0035

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DIVISION OF OIL, GAS AND MINING

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November 6, 1997

TO: File

THRU: Daron Haddock, Permit Supervisor

FROM: Sharon Falvey, Senior Reclamation Specialist

RE: Addition of Federal Lease U-024316, Co-Op Mining Company, Bear Canyon Mine, ACT/015/025-97I, Folder #2, Emery County, Utah

SUMMARY:

The permittee submitted this amendment for Division approval on March 28, 1997, additional information was submitted on October 17, 1997. The main issues addressed in this submittal include the change in environmental resource information, the changes to the PHC, the review of baseline information and, changes in water monitoring. This document will need to be blended with the existing Technical Analyses (TA), so that all technical reviews beyond those related to this amendment are covered.

Analysis:

TECHNICAL ANALYSIS:
ENVIRONMENTAL RESOURCE INFORMATION

GENERAL

Regulatory Reference: R645-301-411, -301-521, -301-721.

As mining has progressed some of the permittee's general understanding of the environmental ground water resources have changed. Related changes in section 7.1.2 and 7.1.3 have been incorporated into this amendment. Major changes are identified and discussed below:

1. Separate and distinct aquifers exist in the Spring Canyon, Storrs and Panther tongues of the Star Point Sandstone rather than one single aquifer within the Star Point/Blackhawk Formation. The formations of the Star Point Sand Stone were stated to be unsaturated in the southern portions of the permit area. The separate potentiometric surface determination is based on information from the in-mine drill holes DH-1, DH-2, and

DH-3. The formations are saturated at the north end of the site. However, the following statements are presented to lend caution to interpretation of this information.

a. The wells were drilled following mining. Therefore, it is unknown what the water elevation in the formations were prior to mining. Two factors may drive this condition, one factor is the presence of the low permeability Mancos tongue and the second is that the outcrops of the formation essentially function as an outlet, similar to a well drawing down the potentiometric surface to some distance up gradient. The separateness of the aquifers in this location probably occurred for some distance up gradient prior to mining.

b. Lateral flow between the tongues of the formation is greater than vertical flow through the tongues except where fractured. This could result in the observed separate piezometric surfaces.

c. Information presented in the Star Point Mine found that the Blackhawk and Star Point formations were in hydrologic connection to the north of the Bear Canyon Mine. (See the CHIA for further information). The Bear Canyon Mine Plan also indicates that all three tongues are saturated at the northern end of the site in Appendix 7-J, pg. 7-33.

2. Previously the permittee indicated that the "Bear Spring flow is derived from water bearing zones north of the mine site and includes water originating from the Star Point Blackhawk contact, cut by the fault to the north of the springs". The permittee no-longer provides a statement in this section about the area that recharges Big Bear Spring. General recharge information is provided under section 7.1.33. Snowmelt at higher elevations provides the recharge for the ground water system and is controlled by; permeability of the strata; surface relief and, rate of snowmelt, formation outcrops, and alluvium within the drainages of the Bear Canyon Area.

   Although some of the water could enter the system in the manner described by the permittee this does not explain the quick recharge and historic seasonal response to snowmelt which would occur through fracture flow. These fracture flows could also contribute to recharge. Big Bear Spring is considered to have a component of modern water recharge as is suggested by tritium dating conducted on the spring.

3. Previously the permittee stated that the Big Bear Spring fault and related sub-parallel fault zones are the primary control for a major amount of ground water occurring in the permit area. The permittee states that the relative dryness of the faults and the existence of fault gouge in the mine indicate that little or no

flow across these faults occur. On page 7-16, the plan states "secondary permeability due to voids in joints or fractures, may occur in a near vertical direction." The description under section 7.1.4 suggests that flows exist which moves downward through permeable strata, faults and joints and then move laterally until other permeable strata, faults and, joints allow vertical movement. In appendix 7-J, page 2-5, Big Bear and Birch Springs are stated to issue from fault and joint zones of the Panther Tongue of the Star Point.

Additional information was provided in appendix 7-J, page 2-7 in the plan. Groundwater has entered the mine through roof bolt holes and fractures. In past PHC discussions, drainage of water from faults and fractures were stated to produce the largest volumes of water flowing into the mine. And, the crossings of the fault in the East Bleeders E ½, SE 1/4 of section 14, was considered the principal source of water in the portal sump which then re-entered the fracture. Now it is presented that the majority of the water is from the sand channel. It is my understanding that the portal sump area was never a collection point for the water dating techniques. See: attached pages 7-6 and 7-17 from the Federal Lease Application U-024316.

4. Previously the permittee stated that secondary permeability is present along the near-vertical joints and bedding plains. Now, the permittee states that permeability is generally low with the exception of the Castlegate Sandstone.

The statement on permeability and porosity for the Star Point formation is more descriptive in section 7.1.4. Fractured zones and fractured bedrock will have the greatest permeability. The peak flows and quick recharge of some springs supports the concept that recharge occurs through permeable fracture flows.

Because the potentiometric surface to the north of the mined area at SW-2 has an increased potentiometric surface gradient in the Spring Canyon Tongue between SW-2 and SDH-1, and because the source of recharge to Big Bear Springs has not been identified, there is a need for additional monitoring and data collection to determine the recharge zone to Big Bear Springs and verify the elevations of the potentiometric surface(s). See: the discussion under baseline information in this TA.

The information presented on pages 1-7 and 1-8, submitted on 06/18/97 are no longer contrary to text presented in other areas of the plan.

Findings:

The permit meets the minimum requirements of this section related to mining the Tank Seam.

HYDROLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-724.

Analysis:

Baseline Information

This section reviews baseline information as it is related to the proposed tank seam lease addition, the addendum is to be attached to appendix 7-J.

Ground-water information

Data is presented for ground water observation wells in table 2-4. Stratigraphic logs were presented for SDH-1, SDH-2 and SDH-3. However, the dates the drilling was conducted was not legible on the logs. The information relating the extent of the mine workings to the uppermost known potentiometric surface of the Blackhawk/Star Point aquifer was provided in the informal conference. That information is now incorporated in the plan with the northern most extent of the proposed workings identified. Information presented in Table 2-4 includes water elevations used to build the cross-section. Water elevations for DH-1A, DH-2 and DH-3A were obtained in December 1995; water elevations from drill holes SDH-1, obtained in August 1994; water elevations in SDH-2 and SDH-3, were obtained in August 1995; and water elevations in drill holes MW-117 and MW-116, were obtained in September 1996.

The location of SDH-3 is now provided on the monitoring location map. In a telephone discussion with Charles Reynold's, environmental engineer for the Co-Op Mining Company, Charles indicated that only one sample was obtained from well SDH-1 before the well failed. SDH-2 has a faulty water monitoring device, which the mine has corrected (fall of 1997).

SDH-1 and SDH-2 lie between the same geologic fault features north of the minesite and may provide data pertinent to the operations. The MW wells lie to the east of the Bear Canyon Fault and are probably in hydrologic isolation from the proposed mining. The water elevation, 7964 feet, at SDH-2 in August, 1995, was obtained in a period where there was a lowering of the potentiometric surface. The observed water elevation at SDH-2 was 7975.8 feet, on September 02, 1997, an increase in elevation of 11.8 feet since the initial well development. The change in water elevation at SDH-2 may be the result of climatic variation and potentially mine pumping operations conducted at Star Point Mine.

The increased potentiometric surface at SDH-2 and steep slope of the potentiometric surface to SDH-1 may indicate that there is a loss of water somewhere between SDH-2 and SDH-1. Additionally it could be that the potentiometric surface at SDH-1 had not stabilized.

The decreased potentiometric surface may be from losses to the surface through Bear Canyon Creek, the McCadden Hollow/Trail Canyon drainage, and the Bear Canyon Fault Zone. The Bear Canyon Fault and sympathetic faults may in turn, re-charge the Big Bear Springs.

SDH-3 is separated from Bear Canyon by the Blind Canyon Fault and an unnamed fault, and was not considered to be information associated with the proposed mining block. However, this data is needed to provide information for the Trail Canyon Mine area. Since little information on the groundwater hydrology of this area is available, the information from SDH-3 is pertinent to the Trail Canyon Mine and some information suggests it may recharge Big Bear Spring. See the updated CHIA for further information.

Spring Data

Baseline spring sampling was conducted for the sites as identified in table 1 below. The sampling period for most sites was conducted from 1993 through 1994 for sites in McCadden Hollow. While the sampling period for springs within Bear Creek Canyon were conducted between 1993 and 1996.

Review of the available information on the McCadden Hollow Springs indicates that the recharge area for most of the spring sites are localized, except for FBC-4 and FBC-13 which may have a more extensive recharge. The recharge area is believed to be more extensive since flow rates were observed throughout the monitoring period. These springs appear to be associated with fault/fracture systems and are located at the northern most portion of the canyon. FBC-13 flowed at the highest rate and ranged from 22 to 60 gallons per/minute over the period for which data was collected.

The Tank Seam is above the potentiometric surface and this reduces the likely hood that mining would intercept the Star Point Potentiometric Surface with the proposed mining. However, in the Willow Creek Mine water was encountered from an unplugged drill hole that allowed water to move into the mine from a lower formation. Pressure from the up gradient potentiometric surface could cause water move into the mine through an un-plugged drill hole, similar to the Willow Creek Mine. Additional drill holes to the Star Point Formation at the northern end of the proposed mine workings may provide additional information with which greater confidence can be placed in determining the hydro-geologic distribution of water in the region.

A well should be completed in each tongue and an adequate time should be allowed for the surface to reach equilibrium prior to elimination of the well. During the period that these wells are monitored, the SDH-2 and SDH-3 wells should also be monitored. SDH-2 and SDH-3 should also be included in the monitoring plan to further analyze the potential impacts and the recharge zone to Big Bear Spring. Both wells should be analyzed using water dating techniques prior to this winter season.

The proposed extent of mining is approximately 2,250.00 feet away from the southern most spring FBC-2 (estimated by the Division from information contained on plates 7-4 and 3-4C). Information on the localized area dip for McCadden Hollow were not presented on the geologic map. However the regional dip of the lower coal bed north of McCadden Hollow is presented by Dohling 1972, as dipping to the south. Therefore, the likelihood of these springs being impacted during this proposed mining phase would be low.

The sampling period for springs in Bear Canyon provided a minimum of 2 samples per quarter over the period sampled (except for the 1st quarter when access is difficult). These sites are located above the coal seam and adjacent to the area proposed to be mined. The Bear Canyon Fault is near the springs. The porosity of the fractures/fault system may play a part in flows at these springs. Spring flows from FBC-12 have ranged from 21 to 100 gpm while flows from site 16-7-13-1 ranged from 4 to 12 gpm. These sites are potentially more susceptible to the effects from mining because they are closer to the proposed extent of the mine. However, they do issue out of the formation above the mine and on the east side of the Bear Creek Fault. The furthest proposed extent of mining occurs to the south of these springs and on the west side of the Bear Creek Fault. A buffer zone is proposed along the creek where the development pillars will not be removed, in order to protect Bear Creek and the Castlegate outcrop. Based on the information reviewed for the Bear Creek Canyon area springs, the operator has obtained adequate baseline data for the proposed tank seam mine operation.

Table 1: Baseline Spring Sampling

Site/Location	Date	Site Condition	Comments
FBC-2/McCadden Hollow.	08/01/91	Flowing	Available in the existing plan.
	10/04/92, 6/21/93, 6/16/94.	Not found	
	3/22/93	No Access	
FBC-3/McCadden Hollow.	08/01/91	Flowing	Available in the existing plan.
	6/21/93,10/15/93,6/16/94	Not found	
	3/22/93	No Access	

FBC-4/McCadden Hollow.	6/24/93, 8/29/93, 10/15/93, 6/15/94, 8/30/94,10/31/94.	Flowing	Existing plan baseline sample obtained 08/01/91, 10/13/92.
	3/22/93, 3/30/94,	No Access	
FBC-12/Bear Creek Canyon.	6/29/93, 8/29/93, 10/15/93, 6/15/94, 8/29/94,10/31/94.	Flowing	
	3/22/93, 3/30/94,	No Access	
FBC-13/North Slope McCadden Hollow.	8/29/93,10/15/93, 6/15/94, 8/30/94, 10/31/94, 6/28/95.	Flowing	Not found on map.
	3/22/93, 3/30/94.	No Access	
16-7-13-1/ Bear Creek Canyon.	6/8/94,10/28/94, 7/10/95, 10/18/95, 7/18/96.	Flowing	Associated Water Right.
	3/22/93, 3/29/95	No Access	

Surface-water Information

Changes in the surface water collection were presented associated with the new lease area. Surface water for the McCadden Hollow Drainage was collected from 1993 through 1994. See table 2. As stated above, the regional dip of the lower coal bed north of McCadden Hollow dips to the south, the likelihood of the springs being impacted during this proposed mining phase is considered low because these springs issue above the coal and are dissected by the drainage north of the area proposed to be mined. This drainage is described as an intermittent drainage. With the exception of spring runoff and precipitation events, the base flows are probably fed by the springs from the north side of the drainage (the combined upstream spring flow values are almost equal to the stream flow for measurements made within the same time). For the presented assumptions and the information reviewed the baseline monitoring for the surface water in McCadden Hollow is determined adequate.

Table 2: Surface Water Sampling

Site/Location	Date	Site Condition	Comments
FBC-1/McCadden Hollow.	6/21/93, 8/29/93, 10/15/93, 6/16/94	Flowing	Existing plan baseline sample obtained 07/31/91
	8/30/94,10/31/94	Dry	Existing plan dry baseline sample obtained 10/04/92
	3/22/93, 3/30/94	No Access	

Baseline Cumulative Impact Area Information

The Division is concurrently conducting an update of the CHIA based on the changes submitted in the PHC. Most of these changes are related to current operations and are not directly a result of the proposed Tank Seam Amendment.

Alternative Water Source Information

On page 1-11 the plan states "...mitigating measures will be employed if any significant impact occurs." On page 7 -34, the plan states "In the event mining reaches far enough north to mine at an elevation below Bear Creek, an adequate barrier will be left to completely prevent any impact to Bear Creek". The Division believes that as long as the fracture is not intercepted (the workings are placed to the west of the fracture), water would be more likely to follow the fracture then move into the mine workings.

Alternate replacement for the State and Federal requirements for 30 CFR 817.54 and lease stipulation 19 (pg.2F-10) are presented on page 3-42. Potential alternate water sources are described, and a commitment is included in the plan to obtain Forest Service approval for water sources affected on the Federal Lease and a commitment to replace water supplies in quality and quantity if the supply is impacted by mining operations. A commitment to replace spring water at the source should springs be affected by subsidence is included on page 3-43, section 3.3.6.

Because this is an underground coal mining activity the requirements of R645-301-727 do not apply. The plan meets the minimum requirements of R645-301-727.

Probable Hydrologic Consequences Determination

The plan states the following on page 1-8. "Bear Canyon Mine will have no impact on the quantity of groundwater." The plan should clarify this statement presenting discussions of ground water quantity changes contained elsewhere in the plan. An incorrect statement is made that suspended sediments will be mitigated. A mitigation plan for suspended sediments was not found in the plan. The permittee has incorrectly used the word, mitigation, the appropriate word for the context used is minimize impacts.

The current mining of Lease U-024316 will occur in the Tank Seam only until additional hydrologic and geologic information can be obtained. The Blind Canyon and Tank Seam have recoverable reserves in this lease but, it is uncertain if they can be mined.

The plan states that minor fracturing has been noted in relation to the Bear Canyon Mine (Plate 3-3). Some fracturing and escarpment rock fall have been noted in the Trail Canyon Mine area. A misleading statement can be found on page 3C-2 under the subsidence monitoring plan. Where it was stated that no actual subsidence has been noted from areas pillared as much as 40 years ago. One significant "chimney plug" subsidence event occurred in a drainage above Birch Springs. This is probably the source for the large flows which affected the Birch Spring in 1989. This event was not mentioned in the discussion. Other minor occurrences were exhibited in areas of relatively low cover and unknown outcrop protection.

To prevent subsidence to Bear Creek and the adjacent ledges, no retreat-mining is projected east of the in-mine fault paralleling the section line between sections 13 and 14, T.16.S., R.7.E. (plate 3-4C). Approximately 1200 feet of cover exists in the S.W. corner of Section 13. A non-subsidence zone in a 100 to 200 ft wide corridor from the outcrop and permit boundary area are shown on Plate 3.

The separate potentiometric surface of the Star Point is provided to support a determination that no adverse impact is expected to occur due to mining the Tank Seam. However, there are several potential recharge scenarios for the Big Bear Spring and one is that the Bear Canyon Fault Zone and sympathetic faults conduct flow to Big Bear Spring. If this is the case, then mining the Tank Seam could increase or decrease flows to the spring. Because, the mine lies above the potentiometric surface and the mining plan is designed to minimize subsidence in this area, the potential for impact is low. This potential impact is not included in the mine plan.

Because the Tank Seam is above the potentiometric surface, it is reasonable to assume mining would not intercept the Star Point potentiometric surface. However, in the Willow Creek mine water was encountered from an unplugged drill hole which allowed water to move into the mine from a lower formation. If there is a hydraulic gradient, water could move into

the mine through a drill hole from pressure. This potential impact is not included in the mine plan.

Additional drill holes to the Star Point formation at the northern end of the proposed mine workings may provide information with which greater confidence can be placed in determining the hydro-geologic distribution of water in the region. A well should be drilled through each tongue and adequate time should be allowed for the water surface to reach equilibrium prior to elimination of the bore hole. During the period that these wells are monitored, the SDH-2 and SDH-3 wells should also be monitored. SDH-2 and SDH-3 should also be included in the monitoring plan to further analyze the potential impacts and the recharge zone to Big Bear Spring. Water from SDH-2 and SDH-3 should be analyzed using water dating techniques.

Findings:

The plan does not meet the requirements of this section. The Permittee should provide the following in accordance with:

R645-301-731. 1) SDH-2 and SDH-3 must be included in the monitoring plan to determine the potential of mining impacts on the Star Point potentiometric surface and to assist in determining the recharge zone to Big Bear Spring monitoring water levels, and 2) water from SDH-2 and SDH-3 should be analyzed using water dating techniques and baseline data parameters, and 3) a well should be drilled through each tongue in the northern portion of the permit area with an adequate time allowed for the surface to reach equilibrium prior to elimination of the well. During the period that in-mine wells are monitored, the SDH-2 and SDH-3 wells should also be monitored.

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:

Monitoring Sampling Location Maps

The amendment includes a monitoring and sample location map. The permit contains a map that shows all previous and existing monitoring sites. This map will need to be updated to show the monitoring required under the findings for the **HYDROLOGIC RESOURCE INFORMATION** of this TA.

Findings:

The plan does not meet the requirements of this section. The Permittee should provide the following in accordance with:

R645-301-731. Update this map to show the monitoring required under R645-301-731 of this TA.

OPERATION PLAN

HYDROLOGIC OPERATIONAL INFORMATION

Regulatory Reference: 30 CFR Sec. 773.17, 774.13, 784.14, 784.16, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-300-140, -300-141, -300-142, -300-143, -300-144, -300-145, -300-146, -300-147, -300-147, -300-148, -301-512, -301-514, -301-521, -301-531, -301-532, -301-533, -301-536, -301-542, -301-720, -301-731, -301-732, -301-733, -301-742, -301-743, -301-750, -301-761, -301-764.

Ground-water Monitoring

The Table 7.1-6 indicates under the heading "Type of data Collected and Reported" that ground water quality monitoring for springs will be obtained once for a low flow sample. It is assumed this refers to the baseline data collected and not the quarterly collection. The reclamation monitoring was previously approved for a single sample at low flow. However, this may need to be changed in the future based on information collected through the operation phase. The reason this should be assessed is because the potential for impact to water quality may be great during a high flow following a low flow period. Additional sites were added and are identified in Table 3.

Table 3: Operational Spring and Groundwater Sampling

Site/Location	Sampling period	Sampling Parameters	Formation
SBC-12, previously FBC-12/Bear Creek Canyon.	May, July, August, October.	Operational	North Horn
FBC-13/1st east in-mine pillared area.	Feb, May, August, October.	Operational	Blackhawk, Sandstone Channel

SMH-1, previously FBC-6/McCadden Hollow.	May, July, August, October	Operational	North Horn
SMH-2 previously FBC-2/McCadden Hollow.	May, July, August, October	Operational	Price River
SMH-3 previously FBC-13/McCadden Hollow.	May, July, August, October	Operational	North Horn
SMH-4 previously Hollow. FBC-4/McCadden	May, July, August, October	Operational	North Horn
SMH-5 previously FBC-5/McCadden Hollow.	May, July, August, October	Operational	North Horn

Further review of the ground water resources suggest additional monitoring is required. The permittee has stated that they will conduct similar drill hole investigations of aquifers as they move into the federal lease. This statement is rather non-committal as to the methods and may not meet the objectives to gather adequate information. See requirements under the findings for the **HYDROLOGIC RESOURCE INFORMATION**.

The permittee has indicated that a waterline will be installed from the Blind Canyon Seam up through a borehole to the Tank Seam. A totalizing meter should be installed and monthly totals, submitted to the Division quarterly, and included in the monitoring plan to quantify the water used in mining and volume of water removed from the Blind Canyon Seam.

Surface-water Monitoring

The surface water collection MH-1, previously baseline site FBC-1, is proposed to be monitored in May, July, Aug, and October in association with the new lease area. According to table 7.1-8 this site is to be monitored according to the operational parameters. The information in the text page 7M-10 conflicts with the table.

The reclamation monitoring was previously approved for a single sample at low flow. However, this may need to be changed in the future based on information collected until the time when reclamation occurs. This should be assessed because the potential for impact to

water quality may be greatest during high base flow periods if water from the mine is recharging the streams.

Findings:

The plan meets the minimum requirements of this section as it relates to the tank seam amendment.

R645-301-731. A totalizing meter should be installed for the a waterline installed from the Blind Canyon Seam up through a borehole to the Tank Seam. Monthly totals should be submitted to the Division on a quarterly bases. This information should be included in the water monitoring plan to quantify the water used in mining, and volume of water removed from the Blind Canyon Seam.

Recommendation:

The permittee should submit the information requested prior to approval of this plan. Water Quality data for SDH-3 and SDH-2 including tritium dating should be completed this year before access problems preclude obtaining the data.