

**Report
of
Commission on
Abandoned Mine Voids
and Mine Safety**

November 15, 2002

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EXECUTIVE SUMMARY

The Governor's *Commission on Abandoned Mine Voids and Mine Safety* was appointed with the objective to improve mining practices and mine safety for underground mines that may be operating in areas adjacent to abandoned mine voids. While the Commission has concentrated its attention on underground coal mines, this report's findings and recommendations should also have relevance to non-coal mines and surface mines. The Commission's activities were not specifically directed at the analysis of the Quecreek mine incident, as investigations were already in progress by appropriate state and federal mine safety agencies. Rather, the Commission focused on the broader issues stated in the Executive Order. Moreover, the Commission was not given access to any documents associated with the state and federal investigations of the Quecreek incident, nor did it have the opportunity to interview the Quecreek miners or the mine operator. Nonetheless, the Commission was able to address the general issue of abandoned mine voids and mineworker safety.

The Governor set the mission and the functions of the Commission as follows:

Mission

"...To investigate and document the hazards posed by abandoned mine voids, in particular the flooding of adjacent operating mines, and to make recommendations regarding the accurate location of voids and avoidance of other hazards associated with mining..."

Functions

"Using the accident at Quecreek Mine as a general reference, make recommendations regarding each of the following:

1. The best engineering practices to be used in the design and layout of modern mines adjacent to abandoned mine workings.
2. The regulatory policies and permit review procedures for permitting mines adjacent to abandoned underground mine workings.
3. The practices and procedures of mine operations in advance of mining to detect mine voids.
4. The training of mine workers who operate mines adjacent to underground mine workings.
5. The inspection and compliance of the mine operations with the approved mine plans and operating requirements.
6. The rescue and response procedures which shall include policies for sharing information with families of miners affected by the accident."

The Commission started with an organizational meeting on September 12, 2002 and had its last meeting on November 6, 2002. During its investigations, the Commission visited the Quecreek

mine, and held three public meetings in the mining districts. Several speakers addressed these public meetings and several others submitted written information to the Commission. The Commission reviewed the state-of-the-art practices, procedures, and technologies in the areas of underground mine operations with regard to inundation potential, evaluation and abatement. The review encompassed existing laws and regulations, engineering practices, operating practices, inspection procedures, training, and emergency response.

The Commission developed recommendations in each of these areas, which will reduce the chances of unanticipated inundation caused by mining into old mine voids. The primary theme of these recommendations is appreciation of the hazards posed by operating mines near abandoned workings. Taken together these recommendations provide a system of legal and regulatory requirements, that will facilitate critical examination of evidence of abandoned mine locations, delineate safe barriers, and strengthen engineering plans necessary to mine within those barriers. With proper appreciation of the hazards, mine operators, examiners, inspectors, and miners can effectively monitor implementation of these plans. Finally, the lessons learned from the successful rescue at Quecreek are merged with the Commonwealth's existing emergency response systems to improve future efforts.

In addition to recommending the development of guidelines for evaluating map information, the Commission recommends that mining professionals be trained on the requirements for evaluating and certifying maps. Finally, the Commission, while acknowledging the remarkable success of the Quecreek rescue effort, notes that there are areas where improvements can be made in the overall emergency response to such mine events. Some of the problems caused by responders' non-familiarity with the rigorous demands of the mine rescue efforts must be eliminated by expanding training beyond that given to mine rescue personnel. The responsibilities and functions of all groups at mine rescue sites must be clearly defined.

The Commission's report provides extensive data and analysis on each of the areas that the Commission investigated, including several recommendations in each area. Major recommendations from each area of the Commission's investigation are listed below in condensed form. A complete listing of all recommendations is included in sections 3 - 8 of this report.

Recommendations

Statutes, regulatory policies, and permit review procedures relating to permitting mines adjacent to abandoned underground workings:

- Consolidate mine safety requirements for anthracite and bituminous mines into a single statute.
- Revise existing mine safety laws to be consistent with most modern regulatory statutes by making the mine operator primarily responsible for compliance at the mine.
- Designate a single Commonwealth agency as the 'official keeper' of mine maps.

- Develop a Technical Guidance Document, which establishes the method to be used when assembling, presenting and evaluating information regarding abandoned mines.
- Require (DEP) a specific evaluation of the “credibility” of the information on the extent of adjacent abandoned mine workings.
- Require detailed interaction and communication procedures between BDMS, BDMO and the operator to ensure verification and validation of the mine maps and abandoned mine voids pertinent to the proposed operation. Require the BDMS to identify the potential for hazards created by mining near abandoned mines as a final review in the prevention of mining into abandoned mine voids.
- Find, identify and catalog (DEP) the “Final Maps” submitted to the Department since 1911.
- Grant DEP statewide authority to copy all mine maps. Additionally, the Commonwealth should systematically inquire into the presence of maps in the public and private sector to expand the Commonwealth collection.
- Charge BDMS with the responsibility of reviewing all safety aspects of a permit for a new mine or expansion of an existing mine. If credible evidence of adjacent abandoned mine workings is not provided, then BDMS should suggest both the appropriate barrier distance and the operational measures needed to maintain the barrier.
- Include MSHA as a notified agency during the permit application process so they can provide health and safety comments and/or recommendations on the proposed underground mining proposal.
- Amend Pennsylvania’s mine safety statutes to allow the Department to promulgate regulations that allow programmatic upgrades to keep pace with technology, to eliminate prescriptive tones, and to shift a share of the responsibility for compliance to the mine operator.
- BDMS should evaluate applications for new mines and designate barrier pillars between the new and old mines based on the veracity of the known information about the abandoned mine voids. Procedures for reducing those barriers during the permit review and memorialized in conditions of the Coal Mining Activity Permit. The procedures should include solicitation of comments from the mining industry, the UMWA, and all other stakeholders.
- Require all future “Final Maps” meet the following criteria:
 1. Meet or exceed the proposed mapping standards of this Commission.
 2. Endorsed and dated by a Professional Engineer or Professional Land Surveyor with appropriate experience and qualifications.
 3. Contain a dated statement and appropriate endorsement by an official representative of the operator (possibly an officer of the company or corporation) that this is the “Final Map”.
 4. Forward to BDMS as per Section 240.

5. Documented by BDMS that the final map has been received, cataloged and filed
 6. Formatted as one contiguous map where possible.
- Implement a preservation program including: archival and photographic storage, electronic recording of original mine maps and georeferencing of electronic maps.
 - Develop databases from production information of mines, which has been collected and recorded since the 1870s. Correlate production data with mine maps in the repositories to provide a more complete picture of the coverage of the collections. Additionally, it is recommended that a systematic review be undertaken to identify potential sources of other collaborating information.
 - Develop guidelines for assessing credibility of location evidence including requiring mine permit applicants to provide the source of information used to locate old mines. Applicants for mine permits should provide the source of information used to locate old mines on maps supplied during the permit process.
 - Establish (DEP) guidelines for the operator and the regulatory agencies to evaluate and establish the limits of a hazard zone from abandoned mine boundaries. Adopt procedures like drilling, in the event that reliable mapping does not exist, to further define the limits of abandoned mines and the appropriate safety barriers.
 - Retain Pennsylvania's 200-foot drilling threshold as a minimum for initiation of drilling, but allow this threshold to be overridden based on site-specific conditions. A site-specific safety barrier should be established around abandoned mine workings in the Coal Mine Activity permit. The width of the barrier should be based upon a critical evaluation of the evidence submitted in the application and from other sources available to the Commonwealth and in no case be less than 200 feet. The application should include plan to detect abandoned mine workings if activities are proposed to be conducted within the barrier or within 500 feet of abandoned workings, whichever is greater. The plan, as approved, should be incorporated into the permit. No activities should occur within the barrier until the plan is implemented to the satisfaction of the Commonwealth. Evaluations of existing mines should follow this same process.

Planning and design of mines adjacent to abandoned underground mine workings:

- Conduct a study to evaluate the utility of mitigation measures to address situations that occur during the operational life of the mine, such as the presence of low, flood-prone areas along escape ways that may hamper mine evacuation in inundation emergencies.
- Establish standards for mine mapping (for currently permitted and future mines) including the following aspects:
 1. Minimum angular and coordinate ties for raw data would be an angular tie of less than 00°01'00'' (1 minute) and a coordinate tie of greater than 1:10,000

(1 foot in 10,000 feet) for any given closed loop survey. The Commonwealth should establish the minimum distance that a closed loop survey is required to be from the final face of a mining section.

2. Elevation closure of +/- 0.01 feet per 1,000 feet. The Commonwealth should establish the minimum distance that a closed loop survey is required to be from the final face of a mining section.
 3. State plane coordinate systems should be NA83 Datum. The Commission recommends older mines be “grandfathered”, meaning they would only be required to establish the coordinate system on the permanent survey monuments and all known mine openings, such as shafts, slopes, drift, boreholes and pump holes.
 4. Elevations, reference mean sea level (USGS elevation) to establish the vertical location of the mine
- Develop a “scale of certainty” system to allow a complete assessment regarding the extent and location of abandoned mine workings with respect to a proposed or active mine.
 - Do not authorize retreat mining or abandonment of the section before the final depth of penetration of each entry can be established. Should immediate abandonment be necessary, require the mine foreman to estimate the final locations of each heading and the engineer or surveyor to distinguish these estimated locations on the map by a symbol. A notation describing the reliability of the approximate area of mining should be made by the engineer or surveyor responsible for the mapping.
 - No major improvement is needed in mine design and layout if the data available for planning is correct. Current mine design procedures and practices are adequate. The Commission recognizes and stresses that many mines operating in areas with abandoned mines and have successfully negotiated their active operations around old mine works.
 - Undertake (Commonwealth) projects to:
 1. Assess the proper technology and methodologies to digitally store and georeference mine maps.
 2. Complete cataloging of all maps contained within the state system into a database and cross-reference to production records maintained by the Commonwealth. Initiate a joint project between DEP, DCNR and OSM repositories to ensure each contains all maps available within Pennsylvania.
 3. Investigate and research procedures for the preservation and protection of maps to avoid further deterioration.
 - Obtain funds for verification and validation of abandoned mine maps from diverse sources including the abandoned mine land funds from OSM, the conservation of

energy funds from the federal Department of Energy, and health and safety funds from MSHA, NIOSH and other federal and state mining agencies.

- Undertake a public advertising campaign to solicit the assistance of the public to locate and copy maps of abandoned mines throughout the state. The airing of a public service message at the time of Disney's Quecreek television movie would be an opportune way to kick off such a campaign.
- Develop communication systems to withstand variable conditions within the mine, including those realized during mine flooding.
- Explore (regulatory agencies) possible assistance from the Federal AML funds or look into setting up a program to assist small operators in funding establishment of "credible evidence" research during permit application.

Detecting abandoned mine voids in advance of mining:

- Utilize visual examinations, drilling processes and the application of geophysical methods, where practical, to verify the existence of abandoned mine voids, particularly where the credibility of the maps is in question.
- Research and develop various geophysical methods and techniques for mining specific applications to enable these techniques to be applied separately or in conjunction with drilling to assist in locating and delineating mine voids.
- Conduct geophysical tests under approved protocols. Request funding for these tests from appropriate government agencies.
- Streamline the requirements regarding the use of horizontal directional drilling techniques for use in characterizing and delineating mine barriers.
- Encourage development of alternatives to the 20-foot test hole procedures required under section 224(b) to protect the miners conducting the drilling.

Inspection and compliance procedures at mines operating near abandoned underground mine workings:

- Develop and implement a protocol for hazard-specific inspections of mines advancing towards abandoned underground mine workings. The Commission recommends the development of specific procedures to; a) inspectors when mining near abandoned mine voids, b) ensure that mine inspectors understand the limits of mine maps, and c) verify and document that approved plans for locating old works are implemented properly.
- Pay particular attention (mine examiners and inspectors) to changes in water conditions in the mine, including flow, color, and odor of water, and roof and floor conditions during an advance towards abandoned mine workings.
- Encourage open and regular communication between DEP, MSHA, mine management and labor.

- Utilize (Commonwealth) water chemistry as a diagnostic tool for alerting mine operators of nearby flooded workings.

Training for miners working in mines close to abandoned mine workings:

- Develop and implement a training module for dealing with mine inundation with mandatory application in “high risk” mines.
- Conduct short, structured “safety talks” routinely at all operations as a low-cost way to impart critical information in a short timeframe.
- Stress the value of Command Center training and make the “emergency communication triangle” training module widely available.
- Develop a continuing education module for mining professionals, mine managers, and mine inspectors.

Rescue and response procedures for mining-related emergencies:

- Adopt the Incident Management System (IMS) as Pennsylvania’s statewide standard for mine emergency response and work with MSHA and NIOSH to integrate the “Command Center” system into IMS.
- Adopt standards of family communication, care and support initiated by the airline industry and American Red Cross, as Pennsylvania’s standards for mine emergencies.
- Conduct table-top and functional exercises of mine emergency responses using IMS as the structure, and evaluate these exercises to improve plans and responses
- Provide training to key individuals outside the mining community on mine emergency response and rescue techniques. Conversely, train key individuals in the mining industry in the procedures of other agencies that may become engaged during a mine emergency.
- Maintain the emergency response contact list of personnel and supplies developed by DEP following Quecreek and utilize it as a resource for all future mine emergencies.
- Actively work (BDMS, NIOSH and MSHA) to remedy the alarming shortage of mine rescue teams, personnel and equipment in the Commonwealth in order to transfer knowledge and expertise from older personnel to a new generation of miners and mine rescuers.
- Establish (DEP) an ongoing budget item to fund the costs of emergency medical personnel providing services at mine emergencies.

The recommendations listed above were voted on and unanimously approved at the Commission’s meeting of November 6, 2002 in State College, PA.

The Commission believes it has fulfilled its mission as outlined in the Governor’s Executive Order. The recommendations above will provide an increased level of safety in Pennsylvania’s underground mines.

1. INTRODUCTION

On September 4, 2002, as a direct result of the Quecreek Mine inundation, Governor Mark Schweiker signed an Executive Order establishing the *Commission on Abandoned Mine Voids and Mine Safety*. (A copy of the Executive Order is attached as Appendix A.) The mission of the Commission was ... *“to investigate and document the hazards posed by abandoned mine voids, in particular the flooding of adjacent operating mines, and to make recommendations regarding the accurate location of voids and avoidance of other hazards associated with mining.”*

The Commission’s functions, as enumerated in the Governor’s Executive Order, were to make recommendations regarding the following:

- Best engineering practices to be used in the design and layout of modern mines adjacent to abandoned mine workings.
- Regulatory policies and permit review procedures for permitting mines adjacent to abandoned underground mine workings.
- Practices and procedures of mine operations in advance of mining to detect mine voids.
- Training of mine workers who operate mines adjacent to underground mine workings.
- Inspection and compliance of the mine operations with the approved mine plans and operating requirements.
- Rescue and response procedures, which shall include policies for sharing information with families of miners affected by the accident.

This report constitutes the Commission’s findings and recommendations.

Encountering water in underground coal mines is not unusual as underground mine openings can intercept and convey surface water and groundwater. When excavated below the water table, mine voids serve as low-pressure sinks inducing groundwater to move to the openings from the surrounding saturated rock. The result is the dewatering of nearby rock units via drainage of fractures and water-bearing strata in contact with the mine workings. Provisions for handling the normal inflow of water into the mines through collecting the water in sumps and pumping it to the outside are standard procedures in the mining industry. However, the sudden influx of large quantities of water into a mine is a dangerous event. When this influx is unexpected, the lives of miners and the safety of the mine are threatened. Such inundations can be associated with loss of lives and property. Inundations of coal mines have occurred from surface waters, nearby aquifers, and from water-logged mine workings in the same mines or in adjacent mines.

The potential for mine workings to be inundated should be recognized as long as mine are operating adjacent to pools of water. The recognition of the inundation potential and the communication of the inundation hazard are essential steps in increasing the perception of the

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inundation hazard to all the miners working in mines with the inundation potential. Unless there is a clear perception of the inundation hazard, there is little likelihood of an assessment of the risk posed by the hazard or of adequate protective measures being taken to eliminate or control the hazard. On the other hand, enhancing the perception of the inundation potential can lead to a mine design that offers increased protection from pools of water, to operational practices that utilize effective monitoring techniques for avoiding the hazards, and to training miners in safe practices and procedures to avoid contacting these hazards. Hazard identification, risk assessment, and risk reduction constitute the major steps for hazard mitigation. All these actions would result in a safe and productive mine.

In the Commonwealth of Pennsylvania, underground coal mining has a long history, dating back to the early 1700s. The Commonwealth was a leading producer of anthracite and bituminous coals that powered the nation's expansion to the west. Needless to say, this voluminous exploitation of the coal reserves has left a legacy of many old and abandoned mines in the anthracite and bituminous coalfields of the Commonwealth. Active mining is conducted in proximity to these old and abandoned mines, which may be filled with water or other fluids. This long legacy of mining has also left behind an extensive record of mine health and safety laws that in later years were to prove to be the mainstay for the federal legislation on coal mine health and safety. The laws of the Commonwealth on anthracite and bituminous coal mines have numerous provisions to ensure safe operation of a coal mine in the vicinity of an abandoned mine. Yet, the occurrence of the Quecreek Mine incident (see sidebar 1) brings to the fore the need to examine the weak links in the process of preparing to mine coal properties that lie adjacent to abandoned mines.

While the federal and state laws with regard to mine boundaries and to the manner to conduct mining when approaching these boundaries are designed to reduce the chances of inundation, the Quecreek Mine incident has raised fundamental questions on the adequacy of the current procedures for designing, permitting, and operating mines in the vicinity of abandoned mine voids. The questions encompass several issues. Some of these are concerned with the sources of data on the abandoned mines, the validation of the data used in the preparation of the mine permit application, and the mine permit evaluation and acceptance. Others are concerned with such issues as the measures that can be taken during the mining process to reduce the chances of accidentally breaching the boundary and the enhancement of the training programs for the miners to improve their appreciation of the inundation hazards in their mines and the means to avoid them.

History of Mine Inundations

Inundations, i.e. unplanned inundations of water or gas, are one of twelve events that are immediately reportable to the federal Mine Safety and Health Administration (MSHA). An MSHA 7000-1 form must also be submitted for each event. The coding and the associated narrative of the form is sometimes confusing, and as a result different analyses of the data can result in slightly different summary statistics. Moreover, if there were multiple injuries from a single event, multiple forms may be filed, thereby resulting in “double counting” of a single inundation. Nonetheless the data are quite enlightening.

Sidebar 1

Quecreek No. 1 Mine – Sudden inundation from uncharted section of adjacent, flooded underground mine*

Fatalities: None **Type of Mine:** Underground - Bituminous coal

Location: Lincoln Township, Somerset County, Pennsylvania

Mining method: room-and-pillar, 35-foot extended cut plan using remote-controlled scrubber miner, ATRS roof bolter, and shuttle cars **Coal seam:** Upper Kittanning **Seam thickness:** 42 to 52 inches locally

Mining History: Underground development of the Quecreek Mine began in March 2001. The Quecreek No. 1 mine was developed via a 4-entry drift portal located in a box cut. After the initial development from the box cut, the 4 entries were expanded to 7 entries. At the time of the inundation, limited development had taken place in the mine. From the portal, the mine’s main entries (Mains) were developed down structure approximately 5800 feet. At approximately 3700 feet inby of the portals, the 1 Left section was developed up-dip and perpendicular to the Mains to a distance of approximately 3200 feet. Work was just beginning on the 2 Left entries, which were being developed approximately 1200 inby of, and parallel to, the 1 Left entries.

Inundation incident: On Wednesday, July 24, 2002, miners working in the # 6 entry of the 1 Left section unknowingly mined to within two feet of uncharted workings of the adjacent, flooded Harrison #2 Mine. The Harrison #2 Mine is located in the Upper Kittanning seam, up structure from the Quecreek workings. Within minutes, as the remote controlled continuous miner was preparing to “clean-up” the cut, a breach formed in the remaining section of barrier and a portion of the Harrison #2 mine pool, an estimated 75 million gallons of water, poured into the Quecreek workings. Eighteen miners were working two active sections in the Quecreek Mine at the time of the barrier pillar failure. Nine miners were working near the point of the barrier breach in the 1 Left section. Nine additional miners were working in the other active section, near the Mains, at the advancing face of the newly started 2 Left section.

When the barrier pillar failed, the 1 Left section crew immediately phoned a warning the 2 Left miners, allowing that nine-man crew to escape to safety along the Mains to the drift entries. The 1 Left section crew were unable to escape due to the flooding of a low “dip area” along the Mains immediately outby of the 1 Left section. Inrushing water accumulated in this low area, blocking the escape route. Miners working at the 2 Left face reached this low area sooner and were able to wade through the rising water and escape to higher ground along the Mains and eventually to the drift entries.

Due to the flooding of the “dip area,” the 1 Left crew was forced to retreat back up the 1 Left headings to the highest ground available. This high point was located in the #1 entry near the working face of the 1 Left section. The 1 Left crew remained trapped at this location for over 75 hours until the early morning hours of July 28th when all nine men were rescued via a 30-inch vertical borehole using an MSHA recovery cage attached to a crane.

Over the past twenty years, i.e. from 1983 to the present, there have been a total of 449 inundations in underground mines: 397 in coal and 52 in metal/nonmetal. These inundations have resulted in 4 fatalities (3 in coal and 1 in metal/nonmetal), 13 lost time injuries (5 in coal and 8 in metal/nonmetal), and 6 injuries with no lost time (6 in coal and 0 in metal/nonmetal). These inundations are shown by commodity and year in Figure 1.

* A detailed history of the Quecreek Mine inundation and the subsequent 3-day rescue operation is included in PA Bureau of Deep Mine Safety accident investigation report.

However, not all of these inundations result from proximity to abandoned mines. In some cases, the active mining has cut into either sumps or sealed areas of the active mine; in other cases, active mining has mined into an old uncharted gas well. There were 134 water inundations and 68 gas inundations from abandoned mines over the past twenty years, resulting in 1 fatality and 1 lost time injury (Figure 2).

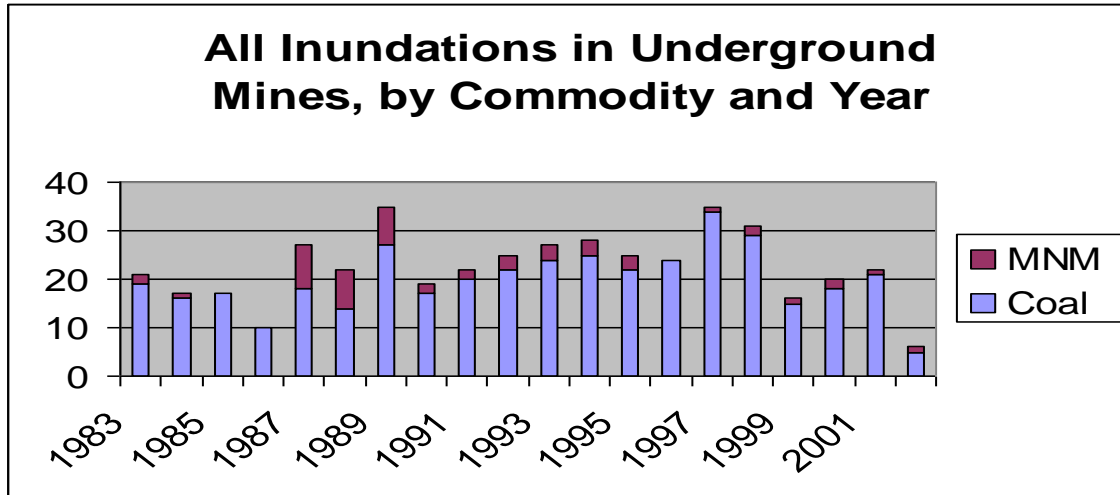


Figure 1. All inundations in underground mines, by commodity and year.

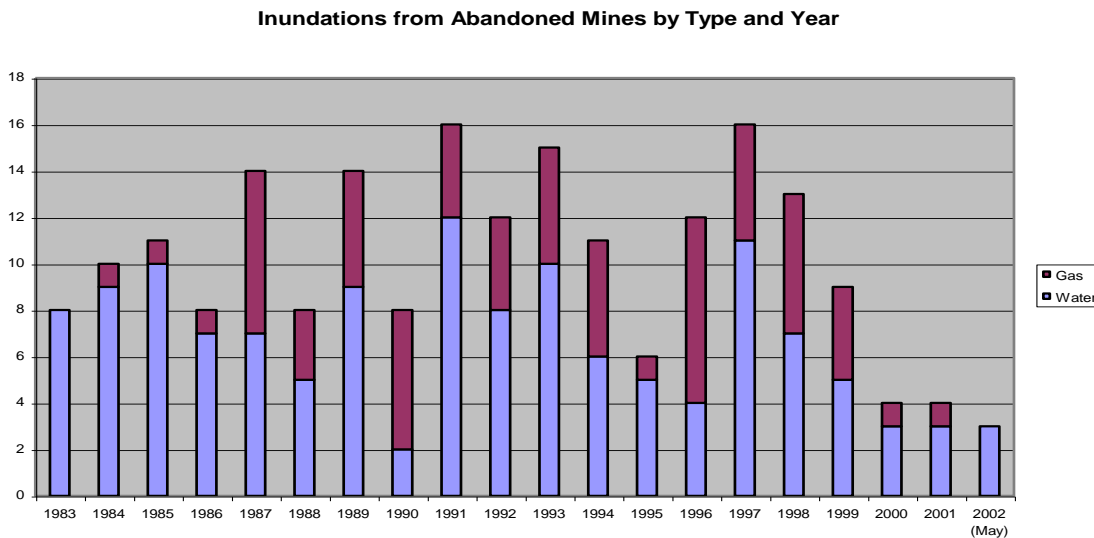


Figure 2. Inundations from abandoned mines into active underground coal mines, by type and year.

Appendix B contains a table of recorded inundations that have occurred in the U.S. since the late 1800s.

The Commission is aware of the failure of a 72-acre coal refuse impoundment near Inez, Kentucky in 2000 (sidebar 2). The National Research Council’s (NRC) investigation and recommendations regarding the Inez incident are relevant to the tasks assigned to the

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Commission. Pertinent recommendations from the NRC's report were reviewed and considered by the Commission.

Sidebar 2

The failure of a 72-acre surface impoundment of liquid waste on October 11, 2000, which released 250 million gallons of the slurry into an underground coal mine, was the focus of a study by a specially constituted committee of the National Academy of Sciences [National Research Council, 2002]. One of the three tasks of the study was to evaluate the accuracy of mine maps and to explore ways and means to improve surveying and mapping of underground mines to delineate more accurately how underground mines relate to current or planned slurry impoundment. The findings and conclusions of this study on mine maps, Chapter 3 in the NRC report, and on the technologies for locating mine workings, Chapter 4 in the NRC report, are relevant to the present study on eliminating or reducing the inundation hazard in an active underground mine from an adjacent mine. The NRC study recognized that maps of mines operating since the 1970s are likely to be more suitable for impoundment design, and that maps of older mines may not be suitable and that mine maps may be inaccurate due to unrecorded final cuts. In these cases, the study stated that additional investigation to locate the underground workings is warranted, and that invasive drilling programs can provide the necessary information. Noting both the cost and environmental issues involved in intensive drilling programs, the study suggested that well-planned and appropriate use of geophysical techniques can help minimize the amount of drilling required to detect mine voids. The NRC Committee however cautioned that no geophysical technique is capable of performing optimally under all geological and topographic conditions and that multiple geophysical techniques may be necessary to reduce the probability for error to an acceptable level. Further, the Committee noted that while the geophysical methods have proved successful in some cases, drilling is still necessary to confirm interpretations of the geophysical and remote sensing data.

2. COMMISSION'S TASKS

The nine-member Commission was sworn in on September 12, 2002 in Harrisburg, Pa. The commissioners unanimously agreed that the Commission would undertake, to the extent possible, an analysis of the publicly available information on each of its functions and solicit information from knowledgeable and interested parties through public hearings.

The Commission agreed that the Quecreek mine accident provided the opportunity to take a systems view to the solution of the problems that are associated with mining near abandoned voids. The Commission divided its work into six tasks:

1. Permitting mines adjacent to abandoned mine workings,
2. Planning and designing of mines adjacent to abandoned mine workings,
3. Operational practices to detect mine voids in advance of mining,
4. Regulatory inspections for compliance with approved plans and procedures,
5. Training of miners working in mines adjacent to abandoned mines, and
6. Emergency response and rescue procedures.

The Commissioners agreed that each task must be addressed with regard to: a) the current state-of-the-art of technology, practice, and procedures in the industry, b) the advanced state-of-the-art in terms of practices, procedures and technology, c) the potential application of the advanced state-of-the-art to the enhance the safety of each of the task, d) the potential limitations of such applications, and e) recommendations arising out of this assessment of the technology, practice and procedures. The commissioners then detailed each task with a list of questions that would serve as a template for the task narrative contained in section 3-8 of this report. The questions generated for each task are listed below.

Task 1. Permitting mines adjacent to abandoned mine workings.

- What are the applicable state and federal statutes and regulations governing mine safety, mine mapping, and mining near abandoned workings?
- Do current applicable laws, regulations or policies limit the regulatory agencies' ability to comprehensively assess the safety implications of mining near flooded underground workings?
- Are specific changes in the 1961 Bituminous Coal Mine Act warranted with regard to its provisions on mining near abandoned underground mine workings?
- What are the current permitting procedures?
- How does DEP deal with storage, availability and georeferencing of mine maps?
- How is the information in the permit application regarding the location and level of inundation of adjacent mine workings verified by the regulatory agency?

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- What interactions take place between the operator and the permitting agency to establish the reliability of the data used in the permit application? If the issues are not fully resolved, what recommendations are made to ensure verification before permit issuance?
- What is MSHA's role in Pennsylvania permitting?

Task 2. Planning and designing mines adjacent to abandoned mine workings.

- What are the current practices and/or considerations regarding design and layout of underground mines adjacent to abandoned mine workings?
- Where do mine operators get information on abandoned mine workings? What measures are taken to verify that the information on hand is the most up-to-date? How is this information used in the layout of mines?
- What is the current state-of-the-art regarding mapping underground mines in the U.S. and does Pennsylvania compare well with national pace-setters?
- What sort of engineering practices could be incorporated to improve mine barrier design and mine map verification in Pennsylvania?

Task 3. Operational practices to detect mine voids in advance of mining.

- What are the current practices and procedures that operators use to verify the validity of assumptions made during the permit application process and design and layout phase of the underground mine's life? Are these practices adequate or is there room for improvement due to technological advances?
- What technologies and methodologies rank as state-of-the-art for detecting underground mine voids?
- What is the current status of remote sensing technologies and their relative applicability and limitations for mapping abandoned mine workings?
- Are there any drilling technologies that may have value in detecting adjacent mine voids? What are their applications and limitations?
- What are the utility and/or applicability of operational indicators, such as changes in water chemistry and/or flow to provide early warning of hazards from adjacent flooded mine workings?

Task 4. Regulatory inspections for compliance with approved plans and procedures.

- Does the frequency and type of inspections allow regulatory agencies to appropriately validate and verify assumptions made during the permitting process? What are the information needs for the regulatory agencies to ensure that such verification is continuously being achieved? How can this information be obtained within the framework of the current state and federal inspection programs?

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- What are the roles of state and federal inspectors? Can data sharing between agencies be improved?
- Is there need for increased or hazard-specific inspection regarding mining near abandoned mine workings?

Task 5. Training of mine workers who operate mines adjacent to underground mine workings.

- Is customized training based on site-specific hazards made available to underground workers? Is training on the hazards associated with, and responses to, sudden inrushes of water from nearby mines specifically needed for miners who may be working near flooded abandoned mine workings?
- Are current training procedures taking advantage of new technologies to make training less intrusive and more available to mine employees?
- Are flooded adjacent workings given appropriate weight during training to increase perceptions of the hazards of sudden mine inundation? Are workers aware of this hazard even when they may not be working in the immediate vicinity of adjacent flooded workings?

Task 6. Rescue and response procedures.

- What is the current status regarding effectiveness and integration of all agencies to systematically respond to mining emergency? How does this status compare with readiness of response to non-mining emergencies?
- How does the size of the coal mining operation impact its ability to respond to emergencies – small v. large operator readiness?
- How can the ability of the government, industry, and public to respond to mining emergencies, particularly those occurring at small mining operations, be enhanced?

3. PERMITTING MINES ADJACENT TO ABANDONED MINE WORKINGS

In the course of its investigation the Commission has considered the role that mine safety laws play in protecting miners from the hazards posed by abandoned mine voids. Several legal provisions protecting miners from the hazards posed by abandoned mine voids, were uncovered and are discussed here.

Pennsylvania Mine Safety Laws

Because of the long history of coal mining in Pennsylvania, the Pennsylvania General Assembly has enacted mine safety laws and amendments many times. The first mine safety laws date to 1870, 99 years before the first major Federal legislation on the subject. The Pennsylvania mine safety laws were the only requirements in effect during the mining of the Harrison #2 Mine, i.e., the abandoned mine encountered by the Queecreek miners.

The provisions of Pennsylvania's mine safety laws for bituminous and anthracite coal developed separately and to this day are set forth in different statutes.¹ The Federal Mine Safety and Health Act and its regulations apply to mines in both coalfields. Sometimes the requirements of these laws are the same or similar, but in many cases they are not. Appendix C.1 is a table that summarizes the current requirements of Pennsylvania laws (bituminous and anthracite) and Federal law on subjects relevant to the Commission's charge.

Mapping: Pennsylvania's mine laws have required some form of mine mapping since 1870 for anthracite coal mines and 1885 for bituminous coal mines. Since 1911 "final" surveyed and certified maps have been required when mine close. A detailed outline of the development of mine mapping in Pennsylvania's mine safety laws is contained in Appendices C.2 and C.3. The changes and refinements to the mine map requirements show that encountering abandoned mine voids containing accumulations of water or gas has been a concern for a long time. Pennsylvania's long standing concern about protecting miners from the hazards posed by abandoned mine voids is evidenced by many of the map related provisions, including requiring mine maps to show adjacent workings and any impounded water and allowing miners to examine the mine maps if they are concerned about encountering dangerous accumulations of water or gas. (Sections 301, 302 and 311 of the Anthracite Act, 52 P.S. §§ 70-301, 70-302 and 70-311; Sections 235 and 237 of the Bituminous Act, 52 P.S. §§ 701-235 and 701-237)

Over the years, the mapping requirements applicable to bituminous and anthracite coal mines have become more similar. The essence of these requirements is as follows: the operator or superintendent of a mine must prepare an accurate map and update that map on a regular basis to show additional workings and other changes. Upon completion of mining, the state mine inspector must be informed and an updated map of the mine must be provided.

However, there are some significant differences between the statutes, which may have an effect on protecting miners from the hazards posed by abandoned mine voids.

¹ Pennsylvania Anthracite Coal Mine Act, Act of November 10, 1965, P.L. 721, 52 P.S. 70-101 – 70-1405 (Anthracite Act); Pennsylvania Bituminous Coal Mine Act, Act of July 17, 1961, P.L. 659, 52 P.S. 701-101 – 701-706 (Bituminous Act).

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Access to Maps. Maps of anthracite mines that are provided to the Department of Environmental Protection (DEP) by operators or superintendents are considered to be “property of the Commonwealth.” Since 1891² miners and members of the public have been able to examine the maps. (Sections 310 and 311 of the Anthracite Act, 52 P.S. §§ 70-310 and 70-311) Bituminous mine maps submitted to the state mine inspector, however, are only “official records,” and generally may not be examined by the public. (Section 239 of Bituminous Act, 52 P.S. § 701-239) The general public only has a right to inspect the “final” bituminous mine map, which today is not submitted to the inspector. (Section 240 of Bituminous Act, 52 P.S. § 701-240) In addition, the “Six Month” maps submitted to DEP pursuant to Section 8 of the Bituminous Mine Subsidence and Land Conservation Act (BMSCLA), 52 P.S. § 1406.8, are public records that may be examined by the public. The “Six Month” maps show mining projections for the next six months and past mining.³

Filing of “Closure Maps.” All anthracite maps are submitted to and retained by the state mine inspector. (Sections 303-05 and 310 of the Anthracite Act, 52 P.S. §§ 70-303 – 70-305 and 70-310) The Bituminous Act does not clearly state where the final bituminous map is to be submitted. It states only that the map shall be provided to “the Department.” (Section 240 of Bituminous Act, 52 P.S. § 701-240) This ambiguity may account for some of the difficulty the DEP has in locating “final” maps, and the many gaps in the official map repositories.⁴ There is anecdotal evidence that during some periods in the past mine owners and operators filed final bituminous mine maps with state mine inspectors, but no clear policy or agency directives have been uncovered. Today it appears that, pursuant to DEP policy, final closure maps are filed in the Bureau of Deep Mine Safety (BDMS) office in Uniontown.

Frequency of updating maps. When the initial mapping requirements were enacted for anthracite mines (1870) and bituminous mines (1885) the mine maps were to be updated every six months.⁵ Despite many advances in mining technology in the past 100 years, which have increased the rate of mining markedly, bituminous maps are still only updated every six months. (Section 238 of Bituminous Act, 52 P.S. § 701-238) However, in 1959, following the Knox Mine Disaster⁶, the General Assembly required anthracite maps to be updated every two months.⁷ (Sections 304 of the Anthracite Act, 52 P.S. § 70-304) This difference in the frequency that mine maps are

² Act of June 2, 1891, P.L. 176, Art. III, Sect. 9.

³ Maps submitted as part of a permit application pursuant to the Bituminous Mine Subsidence and Land Conservation Act and regulations are also public documents that may be inspected by the public.

⁴ The 1897 law, which established the Pennsylvania Bureau of Mines in the Department of Internal Affairs, required mine inspectors to submit maps of all coal mines and annual updates to the maps to the Chief of the Bureau (Act of July 15, 1897, P.L. 279, Section 9). However, this express provision was not retained when the Legislature created the Department of Mines in 1903; the Secretary was only generally authorized to keep records of the office (Act of April 14, 1903, P.L. 180. Subsequent legislation has not expanded or clarified this provision.

⁵ Act of March 3, 1870, P.L. 3, Section 1; Act of June 30, 1885, P.L. 205, Section 1.

⁶ The Knox Mine Disaster was an inundation accident that occurred on January 22, 1959 in Jenkins Township, Luzerne County. Miners working in the Knox Mine Company’s River Slope mine breached the Susquehanna River. Some ten billion gallons of water drained into the interconnected mines, killing twelve miners.

⁷ Act of December 16, 1959, P.L. 1878, Section 2.

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updated is curious and irrational since the rate of advance for the larger and highly mechanized bituminous mines is much greater than for anthracite mines.

Duplicate Surveying. The Anthracite Act requires duplicate surveys to be made of some sensitive portions of the mine. Duplicate surveys are required for areas that will flood and for locating pillars between adjoining properties. (Sections 305 and 312 of the Anthracite Act, 52 P.S. §§ 70-305 and 70-312) Both surveys must be filed with the state mine inspector. Requiring duplicate surveys should enhance the confidence in the location of these areas. No similar requirement exists in the Bituminous Act.

Drilling and Barrier Requirements: The provisions for drilling when approaching inaccessible workings and for establishing barriers with inaccessible workings are generally consistent for bituminous coal and anthracite mines. Each Act requires advance drilling when approaching abandoned workings and each requires a barrier to be established. These provisions also show a long-standing concern about protecting miners from the hazards posed by abandoned mine voids. The purpose of these requirements is preventing miners from encountering impounded water or gas in adjacent abandoned mine voids.

There are, nevertheless, a few differences between the Acts and some shortcomings in each Act.

Drilling. The Bituminous Act is more protective than the Anthracite Act because it requires advance drilling when approaching **any** adjacent mine. (Section 224(b) of Bituminous Act, 52 P.S. § 701-224(b)) The Anthracite Act requires drilling only when approaching inaccessible workings likely to contain water. (Section 238 of the Anthracite Act, 52 P.S. § 70-238)

The Acts specify the distance from adjacent workings when advance drilling must commence, 200 feet for bituminous mines and 100 feet for anthracite mines. The 200-foot distance to commence drilling was added to the bituminous law in 1961.

To operate within that zone requires drilling of holes, in a fan shaped pattern, at least 20 feet in advance of any workings. This kind of requirement first appeared in 1893. The first requirements were for boreholes 12 feet in advance of the workings with angled holes drilled into the ribs. The length of the holes was changed to 20 feet in the 1929 amendments to the law.

In the 1893 statute the boreholes were required when the active workings were in ‘dangerous proximity’ to abandoned workings. After a subsequent court interpretation, the General Assembly restated its intent. The 1911 revised statute required the boreholes when workings advanced to within ‘supposedly dangerous proximity’ to abandoned workings. The current statute dates to 1961 and it replaced the ‘supposedly dangerous proximity’ standard with a 200-foot distance. There is no record available to the Commission that explains the significance of 200 feet. Coincidence suggests that its origin may be an attempt to be consistent with the Safety Zone Act of 1959. That act, passed after the Knox Mine Disaster, requires a 200-foot safety zone from the ‘known perimeter (emphasis added) of water bodies sufficiently large to constitute a hazard to mining’.

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Problems with old maps include maps not showing the full development of the workings, uncertainty of survey methods and non-standardized coordinate systems and scales. Therefore, the requirements of current law can mask the true level of the hazard posed by mining near abandoned mine workings. As no testimony or other evidence presented to this Commission has suggested that the degree of error in determining the distance between mines is limited to more or less than 200 feet, the use of a 200-foot standard can lull mine planners and government regulators into a false sense of security. It should be noted that the design of any barrier pillar, i.e., the barrier of un-mined coal between two mines, is only as good as the accuracy and reliability of the abandoned mine map.

Drilling ahead of the advancing mining face, done in an appropriate way, is a proven technique to identify mine workings. Properly developed, the holes can be used to drain water or gases from the old workings and eliminate the hazard. Any arbitrary distance chosen to begin drilling, whether the 200 feet in the law or the 500 feet specified in administrative orders issued to many mines in September 2002 is measured from an essentially unknown point. Therefore, guidelines are needed to promote establishment of appropriate drilling distances based on site-specific conditions.

Today, many bituminous mines advance workings using remotely controlled continuous mining machines. These machines are capable of a single advance of more than 35 feet. When operating within 200 feet of known workings, drill holes must be advanced 20 feet ahead and at 45-degree angles every 8 feet. To accomplish this requires the machine to back out of the advance each 8 feet, bolt the roof, and then drill the holes. The current law negates virtually all of the advantages of the modern continuous miner. Using the type of advance drilling contemplated by the Acts is outmoded for modern bituminous operations.

A different situation exists in anthracite mines. Continuous mining machines cannot operate in the steeply dipping anthracite seams. Instead advance of the working face is done by hand. Accordingly the rate of advance is much less, typically 6 to 12 feet per day. Drilling 20 feet ahead when operating within 100 feet of suspected abandoned workings is a practical and effective measure. While existing requirements are effective and practical in anthracite mines, advance drilling requirements of the 1961 Act and productive use of modern mining machines are not compatible.

The Commission heard testimony about the success of horizontal drilling to detect mine voids in advance of mining. The Commission also heard about several promising geophysical technologies that, in the near future, may be able to accurately locate abandoned voids in advance of mining. However, because of the specific requirements of the Acts, none of these or other means may be employed without obtaining a variance. The Commission's concerns about the prescriptive nature of the Acts are discussed further below.

Barriers. The Acts require the use of two different empirical formulae to determine the minimum safe barrier between active and abandoned workings. (Section 238 Anthracite Act, 52 P.S. § 70-238; Section 291 of Bituminous Act, 52 P.S. § 701-291) These are two of many barrier pillar equations. More than a dozen formulae were brought to the Commission's attention during testimony; some were developed after the Acts were passed. The Commission

also heard testimony about using computer methods to design barrier pillars. Neither Act, however, allows for the use of alternate formulae or numerical methods to determine barrier sizes. This is another example of a situation where the prescriptive nature of the Acts may not be in the interest of mine safety. The Commission's concerns are discussed later in this section.

Incorporating Changes and Advances In Methods and Technology: Many of the provisions in the Anthracite Act and Bituminous Act are prescriptive in nature, i.e., they specify the particular means and method of compliance. Since neither of the Acts has been amended since the 1960s, all of the provisions date back at least that far and many can be traced back to laws passed in the early Twentieth Century or the late Nineteenth Century. However, it does not follow that all of the Acts' provisions are outmoded simply because they have been in place for many years. To the contrary, many portions of the Acts are valuable and offer viable measures that help to keep Pennsylvania's miners safe every day. This continuing success is a testament to the foresight of the drafters of Pennsylvania's mine safety laws. In many ways, Pennsylvania's mine safety laws were both pioneering and forward looking.

However, in some cases the employment of new technology and practices is hampered by the prescriptive provisions. The Acts do not give DEP the authority to promulgate regulations or otherwise account for changes in mining practices and technology. Such regulation promulgating authority is essential for modern regulatory agencies. Most of the other statutes administered by DEP contain this authority,⁸ as does the Federal Mine Safety and Health Act.⁹ Currently, the only way that new equipment, technology, methods or processes may be approved is by obtaining a variance under the Acts.¹⁰ The applicant must show that the proposed change will provide substantially the same or greater protection than the prescriptive provision that it is replacing. The DEP has in place a policy for handling such variance requests.¹¹

While variance procedures may be a good approach for unique deviations from a norm, they are inherently inefficient and poorly suited to dealing with generally accepted advancements and improvements in mining technology. For example, the Commission heard testimony that modern horizontal drilling methods can be more efficient and effective in determining if abandoned mine voids exist in the area proposed for mining than boring holes into the working face and ribs as specified in Section 224(b) of the Bituminous Act. Though horizontal drilling is a well-known and accepted technology, the only way to use it for this purpose is by obtaining a variance under Section 702 of the Bituminous Act for each mine. Witnesses have told the Commission that this can be a time consuming process. However, given the prescriptive requirements of the Acts, the DEP must require individual variance applications for each mine.

⁸ E.g. Surface Mining Conservation and Reclamation Act, The Clean Streams Law, The Bituminous Land Conservation and Reclamation Act.

⁹ 30 U.S.C. § 811(c).

¹⁰ Section 1402 of the Anthracite Act, 52 P.S. § 70-1402; Section 702 of Bituminous Act, 52 P.S. § 701-702.

¹¹ "Procedure For Processing Requests to Adopt New Items or Methods Under Sections 702 and 1402 of the Pennsylvania Mining Laws," Technical Guidance Document (TGD) No. 580-2200-004. The Environmental Hearing Board approved the use of this TGD. *United Mine Workers of America v. Department of Environmental Protection*, 2001 EHB 1040.

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Compliance Responsibility: The Bituminous Act and Anthracite Act vest the primary responsibility for the operation of the mine and compliance with the law on the mine foreman. (Sections 220-237 of the Anthracite Act, 52 P.S. §§ 70-220 – 70-237; Sections 218-226 of the Bituminous Act, 52 P.S. §§ 701-218 – 701-226) This system dates back to the earlier mine safety laws enacted in the late Nineteenth and early Twentieth Centuries. (*E.g.* Act of May 15, 1893, P.L. 52) In essence, an individual takes personal responsibility for a collective commercial enterprise. However, it is not a commercial enterprise that the mine foreman owns or controls. Nevertheless, the primary sanction when the requirements of the Acts are violated is the suspension or revocation of the mine foreman’s license.¹² There are few avenues to assign responsibility for compliance to the mine owner or operator.

This arrangement appears to be common in other coal producing states, but is unusual in other regulatory contexts. For example, compliance with the environmental and subsidence requirements for the same mine rests with the operator and permittee.¹³ The Federal Mine Safety and Health Act also places the responsibility for compliance on the mine operator.¹⁴

Moreover, there are some provisions of the Pennsylvania mine safety laws, which place duties on superintendents, mine owners and operators. This unsystematic division of responsibilities can lead to confusion. This confusion can be succinctly illustrated by examining the “barrier” related provisions for underground bituminous coal mines. Three different persons or entities have responsibility for implementing three different, but related, barrier provisions. Under Section 224(b) of the Bituminous Act, the mine foreman is responsible for assuring the boreholes are drilled when mining comes within 200 feet of adjacent workings. The superintendent, however, is responsible for establishing the barrier pillar between his workings and an abandoned mine or a property boundary under Section 291 of the Bituminous Act. Finally, under Section 2(b) of the “Safety Zone Act,” the mine’s “Operator and/or the Lessor” must seek any relief from the 200-foot barrier.

The Pennsylvania Anthracite Act and Bituminous Act and their predecessor laws have helped to protect miners for many years. The protection they provide is still important. However, the Commission’s investigation has shown that some provisions should now be amended. The sections that address mine maps, barriers and advance drilling, regulations, and responsibility for mine operations should be amended consistent with the recommendations set forth at the end of this section.

¹² See “Mine Officials Act,” Act of June 3, 1943, P.L. 848, 52 P.S. §§ 11 - 18.

¹³ See generally statutes cited in n. 9, above.

¹⁴ 30 U.S.C. § 803.

Overview of Pennsylvania Mining Regulatory Program For Underground Coal Mining

Program Development: The Commonwealth of Pennsylvania has been regulating aspects of coal mining since at least 1870.¹⁵ The first state agency charged with regulating mining, the Bureau of Mines, was created as a part of the Department of Internal Affairs in 1897.¹⁶ By 1903, however, the agency was upgraded to Department status; the Department of Mines was created to administer the mining laws.¹⁷ The Department of Mines continued to regulate mining in Pennsylvania until 1971 (now SMCRA), though the Department's name was changed to the Department of Mines and Mineral Resources in 1956.¹⁸ The Department, however, took on additional duties and functions, such as mine permitting and reclamation following the passage of the Bituminous Coal Open Pit Mining Conservation Act in 1945 and the Anthracite Strip Mining and Conservation Act in 1947.¹⁹ Up to this time, mine safety was the state's primary regulatory focus.

In 1971, the new Department of Environmental Resources (DER) was created, consolidating several existing state agencies including the Department of Mines and Mineral Industries and the Pennsylvania Topographic and Geologic Survey, which has geologic related functions. The DER added the authority to permit underground coal mines in 1966, with the passage of the Bituminous Mine Subsidence and Land Conservation Act (BMSLCA).²⁰ Following the passage of the Federal Surface Mining Control and Reclamation Act (Federal SMCRA)²¹ in 1977, Pennsylvania attained primacy in 1982, and has operated a federally approved permitting program for surface and underground mines since then. In 1995, the DER was split into two agencies: the Department of Environmental Protection (DEP), and the Department of Conservation and natural Resources (DCNR). All of the mining programs, including deep mine safety stayed with DEP. However, the Topographic and Geologic Survey was placed into the new DCNR.

Given all of these changes in the past century, it is not surprising that some details about the predecessor agencies have been forgotten, and some documents and records may have also been misplaced, lost or destroyed.

Today within DEP's Mineral Resources Deputate, the Bureau of District Mining Operations (BDMO) handles permitting for surface and underground mines. Bituminous mines are permitted in the McMurray district office and Anthracite mines in Pottsville. Deep mine safety is handled by the Bureau of Deep Mine Safety (BDMS) with primary offices in Uniontown (bituminous) and Pottsville (anthracite). The following section examines how these bureaus

¹⁵ See Act of March 3, 1870, P.L. 3 (among other things authorizing mine inspectors), Act 1; Act of April 5, 1870, P.L. 50 (creating offices and clerks in certain counties).

¹⁶ Act of July 15, 1897, P.L. 279.

¹⁷ Act of April 14, 1903, P.L. 180.

¹⁸ Act of May 31, 1956, P.L. 1915.

¹⁹ Act of May 31, 1945, P.L. 1198 (Bituminous); Act of June 27, 1947, P.L. 1095 (Anthracite).

²⁰ Act of April 27, 1966, P.L. 31.

²¹ 30 U.S.C. Section 1201 et seq.

regulate underground mines, and their relationships with each other, the regulated community and other stakeholders.

Permitting Procedures

BDMO Activities: BDMO is responsible for the environmental permitting of mines including the environmental aspects of barrier pillar design. This function is performed at the McMurray District Office for bituminous underground mines and at the Pottsville District Office for anthracite underground mines. The Bureau of Deep Mine Safety (BDMS) does not permit or approve the opening of a new mine or extending the permit boundary of an existing mine.

BDMO has a pre-application procedure that is intended to identify potential issues prior to submittal of a permit application. That process includes a face-to-face meeting between government regulators, the mine operator, and their consultants. After application submittal interaction is both formal through deficiency letters sent by the reviewer to the applicant, and informal through telephone or personal communications to clarify application information. To issue a permit BDMO must be convinced that a preponderance of evidence provided during the application submittal review process supports compliance with the criteria for approval/denial established in 25 PA Code 86.37. If the issues are not fully resolved then BDMO can insist on appropriate modifications, can unilaterally condition the permit, or can deny the application.

The appropriate BDMO office provides portions of mine permit applications to BDMS for their review and comment, specifically regarding compliance with the Bituminous Coal Mine Act (or Anthracite Coal Mine Act) and Pennsylvania's Safety Zone Act. BDMS is provided a 30-day comment period but is not required to comment. BDMS's review is discussed in detail below.

BDMO's goal for environmental permitting of barrier pillars is the control of mine drainage pollution to the waters of the Commonwealth. The physical layout of underground mines is used to control adverse hydrologic impacts to surface waters. The overall strategy is to achieve complete flooding of the mine workings in order to minimize the potential for acid mine drainage. Tactics include:

- Promotion of postmining inundation of the workings through down-dip development, careful location of entries and sizing of barrier pillars.
- Allowing mining only where groundwater flow is slow so that the time for transport of contaminants is longer than the documented natural amelioration rate within mine pools.
- Restricting mining near groundwater discharge zones.

Applicants for permits must certify that the information is accurate to the best of their knowledge. Relevant portions of the application require the seal of a Professional Engineer, Professional Geologist, and/or a registered Professional land Surveyor.

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Bituminous Underground Coal Mines: Applicants for bituminous underground mines are required to provide the following information regarding mines adjacent to the proposed operation:

- A map (1" = 500' scale) showing the areas environmental resources in the general area of the proposed mine including the outlines of other active, inactive, abandoned mine workings (surface, auger, and underground), which lie above, below, or within 1,000 feet laterally of the proposed underground permit area. For other active operations, the proposed limit of coal extraction or permit boundaries must be shown.
- The same map also showing the outlines of mine pools in workings above, below, and within 1,000 feet laterally of the proposed underground permit area, including previously identified 'safety zones' required under the Safety Zone Act.
- Information regarding adjacent (within 1,000 feet of the proposed permit boundary) underground mines including the name of the operator, site name, permit number, status, coal seam(s), mine opening elevations, discharge elevations, and mine pool elevations. Information regarding any discharges from adjacent mine discharges above, below, or within 1,000 feet of the proposed permit boundary including a description of the discharge, mine name, elevation, contributing mine pool level, range of flow rates, and qualityInformation supporting the designs of the barrier pillars proposed around the perimeter of the mine to promote inundation.
- Site specific information and data, which confirms assumptions used in determining barrier width and integrity.
- A narrative evaluation of the potential for postmining inundation to cause or contribute to discharges from adjacent mines.
- A Subsidence Control Plan Map (1" = 500' scale) showing the coal barriers around the permit of the underground permit area.

Anthracite Underground Coal Mines: The following information regarding mine pools and adjacent mining is solicited through the anthracite underground mine application.

- Identification of, and depth to, mine pool underlying the proposed operation.
- Geologic cross-sections showing mine pool elevations.
- Geologic cross-sections showing abandoned underground mines which will be intercepted by proposed mine.
- Descriptions of proposed working in relation to local mine pools including: discharge points from mine pool(s), extent of mine pool(s), elevation of mine pool(s), elevation of lowest working in proposed mine, distances to and name of adjacent mine pools, and name of mine pool or working that will receive drainage from proposed mine after mining.
- Appropriate scale permit map (1" = 100' to 1" = 400") of underground permit area plus 1,000 feet showing boundaries of underground operations, location of active,

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inactive, or abandoned underground mines with location and extent of mine pools, and location and width of all coal barrier pillars.

Non-coal Underground Mines: Non-coal underground mines located in the coal measures, or in other areas where toxic strata may be disturbed during mining, are reviewed from the standpoint of preventing postmining polluttional discharge. As with underground coal operations, these mines are designed to preclude discharges at the mine opening and in shallow cover areas while promoting flooding of the workings. The following information is requested through the non-coal underground mine application.

- Mine Development Map (1" = 400') showing boundaries of proposed underground operation and 1,000-foot perimeter zone, barrier pillars designed to promote post-closure flooding, locations of adjacent active and inactive underground mines.
- Description of measures taken to ensure returning the hydrologic system to premining conditions, including discussion of mine water quantity, adjacent mining, mine closure procedures, and fractures and/or lineaments.

Note: No Pennsylvania law specifically regulating non-coal underground mine safety exists.

Hydraulic barriers: There is no legal or regulatory standard for determining the appropriate width of a barrier pillar for environmental purposes. However BDMO-McMurray uses the formula:

$$\textit{Environmental Barrier Width} = 50 \textit{ feet} + \textit{Predicted Maximum Hydrostatic Head}$$

Any given result of solving this formula is tempered by site-specific conditions like the presence of incised stream valleys, thin or fractured overburden, and the proximity of weathered outcrop material.

BDMO is not authorized to evaluate the safety of proposed mines and the permit issued is not a safety permit. BDMS is provided an opportunity to comment on potential safety issues but lacks statutory authority to issue approvals or permits. (See discussion below.)

The potential exists that the information provided on the existing abandoned mine workings lacks detail or is not verifiable. Seeking out mine openings or mine discharges does not provide direct evidence of the extent of the mine workings. Barrier pillars designed to prevent pollution from the proposed mine are not the same as pillars designed to protect the miners in the mine while it operates. However, significant information is developed in permit applications that could be used to evaluate the safety of the proposed mine.

BDMS Activities: BDMS is notified during the mine permitting process. BDMS is provided with a portion of the mine permit application and is given 30 days to submit comments back to BDMO. The BDMS review consists of ensuring compliance with Section 236 of the Bituminous Act and the Safety Zone Act (Act 729).

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Specifically, BDMS:

- Reviews the mine permit boundary to ensure that all mines located within 1000 feet of the permit boundary or mines within the permit boundary are properly represented to satisfy Section 236 of the Bituminous Act.
- Determines, based upon the information within the permit, whether or not a safety zone will be established pursuant to the Safety Zone Act.

An outline of the in-house procedures used by BDMS engineering staff to review a permit when requested from BDDMO is shown in Sidebar 3.

The method of conveying comments from BDMS to BDDMO has evolved over time. Previously, comments were provided to BDDMO only for those permits that raised BDMS concerns. Usually BDMS engineer called an engineer in BDDMO to explain the concern. Communication continued until the issue was resolved. If the permit information was acceptable, no calls or acknowledgements were made to BDDMO.

In 1999 the process was changed to require a letter from BDMS to BDDMO stating that:

1. BDMS has no comment because the permit is acceptable to BDMS or BDMS lacks jurisdiction.
2. BDMS has comments and issues requiring clarification, which are set forth in the letter.

If it is determined that a Safety Zone is, or may be, required pursuant to the Safety Zone Act within the first stage of mining, then the safety zone requirements are incorporated within the permit process. Otherwise, safety zones are handled within the BDMS plan approval process. The approval authority for safety zones lies with BDMS.

During the Quecreek Mine permitting process, no comments were provided by BDMS to BDDMO on the initial application or revision to add underground acreage.

The Safety Zone Act: The Safety Zone Act requires a safety zone to be established beneath and adjacent to every stream, river and natural or artificial body of water in the Commonwealth that is sufficiently large to constitute a hazard to mining in the opinion and in the discretion of the BDMS. Such safety zones, in the case of such streams and rivers, shall extend horizontally two hundred feet from the high water mark of each bank. In the case of any other body of water sufficiently large to constitute a hazard to mining in the opinion and in the of the BDMS, the safety zone shall extend horizontally 200 feet from the known perimeter of the body of water. In any case, the zone shall extend downward to the limit of the workable beds.

No mining or removal of minerals shall be permitted within the safety zone unless authorization is specifically granted in advance and in writing by the BDMS.

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In no instance will any plan be approved if there is less than 35 feet of rock cover. Factors considered in plan approval shall include thickness of bed, width of mine openings, width of pillars and such other factors as are deemed applicable by the BDMS

Sidebar 3

BDMS's review process regarding application for a new or revised bituminous underground mine includes the following steps:

1. The permit application is reviewed to determine whether or not it is applicable to BDMS's jurisdiction and whether or not "miners safety" is an issue.
2. For permits that are under BDMS jurisdiction, the submitted permit information is reviewed to determine if all appropriate information is included:
 - a. Hydrology module
 - b. Geologic Information
 - c. Subsidence Control and Underground Mine Maps
 - d. Module 9, Surface and Underground mines...
 - e. Exhibit 19.2 Environmental Resources Map
3. Hydrology
 - a. Determine discharge elevations for all mine discharges
 - b. Look at all boreholes and piezometers
 - i. Use to determine where mine pools are located
4. Geologic sections
 - a. Look at cross sections and core-hole logs throughout the mine
 - i. Look for abnormalities
 - ii. Look at inter-burden between seams
 - iii. Look at rock types and structure
5. Subsidence Control Module
 - a. Review planned mining sequence and timing of mining
 - b. Complete review of areas to be mined first for safety zones
6. Complete OSM and BDMS map repository search
 - a. Search OSM maps by quad sheet and UTM coordinates. Compare the OSM maps to the permit maps and BDMS maps
 - b. Search BDMS database by coal company name, mine name, quad sheet and township.
 - c. Use this information to verify that the maps shown on the permit are the latest information available and the workings are aligned properly
7. 19.2 Environmental Resources Map
 - a. Compare outlines of all mines and identified coal seams with module 9.1 and 9.2 information, (surface and underground mines)
 - b. If the information is incorrect or does not correlate, then contact the mine operator or its engineering firm to determine a course of action to correct.
8. Prepare letter of response to BDMS
 - a. Send letter stating that the permit application complies with the Bituminous Coal Mining Act
 - b. Or send letter to BDMS stating reasons for non-compliance with the Act.

BDMS approval process: When a plan approval is required by the Safety Zone Act (or certain provisions of the Bituminous Act), the mine operator will submit a plan to the BDMS mine inspector. The operator's plan is routed from the mine inspector through his supervisor to the Engineering Division. A BDMS mine engineer will review the plan to determine if the barrier is adequate. The required barrier pillar is calculated using either the prescribed requirements of the Bituminous Act or in the absence of a prescribed formula, Ashley's Formula (see sidebar 4) from U.S. Bureau of Mines Information Circular #8741 is used. The formula is $20 + 4t + 0.1d$

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(where t is the seam thickness in feet and d is the depth of cover in feet). After the mining engineer has reviewed the barrier requirements and calculations, the plan and recommended action is routed through the Bituminous Division Chief to the BDMS Director for final action.

The design of any barrier pillar size is only as reliable as the map of the abandoned mine map utilized to calculate and design the barrier pillar. False levels of confidence based on inaccurate mine maps can unduly reduce perception of hazard and result in unanticipated incidents, which can endanger lives and property.

Sidebar 4

In 1927 the Governor of Pennsylvania appointed a commission designated as the Barrier Pillar Commission. In contrast to the current Governor's commission that was formed following a breakthrough of the barrier pillar at the Queecreek Mine, the 1927 commission was established because the pillars required by the Mining Code were causing an "unnecessary economic burden" for the operators.

The legislation that established the commission stated "that its duties shall be to ascertain from investigation the geologic formation and strength of bituminous coals in this Commonwealth and determine the practicable and safe thickness of barrier pillars to be established jointly between adjoining mining properties..."

The Commission reached several conclusions which are relevant to the existing Commission including:

1. "A report covering 84 drowning disasters in England, showed that all but 18 were due to mining through into flooded workings where mine maps of those workings were faulty or lacking. The other 18 were cases of running into water-bearing strata over denuded coal, or into faulty and dislocated strata." Additionally the Commission determined that three inundation deaths occurred in Pennsylvania and the investigation found that "mining had been carried into forgotten or poorly mapped workings. Through as one of the juries found, 'misleading maps and drafts.'"
2. Following hearings, the Commission established a formula for appropriate pillar size, which is still used today. The formula is commonly referred to as the Ashley's Formula (named after Secretary to the Commission, George H. Ashley) and states "...the minimum pillar shall be not less than 20 feet, plus four times the thickness of the coal bed, plus 10 feet for each 100 feet or fraction thereof of cover at the boundary in question".
3. The Commission recommended that "the distance to which drilling must be maintained ahead of workings designed to drain water from abandoned mine workings" be increased to 25 feet. The Commission acknowledged the need for this recommendation because advanced mining methods (of that time) which leave only 3 feet of coal "which might conceivably blow out into the flooded mine".

MSHA's activities: MSHA has no involvement in the permitting process of underground mines in Pennsylvania. MSHA is notified of each coal mine permit application. They issue an ID number and, at least for surface mine permits, need to approve mining within 500 feet of abandoned mine workings. All involvement is separate from the permitting process and involves plans for training, roof control, ventilation, etc.

Mine Map Resources

Legal requirements for mine maps: In the bituminous region a registered engineer or registered surveyor makes mine maps. During operations, in addition to keeping a copy of the map at the mine and providing the inspector their copy, which is updated every six months, the operator is required to exchange maps with operators working in adjacent seams. The anthracite regulations are similar, with a few differences. The most notable one is that maps must be updated every two months. The law requires inspectors to pass maps to their successor. Making copies of anthracite maps without the consent of the operator is prohibited. Despite the requirements of law described above, it is apparent that maps were not passed to the successor inspectors. This is

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evidenced by the events at the Quecreek mine and the Harrison #2 ‘final’ map found in a museum. Making copies of anthracite maps or non-final bituminous maps without the consent of the operator is prohibited.

Upon abandoning all or part of an anthracite mine the operator is required to have the workings ‘surveyed in duplicate and such surveys must practically agree’. A certified copy of the survey map must be filed with the mine inspector. For bituminous mines being abandoned, the operator is to update the mine inspector’s map within 60 days and to ‘send to the Department a tracing or print of [the] complete map which is to be kept by the Department as a public document.’ The engineer or surveyor who makes the map is to certify the copy as true and correct copy of an original map that is a ‘true, complete, and correct map and survey of all the excavations.’

Prior to the 1969 Federal Health and Safety Act, only Pennsylvania law required the filing of a “Final Map” for abandoned mines. Starting in 1911, the Pennsylvania Bituminous Act required a final certified map of the entire mine to be filed with the “Department.” The Federal MSHA regulations require one copy of a final map to be filed with the Coal Mine Safety District Office. Since these state maps were the only “final maps” ever filed prior to 1969, tracing their existence and location is vitally important. Unfortunately, based on information supplied to the Commission by former BDMS Director Water Vicinelli (personal communication), it appears that there was no standard procedure for map submittal in place prior to 1970.

As discussed earlier, mine regulation has been handled by several Commonwealth agencies since the 1890s. The fate of maps submitted to predecessor agencies is unknown. While some may form the core of the state repository collections, it is not known if all maps were so transferred.

Old mine maps are held in various collections and repositories. BDMS, BDMO, Pennsylvania’s Bureau of Topographic and Geologic Survey and Bureau of Abandoned Mine Reclamation have collections of old maps. It is unknown if either the Pennsylvania Historic and Museum Commission or other Commonwealth archives have map collections. BDMO and BDMS have maps of recent and current mines. None of these agencies have published inventories of their collections and none has established specific archival policies. There is no coordination of collection efforts between the agencies. BDMO-McMurray has scanned for electronic storage approximately 2000 maps, and BDMS-Uniontown about 3,500 maps.

The Federal Office of Surface Mining (OSM) has a repository of anthracite maps in its Wilkes-Barre office, and of bituminous mine maps at the Eastern Technical Service Center in Pittsburgh. It is presumed that MSHA also has maps. Another possible Federal source of maps is the U. S. Geologic Survey. Historic maps are added to OSM’s repositories as they become available but maps from recent mines are not collected. Public availability of some maps in OSM’s repositories is limited by confidentiality agreements. OSM is engaged in preservation of the collections through microfilming and electronic storage. Approximately 25% of maps in the Pittsburgh repository are scanned.

Mine maps are also found in public places like universities, libraries, and museums. The availability of a catalogue of these collections is varies. Mining companies, engineering firms, and private individuals also have mine maps. Little is known about the extent or conditions of

these collections. In many cases the owners of these maps may not even know of their existence. How many mine maps are lost when company's close or individuals die is also not known. One individual testifying at a Commission hearing stated he had seen maps in the abandoned offices of five mining companies.

Clearly, the use of old mine maps as a planning tool for present or future mines, or for construction of homes, commercial buildings, or transportation infrastructure, and for evaluating mine subsidence insurance claims, requires verification and validation of their level of accuracy. Underground coal mining in Pennsylvania dates from the 1750s. Significant reserves were mined without any map record of the workings. Maps produced for planning and design, or maps produced before the complete development of the mine can be mistaken for final maps and lead to false conclusions about the extent of mine workings.

Limitations on Use of Old Mine Maps: Survey methods used to develop a map can limit its value. Many old mine maps used mine-specific coordinate systems and datums (elevations). If the monuments used as the base for the coordinates are lost or destroyed then placing the workings on modern maps is approximate at best. Similarly, the scale used may have been modified to accommodate the original surveyor's whims. Testimony provided to the Commission noted that some anthracite maps add 500 feet to the survey elevation. This was apparently done because the workings extended below sea level and the surveyor did not want to use negative numbers. In some cases, wander of the earth's magnetic north pole makes it necessary to adjust "north" to the present system from readings taken in the past.

Lack of inventories and catalogues of map collections hinder useful access and cause duplication of scanning and digitizing efforts. In addition, preservation of maps is jeopardized by lack of proper archival methods. This may adversely affect the maps' legibility, availability, and even existence.

Verification of Mine Workings during permit review: Verification of any information in a permit application is done in several ways: comparison with other files and databases maintained by the Commonwealth, by ground truthing during field visits, by comparisons with knowledge provided by the public or from institutional knowledge of the agency, and through the rational evaluation of the application as a whole. This is also true of verification of old mine workings.

The location of abandoned mine workings is verified by the BDMO reviewer. Applicants typically do not provide the source of their information, an assessment of its validity, or an explanation of how the information was projected onto the current maps. The review process performed to verify abandoned mine workings is described in greater detail in an earlier portion of this report.

Verifying the location of abandoned mine voids and of the hydrologic systems developed in old mines is central to the permit review. The problem has three components. First, it is not reasonable to presume that all old mine workings were mapped. Take as example the mine workings beneath the Hill District in the City of Pittsburgh. Coal mining on those reserves began in the 1700s and exhausted the resource by 1870. If any maps were made of those mines, they do not survive today. Such early mining was not unique to Pittsburgh. The second

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component is assessing the accuracy of maps that do exist. A cursory review of old maps quickly leads to the conclusion that not all surveys are equal. Testimony provided to the Commission pointed out that old maps prepared by large mining companies are often reliable, but those for smaller mines may not be. For example, maps that depict workings on a map that look like ‘crow’s feet’ are suspect. The third component relates to the projection of the old map information onto the proposed mine’s plans. Old mines often were mapped using a site-specific coordinate system and/or map scale. Converting that system/scale to the one in use for the modern mine is crucial. As discussed previously, verification may not be possible if the workings were never mapped, if the surveys do not encompass the final extent of the workings, or if the old survey data cannot be accurately projected onto new mapping.

The permitting of mines under SMCRA and BMSCLA is predicated on the applicant demonstrating and the Commonwealth finding that the information submitted meets the criteria of permit approval. Permit reviewers are not limited in the sources of information used in making that finding. Permit reviewers use application information as a starting point. Comments from the public and other agencies are valuable, but those other agencies may not be focused on providing assistance relevant to abandoned mine voids. Field reviews can help by identifying tell tale signs of past mines.

For bituminous mines, BDMO-McMurray reviewers use the information in the application, maps in the office’s repository, information submitted by the public, and comments from other government agencies.

Notice of the application is forwarded to the Bureau of Mining and Reclamation (BMR) and BDMS. At present BDMS considers the seal of a professional engineer as proof of accuracy of the location of the abandoned mine. The underground mine inspectors are not involved in the process.

BMR provides information on mine workings from its “mylar” files. To verify the location of abandoned mine workings, the BDMO permit reviewer compares application information with DEP’s “mylar” information. This information is a seam-by-seam mapping of the outlines of other applications previously submitted, as mylar overlays to 1:2000 scale topographic maps. With that information, permit and inspection files may be accessible for sites active in the 1970s or later. The reviewer can also compare the application information with maps held in the Commonwealth’s map repositories. The level of adjacent mine workings inundation is typically inferred from the hydrologic data submitted in the application, though other sources, such as survey elevations of discharges or static water levels in wells may be used.

The Bureaus involved in permitting of anthracite mines are better coordinated. The BDMO-Pottsville permit reviewers work closely with BDMS-Anthracite Division staff and inspectors. The review considers all of the information noted above but BDMS does comment. The anthracite underground inspectors are involved and do comment on the applications. Testimony provided to the Commission showed that the applicant, its consultant, BDMO, and BDMS will conduct joint inspections of the proposed site to look for relevant field conditions including openings, subsidence areas, and mine buildings. Industry representatives and a mining engineer specializing in anthracite mining both confirmed this information.

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No comprehensive review of information relevant to locating abandoned mine workings, which is held by the Commonwealth in its many parts, has ever been undertaken. Many other data sources exist. Some are more readily available than others. Reviewers may not fully understand the value of those sources. For example:

- Industry has been submitting information on coal production since the 1870s.
- Inspection records are available for the more modern mines. This may include a confirmation of the sealing of the mine.
- The United Mine Workers of America maintains dues and payroll information that could confirm the closing date of mines.
- Subsidence claims and abandoned mine inquires may shed light on the location of mine workings.
- Other data sources, such as museums and universities, are likely to exist.

The evaluation of historical evidence requires it be considered holistically with all other information. Historical information is often plagued with conflicting facts. The greater the internal consistency between all of the facts the greater the confidence in any conclusions reached using the facts.

Focused use of all information can help to verify information submitted in the application. Verification of mapped information allows for an informal examination of the credibility of the plans of the proposed mine, when questions exist it can allow for engineering plans that factor in the uncertainties.

On the basis on the above discussion, the Commission concludes that verification of data on the location of abandoned mines is presently not a systematic process.

Recommendations

- The Commission recommends that mine safety requirements for anthracite and bituminous mines be consolidated in a single statute.
- The Commission believes that the Acts and all parties involved with underground mining in Pennsylvania would benefit by revising existing mine safety laws to be consistent with most modern regulatory statutes by making the mine operator primarily responsible for compliance at the mine. Naturally, such a change would also necessitate adding new provisions that provide for enforcement tools, such as civil penalties and administrative orders that apply to operators rather than individuals. These tools are also common in most statutes administered by the DEP²²

²² See generally statutes cited in n. 9, above.

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and in the Federal Mine Safety and Health Act.²³

- Pennsylvania's mine safety statutes should be amended to allow the Department to promulgate regulations that allow programmatic upgrades to keep pace with technology, to eliminate prescriptive tones, and to shift a share of the responsibility for compliance to the mine operator.
- The Commission recommends more formal and detailed interaction and communication procedures between BDMS, BDMO and the operator to ensure verification and validation of the mine maps and abandoned mine voids pertinent to the proposed operation. In regard to verifying the accuracy of the abandoned maps, the BDMS must take a more deliberate role in identifying the potential for any hazards created by mining near abandoned mines. They must do so not to relieve responsibility from the operator or consultant, but to serve as a final review in the prevention of mining into abandoned mine voids.
- Since, prior to 1969, the only "Final Map" requirement was to the predecessors of DEP, a deliberate and concentrated effort must be undertaken to find, identify and catalog the "Final Maps" submitted to the Department since 1911. It is necessary to catalog all Commonwealth collections of mine maps. These catalogs should include common metadata fields so that further preservation efforts use the best copy of any given map.
- It is important that DEP have statewide authority to copy all mine maps. While recognizing the issues of private and public interests, as well as property and proprietary rights, the need for the state to deal with future mine permits and future environmental and health and safety issues demands that a workable solution be developed. Museums, universities, and other private agencies may acquire map collections from the mining companies or other sources. However, copies of these maps must be made available to the DEP to avoid situations like Quecreek. Therefore, the Commonwealth should systematically inquire into the presence of maps in the public and private sector to expand the Commonwealth collection.
- A Technical Guidance Document should be developed to establish how information for abandoned mines should be assembled, presented, and evaluated.
- DEP should require a specific evaluation of the credibility of the information on the extent of adjacent abandoned mine workings.
- DEP should establish rational guidelines for the operator and the regulatory agencies to evaluate and establish the limits of a hazard zone from abandoned mine boundaries. In the likely event that reliable mapping does not exist, procedures such as drilling should be adopted to further define the limits of abandoned mines and the appropriate safety barriers.
- Pennsylvania's 200-foot drilling threshold should be retained as a minimum threshold for initiation of drilling, but should be allowed to be overridden based on site-specific conditions. The 'dangerous proximity' standard is, in practice, likely to be more

²³ 30 U.S.C. §§ 814, 820.

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protective, because it requires a site-specific evaluation of the evidence to define the hazard.

- Because BDMO's main responsibility is for environmental purposes, BDMS should be charged with the responsibility of reviewing all safety aspects of a permit. BDMS should provide relevant comments on each application for a new mine, or the expansion of an existing mine. If credible evidence of adjacent abandoned mine workings is not provided, then BDMS should suggest both the appropriate barrier distance and the operational measures needed to maintain the barrier. If either BDMO or BDMS denies a permit application it will not be granted.
- BDMS should evaluate applications for new mines and designate barrier pillars between the new and old mines based on the veracity of the known information about the abandoned mine voids. Procedures for reducing those barriers during the permit review and memorialized in conditions of the Coal Mining Activity Permit. The procedures should include solicitation of comments from the mining industry, the UMWA, and all other stakeholders.
- The Commission recommends that a single Commonwealth agency be designated as the 'official keeper' of mine maps. Policies and procedures should be put in place to ensure the timely transfer of maps from recent, present, or future mines to the designated 'keeper.' It is also recommended that DEP explore the County Recorder of Deeds Office as a secondary location for archiving mine maps.
- All final maps filed with the Department should be based upon the Pennsylvania State Plane Coordinate System. If that particular mine is not in this system, the mine survey control system shall provide the Pennsylvania State Plane Coordinate System values in addition to the local mine coordinate system for its monumentation. The elevation above Mean Sea Level, based upon the North American Datum 1983 for all control points, shall be indicated as well.
- The Commission recommends that all future "Final Maps" meet the following criteria:
 1. All maps should meet or exceed the proposed mapping standards of this Commission.
 2. All maps be endorsed and dated by a Professional Engineer or Professional Land Surveyor with appropriate experience and qualifications.
 3. All maps should contain a dated statement and appropriate endorsement by an official representative of the operator (possibly an officer of the company or corporation) that this is the "Final Map".
 4. All final maps should be filed with BDMS as per Section 240. Final maps should also be filed at a facility to be designated as the central repository.
 5. BDMS should provide documentation that the final map has been received, cataloged and filed
 6. The final map should be in the form of one contiguous map where possible.

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- The Commission recommends implementation of a preservation program that includes archival storage and photographic and electronic recording of original mine maps and georeferencing of electronic maps to increase availability and to improve compatibility with modern map technology.
- The Commission recommends the development of databases containing production information of mines, which has been collected and recorded since the 1870s. This data should be correlated with the maps of mines in the repositories to provide a more complete picture of the coverage of the collections. Additionally, it is recommended that a systematic review be undertaken to identify potential sources of other collaborating information. The collected information should then be organized to facilitate its utility to industry, the public, and government regulators.
- The Commission recommends that guidelines for assessing credibility of location evidence be developed. Applicants for mine permits should provide the source of information used to locate old mines on maps supplied during the permit process because simply sealing a map does not give an opportunity for the regulatory agency to assess the applicant's validation and verification procedures.

MSHA should be included as a notified agency during the permit application process and be given an opportunity to make health and safety comments and/or recommendations on the proposed underground mining proposal.

4. PLANNING AND DESIGNING MINES ADJACENT TO ABANDONED MINE WORKINGS

The most important factor in the planning and designing a safe barrier for mines above, below or adjacent to abandoned mine workings is the correct location of the boundary of the abandoned mine in relation to the proposed boundary of the active mine. The manner in which this information is evaluated has the potential for not properly identifying these boundaries, thus creating the dangers from accidental breaching of the barrier and exposing miners to inundation and explosive and noxious gases in the old workings.

If there is an uncertainty in the identification of these boundaries, then there is a need to develop measures of reliability that can be assigned to the boundary based upon the ability to validate its location. The procedure to validate the assumptions made during the mine permitting stage and precautions to be taken during mining to avoid breaching the barrier should be site-specific. These procedures should include mitigation plans to address unique geologic features, such as a local variations in the coal seam resulting in “low” areas in the mine workings, where fluids can accumulate potentially limiting escape.

Commonly, during the planning and design stages for new mines, nearby abandoned mines cannot be entered and inspected. In some cases major remnant surface structures (shafts and slope entries) of the abandoned mine can be established from a new survey. The new survey can then provide a good basis to assign high reliability to the old mine map and to the extent of workings shown on the old map with regard to their outlines and bearings. However, stringent efforts to verify the boundary of the old mine will be needed during mining. In other cases, old mine workings are in the vicinity of the proposed mine but sufficient monuments are not available to establish the reliability of the old mine maps, or the extent of the working shown on the maps. In general, whatever the reliability of the abandoned workings location prior to planning, designing, and permitting, there is always a certain amount of residual uncertainty as to their exact location. As the mine workings approach these old workings, this uncertainty must be greatly reduced through frequent validation of the assumptions made about this boundary during the mine planning, designing, and permitting stages. Reducing this uncertainty is essential to eliminating the chances of barrier breaching and inundation.

Design of current underground mines adjacent to abandoned mine workings

When abandoned mine workings are believed to be present (adjacent, subjacent, and/or superjacent) within 1000 feet (regulatory threshold for identifying adjacent abandoned workings), the engineer must perform diligent research and obtain the “final” mine map(s) and confirm the location(s) in relationship to the proposed underground mine layout. The engineer must exhaust all possible sources (state, federal, public and private) to ensure he has obtained a copy of the “final” mapping of the mine(s) and he is certain the map indicates the total extent of mining. Cross checking of coal seam names, elevations of coal, and on-site field reconnaissance must be diligent. It is a known fact that past mining activities, particularly in old mines, are not routinely identified on mine maps. It is also not uncommon for archived mine maps to show mine projections, which also lends a degree of uncertainty to the procedure. Any abandoned

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workings identified by the engineer must then be assessed for potential safety concerns (inundation, methane, and carbon dioxide (“black damp”)).

Upon obtaining the final map, the engineer must then locate the mine in relation to the proposed mine layout. This can be done by transformation of a known coordinate system from the abandoned mine, location of surface features from the abandoned mine (slopes, shafts, drifts, boreholes), utilizing known property lines and corners to locate the mine or carefully utilizing surface features shown on the old mine map such as roads, creeks, and power lines.

Following completion of the aforementioned work, the engineer must evaluate the degree of certainty as to the extent and location of the abandoned mine workings.

Once the engineer has confirmed the extent and location of the abandoned mines, barrier pillars must be designed for both the safety of the miners and protection of the environment. Barrier pillars can be designed using numerical modeling techniques or empirical methods developed throughout the years. Guidance on the various empirical methods is contained in the USBM Informational Circular 9427 (1995), “Practical Design Methods for Barrier Pillars”

BDMO utilizes the following rule of thumb to assess the minimum barrier width submitted by the permittee, $W=50+H$, where W is the barrier width in feet and H is the maximum hydrostatic head that exist from the abandoned mine or is possible upon completion of mining of the proposed mine, whichever is greater. BDMS utilizes the formula $W=10+2*T+5*OB/100$ to calculate the required safety barrier pillar between mines. In the equation, W is barrier pillar width, T is the thickness of the coal seam (mining height) and OB is thickness of the overburden at the proposed location. Most small operators in the bituminous coalfield will maintain either the larger barrier pillar width as calculated by BDMO or BDMS or the 200-foot drill limit from abandoned mine workings required by section 224(b) of the Bituminous Act, whichever is greater. The operator will maintain the 200-foot drill limit to avoid downtime and lost revenue due to the drilling requirements.

When the extent and location of abandoned mine workings are known, the Commission believes that the current barrier pillar and test drilling limit requirements the Commonwealth’s laws and permitting procedures are adequate to assure the protection of the coal miners.

Communications: Another safety feature that should be addressed when planning and designing mines is the installation of an in-mine communication system. In-mine communications and communications between miners and outside mine personnel is vital. Inundations can profoundly disrupt normal communications. Miners at the Quecreek Mine commented on the need for a communication system that would allow trapped miners to communicate with the surface. The mine communication system at Quecreek Mine quickly became inoperative as the lines and phones became submerged in water. Unfortunately, the cost to “harden” mine communications systems to survive a disaster and continue to function would be astronomical. The specter of miners trapped underground after a fire, explosion, roof fall or other mine disaster has prodded organizations around the globe to look for methods to communicate with the victims. These so-called “trapped miner” communication systems would be based on technology which could be carried by each miner, and which would serve to provide a basic communication

link during after a disaster. This link wouldn't have the features to meet normal communication needs, but only the ability to communicate basic information. Sidebar 5 provides information regarding new developments in in-mine communications.

Sidebar 5

Two-Way Trapped Miner Communication Systems

The former U.S. Bureau of Mines conducting pioneering research in the 1970's on the propagation of radio waves through tunnels and directly through the earth to detect and locate trapped miners. A body of knowledge was developed on the advantages and limitations of communication systems ranging from VF (300 – 3000 Hz) to UHF (300 to 3000 MHz). Early attempts by the Bureau of Mines showed that VF signals around 1 KHz could be transmitted through more than 1000 feet of overburden. An Australian mining industry research initiative resulted in the commercial availability of a "paging" system for underground mines. The Personal Emergency Device (PED) communication system is a "through-the-earth" transmission system that enables communication of specific messages with individuals underground, no matter their location, and without dependence on cables or wiring underground. It functions with a carrier wave frequency of 1,000 Hz, and employs a frequency-modulated signal for transmitting messages entered to the transmitter from a personal computer. Messages can be directed to an individual, to a group, or to all underground personnel. When a message is received, the cap lamp flashes and the miner can then read the message from the LCD on top of the lamp battery.

There are currently 17 PED systems installed in U.S. coalmines and one in a metal/nonmetal mine. The first successful evacuation of miners attributed to the PED occurred during the Willow Creek mine fire, in Helper, Utah, on November 25, 1998. The paging system was activated when one miner saw flames and telephoned the dispatcher to evacuate the mine. The PED system allowed a mine-evacuation plan to be safely carried out before the mine passageways filled with smoke. All 46 underground miners escaped in approximately 45 minutes. While very successful, the system is not bi-directional (two-way). Thus, miners can be directed from the surface station to evacuate an area, the miners have no means of notifying the surface station of their status or anything else.

Transtek, Inc., demonstrated a prototype of their wireless through-the-earth two-way voice communication system at NIOSH's Lake Lynn Experimental Mine in August of 2000. The underground antenna consisted of two 60-ft diameter loops placed in E-drift near the fan portal. An identical antenna was placed 300-ft above on the surface near the fan house and was offset from the underground antenna by several feet. The voice communication signal (hand sets fixed to each loop) exhibited good clarity at both underground and surface locations. Work is continuing in this area, and Transtek is planning another test within the next few months.

Other two-way systems have been proposed and built utilizing VF and medium frequency (300 - 3000 KHz) to solve the problem under varying conditions. Newer digital technologies for AM radio may open up possibilities for improved medium frequency systems, which depend on wires already in place.

While the technical problems and potential solutions for emergency two-way communications are reasonably well understood, there are no commercial systems which will operate in all situations, and only a small number of companies selling custom systems. Further, there are no "handbooks" which would allow a designer to put together a guaranteed working system in any specific mine. Each system needs to be custom designed and tested for a specific mining environment and its particular functional requirements.

The lack of practical engineering designs coupled with a small potential market²⁴ limits the availability of commercial systems, rather than a lack of basic technical knowledge. NIOSH has and is continuing to work with communication vendors to demonstrate systems at its Lake Lynn facility, but what is needed are demonstrations under real world conditions which could lead to practical guidelines.

²⁴ According to MSHA, there were 1007 underground mines in the US in 2001. MSHA data indicates that only 200 of these mines employ 50 or more workers. This number rises to 500 for mines employing 20 or more.

Information on abandoned mine workings

The information on abandoned mine workings can come from a multitude of sources. The list of possible sources includes:

1. State repositories
2. Federal repositories
3. Present and former land companies or owners;
4. Adjacent land companies or owners (past and present);
5. Field reconnaissance
6. Former mining companies, managers, employees, or owners;
7. Adjacent mining companies, managers, employees, or owners;
8. County property records;
9. The engineer's own files due to past involvement;
10. Annual production records from the State.

The verification of the data obtained is normally based upon the professional judgment of the engineer and mine management. There may never be a final authentication, therefore, there should be some criteria to express this uncertainty. The engineer can further utilize the data obtained to determine if additional use of exploration technologies currently available (geophysical, remote sensing, and drilling) is needed to assist in determining the location and sizing of barrier pillars.

In response to Quecreek, several states have conducted a review of their active mines. MSHA also conducted a review of active mines nationwide. MSHA's risk assessment categories are as follows:

- High Risk Category Mines – old workings within 500 feet, questionable maps, and flooded old workings.
- Intermediate Risk Category Mines – old workings between 500 to 1,000 feet, and some reliable maps.
- Low Risk Category Mines – no old working within 1,000 feet.

According to MSHA, there are respectively 207, 203, and 96 high-risk, intermediate risk, and low risk mines in the United States. Although it is recognized that definition of risk and assignment of risk are complicated, MSHA's approach is at least a start to assessing the problem.

On the subject of enhancing the reliability of old maps where there are questions, several approaches are necessary. The first and foremost method is to cross-reference all available information on production, taxes, workmen's compensation, county property records, subsidence

records, employment records and other records that can indicate the timing and extent of mining activities in the mine. Surveying and mapping to verify the location of surface features should be conducted. Drilling from the surface or from other known locations to establish the extent of the abandoned workings and their conditions can be done. However, drilling is often expensive and cannot be easily interpreted without an adequate number of closely spaced holes.

Application of geophysical tools and techniques can provide an indication of the existence of an anomalous structure or interface, and with proper interpretation, it may be possible to determine the type of structure. Additionally, the age of the maps, the shape of the workings (irregular or haphazard workings can be an indication of poor mapping), and the condition of the maps all should be considered. A combination of these approaches can provide credible evidence regarding a map's level of reliability and can lead to greater confidence in the map.

Mapping underground mines

The practice of mapping underground mines in Pennsylvania is quite diversified. The engineers and surveyors responsible for performing these services have historically used diverse standards and procedures that have led to serious issues with correlating data on maps. Issues regarding the mapping of underground mines include closure standards for mine surveys, coordinate/datum systems, mapping "last cut" workings along barrier pillars, archiving and storage of maps and map availability.

Closure Standards for Mine Surveys: The basis for achieving precise mine maps is the accuracy of the surveying that is performed to control and locate the mine workings. To determine accuracy, a survey must be closed-looped. According to law and sound surveying practice underground operators establish at least two, preferably three, permanent baseline survey points. Surveying accuracy is defined by the closure and measurement of the errors, of such a survey. The errors measured include angular ties as well as coordinate ties. The American Land Title Association (ALTA) has set standards in regard to property surveys depending on the location of the properties. Various coal producing states in the eastern United States have either adopted ALTA or set their own standards for property surveys. Pennsylvania, West Virginia, and Indiana have none specified. (NAS, 2002). MSHA regulations (30 CFR 75.1200-2) require underground mine operators to perform closed-loop surveys. However, the regulations do not establish a distance between the last closed loop and the active or final mine face nor impose a closure standard. Ohio and Virginia are the only eastern coal producing states that have established a closure standard. (NAS, 2002). The underground mines within the Pennsylvania are currently controlled by MSHA standards since standards are not mandated by state law. However, based upon testimony given before the Commission, surveying is possibly being performed in the anthracite coalfield that is not in compliance with MSHA regulations.

Methodology used to determine survey closure varies within the profession. Methodologies used include 1) closed-loop system of the raw data, 2) balancing of angles first and then calculating closure, and 3) a system whereas the surveyor ties into a previous loop and uses the balanced work of the previous loop in the closure calculations. Methods 2 and 3 uses "calculated data" in the determination of the closure, while Method 1 allows the professional to accept or reject the survey based upon the actual raw data collected.

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Underground survey work must be performed by the closed-loop method with minimum closure errors established to ensure mine workings are accurately located in respect to other existing and future mines and surface features. It is necessary to establish the minimum distance that a closed-loop survey is required to be from the final face of a mining section. Although the preference would be the last open crosscut, realistically, a suggested distance would be 100 feet or the next-to-last open crosscut of a mining section.

Equally important as the mine survey is the establishment of elevations within the mine. In the past, mines within both the anthracite and bituminous coalfields in Pennsylvania have established elevations based upon various local assumptions. For example, the Commission received testimony that in one case in the anthracite field a coal company had added 500 feet to the established elevations to avoid dealing with negative or below sea level numbers. With the complexity of the coalfield, due to the steeply pitching seams, it would be virtually impossible to correlate the X,Y,Z location of this mine to other mines and surface features in the area without knowing this unique fact. Another problem, which has commonly occurred in Pennsylvania, as well as throughout the United States, is the establishment of the coal seam names for a particular mine. The seam names often have been established locally, such as the A, B, C, D, and E seams of central Pennsylvania; seams are miscorrelated; or seams are named for whatever coal seam the customer was wanting to buy at the time. Consequently, accurate elevations become crucial in establishing the location of a mine with respect to other active and abandoned mines in the area.

The required locations and intervals for elevations have been set forth by the Pennsylvania mine laws (Bituminous Coal Mine Act and Anthracite Coal Mine Act) and by MSHA regulation (30CFR 75.1200, 30CFR75.1200-1). The operator should be required to note on all mine maps the elevation datum the mine elevations are based on, for example, a nationally known standard system such as the USGS (United States Geologic Survey). As for mine surveys, neither law establishes a closure criterion for elevations. Because mines in both coalfields can occur in relatively close proximity to each other, a closure standard should be established by the Commonwealth to ensure an accurate depiction of a mine regardless of the coal seam name being utilized. A suggested standard would be ± 0.01 feet per 1,000 feet.

Coordinate/Datum Systems: According to Pennsylvania Mine Law and MSHA Regulations (30 CFR75.1200-1(h)), underground mine operators are required to establish two, preferably three, permanent baseline survey points that are coordinated with the associated underground and surface mine traverses. In addition, two permanent elevation bench marks are to be established which reference the elevation survey of the mine. In the past, mine operators have had a choice of using previously established coordinate and elevation datum systems on a property or creating a new system for the mine to state plane coordinate systems. No uniform standards have been set, thus creating the need for coordinate transformation between neighboring mines. As long as the permanent survey stations exist, this does not pose a problem. However, over time, the permanent survey stations have often been lost or destroyed making these transformations impossible to perform.

Two state plane coordinate systems exist in the United States, North America Datum 27 (1927) and North America Datum 83 (1983) and both are widely used by surveyors. The Commonwealth should designate one of these as the preferred system and require all new and

recently permitted mines to convert to that system. Today, requiring all mines to be on a state plane system is not unreasonable. Using state plane coordinates is beneficial because surface planimetric features (roads, utility lines, etc.) are normally referenced to a state plane system and mines can be easily located on maps available to the public that are based on these systems, such as United States Geological Survey topographic maps. Should the permanent survey points be lost or destroyed following final closure of the mine, the location of the mine could still be established.

The conversion of older mines to the designated system could be very time consuming and prone to errors. These mines could possibly be “grandfathered” and would only be required to establish the coordinate system on the permanent survey monuments and all mine openings, such as shafts, slopes, drift, boreholes and pump holes. The coordinate transformation(s) between the local system used by the grandfathered mine and the designated state plane coordinate system should be noted on all maps submitted to the Commonwealth. In regard to the establishment of elevations, for reasons referenced earlier in this report, all mines within the Commonwealth should be required to use or reference mean sea level (USGS elevation) to establish the vertical location of the mine.

Mapping “Last Cut” Workings Along Barrier Pillars. Mapping of the “last cut” along barrier pillars and other locations in the mine has become an area of concern under scrutiny because often, particularly in a continuous miner section using room and pillar retreat mining methods, the last cut in an entry may not be bolted or retreat mining may commence without notification to the engineer or surveyor. Either case may make it impossible for the engineer or surveyor to physically access the area to accurately depict the extent of the mine workings. To produce the most correct and accurate map possible, these practices must be avoided.

The mine foreman should not authorize retreat mining or abandonment of a section before the final depth of penetration of each entry can be established. Should conditions warrant the immediate abandonment of the working faces, the mine foreman should be required to estimate the final locations of each heading and the engineer or surveyor should be required to distinguish these estimated locations on the map by a symbol. The engineer or surveyor, responsible for the mapping, should make a notation describing the reliability of the approximate area of mining.

An engineer or surveyor should not certify that an area of the mine has undergone second, or retreat, mining unless they have direct knowledge or survey data. If the engineer or surveyor has depended on the mine foreman to provide a description of the pillars mined, the engineer or surveyor should be required to note the source of the information used for mapping of the mining activity since this coal recovery is not surveyed but estimated

Archiving and Storage of Maps. Current underground mine maps are required to be collected and stored at both the state and federal levels. On the federal level, MSHA has the regulations and the responsibility as the source of maps for active mines only. Once a mine is closed, MSHA forwards a copy of the final map to the OSM National Mine Map Repository located in Pittsburgh, Pennsylvania. (Maps of anthracite maps are to the OSM Repository in Wilkes-Barre, Pennsylvania.) The major steps followed by OSM in the archiving and storage of mine maps include:

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- Assigning the maps document numbers and checking for completeness and damage.
- Locating and plotting mine maps on topographic maps.
- Preparing data entry sheets.
- Microfilming mine maps and producing the aperture card.
- Assuring quality control in the microfilming process.
- Stamping aperture cards with the document number.
- Entering data sheets into the database and index preparation.
- Filing aperture cards in the repository system.
- Returning the map originals and one copy of the aperture card to the map donor.

According to testimony before the Commission, the OSM Repository in Pittsburgh is currently in the process of digitally scanning the maps contained in the repository. This in-house project is approximately 25 percent complete. The anthracite mine repository in Wilkes Barre has not started the project. The OSM repositories currently contain in excess of 125,000 maps with an excess of 11,290 maps for Pennsylvania. Even with these maps, extensive additional uncharted mining has been discovered in the western-middle and southern anthracite fields in Pennsylvania.

DEP's state repositories are located in Pottsville (anthracite) and in Uniontown and McMurray (bituminous). Collections of maps also exist at DCNR's Bureau of Topographic and Geologic Survey and DEP's Bureau of Abandoned Mine Reclamation. According to testimony before the Commission, there is no database that catalogs these collections. There are ongoing projects within different agencies to digitally scan the maps and some effort is being made to geo-reference the mines; however, this has not been coordinated across the agencies. The Commission has also determined that maps are being stored across the Commonwealth in areas not equipped to preserve and protect the maps from deterioration.

Map Availability. As stated previously in this report, maps of active mine maps are available for public review and copying on the federal level through MSHA and at the state level through the BDMS and BDMO. Maps of closed and abandoned mines may be examined at the OSM repositories in Pittsburgh and Wilkes-Barre along with Pennsylvania state repositories located in Pottsville and Uniontown and McMurray. Maps within the repositories have been obtained and donated from various sources including federal and state agencies, coal and land companies, and individuals. According to testimony before the Commission, complete cataloging of the map repositories does not exist, a comparison between repositories (state and federal) has not been performed, verification whether the maps contained in the repositories are final maps or duplicate maps of the same mine has not been completed and updating of folios (folios are comprehensive bound packets which contain a surface topographic map and maps of mines underlying in descending order) have not been updated since they were originally made.

However, not all abandoned mine maps and final maps can be found in the repositories. Older mine maps may be found at a university, museum, abandoned buildings of defunct coal and land companies. Maps may also be found at consulting companies, individual homes, or the maps could have simply been destroyed.

Recommendations

- The Commission recommends that standards for mapping be established. The recommended standards for various aspects of mapping are:
 1. Minimum angular ties as well as coordinate ties should be established by the Commonwealth for all mines that are currently permitted and all future mines. The recommended minimum standard, for raw data only would be an angular tie of less than $00^{\circ}01'00''$ (1 minute) and a coordinate tie of greater than 1:10,000 (1 foot in 10,000 feet) for any given closed loop survey. (Standards could possibly be relaxed given the specific circumstances such as a hill-top mine with all outcrop reserve and no previous mining in the area.) The Commission recommends a standard for elevation closure of ± 0.01 feet per 1,000 feet. The Commonwealth should establish the minimum distance that a closed loop survey is required to be from the final face of a mining section.
 2. Two state plane coordinate systems exist in the United States, North America Datum 27 (1927) and North America Datum 83 (1983) and both are widely used by surveyors. Choosing which system can be a matter of debate; however, the Commonwealth should designate one of these as the preferred system. (The Commission recommends the NA83 Datum.) All new and recently permitted mines should be required to convert to a unified state-designated system. The conversion of older mines to these systems could be very time consuming and prone to errors. The Commission recommends these mines be “grandfathered”, meaning they would only be required to establish the coordinate system on the permanent survey monuments and all known mine openings, such as shafts, slopes, drift, boreholes and pump holes. The coordinate transformation(s) between the local system used by the grandfathered mine and state plane coordinate system should be noted on all maps submitted to the Commonwealth. In regard to the establishment of elevations, for reasons referenced earlier in this report, all mines within the Commonwealth should be required to use or reference mean sea level (USGS elevation) to establish the vertical location of the mine.
- The Commission recommends that mine foremen not authorize retreat mining or abandonment of the section before the final depth of penetration of each entry can be established. Should conditions warrant the immediate abandonment of the working faces, the mine foreman should be required to estimate the final locations of each heading and the engineer or surveyor should be required to distinguish these estimated locations on the map by a symbol. A notation describing the reliability of the approximate area of mining should be made by the engineer or surveyor responsible for the mapping.

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- Current mine design procedures and practices are adequate. The Commission recognizes and stresses that many mines operating in areas with abandoned mines and have successfully negotiated their active operations around old mine works. No major improvement is needed in mine design and layout if the data available for planning is correct.
- The Commission recommends that mining plans be evaluated by BDMS to ensure that the mine plan includes appropriate mitigation measures to address situations that occur during the operational life of the mine, such as encountering low, flood-prone areas along escape ways, that may hamper mine evacuation in inundation emergencies.
- The Commission recommends projects be undertaken by the Commonwealth to:
 1. Assess the proper technology and methodologies to digitally store and georeference mine maps.
 2. Complete cataloging of all maps contained within the state system into a database and cross-reference to production records maintained by the Commonwealth. Initiate a joint project between DEP, DCNR and OSM repositories to ensure each contains all maps available within Pennsylvania.
 3. Investigate and research procedures for the preservation and protection of maps to avoid further deterioration.
- The Commission views verification and validation of the maps of abandoned mines as a joint task involving the state mining and geological agencies, mining companies, federal agencies connected with mining, mining engineering consultants and certified engineers and miner's representatives, as applicable. Funds for such verification and validation exercises must be obtained from diverse sources including the abandoned mine land funds from OSM, the conservation of energy funds from the federal Department of Energy, and health and safety funds from MSHA, NIOSH and other federal and state mining agencies. As the information gathered during the verification and validation process are useful for numerous other purposes such as water resources, environmental protection control, and community health and safety, the involvement of other agencies, such as EPA and USGS, should also be considered.
- The Commission recommends that the Commonwealth undertake a public advertising campaign to solicit the assistance of the public to locate and copy maps of abandoned mines throughout the state. The airing of a public service message during the airing of Disney's Quecreek television movie would be an opportune way to kick off such a campaign.
- Inundations can profoundly disrupt normal communications, therefore the Commission recommends that communication systems be developed to withstand variable conditions within the mine, including those realized during mine flooding.

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- The Commission recommends that DEP develop a system to determine the “scale of certainty” to allow a proper a more complete assessment regarding the extent and location of abandoned mine workings in respect to a proposed or active mine.
- The Commission recognizes that the ability of a small operator to fund the additional research needed for establishment of the credibility of the evidence presented in the permit application may be limited. The Commission recommends the regulatory agencies involved explore possible assistance from the Federal AML funds or look into setting up a program, similar to OSM’s Small Operators Assistance Program, to facilitate these efforts.

The Commission notes that the Nation Research Council’s (NRC) report, titled *Coal Waste Impoundment: Risks, Responses, and Alternatives*, has provided a set of recommendations for mapping underground mines. The NRC’s report was generated in response to a slurry impoundment breakthrough into an underground mine in Martin County, Kentucky in October of 2000. Approximately 250 million gallons of slurry flowed through abandoned underground mine workings before reaching local creeks and streams. The NRC’s mapping recommendations are included in sidebar 6.

Sidebar 6

Excerpt from Chapter 4 of *Coal Waste Impoundment: Risks, Response, and Alternatives*. (NRC, Nation Academy Press, 2002)

“In many instances, nonexistent, erroneous, or incomplete mine maps prevent knowing the extent, location, and depth of mine areas. Therefore, the committee recommends that MSHA work with OSM and state agencies to establish standards for mine surveying and mapping. These should include the following:

- Determining surface coal outcrop locations by aerial topographic measurements, where adjacent to existing or proposed refuse impoundments,
- Implementing a coordinated and assertive approach to collecting and archiving mine maps,
- Scanning paper copies of mine maps into electronic data files upon receipt,
- Setting standards for minimum closure error for all underground closed-loop surveys and that a closed-loop survey be maintained within a standard distance (to be determined by MSHA),
- Recording the depth of the last cut taken to a level of accuracy to be determined by MSHA,
- Using state plane coordinates or latitude and longitude, and bottom-of-seam elevations as the map base references,
- Listing of appropriate coordinate transformation equation(s) on the mine map,
- Adding a qualifying statement to accompany any coordinate transformation that is based upon the alignment of surface features,
- Improving and maintaining the location of surface controls,
- Determining which mine permit documents should be retained, in what form, and for how long,
- Avoiding the use of coal seam names as the sole basis for determining the vertical location of an abandoned mine.”

5. DETECTING MINE VOIDS IN ADVANCE OF MINING

Currently, operators attempt to verify the existence of nearby abandoned mine voids by cross-referencing all available mapping and by obtaining word-of-mouth information concerning the possibility and location of abandoned mines. Occasionally, exploratory drilling programs, which are designed to evaluate reserves, may inadvertently discover abandoned mine voids. Upon establishing of the existence of abandoned mine voids, barrier pillars are designed utilizing accepted barrier pillar design criteria. It is now recognized, as illustrated previously in this report, that the location of mine voids includes some degree of uncertainty. Consequently, the need to detect mine voids during the mining operation is of paramount importance.

Technologies for detecting underground voids

Several methods have been utilized for the detection of mine voids. Some methods are very basic, such as visually locating surface disturbance resulting from subsidence. Others are quite intense, such as the application of modern geophysical techniques and longhole drilling.

Surface reconnaissance: On-site visual inspections and investigations are utilized in the initial environmental evaluation as part of the permit application. The consulting engineer or geologist travels the surface areas within the permit area as well as the surface areas within 1,000 feet of the permit boundary to gather hydrological and geological information. During this process evidence of previous mining may be discovered. Mine discharges may also indicate the existence of an abandoned mine. This evidence would justify and require further investigation. The application of simple field reconnaissance is limited since only obvious surface disturbance or mine discharge points may be visible to indicate the possibility of an abandoned mine.

Vertical drilling: Vertical drill hole exploration is typically used to establish and evaluate the quality, quantity, limits and mineability of the coal reserve. Vertical drilling is also used in underground mining for mine drainage, communication, power distribution and ventilation. Vertical drilling may also be utilized to prove the existence of a mine void. However, the typical drilling pattern for evaluating reserves is seldom enough to detect or verify, with sufficient reliability, the existence or total absence of voids. In limited applications such as low cover and limited barrier verification vertical drilling may be suitable. Since the vertical drill holes are spaced from one another, an assumption must be made that the area between two “solid” drill holes is also “solid” and free of mine voids. The closer the drill holes are to one another, the more likely the area between the holes is also solid and free of voids. However, vertical drilling may involve a number of problems. Vertical drill holes may not be truly vertical and may drift in any direction. Vertical drilling is limited by surface accessibility. The area required to erect the drill must be nearly level. Drilling perpendicular to the surface contour may be impossible. The cost and reliability of vertical drill holes increase as the depth of cover to the coal seam and mine void increase. Large surface areas may need to be disturbed in order to establish a drilling pattern.

Horizontal drilling: Horizontal drilling techniques have been a standard method for methane drainage in underground longwall panels. Recently, their use for detecting mine voids in

underground mines has been reported. In its simplest form underground drilling is as basic as auger drill holes powered by hand, electricity, air or hydraulics with the ability to drill limited distances with limited directional control. Modern directional drilling was developed by the oil and gas industry and has proven the ability to control the direction of the hole as well the capability of drilling distances in excess of 5,000 feet. Horizontal drilling is the only method of drilling or exploration that can prove an area such as a barrier to be completely solid and completely free of mine voids. Horizontal drilling may be used to both locate and verify mine voids or conversely, to verify a solid coal area and the absence of mine voids.

Geophysical techniques: Applied geophysics is the application of geophysical methods directed towards the determination of subsurface geological structure, lithology, stratigraphy, and the characterization of void and void-filling phases. Applied geophysical methods are tremendously diverse with respect to the types of measurements made and modes of survey. The recognized methods include and may not be limited to measurements of electromagnetic fields, seismic studies, radar, surface imaging, and in-seam applied geophysical techniques. Geophysical techniques do not provide definitive locations or limits of mine voids. Each method has its own unique application and limitations.

Factors affecting the use of geophysics include but are not limited to depth from the surface, previous mining activity, soil characteristics, void fill material or lack of material, geological anomalies and cost.

Robotics: Robotics has been advanced as a possible technique for mapping underground mine voids. Certainly the use of robots would be advantageous but one must recognize this application is only experimental at present. Development of robots that can function in difficult mine environments reportedly is underway. Consequently, the ability of robots to map in this environment has yet to be determined. Pennsylvania and federal mine safety laws maintain rigid standards for permissibility and additional safety considerations, which must be addressed prior to acceptance of a robot into a working mine environment. The application of robotics is limited by the mine environment, mining regulations (state and federal), ability to maneuver over roof falls and through impounded mine water and the ability to access the abandoned mine.

Note: Commissioners Bill Harbert and Steve Kravits prepared comprehensive document on geophysical methods/robotics and longhole horizontal drilling respectively in support of this section. These documents are part of the Commission file and are available upon request.

Mine Void Detection Using Geophysical Surveying

With respect to the detection of mine voids, geophysical methods utilize a variety of both active and passive energy sources and collect data recording displacement (seismic methods), electromagnetic fields (EM and remote sensing methods), or potential fields (gravity, magnetic and self-potential methods) arising from surface, near surface or deep conditions. After data collection, these geophysical records are analyzed and modeled to constrain subsurface structure and the possible presence of subsurface voids. A summary of relevant geophysical methods and cost comparisons is contained in Table 2. Methods discussed and presented at Commission hearings are highlighted.

Table 2. Geophysical Methods – application, limitations, and relative costs.

Method	Interpreted Parameters	Depth or Range of Use	Relative Cost	Advantage	Disadvantage
Airborne Electromagnetic Frequency Domain (FDEM).	Geologic structure*. Groundwater geometry+	150 meters.	Low	Fast. Complete spatial coverage.	Cultural electromagnetic noise. Topography can interfere with measurements.
Airborne Electromagnetic Time Domain (TDEM).	Geologic structure. Groundwater geometry.	500 meters.	Low	Fast. Complete spatial coverage.	Cultural electromagnetic noise. Topography can interfere with measurements.
Ground survey-based electrical and electromagnetic 2D and 3D. (Resistivity Sounding, spontaneous potential, induced polarization, electromagnetic, VLF, and magneto-telluric).	Geologic structure. Groundwater geometry.	10-200 meters.	Low	Fast. Easy data collection.	Some of these techniques are only useful at shallow depths. Some of these techniques have not been well demonstrated.
Magnetics.	Geologic structure. Presence of manufactured materials.	50 meters.	Low	Fast. Complete spatial coverage.	Cultural electromagnetic noise. Topography can interfere with measurements.
Microgravity.	Geologic structure. Voids.	20 meters.	Medium	Easy Data collection.	Require metal in void
Ground survey-based Reflection Seismic; 2D and 3D.	Geologic structure. Voids.	20 meters.	High	Simple Theory.	Geophysical signal is weak.
Ground survey-based Seismic Refraction.	Geologic structure. Voids.	30 meters.	Medium	Simple Theory.	Geophysical signal is weak.
Ground survey Seismic Surface Waves	Geologic structure. Voids.	200 meters.	Medium	Produces 2D image or 3D data cube.	Intensive Data Processing
Ground-penetrating radar.	Geologic structure. Voids.	10 meters.	Low	Easy Interpretation.	Limited Depth of Surface Wave Penetration
Radio Imaging (RIM) cross-hole.	Geologic structure within 3D region between drill holes. Voids. Regions of water concentration between drill holes.	300 meters.	Medium	Easy Data Processing.	Indirect Detection. Velocity Inversion Masking.
Remote Sensing.	Surface geologic and lineation structure.	Top of soil.	Low	Relatively Easy Data Collection.	High conductivity zones can mask underlying strata
Thermal Imaging.	Surface and shallow subsurface structure.	5 meters	Medium	Fast	Limited Depth
InSAR	High resolution topography. Variation in topography related to subsidence.	Dependent on subsidence.	Low	Fast	Limited Depth of Investigation.

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Method	Interpreted Parameters	Depth or Range of Use	Relative Cost	Advantage	Disadvantage
Horizontal Drilling (in seam).	Presence of voids along drill path.	Length of drill hole.	Low	Fast	Subsidence is required.
Horizontal Drilling with Geophysical Tools (in seam).	Presence of voids along or near drill path.	1-5 meter radius zone along length of drillhole.	Medium	Direct Verification.	Void must be drilled.
Radio Imaging (RIM) (in seam).	Geologic structure within 3D region between drill holes. Voids. Regions of water concentration between drill holes.	300 meters.	Medium	Direct in-seam investigation.	Drillhole must pass close to void.
Modified Horizon Sensing on cutting drum	Senses voids ahead during coal cutting.	2-5 meters	Low	Produces Image.	Regions with high dielectric constants can limit signal.
In seam survey Reflection Seismic.	Geologic variation within the strata. Voids.		Medium	Detects Voids ahead of cutting drum.	Limited look-ahead range.
In seam microgravity.	Geologic structure. Voids.		Medium	Produces Image.	Intensive Data Processing

The determinations of subsurface or underground structure based upon geophysical models are by their nature non-unique. A variety of models of geophysical data can, unfortunately, fit measured geophysical data equally well. This non-uniqueness can be visualized as arising from the basic mathematical foundations of geophysical methods. The mathematics involved show that geophysical anomalies are a function of *both* the separation of the geophysical source and receiver and the geometry and magnitude of the contrast in the material property that is producing the anomaly.

However, this lack of a single unique geophysical model or interpretation based upon such a model, should not be regarded as an insurmountable problem because there are limits to the expected type of subsurface structure, or variation in geological material or pore filling phase that are expected to be present in a study region. For example, if a mine void is being investigated using microgravity, the range of estimated cross sectional sizes of the expected void is relatively well known. That is, the range of sizes of underground room and pillars can be estimated from maps of the abandoned mine workings. In addition, rather than being unknown, contrasts in density between a void filled with air, water, or rubble, with respect to the surrounding country rock is also possible to estimate. In this example, using microgravity data with the additional information of the range of likely models produces realistic geophysical models of gravity measurements that are potentially very useful in void detection. The application of multiple types of geophysical methods within the same region of study can significantly increase the accuracy of geophysical subsurface models.

Another limitation to the applied geophysical method is that all such methods are based upon the contrast of a material property within a subsurface region. If this material property does not vary within a study region then there will be no geophysical anomaly at all. A related limitation to applied geophysical methods is that many anomalies become difficult to detect with increasing distance between the instrument making the geophysical measurements and the region being

studied. For mine void detection applications, taking the geophysical instrument underground may represent the best solution to deep mine void detection.

In general geophysical methods can also be classed into those that give a clear indication of structure and subsurface variation and those which show the presence of anomalous structures while poorly constraining the position of these structures. Some methods, such as gravity, will at best identify a region that requires additional study or should be viewed as potentially dangerous. Geophysical methods in general may be best viewed as reducing the region within which dangerous voids may be present. They can help minimize (but not replace) required drilling and give, in some instances, clear indications of dangerous regions that miners should approach with caution. The use of multiple geophysical methods is necessary to reduce the probability of abandoned mine void related accidents.

Directional Drilling

BDMS has given mine operators approval to use in-mine directionally drilled horizontal boreholes in numerous cases. The in-mine drilling was approved to verify that abandoned mine voids will not be intercepted during active or future mine development. Furthermore, MSHA and other state regulatory agencies have accepted in-mine directionally drilled horizontal boreholes as a method of locating abandoned workings and adjacent mines.

Directionally drilled in-mine horizontal boreholes have long been accepted worldwide as a cost-effective method to reduce coalbed methane emissions during mine development. Although in-mine directional drilling technology was developed primarily for degasification, directionally drilled in-mine horizontal boreholes have also been used as an effective alternative for coalbed exploration, water drainage and abandoned mine verification.¹ In-mine directional drilling techniques have also been applied to horizontal boreholes initiated from the surface at outcrops or highwalls. Since 1990, improvements in, or new development of, acoustic and cable real-time transmission permissible survey systems have been primarily responsible for increased implementation of in-mine directionally drilled horizontal boreholes.¹

Geophysical technologies currently being developed that will potentially enhance in-mine directional drilling include radio imaging mapping (RIM) and in-seam seismic¹. These techniques, developed as compliments to directional drilling, will potentially permit the mapping of voids between two parallel boreholes or between a mine entry and a horizontal borehole. The geophysical equipment if used in an in-mine borehole would require permissibility approval by BDMS and MSHA.

Surface directional drilling technology for degasification of coalbeds in advance of mining (otherwise known as articulated drilling or horizontal drilling in the oil and gas industry) has gained popularity in central and northern Appalachian coal basins. The surface directional drilling technique consists of drilling a vertical borehole segment to a predetermined depth and then directionally drilling a ninety (90) degree arc or curve at a designed build rate or radius to intercept the coalbed horizontally. Although, this technique has apparently not been applied to abandoned mine verification, its potential for this application exists for verification of abandoned

mines prior to the permit approval. Drilling, surveying and associated equipment approved as permissible by MSHA would not be required. However, issues including, cost, surface access, permits, and right-of-way logistics, etc., would need to be considered.

In summary, abandoned mine verification horizontal boreholes can be directionally drilled from within the mine, from a highwall or coal outcrop or surface directionally drilled from the surface starting vertical and steered to horizontal to intercept the coal. They can be applied in several ways. First they can serve to establish a safe barrier pillar of coal exists between the borehole and mine development. Secondly, they can be steered to intercept the abandoned mine void in numerous locations. Importantly, in either case, sidetracks intercepting the roof and floor can be conducted to verify the borehole is in the coal and the coal seam is intact.

Examples of Directionally Drilled Horizontal Abandoned Mine Verification Boreholes

In the first example, a mine operator mining the Pittsburgh coal wanted to develop towards an abandoned mine that was closed in 1926. The plan approved by the DEP required an in-seam borehole be drilled parallel to, and 30 feet away from, the suspected abandoned mine boundary. Mining would be allowed to approach no closer than 50 feet to the directionally drilled horizontal borehole. The completed borehole was directionally drilled to 1,990 feet maintaining the desired course. While all directional drilling was conducted, drilling parameters were closely monitored including drill effluent return for color and volume. The borehole enabled the mine operator to safely recover the coal reserve to the boundary established by the borehole.

In another example, a Pennsylvania mine operator used two (2) directionally drilled abandoned mine verification boreholes to “box out” future mine development from abandoned mine works permitting them to turn a corner around the abandoned mine. The abandoned mine verification boreholes were drilled first, parallel to mine development, establishing that a safe barrier of coal exists between the borehole and the mine development. During the directional drilling of the boreholes, several sidetracks were completed due to either difficulty in steering in the very soft coal, saturated with water apparently from the abandoned mine, or because the abandoned mine voids were intercepted. Rubber cement pigs were staged in the borehole segments that intercepted the mine voids to stop the low pressure (~ 20 psi) flow of abandoned mine water into the borehole and to start a sidetrack “out-by” the borehole position or depth the cement pig was installed. After intercepting the abandoned mine several times, indicating the abandoned mine map was not entirely accurate, sidetracks were conducted and ultimately the borehole was completed providing a safe barrier of coal between the boreholes and mine development.

Operational indicators from adjacent flooded mine openings

Testimony provided to the Commission pertaining to changes in water chemistry and/or flow associated with adjacent flooded mine voids was contradictory at best. Testimony was given indicating that changes in water quality and flow had been detected hundreds of feet of flooded mine voids. Testimony was also given that mining may take place within several feet from flooded works with absolutely no indication. The overwhelming consensus seemed to indicate that each mine had its own characteristics and water conditions should be monitored for any

changes. Change may not indicate the existence of a flooded mine void but would certainly justify further investigation.

Until the incident at Quecreek, the characteristics of water underground including quantity, color, chemistry and odor may not have been monitored sufficiently. Changes in water quantity and flow as well as color, chemistry and odor may indicate the existence of a flooded mine void. Water quality in the immediate face area of the mine that differs from baseline water chemistry history of the active mine indicate the existence of a flooded abandoned mine void.

It is the nature of a coal mine for the hydrology to vary throughout the mine. Therefore changes in water flow and chemistry must be recognized as an indicator to a “possible hazard” not necessarily as an indicator to a “hazard”.

Currently, no special inspection or monitoring procedures are required when mining near an abandoned mine void. When the possibility exists for mining operations and personnel to be exposed to abandoned mine voids, mine personnel must be alerted to the existence of the abandoned mine voids and instructed to monitor their work area and environment for changes which may indicate the possibility of a hazard.

Recommendations

- The Commission recommends and encourages the utilization of visual examinations, drilling processes and the application of geophysical methods, where practical, to verify the existence or non-existence of abandoned mine voids. Particularly where the credibility of the maps is in question.
- The Commission recommends the continued development of the horizontal directional drilling techniques and method. Although the present status of this technique appears to be superior to other existing and developing methods enhancement of this method would be highly beneficial. Existing contractors must make provisions to assure the mining industry that the skilled manpower and equipment will be readily available.
- The Commission recommends continued research, development and refinement of the various geophysical methods and techniques to enable these techniques to be applied separately or in conjunction with drilling techniques to provide more positive results pertaining to the location of and definition of mine voids. Request funding from appropriate government agencies for geophysical tests to be conducted under approved protocols.
- Encourage development of alternatives to the 20-foot test hole procedures required under section 224(b) due to exposure of miners to possible safety hazards, such as drilling into a body of water under pressure.

6. REGULATORY INSPECTIONS FOR COMPLIANCE WITH APPROVED PLANS AND PROCEDURES

Prevention of inadvertent breakthroughs into abandoned mine workings begins with identification of the hazard. While risks should be assessed during the engineering of the mine and during review of permits and plans, risk assessment does not end there. It is vital for examiners and inspectors to understand the risks and the measures taken to mitigate any hazards.

Mine Inspections: Both MSHA and BDMS inspect the underground portions of mines. These inspection cycles occur at a minimum rate of once every two months for anthracite mines and once every quarter for bituminous mines and take at a minimum of several days to complete.²⁵

Other inspectors from BDMS inspect surface facilities of underground mines with oversight from OSM. These inspections are done pursuant to SMCRA and regulations developed under it. MSHA also has responsibility for safety aspects of surface activities. The state inspections occur monthly and typically are completed within a day.

Underground mine operators also have responsibilities to examine their workings. The Commonwealth certifies individuals as Mine Officials: mine examiners, assistant mine foremen or mine foremen. Their duties are prescribed by statute²⁶ and include examining the mine, or a definite portion of the mine, for gasses, inspecting roof face and rib conditions, and addressing road and conveyor hazards. The mine examiner's inspection does include verification that the requirements of law or of approved plans are being implemented.

Review of the maps for a mine is an integral part of the examination or inspection. Locations of abandoned mine workings on the maps certified by a professional engineer are not questioned. Inspections of the mines start with a review of the latest maps for the mine and of the citation history of the operation. When adjacent abandoned workings are shown on the map, the inspector ensures that the legal requirements for advance drilling within 200 feet of the abandoned mine, or other such plans as are approved by DEP, are implemented.

BDMS – MSHA Inspection: The state inspection may occur at the same time as the federal inspection but the state and federal personnel do not conduct the inspections jointly. Reports from BDMS and MSHA inspectors are available at the mine but it appears that they do not directly compare results of their inspections.

Communication between the state and federal inspectors is vital to understand risks, identify unusual conditions, and develop appropriate mitigation plans. However, communication cannot overcome gaps in knowledge or the limits of inspections noted below.

²⁵ See Sections 201-16, Bituminous Act, 52 P.S. §§ 701-201 – 701-216; Sections 201-06, Anthracite Act, 52 P.S. §§ 70-201 – 70-206.

²⁶ See Sections 218-28, Bituminous Act, 52 P.S. §§ 701-218 – 701-228; Sections 220-228, Anthracite Act, 52 P.S. §§ 70-220 – 228.

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BDMS Inspectors: The requirements to become a state mine inspector are rigorous. Applicants must be between 30 and 55 years of age, have scored at least 90 % on the inspector examination, have 10 years of practical mining experience (5 years must immediately precede the examination), have practical and comprehensive knowledge of gases, of mining machines and methods, of emergency first aid and mine rescue, of electricity, of ventilation systems.²⁷

State mine inspectors duties include performing regularly spaced inspections of assigned mines to see that ‘every necessary precaution is taken to secure the safety of the workmen’ and that the law is fully obeyed. In the course of an inspection the inspector personally visits each active working face and faces that have advanced since the last inspection to examine ventilation, roof control, and drainage.²⁸ At the end of the inspection the inspector holds an exit conference with the operator to discuss findings, problems, and necessary actions.

In practice, mine inspectors are a recognized and respected part of a mine operation. They typically interact with mine management, miners, and if the mine has one, the safety committee.

Inspections – When Mining Advances Toward Abandoned Workings: When a mine is advancing towards old workings, examiners and inspectors should look for any telltale signs or indicators of nearby impounded water. Such indicators can include a change in the location, quantity, color and odor of water. Testimony provided the commission suggests that in some bituminous mines water leaking into an active mine from an old mine will be yellow or orange in color, and/or have a stale or “rotten-egg smell.” Water within anthracite mines may not have the same color or odor indicators, but the amount and location of water are significant. Inspectors and examiners are generally aware that impounded water in old mines may manifest itself through changes in water location, quantity, color, or odor.

Testimony provided to the Commission also suggests that changes in the chemistry of the water can assist in verification of the risk. Formation water seeping into a mine is likely to have different chemistry than impounded water. Many water filled abandoned mines discharge to the surface at some point. Sampling of those discharges is required during permit review. Sulfate is a common constituent of mine drainage. It is considered ‘conservative’ in that it persists and does not readily break down or react with other constituents. In cases where the formation water encountered by the active workings is low in sulfate, samples from the active workings and from the abandoned mine discharge can form a baseline. In such a case, increasing sulfate concentrations while advancing to the workings may signify an increasing proximity to the abandoned workings. Other chemical constituents or isotopes may also work for this purpose. Physical changes may also indicate that the workings are approaching a flooded mine: Testimony provided to the Commission included observations from miners working in a Pittsburgh Coal seam in southwestern Pennsylvania. The miners noted that the floor of the mine would become soft or slick when approaching abandoned flooded workings. While floor conditions are partially controlled by the geology of the rock that makes up the floor (typically claystone in Pittsburgh Seam mines), other testimony suggests that weakening of the floor is one mechanism of inundations. In two recent cases it is believed that the floor was weakened to such

²⁷ See Sections 105-108, Anthracite Act, 52 P.S. §§ 70-105 – 70-108; Section 105-06, Bituminous Act, 52 P.S. §§ 701-105 – 701-108.

²⁸ See Section 117, Bituminous Act, 52 § 701-117; Section 117, Anthracite Act, 52 P.S. § 70-117.

an extent that the impounded water passed beneath the coal and weakened the rib to the point that it failed. (Ref 7.) Other places to look for changes in the quantity of inflowing water are through the face and the roof. Depending on geologic conditions increases in the amount of water encountered during roof bolting can be a sign of impounded water ahead but in others is not.

Close attention to the approved plans for the mine is necessary when facing the risks from abandoned mine workings. Examiners and inspectors should verify that drilling is done at the appropriate distances and locations and in the proper situations.

Limitations of Inspections: Even the most diligent inspection regime cannot eliminate all risks associated with abandoned mine works. Many mines were never mapped, so risk evaluation and mitigation planning is not possible. However, if a final map is thought to exist, its accuracy must be verified and validated. An inaccurate map may be more dangerous than no map at all. Recognizing that information regarding abandoned mines has limits suggests that care is needed as workings move towards abandoned mines. Inspections of advancing works towards identified hazards consider, but are not specific to, the hazards posed. Hazard specific inspections focus the attention of the inspector on the issue and on any early warnings that may exist. Inspections looking for the changes discussed above can provide significant information on unanticipated conditions.

However, inspections alone cannot overcome the limits of knowledge about abandoned mine workings or replace proper design and operation of mines. Knowledge and implementation of controls cannot overcome improper plans, designs or inaccurate maps. Symptoms and telltale signs may be indicators, however they cannot take the place of proper exploration, design, or operation.

Recommendations

- DEP should develop and implement a protocol for hazard specific inspections of mines advancing towards abandoned underground mine workings. The Commission recommends the development of specific procedures to: a) provide guidance to inspectors when mining near abandoned mine voids, b) ensure that mine inspectors understand the limits of mine maps, and c) verify and document that approved plans for locating old works are implemented properly.
- Mine examiners and inspectors should pay particular attention to changes in water conditions in the mine, including flow, color, and odor of water, and roof and floor conditions during an advance towards abandoned mine workings.
- The Commission recognizes the importance of establishing regular and effective communication between state and federal inspectors and recommends that open and regular communication be encouraged by DEP and MSHA.
- The Commission recommends that the Commonwealth make a thorough and scientifically valid evaluation of the inability of using water chemistry as a diagnostic tool for alerting mine operators of nearby flooded workings.

7. MINER TRAINING

The most valuable asset in a mining operation is the mineworker. Because miners work in a relatively dangerous and dynamic environment, it is critical that they follow an effective safety and health program. Mine safety professionals unanimously agree that training is a critical component of an effective mine safety and health program.

The inundation at Quecreek Mine has raised many questions. Of interest here, are those regarding training, including, “Were these miners trained about inundations,” and “could or should miners be better trained about inundations in the future.” These are complex issues, but there are straightforward answers to these questions, and the Commission has provided recommendations on training.

The Quecreek incident underscores the need for miners who may work in mines with inundation potential to be aware of the locations and contents of adjacent mine voids. Without this knowledge, there will be no perception of the hazard. Secondly, individual miners must be familiar with their mine map so they can recognize the boundary between the current workings and any adjacent mine or mine void. They must be trained to recognize and report any changes in the mine workings arising either from water quantity or quality, floor, roof, or coal characteristics. They should be made aware of the mining company’s policy and procedures with regard to mining near abandoned mine voids, and trained on the tools, techniques and methods that are to be used when mining near voids. If there are aspects of the mine design that can prevent safe exit from the mine in the event of an inundation, such as a local roll where fluids can accumulate and block the entry completely, miners should be made fully aware of this condition through training. In this situation, alternative means of escape must be available and miners must be made aware of them. Finally, miners need to be aware of gas inundation hazards as well as those from water.

Safety professionals from the private and public sectors agree that it is difficult to incorporate additional training components to the present miner training schedule prescribed by federal mine statute (30 CFR Part 48). Moreover, changes in both mining conditions and mining technology has necessitated additional training on topics not envisioned within Part 48, such as hazard communications, noise regulations, and diesel-powered equipment. As work conditions and job functions change within the mining industry, there is a need to evaluate how these changes create new hazards, affect accident and injury possibilities, and call for new opportunities for education and training. Fortunately, alternative training strategies are being developed and applied. These provide a viable mechanism to ensure that miners are adequately trained, including training related to inundations. These strategies, including a discussion of the aging workforce issue can be found in the recently released publication entitled, “Strategies for Improving Miners’ Training,” NIOSH IC 9463, which are available at www.niosh.gov.

While computer-based training is not extensively used in the mining industry, there are several advantages of this type of training. For example, it can overcome some of the limitations of the traditional classroom and on-the-job training programs and promote self-learning. Virtual-reality training modules, developed with an appreciation of the mining environment, would improve

miner's ability to react appropriately to hazardous situations [National Research Council, 2002]. It should be possible to develop a virtual-reality training model for illustrating the dangers of inundation from abandoned mine voids, as well as the safe procedures to be followed to avoid these hazards. However, the application of virtual-reality to miners' safety training is in its infancy. While this approach may be quite beneficial as a tool for training future generations of miners, it may be several years before it will become feasible to use virtual-reality on a widespread basis to train miners. Therefore, training needs to be designed in such a way that it can be easily administered at both large mining operations with ample training facilities and small mining operations with minimal training facilities.

Several effective, low-cost tabletop training simulations dealing with a variety of mine emergency response issues have been developed by NIOSH and MSHA (www.msha.gov). Unfortunately, none of these training exercises focus on the hazard of water inundations. It is recommended that such materials be developed and used at mines where inundations are a threat to the safety of the underground workforce.

The increasing average age of the mining workforce and the projected retirements of trained miners from the industry have also created problems of significant proportions in specialized areas, such as response to mine emergencies and mine rescue teams. During the Commission's hearings, both miner's representatives and mine management alluded to the need to address this area. The problem is also complicated by the fact that small mines are not in the same position as their larger counterparts to respond to such emergencies.

Recommendations

- The Commission recommends the development and implementation of a training module for mine inundation is advisable, and its mandatory application in mines with an inundation risk is recommended. The content of the module needs to be developed, and an effective training intervention must be developed. The Commission recommends, that whenever practical, training should be taken to the workplace. "Toolbox" and video training provide an excellent method of delivering training modules to the workplace and customizing the training. Further, the Commission recommends frequent short, structured "safety talks" conducted at the face or portal which, when done correctly, are a low-cost way to impart much critical information in short time frames.
- Based on the events at Quecreek, Command Center training should be stressed and supported by the government and industry and the "emergency communication triangle" training module should be made widely available.
- The Commission recommends that a continuing education module be developed for mining professionals, mine managers, and mine inspectors.
- Research has shown that people often do not get the information they need for the purpose of taking appropriate action in their workplaces. Structured safety talks, with valid content, presents a procedure to communicate critical information. Material can be developed for use in short safety-training sessions such as start-of-shift safety or "toolbox" talks. The information can be presented in as little as fifteen minutes, and

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can be tailored to any work setting or contingency by employing appropriate examples. Safety talks, done correctly, are a low-cost way to impart much critical information in short time frames and should be done routinely at all operations.

8. RESCUE AND RESPONSE PROCEDURES

Due to the lack of familiarity with personnel and techniques of the many agencies and organizations that may be involved during a mining emergency, there is potential for difficulties to arise. Written, site-specific, emergency response plans (ERP) and regular training for the key individuals involved can minimize these difficulties. As early as 1979, the National Academy of Sciences recommended development of a unified response to mine emergencies. (NRC report, Chapter 4, Underground Mine Disaster Survival and Response). The report recognized the uniqueness of mine disasters and the role that must be played by specialized personnel and that prior training in emergency response and mine rescue techniques is critical for future success. The Commission notes that BDMS provides training and assistance to mine operators to develop ERPs. The Black Wolf Coal Company had a written ERP for Quecreek mine.

The preparation and training of mine rescue personnel was evident at the Quecreek incident. The mine operator followed their ERP and immediately notified appropriate parties, assigned duties to mine personnel, and established a Command Center and locations for family members and news media. The Command Center team comprised of the mine operator, MSHA District 2 Manager, and Director of BDMS or their designated representatives, were responsible for planning and approving the activity of the rescue operation. At Quecreek, over 700 individuals and 100 organizations came together and worked as a team with each contributing their expertise to achieve a common goal.

DEP trains about 80 individuals statewide in emergency response procedures and mine rescue techniques. On a monthly basis, mine rescue team members receive one day training in the use of self-contained breathing apparatus (SCBA), mine gases, fire fighting, mine ventilation, first aid, and rescue techniques. Mine managers are provided two days of training annually on managing mine emergencies.

Additionally, DEP, National Institute for Occupational Safety and Health (NIOSH), Mine Safety and Health Administration (MSHA), and mine personnel participate semi-annually in mine emergency response demonstrations (MERD). MERDs are conducted at NIOSH's underground Lake Lynn Laboratory, MSHA's Bruceton Experimental Mine and mine operators' underground mines. The MERDs consist of a mock mine emergency involving simulated situations that require rescue of miners. Mine rescue team members, mine managers and representatives of federal, state, and labor role-play in their respective duties. These provide individuals the opportunity to practice their training while the emergency response and mine rescue trainers critique and coach the process. The MERDs include simulated explosions and fires requiring mine rescue teams to use SCBA to operate in artificial smoke and visibility of less than 2 feet. The activity of the mine rescue team is in constant communication with, and monitored by, the underground fresh air base and the surface command center team. Individuals representing the mine operator, MSHA, and DEP comprise the fresh air base and command center teams.

Although DEP and the mining community have provided extensive emergency response training to those within the mining industry, very little training has been provided to the non-mining community. The lack of understanding of mine rescue procedures by those outside the mining community caused some conflicting direction at the Quecreek rescue.

At times during the Quecreek operation, different organizations assumed leadership roles. For instance, local first-responders, in this case, Somerset Area Ambulance Service and the Special Medical Response Team (SMRT) were immediately immobilized. Additionally, fire and police organizations arrived on scene shortly after the initial call for help and established a basic command system for fire/rescue and site access operations. Because of the specialized, technical nature of the rescue, when state mine safety personnel arrived on scene, operational management passed to that agency. In turn, when federal officials arrived, liaison was established and lead management responsibility was assumed by MSHA. There was, however, no consistent effort to establish a structured management system for the overall incident as it evolved.

There were instances during the event when at least three, uncoordinated management structures were simultaneously operational. While this situation was resolved from an on-scene operations standpoint, it continued to affect support functions, for example, equipment needed on-scene was being sourced by or supplied through first responders, mine safety agencies (both on-site and in Harrisburg), the county emergency management agency and private sector entities.

Testimony was provided to the Commission describing the contrast between the Quecreek incident and a typical emergency medical response (EMR). The usual response to which EMR, many of which are staffed by volunteers, are called upon to support is a short term, acute event. The crew responds, provides care and transport and returns to station. The regional EMR protocols and system policies that address the traditional response are not written to address an extended standby rescue scenario. Over 100 physicians, paramedics, emergency medical technicians, nurses and various other clinicians and specialists participated in aspects of the emergency medical response to this event. Federal participation also included military assets.

As can be expected with any operation of this magnitude, some communications problems did exist. For example, the number of aircraft and the absence of a single point of communication and coordination for managing their response caused serious disruption.

Uniform Incident Management System

While the Quecreek rescue was a tremendous success from an ERP viewpoint, there is a clear recognition of the need for an effective, uniform management system for such events. The organization of the response and rescue efforts at Quecreek illustrates some of the difficulties that typically arise in large and/or complex operations. For example, the control of the rescue site has been an element in mine rescue training for years, but because of the tremendous public attention to this site, non-essential individuals came across fences and through fields and commingled with rescue workers.

Across Pennsylvania, federal, state and local emergency service, law enforcement, and counter-terrorism task force organizations have begun resolving operational, command, logistics, planning, finance and communication issues in advance by adopting a common approach to handling emergencies. This approach is known as the Incident Management System (IMS). This system is transferable to any organization or group of organizations with responsibility for emergency response operations. Federal, state, county and local agencies responsible for mine

rescue responses could benefit from IMS and should adopt, train and exercise IMS at agency and inter-agency levels.

Incident Management Systems have been given considerable attention within the emergency services and emergency management communities. The system consists of procedures for controlling personnel, facilities, equipment, and communication. Incident Management Systems allow agencies to communicate using common terminology and operating procedures. More information regarding Incident Management Systems can be found in Appendix C.

An effective Incident Management System has five major functional areas:

1. Command
2. Operations
3. Planning
4. Logistics
5. Finance

Personnel from all agencies, in a collaborative and coordinated manner, are assigned to the components of IMS based on their experience and expertise, not on their affiliation. By blending all personnel and agency resources, a “broad view” of the incident is maintained throughout the IMS. The numbers of personnel assigned and the actual units within each section can be expanded and contracted to meet the continuing needs of the incident.

Family member support

Special attention must be paid to the treatment of family members of anyone involved in an emergency situation. At the Quecreek incident, each family was provided with a Red Cross Counselor and a CERT Team member, who stayed with them even after the rescued miners were taken to the hospitals. This arrangement maintained continuity and the families became accustomed to the faces of these individuals and felt comfort in their presence.

The Commission heard testimony from a pastor who opened a counseling center that provided support to the families of the trapped Quecreek miners. He discussed the need for better communication with the family members. Specifically, he noted that there were numerous individuals disseminating information to the families, with no consistent point of contact. This inconsistency reduced the comfort level among the families and eventually led to an atmosphere of suspicion and distrust. Additionally, information was provided from the rescue site, prior to notifying the families, and the families saw the news unfolding on the television. This caused great grief within the family center.


He observed that at times there were hundreds of people in the family center. By asking each family to supply a list of “approved” people, non-essential persons and news media had limited access.

Recommendations

- The Commission recommends that training should be provided to key individuals outside the mining community on mine emergency response and mine rescue techniques. Conversely, it would benefit key individuals in the mining industry to be trained in the procedures of other agencies that may become engaged during a mine emergency.
- The Commission recommends that the Incident Management System (IMS) should be adopted as Pennsylvania's statewide standard for mine emergency response, and the current "Command Center" system should be integrated into IMS. All mine rescuers, operators, and responders should be trained in IMS. Local emergency response agencies should receive mine rescue awareness training to enhance understanding and improve on-scene coordination. All parties involved in mine rescue efforts should regularly communicate, coordinate their activities in advance, development a good understanding of IMS and their respective roles in it, conduct table-top and functional exercises of mine emergency responses using IMS as the structure, and evaluate these exercises to improve plans and responses.
- The Commission supports the mutual aid legislation presently introduced in the legislature as part of the Homeland Security initiatives to ensure the adequacy of resources, the protection of the responders and the site security initiatives presently being developed as part of the Homeland Security effort to better control access at mine emergency sites.
- The Commission recommends that the standards of family communication, care and support initiated by the airline industry and American Red Cross following recent air tragedies be adopted as Pennsylvania's standard for mine emergencies.
- The Commission recommends that the emergency response contact list developed by DEP following Quecreek should be maintained and utilized as a resource for all future mine emergencies.
- The Commission recommends that BDMS continue actively working with NIOSH and MSHA taskforces to remedy the alarming shortage of mine rescue teams, personnel and equipment in the Commonwealth. The remedy should ensure the transfer of knowledge and expertise from older personnel to a new generation of miners and mine rescuers.
- The Commission recommends that DEP establish, as an ongoing budget item, a fund to pay the costs of local law enforcement, fire, rescue, hazardous materials, emergency medical and medical personnel providing services at mine emergencies.

Commonwealth of Pennsylvania
GOVERNOR'S OFFICE

EXECUTIVE ORDER

Subject:		Number:	
Governor's Commission on Abandoned Mine Voids and Mine Safety		2002-10	
Date:	Distribution:	By Direction Of:	
September 4, 2002	B	 Mark S. Schweiker, Governor	

- WHEREAS, on July 24, 2002, miners at Quecreek Mining Company's mine in Lincoln Township, Somerset County, unexpectedly encountered flooded abandoned mine workings; and
- WHEREAS, although nine members of one crew in the mine escaped, the intrushing waters trapped another nine miners who were miraculously saved after a more than 77 hour rescue effort; and
- WHEREAS, the U. S. Department of Labor's Mine Safety and Health Administration and the Pennsylvania Department of Environmental Protection's Bureau of Deep Mine Safety joint investigation of the actual events at the Quecreek Mine will determine specific follow-up enforcement actions with respect to that specific accident; and
- WHEREAS, the Department of Environmental Protection has already taken steps to notify existing mine owners to verify the location of abandoned mine voids in close proximity to their operations; and
- WHEREAS, the Pennsylvania miners and their families need to be assured that existing and future mines are safe from flooding and other hazards associated with the inaccurate location of mine voids; and
- WHEREAS, Pennsylvania's coal mining industry cannot continue to operate safely and contribute to the economy of the Commonwealth without knowing the location of abandoned mine voids.

NOW, THEREFORE, I, Mark S. Schweiker, Governor of the Commonwealth of Pennsylvania, by virtue of the authority vested in me by the Constitution of the Commonwealth of Pennsylvania and other laws, do hereby establish the **Governor's Commission on Abandoned Mine Voids and Mine Safety**, as hereinafter set forth:

1. Mission. To investigate and document the hazards posed by abandoned mine voids, in particular the flooding of adjacent operating mines, and to make recommendations regarding the accurate location of voids and avoidance of other hazards associated with mining.

2. Functions. Using the accident at Quecreek Mine as a general reference, make recommendations regarding each of the following:

a. The best engineering practices to be used in the design and layout of modern mines adjacent to abandoned mine workings.

b. The regulatory policies and permit review procedures for permitting mines adjacent to abandoned underground mine workings.

c. The practices and procedures of mine operations in advance of mining to detect mine voids.

d. The training of mine workers who operate mines adjacent to underground mine workings.

e. The inspection and compliance of the mine operations with the approved mine plans and operating requirements.

f. The rescue and response procedures which shall include policies for sharing information with families of miners affected by the accident.

3. Composition of the Commission. The Commission shall consist of the following nine members appointed by the Governor:

a. A respected mine engineer and member of academia familiar with underground mining, who shall serve as Chair.

b. Member of the United Mine Workers' Association.

c. Mine engineer/surveyor.

d. Geologist.

e. Representative of the Office for Mineral Resources Management of the Department of Environmental Protection.

f. Mine safety professional.

g. Coal mine operator.

h. Drilling expert.

i. Emergency response professional.

4. Terms of Membership.

a. Members shall be appointed to serve until November 15, 2002, unless the Commission is reestablished or dissolved sooner. All members shall serve at the pleasure of the Governor.

b. Should a vacancy occur due to resignation, disability, or death of a member, the Governor shall appoint a successor as expeditiously as possible and the successor shall serve the duration of the unexpired term.

5. Compensation. Members of the Commission shall receive no compensation for their service, except that such members may be reimbursed for actual travel and related expenses in accordance with the Commonwealth Travel and Subsistence Regulations.

6. Meetings and Communication. The Commission shall interview and solicit testimony from experts and citizens to gather information for this investigation. The Commission shall hold public hearings for the purpose of gathering information.

7. Reports. The Commission shall report on current mining practices and regulatory policies and provide recommendations to improve safety when mines are adjacent to abandoned mine workings. By November 15, 2002, the Commission shall present, for the Governor's review and approval, a written report of the Commission's activities and a detailed report including any dissenting opinions of the Commission's findings and recommendations.

8. Executive Agencies. All agencies under the Governor's jurisdiction shall cooperate with and provide assistance as needed to the Commission in performing its functions. The Commission will receive administrative support from the Department of Environmental Protection.

9. Effective Date. This Executive Order shall be effective immediately.

10. Termination Date. This Executive Order shall terminate on November 15, 2002, unless reestablished or sooner rescinded.

Accident Classification	Degree of Injury	Mine Name	Mining Company Name	City	County	State	M/D/Y of Accident	Number of Fatalities	Narrative
Inundation	Fatal	Diamond Mine	Unspecified	Braidwood	Unspecified	IL	02/16/1883	69	This file does not include an actual accident report but instead contains a newspaper account of the disaster. Taken from that account this is a summary of the accident: At this place, by the sudden precipitation of a sea of surface water into the workings of the mine, in the middle of the day, 69 men were engulfed and miserably perished. No listing of victims is included in this article.
Inundation	Fatal	# 1 Slope	Susquehanna Coal Company	Nanticoke	Luzerne	PA	12/18/1885	26	On this morning, a large body of quicksand and water broke through the roof into the Ross vein workings causing the death of twenty-six persons. The cave broke in near the solid face of a counter gangway on the apex of an anticlinal or saddle. The bodies of the entombed men were never recovered. This report includes no listing of victims or injuries.
Inundation	Fatal	Allegheny Mine	Consolidated Company	Frostburg	Unspecified	MD	08/30/1889	?	A mine accident at the Allegheny Mine, Consolidated Company, Frostburg, Maryland, The immediate cause was: Thirty-five men were shut in the mine by an inrush of water. It is unclear from this report how many of these men, if any, were actual fatalities.
Inundation	Fatal	White Ash Mine	Unspecified	Golden	Unspecified	CO	09/09/1889	10	About 4:00 PM., just after men descended the shaft for the afternoon shift, water from Old Loveland Mine shaft broke into the workings of White Ash Mine filling it with Co2, water 140 feet up the 790 foot shaft, and debris covering the cage, prevented an attempt to rescue bodies. Both mines were permanently sealed. There is no listing of victims included with this report.
Inundation	Fatal	# 10 slope	Spring Mountain Colliery	Jeansville	Unspecified	PA	02/04/1891	9	The No. 8 gangway was broken into, and, while two miners made their escape, three miners, five laborers and a bottom man drowned by the flooding waters from the flooded area. There is no listing of names included in this report.

Accident Classification	Degree of Injury	Mine Name	Mining Company Name	City	County	State	M/D/Y of Accident	Number of Fatalities	Narrative
Inundation	Fatal	Primrose Slope	Lytle Coal Company	Minersville	Unspecified	MN	04/20/1892	10	The incident occurred during the driving of a gangway into old workings. In driving this gangway, boreholes had been bored from fifty to one hundred twenty feet in advance. Finally the boreholes reached the old workings, tapping the water. In two or three days after the tapping of the water, it burst into the mine, filling up the lower level and drowning the ten persons employed in driving the tunnels. This file includes no listing of victim names.
Inundation	Fatal	Kaska Williams	Dodson Coal Company	Middleport	Schuylkill	PA	05/26/1898	6	Six men met their death in this colliery, leased by the Dodson Coal Company from the Lehigh Coal and Navigation Company, by water breaking in from old workings which had been abandoned many years before. Depending on inaccurate, misleading maps was the main cause of the disaster. This file does not include a listing of victims.
Inundation	Fatal	North # 3 Mine	Carbon Hill Colliery	Carbon Hill		WA	03/12/1894	1	Victim was killed when he was engaged in putting lagging on top of his timbers and in striking the lagging shook the coal allowing water broke through. He was found 130 feet below with a big gash on his head, which was sufficient to have caused death.
Inundation	Fatal	South Prairie Mine		South Prairie		WA	05/27/1895	1	Victim was killed while loading coal and water came down with such a force that he was thrown over the coal car against the roof.
Inundation	Fatal	Superba and Lemont Mines	Unspecified	Evans Station	Fayette	PA	07/24/1912	18	A tremendous downpour of rain occurred that found its way into the Superba mine and trapped 14 men. At about the same time, the flood found its way into the Lemont mine about 1 mile away, drowning 4 men. This file does not include a listing of victims.
Inundation	Fatal	Wilkeson Mine	Wilkeson Coal and Coke Company	Wilkeson	Unspecified	WA	12/17/1917	6	Cause of Accident: Six men were killed in this mine by an inrush of water and glacial clay which flooded the working areas. This file does not include a listing of victims.

Accident Classification	Degree of Injury	Mine Name	Mining Company Name	City	County	State	M/D/Y of Accident	Number of Fatalities	Narrative
Inundation	Fatal	Carbonado Mine	Unspecified	Carbonado	Pierce	WA	04/08/1927	7	A cave-in occurred in which seven men were killed in a downrush of gravel, mud and water. These men were working in the North Morgan seam, which is covered with about 200 feet of gravel, clay and earth. Without warning, it gave way and rushed into the mine, burying the men who were in its path.
Inundation	Fatal	Unspecified	Unspecified	Unspecified	Unspecified	PA	09/14/1944	2	Two men working in a breast were killed by an inflow of water and earth material. It is believed the men were killed instantly. This file does not include a listing of victims.
Inundation	Fatal	Brosconscious	Brosconscious Coal	Unspecified	Northumberland	PA	12/11/1947	2	One man was killed in an underground drowning accident.
Inundation	Fatal	Laurel Creek Coal Company	Unspecified		Fayette	WV	08/13/1951	5	Woodrow Redden, J. Flint, C. Flint, and R. Vandell Sr., and R. Vandell Jr. died in an underground in rush of water at 11 PM.
Inundation	Fatal	Disaster Holmes Slope Mine	Cano and Martin Incorporated	Forrestville	Schuylkill	PA	03/27/1952	5	A sudden inrush of water occurred in the Homes Slope Mine, Cano and Martin Inc. The accident occurred on Thursday March 27, 1952 causing the death of five workmen. Two other men who were near the slope bottom when the inrush of water occurred were able to escape. Only seven men were employed underground on the second shift.
Inundation	Fatal	Elkol	Kammerer Coal Company	Unspecified	Lincoln	WY	10/12/1952	1	Anthony Gianola died in an underground inrush of water accident at 4:15 PM. He was a mine foreman.
Inundation	Fatal	Baltimore #5	Hudson Coal Company	Unspecified	Luzerne	PA	01/30/1953	1	Patrick V. Garick was injured in an underground inrush of water accident at 3:30 PM. He was a miner's laborer.
Inundation	Fatal	Oak Hill	Philadelphia & Reading C & I Company	Unspecified	Schuylkill	PA	11/05/1953	1	Wasy Urban died in an underground inrush of water accident at 11:30 PM.
Inundation	Fatal	Landsburg	Palmer Coking Coal Company	Unspecified	King	WA	01/29/1955	4	Nathan D. Russell, Frank Stebly, Louis Valente and John Kovash were all fatally injured by an inrush of water.
Inundation	Fatal	# 4 Vein South Dip Slope	Natalie Coal Company	Unspecified	Northumberland	PA	02/21/1955	1	Florian Laskoski died in an underground inrush of water accident at 11:15 AM.

Accident Classification	Degree of Injury	Mine Name	Mining Company Name	City	County	State	M/D/Y of Accident	Number of Fatalities	Narrative
Inundation	Fatal	Collins #6	Buckeye Coal & Limestone Company	Unspecified	Lawrence	OH	07/13/1956	1	Gerald Edwin Rowe died in an underground drowning accident at 8:30 AM.
Inundation	Fatal	Baukol-Noonan	Baukol-Noonan Inc.	Unspecified	Divide	ND	05/10/1957	1	Peter A. Meyer died in an open-cut drowning accident at 3:15 PM.
Inundation	Fatal	River Slope Mine	May Shaft Section Schooley Colliery	Port Griffith	Luzerne	PA	01/22/1959	12	The Susquehanna River broke into the River Slope area of the May Shaft Colliery, Knox Coal Company at 11:42 AM, Thursday, January 22, 1959 entombing 12 men.
Inundation	Fatal	Springfield #4	Barnes & Tucker Company	Unspecified	Cambria	PA	11/10/1959	1	John Klamar was fatally injured in a suffocation accident.
Inundation	Fatal	unspecified	Oglebay Norton Company	Unspecified	Wayne	WV	04/21/1961	1	A deck hand drowned at this surface mine.
Inundation	Fatal	Unspecified	Unspecified	Unspecified	Unspecified	CO	06/13/1961	1	A continuous miner operator was killed when he cut through into an opening containing an accumulation of water.
Inundation	Fatal	Unspecified	Unspecified	Unspecified	Unspecified	MN	06/13/1961	1	A continuous miner operator drowned when he cut through into an opening containing an accumulation of water.
Inundation	Fatal	Dutch Creek Mine	Mid Continent Coal and Coke Company	Redstone	Pitkin	CO	06/13/1961	1	A continuous miner operator lost his life when he was caught by a rush of water. Bureau of Mines
Inundation	Fatal	Middle Split Vein South Dip Slope	M and N Coal Company	Forestville	Schuylkill	PA	07/19/1962	1	One miner was killed and another injured in an inrush of water accident at this mine
Inundation	Fatal	# Three	Zlocki Coal Company	Kulpmont	Northumberland	PA	11/16/1964	1	A laborer drowned in a rush of water at this mine. Bureau of Mines
Inundation	Fatal	Saxsewell No 8 Mine	Gauley Coal and Coke Company	Leivasy	Nicholas	WV	05/06/1968	4	An inundation (water) of part of the active workings of this mine occurred when a continuous miner holed through into the workings of an abandoned mine while cutting the face of No. 3 room left, off 2 right off south main entries. Four men were fatally injured or drowned by the inrush of water. Fifteen men were rescued 5 days later, and six others were rescued 10 days after the inundation occurred.

Accident Classification	Degree of Injury	Mine Name	Mining Company Name	City	County	State	M/D/Y of Accident	Number of Fatalities	Narrative
Inundation	Fatal	Saxsewell # 8	Gauley Coal and Coke Company	Levisay	Nicholas	WV	05/06/1968	4	Four men were killed when they drowned by the inrush of water. Bureau of Mines
Inundation	Fatal	# 12 Mine	Hursel Justus Coal Company, Incorporated	Haysi	Dickenson	VA	12/14/1972	1	Junior Jones McClellan, jack setter was drowned by a sudden inrush of water at 3:30 p.m., Thursday, December 14, 1972. The accident occurred at the face of the inby right crosscut off No. 2 main entry, approximately 100 feet inby Survey Station No. 653, during sumping operations of a continuous mining machine, which mined into unsurveyed sealed areas of the same mine.
Inundation	Fatal	Porter Tunnel Mine	Kocher Coal Company	Tower City	Schuylkill	PA	03/01/1977	9	<u>Nine men were killed by inrush of water.</u>
Inundation of gas	Fatal	Portal Tunnel Mine	Clinchfield Coal Company	Duty	Dickenson	VA	04/04/1978	5	Water inundated some abandoned sections in the Moss No. 3 Portal Mine. On April 4, 1978, five men were killed by an inrush of blackdamp while working to advance the drainway into an abandoned mined-out area of the mine.
Inundation	Fatal	Mine # 1	Evans Coal Company	Shady Point	Leflore	OK	06/06/1979	1	A roof bolter was killed when the continuous mining machine cut into unmapped old workings which were filled with water.
Inundation	Fatal	Lykens # 6 Mine	Kintzel Coal Company	Lincoln	Schuylkill	PA	06/21/1985	1	A partner was killed when a sudden inrush of water impounded in an old abandoned uncharted slope
Inundation	Fatal	Deserdo Mine	Western Fuels Utah Incorporated	Rangley	Rio Blanco	CO	08/22/1991	1	A supervisor was killed when a sump was intentionally mined into releasing 100,000 gallons of water. He was swept away by the sudden release of water.

*A Number of Accidents
Caused into Abandoned Areas*

**COMPARISON OF SELECTED PROVISIONS OF
PENNSYLVANIA MINE SAFETY LAWS AND
FEDERAL MINE SAFETY LAWS**

Requirement Description	Pa. Bituminous	Pa. Anthracite	Federal
Statute	Pennsylvania Bituminous Coal Mine Act, 52 P. S. §§ 701-101 – 701-706.	Pennsylvania Anthracite Coal Mine Act, 52 P.S. §§ 70-101 – 70-1405.	Mine Safety and Health Act 1977, 30 U.S.C. § 801-78.
Regulations	None authorized.	None authorized.	Secretary may develop regulations. 30 U.S.C. § 811.

**COMPARISON OF SELECTED PROVISIONS OF
PENNSYLVANIA MINE SAFETY LAWS AND
FEDERAL MINE SAFETY LAWS**

Requirement Description	Pa. Bituminous	Pa. Anthracite	Federal
Variances	Operator may utilize new “machinery, equipment, tools, supplies, devices, methods and processes” if “substantially” equal to or safer than requirements of the Act. Section 702, 52 P.S. § 701-702.	Operator may utilize new “machinery, equipment, tools, supplies, devices, methods and processes” if “substantially” equal to or safer than requirements of the Act. Section 1402, 52 P.S. § 70-1402.	Upon application Secretary may modify application of any mandatory standard. 30 U.S.C. § 811(c); 30 C.F.R. Part 44.
Pre-Mining Approval	None. ¹	None. ²	Mine operator must register with MSHA. 30 CFR.

¹However, underground bituminous underground mines must receive a Coal Mining Activity Permit (CMAP) under the Bituminous Mine Subsidence

and Land Conservation Act, 52 P.S. 1406.1-1406.21, The Clean Streams Law, 35 P.S. 691.1 - 691.1001, Surface Mining Conservation and Reclamation Act, 52 P.S. 1396.1 – 1396.19, and regulations promulgated under them. This permit is primarily geared toward environmental and surface subsidence concerns. However, permittee must identify, among other things, the location of the mine, its boundary, the type of mining method to be employed, and the location of adjacent mines and elevation and extent of any water impounded therein. 25 Pa. Code 89.154. In addition, the permit review seeks to preserve the hydrologic balance and minimize damage to it and to prevent gravity discharges from the mine. 25 Pa. Code 89.35, 89.36, 89.54. Surface facilities are subject to the Surface Mining Conservation and Reclamation Act, 52 P.S. 1396.1 – 1396.19 and regulations promulgated under it.

²There is no equivalent to the Bituminous Mine Subsidence and Land Conservation Act for underground Anthracite mines. Nevertheless, surface facilities are subject to the Surface Mining Conservation and Reclamation Act, and regulations promulgated under it. Discharges are regulated by the Clean Streams Law and regulation promulgated under it.

**COMPARISON OF SELECTED PROVISIONS OF
PENNSYLVANIA MINE SAFETY LAWS AND
FEDERAL MINE SAFETY LAWS**

Requirement Description	Pa. Bituminous	Pa. Anthracite	Federal
Map (during mining)	Map must be maintained at mine and a copy must be given to the inspector. Must accurately show workings and other features of mine, surface features, adjacent mines, including the elevation and extent of any impounded water. 52 P.S. §§ 701-235, 701-237.	Map must be maintained at map and a copy given to inspector. Must accurately show workings, shafts, adjacent mine lands, location, elevation and extent of impounded water, surface features, etc. 52 P.S. §§ 70-301 – 70-303.	Map must be maintained at mine and a copy must be given to the inspector (if requested). Must accurately show workings and other features of mine, surface features, adjacent mines, including the elevation and extent of any impounded water. Must be certified by registered engineer or surveyor. 30 C.F.R. 75.1200, 75.1200-1, 75.1200-2, 75.1203.

**COMPARISON OF SELECTED PROVISIONS OF
PENNSYLVANIA MINE SAFETY LAWS AND
FEDERAL MINE SAFETY LAWS**

Requirement Description	Pa. Bituminous	Pa. Anthracite	Federal
Map (during mining) – updating	Inspector's map must be updated every 6 months. 52 P.S. § 701-238.	Inspectors map must be updated every 2 months. 52 P.S. § 70-304.	Map should be temporarily updated on ongoing basis; updated and certified every 6 months. 30 C.F.R. 75-1202, 75-1202-1.
Map (during mining) – public access	None without consent. 52 P.S. § 701-239.	Property of Commonwealth; citizens may see during business hours, but may not copy without consent. 52 P.S. §§ 70-310 – 70-311.	Certain parties (Federal and state inspectors, miners, overlying and adjacent landowners) may see map; copies of map taken shall be kept confidential. 30 C.F.R. 1203.

**COMPARISON OF SELECTED PROVISIONS OF
PENNSYLVANIA MINE SAFETY LAWS AND
FEDERAL MINE SAFETY LAWS**

Requirement Description	Pa. Bituminous	Pa. Anthracite	Federal
Map (completion or abandonment)³	Permanently or temporarily abandoned must update inspector's map; permanent closure must submit certified final map to Department. 52 P.S. § 701-240. No specific procedure about where to file.	Prior to abandoning mine or allowing mine to flood must update map with duplicate matching surveys. Final map filed with inspector. 52 P.S. § 70-305.	Permanently or temporarily abandoned must notify inspector; permanent closure must submit certified final map to MSHA. 30 C.F.R. 1204. Shall give notice of closure and file map in Coal Mine Safety District office. 30 C.F.R. 1204-1.

³ Various requirements for closure must be satisfied under the CMAP, including sealing, reclamation and providing for any post-mining discharges. In addition, the DEP, BDMS is responsible for assuring that mine sealing is completed pursuant to the Mine Sealing Act, 52 P.S. Sections 28.1 - 28.8.

**COMPARISON OF SELECTED PROVISIONS OF
PENNSYLVANIA MINE SAFETY LAWS AND
FEDERAL MINE SAFETY LAWS**

Requirement Description	Pa. Bituminous	Pa. Anthracite	Federal
Map (completion or abandonment) – public access	Final map is public document. 52 P.S. § 701-240.	Final map is also property of Commonwealth. 52 P.S. § 70-310. May review during normal business hours.	Final map shall be subject to public inspection. 30 C.F.R. 1204.
Approaching abandoned workings (another mine)	Within 200 feet of abandoned workings commence advance drilling. 52 P.S. § 701-224(b).	Within at least 100 feet of abandoned workings commence advance drilling. 52 P.S. § 70-238.	Within 200 feet horizontally or 50 feet vertically of abandoned workings commence advance drilling. 30 C.F.R. 75.388.

**COMPARISON OF SELECTED PROVISIONS OF
PENNSYLVANIA MINE SAFETY LAWS AND
FEDERAL MINE SAFETY LAWS**

Requirement Description	Pa. Bituminous	Pa. Anthracite	Federal
Barriers⁴	No mining within 50 feet of abandoned workings (unless impounded water drained); barrier pillar calculated by empirical formula. 52 P.S. § 701-291.	Barrier pillar calculated by empirical formula. 52 P.S. 70-238. Owners of adjoining coal properties to leave an adequate barrier pillar. 52 P.S. § 70-312.	None.

⁴ Exclusive of requirements of the so-called "Safety Zone Act," Act of December 22, 1959, P.L. 1994, 52 P.S. 3101-09, which restricts mining from occurring within 200 feet of any body of water that may "constitute a hazard."

Training⁵	None.	None.	Training required for new miners, reassigned miners and annual refresher. 30 U.S.C. § 825; 30 CFR Part 48.
Entity Responsible For Compliance	Primarily mine foreman, though some provisions refer to superintendent, operator or other parties. 52 P.S. §§ 701-218 – 701-226.	Primarily mine foreman, though some provisions refer to superintendent, operator or other parties. 52 P.S. §§ 70-220 – 70-237.	Coal mine and mine operators subject to Act. 30 U.S.C. § 803.

⁵ Though the Pennsylvania Anthracite Coal Mine Act and Pennsylvania Bituminous Coal Mine Act contain no training requirements, the DEP, Bureau of Deep Mine Safety offers safety training programs in both the bituminous and Anthracite fields.

DEVELOPMENT OF PENNSYLVANIA BITUMINOUS COAL MINE SAFETY LAW
MAP REQUIREMENTS AND BARRIER AND DRILLING REQUIREMENTS

Bituminous Underground Mines: Outline of Map Requirements.

(Significant changes from prior version of law are in *italics*.)

Act of June 30, 1885, P.L. 205, Act 169

Section 1 Every owner, operator or superintendent of bituminous coal mine shall make an accurate map of the mine;

1" = 100'

Shall show excavations, shafts, etc.;

Accurately delineate boundary lines between adjacent mines operated by others, and show "relation and proximity of workings thereto;"

Kept at mine for use of inspector, or miner who fears that he is working in a place that is becoming dangerous due to proximity to other workings "which may be supposed to contain water or dangerous gas;"

Map shall be accurately updated every six months with new workings;

When workings are driven to within 10 feet of adjacent mine **or** when any part of the coal mine is abandoned, operator shall give inspector a map of the mine showing portions of workings "in proximity to the boundary line" or abandoned within three months;

Maps given to the inspector are property of the Commonwealth, and to be given to successor;

No copy of map may be made without owner's consent;

If the inspector believes that the map is "materially inaccurate or imperfect" he may require a new map to be made at the owner/operator's expense;

If inspector is wrong, the Commonwealth pays.

Act of May 15, 1893, P.L. 52, Act 48

Article I

Section 1. Operator or superintendent must make an accurate map of the coal mine. Map must be no less than 1" = 200' and prepared by a competent engineer or surveyor.

- The map must accurately delineate the boundary line between the coal mine and other mines and coal lands (Fourth);
- The map must accurately delineate the “relation and proximity” of the “workings of said mine to every other adjoining mine or coal lands” (Fourth);
- The map shall be kept in the general office of the mine for the use of mine inspectors and for other persons working in the mine “whenever said person or persons shall have cause to fear that any working place is becoming dangerous by reason of its proximity to other workings that may contain water or dangerous gas” (Sixth);

Section 2. The map must be updated every 6 months, or more often if necessary. Whenever workings are driven to their destination “a correct measurement of all such workings or excavations shall be made promptly and recorded in a survey book before the removal of pillars”;

Section 3. Within six months of the Act’s passage (November, 1893), the mine shall provide the state inspector a copy of the mine map. The mine shall update the map once a year or twice (if the inspector requires it). The mine maps are official records in the mine inspector’s custody, and are to be transferred to the inspector’s successor;

No person may copy the map without the company’s approval;

Section 4. Mine inspector may require operator to do a survey if the operators fails to provide a map or if the inspector thinks that the map is wrong. If the inspector is mistaken the Commonwealth pays for the survey.

Act of June 9, 1911, P.L. 756

Article II

- Section 1. Operator or superintendent must make an accurate map of the coal mine. Map must be no less than 1" = 200' and prepared by a competent engineer or surveyor.
- The map must accurately delineate the boundary line between the coal mine and other mines and coal lands, and “relation and proximity” of mine workings to adjoining mines or coal lands (Second);
 - The map must show elevation in rooms or entries adjacent to boundary line between mine and adjoining mine(s) on at least 300 foot centers (Third);
 - *The map must show location and elevation of any water dammed or held back in any portion of the mine, and the area of the water (unless inaccessible) (Third);*
- Section 2. *When mine workings are within 300 feet of boundary line between mine and adjoining mines, operator or foreman shall ask mine inspector for information on the location of the adjoining mine, if the workings of the adjoining mine are within 300 feet of the boundary, the operator (of first mine) shall survey the adjacent mine and place its location on its map. On inspector’s written authorization, first mine’s engineer or surveyor may have access to the adjacent mine to survey (Note: this appears to be a 600 foot requirement);*
- Section 3. Copy of map shall be maintained at mine office for inspector, mine inspector and miners who fear that the area where they are working is becoming dangerous due to “proximity to other workings that may contain dangerous accumulations of water of noxious gases;”
- Section 4. At least every six months, operator or superintendent shall update mine map and copy to show “excavations” made since the last revision;
- Mine inspector may require operator to do a survey (and update of map) when, in the inspector’s opinion, the mine is approaching accumulations of “water or noxious gases;”*
- When excavations are driven to destination operator or superintendent shall require mine engineer to check work and notes to certify map (see Section 6);*

Section 5. *Operator shall provide a copy of the updated mine map, or a blueprint every six months;*

The mine maps are official records in the mine inspector's custody, and are to be transferred to the inspector's successor. No one may copy *or obtain information from the map* without the operator's consent, *except to determine location of adjacent mine workings (Section 2);*

Section 6 *Within 60 days of abandoning or working-out a mine, the operator shall revise the inspectors' map to show worked-out or abandoned areas, property lines, etc.;*

Within sixty days abandonment of mine, owner or operator shall send tracing of the mine map (provided to Inspector) to Department of Mines to be kept "as a public document." Engineer shall certify that the tracing is true and accurate and that original is a "true complete and correct map and survey of all the excavations made in said abandoned mine;"

Section 7 Mine inspector has reason to believe that the map provided by the operator is inaccurate he may require a new survey and a new map to be made. Operator is responsible for the cost of the survey if the prior map was inaccurate; Commonwealth pays if the prior map was accurate.

Act of July 1, 1937, Act 464, P.L. 2486
(Amending 1911 Act)

Article II

Section 6. When a mine is "*indefinitely or permanently*" abandoned operator or superintendent must *notify inspector immediately*, and within sixty days extend the inspector's map to show all worked out or abandoned areas, etc.;

Within sixty days of *permanent* abandonment of mine, owner or operator shall send tracing *or print* of the mine map (provided to Inspector) to Department of Mines to be kept "as a public document." Engineer shall certify that tracing *or print* is true and accurate and that original is a "true, complete and correct map and survey of all the excavations made in said *permanently* abandoned mine."

Otherwise 1911 provisions are unchanged. (Due to closing of mines during the Depression?)

Act of July 17, 1961, Act 339, P.L. 659
(map related requirements currently codified at 52 P.S. §§ 701-235 - 701-241)

Article II.

Section 235 Operator or Superintendent shall have a mine map made by registered professional engineer or registered surveyor at a scale of at least 1" = 200'. Map shall include:

- (2) Accurate delineation of boundary line between the mine and adjacent mines or coal lands, "relation and proximity" of mine workings to adjacent mines or coal lands;
- (3) location and elevation of water dammed or held back in any portion of the mine *and the area of the water*;

Section 236 If mine workings are within *1,000 feet* of boundary line between mine and any "adjoining" mine(s), then operator or superintendent shall ask inspector for information on the location of adjoining mine workings;

If workings are within *1,000 feet* of boundary line, then inspector shall tell operator or superintendent who shall survey the adjoining workings;

Inspector may authorize access into adjoining mine by surveyor or engineer to conduct survey;

(Note: This appears to be a 2,000 foot requirement.)

Section 237 Copy of map shall be maintained at mine office for inspector, mine inspector and *authorized representatives of* miners who fear that the area where they are working is becoming dangerous due to "proximity to other workings that may contain dangerous accumulations of water or noxious gases;"

Section 238 At least every six months, operator or superintendent shall update mine map and copy to show "excavations" made since the last revision;

Section 239 Copy of updated map shall be provided to the inspector every six months. Inspector shall maintain the map(s) in his office as an "official record," and transfer the map(s) to his successor;

No one may copy or obtain information from the map without the operator's consent, *except as provided by the Act*. (for an another operator who's

mining within 1,000 feet of the mine?? See Section 2, above.);

When one operator operates a mine on a seam that overlies another operator's mine, the two shall exchange maps for the common area(s);

Section 240 When a mine is abandoned *for one year of more* the operator or superintendent must notify the inspector immediately and, within sixty days, extend the inspector's map to show all worked out or abandoned areas, etc.;

Within sixty days of such abandonment, mine owner or operator shall send tracing *or print* of the mine map (provided to Inspector) to Department of Mines to be kept "as a public document." Engineer shall certify that tracing *or print* is true and accurate and that original is a "true complete and correct map and survey of all the excavations made in *such* abandoned mine;"

Section 241 Mine inspector has reason to believe that the map provided by the operator is inaccurate he may require a new survey and a new map to be made. Operator is responsible for the cost if the prior map was inaccurate; Commonwealth pays if the prior map was accurate.

Bituminous Underground Mines: Outline of Barrier and Drilling Requirements.

Act of June 30, 1885, P.L. 205, Act 169

No drilling requirements.

Act of May 15, 1893, P.L. 52, Act 48

Article V

- Section 3.
- In any place being driven toward or in dangerous proximity to an abandoned mine or part of a mine suspected of containing inflammable gasses or which may be inundated with water;
 - boreholes shall be “kept” not less than 12 feet in advance of the face;
 - and sides not more than eight feet apart.

Article IX

- Section 4.
- Operator may not mine coal within fifty (50) feet of an abandoned mine containing dangerous accumulations of water;
 - until the water has been drained;
 - if necessary to protect safety of miners;
 - in the opinion of mine inspector and engineer of the property;
 - barriers shall be larger, by the following formula:

$$\text{Pillar thickness} = \text{impounded water head} / 1.25$$

Act of June 9, 1911, P.L. 756, Act ?

Article III

- Section 5.
- Changed “operator” to “*superintendent*,”
 - Otherwise same as Article IX, Section 4 of 1893 Act (barriers).

Article IV

- Section 17. – Any “working place” being driven within “*supposedly dangerous proximity*” to an abandoned mine or portion of an abandoned mine, suspected of containing explosive gas or may contain a dangerous accumulation of water¹;
- mine foreman shall see that:
- at least two bore holes are to be “kept” at least 12’ in advance of the face;
 - and holes *of the same depth* shall be drilled diagonally into the side (“rib”) not more than 8 feet apart.

Act of April 10, 1929, P.L. 472, Act 190²
(Amending 1911 Act)

Article III

- Section 5 (Barriers) – Superintendent may not mine coal within fifty (50) feet of an abandoned mine containing dangerous accumulations of water;
- until the water has been drained;
- *Superintendent may not mine coal if there are workings within 3,000 feet of property line;*

¹ This language change may be a response to the Supreme Court’s decision in *D’Jorko v. Berwind-White Coal Mining Co.*, 231 Pa. 164, 80 A. 77 (1911). In that case the Court found there was insufficient evidence to show that the workings were in “dangerous proximity” to workings “suspected of containing” gas or water.

² This change was recommended by a Commission appointed by the Governor to address barrier pillars. The Commission concluded that twenty feet was more representative of a typical cut. See Report of The Barrier Pillar Commission Of Pennsylvania (Bituminous District) To The General Assembly, reprinted in the 1927-28 Pennsylvania Department of Mines, Bituminous Report.

- *Superintendent shall, at a minimum, leave a barrier of unmined coal between workings and property line calculated by the following formula:*

$$\text{Barrier} = 10 \text{ ft.} + (2 \times \text{seam thickness}) \text{ ft.} \\ + (5 \times (\text{distance from mine roof to surface}/100))$$

- *If one side of the property has already been mined closer than allowed by the formula, a larger barrier shall be left on the other side to compensate;*
- *However:*
 - *mine inspector may require a larger barrier if, in his opinion, a larger barrier is needed;*
 - *if superintendents of the adjoining mines agree that no barrier is needed, then they may mine to the property line, if gas and water accumulations are drained;*
 - *disputes to be settled by appeal to board of 3 commissioners appointed by Secretary.*

Article IV

Section 17. Changed the requirements for advance drilling from 12 feet to 20 feet.
(Drilling/
Barrier)

Act of July 1, 1937, Act 464, P.L. 2486
(Amending 1911 Act)

Article IV

Section 17. Expanded coverage from “an abandoned mine or portion of an abandoned mine” to “any portion of an abandoned mine, or idle portion of an active mine.”

(Possibly in response to the Depression?)

Act of May 31, 1947, P.L. 381

Article III

Section 5. Expanded coverage by eliminating requirements that coal mining must be occurring within 3,000 feet. Now applies to any property;

Mine inspector also now participates in the decision that mining up to the property line is safe and acceptable.

Act of July 17, 1961, Act 339, P.L. 659

(map related requirements currently codified at 52 P.S. § 701-224(b))

Article II

Section 224. Whenever the working place approaches within 50 feet of abandoned workings of the same mine, shown by registered engineer or surveyor surveys, or;

Within 200 feet of any other abandoned workings of the same mine, which cannot be inspected and may contain dangerous accumulations of water or gas, or;

Within 200 feet of any workings of an adjacent mine;

Mine foreman shall see that a borehole or boreholes are drilled to a distance of at least 20 feet in advance of the working face;

Boreholes shall be close enough to avoid “holing” into the adjacent mine;

Boreholes shall be drilled into the rib (side) no more than 8 feet apart at a 45 degree angle;

Enough rib boreholes shall be drilled as are needed to protect the miners;

It is unlawful to work any portion of a mine which has water held back or dammed at a higher elevation, unless the Secretary approves;

Section 291 Superintendent may not mine coal within fifty (50) feet of an abandoned mine containing dangerous accumulations of water;

- until the water has been drained;
- Superintendent may not mine coal if there are workings within 3,000 feet of property line;
- Superintendent shall, at a minimum, leave a barrier of unmined coal between workings and property line calculated by the following formula:

$$\text{Barrier} = 10 \text{ ft.} + (2 \times \text{seam thickness}) \text{ ft.} \\ + (5 \times (\text{distance from mine roof to surface}/100))$$

- If one side of the property has already been mined closer than allowed by the formula, a larger barrier shall be left on the other side to compensate;
- However:
 - if, in the opinion of *mine inspector and superintendent of either property*, the calculated barrier is insufficient, a larger barrier will be required;
 - *the thickness of the barrier is left to the judgement of the mine inspector and superintendent or owner;*
 - if *the mine inspector and superintendents* of the adjoining mines agree that no barrier is needed, then they may mine to the property line, if gas and water accumulations are drained;
 - disputes to be settled by appeal to *the Secretary*.

NOTE: Act of December 22, 1959, P.L. 1994 (“Safety Zone Act”), 52 P.S. 3101-09

Section 1
(52 P.S. § 3101) Prohibits mining within 200 feet, measured horizontally, of any “stream, river, or other natural or artificial body of water in the Commonwealth that is sufficiently large to constitute a hazard to mining” in the Department’s opinion.

Sections 2 &3
(52 P.S. §§ 3102-03) Operators may apply to the Department to mine within the Safety Zone.

DEVELOPMENT OF PENNSYLVANIA ANTHRACITE MINE SAFETY LAW
MAP REQUIREMENTS AND BARRIER AND DRILLING REQUIREMENTS

Anthracite Underground Mines: Outline of Map Requirements.

Act of March 3, 1870, P.L. 3, Act 1

- Section 1 Every owner, operator or superintendent of an anthracite mine shall make an accurate map of the mine workings;
- Map shall be at a scale of at least 1" = 100';
- Shall show excavations, shafts, elevations, etc.;
- Accurately delineate boundary lines of coal lands;
- Provide a true copy of the map to the mine inspector, and a copy kept at the mine;
- On January 1st and July 1st of each year, owner or agent shall give to the mine inspector a revised map or "statement" of progress of the workings so that inspector may update his map;
- Before abandoning a mine or pulling pillars, owner or agent shall have mine map verified (updated) and shall notify the mine inspector in writing of intent to abandon or pull pillars;

- Section 2 If owner or agent fails to provide updates to map or if the the inspector believes that the map provided is inaccurate, inspector shall cause a survey to be done at owner/agent's expense;

Act of June 30, 1885, P.L. 218, Act 170

Article III

- Section 1 Every owner, operator or superintendent of an anthracite mine shall make an accurate map of the mine workings;
- Map shall be at a scale of at least 1" = 100';

Map shall show excavations, shafts, inclination of each seam, elevations (where inspector deems necessary);

Date of last survey station and date shall be shown on most advanced workings;

Accurately delineate boundary lines of the mine's lands, and "proximity of workings thereto;"

Provide a true copy of the map to the mine inspector, and a copy shall also be kept at the mine;

- Section 2 Every six months owner, operator or superintendent shall update inspector's map to show extensions made in prior two months;
- Section 3 Prior to abandoning coal mine or "lift" owner, operator or superintendent shall have maps extended to include all workings "as far as practicable" and verified;
- Section 4 If owner or agent fails to provide updates to map (for three months) inspector shall cause a survey to be done at owner/agent's expense;
- Section 5 When inspector believes that the mine map is "materially inaccurate or imperfect," inspector shall ask the Court of Common Pleas to order a new map to be made at expense of owner, operator or superintendent;
- Section 6 If the inspector was wrong, the Commonwealth pays for the survey;
- Section 7 Knowingly causing or allowing a false map to be provided to the inspector is a misdemeanor (\$500 or up to 3 months in jail);
- Section 8 Mine maps shall remain in the inspector's custody, and transferred to successor. No copies of maps may be made without consent of owner, operator or superintendent;
- Section 9 Only miners working in a section of the mine that they fear is becoming dangerous because of proximity to other workings that may contain dangerous accumulations of water or gas may see the inspectors map.

Article XV

- Section 2 Owner, operator or superintendent shall notify the inspector, within two weeks of:
- abandonment of mine;

- reopening of mine;
- pulling pillars.

Act of June 2, 1891, P.L. 176, Act 177

Article III

(These provisions are very similar to the Act of 1870. Only changes or additions will be noted.)

Section 1 Map shall also show the location, extent and elevation of any flooded workings in the mine, and any “dam” holding back the water;

When workings approaches flooded workings or the “dam” the owner, operator or superintendent shall notify the inspector “without delay;”

Section 3 Map must also be updated when any portion of workings will be allowed to flood;

Surveys shall be done in duplicate and must agree, certified copies to be filed with the inspector;

Section 9 Interested citizens may examine the inspector’s map during business hours.

Act of June 28, 1947, P.L. 1094, Act 471
(amending Act of 1891)

No change.

Act of December 16, 1959, P.L. 1878, Act 686

Article III

Section 1 Map must also show location of working faces advanced and pillars pulled since last inspection;

A copy of the map shall be provided to the inspector when the inspector arrives to conduct his inspection;

Section 2 Inspector’s map shall be updated every two months.

Act of November 10, 1965, P.L. 721, Act 346 (52 P.S. 70-101 -- 70-1405)

Section 301 Every operator or superintendent of an anthracite mine shall make an accurate map of the mine workings;

Map shall be at a scale of at least 1" = 100';

Map shall show excavations, shafts, inclination of each seam, elevations (where inspector deems necessary);

Date of last survey station and date shall be shown on most advanced workings;

Map must also show location of working faces advanced and pillars pulled since last inspection;

Section 302 Accurately delineate boundary lines of the mine's lands, and "proximity of workings thereto," pipelines, bodies of water, buildings, etc.;

Map shall also show the location, extent and elevation of any flooded workings in the mine, and any "dam" holding back the water;

When workings approaches flooded workings or the "dam" the owner, operator or superintendent shall notify the inspector "without delay;"

Section 303 Provide a true copy of the map to the mine inspector, and a copy shall also be kept at the mine;

A copy of the map shall be provided to the inspector when the inspector arrives to conduct his inspection;

Section 304 Every two months operator or superintendent shall update inspector's map to show extensions made in prior two months;

Section 305 Map must also be updated prior to abandoning coal mine or "lift" operator or superintendent shall have maps extended to include all workings "as far as practicable" and portions worked to boundary lines;

Any portions of workings allowed to flood;

Must be surveyed in duplicate and surveys must agree. Certified copies of survey to be filed with the inspector;

Section 306 If owner or agent fails to provide updates to map (for one month) inspector shall cause a survey to be done at owner/agent's expense;

Inspector may cease operations until map is provided;

Section 307 When inspector believes that the mine map is "materially inaccurate or imperfect" inspector shall ask the Court of Common Pleas to order a new map to be made at expense of operator or superintendent;

Section 308 If the inspector was wrong, the Commonwealth pays for the survey;

Section 309 Knowingly causing or allowing a false map to be provided to the inspector is a misdemeanor (\$500 or up to 3 months in jail);

Section 310 Mine maps are property of the Commonwealth, shall remain in the inspector's custody, and shall be transferred to his successor. No copies of maps may be made without consent of operator or superintendent.

Section 311 Any miner who fears that the area where he is working is becoming dangerous because of proximity to other workings that may contain dangerous accumulations of water or gas may see the inspectors map;

Interested citizens may examine the inspector's map during business hours.

Anthracite Underground Mines: Outline of Drilling and Barrier Requirements.

Act of March 3, 1870, P.L. 3, Act 1

None.

Act of June 30, 1885, P.L. 218, Act 170

Article XII

Rule 15 When approaching a place likely to contain a dangerous accumulation of water;
Width of entry may not exceed 12 feet;

 Must maintain at least one borehole (near center) at least twenty feet in advance and sufficient flank holes on the sides.

Act of June 8, 1891, P.L. 176, Act 177

Article III

Section 10 Owners of adjoining coal properties shall leave a coal pillar of sufficient width (in each seam) to provide a barrier to protect workers in either mine should a mine be abandoned and allowed to fill with water;

 The size of the pillar shall be determined by engineers from both mines and the inspector;

 Duplicate surveys shall be done, must agree, and must be certified. Copies of the duplicate surveys shall be filed with both mines and the inspector;

 Before abandoning a mine or pulling pillars owner or agent shall have mine map verified (updated) and shall notify the mine inspector in writing of intent to abandon or pull pillars.

Article XII

Rule 15 Unchanged.

Act of June 28, 1947, P.L. 1094, Act 471

Article XII

Rule 15 Whenever a working face is approaching inaccessible workings likely to contain dangerous accumulations of water or gas;

 Operator shall show a stopping distance from such workings of at least

100 feet on mine foreman's map;

One hundred foot barrier shall not be passed until mine engineer and inspector agree upon barrier size and point where borings shall begin;

Borings shall be at least 20 feet in advance, one shall be in the center of face and sufficient flank holes;

Stopping distance shall be greater than 100 feet and [(0.01) (depth below drainage) (seam thickness)] + [(seam thickness) (5)];

Must pump out water to drive entries into barrier.

Act of December 22, 1959, P.L. 1994 ("Safety Zone Act"), 52 P.S. 3101-09

- Section 1 (52 P.S. § 3101) Prohibits mining within 200 feet, measured horizontally, of any "stream, river, or other natural or artificial body of water in the Commonwealth that is sufficiently large to constitute a hazard to mining" in the Department's opinion;
- Section 2 & 3 (52 P.S. §§ 3102-03) Operators may apply to the Department to mine within the Safety Zone.

Act of November 10, 1965, P.L. 721, Act 346 (52 P.S. 70-101 -- 70-1405)

- Section 238 Whenever a working face is approaching inaccessible workings likely to contain dangerous accumulations of water or gas;

Operator shall show a stopping distance from such workings of at least 100 feet on mine foreman's map;

One hundred foot barrier shall not be passed until mine engineer and inspector agree upon barrier size and point where borings shall begin;

Borings shall be at least 20 feet in advance, one shall be in the center of face and sufficient flank holes;

Stopping distance shall be greater than 100 feet and [(0.01) (depth below drainage) (seam thickness)] + [(seam thickness) (5)];

Must pump out water to drive entries into barrier;

Section 312 Owners of adjoining coal properties shall leave a coal pillar of sufficient width (in each seam) to provide a barrier to protect workers in either mine should a mine be abandoned and allowed to fill with water;

The size of the pillar shall be determined by engineers from both mines and the inspector;

Duplicate surveys shall be done, must agree, and must be certified. Copies of the duplicate surveys shall be filed with both mines and the inspector.

Introduction

At any emergency site, there is a great potential for difficulties and stresses to arise as the result of uncoordinated communications, differing lines of authority and responsibility, an absence of long-term familiarity with personnel, equipment and techniques employed by other agencies, and unclear answers to the question, “Who’s in charge?”

Moreover, pressures from the media and others, coupled with the need to act quickly to save life, may result in conflicts and in disorganized leadership that may and often do negatively impact both operations and the public’s perception of the event. These stresses are frequently compounded when federal, state and local agencies interact for the first time on the scene at emergency sites.

The Quecreek Experience

While it is difficult to be critical in the face of success, the organization of the response and rescue efforts at Quecreek illustrates some of the difficulties that typically arise in large and/or complex operations.

Local first-responders from fire, police and emergency services organizations arrived on scene at Quecreek Mine shortly after the initial calls for help and established a basic command system for fire/rescue and site access operations. There was, however, no consistent effort to establish a structured management system for the overall incident as it evolved.

When State mine safety personnel arrived on scene, operational management of the incident, because of its specialized, technical nature, passed to that agency. In turn, when Federal officials arrived, liaison was established and lead management responsibility was assumed by MSHA.

The Somerset County Emergency Management Agency, the county government’s lead disaster management and coordination organization, responded to the incident but found itself outside the chain of communication and coordination and, as a result, was unable to provide assessments of progress, needs or plans.

Within the State Emergency Operations Center in Harrisburg, where all state and local agency responses, communication and unmet needs are typically coordinated, reports and taskings from on-scene responders, congressional aides, state agencies and private contractors were being received with sometimes conflicting contexts.

However briefly, there were instances during the event when at least three, uncoordinated management structures were simultaneously operational. While this situation was resolved from an on-scene operations standpoint, it continued to affect support functions as, for example, equipment needed on-scene was being sourced by or supplied through first responders, mine safety agencies (both on-site and in Harrisburg), the county emergency management agency and private sector entities.

Again, success in this operation cannot be refuted; however, among the legacies of Quecreek must certainly be recognition of the need for an effective, uniform management system for such events.

A Uniform Incident Management System

Across Pennsylvania, federal, state and local emergency service, law enforcement, emergency management and counter-terrorism task force organizations have begun resolving operational, command, logistics, planning, finance and communications issues in advance by adopting a common approach to handling emergencies, the Incident Management System (IMS). This system is transferable to any organization or group of organizations with responsibility for emergency response operations.

Federal, State, county and local agencies responsible for mine rescue responses could benefit from IMS and should adopt, train and exercise IMS at agency and inter-agency levels. The use of IMS at Quecreek would have resolved, in advance, the issues that arose.

Background

Incident Management Systems long have been successfully used in managing available resources at emergency operations.

The Incident Management System was developed as a consequence of fires that consumed large areas of wildland in southern California in 1970. As a result of those fires, agencies saw the need to develop a system that allowed them to work together toward a common goal in an effective and efficient manner.

Incident Management Systems are concepts that have been given considerable attention within the emergency services and emergency management communities. Ironically, many organizations believe they have a command system when what they actually have is an organizational chain of command that is ill equipped for the demands and stresses of incident management.

IMS is designed to be used in response to emergencies caused by fires, mine collapses, floods, earthquakes, tornadoes, hurricanes, riots, hazardous materials, or other natural or human-caused incidents. IMS is designed to begin developing from the time an incident occurs until the requirement for management and operations no longer exists.

The system can be utilized for any type or size of emergency, ranging from a minor incident involving a single organization, to a major emergency involving several agencies.

The system consists of procedures for controlling personnel, facilities, equipment, and communication. Incident management systems allow agencies to communicate using common terminology and operating procedures.

One of the main benefits of a properly designed and instituted Incident Management System is personnel safety and rescuer accountability. No one should be operating in any type of hazardous environment or situation unless a system of accountability and overall safety has been instituted. The Incident Commander has this responsibility, and it is probably the most important responsibility at any situation, regardless of size.

IMS should be designed to go into effect during all emergency responses.

Incident Commanders *cannot* be involved rescuers. Incident Commanders and any related command functions must be carried out separately from actual hands-on

involvement in the operation. If this policy is not followed then all the personnel working at the incident are put in jeopardy.

Components of the Incident Management System

IMS components working together interactively provide the basis for an effective incident management system incorporating the following elements:

- Common Terminology
- Modular Organization
- Integrated Communication
- Unified Command Structure
- Consolidated Action Plans
- Manageable Span of Control
- Designated Incident Facilities
- Comprehensive Resource Management

An effective Incident Management System has five major functional areas:

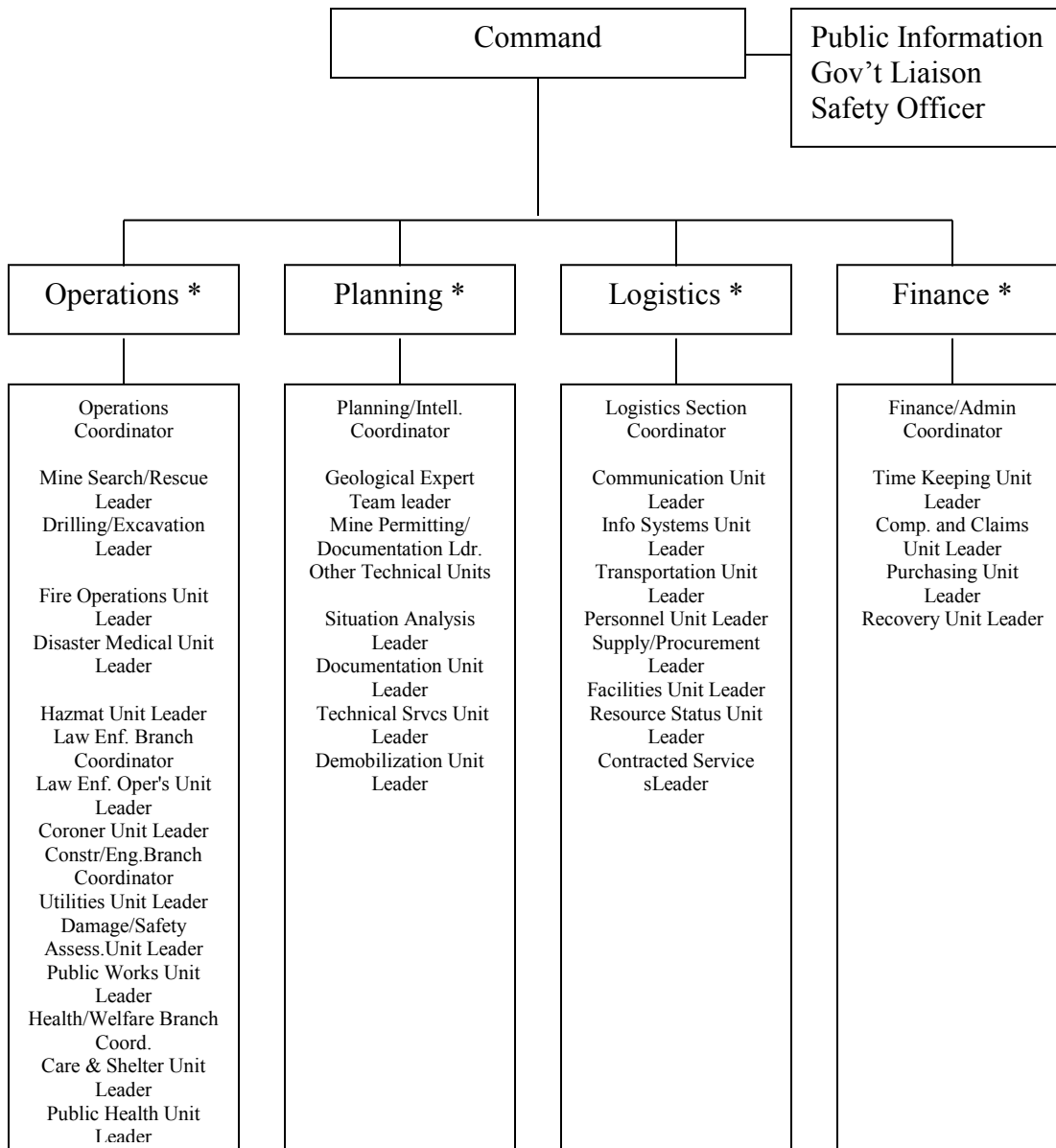
- Command
- Operations
- Planning
- Logistics
- Finance

These functional areas and the personnel assigned to them may expand and contract as incidents progress. Not all functional areas may be needed for every incident; conversely, some incidents may require the establishment of others not listed.

With proper IMS implementation, every possible challenge, obstacle and opportunity will have a member of the Incident Management Team addressing it.

Public Information and Governmental Liaison functions are typically attached to the Command area and report directly to the Incident Commander. The commander, however, cannot be the spokesperson or undertake the liaison function.

The following diagram illustrates a typical IMS structure. Personnel from all agencies, in a collaborative and coordinated manner, are assigned to the components of IMS based on their experience and expertise, not on their affiliation. By blending all personnel and agency resources, a “broad view” of the incident is maintained throughout the IMS. The numbers of personnel assigned and the actual units within each section can be expanded and contracted to meet the continuing needs of the incident.



* Examples of typical assignment/tasks are noted in section breakout beneath each section title.

COMMAND

The Incident Commander is responsible for incident activities including the development and implementation of strategic decisions and for approving the ordering and release of resources.

The duties of the Command Section include the following:

- Obtains incident briefing from prior incident commander or first, on-scene person in charge
- Assesses incident situation
- Conducts initial briefings
- Activates elements of IMS
- Briefs command staff and section chiefs
- Coordinates staff activity
- Manages overall incident operations
- Approves requests for additional resources and requests for release of resources
- Authorizes release of information to the news media
- Ensures incident status summary is completed and forwarded to appropriate state, federal and local operations centers
- Approves plan for demobilization

OPERATIONS

In a mine incident environment, this section of the system deals, first and foremost, with the processes of search, rescue and/or recovery. The personnel assigned to this section are “the doers”. It is their expertise and work that are supported by the other elements.

The Operations Section is responsible for the management of all operations directly applicable to the primary mission. The operations chief activates and supervises organizational elements in accordance with the incident action plan and directs its execution. The operations chief also directs the preparation of unit operational plans, requests or releases resources, makes any expedient changes to the incident action plan as is necessary and reports such to the incident commander.

Among the duties performed by the Operations Section are the following:

- Briefs and assigns operations personnel in accordance with the incident action plan
- Supervises operations
- Determines need and requests additional resources
- Reviews suggested list of resources to be released and initiates recommendations for release of resources
- Assembles and disassembles teams assigned to operations section
- Reports information about special activities, events and occurrences to the incident commander

PLANNING

This section is the expert/technical resource of the operation. Within this section are the geologists, mining engineers, and other technical experts who work with the tools and resources necessary to provide expert guidance to the Operations Section.

The Planning Section is responsible for the collection, evaluation, dissemination and use of information about the development of the incident and status of resources. Information is needed to (1) understand the current situation, (2) predict the probable course of incident events, and (3) prepare alternative strategic and control operations for the incident.

Among the duties of the Planning Section are the following:

- Reassigns initial attack personnel to incident positions as appropriate
- Establishes information requirements and reporting schedules
- Establishes a weather data collection system when necessary
- Supervises preparation of the incident action plan
- Assembles information on alternative strategies
- Identifies need for use of specialized resources
- Provides periodic prediction on incident potential
- Compiles and displays incident status summary information
- Advises general staff of any significant changes in the incident status
- Provides incident traffic plan
- Ensures that normal agency information collection and reporting requirements are being met
- Prepares recommendations for release of resources for submission to the incident commander

LOGISTICS

The Logistics Section obtains the tools and services required to complete the operational mission and provides the services and facilities necessary for the rest of the overall operation. Personnel assigned here include those with purchasing/administration skills, owners' representatives, logistics, food-service and transportation personnel, and infrastructure experts.

The Logistics Section is responsible for providing facilities, services, and materials in support of the incident. The logistics section chief participates in the development and implementation of the incident action plan and activates and supervises the branches and units within the logistics section.

Among the duties of the Logistics Section are the following:

- Plans organization of the logistics section
- Participates in preparation of the incident action plan
- Identifies service and support requirements for planned and expected operations
- Provides input to and reviews communications plan, medical plan, and traffic plan
- Coordinates and processes requests for additional resources
- Reviews incident action plan and estimates section needs for next operational period

- Ensures incident communication plan is prepared
- Advises on current service and support capabilities
- Prepares service and support elements of the incident action plan
- Estimates future service and supports requirements
- Receives demobilization plan from planning section
- Recommends release of unit resources in conformity with demobilization plan

FINANCE

The finance section “keeps the books”, tracking all expenditures, orders, income, donations and similar cost and income centers. The work of this unit ultimately speeds the recovery from the incident by supplying the factual basis for cost recoveries from insurance, governmental and other sources.

The Finance Section is responsible for all financial and cost analysis aspects of the incident and for supervising members of the finance section.

Among the Finance Section duties are the following:

- Identifies and orders supplies and support needs for finance section
- Develops an operating plan for finance function on the incident
- Determines need for commissary operations
- Provides input in all planning sessions on financial and cost analysis matters
- Maintains daily contact with agency(s) administrative headquarters on finance matters
- Insures that all personnel time records are transmitted to home agencies according to policy
- Participates in all demobilization planning
- Ensures all obligation documents initiated at the incident are properly prepared and completed
- Briefs agency administration personnel on all incident related business management issues needing attention, and follows-up prior to leaving the incident

Conclusions

- Any emergencies arising in the mining industry demand effective, efficient and well-prepared responses.
 - IMS provides a proven model by which to manage any incident, large or small.
 - IMS can be adopted by federal, state, county and local agencies as the common approach to emergency response.
 - Once adopted, personnel should be taught to use it and exercises involving participants from all levels of government and from the private sector should be conducted to develop familiarity.
 - IMS should be adopted in Pennsylvania as a “best practice” for mine emergency response.
-

REFERENCES:

NFPA 1500 " Fire Department Occupational Safety and Health Program"

NFPA 1561 " Standard for Fire Department Emergency Management Systems"

"Incident Command System" Fire Protection Publications, Oklahoma State University

"Field Operations Guide" Incident Command System Publications, Oklahoma State University

"Command And Control Of Extrication Operations" Wieder, Michael A.

"Command Operation For Hazardous Materials Incidents" New York State Association Of Fire Chiefs

"Command Staff Helps ICS Work" Hanson, David

"Develop An Emergency Plan That Will Enhance Your Field Operation" Singer, Bill

"Disaster Response: Principles Of Preparation And Coordination" Der Heide, Erik

"The First Few Moments" Hoffmann, John W.

"An Incident Command System Model For Emergency Operations Centers For Smaller Communities" Martin, Wayne J.

"The Incident Command System...It's Not Just For Fires Anymore" Bollinger, Frank

The Incident Command System: Some Modern Applications In Planning, Response, Recovery" Butler, James N.; Heavilin, Robert E.

"Management Effectiveness At The Leader Level" Erb, Roger D.; Monesmith, Jerry L.

"Who Finds The Bulbs When The Lights Go Out?" Catino, Tom

"Who's In Charge?" Sharp, Art; Sharp, Betsy

Commission Questions for the miners trapped at Quecreek Mine

1. What exactly happened? Please provide a detailed description of events immediately before the inundation.
2. Describe the process for obtaining and validating nearby abandoned mine maps during the original permitting process for Quecreek.
3. Regarding old mine workings:
 - a. Were the miners aware that the workings in 1 left would be approaching old mine workings?
 - b. What is the extent of their knowledge on this matter?
 - c. If they had the knowledge, was it from information in the mine maps? Or was it from information provided in the training program by the company officials?
 - d. If they were aware of the old workings, were they aware of the condition in the old workings such as the old workings could have been water filled?
4. During development of the 1 left heading were there any changes such as unusual odors, soft roof and/or floor, excessive roof and/or rib water or excessive water during roofbolting. If so, what action did the miners take?
5. If there was one new advanced technology that could have been used at Quecreek to potentially prevent the incident, which technology do you suggest?
6. Regarding technology to determine the presence of abandoned workings:
 1. Were you aware of technology other than drilling test or probe holes in advance of the continuous miner when active mining is within 200 feet of suspected abandoned mine works prior to the incident?
 2. If yes, how familiar with this technology or technologies?
 3. Since the Quecreek incident have you become aware of new technology or technologies that could have prevented the incident?
7. In your opinion what could be done to guarantee this won't happen again?

**Abandoned Mine Voids and Safety Commission
Agenda**

September 12, 2002 – 10:00 a.m.

Room 105, Rachel Carson State Office Building
Harrisburg, PA

Welcome/Opening Remarks	<i>David Hess</i>
Swearing in of Members	<i>David Hess</i>
Introductions	<i>Scott Roberts</i>
Review of Governor Schweiker's Executive Order	<i>Raja Ramani</i>
Establish Dates/Times/Milestones for Future Meetings and Hearings	
Public Hearing Details	
Update on status of Queecreek	
Format of the Report	
Discussion/Questions & Comments from the Public	
Adjourn	

Agenda
Governor's Commission on Abandoned Mine Voids and Mine Safety

Oct. 3 Public Hearing

Johnstown, PA

- 9:00 – 9:30** Discuss and vote on minutes from Sept. 12, 2002 Commission Meeting
- 9:30 – 10:00** Jeffrey Mihallik (UMWA) Safety of Mine Workers
- 10:00 – 10:30** Timothy Hroblak (UMWA Safety Committee, District #2) Safety of Mine Workers
- 10:30 – 11:00** Daniel Kane (UMWA) Safety of Mine Workers
- 11:00 – 11:30** Peg Trimble (Dept. of Health, Emergency Health Services) Emergency Response Coordination
- 11:30 – 12:00** Beverly Braverman (Mountain Watershed Association) Permitting underground bituminous mines

Lunch Break

- 1:00 – 1:30** Bill Plassio (Pennsylvania DEP, Bureau of District Mining Operations) Bituminous Underground Mine Permitting
- 1:30 – 2:00** Bill Bookshar (Pennsylvania DEP Bureau of Deep Mine Safety) Bituminous Underground Mine Barrier Pillar and Safety Zone Approvals
- 2:00 – 3:00** Lynn Jamison, DEP DMS – inspector for Quecreek
- 3:00 – 3:30** Joe Scaffoni (Pennsylvania DEP Bureau of Deep Mine Safety) Quecreek Mine Inundation

AGENDA

Governor's Commission on Abandoned Mine Voids and Mine Safety October 9, 2002 Public Hearing Quality Inn, Pottsville, PA

9:00 – 9:15 Commission Chairman - Welcome and Introduction – overview of Governor's executive order and charge to the Commission.

9:15 – 10:00 Michael Kuhns, U.S. Office of Surface Mining, Wilkes-Barre mine map repository

10:00 – 10:45 Earl Kieffer, Anthracite Independent Miners Association, Anthracite underground mining

10:45 – 11:30 David Williams, D. Williams & Assoc., Anthracite underground mine surveying

11:30 – 12:15 George Gardner, MSHA, Geophysics and directional drilling

Lunch Break

1:15 – 2:00 Terry Ackman, Dept. of Energy, Geophysics –detecting mine voids

2:00 – 2:45 Frank Kendorski, Agapito and Assoc., Inc, Rock mechanics and mine barrier hydrology

2:45 – 3:30 Glenn Wattle, Stolar Horizon, Inc., Geophysics – detecting mine voids

3:30 – 4:15 Jay Parrish, PA Geologic and Topographic Survey, Archiving, digitizing, and georeferencing maps

4:15 – 5:00 Michael Bubel, DEP, DMS- Pottsville – Anthracite Coal Mine Laws

Note: Underlined times indicate that the presenter provided written testimony or a hard copy of their PowerPoint presentation.

Agenda

Governor's Commission on Abandoned Mine Voids and Mine Safety Public Hearing, October, 23 Ramada Inn, Somerset, PA

- 9:00 am** Commission Chairman, opening remarks / review of Commission's function and goals
- 9:15 am** John Wood (Target Drilling), horizontal drilling to detect mine voids
- 9:45 am** Thomas Mucho (NIOSH), mine planning, design and operation
- 10:15 am** Michael Brnich and Charles Vaught (NIOSH), mine inundation training for underground miners
- 11:15 am** Bill Johnson (D'Appolonia), detecting mine voids using geophysics
- 11:45 am** Peter Saxman, Son of former owner of Saxman Coal and Coke
- 12:00 pm** Albert W. Barnett, Former employee of Saxman Mine
- 12:15 pm** Pastor Barry K. Ritenour
- Lunch**
- 1:30 pm** William L. Whittaker (CMU), detecting mine voids using robotics
- 2:00 pm** Pennsylvania Coal Association, panel
- 3:00 pm** UMWA, panel
- 4:00 pm** Joe Main (UMWA), mine safety

Note: Underlined times indicate that the presenter provided written testimony or a hard copy of their PowerPoint presentation.

**Abandoned Mine Voids and Safety Commission
Agenda**

November 6, 2002

Penn Stater Conference Center, Room 222
State College, PA

IUP Proposal

MSHA Response

Written Materials

Review Present Submissions

Break – Recommendations

Present Recommendations

Conclusions and Report

Items received by the Commission.

All of the information listed below is part of the Commission's official record.

Many of the individuals who gave testimony at the Commission's public hearings presented written material to support their testimony. Those individuals are identified on the agendas in Appendix F.

GAI Consultants submitted several technical papers:

- Mine Closure, Sealing and Abandonment
- Turka, Robert, "Radio Imagine Method Survey Report – Knox II Energy Facility", Oct. 2001
- Underground Mine Disaster Survival and Rescue: An Evaluation of Research Accomplishments and Needs
- Turka, Robert, "Dewatering a mine pool created by a blocked drainage tunnel", GSA Meeting, 1987, abstract.

Formtek – Micheal Drabick, Document and Content Management Software and Domain expertise info.

Kendorski, Frank, Agpito Associates, Inc., U.S. Bureau of Mines contract Report J0285011, Guidance (Kendorski, Khosla, & Singh, 1979)

Skelly and Loy Consulting Engineers, Guidelines for Mining Near Surface Waters- Phase II final and interim reports, U.S. Bureau of Mines, Contract Report H0252083

Quecreek Mine Emergency Response Plan

U.S. Bureau of Mines Information circular 9427, "Practical Design Methods for Barrier Pillars"

Holmberg, Linda, e-mail regarding trapped miner location device.

MSHA, Maps of the Quecreek and Harrison #2 Mines

- 1957 hardcopy of Harrison #2
- 1964 electronic copy of Harrison #2

MSHA Quecreek Mine Inspection Reports- 5/2002- 6/2002

Testimony from the U.S. Senate Appropriations Subcommittee on Labor, Health & Human Services and Education – October 21, 2002 – Johnstown, PA

- Mark S. Schweiker – Governor of PA
- David E. Hess – Secretary PADEP
- David D. Lauriski – Assistant Secretary of Labor - MSHA
- Joseph A. Main – UMWA
- David Rebuck – President of Black Wolf Coal Company

- George Ellis – Pennsylvania Coal Association

Commentary and videotape regarding use of terrain conductivity surveys and borehole camera inspection for locating underground mines, provided by DEP-Bureau of Abandoned Mine Reclamation

Andrew Drebitko – provided a letter recommending issues for the Commission to work on.

Quecreek Mine Permit Applications

Quecreek Mine inspection notes, MSHA inspector – May to June 2002.

Heberlig, Richard, FAX submittal with recommendations on mine rescue procedures

MINUTES
The Governor's Commission on
Abandoned Mine Voids and Mine Safety Meeting
September 12, 2002
Room 105, Rachel Carson State Office Building

The Governor's Commission on Abandoned Mine Voids and Mine Safety (Commission) was called to order at 10:00 a.m. by David E. Hess, Secretary, Department of Environmental Protection. A list of the attendees and a copy of the agenda are attached.

I. Welcome/Opening Remarks

Mr. Hess opened the meeting by welcoming the Commission on behalf of the Governor. The Governor formed the Commission shortly after the Quecreek accident and successful rescue of nine miners. The purpose of the Commission is to look ahead to see if the state is, in fact, looking at the safety of miners in the mines as they are working, in particular, when they are working next to or in proximity to mine voids that may be filled with water. The main focus should be on the location and identification of mine voids. The Governor would like a report by November 15. Mr. Hess asked the Commission members to introduce themselves.

II. Swearing in of Members

At 10:20 a.m. Mr. Hess swore in the Commission members. The meeting was then turned over to Dr. Raja Ramani.

III. Introductions

Introductions were done earlier in the meeting.

IV. Review of Governor Schweiker's Executive Order

Dr. Ramani thanked each of the members of the Commission for agreeing to serve. The in-rush of water in the Quecreek mine is an incident that allows the members to look at how an incident like this happened and how to avoid a future incident. The Governor formed the Commission to take an overview of the problem, from the planning and designing of mines to how to mount an effective effort for rescue. The first and foremost charge of the Governor's Executive Order is the design of mines, especially mines adjacent to abandoned mines. Second, the policies and review process of state agencies in permitting mines adjacent to abandoned underground mines. Third, the Commission needs to look at training. What do we do now that is effective and what can we do in the future to improve training? The Commission also needs to look at inspections and compliance of the mine operations. Are the mines following through

with what was approved for that permit? Finally, the Commission needs to look at the rescue and response procedures. It was noted that small mine operations have unique problems and should be addressed also. Small operations are a very essential part of the mining industry. It is important to address these issues not only from industry point-of-view but also from small operators point-of-view. Dr. Ramani then welcomed comments from the other members.

Frank Kirby said he would like to look at old mine maps and try to get controls of maps before 1970. These maps should then be put into a central repository. The members need to find these old mine maps, especially near the mines today, to try to get a handle on them and to get the most up-to-date maps. Dr. Ramani agreed. The reliability of the maps has to be established. First, to get the most up-to-date map and second, to validate the information on the map.

James Lamant would like to look at the regulations in place in regard to state mining laws. Mr. Lamant would like an explanation to exactly what the law says. Especially in regards to the permitting process as well as public hearings. What weight is given to the public's comments during the permit review process? Dr. Ramani mentioned that this is part of the Commissions work, to review the laws and regulations. Dr. Ramani would like the Department of Environmental Protection (DEP) to have a presentation to go over details of how they approve a permit. Mr. Lamant would like a clarification of Sections 224 and 236 of the Bituminous Coal Mine Act. What does it actually say and what does it really mean? Dr. Ramani agreed and it will be addressed at one of the meetings and DEP will have the appropriate answers.

Jeffrey Kohler wants to underscore the importance of taking a systems approach. The purpose of the Commission is to define the level of safety, design practices of mines, training and response and rescue.

William Harbert thinks it would be appropriate to define test beds where approaches defined by this group could be implemented. Dr. Ramani mentioned that the timeframe is very limited. There are long-term solutions to problems but can take a long time to develop. The Commission should not overlook those but they are not the kind of solutions the Commission is looking for in the short-term. The Commission should take an assessment of where the technology is today, what is the feasibility of this technology to be introduced into the mines immediately and what are the things that agencies can do.

David Smith believes it is important in the mining community that we have in place a uniform response and rescue procedure. We should move towards a position where MSHA and everyone else understand how the Commonwealth and the mining community are going to address these issues. The Commission must work on these things other than in times of crisis. MSHA has very good safety training for their miners. Mr. Smith would like to see the community involved in the process. The community includes firefighters, EMTs, the drilling operators and others. Mr. Ramani agreed. An event like Quecreek involves much more than just the mine. It involves the families of the affected miners, the news media and everything went on so well. Secretary Hess and Governor Schwieker being there on the site, from when from the emergency happened to when the miners were rescued and providing accurate information to the press and reassuring the families they are doing everything within their powers was most helpful. It is more than a mine rescue - it is a total community effort. How do we balance the legal

responsibilities of such agencies with the overall responsibility of individuals such as the Governor, the local and private rescue teams? How do we mount a total rescue effort? Mr. Ramani is looking forward to Mr. Smith's input on these issues.

Steve Kravits believes the agenda at hand will be difficult to accomplish in 2 months. Target Drilling's position is to get involved when a mine calls them to see if they can employ accurately placed in-line directionally drilled boreholes. Target Drilling has demonstrated accuracy within a few feet. As far as assessment of systems technology Target Drilling was pleased with the outcome of Quecreek. Mr. Kravits wishes that the Quecreek operators had known about our technology. He would like to work with other agencies, including MSHA, to see if there are ways to improve their technology. Maybe different techniques can be employed or merged with what we have done. Target Drilling employs technology that adds additional insurance, basically saving lives. Mr. Ramani pointed out that horizontal drilling in mines has made tremendous advances within the last 15 years. It has aided in trying to locate faults and voids in mines, particularly in longwall mines to vent gas. The question really comes down to the perception of a hazard in order to control a hazard. If we don't perceive that there is a hazard then we don't take the precautions needed. The real question is: How can we increase the perception of a hazard? How can we verify and increase the reliability of data? Are there ways to make sure data is more reliable?

James Szalankiewicz noted he was involved in a situation in the late 1980s. In Western Pennsylvania a lot of coal seams outcrop at the surface. If a farmer needed a place to mine coal he went to the crop line and started to dig. Nobody ever mapped these little mines close to the coal crop line. He was involved in hitting one of these mines in the late 1980s, luckily, without a lot of water like Quecreek. One problem is small country coal mines that have not been mapped. The other problem is that there are maps everywhere. There are two primary locations that have maps, one being the Office of Surface Mining (OSM) and the other in McMurray. They are the first place to look but not the last place. The fieldwork in the initial permitting process when you go out to take water samples is a good time to look for signs of a mine opening. Western Pennsylvania is heavy with coal mines and we should be looking at this. The Commission needs to look at the mining laws and update the mapping procedures. Any new mine that is being set up should be required to be on the GPS system. Possibly old mines that are operating can be added on the system also. Regarding Steve's point about the technology, he didn't know about it. The Pennsylvania Coal Association (PCA) helps out if you are a member, but a lot of coal mine operators don't belong to the PCA. The Commission definitely needs to look at technology. Dr. Ramani agrees about the technology. The larger operators pick up the technology first. He would like to make the knowledge of technology widely available. Mr. Roberts believes the Commission should make the Governor aware of any suggested changes to mining laws since the Governor can have an active role in introducing legislation.

J. Scott Roberts believes there are a couple of charges the Commission needs to really look at. One is the validity of mine mapping and the availability of the maps. There are over 100,000 mines maps out there. There are also abandoned mine mapping issues and in Pennsylvania we have a lot of subsidence issues. Once we have that information - how do we judge its validity in making decisions in whether or not the requirements of law have been met to allow issuance of a permit? Mr. Roberts promised to get Mr. Szalankiewicz an interpretation of

the laws. Operationally we need to consider that once a permit is issued, if we are not sure where it is at, how do we deal with it. What design features do we want in that mine? Where, when and how do we want to test for that mine workings? How do we want our mine inspectors and certified mine officials that do examinations of mines to identify potential hazards? Training of the miners on what to do if something happens within the mine is definitely valuable. We need the folks who are directly involved in an emergency to be able to save themselves first to give everyone else a chance to get to them.

Dr. Ramani will meet with Tom Callaghan and Scott Roberts to provide a outline of the issues raised and see where they fit in relation to the tasks spelled out in the Executive Order.

V. Establish Dates/Times/Milestones for Future Hearing Details

Dr. Ramani began the discussion by stating he believes the Commission can have things wrapped up with two or three meetings. Mr. Roberts stated that the Governor is insistent that the Commission hold at least two public hearings. After the two hearings, Mr. Roberts offered the assistance of his staff to help put the draft report together due to the limited timeframe. Dr. Ramani agreed that there should be a central repository for the report but believes the members should write up their own areas so their input can be represented. Each of the members should look at what is the state-of-the-art in terms of the issues under discussion to their area of expertise. It can be a small write up. The members should look at where we are in 2002 compared to 1950. Second thing is the current state of the technology that can be applied. A review of the applicability of each technology or procedure to the task at hand, identification of the limitations of this technology, and finally, recommendations for the Commission. Reports should be forwarded to Mr. Callaghan before it is forwarded to the other members.

Dr. Ramani suggested the regulatory policies and permit review procedures for permitting mines adjacent to abandoned mines be handled by Mr. Roberts, Mr. Lamant and Mr. Szalankiewicz. Mr. Kohler should look into short-term and long-term issues in terms of miners training issues, potential water impoundment and things of that kind. Mr. Kohler offered to look into rescue and response. Dr. Ramani agreed and suggested Mr. Smith can help with another question that needs answered: Who is in charge during a rescue and response situation? Mr. Roberts mentioned that larger operations have a response team set up but smaller operators do not. The small operators do not have the resources. Mr. Harbert will look into the area of remote and in-seam geophysics. Mr. Roberts provided the Commission with copies of available products that have been sent to him since the Quecreek accident and a publication from the National Research Council, which is the most up-to-date copulation on geophysical methods that are out. Dr. Ramani also asked Mr. Harbert to look at the limitations of current geophysical methods.

Mr. Roberts suggested that one of the hearings be held in Somerset. A suggestion was made to tour the Quecreek mine. Mr. Roberts mentioned that the mine is still under MSHA control through an order issued on it but he will look into it. Mr. Roberts suggested having the first hearing on October 3 with the tour on October 2. If it is not feasible to tour the mine the Commission can tour the surface facility. Since the Commission has a wrap up date of mid-

November, Mr. Roberts suggested having the second hearing October 23 or 24 in a central location to include the concerns from anthracite industry. Dr. Ramani believes the Commission should have an open hearing where they can hear from interested persons and invited persons. A lot of people have indicated interest. The Commission can also recommend people they would like to hear from. The second hearing can be held to discuss what they have heard and receive feedback. Mr. Roberts suggested having the second hearing held in Harrisburg or possibly the Pottsville area. Dr. Ramani would like the members to provide their write-ups to Mr. Callaghan on October 24. Mr. Roberts suggested a half-day meeting on November 7 or 8 to go over the draft report and finalize it. Everyone agreed on November 7. Dr. Ramani invited the members to State College for the final meeting. He will make the arrangements.

Discussion turned to how to present the report. Dr. Ramani believes the report should be handed to the Governor first. If anyone has media calls they should refer them to Karl Lasher, who is one of the press specialists assigned to the Mineral Resources Deputate.

The Commission adjourned for lunch at 12:12 p.m.

VI. Public Hearing Details

Mr. Roberts would like the invited guests to provide members with a biography that way it will be on the record and the members can spend their time having the benefit of listening to testimony being able to enter into a dialogue with various experts. For the general public Mr. Roberts would like to know what their credentials are so we can assign weight to their testimony. Because of the short time frame the members should remain focused on the details at hand.

Dr. Ramani, at the Somerset meeting, would like to hear from representatives of miners. Would like them to express what the miners think the Commission should know such as what they experienced. The Commission should advertise and invite them to sign up. He has received calls from a mine engineering consultant in Indiana who has some comments on the permitting procedures. If someone really has substantial comments they should submit it in writing so the members can provide comments. Dr. Ramani would like to hear from DEP and MSHA on how they do things. Would like to identify miners and miner's representatives to provide their comments. Then the members can review the written documentation. If anyone has a person they would like to hear from submit their name to the members and they can set aside time for them to be heard. Mr. Heilman brought up to the members that Barb Sexton would like to have the hearing published in the PA Bulletin as well as the local newspaper. The special requirements should be noted in the notice.

Mr. Kohler suggested that if the members invite someone they should express specifically what they are interested in hearing.

Mr. Szalankiewicz would like to hear more about the reserve of coal and the best effort to find coal.

Mr. Kravits would like someone from DEP to explain what they look for when approving a permit. Mr. Roberts mentioned that we should hear from Deep Mine Safety and MSHA also

because they provide separate authorizations. Dr. Ramani is interested in hearing from the Pennsylvania Geological Survey to discuss the latest advancements in mapping procedures. Mr. Roberts suggested someone should do a presentation on scanning and digitizing older maps. Mr. Szalankiewicz believes we need a central repository for older maps. Mr. Harbert is also interested in the maps because there are issues of offsets between maps, sometimes as much as 100 feet. Dr. Ramani agreed. We need maps to be consistent and maps need to be validated. Virginia has all maps digitized already.

Mr. Roberts also mentioned that Rick Lohr would like to address the Commission. Rick Lohr was the first person on site when the Quecreek accident occurred. Dr. Ramani would like to hear from people who were involved with the Somerset County rescue. They have been involved and can contribute a different perspective.

Mr. Roberts would like to have someone who does pre-shift inspections to find out what they look at when they do the inspection. Do they make note of water, if so, what do they look for. Dr. Ramani agreed. What is their hazard perception, such as wet bottom or wet roof.

Mr. Kirby would like to see someone from training. He heard someone say that the miners at Quecreek were well trained. How do they train them? Do they train them specifically in mine voids? Dr. Ramani recommended someone from NIOSH do a presentation. How will the events of Quecreek affect training in future training programs? Training should be up-to-date. Dr. Ramani recommended the members should look at training as to anticipated hazards. How do you anticipate a hazard and how do you respond. Mr. Roberts would like to know what miners are told to do if they are trapped. Mr. Lamont said that specific training is done in the 40 hours training course. Dr. Ramani pointed out that in the United States miners are taught to escape first. If the miner can't escape they are taught to go to the highest point in the mine and if they can't to make noise such as hitting the roof.

Next question is about best engineering practices to be used in the design and layout of modern mines adjacent to abandoned mine workings. The members would like to find out how small mines get that data and how they are laying out those mines. With regard to regulatory policies and permitting procedures the members need to know what they are looking at. Should have a speaker from Bureau of Surface Mining and Reclamation and perhaps MSHA. How do they perceive precautions such as water flow or wet roof. Dr. Ramani would like to have some people from the mining industry who have experienced such conditions. Dr. Harbert suggested someone from Department of Energy. Dr. Ramani agreed. Next subject is the inspection of the mine. What do inspectors look for and how do they tie it back to a permit application and operating procedures. Mr. Roberts mentioned the Mr. Lamant has copies of the MSHA report from the Quecreek Mine. The report includes mine inspector's notes. Mr. Lamant would like to hear from MSHA on how they react to the inspectors notes and how do they act on it. Suggested Kevin Strickland. Mr. Szalankiewicz stated that MSHA really doesn't get involved. The burden has been placed on DEP and the mine operators. Dr. Ramani believes this is a good set of speakers. The members are to e-mail Dr. Ramani and Mr. Roberts if any other speakers come to mind.

VII. Update on Status of Quecreek

Mr. Callaghan provided a copy of maps from the Quecreek and Saxton Mines. Mr. Roberts explained the maps to the members. On sheet 1 or 4 in the gray area shows where the breakthrough occurred. A copy of a map that was found in the Windber Mine Museum. There is an investigation being done by MSHA and DEP to look at the circumstances of what happened at the breakthrough. MSHA is probably not going to look into the response and rescue. The area that is shown on the Saxton map went from 4 entries down to 2 entries. The continuation of two entries is not shown at all on the map we have. On the little map if you go to the second complete crosscut by Station 211, there is a blind crosscut that is not on this map is where the accident happened. There was a lot of additional mining by the Saxton mine into the reserve that Quecreek thought they had purchased from other people in the past. Since the rescue took place pumping has continued. On Monday after the accident DEP staff started looking into what the effects of the pumping were and by Tuesday they had a pretty good indication that we needed to do something. Then it was a matter of trying to sort out the MSHA order. DEP ordered Quecreek to stop pumping until they provided treatment. Quecreek complied. The discharge from the Saxton mine never dried up so there is still a discharge from that mine. MSHA has completed its interviews with the miners who were trapped in the mine, the officials of the mining company; the engineers who put together the mining company's permit application and others. Next step that MSHA is proposing is having an independent survey done of the Black Wolf operations up to the breakthrough and perhaps the Saxton mine. Mr. Roberts expects MSHA to have preliminary results by mid-November. He is hopeful he can provide those reports to the Commission members. Cost of the rescue is being worked out at this time. DEP is going to sit down and try to mediate these fees. At this time, DEP is going over the Annual Reports comparing what data is on the last map from the mine with our production records. The Governor has directed DEP to order other mines that are adjacent to mine workings. 19 mines are adjacent to abandoned mines out of 29 total permits that were adjacent to other mine workings. 8 of those mines are adjacent to active mines. 1 of the mines has declared bankruptcy so no order was issued. DEP is expecting the companies at 500 feet to give us some reason to believe why they mapped those old mine mappings where they are. On the Quecreek map there is no indication where the information came from. Mr. Szalankiewicz pointed out that the map is only a projection map, which is not unusual. The mine was designed not to have permanent discharge. The key question is how much reliability are we placing on the data we are using to plan our mine. Mr. Kirby will provide the members with a copy of a report done by Skelly & Lloyd titled "*Guideline to Mining Near Water*".

VIII. Format of the Report

A suggestion from Dr. Ramani is to have separate bullet items in the Executive Order and develop a question related to it. Then provide a discussion of the issue and a response to that question. The Commission can develop two or three questions and using Quecreek as a guideline to develop those questions. There can be other reasons why we brought up this question. Then there should be a finding. The Commission can make suggestions and recommendations for those findings. The members can decide if there is a unanimous agreement or not. The recommendation can be more to look at things rather than what needs to be done. Mr. Callaghan will look at it and put it into a draft compilation of findings. Dr. Ramani and Mr.

Roberts will develop a list of questions and send them out to the rest of the members. If the members think the questions has to be modified or reworked let them know before the next meeting. Dr. Ramani asked the members to submit recommendations for people to speak.

IX. Discussion/Questions & Comments from the Public

George Ellis, from the Pennsylvania Coal Association (PCA), which is an organization who represents the coal operators in Pennsylvania. Their operators represent about 90% of the annual production from underground mines. Mr. Ellis request that at one of the hearings to provide an hour for PCA to have a panel of 3 or 4 people to address the 6 or 7 issues. Dr. Ramani stated that the Governor has already provided for a representative of PCA on the commission. Dr. Ramani will accommodate the one-hour request. Mr. Ellis wants the Commission to understand that oerational and regulatory issue are separate. One is the safety component done by PCA safety division and by Deep Mine Safety. The other is the permitting process that is more environmentally oriented and the Department addresses it differently. He believes one issue that needs to be addressed is to improve communications between the Bureau of Deep Mine Safety and the McMurray office. Mr. Kohler would like to have a labor organization to address the issues and get their perspective.

Mr. Kohler asked the members to reconsider the November 7 date. He would like to meet on November 6 instead. All the members agreed to meet on November 6.

Mr. Roberts will let the Commission members know more about the meeting in Somerset. He will provide more information on the tour of the Queecreek mine.

Mr. Ellis is agreeable with each of the hearing dates.

X. Adjourn

The Commission adjourned at 3:10 p.m.

MINUTES
The Governor's Commission on
Abandoned Mine Voids and Mine Safety Meeting
October 3, 2002
Holiday Inn, Johnstown, PA

The Governor's Commission on Abandoned Mine Voids and Mine Safety (Commission) was called to order at 4:30 p.m. by Dr. Raja Ramani. A list of the attendees are attached.

I. Accomplishments

The Commission noted that the Quecreek miners were invited to speak to the Commission and that the Commissioners provided to their Attorney Howard Messer as requested by Mr. Messer, over the phone, a list of questions for the miners to provide information to the Commission at the public meeting. The miners did not speak at the public meeting.

The Commission considered a request for a public meeting to be held at Somerset, PA during evening hours and agreed unanimously. The public hearing was set for the evening of October 22, 2002, and that another public meeting would also be held on October 23, 2002 in Somerset, PA if agreeable to UMWA and PCA.

It was unanimously decided that a formal request would be sent to the Assistant Secretary of Labor (Mr. Dave Lauriski) requesting any draft report that may have been prepared on its investigation of Quecreek Mine incident or any information, even preliminary, on MSHA's findings on the Quecreek Investigations. The Commission also noted that responses from MSHA have not been received to its request for speakers at the October 3 and October 9 meetings yet. It may be worthwhile to follow-up on this matter for the October 9 meeting in Pottsville, PA.

The members reviewed the document, which elaborated on the Governor's charge to the Commission and the list of questions under each of the tasks. Dr. Ramani indicated that the document on the tasks and the questions thereunder are privileged documents for the Commission's use only, and should be used as a guide to write the findings and conclusions of the report. The Commissioners were requested to review the list of questions for comprehensiveness, and add or delete questions, as required, for each task, and send the suggestions to Tom Callaghan as soon as possible.

Another privileged document, titled "*Report of the Governor's Commission*" was discussed. This document outlines the report format. The manner in which the report would be compiled from the inputs of the Commissioners was discussed. It was also indicated that the draft report would be reviewed in the Commission's meeting on November 6, 2002 in State College, PA.

It was decided that written statements would be requested from Bill Bookshar, Deep Mine Safety. It was noted that Bill Plassio, McMurray District Mining Office would provide the text of his statement.

The Agenda for the public meeting on October 9 was discussed. Tom Callaghan gave an idea of the speakers who had signed up so far. The Commissioners suggested a number of topics and speakers [e.g. GAI, D'Appolonia, OSM's mine map repository office, someone from PA EMA, etc.]

The Commission will meet again on October 10, 2002 in Pottsville, PA.

II. Adjourn

The Commission adjourned at 5:30 p.m.

MINUTES
The Governor's Commission on
Abandoned Mine Voids and Mine Safety Meeting
October 10, 2002
Pottsville, PA

The Governor's Commission on Abandoned Mine Voids and Mine Safety (Commission) was called to order at 9:40 a.m. by Dr. Raja Ramani. A list of the attendees are attached.

I. Discussion

Dr. Ramani began the meeting with a discussion about the November 6 meeting in State College. The meeting will be held to go over the draft report. He hopes to have the final draft done by November 8. Dr. Ramani would like the Commission members to arrive the evening before so that the meeting can start at 8 am in the morning. Lynn Brickett will make reservations at the Penn Stater and forward the information to the Commission.

Copies of the respective sections are to be sent to Tom and he will incorporate them into a draft copy.

The report should consist of the following sections:

Executive summary – should be no more than 2 or 3 pages summarizing the Commissions recommendations. This section can form the majority of the press release identifying the problems and our recommendations.

Section III – Background of Commissions appointment - brief description of other inundations. Description of other inundations have been supplied by James Lamont. It should not be to elaborate, just the idea that this is not unique to PA. Dr. Ramani will send information where hundreds of people have been killed. There was one incident in China the same time as Quecreek, another in the Ukraine, Australia, and New South Wales.

Section IV – Commissions task - where the Commission looked at the Executive Order to try to outline the scope of work, develop the questions. The questions are not cast in stone, can be reformatted or eliminated. Questions form the outline for the Commissions sake. The questions consist of the current state-of-the-art potential applications, limitations, etc. Chapter 6 should be written in this manner. Dr. Ramani, Mr. Roberts and Mr. Callaghan determined the questions and the Commission members were asked for feedback.

Section V – Commission activities and meetings – in the back of the report Dr. Ramani suggests that there should be an appendix. Appendix one can be the minutes of the meetings. The second appendix will consist of a list of information submitted to the Committee. Copies of the original documents will be maintained in the permanent record. The next appendix should contain a list of speakers and the meeting that they spoke at.

The Governor's Executive Order should also be included in the appendix.

The Commission should list the three or four major things that should be done to prevent this from happening in the future. Dr. Ramani referred to Mr. Kendorsky's comments about training. Good idea but the Commission needs to be looking into preventing this from happening in the first place.

The genesis of the problem starts with someone wanting a permit and submitting a map showing the area where they want to mine including the area of the abandoned mine. Dr. Ramani wants to keep the concept that when you apply for a permit you will identify your boundary and the abandoned mine. Permitting authority will look at the map and approve it or disapprove it. One area to look at is to have someone submit a map of the boundary of the abandoned mine, and then have it certified by someone as part of the permit application. The permit application then goes to the permitting authority. The question can also be: When the permit is given, how did the permitting authority look at the boundary and approve it?

Dr. Ramani handed out a document to the Commission members for discussion on the Commission's task. The document is marked as privileged and confidential. The members discussed the document at length.

The members discussed the questions that they would like to ask the nine-trapped miners. Copies of the questions were sent to their attorney, Mr. Messer, George Ellis from Pennsylvania Coal Association and Dave Rebuck. Question #3 addresses old mine workings and training, Dr. Ramani knows that Penn State provides training but does not provide inundation training. With regard to question #4, Dr. Ramani would like to know what action did miners take, what is the procedure for reporting changes in the condition of the mine and to whom do they report changes to?

Mr. Roberts suggested talking about past inundations at the Somerset public hearing to be held October 22-23 to find ways to prevent future problems.

Looking at the draft letter addressed to MSHA, Dr. Ramani suggested attaching the Executive Order so that he understands that we are looking at preventing future accidents and not Quecreek. Secondly, he doesn't want it to look like we are demanding the information. He wants them to look at the Order and see if they can provide any useful information. The letter will specifically request a copy of the full Saxman map.

Mr. Szalankiewicz mentioned that they are meeting on Oct. 21 with Senator Specter and others. Senator Specter wants to have a hearing on what went on at Quecreek. They are also meeting with MSHA to try to get some information.

The Commission next discussed the Commission's list of tasks and crucial questions in each of the following areas:

- 1) Best Engineering Practices (BEP) to be used in the design and layout of modern mines adjacent to abandoned mine workings.

Reference was made to the NAS report which deals with the subject of maps. Dr. Ramani believes that this issue was well addressed in this report.

- 2) Regulatory policies and permit-review procedures for permitting mines adjacent to abandoned underground mine workings.
- 3) Practices and procedures of mine operations in advance of mining to detect mine voids.
- 4) Training of mine workers who operated mines adjacent to underground mine workings.

Dr. Ramani will help with this. The basic complaint was that 8 hours of training is not sufficient. Now, compared to three years ago, there is training on dust sampling, noise, diesel fuels, etc.

- 5) Inspection and compliance of the mine operations with the approved mine plans and operating requirements.
- 6) Rescue and response procedures, including policies for sharing information with families of the miners affected by the accident.

The Commission ended the meeting with the concurrence that all writings are to be given to Mr. Callaghan by October 21. The members will have a chance to look at them before October 23. All materials should be sent to Mr. Callaghan by October 28 and between then and November 4 Dr. Ramani and Mr. Callaghan will be working to finalize. The November 6 meeting will start at 8:00 a.m. in State College. Ms. Brickett will notify the members once the date and times are set. Mr. Callaghan will work on draft Nov. 7 and 8. He will send the draft copy to everyone on the 8. The members will look over on the draft copy on Nov. 9 and 10 and by the Nov. 11 a final report should be done. Mr. Roberts will make arrangements with the in-house print shop so the report can include color pictures. The members should spend a great amount of time on the Executive Summary. Making suggestions on some things that DEP can do, some things that the mining company can do, identify technologies.

II. Adjourn

The Commission adjourned at 3:40 p.m.

MINUTES
The Governor's Commission on
Abandoned Mine Voids and Mine Safety Meeting
November 6, 2002
State College, PA

The Governor's Commission on Abandoned Mine Voids and Mine Safety (Commission) was called to order at 9:00 a.m. by Dr. Raja Ramani. A list of the attendees are attached.

I. Discussion

The meeting began with a discussion about the Commission's Task and Critical Questions. The members discussed what was sent to Thomas Callaghan. It was decided to discuss each task and review the final layout for the report. Below is the final approved layout for the report.

II. Task #1 Regulatory Policies Recommendations

Bullet Item Number 1

- Replace 200' standard with the site-specific evaluation
- Adopt guidelines for defining hazard zone
- Modernize statutes to accommodate current technology, eliminate prescriptive tone, share burden with operators
- Bureau of Deep Mine Safety (BDMS) more active role
- Search for 1911-1969 era final maps
- Give BDMS "approve/deny" authority on permits
- Modernize laws
- Consolidate anthracite and bituminous laws
- Allow for programmatic upgrades to keep up with technology
- Don't just mimic MSHA laws – pursue implementation of regulatory process w/ public involvement
- Increase mapping standards

Bullet Item Number 2

- Specific evaluation of application for "credible evidence"
- Create specific communication requirements between Bureau of District Mining Offices (BDMO) and BDMS on adjacent mines, mining plan and barrier pillar
- More active BDMS role in map verification
- Application should provide pillar design with certification by (non-operator) independent engineer with copies to State, Federal and County – written finding
- Establish BDMS procedures to reduce barrier pillars with public comments
- Specifically charge BDMS with safety review of application
- Evaluate application data based on veracity of known information. Establish procedures to reduce pillars in permit conditions

Bullet Item Number 3

- Create map repository and secondary location (county)
- Map on state plane system
- Create criteria for "final" maps
- Implement preservation program w/ archival conditions, photographic record, and electronic storage. Recommend finding fund source and add advisory board
- Develop database of production information
- Systematically search for additional maps. Deal with property rights.

- Catalog all known maps

Bullet Item Number 4

- Application list information source on maps
- Look at all data sources, provide to all interstate agencies

Bullet Item Number 5

- Technical Guidance Document on presenting map information
- Specific communication between BDMS, BDMO and applicant

Bullet Item Number 6

- Include MSHA as a “notified” agency

III. Task #2 - Best Engineering Practices Recommendations

- Surveys by closed loop
 - < Ties of 0°01'00”
 - Coordinate tie 1:10,000
 - Minimum distance established from final face (100’)
- Note elevation datum
 - closure ± 0.01ft/1000
- All mines tied to State Plan ('83)
 - Possible exceptions
- Mine foreman should not retreat before take-up
 - Note exceptions on map
- Note source of 2nd mining information on map
- Project to digitally store and geo-reference maps
 - Pilot project (AML funding)
- Develop database for mapping/production records
- Work with Office of Surface Mining
- Preservation and protection of maps
- Public advertising campaign asking for maps
 - Disney
- Develop “scale of certainty” during permitting
- Barrier designs are adequate if extents are known
- Addition of design mine guidelines
- Reference to National Academy of Science Book, Chapter 4

IV. Task #3 Practices and Procedures

- Location post 1911 map - task force
- Encourage use of physical methods to verify existence or non-existence of mine void
- Encourage further development of long-hole drilling technology in conjunction with geophysical technologies
- Technical guidance developed for long-hole drilling to expedite implementation (702)
- Recommend geophysical test be conducted under controlled protocol to approve technology (be specific)
- Encourage and develop alternatives 20’ drill holes to satisfy §224 B (Bituminous)
- Mine personnel made aware of and consequences of changes in H₂O chemistry, etc.
- Encourage development and implementation of “state of the art” two-way communication

V. Task #4 Inspection Frequency and Type

- Inspectors understand veracity of maps
- Pay attention to changes in mine conditions indicative to old mine workings
- Examine use of chemistry as a diagnostic tool
- Verify and document approved plans for locating old works are being followed
- Encourage regular and effective communication between state and Federal inspectors along with company management and labor representatives
- Make sure historic information is shared between agencies
- Assess mines as the move toward abandoned mine with additional inspections/ evaluations to ensure advance holes are drilled

VI. Task #5 Training

- Develop an “inundation” module for use at medium and high risk mines
 - Safety talk or tailgate training format
- Develop a “continuing education” module for mining professionals/managers/inspectors

- Link to Emergency Response
 - Continue command center training
 - Continue “emergency communications “triangle” module

VII. Task #6 Emergency Response

- Adopt IMS as statewide standard
- Train rescuers, operators, and responders in IMS
- Coordinate-communicate-exercise-evaluation of IMS
- Support Mutual Aid legislation
- Support site security initiatives
- DEP establish responder fund
- Adopt UA 800 standards for families
- Ensure local agencies receive mine rescue awareness training.
 - Alarming drop in rescue and response personnel in Pennsylvania

The following items were approved by unanimous vote by:

Dr. Ramani
William Harbert
Frank Kirby
Jeff Kohler
Steve Kravits
James Lamont
J. Scott Roberts
David Smith
James Szalankiewicz

RAJA V. RAMANI, P.E., C.M.S.P.

Commission Chair

Dr. Ramani holds the emeritus of the Anne B. and George H. Jr. Deike Chair in Mining Engineering at the Pennsylvania State University where he has been on the faculty since 1970 and is a professor emeritus of Mining and Geo-environmental engineering. His professional activities include 6 years of experience in the coal mining industry, and 34 years of research on flow mechanisms of air, gas, and dust in mining environs, innovative mining methods, and health, safety productivity, and environmental issues in the mining industry. Dr. Ramani has been a consultant to the United Nations and the World Bank and has received numerous awards from academic and technical and professional societies. He was the 1995 president of the Society for Mining, Metallurgy, and Exploration, Inc. and served on the U.S. Department of Health and Human Services' Mine Health Research Advisory Committee (1991-1998). He was a member of the Department of the Interior's Advisory Board to the Director of U.S. Bureau of Mines (1995), and a member of the Secretary of Labor's Advisory Committee on the Elimination of Coal Workers' Pneumoconiosis (1995-1996). He was the chair of U.S. National Academy of Sciences' Committee on Post Disaster Survival and Rescue (1979-1981), and served on the NAS Committee on Mining Technologies (2000-2001), NAS Committee on Coal Waste Impoundments (2001-2002), and the Health Research Panel of NAS Committee on the Research programs of the U.S. Bureau of Mines (1994).

WILLIAM HARBERT, Ph.D

Mr. Harbert is the Chair of the Department of Geology and Planetary Science at the University of Pittsburgh, an ORISE Research Associate at the U.S. Department of Energy National Energy Technology Laboratory, Research Associate of the Carnegie Museum of Natural History, Associate Member of the Penn State Astrobiology Research Center and an Adjunct Faculty of Russian and Eastern European Studies at the University of Pittsburgh. He completed undergraduate degrees from Western Washington University in Geophysics and Geology-Mathematics, Masters of Science and a Ph.D. in Geophysics from Stanford University. He has authored or co-authored 27 scientific articles, the textbook "Planet Earth and the New Geosciences" (presently in the Third Edition), and 81 scientific abstracts. He and his students actively use Geophysics, Geographical Information Systems, and other methods to study many topics including abandoned mines.

FRANK R. KIRBY, P.E.

Mr. Kirby holds a B.S. in Mining Engineering from West Virginia University. He is a registered Professional Engineer in Pennsylvania, West Virginia, Virginia, Maryland and Kentucky. Additionally, he is a registered Licensed Land Surveyor in West Virginia.

Mr. Kirby has twenty-four years of experience in coal mine engineering and operations management in the Appalachian Coalfields. Mr. Kirby is currently employed as a Senior Mining Engineer and Project Manager for Skelly and Loy, Inc. in Harrisburg, PA. Prior experience includes working for three coal companies. While at Mettiki Coal Corporation he was Manager of Engineering and during employment with Anker Energy Corporation he held the position of Mine Superintendent along with Senior Mining Engineer at their corporate office. Mr. Kirby held numerous positions while working with Westmoreland Coal Company including Manager

of Engineering, Senior Mining Engineer, Resident Engineer, Mining Engineer (Corporate Staff) and Shaft Engineer.

JEFFERY L. KOHLER, Ph.D., C.M.S.P

Dr. Kohler is the Director of the Pittsburgh Research Laboratory (PRL) of the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (CDC NIOSH). CDC NIOSH is the federal agency responsible for conducting mine safety and health research, and the PRL is internationally renowned for its work in all areas of mining safety and health, including the programmatic areas of training, and emergency response and rescue. Dr. Kohler holds a B.S. in Engineering-Science, and M.S., and Ph.D. degrees in Mining Engineering, all from the Pennsylvania State University.

Prior to his appointment as Director of the Pittsburgh Research Laboratory in 1998, Dr. Kohler was an Associate Professor of Mining Engineering and Director of the Mine Electrical Laboratory at Penn State. While on the faculty he taught courses and conducted research in several areas including electrical systems, materials handling, ventilation, quarry engineering, and mining methods. Prior to joining Penn State in 1981, Dr. Kohler worked for KETRON, as Manager of the Mine Systems Department. Up until the time of his appointment with NIOSH, he provided consulting services to the coal and stone mining industries. He has written numerous publications, and continues to conduct research and publish in the areas of mining safety and health.

Jeffery Kohler is a senior member of the Institute of Electrical and Electronics Engineers (IEEE), a member of the International Society of Explosives Engineers (ISEE), the International Society of Mine Safety Professionals (ISMSP), and the Society for Mining, Metallurgy, and Exploration (SME). Dr. Kohler serves on the board of directors of the National Mine Rescue Association (NMRA), the Global Mining Research Alliance (GMRA), the International Directors of Safety (DS), and the Pittsburgh Coal Mining Institute of America (PCMIA).

STEPHEN J. KRAVITS

After graduating from Slippery Rock University and the University of Pittsburgh with a Bachelor of Arts Degree in Physics and Bachelor of Science Degree in Mining Engineering in December 1980, Mr. Kravits started employment with the U.S. Bureau of Mines' Ground and Methane Control Group in January 1981. As a Technical Project Engineer he directed in-mine methane drainage projects developing directional drilling (downhole motor) techniques and supervised one of the first in-mine uses of a downhole motor and the development of a permissible Preproduction Wireless Survey System for in-seam methane drainage boreholes. In March 1990, Mr. Kravits left the Bureau of Mines to accept a job at REI Drilling, Inc. to serve as Vice President and Operations Manager where he expanded in-mine horizontal drilling capabilities from two (2) men and one (1) drill to eight (8) men and four (4) drills. Mr. Kravits was responsible for marketing, designing and managing in-mine coalbed horizontal directional drilling degasification projects to utilize coalbed methane, abandoned mine gas, and gob gas resources and for water drainage, coalbed exploration, and for identifying the locations of abandoned mine works. Mr. Kravits was responsible for the directional drilling of the first 4,000-foot long in-mine horizontal borehole in the U.S.

In March 1995, Mr. Kravits left REI Drilling to establish AMT Drilling International, Inc. as an in-mine directional drilling contractor using the DDM MECCA real-time borehole surveying system to directionally drill boreholes greater than 4,000 feet. In March of 1998 AMT Drilling International, Inc. changed its name to Target Drilling Inc. As President of AMT Drilling and Target Drilling Inc. he has been primarily responsible for growing the company to 31 employees and eight (8) drill rigs, including six (6) underground horizontal drill rigs, one (1) vertical surface rig and one (1) surface horizontal utility drill rig. His responsibilities include day-to-day financial management; marketing; establishing goals and objectives to maintain the direction of company while managing operations in in-mine gas recovery, abandoned mine verification, coalbed exploration, dewatering, surface construction utility and surface directional horizontal drilling businesses. To date, Target Drilling has directionally drilled >1.3 million feet of in-mine horizontal borehole including 59 boreholes greater than 4,000 feet long emphasizing accurate borehole placement accuracy to within ± 1 degree using its six (6) DDMs. To date Mr. Kravits has published 14 technical articles.

JAMES P. LAMONT

Mr. Lamont is presently employed by the International Union, United Mine Workers of America as an International Health and Safety Representative and has held this position since February of 1996. In this capacity, he is responsible for the Health and Safety of the members in the state of Pennsylvania and New York. Mr. Lamont also spent 8 months in New York City as coordinator of the corporate campaign.

Prior to this position, Mr. Lamont held positions at the Tanoma Mining Company and Barnes and Tucker Coal Company. At these facilities, he held various positions including: mine helper, timberman, shuttle car operator, rock operator, roof bolter operator and mine examiner. Mr. Lamont was elected as Chairman of UMWA Local 2494 Safety Committee, Mine Committee, Organizing Committee 1983 to 1989.

Mr. Lamont possesses numerous mine-related certificates including: Bituminous Miners, Bituminous Shot Firer, Bituminous Cutting Machine- Loading Machine- Drilling Machine Operator, MSHA Surface & Underground Qualified for Methane and Oxygen detection deficiency, Gas detection, Mine Examiner.

Mr. Lamont's formal education includes: classes at the Cleveland Institute of Electronics, MSHA forty (40) hour inspector training, Continuing education at Saint Francis College, and has attended numerous classes at the MSHA Academy in Beckley, WV. He is currently pursuing a Baccalaureate Degree at Indiana University.

Mr. Lamont has significant experience teaching various classes including: joint management-Union classes (JITC), UMWA miner safety training classes at the MSHA Academy which include: Mine Act/ Miners rights, Roof Control, Fire Protection, Ventilation, Mine Emergency Response Development (MERD), Accident analysis and prevention program, Interpersonal communication/ team building, role and responsibilities of Mine Safety and Health Committeemen. (These are inclusive for underground mines, surface mines and related facilities). Additionally, he conducts quarterly safety meetings and seminars for all coal and non coal operations he represents and assisted in annual refresher retraining, and in all other aspects of 30 CFR part 48 training.

J. SCOTT ROBERTS, P.G.

Mr. Roberts is Deputy Secretary for Mineral Resources Management in the Department of Environmental Protection (DEP). In this executive management position, he oversees five program areas, encompassing 580 employees, with an annual operating budget of \$110 million. Mr. Roberts is responsible for the policies and programs that regulate or impact mineral extraction -- coal, industrial minerals, and oil and gas -- as well as the occupational health and safety programs for underground miners. The direct economic impact of these programs in Pennsylvania exceeds \$2 billion annually. Gov. Mark Schweiker named Mr. Roberts to this position on Feb. 12, 2002.

Mr. Roberts served as director of DEP's Bureau of Mining and Reclamation for two years, where he developed and revised Pennsylvania's mining regulations, oversaw federal grants, administered operator assistance programs and served as chairman of the board for Pennsylvania's Mine Subsidence Insurance program. Mr. Roberts previously served as Permits and Technical Services Chief in DEP's Greensburg District Mining Office.

Mr. Roberts is a native of Johnstown, Cambria County, and once served as curator of the Johnstown Flood Museum. He is a Registered Professional Geologist, with degrees from the University of Pittsburgh and California University of Pennsylvania.

DAVID L. SMITH

Mr. Smith became the Director of the Pennsylvania Emergency Management Agency on December 1, 1999, upon appointment by Governor Tom Ridge. He was reappointed to the position on October 6, 2001, by Governor Mark Schweiker.

In October, 2001, he was named to chair the Governor's Task Force on Security that developed a comprehensive assessment and set of recommendations regarding the commonwealth's homeland security. In December, 2001, he was appointed to the Governor's Security Council and currently serves as a member of the Governor's Security Cabinet.

Prior to becoming PEMA Director, he had served as State Fire Commissioner, a position to which he was appointed in January, 1995. During his tenure in that position, he oversaw the transformation of the Office of Fire Safety Services into the independent Office of the State Fire Commissioner.

Mr. Smith brings has extensive, hands-on background that includes service as an educator, firefighter, emergency medical technician, rescue instructor, 911 supervisor and trainer, police officer, municipal manager and regional planner.

He is a native of Northumberland County, Pennsylvania.

JAMES J. SZALANKIEWICZ, PE, PLS

Upon graduation from Pennsylvania State University in 1971, Mr. Szalankiewicz was employed by the National Ocean Survey (formerly the Coast and Geodetic Survey) as a Survey Technician and was responsible for providing survey control for the mapping of Delaware Bay. He was

later assigned to an airport survey party and was responsible for surveying and mapping of airport obstructions throughout the northeastern United States.

In October of 1971, R. B. Shannon and Associates of Kittanning, Pennsylvania employed Mr. Szalankiewicz as a surveyor. His duties involved topographic, engineering and property surveys as well as underground surveying in both bituminous and limestone mines.

In February of 1972, Mr. Szalankiewicz was employed by the Rochester and Pittsburgh Coal Company of Indiana, Pennsylvania. His positions at R & P consisted of Mine Surveyor, Mine Draftsman, Resident Engineer and Mine Planning Engineer.

In January of 1982 Mr. Szalankiewicz left R & P to become Chief Engineer for Darmac Coal, Inc. and Darmac Associates Corporation. Mr. Szalankiewicz responsibilities at Darmac included permitting, exploration, surveying and mapping, mine development and planning, operations and reclamation. In October of 1988 Adobe Mining of Grove City, Pennsylvania purchased Darmac. His duties as Chief Engineer for Adobe Mining were the same as at Darmac.

While employed at R & P and later Darmac Mr. Szalankiewicz was a part-time instructor for several years at the New Kensington Campus of the Pennsylvania State University where he instructed a course in Mineral, Land and Mine Surveying.

In March of 1991 Mr. Szalankiewicz terminated his employment with Adobe to fulfill his obligations as part owner of T.J.S. Mining, Inc. of Shelocta, Pennsylvania. T.J.S. presently operates four underground mines and a coal preparation plant. Mr. Szalankiewicz's daily duties at T.J.S. include engineering, mine planning, surveying and mapping, exploration, operations and human resource management.

Additionally, Mr. Szalankiewicz is a member of several professional societies including: Mining, Metallurgy and Exploration – SME, Pittsburgh Coal Mining Institute of America, Pennsylvania Society Professional Engineers and National Society of Professional Engineers.

DEP STAFF

LYNN A. BRICKETT

Ms. Brickett is currently a project manager in the Environmental Projects Division at the U.S. Department of Energy/Office of Fossil Energy's National Energy Technology Laboratory (DOE-NETL). She also serves as the Technical Focal for the coal utilization by-product (CUB) research area. In this capacity, she reviews proposals, recommends research to be funded, manages and coordinates on-going work and plans research for the future. Ms. Brickett also manages research in the areas of mercury emission control, carbon sequestration and bioremediation of BTEX contaminated soils.

Ms. Brickett has been with DOE-NETL since 1998 where she conducted research on increased utilization of coal utilization by-products and also biological toxicity studies of CUB. Prior to joining NETL, Ms. Brickett worked for the U.S. Bureau of Mines as a Research Biologist. In this position, she conducted studies on biological treatment of acid mine drainage, biooxidation of gold ores, bioleaching of copper ores and bioremediation of contaminated soils and sediments from metal smelting operations.

Ms. Brickett has a Bachelor of Science degree in Environmental Sciences from California University of Pennsylvania. She also has a Masters degree in Environmental Science and Policy from Duquesne University.

THOMAS CALLAGHAN, P.G.

Mr. Callgahn is a hydrogeologist with the Pennsylvania Department of Environmental Protection, Bureau of Mining and Reclamation and is a registered professional geologist in Pennsylvania. He received a B.S. in geology from La Salle University. His current duties include, providing technical support to the Department's permit review staff in the areas of underground mining and coal refuse disposal, acting as a technical expert in litigation cases, conducting reviews of district office complaint investigations, and drafting regulations, technical guidance documents, and policies to support the Commonwealth's six district mining offices in their permitting and inspection duties.

MICHAEL J. HEILMAN, Esquire

Mr. Heilman is an Assistant Regional Counsel in the Department of Environmental Protection, Southwestern Region Office of Chief Counsel. Since joining the office of Chief Counsel in 1987 Mr. Heilman has primarily practiced in the areas of mining and air quality. He received a B.S. in Civil Engineering from the University of Notre Dame in 1980, a J.D. from Duquesne University Law School in 1985, and Masters of Engineering degree in Environmental Pollution Control from Penn State (Harrisburg) in 1998. He is also a registered Professional Engineer in Pennsylvania. Prior to joining the Office of Chief Counsel, Mr. Heilman clerked for the Honorable William D. Hutchinson then of the Pennsylvania Supreme Court (1985-87).

KARL LASHER

Mr. Lasher is an Information Specialist within the Pennsylvania Department of Environmental Protection's Office of Policy and Communications. He handles press and public relations concerns for Mineral Resources Management within DEP and was assigned to handle press relations for the Governor's Commission on Abandoned Mine Voids and Mine Safety. Lasher has worked for DEP since July after working for seven years in the print and broadcast media in Pennsylvania, New York and Maryland. He also has experience working for a video/multimedia production company in Harrisburg.

MEMO

To: Scott Roberts

From: James P. Lamont

Date: 11-15-02

Subject: Signature on Final Report

By this letter I am officially advising you that I can not sign off on the “Governors Commission on Abandoned Mine Voids and Mine Safety” final report for the following reasons:

First, the report in my opinion, fails to address three very important issues that are needed to protect coal miners in the state of Pennsylvania.

1. It gives the clear appearance of removing the 500’ buffer next to abandoned mines, implemented by Governor Schweiker following the Quecreek accident. That 500’ distance added an extra margin of safety to prevent another Quecreek mine accident. The Commission report replaced these enhanced protections for miners, with the pre existing 200’ distance that was in effect at the time of the Quecreek accident.
2. Does not call for ending the practice of having miners drill into a block of coal for a distance of 20’ in advance. This practice can leave the possibility of only a thin 10’ distance between the miners and a lake of water or other inundation hazard. The Commission report only encourages alternatives to that hazard. Evidence however shows that drilling can and is being accomplished for thousands of feet in Pennsylvania coal mines. This long distance drilling can place miners in a safe location.
3. Fails to straight forwardly require or refer to a specific method of physically validating and verifying the boundaries of the coal block to be mined and adjacent mine and voids. The report appears to give too much reliance on mine maps (that, for a number of reasons can be faulty) and other unexplained evidence.

During the past week, commission members were flooded with many documents in a mad rush to complete this report. The end result was a confusing document that can be read and interrupted in different ways. With the Chairman leaving the country, leaving DEP in charge to finalize the document, I believe this left the Commission at a disadvantage in resolving some of the issues such as those in which I have raised.

The Commission also did not have the opportunity to review and address the final reports from MSHA, or the State of which I raised concern about throughout the process. In addition, the Commission also did not have the opportunity to talk with and question the mine operator from Black Wolf, and the opportunity to talk with the 9 miners involved in the accident was unfortunately declined. The Commission on numerous times requested from the State an explanation, and interpretation of section 236 of the State Law. This never did materialize.

The report referenced many good points that were addressed at the public meetings. It did not address, what went wrong at Quecreek. There is much to be examined in the wake of the Quecreek accident. While some questions have been answered, many have not. I believe the States preliminary report did not depict the events that led to the accident at the Quecreek mine. For one thing, testimony from the miners on the events that took place prior to the accident contradicts the state preliminary report.

In closing, I do not feel comfortable placing my signature on a report that has such missing evidence and information that is fourth coming, and a report that does not address the solutions that are needed to protect the miners in this state.

James P. Lamont
James P. Lamont

Commission on Abandoned Mine Voids and Mine Safety

Raja V. Ramani, Ph.D., P.E., CMSP, *Chair* (Penn State University)

William Harbert, Ph.D. (University of Pittsburgh)

Frank R. Kirby, P.E. (Skelly & Loy Consulting Engineers)

Jeffery L. Kohler, Ph.D., CMSP (National Institute for Occupational Safety and Health)

Steve Kravits, (Target Drilling, Inc.)

James P. Lamont, (United Mine Workers of America)

J. Scott Roberts, P.G. (Pennsylvania Dept. of Environmental Protection)

David L. Smith, (Pennsylvania Emergency Management Agency)

James J. Szalankiewicz, P.E., PLS, (TJS Mining)

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