APPENDIX G

GAMMA RADIATION AND COVER SOILS

John

DEPARTMENT OF HEALTH
Environmental Health Programs
Division of Radiation Protection

April 24, 1996

TO: John Blacklaw
Leo Wainhouse

FROM: Dorothy B. Stoffel

SUBJECT: DESCRIPTIONS FOR COVER SOILS AS PART OF THE WDOH QA PROGRAM, WESTERN NUCLEAR TAILINGS RECLAMATION CONSTRUCTION

I have completed my review of the WNI Technical Brief on Radon Barrier Design Evaluation, submitted April 1996. In this document, it is conservatively established that characterized site sands, which have only a small component of fines (i.e., range of 4.1% to 12.8% passing the #200 sieve), can provide adequate attenuation of radon in order to meet the NRC criteria for radon emanation from the covered tailings impoundment. Individual soil samples were combined or composited into samples that conservatively represent the radon attenuation and infiltration characteristics of the tailings reclamation cover materials. The 12.6 foot thickness of the cover was designed on the basis of this conservative model which utilizes parameters developed from the characterization of the site borrow sands.

Sensitivity analyses have established that the percent sand content of the cover material is a key parameter of the material for radon attenuation. The percent sand content and the radon attenuation of a material are inversely related. As the percent sand content of a material increases, the radon attenuation capability decreases. Conversely, as the percentage of fines increases (i.e., the percentage of material that passes the #200 sieve increases), the better the material quality for radon attenuation.

Therefore, through our QA inspection program and through WNI's C/CQ Program, it is only necessary to document that the cover material, as it is placed, is as good as, or better than, the characterized sand material that was utilized in the radon attenuation model. There are four major cover borrow sources that have been identified and characterized at the site. The four principal borrow sources are: (A) in situ and stockpiled alluvial sands (the worst case material), (B) highly weathered quartz monzonite, (C) clay shear zones in the highly weathered quartz monzonite, and (D) previously characterized stockpiled clay. The in situ and stockpiled alluvial sands and the stockpiled clay have been well characterized through standard engineering field and laboratory techniques. Information related to the characterization of these materials is presented in Appendix A of the Tailing Reclamation Plan, approved November 1995.

I have inspected all four proposed cover borrow material types. All four principal borrow material types can be described with standard visual, field soil classification systems. Through utilization of the U.S. Soil Conservation Service (SCS) Soil Classification System and the U.S. Bureau of Reclamation Unified Soil Classification System, it can be readily

established that all four proposed borrow types are as good as, and usually far exceed, the worst case sand utilized in the radon model. The soils associated with the four borrow sources typically have a significantly higher percentage of fines (i.e., material that passes the #200 sieve) than found in the worst case sand.

Based upon visual inspections to date of in situ, stockpiled, and placed cover material, I have developed the following descriptions for three of the borrow material types. I have not developed a description for the clay because it has been adequately characterized (Appendix A - TRP, 1995) and because it classifies as a clay. Therefore, the stockpiled clay has better radon attenuation properties than the worst case sand that was modeled. My field descriptions are based on both the SCS and the Unified Soil Classification Systems. Two references for these visual soil classification systems are:

- ASTM Designation: D 2488 - 90 Standard Practice for Description and Identification of Soils (Visual - Manual Procedure) for the Unified Soil Classification System (Note: Figure 1A and Figure 2 are particularly useful to identify the appropriate soil group symbols);

- Soil Conservation Service Agriculture Handbook No 436. - Soil Taxonomy, A Basic System of Soil Classification for Making and Interpreting Soil Surveys (NOTE: Figure 38 is particularly useful for assigning the appropriate soil textural classes).

Detailed estimates for the silt and clay fractions are not necessary to determine that the borrow material is suitable for the cover and meets the requirements established by the radon attenuation model and the Technical Specifications for the cover. It is only necessary to establish that the total percentage of fines is greater than the percentage of fines (4.1% to 12.8%) in the modeled sand.

(A) ALLUVIAL SAND (In Situ and Stockpiled) - The Worst Case Sand designates as SCS = Sand/Loamy Sand, Unified = SP-SM, with trace amounts of clay. Gravel is generally absent. The sand is a medium sand, poorly graded, (well sorted) and well rounded. Typically, the sand is found to have a significantly higher fines content than the modeled sand in the stockpiles where the sand has been mixed with highly weathered quartz monzonite. The more typical sands designate as SCS = sandy loam, Unified = SW-SM or SW-SC. These sands therefore exceed the modeled sand for radon attenuation properties.

(B) HIGHLY WEATHERED QUARTZ MONZONITE - Highly variable material. However, consistently designates at least as good as SCS = Loam with gravel, often sandy clay loam or silt loam with gravel. Unified = SM with gravel, or SC with gravel. The gravel sized rock fraction is predominantly angular individual mineral feldspars or quartz. The gravel is estimated to be approximately 5mm. The larger rock fraction consists of broken quartz monzonite fragments, typically much smaller

than 6 inches in diameter. There are only occasional rock fragments which approach the 12 inch tech spec limit for the coarse fraction in the bottom 5 feet of the cover.

(C) CLAY SHEAR ZONES IN WEATHERED QUARTZ MONZONITE - Highly Variable Material. Because the material is borrow from clay fracture filled shear zones in the weathered quartz monzonite, the clay content is significantly higher that borrowed material from the highly weathered quartz monzonite. The clay is often the predominant size fraction in these zones. Clay layering 10 feet in thickness is observed in some locations. The silt, sand and gravel fractions are significantly less present than in other described borrow types. The material designates at least as good as SCS = clay loam or sandy clay, with gravel. Unified often = CL, gravelly clay with sand. Occasionally, I observed Unified = ML, sandy silt with gravel.

(D) STOCKPILED CLAY - see Appendix A of the December 1994 Tailing Reclamation Plan for detailed description.

Western Nuclear's Daily Summary Report Forms identify which of the borrow source types are utilized for that day, with daily estimates of volumes. The forms also estimate the rock fraction in order to ensure that the placed cover material meets the Technical Specifications. I recommend that WDOH provide similar documentation in our Field Construction Report Forms (i.e., identify the borrow source type, and document that material meets the technical specifications for suitable cover material). I will continue to routinely monitor the borrow sources and will modify the Soil Classification Descriptions if warranted.

The objective is to ensure that the placed cover material is as least as good as the modeled sand for radon attenuation. At this time, the proposed borrow source material types, and material that has already been placed, often far exceed this requirement to meet the objective.

If the suitability of the cover borrow material becomes questionable in the future because marginal material is encountered, gradation analyses could then be utilized to resolve the concern. Gradation analyses could also be utilized periodically for calibration of the visual field classifications as necessary.

DBS:krf

cc: Gary Robertson
Earl Fordham

APPENDIX H

CORRESPONDENCE ON AUTHORITY FOR CLOSURE PLANS, PLANS AND SPECIFICATIONS APPROVAL, AND ON THE LICENSE TERMINATION PROCESS

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STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

June 6, 1994

Paul Lohaus, Deputy Director
Office of State Programs
U.S. Nuclear Regulatory Commission
Mail Stop 5E4
Washington, D.C. 20555

Dear Mr. Lohaus:

I and my staff would like to thank the Office of State Programs for sending Ray Hall and Joe Kane to our offices for our latest meeting with Western Nuclear, Inc. The subject area was the possibility and pros and cons of dewatering the lined tailings pond at the Sherwood Uranium Mill in eastern Washington. Suggestions and ideas proposed by both Mr. Hall and Mr. Kane where extremely useful, being both insightful and practical. The closure of the Sherwood tailings impoundment is interesting and challenging to regulate because the impoundment is one of only two lined impoundments in the country. We look forward to consulting with you and NRC staff as the closure design work continues for Sherwood.

If you have any questions, please feel free to contact me at (206) 753-3459.

Sincerely,

Gary Robertson

Gary Robertson, Head
Waste Management Section

GR:krf

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STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

June 13, 1994

Ms. Gail Bonanno
Mail Code 6602J
U.S. Environmental Protection Agency
401 M Street
Washington, DC 20460

Dear Ms. Bonanno:

I am writing this letter per your conversation with Gary Robertson on May 12, 1994. The conversation was regarding closure dates and milestones for Dawn Mining Company (DMC) and the Western Nuclear, Inc. (WNI) Sherwood uranium mills. The following information will explain the changes in milestone dates at WNI and DMC.

Western Nuclear, Inc.

The original closure milestone dates for WNI were developed in 1991 as part of the Memorandum of Understanding between the Agreement States, NRC, and EPA. The 1996 milestone date for placement of the final radon barrier for the Western Nuclear, Inc. site at Sherwood was made without the submittal of WNI's final closure plan. After the department provided a date for the placement of the radon barrier, the company submitted its preliminary draft closure plan to the department for review. Based on our preliminary review, three major issues arose which required extensive study time. These issues are: tailings dewatering/geotechnical stability, site geohydrology, and soil surveys for unrestricted release. WNI initiated a project to further evaluate these issues. They included a pilot tailings dewatering study, a geophysical study, and a rewrite of their soil survey plan. WNI has completed the stability study, has installed three new downgradient monitoring wells, has conducted an extensive seismic study of the site, and has modified its soil survey procedures to meet our requirements. The tailings dewatering study is still being evaluated.

Because these issues required such extensive study before any further reclamation could be conducted, the date for completion of the final tailings cover was changed from 1996 to 1998. The department will require that WNI include an explanation for the changes in the milestone dates in their final closure plan (which we estimate will receive departmental approval by May 1995). Based on our review and analysis of the WNI site, the 1998 date for placement of the final tailings cover reflects closure as expeditiously as practicable, considering technological feasibility.

Dawn Mining Company

The original closure milestone date for Dawn Mining Company (DMC) was estimated to be 2010. However, for the following reasons, the department has revised the date to 2019:

- In September 1987, DMC submitted its original closure plan. That submittal initiated the State Environmental Policy Act (SEPA) process, and since that time the department has been involved with the formal closure of the millsite. After the issuance of the Draft Environmental Impact Statement (EIS), the department formed the Technical Advisory Committee (TAC) for the Closure of the Dawn Mining Company Millsite. With the input and review from the TAC, DMC submitted a revised closure plan in April 1991. The 1991 closure plan included the construction of a passive evaporation pond system to process water generated from the ground water remediation project, as well as dewatering tailings disposal area 4 (TDA-4, which contained 100 million gallons of contaminated water at that time). The department issued a Final EIS in November 1991, in which it was stated that the department would prefer the use of clean fill for filling TDA-4, rather than DMC's preferred alternative, which was NORM-type material.

  In response to the department's Final EIS, DMC submitted an alternate proposal to fill TDA-4 with 11.e(2) byproduct material. The department evaluated this alternate proposal and determined that the company could submit a closure plan incorporating this alternative for evaluation. The plan was submitted in segments during the course of a year, and in May 1994, DMC submitted the complete Closure Plan and Environmental Report, which are currently being reviewed by the department. The alternate Closure Plan includes the construction of seven lined passive evaporation ponds for treatment of contaminated ground water, in compliance with the department's order issued in 1989. The evaporation pond system will be constructed over the old, unlined TDA-1, 2, and 3 (the three non-operational impoundments listed in the MOU). Currently there is an interim cover in place over TDA-1, 2, and 3. DMC contracted an EPA-approved firm to conduct radon emanation studies on the three impoundments. Monitoring studies indicated the radon emanation from these three impoundments is less than the 20 pCi/m^2-s flux standard of 40 CFR Part 192, Subpart D.

  Considering that the ground water remediation project has been estimated to take 3-12 years for pumping alone, the department must conservatively estimate 12 years for pumping. We have estimated an additional 10 years for water evaporation. Only after the completion of the remediation project can tailings reclamation start.

- In response to BLM's order to begin operation of the water treatment plant at the Midnite Mine (DMC's source of ore) because the level of contaminated water stored in mine pit #3 had reached a critical level, DMC requested DOH to amend its radioactive materials license to allow processing of the resultant filtercake at the mill. In September 1992, the department issued License Amendment #13, which allows DMC to re-start a portion of the mill circuit to extract uranium from the filtercake (classified as Source Material under NRC and Washington State regulations). This operation is estimated by the company to take a minimum of five years. DMC plans to offset some of the costs of operating the water treatment plant by selling the uranium. The waste material from the filtercake processing is being discharged as 11.e(2) byproduct material into the mill's existing lined impoundment which is listed as operational in the MOU.

The department is currently preparing a supplemental draft EIS to the 1991 Final EIS, which will evaluate environmental impacts from the new alternate closure proposal. The final supplemental EIS which will allow construction of the evaporation pond system should be completed by September 1994.

The department issued Amendment #14 to the Dawn Mining Company radioactive materials license on September 30, 1993. Amendment #14 gave a closure completion date of 2019. This date was based on a conservative estimate of 22 years for ground water remediation (12 years for pumping and 10 years for water evaporation), and 3 years for tailings stabilization, radon barrier placement, and completion of the erosion protection cover.

The department will require that DMC include an explanation for the changes in the milestone dates in their final closure plan. Our evaluation of the DMC site indicates that three years for tailings stabilization and placement of the final radon barrier, after completion of the ground water remediation and evaporation projects, is as expeditious as practicable, considering technological feasibility. Additionally, if the ground water reclamation or other events scheduled in the September 1993 license amendment are completed sooner than the date specified in that amendment, we will adjust the date for placement of the final radon barrier, and if appropriate, will revise the schedules contained in the license accordingly.

If you have any questions, please feel free to contact me at (206) 586-8949.

Sincerely,

for Gary Robertson
T.R. Strong, Director
Division of Radiation Protection

TRS:krf

WD-2a

WNI

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
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April 14, 1995

Paul Lohaus, Deputy Director
Office of State Programs
U.S. Nuclear Regulatory Commission
Mail Stop 03D23
Washington, D.C. 20555

Dear Mr. Lohaus:

As you know, the Department of Health is reviewing the tailings reclamation plan for Western Nuclear, Incorporated's (WNI) Sherwood mill in northeastern Washington State. The department has three concerns about WNI's cover design which must be addressed before we approve WNI's tailings reclamation plan. These concerns are (1) are there circumstances that would allow the cover to be more permeable than the bottom; (2) can the interim cover and final cover be constructed without dewatering the tailings; and (3) are there circumstances that would allow overtopping, which will result due to #1 and 2 above.

Staff from NRC's Division of Waste Management and the Uranium Field Office have attended meetings we have had with WNI concerning their closure plan. Issue areas discussed with NRC staff in attendance include biointrusion, infiltration into the cover, tailings dewatering, synthetic layer for the impoundment cover, and freeze-thaw. Recently, Earl Fordham of my staff and Mr. Ted Johnson of the NRC's Division of Waste Management have discussed erosional aspects of the design of the diversion channel.

A unique aspect of the Sherwood tailings impoundment is the presence of an intact, competent synthetic liner. WNI has recently completed several studies, including geochemical studies, geologic investigations, tailings impoundment investigations, basin hydraulic evaluations, and ground water protection evaluations. The findings from these studies have been used by WNI to conclude that the saturated tailings should not be dewatered before or after construction of either the interim cover or the final cover. WNI is proposing to construct the final cover using natural earthen materials that are necessarily more permeable than the synthetic impoundment liner. Therefore, the cover design allows overtopping (seepage of excess liquid from impoundment rim). Please note that if a cover is more permeable than the bottom liner, dewatering the tails would be superfluous.

We request that NRC state what its position would be for the situation at WNI as it relates to the final draft of the Uranium Recovery Program Policy and Guidance Directive, LLWM 94-01, on Synthetic Liner Considerations during Reclamation of Surface Impoundments at Title II Uranium and Thorium Mill Tailing Sites, dated July 1994. Specifically, if WNI can successfully demonstrate that elements #1, 2, and 3 (as described above) of its tailings reclamation plan will not adversely impact the structural integrity of the cover through differential settlement, subsidence, slope instability, or breaching of the containment walls or cover; and that the plan meets ground water, radon emanation, and longevity requirements; would the NRC allow such a design?

If you have any questions, please feel free to contact me at (360) 753-3459.

Sincerely,

Gary Robertson

Gary Robertson, Head
Waste Management Section

GR:krf

cc: Joseph Holonich, NRC, DWM
Stephanie Baker, WNI
Warren Seyler, Spokane Tribe
Duane Bird Bear, BIA, WA
Stanley Speaks, BIA, OR

Final Draft

URANIUM RECOVERY PROGRAM
POLICY AND GUIDANCE DIRECTIVE
LLWM 94-01

Synthetic Liner Considerations during Reclamation of Surface Impoundments at Title II Uranium and Thorium Mill Tailing Sites

July, 1994

RESPONSIBLE STAFF:

Latif Hamdan

REVIEWED BY:

Daniel Gillen, HLUR

APPROVED BY:

Joseph Holonich,
Chief HLUR

APPROVED BY:

John Greeves

EFFECTIVE UNTIL:

Reevaluation Scheduled:

PURPOSE: This diractive provides general guidance for raview of cartain aspects of raclamation plans for surfaca impoundments at Uranium Mill Tailings Radiation Control Act, Titla II uranium and thorium mill tailings sitas. Tha guidanca is intanded to assist Nuclear Regulatory Commission reviewers in considering how synthatic bottom liners should be handled in raclamation plans proposed by licenseas/owners for new surfaca impoundments. Specifically, the guidanca requiras that staff verify that proposed raclamation and closura plans will eithar adequatala minimiza tha possibility of craating a "bathtub effact" or that potential impacts of a projectad "bathtub effact" will not adversala impact tha structural intagrity of impoundments, or ground-watar quality.

DISCUSSION: NRC regulations generally require that new surfaca impoundments at Titla II uranium and thorium mill tailings sitas (defined as impoundments designed to hold an accumulation of liquid wastas or free liquids) have a liner to prevent tha migration of wastas to the adjacant soil, ground water, or surfaca water, at any time during tha active lifa of the impoundment, including tha closura period (Criterion 5A(1), Appendix A to 10 CFR Part 40). Several licensees have used and/or proposed to use synthatic liners on the bottom of surfaca impoundments at uranium and thorium mill tailings sitas. Use of thasa liners could craata a "bathtub effact" following raclamation and closura of impoundments, due to passive infiltration through the surfaca and buildup of liquids above the liners. Tha "bathtub effact" can potantially have adverse impacts on the structural intagrity of impoundments as well as ground-watar quality. Specifically, tha "bathtub effact" may cause local differantial settlement, subsidance, slopa instability, and/or a breach in the liner, containment walls, and/or cover. This could rasult in contaminant seepage into ground-water and surfaca water, and possibly uncontrolla rallasa of tailings and contaminatad materials to the anvironment.

In general, raclamation and closura plan reviews nead to verify that plans comply with all of the closura and raclamation, and long-tarm surveillanca requirements of tailings disposal sitas in Appendix A to 10 CFR Part 40. Thasa include, among other requirements, stabilization and covering of wastas and closura of disposal areas in a manner that will eliminata or minimiza

the need for maintanance in the post-closure period (i.e., Criteria 6 and 12).

Specifically, closure and reclamation plan reviews should verify that there will be no need for active maintenance in the post-closure period, including maintenance due to a "bathtub effect" or its potential impact at surface impoundment sites. Therefore, the review must ascertain that proposed closure and reclamation plans will adequately minimize the possibility of creating a "bathtub effect", and/or reduce impacts if a "bathtub effect" is inadvertantly created.

Specifically, closure and reclamation plan reviews should verify that there will be no need for active maintenance in the post closure period, including maintenance due to a "bathtub effect" or its potential impact at surface impoundment sites.

In addition, closure and reclamation plans are to be reviewed in consideration of approved liner design and operation in surface impoundments. This is because certain liner design and operation practices are permitted by regulations subject to a licensee or applicant commitment to implement predetermined reclamation and closure plans (Criterion 5A(1)). For example, a design that allows the migration of waste into the liner during facility operation is permitted if the reclamation and closure plan includes removal or decontamination of contaminated soils, equipment, and structures (including contaminated liner).

Licensees are free to propose site-specific reclamation practices that will minimize the possibility of creating a "bathtub effect" and/or alleviate its potential impacts in the post-closure period. However, it will be the responsibility of licensees or applicants to conduct all necessary technical evaluations and analyses to demonstrate that the proposed reclamation plans will effectively preclude either the development of a "bathtub effect" or the occurrence of adverse impacts from a "bathtub effect." Demonstrations may involve, for example, performing water balance analyses and performance assessments, considering embankment design and construction proposals, and using realistic design hydraulic conductivities and geotechnical stability parameters, and should include consideration of proposed dewatering. In all cases, the results and procedures followed must be fully documented.

Licensees should provide for dewatering of surface impoundments, including eliminating free liquids, removing liquid wastes, and solidifying wastes or

wastes residues in place, before placement of the cover. This is to control the initial moisture content in the disposal cell, and thereby reduce the projected pressure head buildup against the impoundment to acceptable levels. This will also reduce the potential for future adverse differential settlement effects on the final cover.

[redacted] If it is not, licensees should provide analyses demonstrating how any resulting water buildup will not adversly affect the long-term stability of the impoundment. Licensees must demonstrate the feasibility of the proposed cover design and construction, using as a general guide, Uranium Recovery Program Policy and Guidance Directive No. LLWM 92-03 "Interim Guidance on Evaluation Procedure for Hydraulic Conductivity of Radon/Infiltration Barriers for Title I and Title II Mill Tailings Sites." Licensees must also demonstrate that the proposed cover will accomplish the intended hydraulic conductivity objectives in LLWM 92-03 considering site-specific conditions.

Licensees should install a tailings impoundment final cover that is at least as impermeable as the liner.

LIMITATIONS: The reclamation practices cited in this directive for minimizing the possibility of creating a "bathtub effect" and/or alleviating its impacts are intended to be neither exhaustive nor limiting. Staff will evaluate any other site-specific reclamation practices proposed by licensees/applicants, on the basis of the existing regulations.

RESPONSIBLE STAFF: Latif Hamdan, PAHB, (301) 415-6639.

WNI

POLICY ISSUE
(Notation Vote)

June 14, 1995 SECY-95-155

FOR: The Commissioners

FROM: James M. Taylor
Executive Director for Operations

SUBJECT: REVIEW OF PREVIOUSLY APPROVED RECLAMATION PLANS

PURPOSE:

To obtain Commission approval of the U.S. Nuclear Regulatory Commission staff plan to review certain previously approved uranium mill tailings reclamation plans for major design deficiencies.

SUMMARY:

The Uranium Mill Tailings Radiation Control Act (UMTRCA) was promulgated by Congress in 1978 to ensure that uranium mill tailings would be stabilized, disposed of, and controlled in a safe and environmentally sound manner. It also added Section 83c to the Atomic Energy Act of 1954, as amended (AEA), which requires the Commission to determine compliance with regulatory requirements at the time of license termination. NRC regulations in 10 CFR Part 40, Appendix A (Appendix A) implement UMTRCA. Appendix A requires that reclamation of uranium mill tailings be conducted in accordance with a plan that provides reasonable assurance of control of radiological hazards to: (i) be effective for 1000 years, to the extent reasonably achievable, but in any case for at least 200 years; and (ii) limit release of radon-222 to 20 pCi

NOTE: TO BE MADE PUBLICLY AVAILABLE WHEN THE FINAL SRM IS MADE AVAILABLE

CONTACT: Joseph J. Holonich, NMSS
415-6643

ENCLOSURE 1

per m^2 per second. Licensees have developed reclamation plans to meet these requirements, addressing among other things, radon attenuation barriers, erosion protection, and slope stability.

However, because of the evolution of guidance and staff practices, and lessons learned from the reevaluation of the Atlas reclamation plan, the staff was uncertain if some approved reclamation plans fully conform to Appendix A requirements. As a result, the staff developed and began to implement a plan to reevaluate previously approved reclamation plans. Industry has expressed opposition to these re-reviews, citing the fact that NRC has approved these plans as meeting the requirements in Appendix A. Some industry criticism of the reviews also cites the small risk that tailings impoundments present.

The staff, therefore, evaluated in a generic manner the risks to public health, safety, and the environment that failure of tailings impoundments would pose. The evaluations considered the three technical areas that the staff identified as potentially not conforming to current guidance for meeting Appendix A requirements. These areas are: 1) erosion protection design; 2) radon barrier design; and 3) seismic design. The staff concluded that there would not be an imminent health, safety, nor environmental risk as a result of potential flaws in those design areas. The staff further concluded that because the government custodian could be required to repair damage to a tailings impoundment, long-term risks could be minimized.

The staff identified three options for addressing previously approved reclamation plans that may not comport with current guidance: 1) accept the plans as originally approved by the staff; 2) complete full detailed reviews of previously approved reclamation plans using current guidance; or 3) perform reviews of the plans only for major design deficiencies based on current information. The staff has put its reviews of previously approved reclamation plans in abeyance pending a Commission decision on this paper. The staff recommends that the Commission approve the third option, to perform an evaluation of the previously approved reclamation plans to determine any major design deficiencies based only on current and/or readily available information. The purpose would be to identify any design features that clearly do not meet the minimum requirements of Appendix A. Only if the staff identifies a design that clearly does not meet the minimum Appendix A requirements, or that has already experienced significant degradation, would the licensee be brought into the review.

BACKGROUND:

Uranium mills are operated under specific licenses issued by NRC (or Agreement States) in conformance with Part 40. The tailings that result from the milling of uranium ore can release significant quantities of radon to the atmosphere for long periods of time. In 1978, Congress passed UMTRCA, which was intended "...to provide for the stabilization, disposal, and control in a safe and environmentally sound manner of such tailings in order to prevent or minimize radon diffusion into the environment and prevent or minimize other environmental hazards from such tailings." In addition, it added Section 83c

to the AEA which states: "Upon termination on [sic] [of] any license to which this section applies, the Commission shall determine whether or not the licensee has complied with all applicable standards and requirements under such license." The AEA also requires the Commission to retain authority for that determination for mills licensed by Agreement States.

In addition, UMTRCA provides for the perpetual ownership and custodial care of remediated mill tailings sites by a government entity. The government custodian will be responsible, under an NRC general license in 10 CFR 40.28, for site monitoring, maintenance, and emergency measures necessary to protect the public health and safety. The State in which the remediated tailings site is located has the option of becoming the government custodian. If the State chooses not to become the government custodian, site ownership will be transferred to the U.S. Department of Energy (DOE) (unless another Federal agency is so designated by the President). During the March 1995 Workshop and at a subsequent meeting on June 6, 1995, DOE personnel have stated that DOE is prepared to become custodian of a site whenever NRC is ready to terminate the license.

In 1983 the U.S. Environmental Protection Agency (EPA) issued standards for mill tailings in 40 CFR Part 192 in accordance with UMTRCA requirements. The longevity requirement in the EPA standard was that mill tailings disposal areas be designed to provide reasonable assurance of control of radiological hazards for 1000 years, to the extent reasonably achievable, but for at least 200 years. The EPA standards also called for radon emanation to be limited to an average over the entire disposal area of 20 pCi per m^2 per second. These standards are incorporated in Appendix A, which is the basis for NRC's regulatory program for the uranium mill industry. The codified criteria preclude reliance on active maintenance as a design feature for a disposal area.

Licensees developed reclamation plans to comply with the requirements in Appendix A. These plans describe, among other things, how the tailings impoundment features will be constructed to meet the radon emanation and longevity requirements in Appendix A. Typically, radon barriers composed primarily of clay are constructed on top of the tailings. Because of its 3.8-day half-life, the radon gas rapidly decays to solid daughters within the clay barrier, so that less than 20 pCi per m^2 per second escape to the atmosphere. The radon barrier, because of its low permeability, also limits infiltration of rainwater into the impoundment.

One aspect of longevity is consideration of the potential impacts of erosion on the stability of the reclaimed tailings cell. Erosion protection features are designed by licensees to meet the longevity standard in Appendix A. The radon barrier is usually covered with native soil in areas where the slope is shallow (1 percent or less) or with rock riprap on steeper slopes. The size of the riprap can range from less than an inch to several feet, and is dependent on the embankment slopes and the maximum expected flow rate of water.

Another consideration for longevity is the ability of the tailings impoundment slopes to remain stable over the long term. The embankments are designed to remain stable under static and dynamic (seismic) loading. Appendix A requires that the impoundment be designed to withstand a maximum credible earthquake on any nearby capable fault. Typically, the tailings, with cover materials, are contoured to slopes of five horizontal to one vertical or shallower. Seismic conditions are usually analyzed pseudo-statically by applying a horizontal seismic coefficient based on the peak acceleration of the design earthquake for the site. This results in an additional static load being applied to the impoundment.

DISCUSSION:

In the mid-to-late 1980s, the staff gradually realized that reviews of erosion protection were leading to inconsistent designs. The standards require erosion protection designs that are to be effective for 200 to 1000 years, with no maintenance relied on in the designs. Such a design is unique, and methods for achieving it had not been evaluated and reported in the engineering literature. Staff recognized that no appropriate NRC guidance existed, and no guidance was available, outside the Agency, in the general technical literature.

Staff, therefore, proceeded to develop definitive technical guidance on erosion protection. In August 1990, the staff issued a Final Staff Technical Position (FSTP), "Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites." After completion of the FSTP and in view of that document's technical conclusions, the staff became concerned that reclamation plans approved earlier might not meet the longevity requirement in Appendix A. Reinforcing and validating these staff concerns, some older sites with erosion protection designs built to pre-1990 criteria were observed to be experiencing problems, such as erosion and sedimentation. These problems appear to have been caused by either inadequate design or poor construction practice, or both. However, additional review is needed to definitively ascertain the significance and cause of these problems.

Besides the erosion protection concerns at sites reviewed before 1990, the staff had earlier concluded that it was not always clear that the methods used for the design of radon barriers were adequate. Licensees must demonstrate design compliance with the radon emission limit of 20 pCi per m^2 per second, to meet Criterion 6 of Appendix A. The staff, therefore, undertook a program to modify and clarify methods for evaluating radon barrier designs. These methods are presented in Regulatory Guide 3.64, "Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers," dated June 1989. The most significant improvements in this guidance relate to a better estimation of values for parameters used to calculate radon flux. Older methodologies used input parameters that may have resulted in underestimation of the radon flux.

In 1993, the staff initiated a detailed reevaluation of the reclamation plan proposed for the Atlas mill in Moab, Utah. This review identified a number of

potential technical concerns, including the erosion protection and radon barrier designs and the seismic stability of the impoundment. Based on the Atlas situation, the staff decided to review all mill sites to determine if seismic issues existed at other sites. For each site, the staff determined, in a simplified manner, if the acceleration used in the geotechnical engineering analysis of the impoundment design would still be considered correct. Preliminary evaluation of the regional seismic acceleration at mill sites identified several cases where regional acceleration substantially exceeds the design accelerations used in reclamation plans. For these impoundments, the next step in the process would be to determine if those piles would remain stable under the new acceleration. The staff would accomplish this step by considering a geotechnical engineering analysis of the impoundment design to determine the capability of coping with the increase in acceleration. The staff has not, however, conducted those geotechnical evaluations.

As a result of the staff's development of guidance on erosion protection and radon barrier design, and its recent experience concerning seismicity in the Atlas review, there is concern that some reclamation plans approved by NRC staff before 1990 may not have had as rigorous a review as those evaluated more recently. Some staff members believed that the designs reviewed without the benefit of guidance may not fully conform to Appendix A, Criterion 6, requirements. Therefore, in 1990 and 1991, the staff requested that licensees with previously approved reclamation plans evaluate their designs, using the current guidance. Licensees were requested to show how their designs compared with the criteria in Appendix A. Although the letters to licensees did not limit the areas for evaluation, the staff was primarily concerned with erosion protection. Responses to these letters have been received from each of the licensees.

In 1994, partly in response to complaints from licensees that staff had not addressed the licensee responses to the 1990 and 1991 letters, staff initiated the reviews of these previously approved reclamation plans. By early 1995, staff had interacted with licensees on five of the eight previously approved reclamation plans. Attachment 1 identifies those reclamation plans and the status of the staff review. It also identifies the reviewing organization and year of approval. These reviews are now being held in abeyance pending confirmation from the Commission of the staff's plans as described in this paper.

Although responses to the 1990 and 1991 requests for licensees to reevaluate erosion protection designs have been varied, there has been industry opposition. The strongest objection came from the Tennessee Valley Authority (TVA). Its senior management challenged the need to reanalyze a previously approved reclamation plan, particularly one that has been implemented and completed. TVA argued that the Edgemont, South Dakota, site was constructed in accordance with a plan that was approved by NRC as consistent with the requirements of Appendix A. TVA is concerned that requiring changes to tailings impoundments to meet current review practices would not be justified, for health and safety reasons.

By letter dated December 15, 1994 (Attachment 2), the Wyoming Mining Association (WMA) wrote to the Chairman raising many of the issues discussed in this paper. The staff's initial response informed the WMA that its concerns were the subject of staff discussion with the Commission, and promised a more detailed response after a final decision is reached. A copy of the proposed, detailed staff response is in Attachment 3. A copy of this paper and its associated Staff Requirements Memorandum (SRM), when released, would also be included in the staff's response to the WMA. In addition, the staff plans to send copies of those documents to the National Mining Association,[1] affected licensees, and Agreement States.

Public Health, Safety, and Environmental Significance

Some of the industry criticism of the staff's review of previously approved reclamation plans focused on the significance, in terms of public health, safety, and the environment, of correcting defects, if they exist, in these plans. The plans are evaluated against technical criteria that do not directly address risk. Although the criteria were derived in part based on risk, the alternatives analyzed compared unregulated tailings impoundments and those reclaimed in accordance with various potential technical standards. Licensees have argued that the reduction in risks to be achieved by redesigning and rebuilding previously approved reclamation plans do not justify the costs involved. The staff therefore evaluated, in a qualitative manner, the public health, safety, and environmental significance of potential design flaws in the three technical areas of concern. However, the Commission has gone on record in Statements of Consideration for rulemakings and in the Generic Environmental Impact Statement on Uranium Milling (NUREG-0706) as concluding that tailings impoundments pose significant risk to public health, safety, and the environment.

Erosion protection

Covers are required to be designed to protect the tailings impoundment from erosion for 1000 years to the extent reasonably achievable, but for at least 200 years. Covers could be eroded in two ways. A severe precipitation event could cause runoff beyond the design capability of the cover, moving rock riprap and soil cover protecting the radon barrier and tailings. Alternately, smaller rainfall events could create rills in sloped soil covers that serve as channels for runoff during succeeding rainfall events, growing deeper and larger with each event. Eventually, gullies could develop that are deep enough to impinge on the radon barrier or the tailings underneath. There are two potential effects of erosional damage to tailings impoundments that are of concern: 1) the radon barrier could be degraded; and 2) tailings could be dispersed to the environment.

If the erosion protection cover on a tailings impoundment were sufficiently eroded, the radon barrier could be exposed and also eroded.

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[1] Previously the American Mining Congress.

The radon barrier is designed to limit radon releases to the air. Although the radon emission averaged over the entire impoundment may still be within the limit, some areas of an impoundment with the radon barrier partially eroded could release more than 20 pCi per m^2 per second. Areas completely denuded of radon barrier could release hundreds of pCi per m^2 per second of radon. However, it is extremely unlikely that more than a small percent of the total surface area of an impoundment would lose the radon barrier, even after many years of erosion, thus limiting the impoundment average radon release rate. For an event where the entire radon barrier was lost, the resultant concentration at the site boundary would likely be above the Part 20 effluent release limit of 0.1 pCi per liter for radon-222. However, most impoundments are in remote locations.

Additionally, the radon barrier serves to limit infiltration of water into the tailings impoundment. If the radon barrier were eroded or entirely removed over areas of the impoundment, more water would be expected to infiltrate into the pile and come into contact with tailings. Over time this water would seep out of the bottom of the impoundment and eventually reach the water table. The effect would be to contaminate the groundwater below and downgradient of the impoundment. The staff has not performed detailed analyses of various scenarios necessary to determine if the additional seepage would likely result in exceedance of groundwater standards. Such an analysis would be highly dependent on site-specific conditions.

The second effect of erosion of the protective cover is the potential dispersal of tailings into the environment. If the erosion cover and radon barrier were removed from a section of the impoundment, the tailings underneath would be exposed and subject to dispersal by wind and water. Tailings could be carried to ephemeral streams during rains and remain in the channels, subject to further dispersal. Tailings could also be carried into permanent streams and dispersed or deposited in stream sediments. In none of these scenarios would there likely be significant doses to individuals who could come into contact with the tailings.

The consequences of potential failure or degradation of erosion protection covers can be mitigated by actions of the long-term government custodian. Since the long-term custodian is required to monitor the site annually, any significant erosion that would occur should be identified. If necessary to protect public health, safety, or the environment, the custodian could be required to repair damage to the impoundment, collect tailings that have been dispersed, and clean up groundwater. Therefore, the staff believes any threat to public health, safety, and the environment, associated with degradation of erosion protection covers, is likely to be minimal.

Radon emanation

Radon barriers are required to be designed to limit radon to an average release of 20 pCi per m^2 per second. This average is taken over the entire surface of the disposal cell. Regulatory Guide 3.64 presents methods to design radon barriers to meet the standard over long periods of time as the barrier dries out and ages. Some previous reviews of radon barriers may not properly account for drying and aging of the barrier materials. Therefore, these designs may release excess radon in later years. However, at least initially, the radon barrier must function properly; licensees are required by Appendix A to confirm, by measurement, that the average radon release rate is below 20 pCi per m^2 per second when the radon barrier is constructed. Because these sites are remotely located, even if excess radon were released in later years it is unlikely that concentrations at the nearest residence would be above Part 20 limits. Therefore, the staff believes the threat to public health, safety, and the environment associated with previously approved radon barriers, is likely to be minimal, if the areas around the sites remain sparsely populated.

Seismicity

Tailings impoundments are required to be designed to remain stable under earthquakes reasonably expected to occur during the design lifetime (1000 years). An earthquake that exceeds the design of a tailings impoundment could cause slope failures and disruptions in the erosion protection and radon barriers. The consequences would be similar to those discussed for erosion protection failures. Also, similar to erosion protection failure, the long-term custodian would be responsible to repair damage from an earthquake if necessary to protect public health, safety, or the environment. Therefore the staff believes any threat to public health, safety, and the environment associated with the seismic design of most impoundments is likely to be minimal. As noted above, several impoundments merit preliminary reconsideration due to much higher acceleration values which were identified in recent reports.

OPTIONS AND RECOMMENDATION:

Given the issues discussed above, the staff has identified three options to address the previously approved reclamation plans. The first option is to discontinue reviews of previously approved reclamation plans; the second is to continue with full detailed reviews of previously approved reclamation plans; and the third is to perform reviews of these plans only for major deficiencies based on currently available information. These options, along with pros and cons of their implementation, are discussed below.

Each option complies with Section 83c. Section 83c is implemented through the Commission's regulations in Appendix A, which also includes the flexibility of regulation permitted by Section 84c of the AEA. Thus, the question of compliance with Section 83c is enveloped within the question of compliance

with Appendix A, and allowed alternatives, as reflected in the individual site licenses. In particular, each license includes reference to Appendix A, and Appendix A provides that alternative requirements are acceptable if they provide equivalent protection "to the extent practicable," taking into account safety and environmental risk and "due consideration" to economic costs.

The policy choices presented in the options will have future consequences (post license termination) in terms of the potential for the occurrence of events of safety significance and related costs to the custodian. Option 2 would tend to reduce such consequences while Option 1 may increase them. The recommendation, Option 3, strikes a middle ground. However, to the extent such consequences can be reasonably foreseen, Appendix A allows the staff to scale up the amount paid over to the custodian for future maintenance.

Option 1 - Accept Most Previous Reviews

Under this option, NRC would decide, as a matter of policy, to grant finality to reclamation plans that have been previously approved by the staff. At license termination, the staff would simply confirm that the reclamation was performed as approved. However, any sites that have degraded before their transfer to the long-term custodian would be required to be repaired, and the licensee would be required to justify that the design meets Appendix A requirements in light of the observed degradation. In addition, the staff would identify to the Commission any previously approved reclamation plans that present significant health, safety, or environmental concerns. The staff would also complete its geotechnical evaluation of the disposal cells which have much higher seismic accelerations and determine if any significant concerns exist. For those disposal cells that were determined to be unstable under the higher seismic accelerations, the licensee would be required to justify that the design meets the requirements in Appendix A.

Pros:

1. Licensees would be assured that NRC approval of a reclamation plan would not be revisited in the future unless unacceptable degradation became apparent.

2. There would be no additional design change impact on most licensees with previously approved reclamation plans (some having completed much or all of construction).

3. Implementation of this option would not result in serious immediate threat to public health and safety or the environment. Any future failure of these reclaimed sites would be unlikely to present an immediate health and safety concern and could be remedied by the long-term government custodian.

4. Staff resources would only be needed for sites with observed degradation or identified significant health and safety concerns.

Cons:

1. Implementation of this option could result in allowing to stand some reclamation plan designs that would not be considered to meet the standards under the current staff guidance and practices. Because these designs may be similar to designs that have already experienced degradation, these previously approved disposal cells may be more likely to degrade or fail in the future than those with more modern designs.

2. Implementation of this option potentially increases the likelihood of the long-term custodian (DOE or the State) having to perform maintenance or repairs on a site after license termination. The requirements in Criterion 6 are in part aimed at minimizing future maintenance and repair, although not guaranteeing it. This maintenance or repair could be expensive and would be a cost to the government that UMTRCA attempted to minimize.

3. Implementation of this option would establish an inconsistency in the application of Part 40 compliance measures to all on-going and future licenses. This option relies on a government maintenance and repair program that assumes that any failure of the radon barrier by erosion or seismic disruption would pose an acceptable radon release until it is detected and fixed. In contrast, licensees with more recent reclamation plan approvals would continue to be held to the more stringent compliance levels of Part 40, which require controlled radon releases up to 200 to 1000 years without reliance on maintenance.

Option 2 - Complete Detailed Reviews of Previously Approved Reclamation Plans

Under this option the staff would remove the current hold on these reviews and complete the reviews using current guidance and staff practice to assess compliance with Appendix A. Evaluations through the normal review and comment process would determine if revisions to previously approved designs would be needed in the three technical areas discussed above to meet Appendix A requirements.

Pros:

1. The review at the time of license termination would be easily accomplished if the updated reviews were to have been recently completed and documented.

2. This option would likely result in more robust designs of disposal cells and less likelihood of future maintenance or repair costs by the long-term Government custodian.

3. The implementation of the applicable standards would be consistently applied to all licensees.

Cons:

1. This option would impose additional design change impacts on licensees with previously approved reclamation plans. The cost to the licensee for

re-analysis, redesign, and additional construction could range up to several million dollars. Western Nuclear, for example, has indicated that in excess of $3 million would be needed to upgrade the existing Day Loma site, to bring it into conformance with the current guidance.

2. The staff estimates an average of 0.7 to 1.0 full-time equivalent (FTE) per site to review previously approved reclamation plans in erosion protection and radon barrier design. These reviews would be billed to the licensee. The billed cost would, therefore, be between $150 thousand to $200 thousand per site. The cost for the preliminary seismic review of 22 sites, already performed by Lawrence Livermore National Laboratory under contract, is $124 thousand and is not being billed to individual licensees (i.e., it is non-fee-recoverable). However, these costs will be recovered from licensees with operating facilities through annual (10 CFR Part 171) fees.

3. The improvement in public health, safety, or the environment (over the no-review option) may not be significant.

4. There would not be finality to NRC approvals of reclamation plans until license termination.

Option 3 - Review Previously Approved Reclamation Plans for Major Design Deficiencies

Under this option the staff would perform a review based on current and/or readily available information to identify sites or reclamation designs that show evidence of failure or degradation. The licensee would be required to repair any design feature that is not functioning as designed or has not been constructed as designed, and to justify how the design could be expected to conform to Appendix A. The staff would also perform an evaluation of the previously approved reclamation plans to determine any major design deficiencies based only on current and/or readily available information. The purpose would be to identify any design features that clearly do not meet the minimum requirements of Appendix A. Only if the staff identifies a design that clearly does not meet the minimum Appendix A requirements would the licensee be brought into the review.

Pros:

1. After the reviews performed under this option are completed, licensees would be assured that NRC approval of a reclamation plan would not be revisited in the future unless unacceptable degradation became apparent or significant new information becomes available that will affect the ability of the design of the facility to adequately protect public health and safety.

2. Implementation of this option would incur less staff and licensee effort and costs than Option 2. The staff expects that because of the manner in which the reviews would be performed, the billed costs to licensees would be considerably less than for Option 2, unless a significant problem is identified. Also, costs to licensees for any design and construction modifications should be significantly less than those for Option 2.

3. This option would eliminate the most significant design problems and should thus reduce the potential maintenance costs that would likely be incurred by the government custodian.

4. The implementation of the applicable standards would be consistently applied (with less impact) to all licensees.

Cons:

1. This option may also be viewed by industry as a backfit, although to a lesser degree. There would be minor design change impact on licensees with previously approved reclamation plans.

2. The staff estimates an average of 0.2 to 0.4 full-time equivalent (FTE) per site would be needed for this option s review of current or readily available information on the previously approved reclamation plans in erosion protection and radon barrier design. These reviews would also be billed to the licensee. The review of the seismic issues would require the same resources as in the other options.

3. The improvement in public health, safety, or the environment (over the no-review option) may not be significant.

Licensee Alternatives during Reviews

Any of the options could result in identification of significant design problems. If the design problem indicates that a reclamation plan is not in compliance with NRC standards, an individual licensee may implement one of several approaches.

1. The licensee can provide additional analysis to show that the plan does meet the standards. For example, the licensee can propose and justify analytical techniques and procedures outside NRC guidance documents.

2. The licensee can revise the reclamation plan (i.e., redesign the impoundment) to meet the standards. Depending on the stage of actual construction at the site, this can result in the licensee having to reconstruct portions of the impoundment that were thought to have been completed.

3. The licensee, under Section 84c. of the AEA and Appendix A, can propose an alternative to specific NRC requirements. Appendix A provides that these alternatives are to be evaluated with reference both to the significance of the safety and environmental risks and the economic costs. A finding must be made that the alternative will achieve, to the extent practicable, the same or greater level of stabilization and containment of the site and protection of public health, safety and the environment. A licensee may be able to demonstrate the impracticability of achieving long-term stability without relying on maintenance. Accordingly, the licensee could propose a design that relied on periodic

maintenance. The licensee would have to identify the maintenance required and show that the site would remain stable if that maintenance were provided. The licensee would also have to provide funds for that maintenance (see Section 161x.(2)(B) of the AEA).

Licensees can also propose combinations of the options described above. Staff expects that for some completed sites, where the cost would be high to reconstruct portions of the impoundment to meet standards, the third approach may be the most palatable recourse for licensees.

RECOMMENDATION:

The staff recommends that the Commission approve Option 3. The basis for this recommendation is that under Option 1, potential problems outweigh the benefits to the Agency or affected licensees, and under Option 2 the potential costs are not warranted by the improvements that would be achieved in health, safety, or the environment. If the Commission approves Option 3, the staff would begin an orderly process to modify and complete its reviews of previously approved reclamation plans. The staff would also send the attached letter (Attachment 3) to the Wyoming Mining Association, along with a copy of this paper and the associated SRM.

The staff would not terminate its detailed review of Atlas because of the significant concerns already identified. Also, some licensees may voluntarily choose to proceed with some or all of their proposed changes to their reclamation plans.

Additionally, many of the concerns identified in this paper may be applicable to reclamation plans in Agreement States. Section 274c.(4) of the AEA states "The 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 section 11e.(2)." Management Directive 9.15 states that the responsibility for making the section 274c(4) determination has been delegated to the Director, Office of State Programs (OSP). These determinations will be made in consultation with the Director, Office of Nuclear Material Safety and Safeguards. The OSP implements section 274c(4) through review of the State's documentation that the applicable standards (the State's regulations and license conditions) have been met. There is no intention of duplicating the Agreement State's review of the licensee's reclamation plan other than that done as part of the staff's routine review of the quality of uranium mill program licensing actions. The Agreement States will be informed of the decision at the next NRC/Industry meeting or through another means following the Commission's decision.

The policy and technical issues have been the subject of extensive discussion among the technical staff. Some staff consider that additional views on background information would be useful for an enhanced understanding of the current situation and the implications of the options presented. This additional view is contained in Attachment 4.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection.

James M. Taylor
Executive Director
for Operations

Attachments:
1. Previously Approved Reclamation Plans under Review
2. Letter from WMA dated 12/15/94
3. Response to WMA
4. Individual staff views

Commissioners' comments or consent should be provided directly to the Office of the Secretary by COB Friday, June 30, 1995.

Commission Staff Office comments, if any, should be submitted to the Commissioners NLT Friday, June 23, 1995, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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PREVIOUSLY APPROVED RECLAMATION PLANS UNDER REVIEW

Licensee	Facility	St	Reclamation Plan Approval		Status of Current Reclamation Plan Review
			Office	Year	
ANC	Gas Hills	WY	URFO	1983	Preliminary review completed, questions sent. Licensee bankrupt; WY will complete reclamation.
Exxon	Highlands	WY	URFO	1988	Not yet reviewed.
Petrotomics	Shirley Basin	WY	URFO	1989	Preliminary review completed, questions sent to licensee.
Sohio	L-Bar	NM	URFO	1989	Not yet reviewed.
TVA	Edgemont	SD	URFO	1986	Preliminary review completed, questions sent to licensee.
Umetco Gas Hills	Above grade	WY	NMSS	1982	Preliminary review completed, questions sent to licensee.
Umetco Gas Hills	A-9 pit	WY	URFO	1988	Preliminary review completed, questions sent to licensee.
Western Nuclear	Day Loma	WY	NMSS	1981	Not yet reviewed.

Attachment 1

WYOMING MINING ASSOCIATION

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15 December 1994

The Honorable Ivan Selin
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Selin:

Subject: Reclamation Plans for Uranium Recovery Sites

The Wyoming Mining Association (WMA) is an industry association of mining companies and associates (suppliers, contractors, service companies, etc.) in the State of Wyoming. The WMA's membership includes uranium recovery operators licensed by the Nuclear Regulatory Commission (NRC). Several WMA uranium recovery licensees have expressed concerns to the association regarding the NRC's handling of their site reclamation plans. The concerns expressed by the licensees regarding their reclamation plans are as follows:

1. **Finality of NRC Approval of Reclamation Plans for Uranium Recovery Sites**

   One licensee, whose reclamation plan was reviewed and conditionally approved in September of 1993 by the staff at the now closed Uranium Recovery Field Office (URFO) formerly in Denver, Colorado, was told in October 1994 during a site visit by members of the NRC's Rockville, Maryland staff that the plan was going to be reopened and reexamined by the Rockville, Maryland staff. This is an NRC approved plan. It appears that the plan is now being subjected to reexamination just because URFO has closed and new NRC personnel in Rockville, Maryland are regulating the project. NRC approval of licensing actions should be just what it says. These actions should not be subject to reevaluation every time new personnel assume responsibility for a project. This particular situation implies that the review and approval given to the reclamation plan by the members of the URFO staff was somehow "substandard" and requires the review and approval of Rockville staff in order to truly be an NRC approved plan.

Another licensee had reclamation plans which were approved by URFO in 1985 and 1988 respectively. The Final Staff Technical Position was released by NRC in August of 1990. This licensee received a letter in 1991 requesting a review of the plan in light of 10 CFR Part 40 Appendix A and the August 1990 Staff Technical Position. The licensee submitted the requested review to the NRC and continued with reclamation. The licensee received a response from NRC in 1994, stating that they must justify their selection of a vegetative cover or use a rock cover. During the three year period between when the licensee submitted its response to the NRC's request for review and when a response from NRC was received, the licensee had discussed the issue with a member of NRC staff. The staff member stated that NRC staff was divided on the question as to whether previously approved reclamation plans should be revisited or not. The licensee was informed that the final outcome would be decided on which side in the dispute within the NRC prevailed.

Another licensee submitted a reclamation plan for their site in the Fall of 1983. The plan was approved in steps by URFO in Denver, Colorado as a series of license amendments. The licensee completed the reclamation work according to the plan approved by URFO in the Fall of 1989. The licensee discussed the completion of the work with the URFO staff and was told that the contractor could be released and the equipment on site could be sold as surplus. The licensee was told to submit a final report and Long Term Surveillance plan to URFO. These documents were submitted to URFO in the Spring of 1990. At this point the licensee believed that reclamation was complete. The licensee received no further direction from NRC. The Final Staff Technical Position on erosion protection was released by NRC in August of 1990. In the Fall of 1990, the licensee received a letter from NRC requesting that they review their reclamation plan in terms of the Final Staff Technical Position and other requirements. The licensee discussed the plan for the review with URFO staff in order to obtain agreement on key assumptions and methodologies. The licensee submitted the review to the NRC in 1992. The licensee received a response from NRC regarding their review in the Summer of 1994. The review stated that the NRC did not agree with the analyses done or the methods used, in spite of the fact that they had been previously coordinated with URFO staff. In this case a licensee was being asked to revisit a reclamation job that they were told was complete by NRC/URFO. In addition review methodologies approved by URFO are now being questioned by the staff in Rockville, Maryland.

On November 19, 1992 you made a speech at a Site Decommissioning Management Plan (SDMP) Workshop in Rockville, Maryland in which you stated, "As described in the action plan, the NRC's decision to terminate a license will relieve the licensee from any further obligation to the NRC to conduct additional cleanup, as long as the licensee decommissioned the site in full accordance with an approved decommissioning plan". The NRC's actions toward uranium recovery licensees appear to violate the regulatory spirit implied in your speech.

This is a very serious issue because the licensees base business decisions and budgets on these plans. Changes in them, once a licensee has been told that the are approved, can be very costly. The long time interval in obtaining a response from NRC, during which no guidance is provided, is in direct conflict with the agency's rules related to decommissioning. The licensee holds a reclamation plan for which final approval has been received and then conducts operations (earthmoving etc.) to implement the plan only to find out three (3) years later that the NRC decides that the plan is unsatisfactory. During this interval the licensee receives no guidance from NRC and is only told that the NRC's staff is divided on the issue and that the outcome will depend upon which side within the agency ultimately prevails. This is not good regulatory practice. Licensees require timely notification from the agency in order to complete reclamation in a timely and cost effective manner.

The issue involving two (2) of the above mentioned licensees are ones which involve regulatory continuity and the disruption of same. The issue of regulatory continuity and the consequences of the disruption of that continuity with the closure of URFO in Denver, Colorado was raised in a letter from the American Mining Congress (AMC) to you dated May 28, 1993 and in comments sent to you by the WMA in 1993. The issues expressed in these letters are now coming true.

The Final Rule on Timeliness in Decommissioning of Materials Facilities imposes a stringent decommissioning timetable on licensees. A decommissioning timetable would be difficult if not impossible to meet given the delays experienced by uranium recovery licensees in obtaining reviews of their submittals. The NRC's Final Conforming Rule on Mill Tailings incorporates reclamation milestones. The Final Conforming Rule does allow for "Delays beyond the time reasonably required in obtaining necessary government permits, licenses, approvals or consent for activities described in the reclamation plan..." Delays of the magnitude described above (three years) make a mockery of any attempt by a licensee to meet any sort of milestone.

Licensees cannot plan or budget if their is no finality to NRC approval and if "approved" reclamation plans are always going to be subject to arbitrary reexamination, revisitation and modification by the NRC at any time after "final approval". This situation makes a regulatory compliance an attempt to "hit a moving target" which is nearly impossible. The industry needs finality of approval and assurance that the NRC will not revisit previously approved reclamation plans if it is to achieve reclamation of uranium recovery sites in a timely and efficient manner.

2. **Delays in Reviewing Submittals**

A least one licensee has experienced a long delay in obtaining a response from NRC on a reclamation plan submittal (a response to an NRC request for review) similar to the delay experienced by the above mentioned licensee. This licensee had a reclamation plan which was approved in 1989. In August 1990 the Final Staff Technical Position on the Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites was issued by NRC. In a letter dated August 2, 1991, the licensee was requested by NRC/URFO to review its reclamation in terms of the thirteen criterion in 10 CFR 40 Appendix A and the Final Staff Technical Position. The licensee submitted the requested review in the Fall of 1991. The licensee then received a response to its review in the Fall of 1994 in which NRC listed numerous comments related to erosion protection, the radon barrier and other geotechnical issues. How can licensees be expected to complete reclamation in a timely manner as expected by the NRC and EPA and as required in 10 CRT 40 Appendix A Criterion 6A (1) given the regulatory delays that are currently being experienced? Licensees require timely responses to their submittals in order for them to properly plan and budget for their reclamation activities

3. **Leakage of Title I Requirements into the Regulation of Title II Sites**

There is growing evidence that requirements for the reclamation of Title I (DOE) sites have been creeping into the regulation of Title II sites especially following the closure of URFO and the transfer of the licensing function to Rockville, Maryland. This issue has been raised by uranium recovery licensees at the Transition Oversight Team meetings and at other occasions. For example, the subject of biointrusion of the tailings impoundment cover appeared in an NRC review of a conceptual tailings management study submitted by one licensee, even though there is no mention of biointrusion in the STP on the design of erosion protection covers for tailings impoundments. The issue of biointrusion, however, is one that is addressed in the regulation of Title I sites. Uranium recovery licensees need clear regulatory guidance to plan their

reclamation and should not be expected to have to address issues that are not explicitly required in the regulations but rather are raised by individuals in the agency who are driven by Title I requirements.

The Wyoming Mining Association appreciates the opportunity of addressing these issues with you. The WMA requests a response from you on these issues and also requests that these issues be placed on the agenda for discussion at the planned NRC/Uranium Recovery Licensee meeting planned for March in Denver, Colorado. If you have any questions please do not hesitate to contact me.

Sincerely yours,
WYOMING MINING ASSOCIATION

Marion Loomis

Marion Loomis
Executive Director

OP:m
6 DEC

cc: Anthony J. Thompson - Pittman, Potts, Shaw and Trowbridge
James Gilchrist-American Mining Congress
Glenn Catchpole-Uranium Producers of America

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

Mr. Marion Loomis, Executive Director
Wyoming Mining Association
Post Office Box 866
Cheyenne, Wyoming 82003

Dear Mr. Loomis:

SUBJECT: FOLLOWUP RESPONSE TO LETTER CONCERNING STAFF REVIEW OF RECLAMATION PLANS FOR URANIUM RECOVERY SITES

On January 10, 1995, Robert M. Bernero responded to your letter of December 15, 1994, to Chairman Selin, in which you raised concerns regarding the finality of U.S. Nuclear Regulatory Commission staff's review of reclamation plans for uranium mill tailings sites. In that letter Mr. Bernero stated that it would be inappropriate to respond to the issues you raised because the staff was in consultation with the Commission on some of the areas identified in your letter. He promised you that once those consultations were complete, the staff would provide you with a more detailed response to your concerns. The staff has recently completed its consultations with the Commission. Attached are copies of the Commission Paper (SECY-xx-yy) discussing review of previously approved reclamation plans and the associated Staff Requirements Memorandum. These documents address in detail your concern about backfit reviews of previously approved reclamation plans. As you can see, the Commission has approved the staff recommendation to review previously approved reclamation plans for major design deficiencies. The staff plans to modify its reviews in an orderly manner and will be in contact with individual licensees in regard to this.

Your letter also identified concerns related to the "leakage" of Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I requirements into Title II reviews, and delays in conducting reviews. With regard to your concern of leakage of UMTRCA Title I requirements into the regulation of Title II sites, you should be aware that the staff is using a common set of guidance documents in implementing these programs. This is because the basic standards are the same in both programs. The major difference is that the U.S. Environmental Protection Agency (EPA) standards have been incorporated into 10 CFR Part 40 regulations only for Title II. Title I reviews simply deal directly with the EPA standards. The staff has indicated to uranium recovery licensees (e.g., at the March 1994 and 1995 workshops with the uranium industry) that the Standard Review Plan that it had developed and implemented in the Title I program is also being applied to Title II reviews. Lessons learned in any particular action will be applied across the two programs.

The long delay in some reclamation plan reviews also concerned you. As indicated at the March 1994 and 1995 workshops, the staff has focused on, during the past few years, and continues to focus on reviews necessary to meet 40 CFR Part 61, Subpart T (Clean Air Act) obligations for final covers. In

response to concerns raised at the March 1994 workshop, the staff began the reviews of the previously approved plans, and, to date, has transmitted comments on five of the eight sites. Earlier this year, the staff put those reviews in abeyance, pending consultation with the Commission. As a result of the recent decision, individual project managers will be in contact with licensees, to expedite the process of modifying the reviews to focus on major design deficiencies. In addition, as we indicated in the October 1994 meeting with industry representatives, the Division of Waste Management reallocated significant resources to support reviews of routine submittals by licensees.

I trust that we have responded to your concerns. If you have any questions, please feel free to contact either me or Mr. Joseph Holonich, Chief, High-Level Waste and Uranium Recovery Projects Branch. I can be reached at (301) 415-7800, and Mr. Holonich can be reached at (301) 415-7238.

Sincerely,

Carl J. Paperiello, Director
Office of Nuclear Material Safety
and Safeguards

cc: Anthony J. Thompson, Shaw, Pittman, Potts, and Trowbridge
Kathlene Sweeney, National Mining Association
Glenn Catchpole, Uranium Producers of America
UR licensees
State representatives

Individual Staff Views

Attachment 4

June 14, 1995

COMMENTS BY MYRON FLIEGEL ON SECY PAPER:
REVIEW OF PREVIOUSLY APPROVED RECLAMATION PLANS

Although I do not disagree with the recommended option in the subject Commission Paper, I have concerns with the manner in which the paper is developed and the options presented. The choice facing the staff, and the Commission, is neither an easy nor a good choice. There are serious repercussions that would result from adopting each of the options identified, but especially from Option 1, that are not adequately described in the paper. Additionally, there is some background and historical information which may be useful to better understand how and why we now face this situation.

The Commission Paper is written primarily from the perspective of risk rather than NRC's responsibility to adhere to its codified standards. I, like many staff involved in the uranium recovery program, have questioned whether the standards are warranted by the risks posed by mill tailings. However, both EPA and NRC have defended the standards as appropriate, after consideration of the risks. If NRC now wants to revisit whether those standards are too restrictive it should do so in a more direct manner. If Option 1 (and to some extent, Option 3) were adopted, it can be viewed as the Commission indirectly repudiating some of the agency's past conclusions that have appeared in Statements of Consideration for rulemakings and in the Generic Environmental Impact Statement on Uranium Milling (NUREG-0706).

Historical perspective - erosion protection

The Commission Paper portrays the concerns related to erosion protection as resulting from the development and revision of guidance leading the staff to question previously approved reclamation plans. The concerns are couched in terms of robustness of design and whether designs meet current guidance. However, I think it is important to understand that the preparation of guidance on erosion protection was actually initiated because some technical staff had major concerns that NRC was approving designs that did not meet the standards in Appendix A.

In the mid to late 1980's, staff in the (old) Division of Waste Management (DWM) were beginning to address erosion protection designs at DOE Title I sites. There was some material in the technical literature on rock riprap design that DWM staff and DOE tried to adopt to the requirement for 1000 year, no maintenance designs. DWM staff also became aware that staff at the Uranium Recovery Field Office (URFO) were looking favorably on licensee designs employing only soil covers. DWM staff were unaware of any technical basis to support a conclusion that a soil cover would last 1000 years with no maintenance. DWM staff concluded, based on experience, that any sloped soil cover would develop a network of small channels to carry away water when it rained. These small channels coalesce and deepen with each succeeding rainfall-runoff event, eventually forming gullies. Given enough time, and 1000 years appeared to be more than enough time, the gullies would erode into the radon barrier and then tailings. It therefore appeared to DWM staff that designs relying on soil covers for erosion protection would not meet EPA and NRC longevity standards.

In discussions, URFO appeared to rely on both Criterion 4, which presented maximum allowed slopes, and engineering judgement to conclude that designs employing soil covers would meet the longevity standard. A great deal of effort went into trying to resolve the technical disagreements between DWM and URFO. Eventually it was decided to prepare a technical document to resolve the issue. The document would present technically defensible methods that could be used to provide reasonable assurance that a proposed cover design would perform as required by the standards. The document, which became the FSTP referred to in the Commission Paper, was a joint effort by the erosion protection experts in DWM and URFO. The FSTP essentially confirmed the earlier conclusion that soil covers could <u>not</u> be relied on for long term erosion protection.

As a result, it became apparent to staff that designs approved (by URFO) before the FSTP, probably did <u>not</u> meet the longevity requirement. That was the reason that staff wrote to licensees in 1990 and 1991, requesting that they show that their (approved) designs meet the criteria in Appendix A.

In summary, it was DWM staff's concern that designs which did not meet Appendix A had already been approved that directly led to the development of the guidance, not the other way around as the Commission Paper implies.

<u>AEA Section 83c interpretation</u>

The legal interpretation of AEA Section 83c described in the paper has some interesting implications under Option 1 and to some extent, under Option 3. As I understand it, Option 1 would result in previously approved reclamation plans that are not revisited (i.e., those not having seismic concerns or showing evidence of degradation) being deemed to have met Appendix A by the following logic: 1) the original review and approval concluded that the appropriate criteria in Appendix A were met, 2) if the original approval was in error with respect to any of the specific requirements in Appendix A (e.g., because of inappropriate technical evaluation), Appendix A allows NRC to accept alternative requirements, and 3) the Commission would conclude, if it approved Option 1, that the reclamation plan met Appendix A because it met an alternative requirement that provides equivalent protection "to the extent practicable," taking into account safety and environmental risk and "due consideration" to economic costs. The Commission Paper would be basis of the Commission's conclusion, even though it does not consider specific reclamation plans, specific costs and specific alternative requirements.

I believe that there are some practical considerations in implementing this approach.

At the time of license termination, an NRC official, probably a Branch Chief, will have to certify that all applicable standards and requirements have been met. What options will that official have, if informed by one or more technical staff, either orally or in writing, that the reclamation does not meet the specific requirements in Appendix A? The official could either sign the certification, relying on the Commission Paper and its associated Staff Requirements Memorandum, or, based on staff concerns, initiate a technical review. If he or she signed the license termination and a hearing or other

legal action ensued, that official could find him or herself in the position of defending the certification that all applicable standards have been met, even though that official had knowledge that the specific requirements in Appendix A were probably not met and alternative requirements had not been specifically evaluated for the reclamation plan. The official may be reluctant to sign such a certification because of legal concerns or simply out of a sense of professional responsibility.

On the other hand, if the certifying official decides to initiate a technical review, the net result will have been to postpone that review from now to some time in the future. However, the result of initiating such a review at the time of imminent license termination could lead to worse consequences if it were determined that the old reclamation plan did not meet Appendix A. The costs to licensees to redesign and rebuild tailings impoundments could be considerably higher years from now. Additionally, there is the possibility that the licensee may not have sufficient resources to redesign and rebuild, (or fund ongoing maintenance by the long-term government custodian) after NRC has approved construction (as conforming to the originally approved design) and released the surety requirement.

The interpretation of 83c or a specific license termination could be challenged, either as a result of the Commission Paper or in a specific licensing case. If challenged, NRC could be in the unusual position of being unable to rely on its technical experts, since its technical experts may not be able to confirm that the specific requirements in Appendix A were met. While there may be little opportunity for challenge by traditional intervening parties, there is a likelihood of objection from DOE.

DOE interactions

DOE has the responsibility under 10 CFR 40.28, as the government long-term custodian, to prepare a Long-Term Surveillance Plan (LTSP) for each site in advance of its license termination. In order to prepare the LTSP, DOE must conduct a detailed study of the site and the reclamation. DOE has begun this process, which will rely primarily on licensee and NRC documents.

DOE has two strong reasons to challenge any instance it identifies of reclamations that do not fully meet the specific requirements in Appendix A:

1. As stated in the paper, reclamation designs that do not meet the specific requirements are more likely to degrade or fail in the future. DOE would be responsible for repairing the damage. The repairs, which could be expensive, would have to be paid for by DOE. DOE, therefore, has good reason to try to prevent sites whose reclamation designs do not meet the specific requirements, from passing through to its custodial care.

2. DOE has been accused, primarily by uranium mill licensees, of wasting money in its program of reclaiming old uranium mill sites under Title I of UMTRCA. NRC, in its concurrence role in the Title I program, has compelled DOE to meet the applicable EPA standards, which are essentially the same standards required, in Appendix A, of NRC

licensees. DOE has done a good job in remediating its sites but at considerably higher cost than NRC licensees typically spend. NRC licensees have tried to avoid some of the design features that DOE has determined are necessary to meet the standards, calling DOE's approach "gold plating." By not challenging designs that do not include those features that DOE concluded were necessary to meet the EPA standards, DOE could be viewed as agreeing with licensees that it did more than necessary and thus wasted money in the Title I program. DOE, therefore has an interest in holding NRC licensees to the same standards that it met.

As reported in the Commission Paper, DOE has stated that it is prepared to become site custodian whenever NRC is ready to terminate a license. However, DOE has also indicated that it will discuss and try to resolve with NRC, any instance in which it, during preparation of the LTSP, determines that a site doesn't meet the standards. DOE also indicated that problems it finds at sites could be remedied by requiring licensees to provide funding for ongoing maintenance. However, the timing may be such that issues may not be raised by DOE until shortly before license termination, resulting in the types of problems discussed above.

EPA interactions

There may be consequences with respect to NRC's interactions with EPA, in proceeding with Option 1 (or to a lesser extent Option 3). At least some of the differences between the two agencies may stem from some EPA staff doubts that NRC is fully committed to implementing standards that originated in EPA. This appeared to be the case with mill tailings groundwater standards, where EPA tried to insert itself in the site-specific approval process of alternate concentration limits. EPA also inserted itself into the Kerr-McGee West Chicago hearing, when it concluded that NRC was not properly implementing its standards. Proceeding with Option 1 (or Option 3) might be viewed by EPA staff as NRC backing away from implementing its standards, thus confirming their opinion of NRC.

Conclusion

All three options have adverse consequences. I think the decision as to which option to choose should not be decided primarily on risk but rather on policy implications with respect to implementing codified standards. The implications of Option 2, which are primarily related to staff resources and costs to licensees, are well laid out in the Commission Paper. Implications of Options 1 and 3 may need to be more completely considered.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

JUNE 29, 1995

MEMORANDUM TO: James M. Taylor
Executive Director for Operations

FROM: John C. Hoyle, Secretary /s/

SUBJECT: SECY-95-155 - REVIEW OF PREVIOUSLY APPROVED RECLAMATION PLANS

The Commission (with all Commissioners agreeing) has disapproved the staff's recommendation to proceed with Option 3 and approved Option 1 with the understanding that the staff has estimated the resources required to implement Option 1 to be about 1 FTE.

Commissioner de Planque noted that the staff is already planning a review of Criterion 4 (site and design criteria) and Criterion 12 (long-term site surveillance) as part of the National Performance Review process. She recommended that the staff re-examine all of Appendix A, in particular Criterion 5 (groundwater) and Criterion 6 (radon barrier and release limits) in terms of risk, benefit and cost. If the reviews of the various criteria in Appendix A result in less stringent requirements for the licensees, they should be allowed to modify their reclamation plans.

cc: The Chairman
Commissioner Rogers
Commissioner de Planque
Commissioner Jackson
OGC
OCA
OIG
Office Directors, Regions, ACRS, ACNW, ASLBP (via E-Mail)

SECY NOTE: THIS SRM, SECY-95-155, AND THE VOTE SHEETS OF ALL COMMISSIONERS WILL BE MADE PUBLICLY AVAILABLE 5 WORKING DAYS FROM THE DATE OF THIS SRM.

ENCLOSURE 2

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D C. 20555-0001

July 14, 1995

John B.

RECEIVED
SEP 1 8 1995
DIV. OF RADIATION PROTECTION

Mr. Marion Loomis, Executive Director
Wyoming Mining Association
Post Office Box 866
Cheyenne, Wyoming 82003

WNI

SUBJECT: FOLLOWUP RESPONSE TO LETTER CONCERNING STAFF REVIEW OF RECLAMATION PLANS FOR URANIUM RECOVERY SITES

Dear Mr. Loomis:

On January 10, 1995, Robert M. Bernero responded to your letter of December 15, 1994, to Chairman Selin, in which you raised concerns regarding the finality of the U.S. Nuclear Regulatory Commission staff's review of reclamation plans for uranium mill tailings sites. In that letter Mr. Bernero stated that it would be inappropriate to respond to the issues you raised because the staff was in consultation with the Commission on some of the areas identified in your letter. He promised you that once those consultations were complete, the staff would provide you with a more detailed response to your concerns. The staff has recently completed its consultations with the Commission. Enclosed is a copy of the Commission Paper (SECY-95-155) discussing review of previously approved reclamation plans, and a copy of the associated Staff Requirements Memorandum. These documents address in detail your concern about backfit reviews of previously approved reclamation plans.

As you can see, the Commission has determined to implement Option 1 of SECY-95-155, i.e., to grant finality to previously approved reclamation plans. At license termination, the staff would simply confirm that the reclamation was performed as approved. However, any sites that have degraded before their transfer to the long-term custodian would be required to be repaired, and the licensee would be required to justify that the design meets 10 CFR Part 40, Appendix A requirements in light of the observed degradation. In addition, the staff would identify to the Commission any previously approved reclamation plans that present significant health, safety, or environmental concerns. The staff would also complete its geotechnical evaluation of the disposal cells, which have much higher seismic accelerations, and determine if any significant concerns exist. For those disposal cells that were determined to be unstable under the higher seismic accelerations, the licensee would be required to justify that the design meets the requirements in Appendix A.

The staff will terminate the review of previously approved reclamation plans where there are no significant seismic stability, health, safety, or environmental issues and no evidence of degradation. The staff plans to terminate the reviews in an orderly manner and will be in contact with individual licensees in regard to this. However, the staff is prepared to work with any licensee who would like to continue the review process to achieve a more robust reclamation plan, and minimize the possibility of future site degradation.

Leakage of T1 Requirements

Your letter also identified concerns related to the "leakage" of Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I requirements into Title II reviews, and delays in conducting reviews. With regard to your concern of leakage of UMTRCA Title I requirements into the regulation of Title II sites, you should be aware that the staff is using a common set of guidance documents in implementing these programs. This is because the basic standards are the same in both programs. The major difference is that the U.S. Environmental Protection Agency (EPA) standards have been incorporated into 10 CFR Part 40 regulations only for Title II. Title I reviews simply deal directly with the EPA standards. The staff has indicated to uranium recovery licensees (e.g., at the March 1994 and 1995 workshops with the uranium recovery industry) that the Standard Review Plan that it had developed and implemented in the Title I program is also being applied to Title II reviews. Lessons learned in any particular action will be applied across the two programs.

Priority for Subpart T reviews

The long delay in some reclamation plan reviews also concerned you. As indicated at the March 1994 and 1995 workshops, the staff has focused on, during the past few years, and continues to focus on reviews necessary to meet 40 CFR Part 61, Subpart T (Clean Air Act) obligations for final covers. In response to concerns raised at the March 1994 workshop, the staff began the reviews of the previously approved plans, and issued comments on five of the eight sites. Earlier this year, the staff put those reviews in abeyance, pending the consultation with the Commission. As a result of the recent decision, individual project managers will be in contact with licensees, to expedite the review termination process. In addition, as we indicated in the October 1994 meeting with industry representatives, the Division of Waste Management reallocated significant resources to support reviews of routine submittals by licensees.

I trust that we have responded to your concerns. This issue will be discussed at the Joint Nuclear Regulatory Commission - National Mining Association Uranium Recovery Meeting to be held in Arlington, Texas, on July 25, 1995. You were informed of this meeting and sent a copy of the agenda by letter dated July 5, 1995, from Joseph J. Holonich, Chief, High-Level Waste and Uranium Recovery Projects Branch. You are encouraged to attend this meeting

with other uranium recovery industry representatives. If you have any questions, please feel free to contact either me or Mr. Holonich. I can be reached at (301) 415-7800, and Mr. Holonich can be reached at (301) 415-7238.

Sincerely,

(Original signed by)

Carl J. Paperiello, Director
Office of Nuclear Material Safety
and Safeguards

Enclosures: SECY-95-155
SRM for SECY-95-155

cc: Anthony J. Thompson, Shaw, Pittman, Potts, and Trowbridge
Kathleen Sweeney, National Mining Association
Glenn Catchpole, Uranium Producers of America
UR licensees
State representatives

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** (Coordinated w/OGC)
* SEE PREVIOUS CONCURRENCE PROOFED BY B. LYNN - 7/14
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OFC	HLUR *	E	HLUR *	E	HLUR *	E	DWM *	E	NMSS	
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UPDATED 6/2/95

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 28, 1995

RECEIVED
OCT 0 2 1995
DIV. OF RADIATION PROTECTION

Gary Robertson, Head
Waste Management Section
Division of Radiation Protection
Department of Health
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P.O. Box 47827
Olympia, WA 98504-7827

Dear Mr. Robertson:

This is in response to your letter dated April 14, 1995, in which you requested that the Nuclear Regulatory Commission state what its position would be with regards to the acceptability of Western Nuclear, Incorporated's (WNI) proposed cover design for the reclamation of the Sherwood Mill tailings impoundment. In particular, you inquired whether NRC would allow a design where the cover is more permeable than the liner, in view of the policy set out in the final draft of the Uranium Recovery Program Policy and Guidance Directive, LLWM 94-01, on Synthetic Liner Considerations During Reclamation of Surface Impoundments at Title II Uranium and Thorium Mill Tailings Sites, dated July 1994. This letter is intended to documemt the discussions you have had with Janet Lambert of the Division of Waste Management (DWM) on the subject.

Although the DWM staff has not reviewed the Sherwood design in detail, the staff considers that it may be difficult for WNI to demonstrate that the proposed design - a design that includes no dewatering of the tailings and a cover that will allow seepage of excess liquid from the impoundment rim - meets the required criteria in Appendix A to 10 CFR Part 40. The NRC staff believes the most critical issue from your perspective, and WNI's perspective, is whether guidance set out in LLWM 94-01 (or Washington equivalent guidance) or any other NRC guidance would automatically preclude a finding that the WNI design is acceptable.

Historically, NRC has taken the position that the build-up of liquids in tailings impoundments is not desirable following reclamation and closure because of potentially adverse impacts on the structural integrity of the facility and on the ground-water quality. In most cases, the NRC staff considers that dewatering the tailings and then installing a cover that is at least as impermeable as the liner serves to enhance the long term performance of a reclaimed tailings pile. LLWM 94-01 does in fact encourage closure designs that will minimize or not produce a "bathtub effect." However, LLWM 94-01 also provides that licensees are free to propose site-specific reclamation designs and practices, and allows for approval of proposed closure plans that may not minimize the "bathtub effect," if those plans reduce or alleviate potential adverse impacts that may be associated with the design.

As you offered in your letter, in order for a design to be acceptable and to be approved by NRC in either case, the licensee has to "successfully demonstrate that its reclamation plan will not adversely impact the structural integrity of the cover through differential settlement, subsidence, slope instability, or breaching of the containment walls or cover; and that the plan meets groundwater protection, radon emanation, and longevity requirements" in Appendix A of Part 40. If a licensee presents such a demonstration, then NRC would likely consider the reclamation plan design acceptable provided all regulatory requirements in Appendix A to 10 CFR Part 40 were met.

If you have any questions, please contact me at 301-415-2326 or Dennis Sollenberger at 301-415-2819.

Sincerely,

Paul H. Lohaus, Deputy Director
Office of State Programs

FILE COPY

W.D.8.9

DEPARTMENT OF HEALTH
Environmental Health Programs
Division of Radiation Protection

October 6, 1995

TO: John Riley

FROM: John Blacklaw John R Blacklaw

SUBJECT: US NRC EVALUATION TASK

The US NRC has responded[1] to a department inquiry regarding NRC's position on certain aspects of the reclamation plan and whether the specific design features proposed by Western Nuclear, Inc. for the Sherwood Tailings Reclamation Plan will be considered acceptable regarding compliance with regulation. The design and policy features in question are: (1) a cover less permeable than the liner (Reference: final draft of the Uranium Recovery Program Policy and Guidance Directive, LLWM 94-01, on Synthetic Liner Considerations During Reclamation of Surface Impoundments at Title II Uranium and Thorium Mill Tailings Sites, dated July 1994), (2) no dewatering of tailings (Reference: NRC staff consider that it may be difficult for WNI to demonstrate that the proposed design - a design that includes no dewatering of the tailings and a cover that will allow seepage of excess liquid from the impoundment rim - meets the required criteria in Appendix A to 10 CFR Part 40, (3) can lack of compliance with guidance (Reference: LLWM 94-01, or other NRC guidance) automatically preclude design acceptability, (4) build-up of liquids in the tailings (Reference: NRC's historical position that build-up of liquids in tailings impoundments is not desirable following reclamation and closure because of potential adverse impacts on structural integrity of the facility and on groundwater quality), (5) long-term performance (Reference: NRC staff consider that dewatering the tailings and then installing a cover that is at least as impermeable as the liner serves to enhance the long term performance of a reclaimed tailings pile), (6) "bathtub effect" (Reference: LLWM 94-01 encourages closure designs that will minimize or not produce a "bathtub effect."), (7) site-specific designs and practices may allow approval, when "bathtub effect" is not minimized, if plans reduce or alleviate potential impacts, and (8) "successfully demonstrate that reclamation plan will not adversely impact the structural integrity of the cover, through differential settlement, subsidence, slope instability, or breaching of the containment walls or cover, and that the plan meets groundwater protection, radon emanation, and longevity requirements". The NRC further states that, "if a licensee presents such a demonstration (See (8) above.), then NRC would likely consider the reclamation plan design acceptable provided all regulatory requirements in Appendix A to 10 CFR 40 were met."

FILE COPY

The department believes that the proposed Tailings Reclamation Plan meets our regulatory requirements in WAC 246-252; which are identical to Appendix A to 10 CFR 40. John Blacklaw with the assistance of John Riley will prepare a response to our letter from the NRC which presents our understanding of how Western's reclamation plan demonstrates compliance. This will be a short report, with Appendix materials gathered from Western's various submittals. The report will be specifically focused to address the concerns expressed in NRC's letter to the department. This report will be presented to the NRC at the upcoming NRC, agreement states, and National Mining Association Uranium Recovery Meeting, to be held in Washington, DC on October 24 and 25, 1995. Gary Robertson will peer review this report.

When available, the Technical Evaluation Report will be submitted to the US NRC covering the department review of the entire reclamation plan.

It is expected that these submittals, along with submittal of the tailings reclamation plan, with addenda, will provide the US NRC with sufficient documentation to review and concur with the department's belief that the Sherwood Tailings Reclamation Plan provides the "demonstration" of compliance required by regulation.

[1](Letter), US, Nuclear Regulatory Commission (Paul Lohaus) to Washington, Department of Health (Gary Robertson), September 28, 1995.

cc: Gary Robertson
Dorothy Stoffel

WD 8a

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 13, 1996

RECEIVED
MAR 1 8 1996
DIV. OF RADIATION PROTECTION

Mr. Gary Robertson, Head
Waste Management Section
Division of Radiation Protection
Department of Health
Airdustrial Center, Building #5
P.O. Box 47827
Olympia, WA 98504-7827

Dear Mr. Robertson:

This is in response to your letter dated October 28, 1995, which provided the Nuclear Regulatory Commission (NRC) with additional information/clarification regarding Western Nuclear, Inc.'s (WNI) Tailings Reclamation Plan for its Sherwood mill facility, and a summary of the analyses and evaluation of that plan performed by the State of Washington Department of Health (WDOH). This letter is to document the discussions that NRC staff had with you and your staff relative to NRC's position on the acceptability of the Sherwood Reclamation Plan, and to further actions planned by WDOH for that facility.

The NRC staff performed a limited review of the package you provided to identify any obvious technical, procedural, or administrative issues which may not have been covered in the analysis of the Sherwood reclamation plan. The limited review was consistent with NRC resource constraints and the Washington State regulatory authority to make the licensing decisions for the Sherwood mill.

While the cover design set out by WNI in the closure plan for Sherwood differs from standard designs at more arid sites, NRC staff did not find that there were any obvious technical issues that were not considered in the WDOH's review and analyses. NRC staff also did not find any obvious procedural or administrative problems associated with the WDOH's review of the plan. WDOH has concluded that WNI's closure plan for Sherwood can assure compliance with the Washington regulations equivalent to NRC's reclamation performance requirements in 10 CFR Part 40, Appendix A. NRC staff is satisfied that WDOH has considered the necessary factors and done the appropriate technical analyses to support their conclusion.

We appreciate your efforts to keep NRC abreast of your review progress and conclusions regarding the Sherwood Reclamation Plan. This coordination will assist NRC to make the compliance determination required prior to the State terminating the license.

If you have any questions, please contact me at 301-415-2326 or Dennis Sollenberger at 301-415-2819.

Sincerely,

Paul H. Lohaus

Paul H. Lohaus, Deputy Director
Office of State Programs

WNI File
W.D.8.a

FILE COPY

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

October 20, 1995

Paul H. Lohaus, Deputy Director
Office of State Programs
United States Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Lohaus:

In response to your letter to me dated September 28, 1995, I am providing additional information/clarification in support of the Western Nuclear, Inc. (WNI) Tailings Reclamation Plan (TRP). The department believes that the proposed closure plan provides a sufficient demonstration to assure compliance with federal requirements in 10 CFR Part 40, Appendix A and equivalent state requirements in WAC 246-252. The department is also conscious of the NRC's role in final compliance review of WNI's proposal, prior to our termination of their radioactive materials license, and therefore wishes to keep the NRC abreast of our review progress and conclusions.

We anticipate completion of our review by December 1, 1995. If the department approves the tailings reclamation plan, WNI plans to immediately begin the bid process so that all construction can be done during the 1996 construction season. It is my understanding that the NRC normally evaluates states' uranium mill closure reviews during Agreement State audits. Since your last visit was during June 1995, we would not anticipate another visit until after WNI's plan has been completely approved by the department and a serious commitment to construction has been made by WNI.

We are therefore enclosing the following discussion for NRC review and comment: "NRC Evaluation Request." This short discussion is supportive of the department's current evaluation perspective. Several references are made in support for this discussion document that are also enclosed for your information. We plan to provide the NRC with our Technical Evaluation Report and a complete copy of the WNI final Tailings Reclamation Plan by mid-December 1995, if it is approved by then.

The enclosed information has been specifically organized to respond to your letter, and contains substantive data and analyses that support our current position that the overall closure plan satisfies all NRC and WDOH reclamation performance objectives. Please recognize that in order to comply with these objectives, site specific considerations unique to the Sherwood Uranium Mill site have

resulted in a cover design not commonly found at other uranium mill sites. We believe that the attached information will provide the NRC with an appreciation that WNI's proposed closure plan satisfies these reclamation performance objectives.

If you have any questions, please feel free to contact me at (360) 753-3459, or John Blacklaw at (360) 753-3350.

Sincerely,

John R. Blacklaw, for

Gary Robertson, Head
Waste Management Section

GR:krf

Enclosures: "NRC Evaluation Request and referenced documents (2 sets)

cc (w/o references [1 and 2]):

Warren Seyler, Spokane Tribe of Indians
Alfred Peone, BIA, WA
Stanley Speaks, BIA, OR
Stephanie Baker, WNI
Lou Miller, SMI
Jerald LaVassar, WDOE

NRC Evaluation Request

SUMMARY

In response to the Department of Health's comments, Western Nuclear, Inc. has proposed to construct a thick (12.5 feet) homogeneous cover, vegetated with natural successional species (including ponderosa pine). As you will see when reviewing the enclosed information, we expect the tailings to remain relatively wet, since the tailings themselves and the impervious liner (hypalon) will limit water export from the tailings. This wet condition will tend to optimize the oxidation-reduction and pH of the tailings to limit groundwater impacts to below regulatory limits. The thickness of the cover enhances the chemical stability of the tailings. The cover design includes the added benefit of expected high rates of evapo-transpiration shown by water balance analysis and predictions of vegetation production.[2] Under conservative assumptions, water balance analysis shows that a relatively small net infiltration of precipitation is only likely in the first few years while vegetation is being established. Groundwater impact analysis predicts that, even with very conservative assumptions (including a net average infiltration rate of 2.2 inches per year), tailings liquid export from potential liner overtopping and/or bottom release from a fully failed impoundment liner will not cause groundwater quality impacts to exceed health-based regulatory limits. After the stabilization period, no net infiltration is expected, and therefore little or no potential for release of tailings liquid is expected. For the longevity requirement of 1000 years, expected average groundwater impacts are therefore bounded by very conservative assumptions and an analytical result that demonstrates compliance to regulatory requirements in the highly unlikely "worst-case."

Cover thickness is based on RADON code analysis using highly conservative assumptions. Radon emanation rates below regulatory limits are therefore assured. The thick, homogeneous cover design is inherently insensitive to biointrusion, freeze-thaw and settlement performance considerations. The reclamation system is therefore structurally stable. The shear mass of the thick cover, the high capacity diversion channel that surrounds the impoundment, and rock and/or vegetation erosion control design features assure the physical integrity of the plan over the long-term.

SPECIFIC ISSUES

Each issue is discussed below in order to address specific NRC letter comments. Within the discussion are references to enclosed documents in support of the discussion.

COVER LESS PERMEABLE THAN THE LINER

The thick cover design uses soil material that has hydraulic conductivity greater than the liner. However, the combination of evaporation from the surface and transpiration by plants of water from the soil profile result in much greater water removal than would be the case with a non-vegetated engineered cover. The design of an engineered clay barrier relies exclusively on lateral movement of water to control infiltration. In contrast, the vegetated soil cover uses runoff, evaporation and transpiration to prevent or minimize infiltration. The transpiration of the vegetative cover results in the great majority of water use. Thus, the hydraulic conductivity of the material alone is an inaccurate

indicator of potential infiltration.

The department believes that the NRC guidance directive, LLWM 94-01, on Synthetic Liner Considerations During Reclamation of Surface Impoundments at Title II Uranium and Thorium Mill Tailings Sites, dated July 1994, should be reconsidered and clarified to allow that limiting infiltration is the primary groundwater performance criterion, and not the permeability of cover or liner layers. We further believe that the thick, vegetated cover design proposed for the Sherwood Mill meets regulatory requirements.

DEWATERING OF TAILINGS AND GROUNDWATER

Dewatering the tailings at the Sherwood Mill probably would cause adverse water quality impacts. The tailings fluid was neutralized as the tailings were deposited, resulting in low concentrations of metals and other contaminants in the tailings fluid. This is presented in Appendix P, Section 4.3.1.[1] However, the tailings themselves are sulfidic, and have a potential to produce acid if exposed to oxygen because of acid production during the oxidation of pyrite and other surfides. This is presented in Section 4.3.2 and 4.3.3. All discussions are supported by detailed information in Appendix P, Attachment D as referenced in Section 4.

Dewatering the tailings would accelerate sulfide oxidation because of the difference in rates of oxygen diffusion through water and air. Oxidation of sulfides results in the production of significant amounts of acid. This in turn results in the leaching and mobilization of heavy metals and other contaminants. A summary of pyrite oxidation is presented on page P. 4-20 in Appendix P. Equations 4.1 and 4.2 require oxygen. In addition, aerobic bacteria increase the rate of equation 4.2 by several orders of magnitude. Thus, pyrite oxidation is virtually eliminated if oxygen is excluded from the tailings. The rate of oxygen diffusion through water is 4 orders of magnitude lower in water than in air.[3] Because of the large difference in diffusion rates, it is desirable, from a geochemical standpoint, to maintain the tailings in their current saturated conditions.

The tailings currently are in a chemically reduced state. (See attachment A) It is preferable to maintain the reduced state because of the very low solubility and mobility of metal sulfides. Dewatering the tailings would introduce oxygen and ultimately oxidize the metal sulfides and release metals and other contaminants that could enter the ground water. The thick cover design also will aid in keeping the tailings in a reduced and non-reactive state. Oxygen profiles through soil covers demonstrate that oxygen is depleted in the upper horizons, because of microbial and plant activity. Thus, no oxygen would be available at depth that could oxidize the tailings material.

DEWATERING OF TAILINGS AND STRUCTURAL INTEGRITY

There are several physical aspects of the thick cover design that preclude potential performance detriments that must be considered and mitigated in relatively thin clay layered cover designs.[4] Biointrusion effects from plants or burrowing animals are much reduced by greater cover thicknesses. WNI's proposed cover design is for a borrow material fill that generally lacks the cohesive properties that are adversely affected by biointrusion effects. Also, the potential for freeze-thaw effects that may occur on thin clay cover designs are essentially eliminated. The proposed cover design is therefore essentially "self healing." The lack of a designed low permeability clay layer in the top portions of the cover (approximately upper 4 feet) assures the performance is insensitive to freeze-thaw effects.

There is potential for settlement of the cover surface for all cover designs over thick slime deposits, such as in the Sherwood Mill tailings impoundment. However, a thick, homogeneous cover design does not experience the permeability defects that are possible in a relatively thin clay layer under settlement. WNI's proposed thick cover design is not sensitive to failure by this performance criteria. The thick cover design has a greater load factor on the soil column due to the larger mass, when compared with thin clay layered designs. Therefore, it will be possible that significant surface settlement and resulting slope changes could occur. This could produce potential for ponding and/or for increased slopes that might erode, considering the gentle slope (1/2%) of the designed impoundment surface. However, the thick cover design is not susceptible to performance defects by these potential occurrences. Evapo-transpiration will likely eliminate potential for sustained ponding of water, except following very large storms. Slope increases remain quite small and will remain erosional stability under the proposed design. It is also likely that the analysis for maximum settlement is highly conservative and unlikely to occur. Even so, the design remains under final review and may be adjusted to compensate (by over filling) for field settlement measurements, or by settlement analysis. Refer to Revegetation Reclamation System Evaluation, Sections 2 and 3[2] for a detailed analysis of the thick cover design.

LONG-TERM PERFORMANCE

The closure plan is protective of long-term groundwater quality based on predictive water quality modeling assuming more infiltration than is likely to occur. Appendix P presents predictive modeling of groundwater quality under two scenarios: first, overtopping as a result of infiltration, and second, as a result of substantial failure of the liner. Both scenarios assume no dewatering of the tailings, a compacted engineered clay barrier and a resulting net infiltration of 2.2 inches per year obtained from the HELP model. A summary of this modeling effort is presented in Section 6, and a more detailed discussion in Attachments D and F. The model was calibrated against an excursion of tailings fluid that occurred in 1984. Under both scenarios, down gradient groundwater quality would be impacted, but would not exceed any applicable groundwater quality standard that would trigger corrective action.

"BATH-TUB EFFECT"

Evaluation of infiltration conducted in conjunction with the design of the thick vegetated soil cover indicates that much less infiltration than 2.2 inches per year would occur. This analysis is summarized in Revegetation Reclamation System Evaluation, Section 3,[2] and a detailed development is presented in Appendix 2. This modeling effort is substantially more rigorous than the HELP model. It is based on established water consumption data for a succession of seral communities leading to an established ponderosa pine forest. Precipitation is based on an observed 103 year record.

Export is the amount of precipitation that the plant community would not utilize, and is a combination of runoff and infiltration. The decrease in water export compared to the HELP model results is because of increased transpiration of vegetation that would become established in 5 to 20 years. Under observed precipitation conditions, a small amount of export is predicted in the first few years, and thereafter, no export is predicted. No danger of a "bathtub effect" is predicted under current condition because no infiltration is predicted.

Under an assumed 25% increase in precipitation (based on climatic change), export is increased.

Monthly export calculations presented in Appendix 2 of the Revegetation Evaluation indicate that most of the export occurs in March and April. Spring runoff would consume most of the increased export, with the remainder resulting in lateral subsurface flow and increased infiltration.

WNI has modeled the "worst-case" scenario related to overtopping as a result of the "bath-tub effect" (Attachment D.17, "Time to Fill Calculations," or Appendix P), based on extremely conservative assumptions. Utilizing these very conservative assumptions, the timeframe for filling the unsaturated tailing and overtopping the liner could occur in 2.3 years.

Under this "worst-case" scenario, the water quality of the overtopping water can be predicted (Attachment D.18, "Diffusion Calculations," of Appendix P). The impacts of this prediction is then evaluated in terms of the known aquifer water quality and aquifer flow parameters. It is adequately demonstrated that under the worst case scenario of liner overtopping, there will be no violations of any applicable water quality standards.

Groundwater quality would not be impacted by overtopping due to lack of contact with tailings solids and the short lifetime of subsurface water within the reclamation cover system, that would preclude any significant upward diffusion of contaminants.

The concern that there will be short-term degradation of groundwater quality while an effective vegetative cover is established is mitigated by implementation of a stabilization period monitoring program. Both the establishment of cover vegetation and groundwater will be monitored. Criteria are being established in the QA/QC Plan and through license condition that ensures a successful vegetated cover within an acceptable timeframe.

DEMONSTRATION OF COMPLIANCE

A demonstration of compliance is considered to be a proposed closure plan that is expected to meet the regulatory requirements with a reasonable assurance. Compliance with NRC guidance as well as "good engineering practice" are additional highly desirable expectations, but not absolutely required. For the Sherwood site, the proposed "Tailings Reclamation Plan" has departed from the traditional design approach. This has become necessary based on recent literature[4] that indicates that biointrusion, freeze-thaw and other potential defects are possible with relatively thin clay layer cover designs. Also, there are several unique features of the Sherwood site that suggest consideration of alternate creative approaches to compliance. Fortunately, the NRC (and state) regulations allow a performance based approach which allow for site-specific solutions. Because of the departments' efforts to consider alternative approaches, new evaluation and review approaches have been developed. For example, there is a quite diverse review staff that provides an interdisciplinary approach. The department also uses a full peer review of each area of expertise. In addition, an open door policy is available between any review staff, the licensee, the public, the Spokane Tribe of Indians (Land Owner), and department management to clarify and resolve any issues of potential concern. The department is hopeful that this submittal will represent a good faith request for the NRC to be openly involved in the review and approval process.

REFERENCES

[1] Sherwood Project, Tailings Reclamation Project, Appendix P (Groundwater Protection Plan),

prepared for Western Nuclear, Inc., prepared by Shepherd Miller, Inc., submitted to Washington, Department of Health, December 1994.

[2] Sherwood Project, Revegetation Reclamation System Evaluation, prepared for Western Nuclear, Inc., prepared by Shepherd Miller, Inc., submitted to Washington, Department of Health, September 1995.

[3] NEDEM 1991 MEND Conference Proceedings, Tome 1, Second International Conference on the Abatement of Acidic Drainage, "Engineered Soil Covers for Reactive Tailings Management: Theoretical Concepts and Laboratory Development," Ernest K. Yanful, Noranda Technology Centre, 240 Hymus Blvd., Pointe-Claire, Quebec, H9R 1G5, Canada, held in Montreal, Canada, September 16-18, 1991.

[4] "An Assessment of Plant Biointrusion on Six UMTRA Project Disposal Cells," by Charles J. Burt, Roy F. Weston, Inc., UMTRA Project, 5301 Central Avenue, N.E., Albuquerque, New Mexico 87108, and Steven W. Cox, Jacobs Engineering Group, Inc., UMTRA Project, 5301 Central Avenue, N.E., Albuquerque, New Mexico 87108

ATTACHMENT A

TAILINGS UNDER REDUCING CONDITIONS

(taken from a pending Shepherd Miller, Inc./Western Nuclear, Inc. submittal to the department)

The primary mechanism for the production of acidic conditions found in the interstitial waters of uranium mill tailings is the oxidation of pyrite. In the presence of moisture and oxygen, pyrite is oxidized, producing H^+ and SO_4^{-2} ions. The acidic condition produced, further leaches other trace metals and radionuclides. Both oxygen and water play an important role in the production of acidic conditions. If oxygen is excluded from the system, the reaction will not occur, or will cease, and acid will not be produced.

At the present time, the tailing are in a saturated condition with the exception of the top few feet. The high phreatic surface prevents the downward migration of oxygen into the system. Since oxygen plays an important role in the oxidation of pyrite, the absence of oxygen will prevent the pyrite from reacting and thus forming acidic conditions. This can be demonstrated by evaluating the oxidation/reduction (redox) state of the tailing below the water table.

Establishing the redox state of the interstitial waters can be performed in two ways: (1 visual observation of water samples collected from wells completed in the tailing, and (2) observation of the mineral phases present in the tailing solids.

(1) Water samples were collected from wells completed in the tailing. The water was clear when brought to the surface at a near neutral pH. Within minutes the water turned red with a subsequent drop in pH. This would indicate that the iron in the water was ferrous and upon exposure to the atmosphere, oxidized to ferric iron with the subsequent precipitation of iron hydroxide.

(2) Samples of the tailing solids were collected. Two samples of the slimes and two samples of the sands were sent to the laboratory for X-ray diffraction and Scanning Electron microscopic analysis. Pyrite was found in all of the tested samples. The pyrite was free of oxide coatings which indicates a reduced condition. Other iron mineral phases such as goethite and ferrihydrite were not found in any of the samples. The presence of pyrite and the absence of goethite and ferrihydrite indicates that the system is reduced.

Geochemical modeling was performed using the chemical composition of the interstitial waters in conjunction with the solid phase assemblage found in the tailing. The results of the water analysis were input into MINTEQA2 with various Eh values at the measured pH. For each Eh value, MINTEQA2 predicted a range of iron and sulfide minerals that could theoretically be present. At Eh values greater than 0 millivolts, ferrihydrite ($Fe(OH)_3$) would be present and above - 100 millivolts,

goethite ($\alpha FeO \bullet OH$) would be present. Both X-ray diffraction and Scanning Electron Microscopy examination of the tailing material did not detect the present of either of these minerals. Therefore, the tailing are reduced with an Eh less than -100 millivolts.

John B

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

October 20, 1995

Paul H. Lohaus, Deputy Director
Office of State Programs
United States Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Lohaus:

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Sincerely,

John R. Blacklaw, for

Gary Robertson, Head
Waste Management Section

GR:krf

Enclosures: "NRC Evaluation Request and referenced documents (2 sets)

cc (w/o references [1 and 2]):
Warren Seyler, Spokane Tribe of Indians
Alfred Peone, BIA, WA
Stanley Speaks, BIA, OR
Stephanie Baker, WNI
Lou Miller, SMI
Jerald LaVassar, WDOE

NRC Evaluation Request

SUMMARY

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SPECIFIC ISSUES

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The department believes that the NRC guidance directive, LLWM 94-01, on Synthetic Liner Considerations During Reclamation of Surface Impoundments at Title II Uranium and Thorium Mill Tailings Sites, dated July 1994, should be reconsidered and clarified to allow that limiting infiltration is the primary groundwater performance criterion, and not the permeability of cover or liner layers. We further believe that the thick, vegetated cover design proposed for the Sherwood Mill meets regulatory requirements.

DEWATERING OF TAILINGS AND GROUNDWATER

Dewatering the tailings at the Sherwood Mill probably would cause adverse water quality impacts. The tailings fluid was neutralized as the tailings were deposited, resulting in low concentrations of metals and other contaminants in the tailings fluid. This is presented in Appendix P, Section 4.3.1.[1] However, the tailings themselves are sulfidic, and have a potential to produce acid if exposed to oxygen because of acid production during the oxidation of pyrite and other surfides. This is presented in Section 4.3.2 and 4.3.3. All discussions are supported by detailed information in Appendix P, Attachment D as referenced in Section 4.

Dewatering the tailings would accelerate sulfide oxidation because of the difference in rates of oxygen diffusion through water and air. Oxidation of sulfides results in the production of significant amounts of acid. This in turn results in the leaching and mobilization of heavy metals and other contaminants. A summary of pyrite oxidation is presented on page P. 4-20 in Appendix P. Equations 4.1 and 4.2 require oxygen. In addition, aerobic bacteria increase the rate of equation 4.2 by several orders of magnitude. Thus, pyrite oxidation is virtually eliminated if oxygen is excluded from the tailings. The rate of oxygen diffusion through water is 4 orders of magnitude lower in water than in air.[3] Because of the large difference in diffusion rates, it is desirable, from a geochemical standpoint, to maintain the tailings in their current saturated conditions.

The tailings currently are in a chemically reduced state. (See attachment A) It is preferable to maintain the reduced state because of the very low solubility and mobility of metal sulfides. Dewatering the tailings would introduce oxygen and ultimately oxidize the metal sulfides and release metals and other contaminants that could enter the ground water. The thick cover design also will aid in keeping the tailings in a reduced and non-reactive state. Oxygen profiles through soil covers demonstrate that oxygen is depleted in the upper horizons, because of microbial and plant activity. Thus, no oxygen would be available at depth that could oxidize the tailings material.

DEWATERING OF TAILINGS AND STRUCTURAL INTEGRITY

There are several physical aspects of the thick cover design that preclude potential performance detriments that must be considered and mitigated in relatively thin clay layered cover designs.[4] Biointrusion effects from plants or burrowing animals are much reduced by greater cover thicknesses. WNI's proposed cover design is for a borrow material fill that generally lacks the cohesive properties that are adversely affected by biointrusion effects. Also, the potential for freeze-thaw effects that may occur on thin clay cover designs are essentially eliminated. The proposed cover design is therefore essentially "self healing." The lack of a designed low permeability clay layer in the top portions of the cover (approximately upper 4 feet) assures the performance is insensitive to freeze-thaw effects.

There is potential for settlement of the cover surface for all cover designs over thick slime deposits, such as in the Sherwood Mill tailings impoundment. However, a thick, homogeneous cover design does not experience the permeability defects that are possible in a relatively thin clay layer under settlement. WNI's proposed thick cover design is not sensitive to failure by this performance criteria. The thick cover design has a greater load factor on the soil column due to the larger mass, when compared with thin clay layered designs. Therefore, it will be possible that significant surface settlement and resulting slope changes could occur. This could produce potential for ponding and/or for increased slopes that might erode, considering the gentle slope (1/2%) of the designed impoundment surface. However, the thick cover design is not susceptible to performance defects by these potential occurrences. Evapo-transpiration will likely eliminate potential for sustained ponding of water, except following very large storms. Slope increases remain quite small and will remain erosional stability under the proposed design. It is also likely that the analysis for maximum settlement is highly conservative and unlikely to occur. Even so, the design remains under final review and may be adjusted to compensate (by over filling) for field settlement measurements, or by settlement analysis. Refer to Revegetation Reclamation System Evaluation, Sections 2 and 3[2] for a detailed analysis of the thick cover design.

LONG-TERM PERFORMANCE

The closure plan is protective of long-term groundwater quality based on predictive water quality modeling assuming more infiltration than is likely to occur. Appendix P presents predictive modeling of groundwater quality under two scenarios: first, overtopping as a result of infiltration, and second, as a result of substantial failure of the liner. Both scenarios assume no dewatering of the tailings, a compacted engineered clay barrier and a resulting net infiltration of 2.2 inches per year obtained from the HELP model. A summary of this modeling effort is presented in Section 6, and a more detailed discussion in Attachments D and F. The model was calibrated against an excursion of tailings fluid that occurred in 1984. Under both scenarios, down gradient groundwater quality would be impacted, but would not exceed any applicable groundwater quality standard that would trigger corrective action.

"BATH-TUB EFFECT"

Evaluation of infiltration conducted in conjunction with the design of the thick vegetated soil cover indicates that much less infiltration than 2.2 inches per year would occur. This analysis is summarized in Revegetation Reclamation System Evaluation, Section 3,[2] and a detailed development is presented in Appendix 2. This modeling effort is substantially more rigorous than the HELP model. It is based on established water consumption data for a succession of seral communities leading to an established ponderosa pine forest. Precipitation is based on an observed 103 year record.

Export is the amount of precipitation that the plant community would not utilize, and is a combination of runoff and infiltration. The decrease in water export compared to the HELP model results is because of increased transpiration of vegetation that would become established in 5 to 20 years. Under observed precipitation conditions, a small amount of export is predicted in the first few years, and thereafter, no export is predicted. No danger of a "bathtub effect" is predicted under current condition because no infiltration is predicted.

Under an assumed 25% increase in precipitation (based on climatic change), export is increased.

Monthly export calculations presented in Appendix 2 of the Revegetation Evaluation indicate that most of the export occurs in March and April. Spring runoff would consume most of the increased export, with the remainder resulting in lateral subsurface flow and increased infiltration.

WNI has modeled the "worst-case" scenario related to overtopping as a result of the "bath-tub effect" (Attachment D.17, "Time to Fill Calculations," or Appendix P), based on extremely conservative assumptions. Utilizing these very conservative assumptions, the timeframe for filling the unsaturated tailing and overtopping the liner could occur in 2.3 years.

Under this "worst-case" scenario, the water quality of the overtopping water can be predicted (Attachment D.18, "Diffusion Calculations," of Appendix P). The impacts of this prediction is then evaluated in terms of the known aquifer water quality and aquifer flow parameters. It is adequately demonstrated that under the worst case scenario of liner overtopping, there will be no violations of any applicable water quality standards.

Groundwater quality would not be impacted by overtopping due to lack of contact with tailings solids and the short lifetime of subsurface water within the reclamation cover system, that would preclude any significant upward diffusion of contaminants.

The concern that there will be short-term degradation of groundwater quality while an effective vegetative cover is established is mitigated by implementation of a stabilization period monitoring program. Both the establishment of cover vegetation and groundwater will be monitored. Criteria are being established in the QA/QC Plan and through license condition that ensures a successful vegetated cover within an acceptable timeframe.

DEMONSTRATION OF COMPLIANCE

A demonstration of compliance is considered to be a proposed closure plan that is expected to meet the regulatory requirements with a reasonable assurance. Compliance with NRC guidance as well as "good engineering practice" are additional highly desirable expectations, but not absolutely required. For the Sherwood site, the proposed "Tailings Reclamation Plan" has departed from the traditional design approach. This has become necessary based on recent literature[4] that indicates that biointrusion, freeze-thaw and other potential defects are possible with relatively thin clay layer cover designs. Also, there are several unique features of the Sherwood site that suggest consideration of alternate creative approaches to compliance. Fortunately, the NRC (and state) regulations allow a performance based approach which allow for site-specific solutions. Because of the departments' efforts to consider alternative approaches, new evaluation and review approaches have been developed. For example, there is a quite diverse review staff that provides an interdisciplinary approach. The department also uses a full peer review of each area of expertise. In addition, an open door policy is available between any review staff, the licensee, the public, the Spokane Tribe of Indians (Land Owner), and department management to clarify and resolve any issues of potential concern. The department is hopeful that this submittal will represent a good faith request for the NRC to be openly involved in the review and approval process.

REFERENCES

[1] Sherwood Project, Tailings Reclamation Project, Appendix P (Groundwater Protection Plan),

prepared for Western Nuclear, Inc., prepared by Shepherd Miller, Inc., submitted to Washington, Department of Health, December 1994.

[2] Sherwood Project, Revegetation Reclamation System Evaluation, prepared for Western Nuclear, Inc., prepared by Shepherd Miller, Inc., submitted to Washington, Department of Health, September 1995.

[3] NEDEM 1991 MEND Conference Proceedings, Tome 1, Second International Conference on the Abatement of Acidic Drainage, "Engineered Soil Covers for Reactive Tailings Management: Theoretical Concepts and Laboratory Development," Ernest K. Yanful, Noranda Technology Centre, 240 Hymus Blvd., Pointe-Claire, Quebec, H9R 1G5, Canada, held in Montreal, Canada, September 16-18, 1991.

[4] "An Assessment of Plant Biointrusion on Six UMTRA Project Disposal Cells," by Charles J. Burt, Roy F. Weston, Inc., UMTRA Project, 5301 Central Avenue, N.E., Albuquerque, New Mexico 87108, and Steven W. Cox, Jacobs Engineering Group, Inc., UMTRA Project, 5301 Central Avenue, N.E., Albuquerque, New Mexico 87108

ATTACHMENT A

TAILINGS UNDER REDUCING CONDITIONS

(taken from a pending Shepherd Miller, Inc./Western Nuclear, Inc. submittal to the department)

The primary mechanism for the production of acidic conditions found in the interstitial waters of uranium mill tailings is the oxidation of pyrite. In the presence of moisture and oxygen, pyrite is oxidized, producing H^+ and SO_4^{-2} ions. The acidic condition produced, further leaches other trace metals and radionuclides. Both oxygen and water play an important role in the production of acidic conditions. If oxygen is excluded from the system, the reaction will not occur, or will cease, and acid will not be produced.

At the present time, the tailing are in a saturated condition with the exception of the top few feet. The high phreatic surface prevents the downward migration of oxygen into the system. Since oxygen plays an important role in the oxidation of pyrite, the absence of oxygen will prevent the pyrite from reacting and thus forming acidic conditions. This can be demonstrated by evaluating the oxidation/reduction (redox) state of the tailing below the water table.

Establishing the redox state of the interstitial waters can be performed in two ways: (1 visual observation of water samples collected from wells completed in the tailing, and (2) observation of the mineral phases present in the tailing solids.

(1) Water samples were collected from wells completed in the tailing. The water was clear when brought to the surface at a near neutral pH. Within minutes the water turned red with a subsequent drop in pH. This would indicate that the iron in the water was ferrous and upon exposure to the atmosphere, oxidized to ferric iron with the subsequent precipitation of iron hydroxide.

(2) Samples of the tailing solids were collected. Two samples of the slimes and two samples of the sands were sent to the laboratory for X-ray diffraction and Scanning Electron microscopic analysis. Pyrite was found in all of the tested samples. The pyrite was free of oxide coatings which indicates a reduced condition. Other iron mineral phases such as goethite and ferrihydrite were not found in any of the samples. The presence of pyrite and the absence of goethite and ferrihydrite indicates that the system is reduced.

Geochemical modeling was performed using the chemical composition of the interstitial waters in conjunction with the solid phase assemblage found in the tailing. The results of the water analysis were input into MINTEQA2 with various Eh values at the measured pH. For each Eh value, MINTEQA2 predicted a range of iron and sulfide minerals that could theoretically be present. At Eh values greater than 0 millivolts, ferrihydrite ($Fe(OH)_3$) would be present and above - 100 millivolts,

goethite ($\alpha FeO \bullet OH$) would be present. Both X-ray diffraction and Scanning Electron Microscopy examination of the tailing material did not detect the present of either of these minerals. Therefore, the tailing are reduced with an Eh less than -100 millivolts.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 13, 1996

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DIV. OF RADIATION PROTECTION

Mr. Gary Robertson, Head
Waste Management Section
Division of Radiation Protection
Department of Health
Airdustrial Center, Building #5
P.O. Box 47827
Olympia, WA 98504-7827

Dear Mr. Robertson:

This is in response to your letter dated October 28, 1995, which provided the Nuclear Regulatory Commission (NRC) with additional information/clarification regarding Western Nuclear, Inc.'s (WNI) Tailings Reclamation Plan for its Sherwood mill facility, and a summary of the analyses and evaluation of that plan performed by the State of Washington Department of Health (WDOH). This letter is to document the discussions that NRC staff had with you and your staff relative to NRC's position on the acceptability of the Sherwood Reclamation Plan, and to further actions planned by WDOH for that facility.

The NRC staff performed a limited review of the package you provided to identify any obvious technical, procedural, or administrative issues which may not have been covered in the analysis of the Sherwood reclamation plan. The limited review was consistent with NRC resource constraints and the Washington State regulatory authority to make the licensing decisions for the Sherwood mill.

While the cover design set out by WNI in the closure plan for Sherwood differs from standard designs at more arid sites, NRC staff did not find that there were any obvious technical issues that were not considered in the WDOH's review and analyses. NRC staff also did not find any obvious procedural or administrative problems associated with the WDOH's review of the plan. WDOH has concluded that WNI's closure plan for Sherwood can assure compliance with the Washington regulations equivalent to NRC's reclamation performance requirements in 10 CFR Part 40, Appendix A. NRC staff is satisfied that WDOH has considered the necessary factors and done the appropriate technical analyses to support their conclusion.

We appreciate your efforts to keep NRC abreast of your review progress and conclusions regarding the Sherwood Reclamation Plan. This coordination will assist NRC to make the compliance determination required prior to the State terminating the license.

If you have any questions, please contact me at 301-415-2326 or Dennis Sollenberger at 301-415-2819.

Sincerely,

Paul H. Lohaus

Paul H. Lohaus, Deputy Director
Office of State Programs

UNITED STATES
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Paul H. Lohaus

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Office of State Programs

WD 8a

UNITED STATES
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March 13, 1996

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Sincerely,

Paul H. Lohaus

Paul H. Lohaus, Deputy Director
Office of State Programs

W-D-2a

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

April 14, 1995

Paul Lohaus, Deputy Director
Office of State Programs
U.S. Nuclear Regulatory Commission
Mail Stop 03D23
Washington, D.C. 20555

Dear Mr. Lohaus:

As you know, the Department of Health is reviewing the tailings reclamation plan for Western Nuclear, Incorporated's (WNI) Sherwood mill in northeastern Washington State. The department has three concerns about WNI's cover design which must be addressed before we approve WNI's tailings reclamation plan. These concerns are (1) are there circumstances that would allow the cover to be more permeable than the bottom; (2) can the interim cover and final cover be constructed without dewatering the tailings; and (3) are there circumstances that would allow overtopping, which will result due to #1 and 2 above.

Staff from NRC's Division of Waste Management and the Uranium Field Office have attended meetings we have had with WNI concerning their closure plan. Issue areas discussed with NRC staff in attendance include biointrusion, infiltration into the cover, tailings dewatering, synthetic layer for the impoundment cover, and freeze-thaw. Recently, Earl Fordham of my staff and Mr. Ted Johnson of the NRC's Division of Waste Management have discussed erosional aspects of the design of the diversion channel.

A unique aspect of the Sherwood tailings impoundment is the presence of an intact, competent synthetic liner. WNI has recently completed several studies, including geochemical studies, geologic investigations, tailings impoundment investigations, basin hydraulic evaluations, and ground water protection evaluations. The findings from these studies have been used by WNI to conclude that the saturated tailings should not be dewatered before or after construction of either the interim cover or the final cover. WNI is proposing to construct the final cover using natural earthen materials that are necessarily more permeable than the synthetic impoundment liner. Therefore, the cover design allows overtopping (seepage of excess liquid from impoundment rim). Please note that if a cover is more permeable than the bottom liner, dewatering the tails would be superfluous.

We request that NRC state what its position would be for the situation at WNI as it relates to the final draft of the Uranium Recovery Program Policy and Guidance Directive, LLWM 94-01, on Synthetic Liner Considerations during Reclamation of Surface Impoundments at Title II Uranium and Thorium Mill Tailing Sites, dated July 1994. Specifically, if WNI can successfully demonstrate that elements #1, 2, and 3 (as described above) of its tailings reclamation plan will not adversely impact the structural integrity of the cover through differential settlement, subsidence, slope instability, or breaching of the containment walls or cover; and that the plan meets ground water, radon emanation, and longevity requirements; would the NRC allow such a design?

If you have any questions, please feel free to contact me at (360) 753-3459.

Sincerely,

Gary Robertson

Gary Robertson, Head
Waste Management Section

GR:krf

cc: Joseph Holonich, NRC, DWM
Stephanie Baker, WNI
Warren Seyler, Spokane Tribe
Duane Bird Bear, BIA, WA
Stanley Speaks, BIA, OR

Final Draft

Blackhan 2/95

URANIUM RECOVERY PROGRAM
POLICY AND GUIDANCE DIRECTIVE
LLWM 94-01

Synthetic Liner Considerations during Reclamation of Surface Impoundments at Title II Uranium and Thorium Mill Tailing Sites

July, 1994

RESPONSIBLE STAFF:

Latif Hamdan

REVIEWED BY:

Daniel Gillen, HLUR

APPROVED BY:

Joseph Holonich,
Chief HLUR

APPROVED BY:

John Graeves

EFFECTIVE UNTIL:

Reevaluation Scheduled:

PURPOSE: This directive provides general guidance for review of certain aspects of reclamation plans for surface impoundments at Uranium Mill Tailings Radiation Control Act, Title II uranium and thorium mill tailings sites. The guidance is intended to assist Nuclear Regulatory Commission reviewers in considering how synthetic bottom liners should be handled in reclamation plans proposed by licensees/owners for new surface impoundments. Specifically, the guidance requires that staff verify that proposed reclamation and closure plans will either adequately minimize the possibility of creating a "bathtub effect" or that potential impacts of a projected "bathtub effect" will not adversely impact the structural integrity of impoundments, or ground-water quality.

DISCUSSION: NRC regulations generally require that new surface impoundments at Title II uranium and thorium mill tailings sites (defined as impoundments designed to hold an accumulation of liquid wastes or free liquids) have a liner to prevent the migration of wastes to the adjacent soil, ground water, or surface water, at any time during the active life of the impoundment, including the closure period (Criterion 5A(1), Appendix A to 10 CFR Part 40). Several licensees have used and/or proposed to use synthetic liners on the bottom of surface impoundments at uranium and thorium mill tailings sites. Use of these liners could create a "bathtub effect" following reclamation and closure of impoundments, due to passive infiltration through the surface and buildup of liquids above the liners. The "bathtub effect" can potentially have adverse impacts on the structural integrity of impoundments as well as ground-water quality. Specifically, the "bathtub effect" may cause local differential settlement, subsidence, slope instability, and/or a breach in the liner, containment walls, and/or cover. This could result in contaminant seepage into ground-water and surface water, and possibly uncontrolled release of tailings and contaminated materials to the environment.

In general, reclamation and closure plan reviews need to verify that plans comply with all of the closure and reclamation, and long-term surveillance requirements of tailings disposal sites in Appendix A to 10 CFR Part 40. These include, among other requirements, stabilization and covering of wastes and closure of disposal areas in a manner that will eliminate or minimize

the need for maintenance in the post-closure period (i.e., Criteria 6 and 12).

Specifically, closure and reclamation plan reviews should verify that there will be no need for active maintenance in the post-closure period, including maintenance due to a "bathtub effect" or its potential impact at surface impoundment sites. Therefore, the review must ascertain that proposed closure and reclamation plans will adequately minimize the possibility of creating a "bathtub effect", and/or reduce impacts if a "bathtub effect" is inadvertantly created.

In addition, closure and reclamation plans are to be reviewed in consideration of approved liner design and operation in surface impoundments. This is because certain liner design and operation practices are permitted by regulations subject to a licensee or applicant commitment to implement predetermined reclamation and closure plans (Criterion 5A(1)). For example, a design that allows the migration of waste into the liner during facility operation is permitted if the reclamation and closure plan includes removal or decontamination of contaminated soils, equipment, and structures (including contaminated liner).

Licensees are free to propose site-specific reclamation practices that will minimize the possibility of creating a "bathtub effect" and/or alleviate its potential impacts in the post-closure period. However, it will be the responsibility of licensees or applicants to conduct all necessary technical evaluations and analyses to demonstrate that the proposed reclamation plans will effectively preclude either the development of a "bathtub effect" or the occurrence of adverse impacts from a "bathtub effect." Demonstrations may involve, for example, performing water balance analyses and performance assessments, considering embankment design and construction proposals, and using realistic design hydraulic conductivities and geotechnical stability parameters, and should include consideration of proposed dewatering. In all cases, the results and procedures followed must be fully documented.

Licensees should provide for dewatering of surface impoundments, including eliminating free liquids, removing liquid wastes, and solidifying wastes or

waste residues in place, before placement of the cover. This is to control the initial moisture content in the disposal cell, and thereby reduce the projected pressure head buildup against the impoundment to acceptable levels. This will also reduce the potential for future adverse differential settlement effects on the final cover.

[redacted] If it is not, licensees should provide analyses demonstrating how any resulting water buildup will not adversly affect the long-term stability of the impoundment. Licensees must demonstrate the feasibility of the proposed cover design and construction, using as a general guide, Uranium Recovery Program Policy and Guidance Directive No. LLWM 92-03 "Interim Guidance on Evaluation Procedure for Hydraulic Conductivity of Radon/Infiltration Barriers for Title I and Title II Mill Tailings Sites." Licensees must also demonstrate that the proposed cover will accomplish the intended hydraulic conductivity objectives in LLWM 92-03 considering site-specific conditions.

Licensees should install a tailings impoundment final cover that is at least as impermeable as the liner.

LIMITATIONS: The reclamation practices cited in this directive for minimizing the possibility of creating a "bathtub effect" and/or alleviating its impacts are intended to be neither exhaustive nor limiting. Staff will evaluate any other site-specific reclamation practices proposed by licensees/applicants, on the basis of the existing regulations.

RESPONSIBLE STAFF: Latif Hamdan, PAHB, (301) 415-6639.

SIGNU SHEET

License Termination Planning Meeting
Sherwood Uranium Mill Closure
March 21, 1996

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MA Pasha	Western Nuclear, Inc. 200 Union Blvd; Suite 300 Lakewood, CO 80228	(303) 989-8675	(303) 989-8993	
P.K. Dellhard	P.O. Box 358 Wellpinit, WA 99040-0358	509/747-2081	509/747-2063	
C. Abeyta	P.O. Box 358 Wellpinit, WA 99040-0358	509/747-2081	509/747-2063	
John Blacklaw	Industrial Blvd., Bldg 5 Olympia, WA 98504	(360) 753-3350	(360) 753-1496	
James Goodman	P.O. Box 100, Wellpinit Wa. 99040	509-258-4581	509 258 9283	
Shannon Work	Givens Funke + Work PO Box 969 Coeur d'Alene, Id 83816	208 667 5486	208 667 4586	
Mark Plessinger	Rust Geotech P.O. Box 14000 Grand Jct., CO 81502	970-248-6571	970-248-6040	
Joe Virgona	US Dept. of Energy PO Box 2567 Grand Junction, CO 81502	970/248-6006	970/248-6023	
Dorothy Stoffel	WDOH 1500 W. 4th Ave, Suite 305 Spokane WA 99204	(509) 624-0598	(509) 456-2997	
Donna R. Bruce	BIA, Spokane Agency P.O. Box 389 Wellpinit, WA 99040	509/258-4561 or 353-3167	509/258-9557 or 258-7541	drbruce@on-ramp.ior.com
Harley W. Shaver	720 South Colorado Blvd. #1212 Denver, Colorado 80222-1934	(303) 757 7500	(303) 756 7085	

SIGN(' SHEET

License Termination Planning Meeting
Sherwood Uranium Mill Closure
March 21, 1996

NAME	COMPLETE ADDRESS	TELEPHONE	FAX #	E-MAIL #
STEPHANIE BAKER	WESTERN NUCLEAR, INC. 200 UNION BLVD/SUITE 300/LAKEWOOD/CO 80228	303-989-8675	303-989-8993	
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W.D.8.9

STATE OF WASHINGTON

DEPARTMENT OF HEALTH

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Olympia, Washington 98504-7890
(206) 753-5871 • (SCAN) 234-5871
TDD (206) 664-0064 • FAX (206) 586-7424

December 2, 1996

Joseph E. Virgona, Project Manager
Grand Junction Project Office
United States Department of Energy
Post Office Box 2567
6425 South Highway 191
Grand Junction, Colorado 81502

Dear Mr. Virgona:

Thank you for your interest in meeting with Washington State Department of Health staff regarding long-term responsibility for the Western Nuclear, Inc., Sherwood Uranium Mill site. The Department of Health very much appreciates your involvement in presentations at the stakeholder's meeting in Spokane on March 21, 1996. As a result of that meeting and the current status of reclamation at the millsite, it is necessary to pave the way for planning and execution of a Long-Term Surveillance Plan (LTSP) as required by federal regulation, 10 C.F.R. Part 40.28, in relation to termination of the license.

Termination of the license requires that long-term care of the disposal site be assured. Generally, under 42 U.S.C.A. §2113 and WAC 246-252-030, title to and custody of the uranium millsite land is required to be transferred to the United States or the state in which the land is located, at the option of the state, for the long-term care of the site. The Sherwood Uranium Mill site, however, is located on the Spokane Indian Reservation in Stevens County.

Under 42 U.S.C.A. §2113(b)(8) and WAC 246-252-030(11), the provisions respecting transfer of title to and custody of millsite land do not apply in the case of lands held in trust by the United States for any Indian tribe, or lands owned by such Indian tribe subject to a restriction against alienation imposed by the United States. In such cases, the licensee is required to enter into arrangements with the Nuclear Regulatory Commission as may be appropriate to assure the long-term surveillance of such lands by the United States. The land on which the Sherwood Uranium Mill site is located is held in trust by the United States for the Spokane Tribe. Therefore, the responsibility for the long-term care of the Sherwood site belongs to the federal government.

Based on the above, the state of Washington does not have the option of obtaining title to and custody of the Sherwood Uranium mill site and is not in a position to assume responsibility for the long-term care of the site. The Department of Health believes that the U.S. Department of Energy has a broad national interest in and significant resources available to most efficiently and effectively provide the long-term care of the Sherwood Uranium Mill site. Even if the option of obtaining title to and custody of the Sherwood Uranium Mill site were available to the State of Washington, the Department of Health is not in a position to assume responsibility for the long-term care of the site, and would still consider the U.S. Department of Energy to be the most appropriate agency to provide the long-term care of the site.

The Department of Health is interested in the long-term protection of the public health and safety with respect to the site and will continue to maintain its involvement in the development of the LTSP.

Please call me at (360) 753-5871, or Gary Robertson of my staff at (360) 753-3459, if you have questions on this letter.

Sincerely,

BRUCE A. MIYAHARA
Secretary

cc: Mike Lowry, Governor
Bruce Wynne, Spokane Tribal Business Council
Alfred Peone, BIA, WA
Stanley Speaks, BIA, OR
James Park, NRC
Ken Bennett, WNI
Stephanie J. Baker, WNI
Gary Robertson, DOH

APPENDIX I

APPROVAL CORRESPONDENCE FOR WNI'S CLOSURE PLAN, PLANS AND SPECIFICATIONS, AND CONSTRUCTION COMPLETION REPORT

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

November 28, 1995

Stephanie J. Baker
Manager, Environmental Services
Western Nuclear, Inc.
200 Union Blvd., Suite 300
Lakewood, Colorado 80228

Dear Ms. Baker:

The Department of Health has completed its review of your Tailings Reclamation Plan, including all addenda to date, and detailed Plans, Specifications and Quality Control procedures applicable to your proposed construction activities. The department finds that the Tailings Reclamation Plan is acceptable and meets the performance objectives contained in regulation, WAC 246-252.

The Department of Health has prepared the attached radioactive materials license amendment Number 22 to License Number WN-I0133-1. The amendment authorizes commencement of construction and specifies conditions for implementation of the Sherwood Project site closure.

Plans, Specifications and Quality Assurance provisions of your recent submittal, "Revised Executive Summary and Technical Specifications," November, 1995, are hereby approved provided the housekeeping issues and specification additions discussed in the attachment are addressed satisfactorily.

Sincerely,

Gary Robertson

Gary Robertson, Head
Waste Management Section

GR/JRB:krf

Attachments

cc: Warren Seyler, Spokane Tribe of Indians
Alfred Peone, US BIA, WA
Stanley Speaks, US BIA, OR
Jerald LaVassar, WDOE
Paul Lohaus, US NRC
Joe Virgona, US DOE

ATTACHMENT

Recommended Housekeeping and Specification Additions

1. Provide a copy of the construction plans and specifications used for construction bidding for department reference. (Only the department-approved Plans, Specifications and Quality Control procedures will be use by the department to assure compliance.)

2. In Section 1.9, "Codes and Standards," page TS-9, eliminate reference to ASTM C 131-89 and ASTM C 535-89 (LA Abrasion tests).

3. In Section 2.2, "Execution," page TS-16, as related to item 6, specify that vegetation selectively buried in the tailings impoundment will include no large debris (tree roots, large intact volumes of organic material, etc.) that could create post-reclamation settlement problems.

4. In Section 3.0, "Excavation," add language to appropriate sections requiring the contractor to scarify slopes prior to adding fill material.

5. In Section 4.2.2, "Placement and Grading of Final Reclamation Cover," page TS-30, add specifications for cover material particle size distribution and/or gradation to meet radon emanation and vegetation transpiration rates, as determined in closure plan analysis.

6. In Section 5.2.7, Tailings Margins," page TS-43, add performance-based specifications for vegetation, rock placement, and/or slope reduction that assure erosional stability, by design. (Use a vegetal stress allowance of 0% below 40% coverage, 100% above 70% coverage, and linear between 40 and 70% coverage, when predicting erosional stability from vegetation.)

7. In Section 6.0, "Revegetation," allow for re-evaluation of the proposed seed mix and planting methods, based on the land use interests of the Spokane Tribe of Indians.

8. In Section 6.2.4, "Restoration," page TS-49, add a specification that topsoil must have a D_{75} of greater than 0.07 inches, or explain why such a requirement may be unnecessary. Representative sampling must be performed on a frequency of every 2000 cubic yards, or daily, whichever is more stringent.

9. In Section 7.2.1, "Soil Cover Placement and Testing," page TS-52, specifications should state that assurance of configuration (quality control measurements) is performed at completion of cover placement, and that the expected settlement that takes place after completion is not a performance or cover stability concern, by design.

10. In Section 7.2.3, "Rock Mulch Placement and Testing, page TS-59, change the measurement grid frequency to 100' by 100', to be consistent with page TS-35.

11. In Section 7.2.4, "Diversion Channel Dimensions," page TS-60, a Quality Control method is needed and the tolerance may need to be increased to assure compliance during construction.

12. In Section 7.2.5, "Ancillary Area Grading," page TS-60, add slope tolerances.

13. Provide a new section, "Section 7.2.7, Vegetation," that includes Quality Control procedures necessary to assure compliance with specifications developed under Section 5.2.7.

14. In Tables 2A and 2B, consider reducing the number of sieve sizes to 4 or 5 to improve construction efficiency.

15. In Table 3, assure that all changes and additions recommended in this attachment which are critical to performance are adequately included in Table 3.

16. In drawings, page 8 (and elsewhere, as needed), revise the cover thickness to be a minimum of 12.6 feet.

17. In the drawings (and elsewhere, as needed), revise the cover thickness topography to include an additional thickness equivalent to an analysis of reasonable expectations of cover surface settlement.

11. In Section 7.2.4, "Diversion Channel Dimensions," page TS-60, a Quality Control method is needed and the tolerance may need to be increased to assure compliance during construction.

12. In Section 7.2.5, "Ancillary Area Grading," page TS-60, add slope tolerances.

13. Provide a new section, "Section 7.2.7, Vegetation," that includes Quality Control procedures necessary to assure compliance with specifications developed under Section 5.2.7.

14. In Tables 2A and 2B, consider reducing the number of sieve sizes to 4 or 5 to improve construction efficiency.

15. In Table 3, assure that all changes and additions recommended in this attachment which are critical to performance are adequately included in Table 3.

16. In drawings, page 8 (and elsewhere, as needed), revise the cover thickness to be a minimum of 12.6 feet.

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

March 12, 1998

Stephanie J. Baker
Manager, Environmental Services
Western Nuclear, Inc.
200 Union Blvd., Suite 300
Lakewood, Colorado 80228

Dear Ms. Baker:

The department appreciates the consistent effort by your company to expedite the reclamation of the Sherwood Project site in an environmentally responsible manner. We are very pleased with the results of construction activities and expect the monitoring and surveillance period to be successful. We encourage you to continue to pursue license termination in an expedient manner. Recent department reviews have been completed, resulting in completion and acceptance of major milestone tasks. Your license has been amended in its entirety to reflect progress at the Sherwood Project.

Your Monitoring and Stabilization Plan (MSP) is accepted, as provided in your September 24, 1997 letter and report and as modified by your February 6, 1998 letter and report. License Amendment #31 has been processed to reflect plan acceptance. Please see Attachment 1 for MSP references.

Your Sherwood Tailing Reclamation Plan (TRP) Construction Completion Report (CCR) and corrective action (CA) referenced above is accepted. License Amendment #31 has been processed to remove requirements relative to Tailings Reclamation. The department has attached comments and requests for clarification to formally complete final details of our CCR verification and to complete our files. Please see the Attachment 1 for TRP references and requests for information and clarification.

If you should have questions in this regard, please contact me at (360) 236-3241, or John Blacklaw at (360) 236-3243.

Sincerely,

Gary Robertson

Gary Robertson, Head
Waste Management Section

cc: Brad DeWaard, WNI
Lou Miller, P.E., SMI
Jerald LaVassar, P.E., WDOE
Steve Link, WSU
Russell Edge, USDOE GJO
Dennis Sollenberger, NRC
Bruce Wynne, Spokane Tribe
Mary Verner, Spokane Tribe
Sharon Yepa, BIA, WA
Stanley Speaks, BIA, OR
Shannon Work, Spokane Tribe

Attachment: (1) Review References and Requests for Information and Clarification

(2) Radioactive Materials License WN-I0133-1, Amendment No. 31

Attachment 1

Review References and Requests for Information and Clarification

MONITORING AND STABILIZATION PLAN REFERENCES

The department has received your Sherwood Project, Tailings Impoundment, Monitoring and Stabilization Plan (MSP) report and letter dated September 24, 1997, prepared comments sent in a letter from Gary Robertson (Health) to Stephanie J. Baker (WNI) dated November 26, 1997, and received responses and recommendations dated February 6, 1998, for license amendment and minor revision to the MSP.

TAILINGS RECLAMATION PLAN REFERENCES

The department has also received your Sherwood Tailing Reclamation Construction Completion Report (in 3 volumes) and letter dated June 27, 1997, regarding construction of the Tailings Reclamation Plan. For reference purposes, note that construction was completed based on the Sherwood Project Tailing Reclamation Plan Technical Specifications, Revision #4, dated November 1996, and confirmed using Construction Component Quality Plan Report and letter, dated May 16, 1996. The department prepared general comments regarding the Construction Completion Report sent in a letter from John R. Blacklaw (Health) to Stephanie J. Baker (WNI) dated August 5, 1997. Your responses to our general comments are contained in your letter dated September 16, 1997, from Stephanie J. Baker (WNI) to Gary Robertson (Health).

The department has also received your letter of August 15, 1997, reporting a Surface Stability Deficiency and Proposed Corrective Action (CA). The department approved your corrective action request by letter from John Blacklaw (Health) to Stephanie J. Baker, dated August 19, 1997. Confirmation of completion for your corrective action has been received and is contained in your Sherwood Monitoring and Stabilization Plan, Post-Reclamation Construction Monitoring, 1997, Vegetation Monitoring Program Report and letter, dated February 12, 1998, from Brad K. DeWaard (WNI) to Gary Robertson (Health). The letter report attached, from Sheila Pachernegg, P.E. to Brad DeWaard (WNI), contains the completion inspection for the Corrective Action.

Department inspectors have made numerous inspections of the Sherwood Project site prior to, during, and after construction of the Tailings Reclamation. Western Nuclear, Inc. performed audits of the construction process to assure compliance with plans and specifications. Shepherd Miller, Inc. staff, under the supervision of Lou Miller, P.E., prepared design documents and supervised preparation of the Construction Completion Report. C.E. Spurlock, Jr. & Associates staff, under the supervision of C.E. Spurlock, Jr., performed construction surveys. Rock gradation and durability tests were conducted by AGRA Earth and Environment, Inc. Inspectors from the state's Department of Ecology (WDOE), Dam Safety Section, reviewed and approved plans and specifications, and inspected the Sherwood Project site during and after construction. Dam Safety Section staff assisted department staff in evaluating design and performance features for site reclamation. A letter from Jerald LaVassar, P.E. (WDOE) to Stephanie J. Baker, dated December 15, 1997, states that the project has been reclassified as "reclaimed."

DEPARTMENT CONCURRENCE WITH WESTERN NUCLEAR, INC. RESPONSES TO GENERAL TRP CCR COMMENTS (based on WNI September 16, 1997 letter)

1. *Site survey data and reports provided by C.E. Spurlock, Jr. & Associates have not been signed and sealed by a licensed Surveyor.*

   Your response that Mr. Spurlock is a licensed engineer (but not a licensed land surveyor) in the state of Washington, as well as a licensed engineer and licensed land surveyor in Wyoming (and other states), as well as experienced in construction surveying, qualifies your CCR data and report. The department appreciates your response and the letter from Mr. Spurlock, dated and stamped August 29, 1997, that provides his credentials and a description of his responsibilities during Sherwood Project Tailings Reclamation construction activities. The department accepts your assertion that Mr. Spurlock's responsibility in the Tailings Reclamation construction is more properly defined as Engineering support, rather than Land Surveying.

   The department is aware that Mr. Spurlock has applied for and tested for licensure in the state for Land Surveyor, and that such a license was not in effect during construction phases of the Tailings Reclamation, and not required, based on his responsibilities at the time.

2. *There is an inconsistency between quality assurance documents and the as-built (CCR) document regarding non-conformities between plans and specifications and quality assurance records.*

   Your response is appreciated in that you consider the as-built document (CCR) a part of the quality assurance program for construction activities. However, the non-conformities that were identifies in the CCR should have been identified during construction, and proper corrective action procedures followed. It may be that some of the more minor non-conformities may not have been identified until after completion of construction, or after quality assurance audits were completed. That contingency would have provided a reasonable explanation, but was not provided in your response.

   In any case, the department has reviewed your non-conformities identified in the CCR and concurs that the Tailings Reclamation meets the purpose and intent of the regulations and is therefore acceptable, even though not meeting the details of design plans and specifications.

3. *The design modification of revising the alignment of the diversion channel, at its most northern extent, for the benefit of monitoring well logistics, was not approved by the department prior to construction. This modification required moving the centerline of the diversion channel approximately 20 feet to the north at the northern corner. This modification was presented and justified in the CCR. The quality assurance program should have identified this as a non-conformance and proposed corrective action according to procedure. Approved plans and specifications should not have reconciled with field survey measurements. A corrective action should have been prepared and presented to the department. The corrective action may have been a formal request for approval of a modification of plans and specifications, or a request for department concurrence with a field change order. The CCR should have identified compliance with*

the approved modification, in whatever form, had it occurred during construction activities.

Your response that you considered this re-alignment to be a minor issue and that the department knew of the modification at the time is insufficient justification for not providing a written modification request for approval prior to implementing the change. License condition 34.A requires approval of plans and specifications (or their modification) prior to commencement of construction.

It is recommended that in the future, any proposed plans or specifications (or modification thereto) be presented to the department prior to construction. Construction could proceed if responsible department staff are fully informed, proposed modifications are pending, and verbal concurrence with responsible department staff has been obtained. If there is a serious or prompt necessity to modify site configuration, make every effort to contact responsible department staff with due urgency prior to implementing such changes. Normal maintenance activities do not need department prior approval or concurrence.

The department has reviewed your modified channel re-alignment non-conformity, identified in the CCR, and concurs that the Tailings Reclamation meets the purpose and intent of the regulations and is therefore acceptable, even though not meeting the details of design plans and specifications.

DEPARTMENT COMMENTS AND REQUESTS FOR CLARIFICATION BASED ON FINAL REVIEW OF THE TRP CCR

1. *Section 2.1.5 discusses casing extensions for monitoring wells MW-2, MW-2A, and MW-4. This section references Appendix C for a description of these well extensions. Appendix C actually contains documents associated with proposed monitoring well extensions, and not the as-built configurations of these extended wells.*

   Construction completion reports for these well extensions are needed. Initial well completion diagrams, Attachment 1 of Appendix C, should be updated with the new elevations, and casing extension and backfill fill materials identified. A certification from the driller that the extensions were constructed consistent with WAC-173-160 requirements must be added to or referenced to the CCR.

2. *Section 2.1.6 describes monitoring well abandonment for monitoring wells MW-5, MW-6, MW-7, MW-8, and MW-9. This section references Appendix D for a description of these well abandonments. Appendix D actually contains documents associated with proposed monitoring well abandonment, and not the as-built configurations of these abandoned wells.*

   Western Nuclear, Inc. submitted well abandonment reports with the as-built configurations for monitoring wells MW-5, MW-6, MW-7, MW-8, and MW-9, and a cover letter, dated February 26, 1996, from Brad DeWaard (WNI) to Leo Wainhouse (Health). The abandonment reports with the well as-built configurations and cover letter should be added to or referenced to the CCR.

3. *Section 2.3.1.2 includes information on materials of construction. Description of cover soil designations A, B, C, and D were not contained in the CCR.*

   Descriptions for cover materials were developed with concurrence between WNI and department staff. A written description is contained in department memorandum from Dorothy Stoffel to John Blacklaw and Leo Wainhouse. This memorandum was transmitted to WNI with a cover letter, dated April 26, 1997, to Corn Abeyta (WNI). Soil cover designations should be added to or referenced to the CCR.

4. *Design plans and specifications and as-built configuration were compared and reviewed by department staff. Several minor non-conformances were identified in the CCR and reviewed by department staff. They were found to conform with regulatory requirements, although not meeting specific requirements of the plans and specifications. In large measure, these were quite minor deviations from design requirements.*

   No action required.

5. *The basis for review of design and as-built configurations was provided in the CCR. The data provided are in tabular form and are clearly and easily interpreted. However, the design basis in the plans and specifications is not specifically provided for each grid point location evaluated by survey. Additionally, the CCR does not contain background data to support measurements provided in CCR tables. The department could not therefore verify or validate the tabular data directly.*

   AutoCAD file data are needed for the grid point locations used to qualify the design by field measurement. Field measurement data from the surveyor are needed for each grid point to compare with AutoCAD file configurations. AutoCAD data should be transmitted, signed and stamped by the design engineer. Field survey data should be transmitted, signed and stamped by the field surveyor. Once the department receives these data, they will be spot-checked for consistency and accuracy with the values provided in tabular form in the CCR. The data will also be used to complete the record.

6. *Section 2.3.1.6 - Subgrade Determinations indicate that all 397 subgrade elevation grid locations are used to evaluate cover thickness. In Table 7, not all 397 grid locations are included.*

   The department is aware that some initial subgrade elevation grid points were placed outside the tailings footprint and are not considered in cover thickness evaluations. The department is also aware of a design modification prepared to address an area of the subgrade where it became impractical to reduce its elevation to initial subgrade design requirements. Please clarify further.

7. *Section 2.3.1.5 indicates that final cover elevations are presented in Table 3. Grid point (233) is listed in Table 5, but not in Table 3.*

   Please clarify.

8. *Section 2.3.1.3 states that "it was assumed in the design that the cover material would be placed as loose as possible." Apparently a soil density value of 1.6 g/cc (99.8 lb/ft^3) was used in the design analysis referenced.*

Is this value of soil bulk density consistent with placement "as loose as possible?" What is the likely as-built soil bulk density? Was 1.6 g/cc the soil bulk density used in design analyses?

9. *Section 2.3.2.1 gives a stated elevation tolerance of +/- 0.1 ft. Approved Plans and Specifications give an elevation tolerance of +/- 0.2 ft.*

   Please clarify.

10. *Section 2.3.2.4 discusses re-alignment of the diversion channel. Alignment of the channel has changed during design review and approval (straightening and offsetting to the east of the east section of the diversion channel), and as reported in the CCR (modification to the north of the northern most corner of the diversion channel). Flow depths and velocities will certainly change as a result of these alignment changes, even though to a relatively minor amount. The CCR states that changes in flow depth and velocities will be relatively minor.*

    Are there any calculations to justify the extent of changes in flow depth or velocity? Please provide an estimate of expected changes and any affect on design configuration that may be justified, or not.

11. *Appendix F (page EEPL-27) indicates that Filter I was used for an area adjacent to Confluence C. Approved Plans and Specifications show a requirement for use of Filter II for that area.*

    Please clarify, and if non-conformance is indicated, please justify adequacy of design.

12. *Appendix G (page 33) indicates that only one measurement of rock thickness was performed on Reach 1 of the Main Embankment Groin. There are three reaches for the Main Embankment. There are several hundred feet of length for these reaches, in total. Some of the groin rock has been covered by other construction materials. There should have been several measurements (every 100 feet) for rock thickness.*

    Please clarify by providing a drawing or sketch showing the extent of all reaches for the Main Embankment groin, showing locations of rock thickness measurements, and clarifying the need for thickness measurement based on approved Plans and Specifications or Quality Assurance requirements. If additional rock thickness measurements are needed, please provide them by inspection, or justify that adequate rock has been placed in the Main Embankment Groins by reference to other documentation from the CCR (e.g., weekly production summaries).

13. *Appendix G (page 1) indicates that only one measurement of rock thickness was performed on the 10-foot wide riprap strip placed at the margin toe. The riprap strip is several thousand feet long. There should have been several measurements (every 100 feet) for rock thickness.*

    Please clarify by providing a drawing or sketch showing the location of rock thickness measurements, and clarifying the need for thickness measurements based on approved Plans and Specifications or Quality Assurance requirements. If additional rock thickness measurements are needed, please provide them by inspection, or justify that adequate

rock has been placed in the margin toe riprap strip by reference to other documentation from the CCR (e.g., weekly production summaries). Department staff inspection of the margin toe riprap strip observed an adequate rock volume, although detail measurements were not taken.

14. *Appendix H contains records that include several write-overs in the logs. Proper modification of logs would contain a mark-through, hand-written addition, and signature or initializing of the modification next to the modified log entry. Only an authorized representative should make such changes.*

    No action required.

15. *Appendix H (last page) appears confusing or misleading regarding "clay" content or "clay" soil types placed in the cover. Moe Pasha indicated clay content in his inspection. Several department inspection reports also indicate "clay" content in cover materials, and elsewhere. There are soil cover designations that include "Clay" type soils. There is also a soil component that indicates soil materials with a particle size less than 0.002 mm diameter.*

    It may be confusing when "clay" is indicated in inspection documents. Inspection documentation should clarify if the comment indicates a "clay" type soil, or the relative portion of "clay" size particles in the soil. There should also be some indication as to the basis for the comment. Is the commenter experienced in evaluating soil? Are there actual measurements of particle size distribution as the basis for the comment? Some indication of particle size distribution (or percent clay) for soils designated A and B is needed. Soil descriptions developed by Dorothy Stoffel for materials A, B, C and D could be referenced. Please clarify.

16. *The discontinuity in elevation at Confluence E1 is not noted in the CCR.*

    This non-conformance has been addressed appropriately in other documents. However, it should have been included in the CCR. No action required.

17. *There is no measurement or verification in the CCR that indicates that riprap is sized or located 50 feet up and down stream from confluences, consistent with design plans and specifications.*

    Were measurements made for the location of these transition points? If so, please provide. If not, please justify adequacy of the as-built configuration and the likely transition placement accuracy. Department inspectors observed placement configurations during construction. Staff observations were consistent with Plans and Specifications, although measurements were not made.

18. *Appendix K contains documentation indicating grain size distribution of placement soils. This information is related to documentation contained in Appendix I. There is no cross-reference indicated.*

    No action required.

19. *Appendix L contains survey data for diversion channel bottom elevations. Nine of the survey data points do not conform to design elevations and tolerances (+/- 0.2 feet). In QA records and in the text of the CCR, there are only two non-conformances indicated.*

Please clarify.

20. *Appendix L contains cross-sectional area data for station 28+00 of the diversion channel. There are three sets of data presented: a hand calculation, a QA record sheet, and as described in the text of the CCR. Results by these three methods are not consistent.*

Please clarify.

21. *The CCR did not indicate the presence of a groundwater spring on the east side of the diversion channel.*

Please clarify.

22. *Appendix N contains a table of data for as-built margin slope measurements that are non-conforming. Data for conforming slopes are not included.*

Please provide margin slope measurement date for all margin slopes.

23. *Appendix N contains as-built margin slope measurements for stations 56+00 and 57+00. Table values and spreadsheet values are inconsistent.*

Please clarify.

24. *Appendix N (end) shows a notation for Mannings' n number. It indicates 0.5. It is likely a typographical error and should be 0.05.*

Please clarify.

25. *Table N-3 of Appendix N indicates flood flow discharge areas. Station 4+00 flow area is considerably different that station 5+00 and beyond. Station 5+00 and beyond flood flow discharge areas are not supported by values of peak discharge in the right column of Table N-3.*

Please clarify and provide corrected information, as appropriate.

26. *Appendix M contains analysis on rock sizing requirements. A D_{50} of 15 inches is noted for Confluence C, based on analysis performed during design development. Actual rock size measurements, made during construction, indicate that rock designated and used as 15-inch rock was found to have a D_{50} of 16.5 to 18 inches. Department review of rock sizing requirements indicates that a rock size D_{50} of 16.49 inches is required. The department used the method recommended by the NRC in NUREG/CR-4651, Volume II, "Development of Riprap Design Criteria by Riprap Testing in Flumes: Phase II."*

Please clarify the rock sizing requirement by analysis, and confirm rock size placed using inspection data, to assure construction as-built adequacy.

AMENDMENT NO. 31

State of Washington

Radioactive Materials License

Pursuant to the Nuclear Energy and Radiation Control Act, RCW 70.98, and the Radiation Control Regulations, Chapters 246-220 through 246-255 WAC, and in reliance on statements and representations heretofore made by the licensee designated below, a license is hereby issued authorizing such licensee to transfer, receive, possess and use the radioactive material(s) designated below; and to use such radioactive materials for the purpose(s) and at the place(s) designated below. **This license is subject to all applicable rules and regulations** promulgated by the State of Washington Department of Health.

1. Licensee Name 2. Address WESTERN NUCLEAR, INC. Sherwood Mill, P.O. Box 352 Wellpinit, Washington 99040	3. License Number WN-I0133-1 is amended in its entirety to read as follows: 4. Expiration Date 5. Reference number Upon license termination

6. Radioactive Material (element and mass number)	7. Chemical and/or Physical Form	8. Maximum quantity licensee may possess at any one time
A&B. Natural Uranium, plus daughters.	A&B. Any.	A&B. Limited to unlimited.

<<->>+<<->>+<<->>+<<->>+<<->>+<<->>+<<->>+<<->>

CONDITIONS

9. A&B **Authorized use:** possession of byproduct material in the form of uranium mill tailings generated by the licensee's past milling operations authorized under radioactive materials license number WN-I0133-1.

10. **Regulatory requirements:** the licensee shall comply with the provisions of RCW 70.121.030, "Mill Tailings--Licensing and Perpetual Care;" Chapter 246-220 WAC, "Radiation Protection--General Provisions;" Chapter 246-221 WAC, "Radiation Protection Standards;" Chapter 246-222 WAC, "Radiation Protection--Worker Rights;" Chapter 246-235 WAC, "Radioactive Materials--Specific Licensees;" and Chapter 246-252 WAC, Radiation Protection--Uranium and/or Thorium Milling," and is subject to the rules, regulations, and orders of the Department of Health now or hereafter in effect, and to the additional conditions specified or incorporated in this license.

11. **Authorized place of use:** the licensee's Sherwood Project, uranium milling facilities located on the Spokane Indian Reservation, Section 2, Township 27 North, Range 37 East in Stevens County, approximately 8 miles southwest of Wellpinit, Washington.

12. **Management:** radioactive material shall be used by, or under the supervision of the Resident Manager.

RADIATION PROTECTION

13. **Survey instruments:** the licensee shall maintain calibrated and operable radiation detection survey meters in adequate numbers so that instruments are available at all times for performing required health physics surveys. Prior to any use, instruments must be checked for consistency of operation with a radiation check source. If the instrument's response to the radiation check source differs from the reference reading by more than 20 percent, the instrument should be repaired if necessary and recalibrated.

14. **Posting of the property:** all entrances to the property and fenceline boundaries shall be conspicuously posted in accordance with WAC 246-221-120.

15. DELETED

16. DELETED

17. DELETED

18. DELETED

19. DELETED

ENVIRONMENTAL PROTECTION

20. **Environmental impacts:** before engaging in any project-related activity not previously evaluated by the department, the licensee shall prepare and record an environmental evaluation of such activity. When the evaluation indicates that such activity may result in a significant adverse environmental impact that was not assessed, or that is greater than that assessed, the licensee shall provide a written evaluation of such activities and obtain prior approval of the department in the form of a license amendment.

21. **Cultural resources:** in order to ensure that no disturbance of cultural resources occurs in the future, the licensee shall have an archeological and historical artifact survey of areas of its property, not previously surveyed, performed prior to their disturbance, including borrow areas to be used for reclamation cover fill. These surveys must be submitted to the department and no such disturbance shall occur until the licensee has received authorization from the department to proceed.

The licensee is authorized to excavate material from the proposed reclamation borrow areas as designated in the licensee's approved reclamation plan, provided that protection of the cultural resources is managed in accordance with statements and representations contained in written cultural surveys, if applicable, provided to the department.

ENVIRONMENTAL MONITORING AND STABILIZATION

22. **Environmental Monitoring and Stabilization Program:** the licensee shall establish and maintain an environmental monitoring programs following the requirements established in "Sherwood Project, Tailing Impoundment Monitoring and Stabilization Plan," September 1997, with comments and additions provided by the department in a letter from Gary Robertson (Health) to Stephanie J. Baker (Western Nuclear, Inc.), dated March 12, 1997.

    A Final Monitoring and Stabilization Plan Report indicating the relative success of post-construction site reclamation shall be provided to the department, 90 days prior to license termination.

23. DELETED

QUALITY ASSURANCE

24. **Quality Assurance:** as applicable, the licensee shall maintain a quality assurance program consistent with the requirements of U.S. Nuclear Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs - Effluent Streams and the Environment." In addition, the licensee shall be required to document the results and recommendations of each annual audit of the environmental monitoring program.

25. DELETED

26. **Documentation retention:** the results of sample analyses and monitoring, the results of calibration of equipment, reports on inspections, and any subsequent reviews, investigations, and corrective actions, shall be documented.

27. DELETED

FINANCIAL SURETY

28. **Financial surety requirements:** the licensee shall maintain a department approved financial surety arrangement, consistent with WAC 246-252-030, Criteria 9 and 10, adequate to cover the estimated costs, if accomplished by a third party, for decommissioning and decontamination of the mill and millsite, for reclamation of any tailings or waste disposal areas, for performance verification of the monitoring and stabilization period, for groundwater restoration, as warranted, and for long-term care and maintenance activities required after license termination.

LICENSE TERMINATION

29. **License Termination:** The final closure date for the Sherwood Mill site, including tailings recontouring and stabilization, radon barrier, and erosion protection cover is December 31, 1998. The final closure date shall only be revised by reason of technological infeasibility, inclement weather, litigation resulting in delays, or other factors beyond the control of the licensee.

ADMINISTRATIVE REQUIREMENTS

30. **Bankruptcy:** the licensee shall notify the department, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any Chapters of Title II (Bankruptcy) of the United States Code (USC) by or against:

    A. A licensee; or

    B. An entity [as the term is defined in 11 USC, Section 101(14)] controlling a licensee or listing the license or licensee as property of the estate; or

    C. An affiliate [as the term is defined in 11 USC, Section 101(2)] of the licensee, and

    D. The licensee's notification must also indicate the bankruptcy court in which the petition for bankruptcy was filed; and

    E. The date of the filing of the petition.

31. **Notifications:** notification to the department under WAC Title 246, and license conditions shall be made as follows:

Required written notice to the department shall be made to: Head, Waste Management Section, Department of Health, Division of Radiation Protection, 7171 Cleanwater Lane, Building 5, P.O. Box 47827, Olympia, Washington 98504-7827.

MILL DECOMMISSIONING PLAN

32. DELETED

TAILINGS RECLAMATION PLAN

33. DELETED

34. **Tailings Reclamation Plan:** the licensee is authorized to conduct Tailings Reclamation Plan activities for the purpose of long-term site stabilization and closure. Special conditions are needed to implement the Tailings Reclamation Plan, as noted below:

    A. Tailings Reclamation Plan activities shall be governed by detailed Plans and Specifications prepared for all construction activities. Such Plans and Specifications shall be reviewed (and stamped) by a licensed engineer, and submitted to the department for approval, prior to commencement of construction. When approved, detailed Plans and Specifications shall be placed under document control procedures. Any modifications of detailed plans and specifications shall be approved by the department.

    B. Quality Control procedures must be prepared that meet the requirements of the license, the closure plan, and approved detailed Plans and Specifications for all construction activities, and submitted to the department for approval, prior to commencement of construction for that activity. Construction hold points shall be negotiated with the department prior to commencement of construction of any element of the design. The purpose of hold points is to allow department staff inspectors an opportunity to verify construction features, before subsequent activities might jeopardize such a verification.

    Quality Control records must be made available to department inspectors, on reasonable notice, during business hours.

    C. Within 90 days after completion of construction, provide a "declaration of construction completion" report that includes: (1) as-built documents, and (2) a licensed engineer's statement (stamped) that, "construction was performed in compliance with department-approved Plans and Specifications." If other activities are provided by licensed or professional operators, a signed

authorization commitment by them must be included in formal completion reports stating that, "construction, monitoring, testing, and/or inspection was performed in compliance with department-approved Plans and Specifications." Examples of applicable licensed or professional operators are: licensed land surveyors, licensed well drillers, geotechnical materials testers, quality assurance inspectors, and radioactive materials laboratory technicians.

35. **Environmental Monitoring Wells:** All monitoring well construction activities shall meet the following:

A. Environmental monitoring wells shall be abandoned according to procedures outlined in Chapter 173-160-560 WAC, "Abandonment of Resource Protection Wells." Plans and Specifications shall be provided to the department for review and approval prior to final surface abandonment, to ensure that the surface is adequately sealed.

B. Plans and Specifications, including extension of well casing and final surface completion shall be consistent with Chapters 173-160-510 and -520 WAC, "Design and Construction of Resource Protection Wells," as applicable.

C. In the event of well failure, the department shall be notified within 72 hours, and Plans and Specifications for a replacement well shall be submitted to the department for review and approval within 30 days.

D. Within 30 days after completion of construction, provide a "declaration of construction completion" report that includes: (1) as-built documents, and (2) a licensed well driller's statement that, "construction was performed in compliance with department-approved Plans and Specifications."

DOCUMENTS INCLUDED BY REFERENCE

36. **Closure Reference Documents:** except as specifically provided by this license, the licensee shall possess and use radioactive material described in Items 6, 7, and 8 of this license in accordance with statements, representations, and procedures contained in the following documents.

State of Washington

Radioactive Materials License

License Number WN-I0133-1

Amendment No. 31

A. **Monitoring and Stabilization Plan:** reference documents specified below constitute the Monitoring and Stabilization Plan, which when completed constitutes closure of the site.

Letter dated September 24, 1997, *Sherwood Project, License Condition #22 (Amendment #30), Monitoring & Stabilization Plan*, signed by Stephanie J. Baker, Environmental Services Manager, Western Nuclear, Inc.

Letter and enclosure dated February 6, 1998, *Sherwood Project, License Condition #22 [Amendment #30], Monitoring and Stabilization Plan: Response to 11/26/97 WDOH letter.*

Letter dated March 12, 1998, signed by Gary Robertson, Head, Waste Management Section.

Date March 12, 1998

By Gary Robertson
Gary Robertson
Waste Management Section

John [redacted]

WESTERN NUCLEAR, INC.

UNION PLAZA SUITE 300, 200 UNION BOULEVARD, LAKEWOOD, COLORADO 80228
TELECOPIER (303) 989-8993 TELEPHONE (303) 989-8675

SEP 1 8 1997

DIV. OF RADIATION PROTECTION

September 16, 1997

Mr. Gary Robertson, Head
Waste Management Section
Washington Department of Health
Division of Radiation Protection
Airdustrial Park, Bldg. 5
P.O. Box 47827
Olympia, WA 98504-7827

RE: WN-I0133-1, LICENSE CONDITION 34C, TAILING RECLAMATION CONSTRUCTION COMPLETION REPORT - RESPONSES TO WDOH QUESTIONS

Dear Mr. Robertson:

On June 27, 1997, Western Nuclear, Inc. [WNI] transmitted the Sherwood tailing reclamation construction completion report. Via letter dated August 5, 1997, you transmitted questions regarding the 06/27/97 WNI completion report. Attached hereto are seven [7] copies of WNI responses to your questions.

In addition, copies are being transmitted directly to the following parties:

- One [1] of this particular submittal is being sent directly to Ms. Stoffel [WDOH; Spokane, WA].
- One [1] copy is being sent directly to Mr. Fordham [WDOH; Richland, WA].

Should you have any questions, please contact us at your earliest convenience.

Sincerely,

Stephanie J. Baker
Manager of Environmental Services
SJB/tic doh\trp\respnd97.sep

w/attachments
cc: CA [w/ attach.]
LLM [SMI] [w/o attach.]
MAP [w/o attach.]
L. Pruett, Esq. [w/o attach.]
EMS [w/o attach.]
H. Shaver, Esq. [S&L] [w/o attach.]

Responses to WDOH Questions

The following presents responses to the Washington Department of Health (WDOH) questions regarding the Sherwood Tailing Reclamation Completion Report. The WDOH questions were transmitted in a letter dated August 5, 1997. The specific question from the August 5, 1997 letter is repeated herein and is followed by our response.

Question 1. **The site survey data and reports provided by C. E. Spurlock, Jr. (Licensed Land Surveyor in Wyoming) have not been signed and sealed. RCW 18.43 requires that they be signed and sealed. We cannot complete our review of the Construction Completion Report until this occurs. The department has previously noted the need for signed and sealed surveys during site inspections and meetings. Please provide a description of license credentials and quality assurance methods used in the production of survey data in support of the surveyor, C. E. Spurlock, Jr. and Associates, Inc. of Lander, Wyoming, since the surveyor is not licensed in the state of Washington.**

Response: All site construction surveying to determine compliance with drawings and specifications was performed by C. E. Spurlock and Associates. Mr. Spurlock is licensed as a Professional Engineer (PE) in Washington. His registration as a PE is appropriate for the construction surveying that he performed at Sherwood as described in the letter from Mr. Spurlock dated August 29 which is attached.

Question 2. **There appears to be inconsistency between quality assurance reports and the completion report. The quality assurance reports indicate that there were very few items of noncompliance found during inspection audits and that they were adequately resolved by corrective actions, and confirmed during audit re-inspection. However, the completion report discussed several remaining items of noncompliance and justifies how, even though not reflecting the design requirements, they meet the state's regulatory purpose (regulation and guidance). Please clarify this apparent inconsistency and provide corrective actions to resolve any remaining discrepancies. Make sure quality assurance reports include all remaining items of noncompliance. WNI Quality Assurance Procedures should be used to resolve these deviations. An addendum report to the completion report is a suggested means of providing the authorizations requested.**

Question 3. **A design modification relocating the centerline of the channel was made to accommodate an upslope placement of WNI's northernmost monitoring well. This defect was not identified by the surveyor or by quality assurance inspection or audit and not formally submitted to the department for review and approval as required by license condition. It is, however, identified in the completion report. This design modification must be formally submitted to the department for review and approval using existing WNI Quality Assurance procedures.**

Response to Questions 2 and 3:

There were four areas where the completion report indicated that as-built conditions did not meet the original specifications. Specifically these areas included:

1. Sixteen of the 87 slope measurements for the margins.

2. The slopes of three of the confluences.

3. The slope and dimensions of the swale outlet apron.

4. The alignment of the diversion channel at stations 48+00, 49+00 and 50+00.

With the exception of the alignment of the diversion channel and the slope of one of the confluences (confluence C), the deviations were insignificant and were also not identified until final site surveying. These deviations were addressed in the completion report and were evaluated in appendices M, N and O and found to meet the performance objectives necessary for each of the elements.

From the beginning, it was recognized that the completion report would be an integral part of the QA/QC program. Specifically, Section 6.0 Audits and Reviews, of the Construction Component Quality Program (WNI, 1996) indicates that the QA/QC documentation will consist of four groups of documents, one of which is the final as-built or completion report. Further, it was recognized that "all other elements of construction not included in the other QA/QC documentation such as the final configuration of the margins and embankment outslopes" would be documented in the As-Built (completion) Report. (Section 6.1.4 Final As-Built Report of the C/CQP). It is therefore obvious that the completion report was always intended to be a critical component of the quality assurance program

and there is no inconsistency between the quality assurance program and the completion report. The completion report is simply another element of the quality assurance program. Since the completion report contains a complete description of all of the discrepancies between the approved drawings and specifications and the as-built conditions, no further discussion or documentation of these deviations are warranted or necessary.

The diversion channel alignment and the slope of confluence C were changed during construction to meet field conditions. The alignment of the diversion channel from station 48+00 through 50+00 was modified to accommodate monitoring wells 2 and 2A. The slope of confluence C was changed to conform with surrounding topography. These changes were made in the field and revisions to the construction (not design) drawings were made to reflect those changes. WNI used the protocol listed in section 11 of the C/CQP (WNI, 1996) to determine that these changes were appropriate and that they were minor enough in nature to be made without officially notifying the WDOH (although WDOH field inspectors were aware of at least the diversion channel alignment change) and changing the approved specifications and drawings. The pertinent sections from the C/CQP (WNI, 1996 along with a logic flow chart are attached.

As with the deviations discussed above, the completion report discusses these deviations and provides justification that the as-built conditions do meet the required performance objectives. Therefore, no further "corrective action or quality assurance reports" are appropriate or necessary.

All deviations between the as-built conditions and the approved specifications and drawings are documented in the completion report. The completion report also evaluates each of the deviations and concludes that the as-built conditions meet all of the applicable performance criteria. WDOH approval of the Reclamation Construction Completion Report will therefore serve as final approval of all aspects of the as-built reclamation system, including the items that deviated from the previously approved reclamation plan specifications and drawings.

Reference

Western Nuclear, Inc., [WNI] 1996. "Construction Component Quality Plan." May 16, 1996.

C.E. SPURLOCK, JR. & ASSOCIATES, Inc.

Consulting Engineers and Land Surveyors

C.E. Spurlock, Jr., P.E. & L.S.

Charles J. Spurlock, P.E. & L.S.

350 Garfield, Solar Suite
Lander, Wyoming 82520-3124
Phone (307) 332-5280
Fax (307) 332-4177

August 29, 1997

Lou Miller
Shepherd Miller, Inc.
3801 Automation Way, Suite 100
Fort Collins, CO 80525

Dear Lou:

In response to your question concerning my license credentials pertaining to the work performed by our company at the Western Nuclear Sherwood Tailings Reclamation site:

I'm currently licensed as a land surveyor in three states but not Washington; I'm also licensed as a professional engineer in two states, including Washington.

Please be assured that survey instruments are not the sole domain of licensed surveyors. Under Washington law, a land surveyor's license is required for the establishment of monuments, boundaries and subdivisions. A licensed land surveyor has specific knowledge about land divisions which is required for the public welfare. This was not work that we undertook at Sherwood. RCW 18.43.020 (9) says in part:

> *"The term "practice of land surveying"....shall mean assuming responsible charge of the surveying of land for the establishment of corners, lines, boundaries and monuments, the laying out and subdivision of land....."*

The construction verification surveying we have performed at Sherwood falls within the definition of the practice of engineering as shown in Washington State Law RCW 18.43.020 (5), which says in part:

> *"The term "practice of engineering".... shall mean.... Consultation, investigation, evaluation, design and supervision of construction for the purpose of assuring compliance with specifications and design...."*

I hereby certify that the construction surveying at Sherwood tailing reclamation project was done by me, or by people under my direct supervision to determine if construction was consistent with design. Furthermore, all our measurements were made using standard procedures and quality assurance methods. My credentials as a Professional Engineer licensed in the State of Washington are both appropriate and applicable for construction verification at Sherwood.

Best Regards,

Charles J. Spurlock
Washington PE No. 33017

EXPIRES 08-05-98

responsible for documenting tests and inspections using the standard forms provided in this CQP. He will report to the WNI QA/QC Engineering Manager.

7) **Design Engineer.** The design engineer will be responsible for determining how potential changes to the design specification, construction drawings or QA/QC process might impact the tailing reclamation plan. The design engineer will report to the WNI Construction Manager.

5.2 Personnel Training and Qualifications

Personnel performing work subject to the requirements of this C/CQP and any component specific requirements shall be qualified to perform assigned work and shall be aware of the nature, goals and procedures of this quality assurance program commensurate with their work responsibilities. All personnel shall possess qualifications deemed appropriate by the Project Team. A record of personnel qualifications and certifications will be filed with the WNI QA/QC Engineering Manager.

6.0 AUDITS AND REVIEWS

Field quality assurance audits will be conducted to verify compliance with technical specifications and QA/QC objectives during construction of the Tailing Reclamation Plan. The WNI QA/QC Engineering Manager will be responsible for periodically observing field and laboratory tests to ensure all tests are being performed in accordance with the technical specifications and the appropriate standard procedures and to verify test results. The results of these audits will be documented in a summary of audit results report that is a part of the QA/QC file.

6.1 Documentation

The construction QA/QC documentation will consist of four groups of documents, 1) Daily Summary Reports, 2) Field Measurement Logs, 3) Quality Compliance Reports, and 4) the Final As-Built Report. Example report sheets and measurement logs are included as Attachment C/CQP.A.

6.1.1 Daily Summary Reports

The Daily Summary Reports will address the details and progress of construction activities. The WNI Construction Manager or his designee will be responsible for completing these reports. These reports will include, at a minimum, the following:

1) project name, date,
2) weather conditions,
3) unit processes, and locations of construction underway during the day,
4) supervisory personnel working in each unit process, including subcontractors,
5) descriptions of areas or units of work being tested and/or observed and documented,
6) off-site materials received, including quality verification documentation,
7) nonconformances and corrective actions taken, and
8) signature of WNI CM indicating the report was reviewed.

The Daily Summary Reports will also summarize the following:

1) results of all visual inspections,

2) physical measurements taken,

3) field and laboratory test results, and

4) volumes of material placed and the number of tests performed on each material.

6.1.2 Field Measurement Logs

The Field Measurement Logs will be used to record the results of physical measurements taken in the field including the following:

- Total Final Reclamation Cover Thickness Measurement Log
- Subgrade Design Verification Log
- Diversion Channel Alignment Design Verification Log
- Riprap, Rock Mulch, and Filter Thickness Log

The WNI Construction Manager or his designee will be responsible for completing these logs and verifying that placed material is in compliance with the technical specifications. In many cases, a licensed surveyor will be responsible for measurements taken to verify specifications are being achieved. All surveying will be conducted using generally accepted surveying practice. The WNI QA/QC Engineering Manager will be responsible for reviewing these logs.

6.1.3 Quality Compliance Reports

The Quality Compliance Reports (QCRs) will be used to document the results of all field and laboratory tests to be performed during construction including the following:

- Visual Inspection Report - Soil Cover Placement
- Rock Durability Test
- Erosion Protection - Placement
- Diversion Channel Riprap Placement - Design Verification
- Diversion Channel Excavation - Design Verification
- Erosion Protection Production (Gradation Testing)

The QCRs will provide reference to the applicable section in the Technical Specifications and will include the required testing frequency. Any notes, charts, sketches, or photographs pertaining to the test will be attached to the QCR. When documenting deviations, nonconformances, and stop work order situations, the report shall provide sufficient details so that acceptability of the necessary corrective action and final resolution can be independently reviewed.

Each QCR will require the signatures of the person performing the test, WNI €M, and WNI QA/QC Engineering Manager.

6.1.4 Final As-Built Report

The Final As-Built Report will document all aspects of the tailing reclamation plan construction. The Final As-Built Report will summarize information in the Daily

Summary Reports, the Field Measurement Logs and the QCR's. The Final As-Built Report will also document all other elements of construction not included in the other QA/QC documentation such as the final configuration of the margins and embankment outslopes. The Final As-Built Report will be completed within 90 days of the completion of reclamation.

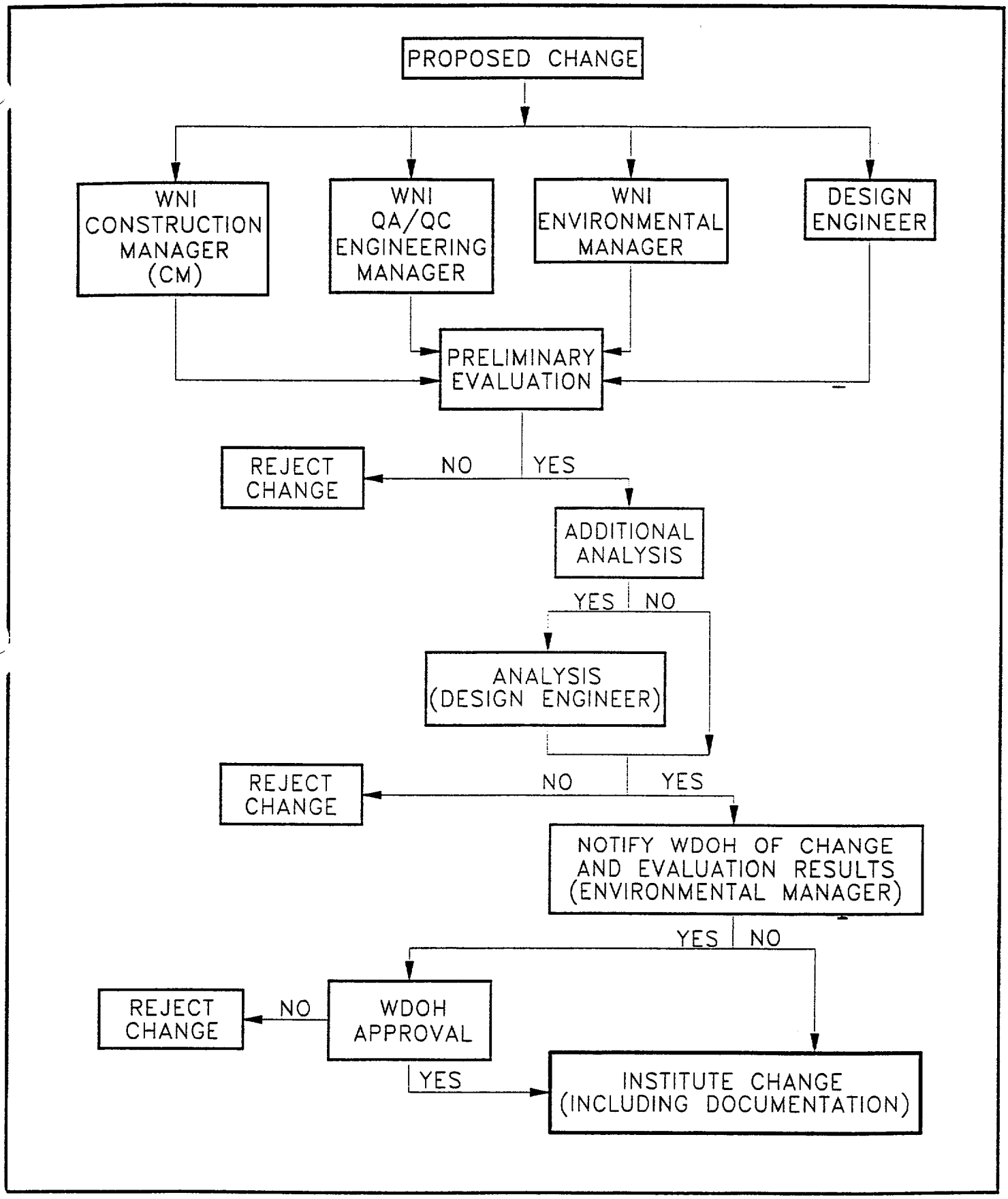
7.0 NONCONFORMANCES

Any item, data, or activity that fails to meet the applicable required minimum standards will be considered a nonconformance. The WNI CM will be responsible for the identification, documentation, evaluation, and disposition of nonconformances. The WNI CM will also be responsible for notifying the appropriate parties.

7.1 Documentation

All nonconformances will be documented in the applicable QCR and summarized in the Daily Summary Report. Nonconformances that require immediate corrective actions will also be documented in a Corrective Action Report. The Corrective Action Report will describe each nonconformance and provide a record of the actions taken to correct the nonconforming condition.

Conditions needing corrective actions shall be addressed promptly by the WNI Construction Manager. The WNI QA/QC Engineering Manager will be responsible for



SMI
SHEPHERD MILLER, INC.

FIGURE C/CQP.3
DECISION PROCESS-DESIGN SPECIFICATIONS, DRAWING AND/OR QA/QC CHANGE

Date:	MAY 1996
Project:	317/40
File:	FLOW-1

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

December 12, 1996

Stephanie J. Baker
Manager, Environmental Services
Western Nuclear, Inc.
200 Union Blvd., Suite 300
Lakewood, Colorado 80228

Dear Ms. Baker:

The Department of Health has completed its review of revisions #1 through #4 to the Western Nuclear, Inc., Sherwood Reclamation Project Plans and Specifications as submitted and contained in final form (replacement pages) in your submittal dated November 11, 1996. In addition, the Department of Ecology, Dam Safety Section has been provided copies of your submittals and has notified DOH that the plans as submitted are acceptable.

Based on the plan review and staff inspection during the active phase of site construction, DOH approves the revised plans and specifications. Final department approval of the completion of the Tailings Reclamation Plan for the Sherwood site will be based on the submission of an as-built report by April, 1997, and subsequent review and approval by the department. The Department of Ecology, Dam Safety Section will also review your as-built submittal.

Sincerely,

John R. Blacklaw

John R. Blacklaw, P.E.
Environmental Engineer

cc: Gary Robertson
Jerald LaVasser, P.E., WDOE
Bruce Barker, P.E., WDOE
Mary Verner, Spokane Tribe of Indians
Donna Bruce, BIA
Corn Abeyta, WNI
Moe Pasha, WNI
Lou Miller, P.E., SMI

John

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

September 3, 1996

Stephanie J. Baker
Manager, Environmental Services
Western Nuclear, Inc.
200 Union Blvd., Suite 300
Lakewood, Colorado 80228

Dear Ms. Baker:

Department staff have completed review of your June 12, 1996 submittal to the department, including JUNE 1996 REVISION # 1 TO APRIL 18, 1996 SHERWOOD PROJECT TECHNICAL SPECIFICATIONS. The revision is hereby approved with the following comments and exceptions:

- On page TS-43, SECTION 7.2.5 indicates that the margin slope is "no steeper than 3H:1V between stations 34 +00 and 90 +00." This is steeper than original calculations allowed for predicting required vegetal stress. Therefore, it is recommended that a re-evaluation of vegetal stress be made for the smaller watersheds and steeper slopes. Since the impact from this issue bears upon the Monitoring and Stabilization Plan rather than the specifications, it may be addressed therein.

- In TABLE 2A, "SUMMARY OF RIPRAP GRADATION REQUIREMENTS," the added column for "REQUIRED" riprap size is presented to allow a means of determining if oversizing is adequate for rock durability scores below 80, per protocol developed in the specifications, and from NRC-based guidance. Earl Fordham's checking of the design sizing has indicated that there is one area of the diversion channel where there is an inadequate factor of safety and that the "required column" required rock size data should be increased. Specifically, Earl found that on the inside bend between confluences E and F, the safety factor drops below 1.0. The rock size associated with this safety factor must be increased in the "required column" only. Please provide a corrected size.

- The area of the site immediately to the west of the impoundment has several watersheds that presently and potentially impact this margin of the site. Several discussions between department staff and Western Nuclear staff have addressed how to ensure that these watersheds will not impact the impoundment or the west groin below the impoundment dam. Department staff are confident in the approaches discussed. Please provide a grading plan that shows the area west of the impoundment toward the mill site.

- Comments of the Department of Ecology, Dam Safety Section shall be addressed in any corrections made.

If you have questions, please contact Earl Fordham at (509) 377-3869 or call me at (360) 753-3350.

Sincerely,

John R. Blacklaw

John R. Blacklaw, P.E.
Environmental Engineer

cc: Jerald LaVasser, WDOE
Bruce Barker, WDOE
Bruce Wynne
Mary Verner
Alfred Peone
Stanley Speaks

Jol B

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

August 5, 1997

Stephanie J. Baker
Manager, Environmental Services
Western Nuclear, Inc.
200 Union Blvd., Suite 300
Lakewood, Colorado 80228

Dear Ms. Baker,

The department has completed a preliminary review of the Sherwood Tailings Reclamation Construction Completion Report submitted on June 27, 1997, and has the following three questions/concerns that need to be clarified:

1. The site survey data and reports provided by C.E. Spurlock, Jr. (Licensed Land Surveyor in Wyoming) have not been signed and sealed. RCW 18.43 requires that they be signed and sealed. We cannot complete our review of the Construction Completion Report until this occurs. The department has previously noted the need for signed and sealed surveys during site inspections and meetings. Please provide a description of license credentials and quality assurance methods used in the production of survey data in support of the surveyor, C.E. Spurlock, Jr. and Associates, Inc. of Lander, Wyoming, since the surveyor is not licensed in the state of Washington.

2. There appears to be inconsistency between quality assurance reports and the completion report. The quality assurance reports indicate that there were very few items of noncompliance found during inspection audits and that they were adequately resolved by corrective actions, and confirmed during audit re-inspection. However, the completion report discussed several remaining items of noncompliance and justifies how, even though not reflecting the design requirements, they meet the state's regulatory purpose (regulation and guidance). Please clarify this apparent inconsistency and provide corrective actions to resolve any remaining discrepancies. Make sure quality assurance reports include all remaining items of noncompliance. WNI Quality Assurance Procedures should be used to resolve these deviations. An addendum report to the completion report is a suggested means of providing the authorizations requested.

3. A design modification relocating the centerline of the channel was made to accommodate an upslope placement of WNI's northernmost monitoring well. This defect was not identified by the surveyor or by quality assurance inspection or audit and not formally submitted to the department for review and approval as required by license condition. It is, however, identified in the completion report. This design modification must be formally submitted to the department for review and approval using existing WNI Quality Assurance procedures.

Although these issues require Quality Assurance corrective actions to resolve, they are not expected to necessitate physical corrections to the site construction, as performed. Once these identified issues are resolved, the department will finalize its review of the construction completion report.

If you have questions, please contact me at (360) 753-3350 or Gary Robertson at (360) 753-3459.

Sincerely,

Gary Robertson
for John R. Blacklaw, P.E.
Environmental Engineer

JRB:krf

cc: Bruce Wynne, Spokane Tribe
Mary Verner, Spokane Tribe
Sharon Yepa, BIA, WA
Stanley Speaks, BIA, OR
Shannon Work, Spokane Tribe
Lou Miller
Corn Abeyta
Jerald LaVassar

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

September 25, 1995

Stephanie J. Baker
Manager, Environmental Services
Western Nuclear, Inc.
200 Union Blvd., Suite 300
Lakewood, Colorado 80228

Dear Ms. Baker:

The department has received your letter proposing a design alternative for the east diversion channel. This proposal has been reviewed by department staff engineers and hydrogeologists, and Department of Ecology Dam Safety Section engineers. Based on this review, the department has determined that the proposed design is acceptable, in concept, as an alternative to the existing diversion channel design and represents a likely improvement in performance. The department will remain supportive of either alternative and will provide prompt review, upon receipt of the final Plans and Specifications.

As with all other aspects of our design review process, this approval is subject to the final determination of the SEPA process and to the radioactive materials license amendment and any reserved conditions (e.g., departmental review and approval of the final Plans and Specifications).

The department review of this proposed alternative resulted in comments that will require written response to provide either justification and/or clarification. (See Attachment A.) The department requests that Western Nuclear, Inc. arrange for a licensed engineering review to address these comments.

If you have questions, please call me at (360) 753-3459, or John Blacklaw at (360) 753-3350.

Sincerely,

for Gary Robertson, Head
Waste Management Section

JRB\GR:krf

Enclosure: Attachment A

cc: Warren Seyler, Spokane Tribe
Duane Bird Bear, BIA, WA
Stanley Speaks, BIA, OR
Bruce Barker, P.E., WDOE

ATTACHMENT A

Department Staff Comments for
Straightened Diversion Channel Alternative

1. Address and clarify erosion protection features for 3H:1V channel side slopes.

2. Provide a justification that moving the diversion channel outlet to the east will provide adequate distance and mass as an intervention from potential erosion of the impoundment or the impoundment outfall.

3. Justify eliminating erosion protection at the outfall and evaluate the downgradient drainage pathway and configuration of the outfall structural area and beyond (downstream). Consider placement of the outfall to coincide with the natural drainage in the area.

4. Address the differences between the original alignment and the proposed alternative for re-alignment of the diversion channel; in terms of impacts to the tailings impoundment surface configuration, to watershed areas and flood flow rates, and to adequacy of design (sufficient conservatism).

5. Clarify the impacts of the alternative diversion channel design on the margin area (area located between the diversion channel and the impoundment cover) and whether the configuration of this area will be fully documented and justified in the final Plans and Specifications. Consider the impacts on configuration (slope), erosion protection, and performance by using this area as a borrow source for impoundment cover fill material.

John

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

June 23, 1995

Stephanie J. Baker
Manager, Environmental Services
Western Nuclear, Inc.
200 Union Blvd., Suite 300
Lakewood, Colorado 80228

Dear Ms. Baker:

Following recent telephone conversations with our staff, regarding your Sherwood Tailings Reclamation Plan (TRP), the department has agreed to document all recent requests for clarification and for information by Plan reviewers. You expressed that you have been preparing responses for these issues based on verbal telephone conversation requests and would like to have our assurance of the specific nature of our requests. Written confirmation of these requests follows and supplements our letters of April 27 and May 3, 1995.

GROUNDWATER PROTECTION

1. Existing well construction of monitoring wells 2 and 2A. The water chemistry for monitoring wells 2 and 2A appears to be significantly different. It is important to understand why the difference in water chemistry exists. Has there been a break in the casing of monitoring well 2? Is water being contributed to the wells from different lithologies? One reasonable method to assess the condition of the wells is to utilize a video camera, which was the technique used on the old monitoring wells at WNI. Not only will videotaping the two wells provide us useful information for completing the assessment of the proposed closure plan, it will serve as a record of conditions at this time for comparison in the future.

   In addition to the question of the difference in the water chemistry between monitoring wells 2 and 2A, there is the question of whether the values for sulfate in monitoring well 2 are reflecting a significant upward trend. It appears that values for sulfate have doubled. What is the explanation for this trend?

2. Chemical characterization of the solution and solids in the Solution Holding Pond (particularly characterization of sulfate and chloride concentrations). The liquids and solids of the Solution Holding Pond need to be chemically characterized prior to

further review and acceptance of the proposed reclamation of this area. At a minimum, characterization of the sulfate and chloride concentrations in the liquids and solids are needed. What are the most appropriate methods in order to adequately characterize the facility for concentrations of these parameters? Are there other parameters which should also be chemically characterized for this facility in order to adequately assess the surface reclamation proposal? Please provide proposed sampling, monitoring, and laboratory methods for characterization of solution holding pond solids and liquids.

It is important to understand what the potential impacts to ground water are for these parameters from the Solution Holding Pond. What is the potential for significant contribution of sulfate, chloride and other significant parameters to ground water? How might this potential impact be significant for the selection of indicator parameters in the downgradient monitoring wells? Is the potential impact significant for the process of setting action levels in downgradient monitoring wells? Has the facility created an impact on the water chemistry of monitoring wells 2 or 2A?

DIVERSION CHANNEL DESIGN

3. Froude Number at nodes between natural drainages and engineered channel. Per Section 17 (Page 53) of the Corps. of Engineers (COE) Manual entitled "Hydraulic Design of Flood Control Channels," a concern has been identified regarding Froude Number. Specifically, what is the Froude Number at the point where the natural drainage channel joins the engineered channel (e.g., where the natural gully enters the engineered rip-rap areas of the natural drainage basins). What is the calculated Froude Number in the vicinity of the intercept nodes between the natural drainages and the engineered diversion channel? Does this Froude Number determination affect the diversion channel assurance of design performance?

4. Super-elevation of hydraulic surfaces at higher velocities around smaller radius bends. In reading the COE's Manual, super-elevation was discussed. Calculations showing the possible significance of this physical effect are not included in the Closure Plan. Please provide an analysis indicating the increase in elevation of the water surface that would result from this effect, for all smaller radius diversion channel bends (e.g., bend between nodes A-B, between C-D, 1st and 3rd bends between nodes E-F, and between nodes G-H on Figure C.1).

5. Diversion channel outlet apron. The Closure Plan provides insufficient detail information concerning the diversion channel outlet, other than that a vein of bedrock was discovered. Please provide the detail necessary to determine if the bedrock is wide enough, thick enough, and long enough to preclude the addition of rip-rap, for the erosional protection of this feature from potential head cutting at the outfall.

6. Angle of intercept from natural drainages to the engineered diversion channel. Is it practical to provide a design of these intercepts at shallower angles (e.g., 45 degrees, or less)?

7. "Bend Stress" influence on design safety factors and rip-rap sizing. Some "bend stress" safety factors are very marginally above 1.0 (e.g., bend between nodes C-D with 5" rip-rap; bend between E-F with 3" rip-rap; and bend between G-H with 3" rip-rap) and very sensitive to water velocity. Please submit detailed analysis showing sensitivity of "bend stress" against probable channel velocity. The department understands that the design velocity is determined by the HEC-2 computer code. Does rip-rap sizing have a sufficient factor of safety, or should the next whole rock size be chosen for the design?

8. Analysis of all bends are needed. On figure C.1 of the Closure Plan, the bend between nodes E-F, and between bend with radius 357' and bend with radius 385,' was not analyzed. Since failure at this bend could result in flow over the impoundment, this bend needs to be analyzed. Please submit the analysis in a form similar to that used for other bends. The bend with radius of 393,' between nodes E-F (per page D.C-12) is not shown on figure C-1. Is this the "missing" bend? The bend at node G is not addressed (e.g., no computer print-out). Please explain this omission, or provide the analysis.

POTENTIAL COST/EFFECTIVE ALTERNATIVE DESIGN CONCEPTS

9. A potentially compliant and reliable design alternative may be available by placement of the diversion channel at, or near the elevation of the tailings and cover and adjacent to the impoundment, while allowing for an erosion protection feature. This design concept has been identified by department staff as a potential design improvement. It is generally depicted by Diversion Channel Alternative CH-7 (figure 7, page R.2-30) from Appendix R of the Closure Plan. This concept has inherently fewer design elements, allowing that it might possibly be more cost/effective than the proposed diversion channel placement. Please provide an evaluation of regulatory compliance, relative performance (reliability, and/or risk for the design criteria used in preparation of the Closure Plan) and relative cost, compared with the proposed design. Only a conceptual design analysis is necessary, at this time.

10. An ancillary concept to this potential alternative is for diversion to an engineered percolation pond located at the present position of the Solution Holding Pond. This concept is generally depicted by Surface Alternative S-3 (figure 10, page R.2-41). Flow from the diversion would pass from the at grade diversion channel (see above diversion channel concept alternative) to a percolation pond to contain and percolate all diverted watershed flow. The potential advantage of this concept is to preclude the erosion protection feature requirements for the impoundment dam and diversion

channel outfalls. A potential impact to groundwater needs to be evaluated for this alternative. (Note: There is only likely diversion channel flow for 100 year floods and larger, up to the PMF.) More normal precipitation events (greater than 99% of total groundwater infiltration) will occur at the watershed surface or in the diversion channel, and will be unaffected by this concept choice. Please provide an evaluation of regulatory compliance, relative performance and relative cost, compared with the proposed design. Only a conceptual design analysis is necessary, at this time.

11. Both of these concepts may benefit from the future design option of a thick homogeneous impoundment cover, in that the construction cuts for the diversion channel, and/or percolation pond could be used for fill for the impoundment cover. Since the impoundment cover design remains tentative, this benefit has not been assessed. Please provide a discussion of logistics for borrow material sources and transportation for the potential thick, homogenous cover design alternative.

If you should have any questions, do not hesitate to contact me at (360) 753-3350, or the individual reviewers: Dorothy Stoffel at (509) 456-3166 for Ground Water Protection, and Earl Fordham at (509) 377-3869 for Diversion Channel Design. Dorothy will be generally unavailable during the month of July. We will find alternative means to address Ground Water Protection questions during that time.

We are attaching our current project assignments for the Western Nuclear, Inc., Sherwood Closure Plan project, for your information, as requested.

Sincerely,

John R Blacklaw, P.E.

John R. Blacklaw
Environmental Engineer

JRB:krf

Attachment: WNI project assignments

cc: Warren Seyler, Spokane Tribe
Duane Bird Bear, BIA, WA
Stanley Speaks, BIA, OR

WNI PROJECT ASSIGNMENTS June 21, 1995

T.R. Strong (Division Manager)
SEPA "responsible official"

Gary Robertson (Section Manager)

John Blacklaw, PE (Environmental Engineer)
Project Manager
Dam Safety/Structural Lead
Impoundment Cover Peer
Licensing/SEPA Lead
Surety/Cost Estimates Peer
Technical Evaluation Report Lead
WDOH Project QA Plan Lead
WDOH Project QC Lead

Leo Wainhouse (Health Physicist)
Soil Remediation Lead
Licensing/SEPA Peer

Dorothy Stoffel (Geo-Hydrologist)
Groundwater Protection Lead
Impoundment Cover, Percolation
Soil Remediation, Sampling
Technical Evaluation Report

Earl Fordham (Health Physicist, Engineer)
Diversion/Erosion Protection Lead
WNI Health and Safety Plan Review
Technical Evaluation Report

Sheila Pachernegg, PE (Civil Engineer Geo-Tech))
Diversion/Erosion Protection Peer
Dam Safety/Structural Peer
Impoundment Cover Lead
WNI QA Plan Review
Technical Evaluation Report

Doug Wells (Health Physicist)
Soil Remediation, Environmental QA

Jamil Ahmad (Health Physicist, Engineer)
Impoundment Cover, RADON
Surety/Cost Estimates Lead
Technical Evaluation Report

Maxine Dunkelman (Geo-Hydrologist)
Groundwater Protection Peer

John Riley (Geochemist)
Groundwater, Geochemistry

Craig Lawrence (Health Physicist)
Licensing, Air Emissions

John Erickson (Section Manager)
Environmental Monitoring, Protocol/Training
Environmental Sampling (air, soil, vegetation, groundwater)
Environmental Monitoring, WNI Annual Report Review

Lilia Lopez (Assistant Attorney General)
Licensing/SEPA, Legal Advisor

Bruce Barker, PE, WDOE (Environmental Engineer)
Licensing, Diversion/Erosion Protection

Jerald LaVassar, PE, WDOE (Environmental Engineer)
Licensing, Dam Safety/Structural

Dennis Sollenberger, NRC
Technical Evaluation Report (Oversight)

WDOH Radiation Laboratory
Soil Remediation Testing
Environmental Testing (air, soil, vegetation, groundwater)

File WD8e ~~WD.2~~ New 1994-96
WNI closure correspondence
Phase 2 - 1994

STATE OF WASHINGTON

DEPARTMENT OF HEALTH

DIVISION OF RADIATION PROTECTION

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October 13, 1994

Stephanie J. Baker
Manager, Environmental Services
Western Nuclear, Inc.
200 Union Blvd., Suite 300
Lakewood, Colorado 80228

Dear Ms. Baker:

The Department of Health has been meeting frequently with Western Nuclear, Inc. (WNI) and your contractor, Shepherd Miller, to review different portions of the preliminary draft Sherwood Project Tailings Reclamation Plan. We have consistently made a variety of comments in response to each portion of the plan, and a few overall comments. These comments were made both verbally at WNI presentations, and in writing, following our review of the material submitted at the presentations. The comments below describe our regulatory position for review of the WNI cover design, as the review relates to bio-intrusion and cover stability.

The department's role as regulator is to review the closure plan and cover design proposed against the criteria in WAC 246-252, especially criteria 4 and 6. We interpret these criteria to also include assessment of the performance of the closure cover as acted upon by bio-intrusion by plants and animals.

It is the role of Western Nuclear to present a feasible closure plan that provides reasonable assurance that the regulatory criteria can be met. It is not the department's role to be prescriptive as to details of the closure plan and cover design. However, we request that the following concepts be included in your plan and factored into your performance evaluation.

Bio-intrusion must be considered in the long-term performance evaluation of the final cover. The department believes there are several methods by which to include bio-intrusion into your performance evaluation. The method is up to you, but we would like you to consider the following factors, or provide a reasonable explanation why a factor is not included, or why you used an alternative method.

Because the cover must be designed to last one thousand years, the site will revert during that time period back to the plant and animal species whose niches match the environment of the site. The climax successional biota community should therefore be determined, and the time period for its establishment should be estimated. The environment should be characterized by such factors as soil type, density, moisture, and drainage, solar and wind exposure, and nutrient level. Both native and non-native species in the vicinity should be evaluated. Our initial expectation without comprehensive study of the environmental conditions is that pine trees will exploit the site and become the major component of the climax community.

The plant species that are expected to be present as part of the climax community should be analyzed for bio-intrusion. By looking at current similar population groups in similar environments, you may estimate rooting depth and density, how plants will affect infiltration, integrity of layers within the cover, erosional stability, and radon attenuation of your proposed cover. We recommend that you take credit for water extraction by the plants you expect in the climax community.

Another area of bio-intrusion to be evaluated is an estimate of the amount of burrowing (and similar activity) by animals that are expected to be associated with the environmental niche that will develop on the site, and how this will affect infiltration, cover layers, and erosional stability.

Other successional biota communities which precede the climax community should be considered in the analyses, if their extent is for a significant period during the thousand-year design life, or if their characteristics would significantly affect the integrity of the cover.

The stability of the closure cover and the underlying tailings must be considered in the design of the cover and analyses of the performance of the cover selected. In addition to bio-intrusion, factors to be evaluated include differential settlement, consistency of the tailings (i.e., the potential need to dewater), stability and longevity of the dam, freeze-thaw effects, and the seismic stability of the region.

Should the stability of the site have the potential to affect the continuity of the layering within the cover, it may be better to design a simple cover with a thick homogenous layer that is self-healing. Self-healing properties may come from texture and cohesion of the layer, as well as thickness. Whatever cover design is chosen, we will need to review an analysis of how that cover will perform after settlement, and an estimate of the amount and likelihood of settlement.

If you have any questions, please feel free to contact me at (206) 753-3459.

Sincerely,

Gary Robertson

Gary Robertson, Head
Waste Management Section

GR/MMD:krf

cc: Paul Lohaus, NRC

file
W.D.8.g

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
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February 14, 1996

Lou Miller
Shepherd/Miller, Inc.
1600 Specht Point Drive
Suite F
Fort Collins, Colorado 80525

Dear Mr. Miller:

This is in response to our recent telephone conversation in which we discussed the necessity of a meeting among the Spokane Tribe of Indians, the Bureau of Indian Affairs, the U.S. Department of Energy, the U.S. Nuclear Regulatory Commission, Western Nuclear, Inc. and its consultant, and the Department of Health. The purpose of the meeting is to outline license termination criteria, federal concurrence requirements, arrangements between WNI and NRC for assuring long-term surveillance, DOE involvement, and release of surety.

The department has recently given final approval of the WNI closure plan, and WNI has scheduled construction of the final cap and the diversion channel during the 1996 construction season, plus site regrading and revegetation. Additionally, the department expects to give final approval of all soil cleanup activities. The meeting has been scheduled for 9:00 a.m. on March 21, 1996, at the Spokane Airport Ramada Inn (across from the airport, within easy walking distance). We expect the meeting to be done by 3:00 p.m. The Ramada Inn can be reached by calling 1-800-272-6232, or call the local number (509/838-5211).

If you have any questions, please feel free to contact me at (360) 753-3459.

Sincerely,

Gary Robertson

Gary Robertson, Head
Waste Management Section

GR:krf