Office of Nuclear Material Safety and Safeguards Procedure Approval

Termination of Uranium Milling Licenses in Agreement States (SA) Procedure SA-900

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Kevin Williams
Director, NMSS/MSST

Clark, Theresa signing on behalf of Williams, Kevin on 04/17/23

Bethany Cecere
Branch Chief, MSST/SLPB

Signed by Cecere, Bethany on 04/10/23

Duncan White
Procedure Contact, MSST/SLPB

Signed by White, Alfred on 04/10/23

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NOTE

Any changes to the procedure will be the responsibility of the NMSS Procedure Contact. Copies of NMSS procedures are available through the NRC Web site at https://www.nrc.gov/agreement-states.html.

I. INTRODUCTION

This procedure describes the review process for making the determination that all applicable standards and requirements have been met prior to Agreement State uranium milling license termination, as required by 10 CFR 150.15a(a) and Section 274c of the Atomic Energy Act of 1954, as amended (Act).

II. OBJECTIVES

A. To establish the procedures to be followed by Nuclear Regulatory Commission (NRC) staff for review of uranium milling license termination proposals submitted by Agreement States.

B. To provide guidance for use by Agreement States on preparation and submittal of uranium milling license termination proposals for NRC staff review.

III. BACKGROUND

A. Section 150.15a(a) of 10 CFR states that the NRC shall have made a determination that all applicable standards and requirements pertaining to material as defined in 10 CFR 150.3(c)(2) have been met prior to termination of any Agreement State license for such material. This provision in NRC's regulations stems from Section 274c.(4) of the Act which reads in part: "[t]he Commission shall also retain authority under any such agreement to make a determination that all applicable standards and requirements have been met prior to termination of a license for byproduct material, as defined in 11e.(2)."

B. Two kinds of Agreement State uranium milling licenses are involved: conventional and non-conventional (mainly in-situ recovery licenses). A conventional uranium mill (which includes heap leach facilities) is a facility that generates mill tailings which will be transferred to a custodial agency for long-term care in accordance with 10 CFR 40.28 after the entire license is terminated. A non-conventional uranium mill is a facility that generates limited quantities of byproduct materials which are normally transferred to conventional tailings impoundments for disposal and therefore no land transfer is required at license termination.

For both types of licenses, the Agreement State is expected to conduct its review for decommissioning, reclamation and/or groundwater restoration in accordance with license requirements and State standards which are compatible with the requirements of 10 CFR Part 40. Agreement States are responsible for approval of the remediation plans of uranium milling facilities in their States and for site inspections to ensure that the actual remedial actions have been completed pursuant to the approved plans. With NRC's determination that all applicable standards and requirements have been met, the Agreement State terminates the specific licenses for its licensees.

C. Historically, the NRC has reviewed non-conventional uranium milling license termination requests from Agreement States on a case-by-case basis without any specific guidance. This procedure describes the specific guidance the NRC staff would use to ensure consistency in the process and information that NRC would need from an Agreement State to make its determination prior to termination of pending and future Agreement State conventional and non-conventional uranium milling licenses. A detailed license termination process for termination of uranium milling licenses in Agreement States is documented in Appendix A.

IV. ROLES AND RESPONSIBILITIES

A. The Office of Nuclear Material Safety and Safeguards (NMSS) Director or designee has overall responsibility for the review and for making the determination required in Section 274c. of the Act that all applicable standards and requirements have been met before an Agreement State terminates a license for byproduct material as defined in Section 11e.(2).

B. The Division of Decommissioning, Uranium Recovery, and Waste Programs (DUWP) Director or designee is responsible for technical review activities associated with completion review reports (CRR), long-term surveillance plans (LTSP), and establishing long-term care fees. As required, DUWP will coordinate with the Office of General Counsel (OGC) and the Division of Rulemaking, Environmental, and Financial Support (REFS).

C. The Division of Materials Safety, Security, State, and Tribal Programs (MSST) Director or designee is responsible for the early interaction and coordination activities with the Agreement State and Federally Recognized Tribes[1] involved in the review.

D. The DUWP Director or designee is responsible for assigning a review team, including a lead project manager (PM), for each license termination project. MSST, OGC, and REFS will provide staff contacts for each review team. The DUWP PM is the review team leader and is responsible for completing the NRC's review of uranium milling license termination proposals submitted by Agreement States. The review team is responsible for conducting the staff evaluation of Agreement State proposals according to this procedure. The MSST contact is the primary interface between the NRC and the Agreement State during the review.

E. It is NRC's responsibility to review, and, if appropriate, concur on the Agreement State's conclusion that all applicable standards and requirements have been met prior to the U.S. Government or the Agreement State assuming responsibility for the site. Agreement States should work with NRC if issues are identified during the review of the CRR. The U.S. Department of Energy or the State submits an LTSP to the NRC describing its program and activities for managing the site after

[1]Federally Recognized Tribes are those listed on the Bureau of Indian Affairs list that is updated annually. See https://www.bia.gov/service/tribal-leaders-directory for a link to the latest list.

termination of the license consistent with 10 CFR 40.28. The PM will lead NRC's engagement with U.S. Department of Energy (DOE) or the State, as needed, regarding the LTSP.

V. GUIDANCE

A. Agreement State's early interaction with NRC

1. Agreement States are encouraged to have early communication with the NRC when considering a different approach in a licensing action that is outside the normal, standard site closure proposals. When a State licensing action is needed in response to such a licensee proposal, an Agreement State should make its own evaluation and determination on whether the licensee's proposal provides reasonable assurance that applicable standards are met. At that time, the Agreement State is encouraged to provide NRC an opportunity to review the basis for its conclusion before the licensing action is taken. NRC will review the State's determination and will provide its views as to whether the basis is sufficient to support the conclusion provided by the Agreement State. Further interactions between NRC and the Agreement State may be needed to avert difficulties during NRC's review of the license termination where the NRC has concerns with a State's conclusions. This interaction is especially important when the Agreement State license action would be either irreversible or very difficult/resource intensive to reverse or correct. Examples include abandonment of monitoring wells, partial releases of a site prior to full license termination and the Agreement State's determination that a licensee's unsuccessful efforts to acquire all necessary land and interests therein for a site necessary to ensure the safe management of the tailings by the long-term care custodian are sufficient.

   In addition, approximately two years prior to submitting a draft CRR to NRC, Agreement States should consider whether NRC staff should be invited to visit sites that are in the process of license termination to discuss the histories and conditions of the sites and receive feedback, if any, from NRC staff. Agreement States may contact the MSST Director or designee to discuss any early interaction activities. Early discussions before the CRR is developed, especially when a different approach is contemplated by the licensee or the State, can help ensure that unforeseen issues are not identified during the CRR review. This includes discussions with NRC staff concerning issues under Agreement State authority that will impact site properties at proposed license termination. For example, an Agreement State should consider submitting an application to the NRC for approval for partial release of the site-specific to soil cleanup areas with cleanup levels alternative to the requirements of Criterion 6(6) in 10 CFR Part 40 Appendix A and for which the State has approved or intend to approve soil cleanup based on-site-specific dose and exposure scenarios that provide a level of protection equivalent to Criterion 6(6).

2. Each Agreement State license amendment that terminates a portion of the site from a license will be considered as a partial license termination and the NRC will make the Atomic Energy Act, Section 274c.(4) determination for each case.

3. In the majority of cases, the ”all applicable standards and requirements” used by NRC in making a determination under 10 CFR 150.15a(a) are the Agreement States standards including legally binding requirements, orders, or license conditions that implement the requirements of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). These standards were established according to the requirements in Section 274o. of the Act during the initial establishment or amendment of the State’s Agreement, during revision of the regulations to maintain compatibility, or during approval of an alternative standard.[2]

B. Technical Bases applicable in NRC’s determination on a License Termination Request:

The determination that all applicable standards and requirements have been met prior to termination of an Agreement State license has two primary supporting bases:

1. The first basis is a CRR submitted by the Agreement State containing the conclusions from the State’s review of a licensee’s completed remedial actions. This report should document the State staff’s bases in summary form for its conclusion that all applicable standards and requirements have been met.

2. The second basis is the NRC’s review of the Agreement State’s uranium recovery regulatory program, currently conducted under the Integrated Materials Performance Evaluation Program (IMPEP). The results of the IMPEP reviews provide the basis for confidence on the determinations and conclusions reached by the Agreement State, as set out in the CRR, and also the basis for confidence that the State’s reviews, licensing actions, and inspections associated with license termination have been conducted appropriately. The periodic reviews of selected technical areas, conducted under IMPEP, which also include training and qualifications of staff and adherence to necessary program procedures, e.g., license termination process for uranium milling licenses or equivalent procedures, will also serve as a basis for finding that all applicable standards and requirements have been met.

[2]As stated in the last paragraph of Section 274o. of the Act, the Agreement State may adopt alternative standards if, after notice and opportunity for public hearing, the NRC determines that such alternative provide an equivalent or greater level of protection for public health, safety, and the environment.

C. Scope of NRC review of CRR

NRC staff should not duplicate the State's review or conduct an independent detailed technical review of the proposed license termination or of any of the specific documentation submitted by the Agreement State licensee. Rather, NRC staff should examine whether the CRR has documented the State staff's bases in summary form for its conclusion that all applicable standards and requirements have been met. The level of detailed information contained in the CRR should be similar to that contained in the sample CRRs which can be found in Appendixes B and C for conventional and non-conventional uranium milling licenses, respectively.

Unless there are obvious flaws identified in the CRR related to the State-approved reclamation, decommissioning and/or groundwater restoration plan, NRC staff will focus its review on whether the State has provided adequate bases in summary form to confirm that closure activities were performed according to the approved plans and specifications. In addition, if any changes or degradation of the design features have occurred since the completion of construction of disposal areas, NRC staff will determine whether the State has evaluated the changes to confirm that the site continues to meet all applicable standards and requirements.

Under unique circumstances NRC staff may require more detailed information than is presented in the CRR if NRC staff determines that the detailed technical information is needed to resolve: (1) issues that may not have been identified under Section V.A.; or (2) issues that were identified under Section V.A. but were not resolved.

D. Two-step CRR review process

A two-step CRR review process would involve an Agreement State formally submitting a draft CRR for NRC review and comment before the Agreement State submits its final CRR.[3]

1. Agreement States should submit draft CRRs to NRC for review and comment. The State staff should alert the PM or the MSST contact at least 1-month before submitting the draft CRR. At least six months before an Agreement State provides a draft CRR, scheduling an NRC site visit will facilitate an effective NRC review. As described in section IV.D, the DUWP Director or designee should assemble a review team.

2. The draft CRR should include the following information depending on whether the license being terminated is a conventional or

[3] The U.S. Department of Energy submits a Long-term Surveillance Plan (LTSP) to the NRC outlining its program and activities for managing the site after termination of the license. The LTSP may contain information that the NRC staff may need to evaluate if the site license is acceptable for termination. Therefore, it is advisable that the draft CRR and draft LTSP be submitted to NRC at the same time to facilitate the review of both.

non-conventional uranium milling license. Sample CRRs for conventional and non-conventional uranium milling licenses can be found in Appendixes B and C, respectively.

a. Conventional Uranium Milling License

(i) A brief description of licensee's activities associated with decommissioning, tailings remediation, and groundwater cleanup, if necessary.

(ii) Documentation that the completed surface remedial actions were performed in accordance with applicable standards and requirements.

(iii) Documentation that the completed site decommissioning actions were performed in accordance with applicable standards and requirements. This documentation should include a discussion of the results of radiation surveys and soil sample analyses which confirm that the licensed site meets applicable standards and requirements for release, including discussion of areas with cleanup levels that are alternative to the Criterion 6(6) requirements. Any deviations from established standards or procedures (e.g., less than the number of radon measurements on the final radon cover outlined in Appendix B, Method 115, 40 CFR Part 61 (Environmental Protection Agency (EPA) radon flux determination procedures)) should be discussed and the rationale for the deviation should be fully explained.

(iv) Documentation that the completed groundwater corrective actions, if necessary, were performed in accordance with applicable standards and requirements.

(v) Discussion of results of State's site closure inspection(s).

(vi) For partial terminations, documentation that release of a portion of the site will not negatively impact the remainder of the site to be closed at a later date. Such documentation could be a statement from the appropriate State regulatory agency which confirms that the impact of releasing a portion of the site has been evaluated and includes the bases for the State's conclusion.

Early discussions before the CRR is developed, especially when new activities are contemplated by the licensee or the State, can help ensure that unforeseen issues do not impact the NRC's CRR review. If the NRC staff cannot conclude that the State's review or the documentation of the licensing action is adequate to support

the State's conclusion, then the NRC staff will further engage with the Agreement State. It is NRC's responsibility to review and if appropriate, concur on the State's conclusion for the U. S. Government prior to the U.S. Government assuming responsibility for the site. Agreement States should work with NRC if issues are identified during the review of the CRR.

Under Section 274o. of the Act, an Agreement State may adopt site-specific alternative standards with respect to sites where ores were processed primarily for their source material content or which are used for the disposal of Section 11e.(2) byproduct material. Before the State can adopt alternative standards, the Commission must make the determination that the alternative standards will achieve stabilization and containment, and that the alternative standards will provide an adequate level of protection for public health, safety, and the environment from radiological and non-radiological hazards associated with the site. If a State plans the adoption of an alternative standard, the NRC can provide guidance on the process.

b. Non-conventional Uranium Milling License (e.g., In-situ Recovery)

(i) A brief description of licensee's activities associated with decommissioning and license termination.

(ii) Groundwater information which demonstrates that the groundwater has been adequately restored to meet applicable standards and requirements.

(iii) Documentation that the production, injection and monitoring wells have been closed and plugged in accordance with applicable standards and requirements. Such documentation could be a copy of correspondence from the State to the licensee which confirms that all wells have been closed and plugged in accordance with the State criteria or a statement from the appropriate State regulatory agency to that effect.

(iv) Decommissioning information which documents that all radiologically contaminated materials have been properly disposed of, transferred to licensee(s) authorized to possess such materials, or meet applicable standards and requirements for release. Such documentation could be a statement from the State which confirms that decommissioning activities have been evaluated and includes the bases for the State's conclusion.

(v) Discussion of the results of radiation surveys and soil sample analyses which confirm that the licensed site meets applicable standards and requirements for release.

(vi) Discussion of results of the State's site closure inspection(s).

(vii) For partial terminations, documentation that release of a portion of the site will not negatively impact the remainder of the site to be closed at a later date. Such documentation could be a statement from the appropriate State regulatory agency which confirms that the impact of releasing a portion of the site has been evaluated and includes the bases for the State's conclusion.

3. The review team will follow the guidance stated in Section V.B. and review the draft CRR using the acceptance Criterion, i.e., whether the draft CRR has documented the State staff's bases in summary form for its conclusion that all applicable standards and requirements have been met. As appropriate, the NRC will consider DOE comments during its review of the CRR . As appropriate, the NRC will consider DOE comments during its review of the CRR to ensure consistency with the LTSP.

4. The review team prepares a letter to the State program Director to document the results of its review. The DUWP Director or designee signs the letter following Office concurrence and no legal objection from OGC. The PM may schedule telephone conference calls or meetings with State staff and team members, if needed, to discuss the results of the review.

5. The State should address NRC's comments by making changes to amend the draft CRR as appropriate. The MSST contact, in coordination with the PM, may schedule telephone conference calls or meetings with State staff and team members, if requested by the State, to discuss the amended draft CRR. When the State completes the amended draft CRR, the State program Director should submit it as the final CRR to the DUWP Director or designee.

6. The review team conducts a review of the final CRR to ensure that all the previous comments have been considered and are reflected in the final CRR. The PM may schedule telephone conference calls or meetings with State staff and team members if the comments are not properly addressed. The State should address those issues by making revisions to the final CRR, if needed.

7. The review team will notify potentially affected Federally Recognized Tribes regarding the review of the CRR as a part of the Tribal outreach program described in TR-100, "Tribal Liaison Roles and Responsibilities."

Upon notification from the State of their plans to submit a CRR, the review team should schedule a meeting with the Tribal Liaisons for assistance in identifying potentially affected Federally Recognized Tribes that may be interested in the CRR. The review team will provide a notification to the Tribes after the draft CRR is received and after the review of the final CRR is completed. Notification of the potentially affected Federally Recognized Tribes should be done by the Tribal Liaisons in MSST.

8. After completing the review, the PM prepares a response letter (samples in Appendix D for conventional licenses and Appendix E for non-conventional licenses) back to the State. The DUWP Director or designee signs the letter following Office concurrence and no legal objection from OGC.

E. LTSP

The DOE or the State submits a LTSP to the NRC outlining its program and activities for managing the site after termination of the Agreement State's specific license. Therefore, it is advisable that DOE prepare a draft LTSP concurrently with CRR preparation, and submit to NRC following NRC's concurrence on the CRR.

For a full termination of a conventional uranium milling license, the NRC staff will also review a site LTSP submitted by the custodial agency. Guidance for the NRC review of the LTSP can be found in Appendixes D and E of NUREG-1620 entitled "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act." NRC's review of the LTSP is not included in NMSS Procedure SA-900. Note that sites that have been partially terminated have involved areas surrounding the actual milling area which were released without the need for an LTSP.

The NRC's review and acceptance of the LTSP is conducted in accordance with 10 CFR 40.28. Acceptance of the LTSP is contingent upon the specific licensee making a serious effort to obtain subsurface rights in accordance with 10 CFR 40 Appendix A, Criterion 11C as determined by NRC or the Agreement State. Issues may arise in obtaining all of the mineral rights and other interests. The NRC will work to address the specific circumstances with the Agreement States on a case-by-case basis. Should issues arise, the Agreement State should contact the NRC as early as possible to ensure timely license termination. Lack of NRC acceptance of a site LTSP can delay termination of the specific license. The NRC staff's acceptance of an LTSP will be documented by written notification to the relevant Agreement State and custodial agency. Coordination and discussion between the DOE or the State, the Agreement State, and the NRC on the long-term Care Boundary and post license termination groundwater monitoring (if any) are crucial to successful license termination and site transfer.

F. Process to be followed for NRC determination:

1. A detailed step by step license termination process for conventional and non-conventional uranium milling licenses in Agreement States is documented in Appendix A. An Agreement State licensee's request for amendment to release a portion of site from its license also requires NRC to make a determination based on a site-specific CRR for that portion of the site. Similar license termination processes should be followed for both partial and entire license termination cases.

2. When a determination that all applicable standards and requirements have been met, the NRC should notify the State of its determination by formal correspondence. Upon notification from the NRC, the Agreement State should be prepared to terminate the specific license, if it is a non-conventional uranium milling license, or to amend the license to remove the remediated or unaffected portion from that license, if the license is being partially terminated.

3. For the full termination of a conventional uranium milling license, the Agreement State should be prepared to terminate the specific license after the following occur: (1) notification of the NRC determination that all applicable standards and requirements have been met; (2) notification that the NRC has accepted the LTSP; and (3), notification of transfer of the long-term care funds to the appropriate State or Federal agency.

4. The long-term custodian (DOE or the State), the Agreement State, and the NRC should coordinate the schedules for the CRR and LTSP development and reviews and communicate these schedules to the licensee. The Agreement State should be the lead for communication with their licensee on the CRR to avoid miscommunication with the licensee.

5. The review team will develop a Safety Evaluation Report documenting its review of the DOE's or Agreement State's LTSP.

6. To fulfill National Historical Preservation Act (NHPA) obligations and National Environmental Policy Act (NEPA) requirements, the following actions should be taken.

   (i) Unless categorically excluded pursuant to 10 CFR Part 51, the review team will develop an Environmental Assessment (EA) to fulfill the NRC's NEPA requirements. The NRC staff can rely on past environmental reviews to satisfy its NEPA obligations associated with the CRR review and the acceptance of the LTSP.
   (ii) Regarding NHPA, the review team should notify potentially affected Federally Recognized Tribes after the draft LTSP is received and after the final EA is completed.
   (iii) Notification of the potentially affected Federally Recognized Tribes should be done in accordance with the agency's NEPA and NHPA

Section 106 processes.

VI. APPENDIXES

Appendix A - License Termination Process

Appendix B - Sample Completion Review Report for Conventional Uranium Milling License

Appendix C- Sample Completion Review Report for Non-conventional Uranium Milling License

Appendix D - Sample NRC determination letter for Conventional Uranium Milling License

Appendix E - Sample NRC determination letter for Non-conventional Uranium Milling License

VII REFERENCES

Section 274 of the Atomic Energy Act of 1954, as amended

10 CFR Part 40, Domestic Licensing of Source Material

10 CFR Part 150, Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters Under Section 274

Management Directive 5.1, Consultation and Coordination with Governments and Indian Tribes (ML112351312)

Management Directive 5.6, Integrated Materials Performance Evaluation Program (ML19213A024)

SECY-99-025, Guidance to Terminate Agreement State uranium recovery Licenses under Requirements of 10 CFR 150.15a(a) and Section 274c

NUREG-1620 Rev. 1, Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act (ML032250190)

Final Report of the Working Group on Uranium Milling License Termination in Agreement States, June 2002.

NMSS Procedure TR-100, “Tribal Liaison Roles and Responsibilities” (ML21088A259)

VII. ADAMS REFERENCE DOCUMENTS

For knowledge management purposes, all previous revisions of this procedure, as well as associated correspondence with stakeholders, that have been entered into ADAMS are listed below.

No.	Date	Document Title/Description	Accession Number
1	9/26/02	STP-02-069, Notice of Opportunity to Comment on Draft Revision of STP Procedure SA-900: Termination of Uranium Milling Licenses in Agreement States	ML022690215
2	12/31/02	STP Procedure SA-900, Termination of Uranium Milling Licenses in Agreement States	ML030170416
3	12/31/02	Analysis of Public Comments on STP Procedure SA-900, Termination of Uranium Milling Licenses in Agreement States	ML030170435
4	7/24/09	FSME-09-061, Opportunity To Comment On Draft Revision To FSME Procedures SA-900, “Termination Of Uranium Milling Licenses In Agreement States”	ML092030348
5	5/17/10	Comments on SA-900, “Termination of Uranium Milling Licenses in Agreement States”	ML101130534
6	5/17/10	FSME Procedure SA-900, Termination of Uranium Milling Licenses in Agreement States	ML101130527
7	10/6/22	STC-22-060, “Notification of the Opportunity to Comment on SA-900, Termination of Uranium Milling Licenses in Agreement States”	ML21165A141
8	4/19/23	Comments of SA-900 “Termination of Uranium Milling Licenses in Agreement States”	ML23019A062
9	4/26/23	STC-23-029, “Termination of Uranium Milling Licenses in Agreement States”	ML23115A433

APPENDIX A - License Termination Process

Termination of uranium milling licenses in Agreement States has been divided into two major parts as follows: (a) termination of conventional uranium milling licenses; and (b) termination of non-conventional uranium milling licenses (mainly in-situ recovery licenses).

(a) Termination of Conventional Uranium Milling Licenses

Steps 1 through 5 and step 7 are applied to entire license termination cases; steps 1 through 6 are applied to partial license termination cases.

Step 1: Licensee Documentation of Completed Remedial and Decommissioning Actions

Licensees are required under 10 CFR 40.42(j) or equivalent Agreement State regulations to document the results of site decommissioning by conducting a radiation survey of the premises where the licensed activities were carried out. The results of this survey, the contents of which are specified at the Agreement State regulation equivalent to 10 CFR 40.42(j)(2), are submitted to the State for review, as a Final Status Survey report. Licensees may refer to the introduction Section of 10 CFR Part 40, Appendix A, or equivalent Agreement State regulations with respect to the use of alternative standards for soil cleanup.

Criteria 5A-5D, along with Criterion 13, of Appendix A under 10 CFR Part 40 or equivalent Agreement State regulations incorporate the basic groundwater protection standards imposed by U.S. EPA in 40 CFR Part 192, Subparts D and E. These standards apply during operations and prior to the end of closure. In addition, under Criterion 6(7), the licensee should address the non-radiological hazards associated with the wastes in planning and implementing closure. The licensee should ensure that disposal areas are closed in a manner that minimizes the need for further maintenance. Licensees may refer to the introduction Section of 10 CFR Part 40, Appendix A, or equivalent Agreement State regulations with respect to the use of alternative standards for groundwater protection.

If the groundwater protection standards are exceeded, the licensee is required to put into operation a groundwater corrective action program (CAP). The objective of the CAP is to return the hazardous constituent concentration levels to the concentration limits set as standards. For licensees with continuing groundwater cleanup, State approval is required for the termination of corrective action. Appropriate groundwater monitoring data and other information that provide reasonable assurance that the groundwater has been cleaned to meet the applicable standards and requirements are submitted to the State for review, as a groundwater completion report.

Step 2: Review of Completed Closure Actions by the Agreement State

Upon receipt of the Final Status Survey report and as necessary, the groundwater completion report, the State staff should review the content of the reports for documentation of acceptable completion of the applicable aspect of closure. The State staff should also review the licensee's completed reclamation of the tailings disposal cell which may be documented in a construction-completion report or similar report submitted by the licensee. As part of its oversight process during decommissioning, the State staff should conduct site inspections, examining first-hand the closure actions taken. Additionally, the State staff should conduct a final construction-completion inspection, which is expected to consist of a site walk-over. State staff is encouraged to discuss the Final Status Survey with NRC prior to submittal of the CRR if the Final Status Survey includes alternative soil standards that have not been reviewed or approved by NRC prior to submittal of the CRR.

Typically, there is an observational period following the completion of remedial actions for the State to assess the potential long-term stability of the tailings disposal cell. Licensees should report significant cell degradation occurring during this period. All identified hazardous constituents for which groundwater compliance sampling is being conducted at a licensed site must be returned to the concentration limits or alternate concentration limits set as standards prior to termination of a specific license. The specific license should not be terminated while an active or passive groundwater CAP is in operation, except in the case where the passive remedy of existing natural attenuation is integral to an established Alternative Concentration Limit (ACL). A specific license should be terminated only after it is demonstrated that the CAP achieved the applicable standards and requirements , and the licensee shows that groundwater will remain at or below those standards for the design life of the disposal cell. Completion of the CAP and/or establishment of an ACL should be discussed between the NRC and the Agreement State staff prior to submittal of the CRR.

Step 3: Site Ready for License Termination

When a licensee has completed site reclamation, decommissioning, and/or groundwater corrective actions, and is ready to request termination of its specific uranium milling license, the licensee should formally notify the State of its intentions.

Step 4: Agreement State Prepares Draft CRR and Submits to NRC

Agreement State staff prepares a draft CRR[4] based on guidance provided in the NMSS Procedure SA-900 and submits the draft CRR to NRC for review.

Step 5: NRC Review of Draft and Final CRRs

Upon receipt of the draft CRR, NRC staff should follow the review process stated in Section V.D. of NMSS Procedure SA-900 to conduct its review.

Step 6: License Amendment for Partial License Termination

Given a determination that all applicable standards and requirements have been met, the NRC should notify the State of its determination by formal correspondence. If it is a partial license termination for which a Long-Term Surveillance Plan (LTSP) is not required, the Agreement State should be prepared to amend the license to remove the remediated or unaffected portion from it.

Step 7: License Termination/Issuance of the General License

In cases involving termination of an entire license, NRC acceptance of the LTSP is required prior to termination of the specific uranium milling license and placement of the site and byproduct material under the general license in 10 CFR 40.28.

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[4] The Agreement State and the NRC should coordinate with respect to the application of any overlapping regulatory authorities prior to or after license termination.

The Agreement State should be prepared to terminate the specific license after the following occur: (1) notification of the NRC determination that all applicable standards and requirements have been met; (2) notification that the NRC has accepted the LTSP and (3) notification of transfer of the long-term care funds[5] to the appropriate State or U.S. Treasury. The long-term care custodian, for its part, should be prepared to accept title to the land and byproduct material.

(b) Termination of Non-Conventional Uranium Milling Licenses (Mainly In-Situ Recovery Licenses)

The following steps are applied to both partial and entire license termination cases.

Step 1: Licensee Documentation of Completed Decommissioning and/or Groundwater Restoration Actions

When the surface reclamation and/or groundwater restoration is complete, the licensee should submit (1) groundwater information which demonstrates that groundwater has been restored in accordance with the applicable standards and requirements and (2) documentation indicating that the production, injection and monitoring wells have been closed and plugged in accordance with the State criteria, to the State for review, as a groundwater completion report.

Licensees are also required under 10 CFR 40.42(j) or equivalent Agreement State regulations to document the results of site decommissioning, which is accomplished by conducting a radiation survey of the premises where the licensed activities were carried out. The results of this survey, the contents of which are specified at the Agreement State regulation equivalent to 10 CFR 40.42(j)(2), are submitted to the State for review, as a Final Status Survey report.

Step 2: Review of Completed Closure Actions by the Agreement State

Upon receipt of the Final Status Survey report, and if necessary, the groundwater completion report, the State staff should review the content of the report for documentation of acceptable completion of the applicable aspect of closure. As part of its oversight process during decommissioning, the State staff should conduct site inspections, examining first-hand the closure actions taken. Additionally, the State staff should conduct a final site inspection, which is expected to consist of a site walk-over.

Step 3: Site Ready for License Termination

When a licensee has completed site decommissioning, and/or groundwater restoration actions, and is ready to request termination of its specific uranium milling license, the licensee should formally notify the State of its intentions.

Step 4: Agreement State Prepares Draft CRR and Submits to NRC

Agreement State staff prepares a draft CRR based on guidance provided in the NMSS

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[5] Prior to license termination, the NRC will establish the final amount of the long-term site surveillance fund to be paid by the licensee in accordance with Criterion 10 of Appendix A under 10 CFR Part 40 or equivalent Agreement State regulations. The NRC's process for determining this amount should include consultations with the long-term care custodian and the licensee. Payment of this amount to the appropriate State or U.S. Treasury is required prior to license termination.

Procedure SA-900 and submits the draft CRR to NRC for review.

Step 5: NRC Review of Draft and Final CRRs

Upon receipt of the draft CRR, NRC staff should follow the review process stated in Section V.D. of the NMSS Procedure SA-900 to conduct its review.

Step 6: License Termination/License Amendment for Partial License Termination

When a determination that all applicable standards and requirements have been met, the NRC should notify the State of its determination by formal correspondence. Upon notification from the NRC, the Agreement State should be prepared to terminate the specific license or amend the license to remove the remediated or unaffected portion from it, if the license is being partially terminated.

In some cases, the NRC staff will conditionally concur on the Agreement State's CRR, typically to ensure that all necessary land transfer activities have been accomplished. The Agreement State staff should ensure that the license remains in effect until full concurrence is obtained from the NRC.

NOTE TO READER

The purpose of this sample CRR is to generally show the expected level of detailed information in a variety of technical areas which should be provided in the CRR. Every site is unique and no single site, or any existing documentation, could serve as a complete template for all aspects of site closure, since each conventional uranium milling site is likely to have its own site-specific conditions. To cover as many aspects of license termination activities as possible, the sample CRR is a composite of examples from a number of existing documents. Stakeholders' comments and input have also been considered and are reflected in the sample CRR.

The sample CRR provides neither a complete list of all applicable standards and requirements that need to be addressed nor complete boiler-plate language to be used as bases for conclusions. Rather, it provides an example of the level of detailed information that would be expected for inclusion in the CRR.

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III. REFERENCES

Agreement State Radiation Control Program

COMPLETION REVIEW REPORT

Date:
Licensee: XXXXX
License Number: XX-XXXX-X
Facility Name: XXXXX
Location: XXXXX, State
Licensed Area Being Terminated: approximately X,XXX acres
Manager:
Technical Reviewers: [John Smith, M.S.,P.E. (Hydrologic Engineer)]

I. SUMMARY

The ABC Company's XYZ site is a conventional uranium milling and tailings site which has been decommissioned and reclaimed under XXX State Department of Health (XDOH) Agreement State authority, derived from Title II of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). UMTRCA requires that prior to termination of the license, the U.S. Nuclear Regulatory Commission (NRC) shall make a determination that the licensee has complied with all applicable standards and requirements. Under the Agreement State program, the State of XXX is responsible for approval of the remediation plans for the XYZ site and for site inspections to ensure that the actual remedial actions have been completed pursuant to the approved plans.

This report documents XDOH's basis for its conclusion that decommissioning, and reclamation have been acceptably completed at the XYZ site. The NRC NMSS Procedure SA-900 entitled, "Termination of Uranium Milling Licenses in Agreement States," was used to prepare this report.

The applicable standards for uranium mill reclamation are Chapter XXX-XXX XAC (State Administrative Code), entitled [Radiation Protection-Uranium and/or Thorium Milling]. This State regulation is consistent with and compatible with NRC regulations, as required by the State's Agreement State status with the NRC.

All applicable standards and requirements, with appropriate references to related sections of the CRR, are identified in Table B-1. [Note to Reader: Table B-1 in this sample CRR does not contain a complete list of all applicable standards and requirements.] XDOH has performed a complete review of the XYZ site for compliance with all applicable standards and requirements. As part of that review, XDOH has prepared a Technical Evaluation Report (TER) (reference) or other technical reviews (reference(s)) to document the State's review. The TER or other technical reviews may provide reference to more detailed evaluations by the State and to ABC's documents submitted for State review during the site's reclamation period. XDOH's reviews of licensee submittals were conducted by using guidance document(s) [NRC NUREG-1620 or equivalent, etc.]

Table B-1 Applicable Standards and Requirements* Related to Topics Discussed in the CRR

Applicable Standards / Requirements			CRR Sections	TER Sections**
10 CFR Part 40 Appendix A or equivalent State Regulations	1.	tailings isolation	Section 2.1	Section X.XX
	4.			
	(a)	erosion potential	Section 2.3	Section X.XX
	(b)	wind protection	Section 2.3	Section X.XX
	(c)	flatness of slopes	Section 2.1.1	Section X.XX
	(d)	self-sustaining vegetative cover or rock cover	Section 2.3	Section X.XX
	(e)	seismic design	Section 2.1.3	Section X.XX
	5.	groundwater cleanup criteria	Section 4.1	Section X.XX
	6.			
	(2)	radon flux	Sections 2.4-2.5	Section X.XX
	(4)	radon measurements and limit	Section 2.4.1	Section X.XX
	(6)	radiation cleanup and control	Sections 3.1-3.2	Section X.XX
	(7)	closure and post-closure impacts	Sections 4.1-4.3	Section X.XX
	13.	groundwater cleanup criteria	Sections 4.1-4.3	Section X.XX
Other applicable standards and requirements				

*As defined in Section V.C. of the NMSS Procedure SA-900 issued on [Month Day, Year].
**Sections in TERs or equivalent reference documents.

XDOH concludes that the specific criteria of 10 CFR Part 40 Appendix A (or State equivalent regulations) are met as follows:

Criterion 1. Tailings Isolation

Erosion, disturbance, and dispersion are minimized.

The contaminated tailings will be protected from flooding and erosion by an engineered rock riprap layer. The riprap has been designed in accordance with the applicable guidance (reference). XDOH staff considers that erosion protection that meets that guidance will provide adequate protection against erosion and dispersion by natural forces over the long-term. As discussed in the CRR Section 2.1 (Table B-1), adequate protection is provided by (1) selection of proper rainfall and flooding events; (2) selection of appropriate parameters for determining flood discharges; (3) computation of flood discharges using appropriate and/or conservative methods; (4) computation of appropriate flood levels and flood forces associated with the design discharge; (5) use of appropriate methods for determining erosion protection needed to resist the forces produced by the design discharge; (6) selection of a rock type for the riprap layer that will be durable and capable of providing the necessary erosion protection for a long period of time; and (7) placement of a riprap layer in accordance with accepted engineering practice and in accordance with appropriate testing and quality assurance controls.

As discussed in the CRR Sections 2.1 and 2.3 (Table B-1), XDOH staff considers that the riprap layers will not require active maintenance over the 1000-year design life, for the following reasons: (1) the riprap has been designed to protect the tailings from rainfall and flooding events which have very low probabilities of occurrence over a 1000-year period, resulting in no damage to the layers from those rare events; (2) the rock for the riprap layers is designed to be durable and is not expected to deteriorate significantly over the 1000-year design life; and (3) during construction, the rock layers have been placed in accordance with appropriate engineering and testing practices, minimizing the potential for damage, dispersion, and segregation of the rock.

Criterion 4.

(a) erosion potential

The site is located in an area that is flooded by off-site floods from XXXX (area). However, as discussed in the CRR Section 2.3 (Table B-1), the site is protected from direct on-site precipitation and flooding by engineered riprap layers for the top and side slopes; the tailings disposal cell will need this protection regardless of where it is located. The riprap for the side slopes and drainage ditches is large enough to resist flooding from the minimal flow velocities of floods occurring from a probable maximum flood (PMF) on the XXXX (area). A large rock apron has been provided to provide protection against the potential migration of the XXXX (area). XDOH therefore concludes that the erosion potential at the site has been acceptably minimized, since any flooding at the site is mitigated by the erosion protection, and the forces associated with off-site floods are minimal.

(b) wind protection

XDOH staff considers that the site is adequately protected from wind erosion by the placement of an engineered riprap layer that protects the tailings from surface water erosion. Studies (reference) have shown that the engineered riprap layer designed to protect against water erosion is capable of providing adequate protection against wind erosion.

(c) flatness of slopes

The relatively flat top and side slopes of the covers is protected from erosion by an engineered riprap layer which has been designed to provide long-term stability (see the CRR Section 2.1.1 (Table B-1)).

The erosion potential of the covers is minimized by designing the rock to be sufficiently large to resist flooding and erosion, based on the slope selected. Thus, XDOH concludes that the slopes, with their corresponding rock designs, are sufficiently flat to meet this Criterion.

(d) self-sustaining vegetative cover or rock cover

See discussions under Criterion 1 regarding erosion, disturbance, and dispersion for the type of information which should be included.

Other criteria

[insert similar summary information for other criteria]

In conclusion, XDOH believes that the ABC's XYZ site has met all applicable standards and requirements. With a determination by NRC, as required by Section 274c.(4) of the Act, that all applicable standards and requirements have been met, the Radioactive Material License, XX-XXXX-X, may be terminated.

II. DOCUMENTATION OF BASES FOR CONCLUSION

Following are XDOH's review results for items specified in the NMSS Procedure SA-900 Termination of Uranium Milling Licenses in Agreement States

1. A brief description of licensee's activities associated with decommissioning, tailings remediation, and groundwater cleanup, if necessary.

ABC completed construction of the mill in [year], and it was operated until [year]. Nominal milling capacity was X,XXX tons of ore per day, with an average design ore grade of 0.XXX percent U_3O_8. ABC received ore and processed it from [insert sources of ore or materials for reprocessing]. Approximately XX.X million tons of tailings were placed in the impoundment from milling operations. The estimated radium-226 activity in the impoundment is XXX curies, and Th-230 activity is estimated at XXX curies (reference).

Mill decommissioning activities began in [year] and were completed in [year]. Approximately XXX,XXX cubic yards (yd^3) of contaminated mill site soils, building equipment, and debris were excavated from the XYZ processing site and hauled approximately XXX miles for placement in the synthetically lined area of the tailings impoundment (reference). Other materials disposed of in the impoundment include [insert direct disposed materials from off-site sources] with estimated radium-226 activities of XXX curies, total uranium activity of XXX curies, and Th-230 activities of XXX curies.

[Impoundments that exist on-site as opposed to a new cell should describe dewatering and other pre-capping activities.]

The mill site was characterized using a combination of scans for gamma radiation and analyses of surface soils, and borehole logging and soils analyses for subsurface deposits. Areas with contamination found to exceed applicable standards and requirements were excavated. Contaminated materials were disposed in the [lined] tailings impoundment or repositories (reference). The site cleanup was monitored and a Final Status Survey was conducted following guidance in [NUREG 1575 (MARSSIM)].

Once filled, the impoundment was covered with XX.X feet of site borrow soils, and re-vegetated. A diversion channel was constructed around three upgradient sides of the impoundment. A rock-armored swale outlet for the impoundment cover watershed was installed. All impoundment and margin areas have been covered with either rock armor (riprap) or re-vegetated to provide structural stability (reference).

A Monitoring and Stabilization Plan, in effect during and after reclamation construction in [year], has been evaluating site performance. XDOH staff inspections and reviews of monitoring data and analytical justifications provided by ABC indicate that the site has reached a stable condition.

When all regulatory requirements are completed, the XYZ site will be transferred to XXX (custodial agency) responsibility. The site reclamation fund, held by XXX, will be terminated and the long-term surveillance and control surety fund, held by XDOH, will be transferred to XXX.

2. Documentation that the completed surface remedial actions were performed in accordance with applicable standards and requirements.

Surface remedial actions include the topics of geotechnical stability, and surface water hydrology and erosion protection.

2.1 GEOTECHNICAL STABILITY

2.1.1 Introduction

This section presents the results of the XDOH's review of the geotechnical engineering aspects of the closure action proposed at ABC's XYZ site. The closure action consists of the consolidation of all contaminated materials from the processing site to the adjacent tailings pile near [City, State]. The final disposal cell is an above-grade stabilized-in-place embankment extending to a maximum height of XXX feet above the prevailing surface grade. Contaminated material and mill debris were added to the disposal cell. The cell was recontoured, and is covered with a X-foot-thick minimum sand cover, plus filter layer and rock armor on the embankment; a XX-inch-thick multiple layer cover plus rock armor over coarse tailings; and a XX-inch-thick multiple layer cover plus rock armor over at least XX feet of regraded coarse tailings over the fine tailings portions of the embankment (reference).

The geotechnical engineering aspects reviewed include: (1) information related to the disposal and borrow sites; (2) materials associated with the closure action, including the foundation and excavation materials, tailings, and other contaminated materials; and (3) design and construction details related to the disposal site, disposal cell, and its cover.

2.1.2 Site Description

The XXX-acre impoundment is adjacent to the former XXX mill, about XXX miles northwest of the town of [City, State]. The site is located within the [local area] and is drained by the XXXX River. The uranium mill tailings were placed in a single pile consisting of approximately XXX million tons. The XXX-acre pile forms a deposit with a maximum height of XXX feet. ABC has covered the sides of the pile with an interim soil cover of variable thickness. As the water in the pond atop the tailings has evaporated, additional interim cover has been placed on portions of the top of the pile, working from the edges inward toward the center.

The former mill area is XXX acres in size and contained building foundations and abandoned mill structures which had been partially demolished. Additional contaminated soil lay outside the confines of the tailings pile. The contaminated soil and building rubble generated from the mill demolition were added to the disposal cell.

2.1.3 Disposal Cell Area

Several subsurface investigations have been performed at the XYZ site in order to characterize the tailings and contaminated materials for geotechnical engineering and radiological aspects of the closure. Drawings in the [Month Year], XXXX report (reference) illustrate the original test boring and test pit locations. Logs of soil borings and test pits were provided in the ABC's earlier submittals (reference). In [Month] of [Year], additional test pits were excavated within the confines of the mill and the tailings embankment. The [year] test pit logs are reported in Appendix X of the [Month Day, year] submittal (reference).

2.1.4 Borrow Areas

Radon barrier clay soils from the XXXX area were evaluated by [reference]. The XXXX borrow area is located about XX miles [west] of the tailings pile. In [year], XX exploratory test pits were excavated in the XXXX area. Sandy soil for the radon barrier was obtained from material excavated during the reconfiguration of XXXX area (reference). In addition to the sampling associated with the reconfiguration of XXXX area, three additional samples were taken from the borrow area.

2.1.5 Geotechnical Investigation Conclusions

XDOH staff has reviewed the subsurface exploration discussed above. XDOH concludes that the geotechnical investigations conducted at the processing, disposal, and borrow sites satisfactorily establish the stratigraphy, that the explorations are in general conformance with applicable provisions of Chapter X of the SRP (reference), and that they are adequate to support the assessment of the geotechnical stability of the stabilized tailings and contaminated material in the disposal cell. Additional in-situ testing was performed to confirm the stratification and strength parameters of the tailings and to confirm the settlement analysis.

2.1.6 Testing Program

Geotechnical engineering characteristics and strength parameters for the tailings, contaminated soil, and natural soils have been determined by ABC, through laboratory analysis of samples from the investigations. Early laboratory testing by [reference], and later testing by [reference], included moisture-density (Proctor) determinations, gradation analyses, specific gravity, saturated hydraulic conductivity determinations, Atterberg Limits, capillary moisture, one-dimensional consolidation, static triaxial, and cyclic triaxial compression. XDOH has reviewed the geotechnical engineering testing program for the XYZ site and concludes that the tests identified above were conducted on representative materials.

ABC's laboratory testing of the XXXX (area) borrow material included gradation, Atterberg Limits, moisture-density determination, specific gravity, saturated hydraulic conductivity, capillary moisture relationships, dispersive tendencies, diffusion coefficient, and triaxial shear strength.

Within the XXXX area, one composite sample was made from the "affected" (contaminated) sandy soils. A second sample was made from "clean". The composite samples were then split into three subsamples and were redivided for geotechnical and radiological sampling.

Laboratory testing by ABC included gradation, Atterberg Limits, moisture-density relationships, specific gravity, diffusion coefficient, and (for the "affected" soils) radium activity and emanation coefficient determination. Three composite samples from [west] of the tailings pile area were tested for gradation, Atterberg Limits, moisture-density relationships, specific gravity, diffusion coefficient, and capillary moisture relationship.

Cover materials were evaluated for durability. Testing included Los Angeles Abrasion, sulfate soundness, absorption, specific gravity, Schmidt Hammer, and Brazilian disk tensile tests. Petrographic analyses were also conducted.

On the basis of the field exploration and laboratory testing programs, ABC concluded that the borrow sites contain suitable quantities of material acceptable for the radon barrier. Testing indicated the soils are non-dispersive.

Based on the review, XDOH staff found that the number and type of tests conducted in the testing program were appropriate for the support of the engineering analyses performed and that the scope of the testing program and the utilization of the test results to define the material properties are in general agreement with the applicable provisions of the guidance document (reference).

2.1.7 Slope Stability

The evaluation of the geotechnical stability of the slopes of the disposal cell containing stabilized tailings and other contaminated materials is presented in this section. XDOH has reviewed the exploration data, test results, slope characteristics, and methods of analyses pertinent to the slope stability aspects of the reclamation plan. The analyzed cross-sections with [10] horizontal to [3] vertical side slopes have been compared with the exploratory records and design details. XDOH found that the characteristics of the slopes have been satisfactorily represented and that the most critical slope sections have been considered for stability analyses.

Soil parameters for the various materials in the disposal cell slope have been adequately established by appropriate testing of representative materials. Soil parameter values have been assigned to other layers (riprap, gravel bedding, bedrock, etc.) by ABC, on the basis of data obtained from geotechnical explorations at the site and data published in the literature. XDOH found that the determinations of these parameters for slope stability evaluation follow conventional geotechnical engineering practice and are also in compliance with the applicable provisions of the guidance document (reference). XDOH also found that an appropriate method of stability analysis (XXXX method) has been employed by ABC to address the likely extreme adverse conditions to which the slope might be subjected for the static case.

Factors of safety against failure of the slope for static and seismic loading conditions have been determined by ABC for both short-term (end of construction) and long-term states. Factors of safety for the static loading conditions were calculated by ABC to be X.X (short- and long-term) which are in excess of minimum required values of X.X and X.X, respectively.

The seismic stability of the proposed slopes was investigated by ABC using the pseudo-static method of analysis, with horizontal seismic coefficients of X.XXg for both the end-of-construction and the long-term cases. The value of the seismic coefficient was consistent with the design ground acceleration value used for the nearby XXXX site. In actuality, a horizontal seismic coefficient equal to X.XX times the maximum ground acceleration, or X.XXg, would be used in a long-term pseudo-static evaluation. As a further exercise, ABC arbitrarily increased the horizontal seismic coefficient in order to determine the value which would imply impending failure. The coefficient which resulted in a factor of safety of unity, implying impending failure, was X.XXg.

Subsequently, ABC performed deterministic and probabilistic ground motion evaluations in [Month Year] (reference). XXXX determined that a peak horizontal acceleration of X.XXg, which represents an event with a mean return period of 10,000 years, was an appropriate value for design (see Section XXX). Since ABC's earlier analysis was based on a peak horizontal

acceleration in excess of X.XXg, and stable conditions were confirmed, the conservativeness of the seismic design with respect to slope stability was substantiated.

Based on review of these analyses and the results, XDOH concludes that the slopes of the disposal cell are designed to endure the effects of the geologic processes and events, including resistance to earthquake and settlement, to which they may reasonably be subjected during the design life and that the analyses have been made in a manner consistent with the guidance document (reference).

2.1.8 Credible Faults

XDOH evaluated potential earthquake sources (such as capable faults) and earthquake hazards for the site. XDOH's determination that the impoundment has not been placed near a capable fault is based upon review and acceptance of geologic information from literature sources, personal communication with personnel at the State Geological Survey, XDOH review of field mapping of the site by ABC's contractor, XDOH review of subsurface geophysical surveys surrounding the tailings impoundment by ABC's contractor, and XDOH personnel conducting independent field evaluations of the structural geology at the site. Historical seismic activity was also reviewed by XDOH.

XDOH review of regional geologic literature has found no evidence of local faulting in the Pleistocene age glacio-fluvial deposits, or in the Miocene age Basalt Member of the River Basalt Group, at least 14.5 million years before present (reference). The U.S. Geological Survey (USGS) Open-File Report 91-441-0, Known or Suspected Faults with Quaternary Displacement in the Pacific Northwest, was also reviewed (reference). Staff at the State Geological Survey was also consulted for information related to faults in the area during XDOH's assessment of ABC's closure plan. XDOH review of Quaternary faults has concluded that the nearest capable fault is in the XXXX area, approximately XXX miles to the northwest.

Detailed geologic mapping at the ABC's XYZ site performed by XXXX found no evidence of faulting in the Pleistocene glacio-fluvial deposits or Miocene age River basalts, XX.X million years before present (reference). Geologic field evaluations at the ABC site by XDOH staff also found no evidence of faults in the glacio-fluvial deposits, XXX River basalts, or Tertiary aged clays found near the tailings impoundment. The layers in the unconsolidated sediments may generally be described as flat lying over structures that have been observed in the older granitic rocks of Cretaceous age. Therefore, the literature review and field mapping indicate that the fracturing and faulting in the Cretaceous rocks are a result of pre-Miocene deformation occurring at least XX.X million years before present.

Two geophysical seismic surveys were conducted for the subsurface around the tailings impoundment by a ABC contractor (reference). XDOH staff independently reviewed the information provided in the XXXX reports and determined that there is no evidence presented in these reports of a capable fault at depth.

Historic seismic data have been reviewed by XDOH and State's Dam safety program. Some of the historic seismic data reviewed are presented in reports prepared for ABC (reference), the XXXX Final Environmental Impact Statement for the ABC site (reference), and the initial engineering report (reference). There are no historic seismic data that suggest large-magnitude earthquakes near the ABC site. Recent earthquake analyses performed by XXXXX have indicated that there have been five low-magnitude events within XX km of the ABC site.

However, XXXX's probabilistic seismic assessment analysis has determined that these low-magnitude seismic events are not significant with respect to stability of the site (reference).

In summary: (1) faults that have been identified and mapped in and near the site to a distance of 100 miles have not moved once in the last 35,000 years, or twice or more in the last 500,000 years, do not have macro seismicity associated with them, nor are they associated with capable faults such as the XXXX fault; and (2) no historic earthquakes have originated near the site that by magnitude, alignment, or magnitude-distance relationship to the site indicate a buried capable fault source, or any other earthquake source, that should be considered explicitly in the seismic design basis assessment for the site. XDOH evaluated low-magnitude seismic events that appear approximately Xxxx km northeast of the site by reviewing geologic maps for the area and personal communication with XXXX State's seismic experts at the State Geological Survey. Based upon XDOH review conducted in the fall of XXXX, XDOH concludes that these low-magnitude seismic events are not associated with earthquakes along the trace of a capable fault, and the data indicate that these events appear to be the result of mine blasts.

2.1.9 Seismic Evaluation

According to 10 CFR 40, Appendix A (or equivalent State regulations), the impoundment may not be located near a capable fault that could cause a maximum credible earthquake larger than that which the impoundment could reasonably be expected to withstand. As used in this Criterion, the term "capable fault" has the same meaning as defined in Section III (g) of Appendix A of 10 CFR Part 100. The term "maximum credible earthquake" means that earthquake which would cause the maximum vibratory ground motion based upon an evaluation of earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material. The guidance document (reference) describes the methodologies that may be used to conduct this evaluation. Details of the review for XYZ site were presented in the TER (reference).

A review was conducted of all recorded earthquakes in [name the tectonic province in which the site is located] and in other tectonic provinces within XXX miles of the site. The review contained the date of occurrence of the earthquake, its magnitude, and the location of the epicenter.

Data were obtained by [e.g., standard photo geologic analysis] and field reconnaissance of the study area and from review of the pertinent literature (references). Information in the form of maps, papers, or other, specific to the area or region, generated by State and Federal agencies or published in the literature were reviewed (references). [Insert conclusions]

Where possible, an association of epicenters or locations of highest intensity of historic earthquakes with tectonic structures was conducted. Epicenters or locations of highest intensity that were not reasonably identified with tectonic structures were identified with tectonic provinces. Maps on which the locations of epicenters of historic earthquakes associated tectonic structures, and tectonic provinces were produced and presented in the TER (references). [Insert conclusions].

In addition to the historical review, the proposed maximum earthquakes associated with [each tectonic province or capable fault or structure] were determined and deterministic and/or probabilistic seismic hazard analyses were conducted.

Seismic design ground motion (PHA)

Capability was determined by [suitable methods, such as those outlined by (reference). For each maximum magnitude earthquake, the PHA at the site was determined using [an accepted attenuation relationship between earthquake magnitude and distance] (reference). The PHA value adopted for each capable fault or tectonic source was no less than the median value provided by the attenuation relationship. Possible soil amplification effects were considered (reference).

To assess potential ground motion at the site from earthquakes not associated with known tectonic structures (i.e., random or floating earthquakes), the largest floating earthquake reasonably expected within [the tectonic province] was identified. [insert site-specific results]. In addition, the largest floating earthquakes characteristic of [any adjacent tectonic provinces] was also identified, since such earthquakes may cause appreciable ground motion at the site [insert site-specific results]. XX miles was used as the site-to-source distance for floating earthquakes within [the host tectonic province]. (For floating earthquakes in other tectonic provinces, the distance between the site and the closest approach of the province boundary was used as the site-to-source distance). The PHA for the site was therefore the maximum value of the PHAs determined for earthquakes from all capable faults, tectonic sources, and tectonic provinces. In summary, ABC has presented information and used acceptable methods of investigations that support its conclusions about the seismic characterization of the site and the seismic design value. Information presented includes descriptions of historical earthquakes, locations of their epicenters, an analysis of the seismic hazard at the site, and the design considered a deterministic and/or a probabilistic PHA [PSHA]. The information presented is sufficient to support an analysis of the geotechnical stability.

2.1.10 Settlement and Cover Cracking

Long-term settlement of materials in the disposal cell, which could result in either local depressions or cracks on top of the cover, was addressed by ABC in XXXX's report of [Month Day, Year]. A proposed settlement monitoring program was provided. Settlement monuments have been installed directly on the tailings prior to the initiation of regrading activities. Construction equipment is required to maintain a minimum distance of XXXX feet from all monuments.

The monuments were surveyed for vertical displacement on a daily basis for the first XXX weeks of initial fill placement, weekly for the following XXX months, and then monthly for the final 2 months. After ABC had concluded that XX percent of the consolidation settlement was complete, and with XDOH's concurrence, final soil cover placement operations began.

Settlement monuments were located in areas where consolidation is expected to be the greatest, including areas believed to have maximum thicknesses of fine tailings. Such an arrangement assures that differential settlement would not adversely affect the integrity of the cover. Additionally, the final soil cover was spread and compacted in a uniform manner to minimize the effects of settlement due to the weight of the final soil cover materials. ABC concluded that XX percent of the primary consolidation should take XX years, based on the fact that there has been no disposal of tailings since XXXX and that the pumping program conducted at the site has accelerated the dewatering process.

In addition, ABC conducted an exploration program within the embankment using XXXX methods. The in-situ data were evaluated along with settlement records to confirm the

conclusion that XX percent of the expected settlement has occurred. The in-situ test results were also used to assess the potential for cover cracking. XDOH found that the settlement monitoring program is sufficient to satisfy applicable portions of Criteria 1, 6, and 12, of 10 CFR Part 40, Appendix A, regarding reclamation design to control radiological hazards for the design life without active maintenance after reclamation is complete.

2.1.11 Liquefaction Potential

The liquefaction potential for the XYZ site was initially evaluated for ABC by [reference]. XXXX evaluated the liquefaction potential based on empirical techniques and on the basis of a laboratory evaluation. Minimum factors of safety of X.XX (empirical) and X.XX (laboratory) were derived in the [reference] study. Based on the similarity in results, and considering minimum acceptable safety factors of X.X, XXXX concluded that no major problem related to liquefaction would occur during the postulated seismic event, which they considered to be a magnitude X event with a hypocentral distance of approximately XX km and a maximum ground acceleration of X.XXg.

An understanding of seismic hazards and the liquefaction process has improved since [year]. Based on more recent interpretations of potential seismic events, and in accordance with a [Month Day, Year] request from the XDOH, ABC re-evaluated the liquefaction potential for the site [reference]. Liquefaction potential was re-evaluated using standard penetration test values, soil gradation, and sample descriptions from previous analyses with updated empirical relationships. The potential induced stresses were estimated from simplified procedures using field-based methods.

Liquefaction susceptibility can be estimated by either of two approaches. The first method correlates resistance with standard penetration test (SPT) blowcounts, measured in-situ. The second method relies on laboratory measurements of dynamic tests that strain soil samples in repeated cycles of motion until liquefaction is induced. [Reference] stated that the field-based method is the preferred analytical procedure.

By using methods detailed in [reference], the in-situ liquefaction resistance was computed. In the [reference] analysis, corrected SPT values are normalized and correlated with the cyclic stress ratio required to trigger liquefaction, in observational data. The field cyclic stress ratio is thus obtained from curves dependent on the normalized blowcounts and soil fines content. For a calculated factor of safety less than X.X, failure is assumed to occur. For a factor of safety between X.X and X.X, liquefaction is not assumed to occur, but the soils may suffer some strength loss.

[Reference] showed that very few sample points indicate susceptibility to liquefaction, and that isolated incidences of liquefaction, if it were to occur, would be deep within the embankment. ABC determined that liquefaction of the tailings and underlying soils is unlikely to occur, and that there is no threat to the stability of the embankment.

Based on a review of the analysis presented by ABC [reference], XDOH concludes that there is adequate assurance of safety with respect to liquefaction damage.

2.1.12 Cover Design

ABC has used three different embankment cover sections, depending on location:

(1) The final cover profile for the embankment consists of X feet (minimum) of sandy soil above the regraded coarse tailings. The sandy soil is capped by a filter layer and rock armor of variable thickness.

(2) The cover profile over coarse tailings consists of:

X inches (minimum) of low-grade ore from the mill area;
XX inches (minimum) of affected soil;
X inches (minimum) of compacted clay; and
X inches of sandy soil.

The coarse tailings areas are covered with rock armor of variable thickness.

(3) The cover profile over fine tailings includes:

X feet (minimum) of regraded coarse tailings;
XX inches (minimum) of affected soil;
XX inches (minimum) of compacted clay; and
X inches (minimum) of sandy soil.

The sandy soil is covered with rock armor of variable thickness.

The cover system described above provides a minimum of XX inches of cover above tailings on the top and sides of the cell. The system has been designed to limit the infiltration of precipitation, protect the pile from erosion, and to control the release of radon from the tailings below.

Tests on the compacted clay from XXXX indicate that hydraulic conductivities are near Xxxx cm/sec at placement conditions. In addition, the physical shape and surface grading of the reclaimed tailings embankment effectively remove surface water resulting from precipitation which falls on the area. The relatively low permeability of the cover materials and the low annual rainfall with high evaporation rate prevent significant tailings recharge.

ABC has evaluated the potential for frost penetration using the [BERGGREN.BAS] computer code developed at the [U.S. Army Corps of Engineers (reference)]. The code has been used on several other uranium mill tailings remediation projects. In order to evaluate the potential for frost penetration, temperature data including the freezing index, mean annual air temperature, length of freezing season, and geotechnical parameters are considered. The model calculates the heat capacity, thermal conductivity, and latent heat of fusion for the soil layers unless these data are entered manually.

Values used in the computer analysis included the mean and worst-case situations based on the available XX years of weather records. In the worst-case scenario, ABC determined that the depth of frost penetration would be XX.X inches. By thickening the sand layer to X inches, and in conjunction with the exterior rock armor, the potential for frost penetration into the clay layer is eliminated, and the cover integrity should not be significantly affected.

XDOH has reviewed the input data used in determining the total frost penetration depth and concludes that these values are a reasonable representation of the extreme site conditions to be expected. Therefore, ABC's evaluation of the frost penetration depth is acceptable to XDOH.

XDOH has evaluated the cover design for geotechnical long-term stability and concludes that the design is acceptable.

2.1.13 Subsidence

ABC presented an analysis [reference] to show that a worst-case scenario of subsidence would not adversely affect the stabilized tailings. The (reference) approach was based on a simplified procedure by [reference] and considered instantaneous subsidence of XX-meter(s) and, for added conservatism, of XX meter(s).

The modified XXXX procedure was developed from finite element analyses and physical models for propagation of earthquake fault ruptures in the bedrock beneath cohesive soil deposits. The analytical and physical model results were also compared with case histories of earthquake fault rupture propagation through soil, such as those described by [reference]. XDOH considers ABC's approach to be conservative for evaluating the surface deformation associated with vertical subsidence caused by salt dissolution because it assumes the deformation to be instantaneous and concentrated within a single narrow zone rather than being incremental and more distributed, as would be expected for salt dissolution subsidence.

ABC's analysis [reference], using the simplified fault rupture propagation model of [reference], indicates that the thickness of alluvium and tailings is greater than the distance of propagation for XX- and XX-meter bedrock offsets. Thus, differential displacements of bedrock, resulting from salt dissolution subsidence under the tailings pile, would not be expected to propagate to the surface and impair the function of the clay cap and radon barrier. XDOH concludes that the analysis was conservative for the reasons discussed above. XDOH therefore concludes that the licensee provided adequate assurance that the potential for differential offsets reaching the surface of the pile as a result of salt dissolution over the next 1,000 years is negligible.

2.1.14 Construction Methods and Features

XDOH has reviewed design text, tables, and drawings in the technical specifications submitted by ABC (reference). The text discusses the investigations and testing which formed the basis of the design and specifications. Additionally, the text discusses the design concept in detail. The text is supported by tables which summarize design parameters and figures which clearly show plans, profiles, and details of the proposed remedial action.

In summary, the side slopes were re-contoured to a [10]H to [3]V proportion. Mill debris has been buried systematically at the toe of the slope. A permanent layered cover provides protection from excessive radon emanation and permits rainfall to drain away satisfactorily.

XDOH has reviewed and evaluated the geotechnical construction criteria provided in the reclamation plan. Based on this review, XDOH concludes that the plans and drawings clearly convey the proposed closure action design features. In addition, the excavation and placement methods and specifications are consistent with accepted standard practice and the guidance document (reference).

2.1.15 Testing and Inspection

XDOH has reviewed drawings and technical specifications submitted by ABC (reference). The technical specifications discuss testing methods and quality control procedures applicable to the remedial work. Appropriate reference is made to the American Society of Testing and Materials

[ASTM] methods which will govern the placement and testing of soil and rock materials. Based on XDOH's review, the plan is found to provide a program for testing and inspection that is generally consistent with the XXXX guidance document (reference).

2.1.16 Conclusion

Based on the review of the geotechnical engineering aspects of the design of the ABC closure action as presented in the reclamation plan, XDOH concludes that the embankment and proposed borrow soils have been adequately characterized. Furthermore, the cover system appears to be adequately designed to resist the effects of freezing conditions which can reasonably be expected. XDOH concludes that the slopes of the disposal cell are designed to endure the effects of the geologic processes and events, including resistance to earthquake and settlement, to which they may reasonably be subjected during the design life and that the analyses have been made in a manner consistent with the guidance document (reference). XDOH concludes that there is adequate assurance of safety with respect to liquefaction potential. In conclusion, the XDOH's review of geotechnical stability has found the XYZ site to be in conformance with regulatory requirements of criteria X, X, X, X, and X in 10 CFR Part 40 Appendix A (or equivalent State regulations).

2.2 SURFACE WATER HYDROLOGY AND EROSION PROTECTION

The constructed reclamation site is robust by design, and includes a thick, vegetated cover design of site soils surrounded by a large surface water diversion channel over X,XXX feet long. The tailings impoundment is situated in a relatively small watershed area (about XXX acres), which limits surface water flow potential. The small catchment area inside the diversion channel is less than XXX acres. The reclamation site is expected to return to a wildlife and forestry land use, similar to the surrounding area, which shows few erosional impacts.

Embankment dam (XX%), margins (XX to XX%), cover (X.XX%), and diversion channel (X.XX to X.XX%) slopes are relatively flat. Erosion protection studies have been performed on these topographic features. Some areas required stabilization by rock (riprap), some by vegetation, and some are naturally stable.

2.2.1 Flood Flow

The primary criteria used to evaluate erosion protection are a determination of long-term erosional stability using Criterion 6 (reference), which requires site stability for 1,000 years. [NRC guidance] was used to develop a conservative design basis. A probable maximum precipitation event was selected and found to be a X-hour storm of XX.X inches, peaking at mid-storm at XX inches per hour (reference). PMF surface water flow rates were determined, based on the worst-case precipitation event, surface flow characteristics (elevations and contours, surface roughness and vegetation) at the site, and antecedent soil moisture (near-saturated or frozen ground), using the [XXX computer program]. The XXXX method was used to verify surface water flow rates on the cover.

XDOH reviewed and independently verified ABC's flood flow estimates. The [reference] method was used to determine that vegetation is not necessary for erosion protection (reference). The margin areas were found to require XX% vegetal coverage for long-term erosional stability, based on a PMF event. Short-term erosion protection requirements were also determined and require XX% vegetal cover, based on a 10,000-year storm (reference). The Monitoring and Stabilization Plan was used to verify vegetation productivity performance after reclamation

construction was completed. The XX% short-term requirement was met in [year], and the trend line for performance since reclamation construction in [year] predicts performance in the XX% range by the [summer] of [year] (reference).

PMF flow rates were determined for the diversion channel to be XXXX cfs (cubic feet per second), and for the swale outlet from the impoundment surface area to be XXX cfs. These worst-case flood flow rates were used to determine channel cross-sections and to size the riprap (reference). Diversion channel cross-sections were designed for both the minimum flow resistance, large velocity case, and for the high resistance, low velocity case. Rock protection is required for the first case with a smaller channel cross-section. Long-term performance requires limited rock protection but a larger cross-section channel.

Using these two cases, the diversion channel was designed for a large cross-section, but with rock placed only in the lower portion consistent with the smaller cross-section (reference). Rock and filter sizing were performed using the XXXX method, as recommended by [NRC guidance]. XDOH reviewed and independently verified ABC's analyses (reference). Rock sizes that were placed met, and generally exceeded the minimum rock sizing required by the analysis-based design. ABC chose to oversize the rock to limit the number of rock sizes produced and placed (reference).

2.2.2 Rock Durability and Gradation

Rock durability and gradation were evaluated during construction to meet approved construction design plans and specifications. An initial petrographic examination per [reference] was made to qualify the rock source. XDOH reviewed the report of the independent evaluation and accepted the rock source (reference). Rock samples were then tested every XX,XXX cubic yards of production for Bulk Specific Gravity and Absorption per [reference], Sodium Sulfate Soundness per [reference], Los Angeles Abrasion per [reference], and Schmidt Hammer Rebound per [reference].

Two different rock sources were used, including a local basalt borrow area and a quartz monzonite area that required blasting.

Rock durability scores, using the XXXX scoring method, averaged XX.X, with the lowest at XX and the highest at XX. XDOH reviewed rock durability test results from the independent laboratory. Rock source gradation was periodically sampled and evaluated by an independent contractor during construction. XDOH inspectors reviewed inspection records during construction and found the evaluations, methods, and records to be adequate. ABC performed a quality assurance construction performance audit program of ABC operations, contractor construction activities, and independent contractor inspections. The ABC auditor reported to corporate management and exercised independent authority, as observed by XDOH inspectors (reference).

XDOH reviewed the data from ABC's construction completion report (reference). The basalt rock source qualified and produced a small fraction of the produced rock (about X,XXX cubic yards). Rock durability test results for basalt scored XX on two tests. The quartz monzonite source qualified and produced most of the rock used during construction (about XX,XXX cubic yards). Rock durability test scores for the quartz monzonite averaged XX.X, with a standard deviation of X.X. XDOH believes that the quartz monzonite source produced uniform rock durability, based on department inspection, the consistency of the rock durability scores, and the small statistical standard deviation for the data. [NRC guidance] provides a minimum rock

durability score of XX, without oversizing. ABC oversized the rock placed by a considerable amount, on average. Oversizing of rock was by design. Rock production used a small number of screens. ABC used only X, X and XX D_{50} (median stone diameter) rock sizes. Placement sizes were greater, compared with design rock sizes developed to meet erosion protection criteria. The erosion protection criteria were also determined based on conservative criteria.

In addition to conservative methods for rock sizing and durability, the structural integrity of the site is not dependent only on rock for erosion protection. The XYZ Millsite has site-specific attributes (soil, bedrock, weather, etc.) that suggest a durable long-term forest and wildlife environment. Therefore, the rock protection placed during construction becomes less important for structural stability (erosion protection) as vegetation becomes established. The rock performance timeframe is about 1000 years (based on XXXX guidance and methods), while the forest succession timeframe is about a 100 years. This is a convenient overlap of performance features.

During reclamation plan development, ABC evaluated erosion protection requirements for the diversion channel for both the vegetated and non-vegetated conditions. For that area, rock was required in the lower section of the channel (for the non-vegetated condition), and not in the upper section of the channel (for the vegetated condition). The difference between conditions is a factor of three in velocity reduction and in channel cross-section increase once vegetation establishes. The long-term performance expectation is for a similar velocity reduction in all areas of the site after vegetation succession occurs.

2.2.3 Vegetation Cover

For the design of the top slope, ABC addressed the stability of the slope under three conditions: (1) bare soil with no vegetation; (2) normal, fair vegetation cover; and (3) poor vegetation cover. The stability of these three cover conditions was evaluated using the allowable shear stress method (reference) and the maximum allowable velocity (reference), with corrections for depth (reference). Additionally, XDOH staff independently evaluated the stability of the top slope, using very conservative assumptions. It was assumed that the vegetation was burned, deteriorated, and/or damaged to the extent that approximately XX% of its shear resistance capability had been removed (reduced from X.X pounds per square foot to X.X pounds per square foot), coincident with the occurrence of the design PMF discharge of X.X cfs. Further, an evaluation was conducted assuming a XX% reduction in shear resistance (X.X pounds per square foot), coincident with a discharge of X.X cfs (PMF with no flow concentration, or FCF) 1). Under both conditions, the proposed slope of X.XX was found to be stable. Following is a summary of calculations performed by ABC and XDOH regarding the stable slope design.

Table B-2 Summary of Calculations on Vegetation Cover Performed by ABC and XDOH

Design Method	Cover Condition	Allowable Stress (lb/ft^2)	Actual Stress (lb/ft^2)	Allowable Velocity (ft/sec)	Actual Velocity (ft/sec)	Stable Slope (ft/ft)
Allowable Shear Stress	Bare	[0.08]	[0.44]	NA		[0.0013]
	Poor	[3.0]	[0.5]			[0.012]
	Normal	[4.2]	[0.6]			[0.030]
Allowable Velocity	Bare	NA		[2.9]	[2.9]	[0.003]
	Poor			[3.8]	[3.8]	[0.01]
	Normal			[3.9]	[3.8]	[0.015]
XDOH Independent Estimate						
(FCF=3)	[90%] Lost	[0.4]	[0.4]	NA		[0.01]
(FCF=1)	[95%] Lost	[0.2]	[0.2]			[0.01]

Additionally, ABC provided further information and justification regarding the design of the vegetation cover in a report (reference) which addresses the concerns raised in XXXX (Reference). These concerns included a conclusion in the [reference] report which indicated that typical soil loss rates in this portion of the United States were so excessive that a soil cover could not be provided for a 1000-year period, based on results of the Universal Soil Loss Equation. ABC performed detailed calculations of the soil loss rates for the specific design and location chosen; these calculations indicated that the design would provide acceptable protection against sheet erosion.

2.2.4 Sedimentation

Sedimentation in the diversion channel was evaluated using the XXXX and XXXX computer programs. The analyses were performed on the PMF case, as well as several lesser flood flow cases, to determine if sedimentation would accumulate in the diversion channel over time and reduce diversion channel flow capacity. It was determined that, except for the first few years after construction, there is no likely flood flow in the channel for flood recurrence intervals less than XXX years, due to expected infiltration. For larger, low-probability flood events, sediment would likely flush out with the expected flood flow. Even without flushing, sediment accumulation predicted by the analysis was approximately X.X feet at the bottom of the diversion channel. The channel was designed so that a minimum of X foot of freeboard would be present, and included a very conservative design PMF basis, sedimentation in the channel, and re-vegetation of the channel (reference). In addition, the channel was constructed somewhat oversized to

meet the design cross-section minimum requirements, and therefore has a capacity excess from the design minimum required.

The impoundment swale outfall requires rock (riprap) erosion protection since it is designed to convey concentrated flood flow from the impoundment surface and to discharge it away from the reclamation site. This area was evaluated with the same analytical tools as the diversion channel and found to be adequate. The design was prepared by ABC and evaluated and approved by XDOH. Worst-case assumptions were used to evaluate the design, based on [NRC guidance]. Vegetation productivity on the impoundment cover has reached a self-sustaining performance level and will continue to improve over time, limiting the probability of occurrence of maximum flood flow (reference). The swale outfall is located over a large area of competent quartz monzonite of sufficient structural capacity, extent, and elevation, that limits potential erosion of cover soils from the impoundment. The swale outfall therefore protects the cover from erosion and promotes sedimentation on the shallow-sloping impoundment surface (reference).

2.2.5 Conclusion

In conclusion, XDOH's review of surface water hydrology and erosion protection has found the XYZ site to be in conformance with regulatory requirements of criteria X, X, X, X, and X in 10 CFR Part 40 Appendix A (or equivalent State regulations).

3. Documentation that the completed site decommissioning actions were performed in accordance with applicable standards and requirements.

3.1 RADIATION CLEANUP AND CONTROL

3.1.1 Introduction

Cleanup of the site was based on the approved decommissioning plan (reference) ([include license conditions or tie downs)]. The decommissioning plan was reviewed by XDOH using guidance document(s)[NRC NUREG 1620 or equivalent, etc.] The operating history of the facility was reviewed in order to ensure that all potential sources of contamination were identified. Applicable standards and requirements were identified during the development of the decommissioning plan and are outlined in Table B-1. Cleanup parameters and guidelines were appropriate and designed to demonstrate compliance. Disequilibrium (Th-230, Ra-226, U-tot) was evaluated, and cleanup criteria were established in accordance with XXX (equivalent Criteria 6(6) rule). [MARSSIM methodologies (NUREG 1575)] were applied ([or an alternate approved method]) for demonstrating cleanup. The MARSSIM process utilized the Data Quality Objectives (DQO) process such that stakeholder data requirements were identified and applied (references). Characterization of the site was performed to identify impacted areas outside the impoundment (e.g., mill buildings, haul roads, bone yards). Background was appropriately determined using reference areas representing the various media [include results]. Areas were then classified properly according to contamination potential.

3.1.2 Millsite Decommissioning

Remediation activities at the site commenced in [year] and ended in [year]. Remediation (demolition/excavation) technologies (or alternate methods) were evaluated and found to be effective. Effluent controls were in effect for air, water, and soil. Environmental monitoring was in place for all affected media. Changes from the decommissioning plan were explained and justified (reference). A total of XX structures were remediated, and approximately XXXX cubic

yards of material were placed in the impoundment, including building rubble, soils, and other permitted materials. Buildings were remediated by XX process. XX acres of the site were remediated to meet the 10 CFR Part 40 Appendix A Criteria 6(6) requirements (or equivalent State requirements). XDOH has reviewed the information as presented in the Mill Decommissioning Completion Report (reference) and the report was found acceptable.

3.1.3 Final Status Surveys

Concurrent with remediation activities, Final Status Surveys (FSS) were conducted to demonstrate cleanup to the stated goals. The FSS designs were reviewed and approved by XDOH (reference). Appropriate instrumentation was chosen for the contaminants of interest and properly calibrated. Th-230 was evaluated by correlation to Ra-226 where feasible, and through soil analysis where a correlation could not be demonstrated. Minimum detectable concentrations of survey instrumentation and other DQOs were compared to plans. The surveys consisted of a combination of gamma scans and soil samples. Borehole surveys for subsurface verification were also made. A summary of survey units, scan and sample results is presented below in Tables B-3-1 to B-3-3.

Table B-3-1 Survey unit summary

Survey Unit Classification	Number of Survey Units	Samples per Survey Unit	Area of Survey Unit, m2
I	75	18	100
II	26	10	100
III	33	varies	Varies

Table B-3-2 Summary of gamma exposure rate ranges

Analytical categories	Gamma exposure rates (mR/h)
Number of surveys	[674]
Minimum	[9]
Maximum	[1,355]
Mean	[16]

[Note: The limit for gamma exposure rate is xxx mR/h]

Table B-3-3 Summary of soil sample analyses

Analytical categories	Concentration (pCi/gm)		
	Ra-226	Th-230	U(total)
Number of soil samples	[354]	[271]	[251]
Minimum	[0.5]	[0.0]	[0.2]
Maximum	[34.3]	[35.1]	[82.4]
Mean	[2.2]	[1.7]	[7.6]

[Notes:
1. Results include background.
2. The limit for Ra-226 in value can range from XXX to XXX pCi/gm.
3. The limit for Th-230 in value can range from XXX to XXX pCi/gm.
4. The limit for U(total) in value can range from XXX to XXX pCi/gm.]

Verification and validation of the survey results combined with an assessment of the quantity and quality of the data were conducted. The data were validated to ensure that the results supported the objectives of the survey. The Final Status Survey was found acceptable.

3.1.4 Independent Verification

An independent verification survey was conducted by XXXX. Approximately XX% of the survey units were surveyed by the independent verification contractor. Results from the independent verification surveys were compared to the results of the site contractor. The results were in relative agreement, indicating that the FSS report is representative of site conditions.

3.1.5 State Oversight [insert narrative]

In addition to the independent verification, XDOH conducted XX site visits, XX inspections, collected XX samples, and conducted XX gamma surveys on XX survey units. Results of the XDOH's surveys were compared to ABC's results and are in good agreement. (references). [Insert Table with results of State analyses].

3.1.6 Conclusion

XDOH's review of radiation cleanup and control has found the XYZ site to be in conformance with regulatory requirements of criteria X, X and X in 10 CFR Part 403.1.4 Independent Verification.

An independent verification survey was conducted by XXXX. Approximately XX% of the survey units were surveyed by the independent verification contractor. Results from the independent verification surveys were compared to the results of the site contractor. The results were in relative agreement, indicating that the FSS report is representative of site conditions and consistent with 10 CFR Part 40, Appendix A (or equivalent State regulations).

3.2 RADON EMANATION

ABC designed the impoundment cover from site soils and determined that an average cover design thickness of XX.X feet was required in order to meet the regulatory limit of 20 pCi/m^{2}s found in Criterion 6 (reference). ABC used the XXXX computer code to perform this analysis. The analysis is based on the concentration of radium-226 in the tailings, and on the site-specific soil parameter values applicable to tailings impoundment cover design for radon emanation control. XDOH reviewed ABC's design and analysis reports using guidance document(s) [NRC NUREG 1620 or equivalent, etc.], verified their results, and approved the design plans and specifications. A sensitivity analysis was performed, using realistic, expected long-term soil parameters, and found that a radon-222 flux of only X.XX pCi/m^{2}s would be expected during the summer and fall when the cover soils are not expected to be saturated (reference).

A thick soil cover of at least XX.X feet thick was placed over the impounded tailings at the XYZ site. The total volume of soil moved during construction to place the cover is in excess of X million cubic yards (yd^3). The vegetated cover was designed to have long-term performance. Natural materials (vegetation, soils, and rock) have been used to prepare and construct the cover design. Actual materials used in construction had a greater proportion of fine material than required by the construction design plans and specifications. The actual thickness of the constructed cover averaged over XX.X feet from the sloped sub-grade. The sub-grade, although made up of radium-226-contaminated material, was produced by regrading the tailings to the required contour and adding additional soil from the contaminated soils cleaned up in the mill area, with clean fill to meet grade requirements. Therefore, the upper portion of the tailings had less radium-226 concentration than was used in the analysis for determining cover thickness. Altogether, the design is quite conservative, and the actual construction met the requirements of the approved design plans and specifications.

3.2.1 Radon-222 Measurements

ABC submitted a reclamation plan which provided the design of a cover system which would reduce the radon-222 flux to XX pCi/m^{2}s or less. Use of a published radon flux model (reference) with the design information provided by the licensee confirmed the radon flux reduction provided by the cover system. ABC also demonstrated that the cover system would continue to reduce radon flux for 1000 years or at least 200 years by using an environment dose assessment model (reference) to confirm that the cover system would perform adequately. After completion of the cover system, ABC made radon flux measurements using the radon flux measurement methodology in [Appendix B, Method 115, 40 CFR Part 61]. A mean radon-222 flux rate of X.XX +/- X.XX pCi/m^{2}s was measured. This measurement is well below the regulatory standard from State regulation XDC-XXX-XXX, Criterion 6 (b), and consistent with the design based on analytical evaluations.

3.2.2 Conclusion

In conclusion, the XDOH's review of radon emanation has found the XYZ site to be in conformance with regulatory requirements of criteria X, X and X in 10 CFR Part 40 Appendix A (or equivalent State regulations).

4. Documentation that the completed groundwater corrective actions, if necessary, were performed in accordance with applicable standards and requirements.

NOTE TO READER – This section provides a template for a CRR where no corrective actions were needed (groundwater protection standard was background or Maximum Contaminant Level (MCL)). For sites where an ACL is established, a note to reader follows section 4.10.

4.1 Hydrogeologic Characterization

The hydrogeology of the site was evaluated prior to construction of the tailings impoundment in [year] and again as part of the design phase of the reclamation cover [year] (reference). The hydrologic evaluation performed by ABC consisted of characterizing the physical parameters controlling groundwater occurrence, groundwater flow, and potential transport of contaminants. The physical parameters consisted of defining the geometry and structure to the subsurface strata, identifying hydraulic gradients and estimating the hydraulic conductivities of the various formations. The uppermost aquifer is a contiguous, unconsolidated coarse sand to silt found to a depth of 30 feet (reference). The hydraulic gradient underlying the impoundment is estimated at 0.01 feet per foot which flow indicated to the south-southwest. The calculated hydraulic conductivities varied between $8x10^{-4}$ and $3x10^{-3}$ centimeters per second (reference).

Results of the tailings impoundment investigations were independently reviewed by XDOH (reference). XDOH staff found that the licensee had used appropriate testing methodologies at a sufficient number of locations to properly characterized the site hydrogeology, No pumping tests were performed; however, a sufficient number of slug testing was performed to adequately define the hydraulic conductivities. XDOH found that the licensee's data are consistent with published regional geological and hydrogeologic literature. XDOH staff found that the investigations met the requirements of Criterion 5G Paragraph (2) for the characterization of the subsurface geology.

4.2 Byproduct Material Characterization

ABC provided a summary of the hazardous and general geochemical constituents of the tailings (solid byproduct material), liquid associated with the tailings (liquid byproduct material) and the likely derived seepage quality in the tailings investigation reports (reference). The hazardous constituents which could be of concern for groundwater are uranium, radium-226, radium-228, thorium-230, arsenic, nickel, and thallium (reference). ABC identified measurable activities of the radionuclides lead-210 and polonium-210 in the solid byproduct material but did not identify measurable activities in the liquid byproduct material. Furthermore, ABC estimated that the seepage would lack measurable concentrations of those radionuclides due to sorption onto the solids. The seepage is characterized by a low pH and elevated total dissolved solids, sulfate, and chloride (reference).

ABC did not perform an analysis for the entire suite of hazardous constituents as listed in Criterion 13. ABC selected the analyses for constituents reasonably to be expected in or derived from the byproduct material in their disposal area based on a review of quality data for similar byproduct material at other facilities, chemical and physical processes employed during operations, and expected reactions with the geologic materials (reference).

XDOH found that the licensee had used appropriate testing methodologies with sufficient quality control/quality assurance to quantify the quality of the solid and liquid byproduct material and potential seepage (reference). Based on the above, XDOH concludes that the licensee had met requirements of Criterion 5G Paragraph (1), Criterion 5B(2), Criterion 5B(3) and Criterion 13 for identifying the chemical and radiological characteristics of the solid and liquid byproduct material (reference).

4.3 Ore Stockpile

ABC constructed and maintained an ore stockpile area at the facility during operations (reference). The ore stockpile area consisted of a concrete pad and sump to capture surface water run-off. The ore stockpile area was constructed with a berm approximate 6 inches high along three-quarters of its perimeter to prevent surface water run-on. During operations, the ore stockpile area was routinely monitored on a weekly basis to ensure compliance with the design (reference).

Upon cessation of operations, the remnant ore was removed and the concrete pad and berms forming the ore stockpile area were properly decommissioned during reclamation (reference). Approximately XX subsurface soil samples were obtained from the vadose zone at 6 locations and various depths from under the former ore stockpile area. The soil quality from the vadose zone underlying the former ore stockpile area was consistent with the soil quality from undeveloped areas of the facility indicating no measurable impacts. Ten groundwater samples were collected from five monitoring wells installed during reclamation in and around the former ore stockpile area. The analytical results for those samples indicate no measurable impacts.

XDOH reviewed the information and concludes that appropriate steps were undertaken during operations to minimize impacts in accordance with Criterion 5H

4.4 Primary Groundwater Protection Standard

During operations, ABC constructed and operated the surface impoundment to minimize the potential for a normal or abnormal release of byproduct material to the subsurface and to maintain its structural integrity (reference). The design included the installation of a liner and a perimeter dike. The liner was constructed of a single layer of 60 mil HDPE that was installed on an appropriately prepared surface. The liner panels used for construction were overlapped by 4 inches and seamed by hot shoe fusion welding (reference). The immediately underlying strata was a 2-foot thick engineered clay with an estimated hydraulic conductivity of $1x10^{-7}$ centimeters per second. Further, ABC had installed lysimeters which were used to dewater the tailings pore water during operations as well as filtered the byproduct material to lower its water content prior to disposal within the impoundment.

ABC maintained constant surveillance of the impoundment through a rigorous daily inspection program (reference). Based on that surveillance, no erosion was noted in the perimeter dikes and no abnormal release of fluids by overfilling, surface water run-off or wind actions.

XDOH reviewed the design, construction and operation data for the impoundment system. XDOH determined that the liner was constructed of suitable material for the chemical setting and was of sufficient thickness to effectively minimize seepage from the impoundment during operations. Furthermore, the seams were welded closed using appropriate methods. Therefore, XDOH concludes that ABC's impoundment system met the requirements of Criterion 5A and Criterion 5E.

4.5 Secondary Groundwater Protection Standard (Criterion 5B(5), Paragraphs (a) and (b))

Prior to operations, ABC installed four (4) monitoring wells surrounding the footprint of the impoundment (reference). The monitoring wells were constructed of 2-inch PVC material consistent with ASTM D5092 standards. The wells had 10-foot 0.020 slot screened horizons

that straddled the water table in the uppermost aquifer. Based on the potentiometric heads, one well was located upgradient of the impoundment and three located immediately downgradient of the impoundment. After installation, the wells were properly developed to ensure proper communication with the aquifer consistent with ASTM D5521/D5521M013 standards.

The depth to water (water table) in the upper aquifer is between 12 and 17 feet below grade (reference). Based on the tailings investigation report (reference), no extensive low permeable horizon existed in the vadose zone under the impoundment which could lead to a significant perched water table.

Prior to operations, groundwater samples were collected from the monitoring wells four times for analysis of the designated suite of analytes (reference). The time between sampling events was quarterly (approximately 90 days) to ensure the collection of independent samples. The sampling procedures consisted of (1) measuring the depth to water with a calibrated tape, (2) purging a well of 3 casing volumes of water using decontaminated stainless-steel bailers, (3) using the bailers, the groundwater samples collected from the wells were poured directly into laboratory-supplied containers consistent with ASTM D6634-14 standards. The samples were properly preserved and cooled to 4°C. An aliquot was field filter for the analyses of dissolved metals. A chain-of-custody accompanied to samples during transit to a State-certified commercial laboratory. In addition to the laboratory analysis, temperature, specific conductance and pH were measured in the field by the sampling personnel at the time of sample collection (reference).

The analytical data from the four sampling events were subjected to statistical analyses for each constituent to determine the background levels (reference). The statistical method used to determine background consisted of the 95-percent Upper Confidence Level of the mean (UCL95). Several constituents had concentrations for one or more sampling events below the minimum analytical detection limit (MDL). For those constituents, the background was either assigned to the MDL or MCL, if the constituent had a MCL defined by EPA's National Drinking Water Regulations (reference).

XDOH reviewed ABC's methodology and found it properly (1) constructed the monitoring wells, (2) performed the sampling events and (3) statistically analyzed the laboratory data. The laboratory and field quality assurance/quality control were within acceptable limits validating the data. Therefore, XDOH found the proposed background met Criterion 5B(5), Paragraphs (a) and (b), and approved the background levels for this site by license condition xx on <date> (reference).

4.6 Detection and Compliance Monitoring Program

As discussed above in Section 4.5, ABC installed a network of four wells to establish the secondary groundwater protection standard. ABC designated three of the four wells that were shown to be downgradient of the impoundment as the point of compliance (POC) wells (reference). Furthermore, ABC concluded that the wells were properly screened and located to provide early time data should a release from the impoundment occur (reference). ABC then propose a groundwater monitoring program that would sample groundwater for the set of analytical parameters established during the pre-operation monitoring on a quarterly basis during operations, closure of the impoundment and through termination of the license. XDOH reviewed the proposed monitoring program procedures, and found it met the requirements of Criterion 5B(1) and Criterion 7A. Consequently, XDOH established the monitoring program through license condition XX on <date> (reference).

Data collected for the monitoring program during operations and closure of the impoundment exhibited levels that did not exceed the secondary groundwater protection standards. XDOH reviewed the data as well as conducted inspections on the field sampling techniques employed by ABC. XDOH determined that ABC had adhered to the approved and/or industry established procedures for the monitoring program and that the data are representative of the groundwater quality at the POC (reference).

4.7 Corrective Actions

Because the data collected for the monitoring program during operations and closure of the impoundment exhibited levels did not exceed the secondary groundwater protection standards, XDOH found that Criterion 5D and Criterion 5F are not applicable to the site as no measurable impacts due to seepage were detected (reference).

4.8 Nearby Receptors

For 1-year before prior to any major site construction, ABC conducted a preoperational monitoring program to establish baseline data for the milling site and its environs in accordance with Criterion 7 (reference). Based on a review of the State database and a land use survey, ABC determined that 1 private drinking-water-supply well, 2 livestock-water-supply wells, no irrigation-water-supply wells and no public water-supply-well exist within 2 kilometers of the impoundment (reference). The drinking-water-supply well and livestock-water-supply wells are owned by the nearest neighbor, Mr. John Doe, which provided consent to sample the wells. Construction information on the wells is limited. The wells were sampled on a quarterly basis during the preoperational program for parameters listed in RG 4.14 (reference).

No perennial stream or surface water impoundments exist within 2 kilometers of the impoundment.

During operations and closure of the impoundment, the wells were sampled quarterly for parameters as listed in RG 4.14. The data for the wells during the operational program was included in the semi-annual effluent monitoring reports submitted pursuant to 10 CFR 40.65. Furthermore, ABC performed an annual land use survey and determined that no additional wells were installed during operations (reference). Based on the data collected during the operational monitoring program, ABC determined that the operations had no environmental impacts to the off-site nearby receptors (reference).

XDOH conducted inspections on the field sampling and evaluated the analytical data and determined that ABC had adhered to the approved and/or industry established procedures for the monitoring program (reference). XDOH concurred with the finding of no environmental impact to any existing nearby receptors thus fulfilling requirements of Criterion 5B(4) and Criterion 7.

4.9 Secondary Groundwater Protection Standard (Criterion 5B(5), Paragraph (c))

Because the secondary groundwater protection standards of Criterion 5B(5), Paragraphs (a) and (b) were not exceeded during operations and closure of the impoundment, ABC determined that an Alternate Concentration Limit (ACL) was unnecessary as a secondary ground protection standard for the site (reference). Furthermore, ABC determined no measurable seepage will continue in the future because (1) of the nature of the cap to minimize future infiltration through

the impoundment provided the minimal maintenance is performed as designed. ABC also recognized that the liner underlying the impoundment may develop leaks in the future. Based on an evaluation of the reasonable extent of leakage in the future, ABC demonstrated by modeling that the seepage would remain sufficiently low to not pose any incremental hazard (Criterion 5B(5), Paragraph (a)) or poses an acceptable hazard f the that no incremental hazard (Criterion 5B(5), Paragraph (b)) (reference).

XDOH reviewed the ABC's evaluation as well as he impoundment cover construction inspections performed by XDOH and ABC's cover design. XDOH reviewed the modeling on potential future seepage and found ABC used reasonably conservative estimates for the future liner integrity. Therefore, XDOH finds that an ACL does not have to be established as a secondary groundwater protection standard in accordance with Criterion 5B(5), Paragraph (c), and that the future hazards will be acceptable consistent with Criterion 5B(6).

4.10 Conclusion

XDOH has made a determination that the closure of ABC's facility is in compliance with State groundwater regulations associated with uranium mill closure. Evidence of adverse impacts to groundwater quality by seepage from the impoundments at ABC's facility do not exist or are not expected in the future.

Operations and closure of the impoundment is in compliance with requirements for impacts to the groundwater media as delineated in Chapter XXX-XXXX of the (State) regulations]. The (State) regulations are compatible with applicable NRC's regulations in 10 CFR Part 40 Appendix A "*Criterion 5*", *Criterion 7*" and "*Criterion 13*", which incorporate the generally applicable groundwater protection standards imposed by EPA in 40 CFR Part 192, Subparts D and E.

NOTE TO READER: If seepage is document, then corrective actions were likely performed and ACLs established as the secondary groundwater protection standard. The CRR should document the corrective actions that were performed that met requirements of Criterion 5D, The CRR should document XDOH's determination that the corrective actions could be discontinued. For an ACL, the CRR should XDOH's determination that practicable corrective actions were considered, the levels are ALARA and the constituents will not pose a substantial present of potential hazard as long as the ACL is not exceeded. Factors listed in Criterion 5B(6) should be addressed. The reader is directed to guidance on ACL applications.

5. Discussion of results of State's site closure inspection(s).

XDOH has performed site closure inspections over the years as the site remediation moved from one phase to the next. XDOH has employed inspection staff or provided specialized consultants to review and verify virtually every aspect of site closure.

XDOH's site inspections were conducted to ensure that the site reclamation activities were performed as required by regulations and license conditions. For significant aspects of reclamation, ABC submitted detailed plans and specifications for the work. These plans were reviewed and approved by XDOH. In these cases, XDOH inspectors have performed many field inspections to verify conformance of site activities to approved plans. This is particularly the case for reclamation construction of the diversion channel and thick, vegetated cover. Of particular emphasis was inspection of soil, rock, vegetation, and groundwater.

Monitoring during site closure has continued to evaluate environmental media and site performance. Periodic inspection and monitoring activities have been performed to determine radionuclide concentrations in soil, air, and groundwater. ABC has been required to perform this monitoring and to report results annually. XDOH has performed split sampling and has evaluated monitoring results in the State's independent laboratory to provide verification of ABC's results.

6. For partial terminations, documentation that release of a portion of the site will not negatively impact the remainder of the site to be closed at a later date.

XDOH has determined that the release for unrestricted use and removal of the subject site will not negatively impact the remainder of the sites associated with the license, which will be released for unrestricted use and removed from the license at a later date, based on the following:

The site being removed from the license is not contiguous with any other site associated with licensed activities; and removal of the site from its associated license will not in any way prevent or hinder the licensee's ability to complete decommissioning of the remainder of the licensed areas.

III. REFERENCES

APPENDIX C - Sample Completion Review Report for Non-conventional Uranium Milling License

NOTE TO READER

The purpose of this sample CRR is to generally show the expected level of detailed information in a variety of technical areas which should be provided in the CRR. Every site is unique and no single site, or any existing documentation, could serve as a complete template for all aspects of site closure, since each conventional uranium milling site is likely to have its own site-specific conditions. To cover as many aspects of license termination activities as possible, the sample CRR is a composite of examples from a number of existing documents. Stakeholders' comments and input have also been considered and are reflected in the sample CRR.

The sample CRR provides neither a complete list of all applicable standards and requirements that need to be addressed nor complete boiler-plate language to be used as bases for conclusions. Rather, it provides an example of the level of detailed information that would be expected for inclusion in the CRR.

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2. Groundwater information which demonstrates that the groundwater has been adequately restored to meet applicable standards and requirements.

3. Documentation that the production, injection and monitoring wells have been closed and plugged in accordance with applicable standards and requirements.

4. Decommissioning information which documents that all radiologically contaminated materials have been properly disposed of, transferred to licensee(s) authorized to possess such materials, or meet applicable standards and requirements for release.

5. Discussion of the results of radiation surveys and soil sample analyses which confirm that the licensed site meets applicable standards and requirements for release.

6. Discussion of results of the State's site closure inspection(s).

7. For partial terminations, documentation that release of a portion of the site will not negatively impact the remainder of the site to be closed at a later date.

III. REFERENCES

Agreement State Radiation Control Program

COMPLETION REVIEW REPORT

Date:
Licensee: XXXXX
License Number: XX-XXXX-X
Facility Name: XXXXX
Location: XXXXX, State
Licensed Area Being Terminated: approximately X,XXX acres
Manager:
Technical Reviewers: [John Smith, M.S.,P.E. (Hydrologic Engineer)]

I. SUMMARY

The ABC Company's XYZ site is an in-situ recovery mining and processing site which has been decommissioned and reclaimed under XXX State Department of Health (XDOH) Agreement State authority, derived from Title II of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). UMTRCA requires that prior to termination of the license, the U.S. Nuclear Regulatory Commission (NRC) shall make a determination that the licensee has complied with all applicable standards and requirements. Under the Agreement State program, the State of XXX is responsible for approval of the remediation plans for ABC and for site inspections to ensure that the actual remedial actions have been completed pursuant to the approved plans.

This report documents XDOH's basis for its conclusion that decommissioning and reclamation have been acceptably completed at the XYZ site. The NRC NMSS Procedure SA-900 entitled, "Termination of Uranium Milling Licenses in Agreement States," was used to prepare this report. The primary applicable standards for uranium mill reclamation are Chapter XXX-XXX XAC (State Administrative Code), entitled [Radiation Protection-Uranium and/or Thorium Milling]. This State regulation is consistent with and compatible with NRC regulations, as required by the State's Agreement State status with the NRC.

All applicable standards and requirements, with appropriate references to related sections of the CRR, are identified in Table C-1 [Note to Reader: Table C-1 in this sample CRR does not contain a complete list of all applicable standards and requirements.] XDOH has performed a complete review of the XYZ site for compliance with all applicable standards and requirements. As part of that review, XDOH has prepared a Technical Evaluation Report (TER) (reference) or other technical reviews (reference(s)) to document the State's review. The TER or other technical reviews may provide reference to more detailed evaluations by the State and to ABC's documents submitted for State review during the site's reclamation period. XDOH's reviews of licensee submittals were conducted by using guidance document(s) [NRC NUREG-1569 or equivalent, etc.]

Table C-1 Applicable Standards and Requirements* Related to Topics Discussed in the CRR

Applicable Standards / Requirements	CRR Sections	TER Sections**
State regulation XX.XXXX Restoration of groundwater with all wells plugged and capped. Criteria for groundwater restoration	Sections 2 and 3	Section X.XX
State regulation XX.XXXX Surface decontamination to a level sufficient for unrestricted use. Criteria for release for unrestricted use	Section 4	Section X.XX
State regulation XX.XXXX Release of equipment and materials. Criteria for release of equipment and materials for unrestricted use	Section 4	Section X.XX
Other applicable standards and requirements		

*As defined in Section V.A. of the NMSS Procedure SA-900 issued on [Month Day, Year].
**Sections in TERs or equivalent reference documents.

In conclusion, XDOH believes that the ABC's XYZ site has met all applicable standards and requirements. With a determination by NRC, as required by Section 274c.(4) of the Act, that all applicable standards and requirements have been met, the Radioactive Material License, XX-XXXX-X, may be terminated.

II. DOCUMENTATION OF BASES FOR CONCLUSION

Following are XDOH's review results for items specified in the NMSS Procedure SA-900 "Termination of Uranium Milling Licenses in Agreement States."

1. A brief description of licensee's activities associated with decommissioning and license termination.

The XYZ project is an in-situ recovery uranium mine located near XXX, State. XYZ's uranium leases cover approximately X,XXX contiguous acres of land. The site facility included a main building (housing offices, a warehouse, a lab, and maintenance facilities), a processing plant, [four PVC lined] water storage ponds, a production wellfield, an irrigation area, and a deep disposal well. The site was operated from [year] to [year] when production operations were ceased.

From [year] until [year] [active/passive] groundwater restoration was performed along with limited surface reclamation. The State Water Commission authorized ceasing groundwater restoration and final plugging of all wells [in the fall of year]. Following plugging of all wells, full-scale surface reclamation and decommissioning began. Any material and/or equipment which was contaminated was disposed of by: 1) transfer to another licensed mine site; 2) decontamination and release for unrestricted use; or 3) disposal at [a licensed byproduct disposal facility]. XDOH has determined that proper release for disposal, recycle or reuse, of all material and/or equipment was adequately documented by ABC.

ABC performed surveys to confirm the effectiveness of reclamation and decommissioning activities. The surveys consisted of scans, direct and/or swipe surveys of all affected areas. [Direct survey of land was conducted by taking readings at 10 meter intervals across the wellfield pattern. Soil samples were taken from four 10 meter by 10 meter areas per acre, or insert applicable survey protocol (e.g., MARSSIM), DCGLs, etc.] Reclamation and decommissioning activities were completed in [year].

In [year], XDOH performed confirmatory surveys of the facility. [Two times background was used as an allowable limit (reference). The survey was performed by walking 10 meters apart moving across the wellfield pattern. Soil samples were taken from a 100 square meter area around areas that exceeded two times background, or insert applicable survey protocol (e.g., MARSSIM), DCGLs, etc.] Post-cleanup surveys conducted by XDOH staff indicate that the site has been decontaminated to a radiation level that meets the State release criteria (reference). Analysis of all soil samples indicates that average radium-226 and uranium concentrations were below release criteria of [5 pCi/gm and xx pCi/gm, respectively]. The uranium release Criterion of XX pCi/gm for uranium was based on the radium benchmark dose method as documented in Appendix E of NUREG-1569.

On-site disposal of radioactive materials was not authorized at this facility, thus there is no land to be transferred to the State or the Federal Government.

2. Groundwater information which demonstrates that the groundwater has been adequately restored to meet applicable standards and requirements.

A letter/letters (attached) dated [Month Day, Year] from XDOH to the ABC provides the following information: XDOH has reviewed the groundwater restoration data for Productions Area XX of

the XYZ mine submitted by ABC. XDOH determined that the groundwater has been restored in accordance with the specifications contained in permit XX-XXXX and as required by State regulations XX-XXX-XXXX. ABC has been authorized to cease any restoration activities, including monitoring, at the production area.

3. Documentation that the production, injection and monitoring wells have been closed and plugged in accordance with applicable standards and requirements.

A letter/letters (attached) dated [Month Day, Year] from XDOH to the ABC provides the following information: In accordance with State regulations XX-XXXX-XX, XDOH revokes permit XXXX. All of the Class III wells were plugged as of [Month Year], and certifications have been received from the mine operator and from an independent registered professional engineer that plugging was accomplished in accordance with the plugging and abandonment plan in the permit.

4. Decommissioning information which documents that all radiologically contaminated materials have been properly disposed of, transferred to licensee(s) authorized to possess such materials, or meet applicable standards and requirements for release.

During surface reclamation and decommissioning all material and equipment was surveyed for radioactive contamination. Any material and/or equipment which was contaminated was released by utilizing one of the following methods: 1) transfer to licensee(s) authorized to possess such materials; 2) decontamination and released for unrestricted reuse or recycling; 3) or disposal at a licensed byproduct disposal facility.

All material and equipment to be released for unrestricted use (e.g., reuse, recycle, or disposal) have been surveyed by ABC to demonstrate compliance with [State regulations for control of radiation XX.XXX]. The surveys consisted of scans, direct measurements and swipes for determination of removable activity. These surveys have been taken and documented by ABC to meet these criteria as summarized below:

(1) Removable surface contamination: 1000 dpm alpha per 100 cm^2
(2) Total surface contamination (average over 1 m^2): 5000 dpm alpha/beta per 100 cm^2
(3) Maximum fixed contamination: 15,000 dpm alpha/beta per 100 cm^2]

All soils have been surveyed to demonstrate compliance with the requirements of State regulation XX.XXX. These surveys have been completed and documented to meet these criteria:

[(1) 5 pCi/gm of Ra-226 averaged over any 100 m^2 area and averaged over the first 15 cm depth of soil; (2) 15 pCi/gm of Ra-226 averaged over any 100 m^2 area and averaged over any subsequent 15 cm depth of soil; and (3) xx pCi/gm of U-nat.]

5. Discussion of the results of radiation surveys and soil sample analyses which confirm that the licensed site meets applicable standards and requirements for release.

Surveys, conducted by ABC, to confirm the effectiveness of reclamation and decommissioning activities were performed by scans, direct and/or swipe surveys of equipment and structures to be turned over to the landowner. [Direct survey of land was conducted by taking readings at 10 meter intervals across the wellfield pattern. Soil samples were taken using applicable survey protocol (e.g., MARSSIM), DCGLs, etc.] ABC subsequently requested termination of its license.

In [Month Year], XDOH staff performed confirmatory surveys of the wellfield. The surveys were performed using [one-by-one sodium iodide probes and XXXX survey meters]. The survey was performed by [walking X meters apart moving across the wellfield pattern (reference), or insert applicable survey protocol (e.g., MARSSIM), DCGLs, etc.].

Background gamma count rate readings were approximately [X.XXX cpm or mR/hr] on all meters. As a result of the surveys, [twenty-nine] areas were identified as having readings greater than the action level. These areas were cleaned up by ABC and resurveyed by XDOH staff. All areas resurveyed had readings which were less than action level.

Concurrently XDOH staff collected soil samples from XX areas. Soil sample results were within the regulatory limits for radium-226 and natural uranium soil concentrations of [5 pCi/gm and xx pCi/gm, respectively], except for [two] soil samples which exceeded these limits.

In [Month Year], XDOH staff returned to the production area to resurvey and take soil samples after the licensee had cleaned the two areas that had exceeded release limits. Soil sample results were within the regulatory limits for radium-226 and natural uranium soil concentrations of [5 pCi/gm and xx pCi/gm, respectively].

6. Discussion of results of the State's site closure inspection(s).

In [Month Year], XDOH staff performed a survey of ABC's XYZ site. The surveys were performed using [one-by-one sodium iodide probes and XXXX instruments]. The purpose of the survey was to allow ABC to release the X.X acres for unrestricted use. [Two times background was used as an allowable limit (reference). The survey was performed by walking 10 meters apart moving across the wellfield pattern.] Background readings ranged from XXXX -XXXX cpm.

[One area was identified which exceeded two times background. A visible pile of pipescale on the surface was the cause for the elevated reading. This area was cleaned up by ABC and a post-cleanup survey indicated no readings above background.]

Since no elevated readings were found in the production [except for the pile of visible pipescale], soil samples were not collected.

On-site disposal of solid radioactive material or byproduct material was not authorized at the XYZ site, thus there is no land to be transferred to the State or the Federal Government. As a result of these findings, XDOH is proposing to remove the XYZ site from the license.

7. For partial terminations, documentation that release of a portion of the site will not negatively impact the remainder of the site to be closed at a later date.

XDOH has determined that the release for unrestricted use and removal of [the subject site] will not negatively impact the remainder of the sites associated with the license, which will be released for unrestricted use and removed from the license at a later date. XDOH based its decision on the following: The site(s) being removed from the license [is/are] not contiguous with any other site associated with licensed activities that may lead to recontamination of the release site(s); and removal of the sites from their associated license will not in any way prevent or

hinder the licensee's ability to complete decommissioning of the remainder of the licensed areas.

III. REFERENCES

APPENDIX D - Sample NRC Determination Letter for Conventional Uranium Milling License

Month Day, Year
, Director
State Agency Address

Dear XXXX

We have completed review of your [Month Day, Year] submittal regarding the proposed termination of Radioactive Material License, XX-XXXX-X, issued to ABC. The license covered the ABC's XYZ site, a conventional uranium mill facility located near XXX, State. You requested in your submittal that the U.S. Nuclear Regulatory Commission (NRC) make a determination that all applicable standards and requirements have been met for termination of the XYZ site license.

The process that we used to make the determination is set out in the Office of Nuclear Material Safety and Safeguards (NMSS) Procedure SA-900. Our determination is based on two supporting bases: review of a Completion Review Report (CRR) documenting the State Department of Health (XDOH) staff's bases for its conclusion that all requirements have been met; and review of State Agreement State uranium recovery program, conducted under the Integrated Materials Performance Evaluation Program (IMPEP).

First, the information you have submitted in the CRR, dated [Month Day, Year], documents that the XDOH has performed a complete review of the XYZ site for compliance with regulatory and license requirements. XDOH's review covered all necessary technical areas and regulatory requirements relating to reclamation of the XYZ site including geotechnical engineering, surface water hydrology and erosion protection, radiation cleanup and control, and groundwater protection. XDOH also conducted appropriate inspections of site reclamation activities at the XYZ site. Based on the review findings documented in the CRR, XDOH concluded that the XYZ site has met all regulatory and license requirements.

Second, the most recent IMPEP review of the State Agreement State Program, conducted in [Month Year], concluded that the State program is adequate to protect public health and safety, and compatible with NRC's regulatory program. This finding is consistent with previous State program evaluation findings.

Based on our review of the above information and in accordance with the provisions at 10 CFR 150.15a(a) and Section 274c. of the Atomic Energy Act of 1954, as amended, we determine that all applicable standards and requirements for the protection of the public health, safety and the environment have been met for the termination of the Radioactive Material License, XX-XXXX-X.

APPENDIX D - Sample NRC Determination Letter for Conventional Uranium Milling License

A copy of our evaluation report, entitled “Documentation of NRC Review on the Termination Findings of the ABC’s Uranium Milling License Submitted by the State Department of Health,” without associated attachments is enclosed.

If you have any questions, or we can be of further assistance, please contact me or DUWP Staff Name at (301) 415-XXXX.

Sincerely,

Director
Division of Decommissioning, Uranium Recovery, and Waste Programs
Office of Nuclear Material Safety and Safeguards

Enclosure:
As stated

APPENDIX D - Sample Completion Review Report for Non-conventional Uranium Milling License
Documentation of NRC Review on the Termination Findings of the ABC's XYZ Uranium Milling License Submitted by the XXXX State Department of Health

Licensee: A... B... C... (ABC) Licensee No.: XX-XXXX-X Location: Area: approximately XXX acres Type of License: Conventional Uranium Milling License Full / Partial License Termination: Full License Termination

A. Documentation of major events/activities related to the review of the Completion Review Report (CRR) for the XYZ site.

1. On [Month Day, Year], NRC staff received a letter from the U.S. Department of Energy (DOE) regarding the Long-Term Surveillance Plan (LTSP) for the ABC's XYZ site. The DOE letter can be found in Attachment X.

2. On [Month Day, Year], NRC staff received the ABC's XYZ draft CRR from XDOH. A letter dated [Month Day, Year] with a copy of the XDOH's draft CRR can be found in Attachment X.

3. The review of the draft CRR was conducted by an NRC staff team. A list of NRC staff technical reviewers can be found in Attachment X.

4. On [Month Day, Year], NRC staff discussed the review process and status of NRC's review of the draft CRR at a meeting with DOE, XDOH and ABC representatives.

5. On [Month Day, Year], after completing review of the draft CRR, NRC staff provided comments to XDOH. The cover letter and attached comments can be found in Attachment X.

6. On [Month Day, Year], NRC staff met at the ABC's XYZ site with DOE, XDOH and ABC representatives to observe site conditions and to discuss LTSP issues. NRC's comments (see Attachment X) on XDOH's draft CRR were also discussed.

7. On [Month Day, Year], NRC staff received XDOH's response to the [Month Day, Year] letter The letter, dated [Month Day, Year] and its attachment, ABC's response letter to NRC's comments, can be found in Attachment X.

8. On [Month Day, Year], NRC and XDOH staffs met to discuss the status of NRC's review, areas needing further information or clarification (see Table below), XDOH feedback and comments on the review process, future actions, and a proposed schedule for completion of the review.

Sample Table

No.	REVIEW AREA	POTENTIAL SIGNIFICANCE
1.	Radiation Cleanup and Control Appendix A to 10 CFR Part 40, Criterion 6(1)(ii), (5) and (6), Radiation Surveys and Soil Sample Analyses	Staff needs further supporting information to complete our review of XDOH's basis for its conclusion that the subject site has been cleaned up to the standards.
2.	Identify applicable standards / requirements	Provide brief description of further supporting information needed to complete NRC's review of XDOH's basis for its conclusion.

9. On [Month Day, Year], NRC staff met with DOE, XDOH and ABC representatives to discuss the status of NRC's review, areas where further information or clarification were needed, and the schedule for completion of the review.

10. On [Month Day, Year], NRC staff received Revision #1 to the draft CRR from XDOH. XDOH indicated Revision #1 to the draft CRR provided responses to NRC's comments as documented in Attachment X. The [Month Day, Year] letter and its attachment can be found in Attachment X.

11. On [Month Day, Year], after completing review of Revision #1 to the draft CRR, NRC staff communicated with XDOH staff through e-mail on areas where further information or clarification was needed. On [Month Day, Year], XDOH staff provided responses to NRC's comments through e-mail. These e-mails can be found in Attachment X.

12. On [Month Day, Year], NRC staff provided comments to DOE on a draft LTSP. The comments reflect consideration of information contained in the draft CRR and resulting from NRC staff review of the draft CRR. The letter notes that because the mill tailings will be saturated for an indefinite period of time, and a large amount of water is impounded behind the dam, the tailings impoundment system is formally classified as a dam. To meet Federal obligations under the requirements of the National Dam Safety Program Act, the dam must be inspected at regular intervals. The letter concludes that additional inspection items must be included in the LTSP to meet applicable requirements. The comment letter and its attachment can be found in Attachment X.

13. On [Month Day, Year], NRC staff received the final CRR from XDOH. Following review, NRC staff concluded that the final CRR addressed all NRC's comments and provided XDOH staff's bases for its conclusion that the ABC's XYZ site has met all regulatory and license requirements. The letter and its attachment can be found in Attachment X.

14. The five issues identified during the [Month Day, Year] meeting were closed based on additional information documented in the final CRR (Items X-X) or based on information provided in the [Month Day, Year] letter from NRC to DOE (Item X). This is summarized in the Table below.

APPENDIX D - Sample NRC Determination Letter for Conventional Uranium Milling License

Sample Table

No.	REVIEW AREA	COMMENTS
1.	Radiation Cleanup and Control Appendix A to 10 CFR Part 40, Criterion 6(1)(ii), (5) and (6), Radiation Surveys and Soil Sample Analyses	Additional information is documented in the Radiation Cleanup and Control portion of the final CRR.
2.	Identify applicable standards / requirements	Additional information is documented in the XXXX portion of the final CRR.

B. Documentation of review comments on items specified in the NMSS Procedure SA-900 "Termination of Uranium Milling Licenses in Agreement States."

1. A brief description of licensee's activities associated with decommissioning, tailings remediation and groundwater cleanup, if necessary.

   Comment: This information is provided in section X of the final CRR. The submitted information was found to be complete.

2. Documentation that the completed surface remedial actions were performed in accordance with applicable standards and requirements.

   Comment: This information is provided in section X of the final CRR. XDOH staff reviewed geotechnical stability, surface water hydrology and erosion protection, and radon emanation aspects of the reclamation of ABC's XYZ site. Based on its evaluation, XDOH concluded that reclamation of the site has met all applicable standards and conformed with design specifications. The submitted information was found to be acceptable.

3. Documentation that the completed site decommissioning actions were performed in accordance with applicable standards and requirements.

   Comment: This information is provided in section X of the final CRR. ABC's initial measurement indicated that XX% of all gamma and soil sample grids were below the radium regulatory limit. Following the initial surveys, all gamma grids and soil grids that were in excess of limits were excavated until results indicated concentrations below the applicable limit. XDOH data confirm that ABC's sampling process was valid. XDOH concluded that residual radioactive material in all the areas potentially impacted by the mill operation was cleaned up to the State standards. The submitted information was found to be acceptable.

4. Documentation that the completed groundwater corrective actions, if necessary, were performed in accordance with applicable standards and requirements.

   Comment: This information is provided in section X of the final CRR. XDOH's review of all groundwater quality data has determined that the hazardous constituents

in the tailings impoundment (uranium, Ra-226, Ra-228, Th-230, arsenic, nickel, and thallium) are stable in groundwater within the range of natural variability and remain below regulatory limits. XDOH concluded that the closure of ABC's XYZ site is in compliance with XXXX State groundwater regulations associated with uranium mill closure. The submitted information was found to be acceptable.

5. Discussion of results of State's site closure inspection(s).

   Comment: This information is provided in section X of the final CRR. XDOH staff performed appropriate site reclamation inspections over the years as site remediation moved from one phase to the next. XDOH employed inspection staff or provided specialized consultants to review and verify all important aspects of site closure. XDOH staff site inspections have provided a presence to ensure that site reclamation activities were performed as required by regulations and license conditions. The submitted information was found to be acceptable.

6. For partial terminations, documentation that release of a portion of the site will not negatively impact the remainder of the site to be closed at a later date.

   Comment: Not applicable. This is a full license termination.

7. IMPEP review of the XDOH uranium recovery regulatory program

   Comment: Based on [year] IMPEP review, the XDOH uranium recovery program was found to be satisfactory based on the IMPEP evaluation criteria. (A satisfactory rating is the highest rating possible for each IMPEP common and non-common performance indicator.) The overall XXXX (State name) Agreement State program was found to be adequate to protect public health and safety and compatible with NRC's program. The IMPEP team had one recommendation in the uranium recovery area that the State develop additional specialized inspection procedures.

Based on review of the above information, as specified in the NMSS Procedure SA-900, and in accordance with the provisions at 10 CFR 150.15a(a) and Section 274c. of the Atomic Energy Act of 1954, as amended, staff determines that all applicable standards and requirements have been met for the termination of the Radioactive Material License, XX-XXXXX-X.

Project Manager: _____ Date: _____
Full Name, Title
Office of Nuclear Material Safety and Safeguards, Division of Decommissioning, Uranium Recovery, and Waste Programs

Division Director: _____ Date: _____
Full Name, Director
Office of Nuclear Material Safety and Safeguards, Division of Decommissioning, Uranium Recovery, and Waste Programs

APPENDIX E -- Sample NRC determination letter for Non-conventional Uranium Milling License

Month Day, Year
, Director
State Agency Address

Dear XXXX

We have completed our review of your [Month Day, Year] and [Month Day, Year] submittals regarding the proposed termination of the Radioactive Material License, XX-XXXX-X, issued to ABC's XYZ site, an in-situ recovery uranium milling facility located near XXX, State. You requested in your [Month Day, Year] submittal that the U.S. Nuclear Regulatory Commission (NRC) make a determination that all applicable standards and requirements have been met for the termination of the XYZ site license.

The process that we used to make the determination is set out in the Office of Nuclear Material Safety and Safeguards (NMSS) Procedure SA-900. Our determination is based on two supporting bases: review of a Completion Review Report (CRR) documenting the State Department of Health (XDOH) staff's bases for its conclusion that all applicable standards and requirements have been met; and review of State's Agreement State uranium recovery program, conducted under the Integrated Materials Performance Evaluation Program (IMPEP).

As indicated in NMSS Procedure SA-900, closure of an in-situ recovery uranium milling site requires a demonstration that the groundwater has been adequately restored, all the wells have been closed and plugged according to the appropriate State statute, disposal or transfer of radioactive material is documented, and radiation surveys and confirmatory soil samples indicate that the site meets applicable standards and requirements for release.

First, the information you have submitted indicates that the groundwater has been restored by the licensee to the satisfaction of XDOH. All the wells have been plugged and abandoned by the licensee as authorized by XDOH. Based on XDOH's review of the license termination, you reported that proper disposition of radioactive materials took place at the site and there has been no on-site disposal of radioactive materials; therefore, there is no need to transfer ownership of land to the State or the Federal Government.

APPENDIX E -- Sample NRC determination letter for Non-conventional Uranium Milling License

XDOH has reviewed the results of radiation surveys submitted by the licensee and performed confirmatory surveys for the subject site. Post-cleanup surveys conducted by XDOH indicate that the site has been decontaminated to a radiation level that meets the State criteria. According to the XDOH report, the analysis of soil samples indicates the radium-226 and thorium-230, and uranium concentrations were below the release criteria of [insert derived Criterion 6(6) values]. The statements made in the submittals indicate that the XDOH has adequately determined that all applicable standards and requirements have been met by the licensee.

Second, the most recent IMPEP review of the State Agreement State Program, conducted in [Month Year], concluded that the [State] program is adequate to protect public health and safety, and compatible with NRC's regulatory program. This finding is consistent with the previous State program evaluations.

Based on our review of the above information and in accordance with 10 CFR 150.15a(a) and Section 274c of the Atomic Energy Act of 1954, as amended, we determine that all applicable standards and requirements for the protection of the public health, safety and the environment have been met for the termination of the Radioactive Material License, XX-XXXX-X.

A copy of our evaluation report, entitled ADocumentation of NRC Review of the Termination Findings of the ABC's Uranium Mill License Submitted by the State Department of Health, without associated attachments is enclosed.

If we can be of further assistance in this regard, please contact me at (301) 415-3340 or DUWP Staff Name at (301) 415-XXXX.

Sincerely,

Director
Division of Decommissioning, Uranium Recovery and Waste Programs
Office of Nuclear Material Safety and Safeguards

Enclosure:
As stated