

## Staff Position on Use of Ablation Technology on Uranium Ore

Mineral Ablation (MA), a joint venture between Black Range Minerals (BRM) and Ablation Technologies (AT) is currently evaluating the use of ablation technology on uranium ore. The use of ablation technology on uranium ore was not considered when the Atomic Energy Act of 1954, as amended (AEA), the Uranium Mill Tailings Radiation Control Act of 1978, as amended (UMTRCA), or the regulations in 10 CFR Part 40 and Appendix A to Part 40 were written. Therefore, the U.S. Nuclear Regulatory Commission (NRC) staff has to evaluate the ablation technology and consider how the existing regulatory framework can be applied. The NRC staff held a public meeting with MA on December 19, 2013, to learn about the ablation technology. The NRC staff also visited MA's facility in Casper, Wyoming on January 30, 2014.

The NRC staff's position is based on definitions and relevant regulations in 10 CFR Part 40 or Appendix A thereto. These are provided below.

*Byproduct Material* means 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. Underground ore bodies depleted by such solution extraction operations do not constitute "byproduct material" within this definition.

*Source Material* means (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of: (i) Uranium, (ii) thorium or (iii) any combination thereof. Source material does not include special nuclear material.

*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.

*Uranium Milling* means any activity that results in the production of byproduct material as defined in this part.

*10 CFR Part 40.13(b)* Any person is exempt from the regulations in this part and from the requirements for a license set forth in section 62 of the AEA to the extent that such person receives, possesses, uses, or transfers unrefined and unprocessed ore containing source material; provided that, except as authorized in a specific license, such person shall not refine or process such ore.

*10 CFR Part 40.22(a)* A general license is hereby issued authorizing commercial and industrial firms; research, educational, and medical institutions; and Federal, State, and local government agencies to receive, possess, use, and transfer uranium and thorium, in their natural isotopic concentrations and in the form of depleted uranium, for research, development, educational, commercial, or operational purposes in the following forms and quantities: (1) No more than 1.5 kg (3.3 lb) of uranium and thorium in dispersible forms (e.g., gaseous, liquid, powder, etc.) at any one time. Any material processed by the general licensee that alters the chemical or physical form of the material containing source material must be accounted for as a dispersible form. A person authorized to

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possess, use, and transfer source material under this paragraph may not receive more than a total of 7 kg (15.4 lb) of uranium and thorium in any one calendar year. Persons possessing source material in excess of these limits as of August 27, 2013, may continue to possess up to 7 kg (15.4 lb) of uranium and thorium at any one time for one year beyond this date, or until the Commission takes final action on a pending application submitted on or before August 27, 2014, for a specific license for such material; and receive up to 70 kg (154 lb) of uranium or thorium in any one calendar year until December 31, 2014, or until the Commission takes final action on a pending application submitted on or before August 27, 2014, for a specific license for such material; . . .

In the following paragraphs, staff has provided a response to issues related to the use of the ablation technology on uranium ore. The issues, as the NRC staff understands them, are presented *in italics*, followed by NRC staff's response.

*Does receipt and processing of uranium ore by MA in Casper, Wyoming, require a specific license?*

Receipt of unrefined and unprocessed ore is an activity that is exempt from regulation in 10 CFR Part 40. An NRC license is not required to possess unrefined and unprocessed uranium ore. The NRC staff has reviewed MA's current activities and determined that, at this time, MA is not processing uranium ore for its source material content. The NRC staff visited MA's facility in Casper, Wyoming and confirmed the research and development nature of the ablation technology. Additionally, to the best of the staff's knowledge, no post-ablation uranium has been sent to a conventional uranium mill. The NRC staff's position is that MA's activities are subject to the general license limits in 10 CFR 40.22. The NRC staff confirmed that MA has limited its one time and calendar year possession of post-ablation uranium to the limits identified in 10 CFR 40.22.

*Is a specific source material license required for the receipt and processing of the uranium ore by MA in Casper, Wyoming?*

Receipt and possession of unrefined and unprocessed uranium ore are exempt from the regulations in 10 CFR Part 40. An NRC license is not required for this activity. The NRC staff has confirmed that MA's current activities are focused on research and development of the ablation technology and that the quantity of material in its possession as a result of its activities is within the amount allowed under the general license in 10 CFR 40.22. Therefore, the NRC staff's position is that MA's current activities do not require a specific license, but are subject to the general license provisions in 10 CFR 40.22. As discussed in the staff's response to the previous comment, MA has limited its one time and calendar year possession of post-ablation uranium to these limits.

*How much and when did MA obtain source material (in the form of ore) at its Casper, Wyoming, facility for processing for its uranium content?*

The regulations in 10 CFR 40.13(b) contain an exemption from licensing requirements for receipt, possession, transfer, or use unrefined or unprocessed ore containing source material.

Accordingly, NRC does not have information on the specific date when MA received uranium ore. Further discussion of the unrefined and unprocessed ore exemption can be found in NUREG-1717 "Systematic Radiological Assessment of Exemptions for Source and Byproduct Materials" (NRC, 2001).

Receipt and possession of unrefined and unprocessed ore is exempt from the regulations in 10 CFR Part 40. The NRC staff's December 12<sup>th</sup> letter asked MA to be prepared to explain how it is verifying compliance with the requirements of 10 CFR 40.22. This regulation contains restrictions on how much source material can be possessed at any one time and in a calendar year. The NRC staff's position is that the general license limits in 10 CFR 40.22 applies to the post-ablation uranium. The timeframe in which MA created the post-ablation uranium, not receipt of uranium ore, is important when considering application of the correct quantity limits in 10 CFR 40.22.

*According to an e-mail from Douglas Mandeville to Bill Von Till, dated August 13, 2013, approximately 100 tons of uranium ore was to be transferred from Colorado to Wyoming. No documentation related to the receipt of that material has been submitted to the NRC Staff. Why not?*

As the receipt and possession of unrefined and unprocessed ore is exempt from regulation in 10 CFR Part 40, there is no requirement that the amount of uranium ore received in Casper be reported to the NRC.

*The date of the receipt of the 100 tons of uranium ore in Wyoming is important. Due to the recent changes to 10 CFR 40.22, MA would have been allowed to possess 15.4 lb of uranium at any one time and receive up to 154 pounds of uranium or thorium in the calendar year ending August 27, 2013.*

MA's date of initial use of the ablation technology and whether that occurred before or after August 27, 2013 is important for determining compliance with the requirements in 10 CFR 40.22 as the allowable possession limits changed after that date. However, the date of receipt of unrefined and unprocessed ore is not critical because possession of unrefined and unprocessed ore is exempt from NRC licensing so that the weight restrictions referenced in the question are not relevant.

*According to the May 29, 2013, Final Rule on Distribution of Source Material to Exempt Persons and to General Licensees and Revision of General License and Exemptions (76 FR 32310, 32322): "In practice, some general licensees who use uranium and thorium in the form of ore (considered by definition to be source material in its entirety) will actually see allowable possession limits significantly increase under the final rule because they only need to account for the mass of the uranium and thorium itself rather than the ore mass." The relevant amount of source material is the ore mass received by MA in Casper.*

The statement that the "relevant amount of source material is the ore mass received" is not consistent with the regulations in 10 CFR Part 40. The regulations in 10 CFR 40.13(b) contain an exemption from licensing requirements for unrefined or unprocessed ore. There are no NRC limits on the amount of unrefined and unprocessed ore that a person can possess, receive, use, or transfer.

*If MA received 100 tons of uranium ore (or even a portion of that amount) prior to August 27, 2013, they would have far exceeded the amount of source material allowed to be possessed at any one time and the amount allowed in any one calendar year under a general license.*

This interpretation of the regulations is inaccurate. The regulations in 10 CFR 40.13(b) contain an exemption from licensing requirements for unrefined or unprocessed ore. The general license limits in 10 CFR 40.22 do not apply to unrefined and unprocessed uranium ore.

*In the MA November 19, 2013, letter to the NRC (ML13326A858), MA states that their ablation processing in Casper, Wyoming, would fall under a general source material license and not be subject to a specific source material license. The MA claims this is because MA did not generate source material exceeding 150 pounds in one calendar year. They reference the May 29, 2013, NRC source material Final Rule. According to 10 CFR 40.22, MA would have been allowed to possess 15.4 pounds of uranium at any one time and receive up to 154 pounds of uranium or thorium in the calendar year ending August 27, 2013. However, MA only mentions the material that they generated, not the source material ore they received. Is the amount of source material ore important for determining compliance with the general license limits in 10 CFR 40.22?*

MA's statements in its November 19, 2013, letter are consistent with the staff's interpretation of the regulations in 10 CFR 40.22. The general license limits in 10 CFR 40.22 do not apply to the amount of uranium ore possessed.

*Is the amount of source material ore that was received prior to August 27, 2013, relevant in determining whether or not a specific source material license is required?*

Possession of unrefined and unprocessed uranium ore is exempt from NRC licensing requirements. Therefore, MA's possession of uranium ore in relation to the August 27, 2013, date is not relevant in determining whether or not a specific source material license is required.

*If 100 tons of source material uranium ore was received after August 27, 2013, and the percentage of uranium was the minimum of .05%, then the mass of uranium in the ore would be 100 pounds. According to the new provisions of 10 CFR 40.22, under a general license MA would not be allowed to possess more than 3.3 pounds of uranium at any one time and not more than a total of 15.4 pounds in any one year if they received the material after August 27, 2013.*

Neither MA's date of receipt of the unprocessed or unrefined uranium ore nor the amount of unprocessed or unrefined uranium ore received is relevant when evaluating compliance with the general license limits in 10 CFR 40.22 as possession of unrefined and unprocessed ore is exempt from NRC licensing requirements. The interpretation of the new general license limits in 10 CFR 40.22 contained in the second sentence is correct; however, these limits do not apply to the possession of unrefined and unprocessed ore.

*Mineral Ablation received and possessed 100 tons of source material ore in Casper, Wyoming. It appears that the amount of source material ore or the amount of uranium contained in that ore exceeded the amount allowed under a general license pursuant to 10 CFR 40.22.*

As discussed in 10 CFR 40.13, possession of unrefined and unprocessed ore is exempt from licensing requirements. Therefore, the amount of uranium ore possessed by MA is not subject to the general license possession limits identified in 10 CFR 40.22.

*The Implementation Guidance for 10 CFR Part 40 (page 11, see ADAMS Accession No. ML13051A824) clearly states that under a general license, MA “may not concentrate or extract uranium or thorium in ores if the primary purpose of the process is to concentrate or extract the source material because you would create waste, which is considered 11e.(2) byproduct material and would require a specific license to possess.”*

As a follow up to the December 19, 2013, public meeting with MA, NRC staff visited MA’s facility in Casper, Wyoming in late January 2014. The purpose of the visit was to verify the conditions at MA’s facility and better understand the scope and magnitude of MA’s current operation. During the visit, NRC staff was able to confirm that MA’s current activities are focused on research and development of the ablation technology as it proceeds towards full scale commercialization. At this time, MA’s use of the ablation is limited to development and refinement of the technology. The NRC staff was able to confirm that the amount of post-ablation uranium possessed by MA is within the general license limits in 10 CFR 40.22. To the best of the staff’s knowledge, no post-ablation uranium has been sent off-site for further refinement into yellowcake. Therefore, at this time, staff’s interpretation is that MA’s activities have not resulted in the creation of 11e.(2) byproduct material and no specific license is required for MA’s current activities.

*During the past year the NRC has written to concerned citizens, written to MA and its associated companies (Black Range Minerals Ltd. and Ablation Technologies LLC), discussed the matter internally, and held a public meeting with MA. The available record does not mention, reference, cite, discuss, or acknowledge the existence of the Implementation Guidance for 10 CFR Part 40.*

*The Implementation Guidance for 10 CFR Part 40 states, at page 11:*

*Q7. Are there any restrictions on processing or using source material under the 10 CFR 40.22 general license?*

*A7. As long as you meet and continue to meet the conditions for possession of source material as stated in 10 CFR 40.22(a), there are only a few restrictions on how you may process or use the source material: (1) you may not administer the source material (or radiation from it) either externally or internally to human beings; (2) you may not concentrate or extract uranium or thorium in ores if the primary purpose of the process is to concentrate or extract the source material because you would create waste, which is considered 11e.(2) byproduct material and would require a specific license to possess; and (3) . . . .*

While referencing or citing guidance may be helpful, the NRC staff bases its compliance decisions based on the language contained in the regulations. The language cited in the guidance is similar to the definition used in 10 CFR Part 40 for byproduct material. Based on NRC staff’s observations during its January 2014 visit to the MA facility in Casper, the NRC staff has determined that MA’s current activities are related to research and development of the

ablation technology. NRC staff's position is that MA's primary current use of the technology is to aid in its research and development activities, not extraction or concentration of uranium or thorium for its source material content. Therefore, the NRC staff's position is that MA's current activities have not generated 11e.(2) byproduct material.

*MA has made clear that the sole purpose of processing uranium ore in Casper, Wyoming, is the concentration and extraction of source material.*

The NRC staff has reviewed the information available on BRM's public webpage. NRC staff observes that in many cases, this information appears to be more promotional in nature and may be intended to generate investor interest in commercialization of the ablation technology. While the NRC staff has not identified any factually incorrect statements, the information available may not be a completely accurate representation of MA's or BRM's current activities. During the NRC staff's January 2014 visit, it was evident to the staff that MA's current activities are focused on research and development of the ablation technology. The NRC staff's finding is based on the limited and intermittent use of the ablation technology on small quantities of uranium as well as other ores.

*No matter when MA received and processed uranium ore and no matter how much uranium ore was received and processed, and no matter how much uranium was removed during that processing, MA could not have done this under a general license. That is because the MA was using to Ablation process for the sole purpose of extracting and concentrating the uranium from the source material ore.*

NRC staff's interpretation is that MA's current activities do not require an NRC specific license based on the limited and intermittent use of the ablation technology on small quantities of uranium ore and the intent behind the use of the technology. Additionally, to the best of the NRC staff's knowledge, no post-ablation uranium has been sent to a conventional uranium mill. NRC staff's position is that MA's current activities are focused on research and development of the ablation technology for potential commercial application to uranium ore, not extraction and concentration for its source material content. Therefore, the NRC staff's position is that MA's current activities are subject to the general license provisions in 10 CFR 40.22.

*The Implementation Guidance for 10 CFR Part 40 states that the waste created from the processing of uranium ore if the primary purpose is to concentrate or extract the source material (i.e., uranium) would be defined as 11e.(2) byproduct material. Such extraction or concentration is called uranium recovery and is regulated under Environmental Protection Agency (EPA) and NRC regulations applicable to various types of uranium milling processes. This definition is also stated in the Atomic Energy Act of 1954, as amended, and the definitions in 10 CFR Part 40.*

The use of ablation technology on uranium ore was not considered when the AEA or the regulations in 10 CFR Part 40 were written. Based on MA's limited and intermittent use of ablation on uranium ore, the NRC staff does not consider MA's current activities to be uranium milling, i.e., the processing of uranium ore for its source material content. The NRC staff's position is that MA's current activities are subject to the general license provisions in 10 CFR 40.22. The NRC staff is at the beginning of its decision making process to determine how the commercial use of the ablation technology on uranium ore will be addressed within the existing regulatory framework.

*According to MA, a slurry is pumped through injection nozzles. This creates a high energy impact zone that scours the uranium from the host rock matter. This process requires physical changes in the ore, whether underground, or above ground. The Ablation process in Casper would have required the crushing of the uranium ore in order to create a slurry, which is a physical process. It requires the removal of the uranium patina from the sand grains, which is also a physical process. It breaks the bonds between the individual sand grains and the mineralized crust. The process concentrates the uranium fraction and separates it from the other fractions. This mechanical separation changes the physical and chemical properties of the ore.*

The NRC staff's understanding of the ablation technology is generally consistent with the description provided in the previous paragraph. Based on MA's limited and intermittent use of ablation on uranium ore, the NRC staff does not consider MA's current activities to be processing of uranium ore for its source material content. The NRC staff views MA's current activities as focused on research and development of the technology. Therefore, the NRC staff does not consider MA's current activities to be uranium milling nor do they result in generation of 11e.(2) byproduct material. The NRC staff has not made a decision as to how commercial scale use of ablation technology will be addressed within the NRC's regulatory framework.

*Although MA claims that there are no physical changes to the ore during the Ablation process, Ablation requires the physical breakdown of the ore so that it may be slurried and the physical removal of the mineralized crust from the small grains of ore. Whether or not Ablation results in physical changes, Ablation is the processing of uranium ore for the primary purpose of extracting and concentrating the source material content of the ore (i.e., uranium). Therefore, the wastes produced from that processing are 11e.(2) byproduct material and the process is considered uranium milling and is subject to the NRC and EPA regulations promulgated under the Uranium Mill Tailings Radiation Control Act of 1978.*

When considering the use of ablation technology on uranium ore, it is important to distinguish MA's current activities, which are focused on research and development of the ablation technology, and potential commercial scale use of the ablation technology. The NRC staff views MA's current activities as focused on research and development of the technology and not extracting and concentrating source material from ore processed for its source material content. Therefore, the NRC staff does not consider MA's current activities to be uranium milling nor do they result in generation of 11e.(2) byproduct material. The NRC staff has not made a decision as to how commercial scale use of ablation technology will be addressed within the existing regulatory framework.

*How does the use of the ablation technology fit within the current regulatory framework? What input will NRC consider when making a decision?*

The use of ablation technology on uranium ore was not considered during the development of the 10 CFR Part 40 regulations. It is possible for development of a new technology to create situations that were not envisioned when the regulations were written. One previous example in the uranium recovery industry was the development of the in-situ recovery (ISR) technology. The NRC staff has reviewed MA's current activities. The NRC staff's position is that MA's current activities are focused on research and development of the ablation technology and that

the general license provisions in 10 CFR 40.22 apply. The NRC staff is at the beginning of its process to determine how full scale use of the ablation technology on uranium ore will be handled within the existing regulatory framework. The NRC staff will base its decision on both safety and legal aspects of the technology. When making its decision, the NRC staff will consider information from a variety of sources, including MA and members of the public. Considering information from a variety of sources, including companies that may be regulated by the NRC, is an important part of the NRC's decision making process.

*What about the disposition of the waste from the processing of uranium ore primarily for its source material content in Casper? The NRC regulation and guidance define that waste as 11e.(2) byproduct material.*

The NRC staff's position is that MA's current activities involve research and development to refine the ablation technology for commercialization. Based on MA's limited and intermittent use of ablation on uranium ore, the NRC staff does not consider MA's current activities to be processing uranium ore for its source material content. Therefore, MA has not created 11e.(2) byproduct material as a result of its current activities. As MA's current possession and use of source material fall within the general license limits identified in 10 CFR 40.22, no specific license is required for permanent disposal of the post-ablation uranium.

During the January 2014, site visit, the NRC staff was told that the material sent to MA for testing of the ablation technology was being returned to the sender to demonstrate ablation's feasibility. Therefore, the material is not being disposed of by MA.

*How much waste was produced, where was the material stored, and how the waste will be disposed ?*

As MA's current possession and use of source material fall within the general license limits identified in 10 CFR 40.22, no specific license is required for permanent disposal. As MA's current activities are subject to the general license requirements, there are no NRC requirements to identify the amount of waste produced, location or material storage, or disposal of the waste. During the January 2014, site visit, the NRC staff was told that the material sent to MA for testing of the ablation technology was being returned to the sender to demonstrate ablation's feasibility. Therefore, the material is not being disposed of by MA.

*If any of the source material produced by MA in Casper was transferred to an entity generally licensed (excepting labs for analysis of the source material), MA would have needed a specific license for the initial transfer.*

The NRC staff has reviewed records related to MA's use of the ablation technology on uranium ore. These records indicate that MA's first use of the technology occurred in either December 2011, or January 2012. As discussed in 10 CFR 40.22(e), initial distribution of source material under a general license before August 27, 2013, may continue for 1 year beyond that date without specific authorization.