

EMERGENCY RESPONSE PLANNING FOR SMALL MINES: WHO NEEDS IT?

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ABSTRACT

This paper discusses emergency response planning with a special emphasis on small minesites. It addresses the importance of an emergency response plan and offers some tips for developing a useful document. The content of the paper is based on U.S. Bureau of Mines research focusing on mine emergency response. Examples from

past mine emergency situations are used to highlight the discussion. The paper is intended to stimulate the thinking of both small mine operators and those safety professionals who work with individuals from small mines. It is not meant to be the final word on emergency response plans.

INTRODUCTION

Emergencies disrupt organizational routine. By their very nature, they create confusion and uncertainty. The expertise needed to respond effectively may not be common in an organization. One reason is that emergencies, being rare events, demand certain skills that are not developed during normal operations. If no one on site has those skills, the natural confusion and uncertainty will be compounded:

. . . the two owners . . . got there basically about the same time . . . I said, "Hey, . . . we've had a rock fall. We got one guy that's not accounted for. What do we need to do here?" . . . These guys have been in business 20 plus years each, and they had never had nothing like this happen before . . .

The two small mine owners mentioned above had put together a management team that possessed the necessary expertise. They had an experienced safety director who assisted them through a lengthy recovery operation. Is there someone at every small minesite who has that responsibility, experience, and ability? If not, what happens

when the unforeseen emergency occurs? Chaos is likely to be the result.

One of the major factors determining how quickly a situation may be brought under control is the amount of emergency response planning that has been done previously by mine management. Emergency response planning in larger organizations is often done as a matter of course by the safety or training specialist at the mine or by a special team at the corporate office. Small mine personnel do not have these luxuries and must therefore put forth a special effort to prepare themselves for the worst, even while hoping the worst never happens. Because small mines usually have fewer immediate assets to draw upon, this planning becomes especially critical.

The insights about planning contained in this paper come from information that was obtained during U.S. Bureau of Mines (USBM) research that has been conducted over the past 4 years. The work is part of an overall USBM effort to improve the efficiency and effectiveness of emergency response activities and thereby protect potential victims and response personnel. The authors have reviewed literature that addresses all types of emergency response. They have also conducted in-depth interviews with 28 individuals who have extensive experience managing large-scale mine emergencies and 10 people who played key roles in responding to a major mine fire. This paper is based on preliminary analyses of these data.

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SOME DEFINING FACTORS OF A SMALL MINE

For the purposes of this paper, a small mine is defined by a number of characteristics that are relevant to emergency response planning and activities. First, a small mine has limited resources, most of which go to production activities. There is little funding or personnel available for emergency response plan research, preparation, and training. The person who is responsible for safety at the mine may also perform a number of other tasks during a workday. This individual therefore has limited time and little (if any) money allocated to planning for a future event that may or may not happen. Second, the work force is small enough that management knows each employee and workers all know each other. If an injury or fatality takes

place, responders know the victim and often also know that person's family. This increases the amount of stress on everyone during a response. A third characteristic of a small mine is local control. In other words, management personnel who conduct daily operations at the minesite will also be accountable for response efforts. There may not be experts from a corporate office who can be called or flown in to assist with decisionmaking. Even when they have a vast knowledge of mining, key decisionmakers at a small mine may have little or no experience with situations they will face during an emergency. All these factors present the operators of small mines with special concerns regarding mine emergency response.

WHY PLAN FOR EMERGENCIES?

According to the U.S. Mine Safety and Health Administration (MSHA) statistics for the 3-year period 1989-1991, there were 76 miners killed, 138 permanently disabled, and thousands more seriously injured at mines employing 50 or fewer workers. When an incident occurs at a site, there will be an effort to rescue any trapped victims, get medical assistance, clean up the affected area, correct all hazards, and return the mine to production as soon as possible. If each of these activities must be planned as it is conducted, valuable time will be lost and responders who are under stress because of the event may not be able to make the best possible decisions. If emergency response planning is done before an event happens, it will be less difficult and take less time to return the mine to normal operation.

A compelling argument for preplanning comes from a situation created when miners survive the initial impact of an event and need immediate rescue. Take, for example, a roof fall that occurred in Pennsylvania (4).³ Two miners were attempting to pry down loose top a couple of feet inby permanent supports when the roof came down on them. One worker was covered completely and the other was pinned from his knees down. Crew members removed the rock from these two victims. A miner who was an emergency medical technician (EMT) administered first aid at the scene and sent both victims outside to arriving ambulances. Initial reports stated that both individuals

suffered broken legs. While this was true and one worker eventually recovered completely, the other worker's right leg had to be amputated.

Frequently, self-protection is not the first thing that rescuers think about when someone is in trouble. The State report on this accident does not mention any safety precautions that the rescuers took while trying to remove the victims. It does not tell whether or not the rescuers had been trained to protect themselves in such a situation. It also does not mention the added stress on two of the rescuers; one was the brother of a victim and the other was a cousin. The cousin was the section EMT and was therefore called on to assess both victims' injuries and treat them. The State Bureau of Deep Mine Safety was not officially notified of the accident. While this violation may not be as important as the life and safety of two miners, it is an important response detail that was not dealt with when the event occurred. In this case, rock removal was relatively easy and the victims were soon on their way to a hospital. But, if the roof fall had been larger and the response longer, would the rescuers have been ready? Would the right telephone calls have been made eventually? Would the victims have time to wait for someone to decide what should be done? These questions cannot be answered for this event, but they should be considered at all mines before a serious injury occurs.

WHAT DOES THE LAW SAY?

A violation was written in the incident cited above because State investigators determined that mine management had not complied with regulations and informed

their agency of the event. While it is not possible here to go through all State regulations pertaining to coal mine emergencies, there are Federal regulations that can be reviewed (6). Both underground and surface mine operators are required by Federal law to be prepared to manage and respond to mine emergencies when they occur.

³Italic numbers in parentheses refer to items in the list of references at the end of this paper.

Underground coal mines are covered under regulations in 30 CFR 49, 50, and 75 while surface coal mines and surface areas of underground coal mines are governed by regulations in 30 CFR 50 and 77.

Regulations under 30 CFR 49 (section 49.9) require all underground mine operators to have a mine emergency notification plan. Within this plan, operators must outline procedures that are to be followed for notifying mine rescue teams when their services are required. Copies of the plan must be posted for workers' information and made available to the miners' representative where applicable. Section 50.2 (h) of 30 CFR 50 stipulates the requirements for notifying MSHA of all accidents. Operators of underground mines must also make arrangements for emergency medical assistance and transportation of injured persons, as specified in 30 CFR 75 (section 1713-1). In addition to making these arrangements, the operator must post at appropriate locations the names, titles, addresses, and telephone numbers of all persons or services that are currently under such arrangements to provide medical assistance and transportation.

Section 383 of 30 CFR 75 requires that underground mine operators conduct practice drills to familiarize their miners with emergency escape procedures. At least once every 90 days, each miner, including those with work locations between working sections and main escapeways, is required to participate in a practice drill. During the drill, each miner is required to travel either the primary or alternate escapeway from his or her working section to the point where the split of air ventilating the section intersects with a main aircourse or 608 m (2,000 ft) outby the section's loading point, whichever distance is greater. All other miners are to participate in escapeway drills by traveling at least 608 m (2,000 ft) in either the primary or alternate escapeway from his or her work location toward the nearest escape facility or drift opening.

Besides the 90-day drills, at least two miners from each production section who work on that section and the supervisor must participate in practice drills and travel through the primary or alternate escapeways to the surface, mechanical escape facilities, or to an underground entrance to a shaft or slope to the surface at least once every 6 weeks. In addition, at least two miners and a supervisor on each maintenance shift shall participate in escapeway drills by traveling through the primary or alternate escapeways to the surface, mechanical escape facilities, or to an underground entrance to a shaft or slope to the surface at least once every 6 weeks. In all cases, each escapeway drill cannot be conducted in the same escapeway as the immediately preceding drill. For the 6-week drills, operators are required to systematically rotate personnel to ensure that all miners participate. The practice escapeway drills required under section 383 of 30 CFR 75 may be used to satisfy the evacuation specifications of

fire drills that are required by section 1101-23 of 30 CFR 75. Either before or during practice drills, miners must be informed of the following: the route of escape and any changes to these routes; the location of fire doors, check curtains, or smoke-retarding doors; and the plans for diverting smoke away from mine escapeways.

The remaining regulations that address emergency response for underground mine operators are related specifically to fires. An operator is required to adopt a program for instructing all miners in the use of fire-fighting equipment and in procedures for evacuating their mine (30 CFR 75, section 1101-23). This program, which is submitted to the MSHA district manager for approval, must include a specific fire-fighting and evacuation plan designed to familiarize miners at an operation with procedures for (1) evacuation of workers not needed for fire-fighting activities, (2) rapid marshalling and deployment of necessary personnel, fire-fighting equipment, and rescue apparatus to the fire scene, and (3) operation of fire-fighting equipment at the mine.

Under the provisions of section 1101-23 of 30 CFR 75, mine operators must ensure that at least two workers per section on each production shift are proficient in the use of all fire-fighting equipment available in that section. Those workers are also to know the location of this apparatus in their section. Operators of attended equipment, such as continuous miners and shuttle cars, must be proficient in using the machine's fire-suppression system. On maintenance shifts, the shift foreman and at least one miner for every five working on that shift must be proficient in the use of fire-fighting equipment available in the mine. In addition, they are required to know the location of this equipment.

Section 1101-23 of 30 CFR 75 also compels operators to ensure that all miners employed underground participate in fire drills. These drills, which must take place at intervals of not more than 90 days, are to simulate those actions required by the MSHA-approved fire-fighting and evacuation plan. Mine operators also have to keep a record of all fire drills held at the mine. Finally, mine operators must provide annual instruction, based on the approved plan, to all miners and to newly employed miners within 6 months of their date of employment.

Surface coal mines and surface areas of underground mines are governed by mine emergency response regulations found in 30 CFR 77. While the stipulations of these regulations are similar to those for underground mines, they are considerably less stringent and subject to greater interpretation. Surface operations are required to make arrangements for emergency medical assistance and transportation of persons injured at the mine, as specified in section 1702 of 30 CFR 77. In addition to making these arrangements, an operator must post at appropriate locations the names, titles, addresses, and telephone numbers

of all persons or services that are currently under such arrangements to provide medical assistance and transportation.

There are also regulations specific to fire emergencies. Under 30 CFR 77, section 1100, operators are to provide fire-fighting facilities and equipment based upon the potential fire hazards at each structure or other facility at their mine. Operators must instruct persons working at these facilities and retrain them annually in the use of available fire-fighting facilities and equipment. Surface mines and surface areas of underground mines must have escape and evacuation plans. Section 1101 of 30 CFR 77 specifies that operators are required to establish and keep up to date a specific escape and evacuation plan that is to be followed in the event of a fire. In addition, this plan has to include the designation and proper maintenance of adequate means for exit from all areas where miners or others are required to work or travel. This includes buildings, equipment, and all areas where persons normally congregate during the work shift. In addition, all employees must receive instruction on the escape and evacuation

plans, fire alarm signals, and applicable procedures to be followed in case of a fire.

Therefore, in terms of general emergency response planning, all mine operators are required by law to do the following:

1. Make arrangements for emergency medical assistance and transportation.
2. Post information about medical assistance providers at appropriate locations.
3. Develop evacuation and escape plans.
4. Train miners in evacuation and escape. (Underground mines must also conduct drills.)
5. Develop an emergency plan for notification of mine rescue teams (underground only).
6. Post emergency plan (underground only).

The minimal mine emergency response planning currently mandated by Federal law consists of addressing those regulations that cite details for fire emergency planning (discussed above) and the items listed here.

IS MORE NEEDED THAN WHAT IS REQUIRED BY LAW?

All rules and regulations only specify what is acceptable at a minimum. Policies attempt to ensure compliance under real-world conditions. Strictly adhering to what is legally required in the way of mine emergency planning may offer enough protection for small-scale accidents or situations in which an evacuation can be accomplished easily. When something more serious occurs, however, minimal planning will provide only for minimal activities related to mine evacuation, obtaining medical attention for any injured workers, and calling for assistance from a mine rescue team. There are no requirements to plan for a well-coordinated response that can protect personnel and return the mine to routine production in an efficient manner.

There is a wide range of possible emergencies that can be encountered at a minesite. Many mining companies have not developed formal plans for dealing with these potential events. Instead, they have relied upon the skills of upper level mine managers and others in analyzing and responding to emergencies as they have arisen. In some cases, these informal procedures have worked well and many events have been managed successfully without the use of a formal emergency plan. At the same time, however, managing a mine emergency without a formal plan can pose great risks and result in poor handling of the event. There may be mine emergencies that exceed the technical capabilities of initial responders. In some events, the best technical people can become involved in front-line

rescue or exploratory work when they could be better utilized on the surface. A disaster may incapacitate or kill key management officials. In other cases, the emergency can be of such magnitude that successful management requires sizable outlays for personnel, materials, technical advisors, and services of external organizations. One way to be prepared is to develop an emergency response plan.

An emergency response plan is an all-encompassing document. It covers many aspects of response, including the following: (1) evacuating the mine, (2) setting up site security, (3) dealing with the media, (4) providing information to family members, (5) determining where cars should be parked to lessen traffic problems, and (6) scheduling shifts for workers, including decisionmakers. There are many other aspects of response that should be considered. However, the resulting plan should not be an encyclopedia that is too long and complex to understand. Instead, the plan should be a living document that is kept up to date, is tested and refined during practice, and is useful if it is ever needed. Selected details of what goes into a plan will be discussed in the section "What's Included in an Emergency Response Plan?" The first step in planning, however, is to decide that simple adherence to the laws regarding emergency response will not offer as much protection to a mine and the people who work there as is possible. Next, one must be willing to allocate resources to go that extra step toward being prepared for a large-scale mine emergency.

HOW IS AN EMERGENCY RESPONSE PLAN DEVELOPED?

When asked whether or not they have a mine emergency response plan, operators often point to a page of instructions hanging by a phone, or to a notebook or manual on a shelf. These documents may, in fact, be the written form of a good plan. But, for the plan to be successfully carried out, it must be more than a document that someone is to refer to when an event occurs. Having a workable plan starts with how it is developed. According to Auf der Heide (*J*), "The process of planning is more important than the written document that results."

A plan should be developed by the individuals who will be involved if it should have to be implemented. In his book "Disaster Response: Principles of Preparation and Coordination," Auf der Heide (*J*) provides several reasons for this. He states that developers will have a better understanding of the plan. They will also know their roles in it. Additionally, personal networking will take place between key responders. The education about emergency response combined with personal relationships people form while writing a plan will prepare them individually for the things they must do if an event occurs. An example of this was given by a safety director who led the planning process for his mine. When a large-scale response was needed, he did not think to refer to the document created. He led the activities based on the education and thinking he had done while creating their response plan:

Sitting down ah, I guess, laying out a format at one time. I did lay out a format for some ah, mines that I was working for, you know, of what to do in case of an emergency; who to call, and what to do . . . As a matter of fact, I'd even made one for this mine, but at that time everything was happening, I didn't even think about it, you know. I had it hanging on the wall. Ah, it was there for everybody to ah, in case of an emergency, to go to. Had the list of all the emergency phone numbers, who to call, who to call first, what information to find out before you call, and so on. And um, it just, like I said, at that time it just, it just went blank that I had that. But I designed it any way, and I prepared it. So it was still in my mind, you know. What I should do.

This responder had learned the plan as it was written and was prepared to carry out the protocols that he had helped develop. At the very least, having individuals with this kind of knowledge and experience at a response will save time and cut down on details being forgotten.

During planning, as mentioned above, connections should be made with organizations and people who will be needed if a large-scale emergency occurs. This includes medical assistance and transportation organizations, mine rescue teams, local law enforcement personnel, equipment suppliers, government regulatory agencies, neighboring mines, and others according to local situations. Asking these people to meet during a nonemergency period is also an important aspect of the planning process: According to Auf der Heide (*J*), "A number of researchers have observed that predisaster contacts among representatives of emergency organizations result in smoother operations in subsequent disasters. . . Furthermore, in the process . . . participants become familiar with the roles of other individuals and organizations involved in the disaster response."

Agreements for sharing resources between neighboring mines during an emergency may be made in the planning process. As one safety director, reflecting on an experience at his mine, relates:

You're going to have to have um, accesses to get equipment. . . Such equipment as extra scoop, or mantrips ah, due to your battery power being exhausted, and not having time to recharge, due to it being traveled in and out.

. . . call . . . someone [at a local mine] up and say, "Hey, . . . in case of emergency, if I need a . . . This might never happen, but um, if I was to need you to bring me supplies, or borrow your truck or something . . . Just, you know, for my sake, can I feel comfortable calling you and say I can borrow your truck, or that you'll go to the store for me." . . . I'd have it like that.

Setting up these relationships prior to an event will save time if such resources are ever needed. Of course, the better these agreements are worked out beforehand, the more effective they will be.

Proper planning will result in experienced personnel and a more easily coordinated response. In terms of coordinating the various individuals and agencies who are involved in a response, having a smaller mine in a more rural area might be a plus. There may be fewer organizations and individuals to coordinate, and it is likely that the people who respond will already know each other. This will cut down on the possibilities for miscommunications and could shorten the time that it takes for responders to know who is playing what role.

WHAT'S INCLUDED IN AN EMERGENCY RESPONSE PLAN?

Adequate mine emergency response plans need to be suitable for use in managing any situation that could arise at a mine. These range from easily foreseen predicaments, such as fires, explosions, inundations, or roof fall entrapments, to even the least probable event, such as a hazardous chemical spill near an intake. If a mine emergency plan is well prepared it can cover the worst foreseeable situation. And, if it is designed to utilize all available resources to achieve predefined objectives, then it is likely that the basic plan can be adapted to cover a wide range of possible emergency situations. The scope of this paper does not permit the presentation of detailed descriptions of all of the elements of a mine emergency plan. This section, however, provides insight regarding some of the major components that comprise a basic mine emergency response plan. The ideas presented were taken from the interviews discussed above and from related literature (5, 7).

Plan Objectives.—A mine emergency plan must contain clearly defined objectives for each portion. If objectives are considered carefully and defined as an integral part of planning, then all individuals engaged in developing the plan, training in its use, or implementing it in an emergency will be better prepared to respond. Quite often, major events are handled initially by individuals who have little or no experience in dealing with a mine emergency. Determining the objectives and stating them within the plan helps personnel with less knowledge and experience deal with the emergency.

Initial Response to the Emergency.—As soon as possible after the onset of an emergency, certain tasks should be done. These items should be listed explicitly in the plan. Some things that the mine operator needs to consider having on this list follow:

1. Determine if miners are trapped or missing and if they have been communicated with.
2. Ascertain the exact nature of the emergency and its location in or about the mine.
3. Notify mine rescue teams if necessary.
4. Notify emergency medical services, hospitals, rescue squads, fire department, or other outside services if they are needed.
5. Notify Federal and State regulatory agencies.
6. Initiate fire-fighting or rescue-and-recovery operations.
7. Determine if all mine fans are still operating.

Command Center and Other Facilities.—Workplaces should be available for use by a number of individuals on the surface. These include company personnel, officials

from State and Federal agencies, miners' representatives, and others who will be involved in directing a response to the emergency. An area needs to be set aside to serve as the command center. Space may also be required for meetings and briefings, servicing mine rescue equipment, first aid administration, a temporary morgue, and other functions.

Definition of Roles and Responsibilities.—Each person who will be participating in handling an emergency, from rank-and-file workers to the mine manager or superintendent, needs to know exactly what his or her responsibilities are during this event. Roles should be so well defined that any qualified person can be assigned any position and know what the associated duties are. This may be accomplished by developing task cards—pocket-size cards that clearly define the duties and responsibilities for each position. The cards can be distributed to responders, who will carry and refer to them at any particular moment during a situation. This will ensure that they have properly attended to all assigned duties.

Rotation of Commanding Personnel.—Depending on the nature of a mine emergency, company officials may be required to be at the scene for several days. In one reported case, a mine superintendent worked 37 h straight at a mine fire before leaving the command center (8). Research has shown that lack of adequate rest severely inhibits a person's ability to make quality decisions. Poor decisions in a mine emergency can jeopardize the lives of responders at the scene and/or severely hamper efforts to deal with the event. Company officials need to make arrangements for rotation of command personnel at the emergency site to ensure that those individuals who will be required to make critical decisions are well rested.

Activities Logging.—At least until additional personnel arrive at a scene, the company should assign someone on the surface to maintain a log of all rescue and recovery activities. This log should be detailed and include all major activities that have occurred since the onset of the emergency.

Fan Operation.—When required, the mine operator should have all surface fans examined to determine their condition. The operator should assign a person to each operating surface fan to ensure its continued operation.

Property Entrance Restriction-Security.—The operator should, as part of planning, establish a policy restricting entrance to authorized personnel in the event of a mine emergency. Only those required to handle the situation should be permitted on mine property. Guards should be assigned at each mine entrance. Often, local law enforcement agencies will provide officers to fill this job.

Mine Maps.—Up-to-date mine maps will usually be needed for use by mine rescue teams, company officials, and others. A sufficient number of current mine maps or prints should be secured and made ready for distribution.

Supplies and Equipment.—Depending on the nature of a particular mine emergency, supplies such as crib blocks, timbers, brattice curtain, concrete blocks, water line, rock dust, and other articles may be needed in quantity very quickly. In the event of a mine fire or explosion, materials such as ready-mix concrete, steel plates, wood, and stone or gravel may be required for sealing the mine. Liquid carbon dioxide may be needed in an attempt to smother a fire. Provision should be made with suppliers and other mining operations to provide these items on short notice when needed. Machinery such as scoop tractors, auxiliary fans, foam generators, power centers, pumps, front-end loaders, bulldozers, drill rigs, and other equipment and tools may have to be brought on site quickly. Arrangements should be made in advance with company purchasing agents and suppliers of this equipment to ensure quick delivery to the minesite of these and all other necessary items.

Interacting With the Media.—Any major mine emergency will draw attention very quickly. In a matter of hours, media representatives will be at the scene to obtain current information about the situation. It is important to determine beforehand how the media is to be dealt with and who will interact with them to ensure dissemination of accurate information. One group of small mine owners are looking to their operators association for support in this area (2). During a response, mine management keeps the operators association staff updated and tells all media representatives to go to that staff for information. The association staff then prepares press releases and handles all inquiries from the media. Whether the media is to be handled by mine personnel or by some designated representative should be decided and communicated before an event occurs.

Needs of Personnel on the Scene.—If a number of responders are required on the scene of a mine emergency for a long period of time, arrangements should be made to provide these individuals with sleeping quarters, food, and other essentials. Agreements can be made in advance with area motels to provide lodging. Local restaurants and grocery stores can be commissioned to provide food as needed.

Needs of Relatives and Friends.—When an emergency occurs, relatives and friends of miners working at the operation may arrive on site seeking information about loved ones. Mine officials should prepare to deal with relatives and friends by providing them with the latest factual information available. If possible, there should be arrangements to have counselors and clergy available to interact with family members during the emergency. A suitable facility might be necessary for family members who wish to remain on site during the response.

Special Needs of Response Personnel and Others Involved.—In a mine emergency, workers and rescue personnel are faced with numerous situations that may result in severe emotional stress and trauma (3). This condition, called critical incident stress, can frequently result in short- or long-term emotional difficulties that affect one's ability to function. There should be arrangements to have counselors, trained in critical incident stress debriefing (CISD), available for workers who witnessed or were involved in the emergency. These counselors could also assist individuals who participated in the response. CISD is a technique for helping normal people cope with stress associated with abnormal events.

Communications.—Communications is one of the most crucial elements in managing a mine emergency. Quality communication links are needed between a command center and the emergency location. There must also be good links between a command center and facilities away from the minesite. An operator needs to assign a person to ensure that mine telephones or other communication systems are in place and working. It is not uncommon for a mine to have only one telephone line servicing the operation. Depending on the nature of an emergency however, additional telephone lines may be needed. The capability to add additional lines during an emergency should be prearranged with the telephone company.

The purpose of this portion of the paper was to stimulate thinking by illustrating some of the many items that must be dealt with during a mine emergency. The elements of a mine emergency response plan that have been mentioned are but a few of the many components that could comprise a quality effort. An important point to remember is that the time to plan for a mine emergency is before an event occurs rather than in the middle of a situation.

IS HAVING A WRITTEN DOCUMENT ENOUGH?

When the planning process has resulted in a final document—a mine emergency response plan—then the next phase of preparation begins. Everyone who works at the minesite should be trained in the plan's contents. They

should also be introduced to the various roles included. Individuals must know what they are likely to be asked to do if the plan were put into use. They should also be aware of company policy on response issues such as site

security and interactions with the media. If possible, miners and responders should be given an opportunity to practice carrying out the plan or, at least, some portion of it. Less direction and coordination will be needed to start up a response if more people are trained to follow the plan. During training, the plan will also be tested and can be revised and refined to match minesite demands.

Preparation for a large-scale emergency should be an ongoing process. Telephone lists and mine maps should be updated routinely. Newly hired workers should be introduced to the mine emergency response plan before

they start to work. On occasion, everyone should be reminded of the plan and of their role(s) in it. When there are changes to a mine, mine management, or local resources, the plan should reflect those changes. The result would be a work force that is more confident of management's commitment to their safety, inspectors who see that the extra step has been taken at this site, and responders and decisionmakers who are better prepared. If the worst happens, management will know that every effort was made to make an emergency response as efficient and effective as possible.

CONCLUSIONS AND RECOMMENDATIONS

As discussed previously, large-scale mine emergencies are infrequent events, and so it is difficult to put daily concerns aside to focus attention on them. They do, however, occur with results that can be devastating economically for the mining operation, and economically as well as emotionally for the individuals involved. These consequences can be mitigated with even limited emergency response planning. Planning is particularly important for small mining operations that will need to call on outside help to mount a sizable response.

There are a number of resources available at little or no cost to the small mine operator who wants to begin planning for a mine emergency. One place to begin is with the sample emergency response plan provided in the appendix to this paper. The plan is a simplified version of one prepared for and being used at an underground coal mine. It could be used as a model for the development of a site-specific plan.

Another source of information is the National Mine Health and Safety Academy at Beckley, WV. The academy is devoted to mine safety training and has both written material and classes on emergency response topics. There is also a fire school on the grounds where miners are trained to fight underground fires. Information about classes being taught at the academy can be obtained by calling the Instructional Services Office at 304-256-3211. Written materials are promoted in a catalogue, which is available through the Business Office at 304-256-3257.

Assistance is also offered through the Center for Emergency Preparedness, West Virginia University Mining Extension, in Morgantown, WV, at 304-293-4211. Like the academy, the center has written materials available and conducts training related to emergency response. Staff members also act as consultants conducting fire audits for mining companies.

Local resources should not be forgotten. Local experts may be needed during an emergency, and those individuals will be happy to help. The best time to meet with these people and coordinate planning efforts is during the planning process. Local law enforcement may be called on to provide site security and should be familiar with the site and the individuals who will be in charge. Ambulance crews and other medical personnel should be contacted so that their part in the response will go smoothly. The American Red Cross or a local civic group may be willing to coordinate activities, such as feeding responders and making family members as comfortable as possible. A church, school, or community center may have rooms that could be used as offices or a press briefing area. It will be much easier for community members to assist in a response if their tasks are defined before an event occurs. The probable needs should be considered and then resources sought to fulfill them. The telephone calls and/or meetings to set up this coordination of resources may save a considerable amount of time and energy and decrease confusion inherent in the situation if a response ever needs to be put in place.

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APPENDIX.—SAMPLE EMERGENCY RESPONSE PLAN

Weplan Mining Company Mine Emergency Preparedness Plan

Introduction

Although substantial improvements in the technical aspects of mining and improved examinations have been made, mine emergencies continue to occur. Because of this fact, we must continue to search for the safest methods to obtain the best results using training and planning skills, and being prepared for positive response in the event of an emergency.

A combination of actions in an emergency many include all of the following:

1. Hazard Control: The immediate action to eliminate the hazard or limit its scope.
2. Evacuation: The orderly exit of miners from affected areas, using designated escape routes, and emergency breathing devices.
3. Survival: Alternate means of survival, such as barricading, when escape routes are blocked.
4. Rescue: The efforts by those outside the mine to locate, communicate with and remove those miners trapped underground.
5. Recovery: The effort to recover missing persons and return the mine to operational or investigative status once conditions permit.

Confusion and disorder after discovery of an emergency is normal. The first few minutes after discovery are crucial. Since almost all emergencies are unique, a program detailing every situation is not possible. However, there are certain elements common to all and the preparation of a written plan can minimize the confusion and disorder associated with the emergency. This program is intended to offer some basic guidelines for responding when an emergency occurs.

Some elements included are:

1. Communications and notifications immediately after discovery of an emergency and at certain intervals thereafter.
2. Responsibilities of certain personnel during the emergency.
3. Selection of a person to be in overall control.
4. Development of an advisory and control group.
5. Evacuation and survival procedures.

6. Rescue and recovery procedures.
7. Surface organization, facilities, and outside sources of assistance for support purposes.
8. Control of outside elements with an interest in the emergency, but not involved with the operation such as news media, relatives and the general public.

It is intended that all persons who have a part in the emergency will review the entire plan and be aware of the contents. If anything is noted that should be changed, it should be brought to the attention of "the Safety Department" for revision as necessary.

Waiting until an emergency to review this plan may be too late to organize an effective emergency operation. Study it frequently.

INSTRUCTIONS

The actions taken in this manual are color coded.

When implementing any step of these instructions, identify the color highlighted and turn to the corresponding color tab for detailed information.

[In the original plan, the underlined words in the following summary were highlighted with colors. The notebook which held the plan included corresponding color tabs. These tabs separated sections consisting of detailed information on each item and blank forms that would be needed to complete the tasks. Headings are used here instead of the colors.]

UNDERGROUND MINE EMERGENCY PLAN

Upon notification or indication of a mine emergency:

IMMEDIATELY...

1. Initiate Event Log
2. Notify personnel adversely affected and document their intentions
3. Notify on-site person in charge
4. Activate on-shift mine emergency or fire fighting procedures

PRIOR TO 15 MINUTES

1. Initiate mine monitoring procedures
2. Notify personnel outby affected area for evacuation or assistance
3. Notify person in charge of mine
4. Notify person in charge of safety
5. Notify critical company manpower

PRIOR TO 1 HOUR

1. Evaluate underground conditions
 - A. Determine emergency location and extent
 - B. Effect of emergency on evacuation, escape and barricading
 - C. Determine fire fighting, mine rescue or other emergency needs
2. Evaluate underground utilities
 - A. Communications
 - B. Ventilation
 - C. Power
 - D. Water
3. Initiate check-in/check-out procedures
4. Provide critical supplies
5. Notify Mine Rescue Team
6. Notify Fire Brigade

RESPONSE PLAN SUMMARY
Page 2

7. Notify EMT's on shift and other medical assistance as needed
8. Notify essential manpower
9. Notify MSHA
10. Notify State Division of Mines
11. Notify Local Law Enforcement

PRIOR TO 4 HOURS

1. Activate gas sampling and fan evaluation procedures
2. Provide essential supplies and services
 - A. Shop
 - B. Engineering
 - C. Other Corporate operations
 - D. Other mines
 - E. Vendors
3. Activate control group organization
4. Notify additional fire brigade members or mine rescue teams
5. Provide for technical assistance from other corporate operations and other local mines

AFTER 4 HOURS

1. Activate advisory group organization
 2. Provide additional outside communications
 3. Provide maximum number of mine emergency teams needed
 4. Activate facility needs procedures
 - A. Control Group area
 - B. Advisory Group area
 - C. Mine rescue briefing area
 - D. Mine rescue benching area
 - E. Mine rescue housing
 - F. Family relations area
 - G. Press and public relations area
 5. Provide necessary supplies and services
 - A. Food services arrangements
-

B. Press and family briefing procedures

6. Initiate mine rescue logs

Mine Emergency
Weplan Mining Company

WHEN	INITIATE	WHO	WHERE	HOW	TIME COMPLETED
Immediately	Event Log	Person who learns of problem until assigned person takes over	Logs and Records Form - See Page 2	As Events Occur	
Prior to 15 minutes	Mine Monitoring	Assigned person	Fan Underground	Mine Monitors	
Prior to 1 hour	Check-In and Check-Out Log	Assign person at Operations Center	Logs and Records See Page 3 Operations Center	Utilize Log for Response Personnel	
After 4 hours	Mine Rescue Team Logs	Advisory Group	Mine Rescue Briefing Room Area Logs and Records See Page 4	Per Available Mine Rescue Teams	

Mine Emergency
Weplan Mining Company

WHEN	NOTIFY	WHO	WHERE	HOW	TIME COMPLETED
Immediately	Persons Affected	Working Sections and Outby Crews	"Sections"	Mine phone, Electrical Power, Belt Shutdown	
Immediately	On site person in charge or person outside	Mine Superintendent or Maintenance Superintendent	Operations Center, or in the Mine	Mine phone, Electrical Power, Belt Shutdown	
Prior to 15 minutes	Persons outby affected area	Working Sections and Outby Crews	Throughout the Mine	Mine phone, Physical Inspection	
Prior to 15 minutes	Person in charge of Mine (Call until one is reached, then go to Safety list)	"Names"	Home Work	"Phone #" "Phone #"	
Prior to 15 minutes	Person in charge of Safety (Call until one is reached, then go to Critical Manpower list)	"Names"	Home Work	"Phone #" "Phone #"	

NOTIFICATION
Page 2

WHEN	NOTIFY	WHO	WHERE	HOW	TIME COMPLETED
Prior to 15 minutes	Critical Company Manpower (Do not repeat if notified above)	"Names"	Home Work	"Phone #" "Phone #"	
Prior to 1 hour	Mine Rescue Team Members	"Names"	Home Work	"Phone #" "Phone #"	
Prior to 1 hour	Fire Brigade Team Members	"Names"	Home Work	"Phone #" "Phone #"	
Prior to 1 hour	Emergency Medical Technicians or other medical assistance as needed	"Names" Local Ambulance	Mine Site Hospital	Mine Phone "Phone #"	
Prior to 1 hour	Essential Manpower as instructed or as needed	"Names"	Home	"Phone #"	
Prior to 1 hour	Company personnel	"Names"	Home Office	"Phone #" "Phone #"	
Prior to 1 hour	MSHA Note: should be called in order by a Safety or Mine official until one is contacted.	"Local" Office Field Office Subdistrict Office District Office Response Coord. - Ron Keaton	"Location" "Location" "Location" "Location" Morgantown, WV	"Phone #" "Phone #" "Phone #" "Phone #" 304-296-2079	

WHEN	NOTIFY	WHO	WHERE	HOW	TIME COMPLETED
Prior to 1 hour	State Mine Officials Note: Should be called in order by a Safety or Mine official until one is contacted	"Main Office" Emergency Number "Names"	"Location" "Location" "Location"	"Phone #" "Phone #" "Phone #"	
Prior to 1 hour	Local Law Enforcement as needed	Sheriff's Office	"Location"	"Phone #"	
Prior to 4 hours	Additional Mine Rescue and Fire Brigade Teams	"Team Names"	"Location"	"Phone #s"	

Mine Emergency Plan
Weplan Mining Company

WHEN	ACTIVATE	WHO	WHERE	HOW	TIME COMPLETED
Immediately	Mine Emergency Procedure	Underground Personnel	At or Inby Affected Area	Fire Fighting and Evacuation Procedures	
Prior to 4 hours	Gas Sampling and Fan Evaluation Procedures	"Name"	Fans and Sampling Points	Mine Monitor and Detectors Sample Bags	
Prior to 4 hours	Control Group Organization	"Names"	Command Center	Command System Structure	
After 4 hours	Advisory Group Organization	"Names"	Advisory Group Location	"Phone #"	
After 4 hours	Command Center	"Name"	Operations Center	See Procedures	
After 4 hours	Advisory Group Area	"Name"	"Location"	See Procedures	
After 4 hours	Mine Rescue Brigade Area	"Name"	"Location"	See Procedures	
After 4 hours	Mine Rescue Benching Area	"Name"	"Local Hotels"	See Procedures	

ACTIVATE
Page 2

WHEN	ACTIVATE	WHO	WHERE	HOW	TIME COMPLETED
After 4 hours	Mine Rescue Housing	"Name"	"Location"	See Procedures	
After 4 hours	Family Relations Area	"Name"	"Location"	See Procedures	
After 4 hours	Press and Public Relations Area	"Name"	"Location"	See Procedures	

Weplan Mining Company
Facility Needs Procedures

1. Command Center

Building Name	
Location	
Phone Number	

2. Staging Area for Teams

Building Name	
Location	
Phone Number	

3. Work Area for Apparatus Maintenance

Building Name	
Location	
Phone Number	

4. Briefing Area for Teams

Building Name	
Location	
Phone Number	

5. Waiting Area for Relatives and Friends

Building Name	
Location	
Phone Number	

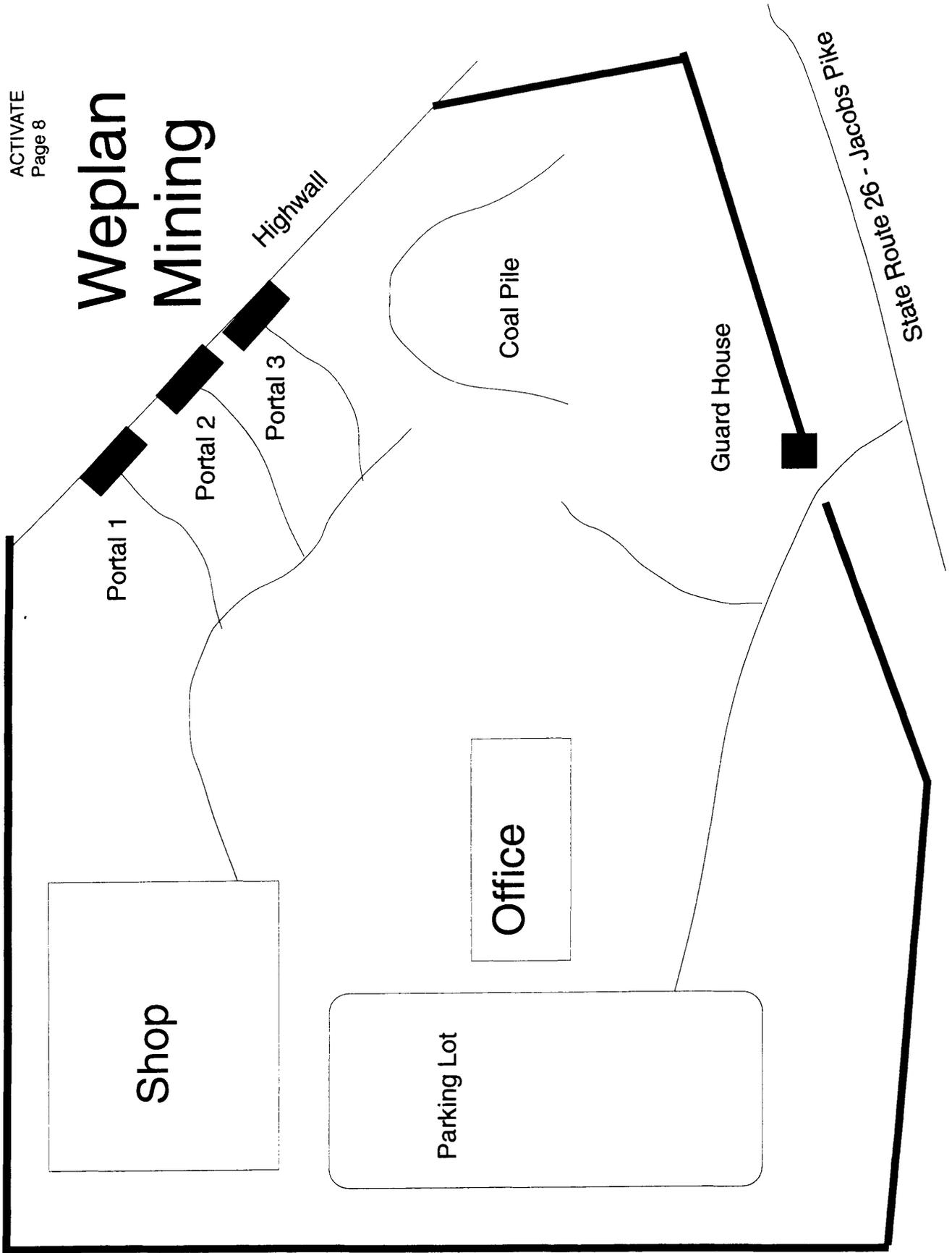
6. Press Room and Information Center

Building Name	
Location	
Phone Number	

7. Food and Sleeping Quarters

Building Name	
Location	
Phone Number	

Weplan Mining



**Mine Emergency
Evaluate Conditions for Decision Making
Weplan Mining Company**

WHEN	EVALUATE	WHO	WHERE	HOW	TIME COMPLETED
Prior to 1 hour	1. Emergency location and extent 2. Effect of emergency on evacuating and barricading 3. Firefighting, Mine Rescue, or other emergency needs	Person in charge of mine	Mine monitor or mine site	1. Review event log 2. Review notification log 3. Review Current Monitoring - CO levels and their locations 4. Prior monitor print-outs 5. Mine maps at display board	

WHEN	EVALUATE	WHO	WHERE	HOW	TIME COMPLETED
Prior to 1 hour	Communications capabilities	Person in charge of mine or designate Facility technician Electrical Foreman	Mine site or mine monitor Facility tech office	<ol style="list-style-type: none"> 1. Test phones <ol style="list-style-type: none"> a. Operations center to underground b. Operations center to mine monitor 2. Fire alarms Mine monitor to underground 	
Prior to 1 hour	Ventilation	Person assigned by person in charge of mine "Name"	Mine monitor Main Fan Borehole Fan	<ol style="list-style-type: none"> 1. Current monitoring <ol style="list-style-type: none"> a. fans on/off b. fans status 2. Physical inspection <ol style="list-style-type: none"> a. Pressure recorder (mine monitor) b. Gas detection with CMX 270 c. Other operation status d. Appearance of exhausting air 	

EVALUATE
Page 3

WHEN	EVALUATE	WHO	WHERE	HOW	TIME COMPLETED
Prior to 1 hour	Electrical Power	<ol style="list-style-type: none"> 1. Person assigned by person in charge of mine 2. Electricians, "Names" 3. Facility Technician 	<p>Mine</p> <p>Mine monitor</p>	<ol style="list-style-type: none"> 1. Physical check of outside and underground power 2. Current mine monitoring 	
Prior to 1 hour	Water System	<ol style="list-style-type: none"> 1. Person assigned by person in charge of mine 2. "Name" 3. Mine monitor operator 	<p>Outside water storage (tank and ponds)</p> <p>Mine monitor</p>	<ol style="list-style-type: none"> 1. Physical inspection <ol style="list-style-type: none"> a. levels b. rate of drop 2. Current mine monitoring 3. Check sprinkler alarms 	

Mine Emergency
Provide for Materials and Equipment
Weplan Mining Company

WHEN	PROVIDE	WHO	WHERE	HOW	TIME COMPLETED
Prior to 1 hour	1. Fire fighting	Assigned persons	1. Underground a. section safety trailer b. outby locations 2. Warehouse	Deliver to emergency site	
Prior to 1 hour	2. Foam generator and foam	1. Persons assigned 2. Fire brigade members	Electrical Shop	1. Deliver to portal 2. Deliver to emergency site	
Prior to 1 hour	3. First aid and/or medical assistance if needed	1. Facilities technician 2. Person in charge 3. Safety department	1. Warehouse 2. Mine monitor room 3. Command center	1. Dispatch ambulance to mine site 2. EMT list	
Prior to 1 hour	4. Gas detection supplies	1. Assigned person 2. Safety Department	Safety Office	Deliver to operations center	

PROVIDE
Page 2

WHEN	PROVIDE	WHO	WHERE	HOW	TIME COMPLETED
Prior to 1 hour	5. Respiratory protection SCSR	Assigned person	1. Operations center/mantrips 2. Warehouse	Deliver to operations center	
Prior to 1 hour	6. Mine rescue breathing apparatus	Qualified mine rescue team member if available	Mine rescue station	Quick bench and respond with or without full team	
Prior to 1 hour	7. Ventilations supplies and/or urethane foam	Person assigned	Warehouse	Deliver to emergency location	
Prior to 4 hours	Essential supplies and services	1. Warehouse/ purchasing - "Names" 2. Engineering - "Names" 3. Other Corporate Operations 4. Other Mines 5. Vendors	Warehouse Office "Mine Names - Contact Person" "Mine Names - Contact Person" "Vendor List"	"Phone #"	
Prior to 4 hours	Chromatograph analysis	"Name"	"Location"	"Phone #"	

WHEN	PROVIDE	WHO	WHERE	HOW	TIME COMPLETED
Prior to 4 hours	Technical assistance from corporate office	"Names"	"Location"	"Phone #"	
After 4 hours	Additional outside communication	"Names"	"Location"	"Phone #"	
After 4 hours	Maximum number of mine rescue teams	"Names"	See Notification Procedure	See Notification Procedure	
After 4 hours	Necessary supplies and services 1. Food service 2. Press and family briefing procedure	"Names"	Family facility Press facility	"Phone #"	

SPECIAL PUBLICATION 18-94

IMPROVING SAFETY AT SMALL UNDERGROUND MINES

Proceedings: Bureau of Mines Technology Transfer Seminar

Compiled by Robert H. Peters



United States Department of the Interior
Bureau of Mines
1994



U.S. Department of the Interior
Mission Statement

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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Compiled by Robert H. Peters

**UNITED STATES DEPARTMENT OF THE INTERIOR
Bruce Babbitt, Secretary**

BUREAU OF MINES