



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

July 24, 2020

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**SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION RESPONSE TO WHITE PAPER
ENTITLED "RECOMMENDATIONS ON THE PROPER LEGAL AND POLICY
INTERPRETATION FOR USING KINETIC SEPARATION PROCESSES AT
URANIUM MINE SITES"**

Dear Mr. Pugsley:

I am responding to the White Paper that you submitted on behalf of Western Uranium and Vanadium Corporation (Western) dated September 13, 2019 (NRC's Agencywide Documents Access and Management System [ADAMS] Accession Number ML19256C834), as supplemented by letter dated January 28, 2020 (ADAMS Accession No. ML20028F116). The White Paper provided analyses and recommendations on legal and policy issues related to the use of the kinetic separation process on uranium ore that has been removed from its host sandstone rock.

The U.S. Nuclear Regulatory Commission (NRC) staff appreciates Western's time and effort involved in sharing its perspective on this issue and recommendations on how kinetic separation could be handled. As you are aware, on October 19, 2016, the NRC staff provided an opinion to the State of Colorado as it evaluated the use of kinetic separation (also referred to as ablation) on uranium ore (ADAMS Accession No. ML16272A302). Additionally, in 2018 the NRC staff identified a path forward for Western to consider in a request similar to the one made to Colorado that would allow for a license of limited scope and duration to further develop the kinetic separation technology (ADAMS Accession No. ML17311A280).

Our October 30, 2019, acknowledgement letter (ADAMS Accession No. ML19289A594) stated that we would contact Western once a path forward has been identified. After considering Western's White Paper, the NRC staff has determined that its previously stated position, as set forth in its October 19, 2016, letter to the State of Colorado, remains valid. In that letter, the staff explained its conclusion that the proposed kinetic separation process would result in the extraction or concentration of uranium from ore processed primarily for its source material content. Therefore, the staff has concluded that Western's regulatory suggestions do not warrant further consideration for rulemaking and did not include Western's regulatory suggestions in its recommendations for in-situ recovery (ISR) rulemaking,¹ if restarting that rulemaking is approved by the Commission. Our responses to some of the points raised in the White Paper related to this conclusion are set forth below.

¹ SECY-19-0123, "Regulatory Options for Uranium in SITU Recovery Facilities" (ADAMS Accession No. ML19221B516) (December 16, 2019).

NRC Has Jurisdiction over Proposed Kinetic Separation Process

The NRC (or a duly authorized Agreement State) has jurisdiction over the proposed kinetic separation activities described in the White Paper. Under section 62 of the Atomic Energy Act of 1954, as amended (AEA), the NRC's jurisdiction attaches when a person seeks to transfer or receive in interstate commerce, transfer, deliver, receive possession of or title to, import or export from the United States any source material after removal from its place of deposit in nature.² Similarly, the NRC's implementing regulations provide that once the source material is removed from its place of deposit in nature it becomes subject to the NRC's or Agreement State's jurisdiction and to the respective regulator's licensing requirements, if the person removing the ore seeks to possess, take title to, transfer, or deliver the ore.³ According to the White Paper, the proposed kinetic separation process would be applied to uranium ore that has already been removed from the host sandstone rock.⁴ Therefore, the NRC staff concludes that the proposed kinetic separation process is not a form of mining, as the kinetic separation process does not entail removing the ore from the host rock but would only be applied after the ore has already been removed or otherwise mined.

Post-Kinetic Separation Material Does Not Constitute Unrefined and Unprocessed Ore

The NRC has exempted "unrefined and unprocessed ores," as defined in 10 CFR 40.4, from NRC licensing in 10 CFR 40.13(b). The statutory basis for the exemption is the AEA section 62 provision which provides "that licenses shall not be required for quantities of source material which, in the opinion of the Commission, are unimportant."⁵ Thus, by this regulation, the NRC does not require a license for the possession, receipt, transfer, or use of unrefined and unprocessed ore. NRC licensing is required for refining or processing the ore.

In response to the White Paper, the staff disagrees with Western's assertion that the post-kinetic separation material is a form of "unrefined and unprocessed ore." The staff finds that the proposed kinetic separation process is a form of "processing" as that term is indirectly defined in the 10 CFR 40.4 definition of "unrefined and unprocessed ore."⁶ As described in the White Paper, the proposed kinetic separation process appears to involve both "beneficiating" and "refining," two terms that are considered processing under the 10 CFR 40.4 definition of "unrefined and unprocessed ore." Although the NRC regulations do not define these terms, we note that several of the activities described as being part of the proposed kinetic separation process, such as the ore being crushed before it is mixed with water to form the slurry, appear to meet the plain meaning or other authoritative definitions of these terms.⁷ Therefore, the NRC staff has determined that the post-kinetic separation material is not a form of "unrefined and

² 42 U.S.C. § 2092.

³ 10 CFR 40.3.

⁴ White Paper, p. 11 ("Kinetic separation involves the identification of a host rock bearing a specific suite of minerals that can be economically recovered assuming that the cost structure associated with the removal of such ore from host rock, *utilization of the kinetic separation process to 'high-grade' the ore itself*, transportation of the 'high-grade' ore to a milling facility, and actual milling is economical in today's environment.") (emphasis added).

⁵ 42 U.S.C. § 2092.

⁶ "Unrefined and unprocessed ore" means "ore in its natural form prior to any processing, such as grinding, roasting or beneficiating, or refining. Processing does not include sieving or encapsulation of ore or preparation of samples for laboratory analysis." 10 CFR 40.4.

⁷ See, e.g., 15 CFR 781.1 (Department of Commerce regulations implementing the Additional Protocols to the 1980 U.S.-IAEA Safeguards Agreement); 40 CFR 372.3 (EPA regulations implementing the Emergency Planning Community Right-to-Know Act); 40 CFR 60.271 (EPA regulations implementing the Clean Air Act); and 26 CFR 1.7704-4 (IRS regulation concerning qualifying income arising from activities related to minerals and natural resources).

unprocessed ore.” As such, Western or another entity wishing to engage in the proposed kinetic separation activities must first apply for and obtain an NRC or Agreement State license.

Kinetic Separation is a Form of Uranium Milling and Generates AEA Section 11e.(2) Byproduct Material

As presented in the White Paper, the proposed kinetic separation process results in the generation of: (i) an uranium ore stream that is sent on to a conventional mill for additional processing; and, (ii) a waste stream for disposal.⁸ These two streams result from a two-phase process, a disassociation phase followed by a separation phase. The disassociation phase involves the crushing of the ore, mixing the crushed ore with water to form the slurry, followed by pumping the slurry through opposing nozzles, which create two high-velocity slurry streams that directly collide with each other. As described in the White Paper, “[t]he collision of these high-velocity slurry streams creates a high energy impact zone where individual particle-to-particle (i.e. mineral-crust sand grain to mineral-crust sand grain) collisions impart energy that disassociates the mineral crust (ore) from the underlying sand grains (waste rock).”⁹ After the disassociation phase, “the post-impact slurry ... can be subjected to separation by physical screening, based on grain size, where the finer ore minerals are separated from the coarser waste rock.”¹⁰

The staff finds that the disassociation phase is a form of uranium extraction, as much of the uranium is being separated from the underlying sand grains. Similarly, the separation phase is a form of both uranium extraction and concentration, as much of the uranium is again being separated from other material that will constitute the waste stream, and the separated uranium will be concentrated in the ore stream. With respect to the waste stream, the White Paper states that the post-kinetic separation waste stream will contain approximately 5% of the uranium that was present in the slurry before the kinetic separation process was begun.¹¹ The White Paper also indicates that the post-kinetic separation waste may be stored on the surface or used as mine backfill.¹²

As such, the staff finds that the proposed kinetic separation process meets the NRC’s definition of “uranium milling,” which is defined as “any activity that results in the production of byproduct material as defined in [10 CFR Part 40].”¹³ In this regard, the proposed kinetic separation process is both an activity that: (i) involves the concentration of uranium for the primary purpose of recovering the subject uranium, and (ii) produces byproduct material. Starting with the byproduct material, the NRC staff notes that the kinetic separation process may very well result in a waste stream relatively cleaner than those of other uranium milling processes. The waste stream, however, as described by Western, still contains a certain amount of uranium. Consequently, the post-kinetic separation waste stream would meet the definition of AEA

⁸ White Paper, pp. 16-17.

⁹ *Id.*, p. 15.

¹⁰ *Id.*, p. 16.

¹¹ *Id.*, p. 17. In a similar statement, the White Paper references “lower concentrations of uranium” in the waste rock fraction or stream. *Id.*, p. 19. The staff notes that Western has not provided any substantive data to validate its claim that the waste stream resulting from its proposed kinetic separation process is relatively “clean” in comparison to other uranium milling methodologies.

¹² *Id.*, p. 22.

¹³ 10 CFR 40.4. The NRC’s definition of byproduct material in 10 CFR Part 40 is based upon the AEA section 11e.(2) definition; the NRC defines the term as the “tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes.” 10 CFR 40.4.

section 11e.(2) byproduct material.¹⁴ In short, the waste stream generated by kinetic separation results from the concentration of uranium in the slurry that is sent to a conventional mill. Moreover, depending on how and where this waste is disposed, the uranium in the waste stream could concentrate over time, and as such may present a risk to human health and the environment.

In making this determination, the staff relies upon the Commission's *International Uranium (USA) Corporation* licensing decision. In that decision, the Commission held that an activity involving the processing of source material generates AEA section 11e.(2) byproduct material if the activity is part of or "within the course of the nuclear fuel cycle."¹⁵ Thus, for example, if uranium particles were present in the waste stream resulting from a phosphate mining operation, then the activity generating that waste stream would not be considered uranium milling. The *International Uranium* decision suggests that the NRC staff can make a reasoned determination, based upon the information available to it, whether a given activity would be "within the course of the nuclear fuel cycle."¹⁶ Therefore, based upon the statements in the White Paper,¹⁷ and applying the statutory meaning of AEA section 11e.(2) as further interpreted by the *International Uranium* decision, it is reasonable for the staff to conclude that the proposed kinetic separation process would result both in uranium being recovered from the underlying ore (through both extraction and concentration as described above), that the recovered uranium would then be subsequently used in the nuclear fuel cycle, and finally, that the post-kinetic separation waste stream would contain AEA section 11e.(2) byproduct material. Based upon this analysis, the staff concludes that its October 19, 2016 opinion sent to the State of Colorado remains valid (ADAMS Accession No. ML16272A302).

In addition, Western references the term "source material processing," which appears to categorize a class of Part 40 licensees that is separate and distinct from those licensees that engage in uranium milling.¹⁸ The White Paper further asserts that the kinetic separation process should be licensed as a form of "source material processing." In response, the staff notes that neither the NRC's 10 CFR Part 40 regulations nor NRC guidance define the term "source material processing." This term is also not used in NRC practice and the staff does not presently classify the NRC's 10 CFR Part 40 licenses into "source material processing," "uranium milling," or other categories.

Submission of An Application

The NRC staff acknowledges that kinetic separation has the potential to be a viable form of uranium milling and would certainly consider an application proposing the use of a kinetic separation process if submitted by Western or another entity. Further, the staff would consider on a case-specific basis any requests for exemptions or alternatives to the requirements in 10 CFR Part 40, Appendix A, as part of review of an application.

¹⁴ Section 11e.(2) byproduct material is defined as "the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content." 42 U.S.C. § 2014(e)(2).

¹⁵ *International Uranium (USA) Corporation*, CLI-00-01, 51 NRC 9, 18 (2000).

¹⁶ *Id.*, at 23 ("From the information in the record, we believe that it was reasonable for the NRC Staff to have concluded that: (1) processing would take place, and (2) uranium would be recovered from the ore.").

¹⁷ White Paper, p. 63 ("Kinetic separation is not intended to concentrate uranium into a single product source; but rather, it is intended to economically *create a high-grade uranium ore* using physical processes that result in a product that resembles that of typical ore sorting or blending. The intent behind the latter is the same as the former: produce a *high-grade uranium ore for subsequent milling.*") (emphasis added).

¹⁸ See, e.g., *id.*, pp. 4-5 and 7.

In accordance with Title 10 of the *Code of Federal Regulations* 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's ADAMS. ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html>.

If you have any questions concerning the above, please contact Douglas Mandeville at 301-415-0724 or via email at Douglas.Mandeville@nrc.gov.

Sincerely,

/RA/

Patricia K. Holahan, Director
Division of Decommissioning, Uranium Recovery
and Waste Programs
Office of Nuclear Material Safety
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cc: G. Glasier, Western Uranium and
Vanadium Corp.

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