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TO: Internal File

FROM: Wayne H. Western, Senior Reclamation Specialist WHW
Peter H. Hess, Reclamation Specialist, Team Lead PHH by SM

RE: Response to Division Order DO00A, West Ridge Resources, Inc., West Ridge Mine, C/007/041-DO00A-5

SUMMARY:

On July 14, 2000, the Division received a response from the permittee relative to Division Order DO00A-1, which dealt with requirements relative to as-built drawings and slope stability analyses for the West Ridge Mine. The Division found several deficiencies on the as-built maps and in the slope stability analysis. On March 18, 2001, the Division received another response from the permittee. In that document, the permittee stated that they did not have all the information that the Division had requested. At that time, the Division returned the entire submittal to the permittee until a complete response could be generated to address all of the Division's previous concerns. The permittee was given additional time to respond to the Division's second round of concerns.

On July 2, 2001, the Division received a response to the third round of deficiencies. In that response, the permittee included a highwall reclamation plan that included a detailed slope stability analysis performed by Agapito Associates, Inc. The Division reviewed the slope stability analysis and found several concerns relative to its relationship with the submitted reclamation proposal. Other deficiencies were also noted and aired to the permittee on October 9, 2001.

On January 15, 2002, the Division received the latest response relative to the highwall elimination plan, which consisted of another slope stability report by Agapito Associates, Inc. The submittal also contained two maps which show the topsoil survey and storage areas.

TECHNICAL ANALYSIS:

OPERATION PLAN

MAPS, PLANS, AND CROSS SECTIONS OF MINING OPERATIONS

Regulatory Reference: 30 CFR Sec. 784.23; R645-301-512, -301-521, -301-542, -301-632, -301-731, -302-323.

Analysis:

As part of the January 15, 2002 submittal, the permittee included a revised Map 2-4, Topsoil Storage Area, and Map 2-2, Mine site Order 1 Soil Survey. Both maps depict the topsoil storage area in the upper right fork, but Map 2-4 has cross-sections through the topsoil storage area that show the pre-mining and operational phase of the upper right hand fork topsoil pile. Sections 0+00, 0+50 and 1+00 (Map 2-4) show cut banks on the east side of the right fork. These are not considered highwalls, as they do not provide access to the Sunnyside coal seams. Therefore, they have not been analyzed as part of the Agapito slope stability analysis.

Map 2-4 has several problems; however, although a Utah registered professional engineer certifies it. These are the topsoil storage area and its cross-sections are not depicted as an ASCA, either on Map 2-4, Topsoil Storage Area, **or on Map 7-2, Mine Site Drainage Map**. This topsoil pile utilizes the following methods of treatment to preserve the resource, and treat the design event, vegetation, pocking, silt fence(s), and a retention basin.

The test plot for the Strych and Midfork test plot area storage piles is identified as ASCA X. The silt fence that surrounds the down slope side of this ASCA is not depicted.

The topsoil storage pile that exists in the right hand fork has not been depicted as an ASCA. Nor is that ASCA discussed in the mining and reclamation plan, (See Appendix 7-4, pages 1, 11 and 12). Although ASCA "Y" is described as a topsoil storage pile, it does not exist, although same was to be located in the upper left fork of "C" Canyon. This must be corrected.

Findings:

The information provided in the proposed amendment is not considered adequate to meet the requirement of this section. Before approval, the permittee must provide the following in accordance with:

R645-301-731.760, Map 7-2, Mine Site Drainage Map must show ASCA.

R645-301-121.200, Appendix 7-4 of the mining and reclamation plan must be corrected to accurately describe the right hand fork topsoil storage pile as an ASCA. Acreages indicated for the other ASCAs discussed should be verified for accuracy, as the acreages depicted on Map 2-4 for the Strych and Midfork topsoil test plot areas do not coincide with those enumerated in Appendix 7-4.

R645-301-121.200, page 7-32 of Volume 3, Chapter 7, Section R645-301-732.100 SEDIMENT CONTROL MEASURES must be revised to accurately reflect the acreages depicted on Map 2-4 (the test plot acreages for the Strych (0.06) and the Midfork (0.07) do not coincide with the statement on page 7-32, "the alternate sediment control area located in the right fork is 0.46 acres..." As noted previously, the left fork stockpile area does not exist, so this statement must also be revised.

RECLAMATION PLAN

BACKFILLING AND GRADING

Regulatory Reference: 30 CFR Sec. 785.15, 817.102, 817.107; R645-301-234, -301-537, -301-552, -301-553, -302-230, -302-231, -302-232, -302-233**Analysis:**

In the permit application package, the permittee proposed to construct a portal highwall area that was smaller than the one which was necessary to construct access to the coal seams inherent with the "C" Canyon area. During preliminary construction, the permittee encountered burnt coal near the outcrop, which was more extensive than originally anticipated. The high temperatures generated during the burn created very unstable roof conditions several hundred feet into the outcrop, particularly in the run-of-mine belt portal area. The permittee could not follow the approved mine plan because they could not adequately control the fragile roof conditions. The highwall was constructed without the submittal of a revision to the operational plan for the portal area. The highwall was enhanced by the construction of a safety bench, which the Permittee believed was necessary to protect employees and machinery from falling debris.

As part of the permit application package, the permittee had proposed utilizing an experimental practice for the storage of the "C" Canyon topsoil "in-situ." This proposal was reviewed and approved by both the Division and the U.S. Department of the Interior, Office of Surface Mining. With the construction of the more extensive portal highwall, the Division developed concerns relative to the reclaim ability of that area and its potential affect on the "in-situ" topsoil storage plan. The Division aired these concerns to the permittee in Division Order DO00A.

The portal highwall is approximately 300 feet long and varies in height from 0 feet to 85 feet in height. The maximum angle from horizontal of the highwall is 73°. The natural slope angle about the highwall is 32°. The permittee plans to reclaim the highwall with a reclaimed slope angle of 40° from horizontal.

The permittee contracted Agapito Associates, Inc. to conduct the slope stability analyses to address the Division's concerns relative to the slope stability of the reclaimed area. This was done in order to develop an acceptable reclamation plan for the highwall area. In addition to the

Agapito analysis, it was necessary for the permittee to conduct a vegetation studies, such that an acceptable revegetation plan could be developed, paying particular attention to the percentage of area covered by flora.

Agapito has on three occasions performed slope stability studies on the highwall area. The Division reviewed two of these and requested additional information. The third analysis was submitted with the permittee's January 15, 2002 response and addresses the following:

- Slope stability
- Pore water pressure
- Vegetation density

Slope Stability

The permittee's consultant describes the geotechnical testing that was performed to determine the design properties of the proposed backfill material for the portal area in Section 2 of the study.

The slope stability analysis was presented in Section 4 of the Agapito report. The slope failure modes that were evaluated include:

- The current geometry; static and pseudostatic.
- Reclaimed backfilled slope without the composite drain; rotational failure surface; static and pseudostatic.
- Reclaimed backfilled slope with the composite drain; rotational failure surface; static and pseudostatic.
- Reclaimed backfilled slope with the composite drain; failure surface at geosynthetic/backfill interface, static and pseudostatic.

The permittee used a commercially available computer software program (XSTABL) to conduct the slope stability analysis. The pseudostatic stability analyses were conducted to simulate earthquake loading. The Division does not have requirements for earthquake load for reclaimed slopes. However, that information is useful for evaluating the general backfilling and grading requirements as well as evaluating AOC.

According to the Agapito analysis, the safety factor of the existing portal highwall is 500 for both static and pseudostatic cases. The explanation given for this unusually high safety factor is that there is a very low potential for failure along geologic structures. The dip of the "in-situ" highwall is primarily sub-parallel to the slope face.

The backfilled slope was modeled with and without a composite drain, as recommended by the Agapito analysis. The drain material will only cover 30% of the current slope face if the Division approves the current design. The composite drain material has inherent lower shear

strengths than the non-covered surfaces have. The backfilled slope with the composite drain was analyzed by Agapito for two failure modes: rotational, and failure of the geosynthetic/soil surface.

The stability analyses conducted for rotational failure (primarily through the backfill material / no composite drain), indicates stable conditions. The resulting safety factors are static, 1.7 and pseudostatic, 1.6. The results of these analyses are presented in the Agapito study.

The stability analyses conducted for rotational failure (through backfill material, with the composite drain in place), indicates stable conditions. The static safety factor was calculated at 1.5. The pseudostatic safety factor is 1.4.

The stability analyses conducted for plane shear failure at the composite drain/backfill interface also indicates stable conditions. Safety factors of 1.3, static and 1.2, psuedostatic have been determined.

The geotechnical model that was developed represents the most critical slope geometry with respect to slope height and slope angle. Shear strength parameters were developed for the backfill materials based on comprehensive testing. Shear strength values for the other design components of the slope were determined from previous investigations at the West Ridge Mine as well as from manufactures' recommendations.

Design

The slope stability analysis and safety factor determinations were all based upon the design recommendations listed within the Agapito study.

Slope angle

The Permittee does not want to decrease the slope angle because they would be required to move the toe of the slope into the experimental practice area. Therefore, that part of the experimental practice area would be lost and the streambed would have to be disturbed and then reclaimed. Maintaining the toe of the reclaimed slope at the current toe of the lower bench is the Permittee requirement for the consultant.

The Permittee wants to protect the "in-situ" experimental practice topsoil storage area. If the slope were extended, part of the experimental practice area would be destroyed and the Permittee would have to reclaim the stream channel by other means. While the Division supports the preservation of the experimental practice area, their first priority is complete highwall reclamation.
Minimum Safety Factor of 1.3

The consultant did slope stability analysis based on the design involving the use of drains. The first analysis involved a rotational failure for which the safety factor was 1.5. The second involved a plane shear failure along the drain backfill interface. The safety factor for that scenario was 1.3. The Division wants to know why the Permittee wants to place drains in the slope if they will significantly reduce the safety factor.

The consultants report recommends that the backfill material should have an internal angle of friction of 38.4° and cohesion of 772 psf. The report also states that the material should be compacted to a minimum of 95% Proctor and recommend that the lift not exceed 2 feet. See Page 9 of the Agapito January 11, 2002 report.

The Division is not aware of any compaction procedures that will result in a 95% proctor when the material is placed in 2-foot lifts. The usual procedure is to place material in 4-inch to 6-inch lifts. Therefore, the Division needs the Permittee to provide information on the type of compaction techniques that would result in a 95% proctor when the material is placed in 2-foot lifts.

Maintain the Toe of the Slope in the Present Location:

The Permittee wants to keep the location of the toe of the slope in the present location in order to preserve the experimental practice area. While the Division supports the continuous use of the experimental practice area, the primary concern is the total reclamation of the highwall.

Minimizing Pore Water Pressures.

The Permittee proposes to place drains in the backfill to handle any water infiltration. The primary concern is to prevent pore pressure build up.

The Division's main concern with the drains is they reduce the safety factor. The Permittee has stated that no seep or spring exist in the highwall. The most likely source of water is from surface infiltration. If the slope design with the drains meets the minimum safety factor requirements then the Division will allow them to be incorporated into the design.

The engineering design standards for the required backfill are listed in Section 3.1 of the Agapito report. They include the following:

- The backfill material must have an internal angle of friction of 38.4 and shear strength of 771.7 pounds per square foot.
- A test fill should be conducted to assess the maximum lift thickness that will result in a 95% Standard Proctor compaction.
- A maximum lift thickness of 2 feet should be implemented and monitored.
- Hand-operated compaction equipment should be used near the slope face to assure adequate compaction.

- Separation of the backfill from the in situ slope should be ensured.
- The reclamation slope face should be irregular.
- Any boulders buried in the slope should have at least 75% of their volume covered.

In order for the Division to approve the highwall reclamation plan, the permittee needs to incorporate the Agapito design recommendations into the mining and reclamation plan. The design recommendations must include detailed cross-sections that show the rock fill, the compacted fill and all drainage controls. The permittee must commit to ensuring that the verification of lift thickness and adequate compaction are met, and that these design requirements, which are critical to ensuring that the required static safety factor for the reclaimed area is met, are certified by a registered professional geotechnical engineer.

General Backfilling and Grading Requirements

The general requirements for backfilling and grading are:

Achieve the approximate original contour in the area. The requirements for achieving AOC are couched in the backfilling requirements. Those requirements include:

- Minimize the off-site effects.
- Achieve a final surface configuration that closely resembles the surrounding area.
- Provide a subsurface foundation for vegetation.
- Support the approved postmining land use.

The general plan to achieve AOC will not change with the new highwall elimination plan. The reclaimed slope will be similar to those in the surrounding areas. The issues involving vegetation are addressed in other sections of the technical analysis.

All highwalls will be eliminated. Drawing 4 of the Agapito study is a cross section of the reclaimed highwall. The fill will be placed such that the existing cuts will be fully reclaimed. No spoil piles or depressions are associated with the highwall.

The Division does have a concern that settling will result in the highwall becoming exposed. The lift thickness will be 2 feet. At best, compaction is only effective to 6 inches. Therefore, 18 inches in every lift will be uncompacted. Over time the uncompacted soil will settle.

The permittee did not address the angle-of-repose for the backfill material and other soils associated with the highwall reclamation. The Division is concerned about the angle-of-repose of the backfill because the reclaimed slope will achieve a vertical angle of 40 from horizontal. Therefore, the permittee must state where the backfill material will come from. The permittee must give the Division all of the engineering properties of the backfill material. These are necessary to ensure that the design requirements, which dictate the required long-term static

safety factor, can be met. The Agapito analysis does show that the reclaimed slope should have a static safety factor of 1.3.

The backfilling and grading requirements have associated design requirements. R645-301-542.300 and R645-301-512.130 requires that a registered professional engineer certify the design for the reclaimed highwall. The designs in the Agapito report were not certified. In addition, the designs in the Agapito report were for an idealized cross section that contains the worst-case scenario. **The permittee needs to take the design requirements in the Agapito report and incorporate them into the reclamation cross sections that deal with the highwall area.**

The Division reviewed the Agapito report and found several items that were not clear to the Division. Those items are:

- What is meant by the post-peak friction angle and why it was used instead of the peak friction angle?
- Why are the moist and saturated unit weights in Table 2 of the Agapito report the same?
- Why is the Proctor value for the lower bench assumed to be 90%?
- Why must the backfill material be compacted to 95% of the Proctor value and why should the lift not exceed 2 feet?
- Why will a drainage system be incorporated into 30% of the slope if no seeps are present and the drainage system will reduce the safety factor?

The Division needs the Permittee to include the laboratory reports for the material properties for the backfill material including the compacted backfill material with cohesion of 772 psf.

Minimizing erosion and water pollution are issues that are addressed in the hydrology section of the technical analysis.

The postmining land use requirements are addressed in that section of the technical analysis.

Findings:

The information in the deficiency response is not adequate to meet the requirements of this section. The permittee must provide the following in accordance with:

R645-301-542.200, The permittee must incorporate detailed cross-sections that show the design requirements for the highwall area. The reclamation cross-sections that have been submitted previously and depicted on Maps 5-6A and 5-6B, Mine site Cross Sections, Right Fork, Stations 23+00 through 27+00 must be modified to reflect the design in the Agapito analysis. Maps 5-6A and 5-6B only depict final surface configurations in the portal highwall area. Additional drawings of the aforementioned cross-sections must show the rock fill, the compacted fill, and all drainage controls. These additional cross-sections for the reclaimed highwall must have the same level of detail as Figure 4 in the Agapito study.

R645-301-542.200, The permittee must incorporate the design requirements for the highwall elimination plan given in Section 3.1 of the Agapito report into the MINING AND RECLAMATION PLAN.

R645-301-542.200 and R645-301-512.120, The permittee must have the designs in the Agapito report certified by a registered professional engineer.

R645-301-542.200, The permittee must explain why they will incorporate drainage systems into the final slope design if no seeps are present and the drainage system will decrease the slope stability.

R645-301-542.200, The permittee must show that the backfill material can be compacted in 2-foot lifts to meet the soil properties that are recommended in the Agapito report.

R645-301-542.200, The permittee must show that the soil settling will not result in the highwall becoming exposed.

R645-301-553.130, The permittee must show that the backfill material used for reclaiming the highwall has an inherent angle of repose greater than the slope angle, which is 40. This material must also meet the other engineering specifications outlined in the Agapito study. **In order to meet all the requirements of this section, the permittee must state from where the backfill material will come.**

R645-301-121.200, The Permittee will clarify each of the following: 1) What is meant by the post-peak friction angle and why it was used instead of the peak friction angle, **2)** Why the moist and saturated unit weights in Table 2 of the Agapito report are the same, **3)** Why the Proctor value for the lower bench is assumed to be 90%, **4)** Why the backfill material must be compacted to 95% of the Proctor value and why the lift should not exceed 2 feet.

R645-301-121.222, The Permittee needs to include complete references in the Agapito report. Incomplete references include Claasen and Hogan (1998) and Rohlman (1993) and Hoek and Brown (1999).

RECOMMENDATIONS:

Division Order DO00A should remain in effect until the permittee has adequately addressed all the issues in this memo.