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TO: Internal File

THRU: Pamela Grubaugh-Littig, Permit Supervisor

FROM: Wayne Western, Environmental Scientist III

RE: Subsidence Evaluation Recommendations, Task # 2100

Summary

In 2003, the Division conducted a study to documents the surface effects of subsidence, done by an intern under the direction of the Division staff. In 2004, the Division followed up on the study by selecting subsidence as a self-evaluation topic. Part of the self-evaluation was to make recommendation about how the Division should monitor and study subsidence.

The Division made the following specific recommendations:

- The Division should follow-up on mitigation activities at identified cracks and ponds at the SUFCO Mine on an annual basis.
- The Deer Creek Mine requires follow up work on the cracks in Rilda Canyon. A proposal to repair subsidence cracks in Rilda Canyon was proposed in early July 2004. This proposal was reviewed by the BLM and FS and the Division and approved in mid-July 2004.

The Division made the following general recommendations:

- Ensure that the subsidence-monitoring plan provides enough information for the Division to determine the degree of subsidence and surface effects.
- Ensure that the annual subsidence report provides the information required by the subsidence monitoring plan.
- Ensure that the Division has the tools to use the information in the subsidence reports to evaluate subsidence.
- Develop subsidence prediction capabilities.

Specific Subsidence Projects

The Division does not have a program to track specific subsidence projects. The program is needed to ensure proper follow up and maintain a database on types and effectiveness of subsidence mitigation.

Subsidence-Monitoring Plan

During the 2004 subsidence self-evaluation, the Division reviewed subsidence monitoring plans from the Bear Canyon Mine, SUFCO Mine, Deer Creek Mine, and the Crandall Canyon Mine. The subsidence monitoring consists of either an aerial survey or ground survey. The Division found that aerial surveys can produce a large amount of accurate data but aerial surveys have limitations. They have an accuracy of plus or minus 1 foot. In most situations, that accuracy is adequate. The major advantages of aerial surveys are:

- Lower costs on large projects.
- Large number of data points.
- Maps and data points usually come from the survey company in electronic form.

The major disadvantages of aerial surveys are:

- In areas with steep slopes such as cliffs, a change in 1 foot in a horizontal direction can have a major change in the vertical elevation. Points in areas of steep vertical relief may bounce around from year to year.
- Dense vegetation can limit coverage area.
- Subsidence surface features usually are not seen or noted.

Ground survey are much more accurate. However, the number of monitoring points are limited due to expense and usually the points are in areas of easy access. Usually the number of points are so low that subsidence isopachs and angle of draw are difficult to determine.

Annual Reports

During the 2004 subsidence self-evaluation, the Division found that the quantity and quality of data varies from mine to mine. For mines with a large number of data points, the amount of information is overwhelming and needs to be presented in visual form such as a map with subsidence isopachs.

For mines with a small number of data points, the data is often present in a spreadsheet. The spreadsheets sometimes contain limited data. At a minimum, the spreadsheet must contain:

- Premining elevation subsidence monitoring points.
- Changes in elevation in the previous year.
- Cumulative changes.

The annual reports often do not contain any information about surface features. At the Deer Creek Mine, a large subsidence crack was observed by mine personal, but the Division did not know about the crack until the intern visited the site.

Evaluate Subsidence

There are four parts to subsidence evaluation.

- Identify if there are problems that need mitigation.
- Notify supervisors and staff to ensure that mitigation occurs as needed.
- Monitor subsidence progression.
- Predicted subsidence to observed subsidence. Specific items of interest are:
    - Depth of cover to surface features.
    - Angle of draw.
    - Maximum amount of subsidence.
    - Time from when subsidence starts to when it ends.