



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8

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Ref: 8EPR-ER

APR 2 2013

ACTION MEMORANDUM AMENDMENT

SUBJECT: Request for a Ceiling Increase for a CERCLA Removal Action at the Flat Top Mine Site, Ludlow, Harding County, South Dakota

FROM: Shun-Ping Chau *SPC*
Federal On-Scene Coordinator

THRU: Laura Williams, Unit Leader *for LW*
Emergency Response Program

David Ostrander, Director *DO*
Emergency Response and Preparedness Program

TO: Martin Hestmark, ARA
Office of Ecosystems Protection and Remediation

Site ID # 08RW

I. PURPOSE

The purpose of this Action Memorandum Amendment is to request and document approval of a ceiling increase for the on-going time-critical removal action described herein for the Flat Top Mine Site (Site), located in Ludlow, Harding County, South Dakota. This Action Memorandum Amendment also provides the rationale for the increased estimated costs for this removal action. The requested ceiling increase places the total estimated costs above the \$2 million limit provided in the National Contingency Plan (NCP) at Section 300.415(b)(5)(i), however EPA will fund this removal action using proceeds from a potentially responsible party (PRP) settlement, thus, the \$2 million limit for funds obligated from the Superfund will not apply to this removal action. To date, EPA has received \$631,978 in settlement proceeds from the PRP, which have been placed in a special account, so, it is estimated only about \$1.9 million of the removal action will be fund financed, which is under the \$2 million limit provided in the NCP.

The proposed removal action is not changed from the original Action Memorandum and includes treating water from the largest mine pit at the Site, returning the treated water to its original use as livestock drinking water and/or pasture irrigation, backfilling and re-vegetating the pit, and drilling wells to replace the livestock water supply.



The budget in the original Action Memorandum did not fully consider all aspects of the work to be conducted such as the costs of sub-contracted technicians to operate the water-treatment equipment, the number of tanks needed for water storage, and disposal of resin cores if they were to become overloaded with radioactive material. The estimated costs also did not take into account the remote location of the Site, the turbidity of the contaminated water, the volume of post-treatment water that must be held and tested before being released, and the rough terrain at the Site which must be graded to accommodate the amount of treated-water. Based on updated and more complete data, the estimated costs for water treatment and testing have increased approximately \$850,000 and the costs for Site construction by about \$250,000.

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, livestock 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):	08RW
CERCLIS Number:	SDN 000802781
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:	October 1, 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 under the jurisdiction of 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 in 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 3).

Present concerns include arsenic found in surface water at levels of 436 to 457 $\mu\text{g/L}$, 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 recommend 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. 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 presently 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. 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 of concern 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 a 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 Actions to Date

1. Previous Actions

There have been no previous actions at the Site.

2. Current Actions

Contaminated water will be treated utilizing high capacity, ion-specific resin that provides selective removal of uranium and other target contaminants. All spent ion resin will be managed such that it does not become loaded with thorium and uranium to the extent of becoming a source material. Two water wells have been drilled in October 2012 to provide alternate source of clean drinking water for livestock.

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 this 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 40 CFR 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.

- (i) *Actual or potential exposure to nearby human populations, animals or the food chain from hazardous substances or pollutants or contaminants;*

According to a human health and ecological risk study conducted by the United States Forest Service at a similar site nearby, a rancher on the average spends approximately two hours outside and could potentially be exposed to uranium and other heavy metals 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 milligram 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.

- (ii) *Actual or potential contamination of drinking water supplies or sensitive ecosystems;*

In addition to livestock, there is evidence that wildlife also use an old mining pit for drinking water, based on tracks and footprints observed during Site visits.

During periods of high rainfall, contaminated water from this old mining pit overflows to other bodies of water at lower elevations.

- (iii) *High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate;*

Elevated levels of uranium on surface soils are subject to the elements and may migrate. During periods of high rainfall, contaminated water from an old mining pit overflows to other bodies of water at lower elevations.

- (iv) Weather conditions that may cause hazardous substances or pollutants to migrate or be released;

During periods of high rainfall, contaminated water from an old mining pit overflows to other bodies of water at lower elevations.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances from this Site may present an imminent and substantial endangerment to public health, or welfare, or the environment.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

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. Original plans did not include replacement of the livestock's contaminated drinking water; however, because the cattle will at some later date enter the market for public consumption, it was decided to expedite the installation of groundwater wells to provide clean water to replace the existing, contaminated sources.

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. Test wells have demonstrated that a sufficient supply of clean groundwater exists for continued ranching operations. Drilling began in October and by year end two wells were completed and in service at appropriate locations to replace the mine pit pond as the source of drinking water for livestock. The property owner will keep his livestock in different pastures and away from the mine pit pond.

Early in 2013, water from the old mine pit, the largest pond north of the old highwall (also with the highest concentration of contaminants within the Site), will be treated using resin exchange for arsenic, molybdenum, vanadium and uranium, established by various state agricultural agencies and university agricultural extensions (Attachment 3). 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 ranch land irrigation.

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.

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 Attachment 2 to this Action Memorandum.

5. Project Schedule

Site assessment was completed in December 2010. The removal action started the week of October 1, 2012.

B. Estimated Costs*

Costs	Original Estimate	Change	Revised Estimate
Contractor	\$1,200,000	\$910,000	\$2,110,000
Other Extramural	\$ 5,000	\$0	\$ 5,000
Contingency	\$ 241,000	\$182,000	\$ 423,000
Total Removal Project Ceiling	\$1,446,000	\$1,092,000	\$2,538,000

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

VI. 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.

VII. OUTSTANDING POLICY ISSUES

None identified at this time.

VIII. ENFORCEMENT

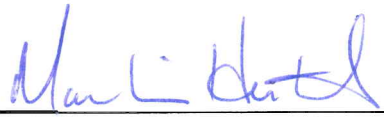
A separate addendum provides a confidential summary of current and potential future enforcement actions.

IX. RECOMMENDATION

This decision document amends 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 is not inconsistent with the NCP. 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 increase of \$1,092,000 from the original project ceiling of \$1,446,000. The total project ceiling, if approved, will be \$2,538,000, of which \$631,978 will be funded from a special account

Approve:



Martin Hestmark, ARA
Office of Ecosystems Protection
and Remediation

4/2/13

Date

Disapprove:

Martin Hestmark, ARA
Office of Ecosystems Protection
and Remediation

Date

Enforcement Addendum

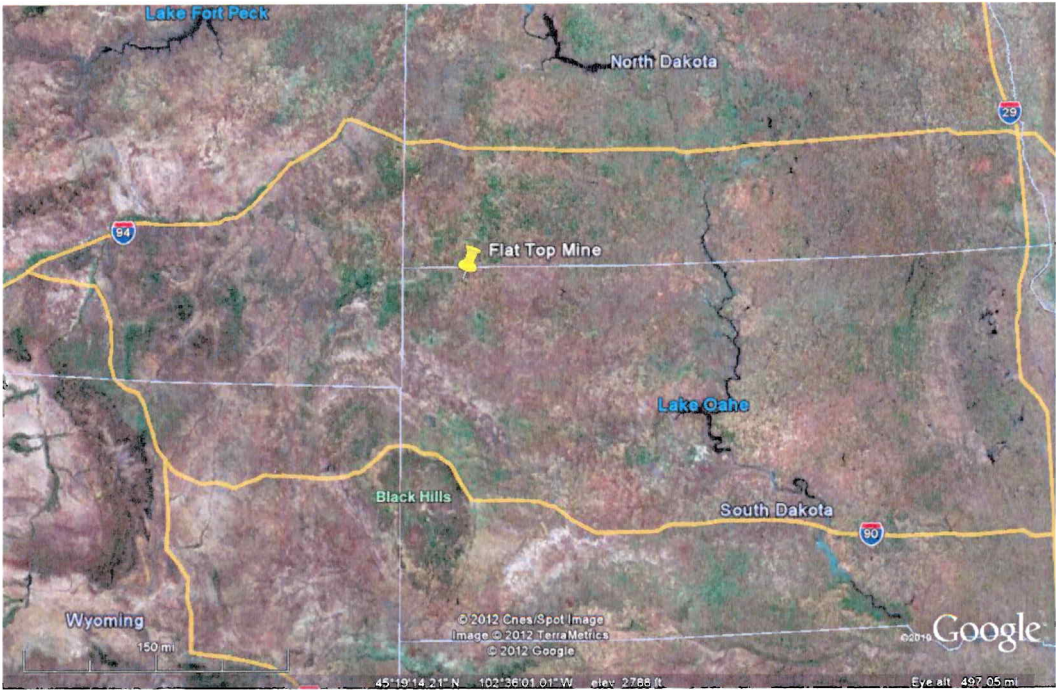
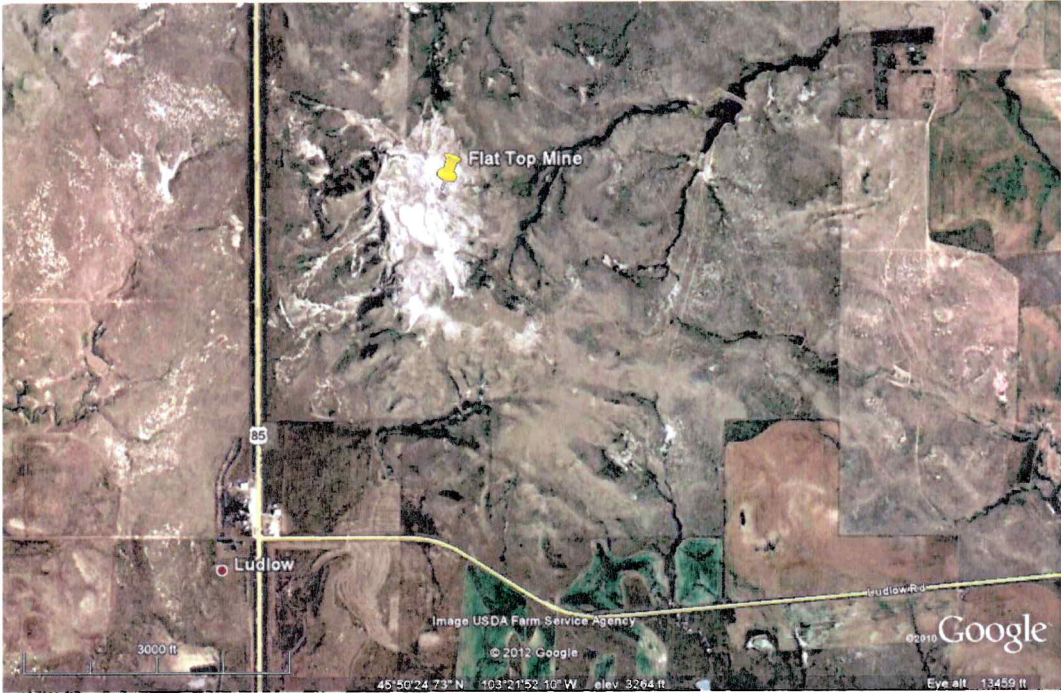
Attachments:

Attachment 1: Maps

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

Attachment 3: Livestock Drinking Water Quality Guidelines - To Be Considered Material

Maps



Attachment 2

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

Statutory and Regulatory Citation	Description	Comment
<p>Chapter 74:29:07 MINIMUM RECLAMATION STANDARDS</p> <p>74:29:07:03. Grading and backfilling -- Necessity.</p>	<p>Grading, backfilling, and other topographic reconstruction methods must be included in the reclamation plan to achieve visually and functionally compatible contours.</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 requirements for this portion of the removal action.</p>
<p>Chapter 74:29:07 MINIMUM RECLAMATION STANDARDS</p> <p>74:29:07:04. Grading and backfilling -- Criteria.</p>	<p>. The following general criteria apply to all grading, backfilling, or other topographic reconstruction methods:</p> <ul style="list-style-type: none"> (1) All reclaimed slopes and slope combinations must meet the following requirements: <ul style="list-style-type: none"> (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 	<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 requirements for this portion of the removal action.</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>	
Chapter 74:29:07 MINIMUM RECLAMATION STANDARDS	<p>Revegetation must meet the following general requirements:</p> <p>(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>74:29:07:06. Revegetation.</p>	<p>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;</p> <p>(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;</p> <p>(3) A reference area may serve as a basis for comparatively measuring reclamation success. Reference areas must meet the following requirements:</p> <ul style="list-style-type: none"> (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 <p>(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 rills or gullies that would preclude successful establishment of</p>	<p>requirements for this portion of the removal action.</p>
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	vegetation or achievement of the postmining land use must be removed or stabilized.	
State Hazardous Waste Management Requirements Land Disposal Requirements SDCL 34A-11 and corresponding rules ARSD § 74:28	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>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>
South Dakota Ambient Air Quality Standards and Air Quality Episodes	ARSD § 74:36:02:02	<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 3

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

