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D1 History and Land Use

The Shirley Basin ISR Permit Area (“Permit Area”) is located in the northeastern corner of Carbon County, south-central Wyoming. The Permit Area is in an unpopulated area about 32 miles north of Medicine Bow, Wyoming, about 67 miles northeast of Rawlins, and 34 miles south of Casper. The Permit Area covers approximately 2,712 acres. The main portion of the Permit Area consists of 12 patented lode and mill site claims owned by Pathfinder Mining Corporation (PMC). The Permit Area also includes lands administered by the United States Bureau of Land Management (BLM), portions of which are covered by 26 unpatented lode mining claims to which PMC controls the mineral rights, approximately 283 acres of BLM lands with lode claims controlled by third-party claimants, fee lands (surface and minerals), and lands administered by the Wyoming Office of State Lands and Investments (surface only). All but approximately 290 acres of the Permit Area is within the existing DEQ Permit to Mine 345C boundary. As a result, much of the landscape within the Permit Area has been significantly modified by historical mining operations. **Figure D1-1a** shows the general location of the Permit and Study Areas. **Figure D1-1b** shows the boundaries of the Permit and Study Areas superimposed on NAIP Imagery taken in 2009.

Elevations within the Study area range from approximately 6,900 to 7,500 feet. The regional landscape consists of low rolling hills, mildly dissected by minor ephemeral drainages. Within the Study Area, this is modified by overburden dumps and mine pits from past mining operations which may diverge from natural ground level by as much as 250 feet. Most pits and dumps within the Study Area have been re-contoured and re-vegetated.

The primary drainage in the Study Area is provided by the perennial Little Medicine Bow River, which lies approximately one-half mile east of the Permit Area. A secondary perennial drainage, Spring Creek, transects the northern portion of the Permit Area (see **Appendix D6**). Spring Creek is fed by small springs and ephemeral drainages from the Dugway Rim, north and outside of the Permit Area.

The climate ranges from arid to semi-arid. The average annual precipitation is approximately 10 inches. The weather is dry and windy, with short, warm summers and harsh, cold winters (see **Appendix D4**).

Vegetation in the Project is dominated by cool season perennial grasses and sagebrush. The grasses are a combination of native grass and re-introduced grass in reclaimed areas of historical mining. The sagebrush (*Artemisia tridentata*) is generally short and stunted, but is well adapted to the cold winter temperatures and limited precipitation that characterize the Study Area. Other vegetation identified within the Study Area includes perennial forbs, cushion plants, semi-shrubs, cacti, shrubs and lichens (see **Appendix D8**).

The land within the Permit Area is a mixture of private, (PMC and local ranchers), publicly owned federal land (managed by the United States Bureau of Land Management (BLM) through Rawlins

Field Office, and the Department of Energy (DOE)), and state land (managed by the Wyoming Office of State Lands and Investments). The primary Study Area of land for use includes a two-mile radius from the Permit Area boundary. Within the Study Area, approximately 61 percent of the land is federally owned, 20 percent of the land is privately owned and 19 percent of the land is state owned (**Figure D1-2**). The Primary land use in the Study Area is rangeland for cattle and wildlife habitat, but the area is also used for dispersed recreation such as hunting, fishing, and off-highway vehicle (OHV) use. Regional land uses include grazing, industry, wildlife habitat, hunting, fishing and dispersed recreation, mining, oil and gas extraction, and energy infrastructure.

D1.1 History

The Shirley Basin Mining District (District) is the second largest uranium producing district in Wyoming. It has a rich mining history that includes the first commercial uranium ISR operation in the United States, and the earliest development by geologists of roll front geologic concepts. Over 51 million pounds of uranium were produced from this district from 1960-1992, including over 28 million pounds produced from the lands currently controlled by Pathfinder Mines Corporation.

The earliest uranium exploration and initial discoveries within this remote basin were made in 1955. However, this remained largely unknown to the public until July 1957 when a claim staking and drilling rush swept the region. Utah Mining Corporation (Utah) acquired a large land position in search of additional resources to feed its Lucky Mc mill in the Gas Hills Mining District. Utah's position focused mainly on the northern portions of the District.

Utah's first ore-hole was drilled in August, 1957 in what is now Pit 3, followed by an extensive exploration drilling program. Sufficient reserves were soon discovered to warrant development and in June 1959 underground mine construction was started in what is now the northern portions of Pit 2. Production by Utah/PMC over the years was by three different methods discussed in greater detail below. Initial mining was by underground methods, with the ore shipped to Utah's Lucky Mc mill in the Gas Hills. However, underground mine dewatering proved difficult. Consequently, underground activities were abandoned in 1964 and replaced by the first successful solution mining (ISR) operation in the United States. In 1970, higher production demands prompted Utah to switch to open pit mining. All mining past that point in time has been by open pit. A mill to process the ore on-site was commissioned by Utah in 1971.

Underground Mining – Utah began underground mine construction in June 1959. Underground methods were selected because portions of the reserves were too deep for open-pit mining under the small production quotas allocated at the time by the U.S. Atomic Energy Commission (AEC). The first ore was produced in March 1960. The ore was transported to Utah's Lucky Mc mill in the Gas Hills Uranium District for processing. However, unstable ground conditions due to the unconsolidated nature of the ore sands and high flow of

groundwater resulted in high mining costs. Near the end of this mining phase, 4,000 to 5,000 gallons per minute had to be pumped from the mine in order to maintain the operation. Underground drifting stopped in November 1963 when the decision was made to switch to solution mining (ISR). A total of 110,000 tons of ore were mined from underground operations containing 1.2 million lbs. of uranium.

ISR Operations — It was recognized early in the underground mining phase that the troublesome issues related to unconsolidated permeable host sands and high groundwater flow could be positive factors for ISR. For this reason, research into ISR began in 1962. This research focused on the site hydrological conditions, optimum geometry of wellfield patterns and production/injection well designs.

Commercial ISR operations commenced in 1964 and continued into 1970 when dewatering associated with planned open-pit mining halted operations. These were the first commercial ISR operations in the U.S. and were considered technologically and economically successful. Production lixiviant employed acid leach chemistry. Produced mining solutions were pumped to a uranium recovery plant on the property containing ion exchange, elution and stripping columns. Uranium slurry from this plant was concentrated and shipped to the Lucky Mc mill for final processing. A total of 1.5 million lbs. of uranium was produced through ISR methods.

Open Pit Mining — In November 1968, Utah announced plans to initiate large-scale open-pit mining operations and to construct an 1,800 ton/day mill on its Shirley Basin property. Overburden stripping began in 1969 and in July 1970 ISR production was halted and replaced by open pit production. The first ore run through the mill was in 1971. Production came from three large pits; Pits 2, 3 and 8. Pit 3 and most of Pit 2 were on ground initially acquired by Utah. Pit 8 was on ground acquired later from Petrotomics Company (Petrotomics). All ground that had been previously mined by underground and ISR methods was eventually mined and removed by later open pit mining within Pit 2. Over the years, Pits 2 and 8 eventually expanded into a single large excavation. PMC's open pit mining operations were terminated in 1992 for market and economic reasons after producing a total of 25,563,100 lbs. of uranium.

Corporate identities controlling the Project varied over its history. In 1963, Utah Mining Corporation merged with a sister company, Utah Construction and Mining Company. Then in 1973, Utah Construction and Mining Company restructured and conveyed its interests to Utah International, Inc. In 1976, Utah International, Inc. conveyed its interest to its subsidiary Lucky Mc Uranium Corporation (Lucky Mc), which subsequently changed its name to Pathfinder Mines Corporation (PMC). In 1985, PMC was purchased by COGEMA (now AREVA). Finally, Ur-Energy USA, Inc. acquired PMC in December 2013.

Other significant early operators in the District were Tidewater Oil Company (Tidewater) [later, Getty Oil Company (Getty)] and Kerr McGee Nuclear. Both focused primarily in the southern portions of the District. Petrotomics, a general partnership between Getty and Kerr McGee

Nuclear, started a mill operation in 1962 just south of the Utah property and operated through 1985. Ore from both Petrotomics and Kerr McGee pits were processed through the Petrotomics mill; as was that from an independent third operator, Uranium Supply Services Corporation who mined the Jenkins Pit.

No production has taken place within Shirley Basin since 1992. Prior to that time, based on internal PMC reports, a combined 51,263,100 lbs. of uranium were mined from the District. Of this total, PMC (and its precursor companies) produced 28,263,100 lbs.

Extensive surface reclamation activities have been accomplished throughout the District since termination of mining. All previously mined pits have been partially backfilled, back-sloped and re-vegetated. Four of the pit complexes have been left with pit-lakes (**Figure D5-5**). Two of these, Pit 2/8 and Pit 3 occur within the PMC Shirley Basin Project area. The other two large pit-lakes lie to the south of the Project. One, now called the Walker-Jenkins Lake, has been converted by the Wyoming Game and Fish Department into a public fishing area. Surface use within the District has returned in part to stock grazing and seasonal hunting, or remains as unused grassland. A portion of the former PMC tailings facility has been converted into a commercial disposal site for 11e.(2) radioactive waste, which is operated by PMC.

The following is a brief summary of the significant milestones in the mineral development history of the Shirley Basin Region and PMC Shirley Basin Project.

1955	Teton Exploration makes first uranium discovery, near Medicine Bow River
1957, July	Claim staking and exploration drilling rush starts
1957, Aug.	First ore hole by Utah Mining Company (Utah)
1959, June	Utah started underground mining development
1964, Oct.	Utah replaced underground mining with ISR production
1970, July	Utah replaced ISR with open-pit mining
1971	First ore run through Utah mill
1976	Utah conveys interest to subsidiary Lucky Mc who changes name to Pathfinder Mines
1985	Pathfinder Mines Corp. purchased by COGEMA (Areva)
1992	Mining is terminated
2013, Dec.	Pathfinder Mines Corp. purchased by Ur-Energy USA, Inc.

D1.2 Rangeland and Grazing

There is no crop production within the Permit Area or within two miles of the Permit Area; the only agricultural production is related to grazing. The study area includes portions of eight BLM grazing allotments: Antelope Springs, Bates Benchmark, East Little Medicine, West Little Medicine, Mine, Moss Agate, Sullivan, and 7E Ranch. Much of the central portion of the study area (and most of the Permit Area) was removed from the BLM's allotment program due to the historical mining and ongoing reclamation activities. (**Figure D1-3**).

D1.3 Wildlife Habitat and Hunting

Wildlife use of the Permit Area is discussed in detail in **Appendix D9**. The Wyoming Game and Fish Department (WGFD) hunting areas for antelope, deer, elk, and mountain lion include the Permit Area. Hunting seasons run from September through December, but hunting occurs primarily in October and November. Hunter days for the areas that include the Permit Area are shown in **Table D1-1**.

D1.4 Recreation and Special Use Areas

The Walker Jenkins Lake, a fishing area managed by the Wyoming Game and Fish Department, is located in the southern portion of the Study Area, and is the only designated recreation area or facility within two miles of the Permit Area. There is some dispersed recreational use in the Study Area consisting primarily of hunting, fishing and OHV use. The general area is designated by BLM as an Extensive Resource Management Area (ERMA), which does not have restrictive use compared to a Special Recreation Management Area (SRMA) or Wilderness Study Area (WSA). According to the BLM's Natural Resource Recreation Settings, the area is managed for Middle Country Designation. This designation does not restrict natural resource development and allows motorized and mechanized uses in most areas with some restrictions (BLM, 1987 and 2004c).

D1.5 Minerals and Energy

Wyoming is a state with active Mineral development. The types of development in the region include uranium exploration and mining, coal, oil and gas, and other minerals. More than 51 million pounds of uranium was produced from multiple mines in the Shirley Basin District, primarily from the 1960s through the 1990s.

Uranium exploration in the Permit Area is described in detail in **Appendix D2** and **Appendix D5**. All but approximately 290 acres of the Permit Area lies within PMC's existing DEQ Permit to Mine No. 345C. Within the Study Area, immediately east and outside of the Permit Area, is PMC's

Shirley Basin Mill Tailings Site (NRC License SUA-442, Docket No. 40-6622). Adjacent to the southern boundary of the Permit Area and within the Study Area, is the former site of the Petrotonics South Shirley Basin open-pit mine and mill site, both of which have been reclaimed/dismantled and are under the perpetual care of the Department of Energy **Figure D1-4**. There are no other active conventional uranium mills, mines or In-Situ-Recovery (ISR) Projects within 50 miles of the Permit Area.

There are currently no known active coal or oil and gas leases, nor has there been any historical production of either within the Study Area.

D1.6 Transportation and Infrastructure

The transportation system serving the Permit Area relies almost exclusively on existing public roads and highways. The local and regional transportation network relevant to the Permit Area consists of primary, secondary, local and improved roads (**Figure D1-5**). The Permit Area is served by: an Interstate Highway (I-80); a US Highway (US 30/287); Wyoming Highways 220 and 487; local Carbon County roads; and BLM roads. In addition to the designated routes, there are a number of four-wheel drive routes that traverse the area for recreation, grazing access, and mineral exploration. The road network within two miles of the Permit Area consists of a heavy-duty, raised-gravel road from SR 487 (the original access road to PMC's Shirley Basin Mine permitted under WDEQ PT0345C), County Road 2 East as a Permit Area access road, BLM roads, passable with most conventional passenger vehicles and un-maintained two-track roads that are passable with four-wheel drive vehicles (**Figure D1-1a**).

A regional power transmission line (64kV) runs in a north-south direction along SR 487. An existing energized power line leads to a transformer bank near the original mine office site on PMC owned land, and from there a currently inactive power line extends to the south-central portion of the Permit Area.

D1.7 Population Distribution

The Permit Area is located in a remote area of northeastern Shirley Basin, in northeastern Carbon County. There are no population centers within two miles of the Permit Area. The nearest town, is Medicine Bow, with a population of less than 300 people, located about 32 miles south of the Permit Area. Casper, Wyoming is approximately 50 miles (by road) north of the Project. Casper, with a population of nearly 60,000, has well-established infrastructure and service industry capabilities. The city of Laramie, Wyoming (population 31,000) is located approximately 78 miles south-southeast of the Project. Rawlins, Wyoming (population 9,400) is located approximately 66 miles to the southwest. Federal and Wyoming highways link all these cities to the Project. **Figure D1-6** shows the population centers within a 50-mile (80-kilometer) radius of the center of the Permit Area.

Five Wyoming Counties lie within a 50-mile radius of the Permit Area. **Table D1-2** presents the population information for Carbon, Natrona, Albany, Converse, and Platte Counties (U.S. Census, 2010). The Carbon County population was 15,885 in 2010 and had a population density of 2.0 people per square mile. The Natrona County population was 75,450 people and a population density of 14.1 people per square mile. Albany County's population was 36,299 people and a population density of 8.5 people per square mile. Converse County's population was 13,833 people and a population density of 3.3 people per square mile. The Platte County population was 8,667 people and a population density of 4.25 people per square mile.