Razzazian, Christopher

From: Hinkle, Vanessa
Sent: Friday, June 21, 2013 10:56 AM
To: Sundblad, Cindy; Hutchinson, Marcella; Russell, Carol; Razzazian, Christopher; Diaz, Angelique
Cc: Bloom, Judy; Jackson, Scott
Subject: final ULP comment letter
Attachments: 20130060.pdf

Here is the final ULP comment letter. Thanks for all your help on this!

Vanessa

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
DENVER, CO 80202-1129
Phone 800-227-8917
http://www.epa.gov/region08

JUN 21 2013

Ref: 8EPR-N

Mr. Ray Plieness
PEIS Document Manager
Office of Legacy Management
U.S. Department of Energy
11025 Dover Street, Suite 1000
Westminster, Colorado 80021

Re: Draft Uranium Leasing Program Programmatic Environmental Impact Statement CEQ #20130060

Dear Mr. Plieness:

The U.S. Environmental Protection Agency (EPA) Region 8 has reviewed the Draft Uranium Leasing Program (ULP) Programmatic Environmental Impact Statement (PEIS) prepared by the U.S. Department of Energy (DOE). Our comments are provided for your consideration pursuant to our responsibilities and authority under Section 102(2)(C) of the National Environmental Policy Act (NEPA), 42 U.S.C. Section 4332(2)(C), and Section 309 of the Clean Air Act, 42 U.S.C. Section 7609.

Project Description

The DOE prepared the Draft PEIS to analyze the reasonably foreseeable potential environmental impacts, including site-specific impacts, and a range of reasonable alternatives for the management of the ULP. DOE's ULP administers 31 tracts of land covering an aggregate of approximately 25,000 acres (10,000 ha) in Mesa, Montrose, and San Miguel Counties in western Colorado for exploration, mine development and operations and reclamation of uranium mines. There are 29 existing lease tracts in the project area; two of the tracts are not currently leased. The following five alternatives are considered in the Draft PEIS:

- Alternative 1 would involve terminating the existing leases and conducting reclamation as needed;
- Alternative 2 would involve terminating the leases and conducting reclamation as needed and then relinquishing all the land to the Bureau of Land Management;
- Alternative 3 would continue with exploration, mine development and operations, and reclamation at the 13 lease tracts for which leases expired prior to July 2007 and terminating the remainder of the leases;

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- Alternative 4, the DOE's preferred alternative, would continue, with some changes, the leases for the next 10 years or another reasonable period, as appropriate; and
- Alternative 5, the no action alternative, would continue the leases exactly as they are written for the remainder of the 10-year period plus the time necessary to complete the PEIS.

The EPA's Comments and Recommendations

The EPA provided scoping comments and we participated as a cooperating agency for this project. The DOE addressed many of our comments in this Draft PEIS resulting in a better explanation of the environmental impacts of the program. Through this process, we have narrowed our recommendations for information that the DOE consider including in the Final PEIS or future project-specific NEPA documents. The following comments and recommendations focus on waste rock piles, human health risk and water impacts.

Waste Rock Piles

Covering the waste rock with an adequate amount of soil is necessary to reduce emissions of radioactive particulates and radon thereby reducing potential for exposure to radiation. Within the PEIS there are inconsistencies in the descriptions of waste rock pile reclamation, making it unclear whether there will be adequate soil cover. Page 4-22 states that during reclamation, waste-rock piles will be covered by a layer of soil to facilitate vegetation growth and page 2-29 states that waste rock would be graded with the slope of the area and then seeded to conform to its surroundings. Also, Table 4.7-7 indicates that some waste-rock piles have been covered with soil, but it is not clear whether there are other waste-rock piles that remain uncovered. We recommend that the Final PEIS clarify that all waste rock will be covered with a protective layer of soil.

We support the mitigation measure in Table 4.6-1 stating that the operator will use modeling and/or monitoring to determine the adequate thickness for surface soil covering waste rock piles, and we recommend that future project-level NEPA documents include the procedures and methods that will be used to determine the minimum cover thickness required to effectively reduce the emissions of radioactive particulates.

Human Health Risk Assessment

COMPLY-R

The DOE used the CAP88-PC model to estimate radiation doses and associated risks for all scenarios considered (e.g., hypothetical small, medium, large and very large mines). For comparison purposes, the COMPLY-R model was used to estimate radiation doses and associated risks for a hypothetical small mine. COMPLY-R is required for determining compliance with the radon National Emission Standard for Hazardous Air Pollutants (NESHAP) of 10 millirem (mrem) per year, found in 40 CFR Part 61 Subpart B. The Draft PEIS does not include results from COMPLY-R for a medium, large, or very large mine and it is unclear how radiation doses will compare to the NESHAP when COMPLY-R, the required computer code, is used for these hypothetical larger mines. We recommend that the Final PEIS provide a table of modeled COMPLY-R results for each hypothetical mine size and compare the results to the NESHAP standard.

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Risk Assessment Scenarios

The Draft PEIS includes an exposure analysis for a mine worker during the operational phase of the mine. It does not include an exposure analysis for a worker performing reclamation in that mine. We recommend that the Final PEIS include an exposure analysis for a worker performing reclamation in the mine or explain why exposures from reclamation in the mine are not included in the risk assessment.

The Draft PEIS does not include an analysis of the risk to a recreationist during the operations phase. There is a potential for recreationists to have greater (short-term) exposure to radiation and radon compared to off-site residents. We recommend that the Final PEIS analyze the risk from the operations phase to a recreationist. As an alternative, the DOE could explain why this receptor was not included in the analysis.

Some of the scenarios analyzed in the risk analysis appear to lack relevant site-specific information. The Draft PEIS assesses the risk assuming resident exposure to one operating mine or a single waste-rock pile. It is not clear whether a resident could be exposed to more than one operating mine and/or waste-rock pile at a time. We recommend that the Final PEIS clarify and update the analysis based on the number of operating mines and waste rock piles a resident may be exposed to. Alternatively, if this information cannot be determined at this time, we recommend that the DOE update the analysis in a future project-level NEPA document.

Radon Risk from Daneros and Whirlwind Mines

Table 4.7-4 states that radon emissions would quickly disperse and that there would be no impact to the general public from the Daneros mine and Table 4.7-5 states that no general public health impacts are predicted from the Whirlwind mine. Although the risk may be very small, stating that the risk is zero is inaccurate. We recommend that the Final PEIS include the dose for the nearest member of the public from Rn-222 from each of these mines, or if a quantitative assessment is not available, we recommend stating that the dose will be limited to below the 40 CFR Part 61 Subpart B regulatory limit of 10mrem/year.

Water Resources

Water Use

The Draft PEIS states that 6.3 million gallons per year of water will be trucked in for use at the mines. The impact of this water use on the local water supply is not provided. Knowing the source of this water and other water demands and trends for different water uses such as irrigation, municipal and domestic use is important for understanding the potential water supply impacts. We recommend that the Final PEIS describe the anticipated water source or sources, and include a water supply analysis for all types of uses in future project-specific NEPA documents.

Surface Water

Water resources in the region affected by this action include surface water in the Upper Dolores, San Miguel and Lower Dolores Rivers. Under all five alternatives, impacts on water quality could occur as a

result of land disturbance and underground mining activities associated with mine development, operations, and reclamation. These impacts would be minimized by the implementation of compliance and mitigation measures and/or best management practices that will be identified in the mine plans. We recommend that the DOE consider requiring the compliance and mitigation measures that are identified in mine plans in future project-specific NEPA and leasing documents.

The Draft PEIS states that the radioactive and chemical constituents of concern are not expected to reach a surface water body near the mining site. We recommend that the Final PEIS explain that this conclusion is based upon new mining activity being restricted within 0.25 miles of perennial streams. We also recommend that the Final PEIS clarify that this mitigation measure applies to springs and other surface water that can be accessed by wildlife and livestock.

Although the DOE is planning to restrict mining activity within ¼ mile of the Dolores River in the future, past mining activities within ¼ mile of the river may have resulted in adverse impacts. Based on the description of the lease tracts in Section 1.2.3, it appears that mining activity may have taken place within ¼ mile of the Dolores River. A description of any known impacts would provide a better understanding of existing conditions. We recommend that the Final PEIS include a description of identified impacts to the Dolores River or its adjacent aquatic resources.

Drinking Water

We appreciate the DOE's efforts to provide information regarding specific mine locations so that we could compare those locations to public drinking water supply sources. We are not currently aware of any public drinking water supplies or source water protection zones that are within the leasing areas. In order to ensure the public is aware of the public drinking water supply sources (e.g., surface water sources including groundwater under the direct influence of surface water sources, and groundwater sources) and to ensure that those sources are protected from potential impacts associated with uranium mining, the EPA recommends that the Final PEIS include a map of the current source water protection areas compared to the lease areas. The source water protection zones are available directly from the Colorado Department of Public Health and Environment Source Water Protection Program Coordinator, John Duggan at (303) 692-3534.

The Draft PEIS states on page 3-73 that groundwater wells located along the pathways of groundwater flow from the lease tracts to the areas of groundwater discharge would have relatively high potential to be affected if groundwater within the lease tracts is adversely affected. The document identifies 15 domestic wells within 1,000 feet of lease tracts that are located along these pathways. It does not explain why potential impacts would be limited to wells with 1,000 feet. We recommend that the DOE consider the hydrogeology in assessing potential impacts to domestic wells and identify in the Final PEIS all domestic wells that could be impacted even if they are greater than 1000 feet from the lease tracts or describe the rationale for limiting the analysis area to 1000 feet.

We recommend that the DOE identify and assure protection of all Underground Sources of Drinking Water (USDWs) in the leasing area in the Final PEIS or future project-specific NEPA documents. Federal Safe Drinking Water Act regulations define a USDW as an aquifer or portion thereof: (a) (1) which supplies any public water system; or (2) which contains a sufficient quantity of ground water to supply a public water system; and (i) currently supplies drinking water for consumption;

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or (ii) contains fewer than 10,000 milligram per liter total dissolved solids and (b) which is not an exempted aquifer (See 40 CFR Section 144.3).

EPA's Rating and Recommendations

Consistent with Section 309 of the CAA, it is the EPA's responsibility to provide an independent review and evaluation of the potential environmental impacts of this project. Based on the procedures the EPA uses to evaluate the adequacy of the information and the potential environmental impacts of the proposed action, the EPA is rating this Draft PEIS as Environmental Concerns - Insufficient Information (EC-2). The "EC" rating indicates that the EPA review has identified environmental impacts that need to be avoided in order to protect the environment. The "2" rating indicates that the EPA review has identified a need for additional information, data, analysis or discussion in the Final EIS in order for the EPA to fully assess environmental impacts from the proposed project. A description of the EPA's rating system is enclosed.

We appreciate the opportunity to comment on these documents, and hope our suggestions for improving them assist you. We would be happy to meet to discuss these comments and our suggested solutions. If you have any questions or would like to discuss our comments, please contact me at (303) 312-6925 or Vanessa Hinkle of my staff at (303) 312-6561.

Sincerely,

Suzanne J. Bohan
Director, NEPA Compliance and Review Program
Office of Ecosystems Protection and Remediation

Enclosure

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Razzazian, Christopher

From: Hinkle, Vanessa
Sent: Wednesday, May 29, 2013 10:49 AM
To: Razzazian, Christopher
Cc: Jackson, Scott
Subject: RE: ULP comment

Chris – I've decided to not include these comments in the letter for two reasons: 1. We have commented on the PEIS before and have not brought these issues up; and 2. They are not priority issues. If there were a more clear indication of an impact that would require diesel particulate filters, we would have a better case for bringing them up in the NEPA context. As for the noise standard exceedance, it is significantly lower than the OSHA level and the DOE has agreed to mitigation. It has been a long time since the NEPA program has brought up a noise issue – and as I understand it, when it was brought up, it involved an airport and mitigation may not have even been available. As I understand it, the NEPA program had a difficult time getting support for the noise comment, even in that case.

Vanessa

From: Razzazian, Christopher
Sent: Tuesday, May 28, 2013 10:33 AM
To: Hinkle, Vanessa
Cc: Jackson, Scott
Subject: RE: ULP comment

Hey,

Saw this after I sent the first email back to you on this. Do you want to discuss still? It's been a little over a month since I reviewed this one so it's not as fresh in my mind.

Let me know, thanks.

Chris

From: Hinkle, Vanessa
Sent: Thursday, May 23, 2013 4:46 PM
To: Razzazian, Christopher
Cc: Jackson, Scott
Subject: RE: ULP comment

Hi Chris – Two more things:

1) Do we really have anything that indicates that if the mitigations are not applied, there will be a significant impact? If we don't have a demonstration that the mitigation is necessary to bring the impacts to below a significant level, do we really have a basis for requiring them in the ROD or lease stipulations?

2) We talked about the noise level previously, but just to recap…Do you know what the basis for the Colorado reg is? It seems rather low, considering that the OSHA PEL is 90 db for an 8 hour TWA. Also, the DOE lists some good mitigation measures, so I think it is covered and I don't think additional comment is necessary.

Thanks,
Vanessa

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From: Hinkle, Vanessa
Sent: Thursday, May 23, 2013 11:10 AM
To: Razzazian, Christopher
Cc: Jackson, Scott
Subject: RE: ULP comment

Hi Chris –

Getting back to your comments on the ULP, do you think the truck engine emissions need to be mitigated and if so, why? Is this something we have brought up to DOE in the past?

Vanessa

From: Razzazian, Christopher
Sent: Wednesday, April 17, 2013 12:42 PM
To: Hinkle, Vanessa
Cc: Diaz, Angelique; Jackson, Scott
Subject: ULP comment

Hi Vanessa, as I said I only have one overarching comment for the ULP, although I could probably give you a lot of little discrete things.

In order for air quality impacts to remain minimal to moderate and temporary in nature it will be necessary for the mitigation listed in Section 4.6 to be included in the ROD, conditions of approval, or as lease stipulations. In addition to the mitigation measures listed we suggest considering the inclusion of diesel particulate filters for diesel driven equipment which can significantly reduce toxic air pollutants from diesel exhaust.

As a side – I notice that they show violations of the Colorado noise limit. It may be good to throw in something about mitigating noise to within the 55 db range for locations that showed impacts above that limit. They include mitigation options that would be able to address this, such as mufflers, noise barriers, etc. (Noise is still in the air program, in case you never hear that☺)

Let me know if you'd like something more detailed. I note that the air emissions mitigation in M-1 of Table 4.6-1 are pretty much going after dust. Where there are measures that would affect combustion sources the language is really just saying that they will comply with current regulatory requirements (which is why I propose another easy control measure with potentially large health impact improvement – the diesel particulate filter).

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Colorado Noise Statute

25-12-103 - Maximum permissible noise levels.

(1) Every activity to which this article is applicable shall be conducted in a manner so that any **noise** produced is not objectionable due to intermittence, beat frequency, or shrillness. Sound levels of **noise** radiating from a property line at a distance of twenty-five feet or more therefrom in excess of the db(A) established for the following time periods and zones shall constitute prima facie evidence that such **noise** is a public nuisance:

Zone	7:00 a.m. to next 7:00 p.m.	7:00 p.m. to next 7:00 a.m.
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

(2) In the hours between 7:00 a.m. and the next 7:00 p.m., the **noise** levels permitted in subsection (1) of this section may be increased by ten db(A) for a period of not to exceed fifteen minutes in any one-hour period.

(3) Periodic, impulsive, or shrill **noises** shall be considered a public nuisance when such **noises** are at a sound level of five db(A) less than those listed in subsection (1) of this section.

(4) This article is not intended to apply to the operation of aircraft or to other activities which are subject to federal law with respect to **noise** control.

(5) Construction projects shall be subject to the maximum permissible **noise** levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of project.

(6) All railroad rights-of-way shall be considered as industrial zones for the purposes of this article, and the operation of trains shall be subject to the maximum permissible **noise** levels specified for such zone.

(7) This article is not applicable to the use of property for purposes of conducting speed or endurance events involving motor or other vehicles, but such exception is effective only during the specific period of time within which such use of the property is authorized by the political subdivision or governmental agency having lawful jurisdiction to authorize such use.

(8) For the purposes of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.

(9) In all sound level measurements, consideration shall be given to the effect of the ambient **noise** level created by the encompassing **noise** of the environment from all sources at the time and place of such sound level measurement.

(10) This article is not applicable to the use of property for the purpose of manufacturing, maintaining, or grooming machine-made snow. This subsection (10) shall not be construed to preempt or limit the authority of any political subdivision having jurisdiction to regulate **noise** abatement.

(11) This article is not applicable to the use of property by this state, any political subdivision of this state, or any other entity not organized for profit, including, but not limited to, nonprofit corporations, or any of their lessees, licensees, or permittees, for the purpose of promoting, producing, or holding cultural, entertainment, athletic, or patriotic events, including, but not limited to, concerts, music festivals, and fireworks displays. This subsection (11) shall not be construed to preempt or limit the authority of any political subdivision having jurisdiction to regulate **noise** abatement. **Source: L. 71:** p. 648, § 1. **C.R.S. 1963:** § 66-35-3. **L. 82:** (10) added, p. 424, § 1, effective March 11. **L. 87:** (11) added, p. 1154, § 1,

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effective May 20.

Am. Jur.2d. See 61A Am. Jur.2d, Pollution Control, § 267.

Residential development of property is not precluded when **noise** emanating onto property exceeds limits set forth in this section. Einarsen v. City of Wheat Ridge, 43 Colo. App. 232, 604 P.2d 691 (1979).

Trier of fact to determine mode to use in measuring noise. Davis v. Izaak Walton League of America, 717 P.2d 984 (Colo. App. 1985).

Applied in City of Lakewood v. DeRoos, 631 P.2d 1140 (Colo. App. 1981).

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Tontechnik-Rechner - sengpielaudio

Deutsche Version

• Decibel Table – SPL – Loudness Comparison Chart •

Table of Sound Levels (dB Scale) and the corresponding Units of Sound Pressure and Sound Intensity (Examples)

To get a feeling for decibels, look at the table below which gives values for the sound pressure levelsof common sounds in our environment. Also shown are the corresponding sound pressures and sound intensities.
From these you can see that the decibel scale gives numbers in a much more manageable range. Sound pressure levels are measured without weighting filters. The values are averaged and can differ about ±10 dB. With sound pressure is always meant the root mean square value (RMS) of the sound pressure, without extra announcement. The amplitude of the sound pressure means the peak value.
Our hearing is a sound pressure receptor, or a sound pressure sensor, because the eardrums (tympanic membranes) are moved by the sound pressure as a sound field size. That is the important effect of the excess sound pressure.
It is not an energy receiver! When listening to music, forget the sound intensity as energy size. The perceived sound consists of periodic acoustic pressure vibrations (sound pressure) which are superimposed on the surrounding static air pressure of 101 325 Pascal (mean atmospheric pressure).
The sound is the change of sound pressure p, which is measured in pascal (Pa) $\equiv 1\ N/m^2 \equiv 1\ J/m^3 \equiv 1\ kg/(m \cdot s^2)$. Usually p is the RMS value.

Table of sound levels L (loudness of noise) with corresponding sound pressure and sound intensity

Sound sources (noise) Examples with distance	Sound pressure Level L_p dB SPL
Jet aircraft, 50 m away	**140**
Threshold of pain	**130**
Threshold of discomfort	**120**
Chainsaw, 1 m distance	**110**
Disco, 1 m from speaker	**100**
Diesel truck, 10 m away	**90**
Kerbside of busy road, 5 m	**80**
Vacuum cleaner, distance 1 m	**70**
Conversational speech, 1 m	**60**
Average home	**50**
Quiet library	**40**
Quiet bedroom at night	**30**
Background in TV studio	**20**
Rustling leaves in the distance	**10**
Hearing threshold	**0**

Sound pressure p N/m² = Pa Sound field quantity	Sound intensity I W/m² Sound energy quantity
200	100
63.2	10
20	1
6.3	0.1
2	0.01
0.63	0.001
0.2	0.0001
0.063	0.00001
0.02	0.000001
0.0063	0.0000001
0.002	0.00000001
0.00063	0.000000001
0.0002	0.0000000001
0.000063	0.00000000001
0.00002	0.000000000001

Sound pressure as Sound field quantity:
The **auditory threshold** is used as the **reference sound pressure** $p_0 = 20\ \mu Pa = 2 \times 10^{-5}$ Pa.
The **threshold of hearing** corresponds to the **sound pressure level** $L_p = 0$ dB at $f = 1$ kHz.

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Sound intensity as Sound energy quantity:
The auditory threshold is calculated as the **reference sound intensity** $I_0 = 10^{-12}$ W/m^2.
The threshold of hearing corresponds also to the **sound intensity level** $L_W = 0$ dB at $f = 1$ kHz.

The sound level depends on the distance between the sound source and the place of measurement, possibly one ear of a listener.
The sound pressure level L_p in dB without the given distance r to the sound source is meaningless. Unfortunately this error (unknown distance) is quite often to find. Many users really wrongly believe that a sound source must have a fixed dB value; e.g. jackhammer = 110 dB and jet plane = 130 dB.
Distance ???
The threshold of pain, depending on the frequency composition, is to find between 120 dB and 140 dB.

Noise is a sound that disturbs or harms.

What we condemn as noise depends not only on the noise level. There are social, physical and psychological factors. Besides the type of noise and personal noise sensitivity there are the expectations of a person which is crucial to its assessment of noise. The "desired" noise is not the classification in 'noisy' or 'too loud'. Kurt Tucholsky wrote: "Our own dog does not make noise, it only barks" and "noise is the sound of the others."

Assumption: The maximum sound pressure that cannot be exceeded because the average air pressure is 101325 Pa. This sound pressure level is:
$L = 20 \times \log(101325 / 0.00002) =$ **194 dB SPL**.
Pay attention, RMS value is not peak value.
A typical false statement: "No noise levels can exceed 194 dB ever". Is the end at 194 dB? In addition to this perception threshold is discussed more often a physical limit to 194 dB. Sound is nothing more than a minor disturbance of air pressure and 194 dB is theoretically the same as the disturbance itself. It must be asymmetric. Even louder noise is possible, but heavily distorted. That's chaos.
This high sound pressure will break all measurement microphones and human beings are completely torn when they are close to the center of a nuclear explosion. No hearing protection (ear muffs or ear plugs) can help you there.
These madness sound levels will never be measured but only estimated or calculated.

Ultrasound between 20 kHz and 1.5 GHz does not belong to our human hearing.
Infrasound below about 16 Hz is not audible for the human ear, but we can feel high sound levels.

The total sound power is emitted by the sound source. Sound power levels are connected to the sound source and are independent of distance.
Sound pressure levels vary substantially with distance from the source.

Sound pressure p in pascals (newtons per square meter) is not the same physical size as intensity J or I in watts per square meter.
... and the sound power (acoustic power) does not decrease with distance r from the sound source - neither with $1/r$ nor as $1/r^2$.

Sound Field Sizes	Sound Energy Sizes
Sound pressure, sound or particle velocity, particle displacement or displacement amplitude, (voltage, current, electric resistance).	Sound intensity, sound energy density, sound energy, acoustic power, (electrical power).
Inverse Distance Law $1/r$	**Inverse Square Law $1/r^2$**

Direct **conversion** of **sound pressure to sound intensity** and vice versa.

Simply enter the value to the left or the right side.
The calculator works in both directions of the ↔ sign.

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Sound pressure p: (air)		Sound intensity I: (air)
1 Pa	↔	0.0025 W/m^2
$\tilde{p} = p_0 \cdot 10^{\frac{L_p}{20}}$ Pa		$I = I_0 \cdot 10^{\frac{L_I}{10}}$ W/m^2

Standard reference sound pressure p_0 = **20 µPa** = 2 × 10^{-5} Pa Pa = N/m^2

Standard reference sound intensity I_0 = **1 pW/m^2** = 10^{-12} W/m^2 Z_0 = 400 N·s/m^3

Sound pressure $p = \sqrt{(I \times Z_0)}$ Sound intensity $I = p^2 / Z_0$

Source of disturbance - Musical instrument? Sound power (German)?

Sound pressure levels are not sound power levels (German)

There is no "dBA" value given as threshold of human hearing.
These values are not given as dBA, but as dBSPL, that means **without any weighting filter.**

Comparison of sound pressure level SPL and sound intensity level

$$L_p = 20 \log_{10}\left(\frac{p}{p_0}\right) \text{ in dB} = L_I = 10 \log_{10}\left(\frac{I}{I_0}\right) \text{ in dB}$$

Sound power level

Differentiate between sound pressure p as a "sound **field** size" and sound intensity I as a "sound **energy** size". $I \sim p^2$ for progressive plane waves.
When it comes to our ears and the hearing, it is recommended that the inappropriate expression of the sound energy parameters, such as sound power (acoustic power) and sound intensity to leave aside. So we are just listening to the sound pressure as sound field size, or the sound pressure level SPL.

The sound pressure level decreases in the free field with 6 dB per distance doubling.
That is the 1/*r* law.
Often it is argued the **sound pressure** would decrease after the 1/r^2 law (inverse square law). **That's wrong.**
The sound pressure in a free field is inversely proportional to the distance from the microphone to the source. $p \sim 1/r$.

How does the sound decrease with increasing distance?
Damping of sound level with distance

Relation of sound intensity, sound pressure and **distance law**:

$$I \sim p^2 \sim \frac{1}{r^2}$$

From this follows $p \sim \frac{1}{r}$

Note: The often used term "**intensity** of sound pressure" is not correct.
Use "magnitude", "strength", "amplitude", or "level" instead.
"Sound intensity" is sound power per unit area, while "pressure" is a measure of force per unit area. Intensity (sound energy size) is not equivalent to pressure (sound field size).

dB scale for field sizes, like volts and sound pressures

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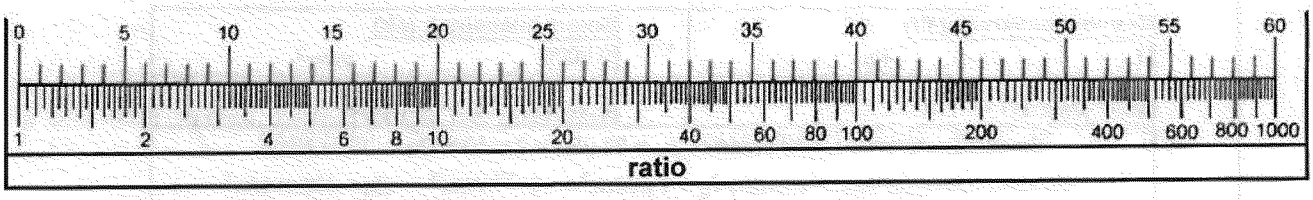
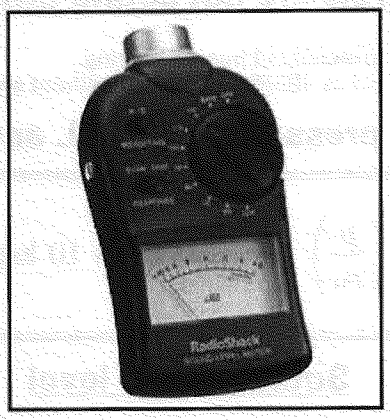


The sound pressure is the force F in newtons N of a sound on a surface area A in m^2 perpendicular to the direction of the sound.
The SI-unit for the sound pressure p is N/m^2 = Pa. $p \sim 1/r$.

How to measure sound pressure?



By the way, sellers always want us to buy a sound pressure level meter with digital display.
But much better, however, is an analogue-to-read display - as in this figure.

Note - Comparing dBSPL and dBA:
There is no conversion formula for measured dBA values to sound pressure level dBSPL or vice versa.
That is only possible measuring one single frequency.

There is no "dBA" curve given as threshold of human hearing.

The weighted sound level is neither a physiological nor a physical parameter.

Pro audio equipment often lists an A-weighted noise spec – not because it correlates well with our hearing – but because it can "hide" nasty hum components that make for bad noise specs.

Words to bright minds: Always wonder what a manufacturer is hiding when they use A-weighting. *)

*) **http://www.google.com/search?q=Always+wonder+what+a+manufacturer+Rane&filter=0**

Readings of a pure 1 kHz tone should be identical, whether weighted or not.

How loud is dangerous?
Typical dbA levels

190 dBA	Heavy weapons, 10 m behind the weapon (maximum level)
180 dBA	Toy pistol fired close to ear (maximum level)
170 dBA	Slap on the ear, fire cracker explodes on shoulder, small arms at a distance of 50 cm (maximum level)
160 dBA	Hammer stroke on brass tubing or steel plate at 1 m distance, airbag deployment very close at a distance of 30 cm (maximum level)
150 dBA	Hammer stroke in a smithy at 5 m distance (maximum level)
130 dBA	Loud hand clapping at 1 m distance (maximum level)

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120 dBA	Whistle at 1 m distance, test run of a jet at 15 m distance
	Threshold of pain, above this fast-acting hearing damage in short action is possible
115 dBA	Take-off sound of planes at 10 m distance
110 dBA	Siren *) at 10 m distance, frequent sound level in discotheques and close to loudspeakers at rock concerts, violin close to the ear of an orchestra musicians (maximum level)
105 dBA	Chain saw at 1 m distance, banging car door at 1 m distance (maximum level), racing car at 40 m distance, possible level with music head phones
100 dBA	Frequent level with music via head phones, jack hammer at 10 m distance
95 dBA	Loud crying, hand circular saw at 1 m distance
90 dBA	Angle grinder outside at 1 m distance
	Over a duration of 40 hours a week hearing damage is possible
85 dBA	2-stroke chain-saw at 10 m distance, loud WC flush at 1 m distance
80 dBA	Very loud traffic noise of passing lorries at 7.5 m distance, high traffic on an expressway at 25 m distance
75 dBA	Passing car at 7.5 m distance, un-silenced wood shredder at 10 m distance
70 dBA	Level close to a main road by day, quiet hair dryer at 1 m distance to ear
65 dBA	**Bad risk of heart circulation disease at constant impact is possible**
60 dBA	Noisy lawn mower at 10 m distance
55 dBA	Low volume of radio or TV at 1 m distance, noisy vacuum cleaner at 10 m distance
50 dBA	Refrigerator at 1 m distance, bird twitter outside at 15 m distance
45 dBA	Noise of normal living; talking, or radio in the background
40 dBA	**Distraction when learning or concentration is possible**
35 dBA	Very quiet room fan at low speed at 1 m distance
25 dBA	Sound of breathing at 1 m distance
0 dB	Auditory threshold

*) A small frequency region makes high volume; see: **Loudspeaker efficiency versus sensitivity**

Rated sound is not specified in phones, but increasingly in dB (A).

"Amateurs" frequently ask about the high dB values from a siren. They are satisfied with each mentioned dB value. But they are not interested on the substantial distancefrom the noise source. That shows that they are just "dummies".

If in the measurement of the noise the distance to the measurement microphone is not specified, this information is worthless. This unfortunately happens quite often.

From a dB-A measurement no accurate description of the expected noise volume is possible.

Table of the Threshold of pain

What is the pain threshold?

You can find the following rounded values in various audio articles and books:

Sound pressure level L_p	Sound pressure p
140 dBSPL	200 Pa
137.5 dBSPL	150 Pa
134 dBSPL	**100 Pa**
130 dBSPL	63 Pa
120 dBSPL	20 Pa

The threshold of pain is known in acoustics as the lowest strength of a stimulus, that is perceived by the ear as painful. Because of the different sensitivity of people it cannot be given an accurate value.

Permissible Exposure Time Guidelines – Sound Pressure Level - SPL

How long can a person endure a certain noise level before hearing impairment occurs?

Sound Pressure Level	Sound pressure	Permissible Exposure Time
115 dB	11.2 Pa	0.46875 minutes (~30 sec)
112 dB	7.96 Pa	0.9375 minutes (~1 min)

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109 dB	5.64 Pa	1.875 minutes (< 2 min)
106 dB	3.99 Pa	3.75 minutes (< 4 min)
103 dB	2.83 Pa	7.5 minutes
100 dB	2.00 Pa	15 minutes
97 dB	1.42 Pa	30 minutes
94 dB - - - - - - - - - -	1.00 Pa - - - - - -	1 hour - - - - - - - - - - - - - - -
91 dB	0.71 Pa	2 hours
88 dB	0.50 Pa	4 hours
85 dB	0.36 Pa	8 hours
82 dB	0.25 Pa	16 hours

Accepted guidelines for recommended permissible exposure time for continuous time weighted average noise, according to **NIOSH-AINSI** and CDC.
For every 3 dB sound pressure level (SPL) over 85 dB, the permissible exposure time is cut in half – before damage to our hearing can occur.
NIOSH = National Institute for Occupational Safety and Health and
CDC = Centers for Disease Control and Prevention.
OSHA = Occupational Safety and Health Administration.
This may not represent a worldwide view of the subject.
Noise is an increasing public health problem and can have the following adverse health effects: hearing loss, sleep disturbances, cardiovascular and psychophysiological problems, performance reduction, annoyance responses, and adverse social behaviour.
A person feels and judges sound events by exposure time, spectral composition, temporal structure, sound level, information content and subjective mental attitude.

Simply enter the value to the left or the right side.
The calculator works in both directions of the ↔ sign.

Sound pressure level:	↔	**Permissible exposure time:**
94 dB + 0 **dB**		60 minutes

Integration times of hearing:
ca. 100 µs to 3 ms / 10 ms (sum localization)
ca. 5 ms - 10 ms: echo threshold / masking
ca. 10 ms coupling width
ca. 50 ms pitch detection (recognition)
ca. 250 ms sound smearing / quasi-stationary processes.

The Psychoacoustic Loudness

Note: Which increase corresponds to a doubling of the sound?
An increase of the sound level by 3 dB corresponds to a doubling (factor = 2) of sound intensity.
An increase of the sound level by 6 dB corresponds to a doubling of the sound pressure.
An increase in the sound level by 10 dB corresponds to the sensation of double the "volume".

The subjective perceived "volume" or "loudness level" and the artificial term "loudness" has not to be mixed with the objective measure of sound pressure as sensation size of the human sense of hearing. The sound pressure as a sound field size is not the same as the sound intensity as sound energy size. Psychoacousticians tell us that a level increase of 10 dB should result in an impression of doubling the loudness (volume). If you have 6 violins as the initial source, then you need 10 times the violins, or 60 violins to double the psychoacoustic volume (loudness).

Half loudness ≡ level −10 dB	Double loudness ≡ level +10 dB
Half sound pressure ≡ level −6 dB	Double sound pressure ≡ level +6 dB
Half power ≡ level −3 dB	Double power: ≡ level +3 dB
four times power ≡ level +6 dB	Ten times power ≡ level +10 dB
Double distance ≡ level −6 dB	Double sources (Double power) ≡ +3 dB

Note: For example, when the sound system with spaced loudspeakers delivers twice the sound pressure as "one" amplifier,the fourfold power is required. So you need to **double** the **"sound pressure"** for example, **four** parallel amplifiers of the same design. Frequently one hears the novice question: How much more speaker power do you need for **double the "volume" (loudness)**? This takes about **ten times** the power.

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Sound Level Comparison Chart and the Ratios

Table of sound level dependence and the change of the respective ratio to subjective volume (loudness), objective sound pressure (voltage), and sound intensity (acoustic power)
How many decibels (dB) change is double, half, or four times as loud?
How many dB to appear twice as loud (two times)? Here are all the different ratios.
Ratio means "how many times" or "how much" ... Doubling of loudness.

Subjectively perceived loudness (volume), *objectively measured* sound pressure (voltage), and *theoretically calculated* sound intensity (acoustic power)

Level Change	Volume Loudness	Voltage Sound pressure	Acoustic Power Sound Intensity
+40 dB	16	100	10000
+30 dB	8	31.6	1000
+20 dB	4	10	100
+10 dB	2.0 = double	3.16 = √10	**10**
+6 dB	1.52 times	2.0 = double	4.0
+3 dB	1.23 times	1.414 times = √2	2.0 = double
- - - - ±0 dB - - - -	- - - - 1.0 - - - - - - -	- - - - 1.0 - - - - - - -	- - - - - 1.0 - - - - -
−3 dB	0.816 times	0.707 times	0.5 = half
−6 dB	0.660 times	0.5 = half	0.25
−10 dB	0.5 = half	0.316	0.1
−20 dB	0.25	0.100	0.01
−30 dB	0.125	0.0316	0.001
−40 dB	0.0625	0.0100	0.0001
Log. size	**Psycho size**	**Field size**	**Energy size**
dB change	**Loudness multipl.**	**Amplitude multiplier**	**Power multiplier**

The psycho-acoustic volume or loudness is a subjective sensation size.

Is a 10 dB or 6 dB sound level change for a doubling or halving of the loudness (volume) correct? About the connection between sound level and loudness, there are various theories. Far spread is still the theory of psycho-acoustic pioneer Stanley Smith Stevens, indicating that the doubling or halving the sensation of loudness corresponds to a level difference of 10 dB. Recent research by Richard M. Warren, on the other hand leads to a level difference of only 6 dB. ***)** This means that a double sound pressure corresponds to a double loudness. The psychologist John G. Neuhoff found out that for the rising level our hearing is more sensitive than for the declining level. For the same sound level difference the change of loudness from quiet to loud is stronger than from loud to quiet.
It is suggested that the sone scale of loudness reflects the influence of known experimental biases and hence does not represent a fundamental relation between stimulus and sensation.
***) Richard M. Warren, "Elimination of Biases in Loudness Judgments for Tones", 1970, Journal of the Acoust. Soc. Am. Volume 48, Issue 6B, pp. 1397 - 1403 and**
Richard M. Warren, "Quantification of Loudness", 1973, American Journal of Psychology, Vol 86 (4), pp. 807 - 825

John G. Neuhoff, "An adaptive bias in the perception of looming auditory motion", 2001, Ecological Psychology 13 (2) pp. 87 - 110 and
John G. Neuhoff, "Perceptual Bias for Rising Tones", 1998, Nature, Volume 395, 10 September

Citation: When known experimental biases were eliminated, half loudness was equal to half sound pressure level (−6 dB) from 45 to 90 dB.
It follows that the determination of the volume (loudness) which is double as loud should not be dogmatically defined. More realistic is the claim:

A doubling of the sensed volume (loudness) is equivalent to a level change approximately between 6 dB and 10 dB.

Subjectively perceived loudness (volume), objectively measured sound pressure (voltage), and theoretically calculated sound intensity (acoustic power)

Psychoacoustic: Relationship between phon and sone

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Conversion of sound units (levels)
Calculations of sound values and their levels
Conversion of voltage V to dBm, dBu, and dBV

Question: What is the standard distance to measure sound pressure level away from equipment?
There is really no standard distance for measuring dB (decibels). It depends on the size of the size of the sound source and the sound pressure level.

Question: How does the sound power decrease with distance"? Answer: "April fool - The sound power does not decrease (drop) with distance from the sound source."

The sound power level or the sound power is firmly committed to the sound source and is really independent from the distance.

Thinking help: A 100 watt light bulb has in 1 m and in 10 m distance really always the same 100 watt, which is emmited from the bulb as light source all the time!

We consider sound fields in air which are described by the scalar quantity p (sound pressure) and the vector quantity v (sound velocity) as a sound field quantity.

Sound pressure p in pascals is not the same physical size as intensity I in watts per square meter.
... and the sound power (acoustic power) does not decrease with distance r from the sound source - neither with $1/r$ nor as $1/r^2$.

Often the **sound pressure**as a **sound field size**is mixed incorrectly with the **sound intensity**as a **sound energy size**. But $I \sim p^2$.

Note: The radiated sound power (sound intensity) is the cause and **the sound pressure is the effect**.
The effect is of particular interest to the sound engineer.
The effect of temperature and sound pressure:
Sound pressure and Sound power – Effect and Cause.

Acousticians and sound protectors (noise fighters) need the sound intensity (acoustic intensity). As a sound designer you don't need that sound energy size. The eardrums of our hearing and the diaphragms of the microphones are effectively moved by the sound pressure or the sound pressure level.

Who is involved in audio engineering, should care less about the cause of intensity, power and energy, but better care on the effect of the sound pressure and the sound level (sound pressure level SPL) on the eardrums and the microphones, and the corresponding audio voltage or its voltage level.

Sound pressure and Sound power – Effect and Cause

Ratio magnitudes and levels

The decibel is defined as a 20 times logarithm of a ratio of linear sizes to each other and as a 10 times logarithm of a ratio of quadratic sizes to each other.
Ratios of electric or acoustic sizes, such as electric voltage and the sound pressure is referred to as ratios (factors), such as reflection factor.
Ratios of square sizes to one another, such as power and energy are called grades, such as efficiency.

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Logarithmically ratios of electric or acoustic sizes of the same unit, we express as measures such as transfer factor, or level, such as sound pressure level.
Levels are measured in decibels - dB in short.

If the output voltage level is 0 dB, that is 100%, the level of −3 dB is equivalent to 70.7% and the level of −6 dB is equivalent to 50% of the initial output voltage.
This applies to all field sizes; e.g. sound pressure.

If the output power level is 0 dB, that is 100%, the level of −3 dB is equivalent to 50% and −6 dB is equivalent to 25% of the initial output power.
This applies to all energy sizes; e.g. sound intensity.

Try to understand this.

Conversion of sound pressure to sound power and vice versa

The sound pressure changes depending on the environment and the distance from the sound source. In contrast, the sound power of a sound source is location-independent.
Formulas for conversion:
Acoustical power (sound power) $P_{ac} = I \times A$ in watts
Sound intensity $I = p_{eff}^2 / Z_0$ in W/m^2 = P_{ac} / A in W/m^2
Perfused area $A = 4 \times \pi \times r^2$ in m^2
Distance measurement point from the sound source r in meters (has only meaning with sound pressure, not with sound power)
Acoustic impedance of air Z_0 = 413 N·s/m^3 at 20 °C
Sound pressure p_{eff} in Pa = N/m^2
In point-like sound sources spherical areas A shall be inserted.
Depending on the arrangement following sections are taken into account: Solid sphere - sound source anywhere in the room, $Q = 1$
Hemisphere - sound source on the ground, $Q = 2$
Quarter Sphere - sound source on the wall, $Q = 4$
Eighth sphere - sound source in the corner, $Q = 8$
Q = direction factor and area $A = (4 \times \pi \times r^2) / Q$

Compare Sound power level and sound pressure level in a distance from the sound source

A typical question: "What is the dB volume of a symphony orchestra?" **Answer:** "It really depends on the distance of the listener to the orchestra." To name the distance is often "forgotten". They want to hear only a decibel number. But only a dB number is really senseless.

The constant unsureness is the answer to the question:
"How many decibels (dB) are doubling a sound"? or "What is twice the sound?"

Answer: Doubling means the "factor 2". What does doubling of a "sound" mean?
Doubling the (sound) intensity is obtained by an increase of the (sound intensity) level of **3 dB.**
Doubling the sound pressure is obtained by an increase of the (sound pressure) level of **6 dB.**
Doubling the loudness feeling is obtained by an increase of the (loudness) level of about **10 dB.**

Simple rule of thumb:
When working with power, 3 dB means double (twice) the factor and 10 dB means 10-fold. When working with voltage or current, 6 dB means double (twice) the factor and 20 dB means 10-fold.

Some information about Hearing Level (HL)
Pure-tone audiometric thresholds are expressed in dB HL

Frequency	dB SPL	dB HL
250 Hz	+15.0	0.0

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500 Hz	+9.0	0.0
1000 Hz	+3.0	0.0
2000 Hz	−3.0	0.0
4000 Hz	−4.0	0.0
8000 Hz	+13.0	0.0

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Razzazian, Christopher

From: Razzazian, Christopher
Sent: Tuesday, May 28, 2013 10:33 AM
To: Hinkle, Vanessa
Cc: Jackson, Scott
Subject: RE: ULP comment

Hey,

Saw this after I sent the first email back to you on this. Do you want to discuss still? It's been a little over a month since I reviewed this one so it's not as fresh in my mind.

Let me know, thanks.

Chris

From: Hinkle, Vanessa
Sent: Thursday, May 23, 2013 4:46 PM
To: Razzazian, Christopher
Cc: Jackson, Scott
Subject: RE: ULP comment

Hi Chris – Two more things:

1) Do we really have anything that indicates that if the mitigations are not applied, there will be a significant impact? If we don't have a demonstration that the mitigation is necessary to bring the impacts to below a significant level, do we really have a basis for requiring them in the ROD or lease stipulations?

2) We talked about the noise level previously, but just to recap…Do you know what the basis for the Colorado reg is? It seems rather low, considering that the OSHA PEL is 90 db for an 8 hour TWA. Also, the DOE lists some good mitigation measures, so I think it is covered and I don't think additional comment is necessary.

Thanks,
Vanessa

From: Hinkle, Vanessa
Sent: Thursday, May 23, 2013 11:10 AM
To: Razzazian, Christopher
Cc: Jackson, Scott
Subject: RE: ULP comment

Hi Chris –

Getting back to your comments on the ULP, do you think the truck engine emissions need to be mitigated and if so, why? Is this something we have brought up to DOE in the past?

Vanessa

From: Razzazian, Christopher
Sent: Wednesday, April 17, 2013 12:42 PM
To: Hinkle, Vanessa

ED_005364K_00013746-00023

Cc: Diaz, Angelique; Jackson, Scott
Subject: ULP comment

Hi Vanessa, as I said I only have one overarching comment for the ULP, although I could probably give you a lot of little discrete things.

In order for air quality impacts to remain minimal to moderate and temporary in nature it will be necessary for the mitigation listed in Section 4.6 to be included in the ROD, conditions of approval, or as lease stipulations. In addition to the mitigation measures listed we suggest considering the inclusion of diesel particulate filters for diesel driven equipment which can significantly reduce toxic air pollutants from diesel exhaust.

As a side – I notice that they show violations of the Colorado noise limit. It may be good to throw in something about mitigating noise to within the 55 db range for locations that showed impacts above that limit. They include mitigation options that would be able to address this, such as mufflers, noise barriers, etc. (Noise is still in the air program, in case you never hear that☺)

Let me know if you'd like something more detailed. I note that the air emissions mitigation in M-1 of Table 4.6-1 are pretty much going after dust. Where there are measures that would affect combustion sources the language is really just saying that they will comply with current regulatory requirements (which is why I propose another easy control measure with potentially large health impact improvement – the diesel particulate filter).

Razzazian, Christopher

From: Razzazian, Christopher
Sent: Tuesday, May 28, 2013 10:05 AM
To: Hinkle, Vanessa
Cc: Jackson, Scott
Subject: RE: ULP comment

Hello,

To try to answer your question – we don't have modeling for this project or HAPs risk assessment, so I don't have something discrete to point to in order to suggest that further mitigation is necessary. However, there is a lot of information out there on the benefits of using diesel particulate filters (primarily reducing HAPs and Hydro-Carbons). Since the document stated that there are residences in the area, I think it would be prudent to suggest the use of particulate filters which would minimize the black smoke that earth movers often spew out.

I don't know the past history for this project, so unfortunately I couldn't tell you whether we've brought this up with the DOE in the past. Sorry about that.

Feel free to give me a call or stop by if you want to discuss.

Thanks,
Chris

From: Hinkle, Vanessa
Sent: Thursday, May 23, 2013 11:10 AM
To: Razzazian, Christopher
Cc: Jackson, Scott
Subject: RE: ULP comment

Hi Chris –

Getting back to your comments on the ULP, do you think the truck engine emissions need to be mitigated and if so, why? Is this something we have brought up to DOE in the past?

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From: Razzazian, Christopher
Sent: Wednesday, April 17, 2013 12:42 PM
To: Hinkle, Vanessa
Cc: Diaz, Angelique; Jackson, Scott
Subject: ULP comment

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In order for air quality impacts to remain minimal to moderate and temporary in nature it will be necessary for the mitigation listed in Section 4.6 to be included in the ROD, conditions of approval, or as lease stipulations. In addition to the mitigation measures listed we suggest considering the inclusion of diesel particulate filters for diesel driven equipment which can significantly reduce toxic air pollutants from diesel exhaust.

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As a side – I notice that they show violations of the Colorado noise limit. It may be good to throw in something about mitigating noise to within the 55 db range for locations that showed impacts above that limit. They include mitigation options that would be able to address this, such as mufflers, noise barriers, etc. (Noise is still in the air program, in case you never hear that☺)

Let me know if you'd like something more detailed. I note that the air emissions mitigation in M-1 of Table 4.6-1 are pretty much going after dust. Where there are measures that would affect combustion sources the language is really just saying that they will comply with current regulatory requirements (which is why I propose another easy control measure with potentially large health impact improvement – the diesel particulate filter).

Razzazian, Christopher

From: Hinkle, Vanessa
Sent: Thursday, May 23, 2013 4:46 PM
To: Razzazian, Christopher
Cc: Jackson, Scott
Subject: RE: ULP comment

Hi Chris – Two more things:

1) Do we really have anything that indicates that if the mitigations are not applied, there will be a significant impact? If we don't have a demonstration that the mitigation is necessary to bring the impacts to below a significant level, do we really have a basis for requiring them in the ROD or lease stipulations?

2) We talked about the noise level previously, but just to recap…Do you know what the basis for the Colorado reg is? It seems rather low, considering that the OSHA PEL is 90 db for an 8 hour TWA. Also, the DOE lists some good mitigation measures, so I think it is covered and I don't think additional comment is necessary.

Thanks,
Vanessa

From: Hinkle, Vanessa
Sent: Thursday, May 23, 2013 11:10 AM
To: Razzazian, Christopher
Cc: Jackson, Scott
Subject: RE: ULP comment

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Vanessa

From: Razzazian, Christopher
Sent: Wednesday, April 17, 2013 12:42 PM
To: Hinkle, Vanessa
Cc: Diaz, Angelique; Jackson, Scott
Subject: ULP comment

Hi Vanessa, as I said I only have one overarching comment for the ULP, although I could probably give you a lot of little discrete things.

In order for air quality impacts to remain minimal to moderate and temporary in nature it will be necessary for the mitigation listed in Section 4.6 to be included in the ROD, conditions of approval, or as lease stipulations. In addition to the mitigation measures listed we suggest considering the inclusion of diesel particulate filters for diesel driven equipment which can significantly reduce toxic air pollutants from diesel exhaust.

As a side – I notice that they show violations of the Colorado noise limit. It may be good to throw in something about mitigating noise to within the 55 db range for locations that showed impacts above that limit. They include mitigation

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options that would be able to address this, such as mufflers, noise barriers, etc. (Noise is still in the air program, in case you never hear that☺)

Let me know if you'd like something more detailed. I note that the air emissions mitigation in M-1 of Table 4.6-1 are pretty much going after dust. Where there are measures that would affect combustion sources the language is really just saying that they will comply with current regulatory requirements (which is why I propose another easy control measure with potentially large health impact improvement – the diesel particulate filter).

Razzazian, Christopher

From: Hinkle, Vanessa
Sent: Thursday, May 23, 2013 11:10 AM
To: Razzazian, Christopher
Cc: Jackson, Scott
Subject: RE: ULP comment

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Vanessa

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Sent: Wednesday, April 17, 2013 12:42 PM
To: Hinkle, Vanessa
Cc: Diaz, Angelique; Jackson, Scott
Subject: ULP comment

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Razzazian, Christopher

From: Diaz, Angelique
Sent: Wednesday, May 08, 2013 2:00 PM
To: Hinkle, Vanessa
Cc: Razzazian, Christopher
Subject: RE: ULP comments
Attachments: air comments DOE PEIS 043013_add, 050813.docx

Vanessa, here are my recommended edits. I am more than willing to look at future versions of this language.

- Angelique

Angelique D. Diaz, Ph.D.
303.312.6344

From: Hinkle, Vanessa
Sent: Wednesday, May 08, 2013 11:12 AM
To: Diaz, Angelique
Subject: FW: ULP comments

Hi Angelique,

I was just wondering whether you had any suggestions for improvement?

Vanessa

From: Hinkle, Vanessa
Sent: Tuesday, April 30, 2013 4:19 PM
To: Diaz, Angelique
Subject: ULP comments

Hi Angelique – Thanks for taking a look at these!

Vanessa

Covering the waste rock with an adequate amount of soil is necessary to reduce emissions of radioactive particulates and radon and to reduce exposure to radiation. Within the PEIS there are inconsistencies regarding the reclamation of waste rock piles. The draft PEIS states on page 4-22 that during reclamation, waste-rock piles will be covered by a layer of soil material to facilitate vegetation growth. Page 2-29 states that waste-rock would be graded with the slope of the area and then seeded to conform to its surroundings, but this section does not discuss covering the waste rock with a layer of soil material. Also, Table 4.7-7 indicates that some waste-rock piles have been covered with soil, but it is not clear whether there are other waste-rock piles that remain uncovered. ~~Covering the waste rock with an adequate amount of soil is necessary to reduce emissions of radioactive particulates and to reduce exposure to radiation.~~ The mitigation measures in Table 4.6-1 states that the operator will use modeling and/or monitoring to determine the adequate thickness for surface soil material covering waste rock piles. We recommend that the final PEIS clarify that in all cases waste rock will be covered with a layer of soil material and describe the procedures and methods that will be used to determine the minimum cover thickness required to effectively reduce the emissions of radioactive particulates and radon.

The draft PEIS does not include an analysis of the risk to a recreationist during the operations phase. There is a potential for a recreationist to be located closer to the mine vents~~workings~~ compared to the nearest off-site resident and therefore, the recreationist may potentially~~could~~ receive a higher dose even though it would be for a shorter period of time. We recommend that in the final PEIS, the DOE analyze the risk from the operations phase to a recreationist. As an alternative, the DOE could include the potential dose that would be received by a recreationist and explain why this receptor was not included in the analysis.

The risk analysis in the draft PEIS uses average radium-226 (Ra-226) activity~~/concentration~~ rather than the "hot spot"~~maximum measured~~ Ra-226 activity~~/concentration~~ from the waste rock. If the hot spot~~maximum measured~~ activity~~/concentration~~ of Ra-226 were used, the dose to the public would be seven times greater. The decision to use the average~~lower estimated~~ Ra-226 activity~~/concentration~~potentially underestimates public radiation dose and also impacts the remaining steps of the assessment. While the ~~The~~ fact that the public dose may be underestimated by a factor of seven is included in various places throughout the PEIS, is not included in many places in the document including the human health risk summaries that are located in Section 2.4.5, Table 2.4-6, and Table 4.1-5, and in the Appendix D description of the use of RESRAD for calculating the radon flux from the surface of the waste rock pile. The information in these parts of the document may mislead a reader who only reads portions of the document and is not aware that average values were used and that a range of public dose exists. ~~that are lower than values from hot spots were used in the analysis~~. We recommend that in the sections of the final PEIS where emission rates, radon flux, ~~-~~or exposure is discussed, the DOE consistently disclose that they may ~~explain that emission rates may~~ be greater by a factor of seven.

The draft PEIS does not include an exposure analysis for the worker performing reclamation work on the underground mine itself. The draft PEIS states that exposures from above-ground mine workings are expected to be less than those from waste-rock piles, but it appears that the document does not include an explanation for this conclusion and an explanation of what the above ground mine workings includes is not given. During operations, there is the potential for 299 mrem/year from inhalation of radon in the

mine. ~~Radon levels from the mine workings are greater than the radon levels from the waste-rock piles, so eventhough the amount of time a person is exposed to the mine workings time may be less, the dose received from the mine workings could potentially be greater than the dose received from the waste-rock piles.~~ We recommend that in the final PEIS, the DOE explain why exposures from reclamation of the underground mine was not included.~~above-ground mine workings are expected to be less than those from waste-rock piles and that the DOE include each receptor's dose from the mine workings.~~

Comment [v1]: Maybe add some actual numbers here if possible.

The justification for some of the assumptions made in the analysis appear to need additional verification. The draft PEIS assesses the risk from one waste-rock pile, but it is not clear whether a resident could be exposed to more than one waste-rock pile at a time.~~s could be present.~~ Also, the distance to the nearest actual resident is not identified and a minimum distance of 500 meters to the nearest receptor is used. If these assumptions do not reflect actual conditions, the risk could be underestimated. We recommend that in the final PEIS, the DOE clarify how many waste-rock piles are anticipated to be near a resident~~present~~ and the distance to the nearest actual resident~~ and receptor~~, and update the analysis accordingly. Alternatively, if this information cannot be determined at this time, we recommend that the DOE update the analysis in a future project-level NEPA document.

Comment [v2]: This may be changed to a more general comment.

The summary of cumulative human health impacts in Section 4.7.4 does not consider receptors that are located within~~within~~ 500 meters of a mine and~~who~~ are exposed to the greatest levels of radiation. This results in an underestimation of the cumulative effects because the analysis excludes the area of, and population who would experience, the greatest impact. We recommend that in the final PEIS, the DOE revise this section so that it includes the results of the analysis for receptors located within 500 meters.

The DOE used CAP88-PC and COMPLY-R to estimate radiation doses and associated risks for all scenarios considered (e.g., ~~CAP88-PC was used to estimate doses from~~ hypothetical small, medium, large and very large mines). For comparison purposes, COMPLY-R was used to estimate radiation doses and associated risks for a hypothetical small mine. COMPLY-R is ~~approved~~ required for determining compliance with the radon National Emission Standards for Hazardous Air Pollutants (NESHAPs) of 10 mrem/yr, found in 40 CFR Part 61 Subpart B. T~~, but t~~he draft PEIS does not include results from COMPLY-R for a medium, large, or very large mine and it is unclear~~. Because COMPLY-R was not used to estimate radiation doses from medium, large, and very large mines, it is unclear~~ how radiation doses will compare to the NESHAPs when the required~~approved~~ computer code~~ model~~ is used for these hypothetical larger mines. We recommend that the DOE provide a range of expected COMPLY-R results, ~~based on the CAP88-PC results and~~ compare the results to ~~ose expected COMPLY-R results to the~~ the NESHAP~~s~~ standard, and use the COMPLY-R results to ~~. We also recommend that the DOE use the expected COMPLY-R results~~ to determine latent cancer fatality risk. ~~Alternatively, the DOE could use COMPLY-R for estimating doses and associated risks from hypothetical medium, large and very large mines and to determine latent cancer fatality risk.~~

The draft PEIS analyzes the collective radiation dose for the population within 3.1 to 50 miles, a range of population from 27,062 to 178,473, depending on the location assumed for the emission point. This methodology is misleading because it averages the dose over a wide area and over a large range of numbers of people. We recommend that in the final PEIS, the DOE analyze the collective radiation dose for subsets within the range of 3.1 to 50 miles to provide a more accurate and meaningful estimate.

Table 4.7-4 states that radon emissions would quickly disperse and that there would be no impact to the general public from the Daneros mine and Table 4.7-5 states that no impacts on the health of the general public are predicted from the Whirlwind mine. We recommend that the final PEIS include the dose for the nearest member of the public from Rn-222 from each of these mines and that the DOE include additional explanation for concluding that the dose would be minimal (i.e. distance to the nearest receptor, etc.).

~~The summary of cumulative human health impacts in Section 4.7.4 does not consider receptors that are located within 500 meters of a mine who are exposed to the greatest levels of radiation. This results in an underestimation of the cumulative effects because the analysis excludes the area of, and population who would experience, the greatest impact. We recommend that in the final PEIS, the DOE revise this section so that it includes the results of the analysis for receptors located within 500 meters.~~

~~The draft PEIS states in Appendix D that the DOE used RESRAD to calculate the radon flux from the surface of a waste rock pile, but the document does not explain whether the radon flux for the maximum sampled Ra-226 activity in the waste rock pile was calculated and considered in the potential impact calculation. The radon flux of the maximum Ra-226 activity in the waste rock pile is necessary to determine the potential maximum exposure. We recommend that in the final PEIS, the DOE include the radon flux for the maximum sampled Ra-226 activity in the waste rock pile.~~

Comment [v3]: I wonder if it would be better to combine this thought with the comment in the third paragraph?

Razzazian, Christopher

From: Razzazian, Christopher
Sent: Wednesday, April 17, 2013 12:42 PM
To: Hinkle, Vanessa
Cc: Diaz, Angelique; Jackson, Scott
Subject: ULP comment

Hi Vanessa, as I said I only have one overarching comment for the ULP, although I could probably give you a lot of little discrete things.

In order for air quality impacts to remain minimal to moderate and temporary in nature it will be necessary for the mitigation listed in Section 4.6 to be included in the ROD, conditions of approval, or as lease stipulations. In addition to the mitigation measures listed we suggest considering the inclusion of diesel particulate filters for diesel driven equipment which can significantly reduce toxic air pollutants from diesel exhaust.

As a side – I notice that they show violations of the Colorado noise limit. It may be good to throw in something about mitigating noise to within the 55 db range for locations that showed impacts above that limit. They include mitigation options that would be able to address this, such as mufflers, noise barriers, etc. (Noise is still in the air program, in case you never hear that☺)

Let me know if you'd like something more detailed. I note that the air emissions mitigation in M-1 of Table 4.6-1 are pretty much going after dust. Where there are measures that would affect combustion sources the language is really just saying that they will comply with current regulatory requirements (which is why I propose another easy control measure with potentially large health impact improvement – the diesel particulate filter).

ED_005364K_00013746-00037

Razzazian, Christopher

From: Distler, Kenneth
Sent: Monday, March 18, 2013 3:18 PM
To: Diaz, Angelique; Russell, Carol; Sundblad, Cindy; Hutchinson, Marcella; Razzazian, Christopher
Subject: FYI....FW: Fed Reg: DOE NOA Uranium Leasing Program Draft PEIS
Attachments: 2013-05777.pdf

"Draft ULP PEIS during the 60-day public comment period, which ends on May 16, 2013."

From: Anderson, Carol
Sent: Monday, March 18, 2013 3:10 PM
To: Strobel, Philip; Distler, Kenneth
Subject: Fed Reg: DOE NOA Uranium Leasing Program Draft PEIS

ED_005364K_00013746-00039

Razzazian, Christopher

From: Distler, Kenneth
Sent: Wednesday, March 13, 2013 2:03 PM
To: Diaz, Angelique; Russell, Carol; Hutchinson, Marcella; Sundblad, Cindy
Cc: Razzazian, Christopher
Subject: DOE Programmatic DEIS Schedule

Thank you for helping review the DOE Programmatic EIS. I dropped the summary draft to each of you yesterday evening. In the back of each document is a disk that has the full Draft Programmatic EIS.
This is a early release of the draft which is apparently due to be public this Friday, the 15th. The public comment period is 60 days. Please have your review and comments to me by **mid April**.

Also, I placed the contents of that disk and our preliminary review comments from June and December here:

I:\30 Day Share\ULP_DOE

You all have done the drill on this twice now so I won't belabor ya with too NEPA review instructions, unless ya really want me to.

- Your comments in email or word document is OK way to transmit.
- As a reminder, we are now in the formal review process so please let me know If you plan to discuss outside the Agency. It's usually best to avoid external discussions.
- DOE identified preferred alt 4 as the preferred so please focus your review on the preferred.

Let me know if you have any questions.

FYI....the original EA(2007) for this project was less than 200 pages....this EIS is almost 1,200.

Again Thanks.

Ken Distler
USEPA Region 8
1595 Wynkoop St
Denver, CO 80202
303-312-6043
distler.kenneth@epa.gov

ED_005364K_00013746-00041

Fw: DOE ULP Project pre deis part 2 EPA Comments

Kenneth Distler to: Christopher Razzazian 12/07/2012 01:24 PM

Ken Distler
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----- Forwarded by Kenneth Distler/R8/USEPA/US on 12/07/2012 01:24 PM -----

From: Kenneth Distler/R8/USEPA/US
To: "Plieness, Ray" <Ray.Plieness@lm.doe.gov>
Cc: Mary Picel <mpicel@anl.gov>
Date: 12/03/2012 11:46 AM
Subject: RE: DOE ULP Project pre deis part 2 EPA Comments

Ray,

Per your request, attached please find our comments for AQ, radiation and bonding. These are a rough draft and I do not have comments from two other folks. I plan on sending the remaining on weds.

I will be in the office this month except the last week. Let me know if you would like to discuss. Thanks.

ULP_Draft_PEIS_comment_template_EPAR8.doc

Ken Distler
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"Plieness, Ray" Ken thank you. Have a great weekend. Ray 11/30/2012 12:23:10 PM

From: "Plieness, Ray" <Ray.Plieness@lm.doe.gov>
To: Kenneth Distler/R8/USEPA/US@EPA
Cc: Mary Picel <mpicel@anl.gov>
Date: 11/30/2012 12:23 PM
Subject: RE: DOE ULP Project pre deis part 2 EPA Comments

Ken thank you. Have a great weekend. Ray

From: Distler.Kenneth@epamail.epa.gov [mailto:Distler.Kenneth@epamail.epa.gov]
Sent: Friday, November 30, 2012 12:22 PM
To: Plieness, Ray
Cc: Mary Picel
Subject: RE: DOE ULP Project pre deis part 2 EPA Comments

Hi Ray, Ok I will send over what we have gathered so far....I'm thinking later today or monday morning.

Ken Distler
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"Plieness, Ray" ---11/30/2012 11:38:58 AM---Ken I appreciate your interest in getting all of the comments to us at once. The internal DOE/ANL t

From: "Plieness, Ray" <Ray.Plieness@lm.doe.gov>
To: Kenneth Distler/R8/USEPA/US@EPA, Mary Picel <mpicel@anl.gov>
Date: 11/30/2012 11:38 AM
Subject: RE: DOE ULP Project pre deis part 2 EPA Comments

Ken I appreciate your interest in getting all of the comments to us at once. The internal DOE/ANL team members are meeting in DC next Monday –Wednesday to develop comment resolution to as many of the comments as we can so it would be really appreciated if you could give us the EPA comments you have so we can make progress on them as well as our other comments during that period. If we get the remainder of the comments on Dec. 5 we can then immediately work on those as well. Even if you give us the comments you have now as unofficial and draft with the final submittal on Dec. 5 that would still be helpful. Thanks, Ray

Ray Plieness
Senior Policy Advisor
Office of Site Operations
303-410-4806

From: Distler.Kenneth@epamail.epa.gov [mailto:Distler.Kenneth@epamail.epa.gov]
Sent: Friday, November 30, 2012 10:42 AM
To: Mary Picel; Plieness, Ray
Subject: DOE ULP Project pre deis part 2 EPA Comments

Mary and Ray, I have not received all the comments from the EPA technical folks for the pre-Draft PEIS ULP. I would like to send them to you all at once - likely have them all by Dec 5. Let me know if that's problematic.

Thanks.

Ken Distler
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DRAFT ULP PEIS (Dated November 2012) COOPERATORS REVIEW RECORD

Reviewer Ken Distler		Reviewer's Email Distler.kenneth@epa.gov
Reviewer's Organization EPA-Region 8	Reviewer's Phone 303-312-6043	Date Dec 2, 2012

Comment No.	Page No./ Line No.	Reviewer's Comments and Recommendation	Comment Resolution
	1-11/3—9	The lessee must consult with all "pertinent Federal, state, and local agencies" regarding development of a "site-specific environmental analysis". However, the consultation as stated appears to be limited to "presence and/or location of all endangered, threatened, and sensitive plant and wildlife species; known cultural resources; and floodplain and wetland areas". We recommend that the consultation requirement of the lessee be broadened to include all potential environmental impacts that could result in downstream or offsite environmental and/or resource degradation, air quality or health-related impacts.	
	1-11/11-13	Recommend that the statement be clarified as per Appendix A stipulation that DOE's Realty Officer sets the performance bond and the basis for calculating that bond amount is found in Appendix Section C.3 (Pages C 21-C 26). Suggest providing the Appendix A statement in this section as follows: "all applicable statutes and regulations and the character and nature of reclamation requirements of the Lease" will be considered in establishment of the bond amount.	
	1-11/15	A copy of the referenced MOU is not provided. Since the performance bond calculation is determined from coordination with CDRMS identified in the MOU, we suggest adding it (or summarizing key portions) as an Appendix since it is pertinent to understanding the Reclamation Bonding process.	
	2-39/2	To be consistent with Chapter 4 discussion on ranges of dosage depending on the radionuclide concentrations assumed for waste	

Comment No.	Page No./ Line No.	Reviewer's Comments and Recommendation	Comment Resolution
		rocks, a short discussion on the range of dose, or discussion on the factor of seven should be discussed similarly to Section 4.1.5.2, lines 11-33.	
	2-40/7-8	"The LCF risk was estimated to be 3 × 10–4/yr, which translates to a probability of about 1 in 2,500 of developing a latent fatal cancer from 1 year of exposure "2,500"… is inconsistent with information in Chapter 4 of "LCF risk of 4 x10–4/yr is calculated for an average miner…"	
	2-58	Footnote "e" should include a reference that the dose was determined using CAP88-PC	
	3-75/23	The DEIS should disclose if the DEIS DCFs given in ICRP 72 for adults were consistently used for COMPLY-R and CAP88-PC models in calculations for this DEIS.	
	4-9/28 and Figure 4.1-1	Conceptual model should include as an additional source of potential exposure above ground the radon emissions coming from the mine ventilation system.	
	4-16/18-20	We suggest including discussion of the 7x factor for the "hot spot" concentration of 168 pCi/g Ra-226 here.	
	4-18	Footnote "d" should include assumed Ra-226 activity.	
	4-19&4-20 Tables 4.1-6, 4.1-7 and 4.1-8	Tables should include the Ra-226 activity assumption	

Comment No.	Page No./ Line No.	Reviewer's Comments and Recommendation	Comment Resolution
	4-22/19	We recommend identifying what the 1 cm reflects. We believe it may be Residual contamination.	
	4-22/1-45	We found this discussion to be somewhat confusing. In line 6 it states that as long as cover is "greater than 6 in…", but the range in line 44 is 0 to 1 foot, then modeled at 1 cm. We suggest clarifying this section to demonstrate that the associated risks of human consumption of cattle/wildlife from grasses and other foliage growing on waste rock piles does not a present adverse impacts to humans.	
	4-23/25	We suggest identifying in the DEIS whether the model considered radioactive decay of Rn-222 in the cover layer and possible uptake of Rn-222 daughters by the roots.	
	4-84 Sidebar discussion (Comparison of CAP88-PC and COMPLY-R)	Suggest clarifying in the EIS that COMPLY-R is required by the mines to show compliance with 40CFR61, Subpart B. We suggest that this be incorporated throughout the DEIS when discussing modeling and 40CFR61.	
		The DEIS should include language per 40CFR61, Subpart B that increased reporting requirements are necessary if the 10mrem/yr limit is exceeded.	
	4-84	In footnote "c" as well as in discussion in the body of the document and in subsequent tables, describe the limitations associated with the 0.0044 emission factor.	
	4-86	Include a discussion on collective dose and how it varies with distance to the source.	

Comment No.	Page No./ Line No.	Reviewer's Comments and Recommendation	Comment Resolution
	4-167/37-38	The air permit application process currently described in the pre-DSEIS may not require modeling and since emissions of NOx (and perhaps PM10 and PM2.5) have the potential to exceed the NAAQS, the DEIS discussion should state how full disclosure including modeling and possible mitigation may need to be presented at a future NEPA stage, such as EA or EIS, when more specific onsite information is available. Depending on specific mine site emissions, AQRV analysis may also be necessary.	
	4-167/40-41	While implementing existing engine emission standards and watering unpaved roads and other PM related mitigation strategies (Table 4.6-1) can reduce NOx and PM related emissions, the assumption that "potential impacts on ambient air quality would be minor and temporary" is not substantiated. Emissions for NOx (275 tpy), PM10(459 tpy) and PM2.5(73.4 tpy) described in Table 4.4-1 resulted from combining all proposed mining activities and not spatially allocating the emissions across the leasing areas. Depending on the spatial allocation (e.g. large and medium, etc. mines in close proximity) these emission may be substantial. We suggest three options, 1) present a plan in the SDEIS that describes how full disclosure including modeling and possible mitigation may need to be presented at a future NEPA stage, such as EA or EIS, when more specific onsite information is available, (depending on specific mine site emissions, AQRV analysis may also be necessary), 2) reducing overall emissions in the SDEIS by reviewing emissions in Appendix C and perhaps adding additional mitigation in the emission inventory, or 3) modeling for full disclosure in the SDEIS.	
	4-286	Assumptions of 23.4 pCi/g Ra-226 as well as the model used should be included in the summaries under each Alternative	
	Appendix D	This Appendix may be referred to by the reader to get a summary of analysis conducted. For this reason it should include the	

Comment No.	Page No./ Line No.	Reviewer's Comments and Recommendation	Comment Resolution
		assumptions made on Ra-226 activity in waste rock as well as the range of values and the factor of 7 variation in resulting dose determinations.	
	Appendix D-9/7	Mention that COMPLY-R is required to show compliance with the 10 mrem/yr regulatory requirement in Subpart B. This paragraph misleads the reader into thinking that CAP88-PC is approved for Subpart B	
	Appendix D, Page D-13.	Comply-R is required by 40CFR61, Subpart B. We recommend changing …"Owners or operators of uranium mines may use COMPLY-R (EPA 1989c)" to "Owners or operators of uranium mines must use COMPLY-R (EPA 1989c)".	
	Table 4.6-1 M-10 last bullet	It is unclear to us how the depth of waste rock cover of 6 inches was determined. We recommend that a discussion be included in the DEIS that describes how the depth was determined or based.	
	Table 4.6-1 M-10 last bullet	The inclusion of the range of radium-226 concentrations is a good addition, since the reader can multiply by a factor of 7 to scale up to the higher concentration. However, in the mitigation table 4.6-1, a process should be disclosed in the EIS that describes how the radium-226 concentrations of each specific mine waste rock pile(s) will be determined and how that result might impact the cover depth.	

Comment No.	Page No./ Line No.	Reviewer's Comments and Recommendation	Comment Resolution
	Section 4.1.5.4	It appears that modeling receptors were placed at a minimum distance of 500 meters from potential sources. Yet from Figure 4.1-2 we are unable to determine the potential for structures that might be located less than 500 meters from the sources. We suggest language be included in the DEIS that ensures structures within the 500 meter distance be will not be exposed to levels above the NESHAP standard. This language could refer to subsequent NEPA actions when more site specific mine information is available.	

DOE ULP project
Kenneth Distler to: Christopher Razzazian 11/29/2012 01:48 PM

Chris I am reviewing the DOE uranium leasing project this week.... Take a look at the following language and table...let me know your thoughts. I added a map to the bottom that has the leases and distance to class I areas. Ken

Thanks

4.4.1.1 Exploration

Types of potential impacts and emission sources are discussed in Section 4.3.1.1. Under Alternative 4, two, four, and six borehole drillings up to the depth of 600 ft (180 m) would occur at 6 small, 10 medium, and 2 large mines, respectively, in any peak year. As shown in Table 4.4-1, estimated air emissions under Alternative 4 are about two to three times higher than those under Alternative 3 but still negligible compared to three-county total emissions for criteria pollutants and VOCs and Colorado or U.S. GHG emissions.

TABLE 4.4-1 Peak-Year Air Emissions from Mine Development, Operations, and Reclamation under Alternative 4[a]

	Annual Emissions (tons/yr)								
Pollutant[b]	Three-County Total[c]	Exploration		Mine Development		Mine Operations		Reclamation	
CO	65,769	8.0	(0.01%)[d]	165	(0.25%)	128	(0.20%)	11.1	(0.02%)
NO_x	13,806	19.6	(0.14%)	57.4	(0.42%)	275	(2.0%)	23.1	(0.17%)
VOCs	74,113	2.4	(0.003%)	1.7	(0.002%)	26.9	(0.04%)	2.3	(0.003%)
$PM_{2.5}$	5,524	1.9	(0.03%)	73.4	(1.3%)	23.5	(0.43%)	34.8	(0.63%)
PM_{10}	15,377	3.6	(0.02%)	459	(3.0%)	45.1	(0.29%)	171.9	(1.12%)
SO_2	4,246	2.2	(0.05%)	6.9	(0.16%)	35.4	(0.83%)	3.0	(0.07%)
CO_2	142.5×10^6 [e]	2,198	(0.002%)	1,600	(0.001%)	25,000	(0.018%)	2,200	(0.002%)
	$7,311.82\times10^6$ [f]		(0.00003%)		(0.00002%)		(0.00034%)		(0.00003%)

[a] Under Alternative 4, it is assumed that 19 mines (6 small, 10 medium, 2 large, and 1 very large) with a total disturbed surface area of 460 acres (186 ha) would be in operation or reclaimed in any peak year.

[b] Notation: CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter with a mean aerodynamic diameter of ≤ 2.5 μm; PM_{10} = particulate matter with a mean aerodynamic diameter of ≤ 10 μm; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.

[c] Total emissions in 2008 for all three counties encompassing the DOE ULP lease tracts (Mesa, Montrose, and San Miguel Counties), except for CO_2. See Table 3.1-2.

[d] Numbers in parentheses are percentages of three-county total emissions, except for CO_2, which are percentages of Colorado total emissions (top line) and U.S. total emissions (bottom line).

[e] Annual emissions in 2010 for Colorado on a CO_2-equivalent basis.

[f] Annual emissions in 2009 for the United States on a CO_2-equivalent basis.

Sources: CDPHE (2011a); EPA (2011a); Strait et al. (2007)

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As a consequence, the types of impacts related to exploration under Alternative 4 are similar to those described for Alternative 3 (Section 4.3.1.1). Exploration activities would occur over relatively small areas, involve little ground disturbance, and require only a small crew and a small fleet of heavy equipment. Thus, potential impacts from this phase on ambient air quality and regional ozone or AQRVs are anticipated to be negligible and temporary. Potential impacts from these activities on climate change would be negligible.

4.4.1.2 Mine Development and Operations

The types of impacts related to mine development and operations under Alternative 4 are similar to those described for Alternative 3 (Section 4.3.1.2).

Air emissions of criteria pollutants, VOCs, and CO_2 from mine development and operations estimated for the peak year are presented in Table 4.4-1 and compared with emission totals for the three counties (Mesa, Montrose, and San Miguel) that encompass the DOE ULP lease tracts combined. Detailed information on emission factors, assumptions, and emission inventories is available in Appendix C. As shown in the table, total peak-year emission rates are estimated to be rather small when compared with emission totals for all three counties. Typically, PM emissions are highest during mine development, while NO_x emissions are highest during operations. During mine development, non-PM emissions would be relatively small (up to 0.42%), but PM_{10} and $PM_{2.5}$ emissions of 73 and 460 tons/yr would amount to about 3.0% and 1.3%, respectively, of the three-county total emissions. PM_{10} emissions result would from explosive use (47%) and site preparation (43%), followed by wind erosion (9%), but exhaust emissions would contribute only a little to total PM_{10} emissions. Site preparation, explosives use, and wind erosion account for 57%, 33%, and 9%, respectively, of total $PM_{2.5}$ emissions. During operations, NO_x emissions of 275 tons/yr would be highest, amounting to about 2.0% of three-county total emissions. NO_x emissions would come mostly from diesel-fueled heavy equipment (e.g., bulldozers or power generators) and trucks. Mesa, Montrose, and San Miguel Counties encompass 2, 17, and 11 lease tracts, respectively, with one lease tract straddling Montrose and San Miguel Counties. It can be presumed that these emissions would spread over wide areas in three counties (over 50 mi [80 km]). However, it is not known at this time where these mines would be developed; thus, the spatial extents of emissions on the various lease tracts as well as which counties are involved are unknown. In particular, an emission factor of about 50 to 80 tons/yr for the large or very large mine group is relatively high (in Appendix C), so there is a potential for near-field exceedances of the 1-hour nitrogen dioxide (NO_2) NAAQS at the lease tract boundary. Thus, detailed air quality impact analysis would be warranted during the air permit application process. These impacts would be minimized by implementation of good industry practices and fugitive dust mitigation measures (such as watering unpaved roads, disturbed surfaces, and temporary stockpiles), as detailed in Table 4.6-1 (Section 4.6). Therefore, potential impacts on ambient air quality would be minor and temporary.

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or project phase? will not conduct permitting modeling for such a source

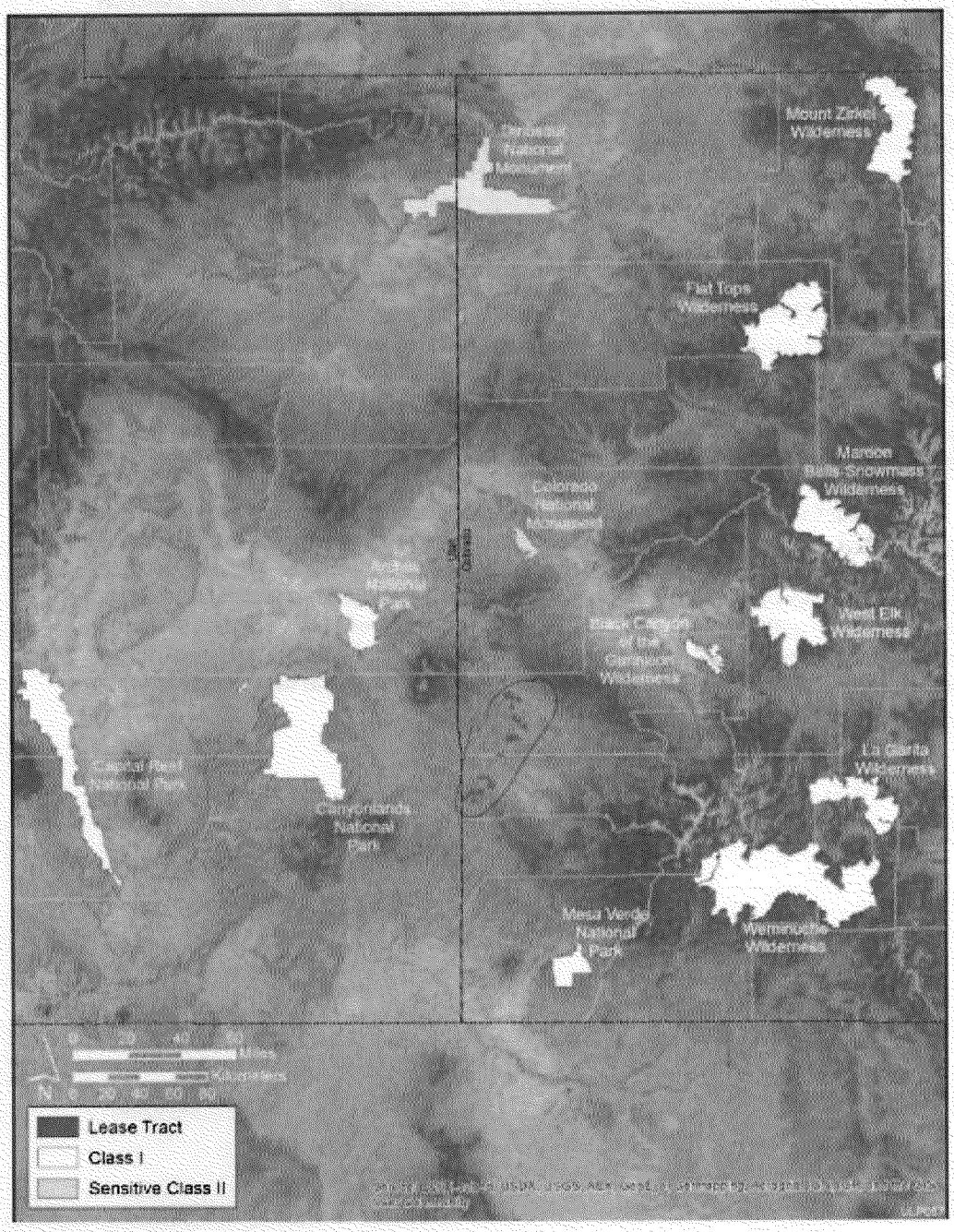
The three counties encompassing DOE ULP lease tracts are currently in attainment for ozone (EPA 2011b), but ozone levels in the area approached the standard (about 90%) (see Table 3.1-3). Recently, wintertime ozone exceedances were often reported at higher

elevations in northwestern Colorado, northeastern Utah, and southwestern Wyoming. However, ozone precursor emissions from mine development and operations would be relatively small (less than 2.0% and 0.04% of three-county total NO_x and VOC emissions, respectively) and would be much lower than those for the regional airshed in which emitted precursors are transported and transformed into ozone. In addition, the wintertime high-ozone areas are located more than 100 mi (160 km) from the DOE ULP lease tracts and not located downwind of the prevailing westerlies in the region. Accordingly, the potential impacts of ozone precursor releases from mine development and operations on regional ozone should not be of concern.

As discussed in Section 3.1.4, there are several Class I areas around the DOE ULP lease tracts where AQRVs, such as visibility and acid deposition, might be a concern. Primary pollutants affecting AQRVs include NO_x, SO_2, and PM. NO_x and SO_2 emissions from mine development activities would be relatively small (up to 2.0%) of three-county total emissions, while PM_{10} emissions would be about 3.0% of three-county total emissions. Air emissions from mine development and operations could result in minor impacts on AQRVs at nearby Class I areas. Implementation of good industry practices and fugitive dust mitigation measures could minimize these impacts.

Annual total CO_2 emissions from mine development and operations are estimated as shown in Table 4.4-1. CO_2 emissions during operations would be much higher than those during mine development. During operations, annual total CO_2 emissions would be about 25,000 tons (23,000 metric tons), accounting for about 0.018% of Colorado GHG emissions in 2010 at 140 million tons (130 million metric tons) of CO_2e and 0.00034% of U.S. GHG emissions in 2009 at 7,300 million tons (6,600 million metric tons) of CO_2e (EPA 2011a; Strait et al. 2007). Thus, potential impacts from the mine development and operations phase on global climate change would be negligible.

4.4.1.2 Reclamation



1

2 **FIGURE 3.1-4 PSD Class I Areas and Colorado Sensitive Class II Areas around the**
3 **ULP Lease Tracts**

DRAFT URANIUM LEASING PROGRAM PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

1 INTRODUCTION

The U.S. Department of Energy (DOE) has prepared the Uranium Leasing Program (ULP) Programmatic Environmental Impact Statement (PEIS) pursuant to the National Environmental Policy Act of 1969 (NEPA) (Title 42, Section 4321 and following sections of the *United States Code* [42 USC 4321 *et seq.*]), the Council on Environmental Quality's (CEQ's) NEPA regulations found in Title 40 of the *Code of Federal Regulations* (40 CFR Parts 1500–1508), and DOE's NEPA implementing procedures (10 CFR Part 1021) in order to analyze the reasonably foreseeable environmental impacts, including the site-specific impacts, of alternatives for the management of the ULP. DOE's ULP administers tracts of land located in Mesa, Montrose, and San Miguel Counties in western Colorado for the exploration, mine development and operations, and extraction of uranium and vanadium ores.

1.1 BACKGROUND

Congress authorized DOE's predecessor agency, the U.S. Atomic Energy Commission (AEC), to develop a supply of domestic uranium. In 1948, the Bureau of Land Management (BLM) issued Public Land Order (PLO) 459, which stated, "Subject to valid existing rights and existing withdrawals, the public lands and the minerals reserved to the United States in the patented lands in the following areas in Colorado are hereby withdrawn from all forms of appropriation under the public-land laws, including the mining laws but not the mineral-leasing laws, and reserved for the use of the United States Atomic Energy Commission." Subsequently, other PLOs increased or decreased the total acreage of the withdrawn lands. In addition, the Federal Government, through the Union Mines Development Corporation, acquired a substantial number of patented and unpatented mining claims, mill and tunnel site claims, and agricultural patents, until the aggregated acreage managed by AEC totaled approximately 25,000 acres (10,000 ha). The areas under consideration are located in western Colorado in Mesa, Montrose, and San Miguel Counties.

Beginning in 1949, the AEC and its successor agencies, the U.S. Energy Research and Development Administration and DOE, administered three separate and distinct leasing programs during the ensuing 60 years, as summarized in Table 1.1-1. To put the production numbers in Table 1.1-1 in perspective, domestic annual uranium production peaked in 1980 at about 44 million lb (20 million kg), of which lease production that year represented about 2.5% of the total. In addition, today's world market produces approximately 100 million lb (45 million kg) of uranium annually and consumes twice that amount. Table 1.1-2 summarizes production rates between 1974 and 1994 and between 1996 and 2008.

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TABLE 1.1-1 Summary of Three Leasing Programs Administered between 1949 and 2008

Years of Operation	No. of Leases	Lease Production (millions of lb)[a]		Royalties Generated (millions of $)
		U_3O_8	V_2O_5	
1949–1962	48	1.2	6.8	5.9
1974–1994[b]	43	6.5	33.0	53.0
1996–2008	15	0.3	1.4	4.0
Totals		8.0	41.2	62.9

[a] Uranium ore is generated as uranium oxide (U_3O_8) and vanadium ore is generated as vanadium oxide (V_2O_5).

[b] Mining operations peaked in 1980.

In preparing for the 1974 leasing period, the AEC evaluated the potential environmental and economic impacts related to the leasing program. This evaluation was documented in *Environmental Statement, Leasing of AEC Controlled Uranium Bearing Lands* (AEC 1972). In 1995, DOE again evaluated the potential environmental and economic impacts related to the leasing program and documented its findings in the *Finding of No Significant Impact for the Uranium Lease Management Program* (DOE 1995a).

When the first leasing program ended in 1962, the AEC directed the lessees to close the mines (to prohibit unauthorized entry), but little was done to reclaim the mine sites. These mine sites became DOE's "legacy mine sites," discussed later in this section.

In 1974, the AEC initiated reclamation bonding requirements in its new lease agreements that ensured that all mine sites would be adequately reclaimed when lease operations ended. During this period, a new lessee could elect to incorporate an existing mine (from the previous leasing program) into its current operation. By so doing, the new lessee accepted the responsibility and liability associated with the ultimate reclamation of that mine site.

In October 1994, DOE initiated a mine-site reconnaissance and reclamation project on the lease tracts. Each lease tract was thoroughly inspected to identify all the abandoned mine sites that resulted from pre-1974 leasing activities. After this identification process, all the mining-related features associated with each site were quantified and assessed for their historic importance. In 1995, in the absence of specific guidance pursuant to the reclamation of abandoned uranium mine sites, DOE initiated discussions with BLM officials (state and local) that culminated in the establishment of a guidance document, *Uranium Closure/Reclamation Guidelines* (BLM 1995) for such sites. DOE's objective in establishing this guidance document was to assure that DOE's lease tracts were reclaimed in a manner that was acceptable to BLM so that the lands could be restored to the public domain and managed by BLM. Subsequently, DOE's "legacy" mine sites were prioritized and systematically reclaimed. Reclamation at the

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TABLE 1.1-2 Summary of Uranium Ore Production from 1974 to 2008

Lease Tract	Dates of Operation 1974–1994	No. and Sizes[a] of Mines in Operation within Lease Tract 1974–1994	Total Production (tons) 1974–1994	Dates of Operation 1996–2008	No. of Mines in Operation within Lease Tract 1996–2008	Total Production (tons) 1996–2008
5	5/77–6/90	1 (L)	100,318	Did not operate	0	Did not operate
5A	Did not operate	0	0	NA[b]	0	NA
6	5/76–8/80	1 (L)	91,859	9/04–2/06	1	14,773
7	7/79–5/81	2 (1 VL, 1 M)	12,441	Did not operate	0	Did not operate
8	Did not operate	0	0	6/05–2/06	1	9,236
8A	Did not operate	0	0	NA	0	NA
9	9/78–9/80	1 (M)	34,056	5/03–2/06	1	20,671
10	5/75–8/90	4 (1 M, 3 S)	66,623	NA	0	NA
11	9/75–12/80	2 (1 M, 1 S)	46,720	Did not operate	0	Did not operate
11A	Did not operate	0	0	NA	0	NA
12	8/77–12/79	1 (S)	7,287	NA	0	NA
13	6/75–10/84	3 (1 L, 2 S)	85,863	Did not operate	0	Did not operate
13A	12/75–10/80	1 (M)	38,158	Did not operate	0	Did not operate
14	Did not operate	0	0	NA	0	NA
15	9/76–4/80	3 (S)	4,646	Did not operate	0	Did not operate
15A	9/79–1/81	2 (S)	8,842	NA	0	NA
16	12/76–6/79	4 (S)	5,709	NA	0	NA
16A	8/75–11/80	3 (S)	3,503	NA	0	NA
17	Did not operate	0	0	NA	0	NA
18	2/80–9/80	1 (M)	6,654	3/05–1/06	1	20,085
19	7/74–7/90	1 (L)	920,018	NA	0	NA
19A	Did not operate	0	0	NA	0	NA
20	Did not operate	0	0	NA	0	NA
21	10/78–12/80	1 (M)	46,542	Did not operate	0	Did not operate
22	3/77–5/82	1 (S)	8,578	NA	0	NA
22A	10/79–7/82	1 (M)	21,369	NA	0	NA
23	5/77–12/81	2 (S)	9,867	NA	0	NA
24	Did not operate	0	0	NA	0	NA

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TABLE 1.1-2 (Cont.)

Lease Tract	Dates of Operation 1974–1994	No. of Mines in Operation within Lease Tract 1974–1994	Total Production (tons) 1974–1994	Dates of Operation 1996–2008	No. of Mines in Operation within Lease Tract 1996–2008	Total Production (tons) 1996–2008
25	8/78–8/80	1 (M)	14,135	Did not operate	0	Did not operate
26	12/75–12/80	2 (S)	2,547	NA	0	NA
27	8/75–4/83	4 (S)	15,923	NA	0	NA
Totals		42[c]	1,551,658		4	64,765

[a] The sizes of the mines are noted with the following abbreviations: VL = very large; L = large; M = medium; and S = small.

[b] NA indicates not applicable, meaning the lease tract was not leased, and thus, was not available for operation or production.

[c] The total of 42 mines represents 1 very large mine, 4 large mines, 9 medium mines, and 28 small mines.

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final legacy mine site was completed in May 2001. DOE reclaimed a total of 161 separate mine sites on 22 lease tracts at a total cost of $1.25 million. kind of low?

In July 2007, DOE issued a programmatic environmental assessment (PEA) for the ULP, in which it examined three alternatives for the management of the ULP for the next 10 years (DOE 2007). In that same month, DOE issued a Finding of No Significant Impact (FONSI), in which DOE announced its decision to proceed with the Expanded Program Alternative, and also determined that preparation of an environmental impact statement (EIS) was not required. Under the Expanded Program Alternative, DOE would extend the 13 existing leases for a 10-year period and would also expand the ULP to include the competitive offering of up to 25 additional lease tracts to the domestic uranium industry.

In 2008, DOE implemented the Expanded Program Alternative and executed new lease agreements with the existing lessees for their 13 respective lease tracts, effective April 30, 2008. In addition, DOE offered the remaining, inactive lease tracts to industry for lease through a competitive solicitation process. That process culminated in the execution of 18 new lease agreements for the inactive lease tracts, effective June 27, 2008. Since that time, two lease tracts were combined into one and another lease was relinquished back to DOE. Accordingly, there are 29 lease tracts that are actively held under lease and 2 lease tracts that are currently inactive.

Between 2009 and 2011, DOE approved seven exploration plans (one each for Lease Tracts 13A, 15A, 17, 21, 24, 25, and 26). These exploration plans primarily involved the drilling of at least one exploratory hole. To date, the approved exploration plans for Lease Tracts 15A and 17 have not been implemented. Exploration activities typically resulted in surface disturbance of less than 1 acre (0.4 ha). Disturbed lands were reclaimed by using polyurethane foam to plug holes, and by using surface soils and established seed mixtures. There was also one mine re-entry plan that was approved and implemented for Lease Tract 26. This plan included mine re-entry activities whereby information was collected within an existing mine and the mine was re-secured. DOE also approved 20 reclamation plans to reclaim disturbed areas located on Lease Tracts 5, 6, 7, 10, 11, 11A, 12, 13, 16, 16A, 17, 19, 19A, 20, 21, 22, 22A, 23, 26, and 27. All approved reclamation plans have been implemented. Reclamation activities addressed open drill holes and vents, land subsidences, and abandoned mine portals and adits. These exploration and reclamation activities are further discussed and evaluated in the cumulative impacts section (Section 4.7).

1.2 CURRENT STATUS OF THE ULP

Colorado Environmental Coalition and three other plaintiffs filed a complaint against DOE in the U.S. District Court for the District of Colorado on July 31, 2008, in which the plaintiffs alleged, among other things, that DOE's July 2007 PEA and FONSI violated NEPA by failing to consider adequately the environmental impacts of expansion of the ULP, and violated the Endangered Species Act by jeopardizing endangered species. On October 18, 2011, the Court issued an Order in which it held, among other things, that DOE had violated NEPA by issuing its July 2007 PEA and FONSI instead of preparing an EIS. In that Order, the Court invalidated the

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July 2007 PEA and FONSI; stayed the 29 leases in existence under the ULP; enjoined DOE from issuing any new leases on lands governed by the ULP; enjoined DOE from approving any activities on lands governed by the ULP; and ordered that after DOE conducts an environmental analysis that complies with NEPA, the ESA, all other governing statutes and regulations, and the Court's Order, DOE could then move the Court to dissolve its injunction (Colorado Environmental Coalition v. DOE, No. 08-cv-1624 [D. Colo. Oct. 18, 2011]).

The Court later granted in part DOE's motion for reconsideration of that Order and amended its injunction to allow DOE, other Federal, state, or local governmental agencies, and/or the ULP lessees to conduct only those activities on ULP lands that are absolutely necessary: (1) to conduct DOE's environmental analysis regarding the ULP; (2) to comply with orders from Federal, state, or local government regulatory agencies; (3) to remediate certain dangers to public health, safety, and the environment on ULP lands; or (4) to conduct certain activities to maintain the ULP lease tracts and their existing facilities (Colorado Environmental Coalition v. DOE, No. 08-cv-1624 [D. Colo. Feb. 27, 2012]).

Currently, of the 31 ULP lease tracts, 29 have active leases and two do not; Lease Tracts 8A and 14 (Parcels 14-1, 14-2, and 14-3) are currently not leased. Lease Tract 8A is a small tract that is isolated and may be located entirely below (or outside) the uranium-bearing formation, which could indicate a lack of ore. Lease Tract 14 comprises three parcels (14-1, 14-2, and 14-3). There was some interest in Parcels 14-1 and 14-2 by potential lessees in the past; however, the third parcel (14-3, which lies east of 14-1) is located almost entirely within the Dolores River corridor and was never leased. Section 1.2.1 describes how DOE administers the ULP; Section 1.2.2 summarizes the requirements in the current leases; and Section 1.2.3 presents site-specific information available on the 31 ULP lease tracts.

On June 21, 2011, DOE published the Notice of Intent (NOI) to prepare this PEIS (see Volume 76, page 36097 of the *Federal Register* [76 FR 36097]). In the NOI, DOE stated that it had determined, in light of the site-specific information that DOE had gathered as a result of the site-specific agency actions proposed and approved pursuant to the July 2007 PEA, that it was appropriate for DOE to prepare a PEIS in order to analyze the reasonably foreseeable environmental impacts, including the site-specific impacts, of a range of alternatives for the management of the ULP for the remainder of the 10-year period that was covered by the July 2007 PEA. After DOE published the NOI, it notified the ULP lessees that until the PEIS process was completed, DOE would not approve any new exploration and mining plans and would not require any lessees to pay royalties.

1.2.1 DOE ULP Administrative Process

DOE's administration of the ULP includes the actions needed to manage the activities conducted at the 31 lease tracts. Table 1.2-1 lists the 31 lease tracts with applicable acreage, current lessee, and the status of each. Figure 1.2-1 shows the locations of the 31 ULP lease tracts. These actions are undertaken to assure that the program's technical and administrative objectives are accomplished. These actions include the following:

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TABLE 1.2-1 Summary of the 31 DOE ULP Lease Tracts in 2011

	Lease Tract No.	Acreage	Current Lessee	County	Status[a]
1	10	638	Golden Eagle Uranium, LLC	San Miguel	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
2	11	1,303	Cotter Corporation	San Miguel	One new underground mine permitted and developed; reclamation of previously disturbed areas needed.
3	11A	1,297	Golden Eagle Uranium, LLC	San Miguel	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
4	12	641	Colorado Plateau Partners	San Miguel	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
5	13	1,077	Gold Eagle Mining, Inc.	San Miguel	Three existing, permitted underground mines; reclamation of previously disturbed areas is needed.
6	13A	420	Cotter Corporation	San Miguel	Exploration plan (one hole) approved; drilling and reclamation of the explored area are completed.
7[b]	14 (1, 2, 3)	971	Not applicable	San Miguel	Lease tract not currently leased.
8	15	350	Gold Eagle Mining, Inc.	San Miguel	One existing underground mine; reclamation of previously disturbed areas is needed.
9	15A	172	Golden Eagle Uranium, LLC	San Miguel	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
10	16	1,790	Golden Eagle Uranium, LLC	San Miguel	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
11	16A	585	Energy Fuels Resources Corp.	San Miguel	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
12	5	151	Gold Eagle Mining, Inc.	Montrose	One existing, permitted underground mine; reclamation of previously disturbed areas is needed.

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TABLE 1.2-1 (Cont.)

	Lease Tract No.	Acreage	Current Lessee	County	Status[a]
13	5A (1, 2)	25	Golden Eagle Uranium, LLC	Montrose	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
14	6	530	Cotter Corporation	Montrose	One existing permitted underground mine; reclamation of previously disturbed areas is needed.
15	7	493	Cotter Corporation	Montrose	Two existing permitted mines—one underground mine and one large open-pit mine; reclamation of previously disturbed areas is needed.
16	8	955	Cotter Corporation	Montrose	One existing permitted underground mine; reclamation of previously disturbed areas is needed.
17	8A	78	Not applicable	Montrose	Lease tract has not been leased.
18	9	1,037	Cotter Corporation	Montrose	One existing permitted underground mine; reclamation of previously disturbed areas is needed.
19	17 (1, 2)	475	Golden Eagle Uranium, LLC	Montrose and San Miguel	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
20	18	1,181	Cotter Corporation	Montrose	One existing permitted underground mine; reclamation of previously disturbed areas is needed.
21	19	662	Energy Fuels Resources Corp.	Montrose	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
22	19A	1,204	Energy Fuels Resources Corp.	Montrose	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
23	20	627	Energy Fuels Resources Corp.	Montrose	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
24	21	651	Cotter Corporation	Montrose	Exploration plan (two holes) approved; drilling and reclamation of the explored area are completed; no area needs to be reclaimed under current conditions.

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TABLE 1.2-1 (Cont.)

	Lease Tract No.	Acreage	Current Lessee	County	Status[a]
25	22	224	Golden Eagle Uranium, LLC	Montrose	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
26	22A	409	Golden Eagle Uranium, LLC	Montrose	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
27	23 (1, 2, 3)	596	Golden Eagle Uranium, LLC	Montrose	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
28	24	201	Energy Fuels Resources Corp.	Montrose	Exploration plan (eight holes) approved; drilling and reclamation of explored area are completed; no area needs to be reclaimed under current conditions.
29	25	639	Cotter Corporation	Montrose	Exploration plan (one hole) approved; drilling and reclamation of explored area are completed; no area needs to be reclaimed under current conditions.
30	26	3,989	Energy Fuels Resources Corp.	Mesa	Exploration plan (six holes) approved; drilling and reclamation of the explored area are completed; mine re-entry plan is approved, bulkhead partially removed, and assessment completed; portal is resecured; reclamation of previously disturbed areas is needed.
31	27	1,766	Energy Fuels Resources Corp.	Mesa	No recent (post-1995) activity conducted; no area needs to be reclaimed under current conditions.
Total		25,137			

[a] On October 18, 2011, a Federal district court stayed the 31 leases, and enjoined DOE from approving any activities on ULP lands. On February 27, 2012, the court amended its injunction to allow DOE, other Federal, state, or local governmental agencies, and the ULP lessees to conduct only those activities on ULP lands that are absolutely necessary, as described in the court's Order. See *Colorado Environmental Coalition v. Office of Legacy Management*, No. 08-cv-01624, 2012 U.S. DIST. LEXIS 24126 (D. Colo. Feb. 27, 2012).

[b] Least Tracts 7 and 7A were combined (February 2011 time frame) into Lease Tract 7.

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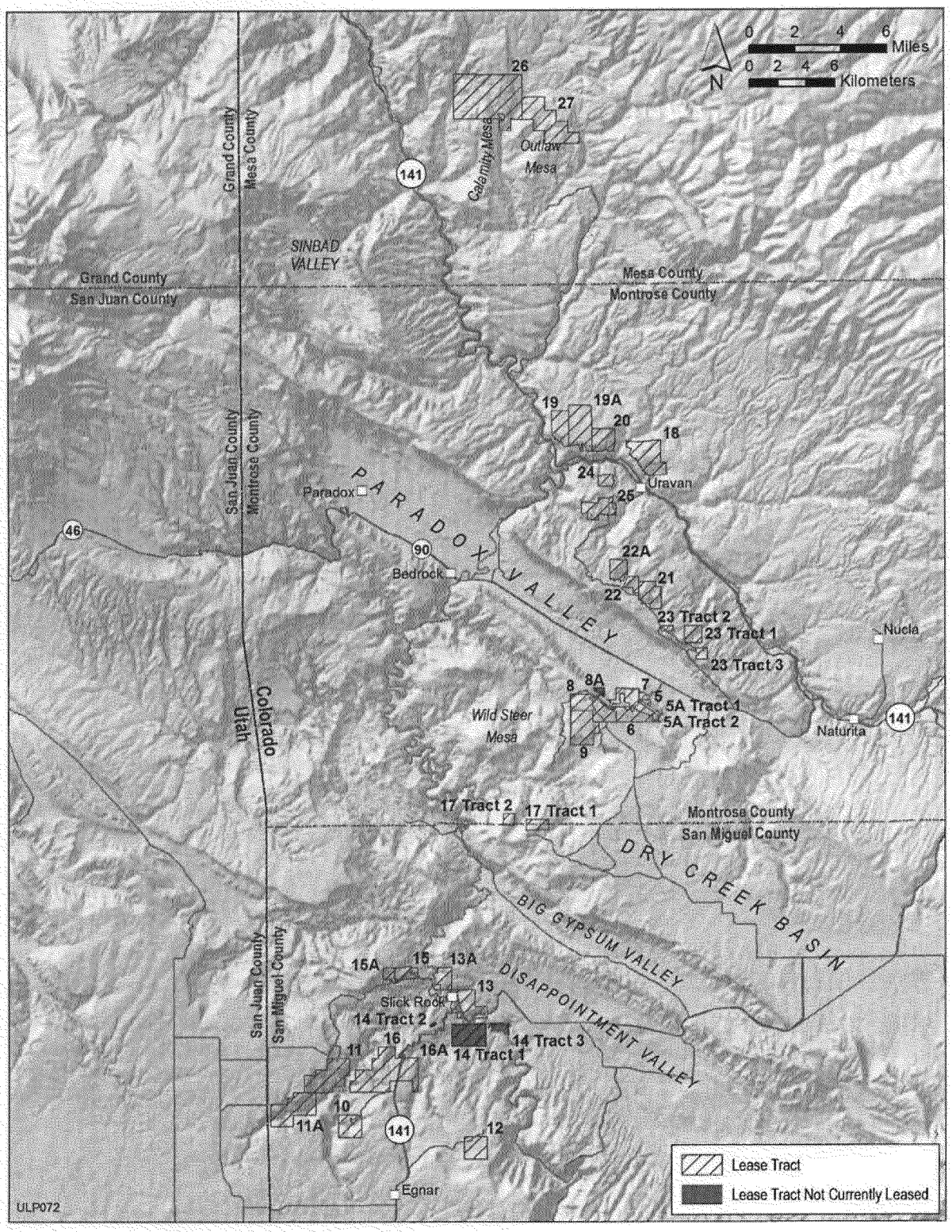

FIGURE 1.2-1 Locations of the 31 ULP Lease Tracts in Colorado

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- Offer the lease tracts to the domestic uranium industry through a competitive royalty-bid process that culminates in the award of each lease to the highest qualified bidder.

- Inspect and maintain lease tract boundary markers and monuments on the lease tracts. Establish and maintain records of survey control points for said markers and monuments.

- Review lessees' exploration and mining plans, in coordination with BLM and the Colorado Division of Reclamation, Mining and Safety (CDRMS), to ensure that they are consistent with Federal, state, and local rules and regulations; existing environmental regulations; lease stipulations; and standard industry practices. Approve or deny each plan as warranted.

- Coordinate with other Federal agencies (e.g., BLM, U.S. Fish and Wildlife Service [USFWS], U.S Environmental Protection Agency [EPA]), state agencies (e.g., CDRMS, Colorado Division of Parks and Wildlife [CPW], Colorado Department of Public Health and the Environment [CDPHE]), local and tribal officials, and private entities as appropriate to address concerns that they may have. Routinely review each Memorandum of Understanding established with BLM and CDRMS to ensure that the agreements remain up to date and reflect actual work practices.

- Establish the amount of reclamation performance bonding appropriate for the amount of environmental disturbance anticipated based on an evaluation of the lessees' proposed activities, including site-specific access routes, exploration drill-hole locations, mine-site support facility locations, and proposed methods of reclamation.

- Monitor lessees' exploration, mine-development, and ore-production activities to ensure compliance with Federal, state, and local environmental regulations and lease stipulations. Identify adverse conditions that need to be addressed and advise the lessees accordingly.

- Review exploration drill-hole logs, drill-hole maps, mine maps, and quarterly reports submitted by the lessees to assess the lessees' progress and verify conditions witnessed during field inspections.

- Review Federal and state mine safety inspection records and reports to identify significant violations or adverse trends and determine whether actions are warranted.

- Monitor and track market prices (spot and long term) for uranium oxide (U_3O_8) and vanadium oxide (V_2O_5) (uranium ore is generated as uranium

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oxide and vanadium ore is generated as vanadium oxide) and keep abreast of activities occurring within the world uranium and vanadium industries.

- Develop and maintain procedures to process and maintain records of ores produced from the DOE lease tracts and delivered to a mill or other receiving station for processing. Calculate the resulting royalties due and payable to DOE. Ensure that royalty payments are submitted in accordance with the lease agreements. Maintain records associated with the number of miles traveled by ore trucks on Federal, state, and county roadways. Ensure that lessees' pulp ore samples are analyzed in accordance with lease agreement requirements.

- Maintain a record of and provide for the routine surveillance of concurrent surface activities (e.g., activities associated with oil and gas leases and special use permits) that are authorized by other agencies with surface-management jurisdiction.

- Evaluate sample plants to verify that they or other facilities receiving lease tract ores have adequate procedures for weighing, sampling, and assaying said ores and for reporting the results to DOE.

- Monitor lessees' reclamation activities to ensure that they comply with Federal, state, and local environmental regulations and lease stipulations. Ensure that these activities are consistent with existing exploration and mining plans and standard industry practices. Monitor post-reclamation sites for 3 to 5 years to assure that adequate vegetation is successfully re-established at the site.

- Oversee the relinquishment of lease agreements when requested by a lessee or the termination of lease agreements for cause when directed by DOE.

Determine the eligibility of inactive, reclaimed lease tracts for restoration to the public domain under BLM's management. Prepare a Request to Relinquish Lands and submit it to the BLM Colorado State Office for processing. Help BLM officials review the Request, and monitor its status until the restoration process is complete.

1.2.2 Lease Requirements

Facsimiles of two generic leases currently utilized for the DOE ULP are shown in Appendix A. (The leases could be modified in the future as a result of this ULP PEIS process.) These two generic leases are the same except for how the royalty payment is determined. Before conducting any exploratory or mining activity, the lessee is required to file a "Notice of Intent to Conduct Prospecting Operations" or "Reclamation Permit Application" with the Colorado Mined Land Reclamation Board for the review and approval of the CDRMS. The lessee is then required to submit three copies of a detailed Exploration Plan or Mining Plan to DOE. This plan must

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include a site-specific environmental analysis and a description of measures to be taken to assure compliance with all Federal, state, and local laws (including all potential impacts that could result in downstream or off-site environmental and/or resource degradation, and air quality or health-related impacts). In addition, the lessee must consult with all pertinent Federal, state, and local agencies—including, but not limited to, the BLM, USFWS, U.S. Army Corps of Engineers (USACE), EPA, CPW, State Historic Preservation Officer (SHPO), and Indian tribal governments—to determine the presence and/or location of all endangered, threatened, and sensitive plant and wildlife species; known cultural resources; and floodplain and wetland areas. Plans are reviewed by DOE in coordination with BLM and CDRMS, and upon DOE's approval, the actions described in the plan can commence. DOE and other appropriate agencies must be notified in writing if the lessee wishes to change part of the plan, and no change can take place until approval is given. After the plan is approved, but before any ground-disturbing activity can commence, the lessee must file a performance bond (the amount is established by DOE) in coordination with CDRMS. This coordination is reflected in the Memorandum of Understanding (MOU) between DOE and CDRMS (DOE and CDRMS 2012).

Upon termination of the lease, the lessee has 180 days to reclaim and return the land to DOE, unless other arrangements have been agreed to in advance. The lessee is required to remove all equipment, stockpiles, and evidence of mining, unless the improvement is a structural support needed to maintain the mine.

1.2.3 Site-Specific Information for the ULP Lease Tracts

In addition to information about the 31 lease tracts presented in Table 1.2-1 (and Figure 1.2-1), site-specific information on 8 of the 31 lease tracts where existing permitted mines are located is summarized in this section. This information, in addition to other site-specific information (in Tables 2.2-1 and 2.2-2) and assumptions discussed in Section 2.2, is used as the basis of the evaluation for potential impacts discussed in Chapter 4. The information for Lease Tracts 5, 6, 7, 8, 9, 11, 13, and 18 discussed in the sections that follow includes the location of the existing permitted mine(s), activities conducted to date, amount of ore generated, and royalty realized. Finally, Table 1.2-2 lists the estimated ore reserves that remain at each of the 31 lease tracts.

1.2.3.1 ULP Lease Tract 5

On Lease Tract 5, the C–JD–5 mine is located in Sections 21 and 22, T 46 N, R 17 W, NMPM, in Montrose County, Colorado (see Figure 1.2-2). The original lease was executed effective June 12, 1974. A royalty bid of 12.00%, payable on ores containing 700,000 lb (318,000 kg) of U_3O_8 secured the lease.

A mining plan was submitted on June 10, 1976, proposing entry by a 16-ft (4.9-m) diameter, 320 ft (98 m) deep, shaft located in the northwest corner of the property. The lessee began sinking the shaft shortly after the plan was approved, and the shaft was bottomed in early

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TABLE 1.2-2 Estimated Remaining Ore Reserve at the ULP Lease Tracts

ULP Lease Tract	Remaining Ore Reserves[a] (lb U_3O_8)
5	230,000
5A	30,000
6	850,000
7	2,800,000
8	330,000
8A	30,000
9	630,000
10[b]	0
11	740,000
11A	300,000
12	160,000
13	330,000
13A	220,000
14	85,000
15	84,000
15A	250,000
16	44,000
16A	18,000
17	75,000
18	1,200,010
19[b]	0
19A	1,500,000
20	800,000
21	1,000,000
22	140,000
22A[b]	0
23	550,000
24	90,000
25	540,000
26	68,000
27	87,000
Total remaining ore reserves	13,000,000

[a] Amount shown equals the lease "bid quantity" minus the total production to date. Values have been rounded to two significant figures.

[b] The lease "bid quantity" has been produced from this tract; any additional reserves that may exist have not been quantified.

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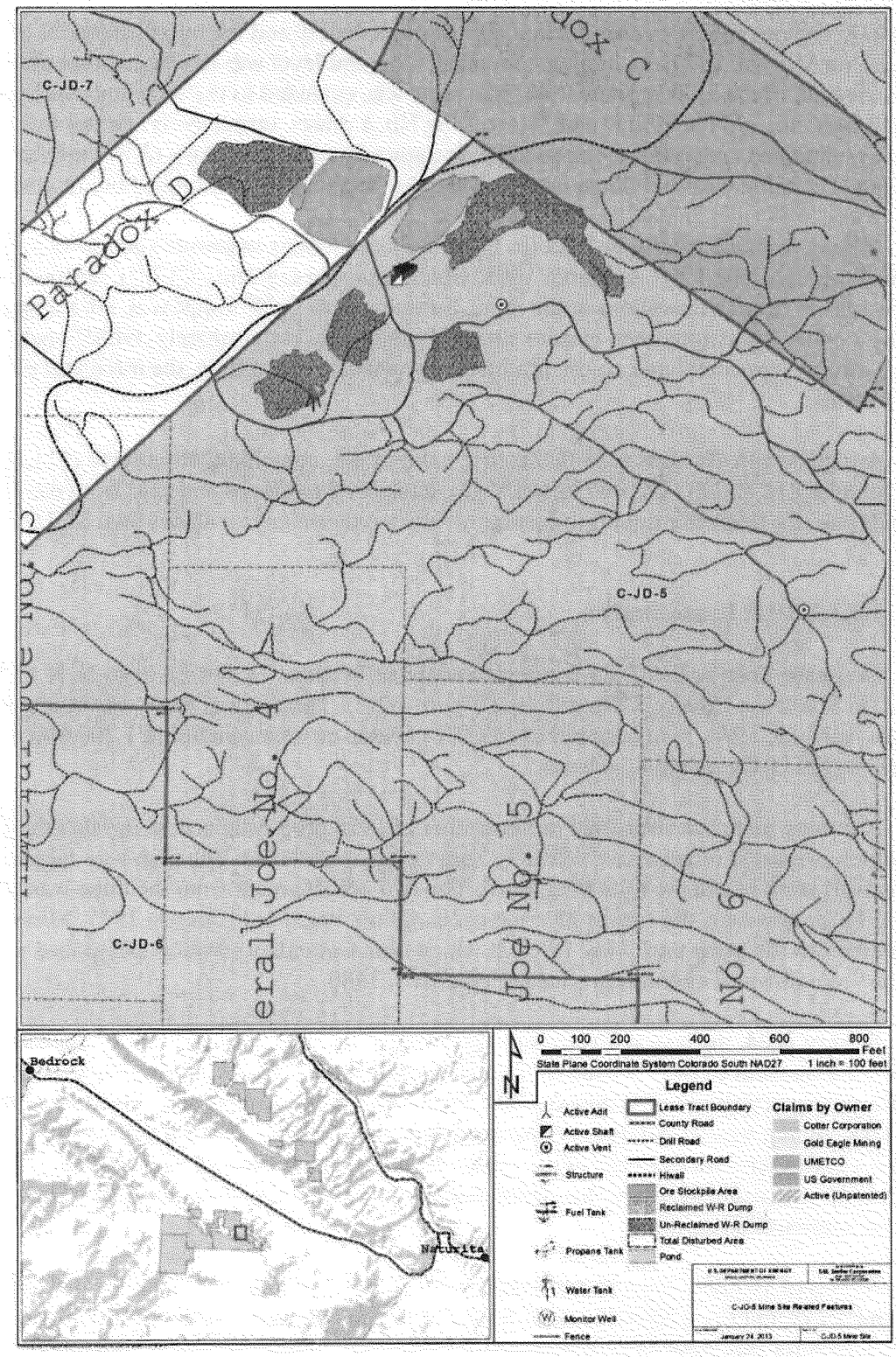

FIGURE 1.2-2 Location of C-JD-5 Mine on Lease Tract 5

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April 1977. The ore zone was encountered almost immediately and the initial shipment of ore was made on May 26, 1977. As mining continued, a second level was developed that ultimately yielded the bulk of the mine's production. The mine was extended to the west and south and connected with the old Paradox D and Mineral Joe No. 4 mines, respectively; during this time, the mine maintained consistent ore production at approximately 3,000 tons (2,700 metric tons) per month. The mine was shut down in early 1980 due to a lack of economical ore reserves.

Mining resumed briefly in 1989 (as the mine's economics improved) and production continued through June 1990. In March 1998, Gold Eagle Mining, Inc. (GEMI), notified DOE of its intensions to resume operations at the mine. Subsequent to DOE's approval, GEMI upgraded the mine's entire infrastructure to current standards and code. Unfortunately, GEMI could not secure a milling agreement and no ore production occurred. At that time, the mine was placed on standby status.

A total of 136,000 tons (123,000 metric tons) of ore, containing 466,000 lb (211,000 kg) of U_3O_8 and 1,812,000 lb (822,000 kg) of V_2O_5, have been produced and sold from the mine. Royalties paid for this lease tract (production royalties plus annual royalties) total $2,154,000.

1.2.3.2 ULP Lease Tract 6

On Lease Tract 6, the C-JD-6 mine is located in Sections 21 and 22, T 46 N, R 17 W, NMPM, in Montrose County, Colorado (see Figure 1.2-3). The original lease was executed effective April 18, 1974. A royalty bid of 14.20% payable on ores containing 1,200,000 lb (544,000 kg) of U_3O_8 secured the lease.

A mining plan was submitted in September of 1975 proposing access through the Duggan Adit, which is located on adjacent, privately held unpatented claims. The plan was approved and development work began the following April. The first ore shipment from the mine was made on May 12, 1976; however, the true production cycle did not begin until August 1977. Mining continued much the same until May 1980, at which time Cotter Corporation announced a temporary shutdown of operations effective August 8, 1980.

In May 2004, the lessee, Cotter, notified DOE of its intensions to resume operations at the mine. Subsequent to DOE's approval and following several weeks of site preparation, Cotter resumed mining activities on August 2, 2004. Production continued through November 2005, at which time mining was suspended and the mine was placed on standby status. In 2008, Cotter installed a lysimeter downgradient of the mine site to determine whether near-surface soils or rock formations contain moisture that could affect (or be affected by) the mine site. The lysimeter is monitored monthly.

A total of 107,000 tons (97,000 metric tons) of ore, containing 350,000 lb (159,000 kg) of U_3O_8 and 2,248,000 lb (1,020,000 kg) of V_2O_5, have been produced and sold from the mine. Royalties paid for this lease tract (production royalties plus annual royalties) total $2,946,000.

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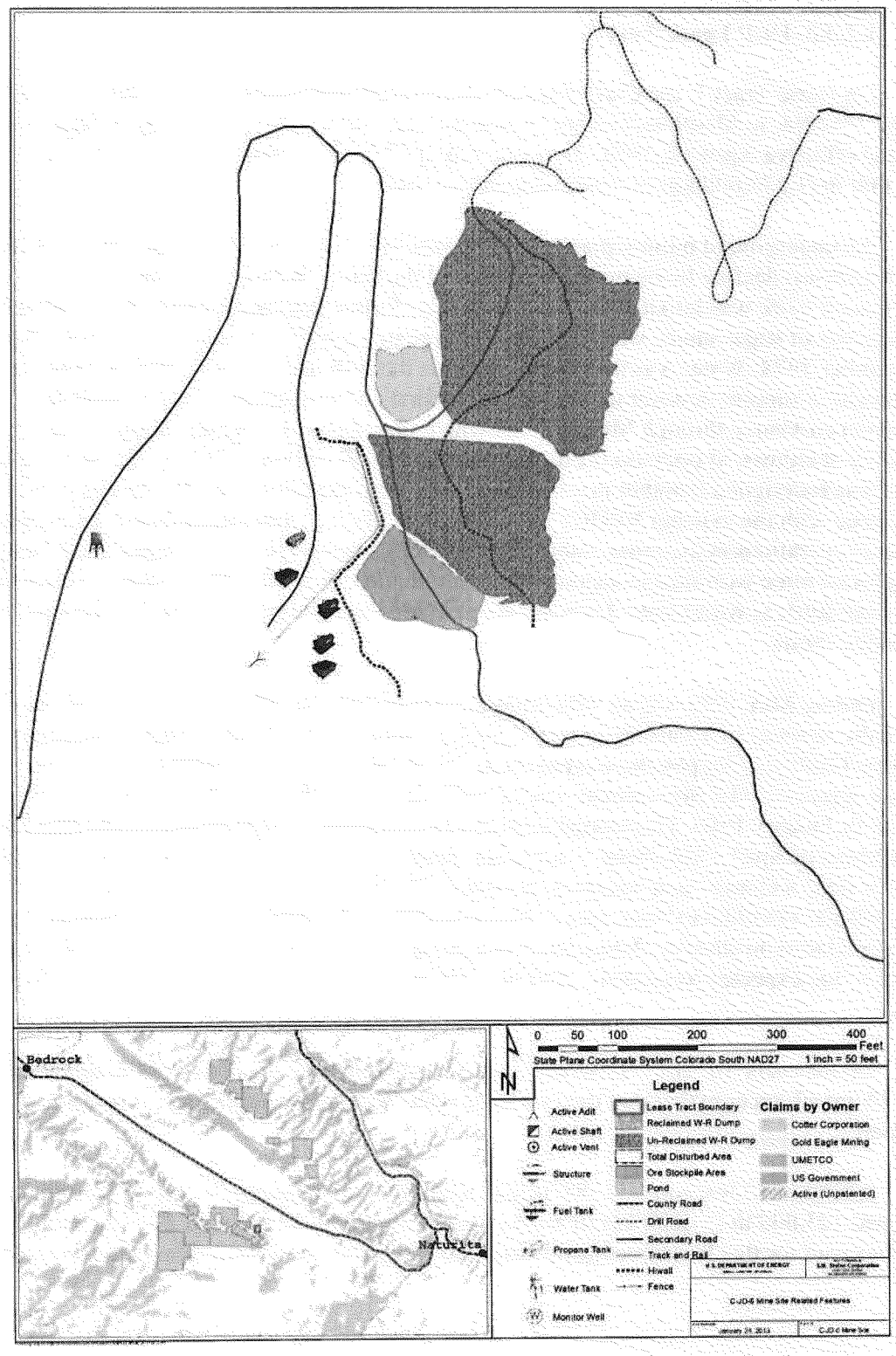

FIGURE 1.2-3 Location of C-JD-6 Mine on Lease Tract 6

1.2.3.3 ULP Lease Tract 7

On Lease Tract 7, the C-JD-7 mine is located in Sections 16, 20, 21, and 22, T 46 N, R 17 W, NMPM, in Montrose County, Colorado (see Figure 1.2-4). The original lease was executed effective April 18, 1974. A royalty bid of 27.30% payable on ores containing 2,800,000 lb (1,270,000 kg) of U_3O_8 secured the lease.

An underground mining plan was submitted in November 1976 proposing entry through a 1600-ft (490-m) decline in the northern portion of the tract. The plan was approved and development work was initiated the following May. Following numerous delays, including the encountering of sugar sands, which require continuous support, the incline was finally bottomed in December 1978. Water was then encountered in the drift and two evaporation ponds were constructed to support dewatering activities. The first ore was shipped in July 1979 and production continued through May 1980, at which time Cotter Corporation announced a temporary shutdown of operations effective May 22, 1980. In June 1980, the water treatment system was redesigned (another pond was built) to bring the mine-water treatment system into compliance with the existing NPDES permit. In June 2005, Cotter notified DOE of its intensions to resume operations at the mine. Subsequent to DOE's approval, Cotter began rehabilitating the underground mine workings to support future production activities. This work continued through November 2005, at which time development activities were suspended and the mine was placed on standby status.

During May 1979, Cotter submitted an open pit mining plan for the property that would require the removal of 13 million tons (12 million metric tons) of overburden and affect some 650 acres (260 ha). The plan was approved in November and Cotter entertained bids on two separate contracts. The first contract was for the removal of the vegetation; that work was initiated in January 1980. The second contract was for Phase 1 of stripping the overburden, which began in April 1980. Phase 1 activities included utilizing the northern portion of Lease Tract 7A (also a Cotter lease tract) for the spoils pile. Stripping activities continued at a rate of 1,000,000 yd^3 (765,000 m^3) per month for 13 months, until March 31, 1981, at which time the mine was placed on standby status due to declining market conditions. Once in production, the operation was expected to produce 500 tons (450 metric tons) of ore per day, averaging 0.30% U_3O_8.

On February 16, 2011, DOE executed a modification to the lease that incorporated Lease Tract 7A into 7, recognizing that the two lease tracts were inseparable due to the open-pit mining operation.

A total of 12,000 tons (11,000 metric tons) of ore, containing 46,000 lb (21,000 kg) of U_3O_8 and 125,000 lb (57,000 kg) of V_2O_5, have been produced and sold from the mine. Royalties paid for this lease tract (production royalties plus annual royalties) total $1,442,000.

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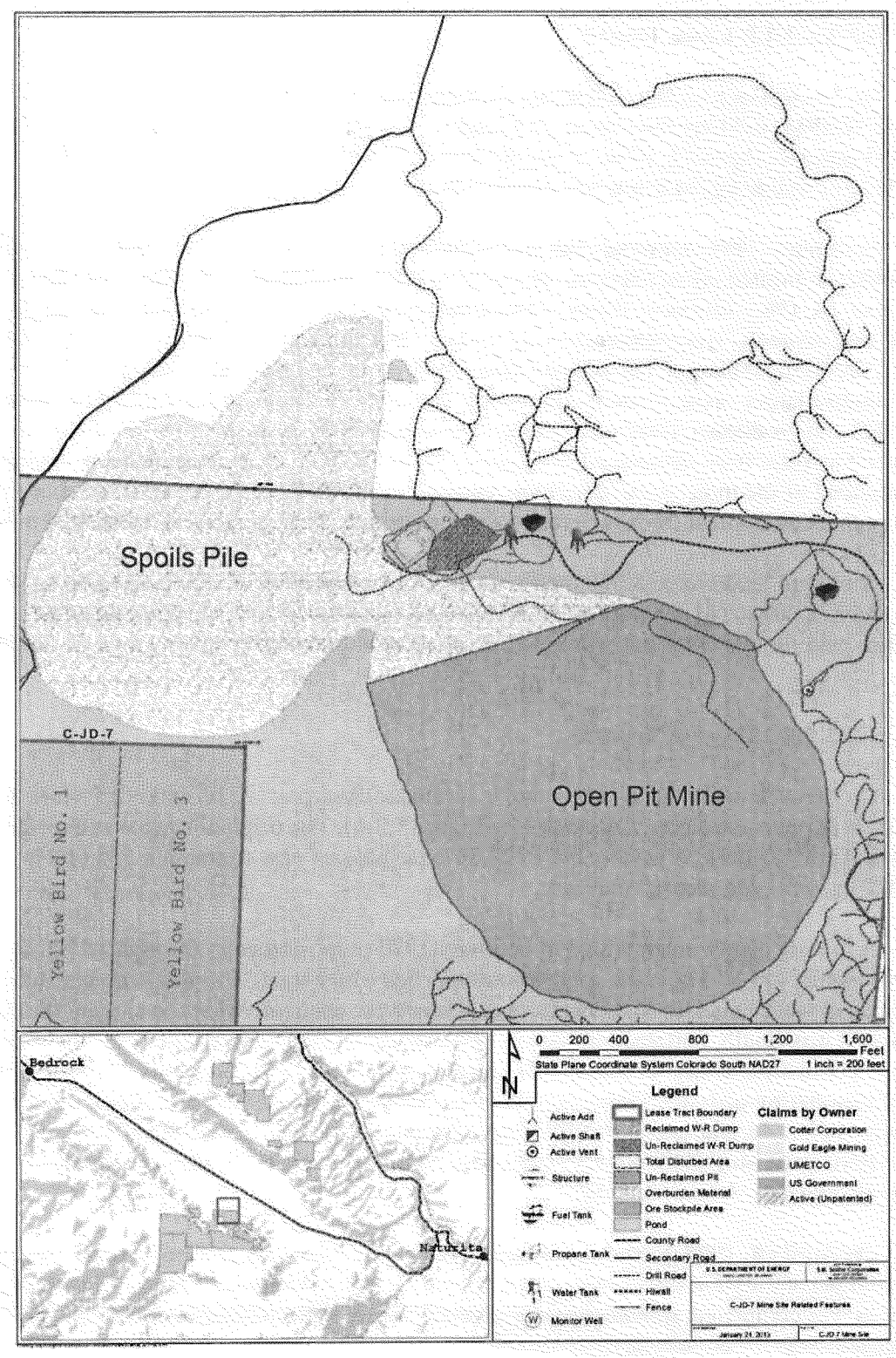

FIGURE 1.2-4 Location of C-JD-7 Mine on Lease Tract 7

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1.2.3.4 ULP Lease Tract 8

On Lease Tract 8, the C-JD-8 mine is located in Sections 17, 18, 19, and 20, T 46 N, R 17 W, NMPM, in Montrose County, Colorado (see Figure 1.2-5). The original lease was executed effective April 18, 1974. A royalty bid of 36.20% payable on ores containing 375,000 lb (170,000 kg) of U_3O_8 secured the lease.

In January 1984, a mining plan was submitted proposing access through the Opera Box Adit, which is located on an adjacent, privately held patented claim. This plan was approved on November 18, 1985; however, it was never acted upon. A revised mining plan, updated to meet current requirements, was submitted in December 2004 and was approved January 21, 2005. Cotter Corporation enlarged the existing Opera Box portal and the main haulage drift to accommodate larger, more modern equipment. The first ore shipment from the mine was made in June 2005 and production continued through November 2005, at which time mining was suspended and the mine was placed on standby status. In 2008, Cotter installed a lysimeter downgradient of the mine site to determine whether near-surface soils or rock formations contain moisture that could affect (or be affected by) the mine site. The lysimeter is monitored monthly.

A total of 9,000 tons (8,000 metric tons) of ore, containing 46,000 lb (21,000 kg) of U_3O_8 and 178,000 lb (81,000 kg) of V_2O_5, have been produced and sold from the mine. Royalties paid for this lease tract (production royalties plus annual royalties) total $1,264,000.

1.2.3.5 ULP Lease Tract 9

On Lease Tract 9, the C-JD-9 mine is located in Sections 19, 29, and 30, T 46 N, R 17 W, NMPM, in Montrose County, Colorado (see Figure 1.2-6). The original lease was executed effective April 18, 1974. A royalty bid of 24.30% payable on ores containing 850,000 lb (386,000 kg) of U_3O_8 secured the lease.

A mining plan was submitted in February 1977 proposing entry through a 1700-ft (520-m) incline of –17.5% in the south-central portion of the tract. The plan was approved and development work began in May. Numerous delays were encountered while sinking the decline; however, it was finally bottomed in March 1978 and development drift work continued toward different ore bodies. Water was soon encountered and two evaporation ponds were constructed to support dewatering activities. Some ore was encountered in August 1978 and the initial ore shipment was made. The ore production rate soon increased and ore shipments were made on a regular basis until May 1980 when Cotter Corporation announced a temporary shutdown of operations effective August 8, 1980.

On April 28, 1998, Cotter submitted a plan to construct two new mine-water treatment ponds and decommission the existing pond system on top of Monogram Mesa. Construction of the ponds was completed, but the ponds were never lined or put into service and the existing pond system was never decommissioned.

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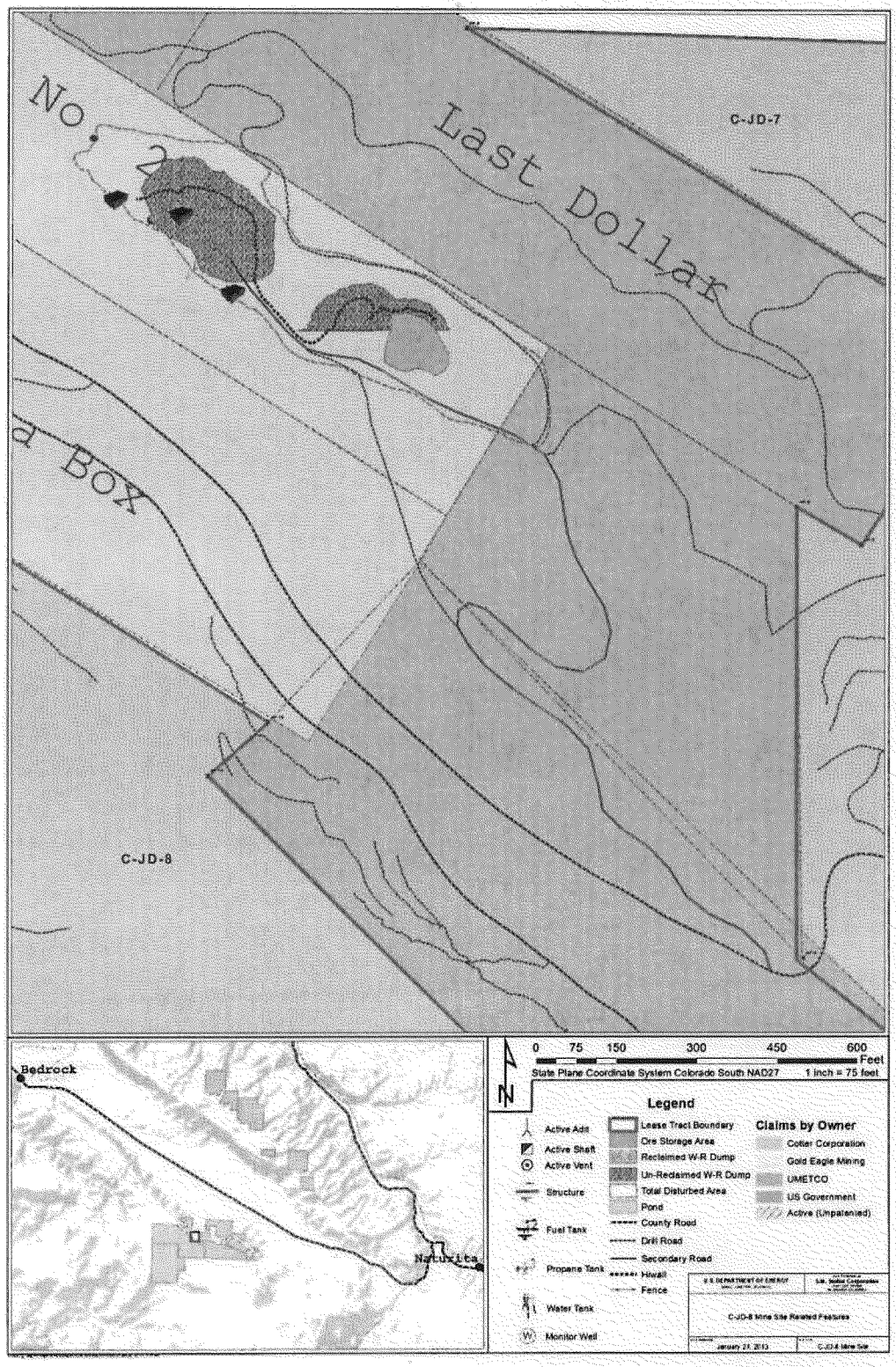

FIGURE 1.2-5 Location of C-JD-8 Mine on Lease Tract 8

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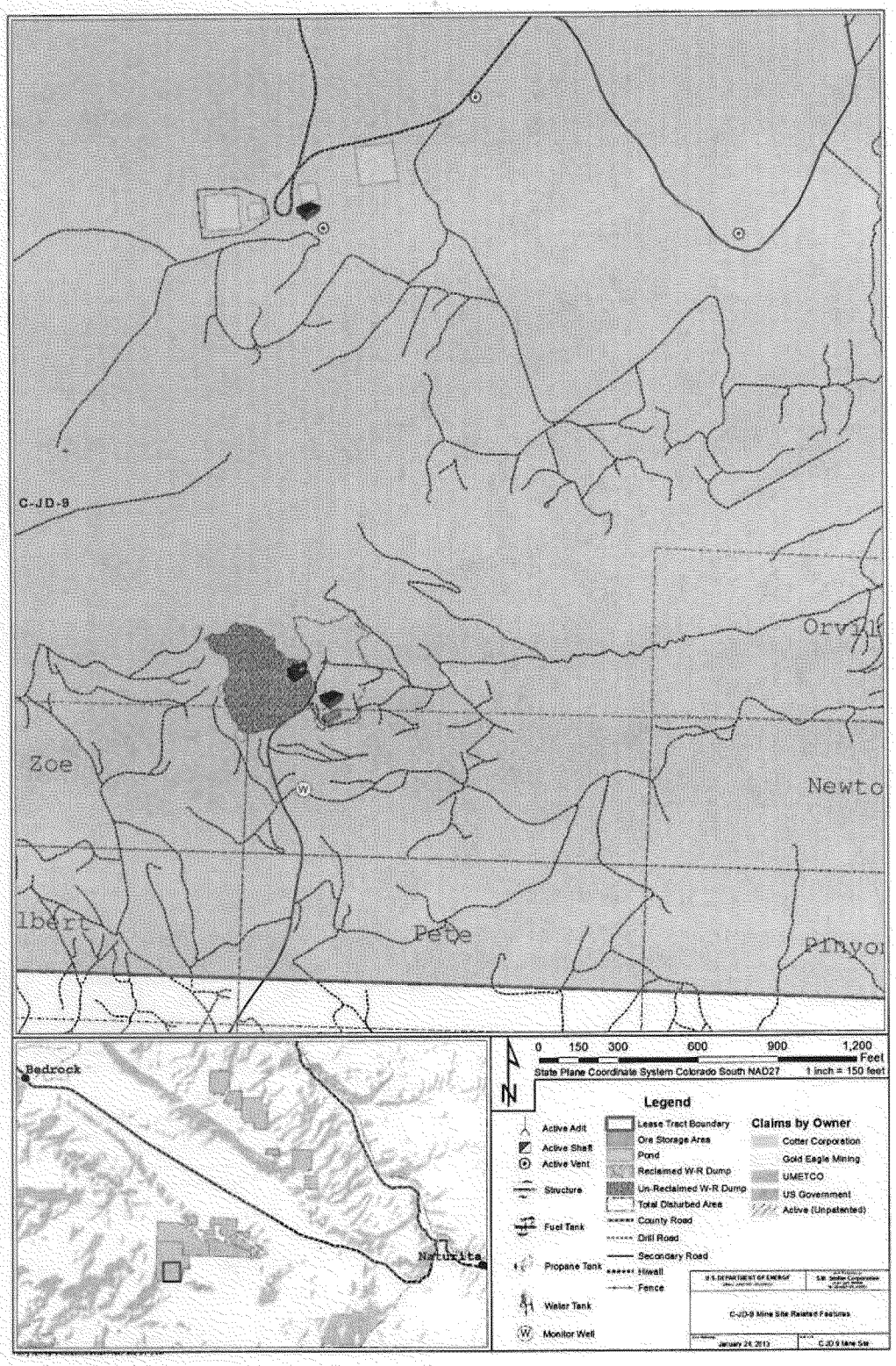

FIGURE 1.2-6 Location of C-JD-9 Mine on Lease Tract 9

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In March 2003, Cotter advised DOE of its plans to resume mining operations at the site. Following several weeks of site preparation, Cotter resumed production activities at the mine. Mine production activities continued through November 2005, at which time mining was suspended and the mine was placed on standby status. In 2008, Cotter installed a lysimeter downgradient of the mine site to determine whether near-surface soils or rock formations contain moisture that could affect (or be affected by) the mine site. In addition, in December 2006 DOE approved the installation of a groundwater monitoring well downgradient of the mine site. The lysimeter and monitoring well are monitored and sampled monthly. In October 2008, Cotter notified DOE of a rockfall that had recently occurred at the mine, approximately 100 ft (30 m) down the main haulage drift from the portal. In discussions between DOE and Cotter, Cotter concluded that it would assess the situation and options.

A total of 55,000 tons (50,000 metric tons) of ore, containing 223,000 lb (101,000 kg) of U_3O_8 and 1,112,000 lb (504,000 kg) of V_2O_5, have been produced and sold from the mine. Royalties paid for this lease tract (production royalties plus annual royalties) total $2,586,000.

1.2.3.6 ULP Lease Tract 11

On Lease Tract 11, the C-SR-11 mine is located in Sections 8, 17, and 18, T 43 N, R 19 W, NMPM, in San Miguel County, Colorado (see Figure 1.2-7). The original lease was executed effective June 12, 1974. A royalty bid of 11.67% payable on ores containing 900,000 lb (408,000 kg) of U_3O_8 secured the lease.

A number of different mining plans were submitted and approved for the lease tract, proposing re-entry into existing mines and resumption of mining activities through existing mine workings. However, only two operations bear any significant recognition: the Brighton and Ike mines. The Brighton mine, located along the rim of Summit Canyon, was in production from December 1975 through April 1977. The Ike mine complex, mined through the Dawson Incline, was in production from August 1975 through mid-December 1980. This operation included some initial work in the existing Ike No. 2 mine, in addition to development of and production from a nearby incline on the Radium No. 8 claim adjacent to the lease tract along the northeast corner. In December 1980, mining activities on the lease tract were suspended and the mines were placed on standby status. In 1999, Cotter Corporation initiated reclamation activities at the Brighton and Ike mines, as well as on legacy mine sites located on the lease tract. The mine portals and ventilation shafts were permanently sealed and closed; the mine waste-rock dumps were recontoured to blend in with the surrounding natural topography, and the disturbed areas were reseeded. These activities were completed in the fall of 2000.

In February 2005, Cotter proposed a new mine for the lease tract located in the south-central portion of the property. Entry was to be gained from a 1,300-ft (400-m) decline, and DOE approved the plan in June 2005. Mine development work began almost immediately and continued through November 2005, at which time mining activities were suspended and the mine was placed on standby status. At that time, the decline had been advanced approximately 250 ft (76 m).

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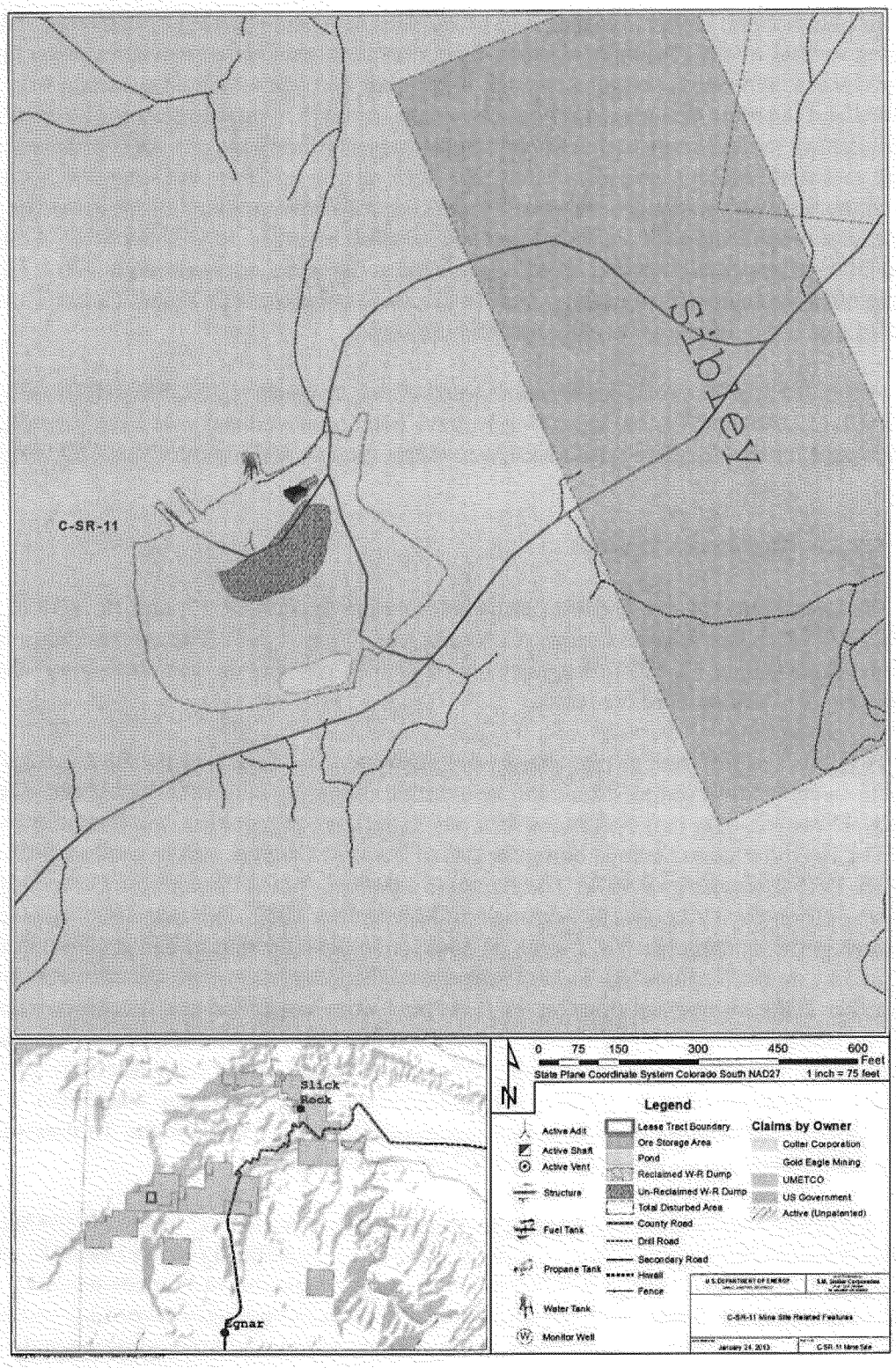

FIGURE 1.2-7 Location of C-SR-11 Mine on Lease Tract 11

A total of 47,000 tons (43,000 metric tons) of ore, containing 162,000 lb (73,000 kg) of U_3O_8 and 925,000 lb (420,000 kg) of V_2O_5 have been produced and sold from the lease tract mines. Royalties paid for this lease tract (production royalties plus annual royalties) total $1,200,000.

1.2.3.7 ULP Lease Tract 13

On Lease Tract 13, the C-SR-13 mine is located in Sections 29, 30, 31, 32, and 33, T 44 N, R 18 W, NMPM, in San Miguel County, Colorado (see Figure 1.2-8). The original lease was executed effective May 24, 1974. A royalty bid of 20.60% payable on ores containing 700,000 lb (318,000 kg) of U_3O_8 secured the lease.

The initial mining plan submitted in January 1975 proposed entry through the Burro Tunnel Mine. The mine portal and a portion of the main haulage drift are located on the lease tract but provide access to the Burro Mine complex, which is located immediately north of the lease tract on the privately held unpatented Burro claims. The plan was approved and production began from an area along the northern boundary of the lease tract in an area of the Burro Mine complex where ore was showing in the heading. Production continued from there and extended southward toward the Ellison Mine. The initial shipment of ore was made in June 1975 and production continued through 1981, at which time the mine was placed on standby status. A second mining plan (the New Ellison Mine) was submitted in November 1978 proposing entry through a new decline into the area northeast of the existing Ellison mine, with which it would connect for ventilation. The plan was approved and development began in May 1979. The incline was bottomed in August 1980 and development continued through December of that year. Although ore is showing in several headings, the operation was limited to development and no ore was produced. In March 1981, the mine was expanded to connect with the existing Ellison mine, establishing a ventilation pathway and a secondary escapeway. Shortly afterward, operations ceased and this mine was also placed on standby status. Other operations were conducted sporadically during this time and include mines such as Hawkeye and Herbert. However, ore shipments from these operations were small and relatively insignificant when compared to the operation at the Burro Mine complex. These smaller mine sites have since been reclaimed. The mine portals were gated to conserve bat habitat, or were permanently sealed and closed; the mine-waste-rock dumps were recontoured to blend in with the surrounding, natural topography; and the disturbed areas were reseeded.

Radon!

A total of 86,000 tons (78,000 metric tons) of ore, containing 323,000 lb (147,000 kg) of U_3O_8 and 2,766,000 lb (1,255,000 kg) of V_2O_5, have been produced and sold from the lease tract. Royalties paid for this lease tract (production royalties plus annual royalties) total $4,047,000.

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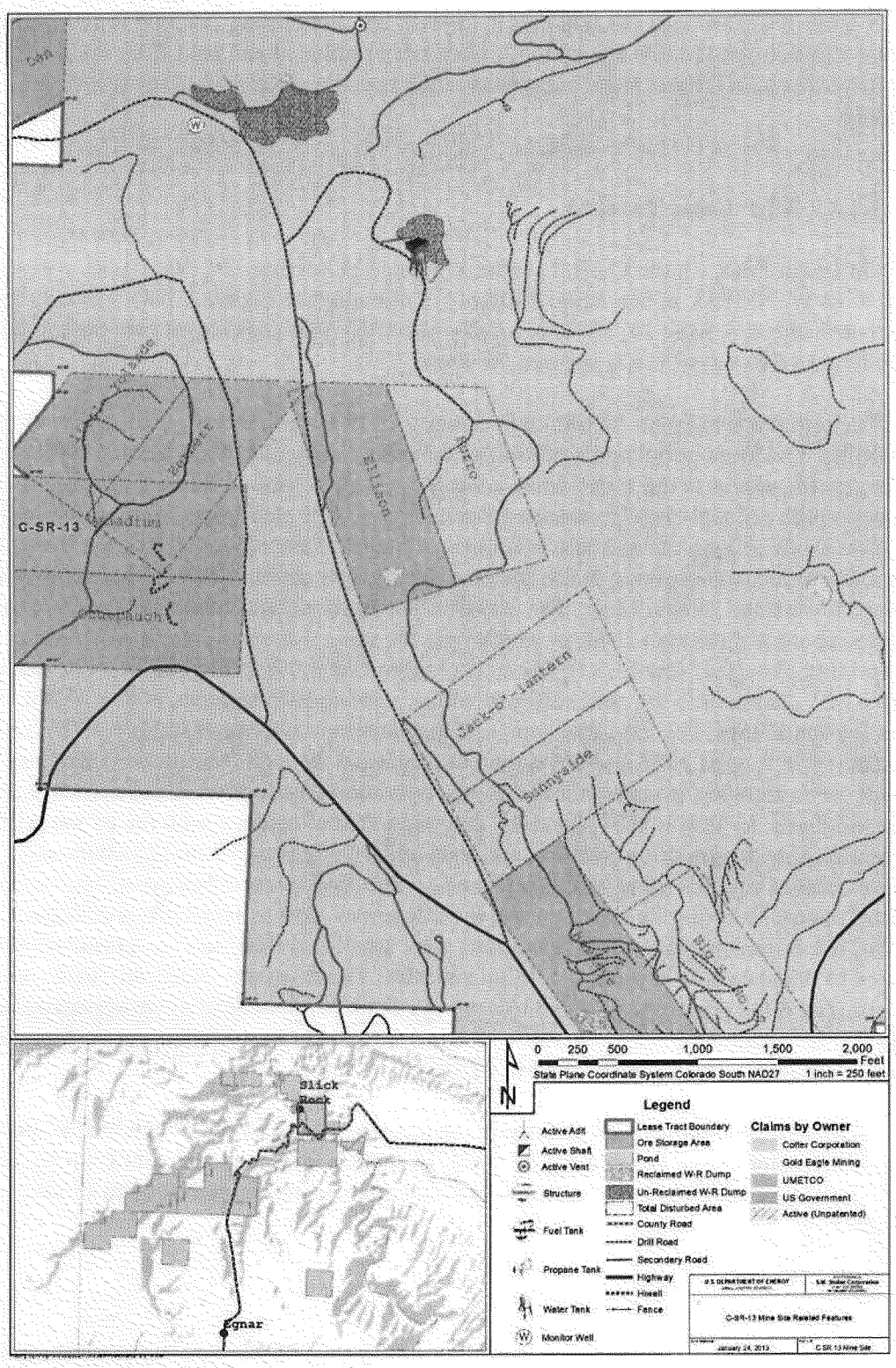

FIGURE 1.2-8 Location of C-SR-13 Mine on Lease Tract 13

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1.2.3.8 ULP Lease Tract 18

On Lease Tract 18, the C-SM-18 mine is located in Sections 21, 22, 26, 27, and 28, T 48 N, R 17 W, NMPM, Montrose County, Colorado (see Figure 1.2-9). The original lease was executed effective April 18, 1974. A royalty bid of 15.60% payable on ores containing 1,300,000 lb (590,000 kg) U_3O_8 secured the lease.

A mining plan was submitted in March 1978 proposing entry through a 1540-ft (470-m) decline in the northwestern portion of the lease. The plan was approved and development began in late May. After numerous delays, the incline was bottomed in September 1979 and production began in December of that year. The initial shipment of ore was made in February 1980. Production continued until May when Cotter Corporation announced a temporary shutdown of operations effective May 22, 1980. The mine was placed on standby status and remained so until October 2000. At that time, Cotter submitted a reclamation plan for a portion of its mining operations on Lease Tract 18. The plan was approved by DOE in January 2001 and reclamation activities were completed in February. The mine portal and ventilation shaft were permanently sealed and closed; the mine-waste-rock dump was recontoured to blend in with the surrounding, natural topography; and the disturbed areas were reseeded. The maintenance shop building was left intact to support Cotter's continuing operations on the lease tract.

In September 2004, Cotter submitted a new mining plan, proposing entry into the southern portion of the lease tract through the Wright Mine located on an adjacent, privately held patented claim. DOE approved the plan in October 2004 and site preparation activities began almost immediately. Mining was initiated in the first quarter of 2005 and shipments of lease tract ore began in March. Mining was suspended in November 2005 and the mine was placed on standby status. In 2008, Cotter installed a lysimeter downgradient of the mine site to determine whether near-surface soils or rock formations contain moisture that could affect (or be affected by) the mine site. The lysimeter is monitored monthly.

A total of 27,000 tons (24,000 metric tons) of ore, containing 136,000 lb (62,000 kg) of U_3O_8 and 1,163,000 lb (528,000 kg) of V_2O_5, have been produced and sold from the mine. Royalties paid for this lease tract (production royalties plus annual royalties) total $1,950,000.

1.3 PURPOSE AND NEED FOR AGENCY ACTION

In light of the site-specific information that DOE has gathered as a result of the site-specific agency actions proposed and approved pursuant to the July 2007 PEA/FONSI, it is now appropriate for DOE to prepare a PEIS in order to analyze the reasonably foreseeable environmental impacts, including the site-specific impacts, of the range of reasonable alternatives for the management of the ULP.

The underlying purpose and need for agency action is to support the implementation of the Atomic Energy Act (AEA) (42 U.S.C. §§ 2096–2097), which authorized and directed DOE to develop a supply of domestic uranium and to issue leases for the mining of uranium and other

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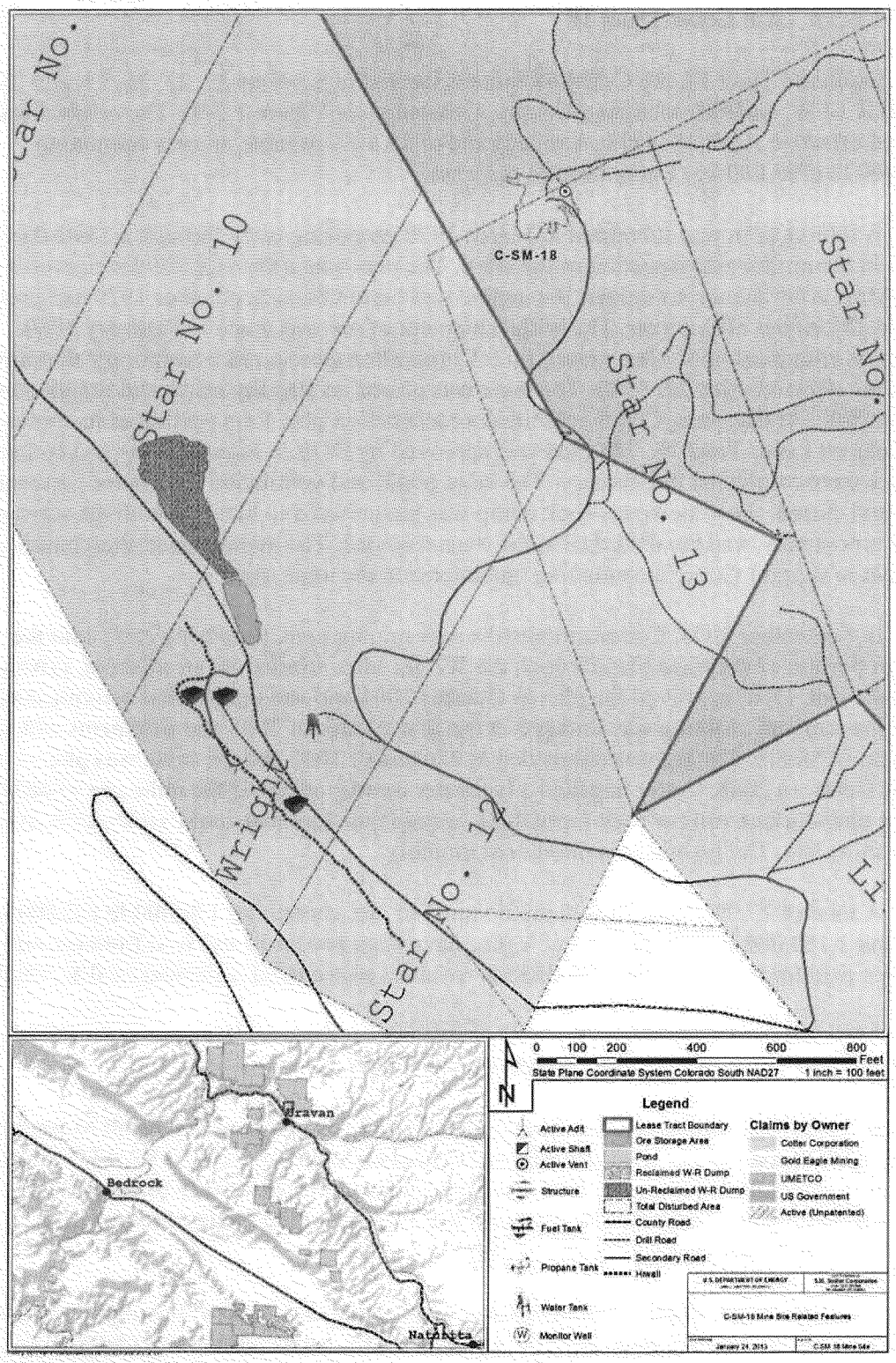

FIGURE 1.2-9 Location of C-SM-18 Mine on Lease Tract 18

source materials to effectuate the provisions of the AEA, and the implementation of the Energy Policy Act of 2005 (Public Law [P.L.]109-58), which emphasized the reestablishment of nuclear power (Sections 601 through 657). In support of these statutes, DOE needs to determine the future course of the ULP, including whether to continue leasing some or all of the withdrawn lands and Government-owned patented claims (referred to as "DOE-managed lands") for the exploration and production of uranium and vanadium ores.

1.4 PROPOSED ACTION

DOE's proposed action is to decide whether to continue the ULP and, if it decides to continue the ULP, to determine which alternative to adopt in order to manage the ULP. DOE developed the range of alternatives by carefully considering DOE's underlying need for action and comments received during the public scoping period for this Draft ULP PEIS.

1.5 SCOPE OF THIS DRAFT ULP PEIS

This Draft ULP PEIS evaluates five alternatives for managing the ULP for which there are 31 lease tracts located in Mesa, Montrose, and San Miguel Counties in western Colorado. These alternatives address the range of reasonable options, which involve (1) terminating the leases and conducting reclamation where needed, with DOE continuing to maintain oversight of the lands without uranium leasing; (2) terminating the leases and conducting reclamation where needed, relinguishing the lands for potential management by BLM and public domain lands, and terminating the DOE ULP; and (3) continuing the ULP with associated exploration, mine development and operations, and reclamation at some or all of the 31 lease tracts. At the time that this Draft ULP PEIS was being prepared, 29 of the 31 lease tracts were actively held under lease, and the remaining 2 tracts had not been leased.

Of the 31 lease tracts, 11 are located in San Miguel County, 17 are located in Montrose County, 2 are located in Mesa County, and 1 is located in both San Miguel and Montrose Counties. The lease tracts vary in size from as small as 25 acres (10 ha) to as large as about 4,000 acres (1,600 ha).

The 29 active leases are held by five companies: (1) Golden Eagle Uranium, LLC; (2) Cotter Corporation; (3) Gold Eagle Mining, Inc.; (4) Colorado Plateau Partners; and (5) Energy Fuels Resources Corporation, Inc.

This Draft ULP PEIS evaluates the three mining phases associated with the underground and surface open-pit mining methods. These phases are the exploration phase, mine development and operations phase, and reclamation phase. Resource areas evaluated are discussed in Chapter 2. The evaluation discussed in this Draft ULP PEIS incorporates site-specific information available regarding the ULP lease tracts (e.g., current status, previous mining operations that occurred, and other environmental information). In addition, since as of now there have been no new mine plans (i.e., for exploration, mine development and operations, or

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reclamation) submitted to DOE by the lessees, the location of where new, future, potential mining would take place and other associated details are not currently known. Hence, the evaluation conducted in this Draft ULP PEIS also incorporates assumptions for developing a reasonable scenario that could represent an upper bound level of possible future mining activity for each of the alternatives, as appropriate. These assumptions are discussed in Chapter 2.

1.6 NEPA PROCESS FOR THE ULP

After this PEIS is completed and at least 30 days after the EPA issues a notice of availability of the Final PEIS, DOE may issue a Record of Decision (ROD) announcing DOE's selection of an alternative for the continued management of the ULP. Section 2.6 of this Draft PEIS identifies DOE's preferred alternative (i.e., Alternative 4, to continue with exploration, mine development and operations, and reclamation on the 31 DOE ULP lease tracts for 10 years or another reasonable time period). After the ROD is issued, as plans (for exploration, mine development and operation, and reclamation) are submitted by the lessees to DOE for approval, further NEPA review for a given action would be conducted. The level of follow-on NEPA review to be done (e.g., categorical exclusion determination, environmental assessment, or environmental impact statement) would depend on the action being proposed by the lessees, as indicated in the plans submitted. This NEPA review would be conducted to inform DOE's decision on approval of the plans, including the conditions DOE would require to mitigate potential impacts. As discussed in Section 1.2.1 (where requirements of current leases are summarized), no activity can be undertaken by the lessees until DOE has approved the plans submitted. DOE's review would be conducted in consultation with Federal, state, and local agencies. Tribal consultation would also be undertaken for site-specific actions, as appropriate. Public participation on the follow-on NEPA review would occur in a manner consistent with the level of review conducted and with DOE and CEQ regulations. Section 1.6.1 discusses the public participation process for this PEIS.

1.6.1 Public Participation on the PEIS

During the preparation of this PEIS, opportunities for public participation have been and are being provided (see Figure 1.6-1). Consistent with CEQ requirements (40 CFR 1501.7) and DOE NEPA implementation procedures (10 CFR 1021.311), an early and open scoping process was carried out to determine the scope of the PEIS and identify significant issues related to the proposed action. An NOI was issued for public review, and a public scoping process was conducted. Public participation is also being solicited for the review of this Draft ULP PEIS during the public comment period. NEPA requires that comments on the Draft ULP PEIS be evaluated and considered during the preparation of the Final ULP PEIS and that a response to comments be provided.

The NOI (76 FR 36097) to prepare this ULP PEIS was issued on June 21, 2011, and a supplemental notice (76 FR 43678) was issued on July 21, 2011, to announce the four public scoping meetings and their locations and to announce the extension of the public scoping period

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to September 9, 2011. Public scoping meetings were held in Montrose, Telluride, and Naturita in Colorado and in Monticello, Utah.

In addition to presenting comments at the scoping meetings, stakeholders were also able to mail comments directly to DOE or submit comments through the project web site (http://ulpeis.anl.gov/). A total of 287 unique "comment documents" were submitted by individuals, organizations, and government agencies to provide comments on the scope of the PEIS. A comment document is a written document, an e-mail submission, or an oral presentation given during a scoping meeting that provided comments on the scope and content of the PEIS. A single comment document may contain multiple comments on one or more issues. There were 61 comment documents provided at the scoping meetings; 164 were mailed to DOE (counting both e-mails and regular mail), and 62 were submitted electronically through the project web site. Of these comment documents, 8 were received from Federal, state, or local government agencies, with the remainder being from individuals or other organizations. Comment documents were received from 13 states; of the 262 comments for which a state of origin was identified, approximately 88% were from Colorado within the potentially affected areas.

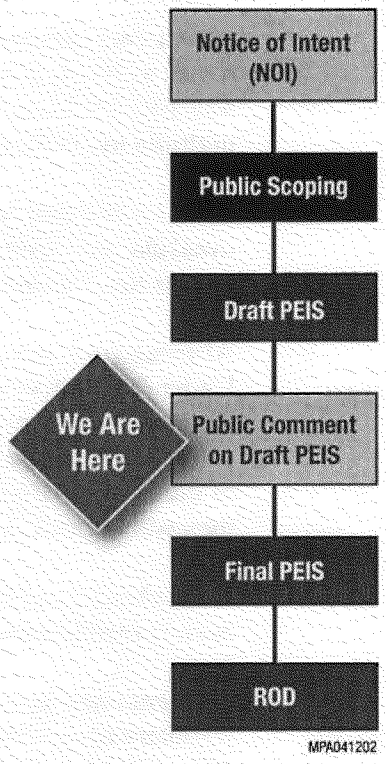

FIGURE 1.6-1 NEPA Process for This PEIS

Comments received during the public scoping period focused on whether or not the ULP or uranium mining at the lease tracts should be continued. Representative comments and DOE responses are provided as follows. The first set of comments (Section 1.6.2) consists of those comments determined to be within the PEIS scope, and the second set (Section 1.6.3) consists of those determined to be outside the scope of the PEIS. A detailed discussion on the comments received is presented in Appendix B.

1.6.2 Comments Considered within PEIS Scope

- *The current leases should be terminated and reclamation conducted, after which uranium mining should not be conducted on the lands. The lands could be restored to the public domain under BLM oversight and the DOE ULP terminated.*

  Alternatives 1 and 2 evaluated in this Draft ULP PEIS address this comment. Under Alternative 1, all leases on the 31 lease tracts would be terminated, and reclamation would be conducted where needed. The lands would then be maintained per DOE oversight without leasing for uranium mining. Alternative 2 evaluated in this Draft ULP PEIS is similar to Alternative 1,

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except once reclamation was completed by lessees, DOE's jurisdiction would return to BLM, if approved by DOI/BLM (in accordance with 43 CFR § 2372.3). If approved, the land would be managed by BLM under its multiple use policies. DOE's uranium leasing program would end.

- *DOE should continue with the ULP and continue to make the 31 lease tracts available for exploration, mine development and operations, and reclamation, as was the case before the preparation of the PEIS was initiated.*

  Alternatives 4 and 5 evaluated in this Draft ULP PEIS address this comment. Under Alternative 4, DOE would continue the ULP with the 31 lease tracts for the next 10-year period or for another reasonable period. Alternative 5 is similar to Alternative 4 except that the lease period is limited to the remainder of the current 10-year lease period, and the leases would continue exactly as they were issued in 2008.

- *DOE should prohibit any further mining or exploration until reclamation has been completed on existing or old leases.*

  As mentioned above, reclamation would be conducted where needed as part of the alternatives evaluated in this Draft ULP PEIS. In addition, all legacy mine sites located on the DOE lease tracts have already been reclaimed.

- *DOE should stipulate protection of the Dolores and San Miguel River watersheds.*

  The preferred alternative includes a requirement for future mines to be at least 0.25 mi (0.40 km) from the Dolores River. The San Miguel River is about 0.3 mi (0.54 km) from the closest lease tracts. The evaluation for water quality discussed in the Draft ULP PEIS considers both the Dolores and San Miguel Rivers.

- *Potential impacts from uranium mining at the DOE ULP lease tracts on air quality, water quality, human health, socioeconomics, transportation, views from sensitive areas, and cultural resources should be evaluated.*

  Chapter 4 of this Draft ULP PEIS analyzes the potential impacts associated with human health and environmental resource areas listed. Potential impacts on noise, soil resources, land use, ecology, environmental justice, and waste management are also analyzed.

- *DOE should undertake its duties under Section 7 of the ESA.*

  DOE is engaged in consultation with the USFWS pursuant to Section 7 of the ESA. A biological assessment (BA) is also being prepared as part of this

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consultation. Chapter 6 of this Draft ULP PEIS presents a summary of this consultation.

- *DOE should collaborate with other agencies, including the CDRMS, BLM, and EPA.*

  DOE is collaborating with various agencies, including CDRMS, BLM, and EPA, on this PEIS process. Section 1.9 presents a list of the cooperating agencies and the commenting agencies.

- *The review and approval process must include a site-specific NEPA review for each proposed mining operation.*

  The PEIS utilizes site-specific data that is available and contains a discussion of the NEPA process that would be conducted once site-specific and project-specific mine plans were submitted by the lessees to DOE for review and approval.

- *Include impacts from the release of radioactive and other toxic materials into the atmosphere from mining and milling operations.*

  The Draft ULP PEIS addresses the potential impacts from the release of material associated with the ore production. The potential impacts of milling operations are outside the scope of the proposed action, but the transportation of ore generated from the ULP lease tracts to the mills and the cumulative impacts from the mills are evaluated in this Draft ULP PEIS.

- *Address the long-term impacts on human health, livestock, and wildlife, including food sources, both locally and regionally, due to mining and milling activities. The PEIS must consider health effects of mining and milling, including cancer incidence, on the human population in towns neighboring the mining operation, workers, and local residents.*

  The analyses of impacts on human health and ecological resources (on livestock and wildlife) address the concern about potential impacts from mining operations. The analysis of human health impacts in Chapter 4 considers the population within a 50-mi (80-km) radius of the lease tract. The region of influence (ROI) for human health impacts was a 50-mi (80-km) radius of the lease tracts. A larger radius of 50 mi (80 km) was selected as the ROI to assess the potential impact as to the population as a whole (i.e., for collective dose evaluation). At this distance, the individual doses would have dropped to negligible levels (<0.1–0.2 mrem/yr), which supports the selection of 50 mi (80 km) as the ROI. The analysis for potential impacts on ecological resources addresses resources in the three counties that encompass the 31 lease tracts. The cumulative impacts evaluated in this Draft ULP PEIS (see

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Section 4.7) address a 50-mi (80-km) radius of the lease tracts and include the White Mesa and Piñon Ridge Mills.

1.6.3 Comments Considered outside PEIS Scope

- *Because of unstable uranium markets and the uncertainty of future commercial development of nuclear power facilities, uranium should be preserved for the future use by the American people until it becomes critical for national strategic energy purposes.*

  The issue presented is not within the scope of the purpose and need for DOE's action (described in Section 1.3 of this Draft PEIS).

- *Analyze a No Action Alternative that would allow the leases to lapse with no reclamation conducted.*

  The option of not performing reclamation when leases lapse or are terminated is not consistent with the requirements of the leases, the ULP, and applicable laws and is therefore not considered a reasonable alternative to evaluate in this Draft PEIS.

- *Analyze the economic benefits of fully reclaiming and rehabilitating all Federal and state lands in the Uravan Mineral Belt and compare that to the economic benefit of maintaining the existing uranium leases over the next 5 years.*

  The economic study suggested is not relevant and is considered outside the scope of this Draft ULP PEIS. It does not meet the purpose and need for DOE's action (described in Section 1.3 of this Draft ULP PEIS).

- *Include an alternative that requires old, inactive, and/or abandoned mines to be reclaimed before new leases are granted or any new mines are established.*

  DOE has reclaimed all abandoned mines within its purview. The 29 leases that currently exist have been in place since 2008, and all mining activities are currently on hold until the completion of this PEIS process.

1.7 OTHER RELATED, SIMILAR, CONNECTED, OR CUMULATIVE ACTIONS

Consistent with NEPA requirements, the identification of related, similar, connected, or cumulative actions to the ULP proposed action was conducted. There are other uranium mining projects planned by other entities for areas near the ULP lease tracts (e.g., Sunday Mines [see Section 4.7.2.2.5]). Although these actions are similar in type of activities conducted and

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2 PROPOSED ACTION AND ALTERNATIVES

Consistent with the purpose and need discussed in Chapter 1, DOE has evaluated five alternatives that address the range of reasonable options for managing the ULP. These options range from terminating all the leases and conducting reclamation where needed, with DOE continuing to maintain oversight of the lands without uranium leasing; terminating the leases and conducting reclamation where needed, restoring the lands to the public domain by the DOI and if approved, placing the lands under BLM's administrative control and terminating the DOE ULP; and continuing the ULP with associated exploration, mine development and operations, and reclamation at some or all of the 31 lease tracts. Table 1.2-1 in Chapter 1 lists the 31 lease tracts and provides information on the current status of each.

DOE developed the range of alternatives by carefully considering DOE's underlying need for action and comments received during the public scoping period for this Draft ULP PEIS. The five alternatives are as follows:

1. *Alternative 1:* DOE would terminate all leases, and all operations would be reclaimed by lessees. DOE would continue to manage the withdrawn lands, without uranium leasing, in accordance with applicable requirements.

2. *Alternative 2:* Same as Alternative 1, except once reclamation was completed by lessees, DOE would relinquish the lands in accordance with 43 CFR Part 2370. If DOI/BLM determines, in accordance with that same Part of the CFR, the lands were suitable to be managed as public domain lands, they would be managed by BLM under its multiple use policies. DOE's uranium leasing program would end.

3. *Alternative 3:* DOE would continue the ULP as it existed before July 2007, with the 13 active leases, for the next 10-year period or for another reasonable period, and DOE would terminate the remaining leases.[1]

4. *Alternative 4:* This is the preferred alternative under which DOE would continue the ULP with the 31 lease tracts for the next 10-year period or for another reasonable period.

5. *Alternative 5:* This is the No Action Alternative, under which DOE would continue the ULP with the 31 lease tracts for the remainder of the 10-year period, and the leases would continue exactly as they were issued in 2008.

isn't this no Action

is this a legal No Action ?

In this Draft ULP PEIS, DOE has evaluated each alternative for its potential impacts on the following 13 human health and environmental resource areas using available site-specific information in combination with assumptions, as appropriate (see Figure 2-1):

[1] In July 2007, DOE issued a programmatic environmental assessment and finding of no significant impact for the ULP, which a U.S. District Court invalidated on October 18, 2011.

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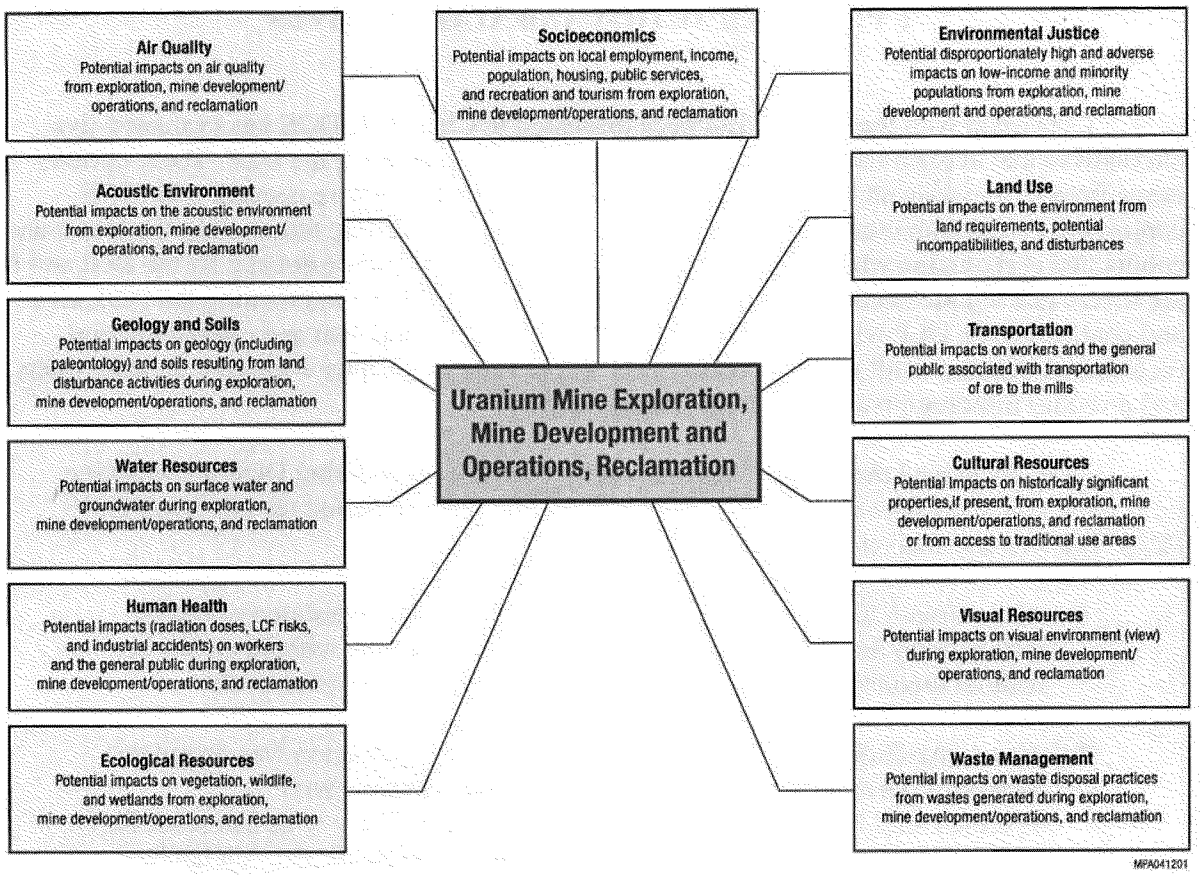

FIGURE 2-1 Thirteen Human Health and Environmental Resource Areas That Are Evaluated for Potential Impacts from Exploration, Mine Development and Operations, and Reclamation

1. Air quality,
2. Acoustic environment,
3. Geology and soils,
4. Water resources,
5. Human health,
6. Ecological resources,
7. Land use,
8. Socioeconomics,
9. Environmental justice,
10. Transportation,
11. Cultural resources,
12. Visual resources, and
13. Waste management.

In addition to the above resource areas, DOE has evaluated cumulative impacts (see Section 4.7) that could occur when potential impacts from the proposed action are

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considered with past, present, and reasonably foreseeable future actions in the region of influence (ROI) for this Draft ULP PEIS. The five alternatives are also analyzed for the three phases of uranium mining: exploration; mine development and operations; and reclamation, as applicable to the given alternative. Section 2.1 discusses the three phases of mining, and Section 2.2 describes each alternative and the associated assumptions developed as basis for the evaluation. Section 2.3 provides the discussion on alternatives considered but not evaluated in detail. Section 2.4 summarizes the potential impacts discussed in Chapter 4. Section 2.5 discusses the irreversible and irretrievable commitment of resources that result from the five alternatives; and Section 2.6 discusses the preferred alternative.

2.1 URANIUM MINING METHODS AND PHASES

The uranium mining methods that have been used on the DOE ULP lease tracts have included both underground and surface open-pit mining. However, underground mining was used most often in the past and is expected to be the primary method used in the future. The mining activities are conducted in three phases as follows: (1) exploration; (2) mining development and operations; and (3) reclamation. These three phases are described in Sections 2.1.1 through 2.1.3. For the purpose of providing relevant information about where the ore generated from the DOE ULP could be milled or processed, Section 2.1.4 presents descriptions of the two mills that could be available to process the ore generated from the DOE ULP lease tracts: the White Mesa Mill and the proposed Piñon Ridge Mill. The processing of the ore generated at the DOE ULP is outside the scope of this Draft ULP PEIS (see Section 2.3). However, the impacts of ore transportation from the lease tracts to the mills and the potential cumulative impacts of the two mills to the ULP proposed action are evaluated (see Section 4.7).

2.1.1 Exploration

The exploration phase is considered a pre-production activity. This phase is typically conducted in a relatively short period of time (i.e., several weeks); however, it can occur annually over the course of several years. It involves planning, obtaining access to the lease tracts, constructing temporary roads as required, and performing exploratory drilling. Exploration holes are drilled to determine the exact location and grade of uranium ore present. A temporary access road is typically prepared to give a drill truck, a pipe truck, and a water truck access to the location identified for exploration; such temporary roads are generally less than 20 ft (6.1 m) in width.

During the exploration phase, surface disturbance would be limited to the minimum area required to obtain a grade and provide for the safe transportation of drilling equipment and personnel. The surface area disturbance would typically include the removal of vegetation and the leveling of high points in the rights-of-way (ROWs). Excavated surface soil material would be stockpiled for use during reclamation. Borrow ditches, crowning, waterbars, culverts, side-slope stabilization measures, and riprap would be used, as necessary, to control erosion.

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Typically, access to a drilling location is established first, and then a site that is about 15 × 50 ft (4.6 × 15 m) is leveled to allow a drill rig to operate. Typically four to six exploration holes are drilled by a driller and an assistant. This activity is carried out by the two workers essentially over a short period of time (two days to two weeks). The exploration holes are typically about 6 in. (15 cm) in diameter and can vary in depth from shallow (tens of feet), to moderate (hundreds of feet), to deep (greater than 1,000 feet). During drilling, grab samples are collected from the drill cuttings for every 5 ft (1,5 m) and saved for geologic study. After the exploration holes have been drilled, a probe truck operated by one worker is brought to the site to gamma-log the hole to determine the depth to and width of the ore zone and ore grade. The ore grade is determined by the chemical assay results for the grab samples sent to the laboratory for analysis. After probing is completed, reclamation via plugging of the exploration holes is performed. However, the temporary roads may or may not be reclaimed immediately. This approach allows exploration to be repeated in the same area if necessary, depending on the results of the probe or grab samples. Reclamation of the temporary roads typically involves contouring the surface, followed by revegetation.

Before this phase can be conducted, an exploration plan must be submitted by the lessees to the DOE for review and approval. In addition, a "notice of intent for prospecting" must be submitted to the CDRMS for approval. The exploration plans are to include descriptions of: (1) the specific areas to be explored and the designated proposed access roads (existing or new) to be used, accompanied by maps and aerial photos, as available; (2) the exploration method to be employed; (3) how compliance with NEPA or other applicable environmental requirements is being achieved; and (4) the reclamation to be conducted on the disturbed areas.

In addition, the lessees would be required to obtain authorization for access to the lease tracts. BLM would administer off-lease access, while DOE would administer on-lease access. The lessees are also responsible for obtaining authorizations from any private, local, and state landowners where oversight is not held by the BLM or DOE.

2.1.2 Mine Development and Operations

As previously mentioned, the most commonly used mining methods for recovering uranium and vanadium ore in the area where the DOE ULP lease tracts are located have been either underground or surface open-pit mining. In situ leaching (ISL) method is not considered to be a viable method because of the location of the ore in "dry" sedimentary strata (see Section 2.4). It is expected that most future mining on the DOE ULP lease tracts would be done by using the underground method because of the location of the anticipated ore resources in the area. Activities common to both underground and surface open-pit mining include accessing the ore deposits, controlling possible pollutants, conducting mine maintenance, hauling ore and waste rock, and transporting ore to the mills for processing.

When the underground mining method is used, the ore and waste rock from the mine workings are transported through adits (almost horizontal mine entrances) and drifts (mine tunnels) to the aboveground storage and waste-rock pile areas by using rubber-tired (trackless)

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equipment. The ore and mine waste rock can also be transported by similar means to the ore skip and hoisted to the surface through the main production shafts. Some amount of waste-rock material may be placed back or "gobbed" into the mine workings after the ore has been completely mined and in which no groundwater issues have been demonstrated to exist.

When the surface open-pit mining method is used, overburden consisting of mudstone, shale, and sandstone is removed first to expose the ore deposit. This material is considered mine waste rock and is removed with conventional heavy equipment (such as excavators or shovels, front-end loaders, scrapers, bulldozers, and haul trucks), and transported and stockpiled at an area designated for such material. The waste-rock pile that remains on the surface eventually is graded and vegetated as part of the reclamation activities. The ore is also removed by using similar equipment.

Before mining, lessees would be required to submit mine plans to DOE for review and approval. Mine plans would include descriptions of the operational activities to be conducted. These operational activities typically involve (1) surface-plant area construction and (2) mine development and operations. These two activities are discussed in more detail in Sections 2.1.2.1 and 2.1.2.2. In addition, a "Reclamation Permit Application" (plan of operations) must be submitted to CDRMS for review and approval.

2.1.2.1 Surface-Plant Area Construction and Operations

The following types of infrastructure are typically located at the plant area of a surface mine site (applicable for both underground and open-pit mining methods): buildings; other structures; utilities; a service area; a storage area; mine water discharge and treatment ponds; a mine waste-rock pile; and other waste containment areas. These make up the infrastructure that supports mining operations. This surface area footprint could take up to 25 acres (10 ha), depending on the size of the mine in operation. The surface mine plant configurations would vary depending on the specific project needs and locations of the lease tracts. Figures 2.1-1 through 2.1-4 show the surface mine plant configurations that are present or were formerly present at several lease tracts. Figure 2.1-5 is a schematic of a generic mine plant surface configuration.

Buildings to be constructed could vary, from offices to maintenance shops to storage sheds. They would be constructed and maintained in accordance with Federal, state, and local regulations. Utility needs could include electricity, air, and water. Electricity to operate mining equipment, lighting, and ventilation fans could be supplied by aboveground lines or through generators. Air compressors would be used to supply the air needed for drilling equipment and tools. Water would be hauled to the mine site from a water supplier. Sewage and wastewater would be disposed of through a septic system or a portable facility.

A service area would also be developed to service vehicles, bulldozers, water trucks, and other heavy equipment used for the mining operations. Fuel storage tanks, water tanks, and 55-gal (210-L) oil barrels, if needed for the operations, would be located in this area. As part of

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FIGURE 2.1-1 Photograph of Mine Plant Surface Configuration at Lease Tract 5

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FIGURE 2.1-2 Photograph of Mine Plant Surface Configuration at Lease Tract 7 (JD-7 Underground Mine)

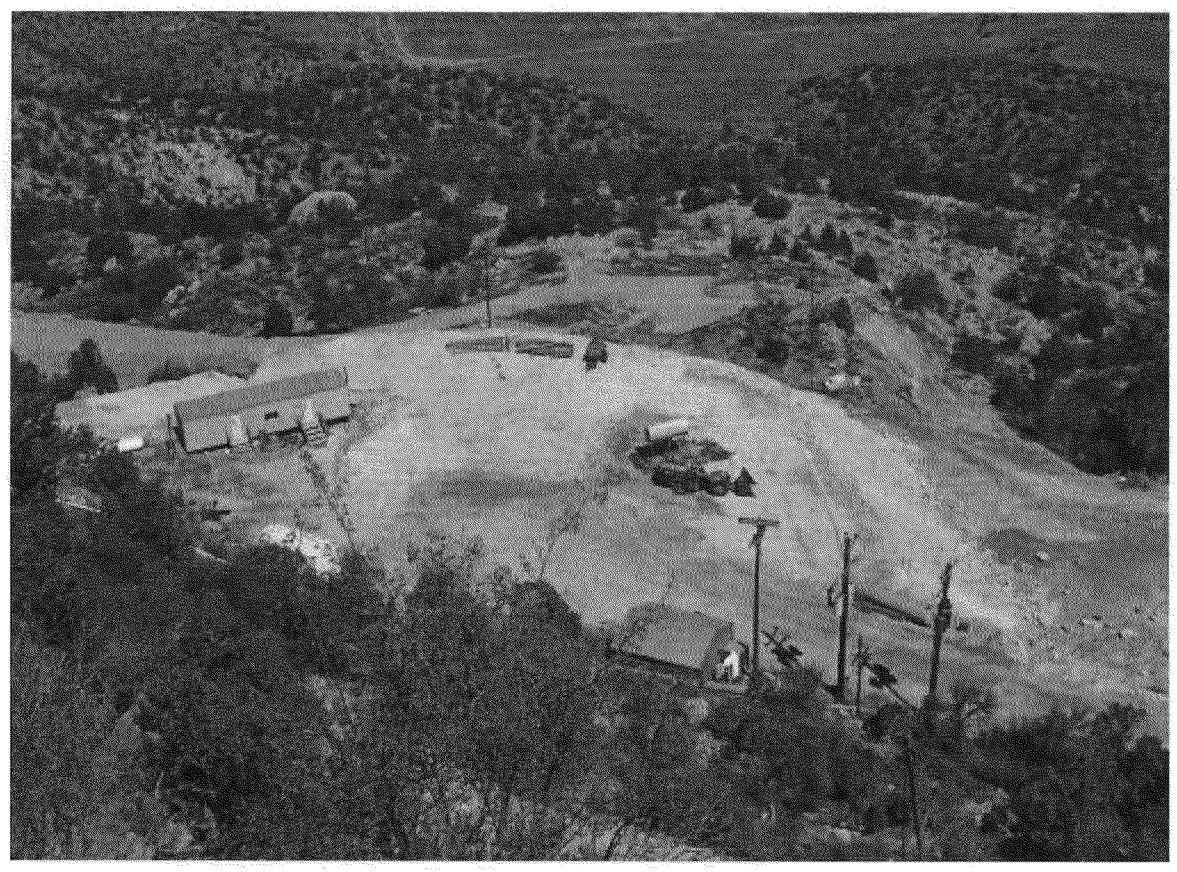

FIGURE 2.1-3 Photograph of Mine Plant Surface Configuration at Lease Tract 8

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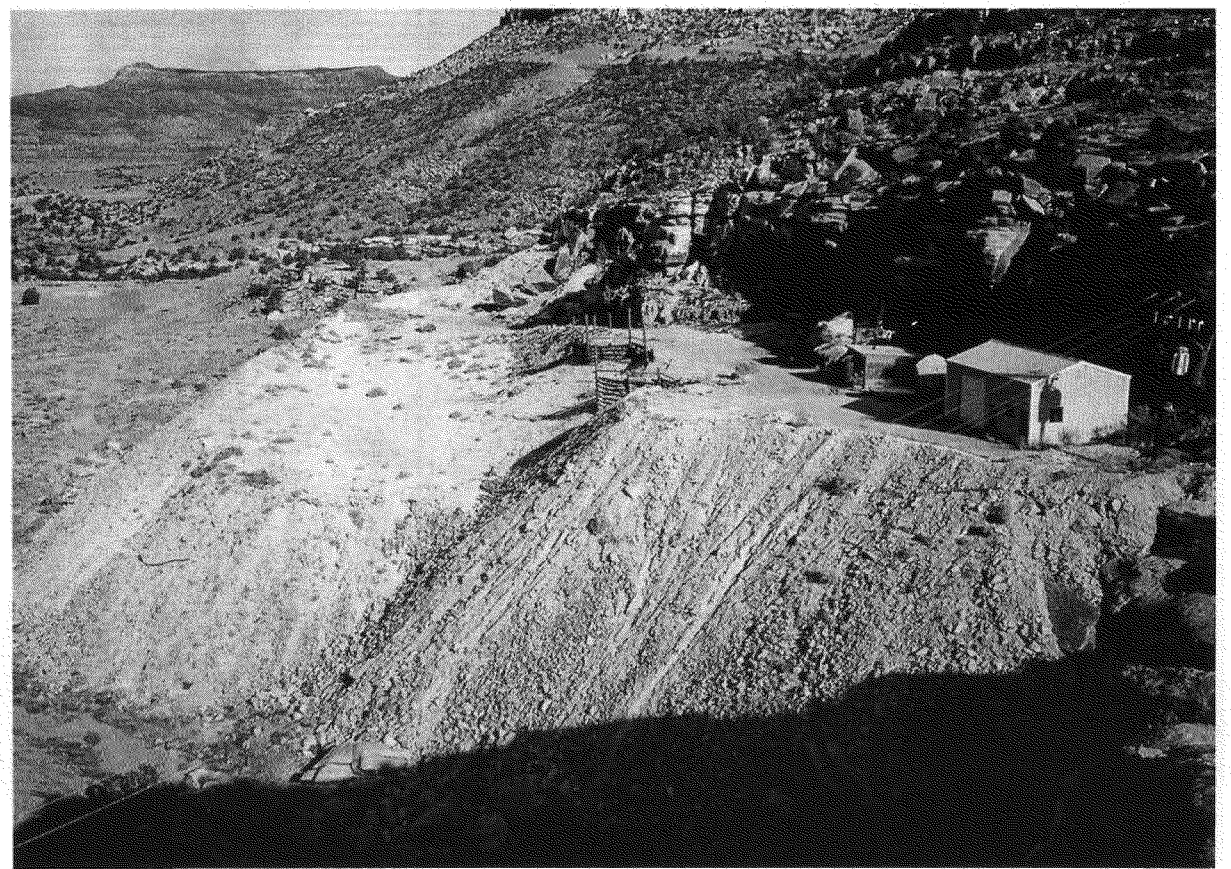

FIGURE 2.1-4 Photograph of Former Mine Plant Surface Configuration at Lease Tract 13A

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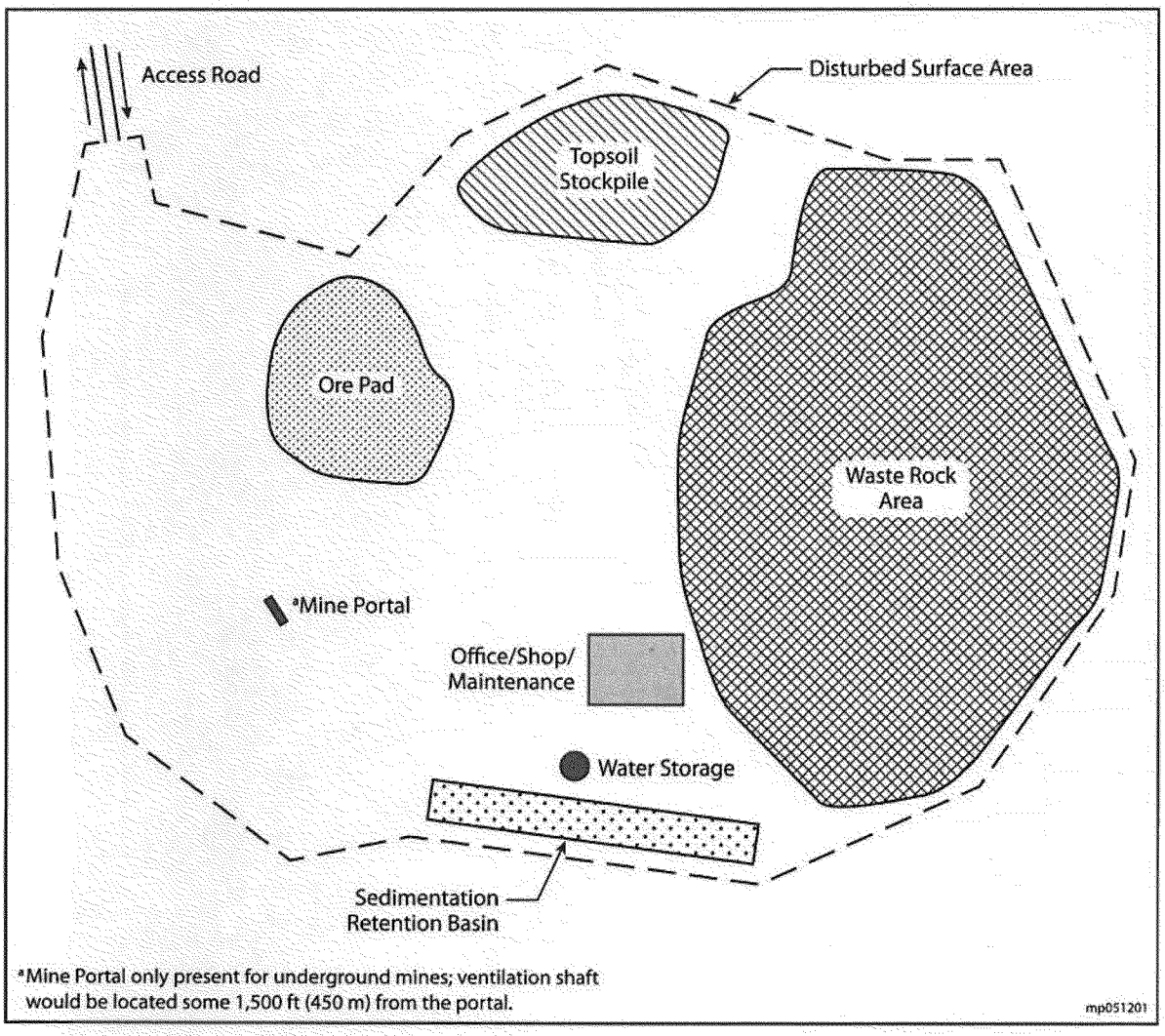

FIGURE 2.1-5 Schematic of a Generic Mine Plant Surface Configuration

maintenance activities, hoses, fuel lines, tank exteriors, and equipment parts stored in the service area would be routinely inspected by the lessee or mine operator. In addition, berms and secondary containment for gasoline, solvent, and oil storage facilities would be installed. If there was a petroleum spill or leak that required notification of Federal and state agencies, the lessee or mine operator would be required to conduct containment and cleanup activities that were consistent with spill prevention and control provisions in the approved mine plan.

Materials and chemicals needed for mine operations would be stored in compliance with Federal, state, and local regulations. Chemicals would primarily include solvents, oils, degreasers, and other substances used to maintain vehicles. Explosives would also be stored away from areas where volatile substances were located. The approved mine plan would also contain a contingency plan that would outline which types of stored material spills would be

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reported. Emergency equipment (e.g., first-aid supplies, liquid spill response supplies, and fire extinguishers) would also be kept on hand. Emergency equipment, such as mine rescue equipment, would be maintained on site in a centralized location that would allow for quick response times in accordance with Mine Safety and Health Administration (MSHA) requirements.

Mine water discharge and/or treatment ponds for receiving discharge water from the mines might have to be built. Before construction, the lessees would have to consult with the USFWS to address any concerns that the agency might have. CDRMS requires water treatment ponds to be adequately designed by a certified engineer, lined, provided with a secondary containment, and equipped with a leak monitoring system as needed. Regulations might require that the ponds be adequately lined, fenced, and netted to ensure that wildlife and livestock and the surrounding environment would not be adversely affected. Water would be pumped into discharge ponds from mine sumps constructed in mine areas where there was an accumulation of water. Mine water would be treated to meet applicable discharge standards, as necessary. Water would then be allowed to flow into a settling pond, where it could be evaporated or discharged to the environment at a discharge location specified per a state water discharge permit and National Pollutant Discharge Elimination System (NPDES) requirements. The state permits are issued and enforced by the CDPHE, Water Quality Control Division. Maintenance of these ponds would include replacing the liners and, when required, reclaiming the ponds after removing the precipitated sediments and liners. Sediment and liners would be disposed of at a state-approved disposal facility. Pond inspection would be conducted by CDPHE as part of its enforcement of the permit. CDRMS also inspects water treatment and stormwater containment structures as part of its permit for maintenance and proper use. ?

The surface-plant area would also hold a mine waste-rock pile. Mining operations (both underground and surface open-pit) would involve the removal of rock materials to allow access to the ore deposits of interest. This would result in large amounts of mine wastes. As mentioned previously, some amount of waste rock might be gobbed back into the mine workings after the ore had been completely mined out where no groundwater issues have been demonstrated to exist. Because it is impractical to separate the waste-rock materials, they could contain small quantities of miscellaneous mining-related debris (remnants of mine timbers, drill steels, and other materials used during the ore removal process). Most of the waste-rock pile, however, would be composed of large fractions of coarse rock. The uranium content of the waste-rock pile would be minimal (0% to 0.05% of uranium). State requirements stipulate that any material containing more than 0.05% of uranium be considered radioactive material and be handled accordingly. In this case, the lessees would take the material to the mills for disposition. Colorado State regulations require lessees to construct diversion channels and berms around the waste-rock piles to prevent stormwater runoff from entering or leaving the piles. Rainwater percolating through the coarse rock would not leach significant amounts of uranium. CDRMS regulations require the construction of stormwater diversion ditches as part of the Environmental Protection Plan (EPP). The design for the stormwater diversion ditches has to be approved by an engineer. radon ?

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Lastly, mining operations would also generate various types of other waste, including domestic trash (e.g., from lunch rooms, used timbers, old mining equipment, empty 55-gal (208 L) petroleum barrels, and other mining debris). These waste materials would be contained temporarily on the surface plant until taken off site to a disposal facility. In addition, the lessee would be required to store and dispose of any hazardous waste that was generated. Similar to the nonhazardous waste, the hazardous waste would also be taken off site for disposal per Federal, state, and local requirements.

2.1.2.2 Mining Method – Underground Mining

Underground mining would typically be accomplished by a random room-and-pillar method. This method involves leaving random pillars of ore and waste rock in place to provide support while ore material is removed. Two different techniques could be used to mine the ore: (1) the drill, blast, and then muck technique (muck refers to the loading and removal of ore or mine waste rock from the mine); and (2) the continuous-miner technique.

The first technique could include the use of jackleg drills or similar devices to drill holes 2 in. (5 cm) in diameter and 6- to 10-ft (1.8- to 3.0-m) deep in the rock face. The holes would then be filled with explosives that would be detonated. The broken material would be removed with shuttle equipment, such as multi-ton haul trucks or buggies. Split-shooting might also be used in areas with narrow ore seams. With this technique, waste rock would be drilled, blasted, and mucked. The same process would then be used to remove the ore seam. After this, shot-creting, rock-bolting, chain-link fencing, or other methods would be used to support the mined areas.

The continuous-miner technique would use a machine referred to as a "miner" that removes ore and waste rock without disturbing the surrounding host rock. The miner would deliver the ore and the waste rock directly to haul trucks for removal. The mined-out areas would then be supported in a manner similar to that used for the conventional method just discussed.

Water would be needed during mining operations. For example, water would be required for underground drilling to suppress airborne dust and to remove cuttings from drill bits. Most underground mines are dry, but some mines, depending on their location, receive seepage from nearby shallow aquifers. This seepage could be one of the sources of water supply for these mines; other sources could include nearby municipal water supplies and other approved sources. If water was not available on site, it would be obtained from the closest available source and hauled to the mines by using water trucks. The amount of water needed would depend on the level of mining activity and the number of workers involved. Applicable Federal, state, and local agency requirements would be met, and permits would be obtained, as appropriate.

During underground mining operations, the safety of mine workers and protection of the environment would be of primary concern. MHSA regulations would require the lessees to do the following:

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- Routinely monitor the mine for air quality and noise level. Ventilation shafts to the surface or other ventilation systems would be constructed, as needed, to ensure that the air quality was protective of the workers.

in the mine not outside near the vent shaft or near a pit mine

- Protect the workers from cave-ins by using steel or timber sets and other cribbing materials to brace mine walls, backs (or ceilings), and other surfaces.

- Secure mine entrances during periods of temporary shutdown and during periods of daily inactivity. Only authorized individuals would be allowed to enter the mines; the public and wildlife would be discouraged from entry by means of fences, gates, posting, and other barriers.

2.1.2.3 Mining Method – Surface Open-Pit Mining

With the exception of the large surface open-pit mine that exists on Lease Tract 7 (which could resume operations in the future to include a potential increase in the current footprint of the open pit mine area), the surface open-pit mining that could be conducted at the ULP lease tracts would consist of relatively small mining operations and would generally use a trenching method. This method involves the removal of small amounts of waste rock to expose the ore. The ore would then be removed by conventional techniques.

Larger operations would generally be conducted via a traditional, benched open pit. The depth and size of the ore deposit would dictate the surface dimensions of the pit and benches and the amount and size of equipment used. Underground mines could be used to access ore deposits around the periphery of the main deposit. The maintenance required for the open-pit mine operations would be done primarily to maintain the side walls of the pit, since they are subject to slope failure and erosion from stormwater runoff.

2.1.3 Reclamation

When mining activities were completed and no future intended lease activities remained, the lessee would be required to initiate reclamation activities consistent with the reclamation provisions included in the approved mining plan. The reclamation provisions would be consistent with BLM's reclamation closure guidelines (BLM 1995) and CDRMS regulations.

Reclamation would include recontouring the land to restore it to its original topography as closely as practicable, replacing surface soil, implementing erosion-control measures, and revegetating disturbed areas with appropriate native and adapted species (a seed mix has been developed for the ULP; see Table 4.1-9 for the list of species included in the seed mix). Surface-plant improvements would be removed in accordance with DOE and other agency requirements. Open shafts, adits, and declines would be closed. Mine waste-rock piles would be graded to a slope (e.g., 3:1 slope or shallower) determined to provide stable soils and where vegetation could grow to desired standards, contoured, covered with surface soil, and seeded in accordance with

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an approved reclamation plan. Residual ores and other radioactive materials inherent to the site but not taken to the mill for processing would be placed back into the mine workings as part of the portal closure process. Effort would be made to retain all topsoil material removed from the area and stockpiled for use in reclamation. In areas where stockpiled surface soil material was insufficient, surface soil might be borrowed from other areas of the lease tract or from areas preapproved by the BLM. CDRMS would require additional permitting up to and including a possible new permit for any "borrow area" unless it is within the approved CDRMS permit boundaries. DOE would monitor reclamation success each year and would require the lessee to correct problems until the reclamation met state and DOE requirements.

At mine sites, debris and waste (other than waste rock) would be managed according to waste management procedures defined in the mine plans (e.g., waste would be transported to permitted landfills or licensed disposal facilities, as in the case of waste containing low-level radioactivity). Consideration would be given to recycling or returning the materials to the manufacturers, as appropriate. Lessees would be required to comply fully with applicable U.S. Department of Transportation (DOT) requirements (49 CFR Parts 100–180).

Appropriate agencies (e.g., CPW, USFWS, BLM) would be contacted before reclamation activities began to assure that wildlife species that might have taken up residence (e.g., bat or bird species listed as sensitive) would not be adversely affected by permanent shutdown activities. Ecosystem concerns associated with wetland areas would be addressed if a determination was made that wetlands were created as a result of mining operations.

2.1.4 Ore Processing

The ore generated from the DOE ULP lease tracts could be taken to two mills for processing—the Proposed Piñon Ridge Mill and the White Mesa Mill (see Figure 2.1-6). The discussion here for the two mills is to provide information about the mills; ore processing is not part of the ULP proposed action. However, as mentioned previously, the impacts of ore transportation from the lease tracts to the mills and the potential cumulative impacts of the two mills (see Section 4.7) to the proposed action are evaluated.

2.1.4.1 Piñon Ridge Mill

Energy Fuels Resources Corporation has planned to construct the Piñon Ridge Mill (a conventional uranium mill) in Paradox Valley, between Naturita and Bedrock in Montrose County, Colorado. In early 2011, the Colorado Department of Public Health and Environment (CDPHE) issued a final radioactive materials license to Energy Fuels Resources Corporation (which is the main asset of Ontario's Energy Fuels Resources, Inc., located in Lakewood, Colorado), following CDPHE's preparations of a decision analysis and environmental impact analysis (CDPHE 2011). Sheep Mountain Alliance then challenged that license by filing a lawsuit against CDPHE in Colorado's District Court for the City and County of Denver. On June 13, 2012, the court issued a decision in which it held that the CDPHE had unlawfully issued the license without conducting the necessary administrative procedures. The court set aside

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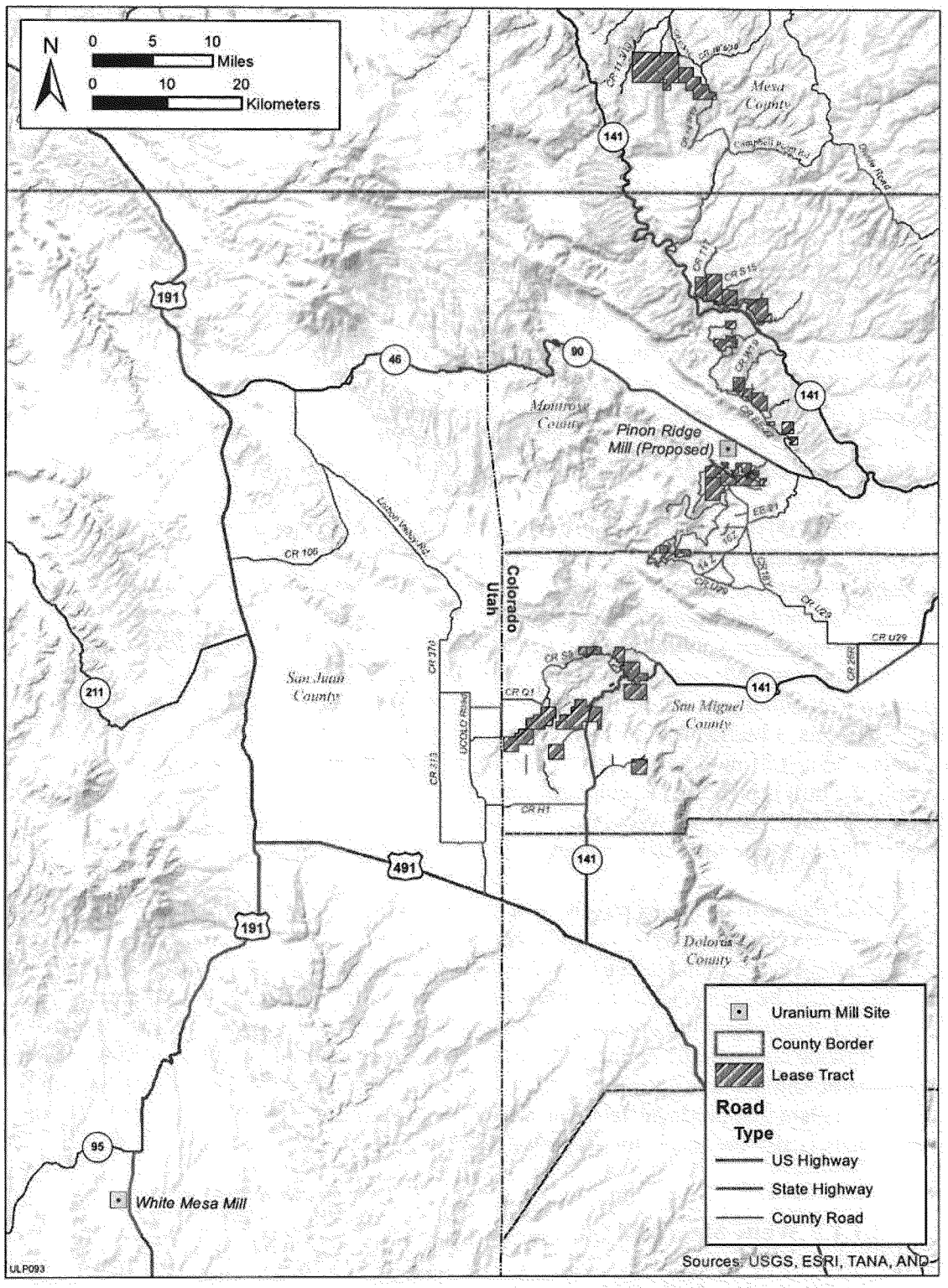

FIGURE 2.1-6 Locations of White Mesa Mill and Proposed Piñon Ridge Mill

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CDPHE's action in issuing the license, remanded the case for further proceedings, and ordered CDPHE to convene an additional hearing. As of the present date, CDPHE has convened that hearing, and the hearing officer has issued findings of fact and conclusions of law that are to be considered in the future deliberation of CHPHE. Pursuant to CDPHE's tentative schedule, in April 2013 it will take final agency action and make a new decision on whether or not to issue the license.

If the CDPHE were to decide to issue a license that is similar to the earlier license, Piñon Ridge Mill would process uranium and vanadium into uranium oxide concentrate (yellowcake) and vanadium oxide concentrate, respectively, by using the solvent extraction process (Energy Fuels Resources 2012a; Edge Environmental, Inc. 2009). The mill is expected to process ore from five to nine mines at any one time, and feeder mines are expected to change over the course of the mill's 40-year lifetime. A surge in uranium exploration, mining, and permitting is anticipated if the mill is constructed, including permitting and development of uranium/vanadium deposits controlled by Energy Fuels Resources (CDNR 25 2012; Energy Fuels Resources 2009; Edge Environmental, Inc. 2009).

If the CDPHE were to issue a new license similar to the earlier license, Piñon Ridge Mill would be constructed on approximately 400 acres (160 ha) of an 880-acre (360-ha) property boundary. Facilities at the mill will consist of mill buildings, including a stockpile pad, mill/leach tank building, boiler building, solvent extraction building, and drying/packaging building; maintenance buildings; waste management facilities such as tailing cells and evaporation ponds; and ancillary facilities, including access roads, an administration building, secondary mill buildings (warehouse, offices, and laboratory), parking facilities, power and heating systems, a fueling station, water pumps, a septic system, and a fence. Construction is anticipated to last 21 months and employ between 125 and 200 workers at its peak. Upon opening, the mill is projected to employ approximately 85 people, working three 8-hour shifts, 24 hours per day, 7 days per week, for 350 days per year. Operations are expected to last for 40 years (Piñon Ridge Mill 2012; Edge Environmental, Inc. 2009).

Host rock will be mined mostly from existing operations (owned and operated by Energy Fuels Resources Corporation) throughout southwestern Colorado and southeastern Utah. Ore would be shipped to Piñon Ridge Mill and received and stored at the ore stockpile pad. From here, the ore will be crushed, mixed with water to create a fine slurry, and then leached with sulfuric acid, resulting in the precipitation of uranium oxide concentrate (yellowcake) and vanadium oxide concentrate, produced at a rate of 500 tons per day. Uranium oxide concentrate would then be shipped to a conversion plant, while the vanadium oxide concentrate would be shipped to a plant that produces ferro-vanadium products (Edge Environmental, Inc. 2009). Energy Fuels is also the lessee for several of the DOE ULP lease tracts.

2.1.4.2 White Mesa Mill

The White Mesa Mill is the only conventional uranium mill operating in the United States. The mill, under the operation of Denison Mines/Energy Fuels Resources Corporation, is

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located off SH 191, 6 mi (10 km) south of Blanding, Utah. It processes ore from the Colorado Plateau and Arizona Strip as well as from alternate feeds. The mill uses sulfuric acid leaching and solvent extraction to precipitate uranium oxide concentrate (yellowcake) and vanadium oxide concentrate. In addition, the White Mesa Mill is licensed to process 18 different uranium-bearing alternate feed materials, which are processed parallel to conventional uranium ore. Alternate feed materials are uranium-bearing materials other than conventional ores, which are classified as waste products by the generators of the materials (Denison 2012a).

The mill was originally licensed to Energy Fuels, Inc., by the NRC on March 31, 1980, and was renewed in 10-year increments in 1987 and 1997. The State of Utah took over regulatory oversight of the mill in 2004, and the mill license was reissued as a State of Utah Radioactive Materials License on February 16, 2005. In addition, the mill possesses 15 license amendments that allow it to process 18 different alternative feed sources. White Mesa Mill also operates under a groundwater discharge permit and an air quality approval order. Air quality, groundwater, surface water, soil, and vegetation monitoring are conducted at regular intervals, and the results of radiometric scans are reported biannually (Denison 2012a).

Denison Mines took ownership of the mill in December 2006. In February 2007, Denison Mines submitted a formal application and all required documents for license renewal to the Utah Department of Radiation Control, which is currently reviewing public comments received during the public review process. The license remains valid during the license renewal process (UDEQ 2012b; Denison Mines 2012a). In April 2012, Energy Fuels Resources announced the purchase of all Denison Mines' U.S. assets, including the White Mesa Mill. The transaction closed in August 2012, allowing Energy Fuels Resources immediate access to the mill (UDEQ 2012b).

White Mesa Mill is licensed to process an average of 2,000 tons of ore per day and produce 8.0 million lb (3.6 million kg) of uranium oxide per year (Denison 2012a). The mill began processing conventional ore in November 2011, after years of processing only alternate feeds. In 2011, the mill produced approximately 1.0 million lb (0.5 million kg) of uranium oxide and 1.3 million lb (0.6 million kg) of vanadium oxide (Denison 2012b). In full operation, the mill employs approximately 150 people (Denison 2012a).

2.2 FIVE ALTERNATIVES EVALUATED

As discussed previously at the beginning of this chapter, DOE evaluated five alternatives for this Draft ULP PEIS; these alternatives are similar to those presented in the NOI (76 FR 36098).

2.2.1 Alternative 1

Alternative 1 would involve terminating the existing leases, of which there are currently 29, and conducting reclamation as needed. Two of the 31 lease tracts are not leased. There are

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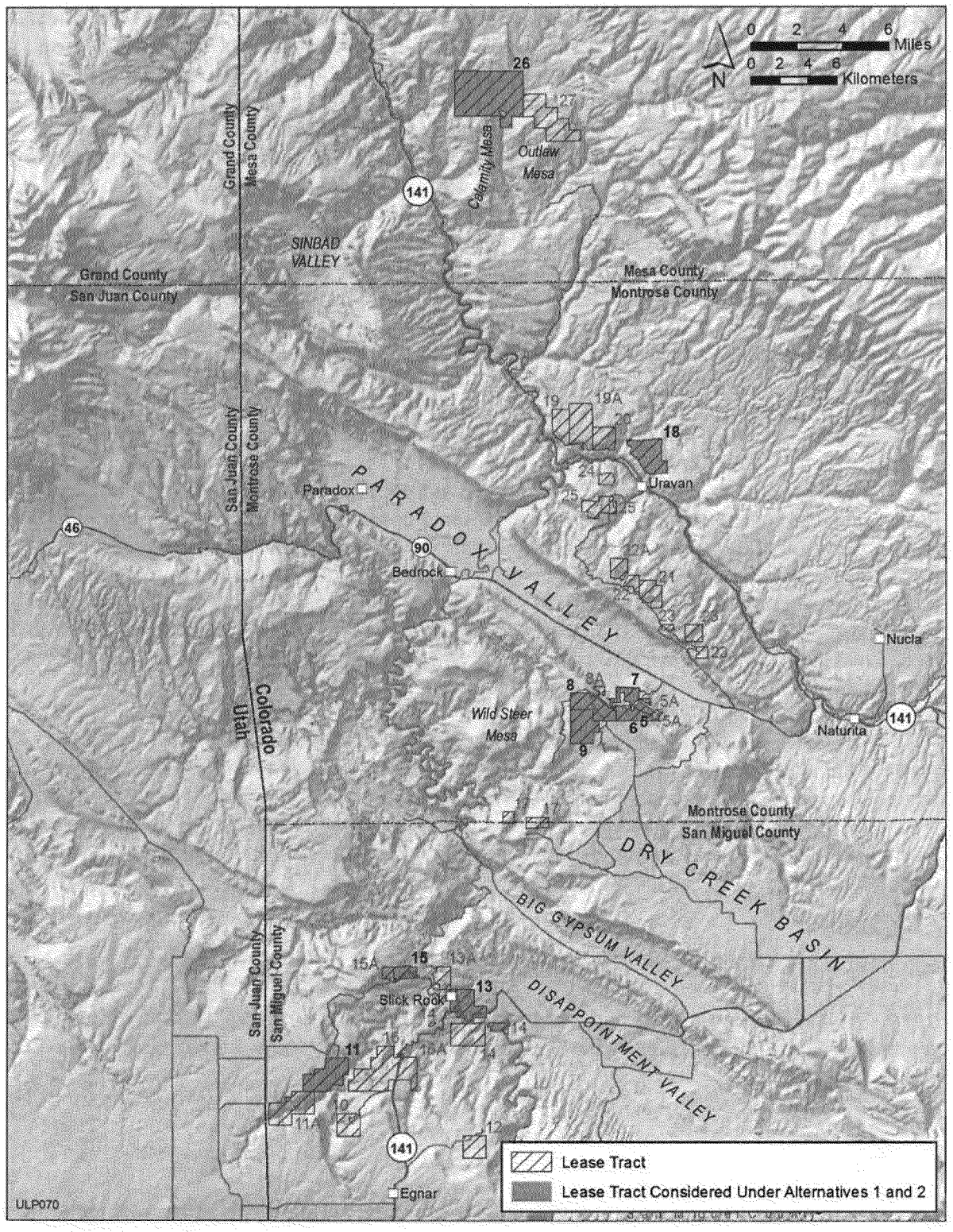

FIGURE 2.2-1 Locations of Lease Tracts Evaluated under Alternatives 1 and 2

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currently no ongoing operations on any of the lease tracts, so no ongoing operations would need to be terminated. Reclamation would need to be conducted at 10 of the 31 lease tracts. These 10 lease tracts (5, 6, 7, 8, 9, 11, 13, 15, 18, and 26) shown on Figure 2.2-1 have areas that were disturbed in the past either for exploration or from operations. Table 2.2-1 presents a list of these lease tracts, the lessees, and the approximate acreage that would have to be reclaimed at each lease tract. Existing structures that would have to be removed during reclamation are also listed. Reclamation plans submitted to DOE for review and approval would have to be consistent with CDRMS requirements. CDRMS requires that reclamation plans take into account existing and planned structures before a permit is issued. The reclamation of these structures is approved prior to the issuance of the permit. Any changes not consistent with the approved plans would require a revision to the CDRMS permit.

After the leases were terminated and reclamation was completed, DOE would continue to manage the withdrawn lands and not lease these lands for uranium mining purposes. Under Alternative 1, after reclamation was complete, essentially no activity would occur on the lease tracts aside from continued maintenance to assure conditions would remain consistent with Federal, state, and local requirements. Surface rights would continue to be held by the BLM, and current activities approved or permitted by the BLM would continue under BLM oversight.

TABLE 2.2-1 Lease Tracts Evaluated under Alternatives 1 and 2

Lease Tract	Lease Tract Acreage[a]	Approximate Acreage of Mine Site Surface To Be Reclaimed	Structures That Need To Be Removed or Reclaimed	Lease Holder
5	151	7	Head frame, hoist house, vent fan, timbered ore bins	Gold Eagle Mining, Inc.
6	530	8	Two vent fans	Cotter Corporation
7	493	210	Small and large shop buildings, three water treatment ponds, 6,000-gal water tank, vent fan, substation	Cotter Corporation
8	955	5	None	Cotter Corporation
9	1,037	8	Shop building, four water treatment ponds, three vents, hoist house, pump house, substation	Cotter Corporation
11	1,303	5[b]	Office trailer, 6,000-gal water tank	Cotter Corporation
13	1,077	8	Grated vent	Gold Eagle Mining, Inc.
15	350	1	None	Gold Eagle Mining, Inc.
18	1,181	4	Shop building, vent fan	Cotter Corporation
26	3,989	1	None	Energy Fuels
Total		257		

[a] Indicates total acreage for the lease tract; only disturbed areas need to be reclaimed as listed in the next column.

[b] In early November 2005, when the mine on Lease Tract 11 was shut down, Cotter Corporation had disturbed just less than 5 acres (2 ha) and had advanced the decline approximately 330 ft (100 m). The development of the decline created a small mine waste-rock dump at the site, which is how conditions remain to date.

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2.2.1.1 Basis for Impacts Analyses for Alternative 1

The affected environment for resource areas evaluated in this Draft ULP PEIS is discussed in Sections 3.1 through 3.13. Impacts discussed in Chapter 4 are based on assumptions summarized in this section and in Appendix C.

It is assumed that the 29 leases would be terminated and that reclamation would commence on the lease tracts where it was needed. Currently, there are 14 reclamation permits on developed leases on the ULP issued by CDRMS, and reclamation would be conducted per existing permits, as appropriate. However, since reclamation plans have not been updated recently for any of the lease tracts, assumptions regarding how reclamation would be accomplished have been developed for the purposes of the evaluations presented in this Draft ULP PEIS. Under current lease requirements, it is assumed that reclamation would span a 3-year period, with field work assumed to be completed for all 10 lease tracts within 1 year in order to analyze a "peak year" that could represent the most potential impacts within a given year. An additional time period of about 2 years is incorporated in the assumption to allow an adequate amount of time for the re-seeding to take hold and for the subsequent final approval and release from the state. A workforce of 29 workers would be employed for 1 year to perform the reclamation field work. It is assumed that a team of five workers would be employed for about 3 to 4 months to conduct the reclamation needed per lease tract. After completing one lease tract, the teams would then proceed to reclaim the remaining lease tracts. Hence, three teams of five workers each are assumed for the reclamation of the nine lease tracts, excluding Lease Tract 7, where the JD-7 mine is located. It is assumed that an additional 14 workers would be required to complete the reclamation of JD-7 in 1 year. It is also assumed that field work associated with all reclamation would be conducted during the day to mitigate potential noise concerns. This approach is consistent with current lease requirements that reclamation commence and be completed within 180 days of the termination of a given lease.

Reclamation undertaken for Alternative 1 would require various types of equipment, including front-end loaders, backhoes, dump trucks, bulldozers, flat-bed trailers with a tractor, pick-up trucks, large track hoes, and scrapers (see Appendix C for details).

Existing waste-rock piles present in some lease tracts would be graded to a slope consistent with the surrounding area (e.g., a 3:1 slope or shallower), covered with surface soil materials (soil or dirt material originally excavated from the lease tract itself), and seeded.

A seed mix for revegetating the disturbed surface areas, including the graded waste-rock piles, has been developed. The list of species included in the seed mix was developed in consultation with the BLM and has been used within the Slick Rock, Naturita, Uravan, and Gateway, Colorado, areas. Seed selection criteria were based on climate and elevation ranges within these areas. Because surface soil conditions, nutrients, and available moisture can vary within these areas, the successful establishment of six or more of the 12 species is considered adequate. The species making up the seed mix are presented in Table 4.1-9. Revegetation efforts on the disturbed areas would be considered satisfactory when soil erosion resulting from the

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operation was stabilized and when a vegetative cover representative of the vegetation that was present before the disturbance was reestablished.

2.2.2 Alternative 2

Under this alternative, the same 29 leases addressed in Alternative 1 would be terminated. The primary difference between Alternative 1 and 2 is that under Alternative 2, after reclamation was completed by the lessees on the 10 lease tracts listed in Table 2.2-1 and shown on Figure 2.2-1, DOE would relinquish all the withdrawn lands for potential management by BLM in accordance with 43 CFR § 2372.3. DOE's uranium leasing program would end. The land would then be under BLM's administrative control, and DOE would terminate the ULP.

Under BLM management, private parties could establish new uranium mining claims under the 1872 mining law. The potential impacts from any future potential uranium mining under BLM management would likely be similar to those discussed in this Draft ULP PEIS (e.g., those discussed for Alternatives 3 through 5, depending on the level of mining activity). If BLM determines that the relinquished lands cannot be managed as public domain lands, the General Services Administration (GSA) would evaluate potential management and disposition options.

would this indicate remediation was not sufficient?

2.2.2.1 Basis for Impacts Analysis for Alternative 2

The basis for the analysis of impacts for Alternative 2 in this Draft ULP PEIS is the same as that for Alternative 1 (discussed in Section 2.2.1). Activities that could contribute to potential impacts would primarily result from the reclamation activities that would need to be conducted. Therefore, resource needs (e.g., number of workers, equipment) for Alternative 2 are assumed to be the same as those indicated for Alternative 1. Reclamation achieved by DOE's lessees for this alternative is expected to meet the reclamation requirements of DOE, BLM, and CDRMS.

2.2.3 Alternative 3

Under Alternative 3, DOE would continue with exploration, mine development and operations, and reclamation at the 13 lease tracts for which leases existed prior to July 2007. The leases on the remainder of the lease tracts would be terminated. The 13 leases before July 2007 were on Lease Tracts 5, 6, 7, 7A, 8, 9, 11, 13, 13A, 15, 18, 21, and 25. Lease Tracts 7 and 7A (separate tracts at that time) were since combined (February 2011) into Lease Tract 7 (held by Cotter Corporation). The lease tracts, which now number 12 (as shown in Figure 2.2-2), either

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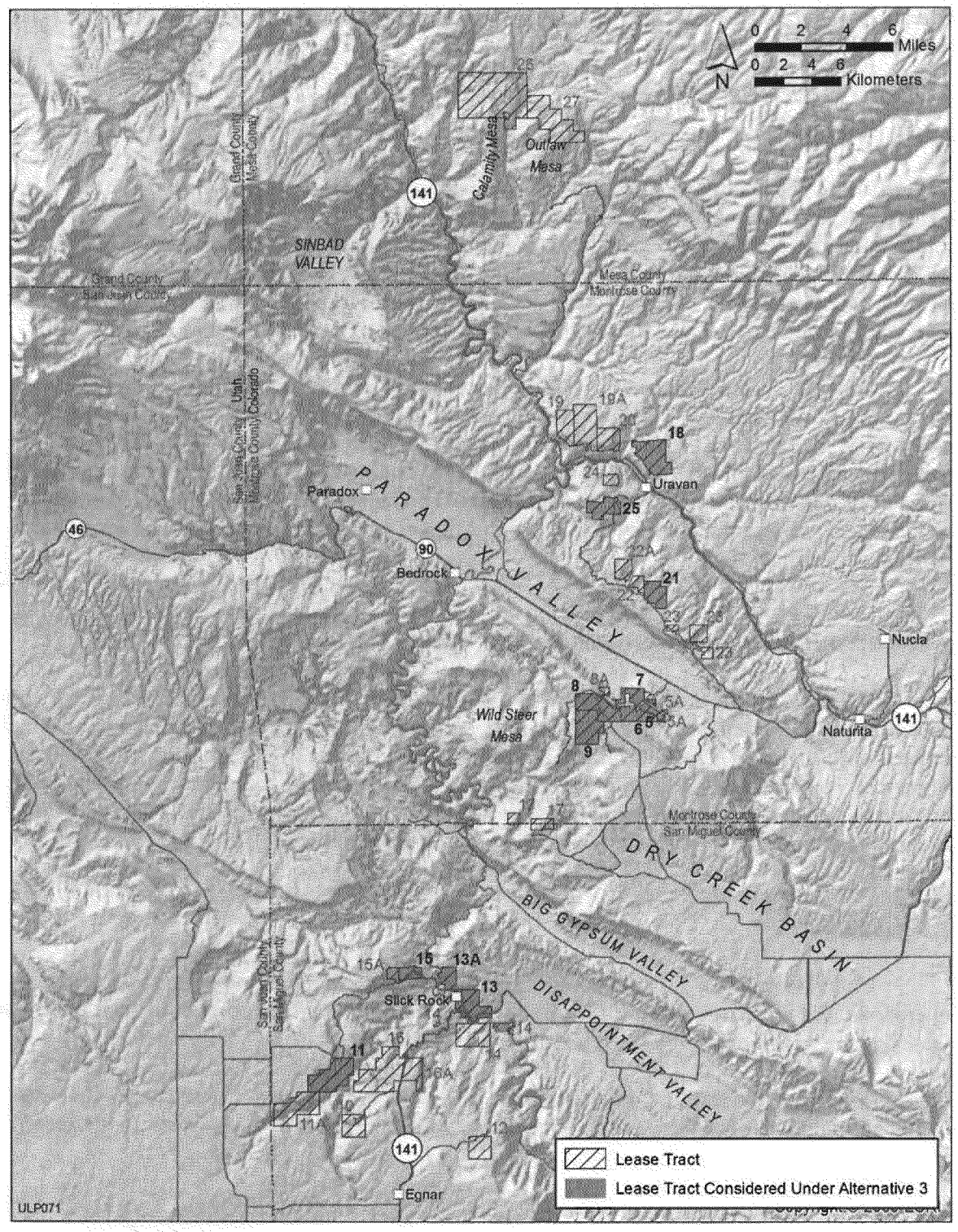

FIGURE 2.2-2 Locations of Lease Tracts Evaluated under Alternative 3

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have approved exploration drill holes and/or have existing inactive mines or permits for new underground mines. Of the 12 lease tracts, 9 are leased to Cotter Corporation, and the remaining 3 are leased to Gold Eagle Mining, Inc. Table 2.2-2 presents a list of the lease tracts evaluated under Alternative 3. Other relevant information about these lease tracts is also presented.

This alternative assumes future mine development and operations would occur on the 12 lease tracts for the next 10 years or for another reasonable period of time, with subsequent reclamation to be conducted after the operations were considered complete. Leases could be extended after the 10-year period was met. It is expected that all mines to be developed at the 12 lease tracts would be underground mines, with the exception of Lease Tract 7, where an open-pit mine currently exists and would likely be operated. This expectation is consistent with the current status of the 12 leases summarized in Table 2.2-2. Notwithstanding the existing, permitted mines located on the lease tracts (that would be expected to resume operations), no new project-specific plans have been submitted to DOE by the lessees. Accordingly, for the purposes of the analyses for this Draft ULP PEIS, additional assumptions have been developed to form the basis of the impacts analyses for Alternative 3, as discussed in Section 2.2.3.1.

2.2.3.1 Basis for Impacts Analyses for Alternative 3

It is assumed that activities associated with the exploration phase would be minor, given that at all 12 lease tracts involved under Alternative 3 contain existing permitted mines or have been the subject of exploration activities. However, assumptions for the exploration phase for Alternative 3 were developed and are summarized in Appendix C (Section C.1). It is assumed that the total disturbed surface area for the exploration of the two small mines, the four medium mines, and the one large mine would be about 0.11 acre (0.04 ha), 0.44 acre (0.17 ha), and 0.17 acre (0.06 ha), respectively. The one disturbed area for the very large open-pit mine (the JD-7 mine) is about 210 acres (80 ha). It is further assumed that the total number of workers for the exploration phase for Alternative 3 is eight workers.

For the purposes of the impact analyses in this Draft ULP PEIS, a "peak year" of activity representing a reasonable upper-bound level of activity was analyzed in order to provide conservative yet reasonable estimates for Alternative 3, addressing impacts that could result from the largest number of mines that could be operated at the same time. The peak year could occur more than once; that is, there could be multiple years with the same number of mines operating at similar ore production rates. It is also reasonable to expect that there would be a smaller number of mines in operation or that ore production could be less in the years other than the peak year(s). Uranium ore from some of the mines could be exhausted before the 10-year lease period, and operations at these mines could end sooner than the 10-year lease period. The potential impacts for years other than the peak year(s) would fall within the range of impacts discussed in Chapter 4.

For Alternative 3, the potential impacts for the 10 year lease period would be expected to be no more than 10 times those for the peak year, if the assumptions for all 10 years of operations are the same as that for the peak year discussed here.

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TABLE 2.2-2 Lease Tracts Evaluated under Alternative 3

Lease Tract	Acreage	Location (County)	Lessee	Current Status
5	151	Montrose	Gold Eagle Mining, Inc.	One existing permitted underground mine
6	530	Montrose	Cotter Corporation	One existing permitted underground mine
7	493	Montrose	Cotter Corporation	Two existing permitted mines: one underground and one very large open pit mine
7A[a]	–	–	–	–
8	955	Montrose	Cotter Corporation	One existing permitted underground mine
9	1,037	Montrose	Cotter Corporation	One existing permitted underground mine
11	1,303	San Miguel	Cotter Corporation	New permit for one underground mine yet to be developed
13	1,077	San Miguel	Gold Eagle Mining, Inc.	Three existing permitted underground mines
13A	420	San Miguel	Cotter Corporation	Exploration of one hole approved; drilling and reclamation of the explored area completed
15	350	San Miguel	Gold Eagle Mining, Inc.	One existing permitted underground mine
18	1,181	Montrose	Cotter Corporation	One existing underground mine
21	651	Montrose	Cotter Corporation	Exploration of two holes approved; drilling and reclamation of the explored area completed
25	639	Montrose	Cotter Corporation	Exploration of one hole approved; drilling and reclamation of the explored area completed

[a] Lease Tract 7A, which existed in 2007, was combined with Lease Tract 7 in February 2011.

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For the mine development and operations phase for Alternative 3, it is assumed that a total of eight mines (two small, four medium, one large, and one very large) would be in operation at the same time in the peak year of operations. Although the lessee companies would develop and operate multiple mines at the same time, they would most likely start with one mine at a time per company and move to initiate the second mine after 8 months or so from the start of the first mine, and so on, until all of the mines assumed to operate at the same time would be in operation. This approach would allow the lessees to optimize their resources. The assumptions related to the peak year are considered reasonable given the number of lease tracts involved, the number of mines in operation in previous operational periods at the ULP (Cotter 2011a) and given that they reflect reasonable expectations regarding potential mining that could be conducted in the near future.

Given that Colorado State permits have already been obtained for most of the lease tracts and given that that these permits hold, the peak year of operations for Alternative 3 could occur as early as year 5 or 6 after the first mine development commenced. The lessees would have to submit a plan to DOE for review and approval prior to the commencement of mining. For existing mines on some of the lease tracts, however, operations could resume sooner and simultaneously; this could result in a peak year that would occur sooner. There could be several peak years, depending on how much ore was available on the lease tracts. It is also expected that some of the mines would be terminated before others, depending on the availability of ore deposits. A 10-year lease period would allow for, on average, about 6 years of operations for each of the mines, and that amount of time might or might not be enough to exhaust the ore that would be available, depending on the lease tracts. However, under Alternative 3, the lease period for a given lease could be extended beyond the 10-year period for another reasonable period, which would then allow additional time for mining operations.

Other assumptions made to estimate potential impacts from this alternative include the tonnage that would be generated by each mine, the size of the surface area that would be disturbed by each mine, the number of workers needed, and the amount of water needed for each mine. (It is assumed that this water would be trucked into the work site and used as potable water, for showers, and for other activities such as dust control.) For Alternative 3, it is assumed that in addition to the two retention pond systems that currently exist at ULP mine sites (located at medium-size mines at Lease Tracts 7 and 9), an additional two new retention pond systems could be utilized for the new mines. Potential future mining operations at lease tracts 8 and 13 could encounter water that might need to employ retention pond systems. These ponds are primarily intended to capture surface water and prevent sediment from entering nearby streams and drainages. The pond volumes are between 330,000 gal (about 1 acre-ft) and 470,000 gal (about 1.5 acre-ft) with discharge rates of between 160,000 gal/mo (0.5 acre-ft/mo) and 280,000 gal/mo (0.86 acre-ft/mo).These assumptions are generally based on past uranium mining experiences in the area and are summarized in Table 2.2-3 (see Appendix C for details).

While the existence of ore stockpiles during active mining operations is expected, the duration is not expected to affect human health and the environment. The Colorado State regulations prohibit the stockpiling of ore at the mine sites for more than 180 days.

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TABLE 2.2-3 Number of Mines, Ore Production Rate, Disturbed Surface Area, Number of Workers, and Water Usage Assumed for the Peak Year of Operations under Alternative 3

	Values for Parameter per Mine Size				
Parameter Assumed	Small	Medium	Large	Very Large	Total of All Sizes
Number of mines	2	4	1	1[a]	8
Ore production total (tons/d)	100 (50 per mine)	400 (100 per mine)	200	300	1000[b]
Total disturbed acreage	20 (10 per mine)	60 (15 per mine)	20	210[c]	310[d]
Number of workers[e]	14 (7 per mine)	44 (11 per mine)	17	51	126
Water usage (gal/mo)	15,200 (7,600 per mine)	124,000 (31,000 per mine)	46,000	160,000	345,000[f]

[a] This is the large open-pit mine that currently exists on Lease Tract 7, also known as the JD-7 open-pit mine.

[b] This amounts to a total of 20,000 tons per month, assuming 20 days per month of operations; and to a total of 2,400,000 tons, assuming 10 years of operations at the peak year level.

[c] The 210 acres at the JD-7 mine is already disturbed. In addition, about 80 acres have already been disturbed for the topsoil storage area, which is located on private land and not on the lease tract.

[d] After accounting for the 210 acres already disturbed at the JD-7 mine, there would be 100 acres of additional disturbance under Alternative 3, based on the assumptions made for the purposes of this Draft ULP PEIS.

[e] It is assumed that the number of workers at each small mine would work for one shift and that the workers at the medium, large, and very large mines would work for two to three shifts.

[f] For the JD-7 open-pit mine, water usage assumed is for 6 months only (summer) for dust suppression activities. Assuming 10 years of operation at the peak-year level, 120 ac-ft of water would be used. Annual water usage is about 3,200,000 gal (9.8 ac-ft). See Appendix C for details.

For the reclamation phase, a workforce of 29 workers would be employed for a 1-year period to perform the reclamation field work for a given peak year (see Appendix C for additional details). It is assumed that a team of five workers would be employed for about 3 to 4 months (adjusting for seasonal considerations) to conduct the reclamation needed per lease tract. Hence, three teams of five workers each are assumed for the reclamation of the nine lease tracts, excluding the JD-7 mine. It is assumed that an additional 14 workers would work on the reclamation of the JD-7 mine for 1 year. The peak year of reclamation has been analyzed to address a reasonable upper-bound scenario to provide a conservative estimate of potential impacts; however, it is expected that reclamation would be conducted for a given lease tract when mining operations were considered complete. Similar to Alternatives 1 and 2, it is assumed that field work associated with reclamation would be conducted during daytime work hours.

Reclamation undertaken for Alternative 3 would require the same equipment as that discussed for Alternatives 1 and 2. Details on assumptions related to (1) other materials needed for both the mine development and operations phase and the reclamation phase, (2) the cost of

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equipment and materials needed, and (3) the sanitary and other waste generated are provided in Appendix C. Data on the emissions generated from these phases of mining for Alternative 3 are also provided in Appendix C.

2.2.4 Alternative 4

All 31 lease tracts (see Table 1.2-1 and Figure 1.4-1 in Chapter 1) are assumed to be available for potential exploration and mining of uranium ores under Alternative 4. Leases on the ULP lease tracts would be continued for the next 10 years or for another reasonable period, as appropriate. The current leases include the stipulation for extending the lease period for a given lease, as needed.

As discussed previously in Section 1.7, Lease Tract 8A and Lease Tract 14 (i.e., Lease Tracts 14-1, 14-2, and 14-3) are currently not leased. Lease Tract 8A is a small tract that is isolated and may be located entirely below or outside the uranium-bearing formation, which could indicate a lack of ore. Lease Tract 14 is composed of three parcels (14-1, 14-2, and 14-3). There was some interest in Lease Tracts 14-1 and 14-2 by potential lessees in the past; however, the third tract (14-3, which lies east of 14-1) is located almost entirely within the Dolores River corridor and was never leased. The leases stipulate that no new mining activity could be conducted within 0.25 mi (0.4 km) of the Dolores River.

As is the case for Alternative 3, no new project-specific plans have been submitted to DOE by the lessees with regard to where and how many mines might be developed and operated in the near future. For the purposes of the analyses for this Draft ULP PEIS, various assumptions have been developed to form the basis of the impact analyses for Alternative 4. These assumptions are discussed in Section 2.2.4.1. Current expectations indicate that most, if not all, of the mines would be underground, with the exception of the JD-7 mine on Lease Tract 7, which is a surface open-pit mine.

2.2.4.1 Basis for Impact Analyses for Alternative 4

It is assumed that under Alternative 4, there would be a total of 19 mines operating at various production rates at the same time during what would be considered the peak year of operations. Similar to Alternative 3, it is further assumed for Alternative 4 that there would be a smaller number of mines in operation in the years other than the peak year, and that this peak year could occur more than once (that is, there could be multiple years with the same number of mines operating at similar ore production rates). It is expected that the potential impacts for years other than the peak year(s) would fall within the range of impacts discussed in this Draft ULP PEIS in Chapter 4. Similar to Alternative 3, the potential impacts for 10 years of operation would be expected to be no more than 10 times those for the peak year, if the assumptions for all 10 years is the same as that assumed for the peak year discussed here.

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Table 2.2-4 presents the assumed number of mines and associated production rates. The size of the mine (small, medium, large, or very large) was assigned based on the assumed ore production rate. The disturbed surface area, which varies somewhat depending on the size of the mine, is also presented in the table.

These assumptions were developed based on a review of historical information and current expectations regarding potential mining that could be conducted in the near future (see Appendix C for detail). For the exploration phase for Alternative 4, it is assumed that a total of 0.33 acre (0.13 ha), 1.1 acre (0.44 ha), and 0.33 acre (0.13 ha) of surface would be disturbed for the 6 small, 10 medium, and 2 large mines assumed, respectively. For the very large mine, 210 acres (92 ha) has already been disturbed at the JD-7 surface open-pit mine. A total of 20 workers would be required to conduct the exploration phase for the number of mines assumed for Alternative 4 (not including the very large open-pit mine at JD-7, for which exploration is assumed to have been completed).

For Alternative 4, an additional important factor taken into account for the assumed ore production rate in the peak year was the milling capacity at the White Mesa Mill and the proposed Piñon Ridge Mill. The maximum capacities were estimated to be 2,000 tons/d for White Mesa Mill and 1,000 tons/d for Piñon Ridge Mill. However, the proposed Piñon Ridge Mill is expected to process only up to 500 tons/d in its initial operating period once it is built, and

How much more milling capacity would be needed if all mines are at max production?

TABLE 2.2-4 Number of Mines, Ore Production Rate, and Disturbed Surface Area Assumed for the Peak Year of Operations under Alternative 4

	Value for Parameter per Size of Mine				
Parameter Assumed	Small	Medium	Large	Very Large (JD-7)[a]	Total of All Sizes
Number of mines	6	10	2	1	19
Ore production rate (tons/d)	300 (50 per mine)	1000 (100 per mine)	400 (200 per mine)	300	2000[b]
Total disturbed surface area (acres)	60 (10 per mine)	150 (15 per mine)	40 (20 per mine)	210[a]	460[c]

[a] The one very large mine that is assumed is the JD-7 open-pit mine (on Lease Tract 7), which has been explored and developed but is currently not in operation. The area developed is about 210 acres.

[b] Total tonnage per day that is assumed to be produced exceeds the assumed milling capacity of 1,500 tons/d, but it is further assumed that the excess tonnage produced could be stockpiled for a few days, since the mills process ore on 7 days per week, while production typically occurs only on 5 days per week. Total tonnage of ore generated for 10 years of operation at the peak-year level would be about 4,800,000 tons.

[c] The total additional area that would be disturbed would be 250 acres, since 210 acres from the JD-7 mine is already accounted for from previous disturbance. The total area disturbed for Alternative 4 is 460 acres. This acreage should remain the same through the life of Alternative 4.

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it is expected to reach its maximum capacity of 1,000 tons/d only after several years of operation. Appropriate approvals would also have to be obtained before the proposed Piñon Ridge Mill could increase its milling capacity. Also, the proposed Piñon Ridge Mill is expected to process uranium ore from other mines in addition to the ore generated from the DOE ULP lease tracts, and doing so could take up at least 65% of its milling capacity. The White Mesa Mill also processes ores from other sources. Hence, the assumption of 2,000 tons/d of total ore production on the DOE ULP lease tracts in the peak year could be considered reasonably conservative in that it takes into account the optimal milling capacity that could be available if the mills operated for 7 days per week.

The peak year could occur as early as the seventh year after operations began, for each of the five companies holding the leases. It is assumed that each company would begin mine development and operations at one mine at a time, with the second mine being developed about 8 months after the first one, and so on, until the entire number of mines planned to operate at the same time would be in operation. It is also likely that the resources for some of the mines would be exhausted after several years (e.g., the resources for the mines that were placed into operation first could be exhausted after six years, so the potential impacts for the years before and after the peak year(s) would be less). This assumption allows for 2 to 3 years for obtaining permits and plan approvals.

Other assumptions developed for these alternatives include those associated with the number of workers needed; the number and types of equipment utilized; utilities, water, and other materials (including diesel fuel and explosives) consumed; and overall capital and operational costs (including worker compensation). Waste generated from operations would include a relatively large amount of waste rock, in addition to rubbish from supplies and materials used at the mines and trash generated by the workers (such as lunch room garbage). Details are provided in Appendix C.

As discussed in Section 2.1, some amount of waste-rock material might be "gobbed" back into the mine workings after ore generation was completed for a particular phase of operations as long as groundwater issues do not exist at the given lease tract. The remaining waste rock would be brought to the surface, stockpiled, and ultimately graded to be consistent with the slope of the area, then seeded to conform to its surroundings. Waste-rock material is considered that material containing a uranium concentration of 0.05% or less. Other waste material or trash would be collected and transported to a waste dump or landfill located in nearby Naturita.

The number of workers needed for mine development and operations would depend on the size of the mine and could vary from 7 to 51 workers. It is assumed that 7, 11, 17, and 51 workers would be needed for each small, medium, large, and very large mine, respectively. These workers would consist mostly of mine workers, with part-time support (as appropriate) provided by administrative, environmental specialist, mechanic, geologist, and engineering staff. Larger mine operations, such as those at a very large open-pit mine, might require a full-time mechanic on staff. Appendix C presents additional information on the number and types of workers assumed for the analysis.

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Equipment needed for mine development and operations would include both underground and surface equipment. The number and types of equipment assumed are listed in Appendix C. The equipment includes diesel skid-steer loaders, diesel trucks or buggies, development drills, production drills, exploration drills, backhoes, highway haul trucks, scrapers, and power generators. The items of equipment needed for mine development and operations at the one very large mine evaluated (the JD-7 surface open-pit mine on Lease Tract 7) are different than those needed for the underground mines assumed under this alternative; primarily surface equipment would be needed at Lease Tract 7.

Water would also be needed and would be trucked in. The volume of water assumed to be needed for a given size of mine is presented in Table 2.2-5. The annual amount of water needed for the 19 mines assumed for Alternative 4 would be about 6,300,000 gal (19 ac-ft). For the use of retention ponds, similar to the discussion in Section 2.2.3.1 for Alternative 3, as many as four retention pond systems would be used to capture surface water and prevent sediment from entering nearby streams and drainages. Similar pond volumes and discharge rates are discussed in Section 2.2.3.1.

Reclamation of the mine operations for Alternative 4 would involve 39 workers over the course of a peak year. It is also assumed that there would be a waiting period of about 1 or 2 years to account for following up on the revegetation and obtaining the necessary release and approval from DOE, BLM, and CDRMS. The equipment required would be similar to that discussed for Alternatives 1 through 3; details are presented in Appendix C.

TABLE 2.2-5 Amount of Water To Be Utilized per Mine under Alternative 4

	Value for Parameter per Size of Mine				
Parameter Assumed	Small	Medium	Large	Very Large (JD-7)[a]	Total of All Sizes
Number of mines	6	10	2	1	19
Amount of water utilized per mine (gal/mo)	7,600	31,000	46,000	160,000[b]	–
Total amount of water utilized (gal/mo)	45,600	310,000	92,000	160,000	610,000[c]

[a] The "very large" mine category applies to the JD-7 open-pit mine only.

[b] The 160,000 gal/mo (0.5 ac-ft) used at the JD-7 mine (since showers are not provided for surface workers) is primarily for dust control and only for six months (summer months).

[c] This amounts to 610,000 gal/mo (1.9 ac-ft/mo) for the six summer months; water use per month for the non-summer months would be about 448,000 gal/mo or 1.4 ac-ft/mo (water use for JD-7 is not included for the non-summer months). Assuming 10 years of operation at the peak-year level, 186 ac-ft of water would be used. Annual water usage would be about 6,300,000 gal or 19 ac-ft. See Appendix C for details.

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2.2.5 Alternative 5

The primary difference between Alternatives 4 and 5 is that the leases for Alternative 5 would be for the remainder of the 10-year period and the leases would continue exactly as they were executed in 2008. This is the No Action Alternative and reflects the current status for the management of the ULP. The ULP is administering the 29 leases that existed in 2008. So far, the 10-year period for these leases has been extended for a time period equivalent to the time taken to prepare and complete this ULP PEIS. It is currently projected that the leases would be extended by about 3 years, which means that instead of expiring in 2018, as originally stipulated, the leases would now be expiring in 2021. The lease tracts are listed in Table 1.2-1, and the locations are shown on Figure 1.4-1. The basis for the impacts analyses for Alternative 5 is discussed next in Section 2.2.5.1.

2.2.5.1 Basis for Impacts Analyses for Alternative 5

It is assumed that because the lease period for Alternative 5 is shorter than that for Alternative 4, a similar number of mines could be operated in a peak year, but to increase ore production, individual mines would be larger (e.g., there would be more medium mines and no small mines). This would enable the production of as much uranium ore as reasonable within the shorter time frame of Alternative 5. Assuming a starting year of 2014, the peak year could reasonably occur after 2 to 3 years from when mine development and operations began (i.e., in 2017 or 2018). The end of the lease period could be in 2021, accounting for the 3 years that elapsed from 2008 (when the leases were signed) to 2011 (when the U.S. district court stayed the leases) and the additional 7 years after 2014 (when the ULP PEIS is expected to be completed and DOE will move the district court to dissolve its injunction). Assumptions for the number of mines in the peak year, ore production rate, and surface area disturbed per mine of a given size are summarized in Table 2.2-6.

The number of workers assumed for Alternative 5 is similar to that assumed for Alternative 4 for a given mine size. It is also assumed that workers for the medium, large, and very large mines would work for two to three shifts.

Water would also be required and would be trucked in. Use of retention ponds would be similar to that assumed for Alternative 4. The volume of water assumed to be needed for a given size mine is presented in Table 2.2-7.

Reclamation for Alternative 5 is assumed to involve 39 workers over the course of a peak year, similar to the assumption for Alternative 4. It is also assumed that there would be a waiting period of about 1 to 2 years to account for following up on the revegetation and obtaining the necessary release and approval from DOE, BLM, and CDRMS. The equipment required would be similar to that discussed for Alternatives 1 through 4.

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TABLE 2.2-6 Number of Mines, Ore Production Rate, and Disturbed Surface Area Assumed for the Peak Year of Operations under Alternative 5

	Value for Parameter per Size of Mine			
Parameter Assumed	Medium	Large	Very Large (JD-7)[a]	Total of All Sizes
Number of mines	16	2	1	19
Ore production rate (tons/d)	1,600 (100 per mine)	400 (200 per mine)	300	2,300[b]
Total disturbed surface area (acres)	240 (15 per mine)	40 (20 per mine)	210[a]	490[c]

[a] The one very large mine that is assumed is the JD-7 open-pit mine (on Lease Tract 7), which has been explored and developed but is currently not in operation. The area developed is about 210 acres.

[b] The total tonnage per day that is assumed to be produced exceeds the assumed milling capacity of 1,500 tons/d, but it is further assumed that the excess tonnage produced could be stockpiled for a few days, since the mills process ore on 7 days per week, while production typically occurs on only 5 days per week. The total weight of ore generated for 10 years of operations at the peak-year level would be about 5,520,000 tons.

[c] Total additional area that would be disturbed would be 280 acres, since 210 acres from the JD-7 mine is already accounted for from previous disturbance. The total area disturbed for Alternative 5 is 490 acres. This acreage should remain the same through the life of Alternative 5.

2.3 ALTERNATIVES CONSIDERED BUT NOT EVALUATED IN DETAIL

DOE identified the range of alternatives for detailed analysis based on the purpose and need for agency action described in Section 1.3.

DOE has focused this ULP PEIS on its authority to manage the leasing of land with known uranium resources withdrawn under AEA PLO 459. The extracted ore would later be converted, enriched, and fabricated into nuclear fuel; used in commercial reactors; possibly reprocessed; and ultimately result in the generation of various radioactive wastes requiring specialized disposal. This ULP PEIS does not discuss the impacts of these actions. The quantity of uranium available on the DOE ULP lease tracts (estimated to be 13.5 million lb, or 6.1 million kg) represents approximately only 1.5% of the available domestic uranium reserves (nearly 900 million lb, or 410 million kg). These domestic reserves represent approximately 7% of the world's known uranium reserves. Uranium mining on the DOE ULP lease tracts would have little to no impact on the nuclear fuel cycle, because this small percentage would not dictate whether or not uranium ore processing would continue. All components of the nuclear fuel cycle will continue to be addressed by proposal-specific and site-specific environmental analyses by the appropriate governmental entity

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TABLE 2.2-7 Assumed Amount of Water To Be Utilized per Mine under Alternative 5

Parameter Assumed	Value for Parameter per Size of Mine: Medium	Large	Very Large (JD-7)[a]	Total of All Sizes
Number of mines	16	2	1	19
Amount of water utilized per mine (gal/mo)	31,000	46,000	160,000[b]	–
Total amount of water utilized (gal/mo)	496,000	92,000	160,000	748,600[c]

[a] The very large mine category applies to the JD-7 open-pit mine (on Lease Tract 7) only.

[b] The 8,000 gal/d used at the JD-7 mine (since showers are not provided for surface workers) is primarily for dust control during the summer (assumed to be for 6 months).

[c] This amounts to 748,000 gal/mo (2.3 ac-ft/mo) for the six summer months assumed. The monthly water usage for the non-summer months would be about 588,000 gal/mo (1.8 ac-ft/mo). Assuming 10 years of operation at the peak-year level, 250 ac-ft of water would be used. Annual water usage would be about 8,000,000 gal, or 25 ac-ft. See Appendix C for details.

There is no need to evaluate the ISL method for mining uranium in this Draft ULP PEIS because it is not considered to be a viable option due to the location of the ore in "dry" sedimentary strata. The ISL method is not suitable considering the geology of the DOE ULP area and the manner in which the uranium ore is located on the lease tracts. The uranium ore at the DOE ULP lease tracts is expected to be deposited along roll fronts following stream bends. The ISL method would require that the ore be located within areas where groundwater is present in relative abundance, which is not the case at the DOE ULP lease tracts. In addition, past mining operations on the lease tracts have been primarily underground (and current permits have been primarily for underground mining).

2.4 SUMMARY AND COMPARISON OF THE POTENTIAL IMPACTS FROM THE FIVE ALTERNATIVES

The impact analyses discussed in this Draft ULP PEIS use a four-level classification scheme to characterize the impacts from the various mining phases (exploration, mine development and operations, and reclamation) under the five alternatives. Impact levels are defined in Table 2.4-1 by resource area. The following sections describe the potential impacts from the five alternatives evaluated for each of the environmental resource areas and human health (see Tables 2.4-4 to 2.4-9, which appear at the end of Section 2.4, specifically after Section 2.4.14, so as to not interrupt the flow of text). Measures identified to minimize potential impacts summarized in this section are identified in Section 4.6. The measures are categorized as compliance measures, mitigation measures, or best management practices (BMPs). The

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1 **TABLE 2.4-1 Definition of Impact Levels**

	Impact Level			
Resource/System	Negligible	Minor	Moderate	Major
Air quality	No measurable impacts.	Most impacts on affected resource could be avoided with proper mitigation. If impacts occur, the affected resource would recover completely without mitigation once the impacting stressor is eliminated.	Impacts on the affected resource are unavoidable; the viability of the affected resource is not threatened, and would recover completely if proper mitigation is applied or proper remedial action is taken once the impacting stressor is eliminated.	Impacts on the affected resource are unavoidable; the viability of the affected resource may be threatened, and the affected resource would not fully recover even if proper mitigation is applied or remedial action is implemented once the impacting stressor is eliminated.
Acoustic environment	Same as for air quality.	Same as for air quality.	Same as for air quality.	Same as for air quality.
Soil resources	Same as for air quality.	Same as for air quality.	Same as for air quality.	Same as for air quality.
Water resources	Same as for air quality.	Same as for air quality.	Same as for air quality.	Same as for air quality.
Human health[a]	Not applicable	Not applicable	Not applicable	Not applicable
Ecological resources[b]	Same as for air quality.	Same as for air quality.	Same as for air quality.	Same as for air quality.
Land use	No measurable impacts.	Adverse impacts on the affected activity, community, or resource could be avoided with proper mitigation. Impacts would not disrupt the normal or routine functions of the affected activity, community, or resource. The affected activity, community, or	Impacts on the affected activity, community, or resource are unavoidable. Proper mitigation would reduce impacts substantially during the life of the project. A portion of the affected activity, community, or resource would have to adjust somewhat	Impacts on the affected activity, community, or resource are unavoidable. Proper mitigation would reduce impacts substantially during the life of the project. Resources could incur long-term effects or unavoidable disruptions to a

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1 **TABLE 2.4-1 (Cont.)**

	Impact Level			
Resource/System	Negligible	Minor	Moderate	Major
Land use (Cont.)		resource would return to a condition of no measurable effects once the impacting stressor is eliminated.	to account for disruptions due to impacts of the project. The affected activity, community, or resource would return to a condition of no measurable effects once the impacting stressor is eliminated.	degree beyond what is normally acceptable. The affected activity, community, or resource would return to a condition of no measurable effects once the impacting stressor is eliminated.
Socioeconomics	Same as for land use.	Same as for land use.	Same as for land use.	Same as for land use.
Environmental justice	Same as for land use.	Same as for land use.	Same as for land use.	Same as for land use.
Transportation[c]	Not applicable	Not applicable	Not applicable	Not applicable
Cultural resources	Same as for land use.	Same as for land use.	Same as for land use.	Same as for land use. All of the affected resource would be permanently damaged or destroyed.
Visual resources[d]	*No contrast:* The contrast is technically visible but unlikely to be seen by the casual observer and unlikely to create discernible contrast.	*Weak contrast:* The contrast is unlikely to be seen by the casual observer but is noticeable to those who look closely at the affected area.	*Minimal contrast:* The contrast is likely to be seen by anyone but does not strongly attract and hold visual attention.	*Dominant contrast:* The contrast is strong enough to attract and hold visual attention and may dominate the view.

[a] Human health potential impacts are discussed relative to regulatory limits.

[b] Ecological resources include vegetation, wildlife, aquatic biota, and threatened, endangered, and rare species. For most biota, these levels are based on population-level impacts rather than impacts on individuals. For species listed under the ESA, the impact levels consider impacts on individuals, when appropriate, as well as on populations. Impacts on species listed under the ESA are discussed using impact levels consistent with determinations made in ESA Section 7 consultation with the USFWS.

Footnotes continued on next page.

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TABLE 2.4-1 (Cont.)

[c] Radiological transportation impacts are quantified based on the latest scientific knowledge regarding radiation and human health, to aid in understanding the general level of potential risks, but the assignment of cutoff or significance levels is not appropriate. The same is true for potential injuries and fatalities as a result of potential traffic accidents.

[d] Because project-specific information is not yet available, the analysis for visual resources focuses only on the potential level of visual contrast (i.e., changes in form, line, color, and texture as compared to the existing or baseline condition) that would occur as a result of mining-related activities on the lease tracts. For this analysis, contrast is characterized as either nonexistent (i.e., no contrast), minimal, weak, or dominant—terms that roughly approximate the four-level classification scheme presented in the table.

compliance measures are those that are required by Federal or state regulations. Mitigation measures are ones that are required in the current leases or would be included when the leases are modified. Finally, BMPs are measures considered to be good industry practices that would be considered during implementation.

2.4.1 Air Quality

Potential air quality impacts under the alternatives evaluated are presented in Sections 4.1.1, 4.2.1, 4.3.1, 4.4.1, and 4.5.1. Under Alternatives 1 and 2, the potential impacts on ambient air quality from reclamation activities are anticipated to be minor and temporary. The primary source of emissions could be engine exhaust from heavy equipment used during reclamation and from fugitive dust that would result from earth-moving activities and exposed ground and stockpiles. Criteria pollutants evaluated indicate particulate matter (PM) emissions for the peak years would be at about 0.5% and 0.9% of the three-county (Mesa, Montrose, and San Miguel Counties) total emissions for $PM_{2.5}$ and PM_{10}, respectively. Among the non-PM emissions (carbon monoxide [CO], nitrogen oxides [NO_x], sulfur dioxide [SO_2], volatile organic compounds [VOCs], and greenhouse gases [GHGs such as carbon dioxide or CO_2]), NO_x emissions from diesel combustion of heavy equipment and trucks could be highest at 0.09% of the three-county total emissions. These low emission levels are not anticipated to cause measurable impacts on regional ozone (O_3), and potential impacts to climate change would be negligible.

Under Alternative 3, air quality impacts for the three phases associated with uranium mining (exploration, mine development and operations, and reclamation) were evaluated. For the exploration phase, a relatively short duration of time and little ground disturbance would be involved, and potential impacts on ambient air quality would be minimal and temporary. During the peak year of mine development and operations, it is estimated that total peak-year emission rates would be small compared with the three-county total emissions. PM emissions would be about 1.5% and 0.66% of the three-county total for PM_{10} and $PM_{2.5}$, respectively. NO_x emissions would be the highest of the non-PM emissions, at about 1.0% of the three-county total emissions. Potential impacts on regional ozone would not be of concern. Air emissions from the

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mine development and operations phase could result in minor impacts on air-quality-related values (AQRVs) at nearby Class 1 areas,[2] but implementation of measures (i.e., compliance measures, mitigation measures, and BMPs discussed in Section 4.6) such as fugitive dust mitigation measures could minimize these potential impacts. Potential impacts on climate change would be negligible. During the reclamation phase, PM_{10}, $PM_{2.5}$, and NO_x emissions would be at 0.98%, 0.55%, and 0.11% of the three-county total emissions, respectively. Potential impacts on ozone and climate change would likewise be negligible during the reclamation phase.

Air quality impacts under Alternatives 4 and 5 were evaluated for the exploration, mine development and operations, and reclamation phases in a manner similar to that done for Alternative 3. As was assumed for Alternative 3, a relatively short duration of time for exploration and little ground disturbance would be involved and potential impacts on ambient air quality would be minimal and temporary. PM_{10} and $PM_{2.5}$ emissions from mine development and operations under Alternative 4 are estimated to be about 3.0% and 1.3% of the three-county total emissions, respectively; NO_x emissions would be highest of the non-PM emissions, contributing about 2.0% of the three-county total emissions. As was discussed for Alternative 3 above, potential impacts to regional ozone would not be of concern. Likewise, air emissions from the mine development and operations phase could result in minor impacts on AQRVs at nearby Class 1 areas, but implementation of measures (i.e., compliance measures, mitigation measures, and BMPs discussed in Section 4.6) could minimize these potential impacts. Potential impacts on climate change would be negligible. During the reclamation phase, PM_{10}, $PM_{2.5}$, and NO_x emissions would be at 1.1%, 0.63%, and 0.17% of the three-county total emissions, respectively. Potential impacts on ozone and climate change would likewise be negligible for the reclamation phase under Alternative 4.

Potential air quality impacts under Alternative 5 would be slightly greater than under Alternative 4. PM_{10} and $PM_{2.5}$ emissions for mine development and operations are estimated to be about 3.2% and 1.4% of the three-county total emissions, respectively; NO_x emissions would be highest of the non-PM emissions, contributing about 2.3% of the three-county total emissions. As was discussed for Alternatives 3 and 4, potential impacts on regional ozone would not be of concern. Likewise, air emissions from the mine development and operations phase could result in minor impacts on AQRVs at nearby Class 1 areas, but implementation of measures (i.e., compliance measures, mitigation measures, and BMPs discussed in Section 4.6) could minimize these potential impacts. Potential impacts on climate change would be negligible. During the reclamation phase, PM_{10}, $PM_{2.5}$, and NO_x emissions would be 1.1%, 0.64%, and 0.18% of the three-county total emissions, respectively, and potential impacts on ozone and climate change would be negligible.

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[2] In the context of the prevention of significant deterioration (PSD) program, all state air quality jurisdictions are divided into three classes of air quality protection. Class I areas are special areas of natural wonder and scenic beauty, such as national parks (over 6,000 acres), wilderness areas (over 5,000 acres), national memorial parks (over 5,000 acres), and international parks that were in existence as of August 1977, where air quality should be given special protection. Class I areas are subject to maximum limits on air quality degradation called air quality increments (often referred to as PSD increments). The rest of the country (including the ULP lease tracts) is designated as Class II areas, for which moderate growth is accommodated and to which less stringent increments are applied. If desired by states or Indian tribes, a Class II area may be redesignated to a Class III area, to which the least stringent increments are applied, but none has done so.

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2.4.2 Acoustic Environment

Potential noise impacts under the five alternatives are discussed in Sections 4.1.2, 4.2.2, 4.3.2, 4.4.2, and 4.5.2.

Under Alternatives 1 and 2, noise levels would attenuate to about 55 dBA at a distance of 1,650 ft (500 m) from a reclamation site, which is the Colorado daytime maximum permissible limit in a residential zone. Reclamation conducted near the boundary of Lease Tract 13 could exceed the Colorado limit.

For the exploration phase under Alternatives 3 to 5, potential noise impacts on neighboring residences or communities would be minimal and intermittent due to the short duration of the activities conducted.

During the mine development and operations phase under Alternative 3, noise levels at about 55 dBA and 50 dBA (Colorado nighttime limit) would be limited to distances of 1,650 ft (500 m) from the mine sites and 230 ft (70 m) from the haul routes, respectively. Activities conducted near the boundary of Lease Tract 13 could exceed the Colorado limit established for residential areas.

Under Alternatives 4 and 5, activities conducted near the boundaries of Lease Tracts 13, 13A, 16, and 16A could exceed the Colorado limit of 55 dBA. Noise from haul trucks could exceed the Colorado nighttime limit within 350 ft (107 m) under Alternative 4 and 380 ft (120 m) under Alternative 5 from the haul route.

Potential noise impacts from reclamation activities under Alternatives 3 to 5 would be similar to those discussed above for the mine development and operations phase.

2.4.3 Soil Resources

Potential impacts on soil resources under the five alternatives are discussed in Sections 4.1.3, 4.2.3, 4.3.3, 4.4.3, and 4.5.3. Potential impacts on soil resources, both on the lease tracts and on adjacent lands where haul roads and utilities would be used, are anticipated to be minor in the exploration and reclamation phases; mine development and operations would involve more ground disturbance and could result in moderate soil impacts, such as soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, and sedimentation of nearby surface water bodies. Soils could also be contaminated by the accidental release of chemicals (fuels, solvents, oils). These potential impacts would be reduced by the implementation of BMPs and mitigation measures.

Under Alternatives 1 and 2, reclamation would result in ground-disturbing activities, such as the removal of structures and foundations, backfilling of portals, grading of the disturbed surfaces, and spreading of topsoil over waste-rock piles. Direct impacts from these reclamation activities would be smaller than those from mine development and operations because

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reclamation activities would occur over a shorter duration. The use of existing access roads would reduce impacts like soil compaction and erosion (e.g., fugitive dust generation).

Under Alternatives 3 through 5, exploration activities would occur over relatively small areas; in addition, potential impacts would be minor, especially with the implementation of good industry practices and mitigation measures.

Mine development and operations under Alternatives 3 to 5 would involve various degrees of potential ground disturbance because the number of lease tracts and number and sizes of mines that would be developed and operated vary among these alternatives. It is expected that potential impacts would be minor under all three alternatives. Hence, potential impacts from Alternative 3 would be less than those from Alternatives 4 and 5. The number of mines assumed to be developed and operated is the same under Alternatives 4 and 5, with mine sizes under Alternative 5 resulting in slightly greater ground disturbance because mines would mostly be medium to large, with no small mines assumed for Alternative 5. The assumed disturbed areas for Alternatives 3, 4, and 5 are about 310 acres (130 ha), 460 acres (190 ha), and 490 acres (200 ha), respectively.

Potential impacts on soil resources during the reclamation phase under Alternatives 3 to 5 would be similar to those under Alternatives 1 and 2.

2.4.4 Water Resources

Potential impacts on water resources under the five alternatives are discussed in Sections 4.1.4, 4.2.4, 4.3.4, 4.4.4, and 4.5.4. Potential impacts on water resources are anticipated to be minor for the exploration and reclamation phases; mine development and operations would involve more ground disturbance and could result in increased soil erosion and surface runoff. Surface water and groundwater could also be potentially contaminated by the accidental release of chemicals (fuels, solvents, oils), mixing of water with varying geochemical characteristics, or cross contamination among aquifers. These potential impacts would be avoided by implementing compliance measures, mitigation measures, and BMPs. The frequently targeted underground source of drinking water in the region (e.g., Navajo Sandstone Aquifer) is not expected to be affected. No public water supply system is present within 5 mi (8 km) from the ULP lease tracts.

Under Alternatives 1 and 2, reclamation activities on Lease Tract 13 would have the greatest potential to affect water resources due to the proximity of the Dolores River and San Miguel River. Soil erosion by water is considered to be minor in general and moderate in some areas. The impacts on groundwater quality by the backfill materials, poor sealing of drill holes and inadequate water reclamation are considered to be minor at Lease Tracts 7, 9, and 13 that have wet underground mines. These potential impacts could be avoided if it is implemented in accordance with reclamation performance standards set forth by the CDWR.

For Alternatives 3 through 5, exploration activities, such as vegetation clearing, drilling, and construction of access roads and drill pads, would occur over small areas. Impacts on water

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resources associated with runoff generation and erosion would be minor. The exploratory drill holes on Lease Tracts 7, 9, 13, and possibly 8A would have the potential to allow groundwater mixing and leaching because of possible accumulation of small amounts of groundwater found in underground mines. The potential impacts are considered to be minor and could be minimized by implementing compliance measures, mitigation measures, and BMPs.

The mine development and operations phase for Alternatives 3 through 5 has the greatest potential (of the three phases) to affect water resources, primarily because of ground disturbance activities, erosion, mine water runoff, the staging of ores and waste rock, alteration of aquifers, mixing of groundwater with varying geochemical characteristics, cross contamination among aquifers, use of chemicals (oil, grease, lubricant), water use, and wastewater generation. Activities near lease tracts closest to the Dolores and San Miguel Rivers would have the greatest potential to affect surface water quality because of erosion. Potential groundwater contamination impacts or dewatering effects would be minor in Lease Tracts 7, 9, and 13 (possibly 8A), where groundwater seepage occurred in underground mines. However, a limited number of existing domestic water wells, associated with Lease Tracts 7, 9, 13, and 8A, would be potentially affected if local groundwater is contaminated or aquifers are dewatered. Based on the assumptions made for Alternatives 3 through 5. potential impacts from Alternative 3 from mine development and operations would be less than those from Alternatives 4 and 5.

The scale of reclamation activities for Alternatives 3 through 5 is expected to increase. Potential impacts from reclamation under Alternatives 3 through 5 would be greater than those under Alternative 1.

2.4.5 Human Health

Potential human health impacts under the alternatives evaluated are presented in Sections 4.1.5, 4.2.5, 4.3.5, 4.4.5, and 4.5.5. The potential impact during the exploration phase would be minimal and limited to only a few workers. Exploration would excavate only small amounts of soil, which would be placed back to fill the drill holes in a short period of time (less than a few weeks). For the mine development and operations phase, potential impacts are analyzed for the mine workers, the general public living close to the uranium lease tracts, and the general public living within 50 mi (80 km) around the uranium lease tracts. For the reclamation phase, potential impacts are analyzed for the reclamation workers as well as the general public living close to the uranium lease tracts. After the reclamation phase, potential impacts are analyzed for recreationists who are assumed to unknowingly camp in a uranium mine area and individuals entering an inactive underground mine (e.g., state inspectors [operating under state regulations] who check on the status of uranium mines after their closure). The analyses involve the estimates of potential human health risks associated with both radiation and chemical exposures.

What about recreation during operation adjacent to the leases

Under Alternatives 1 and 2, potential radiation exposures for reclamation workers were estimated to be about 4.8 mrem, resulting primarily from the external radiation incurred while working on a waste-rock pile; the uranium isotopes and their decay products in the waste rocks

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were the source of the radiation. The corresponding latent cancer fatality (LCF) risk associated with this exposure is estimated to be 4×10^{-6}; i.e., the probability of developing a latent fatal cancer is about 1 in 250,000 (2.5×10^5). These estimates of dose and LCF risk were obtained by assuming a base Ra-226 concentration of 23.7 pCi/g in waste rocks. If the measured concentrations (an average of 3.5 pCi/g for Ra-226) with waste rock samples or the potential hot spot concentrations (168 pCi/g for Ra-226) were used, the radiation dose and LCF risk would decrease or increase by a factor of 7. The DOE dose limit for protection of the general public is 100 mrem/yr from all exposure pathways. No adverse health effect would result from the chemical toxicity of the uranium and vanadium minerals contained in the waste rocks. The hazard index associated with the potential chemical risk is estimated to be 0.043, which is well below the threshold value of 1.

The potential radiation exposure of the general public living close to the lease tracts would result from airborne emissions of radioactive particulates and radon from the surfaces of waste-rock piles. The level of exposure would depend on the distance and direction between the residence and the radiation sources. It is estimated that during the reclamation phase, the potential dose to a member of the general public would be less than 3 mrem/yr if the person lived 1,600 ft (500 m) or farther from a waste-rock pile, which is less than the dose limit of 10 mrem/yr promulgated by the EPA for airborne emissions of radionuclides. The LCF risk would be less than 1 in 330,000 (3.3×10^5) for 1 year of exposure. The hazard index estimated for the chemical exposure is less than 0.02. Again, the above results were obtained assuming a Ra-226 concentration of 23.7 pCi/g in waste rocks.

With the base concentrations (23.7 pCi/g of Ra-226) in waste rocks, it is estimated that after the reclamation phase, a recreationist who unknowingly came close to a waste-rock pile would incur a radiation dose of about 0.38 to 11 mrem through external radiation and radon inhalation, assuming he camped on top of the waste-rock pile for 2 weeks. The corresponding LCF risk was estimated to be about 7×10^{-7} to 9×10^{-6}. No potential chemical risk would be incurred because the surface of the waste-rock pile would be covered by soil materials to facilitate the growth of vegetation, rendering potential exposures through the inhalation of particulates and incidental soil ingestion unlikely. Most encounters of recreationists with the uranium lease tracts would be of a much shorter duration; therefore, the resulting radiation dose and LCF risk would be much smaller than those estimated for a two-week camping.

Based on measurement data collected in abandoned underground uranium mines, radon levels could range from 3 to 39 work levels (WLs) at different locations within the mine. Therefore, the potential radiation exposure to an individual receptor who illegally enters an inactive underground uranium mine for an extended period of time after its closure could be high. Based on the measurement data, a radon dose rate of 7.4 to 86.4 mrem/h was estimated, with a corresponding LCF risk ranging from 9×10^{-6} to 3×10^{-4}/h.

Potential human health impacts for individual receptors during and after the reclamation phase under Alternatives 3, 4, and 5 are expected to be similar to those under Alternatives 1 and 2. This is because for individual receptors, their potential radiation and chemical exposures would be dominated by the contamination sources (i.e., waste-rock piles in this case) that are

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closest to them. If the radiation sources closest to a receptor are the same, the potential health impact on the receptor would depend only on the distances and directions between the sources and the receptor, regardless of the alternative being evaluated. Therefore, the analytical results obtained for the reclamation phase and post-reclamation phase under Alternatives 1 and 2 are applicable for Alternatives 3, 4, and 5. For this same reason, estimates under Alternative 3 for the nearby individual receptor during the mine development and operations phase would be applicable to the same receptors under Alternatives 4 and 5 as well.

Under Alternative 3, the potential radiation exposures for uranium miners were estimated with historical monitoring data from 1985 to 1989. The average radiation dose for underground uranium miners would be about 433 mrem/yr, the majority of which would result from radon exposures. The corresponding LCF risk was estimated to be 4×10^{-4}/yr, which translates to a probability of about 1 in 2,500 (2.5×10^{3}) of developing a latent fatal cancer from 1 year of exposure. The potential chemical exposure for the uranium miners would be insignificant when compared to the potential radiological exposure; hence, it was not analyzed further. Radiation and chemical exposures for individual miners under Alternatives 4 and 5 are expected to be similar to those under Alternative 3.

In addition to radiation and chemical exposures, potential physical injuries and fatalities were analyzed for the uranium miners. Based on the estimates, two nonfatal injuries and illnesses could occur during the peak year of operations under Alternative 3, and five and six nonfatal injuries could occur under Alternatives 4 and 5, respectively.

> The potential radiation exposure of a population within an area can be characterized with a collective dose, which is equivalent to the sum of the individual doses over the population and typically assumes the unit of person-rem.

During the mine development and operations phase, potential radiation exposure of members of the general public who live close to the uranium lease tracts would result primarily from the emissions of radon associated with mining. The potential radiation dose incurred by an individual would depend on the number and size of the closest uranium mine operation as well as the distance and direction between the residence and each of the uranium mines. Based on the estimates, the maximum radiation dose would be about 5.6 mrem/yr at a distance of 3,300 ft (1,000 m) from a small underground uranium mine; at a distance of 6,600 ft (2,000 m), the dose would decrease to less than 3 mrem/yr. If a medium or a large underground uranium mine was close by, the radiation dose would be two or four times the dose estimated from a small underground uranium mine. Based on the estimates, a nearby resident located downwind from a uranium mine in the most dominant wind direction could receive a radiation dose of more than 10 mrem/yr. The collective dose estimated for the population within 50 mi (80 km) from the uranium lease tracts ranges from 6.6 to 38.4 person-rem, with a corresponding LCF risk of 0.01 to 0.05 under Alternative 3. Under Alternative 4, the collective dose is estimated to range from 16 to 93.5 person-rem, with a corresponding LCF risk of 0.02 to 0.1. The collective dose estimated under Alternative 5 is 19.7 to 111 person-rem, with a corresponding LCF risk of 0.03 to 0.1.

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2.4.6 Ecological Resources

Potential impacts on ecological resources for the five alternatives are discussed in Sections 4.1.6, 4.2.6, 4.3.6, 4.4.6, and 4.5.6. Potential impacts on vegetation are anticipated to be minor to moderate and range in duration from short term to long term. Mining activities could result in moderate impacts, such as the degradation and loss of habitats. Potential impacts on wildlife (including threatened, endangered, and sensitive species) are anticipated to be negligible to moderate and would result from the degradation and loss of habitats (including water depletion), wildlife disturbance, and wildlife injury or mortality. These impacts would be localized; the viability of wildlife populations would not be affected. Potential impacts on aquatic biota (including threatened, endangered, and sensitive species) are anticipated to be negligible to moderate and would result from increases in sedimentation and turbidity or an accidental ore spill into a perennial stream or river. These impacts would be localized; the viability of aquatic biota would not be affected.

2.4.6.1 Vegetation

Under Alternatives 1 and 2, potential impacts on vegetation would generally be minor and short term. Areas affected by Alternative 1 and 2 activities would generally consist of previously disturbed areas, and reclamation would generally include relatively small surface areas (approximately 1 to 8 acres [0.4 to 3.2 ha] per mine, other than the JD-7 mine). Reclamation would establish plant communities on disturbed areas, including waste rock; however, resulting plant communities might be considerably different from those of adjacent areas. The successful reestablishment of some plant communities, such as sagebrush shrubland or piñon-juniper woodland, would likely require decades.

Indirect impacts associated with reclamation activities could include the deposition of fugitive dust, erosion, sedimentation, and the introduction of non-native species, including noxious weeds. However, because of the small areas involved and short duration of reclamation activities, these would generally constitute a short-term impact. The establishment of invasive species, including the potential alteration of fire regimes, could result in long-term impacts, although monitoring and vegetation management programs would likely control invasive species. However, potential impacts from Alternatives 4 and 5 would involve a larger disturbed area (i.e., at 460 ac [190 ha] and 490 ac (200 ha) for Alternatives 4 and 5, respectively, versus 310 ac [130 ha] for Alternative 3). In addition, the expected period of disturbance for Alternative 5 would be shorter than that for Alternative 4.

Impacts under Alternatives 3 through 5 would be similar and would range from minor to moderate and short term to long term. Impacts from exploration would include disturbance of vegetation and soils, the removal of trees or shrubs, compaction of soils, destruction of plants, burial of vegetation under waste material, or erosion and sedimentation. Exploration activities are expected to affect relatively small areas, and impacts would generally be short term. The localized destruction of biological soil crusts, where present, would be considered a longer-term impact, particularly where soil erosion has occurred. Impacts would include the destruction of

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habitats during site clearing and excavation, as well as the loss of habitat in additional use areas. Affected areas might include high-quality mature habitats or previously degraded areas. Wetlands present on project sites could be directly or indirectly affected. Indirect impacts from mining would be associated with fugitive dust, invasive species, erosion, sedimentation, and impacts due to changes in surface water or groundwater hydrology or water quality. The deposition of fugitive dust and the establishment of invasive species, including the potential alteration of fire regimes, could result in long-term impacts.

2.4.6.2 Wildlife

Under Alternatives 1 and 2, reclamation would occur on 10 lease tracts. Altogether, 267 acres (108 ha) would be reclaimed, with most of the acreage (210 acres, or 85 ha) involving the surface open-pit mine on Lease Tract 7. Habitats affected by reclamation would generally consist of previously disturbed areas, although some undisturbed habitats could be affected near the outer margins of the areas being reclaimed. Reclamation activities that could affect wildlife include (1) dismantling of structures, (2) generation of waste materials, (3) recontouring of project areas, (4) revegetation activities, and (5) accidental releases (spills) of potentially hazardous materials. Where mine portals exist, reclamation activities would involve either filling the portals or adding bat gates to the openings. Permanent underground mine closure could destroy potential habitat for bats and other wildlife. The use of bat gates in the mine openings would maintain the mines as potential roost-site habitats. However, the use of underground habitats in uranium-rich areas or reclaimed uranium mines could expose wildlife species to uranium or other radionuclides through inhalation, ingestion, or direct exposure.

During reclamation activities, localized obstructions of wildlife movement could occur. There would also be an increase in noise and visual disturbance associated with reclamation activities. Traffic and equipment operations during reclamation could result in low levels of wildlife mortality. Most wildlife would avoid areas where reclamation activities were taking place. Indirect impacts on wildlife could also occur from dust deposition, erosion, sedimentation, and introduction of non-native plant species.

Reclamation would result in long-term, localized improvement of wildlife habitats within the 10 lease tracts. Reclamation would restore or improve up to 267 acres (108 ha) of habitat for many of the representative wildlife species listed in Section 3.6.2 (except amphibians). Removal of water treatment ponds on Lease Tracts 7 and 9 would eliminate potential drinking water sources and habitats for wildlife (particularly amphibian species). However, removal of water treatment ponds would also eliminate potential sources of contaminant exposure for wildlife. For a species whose range does not include the 210 acres (85 ha) to be reclaimed within Lease Tract 7, the amount of habitat reclaimed would be limited. For example, only a maximum of 27 acres (11 ha) of overall desert bighorn sheep (*Ovis canadensis nelsoni*) habitat would be restored or improved.

Overall, impacts on wildlife would be minor during reclamation activities. Under Alternative 1, negligible impacts on wildlife would occur during DOE's long-term management

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of the withdrawn lands. Under Alternative 2, impacts on wildlife during BLM's administrative control would depend on the use of the reclaimed areas and could range from negligible (e.g., if no development or other use, other than use as a natural habitat, occurred) to moderate (e.g., if mining occurred once again on the reclaimed areas).

Under Alternative 3, potential impacts on wildlife from exploration would primarily result from short-term disturbance (e.g., due to equipment and vehicle noise and the presence of workers). Some mortality to less mobile wildlife could occur at the exploration sites, and vehicles could hit wildlife. Impacts on wildlife from mine development and operations could occur from habitat disturbance, wildlife disturbance, and wildlife injury or mortality. The 310 acres (130 ha) disturbed for the eight mine sites during the peak year of operations is 3.4% of the total acreage of the 12 lease tracts now considered under Alternative 3 (Lease Tracts 7 and 7A have been combined into a single Lease Tract 7) and 1.2% of the total acreage of DOE's lease program. This acreage includes the 210 acres (85 ha) that is a previously disturbed area for the JD-7 open-pit mine site. The remainder of the lease tracts (excluding areas where access roads and utility corridors could be required) would be undisturbed by mining activities under Alternative 3.

Although habitats adjacent to a mine site might remain unaffected, wildlife might tend to make less use of these areas (primarily because of the disturbance that would occur within the project site). Regular or periodic disturbance during mine development and operations could cause adjacent areas to be less attractive to wildlife and result in a reduction of wildlife use in areas exposed to a repeated variety of disturbances such as noise. Habitat reduction could result in a long-term (e.g., decades-long) decrease in wildlife abundance and richness within a mine-site area. Wildlife habitat could be adversely affected if invasive vegetation became established in the construction-disturbed areas and adjacent off-site habitats; this could adversely affect wildlife occurrence and abundance.

Loss of 310 acres (130 ha) of habitats spread throughout the lease tracts would be considered a minor to moderate impact, since an abundance of similar habitats occurs in the region and since many of the wildlife species that could potentially be affected are habitat generalists. Clearing, grading, mining, mine spoils placement, vehicles, and other mine development and operational activities could result in direct injury to or the death of less mobile wildlife species (e.g., reptiles, small mammals) or those that inhabit burrows or mines. Mining activity might increase the exposure of wildlife to uranium and other radioactive decay products and to other chemical elements. The average concentration of radionuclides in the waste-rock piles and, presumably, in the mine would mostly be less than the biota concentration guidelines (i.e., 23.7 pCi/g or less), although in isolated hot spots, concentrations might be several times higher than recommended guidelines.

Under Alternative 3, impacts on wildlife would be largely short term and negligible during site exploration and minor to moderate during mine development and operations. Impacts on wildlife from reclamation activities would be similar to those described for Alternative 1 and 2. In general, it is expected that impacts would be largely localized and would not affect the viability of wildlife populations. Long-term impacts on wildlife following reclamation of the

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mine sites would be negligible if no development or other use of the sites (other than that of natural resource protection) occurred. Overall, localized impacts on wildlife would not affect the viability of wildlife populations.

Impacts on wildlife from exploration, mine development and operations, and reclamation under Alternatives 4 and 5would be similar to those under Alternative 3, except that, under peak years of operation for Alternative 4, a total of 460 acres (190 ha) and, under peak years of operation for Alternative 5, 490 (200 ha) of wildlife habitat at 19 mine sites could be disturbed within any of the 31 lease tracts. Under both alternatives, 210 acres (85 ha) for the very large mine (JD-7) have already been disturbed (as were 80 acres [32 ha] for topsoil storage). The differences in impacts under Alternatives 4 and 5 compared with the impacts under Alternative 3 would be limited. However, the potential impacts on wildlife under Alternative 4 and 5 would occur at 11 additional mine sites and affect an additional 150 acres (61 ha) for Alternative 4 or 180 acres (73 ha) for Alternative 5 of land on any of the 31 lease tracts rather than on any of just the 13 pre-July 2007 then-active lease tracts.

Although exploration, mine development and operations, and reclamation activities are expected to be incrementally greater under Alternatives 4 and 5 than under Alternative 3, impacts on wildlife are still expected to be negligible during site exploration and minor to moderate during mine development, operations, and reclamation. Overall, localized impacts on wildlife from either Alternative 4 or 5 would range from negligible to moderate and would not affect the viability of wildlife populations. Impacts on wildlife following reclamation of the mine sites would be negligible if no development or other use of the sites (other than that of natural resource protection) occurred.

2.4.6.3 Aquatic Biota

Under Alternatives 1 and 2, reclamation activities could cause sediment deposition in ephemeral and intermittent streams, and, during storm events, the sediments could potentially reach perennial streams. The potential for this is most likely at Lease Tract 13 through which the Dolores River flows. However, a total of only 8 acres (3.2 ha) at three mine sites is being reclaimed in Lease Tract 13, and only 4 acres (1.6 ha) are being reclaimed for one mine site in Lease Tract 18. Thus, the potential for sediments (including those that could contain radioactive or chemical contaminants) to enter either the Dolores River or Atkinson Creek due to reclamation activities is unlikely, particularly with the appropriate use of BMPs to control erosion.

Reclaimed areas would become less prone to erosion as vegetation becomes established. Following reclamation, the potential for erosion from the reclaimed mine sites would be less than what currently exists for the unreclaimed mine site areas. Overall, impacts on aquatic biota from Alternative 1 would be negligible. Under Alternative 2, impacts on aquatic biota during the BLM's administrative control would depend on the use made of the reclaimed areas and their proximity to aquatic habitats (particularly perennial water bodies) and would be negligible (e.g., if no development or other use, other than use as a natural habitat, occurred) or minor to

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moderate (e.g., if mining occurred on the reclaimed areas, particularly on the reclaimed areas on Lease Tract 13, through which the Dolores River flows).

Under Alternative 3, exploration activities would occur in upland areas and not directly within aquatic habitats (including intermittent and ephemeral drainages). Impacts on aquatic biota from mine development and operation could occur from the (1) direct disturbance of aquatic habitats within the footprint of the mine site, (2) sedimentation of nearby aquatic habitats as a consequence of soil erosion from mine areas, and (3) changes in water quantity or water quality as a result of releases of contaminants into nearby aquatic systems. These impacts would primarily occur during the mine development period and throughout the operational life of the mine. Aquatic biota and habitats most likely to be affected are those associated with small intermittent and ephemeral drainages. Impacts on aquatic biota and habitats from the accidental release of contaminants into intermittent or ephemeral drainages would be localized and small, especially if spill response to a release was rapid. The accidental spill of uranium or vanadium ore into an intermittent or ephemeral stream, or more notably a permanent stream or river such as the Dolores River or San Miguel River, could pose a localized short-term impact on the aquatic resources. However, the potential for such an event is extremely low.

Overall, impacts on aquatic biota would be negligible during site exploration and negligible to minor during mine development, operations, and reclamation. Potential impacts from mine development and operations would last at least 10 years prior to reclamation. Potentially moderate impacts would be possible only for mine sites located near perennial water bodies. In general, any impacts on aquatic biota would be localized and not affect the viability of affected resources, especially if mitigation measures were used.

Under Alternatives 4 and 5, impacts on aquatic resources would be similar to those under Alternative 3, except that 19 mines could be in operation on any of the 31 lease tracts. Overall, localized impacts on aquatic biota would be negligible during site exploration and negligible to minor during mine development, operations, and reclamation. Moderate impacts would be expected only if mines were located near perennial water bodies. In general, any impacts on aquatic biota would be localized and would not affect the viability of affected resources.

2.4.6.4 Threatened, Endangered, and Sensitive Species

Impacts of ULP activities on threatened, endangered, and sensitive species would be fundamentally similar to those impact on vegetation (Section 2.4.6.1), wildlife (Section 2.4.6.2), and aquatic biota (Section 2.4.6.3). However, because of their low populations, listed species are far more sensitive to impacts than more common and widespread species. Low population size makes these species more vulnerable to the effects of habitat fragmentation, habitat alteration, habitat degradation, human disturbance and harassment, mortality of individuals, and the loss of genetic diversity. Although listed species often reside in unique and potentially avoidable habitats, the loss of even a single individual of a listed species could result in a much greater impact on the population of the affected species than would the loss of an individual of a more common species.

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Under Alternatives 1 and 2, reclamation activities would generally cause small, short-term impacts on threatened, endangered, and sensitive species, if present. Although reclamation activities have the potential to create surface disturbances, these disturbances are likely to be short term and are not expected to occur in previously undisturbed areas. The small scale of reclamation activities on previously disturbed areas would generally have a negligible to minor direct impact on sensitive terrestrial species. However, indirect impacts on threatened, endangered, and sensitive species might still be possible (such as those resulting from water withdrawal, erosion, sedimentation, and fugitive dust). Erosion and sedimentation might have a small, short-term impact on sensitive aquatic species. Reclamation activities under Alternatives 1 and 2 are not likely to require large amounts of water from the Upper Colorado River Basin. Therefore, the impact of water withdrawals on aquatic species (particularly the Colorado River endangered fish species) is expected to be minor. Reclamation activities under Alternatives 1 and 2 may affect, but are not likely to adversely affect, the Colorado River endangered fish species or their critical habitat. Impact levels for species listed under the ESA were made consistent with impact determinations made in ESA Section 7 consultation. ULP activities under Alternatives 1 and 2 would have no effect on terrestrial species listed under the ESA. ULP activities under Alternatives 1 and 2 may affect, but not likely to adversely affect, the Colorado River endangered fish species or their critical habitat.

Under Alternative 3, potential impacts on terrestrial threatened, endangered, and sensitive species could range from small to moderate and short term to long term, depending on the location of the mines and amount of surface disturbance. Direct impacts could result from the destruction of habitats during site clearing, excavation, and operations. Indirect impacts could result from water depletions, fugitive dust, erosion, and sedimentation. Most impacts of Alternative 3 ULP activities on terrestrial threatened, endangered, and sensitive species may be minimized or avoided with the implementation measures identified in Table 4.6-1. However, water withdrawals from the Upper Colorado River Basin to support mining activities may result in potentially unavoidable impacts on aquatic biota (particularly the Colorado River endangered fish species). Under Alternative 3, approximately 3,200,000 gal (12,000,000 L) of water would be required to support mining activities during the peak year of operations. This volume of water would equate to approximately 9.7 ac-ft of water during the peak year of operations. Withdrawals of this volume of water from the Upper Colorado River Basin exceed the USFWS *de minimis* threshold of 0.1 ac-ft per year that would have no effect on the Colorado River endangered fish species (USFWS 2009b). For this reason, ULP activities under Alternative 3 may affect, and are likely to adversely affect, the Colorado River endangered fish species and their critical habitat. As discussed in Sections 2.2.3.1 and 4.3.6.4.1, it is estimated that as much as 9.7 ac-ft of water would be needed to support ULP activities during the peak year of operations. It is assumed that the source of this water would be the Upper Colorado River Basin. ULP activities under Alternative 3 would either have no effect on or may affect, but is not likely to adversely affect, terrestrial species listed under the ESA. ULP activities under Alternative 3 may affect, and would likely adversely affect, the Colorado River endangered fish species and their critical habitat. The impacts on the Colorado River endangered fish species would most likely result from water depletions from the Upper Colorado River Basin.

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Under Alternatives 4 and 5, potential impacts would be similar to those under Alternative 3. However, there would be more lease tracts available for mining under these alternatives, thereby increasing the area that could be disturbed or developed and the potential for impacts on threatened, endangered, and sensitive species. The total disturbed area for Alternative 5 is slightly greater than that for Alternative 4.

2.4.7 Land Use

Potential impacts on land use from the five alternatives are discussed in Sections 4.1.7, 4.2.7, 4.3.7, 4.4.7, and 4.5.7. Potential land use impacts are anticipated to be minor for Alternatives 1 through 5. Withdrawn lands would continue to be closed to mineral entry but would remain open for ROW authorizations and oil and gas leasing. Mining activities would likely preclude some land uses, such as recreation or grazing, but surrounding lands would offer opportunities for these activities.

2.4.8 Socioeconomics

Potential impacts on socioeconomics from the five alternatives are discussed in Sections 4.1.8, 4.2.8, 4.3.8, 4.4.8, and 4.5.8. The impact analyses for socioeconomics indicate that potential socioeconomic effects would generally be minor and positive, in that a few jobs would be created and the completion of reclamation activities could have a small, positive impact on recreation and tourism. It is also likely that there would be less in-migration of people to work in the mining jobs created from the alternatives, since there would likely be unemployed workers in the local community to fill these newly created jobs.

Under Alternatives 1 and 2, reclamation activities would require 29 direct jobs and generate 16 indirect jobs. Reclamation would produce $1.7 million in income. There would likely be a minor positive impact on recreation and tourism because of the reclamation that would be completed.

Under Alternative 3, the potential impact is expected to be minor. Mine development and operations would create 123 direct jobs, 93 indirect jobs, $4.7 million in direct income, and $4.0 million in indirect income. In-migration could include up to 87 people moving into the ROI. However, as was discussed above, there is an adequate workforce currently available in the ROI that could supply the labor needed, so there could be less in-migration than estimated in this Draft ULP PEIS as a result. Reclamation activities would require 29 direct jobs and generate 17 indirect jobs. Reclamation would produce $1.8 million in income.

Potential impacts under Alternatives 4 and 5 would be almost the same and are expected to be minor. Under Alternative 4, mine development and operations would create 229 direct jobs, 152 indirect jobs, and $14.8 million in income. In-migration could include up to 115 people moving into the ROI. Reclamation activities would require 39 direct jobs and generate 21 indirect jobs. Reclamation would produce $2.4 million in income. Under Alternative 5, mine

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development and operations would create 253 direct jobs, 152 indirect jobs, and $15.6 million in income. In-migration could include up to 122 people moving into the ROI. Reclamation activities would require 39 direct jobs and generate 25 indirect jobs. Reclamation would produce $2.5 million in income.

2.4.9 Environmental Justice

Potential impacts on minority and low-income populations from the five alternatives are discussed in Sections 4.1.9, 4.2.9, 4.3.9, 4.4.9, and 4.5.9. Potential impacts on the general population could result from the uranium mining activities, but for the majority of resources evaluated, impacts would likely be minor. Specific impacts on low-income and minority populations as a result of participation in subsistence or certain cultural and religious activities would be minor. For the majority of resources, any adverse impacts from ULP activities would not disproportionately affect minority or low-income populations.

2.4.10 Transportation

Potential impacts on transportation from the five alternatives are discussed in Sections 4.1.10, 4.2.10, 4.3.10, 4.4.10, and 4.5.10.

Under Alternatives 1 and 2, no transportation of uranium ore would occur. There would be no radiological transportation impacts. No changes in current traffic trends near the DOE ULP lease tracts are anticipated because no significant supporting traffic or equipment moves would occur, and only about five reclamation workers would be commuting to each site on a regular basis during reclamation activities.

Under Alternative 3, there would be an average of approximately 40 round-trip uranium ore truck shipments per weekday. For the sample case considered, the total annual distance travelled in the peak year by the haul trucks would be about 1.10 million mi (1.77 million km), primarily on State Highways CO 90 and CO 141 and on US 491 and US 191. The estimated attendant traffic accident injuries and fatalities would be about 0.33 and 0.029, respectively. The resultant collective radiological population dose to those individuals living and working near the haul routes was estimated to be approximately 0.14 person-rem, a dose that could potentially result in an LCF risk of 8×10^{-5}. The potential annual collective dose estimated for the truck drivers is 0.71 person-rem, with an associated risk of 0.0004 LCF. Dependent on which lease tracts have mining operations and which mill was used in each case, the total annual distance in the peak year could range from about 0.47 million to 2.22 million mi (751,000 to 3.58 million km), with impacts roughly proportional to the distance travelled.

Under Alternative 4, there would be an average of approximately 80 round-trip uranium ore truck shipments per weekday. For the sample case considered, the total annual distance travelled in the peak year by the haul trucks would be about 2.22 million mi (3.57 million km), primarily on CO 90 and CO 141 and on US 491 and US 191. The estimated attendant traffic

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accident injuries and fatalities would be about 0.63 and 0.057, respectively. The resultant collective radiological population dose to those individuals living and working near the haul routes was estimated to be approximately 0.28 person-rem, resulting in an LCF risk of 0.0002 in the population. The potential annual collective dose estimated for the truck drivers is 1.4 person-rem, with an associated LCF risk of 0.0009. Dependent on which lease tracts have mining operations and which mill was used in each case, the total annual distance in the peak year could range from about 1.14 million to 4.26 million mi (1.84 million to 6.86 million km), with impacts roughly proportional to the distance travelled.

Under Alternative 5, there would be an average of approximately 92 round-trip uranium ore truck shipments per weekday. For the sample case considered, the total annual distance travelled in the peak year by the haul trucks would be about 2.72 million mi (4.38 million km), primarily on CO 90 and CO 141 and on US 491 and US 191. The estimated attendant traffic accident injuries and fatalities would be about 0.81 and 0.073, respectively. The resultant collective radiological population dose to those individuals living and working near the haul routes is estimated to be approximately 0.34 person-rem, a dose that could potentially result in an LCF risk of 0.0002 in the population. The potential annual collective dose estimated for the truck drivers was 1.8 person-rem, with an associated LCF risk of 0.001. Depending on which lease tracts have mining operations and which mill was used in each case, the total annual distance in the peak year could range from about 1.45 million to 4.90 million mi (2.34 million to 7.88 million km), with impacts roughly proportional to the distance travelled.

2.4.11 Cultural Resources

Cultural resources include archaeological sites, historic buildings and structures (including mining features), and historic landscapes and traditional cultural properties, which include natural features and landscapes that hold cultural significance to specific tribal groups. Cultural resources eligible for listing on the *National Register of Historic Places* (NRHP) are called "historic properties." Federal agencies must take into account the effects of their undertakings on historic properties. All unevaluated historic properties must be treated as if eligible for listing until shown to be ineligible (see Section 3.11). Activities that would physically alter the land surface or that would modify the built environment, such as the alteration or demolition of a building, would have the greatest potential for directly adversely affecting cultural resources. However, an undertaking might have indirect effects as well. Resources in areas surrounding the location of the undertaking itself can be affected by increased human presence. Artifacts on the surface might be subject to displacement or damage by trampling or loss by unauthorized, illegal, and unrecorded collecting. The noise generated by the presence and operation of a facility might compromise the solitude that is an important part of the integrity of a traditional cultural property, or it might represent a visual intrusion into a cultural landscape. Road improvements have the potential to disturb cultural resource sites. Access roads already exist for the permitted mines. Disturbance would occur only if existing roads were widened or altered.

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Impacts on a cultural resource are evaluated based on the likely effect each alternative would have on its integrity. Effects resulting from the exploration, mine development and operations, and reclamation phases of uranium mining are analyzed for each of the alternatives when applicable. Table 2.4-2 summarizes known cultural resource sites by lease tract cluster. For the purposes of this analysis, lease tracts have been grouped into four clusters. Since the visual context of a site is an important component of its integrity, the groupings used in Section 3.12 (Visual Resources) are followed here. Site densities were calculated for the surveyed areas of each lease tract. Since it is not known where specific development would take place, it is assumed that any site within a lease tract might be subject to indirect impacts during the exploration, mine development and operations, and reclamation phases. Table 2.4-3 summarizes the number of cultural resource sites likely to be subject to direct and indirect impacts under each alternative. Indirect impacts could occur to all known sites and any newly discovered sites in each lease tract. Direct impacts would occur only when the size or required location of a new facility precluded the avoidance of identified cultural resources or compromised the visual context of a site where visual context is an important part of its integrity

Section 106 of the National Historic Preservation Act (NHPA) requires that areas developed as a result of Federal undertakings be surveyed for the presence of cultural resources prior to project implementation. Through these surveys, cultural resources that are eligible for nomination to the NRHP are identified, and plans would be modified to avoid or mitigate negative impacts on cultural resources. Potential impacts on cultural resources are discussed in Section 4.1.11, 4.2.11, 4.3.11, 4.4.11, and 4.5.11.

Under Alternatives 1 and 2, direct impacts are not expected to occur. However, indirect impacts, such as an increased potential for vandalism related to road or footpath expansion or damage to cultural resources from fugitive dust, could occur on all 111 estimated resources within the 10 lease tracts. Positive impacts could also result, since the termination of uranium mining might result in reduced fugitive dust and ground vibration from heavy equipment and traffic.

Under Alternative 3, indirect impacts on all of the 128 cultural resources located within the 12 lease tracts could occur. Direct impacts are estimated to be possible on 8 of these 128 resources. Potential direct impacts would include the disturbance of buried cultural resources or surface deposits as a result of excavation, vibration from equipment, and fugitive dust. Indirect impacts would include visual disturbance to resources; the introduction of noise to traditional cultural areas; potential damage to traditional plant and animal species; and an increased potential for vandalism, erosion, trampling, and unauthorized collecting related to road or footpath expansion.

Under Alternatives 4 and 5, indirect impacts could occur on the 221 cultural resources located within the 31 lease tracts. Direct impacts could occur on 21 and 23 of these resources, respectively. Types of potential direct and indirect impacts would be the same as those under Alternative 3.

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TABLE 2.4-2 Summary of Known Cultural Resource Sites by Lease Tract Cluster

Lease Tract Cluster	Total Cluster Acreage	Acres Surveyed	Percent Surveyed	No. of Known Sites	Sites per Surveyed Acre
North	5,754	661	11	43	0.0650
North Central	6,398	694	11	56	0.0807
South Central	3,744	325	9	19	0.0584
South	10,013	977	10	103	0.1053
Total	25,909	2,657	10	221	0.0832

TABLE 2.4-3 Summary of Potential Impacts on Known Cultural Resource Sites

	Estimated No. of Sites That Could Be Affected	
Alternative	Indirect Impacts[a]	Direct Impacts
1	111	0
2	111	0
3	128	8
4	221	21
5	221	23

[a] Indirect impacts could occur to all known sites and any newly discovered sites in each lease tract.

2.4.12 Visual Resources

Visual impacts are expressed as contrasts between an existing landscape and a proposed project or activity in terms of form, line, color, and texture. Visual impacts depend on the type and degree of visual contrasts introduced into an existing landscape. Potential impacts on visual resources are analyzed in 4.1.12, 4.2.12, 4.3.12, 4.4.12, and 4.5.12.

Under Alternatives 1 and 2, one or more of the 10 lease tracts would be visible from portions of the Sewemup Wilderness Study Area (WSA), Palisade Outstanding Natural Area (ONA) Area of Critical Environmental Concern (ACEC), Palisade WSA, Unaweep/Tabeguache Scenic and Historic Byway, Tabeguache Area, Dolores River Canyon WSA, Dolores River

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Special Recreation Management Area (SRMA), San Miguel River SRMA, McKenna Peak WSA, San Miguel ACEC, and Trail of the Ancient Byways, which are located within 0 to 25 mi (0 to 40 km) of the lease tracts. Visual contrast of visible activities occurring within the lease tracts would range from none to strong, depending on the viewer's location within the special visual resource area (SVRA). Potential visual impacts that could occur under Alternatives 1 and 2 would include vegetation clearing, landform alteration, removal of structures and materials, changes to existing roadways, vehicular and worker activity, and light pollution in the form of skyglow, light trespass, or glare.

Under Alternative 3, 1 or more of the 12 lease tracts would be visible from portions of the Sewemup WSA, Unaweep/Tabeguache Scenic and Historic Byway, Tabeguache Area, Dolores River Canyon WSA, Dolores River SRMA, San Miguel River SRMA, McKenna Peak WSA, San Miguel ACEC, and Trail of the Ancient Byways, which are located within 0 to 25 mi (0 to 40 km) of the lease tracts. Visual contrast of visible activities occurring within the lease tracts would range from none to strong, depending on the viewer's location within the SVRA. Potential visual impacts that could occur under Alternative 3 include vegetation clearing, exploratory drilling, road construction, support facility construction, worker and equipment presence, and lighting in the form of skyglow, light trespass, or glare. Visual impacts resulting from activities associated with mine development and operations would vary in frequency and duration, given that mining activity could last 10 years or more.

Under Alternatives 4 and 5, 1 or more of the 31 lease tracts would be visible from portions of the Sewemup, Palisade, Squaw/Papoose Canyon, McKenna Peak, Dolores River Canyon, and Cahone Canyon WSAs; the Palisade ONA and San Miguel ACECs; the Unaweep/Tabeguache Scenic and Historic Byway; the Tabeguache Area; the Dolores River SRMA; the San Miguel River SRMA; the Canyon of the Ancients National Monument; and the Trail of the Ancient Byways, which are located within 0 to 25 mi (0 to 40 km) of the lease tracts. Visual contrast of visible activities occurring within the 31 lease tracts would range from none to strong, depending on the viewer's location within the SVRA. Potential visual impacts under Alternatives 4 and 5 would be the same as those under Alternative 3.

2.4.13 Waste Management

In addition to waste rock, other waste materials would also be generated from the exploration, mine development and operations, and reclamation phases of uranium mining. The waste could include solid residue from the treatment of mine water, chemical waste from used oil, antifreeze, and solvents from maintenance activities. Other solid waste materials generated could include concrete from ore pads and foundations, drill steel, mill timbers, and vent bags. Bulk radiological materials would be taken to a mill for uranium recovery, or transported for disposal to a licensed low-level radioactive waste disposal facility. Inert materials, such as the foundation and concrete, would be broken up and buried on the site. Wastes could also be taken to a recycling or a permitted landfill located near Nucla or Naturita, Colorado.

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TABLE 2.4-4 Comparison of the Potential Impacts on Air Quality, the Acoustic Environment, and Soil Resources from Alternatives 1 through 5

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Air Quality	Potential impacts on ambient air quality anticipated to be minor and temporary in nature. It is estimated that PM_{10} emissions would be about 0.92% of emission totals for the three counties and NO_x emissions would be about 0.09% of the three-county totals.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Potential impacts from the exploration phase would be minimal and temporary in nature. Peak-year emission rate estimates would be small during mine development and operations compared with the emission totals for the three counties. PM_{10} and $PM_{2.5}$ emissions could contribute about 1.5% and 0.66 % of the three county total, respectively. NO_x emissions could be highest during operations, contributing about 1% of the three-county total emissions. During reclamation, PM_{10} emissions could be highest, at about 0.98% of the three-county total emissions.	Similar to Alternative 3 in that potential impacts from the exploration phase would be minimal and temporary in nature. Peak-year emission rates could be small during mine development and operations compared with the emission totals for the three counties. PM_{10} and $PM_{2.5}$ emissions could contribute about 3.0% and 1.3% of the three-county total, respectively. Estimates indicate NO_x emissions would contribute about 2% of the three-county total emissions. During reclamation, PM_{10} emission estimates could be highest at about 1.1% of the three-county total emissions.	Peak-year mine development and operations emission rates are estimated to be higher than those under Alternative 4. PM_{10} and $PM_{2.5}$ emissions could contribute about 3.2% and 1.4% of the three-county total, respectively. NO_x emissions would contribute about 2.3% of the three-county total. During reclamation, PM_{10} emission estimates could be highest at about 1.1% of the three-county total emissions.

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TABLE 2.4-4 (Cont.)

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Acoustic Environment	Noise levels would attenuate to about 55 dBA (the Colorado daytime maximum permissible limit) at a distance of 1,650 ft (500 m) from the reclamation sites. Most area residences are located beyond this distance. However, if reclamation activities were conducted near the boundary of Lease Tract 13, noise levels at nearby residences could exceed the Colorado limit.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Noise impacts during the exploration phase on neighboring residences or communities would be minimal and intermittent in nature. During mine development and operations, noise levels at about 55 dBA and 50 dBA (Colorado nighttime limit) would be limited to distances of 1,650 ft (500 m) from the mine sites and 230 ft (70 m) from the haul routes, respectively. Most area residences are located beyond these distances. If activities were conducted near the boundary of Lease Tract 13, noise levels at nearby residences could exceed the Colorado limit. For reclamation, some unavoidable but localized short-term and minor noise impacts on neighboring residences or communities could occur.	Noise impacts for the three phases would be similar to those from Alternative 3. Activities conducted near Lease Tracts 13, 13A, 16, and 16A could exceed the Colorado daytime limit of 55 dBA. In addition, noise from haul trucks could exceed the Colorado nighttime limit of 50 dBA within 350 ft (107 m) from the haul route, and possibly any residences within this distance could be affected.	Similar to Alternative 4, except Colorado nighttime limit exceedance from haul trucks within 380 ft (120 m) from the haul route.

TABLE 2.4-4 (Cont.)

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Soil Resources	Ground disturbances from reclamation activities could result in minor impacts due to soil compaction, soil horizon mixing, soil contamination (from oil and fuel releases related to use of trucks and other equipment), and soil erosion.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Ground disturbances from mining-related activities could result in minor impacts due to soil compaction, soil horizon mixing, soil contamination (from oil and fuel releases related to use of trucks and other equipment), and soil erosion. Potential impacts from Alternative 3 would likely be greater than those from Alternative 1 since there would be impacts from mine development and operations, which would also be conducted.	Potential impact could be greater than that from Alternative 3 since more mines would be developed and operated.	Similar to Alternative 4.

TABLE 2.4-5 Comparison of the Potential Impacts on Water Resources, Land Use, and Waste Management from Alternatives 1 through 5

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Water Resources	Of the 10 lease tracts evaluated for Alternative 1, reclamation activities on Lease Tract 13 has the greatest potential to affect surface water resources due to the proximity to the Dolores River. The potential impacts due to the backfill materials and poor sealing of drill holes would be minor in Lease Tracts 7, 9, and 13 and avoided by implementation of reclamation performance standards set by the CDWR.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Potential impacts (e.g., runoff generation and erosion) associated with exploration would be minor due to the small spatial extent involved. Potential impacts of groundwater mixing and leaching via exploratory drill holes are expected to be minor in a few lease tracts (e.g., Lease Tracts 7, 9, and 13). For mine development and operations, activities on lease tracts closest to the Dolores River and San Miguel River (e.g., Lease Tracts 13 and 18) pose the greatest potential to affect water quality because of erosion. Potential groundwater contamination impacts and dewatering effects would be minor in a few lease tracts (e.g., Lease Tracts 7, 9, and 13). However, a limited number of existing domestic water wells, associated with Lease Tracts 7, 9, and 13, would be potentially affected if local groundwater is contaminated or aquifers are dewatered. Impacts from reclamation activities would be greater than those for Alternative 1.	Similar to the type of potential impacts under Alternative 3, potential impacts associated with exploration (e.g., runoff generation and erosion) would be minor due to the small spatial extent involved. Potential impacts of groundwater mixing and leaching via exploratory drill holes are expected to be minor in a few lease tracts (e.g., Lease Tracts 7, 9, and 13). Also, mine development and operations on the lease tracts closest to the Dolores River and San Miguel River (e.g., Lease Tracts 13 and 18) would have the greatest potential to affect water quality because of erosion. Potential groundwater contamination impacts and dewatering effects would be minor in a few-lease tracts (e.g., Lease Tracts 7, 9, 13, and possibly 8A). The number of domestic wells that might be affected is similar to Alternative 3, and they are associated more with Lease Tracts 5, 6, 8, 13, 16, and 18. Impacts from reclamation activities would be greater than those under Alternative 1.	Similar to Alternative 4.

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TABLE 2.4-5 (Cont.)

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Land Use	Potential impacts due to land use conflicts are expected to be small under Alternative 1; the lands would continue to be closed to mineral entry, and all other activities, like recreation within the lease tracts, would continue.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Potential impacts due to land use conflicts are expected to be minor under Alternative 3; the lands would be closed to mineral entry, and all other activities, like recreation within the lease tracts, would continue.	Potential impacts due to land use conflicts are expected to be small under Alternative 4; the lands would continue to be closed to mineral entry, and all other activities, like recreation within the lease tracts, would continue.	Similar to Alternative 4.
Waste Management	Amounts of waste or trash generated would be small and would be taken to a mill for recovery, or taken to a permitted landfill near Nucla or Naturita.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Amounts of waste that would be generated during exploration, mine development and operations, and reclamation would be small and managed in a manner similar to that described for Alternative 1. Any waste-rock piles that would remain at the mine surface would be graded to be consistent with the surrounding area, provided with a top cover of soil or other material from the mine site, and seeded.	Amounts of waste or trash generated during the three phases would be small but more than those generated under Alternative 3. They would be managed in a manner similar to that described for Alternatives 1 and 3.	Similar to Alternative 4.

TABLE 2.4-6 Comparison of the Potential Impacts on Human Health from Alternatives 1 through 5

Phase of Activities	Receptor	Assessment Endpoint[a]	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mine development and operations	Uranium miner	Individual rad dose (mrem/yr)	NA[b]	NA	433[c]	Same as Alt. 3	Same as Alt. 3
		Individual LCF risk (1/yr)	NA	NA	4×10^{-4} [c]	Same as Alt. 3	Same as Alt. 3
		Chemical risk (hazard index or HI)	NA	NA	1.1[d]	Same as Alt. 3	Same as Alt. 3
	General public – resident	Individual rad dose (mrem/yr)	NA	NA	16–1.9[e] (WL: 0.0013 to 0.00016)	Same as Alt. 3	Same as Alt. 3
		Individual LCF risk (1/yr)	NA	NA	2×10^{-5} to 3×10^{-6} [e]	Same as Alt. 3	Same as Alt. 3
		Collective rad dose (person-rem/yr)	NA	NA	7.5 to 39[f]	17–94[f]	20–110[f]
		Collective LCF (1/yr)	NA	NA	0.01 to 0.05[f]	0.02–0.1[f]	0.03–0.1[f]
		Chemical risk (HI)	NA	NA	<< 1.0[e]	Same as Alt. 3	Same as Alt. 3
Reclamation	Reclamation worker	Individual rad dose (mrem/yr)	4.8 (WL: $<5 \times 10^{-5}$)	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Individual LCF risk (1/yr)	4×10^{-6}	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Chemical risk (HI)	0.043	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
	General public – resident	Individual rad dose (mrem/yr)	3.0–0.03[g] (WL: $<2 \times 10^{-4}$)	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Individual LCF risk (1/yr)	3×10^{-6} to 3×10^{-8} [g]	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Chemical risk (HI)	< 0.010	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1

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TABLE 2.4-6 (Cont.)

Phase of Activities	Receptor	Assessment Endpoint[a]	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Post-reclamation	General public – recreationist	Individual rad dose (mrem/yr)	0.38 to 11[h] (WL: $<2 \times 10^{-4}$)	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Individual LCF risk (1/yr)	7×10^{-7} to 9×10^{-6}	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Chemical risk (HI)	< 0.13	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
	General public – individual entering an inactive underground mine	Individual rad dose (mrem/h)	7.4 to 87[i] (WL: 3 to 39)	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Individual LCF risk (1/h)	9×10^{-6} to 3×10^{-4}[i]	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Chemical risk (HI)	0	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1

[a] Radiation dose and chemical risk (HI) estimates are rounded to two significant figures; LCF risk is rounded to one significant figure. For some radiation doses, the corresponding radon levels in terms of working level (WL) are also listed in parentheses.

[b] NA = not applicable; continued uranium mining would not occur under Alternatives 1 and 2.

[c] The listed values are based on historical data on the average exposures of underground uranium miners.

[d] The impact associated with exposure to particulates containing uranium and vanadium compounds during this phase was estimated based on the radiation dose associated with inhalation of particulates containing uranium isotopes and their decay products.

[e] Potential individual radiation dose and LCF risk for the general public – resident scenario would depend on the location of the residence. The dose and risk are functions of the distance and direction from the residence to the radon emission source. The listed range is associated with a residence located in the dominant wind direction that gives the highest exposures at a distance of 1,630 to 16,400 ft (500 to 5,000 m) to the emission source, which is a medium-underground mine. Potential dose and LCF risk associated with a small underground mine would be about half of the listed values; those associated with a large underground mine would be about twice the listed values. Potential dose and LCF risk associated with a very large open-pit mine would be greater than those associated with a small underground mine but less than those associated with a medium-sized underground mine for a distance of 3,300 ft (1,000 m) or greater. Potential hazard index associated with the exposures of residents is expected to be much smaller than that associated with the exposures of uranium miners (i.e., much smaller than the threshold value of 1). Detailed calculation results are provided in Sections 4.1.5, 4.2.5, 4.3.5, 4.4.5, and 4.5.5 for the five alternatives.

Footnotes continued on next page.

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TABLE 2.4-6 (Cont.)

[f] The collective dose and LCF risk were estimated for the entire population living at a distance of 3.1 to 50 mi (5 to 80 km) from the center of each lease tract group. The collective dose and LCF risk correspond to the peak year of operations. In any other year, the collective dose/LCF risk is expected to be lower than the listed value.

[g] Potential individual radiation dose and LCF risk for the general public – resident scenario would depend on the location of the residence. The dose and risk are functions of the distance and direction from the residence to the source of radon and particulate emissions. The listed range is associated with a residence located in the most dominant wind direction at a distance of 1,600 to 16,000 ft (500 to 5,000 m) to the emission source, which is a waste-rock pile at a scale ranging from small to very large. The waste-rock pile is assumed to be generated by the development and operations of an underground mine for 10 years. Detailed calculation results are provided in Sections 4.1.5, 4.2.5, 4.3.5, 4.4.5, and 4.5.5 for the five alternatives.

[h] The recreationist dose and LCF risk results were obtained based on the assumption that the emission source (i.e., a waste-rock pile) would be covered by 0–1 ft (0–0.3 m) of soil materials.

[i] Potential individual radiation dose and LCF risk for the general public – individual entering an inactive underground mine were calculated on the basis of radon levels that were measured in three abandoned mines in the United Kingdom (Denman et al. 2003).

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TABLE 2.4-7 Comparison of the Potential Impacts on Ecological Resources from Alternatives 1 through 5

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Vegetation	It is expected that impacts under Alternative 1 would generally be minor and short term. Areas affected by Alternative 1 activities would generally consist of previously disturbed areas, and reclamation would generally include relatively small surface areas (approximately 1 to 8 acres [0.4 to 3.2 ha] per mine, other than the JD-7 mine). Reclamation would establish plant communities on disturbed areas, including waste rock; however, resulting plant communities might be considerably different from those of adjacent areas. The successful reestablishment of some plant communities, such as sagebrush shrubland or piñon-juniper woodland, would likely require decades. Indirect impacts associated with reclamation activities could include the deposition of fugitive dust, erosion, sedimentation, and the introduction of non-native species, including noxious weeds. However, because of the small areas involved and short duration of reclamation activities, these would generally constitute a short-term impact. The establishment of invasive species, including the potential alteration of fire regimes, could result in long-term impacts, although monitoring and vegetation management programs would likely control invasive species.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Impacts under Alternative 3 would range from minor to moderate and short term to long term. Impacts from exploration would result from disturbance of vegetation and soils, the removal of trees or shrubs, compaction of soils, destruction of plants, burial of vegetation under waste material, or erosion and sedimentation. Exploration activities are expected to affect relatively small areas, and impacts would generally be short term. The localized destruction of biological soil crusts, where present, would be considered a longer-term impact, particularly where soil erosion has occurred. Ground disturbance from mine development and operations would range from 10 to 20 acres (4 to 8 ha) per mine, except for the 210-acre (85-ha) JD-7 open-pit mine. Impacts would include the destruction of habitats during site clearing and excavation, as well as the loss of habitat in additional use areas. Affected areas might include high-quality mature habitats or previously degraded areas. Wetlands present on project sites could be directly or indirectly affected. Indirect impacts from mining would be associated with fugitive dust, invasive species, erosion, sedimentation, and impacts due to changes in surface water or groundwater hydrology or water quality. The deposition of fugitive dust and the establishment of invasive species, including the potential alteration of fire regimes, could result in long-term impacts.	Impacts would be similar to those for Alternative 3, except a larger area (460 acres, or 190 ha) would be disturbed.	Similar to Alternatives 4 with respect to the amount of area disturbed, but disturbance would be for a shorter period of time (i.e., 10 years versus potentially more than 10 years for Alternative 4).

TABLE 2.4-7 (Cont.)

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Wildlife	Reclamation activities would cause a short-term, localized disturbance of wildlife in the area of the 13 mine sites on 10 lease tracts. Reclamation of 267 acres (108 ha) would result in long-term, localized improvement of wildlife habitats within the 10 lease tracts. Negligible impacts on wildlife would occur during DOE's long-term management of the withdrawn lands.	Similar to Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	There could be impacts on a total of 310 acres (125 ha) of wildlife habitat at 8 mine sites within 1 or more of the 12 formerly active lease tracts during the peak year of operations. Additional habitats could be affected by any access roads or utility lines required for the mines. Impacts on wildlife could occur from habitat disturbance, wildlife disturbance, and wildlife injury or mortality and habitat loss. Overall, localized impacts on wildlife would range from negligible to moderate during mine development and operations, while wildlife impacts would be long term (last for decades), would be scattered temporarily and, especially, spatially, and would not affect the viability of wildlife populations.	Impacts would be similar to those from Alternative 3, except that a total of 460 acres (190 ha) of wildlife habitat at 19 mine sites could be disturbed within any of the 31 lease tracts during the peak year of operations. Overall, localized impacts on wildlife would range from negligible to moderate and would not affect the viability of wildlife populations.	Impacts on a total of 490 acres (198 ha) of wildlife habitat at 19 mine sites within any of the 31 lease tracts during the peak year of operations. Impacts on wildlife would be similar to, but for a shorter time period than, those for Alternative 4. Overall, localized impacts on wildlife would range from negligible to moderate and would not affect the viability of wildlife populations.
Aquatic Biota	Reclamation activities could cause sediment deposition in intermittent and ephemeral streams and possibly the Dolores River. The potential for sediments to enter the perennial streams is negligible to minor due to the limited amount of land undergoing reclamation in any given area. Reclaimed areas would be less prone to erosion as vegetation becomes established.	Similar to Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Impacts on aquatic resources could result from increases in sedimentation and turbidity from soil erosion and runoff during mine development and operations. There would be a very low likelihood of an accidental ore spill into a perennial stream or river. Overall, localized impacts on aquatic biota would range from negligible to moderate and would not affect the viability of any aquatic species.	Impacts on aquatic resources would be similar to those under Alternative 3, except that 19 mines could be in operation on any of the 31 lease tracts during the peak year of operations. Overall, localized impacts on aquatic biota would range from negligible to moderate and would not affect the viability of any aquatic species	Impacts on aquatic resources would be similar to those under Alternative 4, except that the mines would be in operation for a shorter length of time. Overall, localized impacts on aquatic biota would range from negligible to moderate and would not affect the viability of any aquatic species.

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TABLE 2.4-7 (Cont.)

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Threatened, Endangered, and Sensitive Species	Reclamation activities would generally cause minor, short-term impacts on threatened, endangered, and sensitive species. The small scale of reclamation activities on previously disturbed areas would generally have minor direct impacts on sensitive terrestrial species. Indirect impacts associated with water withdrawal, erosion, and sedimentation might have minor, short-term impacts on sensitive aquatic species (including Colorado River endangered fish species).	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Potential impacts on threatened, endangered, and sensitive species could range from small to moderate and short term to long term, depending on the location of the mines and amount of surface disturbance. Direct impacts could result from the destruction of habitats during site clearing, excavation, and operations. Indirect impacts could result from fugitive dust, erosion, sedimentation, and impacts related to altered surface water and groundwater hydrology. Water withdrawals from the Upper Colorado River Basin to support mining activities may result in potentially unavoidable impacts on aquatic biota (particularly the Colorado River endangered fish species). For this reason, ULP activities under Alternative 3 may affect, but are not likely to adversely affect, the Colorado River endangered fish species and their critical habitat.	Similar to Alternative 3. However, there would be more lease tracts available for mining under this alternative, thereby increasing the area that could be disturbed or developed and the potential for impacts on threatened, endangered, and sensitive species.	Similar to Alternative 4, but the total disturbed surface area is somewhat larger than that under Alternative 4.

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TABLE 2.4-8 Comparison of the Potential Impacts on Socioeconomics, Environmental Justice, and Transportation from Alternatives 1 through 5

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Socioeconomics	Potential impact is expected to be minor. Reclamation activities would require 29 direct jobs and generate 16 indirect jobs. Reclamation would produce $1.7 million in income. There would likely be a small positive impact on recreation and tourism because of the reclamation that would be completed.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Potential impact is expected to be minor. Mine development and operations would create 123 direct jobs, 98 indirect jobs, $4.7 million in direct income, and $4.0 million in indirect income. In-migration could include up to 63 people moving into the ROI. Reclamation activities would require 29 direct jobs and generate 17 indirect jobs. Reclamation would produce $1.8 million in income.	Potential impact is expected to be minor. Mine development and operations would create 229 direct jobs, 152 indirect jobs, and $14.8 million in income. In-migration could include up to 115 people moving into the ROI. Reclamation activities would require 39 direct jobs and generate 21 indirect jobs. Reclamation would produce $2.4 million in income.	Potential impact is expected to be minor. Mine development and operations would create 253 direct jobs, 152 indirect jobs, and $15.6 million in income. In-migration could include up to 122 people moving into the ROI. Reclamation activities would require 39 direct jobs and generate 25 indirect jobs. Reclamation would produce $2.5 million in income.
Environmental Justice	Potential impacts on the general population could result from uranium mining activities. For the majority of resources evaluated, impacts would be likely to be minor and would be unlikely to disproportionately affect low-income and minority populations.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Potential impacts are likely to be minor and unlikely to disproportionately affect low-income and minority populations. Specific impacts on low-income and minority populations as a result of participation in subsistence or cultural and religious activities would also be minor and unlikely to be disproportionate.	The types of impacts related to mine development and operations under Alternative 4 would be similar to those described under Alternative 3, but the increase in the disturbed area under Alternative 4 could potentially increase the impacts. Impacts on low-income and minority populations associated with the reclamation activities would be the same as those under Alternative 1.	The types of impacts related to exploration under Alternative 5 would be similar to those under Alternative 3. The types of impacts related to mine development and operations under Alternative 5 would be similar to those under Alternative 4. Under Alternative 5, for the majority of resources evaluated, the impacts would likely be minor and would be unlikely to have disproportionate impacts on low-income or minority populations.

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TABLE 2.4-8 (Cont.)

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Transportation	No transportation of uranium ore would occur. There would be no radiological transportation impacts. No changes in current traffic trends near the DOE ULP lease tracts would be anticipated because no significant supporting truck traffic or equipment moves would occur, and only about five reclamation workers would be commuting to each site on a regular basis during reclamation activities.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	There would be an average of approximately 40 round-trip uranium ore truck shipments per weekday under Alternative 3. For the sample case considered, the total annual distance travelled in the peak year by the haul trucks would be about 1.10 million mi (1.77 million km), primarily on CO 90 and CO 141 and on US 491 and US 191. The estimated attendant traffic accident injuries and fatalities would be about 0.33 and 0.029, respectively. The resultant collective radiological population dose to those individuals living and working near the haul routes was estimated to be approximately 0.14 person-rem, a dose that could potentially result in an LCF risk of 8×10^{-5}. The potential annual collective dose estimated for the truck drivers is 0.71 person-rem, with an associated LCF risk of 0.0004. Dependent on which lease tracts have mining operations and which mill was used in each case, the total annual distance in the peak year could range from about 0.47 million to 2.22 million mi (751,000 to 3.58 million km), with impacts roughly proportional to the distance travelled.	There would be an average of approximately 80 round-trip uranium ore truck shipments per weekday under Alternative 4. For the sample case considered, the total annual distance travelled in the peak year by the haul trucks would be about 2.22 million mi (3.57 million km), primarily on CO 90 and CO 141 and on US 491 and US 191. The estimated attendant traffic accident injuries and fatalities would be about 0.66 and 0.057, respectively. The resultant collective radiological population dose to those individuals living and working near the haul routes was estimated to be approximately 0.28 person-rem, a dose that could potentially result in an LCF risk of 0.0002 in the population. The potential annual collective dose estimated for the truck drivers is 1.4 person-rem, with an associated LCF risk of 0.0009. Dependent on which lease tracts have mining operations and which mill was used in each case, the total annual distance in the peak year could range from about 1.14 million to 4.26 million mi (1.84 million to 6.86 million km), with impacts roughly proportional to the distance travelled.	There would be an average of approximately 92 round-trip uranium ore truck shipments per weekday under Alternative 5. For the sample case considered, the total annual distance travelled in the peak year by the haul trucks would be about 2.72 million mi (4.38 million km), primarily on CO 90 and CO 141 and on US 491 and US 191. The estimated attendant traffic accident injuries and fatalities would be about 0.81 and 0.073, respectively. The resultant collective radiological population dose to those individuals living and working near the haul routes is estimated to be approximately 0.34 person-rem, a dose that could potentially result in an LCF risk of 0.0002 in the population. The potential annual collective dose estimated for the truck drivers was 1.8 person-rem, with an associated LCF risk of 0.001. Depending on which lease tracts have mining operations and which mill was used in each case, the total annual distance in the peak year could range from about 1.45 million to 4.90 million mi (2.34 million to 7.88 million km), with impacts roughly proportional to the distance travelled.

TABLE 2.4-9 Comparison of the Potential Impacts on Cultural Resources and Visual Resources from Alternatives 1 through 5

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Cultural Resources	Under Alternative 1, indirect impacts could occur on all known cultural resources located within the 10 lease tracts. It is estimated that there are 111 resources within the 10 lease tracts (see Table 4.1-12). Direct impacts are not expected because areas to be reclaimed have already been disturbed, and no new land disturbance is expected. Indirect impacts under Alternative 1 would include the increased potential for vandalism related to road or footpath expansion and for the disturbance of a cultural resource from fugitive dust. Significant cultural properties that could be adversely affected by the proposed action would be identified before any ground-disturbing activities occurred, and plans would be modified to avoid or mitigate impacts on cultural resources. There is potential for buried cultural deposits to be uncovered even if sites were not identified on the surface prior to ground disturbance activities.	Same as Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Under Alternative 3, indirect impacts could occur on all known cultural resource sites located within the 12 lease tracts. It is estimated that there are 128 resources within the 12 lease tracts. Direct impacts could occur on eight of these resources (see Table 4.1-12). Potential direct impacts would include the disturbance of buried cultural resources or surface deposits as a result of excavation, vibration from equipment, and fugitive dust. Indirect impacts would include visual disturbance to resources; the introduction of noise to traditional sacred areas; and an increased potential for vandalism, erosion, trampling, and nonauthorized collecting related to road or footpath expansion. Significant cultural properties that would be adversely affected by the proposed actions would be identified before any ground-disturbing activities occurred, and plans would be modified to avoid or mitigate impacts on cultural resources.	Under Alternative 4, indirect impacts on all known cultural resources located within the 31 lease tract could occur. Direct impacts could occur on 21 of these resources (see Table 2.4-3). Types of potential impacts would be the same as those discussed for Alternative 3. Significant cultural properties that would be adversely affected by the proposed action would be identified before ground-disturbing activities occurred, and plans could be modified to avoid or mitigate impacts on cultural resources.	Similar to Alternative 4, except that direct impacts could occur on 23 of the known cultural resources on the 31 lease tracts (see Table 2.4-3).

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TABLE 2.4-9 (Cont.)

Resource/ System	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Visual Resources[a]	Potential visual impacts that could occur under Alternative 1 would include vegetation clearing, landform alteration, removal of structures and materials, changes to existing roadways, vehicular and worker activity, and light pollution. Under Alternative 1, one or more of the 10 lease tracts would be visible from portions of the Sewemup WSA, Palisade ONA ACEC, Palisade WSA, Unaweep/ Tabeguache Scenic and Historic Byway, Tabeguache Area, Dolores River Canyon WSA, Dolores River SRMA, McKenna Peak WSA, San Miguel ACEC, San Miguel SMRA, and Trail of the Ancient Byways, which are located within 0–25 mi (0–40 km) of the lease tracts. Visual contrast of visible activities occurring within the lease tracts would range from none to strong, depending on the viewer's location with respect to the SVRA.	Similar to Alternative 1. However, under BLM's multiple use policies, there could be additional potential impacts.	Potential visual impacts that could occur under Alternative 3 include vegetation clearing, exploratory drilling, road construction, support facility construction, worker and equipment presence, and lighting in the form of skyglow, light trespass, or glare. Under Alternative 3, one or more of the 12 lease tracts would be visible from portions of the Sewemup WSA, Unaweep/Tabeguache Scenic and Historic Byway, Tabeguache Area, Dolores River Canyon WSA, Dolores River SRMA, McKenna Peak WSA, San Miguel ACEC, San Miguel SMRA, and Trail of the Ancient Byways, which are located within 0–25 mi (0–40 km) of the lease tracts. Visual contrast of visible activities occurring within the lease tracts would range from none to strong, depending on the viewer's location with respect to the SVRA.	Potential visual impacts under Alternative 4 would be the same as those under Alternative 3. Under Alternative 4, 1 or more of the 31 lease tracts would be visible from portions of the Sewemup, Palisade, Squaw/Papoose Canyon, McKenna Peak, Dolores River Canyon, and Cahone Canyon WSAs; the Palisade ONA, San Miguel SMRA, and San Miguel ACECs; the Unaweep/ Tabeguache Scenic and Historic Byway; the Tabeguache Area; the Dolores River SRMA; Canyon of the Ancients National Monument; and Trail of the Ancient Byways, which are located within 0–25 mi (0–40 km) of the lease tracts. Visual contrast of visible activities occurring within the 31 lease tracts would range from none to strong, depending on the viewer's location with respect to the SVRA.	Similar to Alternative 4.

[a] ONA = Outstanding Natural Area, SRMA = Special Recreation Management Area, SVRA = special visual resource area, WA = Wilderness Area, WSA = Wilderness Study Area.

Potential impacts on the waste management or disposal practices just discussed would be minor, since capacity is available at the permitted landfills or licensed facilities. Waste that would remain at the mine site would be placed in a manner that is protective to human health and the environment, in compliance with Federal, state, and local requirements.

2.4.14 Cumulative Impacts

Potential impacts from the five alternatives in this Draft ULP PEIS are considered in combination with impacts of past, present, and reasonably foreseeable future actions. For this cumulative impacts analysis, past projects are generally assumed to be reflected in the affected environment discussion. Projects that have been completed, such as the exploration and reclamation activities implemented under the ULP in 2009 and 2011 as discussed in Section 4.7.2.2.7, are generally assumed to be part of the baseline conditions that were analyzed under the five alternatives discussed in Sections 4.1 through 4.5. The summary of ongoing and planned projects or activities in the region of cumulative effects is presented in Table 4.7-11. As mentioned previously, the region of cumulative effects is conservatively assumed to be a 50-mi (80-km) radius. The ROIs for the various resource areas are listed in Chapter 3, and for most of these resource areas, a 25-mi (40-km) radius was identified as the ROI. The analyses for potential environmental justice impacts and potential impacts on the human health of the population generally addressed a 50-mi (80-km) radius, which is why the region of cumulative effects was extended to this larger radius (see Appendix D for information on how the radius was identified as the ROI for each resource area).

The major ongoing projects that are related to uranium mining activities proposed under the five alternatives evaluated in this Draft ULP PEIS include (1) the White Mesa Mill; (2) various permitted uranium mining projects in Montrose, Mesa, and San Miguel Counties, none of which are currently actively producing; (3) the Daneros Mine; (4) the Energy Queen Mine, which is operational but currently inactive; and (5) the ongoing reclamation of abandoned uranium mines (these mines are not on the DOE ULP lease tracts). There are also other projects not related to uranium mining. These include the operating Nucla Station Power Plant, the Lisbon Natural Gas Processing Plant, the New Horizon Coal Mine, other mineral mining projects (for sand, gravel, gold, quartz, and granite), oil and gas exploration, transmission line and transportation ROW projects, grazing, wildlife and vegetation management projects, and National Monument improvement projects.

Several uranium-mining-related projects are also planned and include the planned Piñon Ridge Mill and the Whirlwind Mine near Gateway. Other planned or proposed projects include the Book Cliff Coal Mine near Fruita in Mesa County, a ROW maintenance project for the Western Area Power Administration (WAPA), the reduction of tamarisk and other invasive non-native plant species, and the 2012 restoration of a section of the Hanging Flume located northwest of Nucla.

The environmental impacts discussion in Chapter 4 indicates that potential impacts on the resource areas evaluated for the five alternatives would be minor and could be further minimized

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by implementing measures (i.e., compliance measures, mitigation measures, or BMPs described in Section 4.6) determined in project-specific mine plans. Estimates for potential human health impacts indicate that the emission of radon would be the primary source of potential human health radiation exposure. However, requirements for monitoring and ventilating mine operations and for worker safety are expected to mitigate potential impacts on human health.

Although the various present, ongoing, and planned projects identified in the region of cumulative effects could contribute to impacts on the various environmental resource areas evaluated, it is expected that uranium-mining-related projects would be most similar with respect to the types of potential environmental impacts that could occur, and most of these are located closer to (within 25 mi or 40 km) the lease tracts. However, information for most of the projects is either not available or qualitative in nature.

Based on the information in Table 4.7-12 and other information presented in Sections 4.7.1 and 4.7.2, the potential cumulative impacts on the various environmental resources (e.g., air quality, water quality, soils, ecological resources, socioeconomics, transportation) and human health from uranium-mining-related projects and other non-uranium-mining-related projects when added to the ULP alternatives would result in overall impacts that would be negligible to moderate.

2.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Uranium mining activities associated with the five alternatives evaluated in this Draft ULP PEIS would result in an irreversible and irretrievable commitment of resources. Table 2.5-1 summarizes the estimated amounts of the resources assumed to be utilized with the implementation of any of the five alternatives. These resources would be irreversible and irretrievable in that once utilized, the resources are essentially spent and not replaceable.

The maximum amounts are associated with Alternative 4 based on the assumption of the operational period being 10 years. For Alternative 4, the leases would also likely be extended on a lease-by-lease basis. The period of operations for Alternative 5 is assumed to be five years based on the stipulated lease period for the alternative (i.e., remainder of the 10-year lease period that started in 2008 and no extensions of the leases). For Alternative 4, the preferred alternative, approximately 480,000 tons/yr of uranium ore would be removed from the DOE ULP lease tracts for processing at the mills and ultimately used for various energy purposes. In addition, about 6.3 million gal (19 ac-ft) of water could be utilized during the peak year of mine operations. Other materials that would be expended during operations for Alternative 4 would include about 12 million kWh of electricity, about 11,000 tons of steel, and 590,000 gal (2.3 million L) of fuel and lubricants.

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TABLE 2.5-1 Estimated Amount of Resources Assumed To Be Irreversible and Irretrievable as a Result of the Implementation of the ULP Alternatives

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Uranium ore[a] (tons)	None	None	2,400,000	4,800,000	2,760,000
Water (gal)[b]	160,000	160,000	32,000,000	63,000,000	40,000,000
Fuel and lubricants (gal)[b]	110,000	110,000	300,000	590,000	330,000
Steel (tons)[b]	NA[c]	NA	4,400	9,900	5,300
Electricity (kWh)[b]	NA	NA	580,000	1,200,000	700,00

[a] For Alternatives 3 and 4, assumed 10 years of operations; for Alternative 5, assumed 5 years of operations.

[b] For Alternatives 1 and 2, resource utilized for the reclamation phase only (which would be completed in 1 year of field work); for Alternatives 3 to 5, estimates include 10 years of operations in addition to the 1 year of exploration and reclamation.

[c] NA denotes none assumed.

Source: Appendix C of this Draft ULP PEIS

2.6 PREFERRED ALTERNATIVE IDENTIFIED

DOE's preferred alternative for the management of the ULP is Alternative 4. DOE would continue to allow, after appropriate NEPA analysis, the exploration, mine development and operations, and reclamation of uranium mines on the 31 lease tracts that are being managed under the DOE ULP. As stated in previous sections, the difference between Alternative 4 (the preferred alternative) and Alternative 5 (the No Action Alternative for this Draft ULP PEIS) is the lease period associated with these alternatives. Under Alternative 4, the lease period would be for the next 10 years or for another reasonable period; under Alternative 5, the lease period would be for the remainder of the 10-year period stipulated in the leases executed in 2008. Hence, the number of years available for ore generation would be shorter under Alternative 5 and might not give the lessees enough flexibility to time their mining activities to coincide with periods when the economic market for uranium ore was favorable. The shorter period of time associated with Alternative 5 could also mean that the ore in some of the mines might not be exhausted by the time the lease(s) expired, resulting in the premature shutdown of activities, termination, and reclamation.

The comparison and summary of potential impacts in Section 2.4 indicates that in general, the impacts from Alternative 4 would be similar to those from Alternative 5. The exception is that it is assumed that a slightly greater quantity of ore would be generated each year under Alternative 5. This assumption was made to simulate conditions in which the lessees would expedite the ore production by operating medium-sized to large mines (and not any small mines, which are considered under Alternative 4). The slightly higher amount of ore generated under Alternative 5 would result in slightly greater potential impacts than those under Alternative 4.

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Potential impacts from reclamation activities would be similar under all the alternatives, 1 through 5. Potential impacts under Alternatives 1 and 2 would result only from reclamation. Potential impacts from mine operations would be slightly less under Alternative 3 than under Alternative 4 because it is assumed that fewer mines (with fewer leases—12 versus 31) would be operated under Alternative 3. The assumptions developed for Alternative 4 are considered more realistic based on historical experience and based on the outlook for future uranium mining in the area.

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3 AFFECTED ENVIRONMENT

The ROIs affected by the proposed action presented in this Draft ULP PEIS are described for each resource area evaluated (see Appendix D for additional discussion on the determination of the ROIs). This site-specific information will be used as the basis for evaluating the potential impacts from the alternatives discussed in Chapter 4.

Regions of Influence (ROIs) for the Various Resource Areas Evaluated in This Draft ULP PEIS

Air Quality: Mostly within 31 mi (50 km) from the source(s) but up to several hundred miles, a minimal but cumulative contribution to air quality-related values (such as visibility and acid deposition)

Noise: Within 2–3 mi (3–5 km), from noise source(s) at best

Paleontological Resources: Lease tracts and any other areas on adjacent lands that could be affected by mining activities

Soil Resources: The lease tracts and any other areas on adjacent lands (e.g., unpaved access roads) that could be affected by mining activities

Water Resources: Montrose, Mesa, and San Miguel Counties, primarily on the lease tracts; also the Dolores River, San Miguel River, and their tributaries

Human Health: 50-mi (80-km) radius of the lease tracts

Land Use: The lease tracts and land within a 25-mi (40-km) radius of each lease tract, with an emphasis on specially designated public land areas

Ecological Resources: Montrose, Mesa, and San Miguel Counties, primarily on the lease tracts; the Dolores River, San Miguel River, and Colorado River (for threatened and endangered species evaluation only)

Socioeconomics: Montrose, Mesa, and San Miguel Counties

Environmental Justice: 50-mi (80-km) radius of the lease tracts

Transportation: 25-mi (40-km) radius from the boundary of the lease tracts

Cultural Resources: Lease tracts and any other areas on adjacent lands that could be affected by mining activities

Visual Resources: 25 mi (40 km) from the lease tracts

Waste Management: Surface mine plants on the lease tracts

3.1 AIR QUALITY

3.1.1 Climate

3.1.1.1 General Climate

Wide variations in elevation and topographic features within the area surrounding the ULP lease tracts have an impact on wind patterns, temperatures, and storm tracks in all seasons (NCDC 2011a). The area has a semi-arid, mid-continental climate characterized by abundant sunshine, low humidity, low precipitation, and cold, snowy winters. Strong, outgoing terrestrial radiation provides cool nights. In midwinter, air temperatures are often low, but strong solar radiation and dry air combine to provide generally pleasant conditions.

The local climate is strongly influenced by microclimatic features such as slope, aspect, and elevation. The prevailing wind direction aloft over the region is from the west or the southwest (the westerlies), as it is in most of the United States; however, complex terrains in western Colorado are responsible for deflecting these winds. Accordingly, wind patterns are sometimes dissimilar even over short distances.

The ULP lease tracts are located in southwestern Mesa County and in western Montrose and San Miguel Counties in southwestern Colorado. The elevations of lease

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tracts range from 5,100 ft (1,500 m) to 8,000 ft (2,439 m) with an average elevation of about 6,401 ft (1,951 m). The area surrounding the ULP lease tracts is characterized by complex topography with valleys, canyons, and plateaus, so the climate varies considerably from place to place.

3.1.1.2 Wind

Wind roses (which graphically display the distribution of wind speed and direction) are presented here based on data available from weather stations in place for the proposed Piñon Ridge Mill, because they are located in the center of the ULP lease tracts scattered over a wide area. These stations are referred to as Site 1 (33-ft [10-m] level) and Site 2 (98-ft [30-m] level). Data for a 3-year period (April 2008–March 2011) are shown in Figure 3.1-1 (Rogers 2011). The proposed Piñon Ridge Mill site is located in the eastern Paradox Valley in western Montrose County, which is roughly at the center of ULP lease tracts. The Paradox Valley is aligned in a northwest–southeast direction. Winds are controlled in large part by the valley and ridge topography. At Site 1 (33-ft [10-m] level), winds blow more frequently from the northwest and southeast, reflecting the channeling of winds parallel to the valley axis. The annual average wind speed is about 6.3 mph (2.8 m/s). Average wind speeds are highest in spring at 7.9 mph (3.5 m/s) and lowest in winter at 4.6 mph (2.1 m/s). Prevailing wind directions are from the southeast (about 14% of the time) and the east–southeast (about 14% of the time). Secondary prevalent wind directions are from the northwest and west-northwest about 18% of the time combined. Thus, about half of the time, upslope and downslope winds along the valley axis prevail. However, effects of prevailing westerlies aloft are relatively minor at the surface. Northwesterly upslope winds blow more frequently during daytime, while southeasterly downslope winds (also called drainage winds) prevail at night.

Wind rose at Site 2 (98-ft [30-m] level) of the proposed Piñon Ridge Mill site, which is located about 1.3 mi (2.1 km) south–southeast of Site 1 on the same valley floor but closer to the valley wall, is provided in Figure 3.1-1(b). Wind patterns are somewhat different from those at Site 1 (33-ft [10-m]) level. Daytime upslope winds observed are like those at Site 1, while nighttime downslope winds are relatively weak. Typically, downslope winds are shallower than upslope winds, with little or no turbulence because of the stable temperature structure of the air. Throughout the year, westerly or southwesterly winds prevail at Site 2, especially during nighttime hours, suggesting it is more affected by regional winds than by local flows. Average wind speed at Site 2 is about 5.9 mph (2.6 m/s). As it is at Site 1, wind speed at Site 2 is highest in spring and lowest in winter. Prevailing wind direction at Site 2 is from the west–northwest (about 12% of the time) and secondarily is from the west (about 12% of the time). Winds that range from the southeast clockwise to northwest sectors, which is the lower-left half of the valley axis, account for more than three-fourths of the time.

Typically, wind speeds at higher elevations are faster than those at lower elevations because of surface friction. However, the reverse is observed at the proposed Piñon Ridge Mill. The upslope-downwind speed at Site 2 is lower than that at Site 1, which is located on the central

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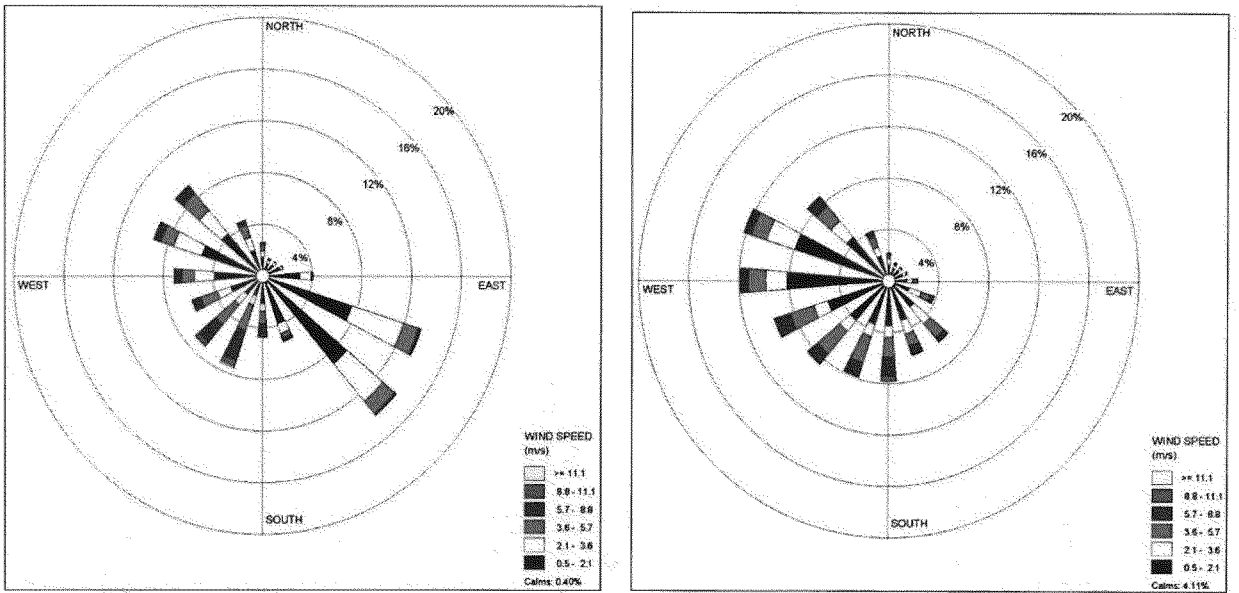

(a) (b)

FIGURE 3.1-1 Wind Roses at the Proposed Piñon Ridge Mill, Montrose County, Colorado, April 2008–March 2011: (a) Site 1, 33-ft (10-m) Level; and (b) Site 2, 98-ft (30-m) Level (Source: Rogers 2011)

valley floor, due to friction with the nearby valley wall at Site 2 and because local flows seem somewhat stronger than regional westerly winds.

Aside from the weather stations at the proposed Piñon Ridge Mill, there is also a BLM Remote Automated Weather Station at Nucla near the ULP lease tracts. Nucla station is located outside the southeastern edge of Paradox Valley, about 2 mi (3 km) south of Nucla and about 11 mi (18 km) east of the proposed Piñon Ridge Mill site. However, wind patterns are quite different from those at Piñon Ridge Mill. As shown in Figure 3.1-2, prevailing wind directions are from the east throughout the year due to predominant nighttime drainage winds from the San Miguel River valley to the east (DRI 2011). During daytime hours, effects of the San Miguel River valley, which runs in a northwest–southeast direction, parallel those of the Paradox Valley, and regional westerly winds are more prominent.

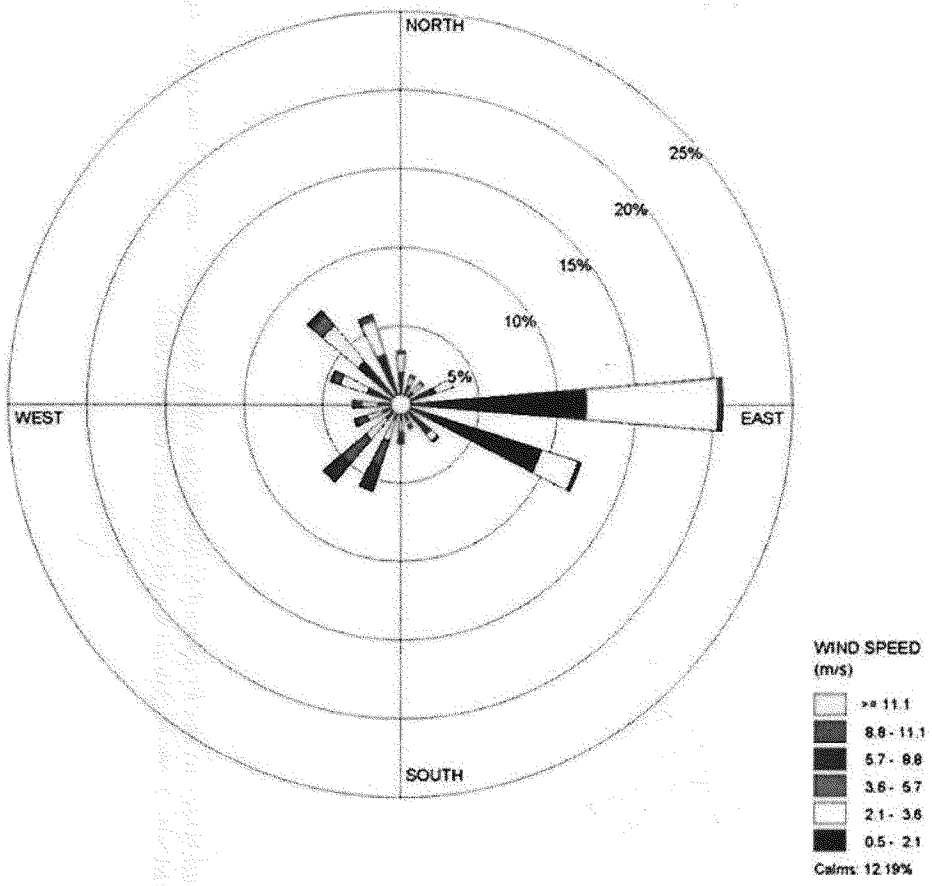

FIGURE 3.1-2 Wind Rose at 20-ft (6.1-m) Level at Nucla, Montrose County, Colorado, 2006–2010 (Source: DRI 2011)

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3.1.1.3 Temperature

Temperatures in the region vary widely with elevation, latitude, season, and time of day. In western Colorado, topography plays a large role in determining the temperature of any specific location (NCDC 2011a). The ULP lease tracts sit at a higher elevation; thus, temperatures there are lower than at lower elevations of comparable latitude. Historical annual average temperatures measured at selected meteorological stations around the ULP lease tracts range from 45.3°F (7.4°C) in Northdale (about 10 mi [16 km] south of the southernmost ULP lease tract at an elevation of 6,680 ft [2,040 m]) to 53.9°F (12.2°C) in Gateway 1 SE (about 6 mi [10 km] northwest of the northernmost ULP lease tract at an elevation of 4,550 ft [1,390 m]), as presented in Table 3.1-1 (WRCC 2011a; DRI 2011). Typically, January is the coldest month, with nighttime lows ranging from 9.0 to 18.0°F (–12.8 to –7.8°C), and July is the warmest month, with daytime highs ranging from 86.5°F to 98.6°F (30.3 to 37.0°C). During the reporting period, the highest temperature of 110°F (43.3°C) was reached in June 1950 at Paradox 1 E and in July 1989 at Uravan, and the lowest of –42°F (–41.1°C) was reached in February 1933 at Northdale. Each year, about 17–76 days had a maximum temperature of ≥90°F (32.2°C), while about 132–205 days had minimum temperatures at or below freezing with subzero temperatures of about 3–18 days.

3.1.1.4 Precipitation

In Colorado, precipitation patterns are largely controlled by mountain ranges and elevation (NCDC 2011a). The interior, continental location, ringed by mountains on all sides, results in low precipitation year-round. Air masses crossing the region, which gather moisture over the Pacific Ocean and traverse several hundred miles of mountainous terrain, have precipitated a large percentage of inherent moisture, and thus the Colorado region receives little precipitation. For the reporting period, annual precipitation ranged from about 9.6 in. (24.3 cm) at Nucla to 16.0 in. (40.7 cm) at Paradox 1 W (WRCC 2011a). Precipitation is relatively evenly distributed throughout the year; however, isolated thunderstorms occur during the summer months. In general, precipitation is somewhat higher in fall months (about 30% of the annual total), and lower in winter months (about 22% of the annual total) around the ULP lease tracts. Snowfall varies by location (ranging on average from about 11 in. [28 cm] in Uravan to about 41 in. [104 cm] in Northdale), with the snowiest months being December through February. In general, snowfall tends to increase with increasing elevation, while precipitation has no clear relationship with respect to latitude and elevation in the area.

3.1.1.5 Severe Weather

Because mountain ranges surrounding ULP lease tracts block air masses from penetrating into the area, severe weather events, such as tornadoes, are a rarity, but floods, hail, high winds, winter storms, and wildfires do occur frequently (NCDC 2011b).

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TABLE 3.1-1 Temperature and Precipitation Data Summaries at Selected Meteorological Stations around the ULP Lease Tracts, in Order of Meteorological Station Starting from North to South

		Temperature (°F)							Precipitation (in.)			
Station[c]	County	Average Monthly Minimum[a]	Average Monthly Maximum[a]	Annual Mean	Extreme Low	Extreme High	No. of Days with Max. Temp. ≥90°F	No. of Days with Min. Temp. ≤32°F (≤0°F)	Total Water Equiv.	Snowfall	Period of Record	Elev. (ft)
Gateway 1 SE	Mesa	18.0	93.2	53.9	–28	106	61.9	132.3 (3.1)	11.40	15.9	1947–2010	4,550
Paradox 1 W[b]	Montrose	17.4	90.1	50.9	–14	106	43.8	153.6 (3.1)	16.02	27.5	1977–1995	5,530
Paradox 1 E[b]	Montrose	12.0	92.5	49.7	–21	110	57.6	181.4 (9.9)	11.73	23.4	1948–1977	5,280
Uravan[c]	Montrose	15.5	95.6	53.2	–23	110	75.9	149.1 (3.8)	12.61	11.1	1960–2010	5,010
Nucla	Montrose	12.6	98.6	52.1	–10	104	NA[c]	NA	9.55	NA	1998–2011	5,860
Northdale	Dolores	9.0	86.5	45.3	–42	103	17.3	205.0 (17.8)	12.49	40.9	1930–2002	6,680

[a] "Average Monthly Minimum" denotes the monthly average of daily minimum values during the period of record, which normally occurs in January. "Average Monthly Maximum" denotes the monthly average of daily maximum values during the period of record, which normally occurs in July.

[b] Paradox 1 W and 1 E and Uravan are located at almost the same latitude.

[c] NA denotes not available.

Sources: DRI (2011); WRCC (2011a)

In the western valleys, localized flood-producing storms are more frequent. Occasionally, remnants of a decayed Pacific hurricane may dump heavy, widespread rains in Colorado (NCDC 2011a). Flash flooding from localized intense thunderstorms is more severe than flooding caused by snowmelt. Since 1994, 88 floods (with 61 flash floods) were reported in Mesa, Montrose, and San Miguel Counties combined (NCDC 2011b). Most floods were reported in towns along the river valleys, including Grand Junction, Gateway, and Mesa in Mesa County; Montrose, Naturita, Nucla, Uravan, and Bedrock in Montrose County; and Telluride and Placerville in eastern San Miguel County. These floods occurred mostly during summer months and caused some property and crop damage.

In these three counties, a total of 58 hail events were reported since 1962; some of these caused property and crop damage (NCDC 2011b). Hail events occurred mostly from May through September. Hail measuring 1.8 in. (4.4 cm) in diameter was reported in nine incidents.

Since 1962, 130 high wind events occurred in the three counties. Most were reported in Mesa County (NCDC 2011b). These high wind events occurred more frequently from May through September, with peak occurrence in June. A high wind with a maximum wind speed of 122 mph (54.5 m/s), which created blizzard conditions, was reported in January 1999 in Mesa County.

Winter snows are fairly frequent but are mostly light and quick to melt, except for the land around the southernmost DOE lease tracts near Edgar/The Spud Patch, which have substantial amounts of snow in some years that remain for much of the winter. Heavy snows in the high mountains are much more common. Since 1993, 410 snow and ice events were reported in Mesa County alone (NCDC 2011b). These caused some property damage and several deaths and injuries resulting from avalanches and traffic accidents.

Since 1999, 24 wildland and forest fires have been reported in the three counties, mostly during summer months, and they caused some property damage (NCDC 2011b). These fires were triggered by lightning in the area. Associated with ongoing global warming, large-wildfire frequency, fire duration, and fire season length have increased substantially in the western United States in recent decades and are projected to increase, especially in the Southwest (USGCRP 2009). This is due primarily to earlier spring snowmelt and higher spring and summer temperatures that reduce the moisture availability and dry out the vegetation that provides the fuel for fires.

Complex terrain typically disrupts the mesocyclones associated with tornado-producing thunderstorms; thus, tornadoes are less frequent and destructive in this region than they are in tornado alley (in the central United States) or Colorado's eastern plains. Tornado frequencies per area in counties within the ULP lease tracts are less than one-tenth of those in the rest of the state. In the period April 1950 to August 2011, a total of 12 tornadoes (0.2 per year) were reported in the three counties (NCDC 2011b): 9 tornadoes in Mesa County; 3 tornadoes in Montrose County; and no tornados in San Miguel County. However, most tornadoes occurring in

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the area were relatively weak (eight F0 and four F1 on the Fujita tornado scale[1]), but one caused injury, and some minor property damage was reported. Most of these tornadoes occurred either in northern Mesa County around the I-70 area or in northeastern Montrose County. However, in October 2005, one F1 tornado hit Bedrock, which is located several miles from ULP lease tracts.

3.1.2 Existing Air Emissions

Mesa, Montrose, and San Miguel Counties have many small-scale industrial emission sources and two coal-fired power plants—Cameo station[2] in Palisade, Mesa County, and Nucla station in Nucla, Montrose County. The absolute amount of emissions, except for emissions from the two coal-fired power plants, is relatively low. The population is sparse, and the population centers and many of the industrial facilities are located along the handful of major roads such as I-70, US 50, and US 550. Several state highways exist around the ULP lease tracts, such as CO 90 and CO 141. Onroad mobile and industrial source emissions are concentrated along these routes.

Data on annual emissions of criteria pollutants and VOCs in Mesa, Montrose, and San Miguel Counties are presented in Table 3.1-2 for 2008 (CDPHE 2011a). Among the three counties, emissions are the highest in Mesa County and the lowest in San Miguel County. Emission data are categorized by type of source: point; area; onroad mobile; nonroad mobile; road dust; construction; biogenic; fires (forest/agricultural fires and structural fires); and so on. In 2008, onroad vehicle sources were primary contributors to total carbon monoxide (CO) emissions in three counties (about 38%), followed by forest/agricultural fires (about 21%). Onroad vehicle sources and point sources were primary and secondary contributors to total emissions of nitrogen oxides (NO_X) in three counties (about 31% and 22%, respectively). Point sources accounted for most of sulfur dioxide (SO_2) emissions in the three counties (over 94%), because of the two coal-fired power plants. Road dust was the primary contributor to PM_{10} emissions[3] (about 29%), with construction being a secondary contributor (about 27%). Biogenic sources (i.e., vegetation—including trees, plants, and crops—and soils) that release naturally

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1 The Fujita tornado scale is classified with the fastest 0.40-km (0.25-mi) wind speeds: F0 (gale); F1 (moderate); and F2 (significant) through F5 (incredible) tornadoes are classified with wind speeds of 40 to 72 mph (19 to 32 m/s), 73 to 112 mph (33 to 50 m/s), and 113 to 157 mph up to 261 to 318 mph (51 to 70 m/s up to 117 to 142 m/s). The new Enhanced Fujita (EF) scale based on 3-second wind gusts was implemented on February 1, 2007. Similar to the original Fujita scale, the ratings are from EF0 to EF5. However, historical tornadoes are still categorized with the original Fujita scale, as are those in the NCDC's *Storm Events* database.

2 The station has shut down at the end of 2010 and thus is no longer in service (see Section 4.7.2.10).

3 Particulate matter, or PM, is dust, smoke, and other solid particles and liquid droplets in the air. The size of the particulate is important and is measured in micrometers (μm), which is 1 millionth of a meter (0.00004 inch). $PM_{2.5}$ is PM with an aerodynamic diameter that is less than or equal to 2.5 μm, and PM_{10} is PM with an aerodynamic diameter that is less than or equal to 10 μm. "Respirable" $PM_{2.5}$ is released into atmosphere through combustion-related sources, such as motor vehicles, power plants, and forest fires, and it can penetrate deep into the lungs. In contrast, sources of "inhalable" PM_{10} include crushing and grinding operations and fugitive dust from vehicles travelling on roads, and this pollutant can enter the respiratory system. These particles can cause or aggravate respiratory, heart, and lung diseases.

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TABLE 3.1-2 Annual Emissions of Criteria Pollutants and Volatile Organic Compounds in Mesa, Montrose, and San Miguel Counties, Colorado, Encompassing the ULP Lease Tracts, 2008

	Annual Emissions (tons/yr)			
Pollutant[a]	Mesa County	Montrose County	San Miguel County	Three-County Total
CO	40,688	19,533	5,548	65,769
NO_X	9,048	3,665	1,093	13,806
VOCs	39,828	21,220	13,065	74,113
$PM_{2.5}$[b]	2,838	2,316	370	5,524
PM_{10}	8,050	5,823	1,504	15,377
SO_2	2,879	1,358	9	4,246

[a] Notation: CO = carbon monoxide; NO_X = nitrogen oxides; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of ≤2.5 μm; PM_{10} = particulate matter with an aerodynamic diameter of ≤10 μm; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.

[b] $PM_{2.5}$ emissions were not included in the CDPHE's 2008 air pollutant emissions inventory database, so they were estimated by using available $PM_{2.5}/PM_{10}$ ratios (ARB 2011; Countess Environmental 2006).

Source: CDPHE (2011a)

occurring emissions accounted for a significant portion of the VOC emissions (about 83%). Forest/agricultural fires were the primary contributor (about 31%) to total $PM_{2.5}$ emissions of three counties, followed by point sources (about 21%).

Most of the Paradox Valley is utilized for open ranching, but some agricultural sources exist near Bedrock, Paradox, and Nucla, Montrose County. There are several minor sources throughout the valley, including aggregate processing operations, concrete batch plants, and uranium/vanadium ore mining (Edge Environmental, Inc. 2009). These operations are primarily sources of PM but can also utilize processes and/or equipment that emit NO_X, SO_2, CO, and some hazardous air pollutants (HAPs). Tri-State Generation and Transmission Association, Inc., operates a 100-MW coal-fired power plant in Nucla, which receives its coal supply exclusively from a coal strip mine, New Horizon Mine, by tractor-trailer truck (Tri-State 2011). The mine is located about 5 mi (8 km) northwest of the plant. The mining activities and coal transportation are sources of PM, while the power plant is a primary source of SO_2, NO_X, PM, CO, and some HAPs.

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In 2010, Colorado produced about 130 million metric tons of *gross*[4] carbon dioxide equivalent (CO_2e)[5] emissions (Strait et al. 2007). Gross GHG emissions in Colorado increased by about 50% from 1990 to 2010, an increase more rapid than that in the nation as a whole, which was attributable to Colorado's population growth. In 2010, consumption-based electricity use (37%), followed by transportation (24%), was the primary contributor to gross GHG emissions in Colorado. Electricity use from coal-fired power plants is the single largest contributor to GHG emissions in Colorado (about 31%). Fossil fuel use (in the residential, commercial, and industrial sectors) and fossil fuel industry accounted for about 18% and 9%, respectively, of total state emissions. Non-energy-related emissions from agriculture, industrial processes, and waste management accounted for the rest of the GHG emissions in Colorado. These gross emissions in Colorado equate to about 2% of total GHG emissions of 6,600 million metric tons of CO_2e in the United States during 2009 (EPA 2011a). Colorado's *net* emissions were about 100 million metric tons of CO_2e, considering carbon sinks from forestry land use and agricultural soils throughout the state.

Climate changes are under way in the United States and globally, and are projected to continue to grow substantially over next several decades unless intense concerted measures are taken to reverse this trend (USGCRP 2009). Climate-related changes include rising temperature and sea level, increased frequency and intensity of extreme weathers (e.g., heavy downpours, floods, and droughts), earlier snowmelts and associated frequent wildfires, and reduced snow cover, glaciers, permafrost, and sea ice. Climate changes are primarily associated with human-induced emissions of heat-trapping gases, so-called GHGs. These emissions come mostly from the burning of fossil fuels (e.g., coal, oil, and natural gas), with considerable contributions from land use changes, such as deforestation or agricultural practices. GHGs include CO_2, methane (CH_4), nitrous oxide (N_2O), and fluorine-containing halogenated substances—hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). These gases are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, and are thus capable of preventing long-wave thermal radiant energy emitted at the earth's surface from leaving earth's atmosphere. The net effect over time is a trapping of absorbed radiation and a tendency to warm the planet's surface and the boundary layer of the earth's atmosphere, and this constitutes the "greenhouse effect." Some GHGs (CO_2, CH_4, and N_2O) are both naturally occurring and the product of industrial activities, while fluorine-containing halogenated substances are man-made and are present in the atmosphere exclusively due to human activities. In 2009, CO_2 emissions account for about 83.0% of total U.S. GHG emissions on the CO_2e equivalent basis, followed by CH_4 (about 10.3%) and N_2O (about 4.5%), with fluorine-containing halogenated substances accounting for the rest (EPA 2011a).

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4 Excluding GHG emissions removed by agricultural soils and as a result of forestry and land use.

5 This is a measure used to compare the emissions from various GHGs on the basis of their global warming potential, defined as the cumulative radiative forcing effect of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas, CO_2. For example, global warming potentials used for GHG emission calculations and reporting are 1 for CO_2, 21 for methane (CH_4), and 310 for nitrous oxide (N_2O) over a 100-year time horizon. For other GHGs, including sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs), global warming potentials are typically much higher. The CO_2e for a gas is derived by multiplying the mass of the gas by the associated global warming potential.

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3.1.3 Existing Air Quality

Under the Clean Air Act (CAA) which was last amended in 1990, the EPA has set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment (EPA 2011b). NAAQS have been established for six criteria pollutants—CO, lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), PM (both $PM_{2.5}$ and PM_{10}), and sulfur dioxide (SO_2), as shown in Table 3.1-3. The CAA established two types of NAAQS: primary standards to protect public health including sensitive populations (e.g., asthmatics, children, and the elderly) and secondary standards to protect public welfare, including protection against degraded visibility and damage to animals, crops, vegetation, and buildings. Any individual state can have its own State Ambient Air Quality Standards (SAAQS), but SAAQS must be at least as stringent as the NAAQS. If a state has no standard that corresponds to one of the NAAQS or if the SAAQS are not as stringent as the NAAQS, then the NAAQS apply. Colorado has a more stringent standard than the NAAQS for 3-hour SO_2 (CDPHE 2011b), as shown in Table 3.1-3.

An area where a criteria pollutant concentration exceeds NAAQS levels is called a nonattainment area. Previous nonattainment areas where air quality has improved to meet the NAAQS are redesignated as maintenance areas and are subject to an air quality maintenance plan. States must have State Implementation Plans (SIPs) that demonstrate how nonattainment areas will meet the NAAQS and how the NAAQS will be maintained in maintenance areas.

Mesa, Montrose, and San Miguel Counties, which encompass the ULP lease tracts, are located administratively within the Grand Mesa Intrastate Air Quality Control Region (AQCR) (see 40 CFR 81.173), along with other west-central counties in Colorado. Mesa County is within Colorado State AQCR 11, while Montrose and San Miguel Counties are within Colorado State AQCR 10. Currently, Colorado State AQCRs 10 and 11 are designated as being in unclassifiable/attainment for all criteria pollutants (EPA 2011c). However, Telluride in San Miguel County, which is located about 58 mi (93 km) east of the southernmost ULP lease tract, has been designated as a moderate maintenance area for PM_{10} since 2001.

The western counties generally have smaller towns, usually located in fairly broad river valleys. Because of the relatively low population density, low level of industrial activities, and relatively low traffic volume in the area, the quantity of anthropogenic emissions is small, and ambient air quality is thus relatively good. This conclusion is nonsensical

Except for PM_{10} data at the proposed Piñon Ridge Mill, there are no recent measurement data for criteria air pollutants around the ULP lease tracts. Currently, CO, O_3, $PM_{2.5}$, and PM_{10} data are collected around the Grand Junction area in Mesa County (CDPHE 2011c). In addition, PM_{10} data are collected in Telluride in San Miguel County, which is designated as a PM_{10} maintenance area. No monitoring stations are operating in Montrose County.

In addition to the standards, Table 3.1-3 presents background levels for criteria pollutants. The highest background concentration levels that are related to the NAAQS for CO, Pb, NO_2, annual $PM_{2.5}$, and SO_2 representative of the ULP lease tracts in the statewide

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TABLE 3.1-3 National Ambient Air Quality Standards (NAAQS), Colorado State Ambient Air Quality Standards (SAAQS), and Background Concentration Levels Representative of the ULP Lease Tracts in Mesa, Montrose, and San Miguel Counties, Colorado[a]

		NAAQS[b]			Background Concentration Levels	
Pollutant	Averaging Time	Standard Value	Standard Type[c]	Colorado SAAQS	Value[d,e]	Location[f] (Year)
CO	1-hour	35 ppm	P	–[g]	7 ppm (20%)	Grand Junction, Mesa County (2008–2010)
	8-hour	9 ppm	P	–	2 ppm (22%)	Grand Junction, Mesa County (2008–2010)
Pb	Rolling 3-month	0.15 μg/m^3	P, S	–	0.037 μg/m^3 (25%)	Denver (2008–2010)
NO_2	1-hour	100 ppb	P	–	38 ppb (38%)	Durango, La Plata County (2008–2010)
	Annual	53 ppb	P, S	–	3 ppb (6%)	Durango, La Plata County (2006–2008)
O_3	8-hour	0.075 ppm	P, S	–	0.067 ppm (90%)	Palisade, Mesa County (2008–2010)
$PM_{2.5}$	24-hour	35 μg/m^3	P, S	–	34.3 μg/m^3 (98%)	Grand Junction, Mesa County (2008–2010)
	Annual	15 μg/m^3	P, S	–	9.2 μg/m^3 (62%)	Grand Junction, Mesa County (2008–2010)
PM_{10}	24-hour	150 μg/m^3	P, S	–	131 μg/m^3 (87%)	Grand Junction, Mesa County (2008–2010)
					89 μg/m^3 (59%)	Piñon Ridge Mill, Montrose County (April 2008–March 2010)
SO_2	1-hour	75 ppb	P	–	38 ppb (50%)	Denver (2008–2010)
	3-hour	0.5 ppm	S	700 μg/m^3 (0.267 ppm)	0.01 ppm (4%)	Denver (2006–2008)

[a] CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of ≤ 2.5 μm; PM_{10} = particulate matter with an aerodynamic diameter of ≤ 10 μm; SO_2 = sulfur dioxide; ppm = part(s) per million; ppb = part(s) per billion.

Footnotes continued on next page.

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TABLE 3.1-3 (Cont.)

[b] Refer to 40 CFR Part 50 and EPA (2011b) for detailed information on attainment determination and the reference method for monitoring.

[c] P = primary standards, which set limits to protect public health, including the health of "sensitive" populations, such asthmatics, children, and the elderly. S = secondary standards, which set limits to protect welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

[d] Monitored concentrations are second-highest for 1-hour and 8-hour CO and 3-hour SO_2; the highest for 24-hour Pb (no rolling 3-month averages available at the time of this writing); 3-year average of 98th percentile of 1-hour NO_2 and 24-hour $PM_{2.5}$; highest annual mean over 3 years for annual NO_2; 3-year average of annual fourth-highest daily maximum 8-hour average for O_3; 3-year average of annual means for annual $PM_{2.5}$; fourth-highest over 3 years for PM_{10} for Grand Junction data but highest over 2 years for Piñon Ridge Mill data; and 3-year average of 99th percentile of 1-hour daily maximum for 1-hour SO_2.

[e] Values in parentheses are background concentration levels as a percentage of NAAQS or SAAQS (for 3-hour SO_2 only).

[f] For each pollutant, the location shown is the closest monitoring station from the ULP lease tracts. For Pb and SO_2, values for Denver are presented to show that even the highest monitored values in Colorado are still well below the standard and thus not a concern.

[g] A hyphen indicates that no standard exists.

Sources: CDPHE (2011b); EPA (2011b,d)

monitoring network were less than or equal to 62% of their respective standards, as shown in Table 3.1-3 (EPA 2011d). However, 8-hour O_3 and 24-hour $PM_{2.5}$ and PM_{10} concentrations were approaching or close to the applicable standard (maximum at about 98% for 24-hour $PM_{2.5}$).

see good air statement on prev. page

In addition, the Energy Fuels Resources Corp. air monitoring program collected PM_{10} data for 24 hours every 6 days at Sites 1 and 2, which are collocated with 10-m (33-ft) and 30-m (98-ft) meteorological towers of the proposed Piñon Ridge Mill, respectively. The 24-hour average PM_{10} data collected at Sites 1 and 2 are presented as a function of time for the period of April 2008 through March 2010 in Figure 3.1-3 (Rogers 2011) and are also presented in Table 3.1-3. The monitored highest 24-hour PM_{10} concentration of 89 $\mu g/m^3$ at the proposed Piñon Ridge Mill was well below the NAAQS of 150 $\mu g/m^3$.

3.1.4 Regulatory Environment

3.1.4.1 Prevention of Significant Deterioration (PSD)

The Prevention of Significant Deterioration (PSD) regulations (see 40 CFR 52.21), which are designed to limit the growth of air pollution in clean areas, apply to a new major source or a modified existing major source within an attainment or unclassified area. PSD

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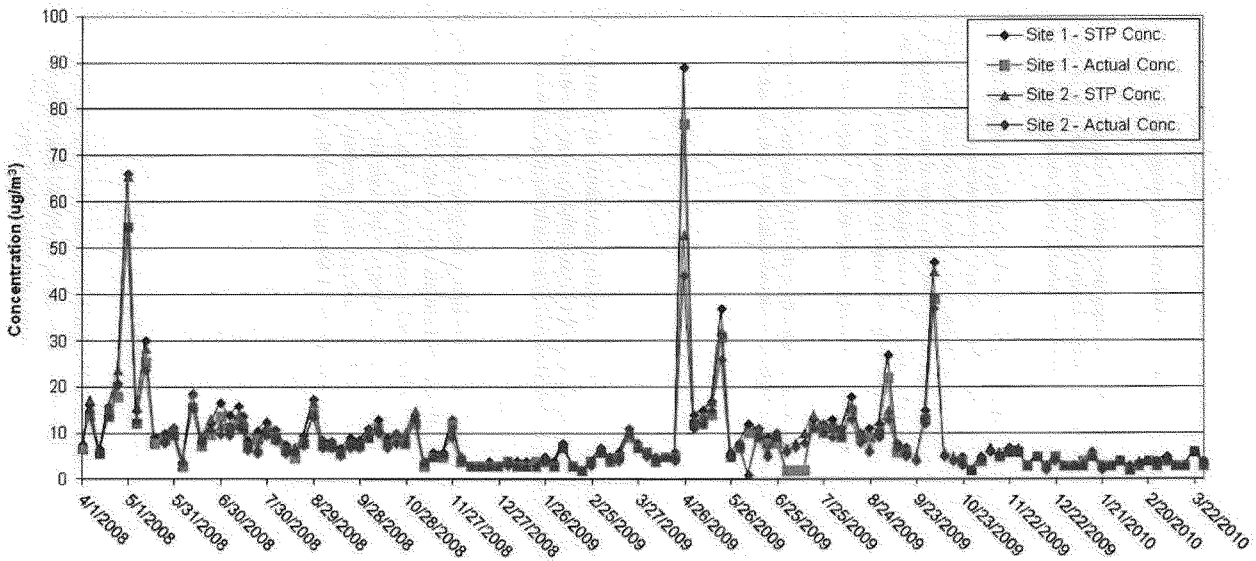

FIGURE 3.1-3 Monitored PM_{10} Concentrations at Sites 1 and 2 of the Proposed Piñon Ridge Mill, April 2008–March 2010 (Rogers 2011)

regulations limit increases in ambient concentrations above legally established baseline levels for selected criteria pollutants, as shown in Table 3.1-4. Incremental increases in PSD Class I areas, such as National Parks (NPs) or Wilderness Areas (WAs), are strictly limited, while those in Class II areas (the rest of the country) allow for moderate growth in emission levels. Most of the area surrounding the ULP lease tracts is classified as PSD Class II. Major (large) new and modified stationary sources must meet the requirements for the area in which they are located and the areas they affect.

As a matter of policy, the EPA recommends that the permitting authority notify the Federal Land Managers (FLMs)[6] when a proposed PSD source would locate within 62 mi (100 km) of a Class I area for a determination of the potential impact on AQRVs, which are discussed in Section 3.1.4.4. There are several Class I areas around the ULP lease tracts, five of which are situated within 62 mi (100 km), as shown in Figure 3.1-4. The permit may still be issued even if the FLM determines that there may be an adverse impact on AQRVs. The nearest Class I area is the Arches NP in Utah (40 CFR 81.430), about 32 mi (51 km) west of the northernmost lease tract. The other four Class I areas within this range include Canyonlands NP in Utah, which is about 34 mi (55 km) west of the southernmost lease tract, and Mesa Verde NP, Black Canyon of the Gunnison WA, and Weminuche WA in Colorado (40 CFR 81.406); these

TABLE 3.1-4 Maximum Allowable PSD Increments for PSD Class I and Class II Areas

Pollutant	Averaging Time	PSD Increment ($\mu g/m^3$) Class I	Class II
NO_2	Annual	2.5	25
$PM_{2.5}$	24-hour	2	9
	Annual	1	4
PM_{10}	24-hour	8	30
	Annual	4	17
SO_2	3-hour	25	512
	24-hour	5	91
	Annual	2	20

Source: 40 CFR 52.21; 75 FR 64864

6 FLM is the Secretary of the department with authority over the Federal Class I areas (or the Secretary's designee). For DOI, the Secretary has designated the Assistant Secretary for Fish and Wildlife and Parks as the FLM, whereas the Secretary of Agriculture has delegated the FLM responsibilities to the Regional Forester and, in some cases, the Forest Supervisor.

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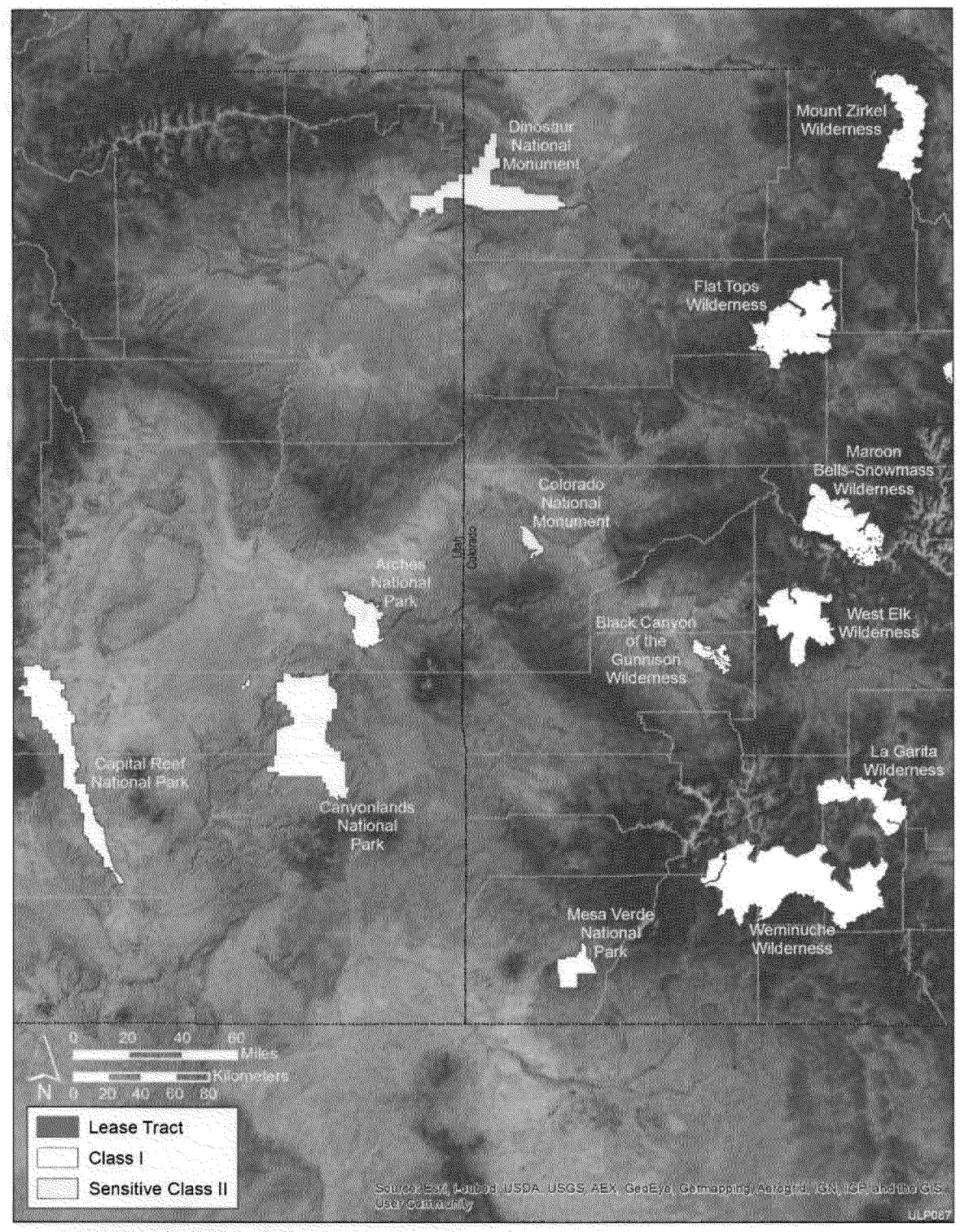

FIGURE 3.1-4 PSD Class I Areas and Colorado Sensitive Class II Areas around the ULP Lease Tracts

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WAs are located about 47 mi (76 km) south–southeast of the southernmost lease tract, 50 mi (81 km) east–northeast of the central lease tract, and 62 mi (100 km) east–southeast of the southernmost lease tract, respectively. There are two sensitive Class II areas that are regulated by CDPHE as Class I for SO_2: Colorado National Monument and Dinosaur National Monument, which are located about 25 mi (40 km) north–northeast and 111 mi (179 km) north of the northernmost ULP lease tracts, respectively. The ULP lease tracts are designated as a PSD Class II area by EPA and the State of Colorado.

increment discussion?

3.1.4.2 Visibility Protection

Visibility was singled out for particular emphasis in the CAA Amendments of 1977. Visibility in a Class I area is protected under two sections of the Act. Section 165 provides for the PSD program (described above) for new sources. Section 169(A), for older sources, describes requirements for both reasonably attributable single sources and regional haze that address multiple sources. FLMs have a particular responsibility to protect visibility in Class I areas. Even sources located outside a Class I area may need to obtain a permit that ensures they have no adverse impact on visibility within the Class I area, and existing sources may need to retrofit controls. The EPA's 1999 Regional Haze Rule set goals of preventing future impairments and remedying existing impairments to visibility in Class I areas. States had to revise their SIPs to establish emission reduction strategies to meet a goal of natural conditions by 2064.

3.1.4.3 General Conformity

Federal departments and agencies are prohibited from taking actions in nonattainment and maintenance areas unless they first demonstrate that the actions would conform to the SIP as it applies to criteria pollutants. Transportation-related projects are subject to requirements for transportation conformity. General conformity requirements (40 CFR Parts 51 and 93, 75 FR 17254, dated April 5, 2010) apply to stationary sources. Conformity addresses only those criteria pollutants for which the area is in nonattainment or maintenance (e.g., VOCs and NO_x for O_3). If annual source emissions are below specified threshold levels, no conformity determination is required. If the emissions exceed the threshold, a conformity determination must be done to demonstrate how the action will conform to the SIP. The demonstration process involves public notification and response and may require extensive analysis.

So does G.C. apply? A: NO

3.1.4.4 Air Quality-Related Values

AQRVs are defined as valued resources that may be adversely affected by a change in air quality from air pollutant emissions, including visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource identified by the FLM for a particular area. Although the permit applicant should identify the potential impacts of the source on all applicable AQRVs of that area, an FLM may ask an applicant to address any or all of the areas of

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concern. The primary areas of concern to the FLMs are visibility impairment and effects of pollutant deposition on soils and surface waters (USFS et al. 2010).

Visibility is a measure of aesthetic value and the ability to enjoy scenic vistas, but it also can be an indicator of general air quality. Visibility degradation is caused by cumulative emissions of air pollutants from a myriad of sources scattered over a wide geographical area, such as combustion-related sources and fugitive sources. The primary cause of visibility degradation is the scattering and absorption of light by fine particles (such as sulfates, nitrates, organic carbon, light-absorbing soot, soil dust, and sea salt) with a secondary contribution provided by gases (such as nitrogen dioxide). In general, visibility conditions in the western United States are substantially better than those in the eastern United States, which has higher pollutant loads and humidity levels. Dust sources vary greatly spatially and temporally but play a more important role in visibility degradation in the arid parts of the western United States. Fugitive dust from wind erosion and anthropogenic activities, including agriculture, construction, grazing, mining, and vehicle traffic on paved and unpaved roads, would be a major concern in the arid desert environment. The typical visual range (defined as the farthest distance at which a large black object can be seen and recognized against the background sky) in most of the West is about 60 to 90 mi (97 to 145 km), while that in most of the eastern United States is about 15 to 30 mi (24 to 48 km) (EPA 2006).

Annual mean reconstructed light extinction coefficients (b_{ext}) and deciview (dv)[7] averaged over 2005–2008 are similar for Class I areas around the ULP lease tracts (Hand et al. 2011): b_{ext} of 20.18 Mm^{-1} and 6.66 dv for Canyonlands NP; b_{ext} of 21.34 Mm^{-1} and 7.07 dv for Mesa Verde NP; and b_{ext} of 20.34 Mm^{-1} and 6.66 dv for Weminuche WA. These values correspond to about 120–125 mi (193–201 km) in visual range.

Much progress has been made to control SO_2 and NO_2 emissions primarily from fossil fuel–fired power plants and onroad/offroad engine exhaust, but dry and wet depositions of sulfur and nitrogen compounds continue to be a problem in the United States. Acid deposition causes acidification of lakes and streams, which has direct impacts on aquatic habitats, and contributes to the damage of trees at high elevation and many sensitive forest soils. In particular, certain sensitive freshwater lakes and streams continue to lose acid-neutralizing capacity (ANC), defined as a measure of the ability for water or soil to neutralize added acids, and sensitive soils continue to be acidified (USFS et al. 2010). In particular, many alpine lakes in the western United States are low in ANC because of thin soils and slowly weathering bedrock. Thus, these alpine lakes are vulnerable to changes in water chemistry caused by acid deposition.

Average total (dry + wet) depositions of sulfur and nitrogen combined at Clean Air Status and Trends Network (CASTNET) stations around the ULP lease tracts are about 2.88 kg/ha/yr for Canyonlands NP; 3.11 kg/ha/yr for Gothic in Gunnison County, Colorado; and 3.82 kg/ha/yr

[7] The extinction coefficient (b_{ext}) represents the ability of the atmosphere to scatter and absorb light primarily by particles and, to some extent, by gases, and has unit of inverse length (inverse megameters, Mm^{-1}). The b_{ext} is related to visual range and deciview (a haziness index designed to be linear with respect to human perception of visibility, analogous to the decibel scale in acoustics). A higher b_{ext} corresponds to a lower visual range and higher deciview values.

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for Mesa Verde NP (EPA 2012b). These deposition fluxes are much lower than those in the eastern United States. In general, nitrogen depositions are primary contributors to total depositions; in the eastern United States, sulfur depositions are more important.

3.2 ACOUSTIC ENVIRONMENT

3.2.1 Sound Fundamentals

Any pressure variation that the human ear can detect is considered "sound," and "noise" is defined as unwanted sound. Sound is described in terms of amplitude (perceived as loudness) and frequency (perceived as pitch). Sound pressure levels are typically measured with a logarithmic decibel (dB) scale.[8] To account for human sensitivity to frequencies of sound (i.e., less sensitive to lower and higher frequencies, and most sensitive to sounds between 1,000 and 5,000 Hz),[9] A-weighting (denoted by dBA) (Acoustical Society of America 1983, 1985) is widely used. This scale has a good correlation to a human's subjective reaction to sound. Most noise standards, guidelines, and ordinances use the A-weighted scale.

To account for variations of sound with time, several sound descriptors are used. L_{90} is the sound level exceeded 90% of the time. It is called the residual sound level (or background level), and it is a fairly steady, lower sound level on which discrete single events are superimposed. The equivalent-continuous sound level (L_{eq}) is the level that, if it were continuous during a specific time period, would contain the same total energy as the actual time-varying sound. In addition, human responses to noise differ depending on the time of the day. People are more annoyed by noise during nighttime hours when there are lower background noise levels. The day-night average sound level (L_{dn}, or DNL) is the average over a 24-hour period, with the addition of 10 dB to sound levels from 10 p.m. to 7 a.m. to account for the greater sensitivity of most people to nighttime noise. The L_{dn} scale is widely used for community noise assessment and has been adopted by several Government agencies (e.g., Federal Aviation Administration, Department of Housing and Urban Development, and Nuclear Regulatory Commission). In general, a 3-dB change over an existing noise level is considered a barely discernible difference, and a 10-dB increase is subjectively perceived as a doubling in loudness and almost always causes an adverse community response (NWCC 2002).

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8 Scales for measuring most familiar quantities such as length, distance, and temperature are linear. Logarithmic scales, such as dB, compress the values of the measurements and are useful for measuring quantities like sound levels that can vary over a large range. For example, two linear measurements of 10 units and 1,000,000,000 units might correspond to values of 1 and 9, respectively, on a logarithmic scale. Logarithmic units also add differently than do linear units. For example, if one object is 6 ft long and a second is twice as long, the second object is 12 ft long. For sounds, however, if one sound level is 50 dB and a second is twice as loud, the second sound level will be 60 dB, not 100 (50 + 50) dB.

9 The frequency is defined as the number of cycles per second, which is denoted by the unit of hertz (Hz). The normal hearing for a healthy young person ranges in frequency from about 20 to 20,000 Hz. The higher the frequency of the waveform, the higher the pitch of the sound heard.

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3.2.2 Background Noise Levels

Background noise is defined as the noise from all sources other than the source of interest. The background noise level can vary considerably, depending on the location, season, and time of day. Background noise levels in a busy urban setting can be as high as 80 dBA during the day. In isolated outdoor locations with no wind, vegetation, animals, or running water, background noise may be under 10 dBA. Typical noise levels in rural settings are about 40 dBA during the day and 30 dBA during the night, which correspond to an L_{dn} of 40 dBA; in Wilderness Areas, typical noise levels are on the order of 20 dBA (Harris 1991).

State highways CO 90 and CO 141 run through or near the ULP lease tracts, and many county roads are scattered all over the ULP lease tracts. The nearest railroad runs as close as about 27 mi (43 km) from the northernmost ULP lease tracts. The nearest airport is Hopkins Field Airport in Nucla, about 7 mi (11 km) east of central ULP lease tracts. Other nearby public airports within a 50-mi (80-km) range include Grand Junction Regional Airport and Mack Mesa Airport in Mesa County, Montrose Regional Airport in Montrose County, Telluride Regional Airport in San Miguel County, and Monticello Airport in San Juan County, Utah . In addition, many private airports and heliports are scattered over the counties encompassing the ULP lease tracts. Most of Paradox Valley, which is located in the center of the ULP lease tracts, is utilized for open ranching, but some agricultural activities occur near Bedrock, Paradox, and Nucla in Montrose County. There are several minor noise sources throughout the valley, including aggregate processing operations, concrete batch plants, and uranium and vanadium ore mining (Edge Environmental, Inc. 2009). There is a 100-MW coal-fired power plant in Nucla, which receives coal from a nearby strip mine (New Horizon Mine) by tractor-trailer truck (Tri-State 2011). In addition, agricultural activities occur near Egnar in San Miguel County, south of the southernmost ULP lease tracts. Accordingly, in addition to natural sound sources (e.g., wind, rain, wildlife), noise sources around the ULP lease tracts include road traffic, aircraft flyovers, animal noise, agricultural activities, industrial activities, and nearby community activities and events. Other potential noise sources are recreational all-terrain vehicles being driven across the ULP lease tracts and ventilation shaft noise from underground mines. In summary, the area around the ULP lease tracts is remote, sparsely populated, and undeveloped; the overall character is considered mostly rural or undisturbed wilderness.

Wheeling next to radon shaft for Angelique. Comply R

No sensitive receptors (e.g., hospitals, schools, or nursing homes) exist within a range of 3 mi (5 km) from the ULP lease tracts. Only 17 residences exist within 1 mi (1.6 km) of the 31 lease tracts; 7 of the 17 residences are adjacent to the 13 lease tracts. To date, no environmental noise survey has been conducted around the ULP lease tracts. It is likely that noise levels along the state highways and near agricultural/industrial activities would be relatively higher (about 50–60 dBA), while levels in areas far removed from manmade noise sources would be similar to wilderness background noise levels (below 30 dBA). On the basis of county population density data, L_{dn} noise level estimates around the ULP lease tracts would be about 38 dBA for Mesa County, 35 dBA for Montrose County, and 30 dBA for San Miguel County (Miller 2002). For comparison, rural and undeveloped areas typically have L_{dn} levels in a range of 33–47 dBA (Eldred 1982).

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3.2.3 Noise Regulations

At the Federal level, the Noise Control Act of 1972 and subsequent amendments (Quiet Communities Act of 1978, 42 USC 4901–4918) delegate the authority to regulate noise to the states and direct Government agencies to comply with local noise regulations. EPA guidelines recommend L_{dn} of 55 dBA as sufficient to protect the public from the effect of broadband environmental noise in typically quiet outdoor and residential areas and farms (EPA 1974). For protection against hearing loss in the general population from nonimpulsive noise, the EPA recommends L_{eq} of 70 dBA or less over a 40-year period.

ULP activities would have to follow applicable Federal, state, or local guidelines and regulations on noise. Colorado has a noise statute with quantitative noise limits by zone and time of day, as shown in Table 3.2-1 (Colorado Revised Statutes, Title 25, "Health," Article 12, "Noise Abatement," Section 103, "Maximum Permissible Noise Levels"). However, Mesa, Montrose, and San Miguel Counties, which encompass the ULP lease tracts, do not have quantitative noise guidelines and regulations applicable to the ULP activities.

TABLE 3.2-1 Colorado Limits on Maximum Permissible Noise Levels

	Maximum Permissible Noise Levels (dBA)[a]	
Zone	7 a.m. to next 7 p.m.[b]	7 p.m. to next 7 a.m.
Residential	55	50
Commercial	60	55
Light industrial	70	65
Industrial	80	75

[a] At a distance of 25 ft or more from the property line. Periodic, impulsive, or shrill noises are considered a public nuisance at a level of 5 dBA less than the levels tabulated. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for (1) the period within which construction is to be completed pursuant to any applicable construction permit issued by the proper authority or (2) if no time limitation is imposed, for a reasonable period of time for completion of the project.

[b] The tabulated noise levels may be exceeded by 10 dBA for a period not to exceed 15 minutes in any 1-hour period.

Source: Colorado Revised Statutes, Title 25, "Health," Article 12, "Noise Abatement," Section 103, "Maximum Permissible Noise Levels"

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3.3 GEOLOGICAL SETTING AND SOIL RESOURCES

3.3.1 Geological Setting

3.3.1.1 Physiography

The lease tracts are located within the eastern part of the Canyon Lands section of the Colorado Plateau physiographic province in southwestern Colorado (Figure 3.3-1). The plateau is an extensive region generally characterized by nearly horizontal sedimentary formations covering an area of about 130,000 mi^2 (340,000 km^2) in the four corners region of Utah, Colorado, Arizona, and New Mexico. It is characterized by high elevation (the general plateau surface has an average elevation of about 5,200 ft [1,600 m], with plateaus and peaks nearly as high as 13,000 ft [4,000 m]) and a deeply incised drainage system, forming steep-walled canyons that expose geologic

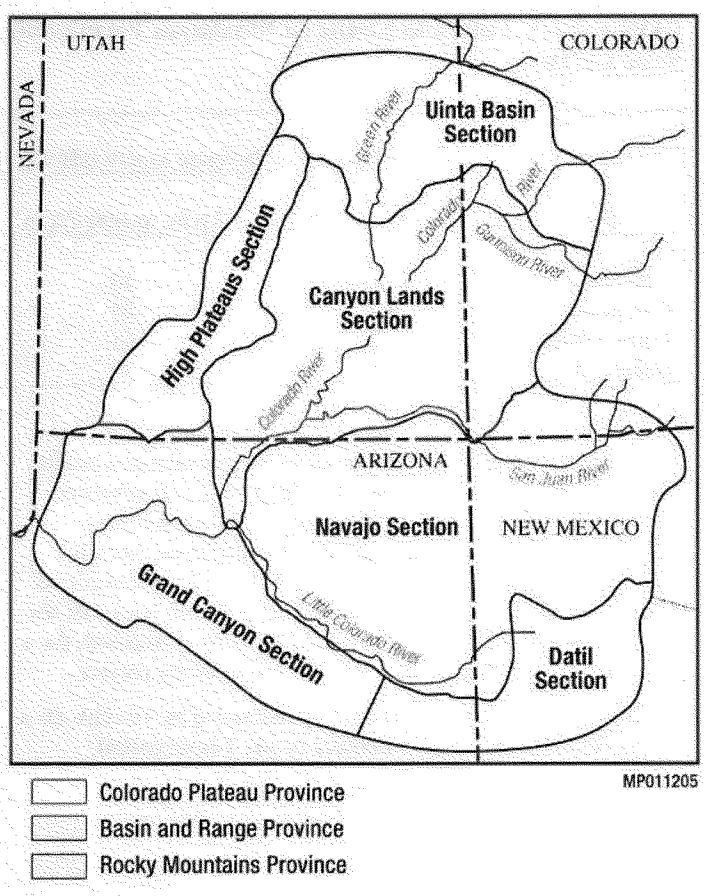

FIGURE 3.3-1 Physiographic Map of the Colorado Plateau (modified from Foos 1999)

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4 ENVIRONMENTAL IMPACTS

DOE is evaluating potential impacts from the five alternatives discussed in Chapter 2 for the management of the ULP. The affected environments in the ROI for each of the 13 resource areas are discussed in Chapter 3. Other site-specific information and assumptions or bases for the impact evaluation for each of the five alternatives are discussed in Chapter 2 (Sections 2.2.1.1, 2.2.2.1, 2.2.3.1, 2.2.4.1, and 2.2.5.1), with additional details presented in Appendix C. The methodology used to evaluate the potential impacts is summarized in Appendix D for each of the resource areas evaluated. Additional discussion on the determination of the ROIs can also be found in Appendix D. To minimize redundancy in the text presented, information that applies to all five alternatives is presented in the text for the first alternative where it is applicable and not repeated in subsequent sections for the remaining alternatives.

4.1 ALTERNATIVE 1

Under Alternative 1, existing disturbed areas at 10 lease tracts (5, 6, 7, 8, 9, 11, 13, 15, 18, and 26) totaling about 257 acres (100 ha) would be reclaimed. It is assumed that the reclamation would be completed within 1 year of field work, followed by an observation period of about 2 years to gauge revegetation performance and obtain state approval.

> Alternative 1: DOE would terminate all leases, and all operations would be reclaimed by lessees. DOE would continue to manage the withdrawn lands, without uranium leasing, in accordance with applicable requirements.

Reclamation activities would involve (1) removing most, if not all, of the surface-plant area improvements (e.g., equipment, buildings, utilities); (2) removing from the site all wastes, contaminated media, and contaminated structures that were not inherent to the site geology and managing them as waste under state or Federal regulations; (3) placing in the mine any residual ores and other radioactive materials inherent to the site; (4) closing open shafts, adits, and inclines; (5) implementing erosion-control measures; (6) grading the waste-rock pile to be consistent with surrounding slopes; (7) replacing surface soils; and (8) revegetating.

4.1.1 Air Quality

Under Alternative 1, during reclamation, primary emission sources would include engine exhaust from heavy equipment and trucks, fugitive dust from earth-moving activities, and exposed ground or stockpiles being eroded by the wind. Engine exhaust emissions from heavy equipment and trucks would include criteria pollutants such as carbon monoxide (CO), nitrogen oxides (NO_X), particulate matter ($PM_{2.5}$ and PM_{10}), and sulfur dioxide (SO_2); VOCs; and greenhouse gases (GHGs) (e.g., the primary GHG, carbon dioxide [CO_2]). Soil disturbances and wind erosion would generate mostly PM emissions. Typically, the amount of fugitive dust emissions is larger than the amount of engine exhaust emissions during the reclamation phase.

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Emissions during the reclamation year were estimated as shown in Table 4.1-1 (see Appendix C for details). PM_{10} emission estimates of about 142 tons/yr are highest, accounting for about 0.92% of emission totals for the three counties (Mesa, Montrose, and San Miguel) encompassing the DOE ULP lease tracts. Most of these PM_{10} emissions, which account for about 2.4% of total emissions in Montrose County, would come from a very large open-pit mine (JD-7). A potential for 24-hour PM_{10} NAAQS exceedances at the lease tract boundary is anticipated when heavy activities would occur near the boundary. Among non-PM emissions, NO_x emissions from diesel combustion of heavy equipment and trucks are highest, up to 0.09% of three-county total emissions. Measures (i.e., compliance measures, mitigation measures, and BMPs) provided in Table 4.6-1 (Section 4.6), would be implemented to ensure compliance with environmental requirements. Thus, it is anticipated that potential impacts on ambient air quality associated with reclamation activities under Alternative 1 would be minor and temporary in nature. These low-level emissions are not anticipated to cause measureable impacts on regional ozone (O_3) or AQRVs, such as visibility or acid deposition, at nearby Class I areas, as discussed in detail in Section 4.3.1. In addition, CO_2 emissions during reclamation are estimated to be about 0.001% of Colorado GHG emissions in 2010 at 140 million tons (130 million metric tons) of CO_2 equivalent (CO_2e) and 0.00002% of U.S. GHG emissions in 2009 at 7,300 million tons (6,600 million metric tons of CO_2e) (EPA 2011a; Strait et al. 2007). Thus, under Alternative 1, potential impacts from reclamation activities on climate change would be negligible.

Reclamation activities will include grading, contouring, topsoil replacement, and seeding and mulching, in such a manner that the approximate original topographic contours are reestablished. The reclaimed areas will be monitored on a regular basis to ensure the integrity is maintained. Accordingly, long-term effects on ambient air quality after the reclamation are anticipated to be negligible.

4.1.2 Acoustic Environment

Reclamation activities would be similar to conventional construction activities in terms of procedures and equipment; however, activities would generally proceed in reverse order and would also proceed more quickly; thus, the associated impacts would last for a shorter time and on a more limited scale. Potential noise impacts on nearby residences or communities would be correspondingly less than those from operational activities. During reclamation, heavy construction equipment that would be used would include a backhoe, bulldozers, a grader, loaders, a track hoe, trucks, and a scraper.

Heavy equipment used during reclamation is similar to that used during mine development and operations, so it is conservatively assumed that noise levels during reclamation would be the same as they were during the mine development and operations phase. A composite noise level of 95 dBA at a distance of 50 ft (15 m) is assumed, as discussed in detail in Section 4.3.2. When only geometric spreading and ground effects among several sound attenuation mechanisms are considered (Hanson et al. 2006), noise levels would attenuate to about 55 dBA at a distance of 1,650 ft (500 m) from the reclamation site, which is the Colorado

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TABLE 4.1-1 Peak-Year Air Emissions from Reclamation under Alternative 1[a]

	Annual Emissions (tons/yr)		
Pollutant[b]	Three-County Total[c]	Reclamation	
CO	65,769	5.8	(0.01%)[d]
NO_x	13,806	12.1	(0.09%)
VOCs	74,113	1.2	(0.002%)
$PM_{2.5}$	5,524	29.1	(0.53%)
PM_{10}	15,377	142.1	(0.92%)
SO_2	4,246	1.6	(0.04%)
CO_2	142.5×10^6 [e]	1,100	(0.001%)
	$7{,}311.8\times10^6$ [f]		(0.00002%)

[a] Under Alternative 1, it is assumed that 10 lease tracts (5–9,11,13,15,18, and 26) with a total area of 257 acres (100 ha) would be reclaimed within a year.

[b] Notation: CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter with a mean aerodynamic diameter of ≤2.5 μm; PM_{10} = particulate matter with a mean aerodynamic diameter of ≤10 μm; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.

[c] Total emissions in 2008 for all three counties encompassing the DOE ULP lease tracts (Mesa, Montrose, and San Miguel Counties), except for CO_2 (see footnotes e and f). See Table 3.1-2.

[d] Numbers in parentheses are percentages of three-county total emissions except for CO_2, which are percentages of total Colorado emissions (top line) and total U.S. emissions (bottom line).

[e] Annual emissions in 2010 for Colorado on a CO_2-equivalent basis.

[f] Annual emissions in 2009 for the United States on a CO_2-equivalent basis.

Source: CDPHE (2011a); EPA (2011a); Strait et al. (2007)

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daytime maximum permissible limit of 55 dBA in a residential zone.[1] If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential areas (EPA 1974) would occur about 1,200 ft (360 m) from the site. In addition, other attenuation mechanisms, such as air absorption, screening effects (e.g., natural barriers by terrain features), and skyward reflection due to temperature lapse conditions typical of daytime hours would reduce noise levels further. Most residences are located beyond these distances; however, if reclamation activities occurred near the boundary of Lease Tract 13, noise levels at nearby residences could exceed the Colorado limit.

It is assumed that most reclamation activities would occur during the day, when noise is better tolerated, because the masking effects from background noise are better at that time than at night. In addition, reclamation activities at the lease tracts would be temporary in nature (typically a few weeks to months depending on the size of the area to be reclaimed). Accordingly, reclamation within the lease tracts would cause some unavoidable but localized short-term and minor noise impacts on neighboring residences or communities. The same measures (i.e., compliance measures, mitigation measures, and BMPs) adopted during the mine development and operations phase, identified in Table 4.6-1 (Section 4.6), could also be implemented during reclamation under Alternative 1.

4.1.3 Geology and Soil Resources

Section 4.1.3.1 provides an overview of various potential impacts on soil resources due to ground disturbance from mining activities at the DOE ULP lease tracts. Section 4.1.3.2 discusses the potential impacts on soil resources under Alternative 1. Section 4.1.3.1.7 provides an overview of various potential impacts on paleontological resources due to ground disturbance from mining activities at the ULP lease tracts. Section 4.1.3.3 discusses the potential impacts on paleontological resources under Alternative 1.

4.1.3.1 Potential Soil Impacts Common to All Alternatives

Table 4.1-2 provides a summary of the types of potential soil impacts common to all alternatives (in varying degrees) and the mining activities that could cause them. These impacts include soil compaction, soil horizon mixing, loss of soil organic matter, soil erosion and deposition by wind, soil erosion by water and surface runoff, and sedimentation, as described below. The implementation of mitigation measures and BMPs to preserve the health and functioning of soils within the lease tracts would reduce the likelihood of soil impacts becoming impacting factors on other resources, such as vegetation, air, water, and wildlife, and it would also contribute to the success of future reclamation efforts. Such measures (i.e., compliance and mitigation measures) and BMPs are detailed in Table 4.6-1 (Section 4.6).

[1] DOE ULP activities might be subject to the much higher levels that pertain to light industrial or industrial zones, as in Colorado Revised Statutes, Title 25, "Health," Article 12, "Noise Abatement," Section 103, "Maximum Permissible Noise Levels."

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Alternative 1, reclamation activities would be expected to cause minimal to weak levels of contrast for views from this SVRA.

Within 5 mi (8 km) of the lease tracts within the South Group, the lease tracts could potentially be visible from approximately 8.7% (5,700 acres or 2,300 ha) of the Dolores River Canyon SRMA; in fact, portions of the SRMA are located within the actual lease tracts, including Lease Tract 13. Between 0 and 25 mi (0 and 40 km), portions of the South Group lease tracts could be visible from approximately 9.0% (5,900 acres or 2,400 ha) of the SRMA. Views of the reclamation activities might be limited and likely would include any existing infrastructure, if present within the mine sites. For this alternative, mining-related activities would be expected to cause weak to strong contrast levels (i.e., not likely to be noticed by casual observers, attracting and holding their visual attention and potentially dominating the view) for views from this SRMA; stronger contrast levels would be expected for views from portions of the SRMA that are located within the South Group; lower contrast levels would be expected for views from areas farther from the lease tracts.

The South Group lease tracts could potentially be visible from approximately 7.4 mi (3 km) of the Trail of the Ancients Byway in Utah. This portion of the byway is located within the "seldom seen" distance zone (i.e., between 15 and 25 mi or 24 and 40 km) and is primarily west of the lease tracts. Views of the lease tracts would be limited, and they would be of brief duration for byway drivers. The byway generally follows US 191. Reclamation under Alternative 1 would be expected to cause minimal to zero levels of contrast for views from along the byway.

4.1.13 Waste Management

Potential impacts on waste management practices (described in Section 3.13) from waste generated during reclamation activities under Alternative 1 are expected to be small. Waste that could remain on the mine sites would be managed accordingly, and disposal capacity at the permitted landfills or licensed facilities would be adequate to accommodate the waste that would need to be transported off site for disposal.

4.2 ALTERNATIVE 2

As would occur under Alternative 1, a total of about 257 acres (100 ha) would be reclaimed at 10 lease tracts (5, 6, 7, 8, 9, 11, 13, 15, 18, and 26). Also similar to what would happen under Alternative 1, the only mining activity to be implemented as part of this alternative would be reclamation.

> Alternative 2: Same as Alternative 1, except once reclamation was completed by lessees, DOE would relinquish the lands in accordance with 43 CFR Part 2370. If DOI/BLM determines, in accordance with that same Part of the CFR, the lands were suitable to be managed as public domain lands, they would be managed by BLM under its multiple use policies. DOE's uranium leasing program would end.

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4.2.1 Air Quality

The types of impacts and resulting emissions would be the same as those described for Alternative 1 (Section 4.1.1). Thus, potential impacts on ambient air quality associated with reclamation activities under Alternative 2 would be minor and temporary in nature. In addition, these activities are not anticipated to cause any measurable impacts on regional ozone or AQRVs at nearby Class I areas. Potential impacts from these activities on climate change would be negligible.

As discussed in Section 4.1.1, long-term impacts on ambient air quality after the reclamation are anticipated to be negligible.

4.2.2 Acoustic Environment

The type of impacts and resulting noise levels would be the same as those described for Alternative 1 (Section 4.1.2). Most residences are located beyond the distances where the Colorado noise limit is reached, but, if reclamation activities occurred near the boundary of Lease Tract 13, noise levels at nearby residences could exceed the Colorado limit.

It is assumed that most reclamation activities would occur during the day, when noise is better tolerated because of the masking effects of background noise that occurs during daytime. In addition, reclamation activities for ULP lease tracts would be temporary in nature (typically a few weeks to months, depending on the size of disturbed area to be reclaimed). Accordingly, reclamation within the DOE ULP lease tracts would cause some unavoidable but localized short-term noise impacts on neighboring residences or communities. Mitigation measures would be implemented to minimize these potential impacts.

4.2.3 Geology and Soil Resources

Soil impacts from ground-disturbing activities at the 10 lease tracts requiring reclamation would be the same as those described for Alternative 1 (Section 4.1.3.1).

4.2.3.1 Paleontological Resources

Impacts on paleontological resources from ground-disturbing activities at the 10 lease tracts requiring reclamation would be the same as those described for Alternative 1 (Section 4.1.3.3).

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4.2.4 Water Resources

Under Alternative 2, impacts on water resources associated with the reclamation activities would be the same as those described for Alternative 1 (Section 4.1.4). The potential impact of soil erosion by water is moderate but temporary in lease tracts along the Dolores River. It is not anticipated that the reclamation activities would injure any existing water rights in the region. Potential impacts on groundwater quality are minor and could be avoided if water reclamation is performed in accordance with reclamation performance measures set by the CDWR. Subsequent impacts on water quality during BLM's administrative control would depend on the use of the reclaimed areas and could range from negligible (e.g., if no development or other use, other than as a natural land, occurred) to minor (e.g., if mining occurred once again on the reclaimed areas).

4.2.5 Human Health

Potential human health impacts to individual receptors under Alternative 2 would be the same as those under Alternative 1 (see Section 4.1.5) because people would conduct the same types of activities and work the same amount of hours regardless of the alternative under consideration. The dimensions of and radioactivity levels in the major radiation sources to which these receptors would be exposed would also be the same.

4.2.6 Ecological Resources

4.2.6.1 Vegetation

Impacts on vegetation under this alternative would be similar to those described for Alternative 1.

4.2.6.2 Wildlife

There would be no difference in reclamation activities under Alternative 2 than those under Alternative 1 (Section 4.1.6.2). Therefore, the potential impacts on wildlife from reclamation activities would be minor. Subsequent impacts on wildlife during BLM's administrative control would depend on the use of the reclaimed areas and could range from negligible (e.g., if no development or other use, other than use as a natural habitat, occurred) to moderate (e.g., if mining occurred once again on the reclaimed areas).

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4.3 ALTERNATIVE 3

Alternative 3: DOE would continue the ULP as it existed before July 2007, with the 13 active leases, for the next 10-year period or for another reasonable period, and DOE would terminate the remaining leases.

Under Alternative 3, eight mines (two small, four medium, one large, and one very large) with a total surface area of 310 acres (130 ha) are assumed to be in operation during the peak year. The three phases involved in uranium mining (exploration, mine development and operations, and reclamation) are evaluated for this alternative. The exploration phase is assumed to require a relatively short duration of time, from 2 weeks to a month for each mine; however, it can occur annually over the course of several years. Mine development and operations would be conducted for about 10 years. Reclamation would be conducted within a time frame of 2 to 3 years after operations ceased.

4.3.1 Air Quality

4.3.1.1 Exploration

The degree of potential impacts on ambient air quality would vary depending on a number of factors, such as existing road conditions, topography, soil properties, vegetation cover, and meteorological conditions (e.g., wind speed, precipitation). Exploration activities would involve little ground disturbance. The exploration phase is assumed to require a relatively short duration, and a small fleet of heavy equipment along with a small crew would be used. In addition, measures (i.e., compliance measures, mitigation measures, and BMPs) would be implemented to ensure compliance with environmental requirements and to mitigate potential impacts, if any (see Table 4.6-1, Section 4.6).

During this phase, exploration activities would occur on all 12 lease tracts, with multiple drill holes on each lease tract. For the analysis, air emissions from engine exhaust and soil disturbances are estimated, assuming that two, four, and six borehole drillings up to a depth of 600 ft (180 m) would occur at two small mines, four medium mines, and one large mine, respectively, on any peak year. Emission sources would include drilling rigs, front-end loaders/bulldozers/skid-steer loaders, and support vehicles (water truck, flatbed truck for extra drill pipe, pickups, and probe truck). Types of air pollutants being emitted are discussed in Section 4.3.1.2, and estimated emissions are presented in Table 4.3-1. Among criteria pollutants and VOCs, NO_x emissions would be the highest, which account for about 0.06% of three-county total emissions. Annual total CO_2 emissions account for about 0.001% of Colorado GHG emissions in 2010 at 140 million tons (130 million metric tons) of CO_2e and account for 0.00001% of U.S. GHG emissions in 2009 at 7,300 million tons (6,600 million metric tons) of CO_2e (EPA 2011a; Strait et al. 2007).

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TABLE 4.3-1 Peak-Year Air Emissions from Mine Development, Operations, and Reclamation under Alternative 3[a]

	Annual Emissions (tons/yr)								
Pollutant[b]	Three-County Total[c]	Exploration		Mine Development		Mine Operations		Reclamation	
CO	65,769	3.3	(0.01%)[d]	74.0	(0.11%)	64.2	(0.10%)	7.2	(0.01%)
NO_x	13,806	8.0	(0.06%)	26.0	(0.19%)	138	(1.0%)	14.9	(0.11%)
VOCs	74,113	1.0	(0.001%)	0.8	(0.001%)	13.4	(0.02%)	1.5	(0.002%)
$PM_{2.5}$	5,524	0.7	(0.01%)	36.4	(0.66%)	11.8	(0.21%)	30.6	(0.55%)
PM_{10}	15,377	1.1	(0.01%)	225	(1.5%)	22.5	(0.15%)	150.3	(0.98%)
SO_2	4,246	0.9	(0.02%)	3.1	(0.07%)	17.7	(0.42%)	2.0	(0.05%)
CO_2	142.5×10^6 [e]	890	(0.001%)	750	(0.001%)	13,000	(0.009%)	1,400	(0.001%)
	$7{,}311.8\times10^6$ [f]		(0.00001%)		(0.00001%)		(0.00018%)		(0.00002%)

[a] Under Alternative 3, it is assumed that 8 mines (2 small, 4 medium, 1 large, and 1 very large) would be in operation, and a total surface (disturbed area of about 310 acres [130 ha]) would be reclaimed in any peak year.

[b] Notation: CO = carbon monoxide; CO_2 = carbon dioxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter with a mean aerodynamic diameter of $\leq$2.5 µm; PM_{10} = particulate matter with a mean aerodynamic diameter of $\leq$10 µm; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.

[c] Total emissions in 2008 for all three counties encompassing the DOE ULP lease tracts (Mesa, Montrose, and San Miguel Counties), except for CO_2. See Table 3.1-2.

[d] Numbers in parentheses are percentages of three-county total emissions except for CO_2, for which the numbers are percentages of Colorado total emissions and percentages of U.S. total emissions.

[e] Annual emissions in 2010 for Colorado on a CO_2-equivalent basis.

[f] Annual emissions in 2009 for the United States on a CO_2-equivalent basis.

Source: CDPHE (2011a); EPA (2011a); Strait et al. (2007).

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Air emissions during the exploration phase would be negligible, and thus potential impacts on ambient air quality would be negligible and temporary. These activities are not anticipated to cause measureable impacts on regional ozone or AQRVs. Potential impacts from these activities on climate change would be negligible.

1-hour NO_x for Rigs?
only coeff bore

4.3.1.2 Mine Development and Operations

During mine development and operations, primary emission sources would include engine exhaust from heavy equipment and trucks, fugitive dust from earth-moving activities, erosion of exposed ground or stockpiles caused by wind, and explosives use (e.g., ammonium nitrate–fuel oil). Engine exhaust emissions from heavy equipment and trucks would include criteria pollutants (such as CO, NO_x, $PM_{2.5}$, PM_{10}, and SO_2), VOCs, and GHGs (e.g., the primary GHG CO_2), while soil disturbances and wind erosion would generate mostly PM emissions. Explosive use would also generate all criteria pollutants, VOCs, and CO_2, but most explosives produce more CO than any other combustion-related pollutants, and large quantities of PM are generated in the shattering of the rock and earth by explosives. Typically, the amount of fugitive dust emissions (e.g., PM_{10}) would be larger during mine development, while the amount of exhaust emissions (e.g., NO_x) would be larger during operations. Mitigation measures and BMPs to address both types of emissions are identified in Table 4.6-1 (Section 4.6).

Air emissions of criteria pollutants, VOCs, and CO_2 from the mine development and operations phase are estimated for the peak year and presented in Table 4.3-1 and compared with emission totals for three counties combined (Mesa, Montrose, and San Miguel), which encompass the DOE ULP lease tracts. Detailed information on emission factors for each activity and on a mine-group basis (such as small, medium, large, and very large mines), underlying assumptions, emission control efficiencies, and emission inventories is presented in Appendix C. As shown in the table, total peak-year emission rates are estimated to be rather small compared with emission totals for all three counties. During mine development, the amount of non-PM emissions would be relatively small (up to 0.19%), and PM_{10} and $PM_{2.5}$ emissions would amount to about 1.5% and 0.66%, respectively, of the three-county combined emissions. PM_{10} emissions would result equally from site preparation (44%) and explosive use (43%), followed by wind erosion (13%), but exhaust emissions contribute only a little to total PM_{10} emissions. During mine operations, NO_x emissions of 138 tons/yr would be highest, amounting to about 1.0% of three-county total emissions. Most NO_x emissions would be from diesel-fueled heavy equipment, such as heavy trucks, bulldozers, scrapers, or power generators. Potential impacts would be minimized by implementing good industry practices and fugitive dust mitigation measures such as watering unpaved roads, disturbed surfaces, and temporary stockpiles (see Section 4.6). Therefore, potential impacts on ambient air quality would be minor and temporary.

The three counties encompassing the DOE ULP lease tracts are currently in attainment for ozone (EPA 2011b), and ozone levels in the area approached the standard (about 90%)

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(see Table 3.1-3). Recently, wintertime ozone[4] exceedances have frequently been reported at higher-elevation stations in northwestern Colorado, northeastern Utah, and southwestern Wyoming. However, ozone precursor emissions from mine development or operations would be relatively small, less than 1.0% and 0.02% of three-county combined NO_x and VOC emissions, respectively, and would be much lower than those for the regional airshed in which emitted precursors are transported and transformed into O_3. In addition, the wintertime high-ozone areas are located more than 100 mi (160 km) from the DOE ULP lease tracts and are not located downwind of the prevailing westerlies in the region. Accordingly, the potential impacts of O_3 precursor emissions from the mine development and operations phase on regional ozone would not be of concern.

As discussed in Section 3.1, there are several Class I areas around the DOE ULP lease tracts where AQRVs, such as visibility and acid deposition, might be a concern. Primary pollutants affecting AQRVs include NO_x, SO_2, and PM. NO_x and SO_2 emissions from mine development and operations in any peak year would be relatively small (up to 1.0% of three-county combined emissions), while PM_{10} emissions would be about 1.5% of three-county combined emissions. Air emissions from mine development and operations could result in minor impacts on AQRVs at nearby Class I areas, but the implementation of good industry practices and fugitive dust mitigation measures could minimize these impacts.

Annual total CO_2 emissions from mine development and operations were estimated as shown in Table 4.3-1. CO_2 emissions would be much higher during operations than during development. During operations, annual total CO_2 emissions would be about 13,000 tons (12,000 metric tons). These accounted for about 0.009% of Colorado GHG emissions in 2010 (at 140 million tons [130 million metric tons] of CO_2e) and for 0.00018% of U.S. GHG emissions in 2009 (at 7,300 million tons [6,600 million metric tons] of CO_2e) (EPA 2011a; Strait et al. 2007). Thus, potential impacts from mine development and operations on global climate change would be negligible.

4.3.1.3 Reclamation

The type of impacts from reclamation under Alternative 3 are similar to those described under Alternative 1 (Section 4.1.1). It is also assumed that reclamation activities under Alternative 3 would occur on about 310 acres (130 ha) of surface area at the peak year of reclamation.

Peak-year emissions during the reclamation phase under Alternative 3 are presented in Table 4.3-1. PM_{10} emissions would be highest, accounting for about 0.98% of three-county

[4] High-ozone incidents during wintertime result from several factors: high solar radiation due to high elevation enhanced by high albedo (defined as solar reflectivity of the earth's surface) caused by snow cover; shallow mixing height below temperature inversion; no or few clouds; stagnant or light winds; and abundant ozone precursors (such as NO_x and VOC) from existing oil and gas development activities (Kotamarthi and Holdridge 2007; Morris et al. 2009). In particular, snow cover plays an important role in UV reflection and insulation from the ground, which reduces the surface heating that promotes the breakup of temperature inversions.

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combined emissions. Among non-PM missions, NO_x emissions from diesel combustion of heavy equipment and trucks would be highest, up to 0.11% of three-county total emissions. Good industry practices and mitigation measures would be implemented to ensure compliance with environmental requirements. Thus, potential impacts on ambient air quality associated with reclamation activities under Alternative 3 are anticipated to be minor and temporary in nature. These low-level emissions are not anticipated to cause any measureable impacts on regional ozone or AQRVs, such as visibility or acid deposition, at nearby Class I areas. In addition, CO_2 emissions during the reclamation phase were about 0.001% of Colorado GHG emissions in 2010 and about 0.00002% of U.S. GHG emissions in 2009, respectively (EPA 2011a; Strait et al. 2007). Thus, under Alternative 3, potential impacts from reclamation activities on global climate change would be negligible.

4.3.2 Acoustic Environment

The noise levels generated by heavy construction equipment would vary significantly depending on various factors, such as the type, model, size, and condition of equipment; operation schedule; and condition of the area where work was being done. Not only are there daily variations in activities, but major construction projects are accomplished in several different phases. Each phase has a specific equipment mix, depending on the work to be accomplished during that phase. Any potential impact analysis should be based on typical activities in each phase.

4.3.2.1 Exploration

For the exploration phase, if existing roads did not provide site access, noise sources would include a grader or bulldozer for construction of an access road. Other noise sources would include vehicular traffic for commuting or delivery to and from the site and, where siting could not avoid brush, chainsaws and chippers for brush clearing.

Most noise-generating activities would occur intermittently during the exploration phase. It is anticipated that all of these activities would be conducted by using only a small crew and a small fleet of heavy equipment and would occur during daytime hours, when noise is tolerated better than it is at night because of the masking effect of daytime background noise. Accordingly, it is anticipated that potential noise impacts during the exploration phase on neighboring residences or communities, if any, would be minor and intermittent.

4.3.2.2 Mine Development and Operations

During this phase, heavy construction and mining equipment would be used. Underground equipment would include loaders, haul or support trucks, and drills, while aboveground equipment would include bulldozers, graders, loaders, haul or support trucks, scrapers, and power generators. During surface-plant area improvements, most activities would occur aboveground. However, most mine development and operational activities would occur above the ground for surface open-pit mines and under the ground for underground mines.

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Ventilation shafts would also contribute noise during mine development and the operation of underground mines.

Primary sources of noise during this phase would include operation of machinery, on-road and off-road vehicle traffic, and, if necessary, blasting. Aboveground equipment includes backhoes, dozers, graders, power generators, and scrapers, while underground equipment includes rock drills; various types of loaders and trucks would be used both above and under the ground. The average noise levels from most of these pieces of heavy equipment range from 80 to 90 dBA, except for a rock drill at a distance of 50 ft (15 m), which is 98 dBA (Hanson et al. 2006). In general, the dominant noise source from most construction equipment is a diesel engine without sufficient muffling that is continuously mining around a fixed location or with limited movement. Except for rock drills, noise levels for typical construction equipment that would likely be used at the DOE ULP lease tracts range from about 80 to 90 dBA at a distance of 50 ft (15 m) from an equipment.

To estimate noise levels associated with these activities, a composite noise level of 95 dBA at a distance of 50 ft (15 m) from the construction site is conservatively assumed, if impact equipment such as rock drills is not being used. Typically, this level could be reached when several pieces of noisy heavy equipment operated simultaneously in close proximity to each other at peak load.

When only geometric spreading and ground effects are considered (Hanson et al. 2006), noise levels would attenuate to about 55 dBA at a distance of 1,650 ft (500 m) from the lease tracts, which is the Colorado daytime maximum permissible limit of 55 dBA in a residential zone. If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential areas (EPA 1974) would occur about 1,200 ft (360 m) from the construction site. In addition, other attenuation mechanisms, such as air absorption, screening effects (e.g., natural barriers by terrain features), and skyward reflection due to temperature lapse conditions typical of daytime hours, would reduce noise levels further. Thus, noise attenuation to Colorado or EPA limits would occur at distances somewhat shorter than the aforementioned distances. In many cases, these limits would not reach any nearby residences or communities. However, when construction occurred near the lease tract boundary, noise levels at residences around Lease Tract 13 would exceed the Colorado limit.

It is assumed that most operational activities would occur during the day, when noise is better tolerated because of the masking effects of background noise during daytime. In addition, mine development activities are temporary (typically lasting only a few months), and they would have some unavoidable but localized short-term noise impacts on neighboring residences or communities, particularly if activities occurred near the residences or communities adjacent to the lease tract boundary.

During mine operations, over-the-road heavy haul trucks would transport uranium ores from ULP lease tracts to either the proposed Piñon Ridge Mill or White Mesa Mill in Utah. These shipments could produce noise along the haul routes. Under Alternative 3, about 1,000 tons per day of uranium ores would be produced. Assuming 25 tons of uranium ore per truck and round-trip travel, the traffic volume would be 80 truck trips per day (40 round trips per day) and 10 truck trips per hour (for 8-hour operation). A peak pass-by noise level of 84 dBA

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from a heavy truck operating at 55 mi/h or mph (88 km/h) was estimated based on Menge et al. (1998). At a distance of 120 ft (37 m) and 230 ft (70 m) from the route, noise levels would attenuate to 55 and 50 dBA, respectively, which are Colorado daytime and nighttime maximum permissible limits in a residential zone. Noise levels above the EPA guideline level of 55 dBA L_{dn} for residential areas would be reached up to the distance of 60 ft (18 m) from the route. Accordingly, Colorado limits or EPA guideline levels would be exceeded within 230 ft (70 m) of the haul route, and any residences within this distance might be affected. ARE THERE ANY?

Depending on local geological conditions, explosive blasting during mine development and operations might be needed. Blasting would generate a stress wave in the surrounding rock, causing ground and structures on the ground surface to vibrate. The blasting also would create a compressional wave in the air (air blast overpressure), the audible portion of which would be manifested as noise. Potential impacts of ground vibration include damage to structures, such as broken windows. Potential impacts of blast noise include effects on humans and animals. Estimates of the potential increases in ambient noise levels, ground vibration, and air blast overpressure and evaluations of any environmental impacts associated with such increases would be required at the site-specific project phase if potential impacts at the nearby residences or structure are anticipated.

Blasting techniques are designed and controlled by blasting and vibration control specialists to prevent damage to structures or equipment. These controls attenuate blasting noise as well. Under Alternative 3, there are several residences within 0.5 mi (0.8 km) of the boundaries of some of the lease tracts. However, given the impulsive nature of blasting noise, it is critical that blasting activities be avoided at night and on weekends and that affected neighborhoods be notified in advance of scheduled blasts. HOW?

There are several specially designated areas (e.g., Dolores River SRMA, Dolores River Canyon WSA) and other nearby wildlife habitats around the DOE ULP lease tracts and haul routes where noise might be a concern. Negative impacts on wildlife begin at 55–60 dBA, a level that corresponds to the onset of adverse physiological impacts (Barber et al. 2010). As discussed above, these levels would be limited up to distances of up to 1,650 ft (500 m) from the mine sites and 120 ft (37 m) from the haul routes. However, there is the potential for other effects to occur at lower noise levels (Barber et al. 2011). To account for these impacts and the potential for impacts at lower noise levels, impacts on terrestrial wildlife from construction noise and mitigation measures would have to be considered on a project-specific basis. These studies would need to consider site-specific background levels and the hearing sensitivity for site-specific terrestrial wildlife of concern.

In summary, the potential for noise impacts from mine development on humans and wildlife is anticipated near the mine sites and along the haul routes, but impacts would be minor and limited to proximate areas unless the activities occurred near a lease tract boundary adjacent to nearby residences or communities or areas specially designated to be of concern with regard to wildlife, if any. Implementation of mitigation measures and BMPs identified in Table 4.6-1 (Section 4.6) and adherence to coherent noise management plans could minimize these impacts.

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4.3.2.3 Reclamation

It is assumed that reclamation activities under Alternative 3 would occur over about 300 acres (120 ha) at any peak year. As discussed in Section 4.1.2, noise levels would attenuate to about 55 dBA at a distance of 1,650 ft (500 m) from the reclamation site, which is the Colorado daytime maximum permissible limit of 55 dBA in a residential zone. If a 10-hour daytime work schedule is considered, the EPA guideline level of 55 dBA L_{dn} for residential areas (EPA 1974) would occur about 1,200 ft (360 m) from the construction site. Most residences are located beyond these distances, but if reclamation activities occurred near the boundary of Lease Tract 13, noise levels at the nearby residences could exceed the Colorado limit.

It is assumed that most reclamation activities would occur during the day, when noise is better tolerated than at night, because of the masking effects of background noise in the daytime. In addition, reclamation activities at ULP lease tracts are temporary in nature (typically a few weeks to months, depending on the area size to be reclaimed). Accordingly, reclamation within the DOE ULP lease tracts would cause some unavoidable but localized short-term and minor noise impacts on neighboring residences or communities. The same mitigation measures and BMPs as those adopted during the construction phase would also be implemented during the reclamation phase (see Table 4.6-1 in Section 4.6).

4.3.3 Geology and Soil Resources

Potential impacts under Alternative 3 on soil resources during exploration, mine development and operations, and reclamation are evaluated and discussed in Sections 4.3.3.1 to 4.3.3.3 below.

4.3.3.1 Exploration

Exploration activities would involve some ground-disturbing activities, such as vegetation clearing, grading, trenching (and sampling), drilling, and building access roads and drill pads. Direct adverse impacts from these activities relate mainly to the increased potential for soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, and sedimentation of nearby surface water bodies. The degree of impact would vary among the lease tracts, depending on the activities needed to explore each mine site and on site-specific factors, such as soil properties, slope, vegetation cover, weather conditions (e.g., precipitation rate and intensity, prevailing wind direction and speed), and distance to surface water bodies. However, because exploration activities would occur over relatively small areas and involve little or no ground disturbance, potential impacts associated with this phase are expected to be minor. Implementing mitigation measures and BMPs (Table 4.6-1 in Section 4.6) would further reduce the level of adverse impacts associated with these activities.

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4.3.3.2 Mine Development and Operations

Mine development activities could potentially result in minor to moderate impacts on soil resources because they would involve ground disturbances that could increase the potential for soil compaction, soil horizon mixing, soil erosion and deposition by wind, soil erosion by water and surface runoff, and sedimentation of nearby surface water bodies on both lease tracts and off-lease land. Ground-disturbing activities would be associated mainly with mine site improvements, such as the construction of buildings (offices and maintenance), utilities, parking areas, roads, service areas (for vehicles and heavy equipment), storage areas (for fuel, chemicals, materials, solvents, oils, and degreasers), discharge/treatment ponds (for mine water discharge), and diversion channels and berms; the use of trucks, heavy earth-moving equipment, and mining equipment; and the construction of various stockpile and loading areas (for waste rock, ore, and topsoil). Off-lease land disturbances would occur on adjacent BLM land and would mainly involve obtaining or improving ROWs for haul roads and utilities and would be subject to BLM's NEPA process. Potential fuel or chemical contamination could result from the use of trucks and mechanical equipment or fuel storage and handling and from the application of chemical stabilizers to control fugitive dust emissions.

Ground-disturbing activities during the operational period would be associated with the stripping of topsoil from areas to be disturbed, the stockpiling of topsoil, and the hauling and storing of ore and waste rock and maintenance of storage areas (for ore and waste rock). These activities could result in minor impacts on soil resources when compared to the level of impacts resulting from mine development.

Under Alternative 3, ground disturbance during the peak production year would occur on an estimated 300 acres (120 ha) across 12 lease tracts, mainly during mine development. Impacts associated with this phase are expected to be minor to moderate. The degree of impact would vary among the lease tracts, depending on the activities needed to prepare and develop each mine site (because some sites are more developed than others) and depending on site-specific factors, such as soil properties, slope, vegetation, weather, and distance to surface water. Implementing mitigation measures and BMPs listed in Table 4.6-1 (Section 4.6) would reduce the potential for adverse impacts associated with these activities.

4.3.3.3 Reclamation

The types of impacts related to reclamation under Alternative 3 would be similar to those described for Alternative 1 (Section 4.1.3.2); however, ground disturbance would occur over a larger area—an estimated 300 acres (120 ha) across 12 lease tracts—than that for Alternative 1.

4.3.3.4 Paleontological Resources

4.3.3.4.1 Exploration. Exploration activities would involve some ground-disturbing activities, such as vegetation clearing, grading, trenching (and sampling), drilling, and building access roads and drill pads. These activities could result in adverse impacts on paleontological

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resources, if present, because they would involve ground disturbances that could expose fossils, making them vulnerable to damage or destruction and looting/vandalism. Field surveys, conducted by a qualified paleontologist early in the reclamation process, would identify areas of moderate to high fossil-yield potential or known significant localities so that these areas could be avoided. In addition, mine operators would notify the BLM of any fossil discoveries so appropriate measures could be taken to protect discoveries from adverse impacts (see also Table 4.6-1). For this reason, it is anticipated that impacts on paleontological resources would be minor.

4.3.3.4.2 Mine Development and Operations. Mine development activities could potentially result in adverse impacts on paleontological resources, if present, because they would involve ground disturbances that could expose fossils, making them vulnerable to damage or destruction and looting/vandalism. Ground-disturbing activities would be associated mainly with mine site improvements, such as the construction of buildings (offices and maintenance), utilities, parking areas, roads, service areas (for vehicles and heavy equipment), storage areas (for fuel, chemicals, materials, solvents, oils, and degreasers), discharge/treatment ponds (for mine water discharge), and diversion channels and berms; the use of trucks, heavy earth-moving equipment, and mining equipment; and the construction of various stockpile and loading areas (for waste rock, ore, and topsoil). Off-lease land disturbances would occur on adjacent BLM land and would mainly involve obtaining or improving ROWs for haul roads and utilities and would be subject to BLM's NEPA process.

Ground-disturbing activities during the operational period would be associated with the stripping of topsoil from areas to be disturbed, the stockpiling of topsoil, and the hauling and storing of ore and waste rock and maintenance of storage areas (for ore and waste rock). These activities could result in minor impacts on paleontological resources, if present.

Field surveys, conducted by a qualified paleontologist early in the exploration phase, would identify areas of moderate to high fossil-yield potential or known significant localities so that these areas could be avoided. In addition, mine operators would notify the BLM of any fossil discoveries so appropriate measures could be taken to protect discoveries from adverse impacts (see also Table 4.6-1). For this reason, it is anticipated that impacts on paleontological resources would be minor.

4.3.3.4.3 Reclamation. The types of impacts related to reclamation under Alternative 3 would be similar to those described for Alternative 1 (Section 4.1.3.3); however, ground disturbance would occur over a larger area (an estimated 300 acres [120 ha] across 12 lease tracts) than the area under Alternative 1.

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4.3.4 Water Resources

Potential impacts on water resources are considered for the three phases of mining (exploration, mine development and operations, and reclamation) in Sections 4.3.4.1 through 4.3.4.3.

4.3.4.1 Exploration

Exploration activities would involve some land disturbance activities, such as vegetation clearing, grading, drilling, and building of access roads and drill pads, but these activities would occur over relatively small areas. Impacts on water resources associated with runoff generation and erosion would be minor, considering the small spatial extent over which exploration activities would occur.

The drilling of exploration boreholes and wells has the potential to alter the geochemical properties of an aquifer and to provide a connection between disconnected aquifers. Drilling and trenching techniques could introduce drilling muds and oxygen into aquifers, which could alter water chemistry and result in changes in pH and solubility conditions relevant to many metal ions, including uranium (Curtis et al. 2006; National Research Council 2012). The exploratory boreholes or wells could also provide a conduit connection between aquifers that could allow the mixing of water of potentially poorer quality (e.g., higher TDS concentrations) from one aquifer to another (National Research Council 2012).

As discussed in Section 3.4, the main water-bearing formations, in ascending order by depth, are Alluvium, Dakota Sandstone, Burro Canyon, Saltwash Member, Entrada Sandstone, and Navajo Sandstone. In lease tract areas, the shallow (or perched) aquifers, such as Alluvium, Dakota Sandstone, and Burro Canyon, have a limited amount of water but are relatively fresh, while the relatively deep aquifers (Saltwash Member and Entrada Sandstone) contain elevated TDS and sulfate (Section 3.4.2), exceeding the EPA secondary drinking water standard (Weir 1983; CGS 2003). The scarcity of groundwater in shallow aquifers results from extremely low groundwater recharge because of low precipitation (12.5 in. or 31.8 cm) and from the high potential for evaporation (38 in. or 97 cm) in the area. Groundwater in the shallow aquifer is used only locally for domestic or stock supply. The upper portion of the Navajo Sandstone aquifer has low TDS and is often a targeted Underground Source of Drinking Water (USDW) (CGS 2003). Within 5 mi (8 km) of lease tracts, however, no public water supply (PWS) wells are present.

The exploratory drill holes are expected to go through alluvial aquifers along the rivers and Paradox Valley or Dakota Sandstone and Burro Canyon aquifers (or perched aquifers) at mesas to reach Saltwash Member, the uranium-containing unit. Historically, most of underground mines are dry in the ULP lease tracts. The potential for groundwater mixing and leaching via exploratory drill holes is minimal. In Paradox and Slick Rock, some groundwater accumulation at a low rate has been found in underground mines in Lease Tracts 7 and 9 near Paradox Valley and in Lease Tract 13 along the Dolores River (Slick Rock) (DOE 2007). During exploration at these lease tracts, impacts associated with the drilling of exploratory boreholes and

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TABLE 4.5-7 Cultural Resource Sites Expected To Be Directly Affected under Alternative 5

Size Categories under Alternative 5	No. of Mines in Each Size Category	Expected No. of Sites by Size Category	Total No. of Sites Expected
Small	0	0.8	0
Medium	16	1.2	20
Large	2	1.7	3
Total			23

4.5.12.1 Exploration, Mine Development and Operations, and Reclamation

Visual impacts would generally be the same under this alternative as the impacts described in Sections 4.1.12 and 4.3.12. As stated for Alternative 4, the primary difference from Alternative 1 would be that activities would occur on all lease tracts.

Visual impacts associated with exploration and mine development and operations are discussed further in Sections 4.3.12.1 and 4.3.12.2. Impacts associated with reclamation activities are discussed further in Sections 4.1.12.1 through 4.1.12.5.

4.5.12.2 Impacts on Surrounding Lands

Under Alternative 5, DOE would continue the ULP with the 31 lease tracts for the remainder of the 10-year period as the leases were when they were issued in 2008. Because of the similarities between Alternatives 4 and 5, impacts on surrounding SVRAs under Alternative 5 would be the same as those under Alternative 4. See Section 4.4.12.2 for the analysis of these resources.

4.5.13 Waste Management

Potential impacts on waste management practices under Alternative 5 would be the same as those under Alternative 4.

4.6 MEASURES TO MINIMIZE POTENTIAL IMPACTS FROM ULP MINING ACTIVITIES

The potential impacts discussed in Sections 4.1 to 4.5 are expected to be minimized or reduced by implementation of the measures listed in Table 4.6-1. These measures apply to the three phases of the proposed action (exploration, mine development and operations, and reclamation), as applicable. The measures have been grouped by the 11 objectives included in

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TABLE 4.6-1 Measures Identified to Minimize Potential Impacts from Uranium Mining at the ULP Lease Tracts

	Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
M-1	**Reduce dust emissions; reduce air emissions**			
	• Apply water or chemical suppressants on unpaved haul roads, disturbed surfaces, and temporary stockpiles.	X NOT REALLY		
	• Limit soil-disturbing activities and travel on unpaved roads.		X[d]	
	• Design and construct new access roads to meet appropriate standards; roads should be no larger than necessary to accommodate their intended function.		X[d]	
	• Cover unpaved access roads, frequently used on-site roads, and parking lots with aggregate.	X		
	• Assure all heavy equipment meets emission standards as required.	X BEYOND ?		
	• Limit idle time of vehicles and motorized equipment.			X
	• Fuel all diesel engines used with ultra-low sulfur diesel (sulfur content of ≤15 parts per million [ppm]).		X[e] NOT ANY MORE	
	• Avoid construction traffic and reduce speeds on unpaved surfaces.			BMP X
	• Ensure that all vehicles transporting loose materials are covered (e.g., with tarpaulins), both when travelling with a load of ore and when returning empty; loads should be sufficiently wet and kept below the freeboard.	X ?		
M-2	**Identify and protect paleontological resources**			
	• Consult with affected BLM Field Offices to determine whether areas of moderate to high fossil-yield potential (i.e., PFYC 3, 4, or 5) or known significant localities occur within proposed areas of disturbance. All PFYC 4 and 5 areas should be field surveyed; PFYC 3 areas should be field surveyed and sampled. Surveys should be conducted along rock outcrops devoid of thick soils and well-developed vegetation to identify exposed fossils. Areas identified as PFYC 3, 4, or 5 may require monitoring by a qualified paleontologist during all excavation and earthmoving activities.	X		
	• For areas of high fossil-yield potential (PFYC 4 or 5), develop a paleontological resources management plan to define mitigation measures (i.e., avoidance, removal, monitoring, or special stipulations) and the analysis, reporting, and curation of any collected fossils.	X		
	• Immediately notify the BLM authorized officer of any paleontological resources discovered as a result of mining activities so that appropriate measures to mitigate adverse effects to significant paleontological resources can be determined and implemented. Operations may continue if activities can avoid further impacts on the fossil discovery or can be continued elsewhere.	X		

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TABLE 4.6-1 (Cont.)

	Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
M-3	**Reduce noise-related impacts**			
	• Maintain equipment in good working order in accordance with manufacturer's specifications.			X
	• Limit noisy activities to the least noise-sensitive times of the day (daytime between 7 a.m. and 7 p.m.) and weekdays and limit idle time for vehicles and motorized equipment.			X
	• Notify area residents of high-noise and/or high-vibration-generating activities (e.g., aboveground and belowground blasting) in advance.			X
	• Employ noise-reduction devices (e.g., mufflers) as appropriate. → We have exceedances of Colorado's Residential standard.			X
	• Provide a noise complaint process for surrounding communities.			X
	• Site noise sources to take advantage of topography and distance; construct engineered sound barriers and/or berms as necessary.			X
	• Limit operational noise to 49 dBA or less within 2 mi (3 km) from an occupied/active Gunnison sage-grouse lek.			X
M-4	**Protect soils from erosion; protect local surface water bodies from contamination and sedimentation; protect local aquifers from contamination**			
	• Identify local factors that cause slope instability (e.g., slope angles, precipitation) and avoid areas with unstable slopes.			X
	• Avoid creating excessive slopes during excavation; use special construction techniques, where applicable, in areas of steep slopes, erodible soil, and stream channel crossings.		X[f]	
	• Apply all dust palliatives in accordance with appropriate laws and regulations; ensure that dust suppression chemicals are not sprayed on (released to) soils or streams.		X[g]	
	• Control and direct runoff from slope tops to settling or rapid infiltration basins until disturbed slopes are stabilized; stabilize slopes as quickly as possible.	X[h]		
	• Assure operators comply with CDRMS requirements regarding groundwater and groundwater contamination.	X		
	• Obtain borrow materials from authorized or permitted sites.		X[i]	
	• Retain sediment-laden waters from disturbed areas with the lease tract through the use of barriers and sedimentation devices (e.g., berms, straw bales, sandbags, jute netting, or silt fences) as necessary.	X[h]		
	• Place barriers and sedimentation devices around drainages and wetlands.		X[g]	
	• Require developers using on-site groundwater supplies to conduct a hydrologic study consistent with that required by the state's environmental protection plan.	X		

TABLE 4.6-1 (Cont.)

Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
• Conduct routine inspections to assess effectiveness and maintenance requirements for erosion and sediment control systems.			X
• Maintain, repair, or replace barriers and sedimentation devices as necessary to ensure optimum control.	X[h]		
• Inspect and clean tires of all vehicles to ensure they are free of dirt before they enter paved public roadways to the extent practicable.			X
• Locate a diversion ditch upstream of the mine site to intercept surface water flow or shallow groundwater and channel it around the site; tailor the location and length of the ditch to site-specific conditions, taking into account the location of mine waste piles, the site topography, and surface flow patterns.	X[h]		
• Place drill holes at a distance from existing water rights to the extent possible.			X
• Plug open drill holes and areas around vent shafts to reduce the volume of groundwater entering an underground mine during operations to the extent possible; use underground sumps to contain water flow, as needed; pump water from groundwater seepage to control water flow, if necessary, into surface mine-water treatment pond.		X[j]	
• Divert water pumped from mines (or drill sites) to a lined sedimentation pond for treatment. Locate settling pond(s) in topographically low areas (but not any that are along drainages or near naturally flowing water). The purpose of treatment is to promote the precipitation of heavy metals through oxidation processes like aeration. (Employ this option at sites at which the mine drainage is high in total suspended solids).	X[h]		
• As sedimentation ponds are cleaned, test sediments and precipitates for proper disposal.	X[h]		
• Locate mine ore storage and waste-rock or tailings piles on topographically high ground so they do not come into direct contact with flowing or ponded water; grade the ore storage area and construct an earthen berm around it. Divert any runoff from the area to a sedimentation pond for testing and treatment.		X	
• Contain any runoff from mine waste-rock piles (e.g., divert it to a sedimentation pond) and treat it, as needed.	X[h]		
• Provide off-site (downgradient) groundwater monitoring consistent with Colorado requirements for groundwater protection permits.	X[i]		
• Site and design mine entrances and activities so that they avoid direct and indirect impacts on important, sensitive, or unique habitats, including, but not limited to, wetlands (both jurisdictional and nonjurisdictional), springs, seeps, streams (ephemeral, intermittent, and perennial), 100-year floodplains, ponds and other aquatic habitats, riparian habitats, remnant vegetation associations, rare or unique biological communities, crucial wildlife habitats, and habitats supporting sensitive species populations.		X[k]	

TABLE 4.6-1 (Cont.)

Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
• Restrict activities at previously mined sites so they do not further encroach toward perennial streams (e.g., the Dolores River); new mining activities should not be allowed within 0.25 mi (0.40 km) of perennial streams; avoid the placement of facilities or roads in drainages, and make necessary accommodations for the disruption of runoff.		X[l]	
• Identify surface water runoff patterns at the mine site and develop mitigation that prevents soil deposition and erosion throughout and downhill from the site; potential adverse impacts could be minimized by incorporating erosion-control techniques such as water bars, weed-free hay bales and silt fences, vegetation, erosion-control fabric, temporary detention basins, and land contours in the construction design.	X[h]		
• Assure that herbicides used meet the specifications and standards of BLM and county weed control staff.	X[m]		
• Seed soil stockpiles to minimize erosion and growth of weeds.			X
• Apply methods such as chisel plowing[n] or subsoiling[o] (tilling), as necessary, to abandoned roads and areas no longer needed to alleviate soil compaction.			X
• Limit herbicide use to nonpersistent, immobile substances. Do not use herbicides near or in U.S. waters, including ponds, lakes, streams (intermittent or perennial), and wetlands, unless the herbicide is labeled for such uses. If herbicides are used in or near U.S. waters, the applicator shall ensure that the applications meet the requirements of the EPA's "Pesticide General Permit for Discharges from the Application of Pesticides." Determine setback distances in coordination with Federal and state resource management agencies. Before beginning any herbicide treatments, ensure that a qualified biologist has conducted surveys of bird nests and of sensitive species to identify the special measures or BMPs that are necessary to avoid and minimize impacts on migratory birds and sensitive species. The herbicides to be used would be approved by BLM through submission of "Pesticide Use Proposal" forms. The state-, county-, and BLM-listed plant species scheduled for eradication that are found in the project area would be eradicated and reported to BLM through submission of "Pesticide Application Records."	X[m]		
M-5 Minimize the extent of ground disturbance and the duration of ground-disturbing activities			
• Reduce the surface footprint of disturbed areas (buildings, service areas, storage areas, stockpile areas, and loading areas) within the lease tracts to the extent possible.			X
• Minimize the duration of ground-disturbing activities, especially during periods of heavy rainfall.			X
• Expand disturbed areas (e.g., waste-rock pile storage areas) incrementally to the extent practicable.			X
• Use existing roads and disturbed areas (and transportation ROWs) to the extent possible (before constructing new roads or disturbing new areas).		X	

TABLE 4.6-1 (Cont.)

	Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
	• If ground-disturbing activities require an extended schedule, employ measures to limit exposure to wind and water during the activity.			X
	• Avoid clearing and disturbing sensitive areas (e.g., steep slopes and natural drainages) and minimize the potential for erosion.		X	
	• Limit access to disturbed areas and staging areas to authorized vehicles traveling only on designated (dust-stabilized) roads.			X
	• Minimize disturbance to vegetation, soils, drainage channels, and stream banks.		X[p]	
M-6	**Restore original grade and reclaim soil and vegetation**			
	• Salvage topsoil and vegetation prior to site disturbance and place in stockpiles (to be used in final reclamation).			X
	• Use DOE-developed seed mixture (see Table 4.1-9).	X[m]		
	• Reestablish the original grade and drainage pattern of all disturbed areas before final reclamation to the extent practicable.		X[p]	
	• Test for agronomic nutrient profile to determine whether amendments are needed to establish vegetation before final reclamation.			X
	• Place topsoil over the top of disturbed areas and seed (e.g., by broadcast or drill seeder).		X	
	• Monitor seeded areas for some period following seeding to ensure vegetation is reestablished.	X[h]		
	• Grade mine waste-rock or tailings piles to create a gently sloping (more stable) surface.		X[f]	
	• Recontour soil borrow areas and cut and fill slopes, berms, waterbars, and other disturbed areas to approximate naturally occurring slopes.		X[f]	
M-7	**Protect wildlife and wildlife habitats (and grazing animals, if present) from ground disturbance and general site activities**			
	• Use wattles or other appropriate materials to reduce potential for sediment transport offsite.			X
	• Avoid unnecessary disturbance or feeding of wildlife. The collection, harassment, or disturbance of wildlife and their habitats should be reduced through employee and contractor education about applicable state and Federal laws.			X

TABLE 4.6-1 (Cont.)

Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
• Minimize the number of areas where wildlife could hide or be trapped (e.g., open sheds, pits, uncovered basins, and laydown areas). For example, cap uncovered pipes at the end of each workday to prevent animals from entering the pipes. If a sensitive species is discovered inside a component, do not move that component, or, if it must be moved, move it only to remove the animal from the path of activity, until the animal has escaped.			X
• Establish buffer zones around sensitive habitats and either exclude project facilities and activities from those areas or modify them within those areas, to the extent practicable.			X
• If any Federally listed threatened and endangered species are found during any phase of the project, consult with the USFWS as required by Section 7 of the ESA and determine an appropriate course of action to avoid or mitigate impacts.	X		
• Schedule activities to avoid critical winter ranges for big game (mule deer and elk) when they are heavily used (December 1 through April 15), or utilize compensatory mitigation (e.g., habitat enhancement or replacement) to offset long-term displacement of big game from critical winter ranges. Compensatory mitigation projects may be developed in coordination with CPW.		X	
• Conduct pre-disturbance surveys for threatened, endangered, and sensitive species within all areas that would be disturbed by mining activities. These surveys would be used to determine the presence of sensitive species on the lease tracts and develop the appropriate measures to avoid, minimize, or mitigate impacts on these species. If sensitive species are located in the area that might be developed, coordination with the USFWS and CPW would be necessary to determine the appropriate species-specific measures.		X	
• Minimize increases in the number of nuisance animals and pests in the project area, particularly any individuals or species that could affect human health and safety or that could adversely affect native plants and animals to the extent practicable.			X
• Monitor to the extent practicable the potential for an increase in the predation of sensitive species (particularly Gunnison sage-grouse) from ravens and other species that are attracted to developed areas and that use tall structures opportunistically to spot vulnerable prey.			X
• Locate soil borings, mine entrances, and travel routes to avoid important, sensitive, or unique habitats, including, but not limited to, wetlands, springs, seeps, ephemeral streams, intermittent streams, ponds and other aquatic habitats, riparian habitat, remnant vegetation associations, rare natural communities, and habitats supporting sensitive species populations as identified in applicable land use plans or best available information and science.		X[g]	
• Conduct pre-construction raptor nest surveys to ensure compliance with the Migratory Bird Treaty Act; follow the recommended buffer zones and seasonal restrictions for Colorado's raptors (CPW 2008).	X[q]		

TABLE 4.6-1 (Cont.)

Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
• Schedule activities to avoid, minimize, or mitigate impacts on wildlife. For example, avoid crucial winter ranges, especially during the periods when they are used. If there are plans to conduct activities during bird breeding seasons, a nesting bird survey should be conducted first. If active nests are detected, the nest area should be flagged, and no activity should take place near the nest (at a distance determined in coordination with the USFWS) until nesting is completed (i.e., until nestlings have fledged or the nest has failed) or until appropriate agencies agree that construction can proceed with the incorporation of agreed-upon monitoring measures. Coordinate the timing of activities with BLM, USFWS, and CPW. Prior to authorization of ground disturbing activities a habitat suitability analysis would be done and for habitats found suitable, a protocol survey would be done. If nesting birds are found, seasonal and year-round buffers would be established with USFWS coordination.		X	
• Avoid and minimize impacts to bats during mine renewal activities (as well as during mine closure and reclamation) as follows:		X	
– Reentry of existing mines that contain winter roosting bats should be avoided during the winter season (October 1 through April 15). For existing mines expected to be reused, exclusion devices could be used to prevent bats from using the mines during winter. This would involve screening out bats by placing chicken wire with ≤1-in. (2.5-cm) mesh across the bat gate or open-access point at mine complexes that are ungated. Exclusions should be installed by September 1, if possible, but no later than September 30.			
– Existing mines utilized as summer roosting sites (other than maternity roost sites) can be handled similarly. The summer season is considered April 15 through September 1.			
– Any mine to be reworked that is used as a maternity roost should undergo an exclusion effort by April 15 and should be maintained from at least April 15 through June 15. Also, the portal(s) should be covered during night to prevent the potential reuse as maternity sites. In the event that a maternity roost will be permanently impacted, consideration should be given to preserving nearby mine features, if possible, to serve as mitigation and as a possible alternate habitat for bats. This is also recommended to mitigate impacts for a large winter roost site that will be permanently impacted. The creation of artificial bat habitat could also serve as an important alternative to mitigate impacts on maternity roosts or large winter roost sites.			
– For mine sites used year round, mining renewal activities should be spring (April through May) or fall (September through October).			
– The development and enactment of bat mitigation should be coordinated with the Colorado Bat Working Group and CPW.			

TABLE 4.6-1 (Cont.)

Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
• Avoid vegetation clearing, grading, and other construction activities during the bird breeding season; if activities are planned during the breeding season, a survey of nesting birds should be conducted first. If active nests are detected, the nest area should be flagged, and no activity should take place near the nest (at a distance determined in coordination with the USFWS) until nesting is completed (i.e., until nestlings have fledged or the nest has failed) or until appropriate agencies agree that construction can proceed with the incorporation of agreed-upon monitoring measures. Coordinate the timing of initial development activities with the BLM, USFWS, and CPW.	X[q]		
• Relocate wildlife found in harm's way away from the area of the activity when safe to do so.			X
• Design stream crossings to provide in-stream conditions that would allow for and maintain uninterrupted movement of water and safe passage of fish; minimize removal of any deadfall and overhanging vegetation that provides shelter and shading to aquatic organisms.			X
• Exclude new mining and other surface-disturbing activities within 0.25 mi (0.4 km) of the Dolores River to avoid impacts on a desert bighorn sheep movement corridor (and other wildlife).		X[l]	
• Limit vegetation maintenance for transmission lines located near aquatic habitats or riparian areas (e.g., use minimum buffers identified in the applicable land use plan or best available science and information) and perform maintenance mechanically rather than with herbicides. Cutting in wetlands or stream and wetland buffers should be done by hand or by feller-bunchers. Tree cutting in stream buffers should only target trees able to grow into a transmission line conductor clearance zone within 3 to 4 years. Cutting in such areas for construction or vegetation management should be minimized, and the disturbance of soil and remaining vegetation should be minimized.			X
• The leaseholder should consult with the USFWS to address concerns regarding mine-water treatment ponds. Water pumped from mines should be diverted to a lined sedimentation pond for treatment. Settling ponds should be located in topographically low areas but not in any areas that are along drainages or near naturally flowing water. The treatment ponds should be constructed in accordance with applicable regulations. As applicable, the ponds should be fenced and netted to prevent use by wildlife (or livestock), including birds and bats. The lower 18 in. (46 cm) of the fencing should be a solid barrier that would exclude entrance by amphibians and other small animals.		X[q]	
• Before mine entrances are closed during reclamation, conduct a summer and winter bat survey, if required, to determine the number and species of bats that could potentially occupy a site. Depending on the results of the surveys, undertake actions that could include the installation of bat gates. If bat surveys indicate no presence of bats, promptly close off all mine openings when finished with mining activities before bats have an opportunity to establish roosts or hibernacula.		X[q]	

TABLE 4.6-1 (Cont.)

	Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
	• Use herbicides that have a low toxicity to wildlife and untargeted native plant species, as determined in consultation with the USFWS. Do not use herbicides near or in U.S. waters, including ponds, lakes, streams (intermittent or perennial), and wetlands, unless the herbicide is labeled for such uses. If herbicides are used in or near U.S. waters, the applicator shall ensure that the applications meet the requirements of the EPA's "Pesticide General Permit for Discharges from the Application of Pesticides." Determine setback distances in coordination with Federal and state resource management agencies. Before beginning any herbicide treatments, ensure that a qualified biologist has conducted surveys of bird nests and of sensitive species to identify the special measures or BMPs that are necessary to avoid and minimize impacts on migratory birds and sensitive species. The herbicides to be used would be approved by BLM through submission of "Pesticide Use Proposal" forms. The state-, county-, and BLM-listed plant species scheduled for eradication that are found in the project area would be eradicated and reported to BLM through submission of "Pesticide Application Records."	X[m]		
	• If a transmission line is required, it should be designed and constructed in conformance with *Avian Protection Plan Guidelines* (APLIC and USFWS 2005), in conjunction with *Suggested Practices for Avian Protection on Power Lines* (APLIC 2006), to reduce the operational and avian risks that result from avian interactions with electric utility facilities. For example, transmission line support structures and other facility structures shall be designed to discourage their use by raptors for perching or nesting (e.g., by use of anti-perching devices). This would also minimize potential increased presence of ravens and raptors that may prey upon Gunnison sage-grouse. Shield wires should be marked with devices that have been scientifically tested and found to significantly reduce the potential for bird collisions.		X[q]	
M-8	**Minimize the establishment and spread of invasive (vegetative) species**			
	• Monitor the area regularly and eradicate invasive species immediately.	X[m]		
	• Use DOE-developed seed mixture (see Table 4.1-9) and weed-free mulch.	X[m]		
	• Clean vehicles to avoid introducing invasive weeds.			X
M-9	**Identify and protect cultural and historic resources**			
	• Assure that all activities comply with Section 106 of the NHPA.	X		
	• Assure that all individuals performing cultural resources management tasks and services meet the Secretary of the Interior Standards for Archaeology and Historic Preservation.	X		

TABLE 4.6-1 (Cont.)

	Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
	• Identify through searches of records, field surveys, and consultation with tribes, as necessary, all cultural resources in the area of potential effects and evaluate them for eligibility for inclusion on the NRHP.	X		
M-10[r]	**Minimize lighting to off-site areas; minimize contrast with surrounding areas**			
	• Design lighting to provide the minimum illumination needed to achieve safety and security objectives. Minimize or eliminate lighting of off-site areas or the sky. All unnecessary lighting should be turned off at night to limit attracting migratory birds, bats, or other wildlife.			X
	• Minimize the number of structures required.			X
	• Construct low-profile structures whenever possible to reduce the structures' visibility.			X
	• Repeat and/or blend materials and surface treatments (e.g., paint buildings) to correspond with the existing form, line, color, and texture of the landscape.			X
	• Select appropriately colored materials for structures, or apply appropriate stains as coatings, so they blend with the backdrop of the lease tract.			X
	• Use materials, coatings, or paints having little or no reflectivity whenever possible.			X
	• Avoid installing gravel and pavement wherever possible to reduce contrasts in color and texture with the existing landscape to the extent practicable.			X
	• Avoid downslope wasting of excess fill material.			X
	• Control litter and noxious weeds by removing them regularly during mine development and operations.			X
	• When accurate color rendition is not required (e.g., roadway, basic security), lighting should be amber in color, using either low-pressure sodium lamps or yellow LED lighting, or an equivalent.		X	
	• Undertake interim restoration during the operating life of the mine, as soon as possible after disturbances have occurred.		X[p]	
	• Ensure that lighting for structures on the mining sites does not exceed the minimum number of lights and brightness required for safety and security and does not cause excessive reflected glare.		X	
	• Use full cut-off luminaires recommended or approved by the International Dark Sky Association to minimize uplighting; direct lights downward or toward the area to be illuminated.			X
	• Ensure that light fixtures do not spill light beyond the lease tract boundaries to the extent practicable.			X

TABLE 4.6-1 (Cont.)

	Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
M-11	**Protect human health from radiological exposures**			
	• Monitor radon emissions and related operational conditions to obtain data for the estimation of more precise radon doses with respect to the potential exposures of nearby residents, including (1) monitoring the radon discharge concentration continuously whenever the mine ventilation system is operational, (2) measuring each mine vent exhaust flow rate, and (3) calculating and recording a weekly radon-222 emission rate for the mine. Model the dose to the nearest member of the public by using COMPLY-R, as required by 40 CFR Part 61, Subpart B.	X		
	• In cases where radon doses to nearby residents exceed the NESHAP (40 CFR Part 61 Subpart B) dose limit of 10 mrem/yr, implement one or more of the following measures to reduce the potential radon exposures: (1) increase the ventilation flow rate, (2) reroute ventilation flow, (3) reroute ventilation to a new vent, (4) modify the vent stack, (5) decrease the vent stack diameter, (6) increase the vent stack release height, or (7) construct additional bulkheads. What will this do? OK	X		
	• Promptly close off all mine openings and install warning signs of potentially high levels of radiation exposures when finishing the mining activities to prevent any inadvertent intrusion to the mine or getting too close to the mine openings.		X	
	• Assure an adequate thickness for the surface soil material covering waste-rock piles before seeding. The thickness should be adequate to prevent the underlying waste rocks from exposure to the ground surface over time. Through modeling and/or monitoring, evaluate measured uranium and decay product concentrations in waste rocks to determine whether the thickness is sufficient to mitigate potential radiation exposures.		X	
M-12	**Assure safe and proper transportation**			
	• Maintain the haul trucks for exclusive use only. Avoid using trucks for cartage of material other than uranium ore unless they have been properly cleaned for unrestricted use.	X		
	• Use a gravel track pad or similar method to minimize tracking of mud and dirt from any mine site onto the local public and county roads that provide site access.			X
	• Assure that uranium ore shipments proceed directly to the mill from the mine location. Identify locations for potential "safe havens" for temporary wayside parking or storage in the event there are unforeseen delays or scheduling issues associated with the mill.		X[s]	
	• Assure that mine and mill operators are aware of the routes used for shipments of uranium ore.		X[s]	

REROUTE FLOW WHERE

shown to be compliant?

How

Don't we already know this and isn't it a compliance measure

TABLE 4.6-1 (Cont.)

Measure Description	Compliance Measure[a]	Mitigation Measure[b]	BMP[c]
• The State of Colorado Highway Access Code recognizes the right of reasonable access, by development, to the state highway system, providing the development mitigates traffic impacts on the highway at the point of access to the state highway. This would also apply to the traffic generation/impacts from the lease tracts considered in the Draft ULP EIS. As a measure to minimize potential traffic impacts due to the ULP proposed action, the following steps would be taken by each lease operator prior to opening a mining operation on a lease tract:			
1. The lessee should contact CDOT to meet for an access pre-application meeting to determine the size and scope of traffic impacts to be considered before submitting an access application.			X
2. The lessee shall submit a complete Access Permit Application to CDOT (Region 5 Access Permit Office) for its review. This application should include a traffic impact study (TIS) that identifies the directional distribution and daily and peak-hour volumes of traffic generated to identify if intersection improvements are warranted. Depending upon the size and impacts of a facility, the requirements for a TIS maybe waived for smaller operations, depending upon the outcome of the pre-application meeting. Typically the lessee would receive a response from CDOT within 20 days if additional documentation was needed before the permit would be completed. If CDOT accepted the application with no revisions, a permit would be issued or denied within 45 days of receipt of the application. If revisions were necessary, the application review period (20-day review) would restart upon receipt of the revised information by CDOT.	X		
3. The mine development constructs intersection improvements per the requirements of the access permit issued prior to commencement of the activity.	X		

[a] Compliance measures are those measures needed to fulfill regulatory requirements. Note that Appendix C of the lease agreement requires lessees to comply with all applicable statutes and regulations. Generic leases for the ULP are presented in Appendix A of this Draft ULP PEIS.

[b] Mitigation measures identified in the table include measures that are required by DOE as identified in current leases or that could be added to the leases when modified. DOE may also identify additional mitigation measures.

[c] BMPs are those practices and activities generally implemented within the industry to conserve resources. These BMPs are not necessarily required by DOE but may be implemented to further reduce impacts.

[d] See Appendix C, Section I of the lease agreement.

Footnotes continued on next page.

TABLE 4.6-1 (Cont.)

[e] Except for older diesel equipment meeting emissions requirements that need higher sulfur content for proper functioning.

[f] See Appendix C, Section L of the lease agreement.

[g] See Appendix C, Section J of the lease agreement.

[h] The CDRMS requires lessees to obtain permits for their mining operations and to submit and follow an EPP. Runoff and run-on are specifically addressed on a site-by-site basis, as are issues concerning hydrology and reestablishment of vegetation.

[i] Article XIII MINING PLAN of the lease agreement addresses the process for reclamation; the ULP will work with the BLM to identify and clear local sources of borrow material.

[j] See Appendix C, Section M of the lease agreement; also required to be submitted under Article XII EXPLORATION PLAN of the lease agreement.

[k] See Appendix C, Sections G and H of the lease agreement, which address the location of mining infrastructure.

[l] See Appendix C, Section T of the lease agreement (for applicable lease tracts).

[m] Requirement of the surface management agency, BLM.

[n] Chisel plowing is a method used to alleviate shallow soil compaction by inserting a narrow tool in soil to depths of at least 14 in. (35 cm).

[o] Subsoiling is a method used to alleviate shallow soil compaction by tillage of soil to depths of at least 14 in. (35 cm).

[p] See Appendix C, Section H of the lease agreement.

[q] Measure per CPW.

[r] Primary source of information is USDA and DOI (2007).

[s] See Appendix C, Section P of the lease agreement.

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Table 4.6-1 and further categorized into the following three categories: (1) compliance measures—measures that are required by applicable regulations; (2) mitigation measures—measures that are identified by DOE as being required and that are identified in the current leases or could be included in the next lease modifications (and may or may not be required to fulfill regulatory requirements); and (3) BMPs—best industry practices and activities that should be considered during implementation, as practicable.

Shall?

Reclamation activities would be conducted to assure that post-reclamation mine conditions are protective of the environment and human health. Mitigation measures such as those listed in Table 4.6-1 would be implemented so that potential exposure to a reasonable end-state scenario (i.e., a recreational visitor scenario at the mine site footprint and within the lease tracts and a resident scenario for outside the lease tracts) would be at acceptable risk levels (e.g., meet applicable dose requirements or the EPA's acceptable risk range) for the appropriate end-state land use.

Specifics associated with the measures (compliance or mitigation measures or BMPs) that involve monitoring, sample collection, and the installation of protective elements (e.g., depth of soil cover on waste-rock piles, the necessity for and/or type of liners for water evaporation ponds, other elements) during operations and reclamation would be identified in the mine plans submitted to DOE for review and approval.

4.7 CUMULATIVE IMPACTS

Potential impacts of the five alternatives in combination with the impacts of past, present, and reasonably foreseeable future actions in the region are considered in this section.

Consistent with 40 CFR 1508.7, in this Draft ULP PEIS, a "cumulative impact" is an impact on the environment that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of the agency (Federal or non-Federal) or person that undertakes such actions. A cumulative impacts assessment accounts for both geographic (spatial) and time (temporal) considerations of past, present, and reasonably foreseeable actions. Geographic boundaries can vary by resource area—depending on the amount of time an impact remains in the environment, the extent to which such an impact can migrate, and the magnitude of that impact. Although the geographic extent of cumulative impacts may be less for some resource areas, the boundary for this analysis is conservatively defined as 50 mi (80 km) for all resource areas (see Figure 4.7-1). The primary factor considered for the purpose of the cumulative impacts analysis for this Draft ULP PEIS is whether the other actions would have some influence on the resources in the same time and space as those affected by the implementation of any of the five alternatives, including the proposed action (i.e., continue the ULP for the remainder of the 10-year lease period or for another reasonable period of time).

The primary uses of land within the immediate vicinity (10 mi [16 km]) of the ULP lease tracts are grazing, wildlife habitat, and uranium/vanadium exploration and development. Most of

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APPENDIX C:

EMISSION INVENTORIES, COSTS, AND OTHER ESTIMATES USED AS A BASIS FOR THE ULP PEIS IMPACT ANALYSES

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APPENDIX C:

EMISSION INVENTORIES, COSTS, AND OTHER ESTIMATES USED AS A BASIS FOR THE ULP PEIS IMPACT ANALYSES

This appendix is a compilation of the emission inventories, cost assumptions and estimates, equipment and materials utilized, and workforce estimates used as the basis for the impact analyses conducted for this Draft ULP PEIS. Estimates of waste volumes (other than those for the waste-rock piles) are also provided. Unless specified elsewhere, the level of effort (number of workers and worker hours), equipment and equipment hours, and cost estimates are based on RS Means construction data (RS Means 2009). Section C.1 presents information to support the analyses for the exploration phase. Sections C.2 and C.3 present similar information for the mine development and operations phase and the reclamation phase, respectively.

C.1 EXPLORATION

Under Alternatives 3 through 5, exploration activities are assumed to occur on the lease tracts being evaluated in this Draft ULP PEIS. Under Alternative 3, Lease Tracts 5, 6, 7, 8, 9, 11, 13, 13A, 15, 18, 21, and 25 are evaluated for potential uranium exploration and mining. Leases for these lease tracts were held in 2007 by Gold Eagle Mining, Inc., and Cotter Corporation. Lease Tract 7 was composed of two tracts (7 and 7A) in 2007, but since then it has been combined into one least tract. Hence, for the purposes of this Draft ULP PEIS, Alternative 3 evaluates 12 lease tracts. Alternatives 4 and 5 evaluate all 31 lease tracts for potential future exploration and mining activities. Tables C.1-1 through C.1-9 tabulate various information developed for use as the basis for the impact analyses presented in Section 4 of this Draft ULP PEIS.

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TABLE C.1-1 Number of Mines Considered per Mine Size and Alternative[a,b]

	No. of Mines per Alternative		
Mine Size	Alt. 3	Alt. 4	Alt. 5
Small	2	6	0
Medium	4	10	16
Large	1	2	2
Very large	1	1	1
Total	8	19	19

[a] Alternatives 1 and 2 are not presented in the table because they do not involve potential future mines to be developed.

[b] The range in size and number of mines considered is based on past mining experience in the region (Cotter 2011a).

TABLE C.1-2 Total Disturbed Acreage per Mine Size and Alternative during Exploration[a,b]

	Disturbed Acreage per Alternative[a]		
Mine Size	Alt. 3	Alt. 4	Alt. 5
Small	0.11	0.33	0
Medium	0.44	1.10	1.76
Large	0.17	0.33	0.33

[a] Alternatives 1 and 2 are not presented in the table because they do not involve potential future mines to be developed. The very large mine size is not considered for exploration because it is only used in reference to the existing open-pit mine on Lease Tract JD-7.

[b] Based on a 20 × 60 ft drilling pad per borehole with two, four, and six exploratory boreholes assumed for each small, medium, and large mine, respectively.

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TABLE C.1-3 Assumed Workforce per Labor Category and Alternative during Exploration

	No. of Workers per Alternative[a]		
Labor Category	Alt. 3	Alt. 4	Alt. 5
Foreman	2.4	5.9	7.0
Laborer	3.4	8.3	9.9
Equipment operator	2.0	4.8	5.7
Truck driver[b]	0.1	0.3	0.3
Cement finisher	0.3	0.8	1.0
Total	8.2	20.1	23.9

[a] No exploration activities for Alternatives 1 and 2.

[b] Also assumed to operate equipment.

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TABLE C.1-4 Assumed Total Costs per Alternative during Exploration[a]

Cost Element	Cost ($ 2009) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Drawings showing boring details	4,810	11,840	14,060
Report and recommendations from PE	10,790	26,560	31,540
Mobilization and demobilization	2,569	6,606	6,606
Mobilization and demobilization, over 500 mi	13,734	35,316	35,316
Air rotary drilling, 6-in.-diameter borehole, unconsolidated, depth of >100 ft	397,667	978,873	1,162,411
Air rotary drilling, 6-in.-diameter borehole, consolidated, depth of >100 ft	132,655	326,536	387,762
Air rotary drilling, 8-in.-diameter borehole, unconsolidated, depth of ≤100 ft	31,488	77,509	92,042
Air rotary drilling, 8-in.-diameter borehole, consolidated, depth of ≤100 ft	17,806	43,830	52,048
Casing for initial borehole	183,082	450,663	535,163
Sample collection during borehole advancement	522,285	1,285,624	1,526,679
Move drill rig around site	72,246	191,609	232,444
Drumming of drill cuttings	202,581	498,474	591,867
Decontamination of drill rig, etc.	1,809	4,453	5,288
Surface pads, concrete (3,000 lb/in.^{2} or psi, 6-in.-thick concrete)	187,534	461,623	548,177
Total direct costs	1,781,057	4,399,517	5,221,404
Contractor's overhead and profit (6%)	107,000	264,000	313,000
Subtotal contractor's costs	1,888,057	4,663,517	5,534,404
Contractor's bond (1%)	19,000	47,000	56,000
Total contractor's field costs	1,907,057	4,710,517	5,590,404
Construction management (10%)	191,000	471,000	559,000
Total field costs	2,098,057	5,181,517	6,149,404
Architect/engineer costs (25%)	524,000	1,295,000	1,538,000
Subtotal	2,622,057	6,476,517	7,687,404
Program management (6%)	157,000	389,000	462,000
Total exploration costs	2,779,000	6,866,000	8,149,000

[a] Exploration activities were assumed to be completed within a 1-year time frame.

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TABLE C.1-5 Assumed Equipment and Total Hours Operated per Mine Size and Alternative during Exploration[a]

Items Assumed	Hours Operated per Mine Size			
	Small	Medium	Large	Very Large
Alternative 3				
Truck, highway, 24,500 GVW,[b] 4×2, 2-axle	214	874	324	0
Flatbed, 8×16 ft	214	862	322	0
Front-end loader, wheeled, 2.5-yd^3 capacity	193	772	290	0
Gas engine, vibrator	221	882	331	0
Water truck	104	416	156	0
Driller/auger	111	452	168	0
Cement truck	141	561	211	0
Alternative 4				
Truck, highway, 24,500 GVW, 4×2, 2-axle	654	2,192	654	0
Flatbed, 8×16 ft	646	2,159	646	0
Front-end loader, wheeled, 2.5-yd^3 capacity	579	1,930	579	0
Gas engine, vibrator	661	2,203	661	0
Water truck	312	1,039	312	0
Driller/auger	339	1,135	339	0
Cement truck	421	1,401	421	0
Alternative 5				
Truck, highway, 24,500 GVW, 4×2, 2-axle	0	3,511	654	0
Flatbed, 8×16 ft	0	3,456	646	0
Front-end loader, wheeled, 2.5-yd^3 capacity	0	3,087	579	0
Gas engine, vibrator	0	3,525	661	0
Water truck	0	1,661	312	0
Driller/auger	0	1,817	339	0
Cement truck	0	2,241	421	0

[a] Exploration activities were assumed to be completed within a 1-year time frame.

[b] GVW = gross vehicle weight.

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TABLE C.1-6 Assumed Total Material Amounts per Alternative during Exploration[a]

	Amount of Materials per Mine Size			
Items Assumed	Small	Medium	Large	Total
Alternative 3				
Diesel fuel (gal)	12,000	49,000	18,000	79,000
Oil and grease (gal)	300	1,100	400	1,800
Water (gal)	12,000	49,000	18,000	79,000
55-gal drums (each)	385	1,539	577	2,501
Concrete (yd^3)	90	360	130	580
Alternative 4				
Diesel fuel (gal)	37,000	124,000	37,000	198,000
Oil and grease (gal)	800	2,700	800	4,300
Water (gal)	37,000	121,000	37,000	195,000
55-gal drums (each)	1,154	3,846	1,154	6,154
Concrete (yd^3)	270	890	270	1,430
Alternative 5				
Diesel fuel (gal)	0	198,000	37,000	235,000
Oil and grease (gal)	0	4,400	800	5,200
Water (gal)	0	194,000	37,000	231,000
55-gal drums (each)	0	6,153	1,154	7,307
Concrete (yd^3)	0	1,420	270	1,690

[a] Exploration activities were assumed to be completed within a 1-year time frame.

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TABLE C.1-7 Assumed Annual Air Emissions on an Individual Mine Basis during Exploration[a]

Criteria Pollutant	Annual Air Emissions (tons) per Mine Size		
	Small	Medium	Large
Total hydrocarbons (THC)	0.1	0.2	0.2
Reactive organic compounds (ROCs)	0.1	0.1	0.2
Nitrogen oxides (NO_x)	0.6	1.2	1.8
Sulfur dioxide (SO_2)	0.1	0.1	0.2
Carbon monoxide (CO)	0.3	0.5	0.8
Total suspended particulates (TSP)	0.1	0.2	0.3
Particulate matter ≤10 μm (PM_{10})[b]	0.1	0.2	0.3
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	0.1	0.1	0.2
Carbon dioxide (CO_2)[d]	68.6	138	206

[a] The latest emission factors were taken from the U.S. Environmental Protection Agency's (EPA's) WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

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TABLE C.1-8 Assumed Total Air Emissions during Exploration[a]

Criteria Pollutant	Total Air Emission (tons) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Total hydrocarbons (THC)	2.2	5.4	6.5
Reactive organic compounds (ROCs)	2.1	5.2	6.2
Nitrogen oxides (NO_x)	17	43	51
Sulfur dioxide (SO_2)	2.0	4.8	5.7
Carbon monoxide (CO)	7.4	18.3	21.7
Total suspended particulates (TSP)	2	5	5
Particulate matter ≤10 μm (PM_{10})[b]	2	4	5
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	1	3	4
Carbon dioxide (CO_2)[d]	2,192	5,415	6,432

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.1-9 Wastes Generated per Alternative during Exploration

Waste Category	Waste Generated (gal) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Sanitary[a]	33,000	81,000	97,000
Other	15,000	36,000	43,000

[a] Amount of sanitary waste was estimated based on the total exploration workforce.

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C.2 MINE DEVELOPMENT AND OPERATIONS

Tables C.2-1 through C.2-16 tabulate various information developed for use as the basis for the impact analyses presented in Section 4 of this Draft ULP PEIS.

TABLE C.2-1 Estimated Material Amounts and Labor Time per Mine Size during Development

	Amount per Mine Size			
Cost Element	Small	Medium	Large	Very Large
Labor (person-hours)	5,015	7,584	11,500	14,671
Steel (tons)	400	528	695	816
Lumber (1,000 board feet)	92	120	153	177
Fuel (gal)	4,981	7,663	11,494	14,559
Lubricant (gal)	1,250	1,750	2,750	3,500
Explosives (tons)	186	249	333	395
Electricity (kWh)	41,000	61,000	102,000	132,000

TABLE C.2-2 Estimated Materials and Labor Time per Alternative during Development

	Amount per Alternative		
Cost Element	Alt. 3	Alt. 4	Alt. 5
Labor (person-hours)	67,000	144,000	159,000
Steel (tons)	4,400	9,900	10,600
Lumber (1,000 board feet)	1,000	2,200	2,400
Fuel (gal)	67,000	144,000	159,000
Lubricant (gal)	16,000	35,000	38,000
Explosives (tons)	2,100	4,700	5,000
Electricity (kWh)	580,000	1,232,000	1,375,000

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TABLE C.2-3 Number of Workers per Mine Size and Worker Salary per Labor Category

Labor Category	No. of Workers per Mine Size				Individual Annual Salary with Overhead and Profit ($)
	Small	Medium	Large	Very Large	
Mine workers	6	10	16	50	81,250
Mechanic	0.1	0.1	0.1	0.1	81,250
Geologist	0.1	0.1	0.1	0.1	137,500
Surveyor	0.1	0.1	0.1	0.1	81,250
Engineer	0.1	0.1	0.1	0.1	81,250
Environmental specialist	0.1	0.1	0.1	0.1	75,000
Other administrative support (e.g., accountant)	0.1	0.1	0.1	0.1	83,333
Total	6.6	10.6	16.6	50.6	

TABLE C.2-4 Annual Worker Salaries per Labor Category and Mine Size

Labor Category	Salary ($) per Mine Size			
	Small	Medium	Large	Very Large
Mine workers	487,500	812,500	1,300,000	4,062,500
Mechanic	8,125	8,125	8,125	8,125
Geologist	13,750	13,750	13,750	13,750
Surveyor	8,125	8,125	8,125	8,125
Engineer	8,125	8,125	8,125	8,125
Environmental specialist	7,500	7,500	7,500	7,500
Other administrative support (e.g., accountant)	8,333	8,333	8,333	8,333
Total	541,458	866,458	1,353,958	4,116,458

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TABLE C.2-5 Number and Cost of Capital Equipment Units per Mine Size

Items Assumed	Number of Units per Mine Size[a]				Unit Cost ($)
	Small	Medium	Large	Very Large	
Underground equipment					
Diesel skid steer loaders, 2-yd^3 capacity	1	2	3	–[a]	55,000
Diesel trucks (buggies), 5- to 10-ton capacity	2	4	8	–	77,800
Development drill, jumbo	1	1	1	–	55,000
Production drills, jacklegs	3	6	9	–	300
Exploration drills, longhole	1	1	2	–	82,000
Diesel boss buggies and utility vehicles	2	3	4	–	12,200
Surface Equipment					
Front-end loader, 2- to 3-yd^3 capacity	1	1	1	1	342,000
Loaders, 8- to 10-yd^3 capacity	–	–	–	3	123,000
Backhoe/skid loader or excavator	1	1	1	1	157,000
Highway haul trucks, 22- to 24-ton capacity	2	2	3	–	599,000
Dump truck, 12 yd^3	–	–	–	3	200,000
Bulldozer, 200 hp	1	1	1	–	315,000
Bulldozer, 400 hp	–	–	–	3	625,000
Motor grader, 140 hp	1	1	1	1	160,000
Flatbed trailer with tractor or 1-ton vehicle	1	1	1	–	10,000
Maintenance truck	–	–	–	1	158,000
Pickup truck, ¾ ton, four-wheel drive	1	1	2	4	30,000
Snow plow	1	1	1	–	62,000
Power generators	1	1	2	–	79,950
Scraper	–	–	–	4	77,200
Truck, ≥60 tons	–	–	–	4	599,000

[a] A dash indicates none.

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TABLE C.2-6 Total Capital Equipment Costs per Alternative

Items Assumed	Total Capital Equipment Cost ($ 2009) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Underground equipment			
Diesel skid steer loaders, 2-yd^3 capacity	715,000	1,760,000	2,090,000
Diesel trucks (buggies), 5- to 10-ton capacity	2,178,400	5,290,400	6,224,000
Development drill, jumbo	385,000	990,000	990,000
Production drills, jacklegs	11,700	28,800	34,200
Exploration drills, longhole	656,000	1,640,000	1,640,000
Diesel boss buggies and utility vehicles	244,000	610,000	683,200
Surface equipment			
Front-end loader, 2- to 3-yd^3 capacity	2,736,000	6,498,000	6,498,000
Loaders, 8- to 10-yd^3 capacity	369,000	369,000	369,000
Backhoe/skid loader or excavator	1,256,000	2,983,000	2,983,000
Highway haul trucks, 22- to 24-ton capacity	8,985,000	22,762,000	22,762,000
Dump truck, 12 yd^3	600,000	600,000	600,000
Bulldozer, 200 hp	2,205,000	5,670,000	5,670,000
Bulldozer, 400 hp	1,875,000	1,875,000	1,875,000
Motor grader, 140 hp	1,280,000	3,040,000	3,040,000
Flatbed trailer with tractor or 1-ton vehicle	70,000	180,000	180,000
Maintenance truck	158,000	158,000	158,000
Pickup truck, ¾ ton, four-wheel drive	360,000	720,000	720,000
Snow plow	434,000	1,116,000	1,116,000
Power generators	639,600	1,599,000	1,599,000
Scraper	308,800	308,800	308,800
Truck, ≥60 tons	2,396,000	2,396,000	2,396,000
Total	27,862,500	60,594,000	61,936,200

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TABLE C.2-7 Estimated Total Capital Costs per Mine Size

	Total Capital Cost ($ 2009) per Mine Size			
Cost Element	Small	Medium	Large	Very Large
Equipment purchase	2,727,000	2,951,000	4,121,000	6,486,000
Labor	242,000	366,000	555,000	708,000
Steel	232,000	306,000	403,000	473,000
Lumber	23,000	30,000	38,000	44,000
Fuel	13,000	20,000	30,000	38,000
Lubricant	5,000	7,000	11,000	14,000
Explosives	124,000	166,000	222,000	263,000
Tires	9,000	14,000	20,000	26,000
Construction materials	223,000	317,000	451,000	554,000
Electricity	4,000	6,000	10,000	13,000
Total direct costs	3,602,000	4,183,000	5,861,000	8,619,000
Contractor's overhead and profit (6%)	216,000	251,000	352,000	517,000
Subtotal contractor's costs	3,818,000	4,434,000	6,213,000	9,136,000
Contractor's bond (1%)	38,000	44,000	62,000	91,000
Total contractor's field costs	3,856,000	4,478,000	6,275,000	9,227,000
Construction management (10%)	386,000	448,000	628,000	923,000
Total field costs	4,242,000	4,926,000	6,903,000	10,150,000
Architecture/engineering costs (25%)	1,061,000	1,232,000	1,726,000	2,538,000
Subtotal	5,303,000	6,158,000	8,629,000	12,688,000
Program management (6%)	318,000	369,000	518,000	761,000
Total capital costs	5,621,000	6,527,000	9,147,000	13,449,000

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TABLE C.2-8 Estimated Total Capital Costs per Alternative

Cost Element	Total Capital Cost ($ 2009) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Equipment purchase	27,863,000	60,595,000	61,937,000
Labor	3,213,000	6,934,000	7,681,000
Steel	2,565,000	5,732,000	6,174,000
Lumber	246,000	555,000	593,000
Fuel	174,000	375,000	414,000
Lubricant	64,000	138,000	152,000
Explosives	1,396,000	3,108,000	3,359,000
Tires	118,000	257,000	283,000
Construction materials	2,717,000	5,958,000	6,524,000
Electricity	57,000	121,000	135,000
Total direct costs	38,413,000	83,773,000	87,252,000
Contractor's overhead and profit (6%)	2,305,000	5,026,000	5,235,000
Subtotal contractor's costs	40,718,000	88,799,000	92,487,000
Contractor's bond (1%)	407,000	888,000	925,000
Total contractor's field costs	41,125,000	89,687,000	93,412,000
Construction management (10%)	4,113,000	8,969,000	9,341,000
Total field costs	45,238,000	98,656,000	102,753,000
Architecture/engineering costs (25%)	11,310,000	24,664,000	25,688,000
Subtotal	56,548,000	123,320,000	128,441,000
Program management (6%)	3,393,000	7,399,000	7,706,000
Total capital costs	59,941,000	130,719,000	136,147,000

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TABLE C.2-9 Assumed Annual Air Emissions on an Individual Mine Basis during Development[a]

Criteria Pollutant	Annual Air Emissions (tons) per Mine Size			
	Small	Medium	Large	Very Large
Total hydrocarbons (THC)	0.1	0.1	0.1	0.2
Reactive organic compounds (ROCs)	0.1	0.1	0.1	0.2
Nitrogen oxides (NO_x)	2.2	3.0	4.2	5.1
Sulfur dioxide (SO_2)	0.3	0.4	0.5	0.6
Carbon monoxide (CO)	6.5	8.8	11.8	14.0
Total suspended particulates (TSP)	11.3	15.5	20.6	58.1
Particulate matter ≤10 μm (PM_{10})[b]	9.6	13.1	17.4	37.5
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	1.2	1.6	2.1	5.0
Carbon dioxide (CO_2)[d]	56.8	84.3	126	162

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

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TABLE C.2-10 Estimated Annual Air Emissions per Alternative during Development[a]

Criteria Pollutant	Annual Air Emissions (tons) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Total hydrocarbons (THC)	0.8	1.8	2.0
Reactive organic compounds (ROCs)	0.8	1.7	1.9
Nitrogen oxides (NO_x)	26	57	62
Sulfur dioxide (SO_2)	3.1	6.9	7.5
Carbon monoxide (CO)	74	165	176
Total suspended particulates (TSP)	262	520	554
Particulate matter ≤10 μm (PM_{10})[b]	225	459	489
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	36	73	78
Carbon dioxide (CO_2)[d]	745	1,601	1,767

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.2-11 Wastes Generated per Alternative during Development

Waste Category	Waste Generated (gal) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Sanitary[a]	136,000	292,000	322,000
Other	60,000	130,000	143,000

[a] Amount of sanitary waste was estimated based on total construction workforce.

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TABLE C.2-12 Total Worker Peak-Year Annual Wages per Mine Size and Alternative

	Annual Wages ($) per Alternative		
Mine Size	Alt. 3	Alt. 4	Alt. 5
Small	1,083,000	3,249,000	0
Medium	3,466,000	8,665,000	13,863,000
Large	1,354,000	2,708,000	2,708,000
Very large	4,116,000	4,116,000	4,116,000
Total	10,019,000	18,738,000	20,688,000

TABLE C.2-13 Peak-Year Annual Water Usage per Mine Size and Alternative during Operations[a]

	Monthly Volume per Mine Size (gal)	Total Annual Volume per Alternative (gal)		
Mine Size		Alt. 3	Alt. 4	Alt. 5
Small	7,583	181,992	545,976	0
Medium	30,666	1,471,968	3,679,920	5,887,872
Large	45,999	551,988	1,103,976	1,103,976
Very large[b]	160,000	960,000	960,000	960,000
Total		3,165,948	6,289,872	7,951,848

[a] Based on per-mine water use from Cotter (2011b) and Ribeiro (2012).

[b] Assumes water usage for 6 months only (summer) for dust suppression activities.

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TABLE C.2-14 Total Peak-Year Annual Cost of Operations per Alternative

Item	Annual Cost of Operations ($) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Mining equipment operations	5,553,000	$5,553,000	4,579,000
Utilities (electricity)	229,000	489,000	546,000
Diesel fuel	180,000	373,000	425,000
Other materials (explosives)	41,000	83,000	95,000
Water	21,000	36,000	45,000
Worker salaries	10,019,000	18,738,000	20,687,000
Total	16,043,000	25,272,000	26,377,000

TABLE C.2-15 Assumed Annual Air Emissions on an Individual Mine Basis during Operations[a]

Criteria Pollutant	Annual Air Emissions (tons) per Mine Size			
	Small	Medium	Large	Very Large
Total hydrocarbons (THC)	0.75	0.59	4.48	8.63
Reactive organic compounds (ROCs)	0.72	0.57	4.30	8.29
Nitrogen oxides (NO_x)	7.36	5.85	44.03	84.71
Sulfur dioxide (SO_2)	0.95	0.75	5.66	10.89
Carbon monoxide (CO)	3.42	2.84	20.30	38.90
Total suspended particulates (TSP)	7.11	0.56	4.23	8.15
Particulate matter ≤10 μm (PM_{10})[b]	4.00	0.53	4.02	7.74
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	0.79	0.47	3.58	6.89
Carbon dioxide (CO_2)[d]	672	532	4,025	7,748

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

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TABLE C.2-16 Estimated Peak-Year Annual Air Emissions per Alternative during Operations[a]

Criteria Pollutant	Annual Air Emissions (tons) per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Total hydrocarbons (THC)	14.0	28.0	31.6
Reactive organic compounds (ROCs)	13.4	26.9	30.4
Nitrogen oxides (NO_x)	137.7	275.5	313.1
Sulfur dioxide (SO_2)	17.7	35.4	40.1
Carbon monoxide (CO)	64.2	128.4	145.1
Total suspended particulates (TSP)	32	65	74
Particulate matter ≤10 μm (PM_{10})[b]	23	45	51
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	11.8	23.5	26.7
Carbon dioxide (CO_2)[d]	13,000	25,000	29,000

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

C.3 RECLAMATION

The reclamation phase would occur under each of the five alternatives evaluated in the Draft PEIS. Tables C.3-1 through C.3-8 tabulate the information developed as a basis for the impact analyses discussed in Chapter 4. The basis for the estimated values used in Table C.3-1 is that it would take 3 months per mine site for 1 team to complete reclamation. Under Alternatives 1 and 2, 10 mine sites would be reclaimed (9 mines plus JD-7, the open-pit mine).

The assumptions made for Alternative 3 would be the same as those made for Alternatives 1 and 2 because essentially the same number of mines would be reclaimed.

The assumptions made for Alternatives 4 and 5 would be the same since the number of mines would be the same (i.e., 18 mines plus JD-7). Each of the 18 underground mines would require 3 months to reclaim by 1 team. It is assumed that there would be 5 reclamation teams for the 18 underground mines. Three of these teams would be able to work for 12 months rather than only 9 months, because they would be working at the southern lease tracts (i.e., where no snow would inhibit field work). Thus, 3 teams × 12 months = 36 months, plus 2 teams × 9 months = 18 months, for a total of 54 months available for reclamation. The open-pit mine (JD-7) would

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be reclaimed by a separate team consisting of 14 workers, and it is assumed that reclamation would take 12 months to complete.

TABLE C.3-1 Assumed Workforce per Labor Category, Team, JD-7 Mine, and Alternative during Reclamation

Labor Category	No. of Workers per Team[a]	No. of Workers for JD-7 Mine	Total No. of Workers per Alternative			
			Alts. 1 and 2[b]	Alt. 3[c]	Alt. 4[d]	Alt. 5[e]
Foreman	1	1	4	4	6	6
Equipment operator	3	10	19	19	25	25
Truck driver[f]	1	2	5	5	7	7
Electrician/mechanic[g]	0	1	1	1	1	1
Total	5	14	29	29	39	39

[a] Other than for work on JD-7 open-pit mine.

[b] Three teams plus the JD-7 team.

[c] Three teams plus the JD-7 team.

[d] Five teams plus the JD-7 team.

[e] Five teams plus the JD-7 team.

[f] Also assumed to operate equipment.

[g] Assumed for very large mine (JD-7) reclamation only.

TABLE C.3-2 Total Disturbed Acreage per Mine Size and Alternative during Reclamation[a]

Mine Size	Disturbed Acreage per Alternative		
	Alt. 3	Alt. 4	Alt. 5
Small	20	60	0
Medium	60	150	240
Large	20	40	40
Very large	210	210	210

[a] Alternatives 1 and 2 would each involve the reclamation of 257 acres (Cotter 2012) as shown in Table 2.2-1 and involve 10 lease tracts.

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1 **TABLE C.3-3 Assumed Total Costs per Alternative during Reclamation**

Cost Element	Costs ($ 2009) per Alternative			
	Alts. 1 and 2	Alt. 3	Alt. 4	Alt. 5
Remove aboveground structures	58,436	62,085	136,157	149,067
Seal portal(s)	23,000	18,400	43,700	43,700
Establish 3:1 slopes	447,621	539,931	801,189	853,440
Pock areas of steep slope to reduce future erosion	486,831	587,229	871,371	928,200
Spread available topsoil over pocking	58,009	69,971	103,829	110,600
Cut and fill and water bars on access road	153,906	185,646	275,474	293,440
Revegetate slope and access road	1,297,055	1,564,541	2,321,577	2,472,985
Place obstruction boulders at access entrance	3,060	2,448	5,814	5,814
Replace ore in mine	13,472	17,963	35,925	41,314
Remove 18 in. of subsurface from ore pad area	98,760	131,680	263,360	302,864
Rip compacted areas	59,427	71,683	106,368	113,305
Spread topsoil over disturbed areas	40,072	48,335	71,723	76,401
Backfill sedimentation pond	28,122	33,922	50,335	53,618
Seal ventilation shafts (72-in. diameter)	85,190	68,152	161,861	161,861
Seal power drop holes	2,540	2,032	4,826	4,826
Remove power drops	4,690	3,752	8,911	8,911
Rip vent and power drop pads	8,327	10,045	14,905	15,877
Push topsoil over vent and power drop pads	3,955	4,770	7,078	7,540
Revegetate area around vent and power drop pads	60,917	73,480	109,034	116,145
Conduct initial site mobilization	49,840	39,872	94,696	94,696
Conduct secondary seeding mobilization	18,380	14,704	34,922	34,922
Total direct costs	3,001,610	3,550,640	5,523,056	5,889,526
Contractor's overhead and profit (6%)	180,000	213,000	331,000	353,000
Subtotal contractor's costs	3,181,610	3,763,640	5,854,056	6,242,526
Contractor's bond (1%)	32,000	38,000	60,000	63,000
Total contractor's field costs	3,213,610	3,801,640	5,914,056	6,305,526
Construction management (10%)	321,000	380,000	591,000	630,000
Total field costs	3,534,610	4,181,640	6,505,056	6,935,526
Architecture/engineering costs (25%)	883,000	1,045,000	1,626,000	1,733,000
Subtotal	4,417,610	5,226,640	8,131,056	8,668,526
Program management (6%)	266,000	314,000	488,000	521,000
Total reclamation costs (rounded)	4,684,000	5,541,000	8,619,000	9,189,000

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TABLE C.3-4 Assumed Equipment and Total Hours of Operation per Mine Size and Alternative during Reclamation

Items Assumed	Total Hours of Operation per Mine Size			
	Small	Medium	Large	Very Large
Alternatives 1 and 2				
Bulldozer, 310 hp	903	0	0	3,719
Diesel skid steer loaders, 2-yd^3 capacity	725	0	0	2,614
Motor grader, 140 hp	233	0	0	729
Excavator , 125 hp	1,179	0	0	4,953
Front-end loader, 2- to 3-yd^3 capacity	1,149	0	0	626
Grass drill and seeder	725	0	0	2,614
Dump trucks, 12 yd	1,189	0	0	1,998
Flatbed trailer with tractor or 1-ton vehicle	144	0	0	16
Pickup truck, ¾ ton, four-wheel drive	0	0	0	4,400
Alternative 3				
Bulldozer, 310 hp	369	1,092	361	3,719
Diesel skid steer loaders, 2-yd^3 capacity	279	806	263	2,614
Motor grader, 140 hp	85	238	77	729
Excavator, 125 hp	487	1,445	479	4,953
Front-end loader, 2- to 3-yd^3 capacity	255	909	427	626
Grass drill and seeder	279	806	263	2,614
Dump trucks, 12 yd	331	1,152	498	1,998
Flatbed trailer with tractor or 1-ton vehicle	32	64	16	16
Pickup truck, ¾ ton, four-wheel drive	0	2,200	2,200	4,400
Alternative 4				
Bulldozer, 310 hp	1,108	2,731	723	3,719
Diesel skid steer loaders, 2-yd^3 capacity	838	2,016	527	2,614
Motor grader, 140 hp	254	595	153	729
Excavator, 125 hp	1,461	3,612	958	4,953
Front-end loader, 2- to 3-yd^3 capacity	766	2,273	853	626
Grass drill and seeder	838	2,016	527	2,614
Dump trucks, 12 yd	992	2,879	996	1,998
Flatbed trailer with tractor or 1-ton vehicle	96	160	32	16
Pickup truck, ¾ ton, four-wheel drive	0	4,400	2,200	4,400
Alternative 5				
Bulldozer, 310 hp	0	4,369	723	3,719
Diesel skid steer loaders, 2-yd^3 capacity	0	3,225	527	2,614
Motor grader, 140 hp	0	952	153	729
Excavator, 125 hp	0	5,780	958	4,953
Front-end loader, 2- to 3-yd^3 capacity	0	3,638	853	626
Grass drill and seeder	0	3,225	527	2,614
Dump trucks, 12 yd	0	4,607	996	1,998
Flatbed trailer with tractor or 1-ton vehicle	0	256	32	16
Pickup truck, ¾ ton, four-wheel drive	0	4,400	2,200	4,400

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TABLE C.3-5 Assumed Amounts of Materials per Mine Size and Alternative during Reclamation

Items Assumed	Amount of Materials per Mine Size				
	Small	Medium	Large	Very Large	Total
Alternatives 1 and 2					
Diesel fuel (gal)	25,000	0	0	76,000	101,000
Oil and grease (gal)	1,300	0	0	3,800	5,100
Water (gal)	45,350	0	0	114,900	160,000
Grass seed (40 lb/acre) (tons)	0.9	0	0	4.2	5.14
Hay, delivered (1 ton/acre) (tons)	47	0	0	210	257
Alternative 3					
Diesel fuel (gal)	9,000	29,000	12,000	76,000	126,000
Oil and grease (gal)	400	1,700	900	3,800	6,800
Water (gal)	29,000	53,400	29,000	114,900	226,000
Grass seed (40 lb/acre) (tons)	0.4	1.2	0.4	4.2	6.2
Hay, delivered (1 ton/acre) (tons)	20	60	20	210	310
Alternative 4					
Diesel fuel (gal)	26,000	71,000	22,000	76,000	195,000
Oil and grease (gal)	1,200	4,100	1,400	3,800	10,500
Water (gal)	53,400	99,900	38,800	114,900	307,000
Grass seed (40 lb/acre) (tons)	1.2	3.0	0.8	4.2	9.2
Hay, delivered (1 ton/acre) (tons)	60	150	40	210	460
Alternative 5					
Diesel fuel (gal)	0	111,000	22,000	76,000	209,000
Oil and grease (gal)	0	6,000	1,400	3,800	11,200
Water (gal)	0	151,200	38,800	114,900	305,000
Grass seed (40 lb/acre) (tons)	0.0	4.8	0.8	4.2	9.8
Hay, delivered (1 ton/acre) (tons)	0	240	40	210	490

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TABLE C.3-6 Assumed Annual Air Emissions on an Individual Mine Basis during Reclamation[a]

	Annual Air Emissions (tons) per Mine Size			
Criteria Pollutant	Small	Medium	Large	Very Large
Total hydrocarbons (THC)	0.05	0.09	0.14	0.92
Reactive organic compounds (ROCs)	0.05	0.08	0.13	0.88
Nitrogen oxides (NO_x)	0.52	0.84	1.30	9.07
Sulfur dioxide (SO_2)	0.07	0.11	0.18	1.18
Carbon monoxide (CO)	0.24	0.41	0.66	4.33
Total suspended particulates (TSP)	2.00	2.97	7.88	157
Particulate matter ≤10 μm (PM_{10})[b]	1.05	1.54	5.98	137
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	0.19	0.29	1.22	28.1
Carbon dioxide (CO_2)[d]	48.6	80.4	128	854

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

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TABLE C.3-7 Assumed Total Air Emissions during Reclamation[a]

Criteria Pollutant	Total Air Emissions (tons) per Alternative			
	Alts. 1 and 2	Alt. 3	Alt. 4	Alt. 5
Total hydrocarbons (THC)	1.2	1.5	2.4	2.6
Reactive organic compounds (ROCs)	1.2	1.5	2.3	2.5
Nitrogen oxides (NO_x)	12	15	23	25
Sulfur dioxide (SO_2)	1.6	2.0	3.0	3.3
Carbon monoxide (CO)	5.8	7.2	11.1	12.0
Total suspended particulates (TSP)	167	180	216	221
Particulate matter ≤10 μm (PM_{10})[b]	142	150	172	175
Particulate matter ≤2.5 μm ($PM_{2.5}$)[c]	29	31	35	35
Carbon dioxide (CO_2)[d]	1,140	1,420	2,200	2,360

[a] The latest emission factors were taken from the EPA's WebFIRE application located at http://cfpub.epa.gov/webfire/.

[b] Assumes that the construction emission factor for fugitive dust PM_{10} is 0.22 ton/acre-mo (average conditions) (SCAQMD 2007).

[c] Assumes that 21% of fugitive dust PM_{10} is $PM_{2.5}$ and that 89% of combustion PM_{10} is $PM_{2.5}$ (SCAQMD undated).

[d] The CO_2 emission factor for diesel fuel was taken from EPA (2008).

TABLE C.3-8 Wastes Generated per Alternative during Reclamation

Waste Category	Waste Generated (gal) per Alternative			
	Alts. 1 and 2	Alt. 3	Alt. 4	Alt. 5
Sanitary[a]	81,000	126,000	162,000	154,000
Other	36,000	56,000	72,000	68,000

[a] Amount of sanitary waste was estimated based on the total reclamation workforce.

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