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State of Utah

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January 27, 1998

TO: File

THRU: Joe Helfrich, Permit Supervisor *JH*

FROM: James D. Smith, Reclamation Specialist *JDS*

RE: Technical Analysis - Chapter 7 Revision - Amendment ACT/041/002-AM97A,
Canyon Fuel Company, LLC, SUFCO Mine, ACT/041/002, File 2, Sevier County,
Utah

SUMMARY

The Division received a revised version of Chapter 7 of the SUFCO Mine MRP from Canyon Fuel Company on March 27, 1997. It contained proposed modifications of the water monitoring program, a revised interpretation or model of the hydrogeology and ground-water systems, and a revised PHC determination. The March submittal also included an amended Spill Prevention Control and Countermeasure (SPCC) plan as Appendix 7-6, and the UPDES permit renewal (effective May 1, 1996) as Appendix 7-7. Separate Technical Analysis (TA) documents were prepared by James D. Smith and Steven M. Johnson that, with additional comments from Peter Hess, were compiled into a final TA dated June 3, 1997. U. S. Forest Service (USFA) comments on the Chapter 7 revision were received on May 5, 1997 and were incorporated into that TA.

None of the Division's TA's of this proposed revision have covered any of Chapter 7 beyond Section 7.3.1.2; Canyon Fuel Company's submittal indicated that, except for pagination, there were no changes from the current Chapter 7 beyond that section. Pagination will change with the final submittal of the revision because the redline and strikeout markings are to be removed.

Canyon Fuel Company's response to the June 1997 TA was received by the Division on November 5, 1997. A letter, dated 28 October, 1997, accompanied that response and contained information pertinent to several of the deficiencies. As part of the response to the June 1997 TA Canyon Fuel Company submitted additional water rights information for Appendix 7-1 and a modified Table 4.7.2-2 for Volume 3. Peter Hess's comments have been

addressed in the Storm Water Pollution Prevention Plan, which is not part of the MRP.

Several remaining deficiencies in the November submittal were identified in a TA dated December 16, 1997, and Canyon Fuel Company's response was received January 14, 1998. This TA is of that January submittal only, and does not discuss sections that were determined to be adequate in previous TA's. Page numbers references in this TA may not match pages in the final version of Chapter 7 after redline and strikeout markings have been removed.

TECHNICAL ANALYSIS

OPERATION PLAN

HYDROLOGIC 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.

Analysis:

Ground-water monitoring.

The Chapter 7 revision includes an operational ground-water monitoring plan beginning on page 7-39 in Section 7.3.1.2 and includes Tables 7-2, 7-3, and 7-4. The plan is based upon the PHC determination and the analysis of all baseline hydrologic, geologic, and other information. The plan provides for the monitoring of parameters that relate to the suitability of the ground water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance. The plan identifies operational monitoring sites, quantity and quality parameters to be monitored, and sampling frequency in Tables 7-2, 7-3, 7-4, and 7-5 and shows baseline and operational monitoring locations on Plate 7-3. The plan describes how the data may be used to determine the impacts of the operation upon the hydrologic balance. Ground-water monitoring data are to be submitted to the Division at least every 3 months and in an annual summary. Ground-water monitoring will continue through the mining and post-mining periods until bond release.

Both water-quality and water-level monitoring are to be continued at the waste-rock-

disposal site (p. 7-39). Information on parameters to be measured and frequency of measurements is currently in Volume 3 of the MRP. In a letter to DOGM (received May 5, 1997) the US Forest Service requested that determination of boron and selenium be continued; boron and selenium have been added to the operational monitoring parameter list in Table 4.7.2-2 of Volume 3.

Based on the recommendation by Mayo and Associates, total alkalinity and total hardness have been removed from the operational ground- and surface-water monitoring plans in Tables 7-4 and 7-5. Waters in the Wasatch Plateau are strongly alkaline: alkalinity is at times twenty times as high as acidity in water samples from the SUFCO mine area. It is most likely that the alkalinity comes almost exclusively from carbonate and bicarbonate ions and that contributions from hydroxide, silicate, borate, and organic ligands are trivial. Both carbonate and bicarbonate alkalinity are included in the operational water-quality monitoring parameters in Tables 7-4 and 7-5, and at the pH values typical of these waters total alkalinity can be closely approximated using carbonate and bicarbonate alkalinity.

The report from Mayo and Associates justifies dropping hardness from the water-quality monitoring program because hardness has limited use in geochemical studies. Also, hardness generally is calculated from milliequivalent concentrations of Ca and Mg ions and the information to determine hardness, if needed, is being measured and reported.

State water-quality criteria for Class 3 - aquatic wildlife (Utah Administrative Code R317-2) for dissolved cadmium, chromium, copper, lead, nickel, silver, and zinc are a function of hardness of the water. Information for the SUFCO Mine in the Division's water-quality database indicates that the only analyses for these metals (no analyses have been done for silver) have been on water samples from the wells at the waste rock disposal site, which is in accordance with Table 7-4 and Table 4.7.2-2 in Volume 3. As shown in the following table, there has been no chromium or lead detected. Cadmium, nickel, and zinc have been detected at concentrations below the listed State water-quality criteria, which were determined for hardness of 100 mg/L. Copper has been detected at concentrations that exceed the listed State water-quality criteria for 100 mg/L total hardness but that are below hardness-dependent criteria as determined from Table 2.14.3b in R317-2. Continued analyses for the six metals will be done from one sample per well during the year preceding each permit renewal. Hardness will continue to be determined quarterly for water from these wells (Tables 4.7.2-1 and 4.7.2-2 in Volume 3).

| Dissolved metals in waste rock disposal site monitoring wells | Number of samples | Exceeding Method Detection Level (MDL) | Exceeding State water-quality criteria @ 100 mg/L hardness | Exceeding State water-quality criteria as determined from actual hardness |
|---|-------------------|--|--|---|
| Cadmium | 32 | 2 | 0 | 0 |
| Chromium (+6 and +3 combined) | 33 | 6 | 0 | 0 |
| Copper | 32 | 11 | 11 | 0 |
| Lead | 32 | 0 | 0 | 0 |
| Nickel | 32 | 3 | 0 | 0 |
| Silver | 0 | | | |
| Zinc | 32 | 27 | 0 | 0 |

Based on the recommendation of Mayo and Associates, sampling for dissolved iron and dissolved manganese has been modified as indicated in Tables 7-4 and 7-5. In waters with a pH greater than 7, iron and manganese do not typically exist in dissolved form but rather as hydroxide complexes. Data show that waters in the SUFCO area have pH values that range from 6 to 9 although values greater than 7 are more common. SUFCO has committed to determine concentrations of both total and dissolved forms of iron and manganese in surface and ground waters with pH levels below 7, but will determine only total iron and total manganese in waters with a pH greater than 7. For the wells at the waste rock disposal site, analyses will continue to be done for dissolved iron and dissolved manganese only.

The ground-water monitoring plan eliminates eleven of the wells that have been used to measure water depths. No new wells are proposed. Canyon Fuel Company has abandoned monitoring at US-77-7 and US-79-12 because they are located in areas that were mined before 1991 and are far from current or projected mining. Varied reasons are given for abandoning measurements at US-77-8, US-77-9, US-79-9, US-79-10, US-81-1, US-81-2, US-81-3, 89-20-2, and 89-21-1 (p. 66, Appendix 7-17) including: the wells have been destroyed by mining; water is no longer accessible due to casing failure; or cement filling the bore hole below the well screen has failed and opened the bottom of the well to new, indeterminable sources of

ground water.

Quarterly monitoring reports on file with DOGM show US-77-8, US-81-1, US-81-2, 89-20-2, and 89-21-1 as failed wells, 89-21-1 apparently having been intercepted by mine operations in 1996. Records show US-77-7, US-79-9, and US-79-12 have always been dry. Dropping these eight wells from the monitoring plan is reasonable and should cause no loss of useful information related to protection of the hydrologic balance.

US-77-9 is open to the lower Castlegate Sandstone and upper Blackhawk Formation, and US-79-10 is open to the upper Hiawatha Coal Seam. These two wells were dry up to 1994 and 1995, respectively, through both wet and dry periods as indicated by the PHDI data in Figure 2a of Appendix 7-17. Since 1994-1995 water levels have been measured consistently (up to October 1996), but at levels deeper than where the bottom of the casing should be, indicating a failure of the cement sealing the bottom of these bore holes. The recent appearance of water in US-77-9 and US-79-10 most likely does not represent saturation of a zone that was previously unsaturated, and the origin of this water is unknown. Because of the apparent failure of the cement, and also possibly of the casing, and the uncertainty of the origin of the water that is being measured, continued monitoring of these two wells would be of questionable value. The data that indicate failure of US-77-9 and US-79-10 are in Table 7-1 of Chapter 7 and in Appendix 7-3 and are discussed on pages 42 and 49 in Appendix 7-17. Continued monitoring of these two wells was not recommended by Mayo and Associates in their report in Appendix 7-17.

US-81-3 was marked "inaccessible" in the fourth quarter 1996 and has apparently been inaccessible several times in the past, but otherwise it provides a good long-term record of water levels in the upper Hiawatha Coal Seam. US-81-3 is located in an area that has never been mined and monitors an area that has been a concern to water users in the past due to loss of flow at several nearby springs. However, Canyon Fuel Company has indicated that water level measurements are no longer possible due to collapse or blockage of the casing and this well has been removed from the monitoring schedule.

The water level in well US-80-4, open to the Castlegate Sandstone, rose six feet following first and second mining below the well in 1983. In August 1985 there was a twenty foot decline, following which water levels declined slowly through 1992. Data collected since 1993 appear to show that the water level has stabilized and may even be increasing. The period from 1993 to 1996 was a dominantly wet period according to the PHDI data shown in Figure 2b of Appendix 7-17. US-80-4 is near US-77-9, which has been removed from the operational monitoring plan because of possible cement or casing failure. In order to provide information on adjustments of the hydrologic systems to the effects of mining, responses of the hydrologic systems to changes in recharge and climatic conditions, or other factors important

to understanding the hydrology and hydrogeology of the permit and adjacent areas and protection of the hydrologic balance, monitoring of water levels in US-80-4 will continue, but yearly rather than quarterly.

A longwall entry was driven near the location of well US-79-13 in 1981 and a longwall panel passed nearby in 1988. The well is open to a sandstone unit that lies approximately two-hundred feet above the upper Hiawatha Coal Seam. Water levels have been measured in this well since 1982 and have shown no long-term change. Information from this well appears to support the concept of little to no hydrologic communication between the coal seam and overlying, saturated strata. The planned yearly monitoring of this well should be sufficient as long as water levels remain consistent with past measurements.

The proposed amendment includes monitoring of seven springs: SUFCO 001, SUFCO 0047, SUFCO 057A, SUFCO 0089, GW-13, GW-20, and GW-21. With the exception of GW-20, these springs are monitored under the current MRP.

Spring 057A has usually been dry during the period it has been monitored, but it had measurable flow in 1987 (the first year of monitoring), 1993, and 1995. Flow appears perhaps to be sensitive to the amount of precipitation. Spring 057A is the only spring that has been monitored in the Duncan Draw - Mud Spring Hollow area, which has been an area of concern to water users in the past due to loss of flow from several springs, including 057A. Quarterly measurement of flow at 057A is to be continued.

Under the water monitoring plan in the proposed amendment, monitoring of in-mine roof drip 062 is to be discontinued. Chemical characteristics of water from this roof drip are well established; water-quality analyses from 1983 to 1996 show little variation. This site is located in the main entry of the mine, and active mining in the vicinity has ceased. The volume of water flowing from this drip has been 0.4 gpm or less since 1986. Continued monitoring would probably yield no significant information.

Equipment, structures, and other devices used in conjunction with monitoring the quality and quantity of ground water onsite and offsite have been properly installed, maintained, and operated. This equipment will be removed or properly abandoned by the operator when no longer needed (p. 7-48a).

Surface-water Monitoring

The Chapter 7 revision includes an operational surface-water monitoring plan beginning on page 7-48 in Section 7.3.1.2 and includes Tables 7-2, 7-3, and 7-5. The plan is

based upon the PHC determination and the analysis of all baseline hydrologic, geologic, and other information. The plan provides for the monitoring of parameters that relate to the suitability of the surface water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance. The plan identifies operational monitoring sites, quantity and quality parameters to be monitored, and sampling frequency in Tables 7-2, 7-3, and 7-5 and shows baseline and operational monitoring locations on Plate 7-3. The plan describes how the data may be used to determine the impacts of the operation upon the hydrologic balance. Surface-water monitoring data are to be submitted to the Division at least every 3 months and in an annual summary. Surface-water monitoring will continue through the mining and post-mining periods until bond release.

Based on the recommendation by Mayo and Associates, total alkalinity and total hardness have been removed from the operational ground- and surface-water monitoring parameters in Tables 7-4 and 7-5. Waters in the Wasatch Plateau are strongly alkaline: alkalinity is at times twenty times as high as acidity in water samples from the SUFCO mine area. It is most likely that the alkalinity comes almost exclusively from carbonate and bicarbonate ions and that contributions from hydroxide, silicate, borate, and organic ligands are trivial. Both carbonate and bicarbonate alkalinity are included in the operational water-quality monitoring parameters in Tables 7-4 and 7-5, and at the pH values typical of these waters total alkalinity can be closely approximated using carbonate and bicarbonate alkalinity. The report from Mayo and Associates justifies dropping hardness from the water-quality monitoring program because hardness has limited use in geochemical studies. Furthermore hardness is generally calculated from milliequivalent concentrations of Ca and Mg ions, which are included in the parameters to be determined.

Based on the recommendation of Mayo and Associates, sampling for dissolved iron and dissolved manganese has been modified, as described in Tables 7-4 and 7-5. In waters with a pH greater than 7, iron and manganese do not typically exist in dissolved form but rather as hydroxide complexes. Data show that waters with pH greater than 7 are more common in the SUFCO area but there have been numerous water samples with pH below 7. SUFCO has made the commitment to determine concentrations of both total and dissolved forms of iron and manganese in surface and ground waters with pH below 7, but will determine only total iron and total manganese in waters with a pH greater than 7.

Canyon Fuel Company proposes to continue to monitor six surface water sites. Sites 022 in Mud Spring Canyon and 030 in East Spring Canyon are being dropped. Except for flows measured at 030 during May and June 1983, no other flows were reported at either site during the period of observation from June 1982 to October 1997.

Stations USFS-109 and USFS-110 have not been monitored since 1991 and they

were not included in the operational monitoring plan that was replaced by this revision. No documentation approving removal of these two stations from previous versions of the monitoring plan could be found in the Division's files, but the removal appears to have taken place at the time of the 1992 permit renewal.

In the Chapter 7 revision, 047A is listed with the stream-monitoring sites in Table 7-2, discussed on page 7-24 under surface-water quality, and shown as a stream monitoring site on Plate 7-3. However in Appendix 7-17 this site is identified as a spring in Table A-1, in Figure 17, and in the text on pages 41, 57, and 68; on page 57 it is described as discharging as a series of small springs in the bottom of a normally dry wash. According to Canyon Fuel Company, monitoring station 047A is in the stream bed and is a surface-water monitoring site, but it is spring fed except during spring runoff or a storm event. The explanation or description of 047A, which helps clarify the apparent discrepancies between Chapter 7 and Appendix 7-17, is on page 7-48b of Chapter 7.

Findings:

Information provided in the proposed Chapter 7 revision is considered adequate to meet the requirements of the hydrology operation plan.

RECOMMENDATION

The revised Chapter 7 of the Convulsion Canyon Mine MRP should be approved to be incorporated into the MRP.