

BACKGROUND:

The American Nuclear Corporation (ANC) site is located in the Gas Hills region in eastern Fremont County, Wyoming. The Gas Hills is a remote, sparsely populated, rural region in Wyoming, with the nearest population center (Riverton, Wyoming) approximately 45 miles (72.4 kilometers) west-northwest of the site. The site occupies approximately 550 acres (222 hectares) that were used for uranium mining and milling activities between 1959 and 1981. ANC suspended milling activities in 1981 due to poor uranium market conditions and began the decommissioning process. On May 9, 1994, ANC notified the NRC that it was ceasing operations and going out of business (ADAMS Accession Number ML071580050). Consequently, ANC forfeited its \$3.2 million surety reclamation performance bond to the WDEQ. In July 1994, the WDEQ agreed to remediate the site (ADAMS Accession Number ML071580059).

In October 1996, the NRC issued a Confirmatory Order outlining the WDEQ's responsibilities for the decommissioning of the site (ADAMS Accession Number ML071520354), and the WDEQ has been conducting limited decommissioning of the ANC site since. Limited decommissioning of the site included placement of an interim cover on TP-1, removal of windblown tailings, decommissioning and capping Tailings Pond No. 2, ongoing groundwater monitoring, and seasonal groundwater remediation. Between May and July 2012, the NRC staff worked with the WDEQ to modify the Confirmatory Order in an effort to conserve the remaining reclamation funds (ADAMS Accession Numbers ML120670346 and ML14122A199). The Confirmatory Order was modified again in July 2014 to further conserve the remaining funds by discontinuing the groundwater corrective action and associated activities. Additionally, the Confirmatory Order used the remaining funds to install new monitoring wells and surface water sampling stations in order to determine the extent of the groundwater plume flowing off-site and, if feasible, to purchase land to extend the site boundary beyond the plume (ADAMS Accession Number ML14206A590).

In May 2016, the WDEQ provided the NRC staff with a draft report entitled "ANC Uranium Mill Tailings Site Report of Engineering Evaluation/Cost Analysis and Prioritization of Reclamation Activities" (ADAMS Accession Number ML16148B084). In addition to submitting the report, the WDEQ requested that the NRC revise the Confirmatory Order to redirect the WDEQ's efforts at the site from collecting surface and groundwater samples to temporarily stabilizing the site and providing surface diversions. Between May and September 2016, the NRC and WDEQ staffs discussed the WDEQ's proposed revision to the Confirmatory Order, and, in November 2016, the WDEQ and NRC staffs agreed on a revised Confirmatory Order. The Confirmatory Order was revised in January 2017 (ADAMS Accession Number ML16354B554). The Confirmatory Order now directs the WDEQ to use the remaining decommissioning funds on stabilizing those areas of the site that have deteriorated and on improving the tailings pile cover in order to prevent additional recharge of contaminants to groundwater and to prevent erosion.

SAFETY EVALUATION:

The objective of the stabilization project is to provide an interim cover over and to construct diversion channels around TP-1. The stabilization project should prevent tailings material from being transported off the tailings pile via wind and rain, reduce potential radon emissions from the tailings pile, and prevent further migration of constituents of concern to groundwater from the emplaced tailings.

The objective is neither to construct the final cover nor to completely reclaim the site in accordance with NRC requirements because adequate funds to complete the reclamation are not available at this time and the stabilization activities are constrained by the funds remaining in the forfeited surety bond. The stabilization activities will not involve the relocation or movement of any emplaced uranium tailings, but it will involve the relocation of mine spoil and site soil potentially containing low levels of windblown tailings. Mine spoil is not regulated by the NRC and most of the material used for the interim cover will be obtained from areas that are upwind of TP-1.

Because of the unique site management posture and the nature of the proposed activities, current interim stabilization activities are more akin to a mine reclamation project rather than a uranium recovery site reclamation. Thus, while the NRC staff reviewed existing guidance in NUREG-1620 "Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978" for insights in reviewing the Plan, NRC guidance was not applicable to the staff's review of the proposal in some respects. Rather, the focus of the staff's review was to determine if the radiation protection and health and safety activities described in the Plan were adequate and could be accomplished in a manner that was protective of workers and the public, given the unique nature of the stabilization project and the NRC's regulatory authority, pursuant to the Confirmatory Order with the WDEQ.

The stabilization project consists of three principal activities: 1) establishing an earthen cover over TP-1; 2) constructing diversion channels around, and a retention pond up gradient of TP-1; and, 3) revegetating the interim earthen cover.

The topsoil layer consists of soil that meets the NRC criteria in 10 CFR 40 Appendix A and is suitable for use as a substrate for the vegetative material that will be planted on the cover. When completed, the TP-1 interim cover will consist of five layers including the existing TP-1 cover, a one-foot layer of unclassified fill material, a three-inch "wicking" layer, one foot of additional unclassified material, and one foot of topsoil. "Unclassified material" consists of soil that may be in excess of the surface limit for soil (15 pCi/g total radium-226 per 10 CFR Part 40, Appendix A), but is not in excess of 25 pCi/gm total radium-226 (15 pCi/g + 10 pCi/g background). The wicking layer consists of sand from the nearby Willow Springs Draw. The purpose of this layer is to ensure vertical downward drainage from the top two cover layers and to prevent potentially acidic material from the tailings from migrating upwards to the revegetated topsoil layer.

Because very limited funds are available for the stabilization project, soil and fill materials will be obtained from existing on-site sources, and this material may contain low concentrations of

radium or uranium. The NRC staff's focus is the health and safety of WDEQ workers and contractors, and the public from potential exposures from this material. Specifically, the NRC staff evaluated the potential exposure to workers from radon and gamma radiation from the existing TP-1 cover and the actions the contractor would use to prevent inhalation of dust by workers. The staff also evaluated WDEQ's proposal with respect to ensuring that material does not travel off-site during stabilization activities. In addition, the NRC staff evaluated the proposed contamination control practices for workers and equipment exiting the work site and how WDEQ will ensure that waste materials that are disposed of off-site will meet unrestricted release criteria.

The Plan includes a description of the health and safety procedures and requirements that the contractor will employ during the stabilization project. It describes the duties and responsibilities of the individuals responsible for health and safety during the stabilization project. It includes a description of the potential hazards at the site and the procedures to avoid them, emergency procedures, and the requirements for workers to comply with the H&S procedures. It also includes a job safety checklist, safety equipment checklist and safety meeting report template. Based on the potential hazards at the site and the scope and duration of the stabilization project the NRC staff has concluded that the responsible personnel, worker requirements and emergency procedures are adequate, as they will ensure that workers are protected from applicable hazards.

Regarding radon inhalation and gamma exposure to workers performing stabilization activities, the NRC staff reviewed the information in the Plan and determined that these exposure pathways should not pose a threat to workers. The contractor has stated that the project would include approximately 80 days of onsite work based on a 10-hour workday (ADAMS Accession Number ML18024A756). Gamma exposure rates on the surface of TP-1 ranged from 30 microrentgen per hour (uR/hr) to 390 uR/hr, with an average exposure rate on the surface of 81 uR/hr (the exposure rates shown in the contractor's Plan include background, i.e., background has not been subtracted from the stated exposure rate (ADAMS Accession Number ML17297A853)). This results in a potential dose to workers on the site of 0.81 milliroetegen (mR) per day. Thus, an 80 day project could result in a dose to workers of 65 millirem (for gamma radiation, mrem and mR values are equivalent), which is below the public dose limit of 100 mrem/yr.

A 2014 radon emanation study by the Oak Ridge Associated Universities (ORAU) (ADAMS Accession Number ML17297A950) indicated that the average radon emanation from TP-1 was 32 picocuries per square meter per second (pCi/m²S), with a low of 2 pCi/m²S and a high of 190 pCi/m²S. Thus, while the average radon emanation rate is above the 10 CFR Part 40, Appendix A limit of 20 pCi/m²S at the average concentration of 32 pCi/m²S, the potential dose to a worker would be approximately 11 mrem (see below).

Based on the estimates above, the staff concludes that the potential doses to workers is acceptable because the potential dose from external exposure and radon is below the NRC public dose limit.¹

¹ These conservative estimates do not consider the reduction in gamma dose or radon emanation as additional cover material is placed on TP-1

$$CEDE = \frac{5000mRem \times \frac{32}{20} \times 1.0 \frac{pCi}{L} \times 0.1 \times 800 \text{ hours}}{2000 \text{ hrs} \times 30 \frac{pCi}{L}} = 10.6 \text{ mrems}^2$$

Regarding measures to prevent dust inhalation by workers, the Plan describes the dust suppression measures that the contractor will employ, including wetting access and haul roads on overburden stockpiles and on TP-1 during earth moving activities. In addition, if dusty conditions are present, workers will be required to wear dust masks or will be required to suspend operations. Workers will be required to wear protective eyewear, long-sleeved shirts, and long pants during operations. Kevlar coveralls; respirators; and latex, rubber, or nitrate gloves will be required if necessary. Workers will be required to wash their faces and hands before eating, smoking, or leaving the jobsite at the end of the day. In addition, WDEQ staff will perform alpha/beta radiation scans of worker's clothing at the end of the day during the first two days of work on the site and when the workers repair the eroded areas on the cover. While it is not anticipated that dust from the site will contain significant uranium or radium activity, evaluating the worker's clothing during the first two days and when they repair the eroded areas in the cover should provide assurance that additional end-of-day evaluations are not necessary. However, if these scans indicate that dust containing elevated levels of uranium or radium are present on workers clothing, the NRC will be contacted, and WDEQ will develop a revised health and safety plan for NRC review and approval before work resumes. WDEQ staff also stated that the results of surveys would be recorded and maintained for review by NRC and WDEQ staff.

Task Order 4 was submitted to the NRC on January 10, 2018 and includes a description of the final site radiation survey that will be performed at the completion of the stabilization activities (ADAMS Accession Number ML18023A379). The survey will consist of evaluating the gamma exposure rate on the surface of the stabilized area using a gamma scintillometer or equivalent instrument. The staff has concluded that this survey is adequate to provide assurance that the gamma exposure rate on the stabilized areas is not a threat to the public health and safety.

The Plan states that a Storm Water Control features will be installed in accordance with a Storm Water Control Plan, which should prevent material migrating offsite during rainstorms. In addition, equipment leaving the site at the end of the project will be washed in a dedicated onsite area (equipment will remain onsite throughout the duration of the project) and the WDEQ will provide alpha survey meters and staff to monitor equipment leaving the site at the end of the project to ensure that uranium or radium contamination is not present on the equipment. The staff has concluded that these activities are adequate to reduce the potential that workers will inhale dust containing tailings material or are exposed to dust via skin contact and that dust and potentially contaminated storm water leaving the site will be controlled.

² Equation 3 from Regulatory Guide 8.34 "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses, July 1992 (ADAMS Accession Number ML090770221)

Finally, all potentially contaminated waste materials generated during the stabilization activities will be disposed of onsite, so transportation requirements, container marking and waste monitoring activities are not applicable.

TECHNICAL REVIEW:

Based on the information provided in the Plan for site preparation, excavation, compaction, sloping and grading, the staff has concluded that the geotechnical stabilization of TP-1 can be accomplished, if the proposed plans including reclamation, grading, drainage and hydrology, are carefully followed and implemented.

CONCLUSION:

Based on the NRC staff's review of the proposed health and safety procedures and stabilization activities described in the ANC Tailings Pond #1 Interim Stabilization Plan Design Memorandum, and the final radiation survey in Task Order 4, the NRC staff has concluded that they are adequate to stabilize TP-1 and protect workers and the public during the stabilization project. However, it is important to record and maintain the results of all surveys for contamination for review by NRC and WDEQ staff to demonstrate that stabilization activities did not have an adverse impact on workers or the public. Therefore, with the provisions that the results of surveys for contamination are recorded and maintained for review by NRC and WDEQ staff, and if elevated levels of radiation are detected on workers, WDEQ will notify the NRC, and provide a revised health and safety plan for NRC review and approval before work resumes, the staff concludes that WDEQ's proposed updated interim stabilization plan and final radiation survey in Task Order 4 is acceptable.