



Case Study: Licensing High Pressure Slurry Ablation

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DISA'S PROPOSED ACTION



Remediation of waste piles and contaminated materials at abandoned mines and other sites

Over 15,000 abandoned uranium mines (or waste piles) in the Western United States – many near tribal locations

Approximately 1 in 5 people in the West live within 50 miles from an abandoned uranium mine

Most of these waste piles:

Created over 4 decades ago

Sit on the surface where uranium has oxidized

Limit use of the land

May cause dose and contamination issues

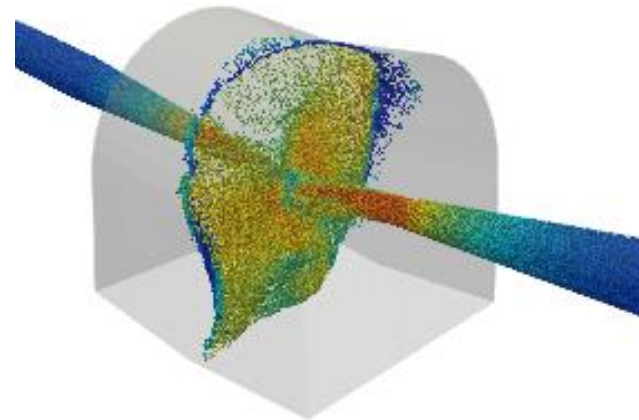
Commission should utilize 10 CFR 40 source material process to license DISA's proposed remediation technology

HPSA OVERVIEW

A New Remediation Technology

High-Pressure Slurry Ablation (HPSA)

- ▶ Pre-conditioned Slurry
- ▶ Unique Application of Energy
- ▶ Mechanical Process
- ▶ Particle-Particle Collisions
- ▶ Physical Separation
- ▶ Modular Unit



Inter-granular fracture
Phase boundary fracture
Grain-boundary fracture



Preferential fracture
Selective breakage



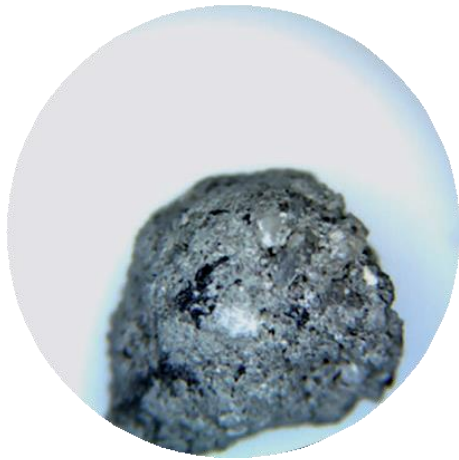
Massive fracture
Random fracture



Abrasion
Attrition
Chipping

THE HPSA SOLUTION

Novel system that reduces energy requirements and neutralizes waste that can be applied to multiple verticals



Sand grain is heavily coated with constituents of concern



Particle-particle collisions allow for efficient separation of targeted constituents



Coating is completely removed yet the clean sand grain remains intact

Reduces overall project costs by up to 50%

Reduces energy needs by up to 40%

Neutralizes waste by up to 100%

REMEDIATION RESULTS



Application of HPSA to the waste rock piles results in two streams of materials:

- **Clean Coarse Fraction** – Post HPSA Treatment
 - Remains onsite and used for site reclamation (reduces transit cost and risk)
- **Concentrated Mineral Fraction**
 - Vanadium
 - Source Material (Uranium or Thorium)
 - Other constituents of concern (e.g., RCRA metals)

Concentrated Mineral Fraction is transported offsite (client dependent)

- Offsite Treatment (alternative feed) – typical commercial client
- Disposal as low-level waste – government clients

NAVAJO NATION TREATABILITY STUDY



QV-M-30-SY		
Parameter	Uranium [mg/kg]	Ra 226 [pCi/g]
Head	230	91.9
Plus 270 Mesh	10.3	5.7
Minus 270 Mesh	640	328
% Reduction Total	95.5%	93.8%
% Recovery Total	95.1%	94.7%
% Mass to Concentrate Fraction	23.8%	

CR-H-30-SY		
Parameter	Uranium [mg/kg]	Ra 226 [pCi/g]
Head	940	228
Plus 270 Mesh	17.7	18.3
Minus 270 Mesh	3320	1010
% Reduction Total	98.1%	92.0%
% Recovery Total	98.3%	94.4%
% Mass to Concentrate Fraction	23.5%	

Note: Data was obtained from Disa's XRF and is not derived from any of the data sponsored by the U.S. EPA Treatability Study on High-Pressure Slurry Ablation.

LICENSING PROCESS SUMMARY



- Submitted application for radioactive materials license to Colorado Department of Public Health and Environment (CDPHE) – 7/30/2021
- Requests for Information Received – 12/8/2021
- RFI Response Submitted – 12/20/2021
- Attempted to use Perma-Fix to conduct live test
- CDPHE Uranium Milling Decision – 2/7/2022

LICENSING PROCESS SUMMARY



- Disa Holds NRC Public Meeting – May 2022

- Disa submits application to NRC – August 2022

- NRC staff rejects application - uranium milling – November 2022

- Submitted appeal letter to Commission – December 2022

- NRC staff preparing vote notation paper – Due June 16, 2023

- Disa prepared to resubmit license application for radioactive materials license

AEA, Section 11

e. The term "byproduct material" means, (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content

Regarding 11e.(2) byproduct material, AEA, Section 84 states:

The Commission deems appropriate to protect the public health and safety and the environment from radiological and nonradiological hazards associated with the processing and with the possession and transfer of such material taking into account the risk to the public health, safety, and the environment, with due consideration of the economic costs and such other factors as the Commission determines to be appropriate.

CDPHE REVIEW AND DECISION



- Application submitted to CDPHE on July 30, 2021
- RAls received on December 8, 2021, and response submitted on December 20, 2021
- Attempted to use Perma-Fix to conduct a test at a Colorado abandoned uranium mine site – reciprocity application submitted January 2022
- CDPHE issues uranium milling decision on February 7, 2022

6 CCR 1007-1, Part 18, Section 18.1.1:

Regulations in this part establish criteria, terms, and conditions upon which CDPHE issues licenses to regulate source and byproduct material, to operate processing facilities, and dispose of byproduct materials.

CDPHE presented criteria for determining whether HPSA is milling:

- Are the proposed activities described within the application consistent with the operation of a uranium processing facility?
- Does the use of HPSA technology meet the definition of uranium milling?
- Does the High-Pressure Slurry Ablation (HPSA) mineral separation technology result in the production of byproduct material?
- Does the process extract or concentrate uranium from ore processed primarily for its source material content?

CDPHE RATIONALE (cont'd.)

- Uranium milling” means any activity that results in the production of byproduct material as defined in Part 18.
- Byproduct material definition in 6 CCR 1007-1 Part 18 same as 10 CFR 40, Appendix A
- Regulations (Colorado or USNRC) constitute circular logic. Because byproduct material is based on intent, regulators can define intent and can deem an activity uranium milling without any objective criteria.

- **Does the process extract or concentrate uranium from ore processed primarily for its source material content?**
- 6 CCR 1007-1 Part 1: “Ore” means naturally occurring uranium-bearing, thorium-bearing, or radium-bearing material in its natural form, to be processed for its uranium or thorium content, prior to chemical processing including but not limited to roasting, beneficiating, or refining, and specifically includes material that has been physically processed, such as by crushing, grinding, screening, or sorting.
- Most definitions of ore contain an economic component. CDPHE’s contains an intent component.
- If the project is remediation, is the uranium or thorium being processed for its source material content? CDPHE - yes; Disa - no.

CDPHE RATIONALE (cont'd.)

- **Is the material that Disa wants to process ore?**
- CDPHE says yes; uses words from Disa's application to support this view – waste rock/uneconomical ore.
- Material is not ore, otherwise it would have been processed. It is a waste.
- Waste rock meets RCRA definition of waste – 40 CFR 261.2
 - Waste rock is a discarded material
 - Discarded materials are those that are:
 - abandoned, recycled (certain circumstances), considered inherently waste-like, a military munition

USNRC REVIEW AND DECISION



- Disa holds public meeting – May 2022
- Disa submits source materials license application – August 2022
- USNRC denies acceptance of application - November 2022
- HPSA technology is an activity that produces byproduct material as it:
 - (i) involves the concentration of uranium and/or thorium for the primary purpose of recovering the source material
 - (ii) from ore
 - (iii) produces tailings or waste.
 - (iv) Material is crushed, slurried, and pumped

- Note the circular logic of the uranium milling-byproduct material definitions
- USNRC relies on definition of ore in RIS 2000-23:
Ore is a natural or native matter that may be mined and treated for the extraction of any of its constituents or any other matter from which source material is extracted in a licensed uranium or thorium mill.
- Waste rock is not ore – it's waste
Ore is not created until Disa treats the waste rock
Material may be disposed or recycled depending upon client
- **Is remediation processing uranium or thorium for its source material content?**


MISSING THE MARK

- USNRC and CDPHE miss the mark on waste minimization.
- Waste minimization is a pillar of environmental management – reduce, reuse, recycle
- Waste minimization:
 - RCRA mandate for large quantity generators
 - Preserves resources
 - Allows uranium recovery facilities to operation more efficiently
- Protecting human health and the environment is a direct result of waste minimization
- Approximately 100 million tons of waste rock at old mines

MISSING THE MARK


- Purpose of UMTRCA – Refer to AEA Section 84
- HPSA produces a clean coarse fraction that does not result in a radiological or nonradiological hazard
- Consequently, clean coarse fraction does not meet the threshold for being regulated as uranium milling

Sidestream recovery carveout

 Created by International Uranium (USA) Corporation (IUSA) Decision, ASLBP No. 98-748-03-MLA:

“If, on the other hand, the material were processed primarily to remove some other substances (vanadium, titanium, coal, etc.) and the extraction of uranium was incidental, then the processing would not fall within the statutory test and it would not be byproduct material within the meaning of the Atomic Energy Act.”

 Rare earth processors, crush, grind, and leach ore; ASLBP carved out rare earths from byproduct material regulations

 HPSA - no chemicals, physical processes, leaves behind safer material. Completely analogous to water treatment plants that concentrate uranium.

CURRENT STATUS



- Disa appealed the USNRC staff's decision on December 20, 2022
- Staff Requirements Memorandum (SRM)-M230126 instructed staff to develop a notation vote paper to evaluating the advantages and disadvantages of different options for the licensing of emerging technologies used for remediation of mine waste.

COMMISSION STATEMENTS



Commissioner Baran to Senate EPW Committee – 04/19/2023

We need to regulate remediation technologies in a way that makes sense. As a matter of policy, I think we want to incentivize the remediation, the cleanup of mine waste. We obviously need to comply with the Atomic Energy Act. That is kind of the issue with these definitions.

Commissioner Caputo to Senate EPW Committee – 04/19/2023

It is difficult under the initial legal review by our Office of General Counsel, it is difficult to envision any remediation technology not falling under that interpretation for milling, which would necessitate functionally a milling license for cleanup of each and every uranium remediation site. So I do believe that there is room to look at this and perhaps get a fresher legal interpretation that would enable remediation.

PUBLIC POLICY AND BENEFIT



▶ **Source Materials License Framework most effectively achieves environmental remediation benefits and protection of public health**

▶ **Waste remediation**

- Return mine sites to useable recreational areas
- Reduce radiological signatures to ALARA
- Alternative feed or disposal of concentrated materials addresses long-standing environmental justice concerns

▶ **HPSA is consistent with the purpose of UMTRCA, as stated in IUSA case:**

- Regulate mill tailings at active mill operations and after operations
- Stabilize and control tailings in a safe and environmentally sound manner
- Minimize or eliminate radiation hazards to the public

LICENSING FRAMEWORK

▶ Source materials framework

- Fully protective of human health and the environment
- Simpler approach to byproduct materials license
- Can be coupled with a request to exempt clean coarse fraction from Appendix A requirements

▶ Byproduct materials framework

- Unnecessary considering data and intent of process
- Requires many exemptions and alternative requests
- Provides no commensurate benefit to protect human health and the environment

HPSA IS A SOLUTION



HPSA is a highly effective Remediation SOLUTION:

15,000 waste rock piles sitting at mine sites for decades

Even record high uranium prices did not result in waste rock processing

Contaminated soils and other wastes can be treated using HPSA



Reducing the quantity and hazard of waste is a responsibility of the NRC



Current byproduct material definition introduces ambiguity



Failure to approve HPSA as a source material limits Federal remedial programs



Commission has opportunity to approve an effective remediation technology

WESTERN MINING WASTE

Site Location: Western Colorado



Residing on the surface since late 1970s

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ECONOMIC



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