

REPORT ON OCTOBER 2000 BREAKTHROUGH AT THE BIG BRANCH SLURRY IMPOUNDMENT

1.0 INTRODUCTION

On October 11, 2000, a combination of coal slurry and water from the Martin County Coal Corporation (MCCC) Big Branch slurry impoundment in Martin County, Kentucky, broke through into an underground mine adjacent to the impoundment, consequently discharging into the receiving streams (Figure 1 [Page 2] and Photo 1 [Page 3]). The purpose of this study, performed by the Office of Surface Mining (OSM), U.S. Department of the Interior, was to evaluate the conditions and sequence of prior events primarily to determine the probable breakthrough mechanism. Also, OSM evaluated other factors, such as designs and approvals, which could have contributed to the 2000 breakthrough. To achieve this, OSM examined documentary evidence of MCCC's activities in and near the impoundment over a period of 30 years.

MCCC operates the impoundment under Kentucky Department for Surface Mining Reclamation and Enforcement (DSMRE) Permit Number 680-8002 and Mine Safety and Health Administration (MSHA) identification number 1211-KY6-0035-01. MCCC operates the underground mine under DSMRE Permit Number 680-5012 and MSHA identification number 15-03752. Coal processing waste from the MCCC Big Branch preparation plant is disposed of in the impoundment.

An estimated 306 million gallons of water and fine coal refuse slurry (hereinafter referred to as slurry) drained from the MCCC impoundment into the adjacent underground mine (Figure 2 [Page 4]; Photos 2 and 3 [Pages 5 and 6]). Approximately 245 million gallons of the water and slurry discharged from the underground mine at the Number 2 North Portals and the South Mains Portal (Photos 4 and 5 [Pages 7 and 8]). The remainder of the slurry was contained in the underground mine. The breakthrough into the underground mine was first noticed about 12:05 a.m. and ended about 4:40 a.m. A detailed chronology of events surrounding the breakthrough is presented in Section 2.3. The discharge from the north portals entered Coldwater Fork, and the discharge from the south portals entered Wolf Creek. This was the second breakthrough event at this impoundment, the first having occurred in May 1994.

The breakthrough in 2000 differed from the 1994 breakthrough in that the 2000 breakthrough resulted in severe stream degradation and property damage. The drop in pool level during the 2000 event was significantly greater and occurred over a shorter time period than the 1994 event. MSHA has estimated that the discharge from the 1994 breakthrough was about one-third the discharge from the 2000 breakthrough (112 million gallons compared to 306 million gallons). Whereas a large amount of the 1994 breakthrough water and slurry was retained in the mine, most of 2000 breakthrough slurry reached the surface. In the 1994 event, clear water comprised most of the surface discharge. During the 2000 breakthrough, slurry was a major component in the outflow.

No personal injuries were reported as a direct result of the 2000 breakthrough. However, the slurry affected over 75 miles of streams in Kentucky and West Virginia causing considerable

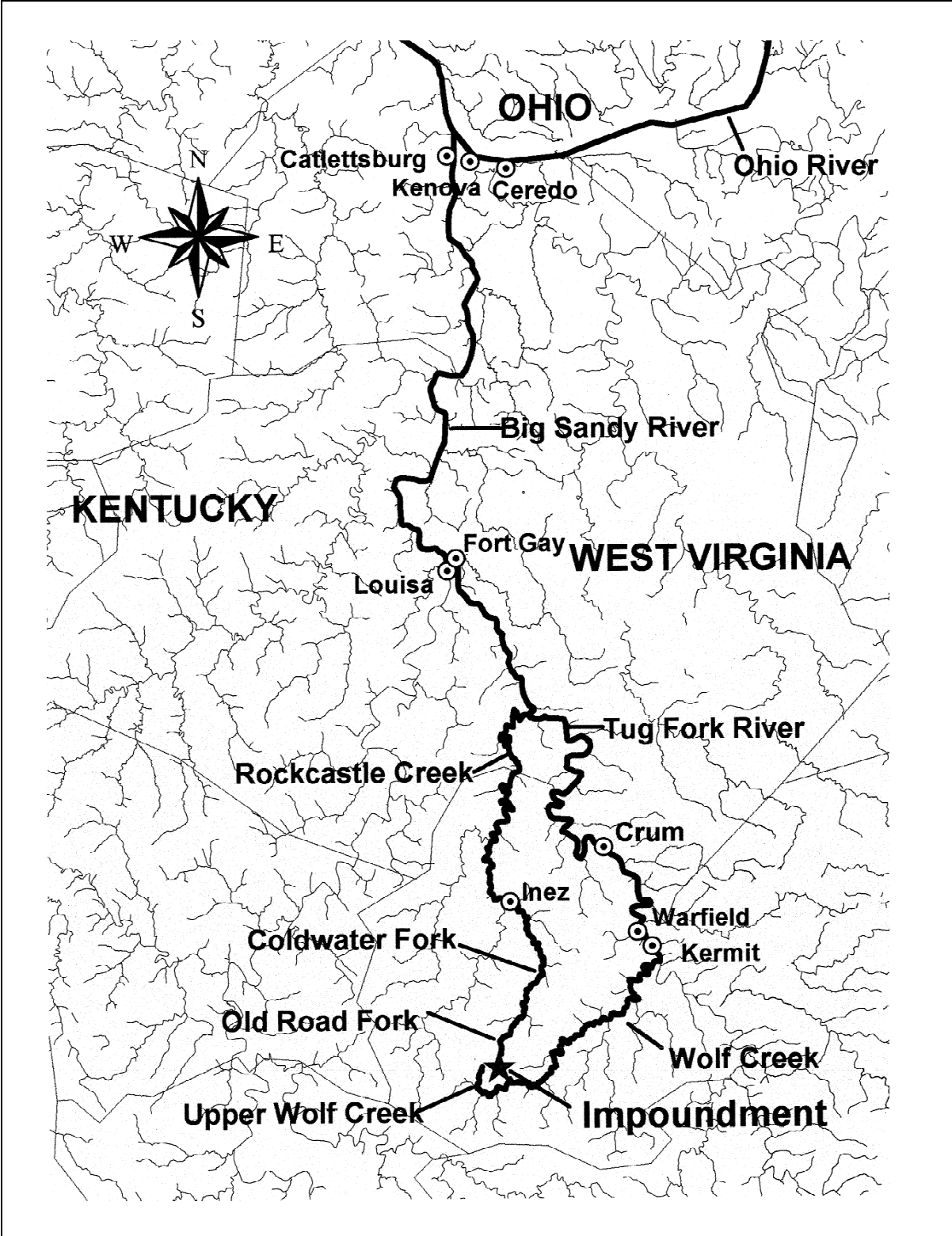


Figure 1. Location Map.

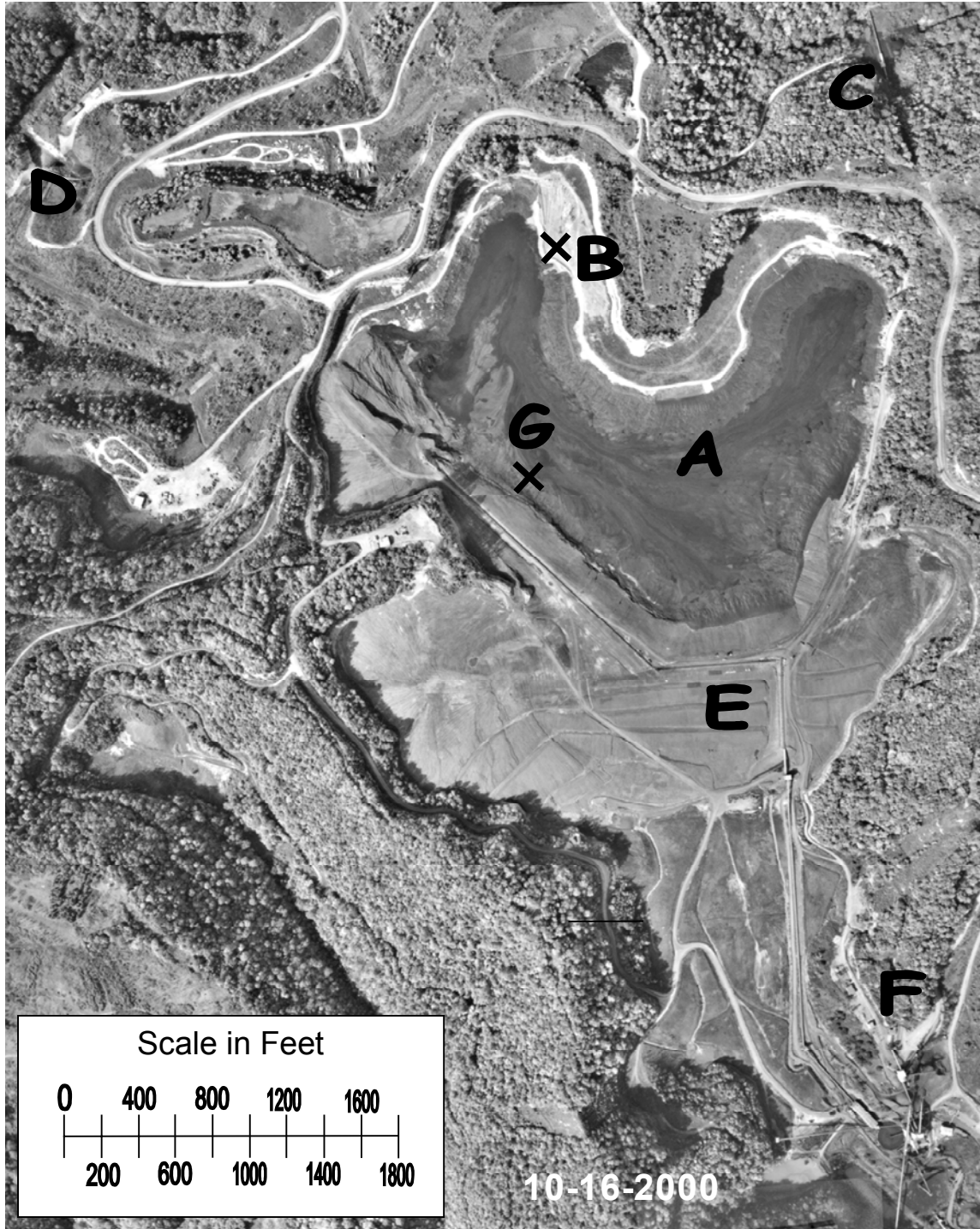


Photo 1. Aerial Photograph of Big Branch Slurry Impoundment - October 16, 2000. Source: Photo Science, Inc. A) Impoundment. B) 2000 breakthrough location. C) Number 2 North Mains Portals. D) South Mains Portal. E) Embankment (dam). F) Preparation plant. G) 1994 breakthrough location.

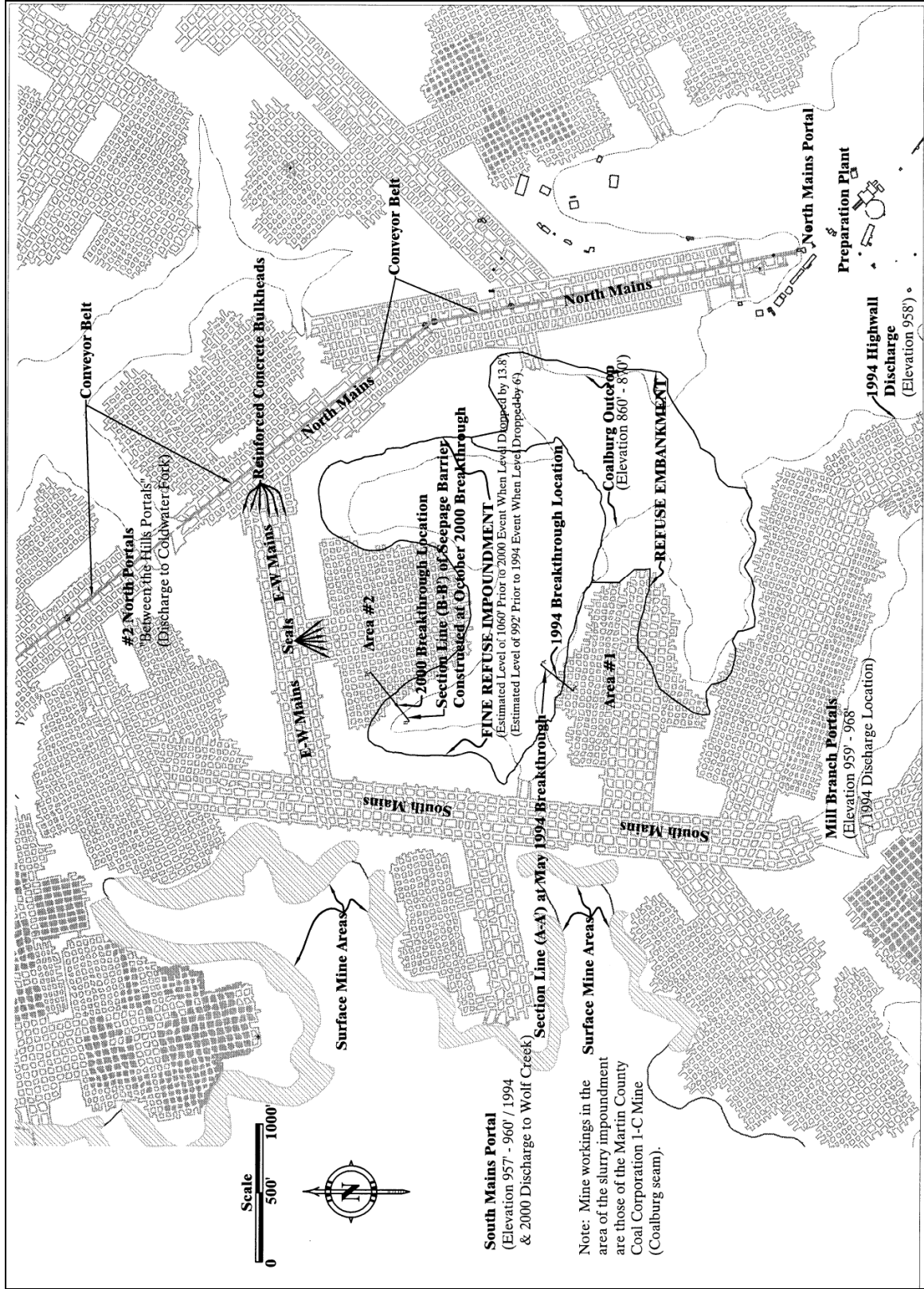


Figure 2. Mine Map.



Photo 2. 2000 Breakthrough Area - October 16, 2000. Source: OSM. Pool elevation about 1,060 feet msl prior to breakthrough and 1,046 feet msl after breakthrough. Mine roof elevation 973 feet msl.



**Photo 3. General View of Impoundment and Embankment - October 16, 2000.
Source: OSM. 2000 breakthrough area to left of photo, out of view.**



Photo 4. Number 2 North Portals - October 16, 2000. Source: OSM.



Photo 5. South Mains Portal - October 16, 2000. Source: OSM.

aquatic impacts. At some locations, the slurry flooded over the banks and was deposited onto adjacent property. Six public water intakes were adversely affected and alternative water supplies had to be arranged. It was reported that the cost to clean up the waterways and affected lands exceeded 36 million dollars.

The Surface Mining Control and Reclamation Act of 1977 (SMCRA) established OSM to oversee the enforcement of surface coal mining and reclamation operations. SMCRA provides that, if certain conditions are met, a state may assume primary authority for the regulation of the surface coal mining and reclamation operations within its borders. Kentucky obtained primary authority in 1982. The Kentucky program is administered by DSMRE. The federal requirements for the proper construction, maintenance, and reclamation of impoundments are in Section 515(b)(13) of SMCRA. The Kentucky requirements are in Section 350.425, Kentucky Revised Statutes, and Sections 16:160 and 18:160, Title 405, Kentucky Administrative Regulations (KAR). Once a state has obtained primary authority, OSM has the responsibility to make the investigations, evaluations, and inspections necessary to determine whether the state program is being administered and enforced in accordance with the approved program provisions. Under this unique partnership, OSM and DSMRE share responsibility for accomplishments as well as problems. Nonetheless, it is OSM's role to investigate the MCCC breakthrough in accordance with its oversight responsibility and record appropriate observations and recommendations.

As a result of several breakthroughs over the last few years, and the latest in Martin County, Kentucky, on November 2, 2000, OSM announced an action plan (Appendix 1) to assure that impoundment breakthroughs into the underground mine do not occur in the future. To accomplish the objectives spelled out in the OSM action plan, the Appalachian Regional Coordinating Center (ARCC) developed an implementation plan (also in Appendix 1) to complete the following three tasks:

Task 1: Establish a regional impoundment technical committee to determine the factors contributing to the MCCC impoundment breakthrough.

Task 2: Expand the technical committee to include state and MSHA technical representatives. The expanded committee, using its combined experience along with information gained from the Kentucky and Virginia experiences, will develop criteria that should be considered in reevaluating high-risk (high breakthrough potential) impoundments over or adjacent to underground mine workings.

Task 3: Develop and implement individual field office work plans designed to minimize the potential for future impoundment leaks or breakthroughs into underground mine workings.

This report is issued to complete Task 1. On July 27, 2001, ARCC issued *Criteria for Evaluating the Potential for Impoundment Leaks into Underground Mines (Existing and Proposed Impoundments)*, to complete Task 2. The field offices in the Appalachian Region are in various stages of implementing Task 3. DSMRE, with assistance from OSM, is currently re-evaluating all existing MSHA-class impoundments in Kentucky. As part of this initiative, DSMRE has taken the following actions: (1) implemented a plan for a joint OSM/DSMRE

permit review and field inspection of each of the 117 MSHA-class impoundments in Kentucky, (2) identified all structures within 500 feet of an underground mine, (3) completed a risk assessment for breakthrough potential on each impoundment including those rated as “high breakthrough potential” by MSHA, (4) revised existing protocols regarding review and approval of slurry impoundments to include a second level of engineering review, (5) revised inspection procedures to require an annual inspection by a DSMRE engineer, and (6) notified each permittee with an MSHA-class impoundment that the MSHA-approved plan and the DSMRE-approved permit must be the same.

MSHA administers the provisions of the Federal Mine Safety and Health Act of 1977 (Mine Act) to enforce compliance with mandatory miner safety and health standards. MSHA enforces the requirements of the Mine Act at all mining and mineral processing operations in the United States. Under the authority of the Mine Act, MSHA conducts accident investigations to determine cause(s) of mine accidents and to use and share this information with the mining community and others for the purpose of preventing similar occurrences. The accident investigations also include determinations of whether violations of the Mine Act or implementing regulations contributed to the accident. MSHA investigated the MCCC breakthrough and the inundation of the active underground mine and released its report of investigation on October 17, 2001. In its report, MSHA arrived at the following conclusions:

“The failure of the Big Branch Refuse Impoundment and subsequent inundation of the 1-C Mine occurred because Martin County Coal Corporation failed to follow its approved Impoundment Sealing Plan, dated August 8, 1994, and subsequent modification, dated September 7, 1995.

The plan, prepared by Ogden Environmental and Energy Services, Inc., specified a seepage barrier to be constructed along the perimeter of the impoundment where mining had occurred near the outcrop of the Coalburg seam. The stated objective of this seepage barrier was to limit the quantity of seepage passing from the impoundment into the underground mine of the 1-C Mine in the Coalburg seam. Additionally, the stated objective was limiting the release of impounded water and fine coal refuse from the impoundment should a breakthrough occur.

The plan specifically states, “...following the completion of the ‘seepage barrier’ fine refuse shall be directed along the barrier by periodically redirecting the discharge of fine refuse slurry. As fine refuse settles and consolidates along the surface of the ‘seepage barrier’, seepage should be further reduced due to the low permeability of consolidated fine refuse.”

Redirecting of the discharge of the fine refuse slurry was not performed. Consequently, approximately 2 feet of water was present against the highly permeable shot sandstone portion of the seepage barrier at the location of the breakthrough. The absence of a fine refuse layer between the water and the shot sandstone in this area made the seepage barrier more permeable than intended. The seepage barrier failed to restrict flow through the barrier into the 1-C Mine, as the approved plan intended.

The August 8, 1994, Impoundment Sealing Plan was developed without the benefit of additional geotechnical investigation of the overburden above the Coalburg coal seam in the area of the proposed seepage barrier. The actual thickness of the stratum above the coal seam and the thickness of the colluvial soil deposits were not determined.

The plan, developed by the consultant and submitted by MCCC, was based on the assumption that the “seepage barrier” and strengthened mine seals would control the flow of any future breakthrough to the point where the active portion of the 1-C Mine would not be adversely affected. It was assumed that, if a breakthrough occurred, the discharge of water and slurry out of the South Mains Portal would not have a significant impact on the safety of miners.

Martin County Coal Corporation’s failure to follow the approved plan resulted in internal erosion (“piping”) occurring at the location of the breakthrough. Over a period of time, the seepage into this area began to carry sand (weathered material) into the mine opening. As material was carried away, a “pipe” (void) formed and worked its way toward the impoundment. As more material was carried in the mine, a larger seepage path was created allowing more and larger particles to be carried away. This process continued until the void developed close enough to the impoundment that the remaining plug of material failed suddenly, allowing the contents of the impoundment to discharge uncontrolled into the mine.”

The Kentucky Department of Mines and Minerals (DMM) administers the provisions of the Kentucky Underground Mining Law. The Kentucky law predates the federal Mine Act. Both Acts generally cover the same mining operations. DMM investigated the MCCC breakthrough under the authority of the Kentucky law.

MSHA, DMM, and DSMRE all took enforcement actions against MCCC concerning the breakthrough. MSHA and DMM each issued a “closure order” that restricts activities in the underground mine until safe conditions can be assured. On February 13, 2001, both MSHA and DSMRE ordered MCCC to submit a permitting action for the final closure and reclamation of the impoundment. Other state and federal agencies have taken separate enforcement actions.

Under the authority of the approved state program, DSMRE investigated the site after the breakthrough for compliance with the terms and conditions of Permit Number 680-8002, as well as the adjoining permits--Numbers 880-7000, 880-7002, and 680-5012. As a result of its investigation, on October 11, 2000, DSMRE issued Non-Compliance (NC) 41-1752, NC 41-1753, NC 41-1754, NC 41-1800, and Imminent Danger Cessation Order (IDCO) 04-1241 to MCCC. Also, on February 13, 2001, DSMRE issued NC 41-1552 to MCCC. DSMRE’s enforcement actions are described in Appendix 2. Following are details of these actions:

IDCO 04-1241, Permit Number 680-8002. This IDCO relates to the conditions, as cited in NC 41-1752, which created an imminent danger to the public and imminent harm to the environment.

NC 41-1752, Permit Number 680-8002. Violations cited included: (1) failed to pass all drainage and slurry through approved sediment control structures prior to discharge into waters of the Commonwealth of Kentucky, (2) engaged in an unsafe practice by allowing substandard water and slurry to flow from an impoundment into the underground mine, creating imminent environmental damage off permit, in Wolf Creek and Coldwater Fork watersheds, and (3) failed to protect the hydrologic balance by allowing substandard water and slurry to enter waters of the Commonwealth of Kentucky.

NC 41-1753, Permit Number 880-7000. Violations cited included: (1) allowed a large discharge to wash away sediment pond #200, and (2) allowed a large discharge to create a huge gully on the mine management area below sediment pond #200.

NC 41-1754, Permit Number 880-7002. Violation cited included: Slurry and coal refuse from the slurry discharge covered up three sediment-holding areas (sumps).

NC 41-1800, Permit Number 680-5012. Violation cited included: Sediment pond #326 is filled with slurry due to the slurry discharge.

NC 41-1552, Permit Number 680-8002. Violations cited included: (1) failed to accurately depict the unmined barrier of coal in the Coalburg coal seam within the impoundment, and (2) failed to comply with the terms and conditions of the approved permit including plans and documents provided as part of the approved permit including: (a) exceeded the approved slurry elevation (pool) for Phase III of the Big Branch slurry impoundment, (b) failed to construct hydraulic mine seal (bulkhead) at first left section, #2 North Main as approved by DSMRE, (c) engaged in the unapproved backfilling of one of the South Mains portals, and (d) failed to construct the seepage barrier according to approved designs.

In addition, Congress requested the National Research Council to examine ways to reduce the potential for similar accidents in the future. To conduct this study, the National Research Council (Council) appointed the Committee on Coal Waste Impoundments. The charge to the committee includes three major components. First, the committee was to examine engineering practices and standards currently being applied to coal waste impoundments and to consider options for evaluating, improving, and monitoring the barriers that retain coal waste impoundments. Second, the committee was charged with evaluating the accuracy of mine maps and exploring ways to improve surveying and mapping of underground mines to delineate more accurately how underground mines related to current or planned slurry impoundments. The third task was to evaluate alternative technologies that could reduce the amount of coal waste generated or allow productive use of the waste. The committee also examined alternative disposal options for coal slurry. The Council's report was released on October 12, 2001. OSM is currently working with MSHA on a comprehensive response to the Council's recommendations. The recommendations formulated in this report will be factored into OSM's comprehensive response to the Council's 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 Emergency Action Plan (EAP).
- MSHA's investigation of the 2000 breakthrough.

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 and certification and actions taken to protect the public. OSM provided copies of this report in draft to DSMRE and MSHA to assure that jurisdiction, determinations, and actions by those agencies were properly described. OSM considered the comments from DSMRE and MSHA and made appropriate changes to clarify the jurisdiction, investigation, and determinations made by those agencies. OSM refined its technical analysis in response to the comments, but did not change appreciably its conclusions and recommendations.

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