

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

OSM's study of the breakthrough at the Big Branch slurry impoundment, conducted by a team of engineers, geologists, and hydrologists, was performed in cooperation with MSHA, DSMRE, and DMM. OSM used information and data relating to:

- General history of the underground mine and impoundment.
- DSMRE permit files and MSHA-approved plans.
- Investigations of the 1994 breakthrough.
- Remedial measures to prevent breakthroughs after 1994.
- MCCC's EAP.
- MSHA's investigation of the 2000 breakthrough.

Based on its own independent technical evaluation, OSM is in agreement with the findings and enforcement actions taken to date by DSMRE and MSHA. The investigations by MSHA and DSMRE were primarily to determine if MCCC had violated the terms and conditions of the permit and plan approvals. MSHA also reported the probable breakthrough mechanism. The scope of OSM's review included the same issues addressed by DSMRE and MSHA enforcement actions, as well as the probable breakthrough mechanism. In addition, OSM's review included an evaluation of the sealing plan approval by DSMRE and certifications and actions taken to protect the public.

The following conclusions and recommendations are based upon OSM's investigation of the factors contributing to the MCCC 2000 breakthrough. Although these conclusions are specific to this investigation, the recommendations are broadly applicable to the prevention of breakthroughs at other impoundments. OSM suggests that the recommendations be used in conjunction with the *Criteria for Evaluating the Potential for Impoundment Leaks into Underground Mines (Existing and Proposed Impoundments)* released by OSM in July 2001. The conclusions are grouped by the issues OSM agrees with MSHA and DSMRE to aid the reader to better understand the actions of the various agencies.

Conclusions:

In agreement with MSHA,

- OSM concludes that the breakthrough was caused by seepage and piping through the outcrop barrier at the southwest corner of the 50-foot long, dead-end entry.
- OSM concludes that MCCC failed to analyze and report a forewarning of the impending breakthrough--the significant increase of drainage from the South Mains Portal pond beginning in September 1999.

- OSM concludes that MCCC did not submit an as-built certification for the constructed bulkheads.

In agreement with DSMRE,

- OSM concludes that MCCC submitted modifications to the 1994 Impoundment Sealing Plan to MSHA but not to DSMRE for approval.

In agreement with both MSHA and DSMRE,

- OSM concludes, after comparing the Triad drilling information with the 1994 Impoundment Sealing Plan, that (a) the **width** of the Coalburg coal seam outcrop barrier (the horizontal distance from the underground mine to the surface) is correctly projected in the plan, but (b) the plan incorrectly indicates that the entire Coalburg coal seam outcrop barrier is **composed** of solid coal and rock.
- OSM concludes that MCCC did not conduct any geotechnical investigation to confirm the **width** or to determine the **composition** of the Coalburg coal seam outcrop barrier either before or after the 1994 breakthrough.
- OSM concludes that MCCC did not construct the seepage barrier in accordance with the 1994 Impoundment Sealing Plan as approved by MSHA and DSMRE.

Additional OSM Findings:

These issues may have been considered by DSMRE and MSHA, but were not addressed by their actions and reports.

- OSM cannot conclude definitively whether the 1994 Impoundment Sealing Plan would have prevented a breakthrough because the seepage barrier was not constructed in accordance with the plan. However, OSM found that the approved sealing plan did not contain a complete analysis of the breakthrough mechanisms and the associated preventative measures.
- OSM concludes that MCCC did not submit an as-built stability analysis, for certification purposes, for the constructed seepage barrier.
- OSM concludes that the 1994 Impoundment Sealing Plan (breakthrough prevention plan) was approved as a minor modification by DSMRE; and therefore, public notice was not required.
- OSM concludes that the EAP submitted to MSHA addressed the consequences of an embankment failure, but did not address the consequences of an impoundment breakthrough.

## Recommendations:

- OSM recommends that adequate geotechnical investigations be conducted to verify the location of the underground mine and the composition of the outcrop barrier and overburden for all existing and proposed impoundments in close proximity to either an active or abandoned underground mine.
- OSM recommends that plans designed to prevent breakthroughs at slurry impoundments be based on the most conservative engineering design standards and be supported by the best site-specific, scientific data available, commensurate with the level of risk posed by the impoundment.
- OSM recommends that the breakthrough prevention plans for any new impoundments or modifications to existing impoundments identify the critical phases of construction and that the registered professional engineer who designed the plan also inspect and certify the critical phases of construction with as-built drawings as appropriate.
- OSM recommends that the breakthrough prevention plans include rigorous hydrogeologic monitoring requirements designed to provide a forewarning of any impending breakthrough.
- OSM recommends that revisions to permits concerning breakthrough prevention be considered major modifications if the breakthroughs would adversely affect the public; and therefore, be subject to public notice and comment.
- OSM recommends that the SRAs assess coordination procedures with MSHA for review and approval of impoundments to ensure proper fulfillment of respective statutory responsibilities.
- Finally, OSM should consider developing national standards for EAPs, through rulemaking, which consider the consequences of an impoundment breakthrough.

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## ACRONYMNS

ARCC - Appalachian Regional Coordinating Center

Blackburn - Blackburn Contracting, Inc.

cm/sec - centimeter per second

DES - Disaster and Emergency Services

DMM - Department of Mines and Minerals

DOW - Division of Water

DSMRE - Department for Surface Mining Reclamation and Enforcement

EAP - Emergency Action Plan

EPA - Environmental Protection Agency

Esmer - Esmer & Associates, Inc.

Excel Mining LLC - Excel

GAI - Geo/Environmental Associates, Inc.

IC - Information Circular, U.S. Bureau of Mines

IDCO - Imminent Danger Cessation Order

IFLOWS - Integrated Flood Observing and Warning System

in/sec - inches per second

KAR - Kentucky Administrative Regulations

KGS - Kentucky Geological Survey

KPDES - Kentucky Pollutant Discharge Elimination System

MCCC - Martin County Coal Corporation

Mine Act - Federal Mine Safety and Health Act of 1977

Minor Permit Revision No. 5 - the permit revision

MRP - Mining and Reclamation Plan

MSHA - Mine Safety and Health Administration

msl - mean sea level

NC - Non-Compliance

NCP - National Contingency Plan

NRC - National Response Center

NWS - National Weather Service

Ogden - Ogden Environmental and Energy Services

OSC - On Scene Coordinator

OSM - Office of Surface Mining

PF - powder factor

SMCRA - Surface Mining Control and Reclamation Act of 1977

SRA - State Regulatory Authority

Summit - Summit Engineering, Inc.

Triad - Triad Engineering, Inc.

TSS - total suspended solids

Unified Command - Unified Incident Command Organization

## **BIBLIOGRAPHY**

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