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 the draft version of the 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 DOE would continue to manage the withdrawn lands, without uranium leasing, in accordance with applicable requirements.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.

In the 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 (e.g., Cotter Corp. 2011, 2012a–g) 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.

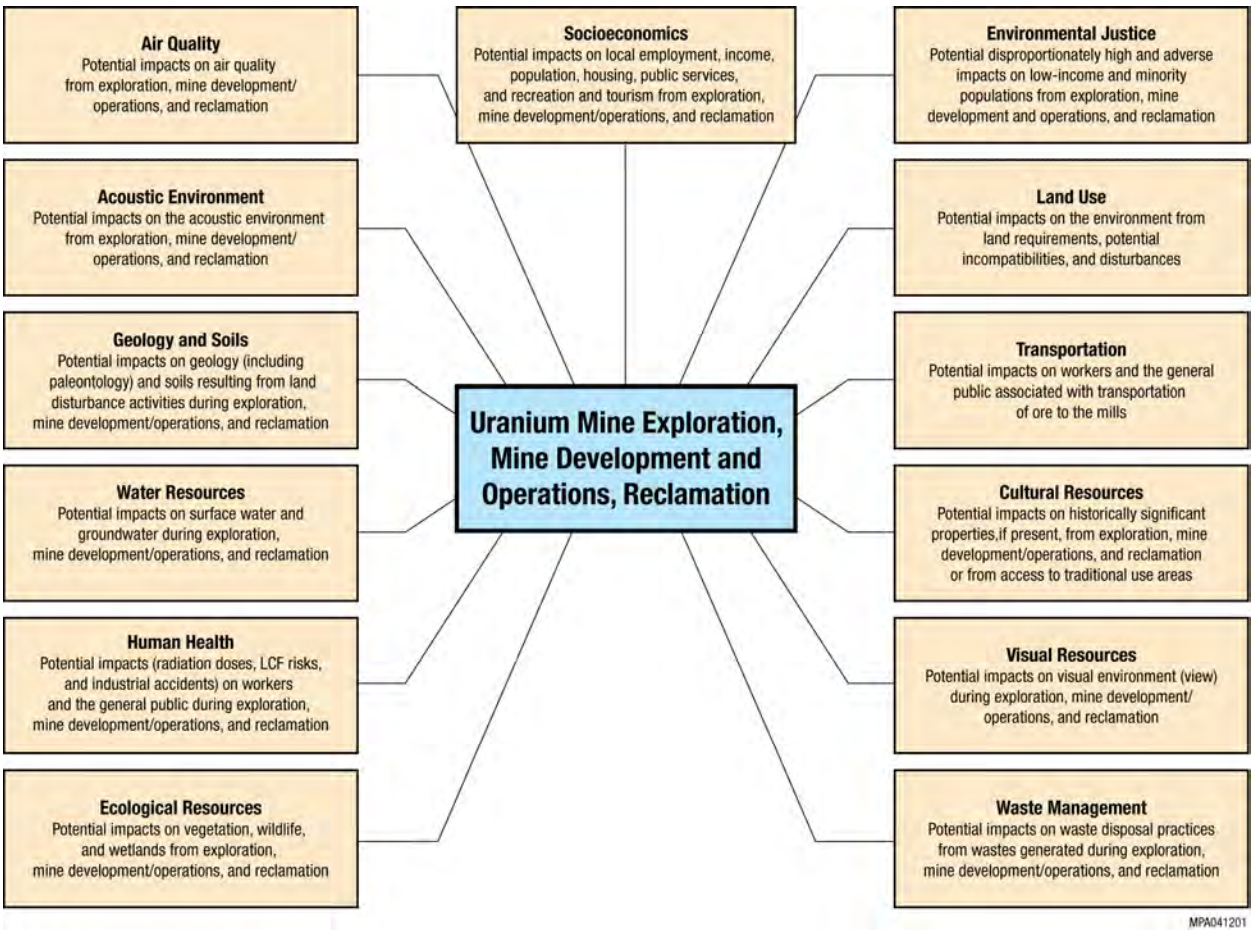

FIGURE 2-1 Thirteen Human Health and Environmental Resource Areas That Are Evaluated for Potential Impacts from Exploration, Mine Development and Operations, and Reclamation

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

considered with past, present, and reasonably foreseeable future actions in the region of influence (ROI) for cumulative impacts for the 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 the 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.

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 (see Section 4.7.2.2.7). 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)

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 maintenance activities, hoses, fuel lines, tank exteriors, and equipment parts stored in the service

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

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

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

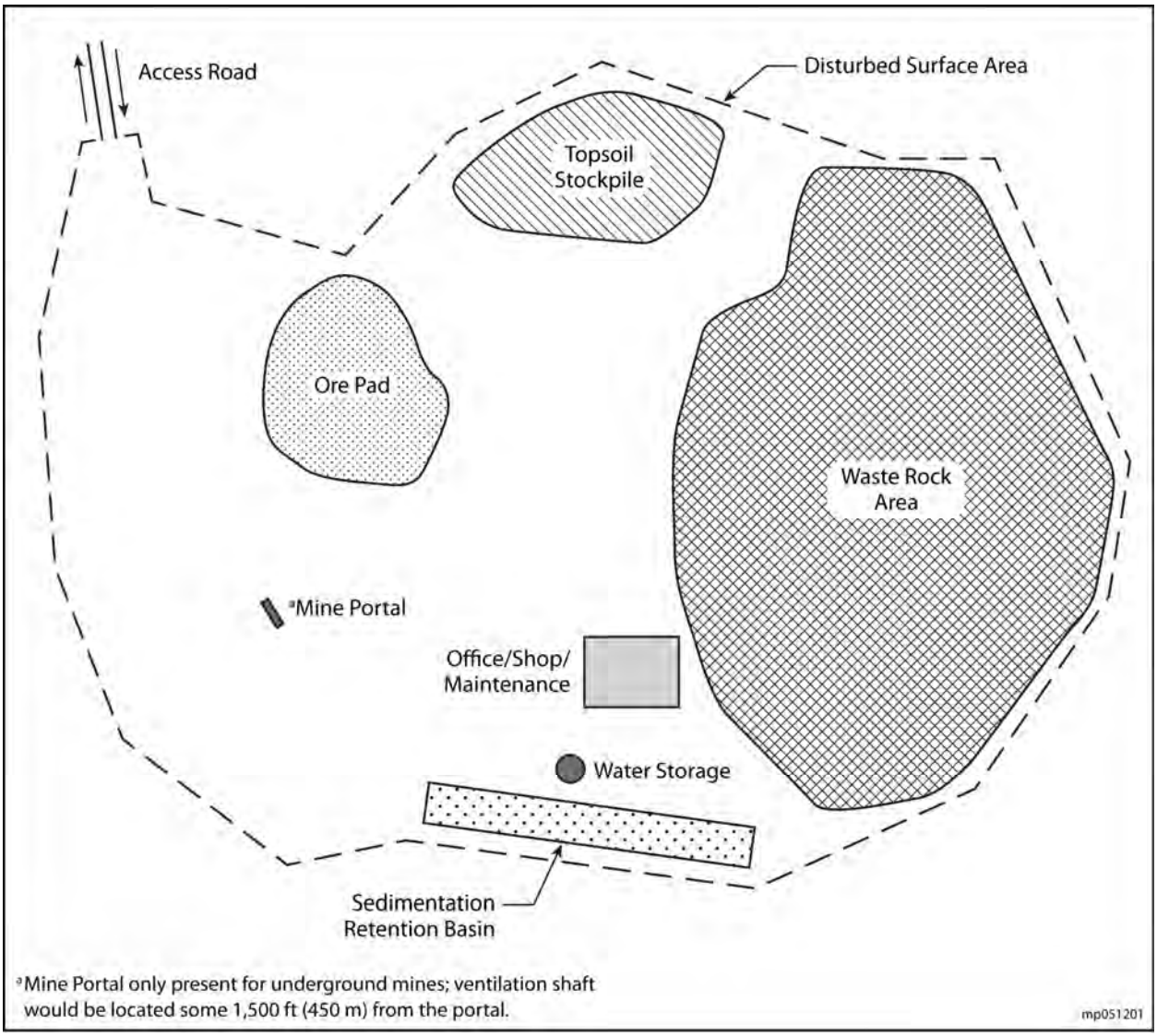

FIGURE 2.1-5 Schematic of a Generic Mine Plant Surface Configuration

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 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 EPP (e.g., Cotter Corp. 2011, 2012a–g). The design for the stormwater diversion ditches has to be approved by an engineer.

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:

- 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.

- 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. Mine permit and mine permit amendment applications are required to include reclamation plans. The following information is partly abstracted from reclamation plans prepared by Cotter Corp. (2011, 2012a–g).

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 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 an asset of Ontario's Energy Fuels, Inc., located in Lakewood, Colorado), following CDPHE's preparations of a decision analysis and environmental impact analysis (CDPHE 2011d). A group of plaintiffs 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 CDPHE's action in issuing the license, remanded the case for further proceedings, and ordered CDPHE to convene an additional hearing scheduled for April 2013. On April 25, 2013, CDPHE decided to issue to Energy Fuels

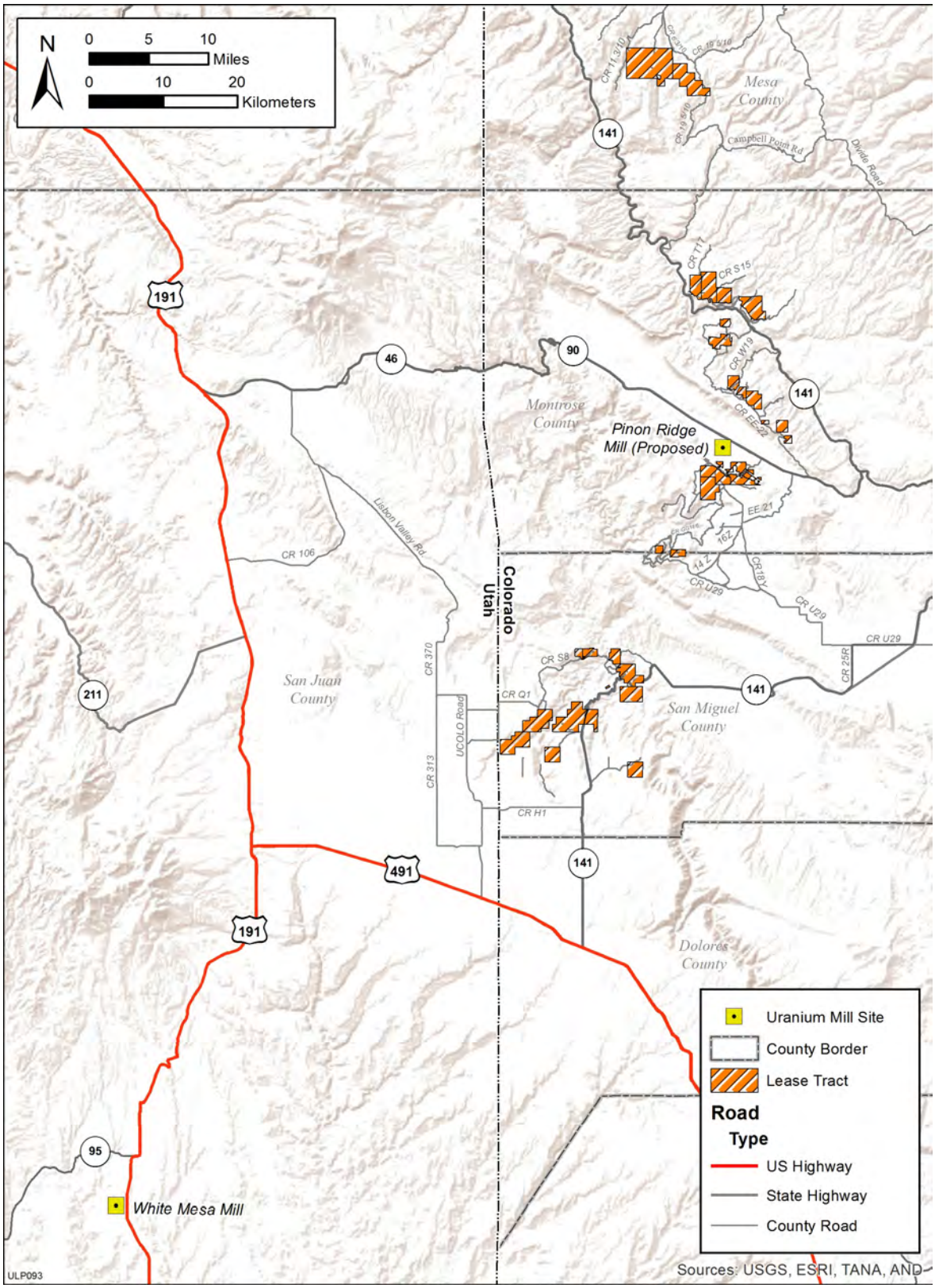

FIGURE 2.1-6 Locations of White Mesa Mill and Proposed Piñon Ridge Mill

Resources Corporation a final radioactive materials license that imposed a number of conditions on the construction and operation of the proposed Pinon Ridge Mill (CDPHE 2013). In May 2013, a group of plaintiffs filed for judicial review of that CDPHE decision in the District Court for the City and County of Denver.

The proposed 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).

The proposed 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 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 the 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 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

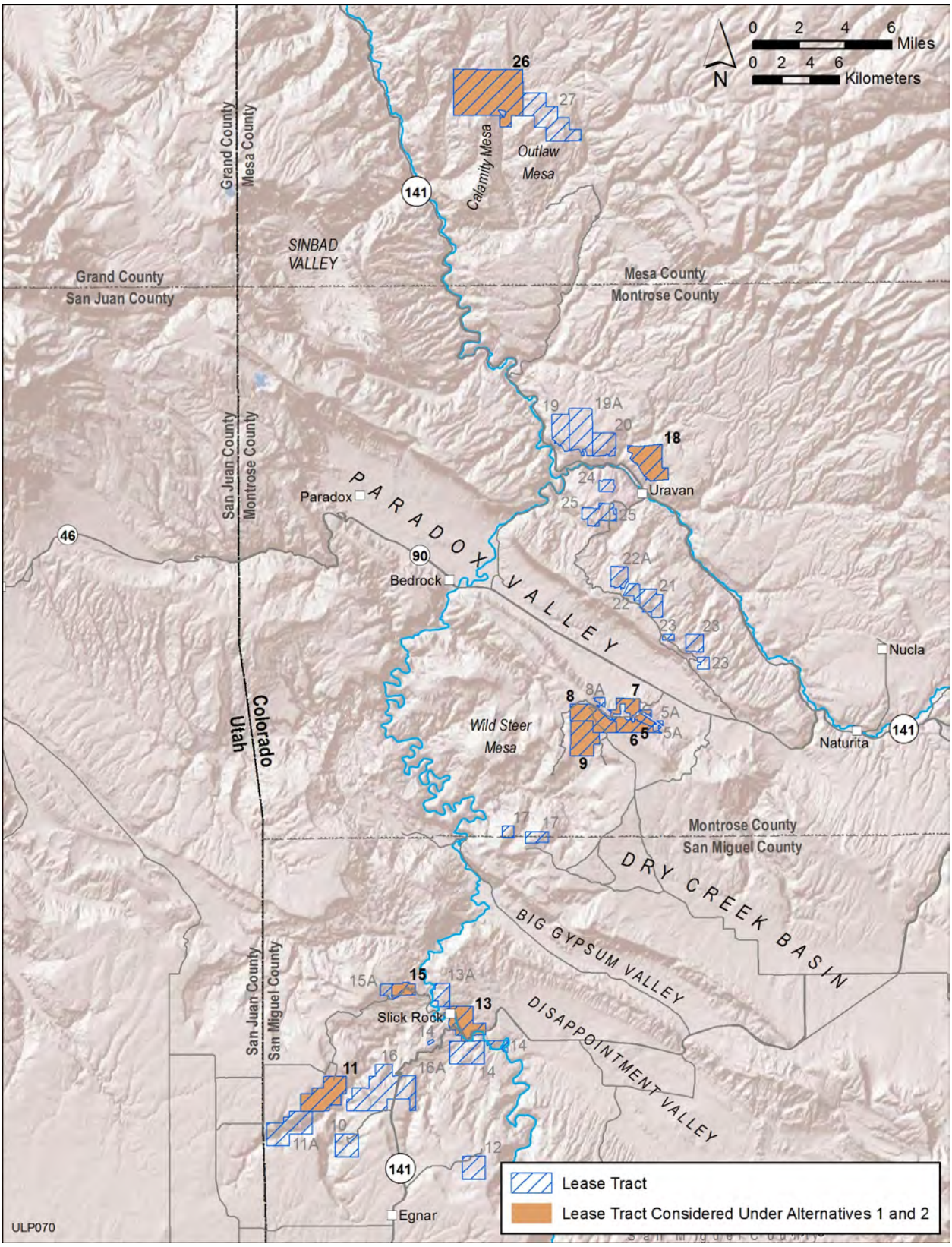

FIGURE 2.2-1 Locations of Lease Tracts Evaluated under Alternatives 1 and 2

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 construction of the decline was temporarily suspended, Cotter Corporation had disturbed just less than 5 acres (2 ha) and had advanced the decline approximately 300 ft (90 m). The development of the decline created a small mine waste-rock dump at the site, which is how conditions remain to date.

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.

2.2.1.1 Basis for Impacts Analyses for Alternative 1

The affected environment for resource areas evaluated in the 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 the 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 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 the 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.

2.2.2.1 Basis for Impacts Analyses for Alternative 2

The basis for the analysis of impacts for Alternative 2 in the 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 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

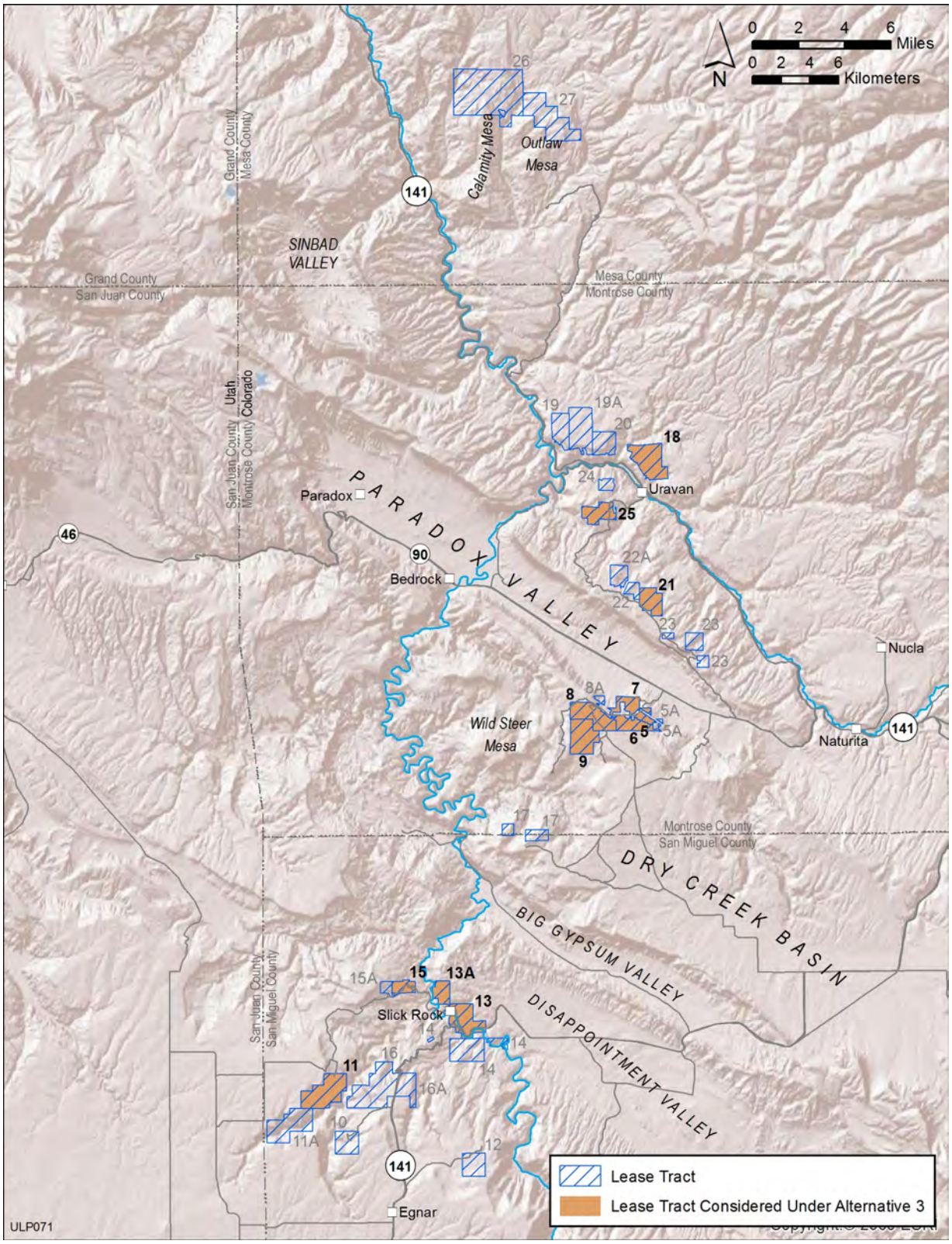

FIGURE 2.2-2 Locations of Lease Tracts Evaluated under Alternative 3

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.

purposes of the analyses for the 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 the 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.

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 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 remain in effect, 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.

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 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

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 the 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 both the mine development and operations phase and the reclamation phase, (2) the cost of 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 the 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 Impacts 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 the 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 would be the same as that assumed for the peak year discussed here.

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

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.

Mill is expected to process only up to 500 tons/d in its initial operating period once it is built, and 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, covered with a layer of soil materials, 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.

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

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

Parameter Assumed	Value for Parameter per Size of Mine: 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.

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.

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 the 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

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.

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.

necessary release and approval from DOE, BLM, and CDRMS. The equipment required would be similar to that discussed for Alternatives 1 through 4.

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 1.4.

DOE has focused the ULP PEIS on its authority to manage the leasing of land with known uranium resources withdrawn under AEA Public Land Order 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. The 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. No decisions to be made under the ULP would affect environmental impacts from the use of uranium, including the management of the back end of the nuclear fuel cycle. 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.

There is no need to evaluate the ISL method for mining uranium in the 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 the 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. Table 2.4-1 provides the intended meaning of the qualitative terms used to describe the levels of potential impact for the various resources evaluated in the ULP PEIS. Sections 2.4.1 through 2.4.14 describe the potential impacts from the five alternatives evaluated for each of the environmental resource areas and human health (see Tables 2.4-4 through 2.4-9, which appear 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 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.

TABLE 2.4-1 Meaning of Qualitative Terms Used To Describe Potential 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	Potential impacts are calculated and results compared to appropriate regulatory limits or guidelines.	Potential impacts are calculated and results compared to appropriate regulatory limits or guidelines.	Potential impacts are calculated and results compared to appropriate regulatory limits or guidelines.	Potential impacts are calculated and results compared to appropriate regulatory limits or guidelines.
Ecological resources[a]	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	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	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

TABLE 2.4-1 (Cont.)

	Impact Level			
Resource/System	Negligible	Minor	Moderate	Major
Land use (Cont.)		affected activity, community, or resource would return to a condition of no measurable effects once the impacting stressor is eliminated.	resource would have to adjust somewhat 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.	unavoidable disruptions to a 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[b]	Radiological impacts are governed by regulations and were found to be negligible. Traffic accident injuries and fatalities are proportional to the distance travelled, with no fatalities expected under any alternative. One potential traffic injury could occur under some alternatives.	Radiological impacts are governed by regulations and were found to be negligible. Traffic accident injuries and fatalities are proportional to the distance travelled, with no fatalities expected under any alternative. One potential traffic injury could occur under some alternatives.	Radiological impacts are governed by regulations and were found to be negligible. Traffic accident injuries and fatalities are proportional to the distance travelled, with no fatalities expected under any alternative. One potential traffic injury could occur under some alternatives.	Radiological impacts are governed by regulations and were found to be negligible. Traffic accident injuries and fatalities are proportional to the distance travelled, with no fatalities expected under any alternative. One potential traffic injury could occur under some alternatives.
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.

TABLE 2.4-1 (Cont.)

	Impact Level			
Resource/System	Negligible	Minor	Moderate	Major
Visual resources[c]	*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.	*Moderate contrast:* The contrast is likely to be seen by anyone but does not strongly attract and hold visual attention.	*Strong contrast:* The contrast is strong enough to attract and hold visual attention and may dominate the view.

[a] 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.

[b] 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.

[c] The analysis for visual resources focuses 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), moderate, weak, or strong—terms that roughly approximate the four-level classification scheme presented in the table.

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 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.

[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.

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 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 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.

Under Alternatives 1 and 2, potential radiation exposures for reclamation workers were estimated to be about 14.3 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 were the source of the radiation. The corresponding latent cancer fatality (LCF) risk associated with this exposure is estimated to be 1×10^{-5}; i.e., the probability of developing a latent fatal cancer is about 1 in 100,000 (1×10^{5}). These estimates of dose and LCF risk were obtained by assuming a base concentration of 70 pCi/g for Ra-226 in waste rocks (Cotter Corp. 2011, 2012a–g). If a higher or lower concentration was assumed (Cotter Corp. 2011, 2012d), the radiation dose and LCF risk would increase or decrease proportionally. 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 0.13, 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 9 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 110,000 (1.1×10^5) for 1 year of exposure. The hazard index estimated for the chemical exposure is less than 0.03. Again, the above results were obtained assuming a Ra-226 concentration of 70 pCi/g in waste rocks.

With the base concentrations (70 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 0.88 to 30 mrem through external radiation, inhalation, and soil ingestion, assuming he camped on top of the waste-rock pile for 2 weeks. The corresponding LCF risk was estimated to be about 1×10^{-6} to 2×10^{-5}. 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 inactive underground uranium mines, radon levels could range from 3 to 39 working 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 6.9 to 89 mrem/h was estimated, with a corresponding LCF risk ranging from 9×10^{-6} to 1×10^{-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 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 was estimated to result in a hazard index of 1.06, which is slightly above the threshold value of 1; therefore, potential adverse health effects may be incurred by uranium miners. 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 statistical data on average injury and fatality rates of mining-related activities, 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 7.5 to 39 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 17 to 94 person-rem, with a corresponding LCF risk of 0.02 to 0.1. The collective dose estimated under Alternative 5 is 20 to 110 person-rem, with a corresponding LCF risk of 0.03 to 0.1.

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 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 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 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 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.

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. For this reason, DOE determined in its May 2013 BA that 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. DOE has completed ESA Section 7 consultation requirements with the USFWS regarding anticipated impacts on the Colorado River endangered fish and other species listed under the ESA. The USFWS then concluded, in its August 2013 BO, that water depletions under Alternative 3 were not likely to jeopardize the continued existence of the Colorado River endangered fish species and not likely to destroy or adversely modify designated critical habitat; that a water depletion fee did not apply (under a 2010 BO that addressed small water depletions); and that further programmatic consultation is not required (see Section 4.3.6.4.1 and Appendix E).

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 the 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 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 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.

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.

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.

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.

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 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.

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 the 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 ROI for cumulative effects is presented in Table 4.7-11. As mentioned previously, the ROI for 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 ROI for 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 the 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 (of the 33 permitted projects, few of the permits are for mines on the DOE ULP lease tracts); (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 several foreseeable projects related to uranium mining, which are currently in the planning phase. These include the Piñon Ridge Mill[3] and Whirlwind Mine near Gateway.

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 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 ROI for 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

[3] 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 CDPHE issued a final radioactive materials license to Energy Fuels Resources Corporation (which is an asset of Ontario's Energy Fuels, Inc., located in Lakewood, Colorado), following CDPHE's preparations of a decision analysis and environmental impact analysis (CDPHE 2011). A group of plaintiffs 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 CDPHE's action in issuing the license, remanded the case for further proceedings, and ordered CDPHE to convene an additional hearing scheduled for April 2013. On April 25, 2013, CDPHE decided to issue to Energy Fuels Resources Corporation a final radioactive materials license that imposed a number of conditions on the construction and operation of the proposed Piñon Ridge Mill (CDPHE 2013). In May 2013, a group of plaintiffs filed for judicial review of that CDPHE decision in the District Court for the City and County of Denver.

to the types of potential environmental impacts that could occur, and most of these are located closer to (within 25 mi or 40 km of) 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.

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 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 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.

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 have 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 (i.e., 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 (i.e., Lease Tracts 7, 9, and 13). For mine development and operations, activities on lease tracts closest to the Dolores River and San Miguel River (i.e., 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 (i.e., 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 (i.e., 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 (i.e., Lease Tracts 7, 9, and 13). Also, mine development and operations on the lease tracts closest to the Dolores River and San Miguel River (i.e., 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 (i.e., 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.

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)	14.3 (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)	1×10^{-5}	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 – resident	Individual rad dose (mrem/yr)	8.9–0.08[g] (WL: $<5 \times 10^{-4}$)	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Individual LCF risk (1/yr)	9×10^{-6} to 8×10^{-8}[g]	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Chemical risk (HI)	< 0.03	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1

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)	0.88 to 30[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)	1×10^{-6} to 2×10^{-5}	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1	Same as Alt. 1
		Chemical risk (HI)	< 0.39	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)	6.9 to 89[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 1×10^{-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. The estimates listed are based on a Ra-226 concentration of 70 pCi/g in waste-rock piles.

[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 1,600 to 16,000 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.

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).

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 Alternative 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.

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, DOE determined in its May 2013 BA that ULP activities under Alternative 3 may affect, and are likely to adversely affect, the Colorado River endangered fish species and their critical habitat. The USFWS then concluded, in its August 2013 BO, that water depletions under Alternative 3 were not likely to jeopardize the continued existence of the Colorado River endangered fish species and not likely to destroy or adversely modify designated critical habitat; that a water depletion fee did not apply (under a 2010 BO that addressed small water depletions); and that further programmatic consultation is not required (Appendix E).	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.

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; however, no disproportionately high and adverse impacts on low-income or minority populations would occur. 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.

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 tracts 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).

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.

2.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Uranium mining activities associated with the five alternatives evaluated in the 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. 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 1.2 million kWh of electricity, about 9,900 tons of steel, and 590,000 gal (2.3 million L) of fuel and lubricants.

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

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 the ULP PEIS

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 the 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 potential 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.

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—13 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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