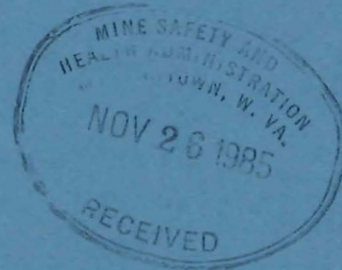


UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DISTRICT 4



INTERIM REPORT OF RETAINING DAM FAILURE
NO. 5 PREPARATION PLANT
BUFFALO MINING COMPANY
DIVISION OF THE PITTSTON COMPANY
SAUNDERS, LOGAN COUNTY, WEST VIRGINIA

February 26, 1972

By

W. R. Park
District Manager

James C. Blankenship, Jr.
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Joseph O. Cook
Supervisory Mining Engineer

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Jimmy L. Shumate
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Coal Mine Health and Safety District 4

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INTRODUCTION

This report is based on an investigation made pursuant to the provisions of the Federal Coal Mine Health and Safety Act of 1969 (83 Stat. 742).

A coal refuse retaining dam near the mouth of Middle Fork, Saunders, Logan County, West Virginia, failed about 8 a.m., Saturday, February 26, 1972. The dam failure released water, refuse, and silt into the valley traversed by Buffalo Creek and created havoc in the narrow valley. The flooding resulted in the confirmed deaths of 114 persons, total destruction of 502 permanent home structures and 44 mobile homes, major damage to 268 additional permanent home structures and 42 mobile homes, and minor damage to 270 additional homes along Buffalo Creek from Saunders to Man, West Virginia, a distance of about 17 miles. It was estimated that about 4,000 persons were left homeless. Numerous homes in the Buffalo Creek area were located above the flood plane and they were not damaged. A considerable number of displaced persons was able to obtain temporary refuge in these homes. The flooding also destroyed about 1,000 automobiles and trucks, highway and railway bridges, sections of railroad tracks and the macadam highway, public utility power cables and poles, telephone lines and poles, and other installations. Mine refuse, silt, and debris were scattered for miles along Buffalo Creek. About 60 persons who resided in the Buffalo Creek area remain on the missing list.

None of the Buffalo Mining Company's personnel who were on duty at the time of the dam failure died or suffered serious injury because

of the flooding. The Middle Fork stream empties into Buffalo Creek at Saunders and Buffalo Creek flows southwest to Man, West Virginia, where it flows into the Guyandotte River. The Guyandotte River flows north toward Logan, West Virginia, and no significant damage as a result of the retaining dam failure was reported along the Guyandotte River.

GENERAL INFORMATION

The Buffalo Mining Company, Division of The Pittston Company, operates five underground mines, a strip mine, and two auger mines in the Buffalo Creek area near Saunders, West Virginia. All coal from the mines is processed through a central preparation plant located on Buffalo Creek about 1/2-mile north of Middle Fork and the town of Saunders.

The initial mine in the area, No. 5, was opened in 1945 by the Lorado Coal Mining Company, and the preparation plant for this mine was begun in the fall of 1946 and completed in 1947. Additional mines were opened in the general area thereafter by the Lorado Coal Mining Company and the successor companies.

The No. 5 mine and the coal properties of the Lorado Coal Mining Company were acquired by the Buffalo Mining Company in 1964, and the mines were operated by this company until June 1970 when the properties were acquired by The Pittston Company.

The officials of the operating company are:

I. C. Spotte, President
D. S. Dasovich, Vice President - Operations
E. J. Wood, General Manager
Ben Tudor, General Superintendent
Mario Varrassi, Safety Engineer

The size and facilities of the preparation plant were increased as required by the increase of the mine product and market conditions. In February 1972, the preparation plant was operated two 7-1/4-hour shifts a day, 5 and 6 days a week. The plant processed about 5,200 tons of run-of-mine, raw, coal a day. On an average daily basis, about 4,200 tons of clean coal was shipped from the plant and about 1,000 tons of refuse, approximately 20 percent of the raw coal, was removed as the raw product was processed through the preparation plant. The refuse was transported to a storage bank on Middle Fork by means of 30-ton trucks and most of the refuse was used to make the retaining dams in the area.

The preparation plant utilizes a wet-cleaning process to remove refuse from the raw coal fed through the plant. About 500,000 gallons of water a day was needed to operate the plant. Water was

used in the process of removing refuse from the raw coal feed and during the processing, the water becomes contaminated with fine coal and refuse particles (solids). This water is replaced or clarified to keep the coal cleaning process working properly. Until 1964, the effluent water was discharged into Buffalo Creek and replaced with clean water; however, because of water pollution regulations, the Buffalo Mining Company began pumping the effluent water from the preparation plant to retaining dam sites on Middle Fork in 1964.

The dam sites provided settling areas for the solid materials in the effluent water, and clear water was decanted from the ponds and reused in the plant. About 450 gallons a minute of this water was pumped to the upper dam site when the plant was operating. Approximately 20 percent, by weight, of the effluent water is solids and based on this estimate, about 500 tons of solid material, fine coal and refuse, a day was being deposited behind the retaining dam that failed. Annually, it is estimated that about 200,000 tons of refuse and 100,000 tons of silt were being deposited in Middle Fork.

The Lorado Coal Mining Company began dumping mine refuse from the cleaning plant in the mouth of Middle Fork valley about 15 years ago. Middle Fork stream flows through a narrow valley with steep mountain sides and empties into Buffalo Creek at Saunders, West Virginia, a small mining town. The initial refuse was dumped near the intersection of the two streams, and miners lived in homes erected along Middle Fork. No effort was made to clear vegetation from the areas where the refuse was dumped, and the refuse bank grew in size and configuration as additional refuse was deposited in the valley. The extending of the refuse bank upstream required the abandonment of the homes, and there were no homes on Middle Fork adjacent to the refuse bank in February 1972. The refuse bank extended upstream 1,500 feet and averaged 600 feet in width.

A retaining dam was developed from the refuse deposits in 1964, at which time effluent water was first pumped into Middle Fork. In 1967, it was necessary to construct a second retaining dam. Extensive silt deposits had accumulated behind the first dam and additional space for refuse was needed. Clarified water from the second dam was then decanted into the remaining area behind the first dam. This clarified water was then recycled through the preparation plant. In 1970, the third retaining dam was completed, and the middle dam along with the first dam was used for the storage of clarified water.

In the early wet season of 1967, melting snows and heavy rains caused all streams in the area to rise, and water flowed over the tops of the unfinished second dam and the first dam and caused some damage in the basement of a home at the mouth of Middle Fork.

In 1971, about 1 year after the third dam (upper dam) was constructed, heavy rain and snow again caused flooding conditions in the Buffalo Creek area, and a portion of the upper dam failed at a location just off center toward the northeast side of the dam. According to a company official, the base of the dam in this area apparently slipped and a portion of the top of the dam collapsed. No downstream flooding or other damage resulted from this failure.

For many years, heavy rain and snowfalls in the January through March periods have normally resulted in some degree of flooding conditions throughout Southern West Virginia, particularly in the Buffalo Creek area.

The lower or first dam was constructed by hauling refuse from the preparation plant and placing it partially across the valley at a point upstream from the then existing refuse pile. This refuse was apparently placed on firm ground. Silt and water from the preparation plant, as well as surface runoff water, were impounded.

The middle and upper dams were constructed by hauling refuse by truck from the preparation plant and dumping it into an area which contained silt and water impounded earlier. No effort was made to clear vegetation or trees prior to dumping refuse or impounding silt. This is evidenced by trees exposed in the dam locations after the failure. This refuse material was dumped across the width of the hollow, thus continuing the impoundment of silt and water pumped from the preparation plant, as well as surface runoff water. The upper dam was dumped on continuously after its inception.

Recently, placing of the refuse was done by dumping trucks either over the ends of the dam and into the impoundments when possible, or by dumping the loads on the top of the dam for spreading. When loads were dumped on top, this material had to be leveled periodically to prevent blocking the access for trucks. This was done by grading the material with a bulldozer and then "back blading" or scraping the material with the back of the bulldozer blade while operating in a reverse direction. This provided a level surface for haulage. Compaction was done only by the weight of the bulldozer and trucks as they moved across the material.

A 24-inch overflow pipe was placed in the upper dam, approximately 10 feet below the level of the compacted area on the left, or lower side of the dam. The overflow water was allowed to discharge into the middle pond for further settling.

A 30-inch pipe carried the overflow, or clarified water, from the middle pond to a diversion ditch adjacent to the mine road on the left side of Middle Fork. Two 24-inch pipes discharged water from

the lower pond and into the diversion ditch through a culvert. Water from the diversion ditch was directed through two culverts to Buffalo Creek where a small impoundment collected this water, as well as stream water. Water was pumped from this point back to the preparation plant for use in the washing processes.

Due to thick silt deposits on the remains of the middle dam and to the extensive damage in the area of the dams, accurate measurements could not be obtained throughout. The attached map, figure 2, indicates that the lower pond was approximately 150 feet by 300 feet, the middle pond 400 feet by 300 feet, and the upper pond varied in width to 430 feet and was around 2,500 feet long. The middle dam was estimated to be 140 feet long, 300 feet wide, and about 30 feet high. The upper dam, shown on figures 2 and 3, varied from 300 to 400 feet long, 450 feet wide, and of varying height.

After the dam failure, a profile taken of the upstream end of the upper dam, shown on figure 3, indicates the depth of the water to have reached a height of 44 feet at the dam. The amount of water estimated to have been impounded behind the upper dam was calculated to be approximately 130,000,000 gallons. The watershed feeding into the impoundment was estimated to be 700 acres.

The amount of refuse material washed out of the upper, middle, and lower dams, and from the burning refuse bank was estimated to be about 1,000,000 tons.

This report is based on a preliminary investigation of the accident area by Bureau of Mines personnel and discussions with company officials and employees.

Discussions were held with the following company officials and employees:

I. C. Spotte, President
E. J. Wood, General Manager
Ben Tudor, General Superintendent
Jack Kent, Strip Mine Superintendent
Waldon Mullins, Superintendent, No. 5 mine
Roby Morgan, Superintendent, Mark mine
Wayne Goodman, Chief Electrician
Luther Browning, Section Foreman
William Peyton, Section Foreman
Bill Linville, Assistant Preparation Plant Foreman
James Morgan, Fire Boss
Brady Elswick, Bulldozer Operator
Fred Miller, Day Shift Truck Driver
Henry Mills, Second Shift Truck Driver

Denny Gibson, Front-End Loader Operator
John B. Wells, Loading Machine Operator
Mason Blankenship, Preparation Plant Employee
Charles Lockhart, Third Shift Maintenance Foreman
Warren Adkins, Third Shift General Inside Laborer

The writers were assisted by the following Bureau personnel:

John J. Somers, Coal-Mine Inspection Supervisor
Gary C. Perry, Ventilation Specialist
Arthur E. Sammons, Coal-Mine Inspector

STORY OF THE RETAINING DAM FAILURE

The week preceding the dam failure was marked by heavy rainfall and thawing snow. Unofficial measurements of rainfall during the 5 days preceding the retaining dam failure showed 3.84 inches of rainfall. The heavy rains caused the local streams to rise and many individuals in the Buffalo Creek area were concerned about flooding and dam failures, especially during the latter part of the week. Many persons living near the Middle Fork retaining dams were apprehensive that these dams might fail or be overrun with the impounded water.

All the mines on Buffalo Creek were active the entire workweek, and mines of the Buffalo Mining Company were operated the 12 mid-night to 8 a.m. shift, February 26, and these mines were scheduled for work on the 8 a.m. to 4 p.m. shift, February 26.

Federal Coal-Mine Inspector Earl Reedy and Mario Varrassi, company safety engineer, drove by the refuse bank and retaining dams on a road parallel to the bank and dams enroute to the No. 5 mine on Tuesday and Wednesday, February 22 and 23, 1972. Inspector Reedy observed that the bank and dams were stable and apparently in satisfactory condition. Reedy estimated that the water impounded upstream was about 15 feet below the top of the upper dam on Wednesday, February 23.

The water impounded by the upper dam continued to rise on Thursday, February 24, and Vice President Dasovich and Jack Kent, superintendent of the company's stripping operations, traveled to and examined the upper dam. During the examination and discussion, they agreed that neither the dam nor the rising water presented danger of collapse or flooding at that time. They were of the opinion that much additional rainfall would be required before a dam overflow could occur. Because the rain was continuing during the conversation, Kent agreed that he would check the dam and rising water regularly Thursday night. At 4 p.m., Thursday, February 24, Kent observed that the water was about 5 feet below the crest of the

compacted portion of the dam. Kent placed a measuring stick 3 feet 9 inches in length at the lowest side of the dam to measure the rise of the water. This stick was placed so that the top of the stick was approximately 1 foot below the compacted portion of the dam.

About 4 p.m., Friday, February 25, Kent returned to the dam and found that the water level had risen between 1 and 1-1/2 feet according to the markings on the measuring stick. During the late afternoon of February 25, heavy rains began to fall and such rain continued during most of the night. Kent thereafter visited the dam at 2-hour intervals and noted that the water was rising an inch per hour until 3:30 a.m., Saturday, February 26, at which time he observed that the water was rising 2 inches per hour. At 4:30 a.m., Kent noted that the water had risen 3 inches in the preceding hour and that only the top 3 inches of his measuring stick was not covered by water. Immediately after the 4:30 a.m. examination of the dam, Kent traveled to a nearby telephone and called Dasovich to inform him of the rising water. Kent asked Dasovich to come to the dam, and an examination was made about 6 a.m., February 26. During this examination, Kent observed that the rising water had covered the measuring stick and was about 1 foot below the compacted portion of the dam.

There were two sections of 24-inch metal pipe available near the dam, and Dasovich decided to have a ditch cut from the impoundment to the diversion ditch and thereafter install a pipe and use it to take care of the impounded water as it continued to rise. Bulldozer operators were called to bring their equipment from a strip mine about 3 miles distant to do the necessary cutting. These men arrived at Middle Fork about 6:30 a.m. and then proceeded to the strip mine. When they returned to the dam site with the bulldozer, the dam failure had occurred. Kent stated that he talked to several other persons during his examinations of the dam and that he telephoned several families in the Lorado and Saunders area after his 4:30 a.m. examination and advised them of the rising water and the possibility of the dam overflowing.

During Kent's examinations of the dams on February 25 and 26, he observed that a slide had blocked the mine access road between the lower and middle dams, causing surface water to be diverted into the middle dam, causing an overflow. Kent contacted an equipment operator and had the slide cleared by 4:30 a.m., February 26. The clearing of the slide permitted the surface water to again flow in the established drainage ditch. At 4:30 a.m., the water was about 1 foot below the top of the middle dam.

Many other company employees discussed in detail their visits to and/or by the dams on Friday and Saturday, February 25 and 26. These men were employees on duty or making voluntary visits to the

dams because of their concern for the stability of the dams and/or possible flooding. One man visited the upper dam between 12 and 12:30 a.m., February 26, and observed the water measuring stick used by Kent. This witness returned to the dam between 7:30 a.m. and 8 a.m., February 26, and stated that he could see water "oozing" up into the piles of loose refuse on the dam. He was wearing low-cut shoes and sank to his ankles in the softened refuse while walking on the dam. He stated further that the dam surface was well soaked and "juicy" and that a platform used by Kent to place his measuring stick was covered by the water. This man remembered Kent's cautioning him earlier that if the platform became covered with water that persons on Buffalo Creek would have to be evacuated. He then left the dam to move his family to safety.

Other persons visiting the dams judged the impounded water behind the upper dam to be from 6 to 10 feet below the top on Friday evening and Saturday morning. The judgments were made from cursory examinations or from walking on the dam. These men did not use Kent's measuring stick or similar means to make their determinations. These men stated that they did not observe any abnormal condition of either the dams or the impounded water.

The small town of Saunders included 23 homes which were located near the mouth of Middle Fork. Twenty of the 23 families had evacuated their homes by late Friday evening, February 25, and traveled to a school house located about 5 miles downstream at Lorado. These families and many others remained in the school house during the night and were unharmed. Families in Saunders evacuated their homes because of their concern that the dam on Middle Fork would fail. The families that remained in Saunders on the night of February 25 did so because of previous warnings of dam failure that did not occur.

About 5:30 a.m., February 26, two men were stopping automobiles traveling up Buffalo Creek at Lorado and warning the travelers of the possible dam failure upstream. Reportedly, most upstream travelers did not stop their travel because of the possible danger.

About 5:30 a.m., a woman at Lorado telephoned the Sheriff's Office in Logan, West Virginia, and reported that the dam on Middle Fork was nearing failure and families on Buffalo Creek should be warned of the possibility of the dam failure and flooding downstream. The Sheriff's Office dispatched two Deputy Sheriffs to Buffalo Creek and the Deputies warned numerous families living in low areas along Buffalo Creek of the possible danger of the dam on Middle Fork failing and flooding the area.

About 8:05 a.m., February 26, both radio stations in Logan, West Virginia, were advised by residents on Buffalo Creek that the dam on Middle Fork had failed and that water was cascading down Buffalo

Creek. The radio stations interrupted their programs and warned all listeners of the dam failure and the need for residents on Buffalo Creek to travel to safe locations. It is believed that these warnings resulted in many families evacuating their homes and traveling to higher safe locations. These warnings undoubtedly saved many lives.

Apparently no person or persons actually saw the initial failure of the upper dam. Persons in three general locations discussed in detail events subsequent to the failure.

Several workmen on the 12 midnight to 8 a.m. shift at the No. 5 mine completed their shift and were enroute to their homes when they became aware of the dam failure. The first of these men to reach the dam area became aware of the failure when the windshield of his car was covered with wet mud, dirt, and slime. Apparently these materials came from the burning refuse pile located about 1,500 feet downstream from the upper dam and, from all indications, was the result of an explosion caused by the sudden inrush of water from the dam failure into the burning refuse pile. He stopped the car, stepped out of the vehicle, and observed water running downstream. He did not hear any unusual noises. The automobile following the first vehicle was also covered by the falling material, and the driver also observed the water running downstream.

At this time, the upper dam had been breached. These workmen estimated that they reached the dam about 8:05 a.m. and one of them immediately turned his automobile and returned to the mine to report the failure. When he reached the mine, an electric light bulb at the shop stopped burning, indicating a power failure. He called to several men in the shop entrance and reported the dam failure. One of these persons tried to place a telephone call to warn those living in the valley, only to find that the telephone was inoperative as a result of the flood damaging the telephone lines.

Other employees from No. 5 mine arrived at the dam site after the failure and observed that the water continued to flow until about 8:30 a.m.

Two company officials were in the No. 5 preparation plant supply house and noticed a fluctuation in the power system. They went outside and observed considerable smoke coming from the direction of the burning refuse bank. One of the men attempted to drive along the mine road leading to the dam, but he stopped when excessive water in the ditch and the road was encountered. He then observed the large body of water flowing from the dam failure.

An equipment operator was grading a slide across the highway along Buffalo Creek upstream from Middle Fork when he observed water coming from the mouth of Middle Fork. He saw the body of water as

it demolished a church adjacent to the refuse pile and as it appeared to roll over the houses in Saunders. He estimated that it took about 30 minutes for the water to pass this location.

Various persons described their impressions of the explosion or explosions that occurred when the water reached the burning refuse bank. It was apparent that large amounts of material had been released from the refuse bank, and soot and fine dust covered the immediate area, showing clearly that explosion forces had been released.

The Bureau of Mines was not apprised of the apparent impending dangers or concern for the dam's stability on February 24, 25, or on the morning of February 26 prior to the dam failure.

SUMMARY

The conditions and practices discussed in this report were observed during surface examinations in the immediate area of the retaining dams and refuse bank. Other information was acquired from discussions with company officials and employees. Such data are summarized as follows:

1. No one actually observed what occurred at the precise moment the upper dam failed, and whether portions of the dam failed first and the dam later collapsed or whether the water overflowed the dam likely will never be known.
2. Rumors of explosives being discharged at the dam and the dam being "blown up" by a person or persons unknown were unfounded. The "assumed shooting cable" was the remains of a telephone system that was used to provide an outside communication line to the No. 5 mine. The telephone system was rendered inoperative as a result of the inundation, and the shot holes were the remains of previous road construction work.
3. The retaining dams were inspected daily by the truck drivers and other employees and officials examined the dams periodically; however, a written record of such examinations was not made. A particular employee or official was not instructed to make a regular examination of the dams for hazards.
4. Prior to the failure, a determination had not been made of the amount of water retained by the dams.
5. Vegetation was not removed in the water storage and refuse areas before dumping was begun nor as the dumping was continued.
6. Materials, such as posts, half headers, wedges, and crib blocks, materials easily subjected to decaying and/or degradation action, were not removed from the refuse. Consequently, such materials were found in the dam.

7. Reportedly, company officials did not contact State agencies to request permission to drain the impoundments or lower their water levels.
8. The dams were not continuously monitored during periods of high precipitation.
9. An emergency plan had not been formulated for negating the hazard of rising water and warning persons downstream of possible flooding.
10. Many persons downstream were not alarmed or unduly concerned when warned of the possible dam failure on Middle Fork and did not seek shelter at safe locations because dam failures and flooding did not occur during previous rainy seasons and similar warnings were given at such times. The immensity of the refuse bank and dams likely convinced many people that serious flooding could not occur from Middle Fork.
11. An estimated 130 million gallons of water, silt, and about a million tons of refuse materials were displaced from the immediate vicinity of the dams.
12. Examination of the retaining dams revealed that adequate engineering practices were not being followed. Other retaining dams located throughout the coal industry have been constructed by similar methods, and this is a prevalent practice. It appears that sufficient engineering data on coal mine refuse type retaining dams is not readily available.
13. These retaining dams were constructed for the purpose of settling solid materials from effluent preparation plant water, which has been a practice used throughout the coal mining industry, mainly to comply with water pollution regulations. Although other methods of clarifying effluent coal preparation plant water are available, even with such methods, the disposition of fine refuse remains a major problem.

REQUIREMENTS

1. Pending results of investigations by the U. S. Department of Interior task force to study coal waste hazards, the U. S. Army Corps of Engineers, and other assigned Government agencies, requirements will be forthcoming.

NOTICES AND ORDERS

Violation - Section 77.216

A delegated official or employee had not been instructed to make weekly examinations of the dams for hazards and weekly records

were not kept. A Notice of Violation No. 1 was issued March 14, 1972, on Form 104(b), requiring that the violation be abated by 8 a.m., on March 21, 1972.

Respectfully submitted,

/s/ W. R. Park

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District Manager

/s/ James C. Blankenship, Jr.

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Subdistrict Manager

/s/ Joseph O. Cook

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/s/ Jerry R. Herndon

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