

**Independent Review of MSHA's
Actions at Crandall Canyon Mine
Genwal Resources, Incorporated
Huntington, Emery County, Utah**

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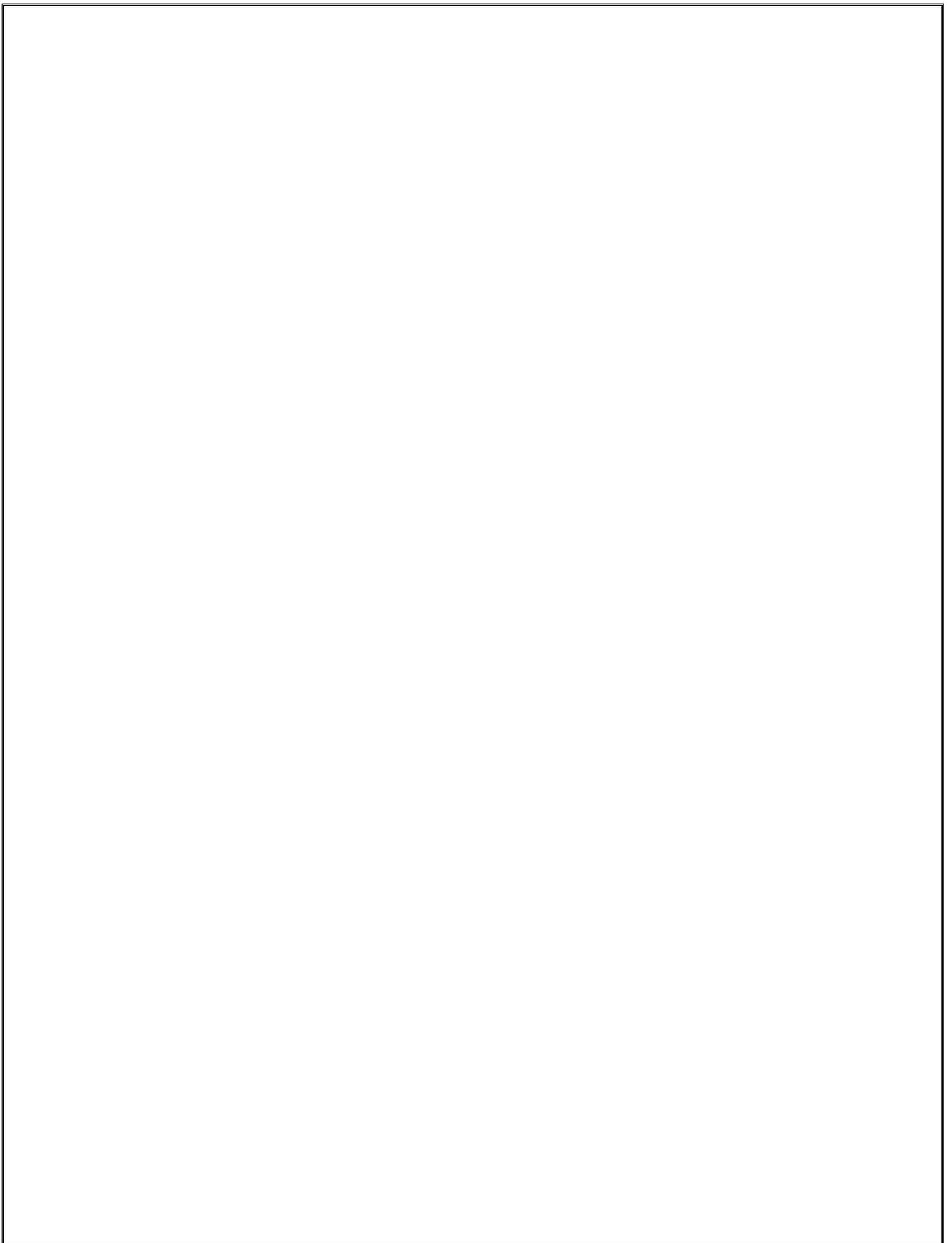
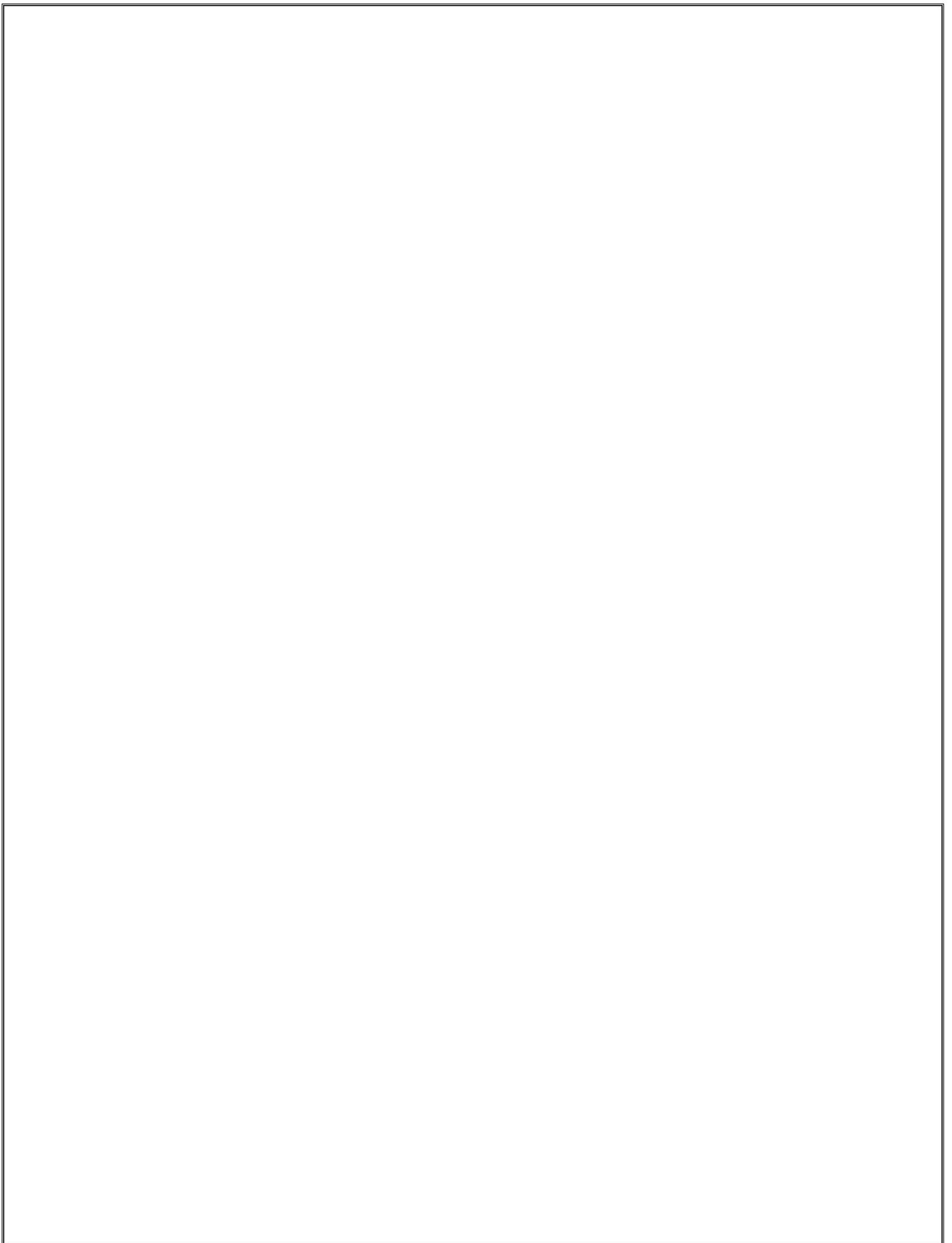


Table of Contents

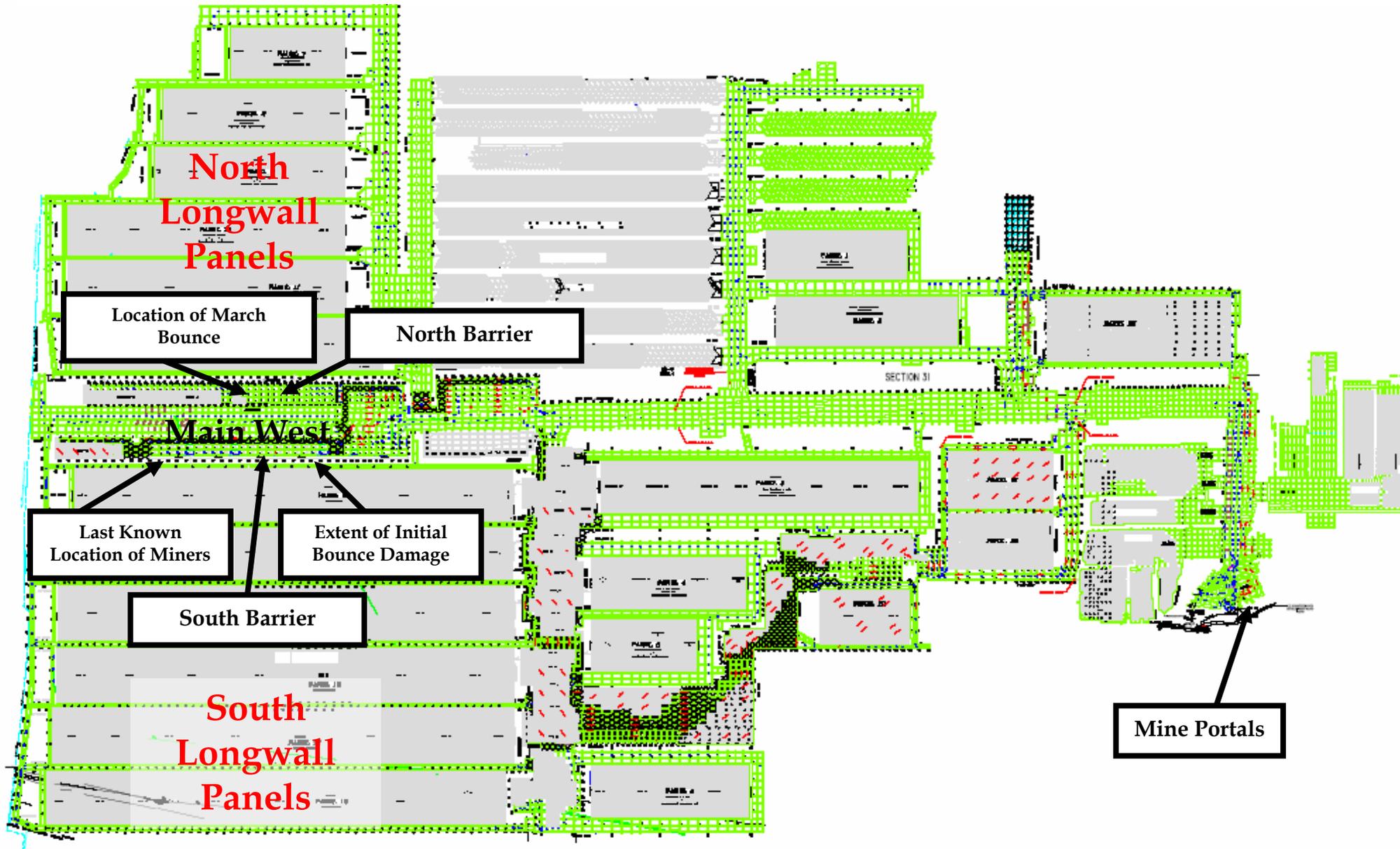
<u>REPORT SECTION</u>	<u>PAGE</u>
CRANDALL CANYON MINE MAP	
INTRODUCTION.....	1
EXECUTIVE SUMMARY	2
BACKGROUND	7
BLM Inspections of Crandall Canyon.....	8
ACCIDENT OVERVIEW	9
The Accident on August 6, 2007.....	9
The Rescue Attempt.....	9
The Subsequent Accident on August 16, 2007	10
The Aftermath.....	10
MSHA’S ACTIONS PRIOR TO AUGUST 6, 2007.....	12
Crandall Canyon Mine Roof Control Plan Approval.....	12
Plan Approval History at the Crandall Canyon Mine	12
Plan Approval History for Mining in the North and South Barriers	13
Plan Approval Deficiencies Identified by the Independent Review Team.....	17
1) Inadequate evaluation of the engineering data submitted by the operator to justify mining in the North and South Barriers	17
2) Inadequate resolution of the inconsistencies identified in the engineering data that was submitted to justify mining in the barriers	20
3) Failure to properly consider the impact of the March 10, 2007, bounce in the North Barrier section prior to approving retreat mining in the South Barrier section	22
4) Failure to observe and evaluate pillaring operations.....	24
5) Contradictions between approved plans and supporting data submitted to justify approval.....	25
6) The adequacy of the required six-month plan reviews	27
7) Field personnel not involved in plan approval process	29
8) Assistance from Technical Support not requested	30
9) Contradictions between approved Roof Control and Ventilation Plans	31
Inspection Activities at Crandall Canyon Mine	33
Section 103(a) Inspections	33
Handling of Complaints.....	35
Erroneous Dates on E01 Event # 4474428 Documents	37
Inspection of Mine After March 2007 Bounce	38
Inspection of North and South Barrier Sections.....	40
Enforcement of § 75.223(b).....	42
Respirable Dust Survey Collections	42
DIRECTION AND ACTIVITIES DURING THE RESCUE ATTEMPT.....	44
MSHA’S Response to the Accident on August 6, 2007	44
Command Center	47
Central Command Center	47
MSHA Person-in-Charge of Mine Rescue Efforts.....	48
Communications	51
Briefings.....	51
Debriefings.....	52
Transportation.....	55
Underground Phone Communication System.....	56

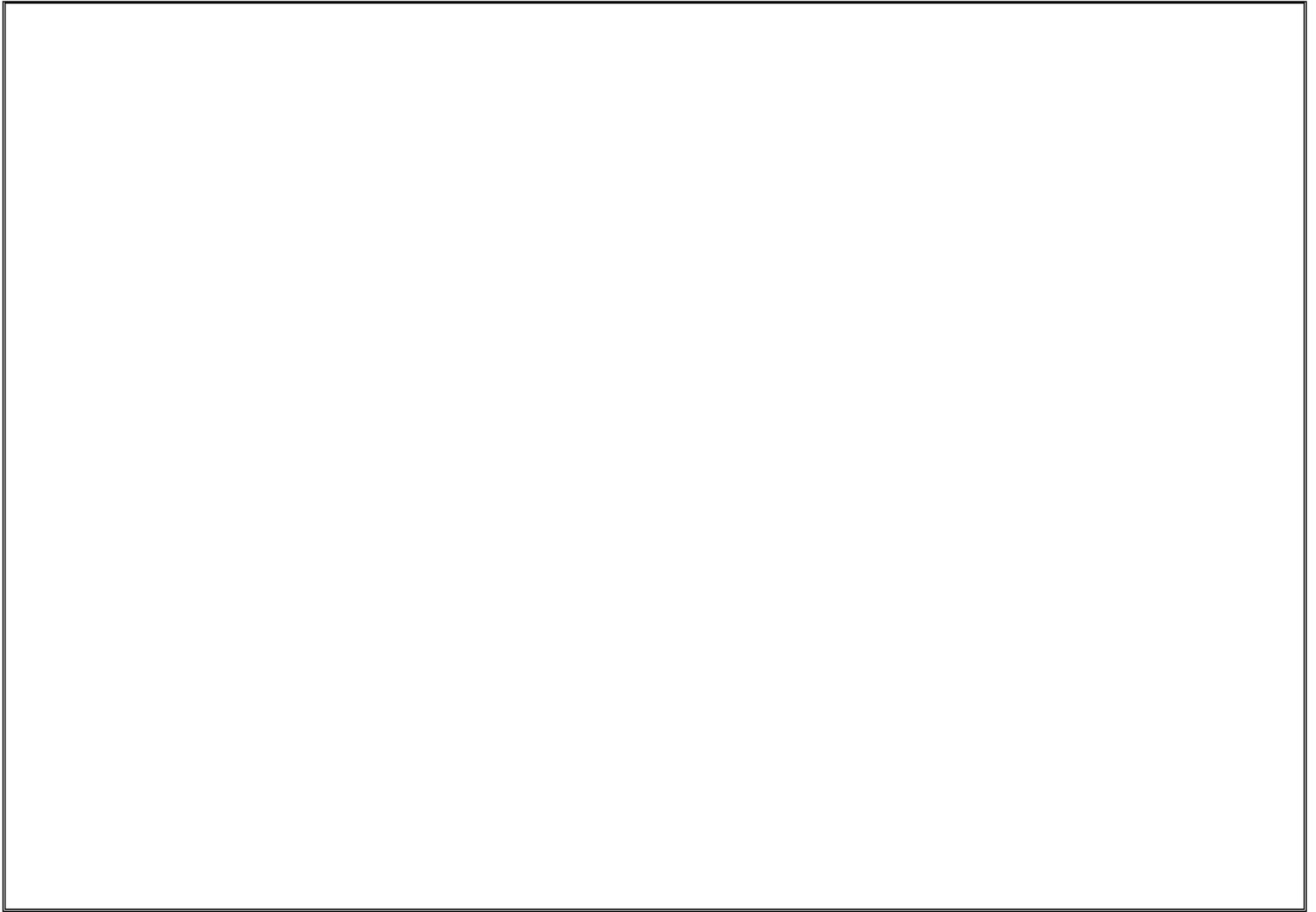
Protective Ground Support Used During Rescue Effort.....	58
Independent Review Team's Findings.....	60
Confidence in the Support System	63
Limitations of the Support System and Failure on August 16 th	63
Section 103(k) Order	65
Initial Issuance of § 103(k) Order	65
Non-Compliance with § 103(k) Order.....	67
Allowing Media Underground	67
Allowing Family Members Underground.....	69
Failure to Control Number of People Entering Mine.....	70
Mine Rescue Teams	73
Failure to Establish Written Plans for Rescue Team Exploration.....	73
Failure to Have a MEU Team Representative as Part of the Command Center.....	74
Failure to Establish a Proper Fresh Air Base and Air Lock	74
Failure to Brief and Debrief Rescue Team Members.....	75
Failure to Have Breathing Apparatus Underground.....	76
Explorations.....	78
Opening in No. 1 Entry	80
Drilling of Boreholes	82
Arrangement of Boreholes	82
Borehole No. 1	83
Borehole No. 2	84
Borehole No. 3	85
Borehole No. 4	86
Borehole No. 5	87
Borehole No. 6	87
Borehole No. 7	88
Borehole Time Summary.....	88
30 Inch Rescue Borehole.....	89
Risk versus Value.....	90
Value Analysis.....	91
1) The extent and severity of the bounce that occurred on August 6 th	91
2) The effects of the bounce on persons in the working section concerning visibility, disorientation, and physical effects	92
3) The low oxygen discovered by exploration parties over the rubble on August 6 th	93
4) The low oxygen detected from Borehole No. 1.....	93
5) No signaling or response of any kind from the 6 trapped miners either through mine phone communications, seismic vibrations, borehole tapping, or visual indications from cameras	94
Risk Analysis	95
1) The bounces that continued to occur during the rescue period.....	95
2) The protection system being used in the No. 1 entry (Rocprops™, chain link fencing, and wire ropes)	96
3) Feedback to the command center persons-in-charge from persons directly engaged in the underground work	97
4) Feedback to the command center persons-in-charge from Technical Support ground control experts who were on site	98
MSHA's Mine Emergency Operations (MEO).....	99
Mine Emergency Equipment.....	99
MEO Information	101
Mine Emergency Operation Telephone Book	101
Headquarters Mine Emergency Procedure Handbook.....	101

Family Liaison.....	103
MINER Act.....	103
Family Liaison Officials Assigned to Crandall Canyon.....	103
Family Briefings	105
Inconsistencies and False Hopes	107
Non-English Speaking Family Members	110
Potential Emotional Involvement with Family Members	111
Primary Communicator.....	113
Origin of the Primary Communicator Provision	113
MSHA as Primary Communicator with the Public and Press	114
Press Conferences	115
Mine Emergency Response Development (MERD)	121
MINER ACT AND MINE EMERGENCY EVACUATION FINAL RULE.....	124
MINER Act	125
Prompt Incident Notification.....	125
Emergency Response Plan Compliance	125
Post-Accident Communications.....	126
Post-Accident Tracking Systems	128
Post-Accident Breathable Air	129
Family Liaison/Primary Communicator	131
Mine Emergency Evacuation Final Rule	131
Self-Contained Self-Rescuers	131
Lifelines	132
CMS&H STAFFING AND RESOURCE UTILIZATION	134
Brief History of Coal Mine Fatalities.....	134
Recent Coal Mining Fatalities.....	135
CMS&H Staffing Levels	136
Use of Specialists in District 9	141
ALLEGATIONS OF INFLUENCE BY THE MINE OWNER.....	144
GENERAL CONCLUSION.....	146
APPENDICES	
Appendix A - List of Persons Interviewed	
Appendix B - List of Ground Control Panel Members	
Appendix C - Inspection Activity of Crandall Canyon Mine	
Appendix D - Crandall Canyon Borehole Map	
Appendix E - Oxygen Content of Air: Signs and Symptoms	
Appendix F - Program Policy Letter No. P06-V-11	
Appendix G - Program Policy Letter No. P06-V-10	
Appendix H - Procedure Instruction Bulletin No. P07-03	
Appendix I - Crandall Canyon Main West Section Map	



Crandall Canyon Mine Map





INTRODUCTION

In August 2007, two accidents at the Genwal Resources Incorporated, Crandall Canyon Mine (hereafter may be referred to as the "Mine" or the "Company") resulted in the deaths of nine persons. Following the second accident, the Secretary of Labor determined the need to evaluate the actions of the Mine Safety and Health Administration (MSHA) both prior to and following the accidents that occurred on August 6th and August 16th. Since 1989, MSHA has conducted internal reviews of the Agency's actions after mining accidents involving three or more fatalities or other significant issues. Both Richard Stickler, the Assistant Secretary for MSHA, and Kevin Stricklin, MSHA's Administrator for Coal Mine Safety and Health, responded to the initial accident at Crandall Canyon, and were involved as MSHA's primary persons-in-charge when the second accident occurred. Thus, the Secretary determined that an evaluation of MSHA's actions by an Independent Review Team (IRT) would be more appropriate. As a result, Earnest C. Teaster, Jr. and Joseph W. Pavlovich, two former MSHA Managers, both of whom have been retired from the Agency for several years, were selected to conduct the independent review. These retirees have no current ties to MSHA, and their impartial evaluation of the circumstances preceding the initial and subsequent accidents could be performed without the direction or oversight of the Agency. The team co-leaders selected five current MSHA employees to assist with the evaluation. Their selection was based on their expertise and knowledge of the Agency's policies and procedures. These individuals were reassigned from their normal duties to work under the direction of the IRT leaders, without any interference or influence from the Agency. An attorney from the Office of the Solicitor (SOL) was also assigned to work with the IRT and to provide legal assistance when required. These individuals worked diligently for long days and spent many weeks away from their families. The professionalism, dedication, and diligence of these individuals were outstanding. Without their contribution, this review would not have been possible.

EXECUTIVE SUMMARY

The *Federal Mine Safety and Health Act of 1977* (Mine Act) states that mine operators, with the assistance of the miners, have the primary responsibility to prevent unsafe and unhealthful conditions and practices in the Nation's mines. MSHA has the responsibility to develop and promulgate mandatory safety and health standards, to inspect mines to determine whether there is compliance with these standards, and to investigate accidents to determine their causes and prevent recurrences.

Purpose The Independent Review Team (IRT) was established to evaluate MSHA's actions relating to the accidents at the Crandall Canyon Mine on August 6 and 16, 2007, and to determine if any of MSHA's actions contributed to the accidents. Specifically, the IRT was charged with evaluating and identifying deficiencies in MSHA's actions preceding the initial accident, evaluating and identifying deficiencies during the rescue attempt, and providing meaningful recommendations to better protect the safety and health of miners and prevent such accidents in the future.

Scope The IRT primarily evaluated the actions of MSHA's Price, Utah Field Office and District 9 as a whole. In some instances, however, the IRT's evaluation extended to all Coal Mine Safety and Health districts or to MSHA in its entirety. The IRT undertook this broader scope when there was evidence that deficiencies were systemic. The date range of the review varied by issue and are defined, where necessary, in the appropriate sections of this report.

Methodology The review compares MSHA's actions with the requirements of the Mine Act, its implementing standards and regulations (Title 30 Code of Federal Regulations), and MSHA policies and procedures. The IRT interviewed MSHA employees and other relevant persons with personal knowledge of related events. Bargaining unit employees were afforded the opportunity to have a representative present during their interviews. All persons interviewed cooperated fully with the IRT. The IRT requested an interview with Robert E. Murray, co-owner and operator of the Mine, but the request was declined. A list of persons who were interviewed is included as [Appendix A](#).

The IRT met with representatives of the victims' families near the beginning of the review. The IRT explained the scope of the review, and extended an offer to each of them to speak with the team privately or in groups. Representatives from most of the families accepted the offer, and provided the IRT with helpful information.

Additionally, the IRT examined inspection records, mine plans, the plan approval process, compliance with pertinent parts of the new Mine Improvement and New Emergency Response Act (MINER Act), and other related records and documentation. The IRT also examined MSHA's interaction with the Mine operator. The Mine was restricted from access before the IRT could conduct a mine-site visit.

The accidents that prompted this Independent Review were ground control failures known as bursts, bounces, or bumps. A burst is defined as an explosive breaking of coal or rock in a mine due to pressure.¹ In coal mines they may or may not be accompanied by a copious discharge of methane, carbon dioxide or coal dust. A bounce, or bump, is defined as the sudden spalling off of the sides of the ribs and pillars due to excessive pressure. For uniformity, this report refers to these ground control failures as bounces.

Findings The IRT identified many deficiencies in MSHA's actions at the Crandall Canyon Mine prior to the August 6, 2007, accident, during the subsequent rescue operation, and in other aspects of MSHA's performance, policies, and procedures. The following are the more significant deficiencies that were identified during this review.

Plan Approval Process

- Inadequate evaluation of the engineering data submitted by the operator to justify mining in the North and South Barriers
- Inadequate oversight of the plan evaluation and approval process by District 9 management
- Inadequate resolution of inconsistencies identified in the engineering data that was submitted to justify mining in the Barriers
- Failure to properly consider the impact of the March 10, 2007, bounce in the North Barrier section prior to approving retreat mining in the South Barrier section
- Contradictions between the approved plans and the engineering data that was submitted to justify plan approval
- MSHA 2000-204 forms completed by inspectors were used as the six-month reviews instead of being conducted by specialists, and concerns identified on the forms were not responded to by the district
- Field office personnel had no input in the plan approval process
- Assistance from Technical Support was not requested during the Crandall Canyon Mine plan review for the North and South Barriers

Inspection Activities

- District 9 personnel did not evaluate the adequacy of the roof control plan during the retreat mining process in the North and South Barriers

Rescue Attempt

- A central command center was not established

¹ The definitions of burst and bounce are from the USBM Dictionary of Mining, Mineral, and Related Terms, United States Bureau of Mines, 1967 Edition

- Persons who could have contributed significantly to the initial ground control evaluations after the August 6th bounce were either not assigned to the rescue effort or were delayed in their arrival
- The MSHA person-in-charge of the rescue operation was not clearly identified
- The MSHA person-in-charge of the rescue operation did not focus his attention solely on the rescue effort, as much of his time was consumed by conducting and/or attending family and media briefings
- MSHA failed to establish protocol for conducting regular formal briefings and debriefings
- The person-in-charge created an environment that hindered open communications with the rescue workers
- MSHA failed to ensure secure communications between the surface and underground
- MSHA failed to obtain all information pertinent to the protective support system used during the rescue operation
- MSHA improperly permitted media representatives and family members to enter the rescue area, and allowed an unlimited number of persons underground during the rescue operation
- MSHA failed to follow established mine rescue protocol at all times at the Crandall Canyon Mine
- The limits of MSHA's authority, responsibilities, and liabilities under the provisions of § 103(k) or § 103(j) of the 1977 Mine Act have never been fully defined
- MSHA failed to conduct a formal Risk versus Value analysis during the underground rescue effort
- MSHA failed to maintain its mine emergency equipment up-to-date and in good repair
- MSHA failed to comply with the provisions of the MINER Act by not acting as the primary source of information to the families of the trapped miners
- MSHA failed to always provide clear and accurate information regarding the mine accident to the families, and did not correct or contradict misleading or incomplete information presented by the operator
- MSHA failed to comply with the provisions of the MINER Act by not acting as the primary source of information to the media and the public
- MSHA failed to always provide clear and accurate information regarding the mine accident to the media, and did not correct or contradict misleading or incomplete information presented by the operator
- MSHA failed to provide adequate training in mine emergency procedures for personnel required to respond to a mine emergency

MINER Act and Mine Emergency Evacuation Final Rule

- The communication and tracking systems in place at the Crandall Canyon Mine complied with MSHA's policy, but did not have the intended effect of providing officials and rescuers a means to contact or locate the trapped miners
- Although MSHA promulgated standards and developed policy addressing post-accident maintenance of trapped miners, there is still a nationwide shortage of SCSRs. There are no commercially-available fully wireless communication or tracking systems

Staffing and Resource Utilization

- The level of staffing in CMS&H has not been adequate to complete mandated inspections and plan reviews
- The Agency's increased focus on compliance assistance and special emphasis activities may have impacted its ability to complete required inspections as mandated by the 1977 Mine Act

These and other deficiencies identified are discussed in detail in this report.

Summary The mine operator has the primary responsibility for the safety and health of their miners, including developing plans which provide maximum safety for their miners. MSHA has the responsibility to review and evaluate these plans to ensure that they are technically adequate and provide protection for miners prior to approving them. MSHA failed to fully meet its responsibility by approving the roof control plans for mining the North and South Barriers. MSHA's failure to adequately evaluate the roof control plans contributed to the occurrence of the August 6th accident. The IRT identified deficiencies in MSHA's performance during the rescue operation that, cumulatively, may have affected the outcome of the August 16th accident.

The IRT found other deficiencies to be evident of a systemic problem, both in District 9, and within MSHA as a whole. The analyses and recommendations presented in this report are intended to improve the Agency's performance to protect the safety and health of the Nation's miners.

This report is in no way intended to disparage the dedicated District 9 personnel who have devoted thousands of hours to conducting inspections and protecting the miners in that district. Through enforcement of the Mine Act, District 9 recognized numerous hazardous conditions and required the operator to take corrective action to achieve a safer and healthier work environment for miners. Their continued dedication to these tasks will be critical to MSHA's mission of improving mine safety and health.

There was no lack of hard work and perseverance put forth by personnel involved in the rescue operation. Underground personnel worked diligently, most often under stressful and dangerous conditions. Their actions were valiant and greatly appreciated. Management personnel from both MSHA and the Company also put forth a tremendous effort during the rescue attempt. They worked long days and countless hours to try to facilitate a rescue, and assumed immense responsibility under intense pressure.

BACKGROUND

The Crandall Canyon Mine was under the jurisdiction of MSHA's Coal Mine Safety and Health (CMS&H) District 9 Office, located in Denver, Colorado, and was inspected out of the Price, Utah Field Office. A regular safety and health inspection was started on July 5, 2007, and was ongoing at the time of the accident. The last date an MSHA inspector was underground at the Crandall Canyon Mine prior to the accident was on July 18, 2007.

The Crandall Canyon Mine is located in Emery County, Utah, about 15 miles northwest of Huntington, and approximately 140 miles south of Salt Lake City. The Mine was opened in 1939 and operated using the room and pillar mining method until it was idled in 1955. In 1983, Genwal Coal Company reopened the Crandall Canyon Mine, and in 1989 Nevada Electric Investment Company (NEICO), a subsidiary of Nevada Power Company, purchased the Mine. The following year, the Intermountain Power Agency (IPA) of South Jordan, Utah, purchased a 50% interest in the Mine. In 1995, Genwal Resources, Incorporated, a subsidiary of Andalex Resources, acquired operating control of the Mine and installed the first longwall. From 1995 until 2005, 22 longwall panels were mined.

In 2006, Utah American Energy, Incorporated, which is a subsidiary of Murray Energy Corporation, purchased Andalex Resources and became a 50% owner of the Crandall Canyon Mine.

Prior to Utah American Energy assuming operating control, longwall operations had ceased, and room and pillar retreat operations were ongoing in the South Mains area of the Mine. Second mining in this area consisted of developing additional rooms into the barriers between the South Mains and the longwall gob areas to the east and west, and then extracting the newly created pillars along with those of the Mains. Pillar extraction in this area was completed in October 2006. As mining in the South Mains area was nearing completion, plans were formulated for mining in the North and South Barriers adjacent to the Main West. There were two mechanized mining sections in the mine: the South Barrier section where the accident on August 6th occurred, and the 3rd North Mains section which was idle at the time of the accident.

The Main West section of the mine extended to the western-most property line, where access was provided to two districts of previously mined longwall panels, with six panels to the north and six panels to the south. The Main West was driven toward Joe's Valley Fault, and ended at crosscut 167. The western-most end of Main West was sealed on November 13, 2004, between crosscuts 118 and 119 after longwall panels in this area were finished. Prior to sealing, approval was granted from the U.S. Department of Interior's Bureau of Land Management (BLM), which was responsible for verifying that the operator was achieving maximum economic recovery of coal under a federal lease.

BLM INSPECTIONS OF CRANDALL CANYON

The Crandall Canyon Mine was mining coal leased to the Company from the federal government. As such, the Mine was subject to oversight by BLM. The BLM inspections did not focus on safety or health, but on compliance with provisions of the federal lease. On November 4, 2004, a BLM inspector visited the Mine to evaluate the Company's request to seal and forgo coal recovery in the Main West. The inspector documented in his report, dated January 24, 2005, that "pressure arches from both side gobs are sitting right down on the main entry pillars" and "side pillar failures were occurring." He also documented "attempts to split pillars under this depth could not hold the top and prevent pillar outbursts."

Genwal Resources, Incorporated initially had no plans for mining the barriers between Main West and the longwall gobs on either side. These barriers were not considered when determining mineable reserves, and were left as support pillars for that area of the mine. However, shortly before Utah American Energy acquired the mine, mining plans were changed to include recovery of coal in the area due to the quality and height of the coal. The plans to mine the barriers were finalized after Utah American Energy took control of the Mine.

On December 14, 2006, the BLM inspector made another inspection at the Crandall Canyon Mine. The Company was developing entries in the North Barrier. In the report finalized on March 5, 2007, the BLM inspector documented, "I warned them to beware of the depth above the ridge and mining a barrier pillar that has been sitting for a number of years. Pulling pillars will be interesting..." Shortly after this report was finalized, a series of bounces occurred that caused the operator to cease mining and pull out of the North Barrier section. (Withdrawal from the North Barrier section is discussed in detail in later sections of this report.)

The Company requested that the BLM inspector investigate and approve the cessation of mining in the North Barrier section. On March 15, 2007, the BLM inspector conducted a special investigation to determine the extent and damage of the bounce. The inspector gave the Company verbal approval to cease mining in the North Barrier section, however, the associated report was not finalized until August 13, 2007. In that report the inspector documented the damage caused by the bounces and stated "the observed conditions were severe."

Because there were no interagency agreements prior to the August 6th accident, there was no contact between BLM and MSHA to discuss the BLM inspector's concerns or the occurrences in the North Barrier section.

ACCIDENT OVERVIEW

THE ACCIDENT ON AUGUST 6, 2007

In the early morning hours of August 6th, a violent bounce of coal pillars occurred in the South Barrier section of the Main West area of the Crandall Canyon Mine. The bounce registered 3.9 on the Richter scale, as measured by the University of Utah in Salt Lake City. (All bounce magnitudes listed in this report are local Richter scale magnitudes.) At the time of the accident, six miners were in the process of extracting coal on the section near crosscut 139. The bounce was so catastrophic that the coal pillars failed outby crosscut 139 to crosscut 120, a distance of approximately 2600 feet. Ventilation controls were damaged or destroyed outby to crosscut 95, approximately 4500 feet from crosscut 139. The six miners were entrapped on the section.

Attempts to contact the six miners on the section proved futile. A repairman, who had just left the South Barrier section in a truck, was near crosscut 108 when he felt the air blast from the bounce. He stated the dust from the bounce was so thick that he could hardly see. He continued to travel outby where he met a co-worker, and they returned to the South Barrier area. They were soon joined by three other miners. They attempted to find a way to the trapped miners by traveling over coal rubble in the entries, but they withdrew due to low oxygen. The Conspec® operator (dispatcher) on the surface tried to contact the miners by mine phone and electronic paging, but received no response.

THE RESCUE ATTEMPT

MSHA was notified of the accident by mine management and responded with personnel and equipment to help facilitate a rescue operation. The Company mine rescue team and other area teams were also notified and responded. Upon the initial exploration by MSHA and rescue team personnel, they found all four entries of the South Barrier section filled with rubble beginning at crosscut 120.

Several approaches were taken during the rescue effort to reach the missing miners. First, MSHA and mine rescue team personnel attempted to find a way over the rubble in each of the four entries of the South Barrier section, similar to what Company personnel had tried immediately after the accident. Again, because of low oxygen, this effort was unsuccessful.

Second, on the afternoon of August 6th, an excursion by mine rescue personnel wearing breathing apparatus was attempted into the Main West sealed area. This area ran parallel to the South Barrier section, and rescuers hoped that access could be gained around the coal-filled entries. However, the area just inby the seals was blocked by roof falls and/or unsafe roof. After the team returned to the fresh air base, command center personnel asked them to try a different route in the sealed area. As the team was preparing to re-enter the sealed area, a significant bounce occurred. The bounce, which registered 1.9 on the Richter scale, forced low

oxygen and dust into the fresh air base, but resulted in no injuries. The rescue team determined the conditions in the Main West were too unsafe, and access through this area was not attempted again.

Third, on the evening of August 6th, an effort was made to load the coal out of the No. 4 entry by using scoops. Early on August 7th, after about 300 feet of the material was loaded out, another bounce occurred that registered 2.2 on the Richter scale and refilled the No. 4 entry with coal, back to where the clean-up had started.

The fourth attempt, starting on August 8th, was to remove the material from the No. 1 entry of the South Barrier section all the way to where the trapped miners were last known to be working. Coal was loaded from the center of the entry by a continuous mining machine and hauled out by shuttle cars. Because of the bounce activity that continued to occur, supports were installed along both sides of the entry to protect the rescue workers. Over the next nine days, slow progress was made through the material in the No. 1 entry. Several additional bounces occurred, often damaging equipment or partially covering the equipment with coal.

Beginning on August 6th, a road was constructed over the difficult surface terrain to provide access for drill rigs. Over the next twenty-four days, seven boreholes were drilled into the Mine to locate the trapped miners. These efforts were unsuccessful.

THE SUBSEQUENT ACCIDENT ON AUGUST 16, 2007

The underground rescue operation continued until the evening of August 16th. The cleanup of the No. 1 entry had advanced approximately 900 feet, to near crosscut 127. At approximately 6:38 p.m., a bounce occurred while nine workers were in the area just outby the continuous mining machine. The bounce, measuring 1.6 on the Richter scale, dislodged the steel roof jacks, chain link fencing, and wire ropes that had been installed to protect the workers. Coal, jacks, fencing, and ropes were blown across the entry from the right side, striking the rescue workers. Heroic efforts by personnel in the area resulted in the extraction of the injured and their quick transport from the Mine, where waiting ambulances and helicopters took them to area hospitals. Tragically, three of the rescue workers were fatally injured, and six others were injured, some seriously.

THE AFTERMATH

All persons were immediately withdrawn from the Mine until conditions could be re-evaluated and consideration of continuing with the underground rescue operation could be made. MSHA and Company officials assembled a panel of ground control experts to determine if the underground rescue attempt could safely continue. The panel of experts arrived at the mine site on August 19th. [See Appendix B](#) for a list of the experts who participated in the evaluation. When they arrived, they were briefed by MSHA and company officials. The panel of experts was given the opportunity to go underground to observe the conditions, but declined. After the briefings were completed, the experts isolated themselves

to deliberate. On August 20th, they met with representatives of MSHA and the Company and provided a statement. Their consensus opinion was that the area remained in a “structurally unstable” state and that “seismic activity and pillar instability will pose a significant risk.” MSHA and company officials made a joint decision that no further rescue attempts would be made through the underground area of the mine.

Drilling of boreholes continued on the surface through August 30th. The information obtained from the boreholes indicated there was no chance of survival for the six trapped miners. On August 31st, all activities to rescue the trapped miners were ceased. Concrete block stoppings were installed in the Mine portals in October 2007 to prevent access into the Mine until it could be permanently sealed. The six miners remain entombed in the Mine.

MSHA'S ACTIONS PRIOR TO AUGUST 6, 2007

CRANDALL CANYON MINE ROOF CONTROL PLAN APPROVAL

Section 75.220(a)(1) specifies that: "Each mine operator shall develop and follow a roof control plan, approved by the District Manager, that is suitable to the prevailing geological conditions, and the mining system to be used at the mine. Additional measures shall be taken to protect persons if unusual hazards are encountered."

Section 75.223 requires that revisions of the roof control plan shall be proposed by the operator when conditions indicate that the plan is not suitable for controlling the roof, face, ribs, or coal or rock bursts. Section 75.223(d) further states that the roof control plan for each mine shall be reviewed every six months by an authorized representative of the Secretary. This review shall take into consideration any falls, of the roof, face, and ribs and the adequacy of the support systems used at the time.

The *General Coal Mine Inspection Procedures, Handbook Number PH06-V-1*, in effect at the time of the accident, states inspectors shall review the operator's currently approved roof control plan and evaluate the plan by making on site observation of the effectiveness of controls being installed. This evaluation shall include information obtained from the miners installing the roof support materials and the operator. The results of this evaluation shall be recorded on MSHA Form 2000-204 and submitted with completed inspection report. The inspector shall observe roof and rib conditions on each active working section to determine compliance with applicable standards, including attention to: roof control failures, roof control plan requirements.

Plan Approval History at the Crandall Canyon Mine

The base roof control plan for the Crandall Canyon Mine was approved on July 3, 2002. The original plan did not include provisions for retreat room and pillar mining. The first plan amendment to allow retreat mining was requested in May 2003, and approved by the District Manager on September 5, 2003. Prior to the retreat mining in the North and South Barriers of Main West, site specific amendments related to pillar mining were approved on four other occasions.

Before the retreat mining in the North and South Barrier sections of the Main West in 2007, the last retreat mining conducted at Crandall Canyon was in the South Mains. The South Mains pillaring was conducted in 2005 and 2006 under provisions of the September 2003 Pillar Mining Amendment.

Plan Approval History for Mining in the North and South Barriers

Crandall Canyon mine management first approached MSHA District 9 personnel in April 2006 about the possibility of mining the barriers surrounding Main West. This initial contact did not consist of a formal written proposal, but rather was part of a discussion with Allyn Davis, District 9 Manager, and Billy Owens, District 9 Roof Control Branch Supervisor, during a meeting concerning issues with another mine owned by Andalex Resources, the parent company of Genwal Resources, Inc. At that time, Owens informed mine management that a proposal with supporting data would be necessary in order to evaluate the possibility of mining in the barriers. In a September 2006 meeting with MSHA, mine management submitted the requested supporting data in the form of two reports from Agapito Associates, Incorporated (AAI), a consulting firm hired by the operator. A formal request for a roof control plan amendment was still not submitted to the District at this time. Following this meeting, Owens informed the mine operator that, upon satisfactory evaluation, plans for mining in the North and South Barriers of Main West would only be approved in stages. Development and retreat mining in each barrier would be approved separately, with each approval contingent upon the successful completion of the preceding stage.

Upon receiving the consultant's reports, Owens assigned an engineer on his staff to conduct a review of the submitted information. The AAI report dated July 20, 2006, described an analysis of the proposed barrier mining which primarily used LAMODEL, a numerical modeling program developed by the National Institute for Occupational Safety and Health (NIOSH). LAMODEL is a boundary element program used to determine stress and convergence levels which are then used to predict ground conditions. The AAI analysis attempted to calibrate the modeling effort by first using the LAMODEL program to simulate historical mining in the 1st North Left area of the Crandall Canyon Mine. After this calibration effort, LAMODEL was then used to approximate conditions as the proposed barrier mining took place. The report concluded that, "the proposed Main West 4-entry layout with 60-foot by 72-foot pillars should function adequately for short-term mining in the barriers," and that, "Model results indicate that planned mining in the barriers will avoid the majority of the side-abutment stress transferred from the adjacent longwall panel gobs."

The second of the two reports submitted to MSHA in September 2006 was a copy of an August 9, 2006, AAI e-mail to mine management. This report included an additional analysis using the NIOSH software program Analysis of Retreat Mining Pillar Stability (ARMPS). ARMPS is an empirically based method for determining pillar stability. The same 1st North Left area of the mine that was used to calibrate the LAMODEL program was used to calculate an acceptable ARMPS stability factor (SF) for the Crandall Canyon Mine. The AAI analysis concluded that retreat mining in this area was, "generally successful with a SF of 0.37." AAI rounded the SF up to a minimum of 0.40 as, "a reasonable lower limit for retreat mining at GENWAL." The AAI analysis concluded that, "the lowest SF for the proposed retreat sequence in Main West barriers is 0.53 under the deepest cover..." and that, "implications are

that the proposed retreat sequence in Main West will be successful in terms of ground control, even under the deepest cover (2200 feet).”

The District 9 engineer assigned to review the AAI reports began his MSHA career in 2004 as a co-op student while still attending the Colorado School of Mines. In May 2006, he graduated with a Bachelor of Science degree in mechanical engineering, and in June 2006 was assigned to the District Roof Control Branch. The engineer reviewed both AAI reports and then conducted his own ARMPS analysis. A LAMODEL analysis was not conducted by District personnel, nor did they request assistance from MSHA’s Technical Support Roof Control Division.

Upon completing his review and subsequent ARMPS analysis, the engineer identified five “inconsistencies” with the AAI reports. Even though a formal retreat mining proposal had not yet been submitted in the form of a roof control amendment, the District responded with a letter dated November 21, 2006, to the operator in which the five inconsistencies were outlined. This letter described a “preliminary analysis for projected pillaring” of the barriers to the North and South of the Main West section and stated that, “the plan, as is currently written, would not be approved.”

MSHA did not receive a written response to the November 21st letter, as normally would be expected to address deficiencies. Rather, the five inconsistencies were reportedly resolved in December 2006 via phone conversations between mine personnel and Owens.

On November 13, 2006, District 9 received a formal plan submittal requesting approval to develop room and pillars in the North Barrier block of Main West. On November 21, 2006, Davis approved this site-specific amendment to the roof control plan. This plan specified development of the North Barrier with four entries on 80-foot centers and crosscuts on 90-foot centers. The submitted mining layout would result in a 135-foot wide barrier between the No. 4 entry and the longwall gob area to the north, and a 55-foot barrier between the No. 1 entry and the old Main West to the south. The amendment included a statement that, “Consultant reports indicate the planned development will avoid the majority of the side-abutment stress transferred from the adjacent longwall gobs.” Additionally, the plan stated that, “during development of the north barrier, conditions will be monitored to determine the possibility of pillar extraction,” and if they appear favorable, “further discussions and plans will be submitted for approval.”

On December 1, 2006, AAI personnel conducted an on-site evaluation of conditions in the North Barrier development mining section. This visit was used to help determine the feasibility of retreat mining in the area. At this time, the face location was in the vicinity of crosscut 123, under approximately 1800 feet of overburden. The entries had been advanced approximately four crosscuts in by the seal location of Main West, which was sealed upon the completion of mining in 2004. AAI’s December 8, 2006, report of this investigation concluded that, “roof, floor, and rib conditions were consistent with analytical predictions.”

On January 3, 2007, the District received a request for approval to retreat mine in the North Barrier section. The submittal included a map showing the sequence of mining and pillars to remain unmined to protect the No. 4 entry as a bleeder entry. The submittal also included the same statement that was in the plan for development mining of the area reiterating that, "consultant reports indicate the development will avoid the majority of the side-abutment stress transferred from the adjacent longwall panels." The plan request further indicated that, "these assessments have been validated by conditions experienced in the mine."

On January 9, 2007, Owens conducted an underground evaluation of conditions on the North Barrier development section to determine if retreat mining was feasible. The engineer who performed the review of the first two AAI reports accompanied Owens during this evaluation. Neither Owens nor the engineer took notes during this evaluation, and there was no written report generated to document this visit. However, Owens recalled that the section was developed to approximately crosscut 138 or 140. The investigation consisted of visual observations of all four entries starting approximately four or five crosscuts outby the face and traveling to the face. Beginning approximately 300 feet outby the face, the pillars were reportedly yielding in a controlled, non-violent manner. Owens judged this to be an indication of desirable pillar yielding and evidence suggesting that the pillars were not storing energy and, thus, were not bounce-prone. Owens stated that he also talked with miners on the section and they described the conditions on the section as being "pretty good." Owens concluded that conditions were deemed favorable for retreat mining.

During the visit, Owens also observed that two-to-three feet of the immediate roof was falling before it could be supported. A discussion ensued about the possibility of leaving roof coal as a preventative measure. Owens recommended that the Company submit a plan revision to address this issue. This revision was submitted by the operator on January 10, 2007, and approved by Davis on January 18, 2007.

One additional issue that was raised by Owens during the January 9th investigation concerned the standing support required in the crosscuts between the No. 3 and No. 4 entries to protect the bleeder entry. Although he concluded from his observations that the pillaring plan could be approved, Owens stated that he had concerns about the adequacy of the Company proposal to protect the No. 4 entry. Therefore, he recommended that this support be increased from what was proposed in the Company's original retreat mining submittal. After the January 9th MSHA evaluation, several written exchanges took place concerning the specifics of the required support. On January 31, 2007, mine management modified the plan received January 3, 2007, to reflect the installation of additional support. Owens officially recommended approval of the plan on this date and forwarded the plan to William Knepp, the Assistant District Manager for Technical Programs, for review. Knepp recommended approval on February 1st. On February 2, 2007, Davis approved the site-specific plan for pillar extraction of the North Barrier of Main West.

On February 23, 2007, District 9 received a request to develop the South Barrier of Main West. The wording for the South Barrier submittal was essentially the same as submitted and approved for the North Barrier. The only notable difference was the plan for the South Barrier development contained the statement that was added via the January 18, 2007, amendment for the North Barrier section that permitted roof coal to be left in areas where weak immediate roof is encountered. On March 6th, Owens recommended approval of the plan, with Knepp reviewing and recommending approval on March 7th. The plan was approved by Davis on March 8, 2007.

On May 17, 2007, a site-specific roof control plan amendment to allow pillar extraction in the South Barrier section was received by the District Office. A drawing, submitted as part of the plan, reflected a change in pillar dimensions that was implemented by the mine as recommended by AAI following a bounce in the North Barrier section in March 2007. Pillar width remained unchanged, but the pillar length increased by 37 feet. The plan included wording similar to that approved for pillar extraction in the North Barrier section. Statements that, "consultant reports indicate the development will avoid the majority of the side abutment stress transferred from the adjacent longwall panels," and that, "these assessments have been validated by conditions experienced in the mine," were once again included.

On May 22, 2007, Owens traveled to the Mine to evaluate conditions on the South Barrier development section to determine if retreat mining would be feasible. An MSHA roof control specialist from the Price Field Office joined Owens in this investigation. According to notes taken by the specialist, an observation of the four entries revealed good roof conditions and "hourglassing" of the pillars. Owens stated that, compared to the North Barrier section, the observed pillar yielding was occurring closer to the face, and even the solid coal rib was yielding. As in the North Barrier section, the observed pillar yielding was thought to be desirable, and viewed as evidence that the pillars were not storing energy and, therefore, were not bounce-prone. Owens determined that retreat mining could be conducted.

Also during the May 22, 2007, investigation, the issue of leaving pillars unmined to protect the bleeder entry was examined in detail. Like the plan for the North Barrier section, the original plan submittal for pillaring in the South Barrier section proposed leaving the pillar between No. 3 and No. 4 entry to protect the No. 4 entry as a bleeder entry. The South Barrier plan also specified that three pillars between entries Nos. 2 and 3 would be left for bleeder entry protection around an area where only three entries were mined at crosscut 140. Owens believed that this was inadequate because the entry to be traveled would now "stair-step" into the gob, creating a pillar-point. Mine management re-submitted the map portion of the plan to reflect that all pillars from crosscuts 139 to 142 would be left intact, and the barrier in this area would not be "slabbed" (mined into).

On June 14, 2007, Owens recommended approval of the plan, also signing for Knepp on that day. On June 15, 2007, William Denning, District 9 Staff Assistant, was acting on behalf of Davis when this plan was forwarded for the District Manager's approval. Denning stated that

he had concerns about approving this plan, but after consulting with Owens and receiving his recommendation, he signed the plan approving pillar extraction in the South Barrier section.

Plan Approval Deficiencies Identified by the Independent Review Team

The IRT identified the following shortcomings with District 9's plan approval process.

- Inadequate evaluation of the engineering data submitted by the operator to justify mining in the North and South Barriers;
- Inadequate resolution of the inconsistencies identified in the engineering data that was submitted to justify mining in the barriers;
- Failure to properly consider the impact of the March 10, 2007 bounce in the North Barrier section prior to approving retreat mining in the South Barrier section;
- Failure of MSHA personnel to observe and evaluate pillaring operations;
- Contradictions between approved plans and supporting data submitted to justify approval;
- The manner in which MSHA 2000-204 forms were used impacted the adequacy of the required six-month plan reviews;
- Field office personnel not involved in the plan approval process;
- Assistance from Technical Support was not requested; and
- Contradictions between Approved Roof Control and Ventilation Plans.

These are discussed in detail as follows.

- 1) **Inadequate evaluation of the engineering data submitted by the operator to justify mining in the North and South Barriers.** At the request of Owens, Crandall Canyon mine management submitted information to support mining in the barriers in the form of two consultant's reports. One of these reports consisted entirely of a discussion of numerical modeling using the NIOSH software program LAMODEL. Neither Owens, nor the engineer assigned to review the information, had ever used LAMODEL to analyze a retreat mining plan. Compared to empirically-based programs (like ARMPS), LAMODEL is fairly complex, requiring the user to construct a mining grid representative of the mining layout and correlated to overburden, and to make informed decisions concerning input parameters such as coal strength, rock modulus, and gob yield properties. Without

technical guidance from someone experienced with the program, the Crandall Canyon pillaring proposal would be difficult for the first time LAMODEL user to analyze. The engineer stated that he attempted to run LAMODEL but that he encountered problems and abandoned his effort.

Furthermore, although the LAMODEL program was available to District personnel, the AutoCAD® program that facilitates creating the mine grid for LAMODEL was essentially unavailable. (Only one copy of AutoCAD® existed for the entire District office, and it was installed on a computer that was not readily available to the Technical Programs group.) The District's review of the LAMODEL portion of the supporting data was, in essence, reduced to a comparison of the input parameters that the consultant used, to those suggested by the default values of the program. No independent verification of the modeling was obtained, and no in-depth analysis was conducted by District 9.

The second AAI report submitted by the Company contained an ARMPS analysis which the engineer was able to evaluate. ARMPS was developed in 1995 by the former U.S. Bureau of Mines (now NIOSH) and is widely used within the mining community to aid in designing pillars for room and pillar retreat mines. As mentioned before, ARMPS is an empirical program, based on more than 250 case studies, and is very user-friendly. The user simply inputs basic parameters such as overburden thickness, mined height, entry width, and basic mine geometry. The program determines a stability factor by comparing the load-bearing capacity of the pillars to the estimated applied load. The stability factor can then be compared to the case studies in the program's database, or against site-specific areas within the mine being analyzed. ARMPS also calculates a stability factor for barrier pillars between the active workings of the mine and gob areas.

As part of his evaluation of the ARMPS analysis conducted by AAI, the engineer also ran his own evaluation using ARMPS. Neither the District ARMPS analysis, nor the one conducted by AAI, examined the stability factor of the barrier pillar between the longwall gob area to the north and the new entries developed into the North Barrier of Main West.

Research conducted by the developers of the ARMPS software concluded that barrier pillars are especially important in bump-prone, deep cover areas. The ARMPS program resource files include a paper entitled, "Deep Cover Pillar Extraction In The U.S. Coalfields" that states: *"Barrier pillars are an essential element in deep cover retreat mine design. Traditionally, barrier pillars have been employed to isolate active panels from adjacent gobs as a stress control technique. As the cover deepens, it becomes more important to isolate the active panel from side abutment loads transferred from the adjacent mined out workings by employing barrier pillars. An important design issue is just how wide the final remnant or inby barrier pillar (after rooming and/or slabbing) should be. This topic is a critical and life threatening design concern in highly stressed environments because of the historically high occurrence of bump incidences during*

partial and full barrier pillar extraction."² The NIOSH researchers found that when the barrier pillar stability factor is greater than 1.9, no bumps occurred. The ARMPS "help file" on stability factors states that "the use of substantial barrier pillars also increases the likelihood of success." Despite such a recommendation, the District 9 ARMPS analysis did not examine barrier pillar stability in any way. Furthermore, the District did not question the mine operator about why the AAI analysis did not discuss barrier pillar stability factors.

The importance of the barrier pillars can best be understood by examining the report prepared by NIOSH for the United States Senate, in which the August bounce events at Crandall Canyon were analyzed.³ The ARMPS analysis conducted by NIOSH concluded that the Barrier Pillar Stability Factor (BPSF) for the remnant barrier pillar that remained after the development of the four entries in the North Barrier was 0.95. Likewise, NIOSH calculated a BPSF of 0.91 for the remnant barrier that was left to the south after the four-entry development into the South Barrier. Both remnant barrier stability factors were less than half of the NIOSH recommended BPSF of 2.0 for deep cover, bump-prone areas. The NIOSH report concluded, "that the two remnant barrier pillars were probably the key elements in the Crandall Canyon pillar design," and that, "the ARMPS program indicates that an elevated risk of bumps was present in the Crandall Canyon West Mains area, due to the deep cover and the low barrier pillar stability factors of the remnant barrier pillars."

In addition to the failure to examine the barrier pillar stability factors, the District 9 ARMPS analysis only evaluated the proposed mining in the North Barrier section. No independent analysis was ever conducted by District 9 for mining in the South Barrier section.

Davis and Knepp are ultimately responsible for approval of plans in District 9. Both were aware that mining was being proposed for the barrier pillars at Crandall Canyon. Mining barrier pillars between gobs under deep overburden was not a typical mining technique, and Davis and Knepp should have provided oversight during the review process for this request. However, neither questioned Owens on his evaluation of the plans for mining the North and South Barriers at the Crandall Canyon Mine.

Conclusion: District 9 failed to conduct a comprehensive review of the supporting data submitted by the mine operator in order to justify mining in the barriers to the North and South of Main West. The District reviewers did not adequately analyze the LAMODEL report, nor did they recognize the importance of Barrier Pillar Stability Factors.

² Deep Cover Pillar Extraction In The U.S. Coalfields, Proceedings, 21st International Conference on Ground Control in Mining, Frank E. Chase, Christopher Mark, and Keith A. Heasley.

³ Evaluation and Control of Coal Bumps, Office of Mine Safety and Health Research, NIOSH, September 28, 2007.

District management's oversight was not adequate during this evaluation process.

District personnel were not trained in the use of the LAMODEL computer application.

Recommendation: Data that is submitted by a mine operator to justify mining and plan approval should be thoroughly evaluated by MSHA.

District management should provide adequate oversight for the plan approval process.

MSHA should provide training to appropriate district personnel in computer software that is commonly used to justify mining plans.

2) Inadequate resolution of the inconsistencies identified in the engineering data that was submitted to justify mining in the barriers. The mine operator did not initially submit a plan to request mining in the barriers. Instead, engineering studies created by AAI were hand-delivered to the District 9 Office by representatives of the operator in September 2006, and they asked that the analyses be evaluated. Owens assigned an engineer to evaluate the studies and to prepare a response. The response generated by the engineer addressed the studies as if they were submitted plans and, therefore, identified that "the plan as currently written, would not be approved." Knepp signed this response for the District Manager as if a plan had been submitted, which normally requires a written response by the operator to address the identified issues. Knepp did not question Owens as to how these issues were to be resolved.

The engineer who reviewed the two AAI reports identified five "inconsistencies" in the reports which were detailed in a November 21, 2006, letter from the District Manager to the mine operator. They are:

- The coal strength used in the LAMODEL analysis;
- The elastic modulus of coal used in the LAMODEL analysis;
- The mine geometry employed in ARMPS;
- How yielding pillars in the model output are interpreted; and
- How the "acceptable" ARMPS stability factor was determined.

The District did not receive a written response addressing these issues. Rather, the inconsistencies were reportedly resolved through phone conversations between Owens and representatives of the Mine, without additional clarifying information being submitted. There is no documentation on how the inconsistencies were resolved. While a formal written response to a letter from the District Manager is not required, in light of the unusual circumstances of mining in the barriers, it should have been requested. At the very least, in the absence of a written response from the mine operator, Owens should have thoroughly documented the details of how the five inconsistencies were resolved.

In addition to the shortcomings of resolving the inconsistencies over the phone and without documentation, Owens' account of the resolution of the inconsistencies was vague and incomplete.

The first two inconsistencies identified by the engineer referred to the coal strength and elastic modulus of coal values that AAI used as input parameters in their LAMODEL analysis. The MSHA engineer observed that both of these values were significantly higher than the default values suggested in the program. For this reason he felt that additional information was warranted to explain how these values were selected. When asked how these issues were resolved with the mine operator, Owens stated the consultant used such values in previous modeling at the Crandall Canyon Mine although the previous modeling was not conducted with the LAMODEL program. While this may be a valid explanation, Owens did not request additional documentation for verification.

The third inconsistency identified by the District 9 engineer was, "the mine geometry employed in the computer model differs from the physical mine map geometry." The engineer told the IRT that he believed the Mine layout used by the consultant was not realistic. He further explained that because of the unknown condition of the pillars in the original Main West section he chose a more conservative approach in his analysis by assuming these pillars were failed. AAI, on the other hand, assumed no stress influence from the Main West. The engineer also stated that the mine geometry inconsistency included the manner in which AAI modeled the bleeder pillar. The engineer believed that it was inappropriate to simply add the widths of the bleeder pillar and the No. 4 entry to the barrier pillar as the consultant had done in its ARMPS analysis. Owens stated that he didn't believe that his engineer modeled the bleeder pillar properly in the ARMPS analysis, and that AAI's method was consistent with ARMPS. The "resolution" of this inconsistency appears to be simply that Owens accepted the consultant's rationale. The NIOSH evaluation mentioned earlier that was conducted for the Senate subsequent to the August events also addressed this aspect. The NIOSH discussion of this aspect indicated the MSHA engineer's initial analysis was the more prudent approach.

The fourth inconsistency described by the MSHA engineer concerned the possibility that pillar yielding zones identified in the consultant's LAMODEL analysis might indicate a violent pillar outburst. Owens stated that this issue was resolved by the consultant's explanation to the operator that the predicted yielding was on the pillar perimeter and not within the pillar core, and thus, was not problematic. Owens did not request additional information to verify the validity of the explanation given.

The last inconsistency listed in the November 21st letter to the mine operator questioned the adequacy of the acceptable stability factor determined by AAI for the Crandall Canyon Mine. The engineer believed that the acceptable stability factor was actually determined for an area that had poor ground conditions and, thus, was not truly acceptable. He

believed that a higher stability factor should be employed. Owens accepted the resolution of this inconsistency by the consultant increasing the stability factor from .37 to .40.

Conclusion: District 9 answered an informal submittal for a plan revision with a formal written response from the District Manager. MSHA has historically required that plan deficiencies identified in writing be answered with a written response. Owens, by resolving the inconsistencies via phone calls, and then failing to document the specifics of such a resolution, did not adhere to MSHA practices.

The resolution of the inconsistencies, as explained by Owens, was lacking detail and substance. Despite the vague nature of the operator's response to the five inconsistencies, MSHA conducted no further ARMPS analyses, and made no other attempt at verifying the consultant's methodology.

Recommendation: The District Standard Operating Procedure (SOP) should be modified to require a written response from the mine operator when plan deficiencies have been identified in writing.

Issues identified with supporting data should be adequately resolved, with any follow-up information verified by MSHA.

3) Failure to properly consider the impact of the March 10, 2007 bounce in the North Barrier section prior to approving retreat mining in the South Barrier section. On March 10, 2007, a significant bounce occurred during retreat mining on the North Barrier section of Crandall Canyon Mine. A large amount of coal was expelled from the ribs, damaging ventilation controls and causing the operator to cease mining operations in this area. Section 50.2 defines an accident as, "a coal or rock outburst that causes withdrawal of miners or which disrupts regular mining activity for more than one hour" and "an unplanned roof or rib fall in active workings that impairs ventilation or impedes passage." As such, it is required under § 50.10 to be immediately reported to MSHA. The bounce that resulted in the mine manager's decision to withdraw from the North Barrier section met the criteria of § 50.2 but was not immediately reported to MSHA.

Despite the failure to comply with Part 50, mine management did have several discussions with MSHA District personnel on March 12th and 13th in which "bouncing" was mentioned. Notes taken by Owens indicate a 12:00 noon phone call on March 12th from Laine Adair, General Manager for the Crandall Canyon Mine, in which pillar bouncing is mentioned. Similarly, notes taken by William Reitze, District 9 Ventilation Branch Supervisor, pertaining to conversations with Adair on March 12th and 13th repeatedly use the word "bounce." The calls with Reitze pertained to an issue with constructing seals for the area, which ultimately escalated to the point where Davis was involved. As part of the seal issue discussion, Davis was informed that the section was being withdrawn due to bounces. A March 13th e-mail from John Fredland, Technical Support seal specialist, to Davis

concerning the seal approval for the North Barrier area which stated: *“As you informed me by phone this afternoon, Crandall Canyon Mine has experienced a bounce ...”* clearly indicates Davis’ knowledge of the bounce.

The March 12th notes from Owens went on to state that the, “Crew decided too much bouncing during mining of pillar.” From all of these notations, it would appear that MSHA had knowledge of a bounce, but yet took no follow-up action to investigate. Owens did not personally investigate the bounce, nor did he direct any member of his roof control staff to do so. In addition, neither he nor any other personnel from the District Office contacted the Price Field Office to ascertain if an inspector was available to investigate the bounce.

When questioned about his knowledge of the March 10th bounce via the March 12th phone call with Adair, Owens stated that it was his impression from this phone call that the reported bouncing had caused the roof to break up and, thus, prevented travel in the bleeder entry. Neither the extent of the bounce, nor the severity of the damage, was conveyed to him. This portrayal conflicts markedly with the account of this phone conversation given by the General Manager to the Crandall Canyon Accident Investigation Team. According to this account, Adair described in detail to Owens the extent of the damage in entries two through four. Reportedly, Adair told Owens that, “in the No. 4 entry there was two pillars that had blown out into the walkway, one-or-two-foot high, and that if you would have been in one of these areas, you would have been seriously injured or maybe even killed.”

Even though there are discrepancies over how mine management portrayed the extent of the bounce, there is no doubt that MSHA knew a bounce had occurred. With this in mind, and in light of the concern expressed by MSHA throughout the plan approval process, it would seem imperative that the bounce be investigated. Simply hearing the word “bounce” should have been a red flag that an investigation was warranted. Additionally, the operator wanted to pull out of the barrier and seal it. The need for an investigation was especially evident considering the fact that the plan to mine in the South Barrier that was then pending approval was essentially a mirror image of the North Barrier mining.

MSHA again was made aware that the March 10th bounce had occurred via an April 18, 2007 report from AAI. This report was received in the District Office on May 15, 2007, prior to approval of pillar extraction in the South Barrier section. This report discusses the March bounce and the consultant’s recommendations to, “refine the pillar design for the south barrier based on the response of the north panel pillars.” In describing the March 10th event, the report states, “A large bump occurred at this point resulting in heavy damage to the entries located between XCs 133 and 139.” Owens stated that when he conducted the May 22, 2007, investigation in the South Barrier section, less than one week after reading the consultant’s report about the large bounce in the North, he didn’t question mine management about the specifics of the March event. No follow-up

questions were asked in an attempt to assess the extent of the bounce or the severity of the damage. No additional ARMPS analyses were conducted by District 9 using the circumstances of the March event as a new site-specific failure point in an effort to recalibrate the acceptable ARMPS stability factor. No attempt was made to analyze the claims made by AAI in the April 18th report or to question its methodology. The failure to conduct additional analyses is striking because the purpose of the four-stage approval process described above was to evaluate the merit of each phase based on the conditions encountered in the preceding one.

Even though mine management did not comply with the reporting requirements of Part 50, there is ample evidence that District 9 personnel had knowledge of the March 10th bounce at the Crandall Canyon Mine. Because the District was concerned enough to approve mining in a four-stage process, knowledge of this bounce should have led to an investigation.

Conclusion: The circumstances of the pillar failure in the North Barrier section should have been considered before approval of the nearly identical mining scenario in the South Barrier. Failure of the District to recognize the significance of the March 10, 2007, bounce was a breakdown in the approval evaluation process.

Recommendation: When plans are to be approved based on the success of a previous plan, any pertinent information, including failures, should be investigated and considered in the plan approval process.

4) Failure to observe and evaluate pillaring operations. Despite the unusual conditions of mining in the North and South Barriers, there was never a concerted effort by MSHA personnel to observe and evaluate pillaring operations in either the North or South Barrier sections. Before the August 6, 2007, accident, District 9 had conducted inspections on both the North and South Barrier sections. The District roof control supervisor, two roof control specialists, one of the Price Field Office supervisors, and six Field Office inspectors had all been to the North and/or South Barrier sections to conduct inspections. A review of inspection reports and time and activity records revealed that, in total, specialists and inspection personnel were in the barrier sections on 17 different days. Only two of these inspection days were conducted when retreat mining was ongoing. Both of these inspection days occurred while the company was mining the South Barrier section's first row of pillars. This section discusses the two days that specialists visited the North and South Barrier sections. The 15 days that inspection personnel were in the North and South Barrier sections are discussed in the [Inspections of North and South Barriers Sections](#) portion of this report.

MSHA policy states that, when necessary, an on-site investigation by technical specialists should be conducted when evaluating a plan's technical adequacy and completeness. Even

though Owens conducted on-site evaluations of mining activities in both the North and South Barriers, those investigations took place during development mining. It would be prudent, in order to evaluate the additional abutment loading from pillar extraction, to also observe pillaring operations. When pillaring operations began on the North Barrier section on February 16, 2007, there was a roof control specialist assigned to the Price Field Office, yet Owens did not assign him to observe retreat operations. In addition, neither Knepp nor Davis questioned the lack of on-site observation of retreat mining operations.

In keeping with the intent of the four-stage plan approval process, an evaluation of pillaring operations in the North Barrier section should have been used as a basis for determining approval of pillaring in the South Barrier section. Furthermore, knowledge of the March bounce event raised the need for observation of pillaring to an even higher level, but such observation never took place.

Conclusion: To adequately evaluate the retreat mining process of a four-stage approval, an on-site investigation should have been conducted while retreat mining was ongoing. The failure of District 9 to observe pillaring operations in the North Barrier section was a missed opportunity to obtain valuable information concerning approval of pillaring in the South Barrier section.

Recommendation: An on-site investigation should be conducted of each phase of all unique or non-typical mining plans.

- 5) **Contradictions between approved plans and supporting data submitted to justify approval.** According to Owens, recommendations made by AAI were used to justify approval to mine the North and South Barriers. However, several of the recommendations made in the April 18, 2007, report were not implemented into the June 15, 2007, approval for pillar extraction in the South Barrier section.

In the April report, AAI recommends that the pillars be lengthened by 37 feet. However, the site-specific plan approved in March for development of the area was not modified to reflect the new recommended pillar size. Although the new pillar size was implemented by mine management, the lack of a plan change meant that it was never a requirement to do so.

AAI concluded that skipping pillars, or leaving pillars unmined, contributed to the March 10th bounce in the North Barrier section, and emphasized the importance of this with the statement in the April report that, "skipping pillars should be avoided in the South Barrier, particularly under the deepest cover." This recommendation was not reflected in the roof control plan. The impact of skipping pillars was not examined by the District (no modeling of this aspect was undertaken), nor was the aspect of "deepest cover" defined in any manner. In fact, Owens required three full rows of pillars to be skipped around the sump

offset between crosscuts 139 and 142 in the retreat mining sequence in the South Barrier. Although Owens required the pillars to be skipped to better protect the bleeder entry and weekly examiner, which was a valid concern, the potential impacts of skipping pillars was not properly evaluated, nor were alternatives explored. For instance, the entire issue of skipping pillars around the sump offset area could have been completely avoided by requiring that retreat mining begin outby crosscut 139.

Yet another inconsistency between the consultant's report and the approved roof control plan concerned slabbing, or mining into, the barrier to the south of the South Barrier entries. The April 2007 AAI report discusses how the wider span created by slabbing 40 feet of the barrier is, "expected to improve caving conditions compared to the north and reduced concentrated loads at the face." Despite this and other statements such as "slabbing the south-side barrier is expected to benefit caving," the roof control plan allowed no slabbing from crosscut 139 to 142. Again, if the consultant report is used to justify the plan approval, recommendations that contradict the consultant should be thoroughly evaluated for any potential negative impact. Such an evaluation was not conducted by the District.

The March 10th bounce in the North Barrier section, and the subsequent AAI report also led to an additional instance where the District failed to adequately evaluate data submitted by the mine operator. One of the primary recommendations made by AAI to protect against "problematic bumping" in the South Barrier section was to increase the length of the pillars. The report stated that, "The added 37 foot length, approximately equivalent to an extra cut, increases the size and strength of the pillars' confined cores, which helps to isolate bumps to the face and reduce the risk of larger bumps overrunning crews in outby locations." This contradicts the July 20, 2006, AAI report that asserted, "model results indicate that increasing crosscut spacing does not significantly improve conditions." District 9 did not question these conflicting statements. Rather, the District accepted the April 18, 2007, AAI report at face value without questioning conflicting statements or verifying the updated modeling.

The approved roof control plan also did not reflect the mining height used as an input parameter by the consultant in both the ARMPS and LAMODEL analyses. These models, and the District's own ARMPS evaluation, limited the mined height input to eight feet. Since both ARMPS and LAMODEL are extremely sensitive to changes in mined height, this should have been recognized and reflected in the roof control plan. The stratigraphic column included in the roof control plan depicts the Hiawatha coal seam as 4-to-10 feet in thickness. Thus, it would be reasonable to assume that the seam would allow development mining that could have exceeded eight feet, but this was not prohibited by the plan. An increase in mining height above eight feet would result in a reduction in pillar stability factors.

Conclusion: The consultant's recommendations that were included in reports submitted by the mine operator to support pillar extraction in the South Barrier section were not consistently included in the approved roof control plan. When the roof control plan contradicted the consultant's recommendations, a thorough analysis of the potential consequences was not conducted.

The District also failed to recognize the importance of mined height in the analysis of stability factors and bump potential of pillars. Plan approval was reportedly based in part on computer modeling which was conducted with an eight-foot mining height, but this was not accounted for in the roof control plan.

Recommendation: Consultant recommendations used to support mine plan submittals should be specifically addressed in such plan approvals.

When plan approval is based on computer modeling, model input parameters should be specifically reflected in the plan.

6) **The adequacy of the required six-month plan reviews.** District 9 had a formal SOP for the review and approval of roof control plans. Specialists, including the roof control supervisor, reviewed all new plans and supplements. Historically, the specialists assigned to the district office would also conduct the mandatory six-month plan reviews required by § 75.223(d). Due to attrition and other work assignments, these duties had been assumed and conducted by mine inspectors in District 9 since early 2006. These reviews were documented by completion of the MSHA 2000-204 Plan Review forms, which were submitted with the required quarterly inspection reports.

While the use of the 2000-204 forms as a means of documenting the six-month plan reviews is in itself not a deficiency, the IRT found an issue that impacted the adequacy of this practice in District 9. The inspectors in the Price Field Office stated that when they documented a plan deficiency on the MSHA 2000-204 form, they seldom received any feedback from the District personnel responsible for that plan area. Inspectors stated that this lack of communication with the District Office concerning plan inadequacies cited via the 2000-204 form was not an isolated instance, but rather an ongoing practice that had existed for some time.

The District 9 Roof Control Branch SOP required the plan reviewer do the following:

- Review comments from the roof control specialist or supervisor;
- Review plan review forms and previous roof control citations issued since the last plan review; and
- If comments from the field personnel will not be incorporated, notify that person(s) of your reasoning for not incorporating the comments.

To determine the validity of the inspectors' assertion, the IRT analyzed 2000-204 forms for District 9 for a two-year time period from August 1, 2005, to August 1, 2007. Of a total of 193 forms reviewed, the team found 44 instances when an inspector had cited a plan deficiency on the 2000-204 form. Of these, 41 had no record of response from the District back to the Field personnel. Only two response letters from Davis to the issuing inspectors were found that addressed the noted plan deficiencies, while one additional response was in the form of a written note on the original 2000-204 form.

Although the District 9 Ventilation Branch stated that some plans were modified based on plan review by inspectors, the IRT could not determine that all deficiencies identified were evaluated because written responses were not provided. In some cases, the plan revisions were made several months after the submittal of the MSHA 2000-204 forms. This often occurred after the issuing inspector had been rotated to another mine and, therefore, had no knowledge that a change had been made.

The District Roof Control Branch had no documentation to show that any plans had been revised because of deficiencies identified on the 2000-204 forms. No formal written responses were provided by the roof control group for any identified deficiency.

On all seven 2000-204 forms reviewed for the Crandall Canyon Mine from December 2005 through July 2007, the inspectors indicated both the roof control and ventilation plans were "adequate."

Section 75.223(d) requires the six-month review to consider any falls of roof, face, or ribs and the adequacy of the support systems used at the mine. A thorough review requires a focused inspection of the mine's conditions, support installation and performance, and work practices. As part of this review, the base plan and all addendums need to be carefully reviewed to ensure they remain up-to-date, complete, and address the current mining conditions. The six-month review was never intended to be conducted solely during the course of a regular inspection. The field review by an inspector is an important part of the plan review process, but it is only one step of the six-month review.

Historically, roof and rib accidents have accounted for approximately 50% of all underground fatalities in coal mines. This fact alone underscores the need for personnel dedicated to perform the reviews as their primary focus, and not as an added burden to the already enormous responsibilities of the regular inspector. Districts should have specialists dedicated to reviewing plan submittals as well as conducting the six-month reviews. The use of specialists to conduct regular inspections, as described later in this report, taking them away from their review duties, has adversely affected their ability to conduct the required reviews.

Conclusion: The District Office failed to respond, as required by SOP, to plan deficiencies identified by field office personnel. The established practice of non-communication over plan deficiencies cited on MSHA 2000-204 forms adversely affected the effectiveness of the plan review process.

The full scope of six-month plan reviews mandated by § 75.223(d) was not fulfilled by using the MSHA 2000-204 forms for such reviews. The practice of only using regular inspectors to conduct the required six-month plan reviews was inadequate.

Recommendation: The District 9 plan approval SOP should be modified to clearly state that a written response is required when a plan has been identified as inadequate via the 2000-204 form. The response should be directed to the appropriate field office supervisor as well as to the inspector who cited the deficiency.

The MSHA 2000-204 forms should be used to provide feedback from field personnel and not as the sole means of conducting the six-month review. Headquarters should require that six-month reviews are conducted by specialists.

7) **Field personnel not involved in plan approval process.** The *MSHA Program Policy Manual, Volume V*, page 8, paragraph (4) (b) specifies that “Management System Controls” should acquire and consider field office input from local inspectors during plan reviews, and address specific recommendations when evaluating a plan for technical adequacy and completeness. The District 9 SOP stated, in part, that if comments from the field are required, the plan reviewer will write a letter to the field personnel requesting that they review the plan and provide written comments.

The district personnel responsible for plan approvals (roof control and ventilation) stated that field personnel were seldom consulted about submitted plans prior to approval or disapproval. They indicated that the 2000-204 forms were reviewed for comments during six-month plan reviews and served to alert them of any plan problems from field inspectors’ observations at the mine.

The field inspectors and field office supervisors interviewed stated that their input was never solicited prior to plan approval. The general response from the field personnel was that they had no voice in the approval or disapproval process.

Neither Davis nor Knepp ensured adherence to the *Program Policy Manual* and District SOP concerning the practice of soliciting input from field personnel.

Conclusion: District management and roof control and ventilation branch personnel did not utilize an important source of information that was available to them. Input from field personnel was not solicited prior to making decisions on recommending approval or

disapproval to the District Manager. The District did not comply with the above stated program policy manual nor their own SOP.

Recommendation: The District Manager should implement a system to assure that, when appropriate, input from field office personnel is obtained prior to recommending approval or disapproval of a plan or plan revision.

- 8) **Assistance from Technical Support not requested.** MSHA's Technical Support maintains a Roof Control Division (RCD) that provides engineering and geological technical services concerning the evaluation of roof support systems, mine design, and actual ground conditions at surface and underground mining operations. The RCD has routinely used the ARMPS program to evaluate retreat mining scenarios. The RCD has also conducted numerical modeling since 1985, and has used the LAMODEL program extensively to evaluate retreat mining layouts, including scenarios at bump-prone mines. In light of District 9's inability to conduct a LAMODEL analysis and their failure to properly evaluate barrier pillar stability factors in the ARMPS analysis, assistance from the RCD should have first been requested in September 2006 to help review the AAI reports.

Another instance where the RCD was not properly utilized was in May 2007. On May 10th, District 9 requested RCD assistance in an investigation at the Company's Aberdeen Mine. The RCD responded by sending two investigators to accompany Owens to the mine on May 23rd. On May 22nd, Owens traveled the Crandall Canyon Mine and observed conditions on the South Barrier development section. RCD assistance was not requested for this investigation even though both mines were in the same area and it would only have required traveling to the Price area one day earlier.

When questioned about why he did not request Technical Support assistance for any evaluations of the submittals at Crandall Canyon, Owens stated that he had "a high level of confidence" in AAI. He also stated that in a lot of instances he didn't have enough time to send things to the RCD for review. However, in this case, a copy of the AAI reports could have been forwarded to the RCD for review without requiring a field investigation. For example, in another scenario from District 9 involving a retreat mining plan, the roof control specialist from the Delta, Colorado Field Office requested assistance via e-mail in early April 2007. An RCD engineer conducted an ARMPS analysis and replied to the specialist within two weeks.

In addition to Owens' failure to consult with Technical Support, Knepp and Davis again failed to demonstrate adequate oversight. Knepp, as Assistant District Manager of Technical Programs, had the responsibility to ensure that sufficient analysis of the submitted data was conducted. Proper oversight by Davis and Knepp would have revealed the inability of the District to conduct a thorough analysis of the data, and should have prompted a request for Technical Support's assistance.

Conclusion: District 9 did not utilize Technical Support's Roof Control Division to assist in evaluating the roof control plan amendments pertaining to mining in the North and South Barriers. RCD had the experts and means to conduct computer modeling that District 9 did not have.

Recommendation: All MSHA districts should use Technical Support whenever plan submittals exceed their ability to fully evaluate the supporting technical data. Districts should also consult Technical Support on retreat mining submittals in instances of overburden greater than 1000 feet that do not meet the NIOSH recommended ARMPS pillar stability factors.

- 9) **Contradictions between approved Roof Control and Ventilation Plans.** MSHA's *Program Policy Manual* specifies that a supervisory technical specialist or engineer ensures that, "cross communication with other plan approval groups occurs when appropriate." This policy is designed to prevent contradictions between related plans. District 9 personnel stated that this was accomplished by having the pertinent specialist branches review and concur with appropriate plans before they were approved.

Review of the approved roof control amendment for pillar extraction in the South Barrier section revealed a conflict with the approved ventilation plan. Although the text of the ventilation plan states that, "The pillar recovery proposed by this plan will be done in accordance with the approved Roof Control Plan," there is still a discrepancy between the two plans. The conflict relates to the number of pillars that were designated on the accompanying maps to remain intact in order to protect the bleeder entry. Specifically, the map plates attached as part of the ventilation plan approved June 1, 2007 depict five pillars to remain around the sump area offset from crosscut 139 to crosscut 142, while the roof control plan plates show eight pillars to remain intact in this area. Also, in this same area adjacent to the sump area offset, the ventilation plan depicts slabbing of the barrier while the Roof Control Plan allows no mining in the barrier.

In addition, a contradiction concerning water accumulations in bleeder entries was identified. The approved roof control plan incorporated language from § 75.334(c)(3) which states, "Bleeder entries will be maintained free of roof falls and standing water in excessive depths which would prevent safe travel of the bleeder." The approved ventilation plan states, "The bleeder measurement point location (MPL) will be located at the deepest point of penetration or the edge of accumulated (roofed) water" and "The MPL proposed for the No. 4 entry of the Main West south barrier would be moved outby if water accumulations were to occur."

In District 9 it was Knepp's responsibility, as Assistant District Manager for Technical Programs, to ensure cross communication between plan groups. Knepp signed off on the subject ventilation plan on May 31, 2007. However, in the case of the roof control plan

amendments for the South Barrier retreat mining, Owens signed the plan on behalf of Knepp on June 14, 2007.

Conclusion: When acting for the ADM for Technical Programs, Owens did not identify the discrepancies between the roof control and ventilation plan amendments for retreat mining in the South Barrier section.

Recommendation: The District 9 Manager should ensure that roof control and ventilation plans are compatible as per MSHA policy.

INSPECTION ACTIVITIES AT CRANDALL CANYON MINE

Section 103(a) Inspections

Section 103(a) of the Mine Act states that authorized representatives of the Secretary shall make inspections of each underground mine in its entirety at least four times a year (regular inspections) for the purpose of determining whether there is compliance with mandatory safety or health standards of the Mine Act.

The *MSHA Program Policy Manual* is a compilation of Agency policies on the implementation and enforcement of the Mine Act and *Title 30 of the Code of Federal Regulations (30 CFR)* and supporting programs.

MSHA's Handbook Series contains procedural instructions related to conducting inspections. The *Coal General Inspection Procedures Handbook* outlines procedures for conducting inspections of coal mines. Relevant provisions of this handbook instruct inspectors to complete certain specified activities when conducting a regular inspection of an underground mine.

MSHA's practice is to conduct one complete safety and health inspection (E01 regular inspection) each quarter at each underground mine. The manner in which District 9 personnel conducted regular inspections at the Crandall Canyon Mine consisted of the inspector beginning the inspection near the start of, or during, the calendar quarter. The regular inspection generally remained open the entire three months, with intermittent inspector presence throughout the entire period. The inspection was completed near the end of the calendar quarter, and the next inspection was subsequently started. [See Appendix C](#) for a listing of all inspections at the Crandall Canyon Mine from January 1, 2006, through August 6, 2007.

The IRT evaluated the six complete E01 inspections that District 9 inspectors conducted at the Crandall Canyon Mine in calendar years 2006 and 2007, prior to the August 6th accident. The E01 inspection that was ongoing when the accident occurred was also evaluated. In addition, the IRT conducted interviews with all inspectors involved in these inspections. These interviews and evaluations were to determine if District 9 complied with MSHA's requirements, policies and procedures for conducting and documenting such inspections.

The following table contains certain data about the inspections evaluated.

Event Number	CY Inspection Quarter	Number of Inspection Days	Number of Inspection Days at Mine	Number of Citations Issued	MMU Time %	Report Writing Time %
4476283	2006-1	15	9	6	24.74%	12.89%
4476331	2006-2	26	18	24	14.37%	21.11%
4476247	2006-3	20	18	37	6.45%	17.66%
4474244	2006-4	16	13	1	19.24%	39.03%
4476407	2007-1	22	14	22	17.94%	31.06%
4474428	2007-2	15	11	8	24.25%	18.89%
4474193	2007-3	7	4	12	27.00%	20.00%

The number of inspection days appeared to be appropriate for the size and conditions of the Mine. The enforcement actions were appropriate for the conditions observed as documented in the inspection reports. However, the number of citations per inspection was not consistent. For example, only one citation was issued during E01 Event # 4474244. There was no change in the Mine operating status during the time frame evaluated that would cause such a discrepancy in the number of citations issued. The Mine had one active and one inactive mechanized mining unit (MMU) during the entire period.

Bob Cornett, the District 9 Assistant District Manager (ADM) for Inspection Programs at the time of the August 6th accident, and Ted Farmer and William Taylor, Supervisory Coal Mine Inspectors in the Price Field Office, indicated they were aware of the inconsistencies in the number of citations issued among different inspectors in the Price Field Office. This inconsistency was prevalent even though the inspectors were going to the same mines. Cornett, Farmer, and Taylor stated that they had addressed the issue with the inspectors who issued few citations and orders, and the inspectors would show improvement for a while, but then the problem would resume.

Two of the inspections also had over 30% of the total inspection time charged to the inspection to report writing, with 39% of E01 Event # 4474244 charged to report writing (this was the same inspection in which only one citation was issued). Inspection time charged for the other five events was consistent, ranging from 13 % to 21 %. Interviews with inspectors revealed that the computer-based Inspection Tracking System (ITS) in place at the time may have

contributed to the high percentages; however, the same system was in place for other inspections during this time frame.

MSHA Internal Review reports for the Sago Mine, Aracoma Alma Mine No. 1, and Darby Mine No. 1 were all released on June 28, 2007. These reports identified that MSHA inspectors and management failed to follow policies and procedures related to regular inspections and failed to adequately document inspection activities and findings. These deficiencies were discussed with MSHA management and supervisors in a MSHA-wide meeting at the National Mine Health and Safety Academy in Beckley, West Virginia, on July 11 and 12, 2007. Further meetings were held with inspectors to discuss the deficiencies and MSHA's response to them. The IRT found several of these same deficiencies in District 9's inspections and reports at the Crandall Canyon Mine. Since these deficiencies occurred over the same time period that these internal reviews covered, and since MSHA did not have time to implement most of the proposed corrective actions, this independent review did not repeat the recommendations on the same deficiencies that are currently being addressed.

Conclusion: District 9 conducted all required inspections at the Crandall Canyon Mine during the time period reviewed.

There was inconsistency in the number of citations issued between inspectors and the amount of time charged to report writing during the inspections.

Supervisory oversight identified the discrepancy in the number of citations issued and addressed it, but was not effective in preventing its recurrence.

Recommendation: District 9 managers and supervisors should use available data, including key indicators, to evaluate inspection data that is inconsistent with other inspections.

Appropriate actions should be taken to correct any deficiencies and to prevent their recurrence.

Handling of Complaints

The Hazardous Condition Complaint (HCC) System was implemented in MSHA's Standardized Information System (MSIS) on January 13, 2006. The HCC system is used to transcribe and record all hazardous condition complaints received and investigated by MSHA. There were 16 complaints investigated by the Price Field Office from January 13, 2006, through August 6, 2007, which were recorded in the HCC system. One of these complaint investigations was at the Crandall Canyon Mine. The Price Field Office also investigated one other complaint at Crandall Canyon under an E01 inspection during this time period that was not recorded in the HCC system.

The Price Field Office did not investigate any complaints given to them verbally (face-to-face). Both supervisors stated that they did not believe that verbal complaints were required to be investigated. The HCC system, however, lists the following types of complaints that must be investigated:

- Hazard Complaint (Online)
- Hazard Complaint Recording
- Telephone
- Verbal (face-to-face)
- Email
- Written (letter/fax/note)

Both supervisors also stated that when Price Field Office personnel received a verbal complaint at a public place, they did not consider this to be a valid complaint and did not investigate them. Sometimes the complaints would come from family members of miners. Both supervisors stated that they did not consider information received in this manner to meet the requirements for a complaint. However, the *Hazards Complaint Procedures Handbook, No. PH02-I-8* defines these as "Other Complaints" which include:

- Signed, written letters, facsimiles, or notes originating from someone other than a miner or representative of miners;
- Unsigned letters, facsimiles, or notes not originating from a miner or representative of miners;
- Unsigned email or messages from invalid email addresses not from, or not identifiable as, originating from a miner or representative of miners;
- Anonymous e-mail or Code-A-Phone messages that can not be identified as originating from a miner or representative of miners; or
- Verbal communications made in person or by telephone by a miner, representative of miners, or other party.

The supervisors stated that they kept no record of complaints that they received by means other than from MSHA Headquarters or telephone.

Both Allyn Davis, the District 9 Manager, and Cornett stated that policy requires that all complaints, no matter who made them or where they were made, were to be investigated. The Managers were aware of complaints made face-to-face in other field offices that were investigated. They were not aware that the Price Field Office had not investigated face-to-face complaints during the review period.

The Price Field Office supervisors also did not enter every complaint they investigated into the HCC system as required. The IRT determined that E01 Event # 4476407, conducted at Crandall Canyon beginning on December 29, 2006, was actually started because of a complaint received in the Field Office by telephone. When asked why the E01 was started in December,

three days before the beginning of a calendar quarter, Farmer stated that a call was received indicating that the conveyor belts and other machinery and equipment at the Crandall Canyon Mine needed to be “looked at.” While they immediately investigated the allegations, no record of this investigation was made in the complaint database.

Conclusion: The Price Field Office was not investigating all complaints as required. Complaints given to Field Office personnel verbally in public places were not responded to in accordance with MSHA’s policies and procedures.

All complaints were not entered into the Hazardous Conditions Complaint database.

Recommendation: The District 9 Manager should ensure that the Price Field Office complies with the *Hazards Complaint Procedures Handbook*.

The District 9 Manager should ensure that all appropriate hazard complaints are entered into the Hazardous Condition Complaint database.

Erroneous Dates on E01 Event # 4474428 Documents

The report for E01 Event # 4474428, conducted from May 30th through July 10, 2007, contained notes and documents with dates of January and February, 2007. The misdated notes and documents are:

- The notes included after June 26th have a date of “27 Jan 07” on pages 1 and 2 (but “27 June 07” on page 3);
- The notes included after June 30th have a date of “02 Feb 07” on the Daily Cover Sheet;
- The General Information Cover Sheet shows a Post-Inspection Conference Date of “02 Feb 07”; and
- The Plan Review form, MSHA Form 2000-204, is dated “02 Feb 07.”

The review of inspection time charged to this event revealed that the inspector was at the mine on June 27th and July 2, 2007. These dates coincide with the “27 Jan” and “02 Feb” dates. The inspection time review also showed that the last date the inspector was at the mine was July 2nd. The notes dated “02 Feb 07” document that the E01 inspection was concluded on that date.

The report also contains an ATF E-Form 5030.5 that is dated “02 July 07.” The inspector stated that this form is completed after the post-inspection conference at the end of the inspection, along with the plan review form. The inspector stated that he started to write “02 Feb 07” on the ATF form, but realized the error and wrote “02 July 07” on it instead. This correction is visible on the form.

The inspector stated that this event was his first inspection conducted after being off work for one and one-half years due to injuries from a vehicle accident. He stated that he didn't know how or why he put the incorrect dates on the notes and documents, and that he could not come up with an explanation. He stated that his notes and documents were original and were not from previous inspections. A review of the E01 inspection, Event # 4476407, conducted during the January - March 2007 calendar quarter, revealed that the misdated notes and forms were not copies of documents from that inspection.

The supervisory review of this inspection report did not discover the erroneous dates. An acting supervisor reviewed the inspection report after it was completed. All documents that had the incorrect dates were initialed and dated by the acting supervisor on July 7, 2007. Taylor, the supervisor for this work group, had initialed and dated some documents and notes in the report, but none that had the erroneous dates. Neither the regular supervisor nor the acting supervisor detected the wrong dates.

Conclusion: The inspector inadvertently put the incorrect dates on documents and notes for Event # 4474428. While the inspector could not explain why the wrong dates were listed, it is apparent that the documents were original and not from the previous inspection.

The supervisor's and acting supervisor's review of the report was inadequate.

Recommendation: The District 9 Manager should ensure supervisory review of inspection notes and reports is thorough.

Inspection of Mine After March 2007 Bounce

On Saturday, March 10th, in the North Barrier section, a bounce occurred that expelled large amounts of coal from the pillar ribs, destroyed ventilation controls, and caused the operator to permanently stop mining in this barrier. On Tuesday, March 13th, a Price Field Office inspector traveled to the Crandall Canyon Mine to continue an ongoing E01 inspection. The inspector did not go underground that day. He stated that he checked records on the surface; he also issued a citation to the Mine for failing to have a secondary hard-wired phone system. He returned to the Mine on Wednesday, March 14th and, among other things, documented checking the weekly examination book and inspecting the North Barrier section's (002 MMU's) equipment. The inspector stated he traveled to just outby crosscut 118 on the North Barrier section and inspected equipment that had been removed from the section. The inspector stated that the operator had "dangered off" the section inby this area, and this indicated to him that he did not need to go beyond crosscut 118.

A company representative informed the inspector that they were withdrawing from the area because the "country got rough" and that the area would be sealed. The inspector said the representative never told him that a bounce had occurred in the North Barrier section. The

inspector asked the representative if the District Office was aware that the operator was withdrawing from the North Barrier section and was told yes. However, no one from the field office followed up with the District to learn what they were told, nor did the District Office contact the field office concerning the bounce.

On March 21st, the inspector examined the sealing project near crosscut 118 of the North Barrier section. The inspector stated that the operator was not working on the seals this day. On March 22nd, the inspector documented in the Inspection Tracking System (ITS) and on the tracking map for this E01 inspection that he traveled into the North Barrier section to crosscut 128, only four to five crosscuts outby the location of the March 10th bounce. The inspector stated that he did not remember traveling into this area, but that he must have since this was documented. He did not remember seeing any damage as a result of the bounce on this day. During a second interview, the inspector stated that he could have been wrong on March 14th concerning the location where the section was dangered off.

Section 75.364 requires the operator to examine the effectiveness of the bleeder system every seven days by either traveling the bleeder system in its entirety or by an alternative means approved in the ventilation plan. At Crandall Canyon, the operator was required to examine the North Barrier bleeder system at an evaluation point approved in the ventilation plan that could move outby as water accumulated. The Weekly Examination for Methane and Hazards records for the North Barrier bleeder system, which was recorded as Main West, showed that the farthest point to which the mine examiner traveled decreased weekly, from crosscut 156 on February 14th to crosscut 149 on March 7th. On March 13th, the mine foreman, who was not the regular mine examiner, made the examination of the Main West to crosscut 148. However, the entry for March 13th documented that the area from crosscut 132 inby was not safe to travel and was dangered off. The next entry, on March 21st, documented the farthest point traveled to in the Main West was to crosscut 128, where it was blocked off with a "Breaker Row" of timbers. This is the same location that the inspector documented traveling to on March 22nd. At this point, the operator was no longer examining the effectiveness of the bleeder system as required.

On March 15th, an inspector from BLM traveled into the North Barrier section to crosscuts 132 to 133. The BLM inspector saw the extent of the bounce and documented extensive rib coal was thrown into the entry ways. His report for this March 15th Mine visit included a map given to him by the operator. This map depicts the coal pillars that were involved in the bounce, the extent of damage to ventilation controls, and the location of the water in the bleeder. The operator had marked on this map that the measuring point location for the bleeder was at crosscut 147.

The MSHA inspector documented in the computer-based ITS that he examined the weekly examination record book on March 14th, 15th, 16th, 19th, 21st, and 22nd. He stated he did not notice the March 13th entry that the Main West was too unsafe to travel. During a second interview, he stated an operator would be in violation if the weekly examination was not

conducted every seven days. However, a citation was not issued even though the record book documented the operator to be in violation when the inspector examined the book on March 21st and 22nd.

Conclusion: The inspector did not adequately examine the weekly examination record book.

Recommendation: District 9 inspectors should be instructed on the requirements and importance of thoroughly reviewing operators' examination record books.

Inspection of North and South Barrier Sections

Before the August 6, 2007, accident, District 9 conducted inspections of both the North and South Barrier sections. A discussion of the District Office's inspections of the barrier sections is in the [Crandall Canyon Mine Roof Control Plan Approval](#) section of this report. This section will address the Field Office inspections.

A Price Field Office supervisor and six inspectors conducted inspections on the North and South Barrier sections between November 2, 2006, and August 6, 2007. A review of inspection reports and time and activity records revealed that field personnel were in the barrier sections on 15 different days.

During E01 Event # 4474244, conducted from November 2 to December 13, 2006, one inspector documented that he was on the North Barrier section a total of six days. A review of the tracking map for this inspection revealed that development of the North Barrier section had just begun. The section was developing north off the old Main West entries and had not begun advancing west between the mined out areas.

During E01 Event # 4476407, conducted from December 29, 2006, to April 18, 2007, two inspectors were on the North Barrier section's 002 MMU on December 29, 2006. At the time, the North Barrier section was still on advance. Another inspector traveled into the North Barrier section on March 22, 2007, to crosscut 128. This was after the operator had removed equipment from the section because of the March 10th bounce. No activity was ongoing in the section on this date.

During E01 Event # 4474428, conducted from May 30 to July 3, 2007, one inspector was on the South Barrier section on five different days. On two of these days, a supervisor accompanied the inspector. The South Barrier section was advancing at the time of this inspection.

During E01 Event # 4474193, which was started on July 5, 2007, and was ongoing at the time of the August 6th accident, an inspector spent two days on the South Barrier section. The South Barrier section had finished advancing and was beginning to retreat mine. On July 17th and 18th, the inspection report documents that the inspector observed retreat mining on the first

pillar extraction. After these two days, the inspector was at the mine only two more days. Both of these days were spent on the surface. MSHA had no other presence at the Mine before the accident.

Of the 15 days that field personnel were in the North and South Barrier sections, only two days were when retreat mining was occurring. Both of these days occurred while the first row of pillars was being extracted in the South Barrier section. There was no inspection time spent in the North or South Barrier sections after retreat mining had sufficiently progressed to the point where the effects of pillar mining could be evaluated.

Statements from Accident Investigation Team interviews with miners who worked in the mine and interviews with family members of the victims revealed that the March 10th and August 6th bounces were not the only bounces that occurred in the North and South Barrier sections. These bounces occurred mainly while retreat mining was occurring.

During each E01 inspection, MSHA Form 2000-204 must be completed. This is a form that inspectors and supervisors use to document their review and deficiencies in either the roof control and ventilation plans in effect at the mine. The forms were completed for all of the inspections reviewed, except the one that was ongoing at the time of the August 6th accident (this one was not required to be completed because the inspection was still ongoing). All of these 2000-204 forms documented the roof control plan to be adequate for the Crandall Canyon Mine. However, all of these forms were completed by inspectors who only observed advance mining in the barrier sections or were at the Mine when no mining activity was ongoing in the barrier sections. None of these inspectors evaluated the retreat mining portions of the plan because they never observed retreat mining in the barrier sections.

The *General Coal Mine Inspection Procedures Handbook, No. PH06-V-1*, in effect at the time of the August 6th accident, states the inspector shall observe the complete mining cycle on the working section. It also states that the inspector shall observe roof and rib conditions on each active working section to determine compliance with applicable standards, including attention to: roof control failures; roof control plan requirements; and information obtained from the miners installing the roof supports and the mine operator. The complete mining cycle and roof and rib condition observations during inspections in the North and South Barrier sections were all during advance mining. There is no requirement for the inspector to return to a section after conducting the original visit to observe a change in mining methods, e.g., if the section begins retreat mining after the inspector observed advance mining, as long as all other inspection requirements have been met. However, to properly evaluate the roof control plan requirements for retreat mining, the retreat mining process needs to be observed.

Conclusion: Although District 9 followed inspection procedures, the retreat mining process was not evaluated at the Crandall Canyon Mine. Without observing the full retreat mining process, the adequacy of the roof control plan could not be evaluated.

Recommendation: MSHA should establish policy that retreat mining should be observed, especially in areas that are bounce-prone and/or under deep cover, to evaluate if the plan is adequate.

Enforcement of § 75.223(b)

Section 75.223(b) requires that each unplanned roof fall and rib fall and coal or rock burst that occurs in the active workings be plotted on a mine map if it:

- (1) Is above the anchorage zone where roof bolts are used;
- (2) Impairs ventilation;
- (3) Impedes passage of persons;
- (4) Causes miners to be withdrawn from the area affected; or
- (5) Disrupts regular mining activities for more than one hour.

A bounce, as stated before, is the equivalent of a coal or rock burst. As such, the standard requires bounces to be plotted on the mine map in the same way that roof falls are plotted. District 9 personnel stated they were well aware of the requirement for the operator to plot the location of roof falls. However, none of them were aware of the requirement to plot the location of bounces that meet the criteria. Therefore, District 9 was not enforcing this standard.

Many inspectors stated that it would be useful to have the location of bounces recorded on a map. They would then be able to determine a trend as to where bounces were occurring.

Conclusion: District 9 did not enforce the requirement that operators plot on mine maps the location of bounces that meet the criteria of § 75.223(b).

If the bounce that occurred in the North Barrier section at Crandall Canyon in March of 2007 had been recorded on a map, it may have caused District 9 personnel to further investigate its occurrence.

Recommendation: The Administrator should ensure that all districts are enforcing the requirements of § 75.223(b), and provide any necessary guidance.

Respirable Dust Survey Collections

The *General Coal Mine Inspection Procedures, Handbook Number PH06-V-1*, in effect at the time of the August 6th accident, stated in part, "respirable coal mine dust samples shall be collected pursuant to the *Coal Mine Health Inspection Procedures Handbook*." The *Health Inspection Procedures Handbook* required all underground active mining sections to be sampled quarterly

unless otherwise stipulated for more frequent sampling. The *Health* handbook further states, "MSHA samples will be valid if production is at least 80% of the average of the previous 30 production shifts. At least one MSHA sampling inspection during the fiscal year must be conducted at a production level equal to or greater than 100% of the average production over the previous 30 production shifts. MSHA samples will be voided with the production (PRO) void code on the dust data card by the inspector if the production is less than the 80/100% level prior to the samples being submitted to the Pittsburgh laboratory."

Three of the six regular E01 inspections conducted at the Crandall Canyon Mine from January 1, 2006, through July 2, 2007, did not have valid respirable dust samples collected.

During the E01 inspection, Event # 4476283, completed during the first calendar year quarter of 2006, a respirable dust survey was conducted on March 22nd. The Respirable Dust Sampling and Monitoring Data form, MSHA Form 2000-86, required to be turned in with each survey documented that the 30-shift average production was 740 tons. The Mine produced 299 tons during that day's survey, which was only 40.4% of the average production. The survey was not voided as required, and the supervisor did not require a new survey.

During the E01 inspection, Event # 4476247, completed during the third calendar year quarter of 2006, a respirable dust survey was not collected. When questioned, the inspector who conducted the majority of the inspection stated the only time he had ever conducted a respirable dust survey was when he assisted another inspector as a trainee. He stated he was helping to complete this inspection and, as it progressed, he would be directed on what inspection activities to conduct. Again, this oversight was not detected by the supervisor.

The respirable dust survey conducted during the second calendar year quarter of 2007, on E01 Event # 4474428, was also an invalid survey. On June 29th, when the survey was conducted, the mine produced 374 tons. The 30-shift average was documented to be 556 tons on the 2000-86 forms for this survey. The production was only 67.3% of the average instead of the required 80%. Again, this oversight was not detected by the supervisor.

Conclusion: District 9 failed to conduct all respirable dust surveys as required at the Crandall Canyon Mine.

Supervisory oversight was inadequate and did not detect the invalid or missing surveys.

Recommendation: The District 9 Manager should ensure that valid respirable dust surveys are conducted in accordance with the *Health Inspection Procedures Handbook*.

The District 9 Manager should ensure adequate supervisory review of inspection activities.

DIRECTION AND ACTIVITIES DURING THE RESCUE ATTEMPT

MSHA's RESPONSE TO THE ACCIDENT ON AUGUST 6, 2007

At 2:52 a.m. MDT on August 6, 2007, a major bounce occurred on the South Barrier section of the Crandall Canyon Mine. The mine operator is mandated to report accidents within 15 minutes to MSHA through a toll-free number that contacts a national call center. At 3:43 a.m., Bodee Allred, Safety Director at the Crandall Canyon Mine, called the number and made official notification of the accident. MSHA's notification system responded accordingly, calling William Denning, District 9 Staff Assistant, at 3:52 a.m. He subsequently notified MSHA management in Denver and the Price Field Office. MSHA policy requires that personnel respond immediately to a mine emergency. The first person on-site will issue the appropriate enforcement action to protect the safety of other miners, and will represent MSHA until relieved by a higher-ranking official. MSHA policy also states that, if two MSHA personnel are dispatched to the mine, one of them will travel underground to evaluate the situation. Supervisors and inspectors from Price responded in a timely manner, with the first inspector arriving at the mine at 5:45 a.m. The Price Field Office personnel performed necessary duties, including: issuing a § 103(k) order to protect miners; traveling underground to assess the situation; transporting the mobile MSHA command center vehicle to the mine site; establishing a command center (which was and remained separate from the company's command center); and assisting in an exploration attempt to establish communication with the six trapped miners. William Taylor, Supervisory Coal Mine Inspector from Price, was the first management person to arrive and established the command center for MSHA.

MSHA management in Denver and Arlington, Virginia (Headquarters), responded to the accident notification by reporting to their respective offices, making the appropriate initial contacts, and getting updates and briefings on the severity of the accident and progress being made in the rescue attempt. At approximately 9:30 a.m., Allyn Davis, District 9 Manager, along with Bob Cornett, Assistant District 9 Manager for Inspection Programs, left Denver to travel to the mine. They arrived at the mine at approximately 5:00 p.m. As the senior MSHA person on-site, Davis took charge of MSHA's role in the rescue operation. Other personnel from the District office also responded, including Denning, who was to perform Family Liaison duties. Headquarters mobilized the MSHA Mine Emergency Units (MEUs) which included mine rescue team members from throughout the country, along with emergency equipment and vehicles from MSHA's Pittsburgh Safety and Health Technology Center (PS&HTC). The seismic detecting equipment vehicles were airlifted by an Air Force C-17 from Pittsburgh, Pennsylvania to Grand Junction, Colorado. The equipment was then driven to the mine and arrived at 10:30 a.m. on August 7th. MEU team members responded from Districts 2, 4, 9, and 10.⁴

⁴ District 2 is located in Hunker, Pennsylvania; District 4 is located in Mount Hope, West Virginia; and District 10 is located in Madisonville, Kentucky.

Two of MSHA's Technical Support roof control experts, Michael Guana and Joseph Zelanko, were told of the accident on August 6th. They were not instructed to go to the mine until noon. By then it was too late to arrange air travel from Pittsburgh to Salt Lake City, so they traveled on August 7th. They arrived at the mine about 5:00 p.m. on August 7th and were immediately sent into the mine to evaluate the situation, but this was more than 36 hours after the accident. Also on August 7th, Richard Stickler, Assistant Secretary for MSHA, Kevin Stricklin, Administrator for Coal Mine Safety and Health (CMS&H), and William Crocco, Chief of Accident Investigations for CMS&H, traveled from Arlington, Virginia, to the mine site, arriving in the afternoon at approximately 2:00 p.m. Upon arrival, Stickler was the most senior MSHA official on-site, although Davis and subordinates continued to approve rescue plans and assume responsibility for many of the activities.

Two persons notably absent from the rescue operation were William Knepp and Billy Owens, both from the District 9 office in Denver. Knepp was the Assistant District 9 Manager for Technical Programs, and had been in this position for several years. He was familiar with mining conditions in the west, and had been involved in various mine emergencies. Davis stated he did not take Knepp because "in my mind, I didn't want to take both ADMs out of the district." Owens was the Supervisor of the Roof Control Branch. Davis said Owens was one of the most knowledgeable and experienced roof control experts in MSHA, especially concerning mining conditions in the western United States under deep cover, where bounces occur frequently. For years, Owens had worked as a Technical Support roof control specialist and supervisor in MSHA's western Technical Support Center, and was the Director of the Center prior to its closing in 1997. He had performed much work in the area of preventing and minimizing bounces throughout his career, yet was not included in the rescue operation. With his expertise, Owens may have been instrumental in evaluating the bounces that were occurring and determining whether the support system being used was adequate to protect personnel. When asked why Owens was not included, Davis responded that he just didn't consider taking him. Davis further stated the he consulted with Owens by phone concerning the rescue operation, but Owens stated he was not "participatory in the recovery in any manner."

Stricklin stated that he and Stickler discussed having Owens brought to the mine. He stated that Stickler said, "since we had tech support there, let's leave Billy Owens in Denver because he's going to be involved in this controversy of the plan approval. We'll keep him separated from what was going on out here." When Stickler was asked if he questioned why Owens was never at the mine, Stickler stated that he never had time to think about it. He stated MSHA had Technical Support personnel from Pittsburgh there and Owens still had work to complete in the Denver office.

MSHA also had a national policy in place on August 6th that required sending managers from other Districts to serve as back-up for the local District Manager during certain types of mine emergencies. MSHA's *Headquarters Mine Emergency Response Procedures, Handbook No. AH99-*

111-8, which was in effect at the time of the accident at Crandall Canyon, stated that promptly after learning of a mine fire, explosion, or inundation where rescue and recovery operations are necessary, the local district manager or other designated district official will notify the appropriate backup district managers and provide the available information on the emergency. The backup district managers or their designees shall proceed immediately to the site of the emergency unless directed otherwise by the Administrator. The backup district managers shall assist the local district manager in the rescue and recovery operations and provide additional support personnel as needed and requested. The designated backup district managers for District 9 were from Districts 7 and 8.⁵

The backup district managers were not notified and did not respond to this emergency. Instead, Irvin "Tommy" Hooker, the Manager from Metal/Nonmetal's Rocky Mountain District in Denver, Colorado, was directed to assist in this emergency by Robert Friend, Deputy Assistant Secretary for MSHA. Hooker had an extensive coal mining background and had previously been an Assistant District Manager in CMS&H's District 9 Office. Hooker was the only other MSHA District Manager onsite while underground rescue activities were ongoing. Historically, MSHA has not followed the policy to utilize backup district managers when a mine emergency occurs. For example, backup district managers did not respond to the Sago Mine explosion, the Aracoma Alma mine fire, or the Darby Mine No. 1 explosion. If a manager from another district did respond to a mine emergency, he was specifically instructed to do so by Headquarters.

Additionally, the accident that occurred at Crandall Canyon was a ground control failure. This type of mine emergency was not addressed in the handbook when requiring back-up managers to respond.

Conclusion: MSHA's overall response to the accident was timely and initial actions were appropriate. However, the following deficiencies were identified.

Owens was not assigned to respond to the rescue operation. Gauna and Zelanko did not arrive until late afternoon of August 7th. As a result, MSHA did not have any ground control experts on site during the critical stages of the initial rescue planning.

MSHA has historically failed to follow policy on having backup managers respond to mine emergencies.

MSHA's handbook did not identify a ground control failure to be a mine emergency that would require back-up managers to respond.

⁵ District 7 headquarters is located in Barbourville, Kentucky, and District 8 headquarters is located in Vincennes, Indiana.

Recommendation: MSHA should respond to any mine emergency with the most knowledgeable personnel available. Contacts to Technical Support should be timely and accurate to allow for their quick response.

MSHA should ensure that backup district managers are notified to respond to all future mine emergencies.

MSHA should revise all mine emergency response procedures, both in Headquarters and the district offices, relating to responding to mine emergencies to include any accident where rescue and recovery operations are necessary, not just fires, explosions, or inundations.

COMMAND CENTER

Central Command Center

Mine rescue protocol dictates the establishment of a central command center that is manned by all appropriate parties. MSHA *Instruction Guide Series (IG) 7, A Guide to Mine Rescue Training – Coal*, published in 2006, states in part, “Located at the hub of the mine rescue operation is the command center, where persons in charge gather to plan and direct the rescue and recovery operation.” It further states, “The command center will have communication equipment...” for maintaining contact with the underground rescue workers.

At Crandall Canyon, in contradiction to mine rescue protocol, two separate command centers were established, one for the company, and one for MSHA. The company and MSHA held meetings to discuss rescue plans, but most of the time, the two entities were separated.

Underground rescue operations lasted over 10 days at Crandall Canyon, which is much longer than most rescue operations. MSHA management stated that both parties believed there was no reason to have a single command center since progress was so slow. Allyn Davis, District 9 Manager, stated, “We would get together when there was exploration. We'd get together upstairs in their facility when we had any kind of exploration activities going on, but we didn't keep the command center when we were just in the routine mining business and loading out material.” With the conditions of and activity in the rescue area underground, a single command center should have been maintained at all times with persons who were focused on the rescue operations to properly evaluate events as they unfolded.

Conclusion: A central command center was not established as per mine rescue protocol.

Recommendation: MSHA should develop a program to train persons-in-charge of rescue and recovery operations. This training should instruct participants in the organization and use of a single command center during mine rescue and recovery operations.

MSHA Person-In-Charge of Mine Rescue Efforts

The MSHA person-in-charge of a mine emergency operation has a very demanding and stressful job. This person must continually monitor and evaluate existing conditions to determine if changes to the rescue or recovery plan are required to eliminate or minimize any hazards to which workers may be exposed. Since the primary concern during a mine emergency is the safety of the workers, the person-in-charge must determine if conditions are safe enough for operations to continue. Decisions become increasingly more difficult when trapped or missing miners are involved. The person-in-charge must weigh and determine if the risks to which rescue workers are exposed are commensurate with the likelihood of the missing or trapped miners surviving the initial accident, or existing in the environmental conditions in the accident area. These decisions are normally made jointly with the mine operator and other parties involved, such as State agencies and representatives of the miners.

There were no State or miners' representatives involved with the rescue effort at the Crandall Canyon Mine, as Utah does not have a State inspection agency and the Crandall Canyon Mine had no designated representatives.

Following notification of a mine accident involving trapped or missing miners, MSHA assigns personnel to the mine to assist in the rescue or recovery operation. The first MSHA person to arrive at the mine is normally an inspector from the local field office. This individual is responsible for taking appropriate action to ensure the safety of the miners, and is considered to be the person-in-charge for MSHA until a higher ranking person arrives at the mine. When an MSHA supervisor or assistant district manager arrives at the mine, he/she assumes the role of person-in-charge for MSHA. Likewise, if the District Manager for the district in which the mine is located goes to the mine, he/she is in charge for MSHA.

MSHA's person-in-charge has the responsibility to approve plans submitted by the operator for conducting the rescue operation, and to direct MSHA's overall activities at the mine. This individual needs to be on site to make important decisions as events evolve. The person-in-charge should designate persons to be in charge on each work-shift, to assure around-the-clock coverage at the mine.

The District 9 Mine Emergency Response Plan (MERP) states that the first Authorized Representative of the Secretary (MSHA enforcement personnel) to arrive at the site will represent MSHA until he or she is relieved or assigned other duties by a higher ranking official. The plan further states that "it is generally understood that the MSHA person-in-charge will normally be the District Manager." The plan does not address who would be in charge if the Administrator or the Assistant Secretary for MSHA arrives at the mine, thus, becoming the highest ranking official for MSHA.

The District's MERP specifies that the identity of the person-in-charge should be well understood by both non-MSHA parties involved in the effort, as well as by MSHA personnel at the scene. Confusion over who is in charge can lead to communication breakdown, indecision, and loss of precious time.

On August 6, 2007, at approximately 5:45 a.m., an inspector from the Price Field Office was the first MSHA person to arrive at the Mine, following notification of the accident. William Taylor, Supervisory Coal Mine Inspector from the Price Field Office, arrived at the mine at about 6:45 a.m. and assumed the responsibility of being in charge for MSHA. Allyn Davis, District 9 Manager, arrived at the mine later that day (at approximately 5:00 p.m.) and became the senior person-in-charge for MSHA. Bob Cornett, Assistant District 9 Manager for Inspection Programs, who accompanied Davis to the Mine, was assigned duties as the person-in-charge on the evening shift. Irvin "Tommy" Hooker, District Manager, MSHA Metal/Nonmetal Rocky Mountain District, arrived at the Mine at about 7:00 p.m. and was assigned the role as person-in-charge on the midnight shift.

On August 7th, at approximately 2:00 p.m., Richard Stickler, Assistant Secretary for MSHA, and Kevin Stricklin, Administrator for Coal Mine Safety and Health, arrived at the Mine site. Normally, the senior official on site during a mine emergency, which is usually the district manager, is considered to be the person-in-charge for MSHA. Since Stickler is the most senior person in MSHA, his arrival at the mine site created some confusion as to who was MSHA's person-in-charge.

Stickler stated that he did not consider himself as the person-in-charge of the rescue operation. Stickler stated that a lot of decisions were made concerning the rescue effort, about which he was not consulted and was not involved. However, he stated that when he was at the mine site he made decisions on matters that were addressed to him and assumed that subordinates came to him because they considered him as the person-in-charge of the rescue operation. Stickler further stated that it was his understanding that Davis had a designated person on each shift to be in charge of MSHA's day-to-day operations at the command center. Stickler stated the "lower level people made the decisions that they were comfortable with", and went to Davis and Stricklin with all other matters for a decision. He stated that Davis and Stricklin would then come to him and they would make a joint decision. Stickler said he did not see a problem with how this system worked.

Stricklin stated that he thought that Davis was the person who was in charge overall, and that on each shift a different supervisor in the command center was in charge. Stricklin stated that he was there to help in any way he could, and did not consider himself in charge. Stricklin also stated that by his position as Administrator for Coal (which is senior to the District Manager), that he could have taken over, but that he did not promote that idea and felt that the district personnel were doing a good job. He further stated that he, Stickler, and Davis would always discuss and agree on revisions to the rescue plan before Davis approved a plan.

Davis stated that when Stickler and Stricklin arrived at the mine they became the senior MSHA people on site, but that he (Davis) continued to approve plans submitted by the Company regarding the rescue effort. Davis indicated that MSHA's team just got bigger when Stickler and Stricklin arrived. He indicated that he reviewed and discussed these plans with the two senior MSHA officials prior to his (Davis') approval. Davis also stated that Taylor was in charge of the rescue effort during the day shift when these three were away from the mine.

District 9 inspectors, supervisors, managers, and MSHA MEU personnel stated that they felt that Stickler, by the very nature of both his position with the Agency and his actions on-site, indicated that he was in charge of the rescue operation. Richard Kulczewski, Public Affairs Director for Department of Labor's Regions 7 and 8, stated, that in his opinion, Stickler was definitely in charge for MSHA.⁶ To show how confusing it was as to who was in charge, Utah Governor Jon Huntsman, Jr., stated that he thought Stricklin was running things at the mine, yet Stricklin was at most press briefings and a lot of family briefings. The Governor also stated that Stickler was trying to take care of families, press, and Murray, and couldn't spend much time at the mine. He stated "Richard [Stickler] just couldn't do everything."

Stickler spent approximately ten hours each day preparing for and conducting family and media briefings. (This is discussed in later sections of this report.) Stricklin and Davis both assisted Stickler in preparing for the briefings. They also accompanied Stickler to most of the briefings. These actions limited the time that the top three senior officials for MSHA were available at the Mine site to oversee rescue operations. This resulted in Taylor, who was in the command center on the day shift, having to attend meetings with Company officials concerning the planning of the rescue operations. Taylor stated that before allowing any changes in the rescue plan, he would have to locate one of the senior officials to obtain their approval.

Conclusion: The MSHA person-in-charge of the rescue operation was not clearly identified by either MSHA personnel or other parties involved at the Mine.

The MSHA person-in-charge of the rescue operation did not focus his attention solely on the rescue effort, as much of his time was consumed by conducting and/or attending family and media briefings.

Recommendation: The Assistant Secretary should establish a policy that clearly identifies who will be in charge of the mine emergency operation when an MSHA official more senior than the District Manager is on site.

The sole responsibility of the person-in-charge of a mine rescue or recovery operation should be to direct and oversee the operation.

⁶ The Region 7 office is located in Kansas City, Missouri, and the Region 8 office is located in Denver, Colorado.

Communications

A major part of any rescue/recovery operation lays in the importance of briefing rescue workers prior to going underground and debriefing those same workers when they return to the surface. This ensures the persons-in-charge in the command center that the rescuers working underground fully understand the underground mission and the importance of all aspects of the work they are assigned. Important feedback can also be obtained that could help the persons-in-charge in planning and managing the operation.

Briefings Briefings should always be conducted prior to rescue workers entering the mine, and should convey the task to be accomplished, including the responsibilities of all persons as to their respective assignments. Work assignments need to be conveyed both verbally and in writing to ensure there is no misconception or lack of understanding on the part of those sent to perform the work. Approved plans should be provided to all workers and they should have a clear understanding of the requirements of the plans. Briefings should be conducted by a person in authority from the command center and should be held in an area where all persons entering the mine, whether company, MSHA, state, labor, etc., can receive the same information at the same time. Questions can be asked and responded to, and all should be made aware of their responsibilities concerning the safety of the operation.

At the Crandall Canyon Mine, regular briefings were not held with MSHA personnel prior to entering the mine. Most inspectors stated that they usually stopped by the MSHA command center and were sometimes handed a copy of the general plan that had been approved. Seldom was the plan ever discussed with them, nor were they assigned specific duties. They were not informed of the occurrences or progress of the work done on the preceding shift, and would usually only receive an update if they happened to encounter inspectors exiting the mine. Some inspectors also stated they were not given an initial briefing on their first day at the mine to inform them of what had occurred or been done underground up to that time. For example, there were inspectors who stated they never knew a bounce had occurred in the No. 4 entry early on August 7th until they were interviewed by the Independent Review Team (IRT).

MSHA dispatched two roof control specialists, Joseph Zelanko and Michael Gauna, from the Technical Support (TS) Roof Control Division (RCD) to the Crandall Canyon accident. Joseph Cybulski, a third specialist and supervisor of the group, later replaced Gauna at the rescue effort. Upon arrival, Gauna and Zelanko were sent underground to evaluate the situation and the approach to the rescue effort. During the course of the rescue effort, the specialists were never clearly briefed or informed of what was expected of them, nor were they briefed on plan changes.

There was also no verification that employees of the company were being briefed prior to going underground. At times, according to the check-in log, there were more than 70 persons in the mine, many of whom were performing work that was not associated with or necessary to the rescue effort. It may not have been necessary to brief every person going underground, but it was important to brief those directly involved in the South Barrier section. An inspector stated that the company foreman who was leading miners on the shift he was working told him he did not have a copy of the plan they were supposed to be using until four days after it was approved. No one could confirm that there was ever an established system or procedure for conducting briefings.

Debriefings Similarly, and even more critical to the operation, was the fact that few, if any, debriefings were conducted with inspectors as they exited the mine. Inspectors observe and experience many things during the course of a shift, and also formulate opinions and ideas based on their experience and knowledge. It is important that this information be conveyed in a formal manner to the persons-in-charge so they can make informed decisions concerning progressing with the operation. Inspectors must be encouraged to relate the information they have acquired during their shift.

No formalized method of obtaining such information was established at the Crandall Canyon Mine during the rescue operation. Davis stated that there was not an “official setup” for debriefing personnel. This is a clear indication that the persons-in-charge were not receiving regular feedback from the inspectors underground. Several inspectors stated that there were times when they wanted to convey concerns or ideas, but that no one was available or had the time to listen to what they had to say. The inspector who was knocked down during a bounce that registered 2.2 on the Richter scale stated that he waited outside in the command center for an hour and one half to tell someone about what had happened and what his concerns were, but no one was available. The supervisor in the command center was so busy taking calls from underground and conveying that information to MSHA Headquarters in Arlington and the District Office in Denver that he never had time to talk.

Other inspectors stated that at the end of their shift, they would stop by the command center and relay what they had seen or done. However, there was no evidence that this information was documented or shared with the persons-in-charge.

There were also several MSHA MEU members on site during the rescue operation, both from the eastern and western teams. These team members, along with their trainers, knew the importance of debriefings. However, no one from the command center debriefed them. The trainers said they sometimes debriefed their team members after a shift. There was no protocol to pass that information up to the persons-in-charge and no evidence that the information was documented or shared with the persons-in-charge.

The RCD specialists stated that they were not debriefed on a regular basis after their underground evaluations, which were almost on a daily basis. They stated that at times they would discuss their observations with the persons-in-charge, but this depended on whether the persons-in-charge were at the mine and available. Often they would just stop by the command vehicle when they arrived on the surface and talked to whoever was there. Again, as with the inspectors and the rescue team members, there was no formal protocol to ensure that their information was consistently elevated to the persons-in-charge. Since the RCD specialists were at the mine because of their expertise in ground control, it was critical for them to be regularly debriefed so that the results of their evaluations could be shared with the persons-in-charge.

There was no documentation or information provided to ensure that company personnel were regularly debriefed during the rescue operation. A significant shortcoming related to this was when approximately twelve miners asked to be withdrawn from the rescue area. MSHA's persons-in-charge said they heard about this but never followed up to interview the miners or find out what their concerns were. Experienced miners, working diligently to try to rescue their fellow co-workers, don't usually ask to be withdrawn without good reason. It would appear that this would have been information that they would need to know.

Inspectors stated that they were calling information outside to the command center at regular intervals. Each hour they would report distance of advance, location of the last Rocprop™ installed, and air and gas readings. They would also report events that happened, such as bounces or equipment breakdowns. This information was entered in the command center logbook. It is important to note that information noted in a log book is not nearly as informative or descriptive as that provided in personal debriefings. Inspectors must be concise when calling outside, and scribes can only abbreviate versions of discussions. This is why personal debriefings are vital to acquiring detailed information and accounts of occurrences that may be critical to managing and directing the operation. This was not taking place at Crandall Canyon. No one could confirm that there was an established system or procedure for conducting debriefings.

MSHA personnel indicated that they were never asked their opinions about the operation, their ideas were never solicited, and they weren't made to feel comfortable in voicing their opinions. Although Stickler stated, "My approach has always been to try to build teamwork when you're involved in these things", and "I tried to do the same thing at Crandall Canyon", it appears this did not occur. One inspector stated, "He doesn't seem very approachable" and "The way he was conducting himself, he just didn't seem like he wanted to be talked to." Many other MSHA personnel made similar comments.

MSHA personnel also indicated they were intimidated from offering information because of circumstances that occurred. Several MSHA personnel stated that, during the course of the rescue operation, Stickler threatened to fire them or send them home if they could not record footage advancement measurements the way that he wanted them recorded. One MSHA

employee stated, "Everybody got fired there at least once." Another MSHA employee stated that Stickler threatened to "Fire us all. It wasn't just me. It was fire us all and get more players, if we couldn't get it in that book the way he wanted it." However, Stickler stated that he did not threaten to fire or replace anyone. He stated that he told Davis his concerns and expected them to be addressed.

The footage measurements were deemed to be so critical for Stickler that the underground workers were given strict orders on how to take the measurements and the criticality of measuring and reporting them every hour. An MSHA employee stated, "I tried to give any explanation to him as to why they were down or they had a bounce, he said very specifically I don't want to hear that. I want to know how far they've advanced and what the footage on the props is." Rescue workers even had to stop or slow the operation at times to obtain the readings, as they could not allow the shuttle cars in the narrow clean-up area while they were there on foot using a tape measure to get the distance advanced. Stickler emphasized to them that estimating the measurement was totally unacceptable and that it had to be exact every hour. This distance was then recorded in the log book in a specific manner, listing the footage to the tail of the miner and also the footage to the last Rocprop™ installed. Then the entry was outlined and highlighted so that Stickler could look at the book and see the measurements instantly. No other entries in the book had to be so specifically identified, such as safety concerns or bounces that were occurring.

A similar issue of briefings and debriefings not being conducted was also identified by the Sago Internal Review report released on June 28, 2007. MSHA's MEU members were not briefed or debriefed regularly during that rescue operation. The importance of conducting briefings and debriefings was discussed during a MSHA-wide training meeting for supervisors and managers at the National Mine Health and Safety Academy held on July 11-12, 2007, approximately three weeks before the Crandall Canyon accident. A portion of the training meeting was to discuss all issues identified by internal review reports for the Sago, Aracoma Alma, and the Darby No. 1 mine disasters. Most District 9 supervisors and managers attended this meeting. Stricklin issued *CMS&H Memo No. HQ-07-094-A* on August 24, 2007, to follow-up and re-emphasize what was discussed in the July meeting. The memo stated in part "Every mine rescue team exiting the mine should be de-briefed by a person/persons designated by the command center. Similarly, no team should be sent underground prior to being thoroughly briefed. The MSHA MEU representatives traveling with the team should be included in all briefings and de-briefings."

Conclusion: There was no protocol established by the persons-in-charge for conducting initial briefings and regular formal briefings. Copies of approved plans were not always provided to or discussed with rescue workers prior to entering the mine.

Stickler's interaction with the MSHA employees on-site during the rescue operation created an environment that hindered the communication process. This may have led to valuable information not being shared with the persons-in-charge.

There was no protocol established by the persons-in-charge for conducting regular formal debriefings.

The July 11-12, 2007, training provided for managers and supervisors to ensure that briefings and debriefings be conducted was ineffective.

Recommendation: MSHA should develop a program to train personnel in charge of rescue and recovery operations. This training should include how to ensure that formal briefings and debriefings are conducted with all personnel involved. Persons-in-charge should be trained on how to create an atmosphere that promotes open communication.

Transportation Shortly after MSHA's initial response to the accident, an 8-hour shift rotation schedule was established to ensure that inspectors and/or MSHA MEU members would be underground with the rescue crews. On each shift, three to four inspectors/MEU members would be on the South Barrier section, observing the work that was occurring, taking measurements of the progress, observing roof and rib conditions, and monitoring air quantities and qualities. These personnel stated that from the beginning of the operation on August 6th until the underground activities stopped on August 16th, they were never afforded regular transportation into and out of the mine.

Diesel-powered pick-up trucks were used to transport personnel into and out of the mine. Since the miners working on the rescue were working 12-hour shifts, the times of shift change didn't align. Inspectors had to do what ever they could to get transportation. Inspectors stated that at the start of their shift they would wait at the portal to catch a ride with someone who might be taking a truck into the mine. When they were preparing to leave the rescue area at the end of their shift, they would leave whenever a ride was available. Because of this, there were a few instances early in the operation in which there was no MSHA personnel underground.

MSHA's persons-in-charge were unaware of this problem and stated that they didn't know the inspectors were having problems getting into or out of the mine. If regular debriefings had been conducted, as discussed above, this information would have been made known to the persons-in-charge.

Conclusion: The persons-in-charge did not ensure MSHA personnel working underground had readily-available transportation into and out of the mine. There was a lack of communication that was occurring between the persons-in-charge and the inspectors working underground.

Recommendation: Persons-in-charge should ensure that MSHA personnel have transportation to the affected area when a rescue or recovery operation is ongoing.

Underground Phone Communication System Shortly after the rescue operation began on August 6th, a fresh air base (FAB) was established at crosscut 120 in the South Barrier section of Main West. The FAB was re-established at crosscut 119 on August 8th. This served as a staging area for the rescue workers loading material out of the No. 1 entry and as the primary communication area for the inspectors to call the surface command center with information as to what was occurring underground. A mine phone was installed near this location, but for the first two days the phone was not operable at times. Therefore, inspectors had to travel outby to another phone that was located at crosscut 109 when they needed to communicate with the surface. This created a difficult situation for the persons underground involved in the rescue attempt, and also for command center personnel if they needed to contact the rescuers.

Once the phone at the FAB was repaired, the communications were improved, but difficulties still arose. The phone line to the surface was tied to these phones: the company command center, the MSHA command center, and the dispatcher. Because there were multiple surface phones, it was impossible for MSHA to secure the phone systems to prevent miscommunications.

There was also difficulty when inspectors tried to report hourly updates, because various persons spread throughout the mine were using the phone system. At times there were over 70 workers underground, working on projects such as cleaning and maintaining belts, rock dusting, and installing roof supports. Also, personnel who were traveling throughout the mine had to call the surface to identify the zones into which they were traveling. This was mandated by the approved Emergency Response Plan (ERP), which required that the location of all persons underground be known. This further minimized the security of the phone systems in that any persons underground in outby areas near a mine phone could overhear conversations between the FAB and the command center.

The Crandall Canyon Mine also had two separate hard-wired telephone lines installed in the mine as required by the mine's ERP. One of these hard-wired systems could possibly have been used exclusively from the fresh air base to the command centers to ensure isolated communication with a secure line in the event of an emergency. When the second accident occurred on August 16th, the phone line was so congested that mine management had to forcefully instruct everyone to get off the line so that the evacuation of the injured could be facilitated.

The lack of command center security was also an issue during the Sago Mine rescue attempt, and was identified as such during the internal review report for that event. This was also discussed during the MSHA-wide training meeting for supervisors and managers at the National Mine Health and Safety Academy held on July 11-12, 2007. The Administrator issued *CMS&H Memo No. HQ-07-094-A* on August 24, 2007, to reiterate what was discussed in the training meeting. The memo stated, in part, "To establish and maintain an effective mine

rescue and recovery operation, both communications and physical access to the command center must be controlled. Once agreement is reached among parties regarding persons permitted in the command center, access should be restricted by closed doors, guards, or other effective controls. Similarly, communications between the command center and the underground operation should not be broadcast or be generally available at surface locations other than the command center.”

Conclusion: MSHA did not ensure secure communications between the underground rescue area and the command center.

Effective communications were not established between the FAB and the surface for the first two days of the operation.

Recommendation: MSHA should develop a program to train personnel in charge of rescue and recovery operations, which would include establishment and security of communication systems.

The command center should ensure communications are established and maintained to the fresh air base before underground rescue operations are allowed in by that point.

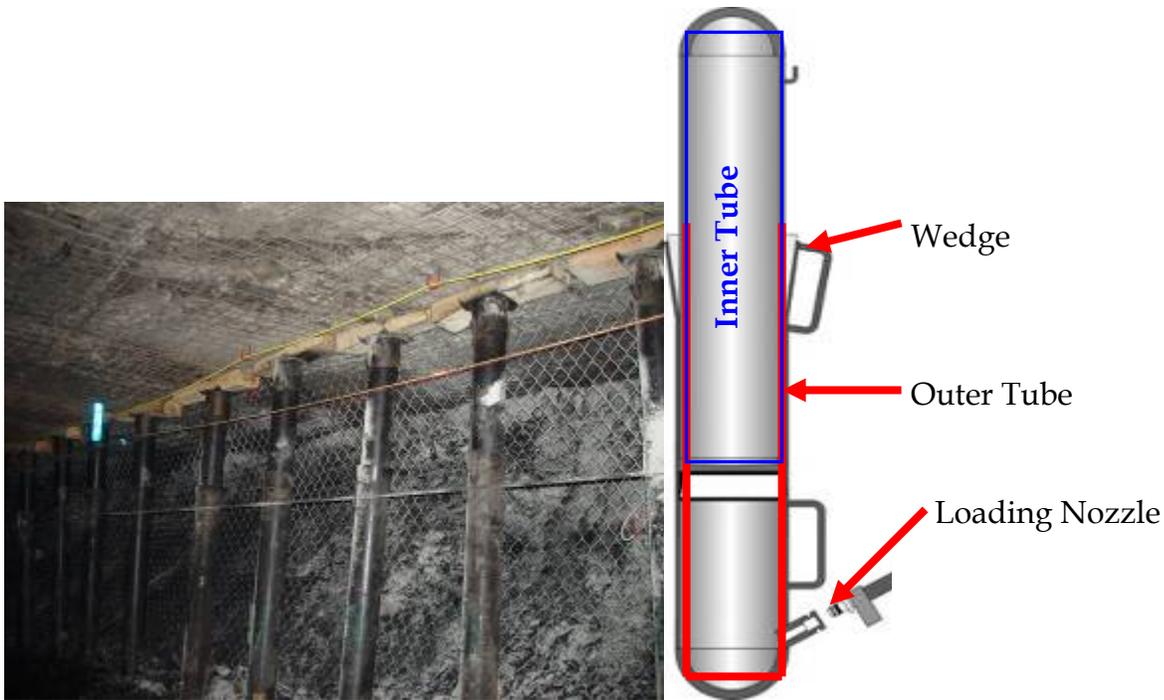
PROTECTIVE GROUND SUPPORT USED DURING RESCUE EFFORT

The bounce that occurred at the Crandall Canyon Mine on August 6th filled all four entries in the South Barrier section with coal rubble for a distance of approximately 2600 feet. This coal rubble provided lateral support for the portions of the coal pillars that remained intact after the bounce occurred.

The initial rescue effort started in the No. 4 entry where loose coal was loaded with scoops and then stored in outby crosscuts. The support consisted of timbers installed in a double row on 5-foot centers in the crosscuts of the No. 4 entry. The No. 4 entry was cleaned for approximately 300 feet when a bounce occurred early in the morning of August 7th and re-filled the area which had just been cleaned. The operator developed and submitted a revised rescue plan which specified that rescue work would take place in the No. 1 entry.

As the coal rubble was loaded out in the No. 1 entry, RocpropsTM, in conjunction with chain link fence and three wire ropes, were installed to provide lateral protection for the rescue workers from coal and rock ejected from the sides (ribs), should another bounce occur. The RocpropsTM were installed on both sides of the entry on 2 ½-foot centers.

RocpropsTM are hydraulic cylinders that are extended against the mine roof and floor by pumping water or other hydraulic fluid into the cylinder. Once the cylinder is set, a locking collar transforms the cylinder into a friction prop which maintains peak loading during yield. The RocpropTM was developed and manufactured in South Africa for deep level mining applications in gold mines. RocpropsTM are used as primary vertical roof support in gold mines and are installed close to the working face. The entries are advanced by drilling the rock faces and loading and shooting explosives which fragment the rock material containing the gold. According to the manufacturer, the support is capable of successfully withstanding lateral forces from explosive blasts 4 ½ feet from the face. RocpropsTM are imported into the United States and exclusively distributed by Strata Products®.



Rocprops™ were chosen by the operator due to their capability to be pressurized between the roof and floor, thus making them an active support. Rocprops™ had been used by the company at its Aberdeen Mine for rib protection in bounce-prone, longwall headgate entries. Chain link fence and one wire rope were used in conjunction with the Rocprops™ at the Aberdeen Mine. The wire rope was either wrapped around the coal pillar or anchored in some manner in the crosscuts to prevent the Rocprops™ from being dislodged in the event of a bounce. However, at the Crandall Canyon Mine the wire ropes could not be wrapped around the coal pillars and were anchored only on one end in the outby crosscuts due to the blockage from the coal rubble. Three wire ropes were used to secure each Rocprop™ to the adjoining Rocprops™, which essentially tied them together.

Timbers with “Jackpots™” were installed in the No. 1 entry in appropriate areas where additional supports were needed in areas outby crosscut 120. Jackpots™ are supplemental devices placed between a timber and the roof and expand as fluid is pumped into them through a pressure relief valve to provide some measure of positive support. Rocprops™ were used exclusively beyond crosscut 120 to provide lateral support as rescue efforts advanced up the No. 1 entry.

As work progressed in the No. 1 entry, the method of pressurizing the Rocprops™ was changed. Initially, a scoop’s power take off (PTO) was used to drive a booster pump to increase the water pressure to 1100 psi. Later, booster pumps were mounted on the continuous mining machine and roof bolting machine so they could be used when in the face area. This accelerated the installation process by eliminating the need for another piece of

equipment to tram in and out of the single entry. While the company's suggested installation set pressure of 1100 psi was a significant increase from the 400 psi to 800 psi range at which Rocprops™ are typically set in District 9 mines, it was never determined if 1100 psi was the appropriate pressure to use in this situation. Neither MSHA nor the company contacted the Rocprop™ manufacturer or distributor for a recommended pressure to use in this application. A representative of the manufacturer later stated that a Rocprop™ could be installed at a maximum pressure of just under 3000 psi. However, it was not known if the floor and/or roof in the Crandall Canyon mine could have withstood a pressure higher than 1100 psi.

The mine roof was considered competent, and in most places the original support system was still intact. The original roof support consisted of 5-foot long, 1-inch diameter resin bolts installed six to a row, through wire screen. There were some areas in the No. 1 entry where a layer of white sandstone above the coal seam had shifted during the bounce event and bent or broke the previously installed roof bolts. As these locations were encountered, the mining machine was trammed from the face to an outby crosscut and a roof bolting machine brought in to replace the damaged roof bolts. Some of these areas were supported by installing steel J-channels against the roof, supported by the Rocprops™ set on both sides of the entry.

Loading of the coal in the No. 1 entry began on August 8th after a conveyor belt tailpiece was installed at crosscut 120 in the No. 2 entry. A remote-controlled continuous mining machine loaded the coal into shuttle cars which transported the material to the dumping point at the tailpiece of the beltline. Rescue efforts had advanced approximately 900 feet in the No. 1 entry when, on August 16th, at approximately 6:38 p.m., a bounce occurred. The bounce was just outby the continuous mining machine and was so violent that it dislodged eight of the Rocprops™ that had been installed on the right side of the No. 1 entry. The supports and a substantial volume of coal from the right rib were blown across the entry, striking several workers who were in this area, killing three and injuring six others. The underground rescue effort was discontinued after the victims were recovered and taken to the surface.

Independent Review Team's Findings

Although the company proposed the use of the Rocprops™ and MSHA concurred, they were not the only support considered. MSHA's persons-in-charge considered and dismissed the use of other support methods, such as steel arches, 3-piece steel square sets, and other standing supports. Some of the systems were not readily available, would take much longer to install, or would require additional entry width. In addition, some systems, such as steel arches and 3-piece steel square sets, are designed to withstand vertical loads, and have no positive roof to floor pressure to withstand lateral forces. These systems would also require a wider area, which conflicted with the desire to leave as much coal rubble as possible to provide lateral confinement for the remaining pillars. Rocprops™ were considered the most viable option due to their size, availability, speed of installation and ability to be pressurized between the floor and roof. MSHA Technical Support specialists contacted Thomas Barczak, Senior

Research Engineer of the NIOSH Pittsburgh Research Laboratory, and an internationally recognized expert on standing roof supports, for his recommendation for a support system. Barczak recommended the use of Rocprops™ for the conditions encountered.

Billy Owens, District 9 Roof Control Branch Supervisor, had extensive experience in the use of Rocprops™. However, he stated that he was not consulted or involved in any way with the support selection used during the rescue effort at the Crandall Canyon Mine. He further stated that he had seen individual Rocprops™ dislodged as the result of a bounce at the Aberdeen Mine. From this experience, he knew the importance of the wire ropes being wrapped around the pillars or securely anchored by bolting to the roof. At Aberdeen, even though individual Rocprops™ were dislodged, they were restrained from further movement because both ends of the wire rope were secured. At Crandall Canyon, the wire ropes were not anchored as they were at the Aberdeen Mine. Owens stated that the inby end of the wire ropes could have been “bolted to the roof”.

During interviews, several of the MSHA inspectors who were monitoring the underground work stated that they had concerns over the adequacy of the Rocprops™ providing protection from a future bounce. They were confident in the Rocprop™ as vertical roof support, but questioned its ability to withstand lateral forces resulting from a bounce. Inspectors stated that they had seen Rocprops™ dislodged at the Aberdeen Mine. Allyn Davis, District 9 Manager, stated that he had heard that Rocprops™ had failed at Aberdeen Mine and that was one of the reasons for requiring three wire ropes instead of one.

Several Rocprops™ were dislodged during the rescue effort by a shuttle car negotiating the turn from the No. 1 entry into the belt entry. One inspector documented in his notes, following a bounce that occurred on August 15th, that it appeared the tops and bottoms of the Rocprops™ had moved, and he questioned their ability to provide support. Another inspector stated that he thought that the bottoms of some of the Rocprops™ in the No. 1 entry had been pushed toward the center of the entry after material had accumulated behind the chain link fencing that was attached behind the props. These inspectors also stated that their input was never solicited in the decision to use or evaluation of Rocprops™ during the rescue effort.

One inspector stated that he was aware of an angled-base bracket that could be used with two Rocprops™ to provide additional lateral support. He had observed this device at other mines and was aware of its ability to withstand lateral forces. The base plate had two sockets for the placement of the Rocprops™, one near-vertical and one angled at approximately 60-degrees. Two spikes, approximately two inches long, were welded to the bottom of the base plate to penetrate the mine floor and resist movement. One Rocprop™ would be pressurized against the roof, just off of vertical, and the second Rocprop™ would be pressurized between roof and floor at an angle, which would wedge the support in tighter if lateral forces were exerted. The photos below show the angled-base bracket and its installation at another mine.



Top of Rockprop™



Bottom of Rockprop™

The inspector indicated that these brackets were available at another mine and management at that mine was willing to ship them to the Crandall Canyon Mine. Officials from the other mine verified they had the brackets available and they were willing to provide them if a request had been made by management at the Crandall Canyon Mine. This inspector stated he informed an MSHA Technical Support Roof Control Division specialist of these brackets during the first week of the rescue effort. Neither the Technical Support specialist nor any other MSHA person interviewed could recall hearing about this method of support, although

they did remember numerous conversations with this inspector. The use of these brackets was never considered for use during the rescue effort.

Neither the manufacturer nor the distributor of Rocprops™ was contacted by anyone from MSHA to seek their input on use or options regarding devices, such as the angled bracket that could be used in conjunction with Rocprops™. The local distributor of Rocprops™ was fully aware of the angle support brackets as they had been sold and used at two other mines in the western region of the United States. These brackets were used effectively at these two mines in areas where additional lateral resistance was required. The manufacturer/distributor could have provided additional information on the maximum setting pressures of the support which could have allowed the maximum installed load for this application.

Confidence in the Support System

When interviewed, the MSHA persons-in-charge all stated that they had confidence in the support system prior to the events of August 16th. They believed that it was the best system available for the conditions. Stricklin stated “We always had concern about the bump activity, but we felt that the support we were putting in would protect us from any additional bump activity. The Rocprops and the fencing and the cables, we thought that that was going to protect us from any bump occurrence.” Stickler partly based his confidence on the fact that the bumps were occurring at the continuous mining machine in by the rescue workers’ location. He stated that he was “confident that the area where we had the ground supports installed that there was not an imminent danger there for any of the workers”. Davis stated that “We made the decision that we thought that was the best we could do and that it had a good likelihood of being successful. We knew that there wasn’t any absolute answer. There are no guarantees.”

In arriving at the initial decision to approve the use of the Rocprops™, chain link fence, and wire ropes, the persons-in-charge primarily utilized input from the company. Once approved, they had subsequent discussions with Technical Support, discussed the pros and cons of alternative support methods, and obtained an independent supporting opinion from a NIOSH expert.

Limitations of the Support System and Failure on August 16th

Like all standing roof supports, the Rocprop™ is designed to withstand a vertical load. Although the Rocprop's™ ability to be pressurized between the roof and floor results in some capacity to resist lateral forces, it was not designed for this purpose. Its ability to withstand lateral forces is dependent on how tight it is installed between the roof and floor, which is impacted by its set pressure and the hardness of the roof and floor. As mentioned earlier, the system as a whole is also dependent on the wire ropes being securely anchored. At Crandall

Canyon the inby end of the ropes was wrapped around the most inby Rocprop™ but was not anchored.

On August 16th, the bounce that killed and injured the rescue workers did not occur at the continuous mining machine, or outby in the middle of a long row of installed Rocprops™. Rather, it occurred at the most vulnerable location of the support system: just outby the mining machine at the unanchored end of the wire ropes.

Conclusion: MSHA's approval to use Rocprops™ for lateral protection during the rescue effort was appropriate, and was further supported by NIOSH.

However, MSHA failed to utilize the knowledge and experience of the District 9 Roof Control Supervisor, the manufacturer, or the distributor, and failed to solicit input from inspectors. Even if this knowledge and experience had been utilized, there is no way of knowing whether the support system could have been altered to withstand the forces of the August 16th bounce.

Recommendation: MSHA should develop a program to train personnel in charge of rescue and recovery operations. This training should address the importance of soliciting and utilizing the experience and expertise of all pertinent resources, especially concerning technical issues.

SECTION 103(k) ORDER

Initial Issuance of § 103(k) Order

A § 103(k) order is a tool MSHA may use when deemed appropriate to ensure the safety of any person in the mine after a mine accident. Section 103(k) of the Federal Mine Safety & Health Act of 1977 states “In the event of any accident occurring in a coal or other mine, an authorized representative of the Secretary, when present, may issue such orders as he deems appropriate to insure the safety of any person in the coal or other mine, and the operator of such mine shall obtain the approval of such representative, in consultation with appropriate State representatives, when feasible, of any plan to recover any person in such mine or to recover the coal or other mine or return affected areas of such mine to normal.” MSHA’s *Program Policy Manual* reiterates this.

District 9’s *Mine Emergency Response Plan* in effect at the time of the accident states that the first MSHA personnel arriving on site after notification of a mine emergency shall issue the appropriate order of withdrawal necessary to ensure the safety and health of the miners. An authorized representative of the Secretary of Labor will issue a § 103(k) order and/or a § 107(a) imminent danger order as soon as practical. These orders provide the basis for further MSHA action to assure that the activities are conducted in accordance with plans acceptable to MSHA.

At 3:52 a.m. MDT on August 6, 2007, William Denning, District 9 Staff Assistant, received notification from the national call center that a bounce occurred at the Crandall Canyon mine. After contacting the mine and confirming the accident, he contacted the appropriate Price Field Office supervisor at 4:09 a.m. The supervisor contacted an inspector and instructed him to go to the Mine and investigate. When the inspector arrived at the field office, he contacted the mine to get an update. At 4:41 a.m., he issued a verbal § 103(k) order over the phone. He then traveled to the mine, arriving at 5:45 a.m. At this time, he restated he was issuing the § 103(k) order. He reduced the order to writing, but the time of issuance was documented to be 4:41 a.m.

During the MSHA-wide managers and supervisors meeting on July 11-12, 2007, at the National Mine Health and Safety Academy, and in response to a previous internal review recommendation, MSHA management gave guidance on the issuance of § 103(k) orders. Most of District 9’s managers and supervisors attended this training. On August 24, 2007, the Administrator issued *CMS&H Memo No. HQ-07-094-A* that re-emphasized this. It states, in part:

[u]pon learning of a mine emergency, as soon as possible, MSHA should issue a 103(k) to the operator along with initial instructions. The order should be

reduced to writing and served to the operator as quickly as practicable. The order should be written so as to protect all persons engaged in the rescue and recovery operation as well as any other persons onsite. Parties onsite should be informed that any activities will be permitted through subsequent modifications of the 103(k) order. The 103(k) order is intended to protect all persons involved in the emergency operation. As such, all parties onsite are subject to the 103(k) order and its subsequent modifications. Each proposed action should be reviewed by the designate senior MSHA person onsite before the 103(k) order is modified and before the action is commenced.

Historically, there has been uncertainty about whether the Mine Act permits a § 103(k) order to be issued verbally over the telephone, or whether it may only be issued once an authorized representative is physically present at the mine site. This memorandum did not clarify the Agency's position on the issuance of verbal § 103(k) orders before an authorized representative arrives at the mine site. It did clarify that all activities on site must be approved through modifications to the § 103(k) order.

In the body of the § 103(k) order, the inspector prohibited all activity in the Crandall Canyon Mine. However, the "Area or Equipment" affected portion of the order indicated that activity was only prohibited in "The Main West Pillar Section in its entirety." The inspector who issued the order indicated that he intended for the entire mine to be evacuated. At the time the § 103(k) order was verbally issued at Crandall Canyon, there were several company personnel underground repairing ventilation controls and attempting to find a way to reach the trapped miners. Since the order prohibited all activity at the mine until the operator obtained approval from MSHA through a rescue or recovery plan, this underground activity was technically in violation of the order.

There may be times, before MSHA arrives, that the operator's actions after the occurrence of a mine emergency could be a matter of life or death. If MSHA has issued a verbal § 103(k) order but is not on-site to evaluate and approve such actions, the operator may be forced to withdraw from the mine and cease the rescue effort in order to comply with the § 103(k) order. Valuable time in reaching trapped or missing miners or progress toward fighting a fire could be lost.

If the issuance of verbal § 103(k) orders is to be permitted, MSHA should establish policy which outlines a mine operator's ability to continue with activities toward rescue or preservation of life and property when a verbal § 103(k) order is issued. Presently, a verbal § 103(k) order would normally require an operator to cease all in-mine activity and withdraw from the mine. With the requirements of training for Responsible Persons, as required by Part

49, and the provisions of each mine operator's emergency response plan, operators are now better prepared to deal with rescue or preservation activities. While such activities are continuing, an MSHA person should remain available by phone contact with the mine operator to discuss such activities until the first MSHA person arrives onsite.

Conclusion: The issuance of a verbal § 103(k) order by phone appears to conflict with the Mine Act and District 9's Mine Emergency Response Plan.

MSHA has not evaluated the effects of a verbal § 103(k) order on the operator's actions after a mine emergency concerning ongoing rescue or recovery activities.

Recommendation: The Administrator should establish clear guidance concerning the issuance of verbal § 103(k) orders. District MERPs should be revised to reflect such guidance.

MSHA should establish policy which outlines a mine operator's ability to continue with activities toward rescue or preservation of life and property if a verbal § 103(k) order is issued.

Non-Compliance with § 103(k) Order

Historically, MSHA has used § 103(k) orders during emergencies to control the work that is performed related to rescue efforts. These § 103(k) orders have allowed MSHA to ensure persons are not exposed to unnecessary hazards. Rescue or recovery plans must be submitted by the operator and approved by MSHA before any activity is allowed in the affected area of the mine.

It is within the scope of MSHA's authority under a § 103(k) order to allow anyone to go underground. However, MSHA's past practice has been to allow only those persons related to or necessary for the rescue or recovery work to enter the affected area.

The IRT determined several instances in which the § 103(k) order at Crandall Canyon was not complied with during the rescue operation, both literally and in this historical aspect. These instances are:

- Allowing media to go underground
- Allowing family members to go underground
- Failing to control the number of people entering the mine

Allowing Media Underground

During the evening's press briefing on August 8th, Robert Murray, co-owner and operator of the Mine, asked if any of the media would loan him a light for his video equipment. He

planned to film the underground rescue activities to show families and media the progress that was being made and the difficult conditions being encountered. A network news crew stated that Murray could use their light if they could go underground and conduct the filming. Murray was receptive to this idea. He turned to Richard Stickler, Assistant Secretary for Mine Safety and Health Administration, and asked him what he thought about it. Stickler told Murray that he did not have a problem with him taking the film crew underground.

The company immediately began to make arrangements for the news crew and other reporters to go underground. When the five selected media personnel arrived at the mine site, they were told by MSHA personnel that they would not be allowed to go underground without approval from the district manager and modification of the § 103(k) order. Shortly thereafter, Stickler arrived and informed the MSHA personnel that he was allowing the reporters to go underground. Stickler stated, when interviewed, that he thought it would benefit the families to see the video. However, if it were necessary for video of the underground operation be taken to show families, MSHA or the operator could have provided experienced personnel to do the filming.

The MSHA supervisor who observed the required hazard training given to the reporters documented that it was “fast and not very good.” It appeared the operator and reporters were in a rush to get underground so the video could be placed on the news that night.

A supervisor and an inspector traveled underground with the reporters to ensure their safety. Interviews with several MSHA personnel who observed the reporters at the face area, along with various inspection notes, revealed that the reporters “delayed”, “held up”, and otherwise “hindered” the rescue operation. Apparently, at one point, the light of the television camera was shining into the eyes of a shuttle car operator, which made it difficult for him to steer around a pillar. According to notes taken by MSHA personnel, Murray stated that the shuttle car operator was a bad operator, and directed that the man be replaced. While the news crew was underground, a bounce occurred that, fortunately, did not cause any injuries. The effects of the bounce were observed on the news video.

The purpose of a § 103(k) order is to provide for the safety of any person in a mine after an accident has occurred. In this case, people were unnecessarily put in harm’s way. The reporters were not familiar with the hazards that were present underground. The lights of the video camera presented a hazard to the rescue workers, as an accident could have occurred because the shuttle car operator was temporarily blinded by the bright camera lights. Many of the MSHA personnel who observed the reporters underground felt it was just a publicity stunt by Murray that hindered the underground operation. Many MSHA personnel stated that they not only had to concentrate on the rescue operation, but that they also had the extra responsibility of ensuring the reporters did not get hurt or interfere with the rescue workers.

On August 7th, the § 103(k) order was modified to allow the operator to use a camera underground in accordance with the Mine’s approved photography plan, and that any other

use of photography equipment would require a specific approval by MSHA. When interviewed, District 9 management said that many mines had an approved plan that would allow them to take pictures in certain areas underground. Some MSHA persons-in-charge believed this photography plan allowed the media to go underground. However, the IRT found that Crandall Canyon did not have a photography plan approved.

MSHA did not give specific approval to allow any other use of photography equipment. On August 8th, the § 103(k) order was not modified to allow the media to go underground. Most MSHA personnel interviewed stated they believed it was a violation of the § 103(k) order for the media to go underground.

A plan approved under the order on August 8th did state, in Part B of Page 2 of that plan, that all unnecessary personnel will be kept out by the fresh air base at crosscut 119. The media crew went in by crosscut 119 to video the rescue operation.

MSHA failed to adequately evaluate the risk of injury by allowing persons not involved in the rescue operation to go into the rescue area. MSHA should be wary of setting precedents of this sort in rescue/recovery work. The second tragic accident at Crandall Canyon on August 16th and the near misses throughout the operation confirm the danger that existed for rescue workers.

Conclusion: MSHA failed to enforce the provisions of the § 103(k) order. Despite Stickler's verbal approval, there was no written approval given for the media to go underground.

MSHA allowed persons who were not involved in the rescue operation to be exposed to underground hazards.

Recommendation: MSHA should ensure compliance with orders issued under section § 103(k) of the Act.

MSHA should not allow anyone who is not directly related to a rescue or recovery operation to be in the affected area.

Allowing Family Members Underground

On several occasions during the rescue operation, two family members were taken underground by the operator. These family members observed the conditions at the recovery area, the method being used to clean up the material from the bounce, and the installation of the support system. They reported their observations at the family briefings.

Both of the family members who were allowed to go underground were experienced underground miners. One was also a member of another coal company's mine rescue team.

Stickler stated that family members “absolutely” did not trust MSHA, and that they thought MSHA was slowing the progress of the rescue. He stated that the reason for permitting family members underground was to “alleviate some of the hostility and distrust that the family members had when they were able to hear it from these experienced miners.” Some family members did say that they trusted family members more than Murray or the government. However, family members stated that the only new information the two members told them was that all entries of the South Barrier section were filled with material.

Most MSHA personnel stated the family members should not have been permitted to go underground. They stated that since the family members were not part of the rescue operation, their underground excursions violated the § 103(k) order. Again, while it is within MSHA’s authority under § 103(k) to approve any plan the operator submits, the operator did not submit a plan to allow the relatives to go underground.

Conclusion: MSHA failed to enforce compliance with the § 103(k) order by allowing family members to go underground during the rescue operation.

MSHA allowed persons not involved in the rescue operation to be exposed to underground hazards.

Recommendation: MSHA should ensure compliance with orders issued under section § 103(k) of the Act.

MSHA should not allow anyone who is not directly related to a rescue or recovery operation to be in the affected area.

Failure to Control Number of People Entering Mine

District 9’s MERP states the first MSHA personnel onsite shall advise company officials to establish a positive check-in and check-out system in addition to the one established at the mine. Each person entering and exiting the mine must sign in and sign out. A check-in and check-out sheet was included in the MERP as an appendix. This sheet was not used during the rescue operation at Crandall Canyon. Neither MSHA nor the company stationed anyone at the portal to keep a log of persons as they entered and exited the mine.

The company implemented a check-in and check-out system that required anyone going underground to inform the dispatcher, attach a name tag on a board in the bath house, and write their name in a notebook. However, there were several instances when MSHA failed to ensure all persons checked in and out of the mine.

A review of this notebook revealed it to be difficult to determine if persons who had checked into the mine also checked out, as that information was not on the same page. Also, the names

of the reporters who went into the mine on August 8th could not be found in the check-in and check-out notebook provided to the IRT. It was also discovered that, at times, MSHA personnel shown to be checked into the mine were actually back at the hotel where they were staying. These persons had finished their shift and left the mine site without anyone documenting that they had exited the mine.

During the rescue operation that took place from August 6th to August 16th, the company and MSHA operated on different working shifts. The operator worked two 12-hour shifts; 6 a.m. to 6 p.m., and 6 p.m. to 6 a.m. MSHA worked three 8-hour shifts; 7 a.m. to 3 p.m., 3 p.m. to 11 p.m., and 11 p.m. to 7 a.m. These overlapping shifts made it even more difficult to ensure that all persons checked in and out of the mine.

Many MSHA personnel stated that there were several occasions when there were people in the rescue area in the No. 1 entry who were observing what was going on, but were not a part of the rescue effort. Most of these observers were company employees who wanted to see what was going on or to offer help. These visits were recurrent even though there were plan revisions to the § 103(k) order that prohibited this. A plan approved under the § 103(k) order on August 8th stated "All unnecessary persons will be kept out by the fresh air base located at x-cut 119." A plan revision on August 11th stated "We have to limit the number of people in the # 1 entry in by xc-119. We are taking more material out of the entry and going into the deeper cover. We have to take every precaution possible. NO person is allowed up in the face area unless designated by the foreman." This statement did not limit the number of persons who could go in by crosscut 119. Instead, it allowed the foreman to determine who could be in the No. 1 entry.

Many inspectors stated that they were not aware when the operator was bringing unnecessary people into the mine until they arrived in the rescue area. The inspectors stated that these unnecessary people were disruptive to the operation in that they had to stop the mining machine and haulage equipment from operating while they were in the face area. The inspectors stated that these were unnecessary hindrances to the operation.

A review of the command center log book showed that the total number of workers underground was being recorded. The log book distinguished between company and MSHA employees and was updated regularly. Various entries in the log showed there to be more than 70 people underground at times. Interviews revealed that many of these people performed work out by the recovery area. Interviews with MSHA personnel and a review of documents revealed that the § 103(k) order was not modified to allow any work out by the recovery area except for some exploration and seal monitoring work. MSHA persons-in-charge were aware that work was being performed in out by areas, but did not know what specific work activities were being performed. Davis stated he did not think out by work was restricted by the § 103(k) order.

Conclusion: MSHA failed to enforce compliance with the § 103(k) order by allowing unlimited persons to go underground without modifying the order.

MSHA failed to enforce compliance with the § 103(k) by allowing work in outby areas without modifying the order or approving a plan to allow such work.

MSHA failed to enforce compliance with the § 103(k) order by not controlling the number of unnecessary persons in the rescue area.

MSHA failed to ensure that an adequate check-in and check-out system was maintained.

Recommendation: MSHA should develop a program to train personnel in charge of rescue and recovery operations. This training should include the provisions and authority of exercising a § 103(k) order and the plan approval process for allowing work to be performed.

MSHA should not allow persons unnecessary to the rescue and recovery operation to enter the affected area.

MSHA should ensure that an adequate system of check-in and check-out is established and followed during a mine emergency.

MINE RESCUE TEAMS

Coal Mine Safety and Health (CMS&H) maintains three Mine Emergency Unit (MEU) teams: two in the East and one in the West. The East and West teams have separate trainers. John Urosek, MSHA's Mine Emergency Rescue Coordinator, is responsible for all mine rescue operations for MSHA, including direction of the MEU teams. After MSHA was notified of the August 6th accident, Mine Emergency Unit (MEU) team members from both East and West were assigned to report to Crandall Canyon to assist in the rescue operation.

The team members from the East had to make arrangements for air travel. All but two team members who responded flew to Utah on August 6th. The other two, due to problems with the airline, did not travel until the next day. The Western MEU team members who were assigned to the Crandall Canyon mine all arrived at various times on August 6th.

Urosek was scheduled to start his vacation on August 6th, but began making arrangements for Crandall Canyon. He talked with Mark Skiles, Director of Technical Support, and Stricklin, and was instructed to continue with his vacation plans. Urosek stated he was told that this event "wasn't an explosion dealing with gases, it was more of a bump situation and the seismic was probably going to be the key group that we would be sending." Urosek was available by phone until he arrived at the mine on August 14th. Jeffery Kravitz, Chief of Scientific Development for MSHA's Technical Support, was designated to act in Urosek's position until Urosek arrived.

During the rescue operation, there were some issues that arose involving the use of mine rescue teams. There were also certain accepted mine rescue procedures that were not followed to ensure safety.

Failure to Establish Written Plans for Rescue Teams Exploration

It is important to have written plans for rescue and recovery work. Plans should be made available to rescue team members and other rescue workers prior to going underground. The § 103(k) order issued for Crandall Canyon stated that "The Mine Operator shall obtain prior approval for all plans prior to implementation..." Between August 6th and August 16th, there were 18 modifications or plan revisions to the § 103(k) order, including two on August 12th that dealt with "apparatus wearers" or rescue team members. However, on August 6th, rescue teams were sent into the mine twice without any written plan to follow.

Early on the morning of August 6th, a rescue team was directed to enter the mine to find access to the trapped miners through the South Barrier entries. The § 103(k) order was not modified for this exploration, and no plan of instruction was approved or given to the rescue team. According to accident investigation team interviews, the captain of the team stated they had "No specific plan" and "No specific instructions" for this exploration.

Later on August 6th, a mine rescue team was directed to breach the Main West seals to explore for an alternative way of reaching the trapped miners. The § 103(k) order was modified to state, in part, “to open the number one seal in the old Main West entries inby crosscut 118 and use mine rescue teams to explore within established mine rescue procedures.” Again, a specific plan was not written as to what the teams should do. The rescue team captain stated in his accident investigation team interview “I did not see one” and “I don’t know if there was one” when asked whether he knew if there was a written plan. The MSHA MEU team member assigned to explore behind the seals with the rescue team stated, “There was no plan established.”

Failure to Have an MEU Team Representative as Part of the Command Center

Historically, the MEU teams have had a representative in the command center. This is normally the team’s trainer(s). They would be involved in decisions related to the safety of the teams and the work the teams would perform. At Crandall Canyon, the trainers were never involved in formulating plans or decisions related to the rescue operation, even though two to four members of MSHA’s MEU were underground each shift. Instead, they were given plans after they were approved. The trainers were underground or conducted other activities on the surface, and went to the command center on occasion, but never in a decision-making role.

Failure to Establish a Proper Fresh Air Base and Air Lock

As stated above, on the afternoon of August 6th, mine rescue team members were instructed to breach the Main West seals to explore for an alternative way of reaching the trapped miners. A fresh air base (FAB) was established approximately 100 feet outby the No. 1 seal. Mine rescue procedures require that an air lock be constructed before breaching a seal. MSHA *Instruction Guide Series (IG) 7, A Guide to Mine Rescue Training – Coal*, published in 2006, states, “The air lock allows the team to enter and exit the unexplored area without contaminating the air at the fresh air base.” It further states “An air lock consists of two doors or stoppings ... which are close to each other in the same passageway. The purpose of an air lock is to separate two different atmospheres while still permitting miners to enter and exit without mixing atmospheres. In order to maintain the air lock, one door ... must be kept closed when the other door is open.”

The “air lock” constructed by the rescue team consisted of a single curtain installed across the entry outby the seal to be breached. The rescue team captain stated in his accident investigation team interview, in part, the curtain was “rolled up so it could be dropped”, and “If we needed to close it, we would close it up.” The MEU team member stated “... it wasn’t much of an air lock.” Additionally, there was not anything over the hole knocked in the seal

until after the teams had explored and came back out of the sealed area. Essentially, there was no air lock separating the fresh air base from the contaminated atmosphere behind the seal.

A six-member team, comprised of members from Utah American, Energy West, and MSHA's MEU rescue teams, was assigned to enter the sealed area. A second six-member team remained at the FAB to serve as back-up to the exploration team. There were approximately eight other miners at the FAB, including some who were not equipped with mine rescue breathing apparatus.

The team explored one possible route behind the seals and found it unsafe. They returned to the FAB and reported this to the command center. They were asked to check another route. As they were preparing to re-don their apparatus to re-enter the sealed area, a ground failure occurred inby the seals. The air blast from this event forced irrespirable atmosphere (6 % oxygen) from behind the seal past the air lock curtain and into the fresh air base where everyone, including persons without apparatus, were assembled. Only two of the team members had finished re-donning their breathing apparatus, so they instructed everyone to evacuate the area. These two team members re-installed the air lock curtain. The MEU member stated "we also tied a piece of [brattice] cloth over the hole in the opening of the seal."

Fortunately, no one was overcome by the low oxygen. Because of the unsafe ground conditions behind the seals, the effort to find a route of travel in that area was abandoned.

Failure to Brief and Debrief Rescue Team Members

IG 7 provides, "Before [the] team goes underground, [they] will attend a briefing session," and "At the briefing, [the team] should be told as much as possible about what has happened at the mine and what conditions currently exist. The briefing officer will give the captain the team's assignment." Additionally, IG 7 states, in part:

When [the team] arrives on the surface, [they] will attend a debriefing session. The team will inform the debriefing official or committee of what the team did, saw, and found during the exploration. The debriefing is a very important aspect of the team's exploration. Often, significant details that appeared to be unimportant while the team was underground or were overlooked in the progress reports will come out during this debriefing session and turn out to be important factors to the operation.

During the Crandall Canyon rescue effort, regular briefings and debriefings were not conducted. One MEU member stated, "There wasn't much briefing." When asked, "Did

anybody sit down with the MSHA people that came out and debrief them as a unit to find out exactly what happened that shift?" he answered, "No."

This failure is discussed at length in the [Communications](#) section of Command Center.

Failure to Have Breathing Apparatus Underground

During each shift of the underground rescue operation, two to four members of MSHA's MEU were underground. They were assigned duties such as taking air quality and quantity readings and observing the work being performed in the No. 1 entry. They were also to be prepared to don their apparatus to provide assistance in the event of exposure to low oxygen. However, breathing apparatus were not kept underground. One of the trainers thought that MEU members were always taking their apparatus underground, but all the team members stated they were not.

IG 7 discusses "barefaced" exploration. The term "barefaced" refers to the act of rescue team members exploring without donning their breathing apparatus. This is done when the mine atmosphere is such that it is safe for them to do so. However, the manual states, "A backup crew with apparatus should be stationed outside the area [being explored], ready to go in immediately to rescue the others if necessary." On August 10th, a barefaced exploration was conducted in the No. 1 entry ahead of where the continuous mining machine was loading material from the bounce. An MSHA inspector and a mine manager attempted to crawl over the material to find out if they could reach the trapped miners this way. (This is discussed in greater detail in the [Explorations](#) section of this report.) While this barefaced exploration was occurring, there should have been breathing apparatus underground in case these two persons needed to be rescued.

It was well known that there were low oxygen levels in advance of the rescue operation. There were times when ground failures inby forced low oxygen out to the rescue workers' location. Oxygen levels as low as 14% to 16% were detected in the rescue area on the days preceding August 16th. Oxygen levels on these days were controlled with air directed to the rescue area by curtains.

On August 16th, oxygen levels of 16% or lower were recorded for at least ten minutes in the area where workers were trying to recover the victims of the second accident. The underground rescue workers called on the mine phone for oxygen, including BG-4 breathing apparatus. MSHA personnel stated that the apparatus had to be retrieved from the surface, taking at least 45 minutes. Quick action by one of MSHA's MEU members in restoring ventilation to the rescue area on August 16th probably prevented low oxygen levels from affecting the rescue workers and the injured workers.

Conclusion: Established and historical mine rescue protocol was not followed at all times at Crandall Canyon.

Recommendation: MSHA should develop a program to train personnel in charge of rescue and recovery operations, including the principles of mine rescue protocol.

EXPLORATIONS

During the underground rescue operation, four attempts, including three involving MSHA personnel, were made by small groups of rescue workers to crawl over the rubble in an effort to reach the trapped miners. One other attempt was made by a mine rescue team to breach the Main West No. 1 seal to evaluate the possibility of reaching the trapped miners through these entries.

When the accident occurred on August 6th, the South Barrier entries were filled with material from the bounce, cutting off access and communication to the working section. Five company employees who were outby the extent of the damage caused by the bounce tried to find a way to reach the trapped miners. The following information was obtained from interviews conducted by the accident investigation team. The miners who were interviewed stated that the entries were restricted, oxygen levels were below 19.5%, and dust in the air was very thick. The first two employees at the mouth of the panel donned SCSRs when the dust in the air became so thick it made breathing difficult. They were soon joined by the other three employees. Two of these had breathing apparatus with full face-pieces. They donned these devices, and four of them tried to advance. The fifth person stayed at an outby mine phone to talk with surface personnel. The four miners stated they made their way to where their paths were blocked. They tried crawling until the space became too low to continue. The area was still bouncing, and the oxygen level dropped to 16%. They decided to retreat and reestablish ventilation to try to provide fresh air to the trapped miners.

After MSHA officials arrived at the mine site, the company requested to send a mine rescue team in to attempt to advance up any of the four entries of the South Barrier section. The mine rescue team entered the mine and established a fresh air base at crosscut 120. From there, they tried to advance up each entry. The rescue team did not wear their breathing apparatus as they advanced because there was only 18 inches of crawl space over the rubble in some areas. Two MSHA inspectors were assigned to accompany the mine rescue team on the excursion. This team advanced over the rubble to approximately crosscut 126 by traversing from one entry to another. They went through low areas created by the rubble material and the metal roof screen that had been torn loose. One of the inspectors stated that the atmosphere was not very dusty and the oxygen level initially encountered was 19.5%. As they advanced, the oxygen level continued to decrease to approximately 15% to 16%, and the group decided to retreat.

The inspectors stated that the rubble material was higher in the entries and lower in the intersections. One of them stated that he believed they could get further by pushing the material aside. Although breathing apparatus would have to be worn due to low oxygen, both stated they thought the trapped miners could be reached by going over the rubble. Other than a short conversation with the supervisor in the command center, they were not formally debriefed by MSHA when they exited the mine. There was no indication that this information was passed on to the persons-in-charge.

Later on August 6th, the company submitted a plan, approved by MSHA, to breach the No. 1 seal in the Main West set of seals and explore inby. An MSHA MEU team member went with the team to the No. 1 seal just inby crosscut 118 of Main West. A hole, measuring about two feet by two feet, was opened in the seal. At this time, another MEU team member came to the seals, and traveled into the sealed area with the rescue team. They advanced inby, starting in the No. 1 entry, then going across to the No. 3 entry through crosscut 120. Each entry was blocked by roof falls or unsafe roof. The farthest the team advanced was to crosscut 121. The team did not travel to the No. 4 or No. 5 entries because of unsafe roof in the crosscut between the No. 3 and No. 4 entries. The team decided to return to the fresh air base.

Once out of the sealed area, the team called the command center and reported their results. The persons-in-charge asked if the team would try to go through crosscut 119 and access the No. 4 or No. 5 entries in order to determine if it was safe enough to advance in. As the team was preparing to re-don their apparatus, a ground failure occurred inby the seals. The team decided that, based on what they had seen in the Main West and the effect this latest event might have had on the roof, it would be unsafe to go back into the sealed area. They informed the command center of their decision. No other exploration attempts were made into the sealed area.

On August 10th, two more attempts were made to explore over the material. One of these occurred in the No. 1 entry. A plan was approved to allow two people, one from the company and one from MSHA, to explore in the No. 1 entry ahead of the rescue work. The explorers used portable radios to keep in contact with personnel at the face area. They were equipped with wire cutters to use on the wire screen if it became an obstacle. The MSHA inspector stated that they advanced about 200 feet inby the continuous mining machine. At this point, communication with personnel at the recovery face could not be maintained with the portable radios. The two explorers retreated from the area. When asked what stopped them from exploring farther, the inspector replied it was the fact that communication could not be maintained. He stated they may have had to cut some wire screen, but physically they could have gone farther, though he was not certain how far.

The inspector stated that, when he exited the mine, he was not debriefed about the exploration. He said he understood that another attempt would be made on the evening shift with another communication system, but he later learned that it was never made.

The final exploration attempt, also on August 10th, was at almost the same time as the venture in the No. 1 entry. An MSHA inspector was asked to proceed up the No. 4 entry as far as he felt safe and collect an air sample. The inspector, a Technical Support (TS) specialist, and the Company safety director went to the No. 4 entry. The TS specialist was stationed at the outer edge of the rubble; the safety director traveled inby with the inspector to approximately crosscut 125; the inspector then traveled inby in the No. 4 entry beyond crosscut 127. There was still fresh air at this crosscut. The inspector stated that he felt safe during this exploration

since the ribs could not further expel coal, as he believed the material in the entry was supporting the ribs.

At this point, the inspector encountered wire screening hanging from the roof that blocked his travel. The inspector stated he could have traveled farther if he had bolt cutters to cut through the screen. He stated that the conditions in by the screen appeared to be the same as what he had traveled through. Since he didn't have any bolt cutters, he took the air samples, and then they all exited the mine. In the command center, the inspector and the safety director reported what they encountered. The inspector also stated the safety director requested to take bolt cutters and go back and try it again, but was told no by command center personnel.

On August 12th, Stickler asked this inspector about the attempt and what he encountered. The inspector told Stickler about the exploration, what he saw, and that he would try again if given the go-ahead. However, no instructions to attempt another exploration was ever given.

Davis stated that he remembered being told that the explorers could not get any further, but the inspectors who made the last two explorations both stated they could travel further.

Stickler stated that following the August 10th exploration attempts, he, Stricklin, and Davis, along with company representatives, decided that additional attempts to explore over the rubble were too risky and no other explorations would be attempted.

Opening in No. 1 Entry

On August 16th, at 5:00 a.m., the advancement in the No. 1 entry was 42 feet in by crosscut 126. At that time, information entered in the command center logbook identified that an opening was observed over the rubble two foot to three foot high and ten foot across the entry.

Ted Farmer, Price Field Office Supervisor, documents the observed opening in his notes for the morning meeting of August 16th. The notes stated, "Company wants to use less than full mine rescue team. Al Davis has a copy of company's exploration plan. Check with Al." His notes further identify "If opening occurs small exploration will be done if it appears that a team could explore. Then a full team with a back up team will then explore." Later, Farmer makes a notation that he "Will get back to operator on plan."

At 9:55 a.m., cleanup in the No. 1 entry had advanced 55 feet in by crosscut 126. At 10:15 a.m., a notation in the logbook identified the hole at the face as being 11 feet wide, two feet high and having a line-of-sight of 20 feet.

At 12:59 p.m., the logbook notation identifies that cleanup in the No. 1 entry had advanced 69 feet in by crosscut 126. At 1:02 p.m. a notation identifies that the hole at the face of the No. 1 entry was now 9 feet wide, two and one-half feet high and the line of sight was now 50 feet.

Farmer's notes also indicate that he attended a meeting with Kevin Stricklin, Administrator for Coal Mine Safety and Health, Davis, and company officials. Although there is no time indicated in the notes as to when the meeting took place, it appears to be sometime either late morning or early afternoon when Stricklin and Davis would have returned to the mine from the morning family and press briefings. Farmer's notes identify that the meeting was to talk about conducting another exploration if the No. 1 entry opened up. He documented that "Kevin suggests to have 4 rescue members for a look and see." Farmer further documented that "management and Urosek will go take a look at the face to check the air movement."

There were no additional notations or discussions concerning conducting the proposed exploration. The copy of the operator's plan discussed in the notes was not found in the documents with the § 103(k) order, nor did Davis or Stricklin discuss in interviews that such exploration was proposed or considered. Later that afternoon, the bounce occurred that caused fatal injuries to three rescue workers and injured six others. No other underground activity was conducted.

It can not be determined how far the exploration over the rubble could have advanced toward the last known location of the trapped miners. The opening that was found could have confirmed to the persons-in-charge that the rubble in the No. 1 entry was decreasing as they neared crosscut 127, and that the rate of advance could be increased. In interviews, this was not identified, nor was it discussed that such an opening existed.

Conclusion: The decision makers determined that it was too risky to continue with explorations over the rubble. However, they did not take into account information and recommendations from persons involved in the explorations when making this decision.

Recommendation: MSHA should obtain all relevant information prior to determining whether to continue or discontinue any rescue or recovery attempt.

DRILLING OF BOREHOLES

Boreholes play an important part in rescue and recovery operations. Much information can be obtained from boreholes, such as mine conditions, mine atmospheres, and location of missing miners. Boreholes can also be used to provide supplies and fresh air to trapped miners. Boreholes have served all of these purposes during past mine emergencies.

At the Crandall Canyon mine, a total of seven boreholes were drilled into the South Barrier area of the Mine in an attempt to locate and communicate with the six missing miners. This section addresses each borehole, including how its location was chosen and the data obtained from it. It also discusses how MSHA had to encourage the operator to drill additional boreholes, and the decision not to drill a large borehole for the rescue capsule.

A map depicting the location and details of the seven boreholes is included as [Appendix D](#).

Arrangement for Boreholes

On the morning of August 6th, Allyn Davis, District 9 Manager, discussed drilling boreholes with Mine officials by phone before he departed Denver for the Crandall Canyon Mine. They decided to drill boreholes to try to determine the location of the miners and the conditions that existed in the South Barrier mining section. Because of the mountainous terrain over the area of the mine where the miners were trapped, there were no existing roads. A road had to be constructed over the difficult terrain in order to provide a truck-mounted drill rig access to the proper location. Since this took time, a smaller drill was delivered to the proposed drill site by a helicopter. While this drill was being delivered and set up, preparations were made to construct a road and deliver a larger drill rig.

The following table provides data concerning each of the seven boreholes.

Borehole Summary

Borehole Number	Start	Finish	Time to Drill	Depth	Time to Move to Next Hole
1	August 7th @ 7:30 p.m.	August 9th @ 9:58 p.m.	50.5 hours	1871 feet	
2	August 8th @ 1:20 p.m.	August 11th @ 1:00 a.m.	59.6 hours	1886 feet	69.2 hours
3	August 13th @ 10:12 p.m.	August 15th @ 10:11 a.m.	36.0 hours	1414 feet	29.5 hours
4	August 16th @ 3:45 p.m.	August 18th @ 9:16 a.m.	41.5 hours	1587 feet	38.0 hours
5	August 19th @ 11:15 p.m.	August 22nd @ 8:30 a.m.	58.3 hours	2039 feet	31.5 hours
6	August 23rd @ 4:00 p.m.	August 25th @ 4:00 p.m.	48.0 hours	1783 feet	60.0 hours
7	August 28th @ 4:00 a.m.	August 30th @ 4:15 p.m.	48.3 hours	1865 feet	

Borehole No. 1

While the small drill rig was flown in by helicopter, equipment was brought in to prepare the site. Again, because of the rugged terrain above the mine site, it was a difficult task to perform. Drilling started with the small rig at approximately 7:30 p.m. MDT on August 7th, about 40.5 hours after the accident occurred.

The location of the first two boreholes was determined by officials at the mine site early on August 6th. Borehole No. 1 was a 2.4 inch diameter hole that was planned to be drilled into the No. 3 entry at crosscut 138. This was the location of the “kitchen”, the area where the miners normally ate. Officials thought that the trapped miners would gather at this location to wait for rescue.

As the first borehole neared the mine level, all rescue workers were withdrawn from the mine as a safety precaution. (Rescue workers were not withdrawn from the mine for any other borehole, as there was no methane detected from this borehole.) Borehole No. 1, which was 1871 feet deep, drilled into the mine at approximately 9:58 p.m. on August 9th, about 50.5 hours after drilling was started and just over 91 hours after the accident. This was a reasonable time, considering the depth of cover and the terrain in the area. The drill rig was shut down and the drill steel was pounded on in an effort to communicate with the trapped miners. There was no response. Because of the small diameter of the hole, a camera could not be lowered into the mine to view the conditions where the borehole penetrated the mine.

When the borehole intersected the mine, MSHA Technical Support (TS) personnel were on site to obtain air quality measurements from the hole. After purging the hole with a vacuum

pump for a period of time, the measurements were taken. The first readings taken, at approximately 10:15 p.m., showed 20.4% to 20.6% oxygen. The TS personnel believed these readings were erroneous, as they expected oxygen levels to be lower. The drill steel was raised and flushed with water. New samples were taken at approximately 1:45 a.m. on August 10th. These samples showed the oxygen level to be approximately 7.4%. Bottle samples were taken that confirmed the reading.

The small drill rig was not equipped with a directional drill head. As such, it was not possible to tell if the borehole was drifting off target. The persons-in-charged believed the borehole might have drifted and intersected an adjacent sealed area instead of the South Barrier section. Measurements taken from the sealed Main West area showed the oxygen level to be 7.5%, and other constituents to be similar to the borehole sample. A directional survey tool was lowered into the borehole on the afternoon of August 10th. It was determined that the hole did intersect the South Barrier section in the No. 2 entry at crosscut 138. This confirmed the oxygen level on the section where the men had been mining was only 7.4%. This oxygen level could not support life. [See Appendix E](#) for a chart showing the effects of low oxygen levels on human life.

There was a 3.5-foot void in the entry where the borehole intersected the mine. The mining height in the area was approximately 8 feet high.

A microphone was lowered into the first borehole, but no sound from the miners was detected. The hole was used to pump fresh air into the mine for the remainder of the operation.

After completing Borehole No. 1, the small drill rig was not used again. All other holes were drilled with the larger truck-mounted drill rig. These larger holes were 8.75 inches in diameter, and were drilled with precision into the targeted area.

Borehole No. 2

While Borehole No. 1 was being drilled, a road and drill pad was prepared to deliver a larger drill rig to the site. The casing was set for borehole No. 2 at approximately 1:20 p.m. on August 8th. Borehole No. 2 intersected the mine at around 1:00 a.m. on August 11th at a depth of 1886 feet, taking around 59.6 hours to complete. The borehole intersected the mine in the No. 2 entry at crosscut 137 at the section's loading point. There was a 5.7-foot void from the roof to the rubble where the hole penetrated the coal seam, and the mining height in this area was approximately 8 feet.

When this hole drilled into the mine, all machinery on the mountain was silenced. The drill steel was pounded on several times, with intervals between each pounding to allow for a

response. Only random noises were heard; there was not a response from underground. Oxygen levels were not obtained from borehole No. 2.

After the drill steel was raised from the hole, a camera was lowered to the mine level. The only visual image was of the wire roof mesh that was installed when the section was developed. The camera was raised from and the borehole was cased. After a few attempts with different cameras and lighting, a better video of the mine at the No. 2 borehole was obtained. The video revealed solid roof in the area, but showed damage to the pillars in the belt entry where the hole intersected the mine. This video was not obtained until approximately 4:30 a.m. on August 13th, more than 48 hours after the borehole intersected the mine. No evidence of the trapped miners was observed in this borehole.

Another camera was lowered into this hole on August 30th. No significant change was observed on this date. Only a little more rib sloughage had occurred.

This hole was also used to pump fresh air into the mine.

Borehole No. 3

As mentioned earlier, the location for the first two boreholes was chosen by officials at the mine site before Richard Stickler, Assistant Secretary for Mine Safety and Health, Stricklin, and Davis arrived. According to Stickler, there was not much enthusiasm from Murray for drilling more boreholes after the first two. Stricklin stated "Murray was getting to a point that he didn't want to put any more boreholes in, and we weren't ready to give up yet." When the conditions and air quality from the first two holes were known, the persons-in-charge determined the miners' best hope for survival would have been to go back into the bleeder entry (No. 4 entry) where they could have barricaded to keep out the low oxygen.

After discussions between MSHA and the company, they decided that Borehole No. 3 would be drilled into the No. 4 entry at crosscut 147. A road was constructed to the area on the mountain over this location. This road and a drill pad were completed, and the No. 3 hole was started at approximately 10:12 p.m. on August 13th, about 69.2 hours after the second borehole was completed.

Borehole No. 3, which was 1414 feet in depth, penetrated the mine at about 10:11 a.m. on August 15th, taking approximately 36 hours to complete. A camera and microphone were lowered into the mine. The camera showed the bleeder entry to be in relatively good condition. Support posts were intact, and the full mining height was observed. Neither the camera nor microphone revealed evidence of the trapped miners. The first oxygen measurement obtained from this hole was 16.2%, as recorded in the command center log book. The miners could survive in this atmosphere, but would have difficulty breathing.

After this hole was drilled, MSHA's seismic location system detected what was later described as a "sympathetic oscillation", or a repeated sound vibration similar to an echo. Jeffery Kravitz, Chief of Scientific Development for Technical Support, did not believe that these vibrations originated from the mine; rather, he thought the vibrations appeared to be an echo in the drill steel in the No. 3 borehole. However, since the seismic equipment indicated that the vibrations could be coming from the area near crosscut 143, MSHA encouraged the company to drill a fourth borehole in that area. The company agreed to drill another borehole.

The No. 3 borehole was the last borehole that was completed before the accident on August 16th that halted the underground rescue operation. Fresh air was pumped into the mine through this hole until after the seventh borehole was drilled.

Borehole No. 4

Borehole No. 4 drilled into the mine in the No. 4 entry at crosscut 142. Drilling started on the hole at approximately 3:45 p.m. on August 16th, about 29.5 hours from the time the No. 3 hole drilled into the mine. This hole penetrated the mine on August 18th at approximately 9:16 a.m., taking about 41.5 hours to complete. The hole was 1587 feet in depth.

After the hole intersected the mine, the steel was pounded on to signal the trapped miners. There was no response. A microphone was then lowered down the hole and monitored for 45 minutes. Again, there was no response. From 11:00 a.m. until 1:20 p.m., all equipment on the mountain was shut down so the seismic location system could be used to detect any response by the miners. Surface explosive charges were detonated at 12:15 p.m., and the seismic system was monitored for a response from the trapped miners. The system did not detect any response.

The drill steel was removed from the borehole so that a camera and another listening device could be lowered into the mine. At this time, the mine atmosphere was "out-gassing," or coming out of the hole. Oxygen levels near crosscut 142 were determined to be 11% to 12%, which could not sustain life for a prolonged period of time. Video obtained from a camera dropped into the mine showed wire mesh holding rocks. The device lowered into the mine with the camera was used to send an audible message. Again, there was no response from the trapped miners.

A small robot was lowered into this borehole on August 30th. The robot trammed a few feet from the bottom of the hole before getting stuck. Problems occurred when trying to obtain video from the camera mounted on the robot. There was mud on the lens, and when the robot trammed, the video feed was lost. The robot provided no evidence of the trapped miners. While trying to retrieve the robot, it became lodged in the hole. The robot could not be retrieved.

Stricklin stated that they held out hope that the trapped miners may have still been alive until after the fourth borehole was found to have an atmosphere that could not sustain life. When the low oxygen levels were found in this borehole, Murray did not want to drill any more holes. However, at the encouragement of Stickler, he agreed to drill a fifth borehole.

Borehole No. 5

Officials decided that the fifth borehole would be drilled into the No. 1 entry at crosscut 133. This location was chosen in order to determine whether the bounce had affected the entry this far outby where active mining was conducted on August 6th. The borehole was started on August 19th at approximately 11:15 p.m., about 38 hours after the 4th borehole drilled into the mine. The hole intersected the mine at approximately 8:30 a.m. on August 22nd, taking around 58.3 hours to drill. The hole's depth was 2039 feet.

When the borehole intersected the mine, a six inch void was encountered followed by 8.5 feet of rubble. The drill steel was pounded on, but there was no reply. When a camera was lowered into the hole, a solid mud obstruction was encountered at 510 feet. This hole could not be used further.

Interviews with MSHA personnel revealed that MSHA wanted a borehole at this location drilled earlier in the operation. After the No. 1 borehole showed the oxygen levels to be unable to sustain human life, officials decided to drill the No. 3 borehole in the bleeder to determine if the miners had traveled there to barricade as previously discussed. Because there was only one drill rig available, Borehole No. 5 was not drilled until after the August 16th accident. When interviewed, MSHA management stated it would have been helpful to know the results of both Borehole Nos. 5 and 6 before the August 16th accident. However, they could not say how it would have affected the continuation of the underground rescue operation.

Borehole No. 6

Again, according to Stricklin, Murray believed that additional boreholes were not needed. However, after discussions with Stickler, Murray agreed to drill a sixth borehole. Officials decided that this hole would be drilled near the last known location of the continuous mining machine, which was in the No. 1 entry at crosscut 139. The borehole was drilled into the No. 1 entry, halfway between crosscuts 138 and 139.

The No. 6 borehole was started on August 23rd at approximately 4:00 p.m., around 31.5 hours after the No. 5 borehole was completed. The hole was 1783 feet in depth, and intersected the mine at approximately 4:00 p.m. on August 25th. This hole took about 48 hours to drill.

The borehole showed there was no void in the No. 1 entry at this location, as the entire eight-foot high entry was filled with coal rubble from the bounce. Neither a camera nor a microphone could be lowered into this hole. The mine atmosphere was not sampled in this borehole because the entire entry was filled with rubble.

Borehole No. 7

Borehole No. 7 was drilled because the family members wanted a borehole to go into the kitchen area. They believed the trapped miners would have gone there while awaiting rescue. Again, according to MSHA personnel, Stickler was instrumental in convincing Murray to drill this borehole.

The No. 7 borehole was started on August 28th at approximately 4:00 a.m. The borehole intersected the mine in the No. 3 entry halfway between crosscuts 137 and 138 at approximately 4:15 p.m. on August 30th. This was about 48.3 hours after it started and 60 hours after the No. 6 hole was drilled into the mine. The borehole was 1865 feet deep. A 2.7-foot void was found at this location. The original mining height was approximately 7.7 feet, and approximately two additional feet of roof rock had fallen out, leaving a total height of 9.7 feet. Seven feet of material filled the mine entry at this location.

After this hole was drilled into the mine, the drill steel was pounded on without any reply. The seismic system's geophones did not detect a response. After the drill steel was removed from the hole, a camera with a microphone was lowered. At 1865 feet deep, approximately at the top of the coal seam, the camera encountered mud and water and could not descend any deeper. The camera was raised approximately five feet. After waiting 10 minutes, another attempt to lower the camera was made. The mud was now five feet higher. It was determined that the hole was plugged.

No mine atmosphere analyses were obtained from this hole.

Borehole Time Summary

Because of the depth of cover over the mine, it took an average of 48.9 hours to complete each of the seven boreholes. Additionally, from borehole No. 2 through borehole No. 7, it took an average of 45.6 hours to start each subsequent borehole once the previous one was completed.

MSHA officials stated that having more than one drill would have been helpful, as there was a lot of downtime between holes. They stated that they requested the operator bring in an additional drill. The operator refused because he believed getting supplies to the drills would be very difficult because of the access roads. Water had to be hauled constantly up to the drill site. With all the other activity on these haulroads, company personnel believed they would

not be able to supply more than one drill. Though MSHA suggested that the operator acquire more drills, Agency personnel were not certain whether the Mine Act provided them authority to order the company to do so. Although a § 103(k) order had been issued at the Mine, MSHA's persons-in-charge considered the use of a § 103(j) order. However, they were not able to determine what MSHA's or the operator's responsibilities and liabilities would be if a § 103(j) order was issued.

If two drills rigs had been used, boreholes No. 4 and No. 5 could have both been completed before the August 16th accident. Having two drills would have eliminated the move and set up time between boreholes. That is, the second rig would have been set up and ready to start as soon as the first drill completed the hole it was drilling. Still, it could not be determined what effect, if any, information from the additional boreholes would have had on the underground operation.

30 Inch Rescue Borehole

At the July 2002 Quecreek mine emergency in Pennsylvania, miners trapped by a water inundation were rescued through a 30 inch borehole using a rescue capsule. The families of the miners trapped at Crandall Canyon wanted a borehole to be drilled for this type of rescue attempt. Persons-in-charge considered this request but decided that it would not be feasible. Because of the time it would take to drill a hole of this depth, the possibility that the strata might shift due to continuing seismic activity, and the low oxygen levels in the mine, they decided it was not feasible to attempt a borehole unless there was evidence that the trapped miners were alive.

Conclusion: MSHA identified the benefit of having more drill rigs onsite, and requested that an additional drill be utilized in drilling boreholes, but the operator refused. MSHA personnel were uncertain of the extent of their authority to order the operator to obtain an additional drill rig. MSHA has never fully evaluated the limits of its authority under a § 103(k) order, nor has it evaluated its responsibilities and liabilities should it issue a § 103(j) order.

The decision not to drill a 30 inch rescue borehole was appropriate.

Recommendation: MSHA should request legal advice from the Office of the Solicitor which clarifies the Agency's authority, responsibilities, and liabilities under § 103(k) and § 103(j) orders.

MSHA should have a contingency plan in place whereby equipment and other resources can be quickly and easily acquired to continue with a rescue or recovery operation if the operator can not or will not provide necessary resources.

RISK VERSUS VALUE

In all rescue and recovery operations, the primary concern must be the safety of the rescuer workers. The persons-in-charge responsible for activities in the command center must constantly compare the risk to those working underground to the value of the work being performed. This concept is the basis for all mine emergency activities. Training in mine rescue, Mine Emergency Response Development (MERD) exercises, and written guidance in directing mine emergencies emphasize the importance of the safety of rescuers.

The following is an excerpt from MSHA's *Headquarters Mine Emergency Response Procedures Handbook*.

"Mine accidents resulting in trapped or missing miners, or several fatalities, impose important responsibilities upon MSHA personnel both at headquarters and in the field. In such cases, the Agency's primary responsibilities include the following:

1. protecting the safety of persons conducting rescue and recovery operations;
2. aiding the recovery of trapped or missing miners;
3. conducting a thorough, objective investigation into the cause of the accident; and
4. taking appropriate enforcement actions."

MSHA management in the command center must constantly be aware of the circumstances of the operation and the risks that are being incurred by the rescuers. To do this, a fundamental rule of the decision-making process must be one of evaluating "Risk vs. Value". The purpose of this section is to discuss the concept of that rule and to determine if MSHA's management conducted such an evaluation.

At every emergency operation, the evaluation of the risk to underground workers must always be at the forefront of the decision making process. Regardless of the type of mine emergency, such as fires, explosions, inundations, roof falls, bounces, or any other event at a mine, there is always a risk to the workers who are being sent underground to mitigate the situation. With all underground rescue activities, consideration must be given to the amount of risk that would be acceptable based on the value of what the assignment will achieve. More risk can be assumed when the value of what can be obtained is higher. For example, if missing miners are known to be alive, persons-in-charge would be willing to assume a higher risk to facilitate their rescue. If the status of missing miners is unknown, the level of risk should be somewhat lower. If persons-in-charge are convinced that the missing miners did not survive, the level of risk should be very low.

Applying these fundamentals to the Crandall Canyon tragedy, specific situational issues should have been evaluated and a risk analysis conducted to confirm that the value of the outcome was commensurate with the risk assumed. The following issues relate to determining the value, which would be the likelihood of survival of the trapped miners:

- The extent and severity of the bounce that occurred on August 6th.
- The effects of the bounce on persons in the working section with regard to visibility, disorientation, and physical effects.
- The low oxygen levels discovered by the exploration teams over the rubble on August 6th.
- The low oxygen detected from Borehole No.1.
- The lack of any signal or response from the 6 trapped miners, either through seismic vibrations, borehole tapping, mine phone communications, or visual indications from cameras.

The following issues relate to determining the risk of continuing with the underground rescue work:

- The bounces that continued to occur during the 10-day underground rescue effort.
- Confidence in the protection system being used in the No.1 entry.
- Feedback to the command center persons-in-charge from persons directly engaged in the underground work.
- Feedback to the command center persons-in-charge from Technical Support experts who were on site.

A discussion of each point listed above follows.

Value Analysis

1) The extent and severity of the bounce that occurred on August 6th. The bounce that occurred on August 6th was of such a severe magnitude that the damage extended outby the working section to crosscut 120, a distance of over 2460 feet (which was 19 rows of pillars in this area). Permanent stoppings were blown out from the force of the bounce to crosscut 95. The persons-in-charge stated that they believed the bump probably originated under the point of deepest cover (overburden) and extended outby and inby for respective distances. Once clean-up advanced in the No. 1 entry to just inby the point of deepest cover, they believed that the amount of material in the entries would reduce, and the area inby would be less affected. The point of deepest cover, 2200 feet, was shown on the mine map near crosscut 129. The amount of overburden was similar both inby and outby the 2200 foot line. If the bounce material extended outby this point of deepest cover to crosscut 120 (nine crosscuts) and a distance of approximately 1160 feet, it would appear logical that it would also extend inby for a similar distance, or to crosscut 138. It would also appear that the forces that blew out

stoppings to crosscut 95 would also extend inby for a similar distance. Since the trapped miners were assumed to be working near crosscut 139, they would have been in an area that would have been affected by bounce material and extreme forces. It could also be assumed that the forces inby could be greater because of the confined area, while the forces that extended outby could spread over additional entries. Considering these facts, it is likely that the six miners on the section would have been affected by the extreme forces generated by the bounce, including being struck by coal propelled from the ribs.

The bounce on August 6th registered 3.9 on the Richter scale as measured by the University of Utah. A mechanic leaving the South Barrier section felt the air blast from the bounce when he was near crosscut 108. He stated "It felt like it slid my whole truck sideways." The rescue workers found one-inch diameter roof bolts bent or broken off and entries to be almost completely filled with coal from the pillars. Many of the MSHA persons interviewed, including those in management positions, said that they felt that the miners could not have survived the initial bounce. One inspector documented in his notes on the initial observation of the effects of the bounce, "[H]ow could anyone survive this?"

2) The effects of the bounce on persons in the working section concerning visibility, disorientation, and physical effects. The effects of the physical conditions of the bounce in the area where the miners were working would have been extremely severe. Many of the District 9 inspection personnel interviewed had experienced bounces numerous times during their working careers, both prior to, and since being employed with MSHA, though none of the magnitude of this bounce. They described the environment immediately following a significant bounce as extremely disorienting. The dust generated was so dense that visibility was zero and breathing was difficult due to the choking effects of the dust. Even with undisrupted airflow, it would take several minutes for the dust to clear enough to obtain limited visibility and improved breathing.

In the South Barrier section, ventilation was disrupted by stoppings that had been blown out to crosscut 95. The entries at crosscut 120 were blocked by rubble nearly to the roof. In an interview with the Accident Investigation team, the mechanic who was at crosscut 108 when the bounce occurred, stated "I couldn't see this close (indicating) in front of my face because the dust was so thick." There would have been no air movement on the section, so it may have taken several hours for the dust to reduce for improved visibility and breathing.

An inspector who was working underground with the rescuers described standing at the belt feeder in the No. 2 entry when a bounce of a 2.2 Richter magnitude occurred at 1:13 a.m. on August 7th. He was knocked down by the forces, and the dust that was generated was so thick that he could not see and breathing was difficult. He was disoriented and it was several minutes before he could find his way out of the area.

Considering this information, the area of the working section would have been severely disrupted by the major bounce that occurred on August 6th. Miners would have been knocked down by the forces. The dust would have made breathing and visibility extremely difficult, and may have remained suspended for several hours before settling. Orientation would have been disrupted to the point that it would have been almost impossible to negotiate travel or determine even which direction was inby or outby. The MSHA persons-in-charge stated they thought that the trapped miners initially would have tried to travel outby. Once the miners found that the entries were blocked they believed that the trapped miners would travel into the No. 4 bleeder entry inby the pillar line and would have built a barricade. However, in the reduced visibility, it would have been difficult to find their way to the No. 4 bleeder entry.

3) The low oxygen discovered by exploration parties over the rubble on August 6th.

Shortly after the accident occurred, five of the Crandall Canyon miners who were outby the extent of the bounce's damage went to crosscut 120 of the South Barrier section to determine what had happened and tried to reach the trapped miners. One of the miners, in his Accident Investigation Team interview, stated "We got in two or three breaks and the oxygen dropped down to like 16 percent," and "we figured, oxygen being so low, let's pull back and work on ventilation and get some air down to our guys."

At approximately 7:30 a.m. on August 6th, an exploration party of MSHA and mine rescue team members entered the mine and advanced to the area of the bounce. Their mission was to negotiate a route of travel over the rubble blocking the entries and to access the section in an attempt to facilitate a rescue. Starting at crosscut 120, by crawling over the rubble and maneuvering their way through the crosscuts and entries, they were able to advance to crosscut 126. The working height in the area had been about 8 feet prior to the bounce, but they described the entries so full of rubble that at times they were lying on their backs and pulling themselves along by the wire mesh bolted to the roof. Their exploration was hindered by reduced levels of oxygen. When the oxygen levels lowered to about 16% they also had to retreat. The origination of the low oxygen and the fact that the oxygen content continued to reduce as the exploration teams progressed inby seemed to be ignored by the persons-in-charge on site. It is likely from the low oxygen readings found by the exploration teams that the section was inundated by the low oxygen at the time the bounce occurred.

4) The low oxygen detected from Borehole No. 1. On August 9th, borehole No. 1 intersected the mine at approximately 10:00 p.m. in the South Barrier mining section. By 1:45 a.m. on August 10th the samples reflected that the atmosphere in the intersected area contained 7.4% oxygen. Earlier, on August 6th, mine rescue teams had breached seal No. 1 of the Main West section adjacent to the South Barrier section and detected a concentration of oxygen in the atmosphere similar to the 7.4% reading found at the borehole location. It appeared that there had been a breach of the barrier separating the two sections and that the low oxygen had migrated from the sealed section into the active South Barrier section. The miners on the

section were equipped with Self-Contained Self-Rescuers (SCSRs) which would provide oxygen for one hour. A storage cache of extra units was available on the section, if they could have accessed it, which would have provided additional oxygen, but only enough to last for a few hours. The findings of low oxygen from the borehole also verified the earlier low oxygen encountered by the exploration party traveling over the rubble on August 6th. The area where the miners were working was inundated with low oxygen levels that would not support life for very long.

5) No signaling or response of any kind from the 6 trapped miners, either through mine phone communications, seismic vibrations, borehole tapping, or visual indications from cameras. During the 10 days that the rescue attempt continued until the second accident on August 16th, there were no indications that the six miners were alive. After the accident occurred, efforts were initially made to contact the missing miners by the mine phone system. It could not be determined if the system was functional as the phone lines could have been damaged by the bounce. There was no response from the missing miners. The company also sent messages through the Personal Emergency Device (PED) system. The messages would have been received by the acting foreman on the section who had a receiver attached to his cap lamp battery. The PED system did not allow for a response to be sent back to the surface, but the messages instructed the miners to pound on the roof or water line. There was no indication that the PED messages were ever received. Shortly after the initial accident, efforts were made to contact the miners by pounding on the water line that supplied the section. The water line would be tapped on several times, and then a period of time was allowed for the trapped miners to respond. No return pounding was ever detected by an MSHA deployed portable seismic location unit attached to the water line.

The surface seismic location system was set up and operational by 10:30 p.m. on August 7th. Although it had limitations of depth (1500 feet), rescuers hoped that a rhythmic or continuous pounding from underground could be detected. The only signal the seismic system picked up was a series of repetitive sounds heard for approximately five minutes on August 15th. Jeffery Kravitz, Chief of Scientific Development for MSHA's Technical Support, stated this signal could not be from the miners because it was "too high of a signal", meaning the signal was too strong to be from the location of the miners. The repetitive sounds were determined to be sympathetic oscillation in the drill steel in Borehole No. 3. When the boreholes were drilled into the mine, efforts were made to tap on the drill steel and listen for responsive tapping. None was ever heard. Microphones were lowered into the boreholes to listen for sounds from the miners. Cameras were lowered into five of the boreholes, but because of obstructions, video could only be obtained from borehole Nos. 2, 3, and 4. No sounds or movements from the missing miners were ever detected by the microphones or cameras.

Risk Analysis

1) **The bounces that continued to occur during the rescue period.** During any mine emergency, the information that is available and that which is obtained through sampling, measurements, communication, etc., must be continually compiled, trended, and evaluated to determine the risk to the underground workers. For example, in the aftermath of an explosion, mine gases are sampled, analyzed, and trended to determine if conditions are favorable for subsequent explosions which would endanger rescue workers. If it is determined that subsequent explosions were probable, the underground operations would be suspended until actions could be taken which would mitigate the probability of subsequent explosions. The data available for bounce events would be the frequency, severity, and location of subsequent bounces as well as information from observations of personnel underground.

During the 10 days that the underground rescue attempt was ongoing at Crandall Canyon, bounces continued to occur. On August 6th, a bounce occurred in the Main West section where a mine rescue team had breached a set of seals. The rescue team had been behind the seals, came out, and was preparing to go back into the sealed area. If the team had been in the sealed area when the bounce occurred, it is likely that they would have been injured. Early on August 7th, an MSHA inspector and company personnel were near the feeder in the No. 2 entry at crosscut 120. A bounce occurred in the No. 4 entry that refilled an area with rubble similar to the amount which had been removed earlier. The inspector and company employees were knocked down by the force of the bounce. Had they been in the No. 4 entry when the bounce occurred, it is likely they would have been badly injured or killed. Several other bounces occurred that were recorded in the logbook and described as covering the continuous miner, creating thick dust, and requiring a head count to make sure everyone could be accounted for.

Inspectors going underground were instructed to report significant events, including bounces that occurred. However, they were never given instruction as to any specific circumstances that would standardize the reporting. Since everyone had different levels of experience with bounces, including many of the inspectors from the eastern MEU team who had no experience with bounces, levels of reporting were not as consistent as they should have been.

Nevertheless, the lack of standardized reporting was irrelevant because none of the persons-in-charge thoroughly analyzed the bounce activity that was occurring. Davis stated that he thought Technical Support Roof Control Division (RCD) personnel were analyzing the bounce activity, but acknowledged that he never directed them to do so. The RCD personnel said they never conducted such an analysis nor did they see one that was conducted by anyone else. They were aware of company personnel collecting some seismic data, but did not know any specifics about it. The RCD personnel further stated they suggested that someone look into installing some seismographs so that a baseline could be developed to ascertain if there was increased seismic activity as the advance continued. They stated Stickler advocated this idea, but when it was determined that MSHA's seismic equipment could not obtain the necessary

data, the idea was not pursued any further. Stickler stated that, at one point, he looked at a plot of seismic activity the company engineers were plotting from information provided by the University of Utah, but could not recognize any trends. While it is unclear what specific insight could have been gained, a thorough analysis of the bounces that occurred may have contributed to the overall risk versus value analysis. No system was in place to make these evaluations. The persons-in-charge may have come to the same ultimate conclusions about how or whether the rescue effort should proceed, but an evaluation of all relevant information should have been conducted.

A log of bounces could have been compiled from entries in the command center logbook, information from the University of Utah concerning seismic activity and Richter scale readings, inspectors' personal notes that contained references and descriptions of bounces, and debriefings with underground rescue workers. One possible analysis that could have been conducted was to compare data from the rudimentary bounce log versus footage of entry cleaned up. Historically, bounce-prone mines have utilized a reduced rate of advance as one way of reducing the number of bounces. For example, a longwall mining section may limit the number of shearer passes when advance rate has been correlated to the number of bounces. During the rescue effort at Crandall Canyon there was a constant desire to increase the clean-up footage rate to lessen the time to reach the trapped miners. On the shift prior to the August 16th bounce that killed and injured additional workers, 57 feet of entry was cleaned up and supported. This was a significant increase in the clean-up advance rate, which at times had been as little as 4 feet per shift. While there is no certainty that any conclusions could have been drawn from such an analysis, it still could have been considered in the risk versus value analysis. Had the persons-in-charge determined that the value had decreased after 10 days into the operation taking into account the factors discussed above in the "Value Analysis" section, perhaps the "risk" could have been reduced by ensuring that footage rates did not spike drastically until the effects could be determined. At the very least, an attempt at analyzing the bounces more thoroughly would have focused more attention on the hazards associated with the continuing bounces.

2) The protection system being used in the No.1 entry (Rocprops™, chain link fencing, and wire ropes). The support system used to protect the rescue workers removing material from the No. 1 entry consisted of Rocprops™ installed near the ribs, backed up by chain link fencing, and tied together with three wire ropes. This system was recommended by the mine operator and approved by MSHA based on the performance of a similar system used at the company's Aberdeen Mine. The system at Aberdeen was used to contain material from the pillars along longwall headgate entries if bounces occurred. The installation at Aberdeen was somewhat different in that a wire rope was wrapped entirely around the pillar being contained or was tied off to Rocprops™ in crosscuts. At Crandall Canyon, the wire ropes were terminated at the most inby Rocprop™ installed. If a bounce occurred at Aberdeen, the Rocprops™ could have been dislodged but still be held in place by the wire rope and/or adjacent Rocprops™. At Crandall Canyon, the Rocprops™ were only tied together.

Therefore, if a Rocprop™ near where the wire ropes were terminated was dislodged by a bounce, it could pull adjacent props along with it. MSHA personnel stated that the system was the best they could use taking into consideration time, ease of installation, and the limited space in the rescue area. Inspectors and supervisors from Price stated that they had seen Rocprops™ and other substantial roof support dislodged by bounces at other mines. However, they were not involved in the process to formulate the support plan for Crandall Canyon, and therefore did not have an opportunity to provide input. One notation in the logbook documents “30 feet of props knocked out at 120 xc” by a shuttle car. Even though a shuttle car can generate significant force, the lateral force from a major bounce would be much greater. Many inspectors stated they questioned the ability of the Rocprops™ to withstand a significant bounce. One inspector documented in his notes after observing a bounce on August 15th that Rocprops™ appeared to have moved, and he questioned the ability of the Rocprops™ to provide support. The personnel underground said they felt comfortable with the protective system if only small bounces occurred and if the bounces were located near the front of the continuous mining machine where no one would normally be working. However, most stated that if a major bounce occurred, the support system would have failed. The persons-in-charge, for the most part, were unfamiliar with Rocprops™ and primarily took the recommendation of mine management of the support to be provided. Although the persons-in-charge had the RCD contact an expert from NIOSH to verify the viability of the Rocprops™, local experience with the support’s ability to resist bounces was not adequately considered. Davis stated that he had heard of Rocprops™ being dislodged at another mine, and that if a significant bounce occurred at Crandall Canyon, it could knock out the Rocprops™. Stricklin stated that “We always had concern about the bump activity, but we felt that the support we were putting in would protect us from any additional bump activity. The Rocprops™ and the fencing and the cables, we thought that that was going to protect us from any bump occurrence.” Stickler stated that they were seeing activity that indicated that there was a high-level of risk in the area inby the Rocprops™. However, he was confident that there was not an imminent danger for any of the workers in the area where the supports were installed.

3) Feedback to the command center persons-in-charge from persons directly engaged in the underground work. It is critical in any rescue operation that persons from the command center debrief persons who are assigned work or duties underground. Information provided by these individuals is important to the persons-in-charge in progressing with the operation and ensuring the safety of persons involved. Personnel are able to explain and describe conditions, events, and concerns more thoroughly and detailed than when the information is called outside by phone during the shift. Inspectors stated in their interviews that they were not being debriefed. At times they stopped by the MSHA command center after their shift and tried to pass on information to whoever was there, but formal debriefings were not conducted. They didn’t know if their information was forwarded to the persons-in-charge. One inspector said that after he was knocked down by a severe bump one night, he tried to talk to the supervisor in the command center to explain what had happened. The supervisor was so busy on the phone briefing MSHA personnel in Headquarters, Denver, etc. that the inspector waited

for an hour and one-half and then went home without passing the information along. No detailed information was provided to the persons-in-charge concerning this critical event.

The persons-in-charge at Crandall Canyon stated that they thought someone was conducting debriefings, but they didn't know who and they weren't receiving feedback from debriefings if they were conducted. MSHA's persons-in-charge could not confirm that company personnel were being debriefed, and therefore, did not receive any feedback from company rescue workers either. It was also common knowledge that approximately 12 company miners asked to be withdrawn from the face area, and were replaced. It could be assumed that these miners may have had critical information as to why they asked to be relieved from the face work. The MSHA persons-in-charge said they did not attempt to interview any of these miners. No other MSHA person talked to any of these miners to find out what their concerns were or why they asked to be withdrawn. This was a valuable source of information that was not utilized.

4) Feedback to the command center persons-in-charge from Technical Support ground control experts who were on site. Two ground control specialists from Technical Support's RCD responded to the accident at Crandall Canyon, arriving on August 7th. They were immediately dispatched underground to evaluate the area and determine which entry would be best to clean up. While underground, the plan to clean up the No.1 entry was approved without their input. The specialists were asked to comment on a plan revision to allow the use of 6 x 8 wooden posts instead of 8 x 8 posts originally approved but which were unavailable. The specialists stated that they never saw nor were they consulted regarding any other support plans or revisions that were submitted to MSHA by the operator. The specialists were underground nearly every day of the rescue operation, observing work, evaluating conditions, and assisting with whatever they could do to help. For example, they observed and questioned the continuous mining machine operators to find out if the debris had to be cut or if it could just be loaded in order to determine the extent of load on the debris. For the most part, the ground control specialists were not debriefed whenever they returned to the surface. They stated that they would usually stop by the command center and tell whoever was there what they observed. Due to the lack of formal debriefings, it is unclear how much of this information the persons-in-charge were aware of. Although the specialists did attend some meetings between MSHA and the company, it was on a limited basis.

Conclusion: MSHA failed to conduct a formal Risk versus Value analysis during the underground rescue effort. While bounce evaluation parameters are not quantifiable like those during a mine fire or explosion, and analyses of bounce activity can not be used to predict when another bounce will occur, an attempt to establish some baseline measurement could have been made.

Recommendation: MSHA should develop a program to train personnel in charge of rescue and recovery operations. This training should include how to use all relevant information available to evaluate the level of acceptable risk compared to the value that will be obtained.

MSHA's MINE EMERGENCY OPERATIONS (MEO)

MSHA's Intranet website is an internal website that cannot be accessed by non-MSHA personnel. This site is primarily for MSHA employees' use and information, and contains links that are employee-related. The website lists MSHA's mine emergency capabilities through links entitled:

- *MEO Vehicle Information*
- *Current Mine Emergency Operations Telephone Book*
- *Headquarters Mine Emergency Response Procedures Handbook*
- *Mine Rescue Teams Nationwide (This link can also be accessed from MSHA's publicly accessible Internet website, <http://www.msha.gov/>)*

Mine Emergency Equipment

The MEO Vehicle Information link depicts mine emergency operation vehicles and equipment that MSHA has available. Some of the vehicles and equipment are vintage, dating back to 1970's models. The vehicles listed below are all located at the Pittsburgh Safety and Health Technology Center near Pittsburgh, Pennsylvania, unless otherwise noted:

- A Seismic Truck which contains the seismic location system.
- An Auxiliary Truck that has the capability of providing electrical power for the Seismic Truck and has a fuel capacity for providing four days of power.
- A TV Probe Truck, which is equipped with camera equipment and TV monitors which is limited to depths of only 1500 feet.
- A Mine Rescue Team Truck that is used to transport mine rescue apparatus and equipment to an emergency. This truck is a 1994 model.
- An Electrical Truck that can be used at the mine site to monitor electrical systems. This truck is a 1994 model.
- A Gas Analysis Van that contains two Gas Chromatographs for sampling of mine atmospheres. This truck is a 1990 model.
- A Ventilation Van (IR Van) that contains gas sampling equipment. This truck is a 1994 model.
- Two Mobile Command Center Vehicles stationed in Beckley, West Virginia. One is a 1994 model and the other is a 1972 model.

There is no listing for the Mobile Command Center Vehicle that is stationed in Price, Utah.

The IR Van, which was driven to Utah from Pittsburgh, Pennsylvania, broke down in Indianapolis, Indiana and had to have a new transmission installed. Technical Support specialists traveling in a pick-up truck with the IR Van were able to transfer some of the

sampling equipment to their truck and continue traveling to Utah, while one member of the team stayed behind with the vehicle to have it repaired.

The Mine Emergency Mobile Command Center vehicle stationed in Price and one of the fleet's newer vehicles, took over one hour to start. MSHA personnel in Price said that they have had problems with this vehicle since it was purchased. The supervisor who drove it to the mine stated that it had problems with the lights and brakes, and that he would not drive it anymore because it was too dangerous.

Jeffery Kravitz, Chief of Scientific Development for MSHA's Technical Support, referred to MSHA's seismic location system as being one-of-a-kind, and having the best capability of any system specifically designed for that purpose. However, the system was developed over 30 years ago and has limitations. For example, the system is only rated to sense sound and vibration at depths to about 1500 feet. The depth at Crandall Canyon was over 1800 feet at the location in the mine where the miners were trapped. The set-up of the system is difficult and time consuming. The geophones must be set up in an array pattern, and the system receiving the signal from the geophones must be in direct line-of-sight with the truck. Crandall Canyon's surface terrain made this difficult. There are also difficulties in transporting the equipment. For the long distance from Pennsylvania to Utah, the equipment had to be transported by flight. Due to problems with making arrangements and getting the equipment loaded onto an Air Force C-17 plane, the equipment did not leave Pennsylvania until 2:00 a.m. EDT on August 7th. The equipment arrived at the mine at 10:30 a.m. MDT on August 7th, and was set-up to detect seismic signals by 10:30 p.m., approximately 44 hours after the initial accident.

Kravitz stated that field tests of the seismic equipment were conducted regularly up until 2000. At that time, funding was discontinued for the field tests. Consequently, monthly testing was conducted where the equipment was stored. Kravitz stated the equipment was extremely reliable during the monthly tests.

MSHA's internal review report of the Sago Mine explosion, released June 28, 2007, recommended that the Director of Technical Support determine the availability of improved technology for locating missing miners. With advances in technology in the last 30 years, a portable system with increased depth capability, easier set-up, and better filtering capability to sense only those sounds made by miners tapping could be designed and constructed. Smaller portable systems could be located at strategic locations in District Offices, easily and quickly transported, and deployed to the affected mine sites.

MSHA has equipment caches in various locations across the nation. Stored in these caches are first response equipment, infrared and electrochemical gas monitoring equipment, gas sample tubing, calibration gases, and a satellite telephone. Two locations of these caches were Price, Utah, and Green River, Wyoming. Satellite phones from these locations were brought to the mine site for use, as well as a satellite cell phone from Arlington, Virginia. The Department of

Labor sent additional satellite phones for use, but these phones did not work because the corresponding satellite was no longer in service. Additional satellite phones had to be purchased during the rescue operation. Even with operable satellite phones, communication was difficult from borehole drill sites to the command center. The satellite phones would only operate from certain locations on the mountain where the boreholes were located. The person providing hourly updates had to travel to each borehole site to obtain information, and then go to the right location to obtain a signal in order to contact the command center.

Conclusion: Some of MSHA's mine emergency equipment is outdated or in a bad state of repair.

Regularly scheduled field tests are not being conducted due to budgetary constraints.

Locations of caches and equipment listed are not readily available in MSHA documentation.

Recommendation: MSHA should evaluate and update, as needed, the mine emergency equipment. The seismic location system should be modernized, which was also identified in the internal review report for the Sago Mine explosion.

Equipment should be field tested, and documented, on a regularly scheduled basis to ensure its readiness and usability during an emergency.

Location of equipment caches should be listed in the Headquarters and Districts Mine Emergency Response handbooks. This cached equipment should be tested regularly, with results documented.

MEO Information

Mine Emergency Operations Telephone Book

This book lists MSHA personnel to contact in the event of an emergency. The website states that the book will be updated semi-annually. However, at the time of the IRT review, the posted update was 1/17/07, or over one year since it was last updated, and many of the names, titles, and contact information were incorrect.

Headquarters Mine Emergency Procedure Handbook

The handbook posted on the website at the time of the August 6, 2007, accident was last updated in 1999. Many persons listed as emergency contacts, both in Headquarters and the district offices, were no longer employed by MSHA or were in different positions within the

Agency. The handbook consisted of 97 pages of information that would be difficult to comprehend at the time of an emergency. Since 1999, there have been several mine accidents where persons have been missing or trapped, most notably, Jim Walters # 5, Sago, Aracoma Alma, Darby, and now Crandall Canyon. Since the handbook was not updated after these accidents, it is evident that no one had been using it.

A review of mine rescue teams listed on MSHA's websites indicates that the list is not current, especially in light of the teams formed in the aftermath of the Sago Mine and Aracoma Alma accidents and the MINER Act. This listing needs to be updated to ensure that all teams are included.

Conclusion: MSHA did not maintain or update the listings in the *Mine Emergency Operation Telephone Book* to reflect changes.

MSHA had not updated the *Headquarters Mine Emergency Procedures Handbook* to reflect changes to personnel or procedures since 1999. The handbook was out of date when the accident occurred on August 6, 2007.

The *Mine Rescue Teams Nationwide* database has not been updated to ensure all mine rescue teams are listed.

Recommendation: The *Mine Emergency Operation Telephone Book* and *Headquarters Mine Emergency Procedures Handbook* should be updated as necessary to reflect changes in personnel and procedures.

MSHA should update the *Mine Rescue Teams Nationwide* database regularly, and at least annually.

FAMILY LIAISON

MINER Act

Section 7 of the Mine Improvement and New Emergency Response Act of 2006 (MINER Act) requires, in part, that the Secretary of Labor establish a policy that:

- (1) requires the temporary assignment of an individual Department of Labor official to be a Liaison between the Department and the families of victims of mine tragedies involving multiple deaths;
- (2) requires the Mine Safety and Health Administration (MSHA) to be as responsive as possible to requests from the families of mine accident victims for information relating to mine accidents; and
- (3) requires, in such accidents, that MSHA shall serve as the Primary Communicator with the operator, miners' families, the press and the public.

On December 22, 2006, MSHA issued *Program Policy Letter (PPL) No. P06-V-11* ([See Appendix E](#)) to implement the provisions of the MINER Act as they relate to responsibilities for both the Family Liaison and the Primary Communicator. The Family Liaison is primarily responsible for keeping family members informed regarding the status of rescue and recovery operations. One of the main responsibilities of the Primary Communicator is to brief the media. The PPL specifies that the Primary Communicator shall be the senior MSHA official on-site or a media specialist from the Department of Labor. The PPL further specifies that the Primary Communicator shall be a person separate from the Family Liaison.

Family Liaison Officials Assigned to Crandall Canyon Mine

MSHA has 17 inspection districts. There are 11 Coal districts and 6 Metal/Non-Metal districts. In January 2007, MSHA selected at least one person from each of the 17 districts to serve as Family Liaisons. These individuals received specialized training provided by the National Transportation Safety Board (NTSB) to prepare them for their duties as the intermediaries between family members and MSHA in the event of a mine tragedy involving multiple fatalities. This training was conducted at the National Mine Health and Safety Academy, and consisted of approximately 24 hours of classroom instruction. The Liaisons stated that this training was of a high quality, but they felt additional training should be provided.

Following the bounce on August 6th, family members of the trapped miners were contacted by Company officials and told to report to the Senior Citizen Center in Huntington, Utah for

updates and briefings on the rescue efforts. The Senior Citizen Center, which is approximately 30 minutes away from the Mine, proved to be an inadequate location because of the accessibility by press and other non-family persons. Since privacy and security were of utmost importance, the families were moved to a nearby junior high school on the evening of August 6th. On August 17th, the families were moved once more, this time to a local church. Area schools were about to begin a new school year and could no longer provide a meeting space for the miners' family members.

MSHA officials assigned Liaisons from Coal Districts 9 and 7, as well as from the Metal/Nonmetal Rocky Mountain District, to the Mine to ensure 24-hour presence with the families. The Liaison from District 9 was designated as the Lead Family Liaison. After about 10 days, the Liaison from the Rocky Mountain District returned to his regular duty station and was replaced by a Liaison from Coal District 10.

Liaison responsibilities included contacting the MSHA command center each hour to obtain the latest data concerning progress of underground and surface rescue operations. Underground information addressed how rescue efforts were progressing, significant occurrences, mine air content, measurements of how far the rescue team had advanced, and the distance that roof supports had been installed since the last report. Surface operation reports included data pertinent to the depth of boreholes, as well as when the boreholes were expected to penetrate the coal bed. The reports also provided information on borehole samples with regard to gas readings for oxygen and carbon monoxide content. In addition, there were updates as to when a camera or microphone would be lowered into a borehole. This information was provided to family members in written form on a "white board" that was displayed where family members could review it at any time. The Liaisons informed family members that they (the Liaisons) were available to answer any questions or concerns related to the accident.

The Liaisons stated that they introduced themselves to the families during their initial meeting with them. However, many family members stated that they were not fully aware that the Liaisons were MSHA employees. There were a large number of people from different organizations, including the American Red Cross, the Salvation Army, various church groups, etc., working at the family center. Unless a person was wearing apparel to identify his or her organization, it was very difficult to determine who they represented, since many of the individuals wore street clothing. Except for one Liaison, who wore a shirt that she provided with an MSHA insignia and the words "Family Liaison" stitched onto the front of it, there were no identifying badges, clothing, emblems, etc. designating the Liaisons as MSHA employees. Family members stated that they knew MSHA officials were present, but that the MSHA personnel were not identifiable. Family members stated that they knew the names and faces of the Liaisons but, in general, did not understand that they were from MSHA. They indicated that the Liaisons did a great job of providing information and answering their questions.

Conclusion: MSHA personnel designated as Family Liaisons provided hourly updates to family members regarding the progress of the rescue effort. They made themselves available to answer questions raised by family members throughout the rescue effort.

Initial training was provided for the Liaisons, but additional training is still needed.

The Liaisons and other MSHA representatives were not easily identified as MSHA employees.

Recommendation: Liaisons should be provided annual re-training, and should also participate in annual MERD exercises.

MSHA should provide Family Liaisons with similar identifying apparel or other effective means to identify them as MSHA employees. MSHA should evaluate providing identifying apparel to all personnel at a mine emergency operation.

Family Briefings

MSHA's PPL regarding the duties and responsibilities of the Family Liaison indicates that the Liaison is to provide updates and meet with family members to conduct regular briefings. Nothing in the PPL indicates that persons other than the Family Liaison will conduct family briefings. The Lead Liaison from District 9 stated that, based on his understanding of the policy, he anticipated he would be required to conduct the family briefings during the rescue effort. However, shortly after arriving at the Mine site, he learned that MSHA's senior person would be conducting two daily briefings, one in the morning at approximately 9:00 a.m. and the other at about 5:00 p.m. in the afternoon. Allyn Davis, District 9 Manager, conducted these briefings until the afternoon of August 7th, at which time Richard Stickler, Assistant Secretary for the Mine Safety and Health Administration, arrived at the Mine site and became MSHA's primary spokesman at these briefings through August 21st. After that date, John (Jack) Kuzar, District 1 Manager assumed these duties. By conducting the family briefings, these senior MSHA officials assumed the duties of the Family Liaison. Robert Murray, Mine Operator, or Robert Moore, Vice President of Murray Energy, conducted the briefings for the Company. These briefings were held where the family members were located, and were conducted jointly by Company officials and MSHA.

Those present at family briefings stated that a Company official almost always started the meeting and addressed pertinent information. Family members stated that MSHA officials' comments were generally confirmation of this information. These family members stated that MSHA officials did discuss things that were specific to MSHA, such as the seismic equipment or the use of the escape capsule. MSHA officials also answered any questions addressed to them during the briefings.

Utah Governor Jon Huntsman, Jr., MSHA personnel, and many of the family members stated that Murray frequently became very irate and would start yelling at the families during the briefings, especially when they asked a question that challenged him or that he did not like. Reportedly, Murray sometimes was so loud that small children of the family members would become startled or even cry. Family members stated that Murray was impatient with and intimidating to the families. They indicated that Murray made statements at their briefings that were not related to the rescue effort. Some of these statements were "You should not talk to the media or the Union"; "the media is telling you lies;" and "the Union is your enemy." Family members stated that they were hesitant to challenge Murray or make him angry for fear he would stop the rescue operation, or would retaliate against the trapped miners by discharging them when they were rescued.

Stickler stated that, following the family briefing on the afternoon of August 7th, he met privately with Murray. Stickler told Murray that Murray's behavior was inappropriate and that he should delegate responsibility for conducting future family briefings to a subordinate. Murray declined the suggestion. Stickler also stated that prior to conducting future briefings Murray would agree on what was to be discussed at the briefings, but once the briefings started Murray would say whatever was on his mind.

Near the end of the morning briefing on August 8th, a person who was translating for the non-English speaking family members asked Murray if he would stop at the end of each statement so she could translate the information prior to going to the next statement. Murray became angry and stormed out of the building.

Shortly after this outburst, Governor Huntsman met with the translator and some of the family members who stated that they could no longer tolerate Murray's behavior. The Governor and Stickler then asked Murray to come back into the building to discuss a possible resolution to the problem. It was decided that Murray would allow Moore to be the company spokesman at future briefings. However, Murray continued to attend many of the family briefings and, eventually, again became the lead spokesman for the Company.

Stickler stated that on several occasions, he and Murray had privately discussed Murray's demeanor during the family briefings. However, there were still times Murray would have outbursts that would upset the families. Finally, on August 21st, Stickler decided that Murray's actions were so detrimental to the meetings that he requested Sheriff Larry Guymon, the Emery County sheriff, to bar Murray from the family center. Stickler stated the request was made to have the sheriff do this was because the 1977 Mine Act does not give MSHA jurisdiction off mine property. Murray attempted to return to family briefings the following day, but was detained by the sheriff. Murray did not conduct any other family briefings during the remainder of the rescue effort.

On October 3, 2007, Governor Huntsman testified before the House Education and Labor Committee on the Crandall Canyon Mine accidents. At the hearing, the Governor stated that

he expected MSHA to take control of the situation, but this wasn't done. During the Governor's interview with the Independent Review Team (IRT), the Governor clarified that this statement was primarily directed toward the way family briefings were being conducted. The Governor stated that, though MSHA's role improved during the later part of the rescue effort, it was his opinion that MSHA never really took control of the briefings. Some family members also stated that, at some point, they thought MSHA would take charge. The consensus was that MSHA never assumed the lead role in the family briefings.

Conclusion: MSHA did not conduct family briefings that were consistent with the provisions of the MINER Act. MSHA failed to control the family briefings.

MSHA's senior officials assumed the duties of the Family Liaison when they conducted the family briefings.

MSHA's authority at family briefings held off mine property has not been defined.

Recommendation: Consistent with the Miner Act, MSHA should be the primary source of all information shared with family members during mine emergencies.

MSHA should clarify or revise the policy to definitively state who will conduct the family briefings for MSHA in a mine emergency.

MSHA should develop a contingency plan on how they will handle family briefings during mine emergencies if company officials or any other party interfere with MSHA's responsibility of being the primary source of information for families.

MSHA should request a legal opinion from the Office of the Solicitor regarding MSHA's authority at the location of the family briefings if they are held off mine property.

Inconsistencies and False Hopes

Program Policy Letter No. P06-V-11 states in part that a qualified agency official will be assigned to act as Liaison for the purpose of being responsive to the needs of families of mine accident victims by providing clear and accurate information regarding the mine accident. Many family members believe they were given misleading or incomplete information regarding the possibility of the miners surviving the initial bounce and their likelihood of survival after the accident. It was not until after the rescue operations ceased that some of them learned the full extent of the accident. They also indicated that Murray made misleading statements similar to "The accident was caused by an earthquake" and "We were not conducting retreat mining when the accident occurred." Governor Huntsman stated that, at times, Stickler would attempt to contradict Murray about these statements, and that Murray would argue with him in front of families. However, some family members could not recall

Stickler contradicting or correcting these statements. They further stated they felt that Stickler also was intimidated by Murray and did very little to correct or dispute incorrect information that was being given to the families. There is no documentation on what Stickler told the families concerning these misleading statements by Murray.

The families stated they were not told in initial briefings by MSHA of the magnitude of the bounce. It was not explained to them that coal would be violently ejected from the ribs. They were not told that the enormous amounts of coal dust placed into suspension by the bounce would greatly limit the trapped miners' visibility and would make breathing difficult for some time. The limited visibility would also disorient the miners. They were not made aware that material from the bounce had filled the four entries at crosscut 120 until they were informed by two family members who were permitted to go underground two days after the accident.

While the rescue attempt was continuing, MSHA's persons in charge stated that they tried to maintain a positive attitude for the families so that they wouldn't give up hope. Regardless, family members stated that they believe they were given a false sense of hope throughout the rescue attempt. They felt a lack of information caused them to believe their loved ones were still alive. They strongly felt they should have been informed of the chances of survival of their love ones from the beginning of the rescue attempt. The Governor agreed with the family members regarding false hope. He stated that much of the false hope was caused by statements made by Murray and that Murray's statements were not always balanced with a sense of reality.

On August 9th, at approximately 10:15 p.m., an inaccurate oxygen reading of 20.6% (almost normal air) was obtained from the No. 1 borehole from a measurement taken by a hand-held instrument. This measurement was taken shortly after the drill steel penetrated into Crandall Canyon Mine. The sample was collected not knowing that the end of the drill steel was plugged with mud. Due to this blockage, the vacuum pump placed on the drill steel could not draw an air sample from the mine atmosphere. This basically resulted in taking an air sample in fresh air.

MSHA personnel responsible for taking the oxygen measurement stated they felt at the time that it was not a valid reading. However, they did record the 20.6 % reading on the record sheet that was being kept near the borehole. They decided that they would take additional measurements to ensure accuracy. Meanwhile, another MSHA employee who was responsible for the required hourly updates to the command center noted the 20.6 % oxygen reading on the record sheet and, thinking it was valid, reported the erroneous information. This heartening news was shared with the family members by Murray and Stickler at 11:05 p.m. on August 9th during a specially called family briefing.

At approximately 1:45 a.m. on August 10th, after additional sampling was done, it was determined that the true oxygen content of the mine air was about 7.4 %. However, families were not told about the misinformation regarding the air sample in the No. 1 borehole until

the 9:00 a.m. briefing. At this time, they were informed that this low oxygen level could not sustain life. Stickler encouraged them not to lose hope because there were still too many unknowns. They also were encouraged by Murray on August 11th that no one had given up hope, because this reading may not mean anything. They were told that the drill steel may have drifted from its intended target into a mined-out area (gob), which would explain the low oxygen reading. It was later determined that the drill had drifted, but that it still intersected the section where the miners were working at the time of the bounce. Some of the family members stated that they could not recall being told that the borehole had intersected the section. This information would have clarified that the miners were potentially exposed to the low oxygen level that would have reduced their chances of survival.

In another situation, the families were told that the seismic location equipment had detected a repetitive signal shortly after the No. 3 borehole had penetrated the coal bed which could have been indicative that the miners were trying to signal the rescuers. The MSHA person operating the seismic equipment did not believe that this tapping could be from the miners because of the rhythm and duration of the tapping. Nevertheless, before this questionable information could be re-evaluated, it was shared with the family members. Thus, a new sense of hope was offered once more.

While the repetitive signal was detected when pounding on the drill steel in the No. 3 borehole, the seismic equipment indicated that the signal was coming from a location approximately 700 feet from the No. 3 borehole. To further investigate the possibility that the tapping may have been from the trapped miners, another borehole (No. 4) was drilled into an area of the mine that was about 700 feet outby the No. 3 borehole. Examinations and testing in the area where the No. 4 borehole penetrated the mine did not detect any signs of the trapped miners.

It was later determined that MSHA's seismic location system had picked up what was described as a "sympathetic oscillation", or a repeated sound vibration similar to an echo. Jeffery Kravitz, Chief of Scientific Development for MSHA's Technical Support, felt these vibrations were not generated from the mine. Rather, he thought the vibrations were created from rescue workers pounding on the drill steel in the No. 3 borehole in an attempt to contact the trapped miners.

Conclusion: MSHA did not always provide clear and accurate information regarding the mine accident to the families.

MSHA did not correct or contradict misleading or incomplete information presented by Murray during the family briefings.

Recommendation: Family members should be given clear and accurate information associated with events surrounding an accident. All information relating to missing or

trapped miners should, to the extent possible, be verified before the information is shared with family members or made public.

Any information disseminated which is later determined to be inaccurate should be correctly communicated to the families as soon as possible.

Non-English Speaking Family Members

Three of the miners who were trapped in the Crandall Canyon Mine on August 6th were of Hispanic heritage. Many of their family members spoke little or no English. A translator was required for family members to understand what was being said at the family briefings. This created some confusion and uncertainty on the part of the victims' families.

An MSHA employee who worked in nearby Salt Lake City, and was bi-lingual, was directed to provide assistance to individuals who had problems understanding English. The employee arrived at the family center on the day of the accident at approximately 9:00 p.m. He answered questions and clarified mining terms for some family members. However, he did not translate information shared during family briefing sessions because other translators were present.

On Tuesday, August 7th, there were Spanish-speaking individuals available to interpret the briefing for the non-English speaking families. However, those persons conducting the briefing did not allow time for translators to immediately repeat the information. Thus, notes were taken by the translators, and discussions were held with the family members at the conclusion of the briefings. This caused some confusion in relaying information. As a result, following the briefing on the morning of August 8th, a translator approached Murray and requested that he (Murray) pause long enough between statements to allow translators to repeat the comments during the briefing, rather than afterwards. The translator indicated that the information would be more accurate if this was done. Murray became angry and stormed out of the meeting. Following a discussion with Governor Huntsman and Stickler, Murray agreed to allow time for translation during the briefing. Prior to this, MSHA had not taken any action to control the briefings in a manner that allowed the translators appropriate time to translate during the briefings.

Conclusion: MSHA initiated prompt action to assign a Spanish speaking employee to provide assistance for the non-English speaking individuals.

During the first two days of the family briefings, MSHA took no steps to have the speaker at the family briefings pause between statements so the interpreters could translate what was being stated.

Recommendation: During a mine emergency involving a non-English speaking family member, MSHA should ensure that information discussed during the family briefings is shared with family members in the most appropriate manner.

MSHA should evaluate every operator's ERP to ensure the plans, where necessary, address providing interpreters for non-English speaking miners and their families in the event of a mine emergency. MSHA should require operators to revise the ERPs if needed.

Potential Emotional Involvement with Family Members

The National Transportation Safety Board (NTSB) is an independent federal agency that has the responsibility for investigating every civil aviation accident in the United States, as well as any significant accidents in other modes of transportation. In 1996, Congress passed the Aviation Disaster Family Assistance Act. This legislation also placed the responsibility for coordinating information to victims and their families impacted by aviation disaster on the NTSB. Many individuals, some within the NTSB, did not believe the NTSB should have the responsibility for family assistance. They were concerned that this additional role would detract from and interfere with their independence and make it more difficult to maintain objectivity. To address these concerns, the NTSB established a policy that personnel conducting the accident investigation would be totally separate from personnel interacting with the families.

District 9's Mine Emergency Response Plan (MERP) specifies "that the person in charge should not be emotionally attached to the victims - for example, a brother, sister, son, or other family member. If such a situation develops, the person-in-charge should delegate authority to a subordinate or to a back-up District Manager." While this plan primarily addresses family members of the person-in-charge, a person who regularly briefs family members, and interacts with them for extended periods, can become emotionally involved with them.

Should it become necessary to discontinue the rescue effort due to unacceptable risks for the rescue workers, and the person-in-charge is emotionally involved with family members of the missing or trapped miners, the person-in-charge potentially could be influenced by emotions, rather than the safety of the rescue workers.

The person-in-charge for MSHA during the rescue effort at the Crandall Canyon Mine also conducted media briefings and two daily family briefings. Frequently, the person-in-charge met with family members after the briefings to address questions or concerns families had, but did not want to bring up during the joint briefings. On occasion, these discussions took place during family members' evening meal which was provided by various organizations such as the Red Cross. This type of interaction, over a prolonged period of time, could result in the person-in-charge becoming too closely involved with family members during the rescue effort.

Conclusion: The MSHA person-in-charge of the Crandall Canyon Mine rescue operation regularly briefed and interacted with family members. Even though the IRT found no indication that, by interacting with family members, the person-in-charge made decisions which were emotionally driven, there is potential for that to occur.

Recommendation: The MSHA person-in-charge of a rescue operation should not brief or interact with family members of trapped or missing miners.

PRIMARY COMMUNICATOR

Origin of the Primary Communicator Provision

The Primary Communicator provision of the Mine Improvement and New Emergency Response Act of 2006 (MINER Act) was an outgrowth of miscommunication that occurred in the aftermath of the January 2, 2006, Sago Mine explosion. In that case, security lapses and communication limitations resulted in victims' family members receiving information that all 12 missing miners were found alive. In fact, only one of the missing miners was alive. Approximately three hours elapsed before the families, public, and the media were informed that only one miner had survived. MSHA had not designated an individual to ensure that accurate information was disseminated to the families, media or public. Congress included the family liaison and primary communicator provisions in the MINER Act to prevent this from happening in the future.

The MINER Act became effective on June 15, 2006, and MSHA's policy addressing the responsibilities of the primary communicator became effective on December 22, 2006. Although MSHA implemented the primary communicator policy on three occasions prior to the Crandall Canyon rescue effort, Crandall Canyon was the first protracted incident during which the policy was employed.

Section 7 of the MINER Act mandated that the Secretary of Labor establish a policy requiring MSHA to serve as the primary communicator with the operator, miners' families, the press and the public in mine tragedies involving multiple deaths.

MSHA Program Policy Letter No. P06-V-11 (December 22, 2006) ([See Appendix F](#)) implements the provisions of Section 7 of the MINER Act. The policy provides that the senior MSHA official on-site and/or a media specialist will serve as the "primary communicator" with the mine operator, miners' representative, media and general public during mine accidents involving multiple deaths or where multiple miners are unaccounted for. According to the policy, the primary communicator is to be a separate MSHA official from the "family liaison," another role required under the MINER Act. Furthermore, the policy provides:

"The Primary Communicator will collaborate with the Liaison to ensure consistent, timely, and accurate information is disseminated to the public and the families. To the greatest extent possible, sensitive information will be shared with the families before being disseminated to the public. Nothing in this policy shall prohibit the mine operator from establishing communication with the families or the public."

An attachment to the policy sets forth a protocol established by MSHA and the Department of Labor's Office of Public Affairs (OPA). The protocol broadly addresses OPA's commitment to provide direction to the primary communicator during mine emergencies. The protocol sets forth four instructions. First, it states that upon learning of a mine accident where multiple miners are trapped, unaccounted for, or multiple fatalities have occurred, MSHA will contact OPA and provide all pertinent information to OPA. Second, the protocol provides that OPA will dispatch personnel to the accident site as soon as possible in order to support MSHA's primary communicator. Third, it provides that OPA and MSHA will jointly develop briefing outlines for purposes of briefing the public and press on a scheduled basis. Fourth, the protocol states that briefings with the press and public shall be conducted by the primary communicator after the family briefings have been conducted.

A second attachment provides specific guidance to be used in applying the policy during mine emergencies. Among the instructions provided in this attachment is the instruction that each district office will maintain one or more persons to serve as primary communicator to brief representatives' of miners, the mine operator, media and state agencies.

Secretary's Order No. 17-2006 (November 1, 2006), entitled *Delegation of Authority and Assignment of Responsibilities for Mine Safety and Health Programs*, directs the Assistant Secretary for Mine Safety and Health to dispatch trained personnel to carry out temporary assignments as primary communicator with the press and public following mine accidents and disasters. The Order also provides that the Assistant Secretary for Mine Safety and Health is to establish qualifications and training requirements for MSHA personnel performing responsibilities under Section 7 of the MINER Act. There was no information obtained during this review to indicate that qualifications and training requirements for Primary Communicators had been established.

MSHA as Primary Communicator with the Public and Press

MSHA policy provides that each district office will maintain at least one individual to serve as the primary communicator during mine emergencies. Allyn Davis, District 9 Manager, stated that, for District 9 the district manager is the primary communicator unless prevented by circumstances. Davis stated that the two assistant district managers were maintained as "substitute" primary communicators in the event that circumstances did not permit the district manager to fulfill the responsibilities of the position.

Throughout the Crandall Canyon rescue operation, various MSHA personnel served in the capacity of primary communicator, based on who the senior ranking official was at the time of their arrival on site. Ted Farmer, Supervisory Coal Mine Inspector in MSHA's Price Field Office, served as the initial primary communicator, until the arrival of Davis on the afternoon of August 6th. Davis ceded the Primary Communicator duties to Richard Stickler, Assistant

Secretary for Mine Safety and Health, when he arrived on the afternoon of August 7, 2007. Stickler served as the primary communicator until August 21st, at which time he left the mine site and was replaced by John "Jack" Kuzar, District 1 Manager, who assumed the role of Primary Communicator.

OPA representatives responded quickly to the accident and provided assistance and direction to MSHA's primary communicator(s). OPA personnel who assisted in the public affairs responsibilities during the rescue attempt included Richard Kulczewski, Regional Public Affairs Director for Region VII (Kansas City, Missouri) and Region VIII (Denver, Colorado); Michael Shimizu, Regional Public Affairs Director for Region X (Seattle, Washington); Matthew Faraci, OPA Special Assistant; and Dirk Fillpot, OPA Special Assistant. OPA personnel routinely provided one-on-one statements to reporters and, on a single occasion, Kulczewski acted as the primary communicator for MSHA.

Press Conferences

In an effort to convey the latest information on the progress of the rescue effort to the press and public, daily media briefings were scheduled twice each day. In accordance with MSHA's policy, press briefings were held subsequent to family briefings in order to ensure that sensitive information was not revealed to families by way of the media. Press briefings were held on a less frequent basis following the accident on Thursday, August 16th.

On the day of the initial ground failure, Monday, August 6th, Murray conducted a number of press conferences. Davis, who was on his way to the mine, instructed Farmer by telephone to accompany Murray to the family and media briefings. Farmer served as MSHA's primary communicator by virtue of Davis' designation. During this briefing, Murray made a lengthy, emphatic statement including an assertion that the location of the missing miners was known, that "we will get to them, it's a matter of how quickly", and that an earthquake caused the ground failure. Following his presentation, Murray answered all of the questions posed by the media. After answering those questions, Murray finally turned the briefing over to Farmer by asking, "Do you have anything to add to it, . . .?" In response, Farmer briefly stated that the Agency had employees underground who were working with the mine operator to rescue the trapped miners, and that MSHA personnel from Denver, Colorado, were en route to the mine.

Davis arrived at Crandall Canyon on the afternoon of August 6th, at approximately 5:00 p.m. MDT. Upon his arrival, Davis was the senior MSHA official on-site and, accordingly, was the primary communicator. At approximately 6:00 p.m. MDT that evening, Davis participated in a press conference with Murray. As was the case in the press briefing that Farmer had attended earlier in the day, Murray assumed the role of chief spokesperson. The press conference began with Murray's statement. Similar to the briefing discussed above, Murray promised that "we will be here on our feet until we get the men out, one way or the other." Murray also surmised that the six trapped miners, "may just be sitting in there with plenty of

air and water waiting for us to come get them, which they know we'll do." Once he completed his remarks, Murray turned the briefing over to Davis, stating, "I'll turn the meeting over to Mr. Al Davis, the District Manager of the Federal Mine Safety and Health Administration for anything he would like to say and then I'll be pleased to answer any questions that you have. . . ." Davis commented, in brief, on the removal of debris from the entries, transportation of machinery to the mine, performance limitations of the seismic equipment, and the intended functions of the boreholes. Thereafter, Murray asked the assembled reporters if they had any questions. A number of questions were asked by the reporters and Murray undertook responsibility for responding to the overwhelming majority of those questions.

On the morning of Tuesday, August 7th, at approximately 9:15 a.m. MDT, another press conference was conducted. For many reasons, this briefing was particularly illustrative of the subordinate role to which MSHA's primary communicators had at the press briefings. During this briefing, Murray again assumed the role of chief spokesperson and primary communicator, stating that the press would "hear from Mr. Davis later." As with the press briefing discussed above, Murray provided comments at length, many of which were unsubstantiated and/or unrelated to the ongoing rescue effort. During this press briefing, Murray:

- insisted that the ground failure was the result of an earthquake;
- stated that he and MSHA knew exactly where the missing miners were located;
- discussed his personal opinions of global warming legislation and national energy policy, stating that "every one of these global warming bills that has been introduced in Congress to date eliminates the coal industry and will increase your electric rate four- to five-fold" and that "people on fixed incomes will not be able to pay their electric bills";
- provided his opinion that the coal industry is essential to the U.S. standard of living and the ability of products manufactured in the U.S. to compete in the global marketplace;
- implored the press to "please accept my offer" to go to one of his underground Utah coal mines once the rescue operation had concluded;
- discussed the origin and corporate relationships of Murray Energy;
- discussed his personal mining experiences;
- stated his belief that the Lord had already determined the missing miners' fate;
- stated that there was no "retreat mining" occurring in the immediate vicinity of the miners. Further, Murray insisted that the press should:

take the word retreat mining out of [their] vocabulary [because] those were words invented by . . . [people] . . . who are lackeys for the United Mine Workers, and officials at the United Mine Workers that would like to organize this coal mine. You people don't understand that. I'm telling you that. That's a fact! Retreat mining had absolutely nothing to do with the disaster that happened here, nor was there any retreat mining

happening at the time of the disaster!;

- stated that at the time of the ground failure, miners were "primary mining . . . on the advance."
- stated that officials of the United Mine Workers of America (UMWA) were responsible for spreading the report that the mine was retreat mining solely out of a motivation to organize Crandall Canyon's miners;
- asserted that the Crandall Canyon mine was in compliance with all laws and approved plans;
- stated that there was enough good air in the mine for the trapped miners to remain alive for weeks;
- accused four individuals, by name, of providing self-serving, false statements to the media and cautioned the media to question the veracity and motivation of statements made by the named individuals;
- accused a reporter, by name, of "particularly bad reporting", and cited two news agencies, one of which employs the named reporter, of reporting false statements;
- promised that rescuers would get to the trapped miners; and
- stated that he would "not leave this mine until those men are rescued dead or alive."

During this press briefing, Murray also attempted to "prove" that an earthquake caused the ground failure. In so doing, Murray quoted preliminary information recorded by the University of Utah's seismograph station. As proof of the "earthquake", Murray offered detailed information related to the seismic event's characteristics, location, depth, and duration. Based on this information, Murray adamantly asserted, "it was an earthquake!" Murray continued to assert that an earthquake caused the ground failure well into the second week of the rescue effort. He repeatedly made this assertion during press briefings even after a University of Utah press release on August 9, 2007, stated:

"The M3.9 event does not have the characteristics of a typical, naturally occurring earthquake. Instead, preliminary observations suggest a shock induced by underground coal mining. Detailed seismological analyses by scientists at the University of California at Berkeley support this interpretation..."

Davis made comments on behalf of MSHA only after Murray completed his remarks and turned the briefing over to Davis. Davis made a brief statement during which he declined to engage in conjecture about the cause of the ground failure. Davis also provided information about a bounce that occurred in the early morning hours of Tuesday morning.

At no point during his statement or in responding to press questions did Davis address Murray's contentions that Murray and MSHA knew the exact location of the missing miners, or that there was no retreat mining occurring at the time of the ground failure. However,

Davis did clarify that there was no way of determining whether air in the immediate vicinity of the missing miners was respirable or what the quality/quantity was likely to be. Murray concluded the briefing and scheduled a follow-up press conference for 6:30 p.m. MDT that evening.

Shortly after the Tuesday morning press briefing, U.S. Representative George Miller, Chairman of the House Education and Labor Committee, and U.S. Representative Lynn Woolsey, Chairwoman of the House Subcommittee on Workforce Protections, issued a press release rebuking the caliber of the briefing. The House Education and Labor Committee has jurisdiction over MSHA and worker safety. In reaction to the briefing, the release stated:

“The families of the six trapped miners are deeply worried about the welfare of their loved ones. They need and have a right to the most credible, objective, and up-to-date information available about the status of the rescue effort. So does the public. Following the Sago disaster, during which miners’ families received incorrect information, the Congress made it the primary responsibility of the U.S. Mine Safety and Health Administration to provide the families and members of the news media with the most accurate possible information. The news conference held this morning at the mine did not meet this standard. U.S. Labor Secretary Elaine Chao must ensure that additional public communications regarding the rescue activities at the Crandall Canyon Mine are conducted by MSHA in order to ensure that the families and the public receive accurate information in a timely and responsible manner.”

Despite the Committee's admonishment, MSHA continued to permit Murray to lead the press briefings.

On the afternoon of Tuesday, August 7th, Stickler arrived at Crandall Canyon and assumed the role of MSHA's primary communicator. The first press conference that he attended was held at approximately 3:30 p.m. MDT. Murray was not present at this briefing. Governor Huntsman made the opening statement during which he introduced Stickler and Stricklin. Following the Governor's remarks, U.S. Senator Robert F. Bennett and U.S. Representative Jim Matheson made comments. Afterward, Stickler provided comments apprising the media of the status of the rescue effort.

After his statement, Stickler answered a number of questions. He touched on the topics of whether the ground failure was caused by an earthquake, and whether the mine was engaged in retreat mining at the time of the incident. However, he failed to definitively answer the questions. In addressing the earthquake issue, Stickler repeated the answer given by Davis earlier in the day - - that MSHA did not know if an earthquake caused the accident, but that an investigation team would be assembled at the appropriate time to answer questions related to the cause. Concerning retreat mining, Stickler stated that, while there had been some retreat mining at the Crandall Canyon mine, he did not yet know whether retreat mining was occurring in the area where the missing miners had been working. Stickler fielded additional questions until the briefing was completed.

Davis and Stickler did not take these and other opportunities to correct misleading or false statements that Murray had made. Both Company and MSHA personnel had previously acknowledged a bounce had occurred early on the morning of August 6th. The mine map and information from the miners clearly showed that retreat mining was occurring on the South Barrier section. The exact location of the trapped miners was not known. At no time did MSHA's Primary Communicators rebut Murray's statements. By failing to provide clear and accurate information, MSHA did not comply with the Primary Communicator provision of the MINER Act.

Additionally, following several of the first week's press briefings, Murray provided written press releases to members of the media. These releases reiterated verbal statements he made during the immediately preceding briefing. MSHA did not issue similar press releases. The Agency's decision not to issue written press releases appears to have deprived it of an important opportunity to help establish itself as the primary communicator by providing critical, factual information to the press. Although MSHA policy does not mandate that written statements be provided to the press, it does state that "the Primary Communicator, Liaison, and OPA personnel will jointly develop briefing scripts." It could not be determined that such scripts were developed or that written information was provided to the media.

At Crandall Canyon, MSHA and the Company conducted joint press briefings. Their cooperative approach to conducting press briefings was intended to emphasize the fact that the rescue effort was a shared undertaking. On the evening of August 8th, Murray arrived at and began the press briefing before Stickler arrived. Stickler, who was serving concurrently as MSHA's primary communicator and family liaison, arrived at the press briefing after Murray because he had remained at the family center to answer questions posed by family members. Stickler stated that, after the press briefing concluded, he told Murray it was unacceptable for him to begin press briefings prior to the arrival of MSHA's primary communicator. Stickler further stated that he advised Murray that MSHA would lead future press briefings and that Murray was welcome to provide comments or statements following MSHA's initial statement.

As discussed in detail in the [Command Center](#) section of this report, the senior MSHA persons on site were serving as the persons-in-charge. These persons-in-charge were also conducting

the family and press briefings, and as such assumed the roles of Family Liaison and Primary Communicator. Each of these roles has significant duties, and each needs to be filled by a person dedicated to that position. As stated earlier in this section, MSHA policy already requires the Family Liaison and Primary Communicator to be separate officials.

Beginning on Thursday, August 9, 2007, Stickler took the lead spokesperson role in the regularly scheduled press conferences. Of particular note is the fact that even after Stickler took the lead role in press briefings, actions by Murray and the media undermined his ability to effectively fulfill the responsibilities of the primary communicator. Frequently, upon the conclusion of a regularly scheduled press conference, Murray would leave the briefing and provide additional impromptu briefings to the press without the presence of MSHA's primary communicator. Through much of the rescue effort, Murray made solo television appearances without being accompanied by the primary communicator. These actions, especially the spate of solo appearances in the first several days of the rescue effort, helped to establish and solidify Murray's ostensible role as the spokesperson and principal source of information on the incident. Neither the MINER Act nor MSHA policy provides MSHA with the authority to prevent Murray from establishing communication with the press. On other occasions, television networks opted to broadcast Murray's statements only. In these instances, networks would begin coverage of press conferences after Stickler had already made his comments or, alternatively, would return to regularly scheduled programming once Stickler began his statement. Here again, MSHA had no authority to manage the programming choices or schedules of the television networks that chose not to broadcast Stickler's statements.

Conclusion: MSHA failed to serve as the primary communicator with the press and public during the Crandall Canyon rescue effort until more than three days after the initial ground failure. By then Murray had established himself with the media as the primary communicator on information about the rescue effort.

MSHA's primary communicators failed to consistently and/or timely correct erroneous or unsubstantiated information or statements given by the operator.

MSHA's senior official onsite served in the capacity of person-in-charge of the rescue operation, Family Liaison with the families, and Primary Communicator with the media and public. The roles of the person(s)-in-charge of the rescue operation, Primary Communicator, and Family Liaison are critical roles and should be fulfilled by individuals dedicated solely to serving each respective role.

The Assistant Secretary failed to establish qualifications and training requirements for MSHA personnel performing primary communicator responsibilities. None of the persons who served as primary communicators during the Crandall Canyon rescue effort received training to do so.

Recommendation: Consistent with the MINER Act, MSHA should be the primary source of all information shared with the media during mine emergencies.

MSHA should ensure that erroneous or unsubstantiated information provided to media and the public is corrected as soon as practical.

MSHA should establish a policy mandating that a separate individual be assigned to fulfill the roles of person-in-charge, family liaison, and primary communicator during an emergency.

In accordance with Secretary's Order No. 17-2006, the Assistant Secretary should immediately establish qualifications and training requirements for MSHA personnel who serve as primary communicators at accident sites.

MINE EMERGENCY RESPONSE DEVELOPMENT (MERD)

Historically, the mining industry has experienced many accidents involving trapped or missing miners. The two accidents that occurred at the Crandall Canyon Mine on August 6 and August 16, 2007, are grim reminders that such accidents continue to occur in the mining industry. Therefore, it is essential that MSHA personnel be fully trained and prepared to respond to mine emergencies and that they are knowledgeable in the standard procedures that must be followed at each rescue or recovery operation. The established protocol to be followed during a rescue operation, such as briefing and debriefing rescue workers, one central command center, etc., represent many years of experience in dealing with mine emergencies. The protocol has proven to be very effective and beneficial in conducting a mine rescue operation. The basic procedures are applicable at each mine emergency, whether it is a mine fire, explosion, water or gas inundation, roof collapse, bounce, or other type of an accident involving trapped or missing miners.

According to a report authored by MSHA Technical Support personnel, MSHA surveyed its managers in 1980 to determine what skills were needed to manage a mine emergency operation.⁷ The feedback "indicated a strong need to develop a crisis management training mechanism which would emphasize emergency problem solving, procedures and role clarification, and provide an exchange of knowledge which would be useful to managers participating in rescue and recovery activities."

Subsequently, MSHA developed a training program for managers entitled Managerial Emergency Response Development, which is now referred to as Mine Emergency Response Development (MERD). The program was a two-day seminar which included presentations by experts regarding recent mine emergencies and then the working of a simulated mine

⁷ *The Mine Emergency Capabilities of The Mine Safety and Health Administration*, by Robert G. Peluso and Jeffery H. Kravitz.

emergency with role-playing by all participants. The exercise simulated, as closely as possible, the activities, interactions, and pressures encountered in a real emergency. MERD training was given the highest ratings by MSHA's managers, and spin off training was extended to labor groups, mining companies and other government agencies.

Unfortunately, MSHA elected to discontinue this training for managers in 1990, according to training records maintained at the National Mine Health and Safety Academy. Since that time, there has been a turnover of most of the MSHA managers. Kevin Stricklin, Administrator for Coal, stated that since 2006, eight of the 11 Coal Mine Safety and Health District Managers are new to that position. Neither the District 9 Manager nor the Assistant District 9 Manager for Inspection Programs had received the MSHA MERD training. Both assumed their current positions after the MERD training was discontinued. Any and all knowledge and expertise these two managers have in dealing with mine emergency rescue operations was acquired through first hand experience. The three roof control specialists from MSHA's Technical Support Roof Control Division who performed duties during the rescue operation at the Crandall Canyon Mine have not received MERD training and had never been involved in any type of mine emergency. Most of the current District Managers, Assistant District Managers, and management personnel in Headquarters have never participated in an MSHA MERD Training exercise.

Several MSHA management personnel involved with the rescue effort at Crandall Canyon Mine were of the opinion that many of the established procedures for conducting mine rescue operations were only applicable while explorations were ongoing. Due to the misconception of what a mine rescue operation entails, many of the standard procedures that should have been followed were not adhered to during the rescue operation. For example, there was no formal process established for briefing rescue workers before they entered the Mine or debriefing them after they exited the Mine. The term "mine rescue/recovery operation" is used to describe the actions taken at a mine to rescue or recover trapped or missing miners. Whether miners are trapped or are missing as a result of a fire, explosion, inundation of water, roof falls, bounces, or other reasons, the procedures for conducting a mine rescue/recovery operation are applicable. Historically, ground control failures have not been identified as mine emergencies in many of MSHA's policies and procedures.

Conclusion: MSHA failed to provide appropriate MERD training to prepare its managers for directing a mine emergency.

Most MSHA policies and procedures addressing mine emergencies do not include ground failures. Normally, these policies and procedures only address mine fires, explosions, and inundations.

Recommendation: MSHA should develop a program to train personnel in charge of rescue and recovery operations, which includes the MERD training program. The MERD training should be provided annually, not only for top managers, but also supervisors, inspectors,

appropriate personnel from Technical Support, and all other personnel who may be involved in a mine emergency operation.

MSHA should revise its policies and procedures to recognize that ground control failures, and any other events in which miners are trapped or missing, constitute mine emergencies that should be responded to in the same manner as fires, explosions, and inundations.

MINER ACT AND MINE EMERGENCY EVACUATION FINAL RULE

In response to the fatal accidents at the Sago Mine and the Aracoma Alma Mine # 1 in West Virginia, Congress enacted the Mine Improvement and New Emergency Response Act of 2006 (MINER Act), which was enacted on June 15, 2006. MSHA issued emergency temporary standards (ETS) relating to Mine Emergency Evacuations on March 9, 2006. On December 8, 2006, MSHA's Mine Emergency Evacuation Final Rule (Final Rule) superseded the ETS. The MINER Act and Final Rule established new standards and provisions providing for the evacuation of miners endangered by an emergency, and the maintenance of miners trapped underground if evacuation was unachievable.

Due to technical infeasibility, some of the MINER Act provisions were subject to a delayed effective date. This section of the independent review report addresses District 9's enforcement of the MINER Act and Final Rule at Crandall Canyon and within the district as a whole. The specific topics reviewed are:

- MINER Act
 - Prompt Incident Notification
 - Emergency Response Plan (ERP) compliance
 - Post-Accident Communications
 - Post-Accident Tracking System
 - Post-Accident Breathable Air
 - Family Liaison/Primary Communicator
- Final Rule
 - Self Contained Self-Rescuers
 - Lifelines

MSHA issued guidance and policy related to the MINER Act and Final Rule through Program Information Bulletins (PIBs), Procedure Instruction Letters (PILs), and Program Policy Letters (PPLs). Through March 2008, at least 12 PIBs, PILs, and PPLs were issued to establish or clarify compliance responsibilities for mine operators and enforcement procedures for MSHA. Each of these directives can be found on MSHA's website by following the appropriate links.

There was considerable confusion on the part of both mine operators and MSHA field personnel concerning MSHA's policy and guidance. For example, at least four of the PIBs, PILs, and PPLs related to the Post-Accident Breathable Air provisions of ERPs. In an effort to eliminate this confusion, Districts designated individuals to help operators understand the standards and submit approvable plans, and to answer MSHA personnel's questions. Many District 9 personnel stated that they still did not understand all of the provisions of the MINER Act and Final Rule.

MINER ACT

The MINER Act amended the Federal Mine Safety and Health Act of 1977 in an effort to improve safety for miners. At the Sago Mine and Aracoma Alma Mine, 14 miners lost their lives. Of these, 13 survived the initial events but were not able to escape the mine. The MINER Act required mine operators to implement better ways to either evacuate mines after accidents or provide means to protect miners if they could not escape.

Prompt Incident Notification

The MINER Act amended the Mine Act to require more prompt and stringent notification of an accident to MSHA. Mine operators are now required to provide notification within 15 minutes of the occurrence of an accident, and will be assessed a substantial penalty for failing to comply. MSHA subsequently amended § 50.10 to state:

“The operator shall immediately contact MSHA at once without delay and within 15 minutes at the toll-free number, 1-800-746-1553, once the operator knows or should know that an accident has occurred.”

A national 24-hour call center was established by MSHA to ensure there was someone available to receive notification from an operator in the event of an accident. Once the call center is notified of an accident, a designated person in the appropriate district is contacted and given the information. This designated person then makes further contacts as outlined in that district’s Mine Emergency Response Plan.

From June 15, 2006, (the date the MINER Act was enacted) to August 6, 2007, District 9 issued 16 citations of this standard. Inspection personnel stated that they understood the requirement for the operator to promptly notify MSHA when an accident occurs.

Conclusion: District 9 was properly enforcing this provision.

Recommendation: None.

Emergency Response Plan Compliance

The MINER Act requires each operator to develop and adopt a written emergency response plan (ERP). Pertinent parts of the ERP address post-accident communications, post-accident tracking systems, and post-accident breathable air. The Independent Review Team evaluated District 9's enforcement of these provisions ERP, as required by the MINER Act.

Post-Accident Communications

The MINER Act requires each mine operator's ERP to address how communications would be maintained to miners trapped in the aftermath of an emergency in which they could not escape from the mine. The Act states the ERP shall provide persons underground a redundant means of communication with the surface, such as secondary telephone or equivalent two-way communication. *Program Policy Letter (PPL) No. P06-V-10* ([See Appendix G](#)) gives the following guidance on how the operator could comply with the post-accident communications requirement:

“When hardwired systems are used to meet the MINER Act requirement for redundant communication between surface and underground personnel, wires should be routed through separate entries or boreholes continuous to the surface. MSHA interprets the term “wireless,” as used in the MINER Act, to mean that no wired component of the system exists underground where it may be damaged by fire or explosion. Post-accident communication technology would be considered acceptable if, based on its location in the mine and the history of mine explosions and fires in the mine, it is likely to withstand the event intact. A reasonable timetable for installation should be included in the plan.”

The accident that occurred at Crandall Canyon was neither a fire nor an explosion, but a ground control failure (bounce). The guidance about where to locate hardwired systems does address the occurrence of a bounce. The guidance also states that the “history” of explosions and fires in the mine will play a part in determining whether the post-accident communication will be acceptable. Most mines do not have a history of fires or explosions, and thus would not be able to use these criteria to determine the acceptability of the post-accident communication system.

The MINER Act also requires that within 3 years from its enactment, the operator must have a plan approved to provide for wireless communication between underground and surface personnel. If this requirement cannot be met, the plan must state the reasons why such requirement cannot be adopted. Nevertheless, if this is the case, the plan must provide an effective, alternative way for the operator to communicate with underground miners. At the time of the Crandall Canyon accident, there were no commercially available or MSHA-approved wireless communication systems that could be used to comply with this provision. MSHA also has not developed a policy that would outline what the requirements would be for an acceptable wireless communication system.

District 9 had 26 underground mines when the August 6, 2007, accident occurred at Crandall Canyon. Of these, 25 had approved ERPs; one mine had a partially approved plan. All District 9 ERPs addressed post-accident communications in the same way. Each mine was required to have two “hardwired” phone systems installed in separate entries. When technology became available, wireless communication systems would be installed. The ERP in

place for the Crandall Canyon Mine at the time of the accident was approved on June 13, 2007, and required the mine to have two hardwired phone systems routed through separate entries.

At the time of the August 6th accident, the Crandall Canyon Mine also employed a Personal Emergency Device (PED) system to communicate with miners underground. The PED system sent a signal from a transmitter through wired antennas that extended throughout entries in the mine. The signal traveled from the antenna to a receiver installed on certain miners' cap lamp batteries. The operator could use the PED system to send messages from the surface to any miner underground who was equipped with a receiver. Miner(s) who received the message could not reply through the PED system, as it was only designed for one-way communication. Still, important information could be sent through the PED, and miner(s) receiving the message could potentially use mine phones to reply. The PED was a communication system implemented by the operator that was in addition to the required hard-wired phones.

On March 13, 2007, a citation was issued at the Crandall Canyon Mine for failure to install a second hardwired communication system. A secondary system was installed and the citation was terminated on April 11, 2007. The Crandall Canyon Mine had two hardwired systems and was in compliance with this provision when the accident occurred on August 6th. District 9 issued citations to seven other mines for failing to comply with this provision of the MINER Act prior to the August 6th accident.

After the bounce at Crandall Canyon on August 6th, the operator tried without success to establish communication with the missing miners. Since one of the trapped miners had a PED receiver, attempts were made using both hardwired phone systems and the PED. There was no response from the trapped miners. It is likely that both hardwired phone lines were damaged beyond use by the effects of the bounce, as both mine entries where the lines were installed were essentially filled with material that was violently expelled from the coal pillars. Additionally, as described in previous sections of this report, it is likely that the six trapped miners did not survive the bounce and therefore could not have been communicated with.

When wireless communication systems are approved and installed, there should be controls in place to ensure security of that system in the event of a mine emergency.

Conclusion: District 9 properly enforced this provision of the MINER Act. All operators in District 9 had ERPs that addressed post-accident communications.

The communication system in place at the Crandall Canyon Mine complied with the MINER Act and MSHA's policy, but did not have the intended effect of providing officials and rescuers a means to contact the trapped miners.

It can not be determined if proposed wireless communication systems have security controls built into the system.

Recommendation: The Agency should determine if there are any actions that can be taken to expedite the development, manufacture, approval, and installation of wireless systems that would be able to provide communication to trapped or missing miners in the event of any type of mine emergency.

MSHA should develop policy that outlines the requirements for an acceptable wireless communication system.

MSHA should evaluate how to maintain security in the event wireless communications are used at a mine involved in future mine emergencies.

Post-Accident Tracking System

The MINER Act requires mine operators' ERPs to, consistent with commercially available technology and with the physical constraints, if any, of the mines, provide for above ground personnel to determine the current, or immediately pre-accident, location of all underground personnel. Any system so utilized must be functional, reliable, and calculated to remain serviceable in a post-accident setting. *PPL No. P06-V-10* also gives the following further guidance on how the operator could comply with the post-accident tracking requirement:

“Until post-accident tracking technology becomes commercially available and MSHA approved, MSHA will accept a dispatcher system, or equivalent system, that has as a function the tracking of persons underground. A dispatcher system should track location of personnel in writing, on a map, or electronically, for the duration of the shift. The tracking system used by the operator should be able to determine the current, or the immediate pre-accident location of all underground personnel.”

The MINER Act also requires that within 3 years from its enactment, a plan should be approved to provide for an electronic tracking system that would allow surface personnel to determine the location of persons trapped underground. If this requirement can not be met, the plan must state the reasons why the provision cannot be adopted. Such plans must also provide an effective, alternative means for the operator to track underground miners.

District 9 had 26 ERPs in effect on August 6, 2007, and all addressed post-accident tracking systems. These tracking systems involved some form of communication with the surface and a record system maintained by a person on the surface. The underground location of miners was tracked by areas of the mines, with many ERPs referring to these areas as "zones."

The post-accident tracking system the Crandall Canyon mine consisted of a dispatcher on the surface who used a magnetic tracking board and/or a written log. Location zones were utilized, and as miners entered these zones, they reported to the dispatcher as to their location.

It should be noted that the PED system, discussed previously, could not be used as a tracking device.

District 9 determined that the Crandall Canyon Mine was in compliance with the tracking system requirement. District 9 issued one citation at a mine other than Crandall Canyon for non-compliance with this provision prior to the August 6th accident.

An electronic tracking system that could pin-point the location of persons in real time was not commercially available prior to the accident at Crandall Canyon. No system had been submitted to MSHA for approval. MSHA also has not developed a policy that would outline what the requirements would be for an acceptable wireless tracking system. There were systems available that had sensors that could receive a signal as a transmitter attached to a miner as he passed the sensor. However, such systems could not determine which direction the miner was traveling or where he was located if he was between sensors.

If the exact location of the trapped Crandall Canyon miners were known, boreholes could have been drilled to that location to determine their condition before the second accident on August 16th.

Conclusion: District 9 ensured the operators had addressed post-accident tracking systems in their ERPs. The tracking system in place at the Crandall Canyon Mine complied with MSHA's policy, but did not have the intended effect of providing officials and rescuers a means to locate the trapped miners.

Recommendation: The Agency should determine if there are any actions that can be taken to expedite the development, manufacture, approval, and installation of electronic tracking systems that would be able to accurately determine the location of trapped or missing miners in the event of any type of mine emergency.

MSHA should develop policy that outlines the requirements for an acceptable wireless tracking system.

Post-Accident Breathable Air

The MINER Act requires mine operators to provide for emergency supplies of breathable air for miners trapped underground during a mine emergency. The specifics of how each mine operator will comply are incorporated into the operator's approved ERP. The amount of breathable air must be sufficient to maintain trapped individuals for a sustained period of time. MSHA's *Program Information Bulletin (PIB) No. P07-03* ([See Appendix H](#)) further defines methods that the operator could employ to satisfy the breathable air requirement. This PIB also outlined that mine operators must implement the breathable air provisions not more than 60 days after an ERP is approved.

At the time of the accident, the ERPs for District 9 mines all addressed post-accident breathable air. Each approval letter informed the operator that all portions of the ERP were required to be implemented immediately, with the exception of the breathable air provisions, which had to be implemented within 60 days from the date of the approval letter. According to information compiled by the district, only two mines had breathable air provisions fully in-place by August 6, 2007. Nineteen operators had rescue chambers on order for all or part of their mines.

District 9 issued 2 citations to operators for failing to comply with a portion of their ERP's breathable air provisions. Both citations were issued after the August 6th accident. The Crandall Canyon Mine was not cited for this condition.

Crandall Canyon's ERP was approved on June 13, 2007. With the 60-day extension, the mine was required to have breathable air in place by August 12th. The Crandall Canyon mine did not have the required breathable air in place by the August 6th accident, and had only 6 more days to comply with the requirement.

The ERP approved for the Crandall Canyon Mine documented that the breathable air atmospheres would be maintained in safe havens, which were defined as a barricaded section of an entry or crosscut. These safe havens were to be provided within 2000 feet of the section's loading point and in close proximity to every other outby Self-Contained Self-Rescuer (SCSR) storage cache. However, the spreadsheet on the database used by District 9 to track the compliance of operators with this provision documented that rescue chambers were on order for Crandall Canyon, with delivery scheduled for April 2008, as per the company's purchase order (PO). Additionally, the letter of commitment showing Crandall Canyon had ordered the rescue chamber was dated August 9, 2007. This was three days after the bounce occurred that trapped the miners, and three days before the maximum 60-day extension for Crandall Canyon to implement the breathable air provision expired. Crandall Canyon mine management apparently made no effort to implement the breathable air provisions before the accident. When the accident occurred, the operator still had six more days to comply before the 60-day extension expired. Therefore, District 9 could not cite the operator for non-compliance.

At the time of the August 6th accident, Crandall Canyon and most other mines in District 9 had not implemented the breathable air provisions of the ERPs. Most mines had obtained purchase orders showing that rescue chambers were on order, and were several months away from being delivered. By the time many of the rescue chambers were scheduled to be delivered, one and one-half to two years would have lapsed since the MINER Act was enacted. In the meantime, miners were not provided with any more post-accident breathable air (other than some SCSRs, which will be discussed in the next section of this report) than the miners at the Sago Mine and Aracoma Alma Mine # 1 were provided.

Conclusion: All operators in District 9 were required to address how post-accident breathable air would be made available. District 9 followed national policy established under *PIB No. P07-03*.

It is relevant to note that, even if Crandall Canyon had the safe havens installed 2000 feet outby the working section's loading point, the trapped miners could not have reached it. The amount of material that was expelled from the coal ribs in all four entries made it impossible for the miners to travel off the section to the safe haven's breathable air.

Recommendation: The Agency should determine if there are any actions that can be taken to ensure that Post-Accident Breathable Air is provided in accordance with the MINER Act as expeditiously as possible.

Family Liaison/Primary Communicator

The implementation of these provisions of the MINER Act is discussed in detail in the sections of this report entitled [Family Liaison](#) and [Primary Communicator](#).

MINE EMERGENCY EVACUATION FINAL RULE

MSHA issued emergency temporary standards (ETS) addressing mine emergency evacuations on March 9, 2006. The ETS was superseded by the Mine Emergency Evacuation Final Rule (Final Rule), which was promulgated on December 8, 2006, and was effective upon publication. Pertinent parts of the ETS and Final Rule established standards with which mine operators must comply concerning self-contained self-rescuers (SCSR) and lifelines. This section of the report will examine how MSHA and District 9 enforced these requirements.

Self-Contained Self-Rescuers

The Final Rule addresses the training in and availability of self-contained self-rescuers (SCSR). Section 75.1714-4 requires

- Additional SCSRs in work places;
- Additional SCSRs on mantrips; and
- Additional SCSRs in escapeways.

Before the ETS for mine emergency evacuations was published, one SCSR was required to be provided for each miner underground unless the mine had a storage plan that required more. The Final Rule now requires at least one additional SCSR for every person at fixed work

locations, and along normal travel routes for persons who do not have a fixed work location (pumper, examiner, etc.).

Another requirement of the Final Rule is that one additional SCSR be provided for each person on mantrips or mobile equipment used to transport miners into or out of a mine. Also, operators must provide caches of SCSRs in each escapeway at 30-minute travel distances. These caches must contain at least one SCSR for each person who could be in by that location at any given time.

Following the passage of the new requirements for SCSRs, there was a huge demand but a short supply of the devices. In *Program Policy Letter No. P06-V-10* ([See Appendix G](#)), MSHA permitted mine operators to provide a valid purchase order showing a delivery date until SCSRs became available. District 9 was following national policy on the acceptance of purchase orders showing SCSRs had been ordered. The district's ERP compliance spreadsheet indicated that 17 of the district's active underground mines had SCSRs on order on August 6, 2007. Only two mines were documented as having all SCSRs in place, and one other mine was documented as a new mine and the SCSRs not yet required. The district's ERP compliance spreadsheet showed that SCSRs were still on order for the Crandall Canyon Mine, but the Accident Investigation team determined the Mine's records showed they had all required SCSRs at the time of the accident on August 6th.

Mines in District 9 employ approximately 3850 underground miners. At the time of the August 6th bounce, the district's ERP compliance spreadsheet showed that these mines still had 6337 SCSRs on order. All districts were experiencing a similar shortage of SCSRs.

Conclusion: District 9 followed national policy by ensuring that all operators at least had a valid purchase order to demonstrate that they were making a good faith effort to provide SCSRs. However, the majority of mines in District 9 did not have the required number of SCSRs on August 6, 2007.

Recommendation: The Agency should determine if there are any actions that can be taken to ensure that SCSRs are provided in accordance with the Final Rule as expeditiously as possible. This should include re-evaluating the policy of allowing the operator to obtain a purchase order for the purchase of equipment as compliance with this standard.

Lifelines

The Final Rule outlines requirements of lifelines that mine operators were to install in each escapeway. The standards require that lifelines be:

- Continuous and durable;
- Installed and maintained throughout the length of each escapeway; and

- Equipped with directional indicators.

These requirements became effective on the date the ETS was published. Since there was not a federal standard prior to this that required lifelines, most of the Nation's mines did not have lifelines installed. As with the SCSRs, there was a rush by the operators to purchase lifelines, and many vendors did not have any in stock. MSHA allowed mine operators to provide valid purchase orders to suffice for a reasonable amount of time until lifelines became available.

According to District 9's database, all operators had installed lifelines in both escapeways at the time of the August 6th accident. District 9 issued one citation under this provision to an operator for failing to install a lifeline in the secondary escapeway before the August 6th accident. The Crandall Canyon Mine was in compliance with this standard.

As a result of the bounce on August 6th, the escapeways in Crandall Canyon became impassable. This made the lifelines unusable.

Conclusion: District 9 properly enforced the requirement to install lifelines in each escapeway.

Recommendation: None

CMS&H STAFFING AND RESOURCE UTILIZATION

BRIEF HISTORY OF COAL MINE FATALITIES

Since enactment of the Mine Safety and Health Act of 1977 (Mine Act), great advances have been made in reducing the number of fatalities in our Nation's coal mines. During calendar year (CY) 1977, a total of 139 coal miners lost their lives in mining related accidents, which was a 32 % reduction from the 203 fatalities that occurred in CY 1969, when the Coal Mine Health and Safety Act of 1969 was enacted. During CY 2005, the coal industry reached a record low of 23 fatalities, which equated to an 83.4 % reduction in fatalities during this 28 year tenure under the 1977 Mine Act. The number of coal miners working in this country was 237,506 in CY 1977 compared to 116,436 in CY 2005, a 51 % reduction. Meanwhile, the amount of coal produced in this nation increased from approximately 671 million short tons in CY 1977 to approximately 1.1 billion short tons in CY 2005.

The United States (U.S.) currently is second only to the Peoples Republic of China in coal production. Compared to the U.S.'s approximate 1.1 billion short tons in CY 2006, China produced 2.7 billion short tons in CY 2006. However, the U.S. has averaged around 30 coal mining related fatalities each year during the last decade, while China had reported 3786 coal mine fatalities in 2006, their lowest yearly total to that date.

Coal Mining Fatality Table 1977-2007
Office Workers included in Data

Year	# of Miners	Fatals	Year	# of Miners	Fatals
1977	237,506	139	1993	141,183	47
1978	255,588	106	1994	143,645	45
1979	260,429	144	1995	132,111	47
1980	253,007	133	1996	126,451	39
1981	249,738	153	1997	126,429	30
1982	241,454	122	1998	122,083	29
1983	200,199	70	1999	114,489	35
1984	208,160	125	2000	108,098	38
1985	197,049	68	2001	114,458	42
1986	185,167	89	2002	110,966	28
1987	172,780	63	2003	104,824	30
1988	166,278	53	2004	108,734	28
1989	164,929	68	2005	116,436	23
1990	168,625	66	2006	122,975	47
1991	158,677	61	2007	123,202	33
1992	153,128	55			

RECENT COAL MINING FATALITIES

During calendar years 2006 and 2007, the coal industry suffered a tragic increase in fatalities. In CY 2006, 47 coal miners lost their lives while working in our Nation's coal mines. Of these 47 fatalities, 19 were the result of three horrific events in which multiple fatalities occurred. On January 2, 2006, twelve miners lost their lives as a result of an explosion at the Sago Mine. Seventeen days later, on January 19, 2006, two miners lost their lives following a mine fire at the Aracoma Alma Mine # 1. Four months later, on May 20, 2006, five additional miners lost their lives during the industry's second explosion of CY 2006 at the Darby Mine No. 1. These three major events accounted for 40 % of the coal fatalities in CY 2006.

In CY 2007, 33 miners lost their lives in our Nation's coal mines. The August 6th accident at the Crandall Canyon Mine claimed the lives of six miners and the subsequent accident on August 16th resulted in the deaths of three rescue workers. There were three other accidents that resulted in more than one fatality in CY 2007. On January 13, 2007, two miners were fatally injured as a result of a fall of roof accident at Brooks Run Mining Company LLC's Cucumber Mine. On April 17, 2007, two miners' lives were lost during a fall of highwall incident at Tri-Star Mining Inc.'s Job #3. On August 10, 2007, three miners died in an accident during construction of a shaft at Gibson County Coal LLC's Gibson Mine. These four accidents accounted for 48.4 % of the fatalities in CY 2007.

The number of multiple fatality accidents since CY 1995 has progressively increased. The following table shows the number of accidents involving multiple fatalities by calendar year since 1995:

Calendar Year	# of Multiple Fatality Events		Calendar Year	# of Multiple Fatality Events
2007	4		2000	0
2006	3		1999	1
2005	2		1998	1
2004	0		1997	1
2003	2		1996	1
2002	0		1995	1
2001	1			

CMS&H STAFFING LEVELS

District staffing levels provided by CMS&H Headquarters from January 2003 to July 2007 indicate that the number of regular underground inspectors available to do regular inspections decreased from 294 to 268. The number of technical specialists in the districts decreased from 196 to 160 for the same time period, and was at a low of 146 in January 2006. This was during a time period when the number of mining fatalities was at all time low levels, and as accidents reduced, so did the level of funding for MSHA provided by Congress. MSHA staffing was approaching such reduced numbers that districts were having difficulty completing the required number of mandatory inspections. Specialists were being taken away from their duties of evaluating submitted plans for approval and conducting evaluations underground, and were being required to assist with conducting underground inspections. District 4, CMS&H largest district located in Mt. Hope, West Virginia, began conducting "Enhanced Spot" inspections at some underground mines because they did not have the resources to inspect all of them. These inspections only consisted of examining representative areas of the mine. Based on information provided concerning completion rates for 2006, MSHA did not conduct 146 inspections at 108 of the 731 underground mines that should have been inspected.

After the accidents at Sago, Aracoma Alma, and Darby, and due to intense pressure from critics, MSHA began to attempt to staff up to appropriate levels. Hiring began en masse. At the time of the Crandall Canyon accident MSHA had a total of 245 underground inspector trainees in the process of becoming inspectors. It should be noted that the time frame for a newly hired trainee to achieve inspector status takes about one full year. This would include attending a minimum of four training modules at the Mine Health and Safety Academy, along with traveling with regular inspectors for field training. This field training mainly consists of the 245 trainees traveling with the 268 underground inspectors available to inspect mines. As the number of inspectors decreased between the years 2003 to 2007, MSHA failed to backfill a large number of those positions from which inspectors retired. Even when MSHA did replace retirees, the time to hire and train the replacements generally exceeded one year. The shortage of inspectors continues as of the writing of this report. Presently, MSHA is utilizing overtime at a rate of about \$10 million per year to complete inspections, along with requiring specialists and supervisors to participate in inspection activities. Although MSHA's primary responsibility is to complete inspections, it is presently utilizing a special emphasis program called the "100 % Inspection Program" to complete inspections.

As the number of inspectors was steadily decreasing, the industry was steadily increasing along with the demand for coal. From 2002 to 2006 the number of underground coal-producing sections called Mechanized Mining Units (MMUs) increased from 811 to 882. The number of active MMUs was often a measuring tool used by MSHA to determine staffing levels of inspectors. During the same time period (2002 to 2006), the coal industry reported an increase of hours worked underground from 163,844,829 man hours to 188,990,182 man hours. This indicated an obvious growth in the industry. By not replacing retiring inspectors or hiring additional inspectors, MSHA failed to react to the significant increase in workload.

MSHA allowed its staffing to decrease so severely that, from 2001 to 2006, the total inspection time of MMUs decreased from 193,364 hours to 158,172 hours. This demonstrates that while the industry was increasing significantly in size, MSHA was decreasing in size. MSHA did not have enough inspectors to spend adequate inspection time where the greatest number of miners were working and the greatest dangers existed. Only after the increase of fatal accidents from 23 in 2005 to 47 in 2006, did MSHA recognize that it had a severe shortage of inspectors.

The table below references the Total Number of CMS&H District Employees. In response to the increased number of fatalities, the Agency began increasing the number of employees significantly in late 2006 reaching 1119 in July 2007. However, 245 of these employees were inspector-trainees at the time of the August 6th accident. These inspector trainees do not contribute significantly to required inspection activities during their first year while they are receiving training.

CMS&H District Staffing Levels⁸

As of this Date	Total # of CMS&H Employees	Total # of Other ARs	Total # of UG ARs	Total # of Trainees	Total # of Non-ARs
1/31/2003	1026	438	294	46	248
4/30/2003	1018	441	285	43	249
7/31/2003	1010	443	276	44	247
10/31/2003	1033	444	278	61	250
1/31/2004	1019	434	286	52	247
4/30/2004	1011	429	310	28	244
7/31/2004	987	422	302	18	245
10/31/2004	997	421	301	33	242
1/31/2005	985	404	296	47	238
4/30/2005	995	400	291	65	239
7/31/2005	966	386	279	72	229
10/31/2005	987	390	282	85	230
1/31/2006	955	378	286	66	225
4/30/2006	964	375	282	85	222
7/31/2006	953	373	270	96	214
10/31/2006	998	375	275	131	217
1/31/2007	998	363	270	149	216
4/30/2007	1081	370	266	223	222
7/31/2007	1119	387	268	245	219

⁸ In this table, the "Total # of Other ARs" include managers, supervisors, specialists, and surface inspectors. The "Total # of UG ARs" is the number of regular underground inspectors. An "AR" is an Authorized Representative of the Secretary of Labor.

In addition to the decreased levels of staffing and time devoted to conducting inspection activities, the agency also faced budget cuts. The next table shows CMS&H's Budget Authority since FY 2000. CMS&H generally receives a relatively small budget increase on an annual basis, which is mostly consumed by salary increases. However, CMS&H's budget was reduced from \$117.2 million in FY 2002 to \$112.3 million in FY 2003. At the time of the increase of fatalities in FY 2006 and 2007, CMS&H's budget was at \$117.1 million, still below its' FY 2002 level. Following these fatalities, CMS&H received funding to allow for hiring of new inspection personnel and its budget was increased to \$140.7 million in FY 2008.

**Mine Safety and Health Administration
Budget Authority
(Dollars in Millions)**

Fiscal Year	Enforcement: Coal	Enforcement: Metal/Non-Metal	Enforcement: Standards Development	Assessments	Educational Policy and Development	Technical Support	Program Administration	Pension and Health Costs	Program Evaluation & Information Resources	Total, MSHA Budget Authority	Full Time Equivalents	CMS&H Employees at End of Fiscal Year
2000	110.6	49.7	1.5	3.9	26.9	25.3	10.2			228.0	2,317	
2001	114.5	55.1	1.8	4.3	31.5	27.1	12.2			246.3	2,357	
2002	117.2	61.1	2.4	4.8	27.9	28.1	12.6	13.8		267.9	2,310	
2003	112.3	63.9	2.3	4.8	28.0	28.7	14.3			254.3	2,264	1,045
2004	114.8	65.5	2.3	5.2	30.4	24.5	12.2		13.9	268.8	2,334	1,021
2005	115.3	66.7	2.4	5.2	31.3	25.1	15.6		17.5	279.1	2,187	997
2006	117.1	68.1	2.5	5.4	31.7	25.5	11.9		15.5	277.7	2,136	984
2007	117.1	68.1	2.5	5.4	31.7	25.5	11.9		15.5	277.7	2,240	1,148
2008	140.7	72.3	2.7	5.7	34.3	28.2	13.4		16.2	313.5	2,306	

During the period that fatal accidents were decreasing prior to 2006, CMS&H experienced decreased funding levels, which led to inadequate staffing levels. Although coal mining fatalities were declining, the inherent hazards of mining coal remained the same. The Agency did not remain vigilant in its efforts to prevent future accidents through inspections and plan review activities.

Another point worthy of discussion is that MSHA's Budget Authority changed in focus. Prior to FY 2002, the justification for Enforcement: Coal was as follows:

"The Coal Mine Safety and Health activity is responsible for ensuring the safety and health of the Nation's coal miners through periodic regular inspections, special investigations, special emphasis programs, and compliance and training assistance."

However, the Agency's focus changed in the FY 2002 Budget Authority justification for Enforcement: Coal. This justification was as follows:

“The Coal Mine Safety and Health activity is responsible for ensuring the safety and health of the Nation’s coal miners through special emphasis programs, compliance and training assistance and periodic regular inspections and special investigations.”

This statement places more focus on the use of special emphasis programs and compliance and training assistance by listing them at the beginning of the statement. In the meantime, periodic regular inspections and special investigations were moved to the end of the statement, which implies that they should receive less attention.

Following this change in focus, numerous compliance assistance and special emphasis programs were developed that required inspection personnel to redirect a portion of their time away from inspections mandated by the Mine Act. During the initial phases of these programs and initiatives, inspectors were required to visit all mines within a specified timeframe. These programs and initiatives required postponing inspection activities that were underway in order to meet an initiative's completion requirements. These activities required the use of specialists to ensure completion in a timely manner.

This new direction resulted in such an overwhelming number of different special emphasis programs, compliance assistance programs, and initiatives that an enormous amount of the inspectors’ focus was diverted away from completion of regular inspections. Each CMS&H district office was also encouraged to develop and implement programs and initiatives based on specific issues encountered within the district.

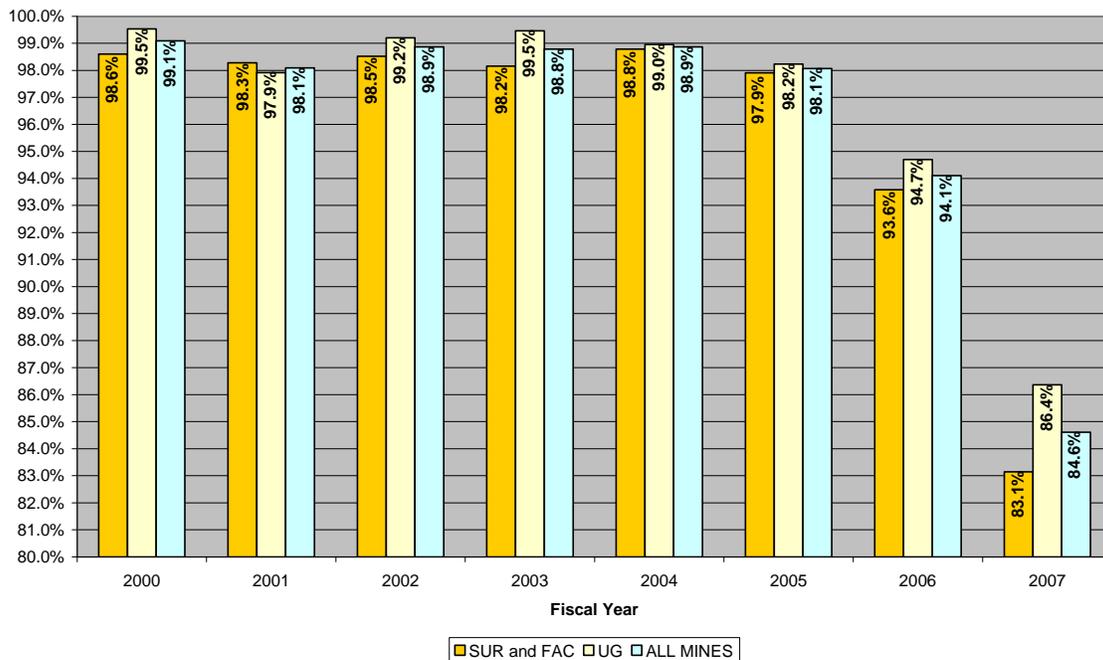
Furthermore, implementation of these initiatives resulted in additional reporting requirements. Each district was required to submit a report on a weekly basis describing the types of programs and initiatives conducted and the results of each. This report was in addition to the spreadsheets and other data collection methods that were necessary to adequately track the continuous progress of these programs and initiatives. The instructions received for compiling this report were to include only information concerning these programs and initiatives. The report, entitled “Weekly Significant Activities Report,” gave the impression to field personnel that special programs and initiatives were more important than inspections and enforcement activities.

MSHA personnel stated that these activities definitely distracted them from focusing on mandated inspections. Although these compliance activities certainly have value and can provide a positive impact on the coal industry, MSHA does not possess the staffing or funding to effectively conduct mandated inspections along with a multitude of additional activities.

This is further supported by the Agency’s failure to complete 100% of regular inspections as mandated by the 1977 Mine Act. As the chart below indicates, CMS&H was completing nearly 100% of the required inspections in each area until FY 2006. In FY 2006 and FY 2007, the

completion rate decreased dramatically. While the decrease in completed inspections was not a nationwide problem, the shortage of inspectors was the key factor in the failure to complete the mandated inspections.

**CMS&H Inspection Completion Rates
FY 2000 to 2007**



As shown by the table below, on January 31, 2003, District 9 had a staffing level of 27 underground Coal Mine Inspectors (UG CMI) and 15 underground specialists. At the time of the August 6th accident at Crandall Canyon, District 9 had a staffing level of 20 total UG CMIs and 13 specialists. In three years, District 9 lost nine enforcement personnel, a decrease of 21 %.

As of this Date	# of D9 UG CMI's	# of D9 UG Specialists	# of UG CMI's		# UG of Specialists		# of Inspectable UG Mines	
			Price F.O.	Castle Dale F.O.	Price F.O.	Castle Dale F.O.	Price F.O.	Castle Dale F.O.
1/31/2003	27	15	9	4	2	1	9	5
4/30/2003	27	15	9	4	2	1	9	5
7/31/2003	26	15	9	4	3	1	9	5
10/31/2003	26	15	9	4	3	1	9	5
1/31/2004	26	15	9	4	3	1	8	5
4/30/2004	26	15	9	4	3	1	8	6
7/31/2004	25	15	9	3	3	1	8	6
10/31/2004	24	15	9	3	3	1	9	5
1/31/2005	24	15	9	3	3	1	9	4
4/30/2005	25	16	9	3	3	1	13	0
7/31/2005	27	14	9	2	3	1	13	0
10/31/2005	26	13	9	2	3	1	13	0
1/31/2006	23	11	8	2	1	1	13	0
4/30/2006	21	13	9	Closed	3	Closed	13	0
7/31/2006	21	13	9	Closed	3	Closed	13	0
10/31/2006	20	13	8	Closed	3	Closed	13	0
1/31/2007	21	13	8	Closed	3	Closed	13	0
4/30/2007	21	13	9	Closed	2	Closed	13	0
7/31/2007	20	13	9	Closed	2	Closed	13	0

As of January 31, 2003, the Price and Castle Dale Field Offices had a combined total of 13 underground inspectors conducting inspections at 14 underground mines. After the closure of the Castle Dale office in April 2006, there were a total of nine inspectors required to inspect 13 mines. At the time of the August 6, 2007, accident at Crandall Canyon, these levels remained unchanged.

USE OF SPECIALISTS IN DISTRICT 9

The decrease in the number of regular inspectors caused Coal Mine Safety and Health (CMS&H) to use specialists to ensure that mandated inspections were completed. This was a nationwide problem, and District 9 was no exception. For example, one District 9 specialist stated "I do regular inspections," and "I go all over the place to do regulars." Using specialists in this way removes them from their normal duties. This can also create problems in the quality of inspections. Some specialists had not conducted complete regular inspections for a number of years, and were not familiar with many of the changes in inspection policies and procedures.

Other specialists had limited inspection experience outside their specialized area, but were sometimes required to conduct complete inspections. An example of this occurred at Crandall Canyon. A specialist was assigned to help inspect the surface electrical components at the mine. The regular inspector was moved to another mine, so the specialist was required to conduct most of the underground inspection as well. During this inspection, several inspection items required by procedure and policy were not conducted or documented, including the quarterly respirable dust survey. The specialist stated "It was my understanding that I was helping with the EO-1 to the best that I could and that as things progressed, if there was more help needed, I would be directed. As far as taking the initiative to go and review what all had been done or what might be done, that wasn't my responsibility." He also stated that he assisted on regular inspections because the Price Field Office was doing everything they could to ensure all required inspections were being conducted.

During the time that the plans for mining the North and South Barriers were being reviewed for approval, District 9 was not fully staffed in the roof control branch. The roof control branch consisted of a supervisor, Billy Owens, one engineer in the district office, and one specialist in each of the Delta, Colorado, and the Price, Utah Field Offices. Owens reviewed plans and revisions when they were submitted because no one else was available, especially when the engineer was away attending inspector training classes at the National Mine Health and Safety Academy in West Virginia. The specialist in Delta was also away from her duties for an extended period of time for various reasons. The specialist in Price also had collateral duties as a special investigator, and eventually took that position full time. The Price specialist was also a member of MSHA's Mine Emergency Unit and assisted in mine rescue contests, both of which took time away from his specialist duties. District 9 tried to hire an additional engineer, but was unsuccessful.

The specialist groups' inadequate staffing levels also contributed to a failure to adequately conduct certain reviews. Section 75.223(d) provides that the roof control plan for each mine shall be reviewed every six months. Section 75.370(g) states that the ventilation plan for each mine shall be reviewed every six months. The ventilation branch was also responsible for reviewing and approving Emergency Response Plans and Seal Construction plans, both of which were required as a result of the fatal accidents in 2006. One purpose of the six month reviews is to ensure the plans continue to be adequate for the conditions of the mines.

However, in District 9 these required reviews were not being conducted by specialists as historically had been done throughout MSHA. William Reitze, Ventilation Branch Supervisor, stated, "we've done two, maybe two in the last year, year and a half." Owens stated, "I'm lucky to get --- with the diminishing staffing that I've been having over the recent years, I'm lucky just to get plans out in some sort of timely manner without even considering a six month review of a plan." He also stated, "But instead I get memos everyday telling me take your specialist out and do EO-1s, take your specialist out and do initiatives." William Knepp, Assistant D9 Manager for Technical Programs, stated, "We can't do six month reviews

anymore. We can't keep up with those. We have to rely on those inspector reviews." The "inspector reviews" Knepp referred to were the 2000-204 forms that were completed during each regular inspection. See the [Crandall Canyon Mine Roof Control Plan Approval](#) section of this report for further discussion of the adequacy of this method.

Conclusion: Beginning in 2006, the level of staffing in CMS&H was inadequate to complete mandated inspections and comprehensive 6-month plan reviews.

The Agency's increased focus on compliance assistance and special emphasis activities may have impacted its ability to complete required inspections as mandated by the 1977 Mine Act.

Recommendation: CMS&H's budget should be sufficient to permit the Agency to maintain staffing levels which allow the Agency to consistently perform all required inspections and plan reviews.

CMS&H's focus on compliance assistance and special emphasis activities should be revisited to determine the effect these activities have on the completion of mandatory inspections and plan reviews. The Administrator should ensure that enforcement related special emphasis activities do not interfere with the inspectors' completion of mandatory inspections and plan reviews.

MSHA should evaluate whether non-enforcement activities should be conducted by personnel other than CMS&H employees.

ALLEGATIONS OF INFLUENCE BY THE MINE OWNER

The Independent Review Team (IRT) evaluated whether Robert Murray, owner of Murray Energy Corporation and co-owner and operator of the Crandall Canyon Mine, used his influence to have MSHA personnel removed from having enforcement responsibilities at mines that Murray owned. The IRT identified three cases from 2001 to 2007 where there are implications that Murray may have used his influence to have MSHA personnel re-assigned.

The first case involved Murray's Maple Creek Mine in District 2. In 2001, Kevin Stricklin, then the Assistant District Manager (ADM) for inspections, and Thomas Light, then the field office supervisor who was assigned the Maple Creek Mine, had taken enforcement actions that had idled the mine. Murray had meetings with both district and Headquarters personnel concerning the Maple Creek Mine, with Murray making some comments that could be construed as threatening. A few months later, both Stricklin and Light were reassigned to different jobs which took away their direct enforcement responsibilities over the Maple Creek Mine. These reassignments occurred in the middle of a pay period and were effective immediately, which is unusual. Neither was given any reason why the reassignments were made, other than it was to better operate the district.

The next case concerned Murray's Powhatan No. 6 Mine in District 3. This incident involved Tim Thompson, then the District 3 Manager (DM) in Morgantown, West Virginia, and William Ponceroff, then the District 3 ADM for enforcement. The Powhatan No. 6 mine had been issued a high number of citations and orders. Murray again met with district and Headquarter personnel, and again statements were made that could be considered as threats. Shortly after this meeting, Thompson was transferred to a job that removed him from all enforcement oversight of Murray's mines. Ponceroff, however, was not moved to another position. Although the timing of Thompson's transfer appears to coincide with the meeting, Thompson wrote a 2006 letter stating that he was not removed from the DM position as a result of any actions by Murray.

The last incident involved an inspector in District 9 who was conducting an inspection at the Crandall Canyon Mine. Before Murray took control of the mine in 2006, the inspector was accused of alleged harassment against a contractor employee. Investigations by the district determined there was no basis for the allegation. The inspector, who was removed from the Crandall Canyon Mine while the investigation was going on, later issued an order at another one of the mines that Murray had purchased in District 9 which idled the mine's longwall for several shifts. This inspector was known to be one who issued a lot of citations and orders. Murray, during a telephone conference call, told district management that he didn't want the inspector back on his properties, alluding to the harassment charge. He also made statements referring to his political connections. At the beginning of the next quarter, all of Murray's mines in the field office in which the inspector worked were placed in another work group, so that the inspector would not have any of Murray's mines assigned to him to inspect. When

asked why, district management stated it was because the supervisor for whom the inspector worked had two sons who worked at Murray's mines, and they did not want them to be affected by the supervisor's responsibility to inspect the mines.

Over a period of seven years, there were three instances in which allegations of Murray making threats against MSHA personnel were discovered. In all three cases, MSHA personnel with whom Murray had problems were removed from enforcement responsibilities for his mines. However, there is no direct evidence that links their removal to Murray. Additionally, there appears to be no lasting effect on the careers of those involved. Stricklin has been promoted to Administrator for Coal, Ponceroff has been promoted to District Manager, and Light has been promoted to Assistant District Manager.

Conclusion: Although the circumstances surrounding the removal of MSHA personnel from inspection authority over Murray's mines were unusual, the IRT found no conclusive evidence that anyone was removed or transferred as a result of threats by Murray.

Recommendation: None

GENERAL CONCLUSION

Internal Reviews conducted by MSHA since 1989 indicate that many deficiencies were repeatedly identified. The “Corrective Actions” taken by the Agency to address the identified deficiencies in many cases were to increase documentation requirements for enforcement personnel. Increased documentation did not eliminate these problems. Rather, it appears that the corrective actions resulted in additional paperwork that was detrimental to the Agency’s performance. Many inspection personnel stated that the increased documentation distracted them from their primary goal of conducting inspections, lowered morale, and has not enhanced the safety of miners.

In July 2007, a 2-day meeting was held for Coal Mine Safety and Health managers, supervisors, and conference/litigation representatives to discuss the 150+ deficiencies that were identified by the Sago, Aracoma Alma, and Darby Internal Review teams. Most of the meeting focused on the deficiencies, recommendations, and corrective actions that were identified by the reviews. The Crandall Canyon Independent Review Team identified some of the deficiencies discussed at the meeting also occurred during the rescue operation at the Crandall Canyon Mine, which was less than a month after the meeting. Some of the repeated deficiencies were related to command center security, briefing, debriefing, and § 103(k) order issues.

The deficiencies and recommendations identified in this report are intended to enhance MSHA’s performance in protecting the health and safety of the Nation’s miners. The Independent Review Team hopes that the recommendations will result in significant changes that will improve MSHA’s roles in administering the Mine Act and its implementing regulations. MSHA’s corrective actions should result in positive steps being taken to eliminate the deficiencies, and not simply by increased documentation requirements or inadequate training.

Signature Page

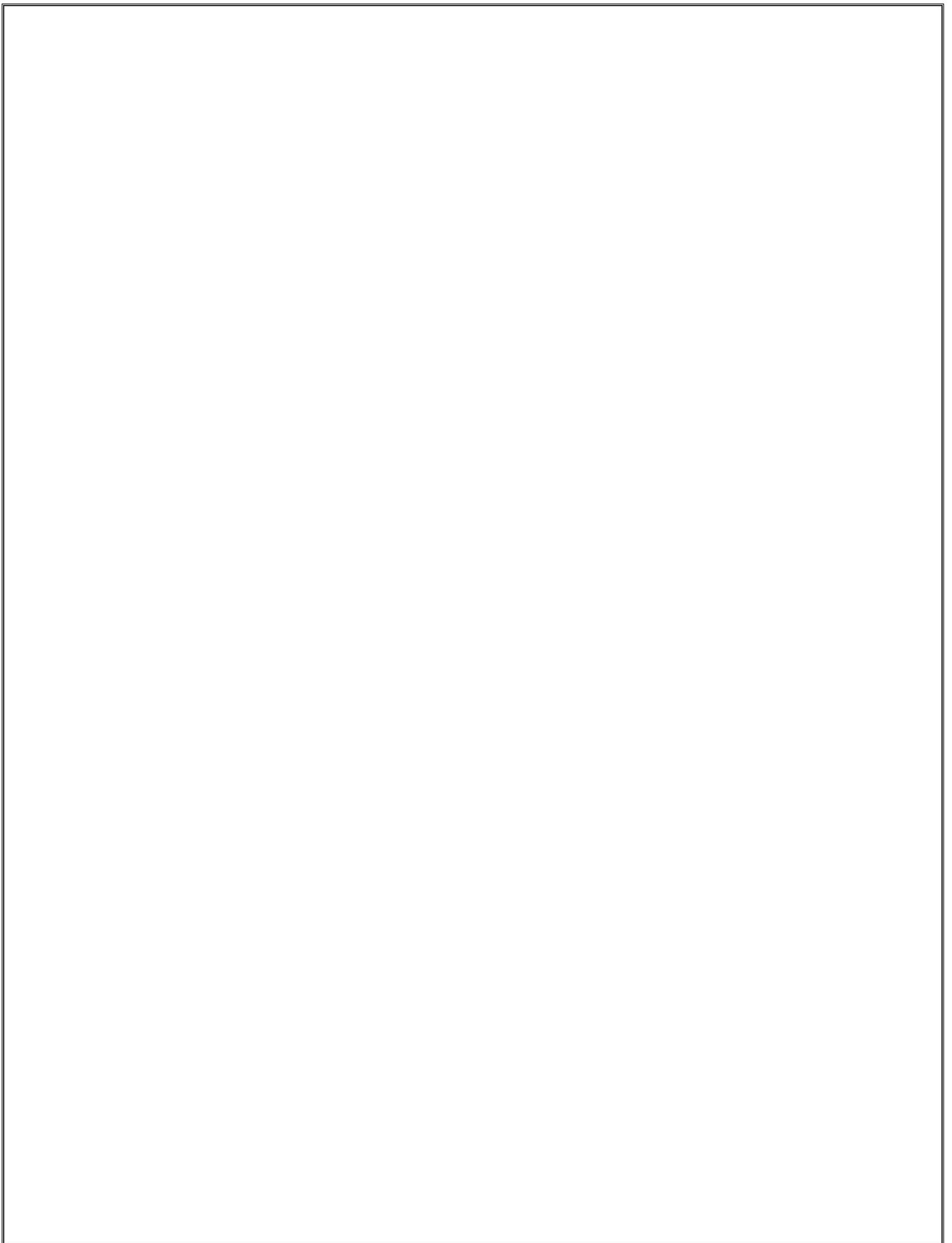
This report is submitted in response to your request that an independent review be conducted of MSHA's actions at the Genwal Resources, Inc. Crandall Canyon Mine.

Respectfully submitted,

Earnest C. Teaster, Jr.
Co-Chairman
Crandall Canyon Independent
Review Team

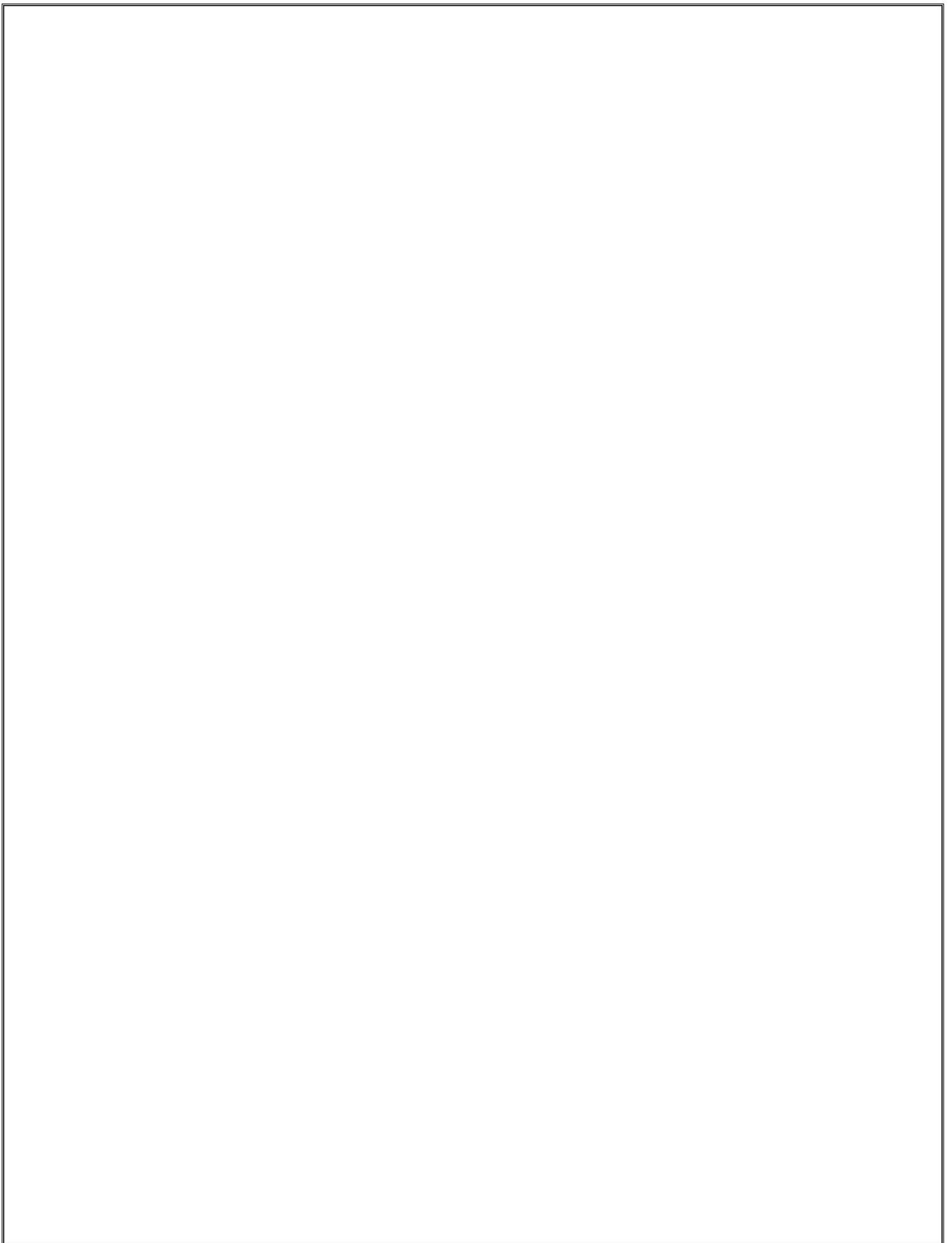
Joseph W. Pavlovich
Co-Chairman
Crandall Canyon Independent
Review Team

Dated July 21, 2008



APPENDIX A

LIST OF PERSONS INTERVIEWED



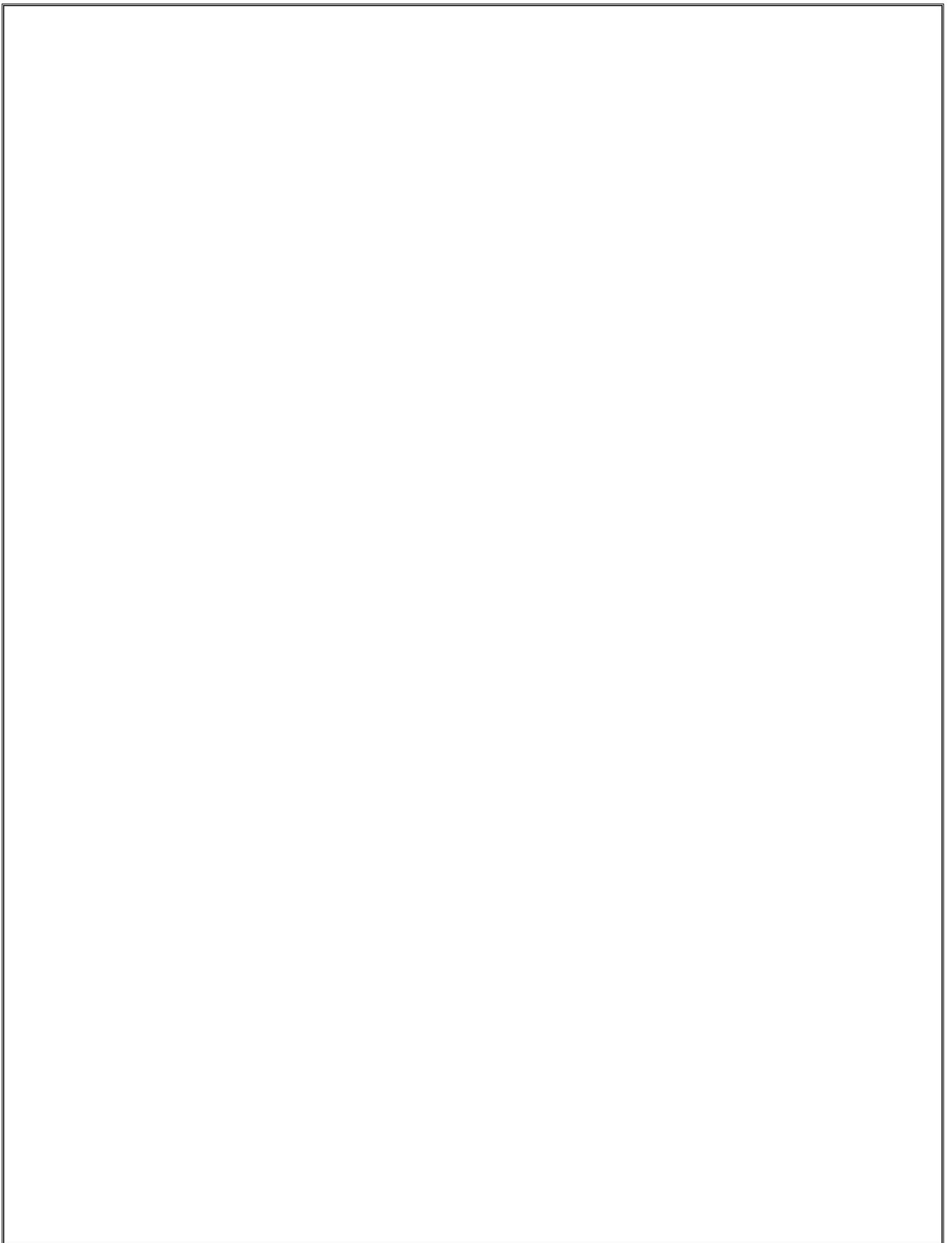
List of Persons Interviewed

Adamson, Rodney CMI - Electrical Engineer, District 10
Allen, Bradley K. CMI, District 9 - Delta, CO Field Office
Anderson, Terry R. CMI, District 9 - Price, UT Field Office
Boyack, Dennis P. CMI, District 9 - Price, UT Field Office
Boyle, Richard J. Diesel Specialist, District 9 - Price, UT Field Office
Brown, Dewayne K. CMI, District 9 - Price, UT Field Office
Brown, Jr., Virgil F. MEU Specialist, NMH&S Academy, Beaver, WV
Cook, III, William..... Supervisory CMI, District 10 - Beaver Dam, KY Field Office
Cornett, Bob E. District Manager, District 3
Crocco, William..... AI Program Manager, CMS&H, Arlington, VA
Cybulski, Joseph A. Chief Roof Control Division, PS&HTC
Davis, Allyn K. District Manager, District 9
Del Duca, II, Peter A. Mining Engineer, District 9
Denning, William G. Staff Assistant, District 9
Diederich, Kim S. Mining Engineer - Ventilation Division, PS&HTC
Durrant, Donald E. CMI, District 9 - Price, UT Field Office
Falk, Steven W. Mining Engineer, BLM - Price, UT Office
Farmer, Ted E. Supervisory CMI, District 9 - Price, UT Field Office
Fleshman, Jeffrey L. Ventilation Specialist, District 9
Frey, Danny A. Supervisory CMI, District 9 - Craig, CO Field Office
Gauna, Michael..... Mining Engineer, Roof Control Division, PS&HTC
Gibson, Donald E. Supervisory CMI, District 9 - Gillette, WY Field Office
Gray, Robert H. Supervisory CMI - Health, District 10
Grosely, Barry G. CMI, District 9 - Price, UT Field Office
Gunderson, Randy E. CMI, District 9 - Price, UT Field Office
Hicks, Michael H. CMI, District 4
Hixson, Ronald E. Ventilation Specialist, District 2
Hooker, Irvin T. District Manager, District 7
Huntsman, Jr., Jon M. Governor, State of Utah
Johnson, Scott K. CMI Trainee, District 2 - Ruff Creek, PA Field Office
Knepp, William P. Assistant District Manager - Technical, District 9
Kravitz, Jeffery..... Chief of Scientific Development, MSHA Technical Support
Kulczewski, Richard J. DOL Public Affairs Director, Region 7 & 8
Kuzar, John A. District Manager, District 1
Laufenberg, Richard R. District Manager, Rocky Mountain District - M/NM
Light, Thomas..... Assistant District Manager - Enforcement, District 2
Marcum, Carla B. Ventilation Specialist, District 7
Markosek, Frank E. CMI, District 9 - Price, UT Field Office
Martin, James A. CMI, District 9 - Price, UT Field Office
Matthews, Edward O. CMI, District 4 - Mt. Carbon, WV Field Office
McGill, Cheryl S. LDP Manager, NMH&S Academy, Beaver, WV

Moore, III, Clarence W.Mining Engineer - Ventilation Division, PS&HTC
 Norton, Kent L. Training Specialist, Educational Field Services
 Owens, Billy D.Supervisory CMI - Roof Control Division, District 9
 Paletta, Ronald F. CMI, District 9 - Price, UT Field Office
 Pruitt, James I. CMI Trainee, District 9 - Price, UT Field Office
 Ramey, Larry W.Supervisory CMI, District 9 - Delta, CO Field Office
 Reitze, William P. Supervisory CMI - Ventilation Division, District 9
 Saint, Peter P. CMI - Electrical, District 9 - Aztec, NM Field Office
 Sanchez, Frederick M. Training Specialist, Educational Field Service
 Serazio, Bradley J. CMI Trainee, District 9 - Delta, CO Field Office
 Shumate, Michael W.CMI, District 4 - Mt. Carbon, WV Field Office
 Shumway, Michael E. CMI, District 9 - Price, UT Field Office
 Stickler, Richard E. Assistant Secretary of Labor, Arlington, VA
 Stricklin, Kevin G.Administrator for CMS&H, Arlington, VA
 Taylor, William M.Supervisory CMI, District 9 - Price, UT Field Office
 Urosek, John E.MERC, MSHA Technical Support
 Waggett, Jeffrey N.Mining Engineer - Ventilation Division, PS&HTC
 Zelanko, Joseph C.Civil Engineer - Roof Control Division, PS&HTC

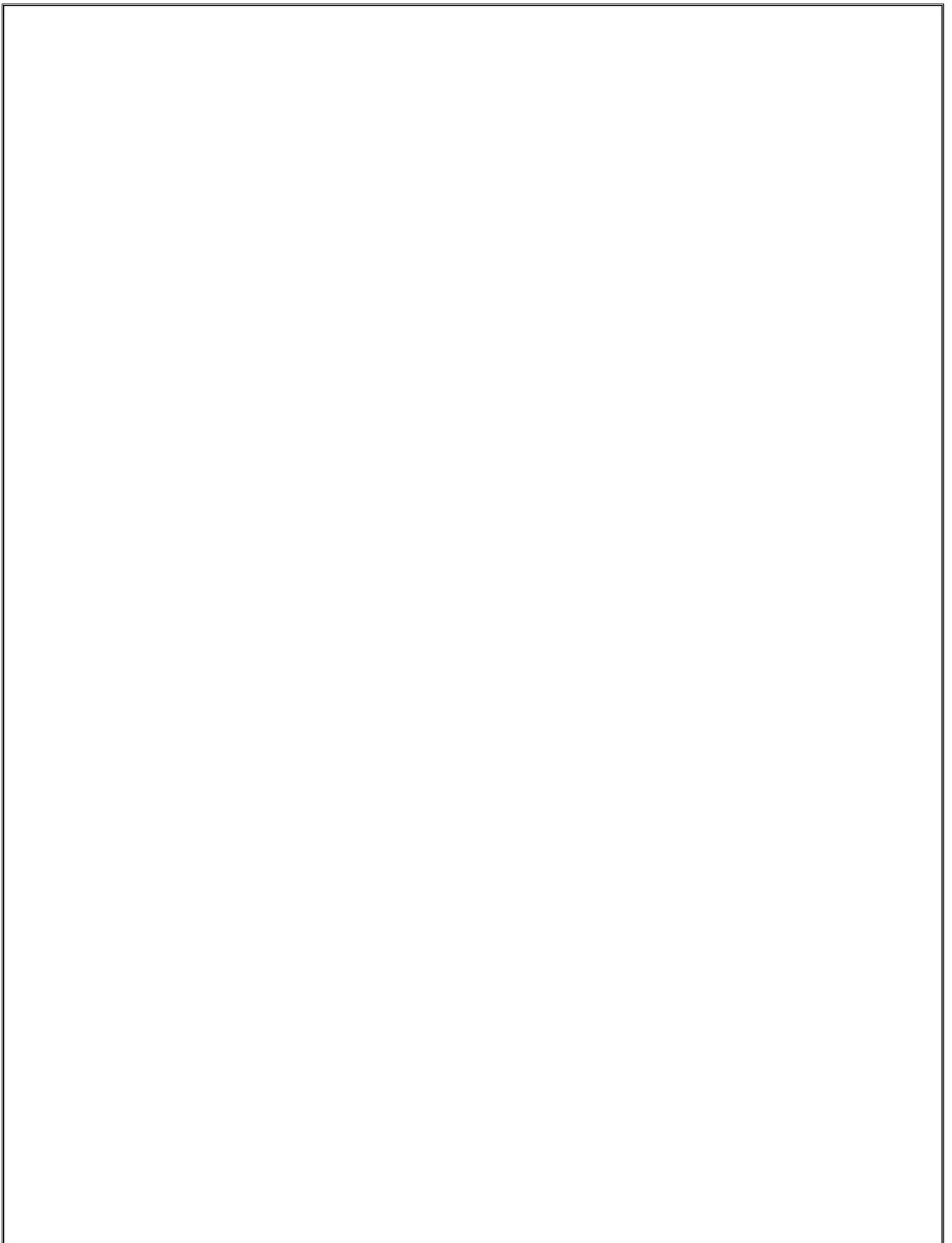
APPENDIX B

LIST OF GROUND CONTROL PANEL MEMBERS



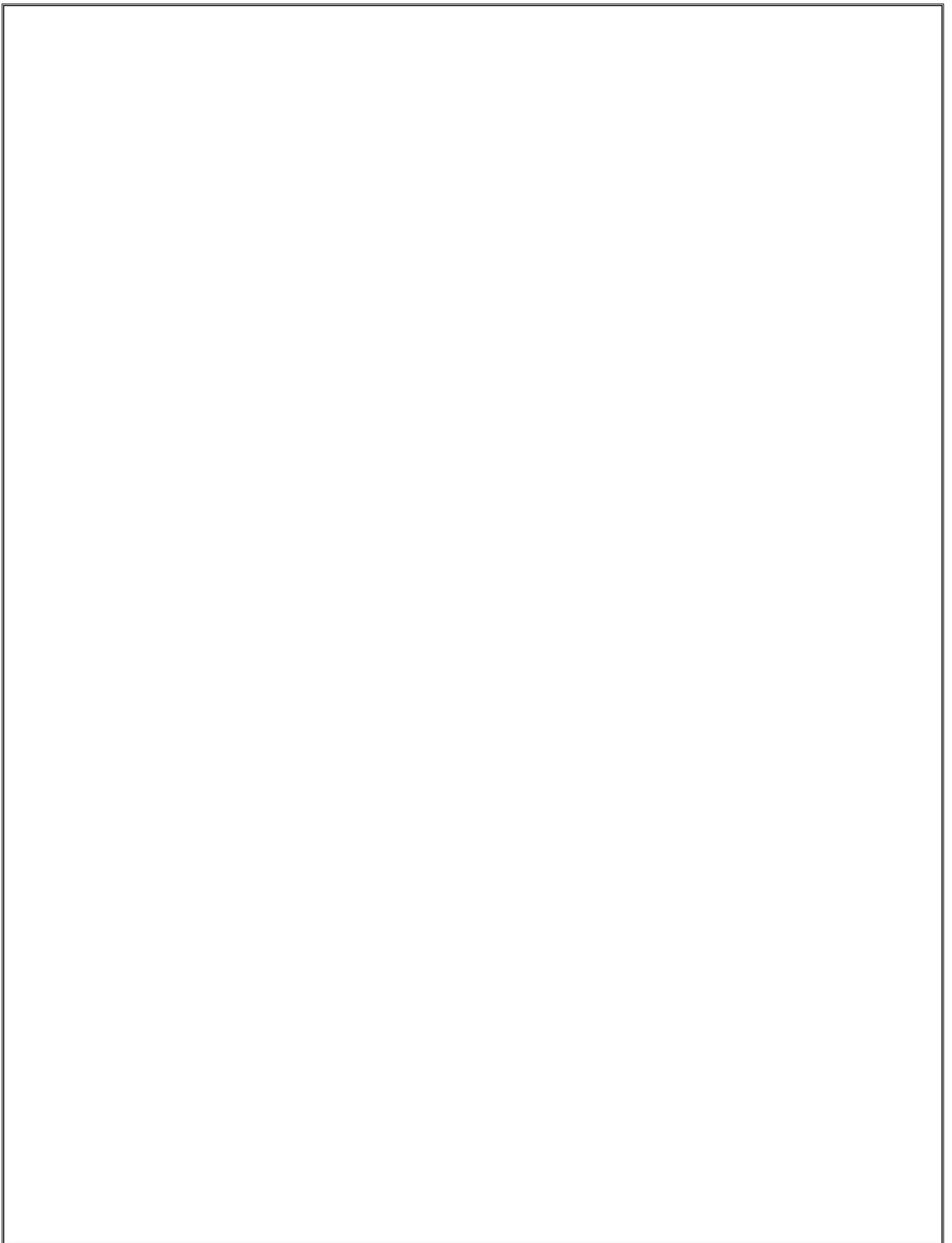
List of Ground Control Panel Members

Gerry Finfinger NIOSH
Keith Heasley..... West Virginia University
Anthony Iannocchione NIOSH
Hamid MalekiConsultant, Maleki Technology
Chris Mark NIOSH
Morgan Moon Mining Consultant
Rick Olsen.....Consultant, RODEC, Inc.
Pete Swanson NIOSH



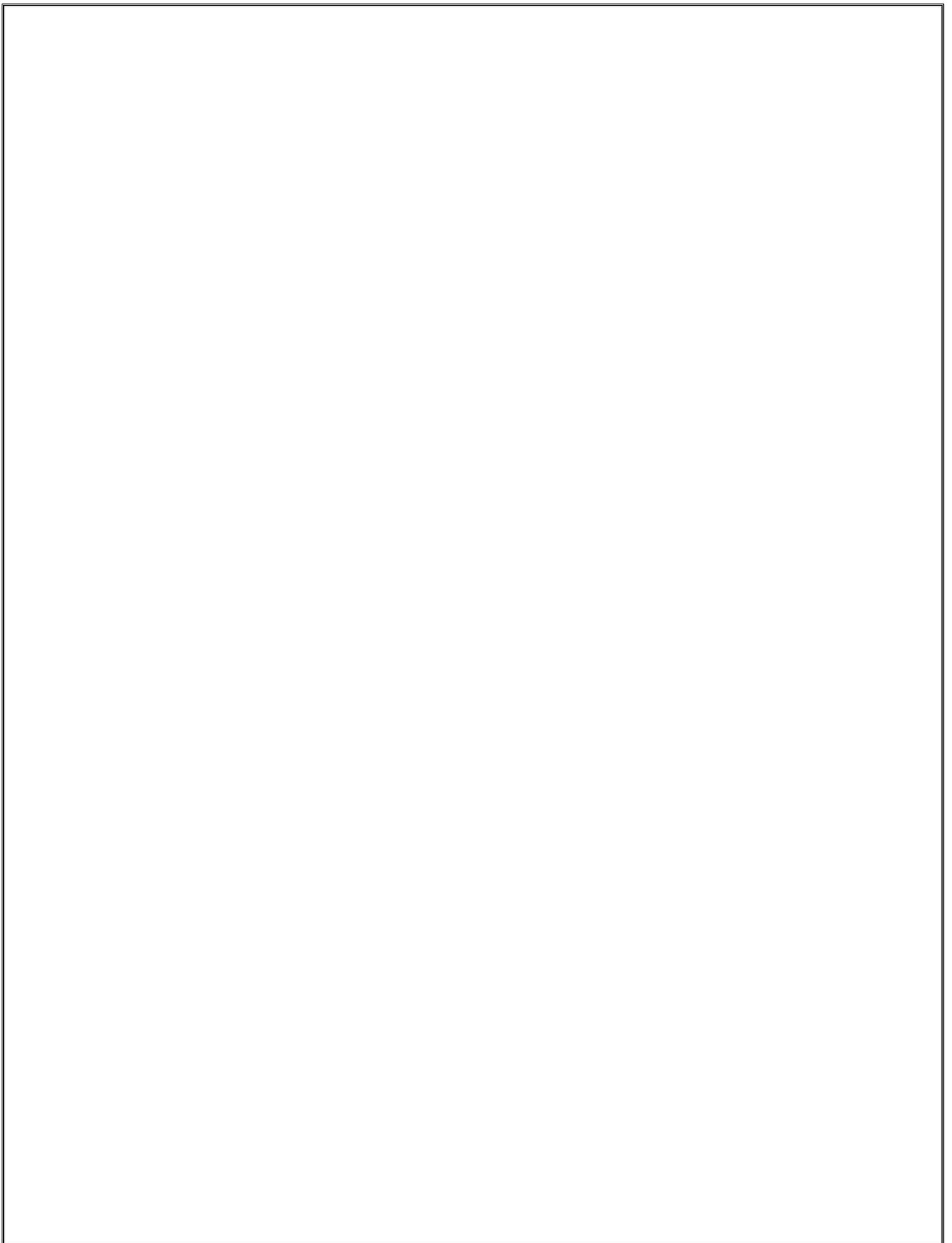
APPENDIX C

INSPECTION ACTIVITY OF CRANDALL CANYON MINE



**Genwal Resources, Inc., Crandall Canyon Mine
MSHA I.D. 42-01715
(1/1/2006 to 8/6/2007)**

Event Number	Activity Code	Activity Code Description	Beginning Date	Ending Date
4476283	E01	Regular Safety and Health Inspection	1/3/2006	3/30/2006
4474126	E16	Spot Inspection	1/24/2006	6/15/2006
4476331	E01	Regular Safety and Health Inspection	4/3/2006	6/28/2006
4476247	E01	Regular Safety and Health Inspection	7/5/2006	9/22/2006
4477639	E16	Spot Inspection	9/25/2006	10/3/2006
4474244	E01	Regular Safety and Health Inspection	11/2/2006	12/13/2006
4476407	E01	Regular Safety and Health Inspection	12/29/2006	3/29/2007
4474269	E03	103 (g) Written Notification Hazard Complaint Inspection	2/1/2007	2/7/2007
4476315	E12	110(c), 110(d) Investigation (Willful or Knowing Violation)	3/1/2007	10/18/2007
4476320	E12	110(c), 110(d) Investigation (Willful or Knowing Violation)	3/1/2007	11/21/2007
4474279	E16	Spot Inspection	4/11/2007	4/11/2007
4476485	E20	Roof Control Technical Investigation	5/22/2007	5/22/2007
4474428	E01	Regular Safety and Health Inspection	5/30/2007	7/2/2007
4474193	E01	Regular Safety and Health Inspection	7/5/2007	9/28/2007



APPENDIX D

CRANDALL CANYON BOREHOLE MAP

Crandall Canyon Borehole Map

Borehole #3

Location: #4 Entry, X-cut 147
 Started: 8/13/2007
 Completed: 8/15/2007
 Total Time: 36 Hours
 Depth: 1414 Feet
 Air Quality: 16.2% O₂
 Conditions: Relatively Good
 Conditions, Support
 Posts Intact, Full
 Mining Height

Borehole #4

Location: #2 Entry, X-cut 142
 Started: 8/16/2007
 Completed: 8/18/2007
 Total Time: 42 Hours
 Depth: 1587 Feet
 Air Quality: 11-12% O₂
 Conditions: Wire Mesh Holding
 Roof Rock, Muddy

Borehole #7

Location: #3 Entry, X-cut 137
 and 1/2
 Started: 8/28/2007
 Completed: 8/30/2007
 Total Time: 48 Hours
 Depth: 1865 Feet
 Air Quality: Not Obtained
 Conditions: 7 Feet of Material in
 Entry

Borehole #1

Location: #2 Entry, X-cut 138
 Started: 8/7/2007
 Completed: 8/9/2007
 Total Time: 49 Hours
 Depth: 1780 Feet
 Air Quality: 7.4% O₂
 Conditions: 3.5 Foot Void

Borehole #6

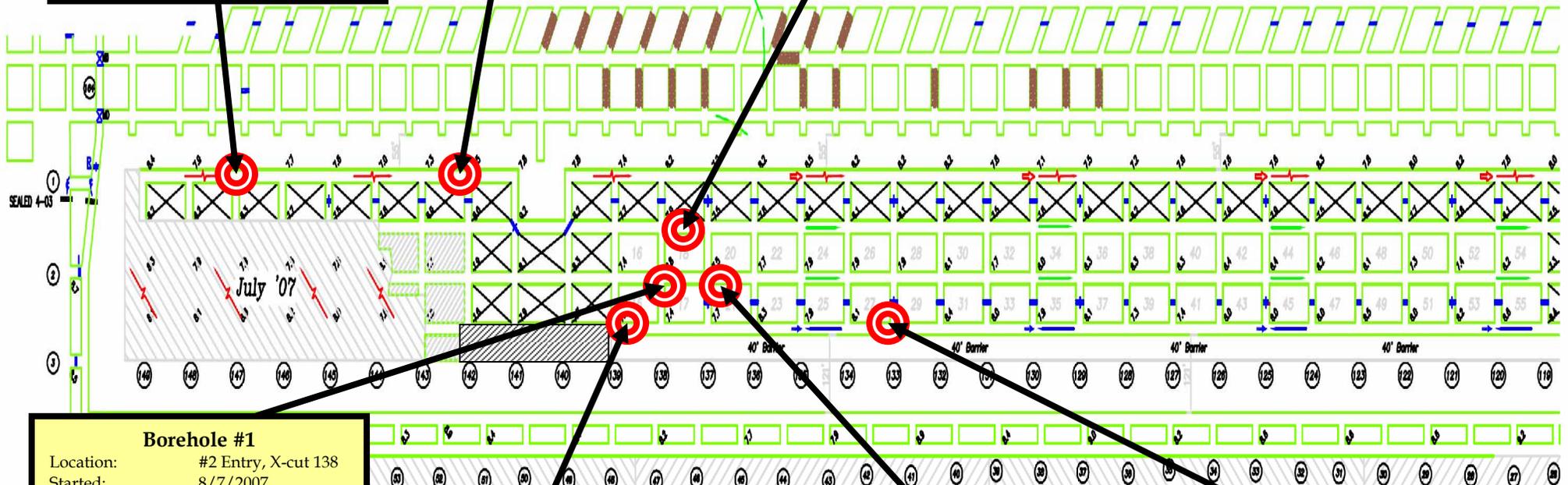
Location: #1 Entry, X-cut 138
 and 1/2
 Started: 8/23/2007
 Completed: 8/25/2007
 Total Time: 48.5 Hours
 Depth: 1783 Feet
 Air Quality: Not Obtained
 Conditions: No Void, Entry Full of
 Material

Borehole #2

Location: #2 Entry, X-cut 137
 Started: 8/8/2007
 Completed: 8/11/2007
 Total Time: 59.5 Hours
 Depth: 1880 Feet
 Air Quality: Not Obtained
 Conditions: 5.7 Foot Void, Solid
 Roof, Damage to Ribs

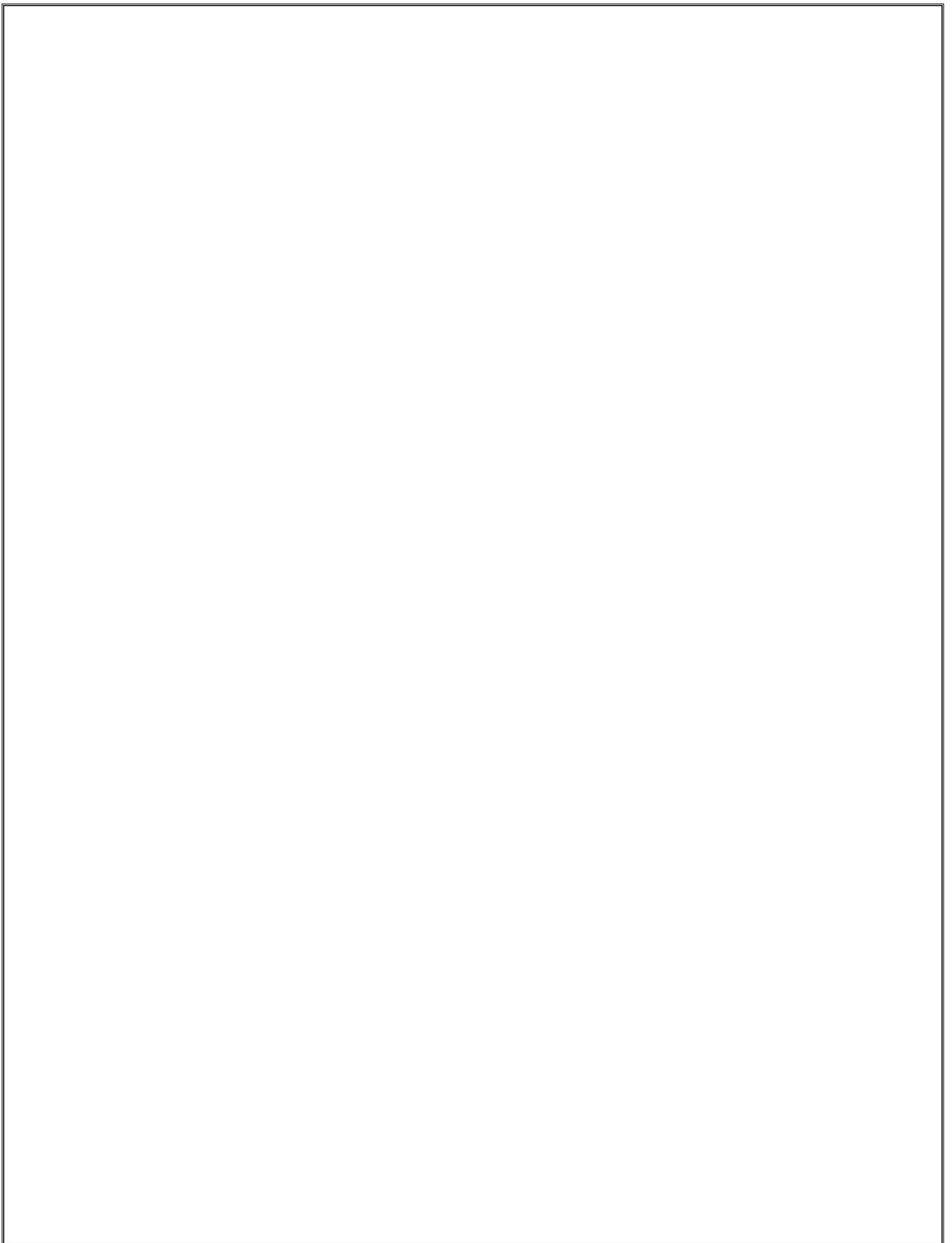
Borehole #5

Location: #1 Entry, X-cut 133
 Started: 8/19/2007
 Completed: 8/22/2007
 Total Time: 57 Hours
 Depth: 2033 Feet
 Air Quality: Not Obtained
 Conditions: 6 Inch Void, Rest of
 Entry Full of Material



APPENDIX E

OXYGEN CONTENT OF AIR: SIGNS AND SYMPTOMS

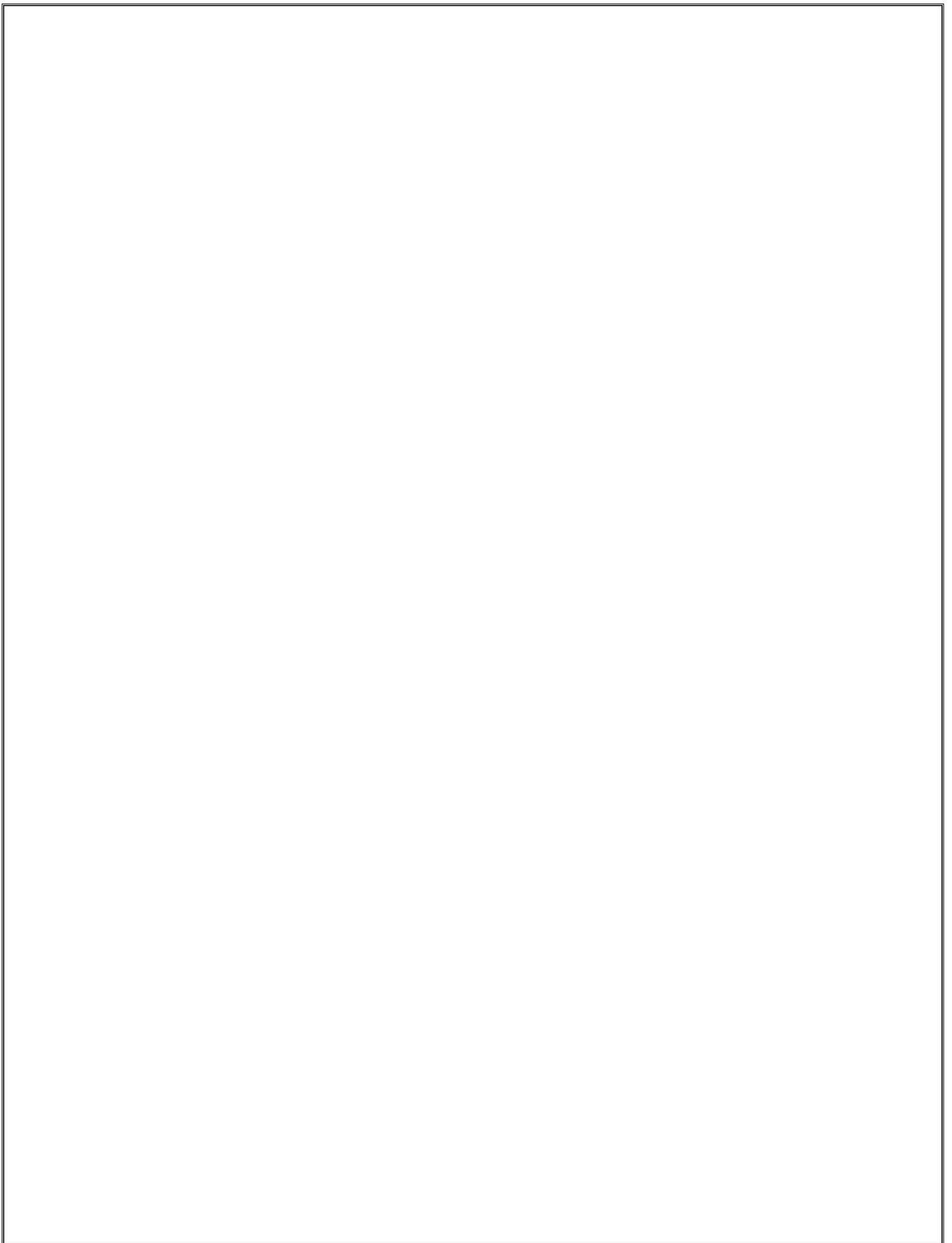


Oxygen Content of Air: Sign and Symptoms of Persons at Rest

Oxygen Content of Air	Signs and Symptoms
15% - 19.5%	<ul style="list-style-type: none"> -Decreased ability to work strenuously. -May impair coordination and May induce symptoms in persons with coronary, pulmonary, or circulatory problems
12% - 15%	<ul style="list-style-type: none"> -Deeper Respirations -Increased Pulse Rates -Impaired Coordination, Perception, and Judgment
10% - 12%	<ul style="list-style-type: none"> -Further increase in rate and depth of respirations -Further increase pulse rate -Performance Failure, Giddiness, Poor Judgment, and Blue Lips
8% - 10%	<ul style="list-style-type: none"> -Mental Failure, Nausea, Vomiting, Fainting, Unconsciousness, Ashen Face, and Blue Lips
6% - 8%	<ul style="list-style-type: none"> -8 minute exposure, may be fatal in 50-100% of victims -6 minute exposure, may be fatal in 25-50% of victims -4 to 5 minute exposure, recovery with treatment
4% - 6%	<ul style="list-style-type: none"> -Coma in 40 seconds, Convulsions, Respiration Ceases, and Death

APPENDIX F

PROGRAM POLICY LETTER NO. P06-V-11



EFFECTIVE DATE: 12/22/2006

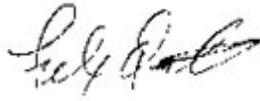
EXPIRATION DATE: 03/31/2009

PROGRAM POLICY LETTER NO. P06-V-11

FROM: KEVIN G. STRICKLIN
Acting Administrator for
Coal Mine Safety and Health



FELIX A. QUINTANA
Administrator for
Metal and Nonmetal Mine Safety and Health



JEFFREY A. DUNCAN
Director of Educational Policy and Development



SUBJECT: Family Liaison and Primary Communicator: Implementation of
Section 7 of the Mine Improvement and New Emergency
Response Act of 2006

Scope

This Program Policy Letter (PPL) is intended for miners, miners' family members, miners' representatives, mine operators, independent contractors, Mine Safety and Health Administration personnel and other interested persons.

Purpose

Section 7 of the Mine Improvement and New Emergency Response Act of 2006 (MINER Act) requires the Mine Safety and Health Administration (MSHA) to assign an individual to serve as a Family Liaison (Liaison) between MSHA and the families of victims of mine tragedies involving multiple deaths. MSHA is to be "as responsive as possible to requests from the families of mine accident victims for information relating to mine accidents." In addition, in such accidents, MSHA must "serve as the primary communicator with the operator, miners' families, the press and the public." This PPL sets forth policy implementing the provisions of Section 7 of the MINER Act. A companion revision to the Emergency Operations Manual will set forth specific guidance to be used in applying this policy during a mine emergency.

Policy

Family Liaison

MSHA will develop a pool of qualified officials who will be prepared to serve as Liaison in the event of a mine accident resulting in multiple fatalities. The persons selected for this pool will have appropriate technical expertise to effectively respond to technical questions as well as skills in crisis/grief management and communication. Similar to that of an accident investigation team member, this assignment as liaison should be the individual's highest priority responsibility from the beginning of the assignment until the investigation is complete.

Upon notification of a possible mine accident where multiple miners are unaccounted for, the appropriate Administrator will promptly assign a qualified agency official to act as Liaison for the purpose of being responsive to the needs of families of mine accident victims by providing clear and accurate information regarding the mine accident. The assigned Liaison will travel to the site as soon as possible and be briefed by the MSHA official in charge of accident activities in order to promptly establish communication with the victims' families. The Liaison will make arrangements to meet with family members for regular briefings and will remain accessible to family members during the emergency. Upon completion of the rescue at the site, the Liaison will remain in contact with families by telephone, cellular phone, email, and conventional mail for the duration of the investigation until the report is delivered.

During any resulting accident investigation the Liaison will continue to be responsive to the needs of the families until the investigation is complete and MSHA issues a final report. The Liaison will continue to interact with the accident investigation team for the purpose of responding to questions from and transferring information to victims' family members. Requests for information from the families will be governed by the Freedom of Information Act and will be expedited to the greatest extent possible.

Primary Communicator

A separate MSHA official (senior MSHA official onsite and/or media specialist) will serve as the primary communicator with the mine operator, miners' representative, media and general public during such mine accidents. The Primary Communicator will collaborate with the Liaison to ensure consistent, timely and accurate information is disseminated to the public and the families. To the greatest extent possible, sensitive information will be shared with the families before being disseminated to the public. Nothing in this policy shall prohibit the mine operator from establishing communication with the families or the public.

Background

On June 15, 2006 the MINER Act became effective. Section 7 of the MINER Act requires that the Secretary establish a policy that-

- (1) requires the temporary assignment of an individual Department of Labor official to be a liaison between the Department and the families of victims of mine accidents involving multiple deaths:
- (2) requires the Mine Safety and Health Administration to be as responsive as possible to requests from the families of mine accident victims for information relating to mine accidents:
- (3) requires that in such accidents, that the Mine Safety and Health Administration shall serve as the primary communicator to operators, miners' families, the press and the public.

Authority

The Federal Mine Safety and Health Act of 1977, 30 U.S.C. 801 et seq., as amended by the MINER

Act, Pub. L. No. 109-236, June 15, 2006, 120 Stat. 493.

Issuing Office and Contact Person

Coal Mine Safety and Health, Accident Investigations Program Manager,

William Crocco, (202) 693-9507

e-mail: crocco.william@dol.gov

Metal and Nonmetal Mine Safety and Health, Accident Investigations Program Manager,

John K. Radomsky, (202) 693-9614

e-mail: radomsky.john@dol.gov

Distribution

MSHA Program Policy Manual Holders

[See Attachments](#)

PROGRAM POLICY LETTER NO. P06-V-11 ATTACHMENTS

U.S. Department of Labor



Primary Communicator Protocol

The Department of Labor Office of Public Affairs
and
The Department of Labor Mine Safety and Health Administration

Section 7 of The Mine Improvement and New Emergency Response Act of 2006 (MINER Act) requires MSHA to serve as the "primary communicator" with the press, the public, the operator and miners' families following a mine tragedy involving multiple deaths. By Department of Labor Secretarial Order 17-2006, the Assistant Secretary for Public Affairs (OPA) in consultation with the Assistant Secretary for Mine Safety and Health (MSHA) will provide direction to the "primary communicator" following a mine tragedy involving multiple deaths.

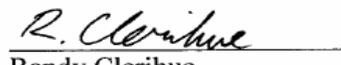
Accordingly, OPA and MSHA agree to the following protocol.

1. Upon notification of a mine accident where multiple miners are trapped, unaccounted for, or multiple fatalities have occurred, MSHA will notify OPA and will provide all pertinent information regarding the incident.
2. OPA should dispatch personnel to the accident site as soon as possible to provide support to MSHA's "primary communicator."
3. OPA and MSHA should jointly develop briefing outlines that will serve to brief the press and the public on a scheduled basis.
4. Briefings with the press and public shall be conducted by the "primary communicator" after the family briefings have been conducted.

This Protocol may be modified at any time by mutual agreement of MSHA and OPA.

This Protocol is agreed to this 22nd day of December, 2006.


Richard Stickler
Assistant Secretary for
Mine Safety and Health


Randy Clerihue
Assistant Secretary for
Office of Public Affairs

Family Liaison/Primary Communicator Accident/Illness Investigation Handbook, HQ Mine Emergency Handbook

Upon notification of any mine accident involving multiple deaths or where multiple miners are unaccounted for, the Administrator or his deputy will assign and immediately deploy to the accident site MSHA personnel to serve as Primary Communicator and Family Liaison.

Family Liaison (Liaison)

- Each MSHA District will maintain one or more persons to serve as Liaison to address the needs of a miner's family following a mine accident.
- These persons will be specifically trained to deal with families following mine accidents.
- The Liaison is not a counselor but may be required to coordinate support for family members with crisis management professionals such as the American Red Cross.
- The Liaison will establish a 24 hour a day schedule rotation that ensures that they are available at all times for family members throughout the rescue/recovery operation at the site.
- The Liaison will establish a schedule to brief family members on new and emerging information prior to its release to the public.
- The Liaison will be responsible to coordinate with the Primary Communicator to ensure identical information is released during their respective briefings.
- The Liaison may be responsible to interact with local officials to establish a facility where families may be centrally located.
- Upon completion of the onsite rescue/recovery, the Liaison will ensure that family members continue to be informed regarding status of the Investigation Report and significant issues.
- The Liaison will remain accessible to family members by telephone, cellular phone, email, and conventional mail until the report is delivered to each family.
- The Liaison will maintain a written log that documents all significant events.

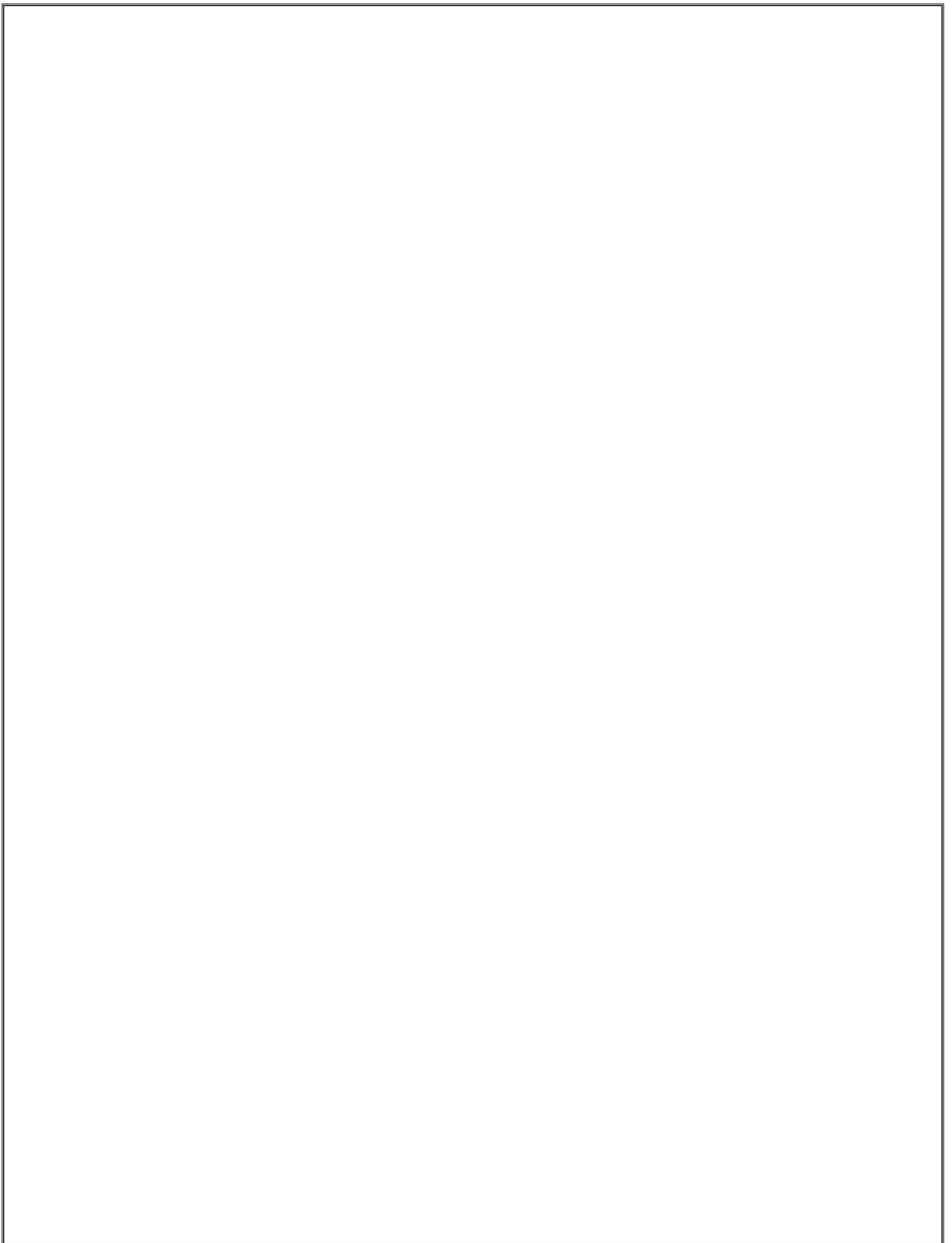
- Upon request for Agency documents from family members, the Liaison should coordinate with SOL to ensure the release is appropriate.
- This assignment should be the Liaison's highest priority responsibility from the beginning of the assignment until the investigation is complete and a final report is issued.

Primary Communicator

- Each MSHA District will maintain one or more persons to serve as Primary Communicator to brief representatives' of miners, the mine operator, media and state agencies.
- The Primary Communicator will be responsible to brief Office of Public Affairs (OPA) personnel upon their arrival at the site.
- The Primary Communicator, Liaison, and OPA personnel will jointly develop briefing scripts.
- The Primary Communicator and Liaison will coordinate to ensure that identical information is released to all parties.
- The Primary Communicator and Liaison will ensure that sensitive information is released to family members prior to the public.
- The Primary Communicator will establish contact with representatives of State Agencies, the mine operator, miners' representatives, and the media to facilitate briefings.
- The Primary Communicator will develop a cooperative protocol with State officials to ensure conflicts are avoided.
- The Primary Communicator will establish a 24 hour a day schedule rotation that ensures that they are available at the accident site.
- The Primary Communicator will share new and emerging information with the Liaison at the earliest possible opportunity.
- The Primary Communicator will maintain a log that documents all significant events.
- The rules of FOIA apply to all requests for Agency documents.

APPENDIX G

PROGRAM POLICY LETTER NO. P06-V-10



EFFECTIVE DATE: 10/24/2006

EXPIRATION DATE: 03/31/2008

PROGRAM POLICY LETTER NO. P06-V-10

FROM: KEVIN G. STRICKLIN
Acting Administrator for
Coal Mine Safety and Health



SUBJECT: Reissue of PPL No. P06-V-9: Implementation of Section 2 of the Mine Improvement and New Emergency Response Act of 2006

Scope

This Program Policy Letter (PPL) is intended for underground coal mine operators, miners and miners' representatives, independent contractors, Mine Safety and Health Administration (MSHA) enforcement personnel, and other interested parties working in underground coal mines.

Purpose

Section 2 of the Mine Improvement and New Emergency Response Act of 2006 (MINER Act) requires underground coal mine operators to have, within 60 days of enactment, an Emergency Response Plan (ERP), which is to be approved by MSHA and takes into account comments from miners and miners' representatives. Congress accordingly places an immediate responsibility on the part of the underground coal mine operators to develop plans to effectuate the purposes and requirements of the MINER Act.

This PPL provides policy and guidance to underground coal mine operators to facilitate the development of their ERPs. This PPL supercedes the previous reissue. Specifically, it supplements and clarifies the information provided in PPL No. P06-V-9 regarding emergency supplies of breathable air, appropriate distances between Self-Contained Self-Rescuers (SCSRs) in escapeways, and the process for ERP approval.

Policy

The MINER Act addresses both the evacuation of miners endangered by an emergency and the maintenance of miners trapped underground. MSHA emphasizes that, in the event of a mine emergency, every effort must be made by miners to evacuate the mine. Barricading should be considered an absolute last resort and should be considered only when evacuation routes have been physically blocked. Lifelines, tethers, SCSRs, and proper training provide essential tools for miners to evacuate through smoke and irrespirable atmospheres.

In accordance with the MINER Act, underground coal mine operators must develop, adopt, and submit an Emergency Response Plan (ERP) to the appropriate MSHA District Manager no later than August 14,

2006. The MINER Act requires that the ERPs address both the evacuation of miners endangered by an emergency and maintenance of miners trapped underground. These plans must:

- a. Afford miners a level of safety protection at least consistent with the existing standards, including standards mandated by law and regulation;
- b. Reflect the most recent credible scientific research;
- c. Be technologically feasible, make use of current commercially available technology, and account for the specific physical characteristics of the mine; and
- d. Reflect the improvements in mine safety gained from experience under [the MINER] Act and other worker safety and health laws.

The provisions of the ERP, except for the completion of training, shall be effective upon adoption by the operator and are subject to MSHA's subsequent approval. In accordance with the MINER Act, MSHA will review the ERP at least every six months. Operators must periodically update ERPs to reflect: changes in operations in the mine, such as a change in systems of mining or mine layout, and relocation of escapeways; advances in technology; or other relevant considerations. When changes to the ERP are required, MSHA approval must be obtained before the changes are implemented. Training in the ERP provisions should be completed within thirty days of approval of each provision.

Section 2(b)(2)(B)(i) of the MINER Act requires that the ERP shall provide for the evacuation "of all individuals endangered" by an emergency. The individuals covered by this provision do not include properly trained and equipped persons essential to respond to a mine emergency, as permitted in 30 C.F.R. § 75.1501(b).

In considering comments from the miners or their representatives as specified in Section 2(b)(2)(C) and (D) of the MINER Act, MSHA will follow the procedure outlined for submission and approval of ventilation plans as noted in 30 C.F.R. § 75.370(a)(3)(i) through (b). ERPs consistent with this PPL will facilitate approval of these plans by MSHA. At its discretion, MSHA may approve equivalent compliance alternatives to those in this PPL.

Emergency Response Plan - Content

1. Post-accident Communication

When hardwired systems are used to meet the MINER Act requirement for redundant communication between surface and underground personnel, wires should be routed through separate entries or boreholes continuous to the surface. MSHA interprets the term "wireless," as used in the MINER Act, to mean that no wired component of the system exists underground where it may be damaged by fire or explosion. Post-accident communication technology would be considered acceptable if, based on its location in the mine and the history of mine explosions and fires in the mine, it is likely to withstand the event intact. A reasonable timetable for installation should be included in the plan.

This provision applies to all mines except anthracite mines with one intake and one return aircourse. In these mines, the redundant hardwired systems may be placed in the same aircourse.

2. Post-accident Tracking

Until post-accident tracking technology becomes commercially available and MSHA approved, MSHA

will accept a dispatcher system, or equivalent system, that has as a function the tracking of persons underground. A dispatcher system should track location of personnel in writing, on a map, or electronically, for the duration of the shift. The tracking system used by the operator should be able to determine the current, or the immediate pre-accident location of all underground personnel.

3. Post-accident Breathable Air

A. *Maintenance of Individuals Trapped Underground*

For an ERP to be approved, it must specifically address the type, amount, and location of post-accident breathable air necessary to maintain individuals trapped underground for a sustained period of time. Oxygen, compressed air, or other alternatives may be used to meet this requirement.

On August 30, 2006, MSHA published a Request for Information (RFI) in the Federal Register seeking further information from the mining community on "topics related to post-accident breathable air that would be sufficient to maintain miners trapped underground for a sustained period of time." Once MSHA is able to review the information received, the Agency will provide additional guidance. In the meantime, however, mine operators shall gather information from available resources and provide for emergency supplies of breathable air.

B. *Additional SCSRs in Escapeways*

In addition to the two SCSRs provided on the section for each miner as required by the emergency temporary standard, the plan should provide for storage of SCSRs at 30 minute intervals in escapeways. MSHA interprets the MINER Act phrase that "caches of self-rescuers providing in the aggregate not less than 2 hours per miner to be kept in escapeways from the deepest work area to the surface at a distance of no further than an average miner could walk in 30 minutes" to mean that one-hour of oxygen per miner should be provided at each SCSR storage location in each escapeway.

The table below provides allowable 30-minute travel distance intervals. Please note that the distances in this table vary from those provided in P06-V-9.

Distances for SCSR Storage Locations	
Average Seam Height (in.)	Distance in Feet (30 min.)
Crawl - less than 40	2200
Duck Walk - 40 to 50	3300
Walk Head Bent - 51 to 65	4400
Walk Erect - more than 65	5700

The above table is based on the 1995-1996 NIOSH/MSHA study summarized as "The Oxygen Cost of a Mine Escape" Kovac, Kravitz, Rehak (1997). It does not apply to mines with grades over 5%. In post-accident evacuation situations, miners could encounter smoke, dust, fallen materials and disorienting surroundings, impeding their evacuation. The mental and physical condition of the miner in a mine emergency could contribute to additional oxygen use. In addition, the slope of escapeways miners must travel vary, potentially increasing the amount of oxygen consumed. This derated distance table derived from the study takes these factors into account to determine an acceptable 30 minute travel distance between SCSR storage locations.

Alternatively, a functionality test may be used to determine the distance that an "average miner" could travel in 30 minutes. The mine operator should calculate this distance by using the average distance that a representative sample of miners walks in 30 minutes over a portion of the mine that is representative of each escapeway. A representative sample of miners would be a cross-section of the population of all miners who would have to evacuate the mine and use the SCSRs stored in the escapeways. In other words, the sample should include miners of various ages, weights, fitness levels, and smoking habits. In general, it is appropriate for mine operators to include at least 20 miners in the walking trial in order to obtain an accurate representation of the entire mine population. If the workforce is 20 or fewer, all miners should be included in the walking trial. A representative portion of the escapeway would have an entry height, slope, and underfoot conditions similar to those of the entire escapeway.

C. Other SCSR Considerations

The ERP should contain a provision for storage of at least one SCSR provided at no further than 30 minute travel distances for the evacuation of miners such as pumpers or examiners working in remote areas at locations accessible to these personnel in bleeders and other remote areas of the mine.

The ERP should contain a provision adopting the manufacturer's recommendations for SCSR maintenance, routine examinations, storage, and retirement. The ERP should also address SCSR performance by specifying a schedule for opening, initiating the breathing cycle, and establishing operational reliability for a representative number of SCSR units on an annual basis. Units at the end of their service life, if available, may be used for this purpose. The ERP should also provide for replacement of retired SCSRs with technologically advanced SCSRs as they become commercially available and are approved for use in mines.

4. Post-accident Lifelines

MSHA interprets the "flame-resistant" lifeline requirement of the MINER Act to mean that lifelines must meet the requirements of 30 CFR 18.65. Consistent with the MINER Act, operators may continue to use lifelines on order or in use at the mine until the lifelines are replaced, or the statutory three-year period has elapsed.

Where directional cones are used to meet the requirement for directional lifelines, the ERP should be consistent with the National Institute for Occupational Safety and Health's (NIOSH) recommendation that directional cones are to point in the inby direction. See *Emerging Technologies: Aiding Responders*

in Mine Emergencies and During the Escape from Smoke-Filled Passageways by Ronald S. Conti, National Institute for Occupational Safety and Health.

5. Training

The ERP should contain provisions for training in evacuation procedures for all persons prior to going underground. This provision does not apply to Federal and state government officials or to short-term visitors who have appropriate SCSR and hazard training and are taking a tour accompanied by knowledgeable operator officials. This training should be conducted quarterly and can be part of the mine emergency evacuation training under 30 CFR 75.1502.

In addition, the ERP should include SCSR hands-on training in donning and transferring from one SCSR to another for each type of SCSR carried or stored in the mine. Training should demonstrate the proper insertion of the mouthpiece and emphasize the importance of keeping the mouthpiece inserted until reaching fresh air.

The ERP should contain a provision that one of the quarterly training drills on donning of SCSRs will take place in artificial smoke or an environment simulating smoke. Also, where possible, the ERP should provide that a training unit that replicates actual conditions of use will be used for this training. The ERP should contain a mechanism to assure that all training on the ERP procedures was conducted.

6. Local Coordination

Consistent with the MINER Act, the ERP shall include procedures for notifying key personnel, such as a call list for mine rescue teams, local emergency responders, mine personnel, state and federal officials, and other parties that may be required. Consistent with the MINER Act, the ERP shall include the procedures the operator will follow to familiarize local emergency responders with surface functions that may be required in the course of mine rescue work, such as logistics, traffic control, and supplies on the surface. Operators should make every effort to arrange on-site visits by local emergency responders to familiarize them with the surface facilities at the mine and the functions that may be required of the responders.

The ERP should include a provision to provide MSHA with advance notice of on-site activities related to local emergency response coordination so that MSHA has the opportunity to observe or participate.

7. Additional Plan Content Provisions

To provide for the maintenance of miners trapped underground, the ERP should include the following for each working section:

1. Two inflatable stoppings or other quick deployable barricade units should be provided within 6 months of becoming commercially available. Until these units are available, sufficient barricading materials to construct two air-tight barricades; the barricading material shall, at a minimum, include 4 brattice boards equal to the entry width, brattice cloth, sealant material, eight roof jacks, powered spad gun with sufficient spads, trowel and protective gloves, two claw hammers and nails, and 240 pounds of rock dust;

2. Inflatable shelters or equivalent may be used in lieu of barricading materials or other quick deployable units;
3. Food and potable water sufficient for a sustained period of time; and
4. First-aid kits, blankets, multi-gas detectors, and chemical light-sticks or other effective permissible light sources.

The ERP should include a list of readily available suppliers of mine emergency and rescue equipment. A means for satisfying this requirement is to include a copy of MSHA's Mine Emergency Operations (MEO) database information for the mine in the ERP. See

<https://lakegovprod1.msha.gov/MEO/Default.aspx>.

The ERP should include plans for post-accident logistics and coordination that at a minimum address: the location, necessary equipment, and security of the command center; the facilities available to accommodate families and the security for families of the affected miners; the location for the press; and the arrangements for traffic control.

Emergency Response Plan - Approval Procedure

The MINER Act specified that ERPs be developed and adopted no later than 60 days after the date of enactment of the Act (August 14, 2006). Once submitted, the plan is considered to be adopted by the mine operator and the operator should begin to implement its plan where possible by obtaining equipment, showing a purchase order for the purchase of equipment, or conducting training as appropriate. As MSHA reviews the Plans, the Agency will send approval letters notifying mine operators of the ERP provisions found to be in compliance with the MINER Act. Furthermore, approved ERP provisions are fully effective, and are also subject to enforcement. Inspectors will check for compliance during subsequent inspections.

ERP provisions that have not been approved and have not been included in the approval letter are still being carefully reviewed by MSHA. MSHA will send a deficiency letter to the mine operator explaining which items have not been approved and what additional information should be included when the provisions are resubmitted to MSHA.

Background

On June 15, 2006, the MINER Act became effective. Section 2 of the MINER Act amends Section 316 of the Mine Safety and Health Act of 1977 to address emergency response plans.

Paragraph (b)(2) of Section 2 of the MINER Act requires that not later than August 14, 2006 (60 days after the date of enactment), each underground coal mine operator shall develop and adopt a written emergency response plan that provides for the evacuation of all individuals endangered by an emergency and the maintenance of individuals trapped underground in the event that miners are not able to evacuate the mine.

Authority

The Federal Mine Safety and Health Act of 1977, 30 U.S.C. 801 as amended by the MINER Act, Pub.

L. No. 109-236,
June 15, 2006, 120 Stat. 493.

Internet Availability

This program policy letter may be viewed on the World Wide Web by accessing the MSHA home page (<http://www.msha.gov>) and by choosing "Compliance Info" and "Program Policy Letters".

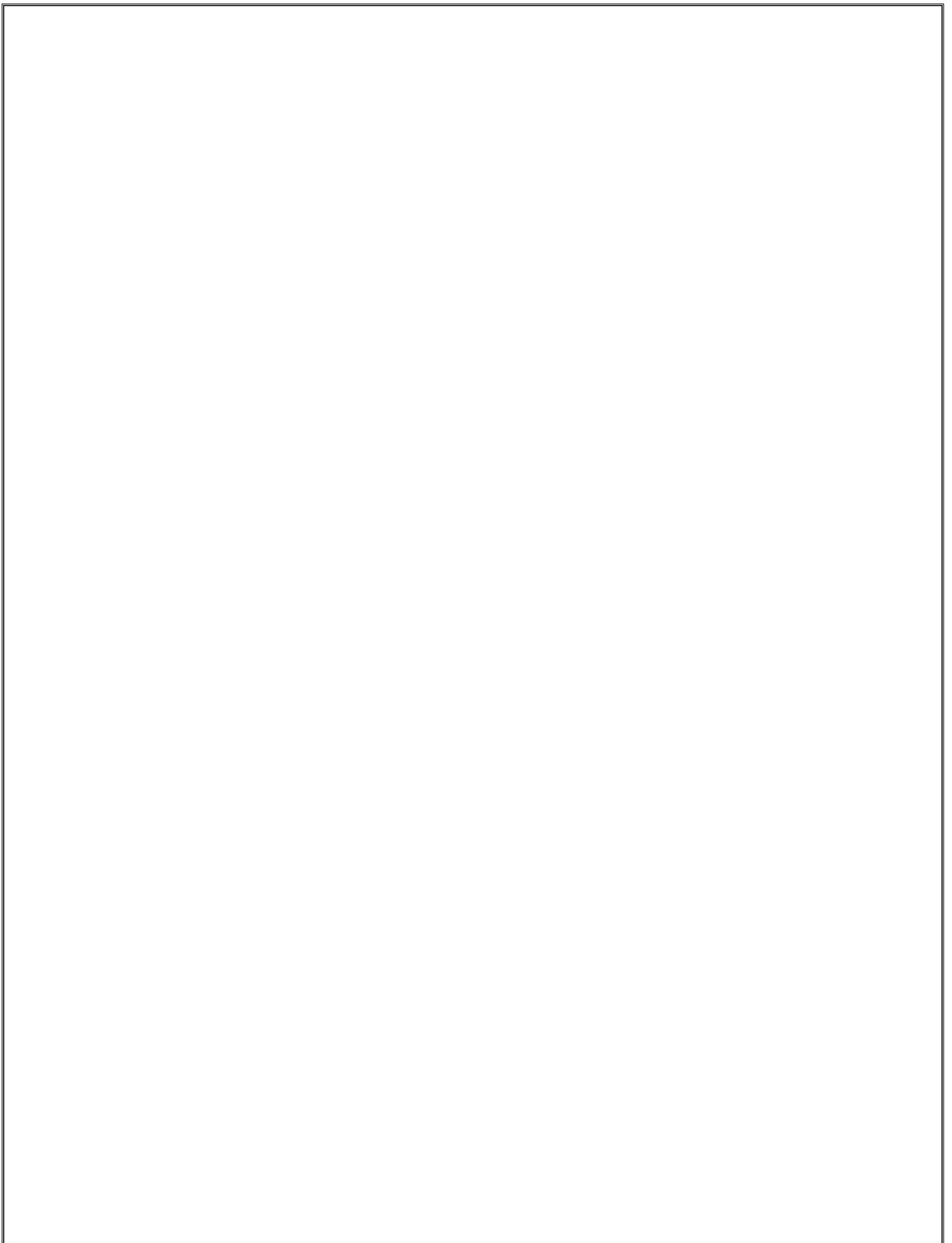
Contact Person(s)

Terry L. Bentley, (202) 693-9521
Chief, Division of Safety
Coal Mine Safety and Health
E-mail: bentley.terry@dol.gov

Distribution

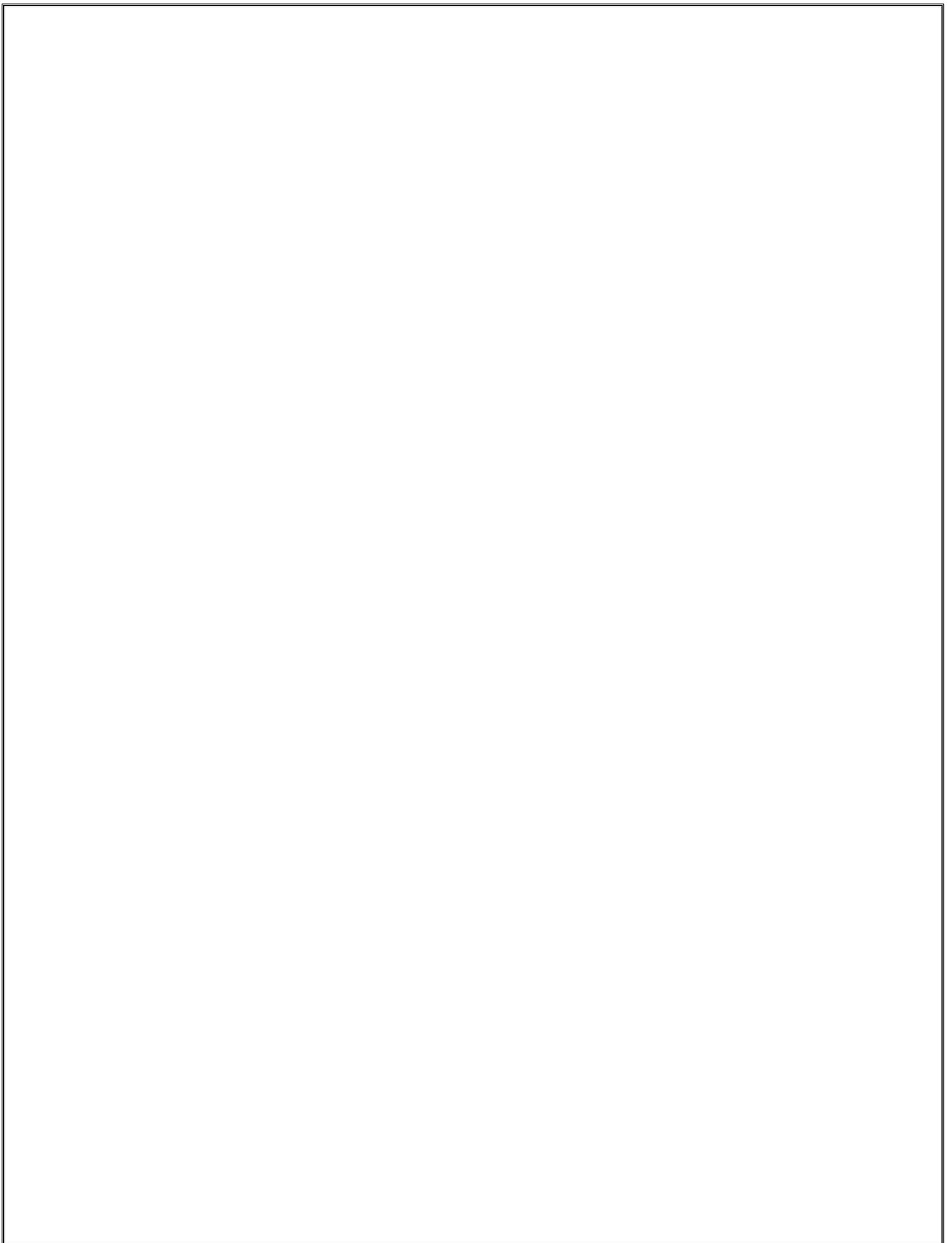
MSHA Program Policy Manual Holders
Miners' Representatives
Coal Mine Operators
Special Interest Groups

See [Request for Information](#)



APPENDIX H

PROGRAM INSTRUCTION BULLETIN NO. P07-03



ISSUE DATE: February 8, 2007

PROGRAM INFORMATION BULLETIN NO. P07-03

FROM: KEVIN G. STRICKLIN
Acting Administrator for
Coal Mine Safety and Health



SUBJECT: Implementation of Section 2 of the Mine Improvement and New Emergency Response (MINER) Act of 2006: Options for Providing Post-Accident Breathable Air to Underground Coal Miners. This Program Information Bulletin should be used in conjunction with Program Policy Letter No. P06-V-10

Who needs this information?

Underground coal mine operators, miners and miners' representatives, independent contractors, Mine Safety and Health Administration (MSHA) enforcement and technical support personnel, and other interested parties need this information. This Program Information Bulletin (PIB) is issued to provide additional guidance to mine operators and MSHA district managers. This information should be used in conjunction with Program Policy Letter (PPL) No. [P06-V-10](#) (October 24, 2006), concerning implementation of emergency response plans.

What is the purpose of this PIB?

Section 2 of the MINER Act requires that each underground coal mine operator adopt a written accident response plan ("emergency response plan" or ERP) that, among other things, "provide[s] for ... emergency supplies of breathable air for individuals trapped underground sufficient to maintain such individuals for a sustained period of time." In this PIB, MSHA reiterates that, in the event of a mine emergency, the first line of defense is to evacuate the mine.

PIBs are temporary directives used to disseminate information or announcements of immediate interest to MSHA employees, mine operators, and other parties. This PIB is intended to be advisory in nature and informational in content. While Section 2 of the MINER Act imposes breathable air requirements on operators, this PIB does not impose additional requirements independent of the MINER Act. It does, however, represent the Secretary's interpretation of the quantity of breathable air that would be sufficient to maintain miners for a sustained period of time. This PIB discusses options for operators that may be of assistance in developing ERPs and for MSHA district managers who must exercise their discretion in approving ERPs. This PIB focuses on the quantity of breathable air needed, addresses the means for providing that air to trapped miners, and informs mine operators that they should train miners on the breathable air provisions of the ERP. In accordance with the MINER Act, post-accident breathable air is intended to maintain trapped miners until rescue teams reach them.

Information

I. Quantity of Breathable Air. In determining the quantity of breathable air necessary to sustain trapped miners, operators should consider specific mine conditions. The ERPs should identify all relevant variables that may impact the time required, under a variety of adverse conditions, to provide breathable air to trapped miners.

Below are some options that may satisfy the breathable air requirement:

1) An established borehole capable of providing fresh air to a location within 2,000 feet of the working section or a hardened room in accordance with the Emergency Mine Evacuation final rule (71 FR 71037, 71430, December 8, 2006), located within 2,000 feet of the working section.

2) Each miner should be provided a 48-hour supply of breathable air, if advance contingency arrangements have been made to reliably assure that miners who cannot be rescued within 48 hours will receive additional supplies of breathable air sufficient to sustain them until rescue. These contingency arrangements should be based on the following (other arrangements offering similar levels of protection also may suffice):

a) A pre-arranged, pre-surveyed area for barricading or other location that would isolate the miners from contaminated environments, located within 2,000 feet of the working section.

b) The capacity to promptly transport a drill rig to a pre-surveyed location such that a drilled hole would intersect the area designated for barricading (or other alternatives that would isolate the miners from contaminated environments).

3) Each miner should be provided a 96-hour supply of breathable air located within 2,000 feet of the working section.

4) The operator may use other methods to provide breathable air sufficient to sustain miners trapped underground for a period of time that reasonably would be expected to establish a fresh air source for trapped miners, as long as these methods provide equivalent safety protection.

II. Location and Method of Providing Breathable Air. The ERPs should describe the operator's method for providing breathable air to trapped miners and establish the locations in which breathable air will be maintained. PPL 06-V-10 described some options through which miners could isolate themselves from contaminated/hazardous environments. ERPs should provide for breathable air within areas designated for barricading (or other alternatives that will isolate the miners from contaminated environments) and should establish the location of these areas. The locations of these areas should be shown on the escape map.

Within these areas, the supply of breathable air could be provided through various methods, including the following:

- A. Boreholes with fresh air blowing fans capable of providing fresh air to trapped miners;
- B. Buried or otherwise protected air lines supplied by surface positive pressure blowers and routed to locations that will isolate miners from contaminated environments;
- C. Compressed air cylinders, oxygen cylinders, or chemical oxygen generators located at a designated area for barricading or other alternatives that would isolate miners from contaminated environments. When supplying breathable air through one of these methods, carbon dioxide scrubbing capability is necessary to prevent contamination of the isolated environment.

MSHA has issued further information in Hazard Awareness for Compressed Air and Compressed Oxygen, which is available at www.msha.gov. MSHA has also developed additional information concerning methods for providing breathable air. This additional information addresses calculations for developing quantity of breathable air, and includes scrubbing capability, where applicable. This information is also available on MSHA's website (See Attachments).

III. Training in the Use of Breathable Air. ERPs should specify that all persons going underground will be trained on the breathable air provisions in the ERP.

IV. Timetable for Submission and Implementation of Breathable Air Portion of ERP.

- A. Submission of the portion of ERP addressing breathable air. Mine operators must submit this portion of the ERP not more 30 days after the date of this PIB.
- B. Implementation of the portion of ERP addressing breathable air. Mine operators must implement the breathable air provisions of the ERP not more than 60 days after the plan is approved.

What is the background for this PIB?

On June 15, 2006, the MINER Act became effective. Section 2 of the MINER Act amends Section 316 of the Federal Mine Safety and Health Act of 1977 and requires underground coal mine operators to develop and adopt, within 60 days of enactment, a written emergency response plan which is to be approved by MSHA. This section further requires that the ERP provide for the evacuation of all individuals endangered by an emergency and the maintenance of individuals trapped underground in the event that miners are not able to evacuate the mine. This Act requires that all emergency response plans shall provide for emergency supplies of breathable air for individuals trapped underground sufficient to maintain such individuals for a sustained period of time.

What is MSHA's authority for this PIB?

The Federal Mine Safety and Health Act of 1977, as amended by the MINER Act, June 15, 2006.

Where is this PIB on the Internet?

This information may be viewed on MSHA's home page (<http://www.msha.gov>), choosing "Compliance Info" and "Program Information Bulletins."

Who are the MSHA contact persons for this PIB?

Coal Mine Safety and Health
Terry Bentley, (202) 693-9500
E-mail: Bentley.Terry@dol.gov

Who will receive this PIB?

MSHA PPM Holders
Underground Coal Operators
Miners' Representatives
Independent Contractors
Special Interest Groups

Attachments

- [Methods for Providing Breathable Air](#)

URL: <http://www.msha.gov/regs/complian/PIB/2007/pib07-03attach2.pdf>

- [Hazard Awareness: Using Compressed Air and Compressed Oxygen To Provide Breathable Air Underground](#)

URL: <http://www.msha.gov/regs/complian/PIB/2007/pib07-03attach.pdf>

- [Questions and Answers](#)

URL: <http://www.msha.gov/regs/complian/PIB/2007/pib07-03QandAs.asp>

APPENDIX I
CRANDALL CANYON MAIN WEST SECTION MAP

Crandall Canyon Main West Section

NORTH BARRIER

Location of March 2007 Bounce

Main West

Location of Main West Seal No. 1

Last Known Location of Miners

Location of August 16 Accident - Just Outby Crosscut 127

Extent of Initial Bounce Damage - Crosscut 120

SOUTH BARRIER

