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State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

Michael O. Leavitt
Governor
Ted Stewart
Executive Director
James W. Carter
Division Director

1594 West North Temple, Suite 1210
Box 145801
Salt Lake City, Utah 84114-5801
801-538-5340
801-359-3940 (Fax)
801-538-7223 (TDD)

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TO: File 2

THRU: Daron Haddock, Permit Supervisor

FROM: James D. Smith, Reclamation Specialist

RE: Technical Analysis of Permit Application, Canyon Fuel Company, Dugout Canyon Mine, ACT/007/039, File 2, Carbon County, Utah

SUMMARY

Coastal States Energy Company submitted a Permit Application Package (PAP) for the Dugout Canyon Mine, including a Mining and Reclamation Plan (MRP), in March 1996. Deficiencies were identified in the geology and hydrology sections. Revisions and corrections were submitted by Canyon Fuel Company, the successor to Coastal States Energy Company, on May 1997. This second submittal has provided adequate response to most of those deficiencies identified previously, but several deficiencies remain that require an adequate response before the permit application is approved.

TECHNICAL ANALYSIS

ENVIRONMENTAL RESOURCE INFORMATION

GEOLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 784.22; R645-301-623, -301-724.

Analysis:

Geologic information includes a description of the geology of the proposed permit and adjacent areas down to and including the stratum immediately below the lowest coal seam to

mined and the aquifer below the lowest coal seam to be mined that may be adversely impacted by mining. This description includes the areal and structural geology of the permit and adjacent areas, and other parameters that influence the required reclamation. It also shows how areal and structural geology may affect the occurrence, availability, movement, quantity, and quality of potentially impacted surface and ground water. The description is based on maps and plans required as resource information for the plan, detailed site specific information, and, geologic literature and practices.

Descriptions of the stratigraphy and lithology of strata from the Mancos Shale up to the Colton Formation and of Quaternary pediment gravels and alluvium are in Section 624.100. That section also contains a discussion of geologic structure and a very brief description of the nature, depth, and thickness of the coal seams and the interburden between the Sunnyside, Rock Canyon, and Gilson seams. Plate 6-4 is an isopach map of the Rock Canyon seam overburden thickness and Plate 6-5 is an isopach map of the Rock Canyon to Gilson seam interburden thickness.

Although the Gilson and Rock Canyon seams are both sufficiently developed to allow for economic mining in the proposed permit area, only the Rock Canyon seam is to be mined under the proposed MRP. Minable coal in the Rock Canyon seam ranges from five to eight feet in thickness (DCMRP p. 6-15). There are no isopach maps of the coal seams. Reference is made to an R2P2 for coal seam isopach maps (DCMRP p. 6-15), but because no Federal coal is involved in this proposed permit the R2P2 for adjacent areas may not provide needed information.

Appendix 6-1 contains cutting and core logs for drill holes 3-1, 9-1, 9-2, 10-1, 11-1, 13-1, 13-2, 14-1, 15-1, 15-2, 15-3, 19-2, HCC-4 (H-4), KCC-A and KCC-E. Collar or ground elevations are included in Appendix 6-1. Drill hole locations and elevations are shown on Plate 6-1.

Some bore holes have been logged from the surface to total depth, for others only the coal seams and adjacent strata have been logged. Together, the logs describe lithologic characteristics and thickness of each stratum from the surface to below the coal seams. Ground water occurrence is not indicated on these logs. Bore hole logs were used to construct the cross sections on Plate 6-3, which show the interval from the Sunnyside coal zone to below the Gilson coal zone. Figure 6-1 is a more general cross section from the surface to the Mancos Shale.

Analysis reports on coal, floor, and roof samples from the Rock Canyon and Gilson seams are found in Appendix 6-2. Floor and roof samples of the Rock Canyon seam were collected from one of the portals of the abandoned Rock Canyon seam mine in Dugout Canyon (portals shown on DCMRP Plate 5-1) and a sample of coal was taken from a fresh coal outcrop

located a few-hundred feet inside. The locations where the coal, roof, and floor samples were collected for the Gilson seam are not identified in the MRP; because the Gilson seam is not to be mined under the proposed MRP this information is not required for permit approval, but it should be provided for clarity.

Samples were analyzed for acid- or toxic-forming and alkalinity-producing materials, including total sulfur but not pyritic or other specific forms of sulfur. BTU, ash, and sulfur content of the Rock Canyon coal are briefly summarized at the end of Section 624.100. No unacceptable values were reported for the parameters listed in Table 2 of UDOGM's "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining".

Limited topsoil will be available for reclamation, so selected overburden materials are planned for use as topsoil supplements during reclamation. The MRP contains a commitment (DCMRP p. 2-22 and 2-23) that where overburden materials are used to supplement topsoil, they will be used only after it has been demonstrated that the resultant soil is suitable for supporting revegetation.

Data from one location are probably insufficient to determine the potential for acid- and toxic-forming materials for the entire proposed mine. Information in the PAP on potentially acid- and toxic-forming materials is insufficient. Additional testing is needed to determine whether reclamation as required by R645-301 and R645-302 can be accomplished. (Although not part of this permit submittal, future development of a waste-rock disposal site has been contemplated.) Data from the adjacent Soldier Creek Mine and other operations in the Book Cliffs may be available to augment the determination of the potential for acid- and toxic-forming or alkalinity-producing material.

Clay content was determined for the roof and floor rock samples. The sample from the roof of the Gilson seam contained twenty percent clay, but clay content of the other roof and two floor samples was less than ten percent. Drill-hole logs indicate lithology of strata immediately above and below the minable coal varies within the permit and adjacent areas. Several factors, such as thickness of overburden, use of a 35^0 angle of draw in formulating the subsidence control plan, anticipation that most of the land within the permit area will eventually be affected by subsidence, and the low potential for material damage from subsidence, indicate additional determination of engineering properties of roof and floor rock would be of little value. No additional determinations of thickness and engineering properties of clays or soft rock are needed prior to approval of the proposed MRP.

Rock Canyon coal thickness in the proposed permit area ranges from 5 to 8 feet, except for a want, described as being in the north-central part of the proposed permit area, where coal thins to under three feet. Maximum subsidence can be projected as 3.5 to 5.6 feet, based on

the assumption that the surface will subside up to 70% of the thickness of the extracted coal. Overburden thickness ranges from 600 feet in the south part of the proposed permit area to over 2400 in the north. Overburden consists of the upper Blackhawk Formation, the Castlegate Sandstone, and the Price River, North Horn, and Flagstaff Formations, which are described in Section 624.100. Gilson to Rock Canyon interburden thickness is 30 to 80 feet over most of the proposed permit area, and up to 100 feet at the west edge (Plate 6-5), and Rock Canyon to Sunnyside thickness is 140 to 180 feet.

The application includes geologic information in sufficient detail to assist in determining the probable hydrologic consequences of the operation upon the quality and quantity of surface and ground water in the permit and adjacent areas, including the extent to which surface and ground water monitoring is necessary; and determining whether reclamation as required by the R645 Rules can be accomplished and whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area.

At this time the Division does not require the collection, analysis, and description of additional geologic information to protect the hydrologic balance, to minimize or prevent subsidence, or to meet the performance standards.

The applicant has made no request the Division to waive in whole or in part the requirements of the bore hole information or analysis required of this section. However, the applicant has requested, within the text of the PAP, that the information in Appendices 6-1 and 6-2 be kept confidential. The Applicant should provide this information in a folder or binder separate from the rest of the PAP and marked "Confidential".

Findings:

Information in the geologic resource section is not considered adequate to meet the requirements of this section. Prior to approval the applicant must provide the following in accordance with:

R645-301-121.200, -622.100, The locations where the coal, roof, and floor samples were collected for the Gilson seam are not identified in the MRP.

R645-301-624.210, -722.100, Ground water occurrence is not indicated on logs in Appendix 6-1, nor anywhere else in the PAP.

R645-300-124.300, Information for which confidentiality has been requested has not been submitted separate from the rest of the PAP in a folder or binder marked "Confidential".

R645-301-522, -622.200, -623.300, -625, Isopach maps of coal thickness are needed to evaluate the subsidence control plan and to evaluate maximization of coal recovery.

HYDROLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-720.

Analysis:

A potentiometric surface map for the Castlegate Sandstone is shown on Plate 7-3. The gradient is to the north, downdip. USGS data indicate that ground water flow in the Blackhawk-Starpoint aquifer also is to the north.

There appear to have been slow, long-term declines of hydraulic head measured in the Blackhawk Formation by monitoring wells GW-5-1 and GW-6-1, but when mining came within 150 feet and 2100 feet, respectively, of these wells in 1993 there was a slight rise of head followed by rapid declines. GW-32-1 has shown generally increasing water levels since monitoring began in 1990.

SCCC has concluded it is fruitless to attempt a map of the potentiometric surface of the Blackhawk Formation, using data from GW-5-1, GW-6-1, and GW-32-1, because of outcrops in Soldier Canyon. The nearest Blackhawk outcrop (Plate 6-1) is updip of and over a mile from the three wells, and there are no springs issuing from the Blackhawk Formation in Soldier Canyon or within several miles of the canyon. Mine workings have been advanced from the outcrop in Soldier Canyon towards the locations of the monitoring wells since 1906, although most coal removal has been in the past 20 to 30 years. Based on data from GW-5-1, GW-6-1, and GW-32-1, SCCC has concluded that mining has had little or no effect on ground water levels in the Blackhawk Formation except very near the mine workings. Data in the MRP indicate an irregular potentiometric surface in the Blackhawk Formation near the Soldier Canyon Mine that is influenced by the outcrop of the Blackhawk Formation in nearby Soldier Canyon, the mine workings, and the lateral discontinuity of the strata. The non-uniformity of length and placement of screened zones within the strata affect data reliability or continuity (DCMRP p. 7-29).

Regional hydrostratigraphy from the Colton Formation down to the Mancos Shale is discussed in Section 724.100. Structural geology is discussed in Section 624.100.

Ground water occurs in perched aquifer systems and in the regional system in the Blackhawk Formation and underlying Star Point Sandstone. These systems and ground water occurrence, including ground water in mines, are described and discussed in Section 724.100 and Appendix 7-3.

Sampling and analysis.

Where feasible, all water-quality analyses performed to meet the requirements of the Coal Mining Rules have been conducted according to the "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434. Where feasible, water-quality sampling has been conducted according to the methodologies in the same two references.

Baseline information.

Ground-water information.

There are no water-supply wells in the permit or adjacent areas. Locations of ground water monitoring wells are shown on Plate 7-1. Collar elevations, depths, and other information are summarized in Table 7-1. Locations of springs are shown on Plate 7-1 and water rights are shown on Plate 7-2. Ground water is used for wildlife and stock watering. Monitoring locations are shown on Plate 7-1. A hydrologic evaluation of the area, by Mayo and Associates, is in Appendix 7-3.

Data on ground water have been collected by the Soldier Canyon Mine operators from 97 springs, seeps, and mine water inflows in and adjacent to the proposed permit area. An additional 8 dry locations have been monitored. Some data are from as early as 1976. In 1995, 58 spring and seep locations were monitored, an average of twice each: 44 had at least one measured flow, 7 had only seepage, and 7 were dry. In addition, 9 in-mine locations were monitored, once each. Water quality analyses and isotope ratio determinations were performed. Many of these locations had not been monitored previously.

Data in Appendix 7-2 are from multiple sources, so not all samples were analyzed following DOGM Guidelines. However, the data are indicative of baseline conditions within the permit and adjacent areas. Manganese data in Appendix 7-3 represent determination for total manganese concentrations.

Information on ground water monitoring is summarized in Table 7-2 of the PAP and monitoring results are summarized in Appendix 7-2 of the PAP. Water monitoring that

potentially meets the minimum requirements of SMCRA and the Utah Coal Mining Rules appears to have been done at only 13 (6 springs and 7 in-mine locations) of the 97 sites. Seasonal quality cannot be determined from the small number of samples (average of three) analyzed for each site.

Wells GW-10-2, GW-11-2, and GW-24-1 (all completed in the Castlegate Sandstone) and springs SP-45 (Colton Formation), SP-2 Flagstaff Formation), SC-14 North Horn Formation) , and SC-80 (Castlegate Sandstone) will be used to monitor ground water conditions in the proposed permit area. Locations of wells and springs to be monitored are on Plate 7-1.

Spring SC-80 is located outside the proposed permit boundary and updip of the proposed mine. Dugout Canyon, deeply eroded into the Book Cliffs, at least partially isolates this spring and the hydrologic system supporting it from the area to be mined. This spring appears to be a poor choice for monitoring effects of the proposed Dugout Canyon Mine on the Castlegate aquifer, but it and the nearby SC-81 appear to be the only springs issuing from the Castlegate sandstone in the permit and adjacent areas.

Mining operations at the Soldier Canyon Mine intercept ground water stored in the Blackhawk Formation in regional and perched systems. Indications are that ground water from younger, shallower strata is not being affected by the mine. Mine operations at Dugout Canyon are predicted to have a steady-state inflow of up to 220 gpm from sources within the Blackhawk Formation without disturbing ground water systems in the younger, overlying strata.

Ground-water quantity descriptions include approximate rates of discharge or usage and depth to the water in the coal seam and in each water-bearing stratum above and potentially impacted stratum below the coal seam.

The determination of the probable hydrologic consequences (PHC) indicates adverse impacts to the hydrologic balance, on or off the proposed permit area, will not occur. Acid-forming or toxic-forming materials that may result in the contamination of ground-water or surface-water supplies are not present. Supplemental information is not needed to evaluate such probable hydrologic consequences and to plan remedial and reclamation activities.

Surface-water information.

Baseline cumulative impact area information.

Hydrologic and geologic information for the cumulative impact area, necessary to assess the probable cumulative hydrologic impacts of the proposed operation and all anticipated mining on surface and ground water systems are available from appropriate Federal or State agencies. The applicant has gathered additional information and submitted it as part of the PAP.

Modeling.

Modeling techniques, interpolation, or statistical techniques have not been used in preparing the permit application.

Probable hydrologic consequences determination.

The PHC determination, prepared by Mayo and Associates, is in Appendix 7-2. Previous studies in the vicinity of the Soldier Canyon Mine were reviewed for information on geology, hydrology, and hydrogeology. They were also reviewed for data on discharge, sediment, and other surface and ground water parameters, and seventeen additional ground and surface water samples were collected in 1995 for chemical and isotopic analyses. In spite of a large data base, most of the analyses lack information on the basic parameters required by the Coal Mining Rules and SMCRA, and on seasonal variation.

Potential adverse effects to the hydrologic balance from the proposed mining operations are: decreased stream flows and spring discharges due to capture of surface or ground water by subsidence, bedrock fracturing, and aquifer dewatering; increased stream flows due to increased discharge of ground water from the Blackhawk Formation through the mine workings; and increased ground water recharge to overlying ground water systems.

Chemical and isotopic analyses of ground water, data from hydrographs, and the behavior of ground water systems in and adjacent to the Soldier Canyon Mine indicate that mine has not adversely impacted ground water quantity or quality. Subsidence and surface fracturing have not occurred above the Soldier Canyon Mine. Mining locally dewaters strata immediately adjacent to the Blackhawk Formation but does not appear to draw additional recharge from other overlying or underlying ground water systems. Similar geologic, hydrogeologic, and hydrologic conditions exist at the proposed Dugout Creek Mine and the proposed operations should not adversely impact water quantity or quality in ground water systems overlying and underlying the coal to be mined.

Baseflow in Soldier Creek upstream of the Soldier Canyon Mine and the Blackhawk Formation outcrop responds to seasonal climate variations, low flow in the creek being as little as 5 gpm in drought years and as high as 140 gpm in wet years. Andalex has

determined average low flow is approximately 50 gpm. Below the mine, mine discharge is a major contributor to stream flow, especially during summer and autumn. Measured flows for August have been as low as 170 gpm.

Steady-state inflow to the Dugout Canyon mine is expected to be approximately 220 gpm (DCMRP p. 7-49). Mine consumption is estimated to be 30 gpm, leaving 190 gpm discharge to Dugout Creek, which would represent an increase of approximately six percent over average annual flow.

In Appendix 7-3 it is estimated that the maximum discharge from both the Dugout Canyon Mine and the Alkali Tract of the Soldier Canyon Mine will be 800 gpm, and that approximately 400 gpm of the maximum can be attributed to each operation. If this maximum rate were sustained for a full year it would be a thirteen percent increase in the estimated average annual flow.

The potential for mine water discharge and increased flow rates in Dugout Creek are based on the studies of Lines (1985 - see DCMRP for reference). Actual data that could be used to correlate coal production rates to mine water discharge rates at the Soldier Canyon Mine and to predict mine water discharge rates for the Dugout Canyon Mine are not in the PAP.

Subsidence, propagation of fractures from mine workings to the surface, and increased infiltration at the surface induced by dewatering of ground water systems have the potential to increase the rate and quantity of recharge to ground water systems overlying the Blackhawk Formation. At the Soldier Canyon Mine, ground water systems in the Blackhawk Formation are hydraulically isolated from ground water systems in overlying strata, and subsidence and fracturing have not altered the hydrologic balance between ground water systems. There has been no observed increase in rate or quantity of recharge at the Soldier Canyon Mine and no increase is expected at the Dugout Canyon Mine.

Alternative water source information.

Findings:

Information in the sections on hydrologic resources that were reviewed for this Technical Analysis is considered adequate to meet the requirements of those sections.

MAPS, PLANS, AND CROSS SECTIONS OF RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.24, 783.25; R645-301-323, -301-411, -301-521, -301-622, -301-722, -301-731.

Analysis:

When required by the Coal Mining Rules, cross sections, maps, and plans included in the MRP and have been prepared by or under the direction of and certified by a qualified, registered, professional engineer with assistance from experts in related fields.

Affected Area Boundary Maps

Archeological Site Maps

Coal Resource and Geologic Information Maps

Surface geology for the permit and adjacent areas is shown on Plate 6-1, a certified map. Elevations (to the nearest 40 feet) and locations of test borings are also shown on Plate 6-1. Coal crop lines are shown on Plates 6-1 and 6-2. Strike and dip of strata at the surface are shown on Plate 6-1 for several locations within and adjacent to the southwest corner of the proposed permit area: dip is also indicated by cross-section A-A' (Figure 6-1). Strike and dip are apparently uniform over a larger area, but explicit information for the larger area would be useful.

Limited information on nature, depth, and thickness of the Rock Canyon seam, which is the coal seam to be mined, is on bore hole logs in Appendix 6-1 and on cross-sections B-B' and C-C' (Plate 6-3). Similar information on the overlying Sunnyside seam and the underlying Gilson seam is on cross-sections B-B' and C-C' (Plate 6-3), and also on bore hole logs in Appendix 6-1. Overburden is shown on bore hole logs in Appendix 6-1. Plate 6-4 is an isopach map of the Rock Canyon seam overburden thickness and Plate 6-5 is an isopach map of the Rock Canyon to Gilson seam interburden thickness. There is no isopach thickness map of the Rock Canyon seam nor of the Gilson seam, the other minable seam, nor of the Sunnyside seam, the principal rider seam.

Cultural Resource Maps

Existing Structures and Facilities Maps

Existing Surface Configuration Maps

Mine Workings Maps

Monitoring Sampling Location Maps

Locations and approximate elevations of bore holes are shown on Plate 6-1. Collar elevations, some estimated from topographic maps, and elevations of cored sections are given in Appendix 6-1.

Elevations and locations of monitoring stations used to gather data on water quality and quantity in preparation of the application are on Plate 7-1.

Permit Area Boundary Maps

Surface and Subsurface Ownership Maps

Subsurface Water Resource Maps

A potentiometric surface map for the Castlegate Sandstone, covering the eastern portion of the proposed permit and adjacent areas, is shown on Plate 7-2. There are no maps, plans, or cross-sections showing potentiometric surfaces for shallower or deeper strata. Subsurface water within the proposed permit and adjacent areas occurs mainly in perched aquifers in the Blackhawk Formation, the underlying Starpoint Sandstone, and in overlying strata, so an exact areal and vertical distribution of ground water is not known. There is no map of a potentiometric surface for a regional aquifer. Data in the MRP indicate an irregular potentiometric surface in the Blackhawk Formation, near the Soldier Canyon Mine, that is influenced by the outcrop of the Blackhawk Formation in nearby Soldier Canyon, the mine workings, and the non-uniformity of screen length and placement within the strata, and the lateral discontinuity of the strata (DCMRP p. 7-29). There is no portrayal of seasonal

differences of head in different aquifers on cross sections or contour maps, but hydrographs for several springs and graphs of water levels in four monitoring wells are provided.

The relationship of geology to ground water is discussed extensively in the text, yet there is no map that relates geology to ground water occurance, in particular the location of springs in relation to surface exposures of stratigraphic units.

Spring 10 issues from the North Horn Formation but the water may originate in a deeper formation and reach the surface through a fracture. The chemistry and long-term hydrographs of Spring SP-10 are more consistent with a deep source, rather than a shallow source such as seen in springs issuing from the Flagstaff, North Horn, and Price River Formations. Isotopic and solute compositions are similar to those in ground water from the Blackhawk Formation. There is no fracture mapped but the major water-bearing fracture in the Soldier Canyon Mine coincides approximately with the surface location of this spring.

Surface Water Resource Maps

There are no water-supply intakes for current users of surface waters flowing into, out of, and within the proposed permit and adjacent area. Surface waters that will receive discharges from affected areas in the proposed permit area are shown on Plate 7-1. Location of surface water bodies such as streams, lakes, ponds, springs, constructed or natural drains, and irrigation ditches within the proposed permit and adjacent areas are shown on Plate 7-1.

Vegetation Reference Area Maps

Well Maps

There are no gas and oil wells within the proposed permit and adjacent areas. There are no water wells in the proposed permit and adjacent areas.

Contour Maps

Findings:

Resource information presented on maps, plans, and cross sections is not considered adequate to meet the requirements of this section. Prior to approval the applicant

must provide the following in accordance with:

R645-301-522, -622.200, -623.300, -625, (Repeat) Isopach maps of coal thickness are needed to evaluate the subsidence control plan and to evaluate maximization of coal recovery.

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