assumptions used to calculate evapotranspiration will be justified for applicable conditions.

RAI No. 35: SMC should provide justification for why the rational method for calculating runoff from small watersheds described in this section is appropriate for describing runoff at the clay barrier layer and calculating the values for the runoff coefficient that will be used in the RESRAD dose modeling. In applying this method, SMC should provide stronger justification for the assumptions made about the values used for c_1, c_2 and c_3 used to calculate the runoff coefficient under the various levels of degradation. Analysis of how runoff from the barrier changes with time should include an analysis of how the biointrusion/drainage layer degrades and how that degradation affects drainage from (flow through) the layer. Alternatively, SMC could use a different method of calculating runoff from the engineered barrier that accounts for how each layer of the barrier affects the total amount of runoff from the barrier as a whole. Included in that analysis should be a discussion of how the individual layers of the barrier degrade over time under both the controls in-place and controls-fail conditions and how that degradation affects runoff. SMC needs to describe how the values calculated for the runoff coefficient under the controls in- place and controls fail conditions will be used in the RESRAD dose modeling. SMC should also perform a sensitivity analysis on this parameter in the dose analysis and provide justification for the range of values used for the parameter in the sensitivity analysis.

> **SMC Response:** The original approach to estimating runoff was based in part on certain restrictions associated with the RESRAD computer code, which does not allow for the direct representation of different layers within a multi-layer engineered barrier. However, the need to further analyze the contribution of each individual layer to runoff under various conditions as part of the risk-informed approach is acknowledged.

Action to be Taken: More detailed, multi-layer analyses of runoff for the as-built and degraded conditions, and associated sensitivity analyses, will be provided within Rev 1b of the DP. The methods and assumptions used to calculate runoff will be justified for applicable conditions.

RAI No. 36: Analysis of evapotranspiration needs to be consistent with the state of the cover in the as-built condition (no vegetation present). Additionally, SMC should consider the presence or absence of vegetation on the surface of the engineered barrier in its evaluation of how infiltration changes as the barrier degrades over time under both the controls in-place and controls fail conditions. Depending on results of leach tests and overall performance of the engineered barrier, SMC should be aware of and possibly consider an alternative design in which the erosion control layer consists of a rock/soil matrix which either includes vegetation from the start or allows for vegetation to take root naturally over time and evaluate the infiltration that would occur from such a design.

SMC Response: The need to further analyze the contribution of certain layers to infiltration under various conditions as part of the risk-informed approach is acknowledged.

Action to be Taken: As indicated in the response for RAI No. 29, more detailed, multi-layer analyses of infiltration for the as-built and degraded conditions, and associated sensitivity analyses, will be provided within Rev 1b of the DP. The methods and assumptions used to calculate evapotranspiration will be justified for applicable conditions.

RAI No. 37: SMC should provide justification for assumptions made in its analysis of infiltration regarding the level of degradation of the barrier layers that occurs under both the controls in-place and controls-fail conditions. Justification should be provided for the ranges of values used in the sensitivity analysis. This justification should include examples from analog sites, field experiments, or citations from recent research, etc. SMC should explicitly describe how the results of this analysis will be utilized in the RESRAD dose modeling.

SMC Response: The need to further analyze the contribution of each individual layer to infiltration under various conditions as part of the risk-informed approach is acknowledged.

Action to be Taken: As indicated in the response for RAI No. 29, more detailed, multi-layer analyses of infiltration for the as-built and degraded conditions, and associated sensitivity analyses, will be provided within Rev 1b of the DP. The methods and assumptions used to calculate infiltration will be justified for applicable conditions.

RAI No. 38: SMC needs to correct the depth of frost penetration assessment based on concerns related to the use of large-scale regional maps for site-specific information and considering the methodology in the following Reference: "Protective Layer Design in Landfill Covers based on

Frost Penetration," by Gregory M. Smith and Ronald E. Rager, ASCE Journal of Geotechnical and Geoenvironmental Engineering, Vol. 128, Issue 9, pp 794-799, September 2002. Based on the re-assessment, SMC needs to modify its conclusions, or otherwise provide further justification of the original numbers given in the analysis.

SMC Response: The need for further justification of frost penetration analyses is acknowledged.

Action to be Taken: A further analysis of frost penetration will be included in Rev. 1b of the DP.

RAI No. 39: SMC needs to indicate what engineered barrier components each of the 6 numbered materials corresponds to within the slope stability analysis. In addition, SMC needs to provide the basis (from investigations and material testing) for slope stability property values assigned to each of the materials used as input to the modeling, including the subsurface materials.

SMC Response: Concur.

Action to be Taken: The materials represented within the slope stability analysis will be identified relative to the engineered barrier components they represent and the basis for the slope stability property values assigned to each will be discussed in Rev. 1b of the DP.

RAI No. 40: The settlement analysis discussion includes an assumption that all the subsurface materials are sand deposits subject to small rapid settlement, and that co-locating the contaminated materials as discussed in RAI 13 will eliminate any significant settlement of these materials. Therefore, SMC concludes settlement is not an issue. Regarding the subsurface materials, there should be site borings with Standard Penetration Test blow-counts to demonstrate there are no loose sands or layers of silts and clays that would invalidate the settlement assumption. In addition, as discussed in RAI 13, there is no basis for the assumption that the contaminated material placement approach will not result in voids and future settlement. SMC needs to provide a stronger basis for its settlement assumptions, including information on subsurface soils from site investigations and material testing, and information on placement of contaminated materials in response to RAI 13.

SMC Response: As discussed in the response to RAI 2, a subsurface geotechnical investigation has been conducted at the site that will provide more information for the basis of the assumptions used in the settlement analysis.

Action to be Taken: Further justification for SMC's settlement analysis will be provided in Rev. 1b of the DP.

RAI No. 41: The discussion includes an assumption that the subsurface consists only of non-loose sands and silts that are not subject to liquefaction. Again, there should be borings and site information to demonstrate this. SMC needs to provide a stronger basis for its liquefaction assumptions, including site information and information on subsurface soils from site investigations and material testing. SMC is referred to Regulatory Guide 3.11, Rev 3 (ML082380144) for the process of liquefaction analysis. The Regulatory Guide may also be found on the NRC's Web Site.

> **SMC Response:** As discussed in the response to RAI 2, a subsurface geotechnical investigation has been conducted at the site that will provide more information for the basis of the assumptions used in the liquefaction analysis.
>
> **Action to be Taken:** Further discussion of the liquefaction analysis for the Newfield site will be provided in Rev. 1b of the DP.

RAI No. 42: SMC needs to include in the engineered barrier documentation a more complete tie to the dose modeling analysis, including but not limited to: 1) what degradation assumptions will be made to input the dose model scenarios under both control and loss-of-control situations; and 2) plans to identify how much degradation would have to occur to result in non-compliance under the loss-of-control situation.

> **SMC Response:** Concur.
>
> **Action to be Taken:** The relationship between the engineered barrier design and the dose modeling analysis will be addressed in detail in Rev. 1b of the DP.

<u>**Appendix C (Quality Assurance and Quality Control Construction Plan)**</u>

RAI No. 43: Page 3-8 states that a petrographic analysis would be completed in accordance with ASTM C- 295-90. However, specific objectives of the petrographic analysis also should be identified and should include, confirming the absence or small, insignificant amounts of potentially adverse minerals such as olivine and sericite. Revise the procedure as suggested above.

> **SMC Response:** Concur.
>
> **Action to be Taken:** The objectives of the petrographic analysis will be addressed in Rev. 1b of the DP.

Appendix D (Operation and Maintenance Plan)

RAI No. 44: Figure 2-4 on page 2-1 shows the new footprint of the engineered barrier falling outside of the restricted use area boundary. Revise Figure 2-3 by changing the restricted use area boundary that incorporates the new footprint of the engineered barrier or revise the footprint. The revised boundary of the restricted area should also consider the long-term monitoring plans when revised to include the location of future groundwater monitoring wells and the need to maintain controls on these wells.

> **SMC Response:** Concur.
>
> **Action to be Taken:** A revised Figure 2-3 that incorporates the new footprint of the engineered barrier will be included in Rev. 1b of the DP. The revised figure will also incorporate any additional area needed to support long-term monitoring and maintenance activities.

RAI No. 45: Discuss the applicability of the results of recent ongoing studies on the effectiveness of monitoring programs to verify cover performance for reducing infiltration such as reported by recent ACAP studies (Malusis, M. and Benson, C. (2006). "Lysimeters versus Water-Content Sensors for Performance Monitoring of Alternative Earthen Final Covers." Unsaturated Soils, Geotechnical Special Publication 147, 1, ASCE741-752)). Discuss long-term monitoring methods and duration for the total system or justify why such long-term monitoring is not needed. Discuss the sampling and analysis plans for radionuclides in the water that has percolated through the pile considering the results of ongoing leach tests and sampling under the piles. If no long-term confirmatory testing is proposed, provide the justification for this decision.

> **SMC Response:** The need to evaluate long-term monitoring methods is acknowledged.
>
> **Action to be Taken:** The cited reference will be reviewed along with other references as applicable. Long-term monitoring methods and sampling/analysis methods will be discussed, along with suitable justifications, in Rev. 1b of the DP.