



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 8**

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Ref: 8EPR-SA

**ACTION MEMORANDUM**

**SUBJECT:** Approval and Funding for a Removal Action at Flat Top Mine Site, Ludlow, Harding County, South Dakota

**FROM:** Shun-Ping Chau, OSC *EPC*  
Emergency Response Unit

**TO:** David Ostrander, Director  
Preparedness, Assessment and Response Program

**THRU:** Laura Williams, Unit Leader *L. Williams*  
Emergency Response

Site ID # SDN000802781

**I. PURPOSE**

The purpose of this memorandum is to request and document approval of the selected Time-Critical Removal Action described herein for the Flat Top Mine Site, located in Ludlow, Harding County, SD. This Removal Action will address the actual or potential threat to human health and the environment posed by uranium, arsenic, vanadium and molybdenum contamination in surface drinking water and in the grazing areas for livestock raised for human consumption, as well as actual and potential human and wildlife exposure to these hazardous substances. No nationally significant or precedent-setting issues are associated with this Removal Action.

**II. SITE CONDITIONS AND BACKGROUND**

Site Name: Flat Top Mine  
Superfund Site ID (SSID): SDN000802781  
NRC Case Number: n/a  
CERCLIS Number: 0802781  
Site Location: Ludlow, Harding County, SD  
Lat/Long: 45.845678, 103.367853  
Potentially Responsible Party (PRP): please refer to enforcement addendum  
NPL Status: not listed



Removal Start Date: July 9, 2012

**A. Site Description**

**1. Removal Site Evaluation:**

The Flat Top Mine Site is northeast of the town of Ludlow, Harding County, South Dakota (Attachment 1). Uranium mining activities occurred around Ludlow in the North Cave Hills, South Cave Hills and Flint Buttes from the late 1950s to 1964 under the General Mining Laws and Public Law 357, which did not require any restoration. The North Cave Hills and South Cave Hills are part of the Custer National Forest and subsequently owned by the United States Forest Service (USFS). The Flat Top Mine is located in the Flint Buttes and is currently on private ranch land.

There have been two previous studies by the South Dakota School of Mines and Technology and the Oglala Lakota College around 2006 and 2007, but no clean-up activities have been done at the Flat Top Mine.

Site assessment work conducted in 2009 and 2011 showed that the highest concentration of contamination occurs at and around an old mine pit that is now the largest pond on the north side of an old highwall, approximately 0.5 miles north of the town of Ludlow. Uranium was detected in soil sediments with concentrations up to 770 parts per million (ppm) and in surface water with concentrations up to 558 micrograms per liter ( $\mu\text{g/L}$ ). EPA sets the safe drinking water standard for humans at 30  $\mu\text{g/L}$ , and guidelines from several agricultural extension offices recommend a standard of 200  $\mu\text{g/L}$  for livestock (Attachment 4).

Other elements of concern with elevated levels in the surface water were arsenic with concentrations ranging from 457 to 536  $\mu\text{g/L}$ , vanadium with concentrations ranging from 73 to 258  $\mu\text{g/L}$ , and molybdenum with concentrations ranging from 894 to 1,730  $\mu\text{g/L}$ . The guidelines for drinking water standard for livestock allows for a maximum arsenic concentration of 200 to 500  $\mu\text{g/L}$ , maximum vanadium concentration of up to 100  $\mu\text{g/L}$ , and maximum molybdenum concentration of 300 to 500  $\mu\text{g/L}$ .

**2. Physical location**

The site is located northeast of the town of Ludlow, in Harding County, South Dakota. Mining activities in the 1950s affected almost 1,000 acres of land in the region. The remnants of Flat Top Mine consist of a water filled pit approximately 1,200 ft by 500 ft. A series of smaller pits, test pits and trenches are currently located within approximately 10,000 acres of undeveloped land used for cattle and sheep ranching but also includes some

residential structures.

During periods of high rainfall, water from the largest pit has been known to overflow and reach areas at lower elevations. Over time, this could potentially spread the contamination over a wider area.

### **3. Site characteristics**

The 153 (year 2000 estimate based on zip code) residents in Ludlow obtain their drinking water from wells. In 2009, samples of well water were obtained from the school house/community center and two residences. The samples showed that concentrations of all metal contaminants were below drinking water standards for both humans and livestock. There was, however, a potential risk of recharge from surface water contaminating the groundwater.

According to a study, "*Human Health and Ecological Risk Assessment - Riley Pass Uranium Mines, South Dakota*," conducted by a private contractor for the USFS, a rancher on average spends approximately two hours outside and could potentially be exposed to these metal contaminants by inhalation and ingestion. Arsenic is known to be a human carcinogen. Uranium is known to be a toxin to the kidney; long-term exposure to radiation could result in an increase in cancer risk.

The risk assessment also identified the consumption of animal products with elevated uranium, arsenic and other heavy metals as another potential risk to humans.

High levels of molybdenum consumption (20 to 100 milligrams per kilogram of body weight) in cattle can cause scouring and harsh coats. It has also been stated by the United States Department of Agriculture, that even low levels of molybdenum can have an adverse effect on cattle fertility.

Vanadium is not considered a human carcinogen. At extremely high levels, however, it can cause adverse health effects in humans and livestock.

### **4. Release or threatened release into the environment of a hazardous substance, pollutant or contaminant:**

Uranium, arsenic, vanadium and molybdenum, defined by CERCLA Section 101(14) as hazardous substances, are naturally occurring in the Flint Buttes area. Previous mining activities removed the vegetation and top soil cover in certain areas and left large piles of waste materials and open pits that collect surface water. Many of the waste material piles have been covered with vegetation, but humans, livestock and wild animals are exposed to higher than background levels of these hazardous substances in water which collects in

open pits.

**5. NPL status**

The site is not on the NPL, nor is it currently proposed for inclusion on the NPL.

**6. Maps, pictures, & other graphic representations**

Location maps of the Flat Top Mine Site are included as Attachment 1.

**B. Other Action to Date**

**1. Previous Actions**

There have been no previous CERCLA Removal Actions at the site.

**2. Removal Actions**

Water treatment methods and the corresponding levels of effectiveness are currently being considered.

**C. State and Local Authorities' Roles**

EPA has coordinated with the State in developing the ARARs. State and local authorities will be kept updated of removal activities.

**III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES**

The Removal Action will address the discovery of a release or substantial threat of release of hazardous substances at the site. The conditions at the site present a threat to public health and the environment and meet the criteria for initiating a Removal Action under 40 CFR §300.415(b)(2) of the National Contingency Plan (NCP).

Uranium in soil and uranium and arsenic in surface water pose a potential health risk to humans, livestock and wildlife. Molybdenum and vanadium, in surface water consumed by livestock at the concentration found at the largest pond at the site, can have adverse health effects on livestock.

Although all factors were considered, the following factors from Section 300.415(b)(2) of the NCP form the basis for EPA's determination of the threat present and the appropriate action to be taken.

- Actual or potential exposure to nearby human populations, animals or the food chain

from hazardous substances or pollutants or contaminants [300.415(b)(2)(i)].

- Actual or potential contamination of drinking water supplies or sensitive ecosystems [300.415(b)(2)(ii)].
- High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate [300.415(b)(2)(iv)]. Elevated levels of uranium on the surface are subject to the elements and may migrate.
- Weather conditions that may cause hazardous substances or pollutants to migrate or be released [300.415(b)(2)(v)].

#### IV. PROPOSED ACTIONS AND ESTIMATED COSTS

A separate addendum will provide a confidential summary of current and potential future enforcement actions.

##### A. Proposed Actions

###### 1. Proposed action description

This Removal Action will eliminate the most significant exposures of uranium, arsenic, vanadium and molybdenum to humans, livestock and wildlife. Water from the old mine pit, now the largest pond north of the old highwall (also with the highest concentration of contaminants within the site), will be treated using resin exchange to meet livestock drinking water standards for arsenic, molybdenum, vanadium and uranium, established by various state agricultural agencies and university agricultural extensions. (Appendix 4) Treated water will meet the standards as stated in Section A 1. Removal Site Evaluation, and will be used for livestock drinking water and/or to irrigate ranch land.

While the contaminated water is being pumped out and treated, rock debris around the pit will be returned to the pit. The pit will be filled in and covered with soils native to the area and suitable to support the growth of local vegetation, thereby minimizing the threat from future migration of contaminated soils.

One or two wells will be drilled at appropriate locations to replace the pond as the source of drinking water for livestock and wildlife. In 2009, samples of well water were obtained from the school house/community center and two residences. The samples showed that concentrations of all metal contaminants were below drinking water standards for both humans and livestock.

Proper water treatment, backfilling, lining and/or capping using low

permeability soil materials, and contouring the old mine pit will minimize human, livestock and wildlife exposure to uranium, arsenic, molybdenum and vanadium.

Livestock grazing is the current and foreseeable future land use. Post removal site control is not necessary.

## 2. Contribution to remedial performance

It is anticipated that the Removal Action will be the final response for this site.

## 3. Engineering Evaluation/Cost Analysis (EE/CA)

EPA has determined that a time-critical removal is warranted and, therefore, an EE/CA is not appropriate for this site.

## 4. Applicable or relevant and appropriate requirements (ARARs)

Removal Actions conducted under CERCLA are required to attain ARARs to the extent practicable. In determining whether compliance with ARARs is practicable, EPA may consider appropriate factors including the urgency of the situation and the scope of the Removal Action to be conducted. A table containing site-specific ARARs and To Be Considered (TBC) material is provided as Appendix 2 to this Action Memorandum.

## 5. Project Schedule

Site assessment was completed in December 2010. Removal Action is expected to start the week of July 9, 2012. Barring any unexpected circumstances and excluding the time for vegetation to become re-established, the duration of this Removal Action is estimated to be 8 to 10 weeks.

### B. Estimated Costs\*

Contractor costs (ERRS/START staff, travel, equipment)	<b>\$1,200,000</b>
Other extramural costs (Strike Team, other Fed Agencies)	<b>\$5,000</b>
Contingency costs (20% of subtotal)	<b>\$241,000</b>
<b>Total Removal Project Ceiling</b>	<b>\$1,446,000</b>

\*EPA direct and indirect costs, although cost recoverable, do not count toward the removal ceiling for this Removal Action. Liable parties may be held financially responsible for costs incurred by the EPA as set forth in Section 107 of CERCLA. "

**V. EXPECTED CHANGE IN THE SITUATION SHOULD ACTIONS BE DELAYED OR NOT TAKEN**

A delay in action or no action at this site would increase the actual or potential threats to public health and/or the environment.

**VI. OUTSTANDING POLICY ISSUES**

None identified at this time.

**VII. ENFORCEMENT**

A separate addendum will provide a confidential summary of current and potential future enforcement actions.

**VII. RECOMMENDATION**

This decision document represents the selected Time-Critical Removal Action for the Flat Top Mine Site in Harding County, South Dakota, developed in accordance with CERCLA as amended, and not inconsistent with the National Contingency Plan. This decision is based on the Administrative Record for the site.

Conditions at the site meet the NCP section 300.415(b) criteria for a Removal Action and I recommend your approval of the proposed Removal Actions. The total project ceiling, if approved, will be \$1,446,000, of which \$631,978 will be funded from a special account and \$814,022 from the Regional removal allowance.

Approve:

  
\_\_\_\_\_  
David A. Ostrander, Director  
Preparedness, Assessment and  
Response Program

  
\_\_\_\_\_  
Date

Disapprove:

\_\_\_\_\_  
David A. Ostrander, Director  
Preparedness, Assessment and  
Response Program

\_\_\_\_\_  
Date

**Attachments:**

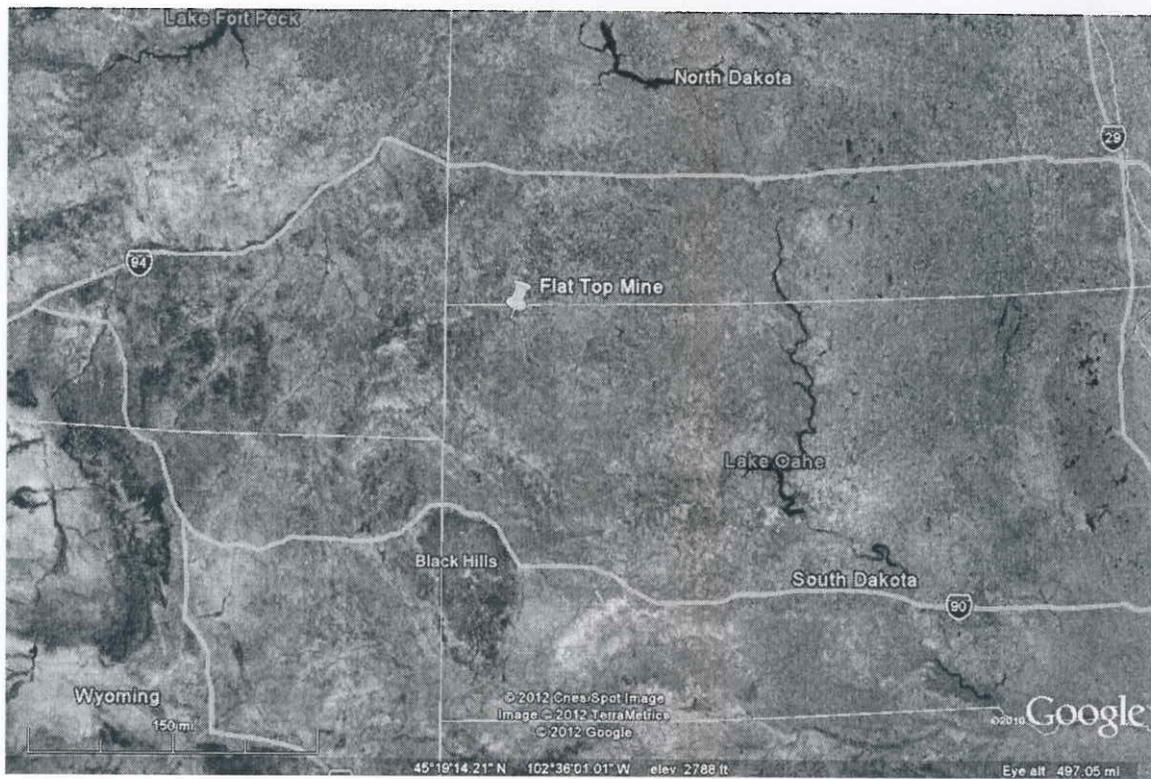
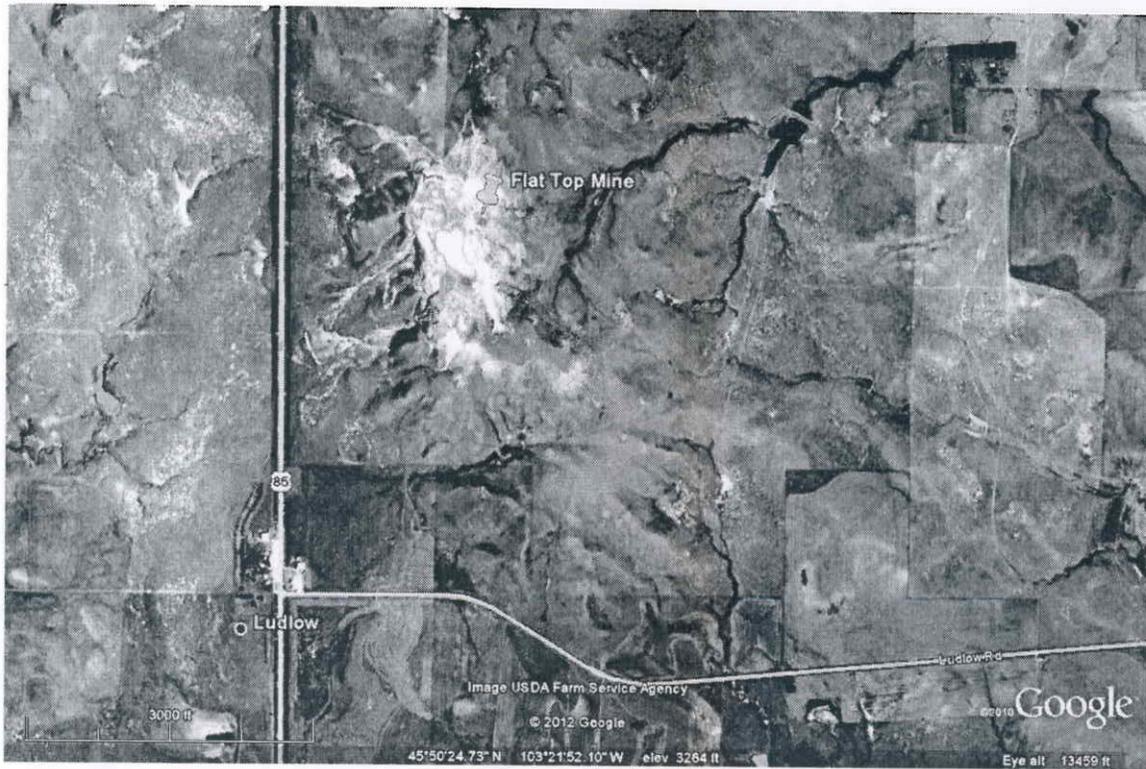
Attachment 1: Maps

Attachment 2: Applicable or Relevant and Appropriate Requirements (ARARs)

Attachment 3: Enforcement Addendum

Attachment 4: Livestock Drinking Water Quality Guidelines - To Be Considered (TBC) Material

Attachment 1  
Maps





Attachment 2

Applicable or Relevant and Appropriate Requirements (ARARS)  
 Flat Top Mine, Ludlow, Harding County, South Dakota

<b>Statutory and Regulatory Citation</b>	<b>Description</b>	<b>Comment</b>
Chapter 74:29:07 MINIMUM RECLAMATION STANDARDS  74:29:07:03. Grading and backfilling -- Necessity.	Grading, backfilling, and other topographic reconstruction methods must be included in the reclamation plan to achieve visually and functionally compatible contours.	The filling of the pit with waste rock, covering with clean soil and revegetating is reclaiming this former mining site, so these reclamation standards are relevant and appropriate requirements for this portion of the removal action.
Chapter 74:29:07 MINIMUM RECLAMATION STANDARDS  74:29:07:04. Grading and backfilling -- Criteria.	. The following general criteria apply to all grading, backfilling, or other topographic reconstruction methods: (1) All reclaimed slopes and slope combinations must meet the following requirements: (a) Be visually and functionally compatible with the configuration of the surrounding area; (b) Be suitable for the postmining land use; (c) Be structurally stable; and (d) For fill slopes or other slopes composed of unconsolidated material, not exceed the angle of repose; (2) All grading, backfilling, and topographic reconstruction must control erosion and sedimentation, protect areas outside the affected land from slides or other damage, and minimize the need for long-term maintenance. Erosion control measures must be implemented during all	The filling of the pit with waste rock, covering with clean soil and revegetating is reclaiming this former mining site, so these reclamation standards are relevant and appropriate requirements for this portion of the removal action.

<p>Chapter 74:29:07 MINIMUM RECLAMATION STANDARDS</p>	<p>Revegetation must meet the following general requirements:  (1) Vegetative species and composition must be</p>	<p>The filling of the pit with waste rock, covering with clean soil and revegetating is reclaiming this former mining site, so these reclamation standards are relevant and appropriate</p>
	<p>phases of construction, operation, reclamation, and closure. Detailed plans indicating dimensions, location, spacing, and design of erosion control techniques are required;</p> <p>(3) All grading, backfilling, and topographic reconstruction must be completed as soon as feasible after mining ceases. The operator shall establish reasonable timetables consistent with good mining and reclamation practices;</p> <p>(4) Depressions for the accumulation of water are not allowed unless they are consistent with the approved postmining land use;</p> <p>(5) Original drainage must be preserved as much as possible. Alternative drainage may be approved by the board if it is functionally compatible with and complements the prevailing hydrologic balance of the surrounding area;</p> <p>(6) When highwall reduction or elimination is not proposed, the applicant must provide justification demonstrating that such reduction or elimination is impossible, impractical, or aesthetically undesirable. If they are not eliminated, all highwalls must be stabilized; and</p> <p>(7) Landforms created as the result of grading, backfilling, or topographic reconstruction of the affected land must blend in with and complement the visual continuity of the surrounding area. Mitigation techniques such as land shaping, rock sculpting, or visual screening may be used to minimize negative visual impacts.</p>	

74:29:07:06. Revegetation.

appropriate for the postmining land use. The species of vegetation to be used must be described in the reclamation plan, indicating the composition of seed mixtures and plant types and the seeding and planting rates per acre. Vegetative species and composition must be selected in consultation with the local conservation district, the landowner, and the department of game, fish, and parks if wildlife habitat is included as a postmining land use. Introduced, naturalized, or nonnative plant species may be used only if they are suitable for the postmining land use and are approved by the board;

(2) The applicant must develop methods and procedures for revegetation which incorporate reference areas, baseline data comparisons, or other procedures to determine postreclamation revegetation success;

(3) A reference area may serve as a basis for comparatively measuring reclamation success. Reference areas must meet the following requirements:

- (a) Be large enough to make comparisons;
- (b) Be located in areas where they will not be affected by future mining while serving their designated use;
- (c) Be managed in a way that will not cause significant changes in the cover, productivity, species diversity, and composition of the vegetation; and
- (d) Be representative of the postmining land use; and

(4) Seeding and planting must be done in accordance with accepted agricultural practices. Affected lands shall be seeded during the first normal period of favorable planting conditions after final topsoil preparation, unless an alternative plan is approved. Any tills or gullies that would preclude successful establishment of

requirements for this portion of the removal action.

	vegetation or achievement of the postmining land use must be removed or stabilized.	
<p>State Hazardous Waste Management Requirements Land Disposal Requirements</p> <p>SDCL 34A-11 and corresponding rules ARSD § 74:28</p>	<p>LDRs prohibit "placement" of hazardous waste without treatment by a particular technology or to a particular concentration. These restrictions are applicable to waste with the characteristic of toxicity under 40 CFR section 261.24.</p>	<p>The levels of arsenic in the pit water indicates the water may be a characteristic waste. If treated wastewaters from the pit are placed on land, this wastewater must be treated to meet LDRs. In particular, the water must be treated such that it does not exhibit the hazardous characteristic of arsenic. Since water from the pit will be treated to an agricultural standards below 5mg/L this requirement is met.,</p>
<p>South Dakota Ambient Air Quality Standards and Air Quality Episodes</p>	<p>ARSD § 74:36:02:02</p>	<p>South Dakota has adopted the federal standards for particulate (PM 10 and PM 2.5). These standards apply to the entire State of South Dakota, and no person may cause these standards to be exceeded. These standards include normal background levels of air pollutants</p> <p>South Dakota has adopted the federal standards for particulate. Dust mitigation control measures will be implemented during construction activities.</p>

Attachment 4

Livestock Drinking Water Quality Guidelines – Upper Limits

Uranium	Arsenic	Vanadium	Molybdenum	Source
200 ppb	500 ppb	100 ppb	500 ppb	Manitoba Agriculture, Food and Rural Initiatives
	200 ppb	100 ppb		Montana State University Extension Service
	100 ppb	100 ppb		Ohio State University Extension
	200 ppb	100 ppb		Utah State University Cooperative Extension
	1000 ppb		300 ppb	University of Wyoming Department of Veterinary Sciences and Renewable Resources, Wyoming Department of Game & Fish, Wyoming Department of Environmental Quality

