POLICY ISSUE
NOTATION VOTE

RESPONSE SHEET

TO: Brooke P. Clark, Secretary

FROM: Commissioner Caputo

SUBJECT: SECY-23-0055: Options for Licensing Emerging Technologies Used for Remediation of Mine Waste

Approved X **Disapproved** X **Abstain** ____ **Not Participating** ____

COMMENTS: **Below** ____ **Attached** X **None** ____

Entered in STAR
Yes X
No ____

Annie Caputo

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Signature

Date

Commissioner Caputo's Comments on SECY-23-0055, Options for Licensing Emerging Technologies Used for Remediation of Mine Waste

SECY-23-0055 presents an important policy issue for the Commission to address regarding the NRC's role in the remediation of abandoned uranium mine sites.[1] As described by the Abandoned Uranium Mines Working Group, an abandoned mine is "one where the development, mining, and other operations ceased with no evidence to demonstrate that the operator intended to resume mining."[2] There are thousands of abandoned mine sites.[3] While these mine sites are no longer operational, the lingering legacy of uranium contamination in land and water has long driven concerns due to the potential health effects.[4] While remediation is long overdue, effective and economically viable solutions remained elusive.

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) provides for the safe and environmentally sound disposal, long-term stabilization, and control of uranium mill tailings in a manner that minimizes or eliminates health hazards to the public.[5] Congress enacted Title I of UMTRCA to remediate existing unregulated mill tailings piles at inactive processing sites.[6] To address mill tailings produced at active, NRC-licensed sites, Congress enacted Title II of UMTRCA. Since the passage of UMTRCA, the NRC has executed its responsibilities in terms of safely regulating milling activities.[7]

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[1] The NRC does not regulate conventional uranium mines. *See* https://www.nrc.gov/materials/uranium-recovery.html (last reviewed/updated Mar. 31, 2023); https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-uranium-recovery.html (last reviewed/updated June 29, 2015).

[2] Abandoned Uranium Mines Working Group, Addressing Health and Safety Risks of Abandoned Uranium Mines Multiagency Strategic Plan, 1 n.1, (Dec. 3, 2023), available at https://www.energy.gov/sites/default/files/2023-03/AUMWG_Strategic_Plan_2022_Final.pdf. This report acknowledges that some abandoned mine sites may have "viable responsible parties" and others may not. *Id.*

[3] *See* https://www.epa.gov/radiation/tenorm-uranium-mining-residuals (last updated Feb. 20, 2024) (stating EPA's database of uranium mines "includes 15,000 mine locations with known or potential uranium occurrence in 14 western states"); https://www.epa.gov/navajo-nation-uranium-cleanup/aum-cleanup (last updated Apr. 19, 2024); EPA, Abandoned Uranium Mine Settlements on or near the Navajo Nation (Nov. 2022), available at https://www.epa.gov/system/files/documents/2023-02/epa-factsheet-abandoned-uranium-mine-settlements-on-the-navajo-nation.pdf.

[4] *See* https://www.epa.gov/navajo-nation-uranium-cleanup/aum-cleanup (last updated Apr. 19, 2024); Your Health: Uranium and Radiation on the Navajo Nation (Dec. 2014), available at https://www.epa.gov/sites/default/files/2016-06/documents/atsdr_uranium_and_radiation_health_dec_2014.pdf.

[5] *See* https://www.nrc.gov/info-finder/decommissioning/uranium/index.html (last reviewed/updated Oct. 31, 2022).

[6] Representative Marriott urged Congress to act quickly to remediate the inactive mill tailing sites. *See* Uranium Mill Tailings Control Act of 1978: Hearings on H.R. 11698, H.R. 12229, H.R. 12938, H.R. 12535, H.R. 13049, and H.R. 13650 Before the Subcomm. on Energy and Power of the House Comm. on Interstate and Foreign Commerce 95th Cong. 92 (1978).

[7] *See* https://www.nrc.gov/info-finder/decommissioning/uranium/index.html (last reviewed/updated Oct. 31, 2022).

However, abandoned uranium mine sites have languished for decades.[8] While UMTRCA did not address uranium mining, mine waste produced from uranium mining, or remediation of inactive uranium mine sites, its goal to remediate inactive milling sites is relevant here. As Representative Marriott stated during a congressional hearing on several bills designed to establish a remedial action program for inactive uranium mill tailings —"[w]ith the need clearly established and recognized, the sites identified…we need to act fast."[9] Following that same thought process, it is imperative that the Commission enable remediation of inactive uranium mine sites to be carried out in a safe, efficient, and timely manner.

During the April 2022 Commission Meeting at the Navajo Nation, the Commission expressed NRC's commitment to ensuring that any proposed solution for the remediation of the sites is protective of public health and the environment while also acknowledging the burdens that local and native people face through chronic exposures.[10] This is not a problem just facing the Navajo Nation.[11] While over 500 such sites are on or near the Navajo Nation, the EPA's database includes over 15,000 locations.[12] EPA's database of abandoned uranium mine locations "primarily focuses on the uranium mines in the western continental United States, where most of the abandoned uranium mines are located."[13] EPA also estimates that of these abandoned uranium mines, "about 75% are located on [f]ederal or tribal lands."[14]

Emerging technologies to remediate mine waste have the potential to improve public health and the environment by reducing the uranium and radium content of abandoned mine waste and facilitating cleanup of abandoned sites.[15] EPA is also focused on potential future uses for

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[8] *See* Department of Energy Fact Sheet, UMTRCA Title I & Title II Disposal and Processing Sites (Feb. 2024), available at https://www.energy.gov/lm/articles/umtrca-title-i-and-ii-disposal-and-processing-sites-fact-sheet.

[9] Uranium Mill Tailings Control Act of 1978: Hearings on H.R. 11698, H.R. 12229, H.R. 12938, H.R. 12535, H.R. 13049, and H.R. 13650 Before the Subcomm. on Energy and Power of the House Comm. on Interstate and Foreign Commerce 95th Cong. 92 (1978).

[10] Meeting on the Ten-Year Plan to Address Impacts of Uranium Contamination on the Navajo Nation and Lessons Learned from Former Uranium Mill Sites, 108 (Apr. 22, 2022) (ADAMS Accession No. ML22175A052).

[11] *See* https://www.epa.gov/radiation/tenorm-uranium-mining-residuals (last updated Feb. 20, 2024).

[12] *See* Abandoned Mines Cleanup, Settlement https://www.epa.gov/navajo-nation-uranium-cleanup/aum-cleanup#:~:text=EPA%20has%20entered%20into%20enforcement,the%20523%20abandoned%20uranium%20mines (last updated Apr. 19, 2024). EPA reports that funds are available to begin the assessment and cleanup of 230 of the abandoned sites. *Id.*

[13] Oversight Hearing on Federal Actions to Clean Up Contamination from Legacy Uranium Mining and Milling Operations Before the Committee on Environment and Public Works, 112th Cong. (Oct. 6, 2011) (EPA Responses to Post Hearing Questions and Questions for the Record).

[14] *Id.*; *see also* H.R. Rep. No. 116-225, at 3 (2019).

[15] For example, a recent study shows that one emerging technology achieved a greater than 90 percent reduction in uranium and radium-226 concentrations in the treated coarse fraction. Navajo Abandoned Uranium Mines Eastern and Northern Regions High-Pressure Slurry Ablation Treatability Study Report (Dec. 2023), available at https://www.epa.gov/system/files/documents/2024-01/raes-68he0923d0002-task-0004-nnaum-final-high-pressure-slurry-ablation-treatability-study-report-2023-12.pdf.

remediated sites.[16] However, remediation technologies for these abandoned sites has not been economically viable to date.[17] The majority of these abandoned mines are not currently funded for cleanup. What limited cleanup activities that have been conducted, have largely focused on removing and disposing of the material or covering the material on site.

As a general policy matter, the Commission should apply regulations in a way that enables remediation, thereby protecting public health and the environment. For the reasons discussed in more detail below, Option 2B, appropriately conditioned, strikes the right balance to allow remediation of these abandoned uranium mine sites and provide for adequate NRC oversight.

I appreciate the staff's thorough analysis of the regulatory history and the risks and benefits associated with each option presented in SECY-23-0055. However, Option 1, the uranium milling regulatory framework found in 10 CFR Part 40 and Appendix A, will not enable remediation. Option 1 requires an applicant to obtain a milling license for each site. Given that the EPA has documented thousands of locations in need of remediation, obtaining an individual milling license for each one seems the most inefficient and overly burdensome option presented in SECY-23-0055. These sites have been abandoned for decades. Applicants have had the option to obtain milling licenses for remediation under Appendix A to 10 CFR Part 40 since its promulgation on October 3, 1980.[18] However, no applicant ever has. If remediation was economic and viable under Option 1, the status quo, it would have already occurred or certainly at least be well on its way for a portion of the abandoned sites. The fact that thousands of sites remain abandoned and unaddressed is an indication that Option 1 is not a viable pathway for remediation.

In addition, Option 1 is not appropriately risk-informed nor is it consistent with our Efficiency Principle of Good Regulation where regulatory activities should be consistent with the degree of risk reduction they achieve. In conventional milling operations, the ore is crushed and chemically treated to extract the uranium and convert it to a form called yellowcake, a powder that can be processed into fuel. The regulatory framework in 10 CFR Part 40 and Appendix A was created to address radiological and non-radiological hazards of uranium milling operations. Appendix A was not created with emerging mine waste remediation technology in mind and is not well suited to license it. Hence, applying Option 1 to a remediation technology would not be efficient. On the contrary, Option 1 would be the most resource intensive (for both the staff and applicant) and time-consuming approach for the review of these types of licensing applications without a commensurate safety benefit.

Option 2B, a service provider license with appropriate conditions, provides a suitable regulatory framework for licensing these emerging technologies in accordance with UMTRCA and the Atomic Energy Act, without the need for rulemaking or statutory change. The regulatory framework for source material is more appropriate for emerging mine waste remediation technology because of the nature of the process and the characteristics of the substances utilized in and resulting from the process.

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[16] *See* Abandoned Mine Lands: Revitalization and Reuse, https://www.epa.gov/superfund/abandoned-mine-lands-revitalization-and-reuse (last updated Oct. 17, 2023).

[17] *See* Department of Energy Report to Congress, "Defense-Related Uranium Mines," (Aug. 2014), available at https://energy.gov/lm/downloads/defense-related-uranium-mines-report-congress-august-2014. This report notes that remediation costs for abandoned mine sites can vary significantly, ranging from $10,000 to $80,000 for small mines and $4,900,000 to $15,400,000 for large mines. *See id.* at 15.

[18] 45 Fed. Reg. 65521 (Oct. 3, 1980).

Application of an emerging technology to remediate abandoned mine waste under Option 2B should be limited to mines that are and will continue to be inactive. For the purposes of Option 2B, an abandoned uranium mine should be defined to mean a mine where the development, mining, and other operations ceased at least 30 years ago with no evidence to indicate that mining will be resumed. Mines that have been in operation within the past 30 years would not be considered abandoned. It is reasonable to assume that a mine that has been abandoned for 30 years or more will remain shut down and as a result the mine waste will continue to remain unaddressed. Option 2B, appropriately conditioned, provides a practical and suitably protective approach to regulating remediation of such abandoned mine waste.

The history of U.S. mine operation and production indicates that by 1992,[19] most conventional uranium mines ceased operations and most domestic uranium production had largely transitioned to in-situ uranium recovery activities. In 1989, the president of the Uranium Producers of America testified before Congress that "all but 5 underground [uranium] mines have been shut down."[20] For example, the last uranium mine near Navajo Nation closed in 1989.[21] In 1994, there were zero underground or open pit mines reported in operation.[22]

Therefore, mine waste, such as waste rock, spoil, or overburden, that has been abandoned for 30 years or more should not be considered ore for the purposes of the definition of 11e.(2) byproduct material.[23] As currently defined in guidance, ore means "a natural or native matter that may be mined and treated for extraction of any of its constituents or any other matter from which source material is extracted in a licensed uranium or thorium mill."[24] The staff should update its guidance to exclude mine waste, such as waste rock, spoil, or overburden, that has been abandoned for 30 years or more from the definition of ore. As the staff notes in

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[19] *See* Energy Information Administration, "Uranium Industry Annual 1993 Report," published in September 1994, https://www.eia.gov/uranium/marketing/archive/047893.pdf#page=40 (last accessed July 8, 2024).

[20] The Need for Uranium Enrichment Enterprise Restructuring and Uranium Mining Revitalization Before the Subcomm. on Energy Research and Development of the S. Comm. On Energy and Natural Resources, 101st Cong. 272 (1989) (statement of Gerald Grandey, President, Uranium Producers of America).

[21] *See* Ten-Year Plan to Address Impacts of Uranium Contamination in the Navajo Nation (last updated January 2021), available at https://www.epa.gov/sites/default/files/2021-02/documents/nnaum-ten-year-plan-2021-01.pdf.

[22] *See* Energy Information Administration, DOE/EIA-0368, Uranium Industry Annual 1995, at 6 (Table 4, U.S. Uranium Mine Production and Number of Mines and Sources, 1986-1995) (May 1996). According to the EPA, the "volume of waste, including overburden, produced by open-pit mining is approximately 45 times greater than wastes produced from underground mining." *See* https://www.epa.gov/radiation/tenorm-uranium-mining-residuals#regulation (last updated Feb. 20, 2024).

[23] The Canadian Nuclear Safety Commission (CNSC) describes the main types of waste generated by uranium mining and milling to be mill tailings and waste rock. CNSC describes waste rock to be "rock material removed from the mine to gain access to the ore" which has "very little to no concentration of uranium." *See* Uranium mines and mills waste, https://www.cnsc-ccsn.gc.ca/eng/waste/uranium-mines-and-millswaste/ (date modified Aug. 9, 2023). Historically, "waste rock produced by underground and open pit mining was piled up outside the mine." EPA, About Radioactive Waste From Uranium Mining and Milling, https://www.epa.gov/radtown/radioactive-waste-uranium-mining-and-milling#about-uranium-mining-and-milling (last updated Feb. 15, 2024).

[24] Regulatory Information Summary 2000-23, "Recent Changes to Uranium Recovery Policy" (Nov. 30, 2000) (ADAMS Accession No. ML003773008).

SECY-23-0055, by redefining ore to exclude such material, the NRC would not consider the remediation technology as generating 11e.(2) byproduct material. If the residual on-site material following application of the remediation technology is not considered 11e.(2) byproduct material, then the activity does not meet the definition of uranium milling in 10 CFR 40.4. Therefore, Appendix A to Part 40 would not apply.

I agree with Commissioner Wright that license conditions may be appropriate. Thus, the staff should consider including license conditions in service provider licenses for emerging technologies to remediate abandoned mine waste. For example, the staff should consider including a license condition to ensure that a remediated site meets release criteria in 10 CFR Part 20, Subpart E and to ensure that the NRC would not terminate the license until the conditions for site release have been met.

The staff should also consider previous relevant experience in developing the license conditions. As the staff notes, the NRC has experience issuing a service provider license without a site owner licensee.[25] The NRC issued a service provider license under the Part 40 source material framework to Water Remediation Technology, LLC (WRT). In that instance, WRT was authorized to use its remediation technology for the "[r]emoval of naturally-occurring uranium from current or potential drinking water sources, sources impacted by mining operations, drilling fluids or other solutions resulting from oil and gas exploration operations, and other groundwater or surface water sources as part of remediation or general water treatment operations."[26] While known emerging mine waste technologies, such as high-pressure slurry ablation, differ from WRT's system, the purpose is the same: remediation.

The staff should incorporate a requirement for the licensee to notify the NRC of the commencement of remediation activities prior to installing equipment and beginning operations at an abandoned uranium mine temporary job site. Notifications should not be considered amendments to the service provider license. The staff should maintain a publicly available list of remediation sites including the status of remediation up to and including verification that site release criteria have been met. Additionally, the staff should include a license condition to require that the service provider licensee provide financial assurance, consistent with 10 CFR 40.36. Similar to the condition in WRT's license, the licensee should adjust the decommissioning cost estimates on a triennial basis or at license renewal to reflect changes, pursuant to NRC requirements.

Finally, the staff has the authority to consider pilot programs. If an applicant opts to pursue a pilot project, the staff should explore and consider such requests as a service provider under the 10 CFR Part 40 source material framework. Pairing Option 2B with a pilot program would allow NRC to exercise the service provider license process for remediating abandoned mine waste and the effective application of the source material framework in 10 CFR Part 40 for the purpose of remediation. As part of the pilot program, the staff should consider limiting proposed remediation activities to those conducted at existing abandoned uranium mine sites that otherwise involve limited or no new ground disturbing activities.

[25] SECY-23-0055 at 24.

[26] Material License SUC-1591 for Water Remediation Technology, LLC (ADAMS Accession No. ML18208A491).