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

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340
801-359-3940 (Fax)
801-538-5319 (TDD)

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TO: Daron Haddock, Permit Supervisor

FROM: Wayne H. Western, Reclamation Engineer WHW

RE: White Oak Forest Service Stipulations, White Oak Mining and Construction Co., Inc., White Oak Complex, ACT/007/001, Folder #2, Carbon County, Utah

Synopsis of Concern of #1

Discuss engineering designs so that uniform subsidence is achieved.

Analysis

In 1993 Dr. Kenneth C. Ko completed a report entitled "Subsidence Potential Over Two-Seam Developments" which address subsidence at the White Oak Mines. A copy of the report is located in Section 523 of the 1993 Appendix. Dr. Ko's concludes that subsidence should not occur under normal circumstances.

Dr. Ko did a two-dimensional finite element analysis of the room-and-pillar mining under Boardinghouse Creek. The two conclusions stated in the report are:

1. The first conclusion is that in all of the analyses performed, no evidence of subsidence, as a continuous path of yield rock connecting the mine to the ground surface, was observed as a result of developing a two seam mining system beneath Boardinghouse Creek.

2. The second conclusion is that even when the strength of the overburden material was reduced to an unreasonably low level, there was still no evidence of subsidence.

Dr. Ko's report shows that the pillars in the White Oak Mine will prevent large trough like subsidence features from forming. The Division agrees with those conclusions.

There were no studies that addressed the long term pillar stability. Over time pillars may weather and lose strength. Weakened pillars may fail and the result would be creation of large subsidence features.

Subsidence is measured during an annual pedestrian survey. The pedestrian survey can locate surface features such as creaks and sinkholes. Subsidence troughs are difficult to detect on the pedestrian surveys.

Recommendation

1. The Operator needs to address the long term pillar stability. Will the pillars fail over time, if so what subsidence features will be created?

Synopsis of Concern #2

Discuss past chimney subsidence.

Analysis

A sinkhole was formed as by "chimney" subsidence. The overburden thickness at the sinkhole was 289 feet. The Ko report says that chimney subsidence usually will be restricted to ten times the extraction thickness. The reason a sinkhole formed, in an area where the overburden to extraction ratio exceeded 14, was due to exceptionally weak rock.

In Chapter 10.6 of SME Mining Engineering Handbook subsidence sinkholes in Colorado, Utah and Wyoming occur at seam thickness to overburden ratio of 10 to 15. According the SME report the sinkhole at the White Oak Mine is not unusual and others may occur.

The Ko report suggests that sinkholes will not occur when the extraction to overburden ratio is greater than ten because material that falls into the void will swell. The swell factor for most rocks and soil is 10% or greater.

In many sinkholes the material that falls into the void is removed by groundwater or surface water piping. Erosion can offset the swelling effects and increase the void to overburden ratio of a sinkhole. The maximum depth of a sinkhole is not limited by the swell factor of the surrounding material.

The Operator proposes to protect the perennial stream by only removing the first 10 feet of coal and not mining any areas where the overburden in less than 200 feet. Since the Operator assumes a maximum void to overburden thickness of 10 the minimum safety factor is 2.

Since other studies show that sinkholes can form when the void to overburden ratio is 15 or greater the Division believes that a 200 foot overburden minimum to protect perennial streams is inadequate. The perennial streams can be protected by restricting mining to areas with 500 feet or more of overburden, or by preventing roof collapse.

Recommendations

1. Mining under perennial must be limited to area with more than 500 feet of overburden or by preventing roof failure.

Synopsis Concern of #3

The Operator will commit to first mining only beneath perennial streams.

Analysis

A commitment has been added to page 0-5 of the MRP that states that "White Oak also commits to limit mining to first mining only beneath perennial streams." A statement to limit mining to "first mining only within the 250 foot buffer zone over Boardinghouse Creek" has been added.

The Division believes that those commitments are inadequate to protect perennial streams from subsidence features. Addition measures must be taken to protect the perennial streams. See recommendations for "Concern #3".

Recommendation

1. See recommendation for "Concern #3".

Synopsis of Concern #4

Perennial streams discussed in the original 1994 OSM Technical Analyses (including Mud and Eccles Creeks) have been identified on Map R645-301-722.100a. Boardinghouse Creek has also been identified on the map as having perennial flow in September of 1994.

Analysis

Mud and Eccles Creeks are not shown on Map R645-301-722.100a. Boardinghouse Canyon is shown but the stream is not identified.

Recommendation

1. The Operator needs to have the text be consistent with the maps.