

# BRUSHY FORK SLURRY IMPOUNDMENT FINAL REPORT

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## APPENDICES/ATTACHMENTS (not included in pdf version of report)

Location Map of WV Coal (Slurry) Impoundments  
Location Map of WV Impoundments (by County)  
DEP TAGIS Impoundment Database (41 fields)  
Metals in Coal Cleaning/Slurry (CCC, et al Report, 2000)  
MSHA Impoundment Database (14 fields)  
MSHA Risk Assessment Procedures (12/1/1997, posted on Web 12/4/2000)  
MSHA Slurry Composition (General)  
MSHA Toll-free contacts and phone numbers  
Material Safety Data Sheet (for Superfloc A-1885 RS flocculant, a chemical of concern)  
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### Permit Map Plates – Annotated (see map tubes)

- Dam in Cross-section (original permit v. current and long-term plan)
- Dam in Plan View (with Eagle workings depicted)
- Comparison of Areas, Original Permit and IBR-6
- Eagle Mine Workings (with dip direction, slurry pathway)
- Eagle Mine Workings Shadow Area under Impoundment
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- Eagle Pillar Locations and Sizes (beneath impoundment)
- Emergency Evacuation Plan (map of routes, flood inundation areas)

## **Brushy Fork Slurry Impoundment – A Preliminary Report**

By: Rick Eades, Independent Hydrogeologist

For: Ohio Valley Environmental Coalition

December 8, 2000

### **Introduction**

The Ohio Valley Environmental Coalition (OVEC) requested that I perform a review of the Brushy Fork Slurry Impoundment permit, based on a large number of concerned citizens, my past experience with the site assisting Coal River Mountain Watch, and recent elevated concerns following the October 11 breakthrough and slurry discharge from an Martin County Coal Company/A.T. Massey facility in Martin County, Kentucky.

Brushy Fork Slurry Impoundment is located in extreme westernmost Raleigh County, West Virginia (WV). Brushy Fork is a tributary of Little Marsh Fork, that flows into Marsh Fork, comprising part of the headwaters of the Coal River upstream of Whitesville.

The following final report identifies some of the findings of this effort. A preliminary report was offered 12/4/2000 to assist in preparation for public hearings on December 5, 2000 which will address the Brushy Fork facility permit renewal. The final section offers several points regarding the Marfork Coal Company presentation at the public hearing and notes discrepancies between those claims and permit documents on file at DEP and provided by permit reviewer Greg Demyan.

### **Brief Background**

Twice in 1999, I was asked to evaluate Brushy Fork Incidental Boundary Revision (IBR) requests, for the purpose of preparing comments for public hearings. IBRs are modifications to original permits. The Brushy Fork Slurry Impoundment was originally granted a permit November 11, 1995. In 1999 and later in 2000, I provided assistance as a staff member of West Virginia Citizen Action Group and on behalf of Coal River Mountain Watch. I had very limited time and resources to conduct a thorough permit review and had to base my concerns on more generalized evaluations after brief review of a selected maps and permit files.

In a July 2, 1999 public hearing addressing a request to expand of the dam/impoundment, I testified that I did not know of a larger facility in West Virginia, had asked DEP officials if they did. At that time, they too were not sure if any single slurry impoundment in the state was larger in size. I raised concerns about:

- the quality and consistency of refuse compaction in the dam itself,

- adequacy of underdrains,
- the life expectancy for underdrains for such a long duration project,
- potential for the filter fabric to breach, allowing the drain to plug and fail
- the adequacy of only 5 piezometers to measure water levels within the refuse,
- maintenance of piezometers in likely shifting or settling refuse, and
- overall adequacy of monitoring plans, the underdrain, and material stability for the life expectancy of the facility.

My initial concerns were with the safety of the dam itself, given the immense size of the facility and population centers directly downstream. At that time, violations for inadequate refuse compaction had been previously issued. Releases of significant “black water” has already occurred into the Coal River earlier in the year, and additional actions had been taken on site to correct a broken slurry line – identified as the source of that problem. Also of concern at the initial hearing was the existence and adequacy of emergency evacuation plans for communities downstream of the facility.

In December 1999, a second public hearing occurred on separate IBRs (#5, to allow mining of Chilton seams before continued filling of the impoundment, and #6, to expand the facility size). At that time, I expanded my testimony to include specifics about mining and blasting associated with coal extraction and relative to underground mine roof integrity, as well as the general concern of the very long term impacts. Again based on a short review, I questioned blasting where underground mines existed in the Eagle coal seam, the possibilities for adversely affecting near surface bedrock in a way that could possibly enhance pathways for slurry to be released via the subsurface and bypass the dam.

I challenged all Marfork and DEP folks in favor of the expansion to reconsider the scale, arguing that approving a dam crest increase of nearly 400 feet was ludicrous (the dam structure was already approved to a vertical relief of over 500 feet). To bring the picture more forcefully to light, I offered that water and gravity had carved the valley of Brushy Fork, Marsh Fork and the Coal River from solid bedrock. Those same forces would surely carve the softer refuse out of the valley and re-deposit it in the Coal and Kanawha River basins given enough time. No one could or dared refute this assertion. Subsequent to the hearing, DEP approved only a 100-foot increase in dam height and Coal River Mountain Watch appealed the IBR-6 approval to the Surface Mine Appeal Board.

In May 2000 the Surface Mine Appeal Board heard Coal River’s appeal, which was not strong on a “regulatory process” basis. DEP and Marfork attorneys essentially acted as co-counsel throughout that hearing. In testimony, I challenged the DEP about their monitoring plan for potential subsidence and breakthrough of the slurry into the underlying Eagle Coal Seam. The Eagle mine workings map indicated it directly underlaid a substantial portion of the impoundment area with what then appeared to be less than 200 feet of interburden separating the two.

As it turned out, DEP had required no new groundwater monitoring despite the fact that IBR-6 expanded the facility by 272 acres, bringing coal waste and slurry into horizons that might allow for impacts on groundwater. Note that the original permit was for only 270 acres, and with IBR-6 had grown to 645 acres. The DEP permit reviewer testified that the original permit had one groundwater monitoring well. That well was an old residential well that provided little useful information on subsurface conditions, and was not properly located to be useful regarding groundwater impacts, subsidence or breakthroughs in the area of concern (commonly referred to as the “shadow zone,” where mining directly underlies the dam and pond).

The SMAB denied the appeal, but granted the permit expansion only on the condition that a new groundwater monitoring plan be developed and implemented. Unfortunately, the Board did not require a deadline for the monitoring plan and well installation, and as of this writing the plan has still not been developed.

During testimony before the Board, it was established that DEP permit reviewer Greg Demyan had only inspected the Eagle mine workings on one occasion, and that was during August 1999 at the conclusion of possibly the 2 driest years on record in the last century. He had found the mine to be dry and the roof in good condition based on visual observations. Although I had commended DEP on the apparent thoroughness of roof stability studies they had required, I had raised doubts that they had fully evaluated natural fractures or the impact fractures might have on stability. I noted that fractures provide the primary vertical pathway for groundwater to move into the roof material, and any presence of groundwater could contribute to long-term concerns about material stability.

Coal River Mountain Watch considered our efforts to be a success, in that the SMAB ruling limited the expansion and ensured some degree of additional safety, if for no other reason than putting Marfork Coal Company on notice that the Board and citizens were going to be evaluating the facility with newer levels of concern for potential subsidence and slurry breakthrough.

### **November-December 2000 Data Collection and Methodology**

Given the catastrophic October breakthrough of slurry from the Martin County, Kentucky (KY) site into underground mine workings and subsequent severe damage to over 70 miles of streams and rivers, additional review of the Brushy Fork site during November and December largely focused on potential risks for any similar occurrence at this facility. Several data sources were accessed, although follow through with the Mine Safety and Health Administration and several other regulatory officials is still needed to assess possible blasting induced fractures, fires within the up sequence Dorothy coal seam in the area, and other safety concerns. Data contained herein were provided in part from:

- Oak Hill DEP Office of Mines and Minerals (OMM) file review – 11/28/2000
- Personal communication with DEP permit reviewer Greg Demyan

- Personal communication with DEP lead engineer Ed Wojtowicz
- Personal communication with DEP/Nitro subsidence engineer Dalip Sarin
- Nitro DEP TAGIS mapping unit
- Personal communications with TAGIS staff, Michael Shank
- Personal communication with Carolyn Johnson, Citizen Coal Council
- Personal communication with Nathan Fetty, WV Rivers Coalition
- Personal communication with Pam Nixon, DEP Environmental Advocate
- Personal communication with John Ailes, Deputy Chief OMM/Nitro
- Personal communication with Mike Castle, DEP Director
- Personal communication with Tom Galya, DEP mining and groundwater expert
- Personal communication with Ed Griffith, DEP Region 3 oversight
- Personal communication with Mike Zeto, DEP OWR Biologist
- Information provided during the 12/5/2000 public hearing in Whitesville.

Vivian Stockman and Clayton Scott also provided assistance, during Oak Hill file reviews. No effort was made during this work to assess compliance with NPDES permit requirements. Future contacts with DEP's George Jenkins will be necessary to establish, what inspection and enforcement actions have been taken chronologically at the site.

Data on violations, citations, fines levied and paid is still needed, especially given the 9/21/2000 runoff/discharge event from what Massey/Marfork officials claim was the downstream face of the dam (an area DEP's Greg Demyan said may be purposely getting steeper).

Note that data collection does not reflect a comprehensive review of all existing records, and that inspection reports and history of violations were not present in the Oak Hill file when those files were reviewed on the afternoon of 11/28/2000. The brief review of IBRs and permit files was limited to collectively less than 36 hours of effort. Note that DEP reviewer Greg Demyan has spent approximately 800-1000 hours reviewing and commenting on the permit and its various IBRs.

## **Preliminary Findings**

### *Big Picture of West Virginia Impoundments and Slurry Ponds*

During the file search and interviews, I was able to obtain a number of maps and documents pertaining to the status of slurry impoundments in West Virginia. Much recent activity has occurred in the regulatory community to inventory sites, assess risks of breakthroughs, and prioritize sites in terms of risk. Separate task forces have been hatched, including ones by MSHA, the Office of Surface Mining (OSM), and the DEP. The following items are included as attachments, and will subsequently be annotated and included as appendices of the final report:

- Map of 136 (some may be redundant) facilities in WV (DEP TAGIS)
- Map of permitted facilities by county, indicating 134 sites (DEP TAGIS)
- Aerial photo of Brushy Fork in 1996 @ early stages of construction (DEP TAGIS)

- DEP database of all 136 facilities (contains facility name, company and phone, MSHA ID No., DEP ID No., status, dam name, dam classification, watershed, county, DEP Inspector and phone, renewal dates, latitude, longitude, description with notes on underground mines existing, original date of permit issuance, expiration date, status of renewals, inspection status, responsible party/operator name, original acres, current acres, reclaimed acres, watershed ID no.).

MSHA has developed its own database (see attachments) and classifications for the impoundments, which note high risk and moderate risk sites, based primarily on risk to miner's safety and threats to the safety of the general public. MSHA has statutory authority to protect the environment only as a tertiary responsibility. OSM has statutory responsibility for all surface mining operations, including the placement of mine wastes, and apparent primary responsibility for environmental protection. The slurry dam is composed of mine waste or refuse, while the pond created by the dam is used to hold slurry from coal cleaning and processing. The slurry pond allows solids to settle to the bottom, with water at the top clearing up enough for reuse or discharge.

MSHA officials have apparently told Whitesville resident Freda Williams that the site is the "top" high priority in the area, although current status of the database ranks it as Moderate in risk, just as the Martin County KY site was ranked before it broke through.

#### *Brushy Fork Slurry Impoundment – Permit Numbers and Contacts*

- DEP permit number - 3010-95
- Company – Marfork Coal Company (subsidiary of A.T. Massey)
- Company phone – 304-854-1854
- Company contact – Paul McCombs (regarding permitting activities)
- DEP Region oversight – Region 3, Oak Hill OMM
- DEP Region 3 phone – 304-465-1911
- DEP Region 3 contact – Greg Demyan (permit reviewer)
- DEP Region 3 inspector – Tom Wood
- DEP Region 3 inspector phone – 304-877-5805
- MSHA ID number –1211WV40234-02

Hazard ranking performed by MSHA characterizes the site in terms of risk, with first emphasis on miner safety, as moderate risk for breakthrough potential.

#### *Brushy Fork Slurry Impoundment Size and Uniqueness*

Size – Currently permitted acreage at Brushy Fork Slurry Impoundment is 645 acres, making it the single biggest facility of its type in Southern WV’s coal fields, based on current TAGIS database review. Only 2 permits in Northern WV are larger in acreage. A Monongalia/Marion County site (or complex of permitted facilities) is currently 892 acres. A Harrison/Marion County site (or complex of permitted facilities) is 1056 acres. Hence, the preliminary review of data suggest the Brushy Fork site is 3<sup>rd</sup> largest permitted impoundment in WV, although the larger sites may in fact represent more than one pond or facility in complexes. If, as suspected, the large northern WV sites are comprised of more than one pond or facility, that would mean the Brushy Fork facility would be the biggest such site in WV history.

Note that some DEP database uncertainty still exists and needs to be resolved. For instance, the Monongalia/Marion site is listed on 7 separate lines (rows), but has the same acreages and start dates for each. The Harrison/Marion site is listed on 8 separate lines (rows), with the same acreage and dates.

Size Relative to Age of Facility - In terms of timetables, the 2 large facilities in Northern WV were started in 1983 and are still in operation. The Brushy Fork impoundment was originally approved in late 1995, and is projected to take about 27 years to complete. This timetable would suggest the facility would still be operating in the year 2022. In essence, no facility larger than Brushy Fork has been permitted in the past 17 years in WV. Note that Marfork Coal Company wanted a much larger expansion than was granted in IBR-6 for Brushy Fork. In their effort to obtain IBR-6, Marfork applied to expand the dam height to a crest of 2240 feet in elevation (instead of the 1942-foot dam crest granted).

#### *Dam Height and Coal Waste*

The toe of the dam occurs at an elevation of 1320 feet (msl), and the currently approved crest of the dam is at 1942 feet (msl), meaning the vertical relief will rise to 622 feet (elevation change from toe to crest, based on map plates). The DEP permit reviewer noted that the actual approval to date is for a crest at 1893 feet, which provides a vertical relief of 573 feet. For comparison, the New River Gorge Bridge is just over 870 feet, at its deck, above the New River. Had Marfork’s full expansion been granted – or in the event it ever is – the impoundment height would reach 920 feet. That is higher than the New River Gorge Bridge.

Within the impoundment, the permitted thickness of the coal waste or refuse seems to be 450 feet or less at any one point in the current dam, based on review of engineering cross-sections (Profile A-A’ in the 7/16/98 Geo/Environmental Associates Report, Sheet 8 of 13).

#### *Slurry Impoundment Area and Volume*

The volume of slurry currently permitted behind the dam at “normal” stage is 15,672 acre-feet. Note that an acre-foot is just what it sounds like, as an acre sized area would be uniformly filled to a depth of one foot. More importantly, the volume that would be allowed under maximum reservoir levels is 18,830 acre-feet.

The area of the approved pond at normal stage is 112.9 acres and increases to 127.7 acres at maximum designed reservoir levels. For comparison, the Martin County KY site was a 72-acre pond. Subsequent to file reviews, Massey/Marfork officials identified that the pond would reach 153 acres. This discrepancy had not been resolved at the time this report was completed. Massey officials have confirmed that the pond would be permitted to store nearly 5 billion gallons of slurry, 20 times more than the amount released at the Martin County, KY site.

Should Marfork Coal Company be successful in further expanding the dam, it could eventually hold over 22,700 acre-feet of slurry at normal stage. That is roughly equivalent to slurry aquarium with a base the size of a football field and a height that is higher than Mount McKinley, the highest mountain in North America.

#### *Coal Waste and Slurry Composition (Generally) and Potential Concerns*

Although many in the industry and in the regulatory community contend that the coal waste is nothing more than rock and dirt that is only partially true. Refuse in the dam itself can be characterized this way to a degree. Slurry cannot. Even the coal waste within the dam itself must be viewed with some reasonable suspicions; as such a facility, which operates over a 27-year period, would be potentially attractive for other types of un-permitted disposal.

The processing of coal involves methods of sorting out waste rock, including floating the coal to get heavier waste rock to settle out and be separated. In various stages, coal cleaning also includes the use of flocculants (which help solids solidify and drop out of suspension). Coal cleaning also involves cleaning the coal of impurities, which often includes the use of surfactants or soaps. All of these processes may involve chemical usage, which could present environmental concerns in the future.

One of the compounds sometimes used as a flocculant is of serious concern. It is not known at this time is that flocculant has been used in coal cleaning or slurry at the Brushy Fork site or nearby prep plant. Superfloc A-1885 RS Flocculant is described in Material Safety Data Sheet toxicology sections as follows, “contains (a) chemical(s) known... to cause cancer and birth defects or other reproductive harm.” Martin County KY cleanup and water monitoring efforts have been complicated by concerns this chemical may have been in their slurry.

Serious concerns exist with regard to heavy metals occurrence in coal slurry or sludge. Chemical analyses of the sludge and water, and toxicology reports, are still (!) pending almost 2 months after the Martin County KY disaster. If those data indicated

any concern for flocculant contamination (poly acrylamides), that data almost certainly would have been released for liability reasons. More likely, the sample analyses have shown at least some significant levels of heavy metals released to the environment from the breakthrough, and news accounts have said only that mercury, lead, and arsenic have been found – but not the concentrations and locations/extent of those findings.

Metals of concern in coal slurry include mercury, lead, arsenic, chromium, cadmium, boron, selenium, nickel, and others. Typically, when coal mining impacts sediment or water quality, the metals analyses are for iron, manganese, and aluminum only. These latter metals are often found in high concentrations and must be treated. However, metals such as mercury, lead, or arsenic are much more sinister in terms of health impacts and are not typically analyzed for in mine drainage or discharge because they generally occur in very low or even non-detectable concentrations.

In coal slurry, because the coal is cleaned to remove impurities and the “fines” within the slurry eventually settle to the bottom of the pond forming sludge, that slurry/sludge is likely to concentrate trace metals. The presence of these more problematic metals in coal has long been known. Groundwater beneath the John Amos coal-fired power plant and its coal stockpiles has been shown to be contaminated with mercury. When coal is burned, mercury, arsenic, and lead can be by-products in the air emissions (last year John Amos reported 44 tons of lead, 25 tons of arsenic, and 12 tons of lead emitted in a single year).

These same metals are removed from raw coal by coal washing as well. Obviously, coal-fired utility companies who buy the coal would prefer the lowest concentrations possible for their storage and use (and subsequent liabilities).

The Citizen Coal Council, Clean Air Task Force, and Hoosier Environmental Council published a report in March 2000 that indicates metals removal during coal washing does present some serious concerns about their fate in slurry and sludge from that process. The report summarized metals from raw coal production and the amount removed in coal cleaning as follows:

<u>Metal</u>	<u>present in raw material</u>	<u>removed in coal washing</u>
Mercury (Hg)	109 tons	13 tons
Arsenic (As)	7884 tons	3236 tons
Cadmium (Cd)	750 tons	251 tons
Chromium (Cr)	8810 tons	2474 tons
Nickel (Ni)	9339 tons	2754 tons
Selenium (Se)	2587 tons	1098 tons

The above metals data is for all coal mining in the United States annually, and serves to underscore the veracity of claims that heavy metals could be a significant problem in slurry derived from coal processing and washing. Potential health effects from some of these metals are typically far more disturbing than the metals commonly

monitored at mine sites (iron, manganese, aluminum), although the risks from manganese and aluminum may be further illuminated in the future.

### *Historic Coal Mining Beneath The Currently Permitted Impoundment*

Several seams have been mined beneath the Brushy Fork impoundment. This preliminary report addresses only 2 seams of primary interest – the Eagle and Powellton. No additional time or effort has gone into assessing mining in the #2 Gas seam, the Winnifrede seam, Dorothy seam, or other seams, as the current layout of the site may more directly impact the mine workings in the Powellton or Eagle seams.

#### *The Eagle Coal Mine Workings*

The greatest concern at present is with the Eagle mine workings. Illustrations are attached that best document this concern. As shown in the previously referenced A-A' cross section of 1998, the Eagle seam may occur within as little as 100 feet of the base of the impoundment. The Eagle seam has been deep mined extensively in the area by room and pillar method. There is no indication at this time that second mining, which robs the pillars and allows subsidence (either by continuous or longwall methods) has occurred in the Eagle. In addition, Eagle mine workings include some long tunnels that are also used to transport coal to Marfork's prep plant underground from other operations.

Two separate attached plates graphically show the extent of Eagle mine workings directly beneath the pond area of the impoundment. The mine workings extend significantly to the northwest. One of those map plates shows only a partial area of the permitted slurry pond. Over 350,000 square feet of that partial area of the approved pond is estimated to be underlain by Eagle mine workings.

Although Marfork and their consultants, at the continued requirement and direction of DEP, have gone to great extents to determine the coal pillar strengths and repeatedly state that there is little (in one case, saying infinitesimally small) chance of subsidence in the mine and subsequent slurry breakthrough, my general feeling is that conclusion is suspect.

Mining engineering "common sense" dictates that you leave only the amount of coal in pillars necessary to support the roof, extracting the rest for profit. The roof support that they considered necessary in the old Eagle coal seam was likely never designed to bear more of a load than the earth (overburden) in its natural state provided. Put differently, the pillars are coal that is left for one reason – to prevent the overburden or roof from caving in (subsiding). It seems highly unlikely that these pillars were designed to not only support the overburden, but also over 400 feet of compacted coal waste, or several hundred feet of high density coal slurry placed on top of the overburden.

Some may take exception with the following comments. So be it. I believe that consultants are cursed by a "Catch 22" which is completely unspoken in the public arena,

but understood by any who have served in that capacity for any length of time. The catch is – to be a successful consultant you must be highly technically competent, but to provide technical results which do not favor the client’s “intended use” of the data may well mean that the consultant will get few or no future contract awards. Put another way, consultants must find the “least-case scenario” of environmental risk, somewhere within their credible methods, to enable coal companies to do whatever they want to. Otherwise, coal companies will simply find another consulting company to do the job. How do I know this? I was a consultant for 16 years (Science Applications International Corporation, Midwest Research Institute, and a small New England firm) and served dozens of commercial and government clients.

So, I do not believe that sufficient coal was left in the Eagle pillars to prevent subsidence from the additional load within the Brushy Fork Slurry Impoundment. This is not a blanket indictment of efforts to establish that the roof is safe for 400+ feet of additional material. Rather, it is based on simple economics. The coal companies would never leave that much coal underground to be “overly” safe.

In my opinion, any engineering firm that came up with a design to leave coal underground in oversized pillars, in the remote event that someday, someone would allow a slurry dam higher than the New River Gorge Bridge (when excessive coal pillars and roof stability would be needed), would have never worked again for that coal company.

As I see it, Marfork and their consultants are rolling the dice. They hope to extend the dam rapidly up-valley within Brushy Fork. By doing so, they would gradually have more and more rock between the bottom of the facility (as the coal remains closer to horizontal and the natural valley floor climbs upward). Eventually, the slurry within the pond would be several hundred feet above the old Eagle coal mine and the safety factor might increase. I’ll bet some of the consultants were much more comfortable taking that risk prior to the failure at Martin County.

Let there be no doubt, THE job of coal/mining engineering consultants today is to assist coal companies in getting permits. They have to do whatever they can to achieve that goal. That is their job! Otherwise, they are out of business.

I have to assume that many of the same engineering methods, in use at the Brushy Fork site for determining that these underground mine roofs will hold, are being used elsewhere. I am quite sure as we see inspections increase at other sites that we will see subsidence sinkholes and high-risk impoundments – right where consultants and mining companies said subsidence wouldn’t happen. This, in essence, was the case at the Martin County site.

*Given that MSHA and Kentucky officials never saw the Martin County disaster coming, I am less than comfortable with regulatory reassurances that they don’t see any other “earth-shattering” sites out there (as an MSHA official stated last week). And the shear volume of material at Brushy Fork combined with the close*

*proximity to the Eagle Coal seam workings indicates this facility warrants the utmost caution.*

#### *Dip Direction Within the Eagle Coal Mine Workings*

Fortunately, the Eagle seam dips in a direction (northwesterly) such that any breakthrough would direct slurry down dip for several miles within the old mine before the potential breakout point to the surface along Coon Hollow (see attached map). The concern I had originally in 1999 with a breakout possibility at the first Eagle mine entrance downstream along Brushy/Marsh Fork does not appear well founded. Still, the pathway for slurry within the mine is not the issue, as much as preventing breakthrough in the first place.

#### *Studies on Pillar Strength and Stability Within the Eagle Mine Workings*

The consultants have gone to great lengths to measure the stability of pillars beneath the impoundment. They have used state-of-the-art techniques and accepted computer models. They contend that the pillars are safe. However, they did identify 9 pillars of concern that had safety factors of less than 1.5 (a safety factor of 1 suggests the pillar will fail). An attached figure shows the location of the pillars of concern.

Those pillars with low safety factors were universally the smaller pillars. Smaller pillars in this instance are those less than 40 feet on each side, or narrow pillars where one side is less than 30 feet. In spite of reassurances from the consultants and approvals by DEP, some pillars directly beneath the slurry pond are small and present additional concerns (see permit maps).

#### *The Powellton Coal Seam Mine Workings*

Photo documentation within the DEP files reveals a substantial effort by Marfork's contractors to seal existing auger holes in the Powellton, prior to expanding the impoundment over the areas where the Powellton outcrops. This reflects the obvious concern of DEP and subsequently Marfork that these auger holes could be pathways for slurry, water, and pressure to further add stress to the Eagle horizon below or potentially result in a breakthrough into the Powellton itself. Even though the plugging efforts may be sincere, they only plug about the first 6 feet of auger hole (according to Greg Demyan's 11/28 comments and photos taken at the site). The entire length of auger holes in the Powellton is not being sealed, which in many cases is a few hundred feet. Some risk remains in spite of current efforts to address this pathway.

The Powellton has also been extensively deep mined in the area to the west and northwest of the Brushy Fork site. An attached map plate indicates the current extent of mining.

Potentially more troublesome, that same map plate indicates a substantial area within the Powellton where underground mining is being considered. That area extends to within 200 feet (the common setback in practice as described by DEP officials) of the footprint of the slurry dam. Given the relatively gigantic size and volume of the Brushy Fork slurry impoundment, it seems more than prudent to re-evaluate any further mining in the Powellton. In general, mining there and continuing to expand the impoundment over the Eagle seam below appears to be playing with fire.

Note that the TAGIS database indicates that Independence Coal Company (believed to be another Massey subsidiary) has an active permit to mine in the Brushy Fork area. Location of that permit area, and what seam(s) of coal are to be mined, is yet to be determined.

### *Emergency Planning and Evacuation Routes*

In the past few years, citizens in the area have been highly concerned about the existence of an emergency evacuation plan, its availability in the community, and the appropriateness of what actions would be taken by whom under what circumstances. After the December 1999 public hearings, citizens were much more aware of the plan. Whitesville is situated approximately 4 miles downstream of the impoundment, and numerous other towns downstream along the Coal River would be impacted by any significant release.

Given recent events in Martin County, KY, a new perspective on the plan is offered. Originally I was somewhat concerned about evacuations from Zone 2 of the plan, where residents in the Sylvester area would have to drive roughly 4 miles upstream (into the face of any trouble) to exit the Coal River valley toward Beckley. My concerns were buffered because I was not as worried about a dam failure and sudden flood as I was a slurry breakthrough into underground mines.

Given the Martin County KY experience, I have revised my concerns. The Brushy Fork impoundment presents enough risk to me to re-structure the entire emergency response plan. Any restructuring of the plan should take into account all the lessons learned in Kentucky and along the Tug Fork where some water supplies have still not returned to normal (and never will in my opinion). Also, the plan must consider that less than 15% of the slurry escaped the Martin County pond. A worst-case scenario should be developed and the emergency and evacuation plan should be modified for that scenario which would include a potential breakthrough.

### *Bonding*

The Brushy Fork facility currently has posted a bond of slightly over \$2.9 million dollars. That amounts to almost exactly \$4,500 per acre, with the last IBR noted as requiring \$4,600/acre. In today's world of mining reclamation, which is the purpose of

the bond should the operator bail out on the site, that may seem like a reasonable amount of money to do the job. But given that the facility could be in operation until the year 2022, and reclamation costs can be assumed to rise substantially (we don't even know if refuse material will subsequently require more scrutiny in terms of chemical composition or what stability will really be like on a facility this size), the amount that currently exists in the bond may well be woefully short if the operator walked.

Note that bonding can and does increase with each "incidental" revision to the permit. At Brushy Fork, the following bonding has been required by the DEP:

• Original permit	\$1,242,000
• IBR-1	18,400
• IBR-2	0
• IBR-3	55,200
• IBR-4 (withdrawn and rolled into IBR-6)	0
• IBR-5	400,200
• IBR-6	1,200,000
• Total	\$2,915,800

Note also that as the permit area expands, the volume of coal waste and slurry expand "exponentially" from the original permit. Hence, with the long term restoration of the site possibly tied to slurry composition problems, the whole bonding issue may have to be revisited by the Legislature to create a scaled bonding that dramatically increases as the liability does due to expansions that are volumetrically huge.

### *Insurance*

Efforts to acquire insurance information will be needed. It was determined that original insurance policy is on file in DEP's Nitro office, although time constraints precluded a review and inclusion of coverages herein. However, certain companies are indicated to be locked in on sweetheart deals that could well disappear. Especially given the Martin County KY disaster, the matter of sufficient insurance cannot be overstated.

Insurance coverage should be re-assessed – if necessary Legislatively - and required to cover a worst-case scenario. This is especially true at any high-risk sites, or for particularly large or long-term operations such as Brushy Fork.

Insurance policies should spell out full coverages for municipal and domestic water supplies, alternative roadways for residential travel, all monitoring and design and cleanup in the event of a catastrophic release, and everything for which any resident or municipality or the state or federal government have to bear in the way of costs.

Such coverage should be required to cover all taxpayer expenses as well, such as travel and expenses for all response teams and contractors. A long list of detailed cost impacts should be generated based on the Martin County experience, including everything from vet bills and burying dead pets, to boarding horses, to sewer line

construction for failed septic systems, to alternative supply water lines that can withstand seasonal stresses such as freezing, to retrofits on water supply plants, etc.

***Selected Notes from the 12/5/2000 Public Hearing in Whitesville***

The following is a partial list of Marfork Coal Company official Paul McCombs' and Marfork consultant Scott Ballard's (Geo/Environmental Associates) comments at the public hearing. I have also noted my public hearing corrections to, or disagreements with, some of their statements. Marfork representatives seemed to consistently provide a spin to understate or misrepresent elements of the permit and stability concerns in the Eagle mine workings directly below the impoundment. At times, they presented doctored illustrations and sounded as if even they did not know if the facility would be safe.

*Whatever I offered for the record in my questions and testimony to refute or draw into question the accuracy of Marfork positions is directly referenced as such below.* Regarding some of the Marfork statements, I've also offered commentary that was not offered into the record, but is added herein to further illuminate some dubious positions. To obtain a complete and accurate account of the 12/5/2000 public hearing comments, purchasing the tape recorded by DEP is highly recommended.

- Width of the dam – McCombs offered that the dam at the crest was “presently 250 to 300 feet wide.” I testified that as permitted it was over 1,000 feet wide (actually closer to 1,500 feet). My “width” represented the dam width across the valley, not in the upstream-downstream direction which I believed gave a false impression of its massive size.
- Acre-feet in storage of the slurry – McCombs, and later Marfork consultant Ballard, said the pond “capacity” at present was 2,600 acre-feet of slurry. I testified that the slurry pond capacity under the current permit was about 17,500 acre-feet (actually 15,700). I did not address another concern – that Marfork was possibly worried about the ability of the underlying mine workings to support a larger load, and they were purposefully and quietly keeping the volume very small to minimize breakthrough potential. Note that the DEP TAGIS database had a note wondering if the impoundment was in the reclamation phase, based on what I assume was an inspection/flyover(?) that found the denuded pond area to be minimally filled.
- Acre-feet in storage of slurry if plans for expansion are approved – McCombs noted the slurry volume could reach 21,000 acre-feet. I noted that at full capacity (normal stage) the permit said 22,000 plus acre-feet. The pond would hold more than that at maximum stage after heavy rainfalls.
- Pressure and weight of slurry on subsurface – McCombs was asked by an attendee “what is the total pressure at the bottom (of the pond)?” He deferred to Ballard who said at one point, “when the material (slurry) consolidates, you never really see that pressure (earlier described as 75 pounds per cubic foot) because it

- solidifies.” I stated in testimony how I wasn’t sure how the slurry (in any stage of consolidation) defies the laws of gravity. Given the pressure per cubic foot and capacity cited in presentations by Marfork, the pressure by weight would be more than 8.7 billion pounds (nearly 500,000 tons). If you consider the permitted pond volume, that weight would amount to over 3,000,000 tons, on which we must assume gravity will be acting – and Eagle coal pillars were not designed to bear.
- Slurry permitted by gallons – When asked how many million gallons of slurry were permitted in the pond, McCombs did not know. I later offered that the pond was permitted to hold 5 billion gallons of slurry, more than twice the amount held by the dam in Martin County. McCombs or Ballard later admitted this was true, but took the opportunity to offer a misleading caveat saying that was “over time” – instead of at a single point in time.
  - Slurry chemistry – Ballard at one point noted that “he didn’t know about heavy metals in refuse.” It seemed to me that he inadvertently forgot to mention the concern is amplified with the slurry, not the refuse. I read into the record the heavy metal data shown earlier in this report that described huge volumes of serious metals being removed from raw coal by coal washing/processing – metals that end up in the slurry.
  - Aside - DEP’s Charles Grafton interjected that (paraphrased) the refuse is like valley fill material from road construction. I offered that in no way is slurry similar to road waste valley fill material, in that slurry concentrates metals and often includes residuals from surfactants and flocculants. I stifled the urge to ask him if he had been attending any Bill Raney/Ben Greene mind control seminars.
  - Thickness of “solid rock” (interburden) between bottom of the pond and the Eagle coal mine roof – McCombs said “about 200 feet” and later when asked what is the least distance, said “190 feet.” I referenced the permit cross section which showed a location with only 100 feet, and about 170 feet at the indicated point of mine working limits. I also noted how Marfork’s visual aid of a colorized cross-section showed the Eagle coal seam terminating before it reached the lowermost point in the pond, which was very misleading.
  - Mine pillars stability (in large part, a function of size) – McCombs stated that mining in the Eagle coal seam had been “leaving 50 by 50-foot blocks on center.” I offered for the record that there were numerous pillars smaller than this, with many less than 40 by 40 feet, and some with sides less than 30 feet, as shown in permit maps produced by Marfork’s consultants. Pillar strength is reduced when sloughing (spalling of coal from the side of pillars) occurs.
  - Eagle coal pillars safety factor calculations – When asked how he expected the (Eagle) pillars to last, McCombs referenced the consultants who simulated pillar strength and safety, saying in effect the pillars were “in excess of 2.” Aside - pillar safety factors of 1 indicate failure. I noted for the record that Marfork’s

- own consultants found 9 pillars with safety factors less than 1.5 and had already taken steps to shore up one of those pillars, as shown in permit maps. I challenged Marfork to provide additional stability to all 9 suspect pillars at a minimum, and to re-survey the entire mine workings given the propensity for sloughing to have reshaped pillars and the possibility of “over-mining” or driving past where mine working maps indicate the mine terminates.
- Eagle (?) or other mining considerations with respect to the impoundment – Ballard, apparently exasperated at one point, said the “mine (workings)... were engineered to work with this facility.” Not likely, as mining has been ongoing for many years in the area, long before the slurry impoundment’s original permit application. Besides the Eagle, Powellton, #2 Gas, and Winnefrede, the Dorothy seam had been mined starting over 40 years ago according to McCombs.
  - MSHA seismic monitoring – In response to an attendee’s question about MSHA seismic monitoring for dam stability, Ballard stated that MSHA only monitored the dam (mine waste) stability, not the underground mine workings or pillars. WOW! Maybe they should revise that program to include monitoring of seismic affects on the pillar integrity, given the Martin County disaster.
  - Pillar failure – At one point Ballard admitted he could not guarantee that the pillars (in Eagle workings) would not fail. Very reassuring. Did DEP hear that?
  - Added pressure – The hearing did not address the added pressure of water from maximum storm runoff up-basin into the impoundment. However, Ballard took an opportunity to offer that “some (impoundments) may have only 20 to 30 feet of water in the pond.” I believe he said this to minimize fears that the slurry could flow into underground mines. I did not, in testimony, remember to note that huge volumes of water will occasionally be in the pond after storm events (maximum vs. normal stage in permit language), adding to downward pressures and providing sufficient water to transport slurry wherever gravity wants to take it.
  - Emergency plan – After attendees questioned if the emergency plan existed and why some local officials did not know of the plan, McCombs just stated that it was on file at DEP (which he had said a year ago). I offered that in light of Martin County disaster, where only 250,000 million gallons of slurry released versus the 5 billion gallons permitted at Brushy Fork, that the whole plan should be revisited. I also noted for the record that Zone 2 had residents within the Coal River driving upstream (into the face of any breakthrough) for over 4 miles before exiting the valley toward Beckley – not a route I would be inclined to take if the water/slurry was rising.
  - Other slurry breakthroughs – McCombs stated that he did not know the amount of interburden (distance between the slurry pond and the underlying mine roof) that existed in the Martin County disaster. That seemed a little ridiculous given the liability Massey (Marfork’s parent company) shares at both sites. Ballard

adamantly stated that breakthroughs were into “old, old mines.” Apparently, Ballard couldn’t add any detail to McCombs’ lack of knowledge about Martin County, but had become a historian on other breakthroughs.

- Alternative mine waste and slurry disposal – When asked about methods in Europe, McCombs stated he did not know about those methods. Ballard later added that they were mining here and he had not studied European methods. In some circles, this is referred to as “Ostrich Syndrome.” I noted that in only about 150 hours of work on refuse impoundments, I had discovered alternative methods of coal processing and waste disposal practiced in Europe, Zambia, India, etc. (which include dry placement in underground mine workings). Note that DEP engineer Dalip Sarin also knows about these methods. When questioned further by an attendee why McCombs would not know about these methods, he simply said he “thinks this (slurry dams) is the best practice we’ve got.” Compared to what – the alternative methods you he didn’t know about?
- Coal waste disposal underground – Ballard stated that it was primarily EPA’s fault that we were not pursuing this alternative, based on concerns of groundwater contamination (presumably from metals). Interestingly, Ballard stated earlier that he “didn’t know about heavy metals in refuse.”
- Slurry pond closure – McCombs showed an illustration of one stage of pond closure, failing to note that closure might not occur for 10-20 more years. In the illustration, the fork of the pond overlying the Eagle workings was preferentially filled first, which indicated to me that Marfork wants to cover the area over the Eagle mine workings first to avoid liability. McCombs did offer reassurance that there would be “no water at abandonment” in the pond. When asked who would be responsible for it then, McCombs wasn’t sure, but then either he or Ballard added that Black King Development owned the site and as owners would be responsible. Wrong again according to certain permit documents. Permit documents cite Black King Mine Development Company as the leaseholder (and Marfork as a Sub-lease holder), and the surface owner as Western Pocahontas Limited Partnership. By the time this facility closes, where will those companies be? And in the days, months, years, and eons that follow, as the refuse and slurry are re-deposited into the channels of the Coal and Kanawha Rivers, where will these “shell-game” coal operators be? And where will the MSHA, OSM, and DEP regulators be that enabled this colossal monster?

***Possibly the most interesting comment offered into the record by Marfork or their consultant may have slipped under many people’s radar screen. Maybe DEP, OSM, and MSHA should get copies of the tape and replay it, before they enable another A.T. Massey subsidiary to endanger the public and environment. Ballard (in effect, representing Marfork and Massey) stated, “We’ve reduced the risk. Can we reduce the potential (for slurry breakthrough)? That’s what this is all about.”***

Not really.... Mr. Ballard, Mr. McCombs, DEP regulators in attendance, or other interested parties. **Statutes say impoundments are to prevent breakthroughs.**

*Miscellaneous Considerations*

A.T. Massey is the parent company for both Martin County Coal Company (KY) and Marfork Coal Company (Brushy Fork). Consultants that served MCCC include Ogden Environmental. Geo/Environmental, which often represents Marfork's concerns, has staff that departed from Ogden, including Scott Ballard. This may be of no concern, but may also suggest increased vigilance with which regulatory oversight at the Brushy Fork facility occurs.

All parties with any concerns about the integrity of slurry ponds located over deep mines should err on the side of caution at this time. Experience is the best teacher. Let's all pray we are learn something from the Martin County KY experience, and that neither automatic pilot levels of denial – nor business as usual mentalities - will govern our actions.