



# High-Pressure Slurry Ablation Treatability Study Results

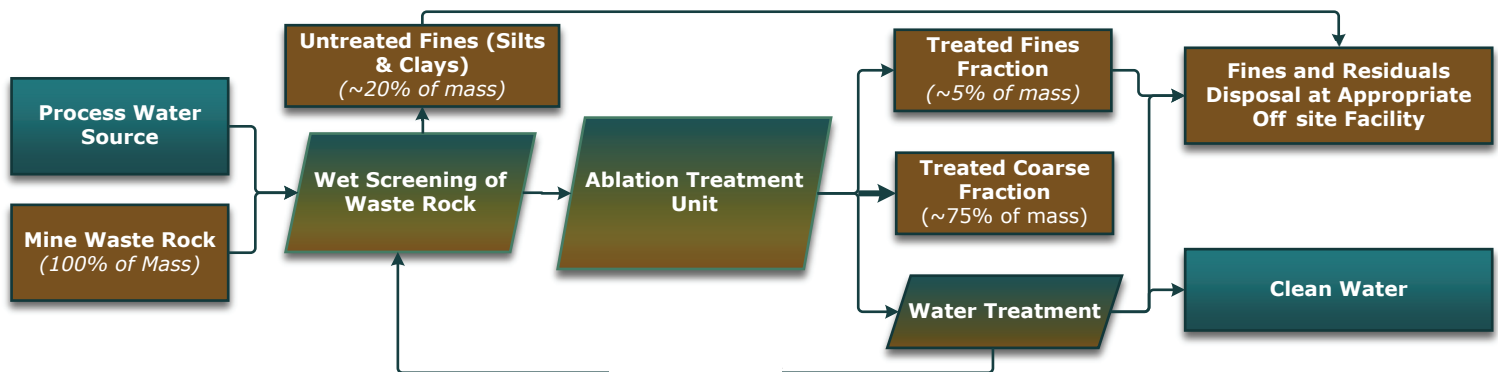
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The U.S. Environmental Protection Agency (USEPA), in consultation with the Navajo Nation EPA (NNEPA), conducted a treatability study of the Disa Technologies, Inc. (DISA) high-pressure slurry ablation (HPSA) mine waste treatment technology in Summer 2022. The treatability study was conducted to assess ability of the technology to remove radium-226 and uranium from waste at the Quivira Church Rock No. 1 Mine (CR-1), the Old Church Rock Mine (OCRM), and the Cove Transfer Station (CTS). A bench scale study was conducted to evaluate initial waste treatability and then field demonstrations were conducted at each mine site. This fact sheet provides an HPSA technology overview and the treatability study objectives, key findings, and comparison to cleanup levels.



## Technology Overview

The HPSA technology involves 1) initial separation of clays and silts too small to effectively treat using HPSA, 2) erosion of minerals from surfaces of soil particles in a wet slurry inside the ablation treatment unit using particle to particle collisions, 3) separating eroded mineral fines from coarse particles using wet screens, 4) treatment and recycling of process water for reuse, and 5) settling and removing water from treated and untreated fines and the clean coarse fraction. After treating all waste, water will be treated before disposal.



## Treatability Study Objectives

The key objectives of the HPSA treatability study were to answer the following questions:

1. Can HPSA technology treat uranium mine waste to achieve concentrations in the treated coarse fraction at or below site-specific cleanup goals?
2. What is the removal efficiency of metals in various geologies, in various uranium mineral types, and at various untreated concentrations?
3. What is the output quantity (mass) ratio of clean material (at or below site-specific cleanup goals) to treatment fines material (above site-specific cleanup goals)?
4. What is the estimated cost per ton for HPSA treatment of mine waste?

## Study Locations and Waste Characteristics

The HPSA treatability study was conducted using waste rock from three uranium mine sites on the Navajo Nation. Uranium and Radium-226 are the contaminants of concern in this study. Low, medium, and high concentration waste locations were identified for study at each mine site. The characteristics of the waste at each site are described below.

- OCRM and Quivira CR-1 mines were selected for intact waste rock piles and CTS for low-level mixed materials.
- Waste rock at OCRM and Quivira CR-1 mines is sandy with small amounts of silt and little clay.

- CTS mixed waste is fine sands with ore chips and large silt and clay fractions.
- Uranium and Ra-226 concentrations are highest at OCRM, moderate at Quivira CR-1 and lowest at CTS.
- Uranium is a surface coating on sand grains in the waste rock from mining and what is treated by the HPSA technology.

## HPSA Treatability Study Activities

- May 10-11, 2022. initial site visits to identify areas at each site with a range of concentrations.
- May/June 2022. Conducted bench-scale study using medium concentration waste from each site.
- August 2022. Conducted field pilot study at three sites using a batch pilot unit.
- August 2022. Held a community and industry demonstration of HPSA technology at CTS site in Cove.
- September to December 2022. Performed post-field studies to determine optimal particle size.
- December 2023. Finalized HPSA Treatability Study Report.



## Key Findings

- HPSA treatment did not achieve site-specific Navajo residential cleanup goals for uranium or for Ra-226 for waste processed at any of the three sites (See chart below).
- HPSA treatment results showed from 61.0 to 94.3 percent reduction in uranium and 51.2 to 91.5 percent reduction Ra-226 concentrations in the treated coarse fraction depending on waste characteristics.
- HPSA treatment produces 46.9 to 76.7 percent treated coarse material and 23.3 to 53.1 percent treated and untreated fines.
- Treated coarse material does not leach metals or radionuclides above water quality standards.
- Treated fines require disposal in a low-level radioactive waste disposal facility or RCRA Subtitle C Landfill.
- HPSA technology requires 13 gallons per minute (GPM) of water for slurring of material in a 50-ton per hour (TPH) treatment system and 25 GPM for a 100-TPH treatment system.
- HPSA technology using a 50-TPH and 100-TPH system operating 2 shift per day, 7 days a week would cost approximately \$39.65 and \$33.61, respectively per ton of waste treated.

## Comparison to Cleanup Levels

Parameter / Metal	Old Church Rock Mine		Quivira Church Rock 1 Mine		Cove Transfer Station	
	Uranium (mg/kg)	Radium-226 (pCi/g)	Uranium (mg/kg)	Radium-226 (pCi/g)	Uranium (mg/kg)	Radium-226 (pCi/g)
Average Starting Concentration	413	117	247	82	31.5	9.8
Average Treated Concentration *	12.1	12.6	11.0	5.9	14.7	4.6
Site Cleanup Level	3.2 Residential	1.6 Background	3.2 Residential	2.0 Background	3.2 Residential	2.4 Background

\* In treated coarse fraction

mg/kg - milligram per kilogram • pCi/g- picocuries per gram

## How Can You Learn More?

The treatability study report can be downloaded at <https://www.epa.gov/navajo-nation-uranium-cleanup/pilot-studies>

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