PROPOSED NRC STAFF FINAL TECHNICAL POSITION ON ALTERNATE CONCENTRATION LIMITS TITLE II URANIUM MILL SITES

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ABSTRACT

The U.S. Nuclear Regulatory Commission staff (NRC) has completed the Final Technical Position for the application of Alternate Concentration Limits (ACLs) at Title II Uranium Mill sites. The Final Technical Position was prepared considering comments on the draft version, which was released in June, 1988. The Final Technical Position applies solely to Title II mills, which are regulated by the NRC under Appendix A of 10 CFR Part 40.

ACLs represent one of three alternative standards available to licensees for complying with the groundwater protection regulations, before the property is transferred to a governmental entity for perpetual care. The other two standards are the drinking water Maximum Concentration Limits (MCLs) and background water quality. ACLs are site-specific standards, and ACL applications for individual mill sites must be submitted to the NRC for approval.

The Final Technical Position provides guidance for establishing ACLs that meet the regulatory requirements, and acceptance criteria to assess and evaluate ACL applications. The Technical Position specifically requires that ACL applicants conduct a detailed *Hazard Assessment* and a *Corrective Action Assessment* for demonstrating that the regulatory requirements are met for particular sites. In addition, the Technical Position includes guidance on the format and content of ACL applications, and detailed review procedures; and also requires that the review findings be documented to provide a technical basis for the regulatory decisions concerning the acceptance of proposed ACLs.

The Final Technical Position provides a uniform basis for establishing ACLs and for reviewing and evaluating ACL applications, and will be useful to both the licensees as well as reviewers from NRC and possibly Agreement States.

INTRODUCTION

The Uranium Mill Tailings Radiation Control Act, as amended (UMTRCA) (1) required the U.S. Environmental Protection Agency (EPA) to establish standards for protecting public health, safety, and the environment from radiological and non-radiological hazards associated with the processing and disposal of uranium and thorium tailings from Title II (active) mills. These mills are commercial processing sites licensed by the U.S. Nuclear Regulatory Commission (NRC). The EPA standards were promulgated in 40 CFR Part 192 Subparts D, and E (2). These standards basically incorporated the groundwater protection standards previously developed by EPA under authority of the Solid Waste Disposal Act and described in the hazardous waste regulations of 40 CFR 264, which included provisions for establishing alternate concentration limits (ACLs) as a part of the site-specific groundwater protection programs for regulated units (40 CFR 264.93(3)).

EPA's groundwater protection standards have historically relied on the native, background water quality, or the maximum concentration limit (MCL) of designated constituents in drinking water as enforceable compliance limits. Conceptually, background water quality poses no incremental hazard and the established drinking water MCLs represent acceptable hazards. Additionally, since these two compliance standards may not be practicable at some sites, the EPA standards included provisions for establishing ACLs. ACLs are alternative limits that may be proposed by licensees for specific sites, and approved by the NRC when the applicable regulations are satisfactorily met.

The NRC incorporated the EPA's standards, including the ACL provision in its own regulations governing the disposal of uranium mill tailings on November 13, 1987, within Criterion 5B(6) of Appendix A, 10 CFR Part 40 (3). In addition, the NRC staff developed a draft guidance document on ACLs in 1988, which outlined the acceptable requirements for submitting and reviewing ACL applications (4). The availability of this document, as a Draft Technical Position, was published in the Federal Register and comments were requested from the public and interested parties. Comments on the Draft Technical Position were received from several government and private organizations. These comments were thoroughly reviewed and analyzed, and the Final Technical Position was prepared after consideration of these comments.

Purpose and Scope

The purpose of the Final Technical Position on ACLs is to provide: (1) guidance for the NRC staff's interpretation of the requirements for establishing ACLs according to Criterion 5B(6), Appendix A, 10 CFR Part 40; (2) standard format and content for ACL license applications; and (3) consistent NRC staff review procedures for ACL applications. The document is intended for use by licensees, NRC staff, and possibly by Agreement States for evaluating ACL proposals

and establishing ACLs at Title II uranium mills. These mills encompass 28 facilities which are maintained by private licensees and are now in various stages of decommissioning.

The Technical Position applies only to ACL applications for sites regulated under Title II of UMTRCA. It is organized in three parts to provide the necessary guidance for both the ACL applicant and the NRC reviewer. Section 1 provides the background and regulatory basis for the Technical Position. Section 2 presents a format and content for a generic ACL application. Section 3 describes the general ACL application review process and presents guidelines for a detailed application review.

General Requirements

The Final Technical Position describes the general regulatory requirements that must be met for establishing ACLs at Uranium Mill Title II sites. The Technical Position requires that ACLs may be established for individual constituents as site-specific groundwater protection standards, provided it can be demonstrated that the applicable regulations in Appendix A to 10 CFR Part 40 will be met. Specifically, the Technical Position requires that: (1) the constituent will not pose a substantial present or potential hazard to human health or the environment, as long as the ACLs are not exceeded; and (2) the ACLs are as low as reasonably achievable considering practicable corrective actions. ACLs may not be proposed to delay the implementation of corrective action programs. However, revised ACLs may be proposed if new information indicates that the ACLs should be modified.

The Technical Position underlines the importance of the Point of Compliance (POC) and the Point of Exposure (POE), both of which must be identified and considered in establishing ACLs. The POC is defined in Appendix A to 10 CFR Part 40 as the site-specific location in the uppermost aquifer where the groundwater protection standard must be met. In contrast, POEs are defined as the locations where humans, wildlife, or other environmental species could reasonably be exposed to hazardous constituents from the groundwater. For example, the POE may be represented by one or more domestic wells that could be constructed and could result in withdrawal of contaminated groundwater, or the locations where aquatic biota may be exposed to hazardous constituents as a result of contaminated groundwater discharge to a river. In any case, groundwater quality at the POEs must be maintained at levels that are protective of potential receptors, and the maximum allowable concentrations at the POE will provide the basis for establishing ACLs at the POC. Figure 1 conceptually depicts the positions of the POC and POE in relation to a tailings disposal cell.

In practice, the POC will be located within a vertical surface representing the intersection of the downgradient edge of the reclaimed tailings impoundments with the uppermost aquifer. POEs, in most situations as shown in Fig. 1, will be located at the downgradient boundary of the land that will be transferred to either the United States or a State for long-term institutional control after the license termination. The spatial relationship between the POC and POE is critical to the establishment of ACLs. Natural processes such as dilution, dispersion, decay, and sorption may attenuate hazardous constituents between the POC and POE. Thus, ACLs established at the POC may be greater than the appropriate

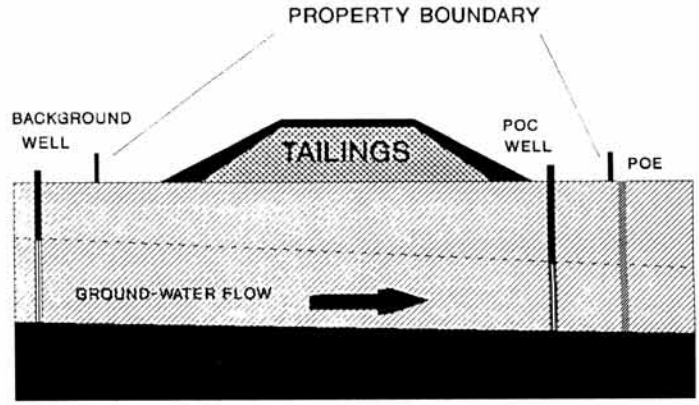

Fig. 1. Schematic representation of the POC and POE.

health and environmental concentration limits at the POE and still be protective of human health and the environment.

Table I shows the recommended generic outline, which the ACL applicants can use, when developing their ACL applications.

Specific Requirements

The Final Technical Position requires that the ACL applicants conduct a detailed *Hazard Assessment* and a detailed *Corrective Action Assessment*, in order to demonstrate that the applicable regulations in Appendix A to 10 CFR Part 40 will be met at a particular site. These assessments are discussed in detail in the Technical Position and are summarized below.

Hazard Assessment. The *Hazard Assessment* must demonstrate that the proposed ACLs will not pose a substantial present or potential hazard to human health or the environment, as long as the ACLs are not exceeded.

The Technical Position requires that establishing ACLs for particular sites encompasses the following evaluations, as described:

1. characteristics, distribution, and extent of hazardous constituents as a contamination source, as well as the potential for future releases of constituents;
2. transport of hazardous constituents in groundwater and hydraulically-connected surface water; and,
3. risks associated with exposure of humans and the environment to the identified hazardous constituents.

The source characterization should include both waste characterization and facility characterization, and should provide reliable estimates of the release rates of hazardous constituents as well as constituent distributions. A waste characterization should include identification of hazardous constituents in the waste and in the leachate generated by the waste, including any degradation products of the constituents. The facility characterization will address the uranium recovery process(es) used at the facility; types and quantities of the reagents used in milling; ore compositions milled at the facility; and historical and current waste management practices. The facility information, when considered in conjunction with the physical and chemical composition of the waste, provides the basis for estimating the source term used in the contaminant transport evaluation.

The transport evaluation should provide estimates of the projected movement and distribution of hazardous constituents in the groundwater and hydraulically-connected surface water. This evaluation generally includes: (1) hydrogeologic

TABLE I

Standard Format of an ACL Application

Executive Summary

Table of Contents

1. General Information
   - 1.1 Introduction
   - 1.2 Facility Description
   - 1.3 Extent of Ground-Water Contamination
   - 1.4 Current Ground-Water Protection Standards
   - 1.5 Proposed Alternate Concentration Limits
2. Hazard Assessment
   - 2.1 Source and Contamination Characterization
   - 2.2 Transport Assessment
   - 2.3 Exposure Assessment
3. Corrective Action Assessment
   - 3.1 Results of Corrective Action Program
   - 3.2 Feasibility of Alternate Corrective Actions
   - 3.3 Corrective Action Costs
   - 3.4 Corrective Action Benefits
   - 3.5 As Low As Reasonably Achievable Demonstration
4. Proposed Alternate Concentration Limits
   - 4.1 Proposed Alternate Concentration Limits
   - 4.2 Proposed Implementation Measures
5. References
6. Appendices and Supporting Information

characteristics of the disposal site area; (2) groundwater flow direction and flow rates; (3) background water quality; and (4) estimated contaminant transport rates, geochemical attenuation, and concentrations of hazardous constituents in the groundwater and hydraulically-connected surface water. The hydrogeologic characterization must describe the groundwater environment in sufficient detail to define the hazardous constituent transport mechanisms.

Evaluating the potential adverse impacts on human health and the environment requires that licensees consider the 19 factors provided in Table II, in assigning ACLs to individual hazardous constituents. These factors address the present and potential adverse impacts on both groundwater quality, and the quality of hydraulically-connected surface waters. ACL demonstrations are expected to utilize monitoring data and physical characteristics of the site, as well as the proposed reclamation plan criteria, to demonstrate that hazardous constituents in the groundwater will meet the criteria in Table II. In the absence of this type of information, modeling based upon an adequate amount of monitoring data and site characterization work, is an acceptable alternative.

Health and environmental impact evaluation will involve determining whether or not the proposed ACL concentrations of hazardous constituents pose substantial present or potential hazards to human health or the environment. This determination can be made considering the risk to human health that is expected from exposure to the hazardous constituents in concentrations equivalent to the proposed ACLs. ACL applicants will need to demonstrate that such a risk at a particular site would be within the maximum permissible risk level permitted by the regulations. The applicant should consider drinking water MCLs, reference doses (RfDs), or risk

TABLE II

Factors for Consideration in Establishing Alternate Concentration Limits
[10 CFR 40, Appendix A, Criterion 5B(6)]

A. Potential Adverse Effects on Ground-Water Quality

1. Physical and chemical characteristics of the waste in the licensed site, including its potential for migration.
2. Hydrogeological characteristics of the facility and surrounding land.
3. Quantity of ground water and the direction and rate of ground-water flow.
4. Proximity and withdrawal rates of ground-water users.
5. Current and potential future uses of ground water in the area.
6. Existing quality of ground water, including other sources of contamination and their cumulative impact on ground-water quality.
7. Potential for health risks caused by human exposure to waste constituents.
8. Potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.
9. Persistence and permanence of potential adverse effects.

B. Potential Adverse Effects on Hydraulically-Connected Surface-Water Quality

1. Volume and physical and chemical characteristics of waste in the licensed site.
2. Hydrogeological characteristics of the facility and surrounding land.
3. Quantity and quality of ground water, and the direction and rate of ground-water flow.
4. Patterns of rainfall in the region.
5. Proximity of the licensed site to surface waters.
6. Current and future uses of surface waters in the area and any water quality standards established for those surface waters.
7. Existing quality of surface water, including other sources of contamination and the cumulative impact on surface water quality.
8. Potential for health risks caused by human exposure to waste constituents.
9. Potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.
10. Persistence and permanence of potential adverse effects.

specific doses (RSDs) in assessing potential health hazards for each constituent for which an ACL is proposed.

The reviewer then confirms that the applicant has used the appropriate risk level. The standards in 40 CFR Part 190 can be used as a guide to make this determination. Based on a risk conversion factor of 5×10^{-4} per person-rem (5), for doses to the public that are within the limits of 40 CFR Part 190, the maximum annual individual risk would be approximately 1×10^{-5}. For the purposes of the ACL guidance, it should be understood that this value (10^{-5}) represents the combined total risk from radiological and non-radiological hazardous constituents.

The applicant should consider the cumulative effects of human exposure to hazardous constituents at the proposed ACLs, along with other constituents present in contaminated groundwater. An additive approach must be utilized in assessing adverse effects associated with exposure to hazardous constituents.

Corrective Action Assessment. The *Corrective Action Assessment* identifies practicable remediation alternatives; evaluates their technical feasibility; evaluates the costs and benefits associated with the feasible alternatives; and demonstrates that the proposed concentration limits are as low as reasonably achievable, considering practicable corrective actions. The assessment should provide supporting calculations and assumptions used in estimating the costs and benefits of each of the alternatives.

The *Corrective Action Assessment* considers at least three different target concentration limits, which are at or below the level identified in the *Hazard Assessment* and that can reasonably be attained by practicable technologies. A proposed ACL that is within the limit determined by the *Hazard Assessment* and that is selected on the basis of a cost-benefit evaluation will be an acceptable demonstration of the 'as low as reasonably achievable' requirement. If practicable corrective actions lead to constituent concentrations below those identified in the *Hazard Assessment*, then it may not be necessary to achieve the most stringent alternative.

Ultimately, ACLs must be protective of human health and the environment at the POE. If there is a case where there is no practicable corrective action involving ACLs which is protective of human health and the environment, then the ACL framework is not appropriate for a licensing action. Instances such as this would then be addressed by the Commission on a case-by-case basis.

CONCLUSION

The NRC's Final Technical Position on ACLs provides guidance for establishing ACLs for Title II Uranium Mill sites. The acceptance reviews of ACL applications will be conducted in consideration of the requirements outlined in the Final Technical Position. The Final Technical Position on ACLs requires that the ACL applicants conduct a detailed site-specific *Hazard Assessment* and a *Corrective Action Assessment* in order to demonstrate that the regulatory requirements are met for particular sites. The Technical Position should be useful to licensees and reviewers of ACL applications, and will provide a uniform and consistent basis for reviewing such applications.

REFERENCES

1. Public Law 95-604, URANIUM MILL TAILINGS RADIATION CONTROL ACT OF 1978, AS AMENDED.
2. "Standards for Remedial Actions at Inactive Uranium Processing Sites," U.S. Environmental Protection Agency, Federal Register 48 FR 45946, October 7, 1983.
3. "Uranium Mill Tailings Regulations; Ground-Water Protection and Other Issues," U.S. Nuclear Regulatory Commission, Federal Register 52 FR 43553, November 13, 1987.
4. "Notice of Availability," U.S. Nuclear Regulatory Commission, Federal Register 53 FR 24820, June 30, 1988.
5. "Health Effects of Exposure to Low Levels of Ionizing Radiation BEIR V," Committee on Biological Effects on Ionizing Radiations, National Research Council, 1990.