Washington State Department of Health
Environmental Health Programs
Division of Radiation Protection
Waste Management Section

COMPLETION REVIEW REPORT
REVISION 2

Date: November 2000

License Number: WN-I0133-1

Licensee: Western Nuclear, Inc.

Facility: Sherwood Uranium Mill Project

Manager: Gary Robertson, Head, Waste Management Section

Technical Reviewers: Jamil Ahmad, M.S. (*Health Physicist, Nuclear Engineer),* Bruce Barker, M.S., P.E. (*Hydrologic Engineer),* John Blacklaw, M.E., P.E. (Project Manager, *Environmental Engineer),* Nancy Darling, B.S. (*Hydrogeologist),* Earl Fordham, B.S., C.H.P., P.E. (*Certified Health Physicist, Environmental Engineer),* Jerald LaVassar, M.S., P.E. (*Geotechnical Engineer),* Steven Link, Ph.D. (*Botanist),* Sheila Pachernegg, M.S., P.E. (*Geologic Engineer),* John Riley, Ph.D. (*Geochemist),* Gary Robertson, B.S. (*Health Physics, Administration*), Dorothy Stoffel, M.S. (*Hydrogeologist),* and Martin D. Walther, M.S., P.E. (*Hydrologic Engineer)*

PURPOSE

This report's purpose is to justify Washington State Department of Health's (WDOH's) license termination action at the Western Nuclear, Inc. (WNI) Sherwood Uranium Mill Project site near Wellpinit, Washington for U.S. Nuclear Regulatory Commission (NRC) concurrence.

The state's oversight of the licensee and the state's regulatory program adequacy are evaluated by the NRC. The NRC Procedure entitled *Termination of Uranium Mill Licenses in Agreement States, Procedure: SA-900* was used to prepare this report. This completion report contains information organized as recommended in Step 6 of Appendix B of Procedure SA-900 (NRC 1999).

1. **A brief description of licensee's activities associated with decommissioning, tailings remediation and/or groundwater cleanup.**

INTRODUCTION

The Western Nuclear, Inc.'s (WNI) Sherwood Uranium Mill Project site is the first large conventional uranium mill and tailings site decommissioned and reclaimed under Washington State Department of Health (WDOH) Agreement State authority, derived from Title II of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA). UMTRCA requires that prior to termination of the license, the regulatory agency shall make a determination that the licensee has complied with all applicable standards and requirements. Under the Agreement States program, the state of Washington is responsible for approval of the remediation plans for WNI and for site inspections to ensure that the actual remedial actions have been completed pursuant to the approved plans (NRC 1999).

The Sherwood Project site is located on the reservation of the Spokane Tribe of Indians. WNI is the Sherwood Uranium Mill Project site operator, and has an operating lease with the Spokane Tribe of Indians.

This report documents WDOH's basis for its conclusion that decommissioning and reclamation have been acceptably completed at the Sherwood Uranium Mill Project site. With concurrence from the NRC, the state's specific license with WNI may be terminated.

BACKGROUND

WNI completed construction of the mill in 1978, and it was operated until 1984. Nominal milling capacity was 2,100 tons of ore per day, with an average design ore grade of 0.088 percent U_3O_8. The company received ore and processed it from an open pit mine located approximately one-half mile west of the Sherwood mill. The mill ceased operations prior to reaching the major portion of the ore-body, and the design ore grade was never realized. Acid-leached tailings were neutralized with lime prior to placement in the synthetically lined, Sherwood disposal cell. Approximately 2.9 million tons of tailings were placed in the impoundment from milling operations. The estimated radium-226 activity in the impoundment is 470 curies (WDOH 1998).

Mill decommissioning activities began in 1992 and were completed in 1995. Approximately 350,000 cubic yards (yd^3) of contaminated mill site soils, building equipment, and debris were excavated from the Sherwood processing site and hauled approximately one-half mile for placement in the synthetically lined area of the tailings impoundment (WDOH 1998).

The millsite surface soils were sampled and analyzed by laboratory methods or gamma detection. Some areas were monitored for gamma radiation using portable gamma counters. Areas found to exceed soil contamination standards were excavated. Contaminated soils were disposed in the lined tailings impoundment (WDOH 1998).

Once filled, the impoundment was covered with more than 13.6 feet of site borrow soils, and re-vegetated. A diversion channel was constructed around three upgradient sides of the impoundment. The impoundment dam, constructed during operations, was re-graded to provide a 20 percent (1v:5h), rock-covered outslope. A rock-armored swale outlet for the impoundment cover watershed was installed. All impoundment and margin areas have been covered with either rock armor (riprap) or re-vegetated to provide structural stability (WDOH 1998). See figure on page 22.

A Monitoring and Stabilization Plan, in effect during and after reclamation construction in 1996, has been evaluating site performance. Recent WDOH staff inspections and reviews of monitoring data and analytical justifications provided by WNI indicate that the site has reached a stable condition, that all license conditions and regulatory requirements have been met, and that the license may be terminated (WDOH 2000).

When all regulatory requirements are completed, the Sherwood Uranium Mill Project site will transfer to U.S. Department of Energy (DOE) responsibility. The NRC will provide regulatory oversight under a general license. The site reclamation surety fund, held by the U.S. Bureau of Indian Affairs (BIA), will be terminated and the long-term surveillance and control surety fund, held by WDOH, will be transferred to the federal government. The land will remain under the control and benefit of the Spokane Tribe of Indians (WDOH 2000).

REVIEW OF COMPATIBILITY AND ADEQUACY OF THE STATE'S AGREEMENT STATE PROGRAM

The NRC Agreement State program mandates NRC oversight of the state's program. One means of oversight is the NRC's periodic audit of state programs, where technical and administrative staff from the NRC visit the state, talk with staff, review documents, and assure adequacy of the state's program. The NRC's Integrated Materials Performance Evaluation Program (IMPEP) provides confidence that the state's reviews, licensing actions, and inspections associated with uranium mill programs have been conducted appropriately. In August 1999, the NRC performed an IMPEP review of WDOH and found the uranium mill program to be "adequate and compatible" in all aspects (WDOH 1999).

REVIEW OF LICENSEE REGULATORY COMPLIANCE FOR LICENSE TERMINATION

The applicable regulatory requirement for uranium mill reclamation is Chapter 246-252 WAC (Washington Administrative Code), entitled *Radiation Protection – Uranium and/or Thorium Milling*. This state regulation is consistent with and compatible with federal regulations, as required by the state's Agreement State status with the NRC. Consistency and compatibility with federal regulatory requirements have been assured by NRC's audits of the state's Agreement State status.

The state's review of compliance with regulatory and license requirements is documented by discussion of each major topic addressed in the regulations. The primary references are the state's Technical Evaluation Report (TER) (WDOH 1998) and TER Supplement (WDOH 2000). These reports document the state's technical reviews. These TERs further reference the department's detailed evaluations and WNI's documents submitted for state review during the site's reclamation period.

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

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

GEOTECHNICAL STABILITY

WNI has performed all reclamation activities as expeditiously as practical and prudent and has not requested to extend the time for performance of any required milestones. All aspects of reclamation were planned in advance, prepared by experienced professionals, reviewed by the department, performed under a quality assurance program, and evaluated in as-built completion reports. All aspects of reclamation have been found technically feasible during department reviews (WDOH 1998, pg. 11-17).

The Sherwood Uranium Mill Project is located in rural Stevens County, Washington, on the Spokane Tribe of Indians reservation. The millsite is located away from large population centers and isolated from natural transportation routes or roadways. The impoundment is not located near a capable fault, as determined by geophysical studies, technical document review, seismic analysis, and field investigations (WDOH 1998, Pg. 9). The Sherwood Project site impoundment received only ore material from their own mine site.

The reclamation design used at the Sherwood Project site is based on conformity to the surrounding natural environment, and is built so that no ongoing active maintenance is expected.

Slope Stability

Dike structures constructed at the Sherwood site include the impoundment dam embankment and the margin areas (berm) located between the impoundment and the upgradient surface water diversion channel. The embankment dam was initially constructed at the beginning of operations. It had 33% (1v:3h) side-slopes and was designed, approved and constructed under the state's Dam Safety regulatory program (WDOH 1998, pg. 11). During reclamation construction in 1996, the dam was shortened in height so that it was consistent with the impoundment cover elevation, and graded to a more gentle 20% (1v:5h) front-slope. A rock armor (riprap) was placed in the groins on each side of the dam and on the sloped surface of the reconstructed dam embankment. The dam embankment and the margin areas were evaluated for slope stability and found to be acceptable, based on WNI's analysis, as reviewed by the department (WDOH 1998, pg. 13).

The dam embankment reconstruction design was prepared by WNI, including an evaluation for earthquake and slope stability. Licensed engineers from both the Dam Safety regulatory program and the Department of Health reviewed the design, independently verified the design calculations, and approved construction plans and specifications.

Capable Faults

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

Department of Health review of regional geologic literature has found no evidence of local faulting in the Pleistocene age glacio-fluvial deposits, or in the Miocene age Wanapum Basalt Member of the Columbia River Basalt Group, at least 14.5 million years before present (Yates et al 1966; Becraft and Weis 1963; Waggoner 1990). The USGS Open-File Report 91-441-0, *Known or Suspected Faults with Quaternary Displacement in the Pacific Northwest*, was also reviewed (Rogers, et al 1991). Staff at the Washington State Geological Survey were also consulted during WDOH's assessment of WNI's closure plan for information related to faults in the area. WDOH's review of Quaternary faults has concluded that the nearest capable fault is in the Lake Chelan area of the Cascade Mountains, approximately 100 miles to the west/northwest.

Detailed geologic mapping at the WNI site performed by Shepherd Miller, Inc. found no evidence of faulting in the Pleistocene glacio-fluvial deposits or Miocene age Columbia River basalts placed 14.5 Million Years Before Present (Appendix P, 1994 Closure Plan; and Ground Water Protection Plan Technical Integration Report, 1995). Geologic field evaluations at the WNI site by WDOH personnel also found no evidence of faults in the glacio-fluvial deposits, Miocene Columbia River basalts, or Tertiary aged clays found near the tailings impoundment. The layers in the unconsolidated sediments may generally be described as flat lying over structures that have been observed in the older granitic rocks of Cretaceous age. Therefore, the literature review and field mapping indicate that the fracturing and faulting in the Cretaceous rocks are a result of pre-Miocene deformation occurring at least 14.5 Million Years Before Present.

Two geophysical seismic surveys were conducted for the subsurface around the tailings impoundment by a WNI contractor (Cooksley 1992 and Cooksley 1995). WDOH staff independently reviewed the

information provided in the Cooksley reports and determined that there is no evidence presented in these reports indicating the presence of a capable fault at depth.

Historic seismic data have been reviewed by Department of Health and Ecology's Dam safety program. Some of the historic seismic data reviewed are presented in reports prepared for Western Nuclear (Volpe 1994 and Volpe 1995), the 1976 Final Environmental Impact Statement for the Sherwood facility (Bureau of Indian Affairs), and the initial engineering report (D'Appolonia 1977). There are no historic seismic data that suggest large-magnitude earthquakes near the Western Nuclear site. Recent earthquake analyses performed by LaVassar (WDOE 2000) indicate that there have been five low-magnitude events within 23 km of the Western Nuclear site. However, LaVassar's probabilistic seismic assessment has determined that these low-magnitude seismic events are not significant with respect to stability of the site.

In summary: (1) faults that have been identified and mapped in and near the site to a distance of 100 miles have not moved once in the last 35,000 years, or twice or more in the last 500,000 years, do not have macroseismicity associated with them, nor are they associated with capable faults such as the Lake Chelan fault; and (2) no historic earthquakes have originated near the site that by magnitude, alignment, or magnitude-distance relationship to the site indicate a buried capable fault source, or any other earthquake source, that should be considered explicitly in the seismic design basis assessment for the site. WDOH evaluated low-magnitude seismic events that appear approximately 28-78 km northeast of the site by reviewing geologic maps for the area and personal communication with Washington State's seismic experts at the Washington State Geological Survey. Based upon WDOH review conducted in the fall of 2000, WDOH concludes that these low-magnitude seismic events are not associated with earthquakes along the trace of a capable fault, and the data indicate that these events are the result of mine blasts.

Seismic Evaluation (WDOE 2000)

A Probabilistic Seismic Hazard Analysis (PSHA) of the likelihood of both cracking of the cap and liquefied tailings reaching the ground surface has been performed. That analysis reflects the combined probability of experiencing ground motions sufficient to trigger liquefaction and the probability that the liquefied zone would have a surface manifestation in the form of cracking or boils of tailings material. The PSHA predicts an annual probability of experiencing liquefaction within some zone of the tailings of 0.000363 (once per every 2,752 years).

The PSHA was performed, as there are no known capable faults in the general vicinity of the project. The PSHA considered as loads the suite of earthquakes between Magnitude 5 and the Maximum Credible Earthquake for each seismotectonic source zone as is accepted practice in the field. The resulting cyclic shear stresses (load) induced in the soil column by the suite of earthquakes were assessed with SHAKE91. The cyclic shear resistance (capacity) was estimated from an empirical relationship based on the SPT N-value data from site borings. The Seed-Idriss criteria were employed to predict the occurrence of liquefaction. One boring (B-7) was selected as representative of the

worst-case conditions in the tailings material. The PSHA considered uncertainty in the maximum magnitude of earthquakes, attenuation relationships, and the magnitude-frequency of earthquakes.

The occurrence of a surface manifestation of liquefaction given liquefaction at depth is a function of the thickness of the non-liquefied cap. For a cap thickness greater than 15 feet, case histories (Ishihara 1985) suggest that there will not be a surface manifestation for ground surface accelerations up to 25% of gravity (0.25g). Accordingly, a second analysis was performed to determine whether there would be a surface manifestation of liquefaction of the process slimes at depth. This analysis involved generating a ground surface acceleration of approximately 25% of gravity for the range of earthquakes between magnitude 5 and the maximum credible magnitude. The thickness of the non-liquefied cap was calculated. In all cases, the analysis predicted that the non-liquefied thickness of the cap would exceed 16 feet. Thus, an empirical correlation developed from case histories suggests there would not be a surface manifestation from liquefied zones at depth. The calculated annual probability of experiencing a peak ground acceleration of 0.25g at the site, considering all earthquake source zones, was 0.0001058 (once per every 9,450 years). Thus, the occurrence of a surface manifestation of liquefaction is more remote than 1 in 10,000, the 1,000-year regulation-based longevity requirement.

The probability of cracks occurring in the cap is essentially the same as for the occurrence of tailings material reaching the ground surface. Focusing on surface cracking as a separate event was judged unnecessary for the specific conditions of the cap at Sherwood for the following reasons. The 13.6-foot minimum thickness (as-built) cap is composed of a non-cohesive, slightly gravelly, silty sand. While cracking could result from earthquakes, cracks that might form would collapse, as the soil lacks cohesion to maintain a free-standing void.

The reclamation cap therefore affords a level of structural stability, longevity, and reliability, in accord with the intent of the governing statute.

Although the probability of a surface manifestation is acceptably remote, liquefaction can still occur. As a responsible steward of the facility, it would be appropriate to have a contingency plan to inspect the site, should a large earthquake occur in the immediate vicinity of the facility.

The following table provides guidance as to the combination of earthquake magnitude and epicentral distance that should trigger a site inspection. The relatively large epicentral distances cited for small events reflect the uncertainty in locating earthquakes in this region where there are few recording stations.

Table 1: Earthquake Magnitude/Epicentral Distance Requiring Inspection

Earthquake Magnitude Interval - M_w	Minimum Epicentral Distance - kms
5 to 5.5	23
5.5 to 6.0	60
6.0 to 6.3	75
6.3 to 6.75	100

6.75 to 7.4	200

Liquefaction Potential

Earthquake potential to cause liquefaction was evaluated by WNI and reviewed by professional engineers from the Dam Safety regulatory program. Both the dam embankment and the tailings slimes and sands were evaluated. The dam embankment was found to be incapable of liquefaction due to a low probability for the occurrence of soil moisture saturation. However, since the tailings slimes and sands are expected to remain saturated over the long term, they could become "liquefied" during a significant seismic event, which could produce rafting of the surface if a conventional thin clay barrier surface cover had been installed. As indicated in the Seismic Evaluation section, an annual probability of experiencing liquefaction within some zone of the tailings is 0.000363 (once per every 2,752 years), based on conservative assumptions.

The cover design approved and constructed for the Sherwood site is a thick (13.6 feet minimum) cover of non-cohesive local borrow soils, which ameliorates the liquefaction concern. The potential for surface expression of slimes or sand boils is limited because of the thick cover design, which is expected to continue performing as designed because of its self-healing nature (WDOH 1998, pg. 15). Also, tailings slimes and sand layers are lenticular, not interconnected, and do not have broad lateral extent over the impoundment. The potential for liquefaction was modeled in the Seismic Evaluation using very conservative assumptions about thickness and lateral extent of the slimes and sand layers. Therefore, in the unlikely event of liquefaction of some areas of tailings at depth, there is an even more remote chance of performance defects over large areas of the impoundment. As indicated on page 7 under Seismic Evaluation, if such a large seismic event were to occur within a minimum epicentral distance (probability of recurrence of less than 1 chance in 10,000 years), then an inspection (and corrective action, if needed) of the site by the custodial agency is recommended.

Settlement Potential

The department reviewed settlement potential from loading by subgrade and cover materials (more than 13.6 feet), under saturated and unsaturated conditions and due to liquefaction-induced settlement (as a result of earthquakes). Although settlement amounts could be from 1 to 9 feet, there were no detrimental site performance defects identified due to settlement expected at the Sherwood site (WDOH 1998, pg. 13). As indicated in the Seismic Evaluation section, the likelihood of defects from excessive settlement is remote. Tailings material was characterized for physical properties by WNI. Settlement potential was then determined. WNI found that settlement of tailings could produce a small seasonal pond. WNI and WDOH independently evaluated site performance issues that might then occur, and determined that site reclamation performance was not affected. It was further found that a seasonal pond would add to the environmental diversity and strengthen the long-term ecology of the site (WDOH 1998, pg.14).

De-watering of Tailings

An evaluation of the geochemical properties of the tailings by department staff determined that dewatering of tailings pore fluid was not practical or technically necessary (WDOH 1998, pg. 26-31).

In conclusion, the department's review of geotechnical stability has found the Sherwood Project site to be in conformance with regulatory requirements of criteria 1, 4, 5, 6A, and 12.

SURFACE WATER HYDROLOGY AND EROSION PROTECTION

The constructed reclamation site is robust by design, and includes a thick, vegetated cover design of site soils surrounded by a large surface water diversion channel over 8,000 feet long. The tailings impoundment is situated in a relatively small watershed area (about 800 acres), which limits surface water flow potential. The small catchment area inside the diversion channel is less than 200 acres. The reclamation site is expected to return to a wildlife and forestry land use, similar to the surrounding area, which shows few erosional impacts.

Embankment dam (20%), margins (20 to 33%), cover (0.25%), and diversion channel (0.25 to 0.75%) slopes are relatively flat. Erosion protection studies have been performed on these topographic features. Some areas required stabilization by rock (riprap), some by vegetation, and some are naturally stable.

Flood Flow

The primary criteria used to evaluate erosion protection are a determination of long-term erosional stability using Criterion 6 (WDOH 1997), which requires site stability for 1,000 years. NRC guidance was used to develop a conservative design basis. A probable maximum precipitation (PMP) event was selected and found to be a 6-hour storm of 11.5 inches, peaking at mid-storm at 18 inches per hour (WDOH 1998, pg. 19). Probable Maximum Flood (PMF) surface water flow rates were determined, based on the worst-case precipitation event, surface flow characteristics (elevations and contours, surface roughness and vegetation) at the site, and antecedent soil moisture (near-saturated or frozen ground), using the HEC-1 computer program. The Modified Rational Method was used to verify surface water flow rates on the cover.

The department reviewed and independently verified WNI's flood flow estimates. The NRC/Horton method was used to determine that vegetation is not necessary for erosion protection (WDOH 1998, pg. 20). The margin areas were found to require 39% vegetal coverage for long-term erosional stability, based on a PMF event. Short-term erosion protection requirements were also determined and require 35% vegetal cover, based on a 10,000-year storm (WDOH 2000, pg. 8). The Monitoring and Stabilization Plan (MSP) was used to verify vegetation productivity performance after reclamation construction was completed. The 35% short-term requirement was met in 1999, and the trend line for performance since reclamation construction in 1996 predicts performance in the 50% range by the summer of 2000 (WDOH 2000, pg. 7-8).

PMF flow rates were determined for the diversion channel to be 5,325 cfs (cubic feet per second), and for the swale outlet from the impoundment surface area to be 720 cfs. These worst-case flood flow rates were used to determine channel cross-sections and to size the riprap (WDOH 1998, pg. 20). Diversion channel cross-sections were designed for both the minimum flow resistance, large velocity case (expected just after reclamation is completed), and for the high resistance, low velocity case (expected after the channels have re-vegetated). Rock protection is required for the first case with a smaller channel cross-section. Long-term performance requires limited rock protection but a larger cross-section channel. Using these two cases, the diversion channel was designed for a large cross-section, but with rock placed only in the lower portion consistent with the smaller cross-section (WDOH 1998, pg.21). Rock and filter sizing was performed using the Safety Factors Method or the Stephenson Method, as recommended by NRC guidance. The department reviewed and independently verified WNI's analyses (WDOH 1998, pg.54). Rock sizes that were placed met, and generally exceeded the minimum rock sizing required by the analysis-based design. WNI chose to oversize the rock to limit the number of rock sizes produced and placed (WDOH 1998, pg. 55).

Rock Durability and Gradation

Rock durability and gradation were evaluated during construction to meet approved construction design plans and specifications. An initial petrographic examination per ASTM C 295 was made to qualify the rock source. The department reviewed the report of the independent evaluation and accepted the rock source (WDOH 1998, pg. 55; and WDOH 2000, pg.6). Rock samples were then tested every 10,000 cubic yards of production for Bulk Specific Gravity and Absorption per ASTM C 127, Sodium Sulfate Soundness per ASTM C 88, Los Angeles Abrasion per ASTM C 535, and Schmidt Hammer Rebound per ASTM C 805 (WDOH 1998, pg. 55).

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

Rock durability scores for quartz monzonite samples, using the NRC-recommended scoring method, averaged 80.1, with the lowest at 78 and the highest at 81. The department reviewed rock durability test results from the independent laboratory. Rock source gradation was periodically sampled and evaluated by an independent contractor during construction. Department inspectors reviewed inspection records during construction and found the evaluations, methods, and records to be adequate. WNI performed a quality assurance construction performance audit program of WNI operations, contractor construction activities, and independent contractor inspections. The WNI auditor reported to corporate management and exercised independent authority, as observed by department inspectors (WDOH 1998, pg.48-50).

The department reviewed the data from the licensee's construction completion report (SMI 1997, Vol. 1, Table 1). The basalt rock source qualified and produced a small fraction of the produced rock (about 7,626 cubic yards). Rock durability test results for basalt scored 90 on two tests. The quartz

monzonite source qualified and produced most of the rock used during construction (about 82,056 cubic yards). Rock durability test scores for the quartz monzonite averaged 80.1, with a standard deviation of 0.6. The department believes that the quartz monzonite source produced uniform rock durability, based on department inspection, the consistency of the rock durability scores, and the small statistical standard deviation for the rock durability monitoring data. See the table below for rock durability monitoring data.

Table 2: Rock Durability Score Data

Test Number	Bulk Specific Gravity	Adsorption (%)	Sodium Sulfate Soundness (%)	Schmidt Impact Hammer	Calculated Rock Durability Rating (WNI)	Minimum Rock Durability Rating (NRC)
1	2.62	0.15	2.6	57.1	80	80
2 *	2/86	1.2	1.5	66.6	90	80
3*	2.82	1.5	1.7	67.2	90	80
4	2.61	0.7	2.5	54.6	79	80
5	2.63	0.4	1.9	56.2	80	80
6	2.63	0.4	2.2	56.7	80	80
7	2.63	0.3	1.7	57.6	80	80
8	2.63	0.3	1.7	57.5	81	80
9	2.64	0.4	1.4	62.2	81	80
10	2.64	0.4	1.5	61.9	80	80
11	2.62	0.3	2.2	57.0	80	80
12	2.63	0.4	2.1	58.1	80	80
Average	2.63	0.38	1.98	57.89	80.1	
Standard Deviation	0.01	0.12	0.37	2.52	0.6	

** Basalt Samples. Average and standard deviation results are for quartz monzonite samples only.*

The U.S. Nuclear Regulatory Commission (NRC) guidance recommends a minimum rock durability score of 80, without oversizing. WNI oversized the rock placed by a considerable amount, on average. Oversizing of rock was by design. Rock production used a small number of screens. The licensee used only 3", 6" and 15" D_{50} (median stone diameter) rock sizes. Placement sizes were greater, compared with design rock sizes developed to meet erosion protection criteria. The erosion protection criteria were also determined based on conservative criteria.

In addition to conservative methods for rock sizing and durability, the structural integrity of the site is not dependent only on rock for erosion protection. The Sherwood millsite has site-specific attributes (soil,

bedrock, weather, etc.) that suggest a durable long-term forest and wildlife environment. Therefore, the rock protection placed during construction becomes less important for structural stability (erosion protection) as vegetation becomes established. The rock performance timeframe is about a thousand years (based on NRC guidance and methods), while the forest succession timeframe is about a hundred years. This is a convenient overlap of performance features.

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

Sedimentation

Sedimentation in the diversion channel was evaluated using the HEC-6 and SEDCAD+ computer programs. The analyses were performed on the PMF case, as well as several lesser flood flow cases, to determine if sedimentation would accumulate in the diversion channel over time and reduce diversion channel flow capacity. It was determined that, except for the first few years after construction, there is no likely flood flow in the channel for flood recurrence intervals less than 100 years, due to expected infiltration. For larger, low-probability flood events, sediment would likely flush out with the expected flood flow. Even without flushing, sediment accumulation predicted by the analysis was approximately 1.5 feet at the bottom of the diversion channel. The channel was designed so that a minimum of 1 foot of freeboard would be present, and included a very conservative design PMF basis, sedimentation in the channel, and re-vegetation of the channel (WDOH 1998, pg.23). In addition, the channel was constructed somewhat oversized to meet the design cross-section minimum requirements, and therefore has a capacity excess from the design minimum required.

The impoundment swale outfall requires rock (riprap) erosion protection, since it is designed to convey concentrated flood flow from the impoundment surface and to discharge it away from the reclamation site. This area was evaluated with the same analytical tools as the diversion channel, and found to be adequate. The design was prepared by WNI, and evaluated and approved by the Dam Safety regulatory program and WDOH. Worst-case assumptions were used to evaluate the design, based on NRC guidance. Vegetation productivity on the impoundment cover has reached a self-sustaining performance level and will continue to improve over time, limiting the probability of occurrence of maximum flood flow (WDOH 1998, pg. 24; and WDOH 2000, pg. 6-8). The swale outfall is located over a large area of competent quartz monzonite of sufficient structural capacity, extent, and elevation, that limits potential erosion of cover soils from the impoundment. The swale outfall therefore protects the cover from erosion and promotes sedimentation on the shallow-sloping impoundment surface (WDOH 2000, pg. 6).

RADON EMANATION

WNI designed the impoundment cover from site soils and determined that an average cover design thickness of 12.6 feet was required in order to meet the regulatory limit of 20 pCi/m^2s found in Criterion 6 (WDOH 1997). WNI used the RADON computer code to perform this analysis. The analysis is based on the concentration of radium 226 in the tailings, and on the soil parameter default values recommended by the NRC in guidance documents applicable to tailings impoundment cover design for radon emanation control. The department reviewed WNI's design and analysis reports, verified their results, and approved the design plans and specifications. A sensitivity analysis was performed, using realistic, expected soil parameters, and found that a radon 222 flux of only 0.13 pCi/m^2s would be expected during the summer and fall when the cover soils are not expected to be saturated (WDOH 1998, pg. 41).

A thick, homogeneous soil cover of at least 13.6 feet thick was placed over the impounded tailings at the Sherwood Project site (per as-built inspection reports). The total volume of soil moved during construction to place the cover is in excess of 3 million cubic yards (yd^3). The vegetated cover was designed to have long-term performance. Natural materials (vegetation, soils, and rock) have been used to prepare and construct the cover design. Actual materials used in construction had a greater proportion of fine material (percent less than #200 sieve) than required by the construction design plans and specifications. The actual thickness of the constructed cover averaged over 13.6 feet from the sloped sub-grade. The sub-grade, although made up of radium 226-contaminated material, was produced by re-grading the tailings to the required contour and adding additional soil from the contaminated soils cleaned up in the mill area, with clean fill to meet grade requirements. Therefore, the upper portion of the tailings had less radium 226 concentration than was used in the analysis for determining cover thickness. All together, the design is quite conservative and the actual construction more than exceeded the minimum requirements of the approved design plans and specifications.

Radon 222 Measurements

WNI performed radon 222 flux measurements on the tailings impoundment after final cover placement. Measurements were performed in compliance with requirements of WAC 246-252-030 (10 CFR Part 40, Appendix A). Sampling was performed using the Large Area Activated Charcoal Canister (LAACC) method. Measurements of the approximately 80-acre surface were performed October 2-3, 1996. A mean radon 222 flux rate of 0.51 +/- 0.03 pCi/m^2s was measured (PQL of 0.5 pCi/m^2s). This measurement is well below the regulatory standard from state regulation WAC 246-252-030, Criterion 6 (10 CFR 40 Appendix A, Criterion 6), and consistent with analytical evaluations, using realistic assumptions and expectations, performed at the Sherwood site (WDOH 1998, pg. 42).

A report of results of testing and analysis for the October 2-3, 1996 radon 222 emanation flux rate evaluation was received December 16, 1996, and reviewed by department staff. The report includes details of the testing equipment, methods, and analytical procedures used in the evaluation. This report remains on file with the department and is available to the custodial agency (DOE) upon request. DOE has requested and received many of the main reports and documents necessary to manage the site and

may have already received this report. Criterion 6(c) requirements for radon 222 flux emanation rate measurement reporting and records management have therefore been met (WDOH 1998, pg. 42).

3. **Documentation that the completed site decommissioning actions were performed in accordance with license requirements and regulations. This documentation should include a discussion of results of radiation survey and confirmatory soil samples that indicated that the subject site meets unrestricted release requirements.**

RADIATION CLEANUP AND CONTROL

On October 31, 1994, WNI submitted the Radiological Verification Program (RVP) (see Revision 6 to the WNI Mill Decommissioning Plan) (SMI 1994) to the Department of Health for review and comment. Following several meetings between WDOH and WNI, a formal comment letter was sent to WNI on January 24, 1995. In response to WDOH's letter, WNI submitted Revisions 7 and 8 to the Mill Decommissioning Plan (SMI 1994), which WDOH subsequently found acceptable and approved on March 22, 1995 through issuance of Amendment 19 to WNI's radioactive materials license (WDOH).

WDOH determined that the RVP provided reasonable assurance that:

- appropriate regulatory standards for soil cleanup are utilized;
- all potentially contaminated areas associated with WNI's mill are properly identified for soil verification;
- background values for radium, thorium, and uranium established by WNI are representative of each soil type identified by WNI and WDOH staff at the Sherwood facility (SMI 1994);
- soil cleanup standards could be met in process areas such as the millsite barium chloride pond and the clairicone spill area where an accurate correlation or association cannot be developed, through 100% soil sampling and analysis;
- soil cleanup standards for Ra-226 and Th-230 could be met in areas of natural soil deposition by gamma surveys because of the correlation to radium concentrations, and the assurance that an accurate association exists between radium and thorium;
- soil cleanup action levels ensure a 95% or greater confidence that cleanup standards are complied with;
- WNI's Quality Assurance and Quality Control Program would properly control field and laboratory activities, and data management.

Following mill building demolition and disposal into the tailings disposal area, and prior to initiation of the RVP, WNI excavated approximately 70,000 cubic yards of soil from the mill area. The majority of the excavated soil was from areas where it was believed that elevated residual radioactivity might exist (70,000 cubic feet equates to an average depth of approximately 1.5 feet). In accordance with the approved RVP, approximately 4,000 ten-meter by ten-meter grids were established for gamma correlation surveying. In approximately 300 of these grids, soil samples and analyses were conducted to confirm the gamma-radium correlation. In areas where a correlation could not be demonstrated,

approximately 800 additional ten-meter by ten-meter grids were established for soil sample analysis. Core samples approximately 3" in diameter and 6" deep were taken. Since contamination resulting from the milling operation originated at the ground surface, the concentration of contaminants would be greater near the surface and would decrease with depth. Therefore, it was determined that the soil sample protocol would only require sampling below 6" if contamination was found in the upper 6" soil profile. For the 11 grids where the subsurface radium standard was applied, the average minimum and maximum for Ra-226 was 1.0, 1.32, and 2.4; for Th-230 it was 2.26, 16.92, and 33.99. For these sample locations, the estimated Ra-226 at 1,000 years is 1.57, 7.17, and 13.42. WNI documented that at least six inches (but in most cases several feet) of fill were placed on these areas.

WNI's standard procedure for excavating areas identified as requiring cleanup was to over-excavate several feet of material in an effort to lower residual radionuclide concentrations to levels which could be considered ALARA, rather than excavating only to surface soil regulatory limits. ALARA philosophy was considered when establishing action limits for soil cleanup. The allowable action limits were therefore reduced by 15%. As a result, grids having soil sample results in excess of approximately 2.5 pCi/g of radium 226 or thorium 230 were cleaned and re-sampled. After these areas had been cleaned up to the approved radium/thorium concentration levels, a new issue regarding uranium concentrations in soils arose. In response to this issue, WDOH evaluated and approved WNI's proposed concentration limit for uranium and their verification procedure. An additional 200 ten-meter by ten-meter grids were established for uranium soil sample analysis, and approximately 95% of them were found to be below the cleanup action level. In areas where soil cleanup action levels were exceeded, soil was removed and the area re-tested until it complied (SMI 1996).

WNI Results

A total of 305,000 additional cubic yards of potentially contaminated soil were excavated and placed in the tailings disposal area as a result of soil cleanup activities. By the time the millsite cleanup was complete, WNI had performed 4,968 gamma surveys and had 1,320 soil samples analyzed (SMI 1996). The WNI data base of gamma survey measurements and laboratory analyses for radium 226, thorium 230, uranium 238, and total uranium was analyzed to obtain the minimum, average, and maximum results, which are presented in Tables 3, 4, 5.a, and 5.b, below.

Table 3: WNI's Gamma Results for Each Soil Type

	Integrated Counts				Composite Counts			
Soil Type	**Min**	**Ave**	**Max**	**Limit**	**Min**	**Ave**	**Max**	**Limit***
Float	915	1512	2101	2110	904	1410	2171	2050/2250
Sand	1128	1550	2093	2110	1111	1435	2068	2050/2250
Quartz	1178	1986	2675	2680	1169	1744	2375	2100/2380

** The limit depended upon which of the two instruments was used for collection. The first listed limit is for serial number 98616 and the second is for 98631.*

Table 4: WNI's Analytical Results for Each Soil Type for Ra-226, Th-230, and U-nat

	Ra-226 (pCi/g)				Th-230 (pCi/g)				U-nat (pCi/g)			
Soil Type	**Min**	**Ave**	**Max**	**Limit**	**Min**	**Ave**	**Max**	**Limit**	**Min**	**Ave**	**Max**	**Limit**
Float/Sand	0.67	1.35	5.78	6.07	0.73	2.42	12.3	*	2	4.0	16	***
Quartz	0.87	1.77	5.62	6.44	0.94	2.28	8.26	**	2	5.3	13	***

** The limit is based on the radium 226 concentration found. The limit can range in value from 6.07 to 15.3 pCi/g. See Section 2.2.1 of Volume 2 of the Radiological Verification Completion Report dated July 1996.*
*** This limit is also based on the radium 226 concentration found. The limit can range from 6.44 to 15.7 pCi/g. See Section 2.2.1 of Volume 2 of the Radiological Verification Completion Report dated July 1996.*
**** This limit is also based on the radium 226 concentration found. The limit can range from 12.14 pCi/g to 32.88 pCi/g. Details can be found in Section 2.2.1 of Volume 2 of the Radiological Verification Completion Report dated July 1996.*

Table 5.a: WNI's Analytical Results for the State Split Samples

	Ra-226 (pCi/g)**			Th-230 (pCi/g)			U-238 (pCi/g)		
Soil Type	**Min**	**Ave**	**Max**	**Min**	**Ave**	**Max**	**Min**	**Ave**	**Max**
All*	0.90	1.52	9.21	0.73	3.74	22.14	0.87	2.27	7.06

** These soil samples were split with WDOH and the results were compared (see Table 7.a). Some of the grids sampled exceeded the standards for the site. These grids were later cleaned and re-surveyed or sampled until they were in compliance with the standard.*
*** This limit is also based on the radium 226 concentration found. The limit can range from 12.41 pCi/g to 32.88 pCi/g. Details can be found in Section 2.2.1 of Volume 2 of the Radiological Verification Completion Report dated July 1996.*

Table 5.b: WNI's Analytical Results for the State Split Samples

	U-nat (pCi/g)		
Soil Type	**Min**	**Ave**	**Max**
All*	1.75	4.91	15.70

** These soil samples were split with WDOH and the results were compared (see Table 7.b). Some of the grids sampled exceeded the standards for the site. These grids were later cleaned and re-surveyed or sampled until they were in compliance with the standard.*

State Results

During the millsite cleanup, WDOH conducted numerous inspections to ensure compliance with conditions of the RVP. WDOH also conducted its own sampling and analysis verification program. WDOH staff collected or split 100 samples with WNI and sent them to the state laboratory for independent analysis, and performed 39 gamma grid confirmation surveys in the same areas as WNI. The state's database of gamma survey measurements and laboratory analyses for radium 226, thorium 230, uranium 238, and total uranium was analyzed to obtain the minimum, average, and maximum results, which are presented in Tables 6, 7.a, and 7.b, below.

Table 6: WDOH's Gamma Results for Each Soil Type

	Integrated Counts			
Soil Type	**Min**	**Ave**	**Max**	**Limit**
Float	1235	1500	1944	2110
Sand	1286	1500	1753	2110
Quartz	1720	1903	1086	2680

Table 7.a: WDOH's Analytical Results for the State Split Samples

	Ra-226 (pCi/g)			Th-230 (pCi/g)			U-238 (pCi/g)		
Soil Type	**Min**	**Ave**	**Max**	**Min**	**Ave**	**Max**	**Min**	**Ave**	**Max**
All	0.99	1.71	5.84	0.72	4.2	23.9	0.63	2.04	7.22

Table 7.b: WDOH's Analytical Results for the State Split Samples

	U-nat (pCi/g)		
Soil Type	**Min**	**Ave**	**Max**
All*	1.63	5.3	14.2

** This limit is also based on the radium 226 concentration found. The limit can range from 12.41 pCi/g to 32.88 pCi/g. Details can be found in Section 2.2.1 of Volume 2 of the Radiological Verification Completion Report dated July 1996.*

Millsite Decommissioning

The only structures remaining within the former mill area are the pump house and its water storage tank. Following mill demolition, the exterior siding and insulation were removed from the pump house and disposed of in the tailings impoundment. The metal siding, pump equipment, interior piping, and the water storage tank were surveyed by WNI and found to meet regulatory requirements. The department has reviewed this information as presented in the *Mill Decommissioning Completion Report* (WNI 1997) and concurred with WNI's finding that these structures can be free-released.

Cover Material

Most of the cover material used in the tailings impoundment came from areas identified by WNI in their RVP as secondary and tertiary, as well as a borrow site in which topsoil was stored when the tailings disposal area was first constructed. These areas were surveyed by WNI and found to be at background levels. In Appendix C, Revision 6 of the *Sherwood Project Mill Decommissioning Plan* dated October 1994, radium levels in the borrow areas averaged between 1.0 and 1.4 pCi/gm, depending on soil type. The department has conducted a confirmatory survey of 570 gamma

measurements, using microR meters, which found that gamma radiation levels on the top of the completed impoundment are at background (17-24 uR/hr). Competent monzonite outcrops, located off the tailings disposal area in unimpacted background areas near the impoundment, had readings as high as 30 uR/hr.

Summary

WNI's initial measurements indicated that 95% of all gamma and soil sample grids were below the radium regulatory limit. Following these initial surveys, all gamma grids and soil grids that were in excess of limits were excavated until results indicated concentrations below the applicable limit. Department of Health data confirm that WNI's sampling process was valid. Based on the above information, WDOH staff believe that residual radioactive material in all the areas potentially impacted by the mill operation was cleaned up to the standards set in WAC 246-252-030(6)© (WDOH 2000, pg. 42-46).

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

GROUND WATER REMEDIATION

There is no evidence of impact to ground water at WNI's Sherwood Tailings facility. From the beginning of WNI's operations, tailings were neutralized prior to discharge to the lined impoundment, significantly reducing the risk for ground water contamination (WDOH 1998, pg.5).

The hydrogeology of the site was evaluated prior to construction of the tailings impoundment in 1978 and again as part of the design phase of the reclamation cover. The basin hydrologic evaluation was performed by WNI to characterize physical parameters, which control ground water occurrence, flow, and potential transport of contaminants. Results of this evaluation and the tailings impoundment investigation were reviewed by WDOH (WDOH 1998, pg. 31-34). WDOH supplemented review of WNI's hydrogeologic evaluation with geologic and hydrogeologic field evaluations by WDOH staff. WDOH staff also independently reviewed published geologic and hydrogeologic literature for the area of WNI's facility. WDOH staff reviews have confirmed the findings reported by WNI (WDOH 1998).

Monitoring Wells

Monitoring wells have been in place and monitoring ground water at locations surrounding the tailings impoundment from before operations began through the Monitoring and Stabilization phase of the project. Ground water data have been evaluated by WDOH since 1978 for possible leakage from the impoundment (WDOH 1998, pg. 35). WNI sampled tailings pore fluid for all hazardous constituents defined by WDOH regulations (Chapter 246-252 WAC) and found that the hazardous constituents which could be of concern for ground water are uranium, radium 226, radium 228, thorium 230, arsenic, nickel, and thallium (WDOH 1998, pg. 29-31). Therefore, ground water samples were analyzed for these constituents along with other indicator parameters such as TDS, pH, temperature,

sulfate, chloride, and other metals. Samples have been analyzed quarterly by WNI since before operations began.

State Results

WDOH has split ground water samples from all of the monitoring wells with WNI and had the samples analyzed at the department's independent laboratory. Samples have been obtained from monitoring wells by WDOH semi-annually since operations began in 1978, through 1999. Ground water samples are collected by WDOH when static water levels of the aquifer are at the seasonally high and low periods of the year. Review of the analytical results from the department's laboratory shows the same water quality trends compared to the analytical results from WNI's laboratory.

The Monitoring and Stabilization Plan included three levels of monitoring for frequency and constituent evaluation, depending upon conservative trigger exceedances. Although conservative trigger levels have resulted in increased monitoring surveillance, no federal or state regulatory standards have been exceeded (WDOH 2000, pg. 8-9). WDOH's review of all ground water quality data has determined that the hazardous constituents in the tailings impoundment (uranium, radium 226, radium 228, thorium 230, arsenic, nickel, and thallium) are stable in ground water within the range of natural variability and remain below regulatory limits. Fluctuations in static water level and other indicator parameter values (e.g., sulfate and chloride), observed during post-reclamation construction compliance monitoring, are consistent with anticipated trends and values (WDOH 2000, pg. 8-9).

Geochemistry

An extensive independent geochemical review of the tailings impoundment and chemistry of the ground water was conducted by a WDOH Ph.D. Geochemist. The purpose of the review was to evaluate long-term water quality of the site. The conclusions of this review are that the tailings should remain saturated (not dewatered), and ground water quality should remain good (WDOH 1998, pg. 29-31). Dewatering of tailings was considered, but WDOH determined that for long-term ground water protection, dewatering of tailings was not desirable or required (WDOH 1998, pg. 29-31).

Summary

WDOH has determined that the closure of WNI's Sherwood facility is in compliance with Washington State ground water regulations associated with uranium mill closure. The closure is specifically in compliance with the following ground water criteria delineated in Chapter 246-252-030 WAC, Criterion 5, 6(g), and 13, which incorporate the basic ground water protection standards imposed by EPA in 40 CFR Part 192, Subparts D and E; and imposed by NRC in 10 CFR Part 40, Appendix A, Criterion 5, 6(7), and 13, which specifies ground water monitoring requirements.

5. Discussion of results of State's site closure inspections

Department of Health professional staff have performed many site reclamation inspections over the years as site remediation moved from one phase to the next. The department has employed inspection staff or provided specialized consultants to review and verify virtually every aspect of site closure. Please see page 1 of this report, indicating the technical reviewers (and their credentials and expertise) involved in recent reclamation inspections and reviews (over the past five years). There have been many other department staff involved in the WNI project, who have provided state regulatory responsibility and stewardship of this site during its early phases.

Results of state staff site inspections have provided a presence to ensure that site reclamation activities are performed as required by regulation and license condition. For major construction activities, WNI submitted detailed plans and specifications for the work. These plans were reviewed and approved by the department. Department staff inspectors performed many field inspections to verify conformance of site activities to approved plans. Inspections were performed for reclamation construction of the diversion channel and thick, vegetated cover, with particular emphasis on inspection of soil, rock, vegetation, and ground water.

During and after site closure construction, monitoring has continued to evaluate environmental media and site performance. Periodic inspection and monitoring activities have been performed to determine radionuclide concentrations in soil, air, and ground water. WNI has been required to perform this monitoring and to report results annually. The department has performed split sampling and has evaluated monitoring results using the state's independent laboratory to provide verification of WNI's results.

6. **Documentation that release of this portion of the site will not negatively impact the remainder of the site to be closed at a later date, if it is a partial license termination case. Such documentation could be a statement from the appropriate State regulatory agency which confirms that the impact has been evaluated and included the bases for the State's conclusion.**

WNI has chosen to perform a complete license termination of the entire site at once, without any partial or phased license termination. Therefore, the department has not been required to consider any such case or to evaluate the relative impact of partial termination on the remainder of the site.

SUMMARY AND CONCLUSIONS

The Department of Health has performed a complete review of the Western Nuclear, Inc. Sherwood Project site for compliance with regulatory and license requirements. As part of that review, the department has prepared a Technical Evaluation Report (TER) (WDOH 1999) and TER supplement (WDOH 2000) to document the state's review. Department staff inspectors have performed inspections of all aspects of site reclamation. The state has also prepared this completion review report in accordance with the NRC Procedure: SA-900, entitled *Termination of Uranium Mill Licenses in Agreement States, Procedure: SA-900* (NRC 1999).

In final conclusion, the department believes that the Western Nuclear, Inc. Sherwood Project Uranium Mill site has met all regulatory and license requirements and that the radioactive material license, WN-I0133-1, may be terminated upon concurrence by the NRC and completion of final administrative and financial arrangements.

REFERENCES

Ishihara, Kenji, 1985, *Stability of natural deposits during earthquakes*, Proceedings of the 11th International Conference on Soil Mechanics & Foundation Engineering, A.A. Balkema, Aug. 1985, pg. 359-362.

NRC 1999, Program Management Information: OSP Procedure SA-900, Termination of Uranium Mill Licenses in Agreement States (SP-99-024), April 20, 1999.

SMI 1994, Sherwood Project, Radiological Verification Program.

SMI 1996, Sherwood Project, Radiological Verification Completion Report.

SMI 1997, Sherwood Tailings Reclamation Construction Completion Report, June 1997.

WDOE 2000, Probabilistic Seismic Hazard Assessment, October 2000.

WDOH 1997, Chapter 246-252 WAC (Washington Administrative Code), *Radiation Protection—Uranium and/or Thorium Milling*, July 17, 1997.

WDOH 1998, Sherwood Uranium Mill Project, Technical Evaluation Report, June 1998.

WDOH 1999, Final Report for the Integrated Materials Performance Evaluation Program (IMPEP), December 3, 1999.

WDOH 2000, Sherwood Uranium Mill Project, Technical Evaluation Report, Monitoring and Stabilization Plan Supplement, February 2000.

WDOH, WNI's Radioactive Materials License, WN-I0133-1.